Expansion of Hong Kong International Airport into a Three-Runway System

Project Profile

May 2012

Airport Authority Hong Kong

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1. Basic Information

1.1 Project Title

Expansion of Hong Kong International Airport into a three-runway system.

1.2 Purpose and Nature of the Project

1.2.1 Background

Hong Kong International Airport (HKIA or Airport) has been in operation since 1998. Over the years, the HKIA has been playing a significant role in Hong Kong's economy and has experienced high growth rates of passengers, cargo and aircraft movements.

HKIA's original design was based on the 1992 New Airport Master Plan. This document estimated that by 2040 HKIA would handle 87 million passengers, 9 million tonnes of cargo and 380,000 aircraft movements, the majority of which would be from origin and destination traffic.

Over the past decade, demand has increased dramatically and the mix of aircraft has changed. As a hub airport, HKIA now serves a significant volume of transfer/transit traffic and a growing number of narrow body aircraft. Given that air traffic demand is forecast to reach 97 million passengers, 8.9 million tonnes of cargo and 602,000 flight movements per year by 2030 for HKIA, these changes, coupled with supply constraints, mean HKIA must optimise runway capacity to meet growing demand.

To meet these challenges, the Airport Authority Hong Kong (AAHK) has put forward two development options in HKIA Master Plan 2030 for public consultation from 3 June 2011 to 2 September 2011. Option 1 is to maintain the airport's two-runway system, and Option 2 is to expand into a three-runway system. The University of Hong Kong's Social Sciences Research Centre (SSRC) had compiled the results of the public consultation, having taken into account a combination of eight individual considerations which include:

1. Benefit to Hong Kong's air connectivity with the rest of the world;
2. Benefit to Hong Kong's competitiveness;
3. Creating more job opportunities for Hong Kong's workforce;
4. Benefit to Hong Kong's economic growth;
5. Benefit to the quality of airport services and facilities;
6. Making it more convenient for you and your family to travel;
7. Construction cost; and
8. Environmental impact.

The results show that majority (73%) of respondents to the questionnaire preferred Option 2, i.e. a third runway and associated airport infrastructure and facilities to be provided to meet the projected increases in passenger and cargo traffic at HKIA for the next 20 years and possibly beyond.

On 20 March 2012, approval from the Government of Hong Kong Special Administrative Region (the 'Government') was obtained to adopt Option 2 (three-runway system) as the future development option for HKIA for planning purposes and for AAHK to proceed with the statutory Environmental Impact Assessment (EIA) process.

1.2.2 Master Planning Process

AAHK produces a 20-year master plan for development of HKIA that is updated every 5 years. This master plan is part of a rolling planning process intended to achieve the following:

- Identify the development needs of HKIA
- Achieve sustainable growth
- Retain long-term competitiveness and position as an international aviation hub

For the preparation of HKIA Master Plan 2030 (hereinafter referred as MP2030), a number of consultancy studies and assessments were conducted during 2008-2011 to research into different strategic aspects of airport planning for AAHK to map out two development options for HKIA in the next 20 years. These studies comprise the following:

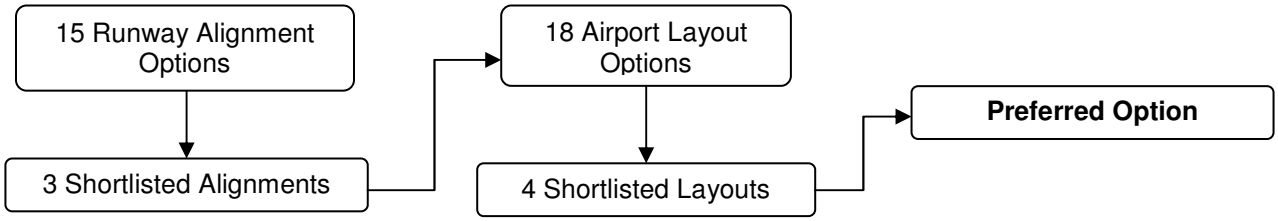
- Airport Facilities Planning
- Primary Air Traffic Forecast
- Airspace and Runway Capacity Analysis
- Preliminary Financial Assessment
- Economic Impact Analysis
- Initial Land Formation Engineering Evaluation
- Preliminary Engineering Feasibility and Environmental Assessment
- Preliminary Air Quality Impact Analysis
- Preliminary Aircraft Noise Impact Analysis

The two development options have their respective pros and cons, which MP2030 has provided detailed comparison against 5 key considerations: air connectivity, economic benefits, construction costs, funding and environmental issues.

Based on the findings of MP2030 and the result of the public consultation, AAHK made a recommendation to the Government in December 2011 to approve, in principle, the three-runway option as the future development option for HKIA for planning purposes and to endorse that AAHK proceed with the statutory EIA process and the preparation of associated design details.

1.2.3 Deriving the Recommended Third Runway Alignment and Airport Layout Plan

In determining the recommended third runway alignment and airport layout plan, the key factors evaluated by MP2030 include safety, operational efficiency, customer convenience, and environmental consideration. The recommended airport layout plan to accommodate the air traffic forecast demand up to 2030 was derived from a comprehensive process involving evaluations of alignment options for the third runway as well as subsequent layout options for other supporting infrastructure and facilities as illustrated below.



1.2.3.1 Runway Alignment Options

MP2030 Consultant evaluated a total of 15 alignment options taking into consideration factors such as operational safety, capacity gain potential, environmental issues, air traffic control (ATC) and Pearl River Delta (PRD) airspace issues. The 15 alignment options generally fell into three groups, as summarised in **Table 1.1**.

Table 1.1: Summary of Main Alignment Types

Brief Description of Alignment Type	Summary of Evaluation
A near-perpendicular runway to the existing runways	Can be used for departures to the north only, resulting in imbalance in departure and arrival capacity. Also can only be used in certain wind conditions only. Therefore, appears infeasible for capacity expansion.
A runway aligned at an angle to the existing runways	Conflicts with air traffic procedures between the third runway and the existing runways. Dependent operations create little or no additional capacity increase. Therefore, lack of usability makes this option impractical.
A parallel runway with the existing runways	Allows independent operations of all three runways, provided that the runway separation is adequate.

In conclusion, any non-parallel new runway option has been eliminated due to factors including terrain constraints; conflicts with air traffic procedures; clashes with traffic flying into and out of neighbouring airports; restrictive operating dependencies required for safe landings; and the negligible gains in capacity that can be achieved with non-parallel alignments. Environmental constraints and opportunities were also identified at the outset and considered qualitatively as part of the initial screening process. These include impacts on marine ecology including Chinese White Dolphins; water quality; future aircraft noise; and proximity to the Marine Park.

After elimination of various alignment options due to aforementioned constraints, 3 runway alignment options were shortlisted out of the 15 alignments evaluated. They include:

- A far-spaced alignment which avoids the Contaminated Mud Pits (CMP) and is situated just north of the Airport island but close to the existing Sha Chau and Lung Kwu Chau Marine Park;

- A normal-spaced alignment which overlaps part of the CMP and is about halfway between the existing Sha Chau and Lung Kwu Chau Marine Park and the existing Northern Runway; and

- A close-spaced alignment which is right next to the existing Northern Runway and largely avoids the CMP but is nearest to more sensitive marine ecology along the north Lantau shoreline.

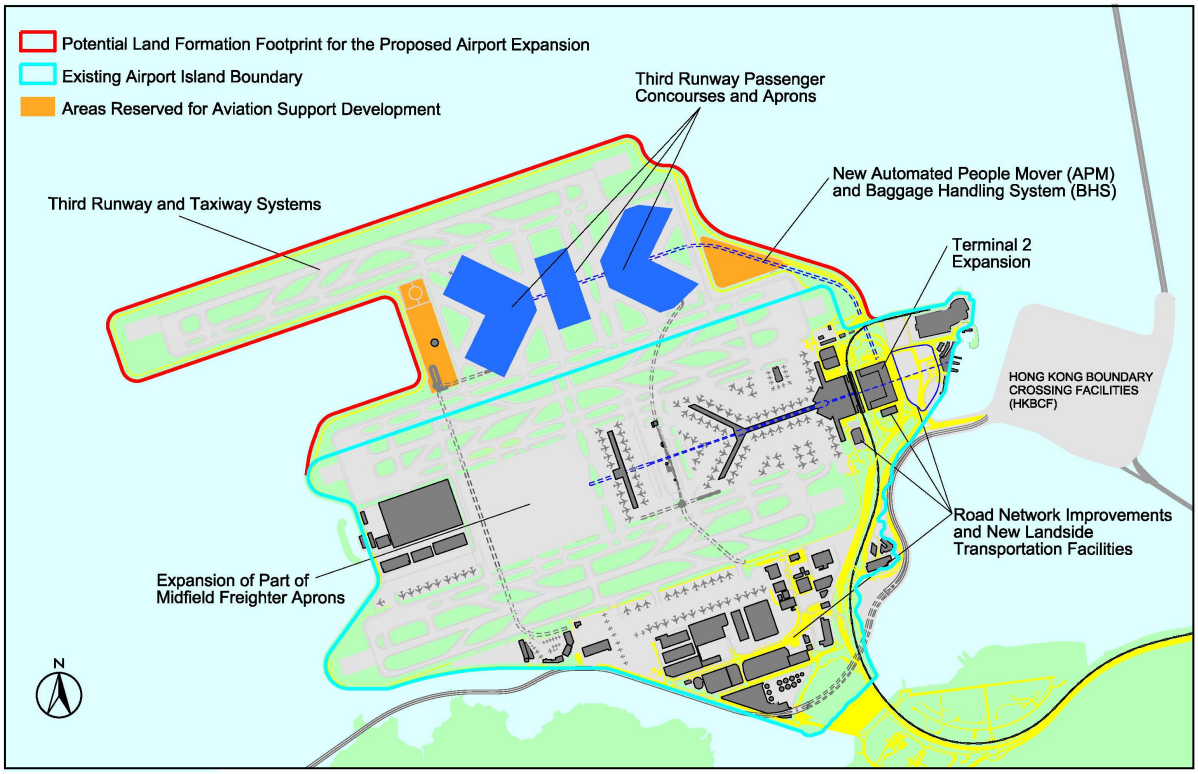
These were taken forward for further evaluation with respect to airport layout options.

1.2.3.2 Airport Layout Options

Based on the 3 shortlisted alignment options, a total of 18 subsequent airport layout options were developed to cover permutations of apron, passenger terminal and concourse expansion locations. These were evaluated against the major criteria including airfield efficiency, passenger convenience, cargo operations efficiency, surface access quality and environmental differentiators which include air quality, water quality and hydrodynamics, waste, marine ecology and Chinese White Dolphins, fisheries, noise, landscape and visual impacts. The preferred layout for three-runway system was then defined, as tentatively illustrated in **Figure 1.1**, which is subject to changes during the EIA process.

As explained in MP2030, the east-west position of the Third Parallel Runway depends on the terrain surrounding the airfield such as Tai Mo Shan and Castle Peak. Preliminary procedure design work indicates that a fully parallel alignment of the Third Runway with respect to the existing two runways' positions would provide for better integration of airport operations but would have an unacceptable climb gradient for missed approach and departure in the Runway 07 direction. As a result, the extent of westward staggering of the runway with respect to the existing North Runway's threshold position will be required as illustrated in the conceptual layout in MP2030, but the exact extent of which has to be subject to validation from further air traffic control (ATC) procedure design studies.

Figure 1.1: Tentative Layout of the Three Runway System



1.2.3.3 Refinements to Enhance Environmental Performance

The environmental performance enhancement assessment also identified several improvements that can be made to the construction methodologies in order to further reduce environmental impacts. These include the followings:

- Adoption of minimum underwater piling – based on the preliminary engineering assessments, it was identified that underwater piling is unlikely required for land formation and only a limited number of marine piles will be required for marine approach light structures, thus minimizing generation of underwater noise that may affect the Chinese White Dolphins and other marine fauna.

- Adoption of non-dredged reclamation with Vertical Drains methods – dredged reclamation has in the past been considered to be the conventional method for land formation, and this was the method that was adopted for construction of the existing airport platform. However, this method requires removal of the existing soft marine sediments, which would release substantial suspended solids and also disturb the CMP. Hence while preliminary options assessments considered the potential environmental impacts associated with dredging and disposal of sediment, considerations for further environmental enhancement has identified that non-dredge methods are available which will avoid the need for dredging during reclamation, and thus can reduce some of the environmental impacts associated with land formation. A well established non-dredge method involves placing a layer of fill over the marine mud, and using vertical wick drains to remove the retained pore water within the marine mud. This method can be adopted for reclamation of areas outside the CMPs, and offers significant environmental improvements in terms of waste generation, water quality impact and associated indirect marine ecology impact. For areas sensitive to settlement such as seawall construction it is considered conventional to carry out limited dredging beneath the seawall foundation. However, for the reasons stated above a non-dredged construction method will also be adopted for the sea wall construction.

- Adoption of non-dredged reclamation with Deep Cement Mixing method – In the area above the CMPs, the above non-dredged method is not considered to be preferable due to the potential leaching of contaminated water from the mud pits. To overcome this, a technique called Deep Cement Mixing (DCM) is proposed whereby cement is injected and mixed into columns of the soft mud below a sand capping layer to increase its strength and stiffness, allowing land formation above without the release of contaminated sediment. This method has been widely used in Japan and Asia but has not previously been implemented in Hong Kong, thus the environmental acceptability of this new technique has been tested via field trials before recommending large scale implementation. Field trial of the DCM method was undertaken in February 2012. The DCM trial included the formation of 5 clusters of twin DCM columns about 20m in length below the existing seabed in a CMP around 900m north of the Airport island. A comprehensive environmental monitoring programme was conducted before, during and after the DCM trial, which included in-situ testing of parameters such as dissolved oxygen, turbidity, pH, salinity, ammonia nitrogen and total alkalinity; laboratory testing of suspended solids, heavy metals and organics; as well as measurement of under-water noise levels. All the environmental monitoring results of the DCM trial will be reviewed and analyzed in detail in order to

support the assessment of potential environmental impacts of the proposed DCM construction method during the EIA study.

1.2.3.4 Summary of the Environmental Planning and Options Assessment Process

As demonstrated in the aforementioned sections, the consideration of environmental factors has been embedded throughout the process of master planning and options assessment, and has been a key consideration in deriving the recommended third runway option. The current recommended third runway option set out in this Project Profile is thus a result of the combined optimisation of environmental as well as engineering and other important considerations for expansion of the HKIA.

1.2.4 Public Consultation

Public consultation for the HKIA Master Plan 2030 was completed in September 2011. About 200 seminars, meetings, briefing and forums were conducted during the public consultation period. In addition, the Master Plan exhibitions attracted over 25,000 visitors. Moreover, the dedicated website and online videos recorded over 180,000 visits/views. Eventually, more than 29,000 completed questionnaires were received. Results of the public consultation, as compiled by the University of Hong Kong's Social Sciences Research Centre (SSRC), show that around 80% of the respondents to questionnaire agreed or strongly agreed that AAHK should decide urgently on HKIA's future expansion plans. Moreover, about 73% of the respondents preferred Option 2, i.e. a third runway and associated airport infrastructure and facilities to be provided to meet the projected increases in passenger and cargo traffic at HKIA for the next 20 years and possibly beyond.

1.3 Name of Project Proponent

The Airport Authority Hong Kong (AAHK)

1.4 Location and Scale of the Project

1.4.1 Site History

The proposed Airport expansion is to the north of the existing Airport island. This site has historically been part of the open waters off the northern coast of Lantau Island, with no previous land formation. However, part of the site was used for disposal of contaminated mud by the Government since early 1990s. The CMP within the site boundary have since been filled and capped. Active CMP operated by the Government exist outside the site to the east. In addition, a section of the existing submarine aviation fuel pipelines and the existing 11kV submarine cable of China Light and Power Company (CLP) lying adjacent to the fuel pipelines fall within the boundary of the Project site.

1.4.2 Project Components

Land is required to be formed to the north of the existing Airport island by reclamation to provide a platform for the development of the third runway and all associated airport infrastructure and facilities. The tentative layout of the Project is shown in **Figure 1.1**,

which will be further developed and refined. The Project involves the following key elements:

(i) Land formation of about 650 ha to the north of the existing Airport island including a portion over the CMP;

(ii) Construction of a third runway, related taxiway systems and navigation aids, and airfield facilities;

(iii) Construction of the third runway aprons and passenger concourses;

(iv) Expansion of part of the midfield freighter apron on the existing Airport island;

(v) Expansion of the existing passenger Terminal 2 (T2) on the existing Airport island;

(vi) Extension of the automated people mover (APM) from the existing Airport island to the passenger concourses of the third runway;

(vii) Extension of the baggage handling system from the existing Airport island to the aprons of the third runway;

(viii) Improvement of the road network in the passenger and cargo areas and new landside transportation facilities including new car parks on the existing Airport island;

(ix) A greywater recycling system at the proposed Airport expansion area (with a capacity of not more than 15,000m^3 per day);

(x) Necessary modifications to existing marine facilities including the underwater aviation fuel pipelines and 11kV submarine cable between HKIA and the off-airport fuel receiving facilities, sea rescue facilities and aids to navigation; and

(xi) Any other modification, reconfiguration, and/or improvement of the existing facilities on the existing Airport island as a result of the third runway.

1.5 Number and Types of Designated Projects

The existing HKIA is an exempted designated project under the Environmental Impact Assessment Ordinance (EIAO). The proposed HKIA expansion involves material changes to the exempted project under Section 9(4) of the Ordinance. An Environmental Permit is therefore required before the construction and operation of the Project. With reference to Part I of Schedule 2 to the EIAO, the designated projects to be covered as part of the proposed HKIA expansion are envisaged to include, but are not limited to:

- For the reclamation: C.1. Reclamation works more than 5 ha in size;
- For the proposed third runway and its associated facilities: B.1. An airport (including its runway and the development and activities related to aircraft maintenance, repair, fueling and fuel storage, engine testing or air cargo handling);
- For extension of the Automated People Mover (APM) to the expanded Airport region: A.2. A railway and its associated stations;

- For extension of the existing APM as well as the airside vehicular tunnels to the expanded Airport system: A.7. A road or railway tunnel more than 800m in length between portals;
- For reuse of the treated greywater: F.4. An activity for the reuse of treated sewage effluent from a treatment plant; and
- For diversion of the submarine fuel pipeline: H.2 A submarine gas pipeline or submarine oil pipeline.

1.6 Name and Telephone Number of Contact Person(s)

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2. Outline of Planning and Implementation Programme

2.1 Project Planning and Implementation

As the Project Proponent, AAHK assumes overall responsibility for the planning, design, construction and operation of the Project. Under HKIA Master Plan 2030 Study, AAHK has engaged external Consultants to review and recommend an optimal layout plan for the proposed Airport expansion, to assess the preliminary environmental impacts and engineering feasibility aspects. The Project will be carried forward to scheme design, detailed design, tender and construction supervision by Consultants, and implemented by Contractor(s) to be appointed by AAHK at a subsequent stage.

2.2 Project Programme

Having received the approval of the Government to adopt a three-runway system as the future development option for HKIA for planning purposes, the AAHK will proceed with, among other things, the statutory EIA process which will take about two years to complete. Upon completion of the work, a final decision on whether to proceed with the development of the three-runway system will be made when the relevant inputs are available. If AAHK is given the approval to proceed with the construction works, the tentative Project timetable is as follows:

Timeframe	Key Milestone
Early 2014	Expected completion of the EIA
Mid 2015	Expected commencement of major construction works
End 2022	Expected completion of the three-runway system

2.3 Interactions with Broader Programme Requirements or Other Projects

Subject to further investigation and confirmation with the relevant project proponents as part of the EIA study, potential projects that would interface with the proposed Airport expansion during its construction and/or operation phases are reviewed and identified as follows:

- Hong Kong-Zhuhai-Macao Bridge (HZMB);
- HZMB Hong Kong Link Road;
- HZMB Hong Kong Boundary Crossing Facilities;
- Tuen Mun – Chek Lap Kok Link;
- New Contaminated Mud Marine Disposal Facility at HKIA East/ East Sha Chau Area;
- Lantau Logistics Park;

- Tung Chung East and West Future Development;
- Development of the Integrated Waste Management Facilities Phase 1; and
- Sludge Treatment Facilities.

In addition to the aforementioned projects, a section of the existing submarine aviation fuel pipelines fall within the boundary of the Project area. This would be re-routed for implementation of the Project. An existing 11kV submarine cable of CLP lying adjacent to the submarine fuel pipelines would also require diversion.

Potential cumulative environmental impacts of the Project, through interaction or in combination with the above projects will be considered as part of the EIA study.

3. Possible Impact on the Environment

3.1 Outline of Process Involved

The major elements that will be constructed and/or operated as part of this proposed Expansion of HKIA are the following:

- Reclamation
- Airfield & Apron works
- Passenger Terminal and Concourse buildings
- Automated people mover
- Baggage handling system
- Vehicular and APM/Baggage tunnels
- Airport access and infrastructure

For the reclamation works, the use of Deep Cement Mixing (DCM) is proposed for the area over the contaminated mud pits (CMP) to prevent the potential of leakage of contaminants from the CMP and eliminate the need for dredging works especially within the CMP area, in order to avoid and/or minimise environmental impacts from reclamation activities. For non-CMP area, DCM will be considered to apply underneath the runway and conventional vertical drains will be used for the remaining areas. A non-dredged method will also be adopted for seawalls construction.

3.2 Existing Available Data

AAHK engaged various consultants to undertake a number of preliminary studies to assess the demand for, and various options relating to, expansion of the Airport, and to conduct preliminary environmental appraisals covering air quality, hazard to life, noise, water pollution, waste management and CMP, marine and terrestrial ecology, Chinese White Dolphins, fisheries, landscape and visual and cultural heritage. The studies include:

- Preliminary Engineering Feasibility and Environmental Assessment – Comparative Environmental Assessment (Mott MacDonald);
- Preliminary Aircraft Noise Impact Analysis – Final Noise Contour Report (URS Corporation); and
- Preliminary Air Quality Impact Analysis – Final Report (Arup).

The Agriculture, Fisheries and Conservation Department have conducted studies on marine ecology in the region, which provide various databases of information, for example the Port Survey 2006 on fisheries; the Consultancy Study on Marine Benthic Communities in Hong Kong; and Monitoring of Marine Mammals in Hong Kong waters for

Chinese White Dolphin abundance and distribution. This information will be used in the evaluation of possible environmental impacts associated with this Project.

Studies undertaken for the Hong Kong – Zhuhai – Macao Bridge projects as well as other EIA projects in the vicinity are also available for reference.

3.3 Possible Environmental Impacts

Potential impacts on the environment during the construction and operation phases of the Project have been identified based on a preliminary environmental assessment exercise and are summarised below.

3.3.1 Air Quality

3.3.1.1 Construction Phase

Construction dust could be generated from construction activities such as land formation, filling, material handling and hauling during land formation, movement of construction traffic over reclaimed land, and wind erosion from the site after reclamation works. Concrete batching plants; bituminous surfacing materials production facilities and/or similar facilities may also be needed subject to detailed design and construction requirements. If uncontrolled, the extent of construction dust impacts resulting from wind erosion and construction vehicle movements on the unpaved reclaimed land could potentially be significant due to the large area involved in the Airport expansion works. There would also be air pollutant emissions from operation of construction plant, vehicles and barges.

Cumulative impacts from other potential concurrent projects in the vicinity would also be considered.

3.3.1.2 Operation Phase

During the operation phase, airport emission sources include aircraft engines, auxiliary power units (APUs, on-board generators), ground support equipment (GSE), Government flying services, aviation fuel tank farm, fire training activities, engine run-up testing, aircraft maintenance centre, catering, and vehicular emissions.

Under the proposed Airport expansion option there would be potential increase in air pollutants generated from airport operations due to an increase in carrying capacity and the subsequent phased increase in aircraft movements. The key air pollutants generated include carbon monoxide (CO), nitrogen oxide (NO_x), sulphur oxide (SO_x), hydrocarbons (HCs), volatile organic compounds (VOCs) and particulates. Increased aircraft movements would potentially contribute to air pollution because of NO_x emissions from aircraft during landing and take-off, but future aircraft are expected to be cleaner and more efficient with less emission. According to a review by the International Civil Aviation Organisation's Committee on Aviation Environmental Protection, it is anticipated that in the midterm future, all aircraft produced will meet a considerable reduction from the current standards set in 2004 for NO_x emission.

There will be an interim phase that the existing North Runway will be closed to allow for tunnelling and modification works to be carried out while the third runway will be open for interim operation, hence potentially resulting in temporary changes to aircraft movements at HKIA. The potential air quality impacts associated with this interim phase arrangement as well as full operation of the three-runway system will be addressed in the EIA.

Increased vehicular traffic emissions will be induced by expanded operation of the Airport. The airport emission inventory and dispersion modelling exercise at maximum operating conditions of the Project will be conducted in a manner that adhere fully to the clear Environmental Protection Department (EPD) guidance on acceptable methodologies and modelling tools. The potential cumulative emissions from nearby infrastructure projects will also be considered.

The Project Proponent supports the proposed new air quality objectives (AQOs) and package of air quality improvement measures announced by the Government on 17th January 2012. Notwithstanding the prevailing statutory requirements, the Project Proponent will adopt the proposed new AQOs, which are expected to come into effect in 2014, as the benchmark for conducting the air quality impact assessment under the EIA study.

3.3.2 Noise

3.3.2.1 Construction Phase

Airborne noise would be generated from construction activities such as land formation, infrastructure works and operation of powered mechanical equipment (PME). In addition to noise from operation of powered mechanical equipment, noise would also be generated from traffic, especially heavy vehicles, onsite and along access roads.

Potential cumulative noise impact from other potential concurrent projects nearby would also be considered.

3.3.2.2 Operation Phase

Aircraft Noise

The main potential noise impact created under the operation phase of the Project, and one that is of most concern to local residents is aircraft noise. Aircraft movements at HKIA would certainly increase due to the operation of the three-runway system. As mentioned in **Section 3.3.1.2**, there will be potential temporary changes in aircraft movements at HKIA during the interim phase, in which the existing North Runway will be closed while the third runway will be open for interim operation. The EIA will address the potential noise impacts during both the interim phase and full operation of the three-runway system.

Aircraft noise evaluation is conducted in accordance with guidelines established by the International Civil Aviation Organisation (ICAO) and the US Federal Aviation Administration (FAA). The FAA's Integrated Noise Model is an internationally accepted tool for assessing airport noise exposure, which is used to generate Noise Exposure Forecast (NEF) contours around the airport and its flight paths.

NEF is a tool for land use planning, primarily used to define areas where the construction of certain types of building is “acceptable” or “unacceptable”. Contours are defined for 25, 30 and 40 NEF levels. According to the Hong Kong Planning Standards and Guidelines, all land uses are considered acceptable if they fall outside the NEF 25 contour.

Preliminary Aircraft Noise Impact Analysis in MP2030 indicated potential expansion of NEF 25 contour northward over waters only, without newly covering any additional residential areas. Nevertheless, the NEF associated with the proposed three-runway system will be updated for further assessment of noise impact.

Fixed Plant, Ground Support Equipment and Auxiliary Power Unit

New facility infrastructure is required in the Project. Ventilation systems and chiller plants would be provided in these facilities. The openings of the ventilation shafts and the chiller plants would be the major sources of fixed plant noise during operation. The daily activities of the GSE, i.e. various kinds of trucks, tractors and loaders in the expansion area would also generate noise during the operation phase.

The Ancillary Power Units (APUs) are on-board generators on aircraft providing electrical power when the main engines are shut down. The APUs are often turned on when the aircraft is at passenger/cargo stands during loading/unloading. The operation of the APUs is another noise source during the operation phase.

3.3.3 Water Quality and Hydrodynamics

3.3.3.1 Construction Phase

Potential Impact from land formation works

During the construction period required for land formation works there would be a potential increase in suspended solids concentration at Water Sensitive Receivers (WSR) near the Project site and within the North Western Water Control Zone. One of the main water quality concerns is the potential release of sediment fines, including potentially contaminated mud and interstitial waters from the CMP.

The materials to be used for land formation will mainly consist of marine sand, public fill and rock fill. While dredging activities will be avoided for the land formation, other construction activities adjacent to and in the water may potentially cause sediment suspension into the water column, with possible consequence of reducing dissolved oxygen level and increasing nutrient levels, which could affect ecologically sensitive receivers.

Suspended sediment could be transported by water currents to form sediment plumes, which would gradually resettle. The impact from sediment plumes could potentially cause water quality impact and non-compliance of the Water Quality Objective (WQO) at specific WSRs. The WQO of suspended solids is defined as not allowing an elevation of 30% above the background caused by human activity. Therefore, the extent of elevation of ambient suspended solids concentrations would determine if the impact is considered adverse or not. In addition, the extent of impacts to the WSRs depends heavily on the relative location of the sensitive receivers to the source of water pollution.

Potential Impact from other construction works

Potential impacts on water quality could also result from other land-based construction works, such as construction runoff and sewage generated by the construction workforce. Surface runoff from construction site may contain considerable loads of suspended solids and contaminants discharged into the storm drains or natural drainage. Accumulation of solid and liquid waste such as packaging material, construction materials, sewage effluent from the construction workforce, and spillage of oil, diesel or solvents by vessels and vehicles involved with the construction, if uncontrolled, could lead to deterioration in water quality.

3.3.3.2 Operation Phase

The potential impacts on water quality during the operation phase may be divided into three broad areas:

- The potential marine water quality impacts due to changes in hydrodynamic patterns as a result of the reclamation and land formation;
- The potential impacts to tidal currents and wave propagation that could cause changes to sediment transport and deposition patterns; and
- The potential water quality impacts due to wastewater discharges (sewage effluent and stormwater) from the operation of the Airport expansion facility and the associated infrastructure.

Impacts on the hydrodynamic regime surrounding the Airport could be resulted from reclamation due to altered tidal flow. Any changes in tidal flow would be important as they would indicate changes in the flushing capacity of the affected region, which could in turn affect water quality. The new land formed may potentially introduce areas that are subject to poor or inadequate flushing capacity, which subsequently may result in deterioration of water quality over a long period of time.

If there are changes in tidal flow, there may be potential impacts on sediment/erosion patterns on the sea bed. If increase in sediment deposition is excessive, there may be changes in flushing capacity at the existing airport channel by reducing the water depth.

Potential impacts on water quality may include surface runoff and accidental chemical spillage, but these are expected to be minor and insignificant. The added facilities in the Airport expansion area would generate wastewater, primarily in the form of sewage effluent or washdown waters. The increase in impermeable surfaces due to the added facilities and infrastructure will result in increased stormwater run-off. The stormwater may contain pollutants, such as fine sediments, organic compounds and oils/greases that could potentially affect water quality in the receiving waters. These impacts may be cumulative with other concurrent projects in the vicinity. It will, therefore, be necessary to specify suitable measures in the design of the stormwater system as per the current legislation and requirements to minimize the potential for such cumulative impacts.

3.3.4 Marine Ecology

3.3.4.1 Construction Phase

During construction phase of the Project, potential impacts on marine ecology may include direct impact and indirect disturbance on marine wildlife at the proposed site and off-site area. For direct impact on marine ecology, benthic habitat at the proposed works area would be gradually lost during land formation works. A significant part of the benthic habitat has been subject to substantial disturbance from the construction and operation of CMP and formed by recolonization after capping of CMP, while other parts has been subject to disturbance from other major projects in the past. The ecological value of the benthic habitat is subject to further ecological survey.

Marine works such as land formation and filling would possibly generate increased level of suspended solids, generation of sediment plume, re-deposition of sediment and subsequent deterioration of water quality which might indirectly cause disturbance impact on marine habitat and wildlife. Of particular concern is the potential impact on Chinese White Dolphins (CWD) as their habitat range also covers the area of the proposed reclamation. Any sediment plume generated would potentially disturb marine invertebrates inhabiting the sediment, food supply for fish and subsequently the feeding opportunities for CWD. Accidental chemical spillage to the surrounding waters during offshore and coastal construction may also have potential impacts on the nearby marine ecology.

Other potential indirect impacts on CWD and their calves caused by the construction works would be underwater noise and increase in marine traffic. Underwater noise generated from a limited number of marine piling, motors of construction vessels and activities might disturb CWDs' feeding and socializing activities as dolphins rely on echolocation for hunting, communication and navigation. Construction vessels may also increase the marine traffic surrounding the Airport, and this might be a hazard to CWDs due to an increase in the risk of being hit by vessel traffic.

3.3.4.2 Operation Phase

Reclamation required for the Project would lead to permanent change in hydrodynamics flow and reduction of marine benthic habitat, areas used by CWD and other marine fishes. Nevertheless, a significant part of the sea bed area within the Project site has been subject to substantial disturbance as a result of the CMP project and other major developments in the past, while previous studies have identified that the marine benthos inhabiting this area are of low ecological importance. The potential impact on temporary reduction of intertidal and sub-tidal habitats on the existing Airport island would unlikely be significant as these habitats could be readily recreated by recolonization around the new land mass. Nevertheless, such habitats are subject to further ecological survey and evaluation during the EIA.

The possible operation phase impacts on CWD would include the reduction of available feeding grounds due to the reclaimed land formed, and potential encroachment into CWD travelling "corridors" between known areas of higher dolphin abundance.

3.3.5 Fisheries

3.3.5.1 Construction Phase

Possible increase in suspended solids concentration and deterioration of water quality as well as potential accidental chemical spillage may cause disturbance to fisheries production and fishing operations in the region. These may eventually lead to loss in fisheries value due to construction of the Project.

The construction of the proposed development will lead to an increase in human activities in the open sea at the northern and western Lantau waters. The increase in construction vessels and marine traffic around the original migratory route of the fishes may cause a change in their route and behaviour.

3.3.5.2 Operation Phase

The proposed reclamation and marine exclusion zone of the third runway would lead to direct loss of marine area of fish spawning and nursery grounds which may affect fisheries' resources and fishing operations within the Project area and in adjacent waters. The overall fisheries production may be reduced due to potential loss of fisheries resource at the northern and western Lantau waters and change in hydrodynamics flow that influence the abundance of the marine fish and/or spawning ground.

The potential impact on the recovery of the marine ecosystem and the development of sustainable fisheries in the wake of the forthcoming trawling ban and ban on commercial fishing in Marine Parks will also be considered.

3.3.6 Waste Management

3.3.6.1 Construction Phase

Potential waste management implications during the construction phase will be from generation, handling and disposal of waste. The construction phase of the Project will generate a variety of wastes that can be divided into distinct categories based on their composition and ultimate methods of disposal. The identified waste types include:

- Construction and demolition (C&D) materials;
- Marine sediment;
- Chemical waste; and
- General refuse.

Construction and demolition (C&D) materials

C&D materials would arise from demolition of existing seawalls and generated as excess fill materials and other construction materials.

Marine sediment

Some marine sediment may be generated from the construction activities such as piling works. Disposal of sediment via dumping at sea will require permits under the Dumping at Sea Ordinance (DASO).

Chemical waste

The maintenance and servicing of construction plant and equipment may generate some chemical wastes such as cleaning fluids, solvents, lubrication oil and fuel. Maintenance of vehicles may also involve the use of a variety of chemicals, oil and lubricants. It is difficult to quantify the amount of chemical waste that will arise from the construction activities since it will be dependent on the Contractor's on-site maintenance requirements and the amount of plant utilised.

Chemical wastes arising during the construction phase may pose environmental, health and safety hazards if not stored and disposed of in an appropriate manner as stipulated in the Waste Disposal (Chemical Waste) (General) Regulation. The potential hazards include:

- Toxic effects to workers;
- Adverse impacts on water quality from spills and associated adverse impacts on marine biota; and
- Fire hazards.

General refuse

The construction workforce will generate refuse comprising food scraps, waste paper, empty containers, etc.

3.3.6.2 Operation Phase

Waste produced during the operation of the three-runway system will mainly comprise commercial and industrial waste. Commercial waste could be generated from areas such as offices, restaurants, retail areas and other facilities. Industrial waste including paint, solvent and raw material could be generated from maintenance and renovation activities.

3.3.7 Landscape and Visual

3.3.7.1 Construction Phase

Potential landscape impact during the construction phase will be mainly on the water landscape to the north and west of the existing Airport due to the change in landscape resource associated with reclamation works. The construction works would potentially cause visual disturbance to Visual Sensitive Receivers (VSRs). The level of visual impact would depend on a number of factors including scale of the construction activities, duration, the degree of visibility and the viewing distance between the proposed construction works and the VSRs. There may also be cumulative visual impacts due to concurrent construction activities, particularly for the Hong Kong-Zhuhai-Macao Bridge

projects (Hong Kong Boundary Crossing Facilities and Hong Kong Link Road), Tuen Mun-Chek Lap Kok Link and the Tung Chung East and West Future Developments.

3.3.7.2 Operation Phase

The potential landscape and visual impact from the new land mass and infrastructure would be permanent and irreversible. However, the only landscape resource that will be directly impacted is open waters.

3.3.8 Cultural Heritage

3.3.8.1 Construction Phase

The existing Airport is located on a reclaimed island where no built heritage is found. Potential impact from construction activities on built heritage is unlikely as there would be no physical encroachment or interference with any known cultural heritage areas.

Marine archaeological deposit, if present, within the Project area would be affected by the proposed reclamation. However, as the area has already been disturbed by previous development, substantial archaeological remnants are unlikely.

3.3.8.2 Operation Phase

No cultural heritage issue is anticipated during the operation phase of the Project.

3.3.9 Hazard to Life

3.3.9.1 Construction Phase

None of the facilities at the existing Airport are classified as Potentially Hazardous Installation (PHI). In addition, no blasting activities are envisaged during the construction phase and the diversion of the existing submarine pipeline will adhere to the relevant legislative health and safety requirements. Therefore, construction of the Project is unlikely to pose significant safety issues of concern.

3.3.9.2 Operation Phase

It is not anticipated that bulk storage of aviation fuel would be required at the proposed expansion area. Besides, the proposed expansion area is also located away from the existing fuel tank on the Airport island. No significant issues are expected accordingly to Hong Kong risk guidelines. Therefore, operation of the Project is unlikely to bring any adverse effect in terms of hazard to life.

4. Major Elements of the Surrounding Environment

The major existing and planned sensitive receivers and sensitive parts of the natural environment which might be affected by the implementation of the Project are identified during the preliminary environmental assessment and outlined in this section.

4.1 Air Quality

4.1.1 Air Sensitive Receivers

Potential existing air sensitive receivers (ASRs) identified are detailed in **Table 4.1**.

Table 4.1: Summary of existing potential ASRs identified at preliminary stage

Potential ASRs	Use
East of Airport island	
HKIA Passenger Terminals 1 and 2	Administration/ Commercial
HKIA Tower	Office
Regal Airport Hotel and Mariott Hotel	Hotel
AsiaWorld-Expo	Commercial
South of Airport island	
Catering services buildings	Factory
CNAC, Dragonair Towers, CAD Headquarters Buildings	Office
Cathay Pacific Buildings	Office and crew-hotel
North Lantau	
Sha Lo Wan Village	Residential
San Shek Wan Village	Residential
Tin Sum (west of Tung Chung Bay)	Residential
Tung Chung New Town	Residential

Potential planned ASRs include:

- Planned air sensitive uses (e.g. offices, hotel and passenger terminal building retail areas) at the Midfield, North Commercial District and Airport expansion area; and
- Planned air sensitive uses at the area for the remaining development of Tung Chung.

4.1.2 Existing Air Pollution Sources

Currently, the main stationary sources of air pollutant emissions in the vicinity of the existing Airport island include the CLP power plant at Castle Peak, the EcoPark at Tuen Mun Area 38, and various stationary facilities on the existing Airport island itself such as auxiliary power units (APU), engine testing, fire training, catering etc. Industrial emissions are governed and regulated by their Specified Process Licence (SPL), which limits the allowable emission of certain air pollutants. The power plant at Castle Peak is also subject to emissions capping and other emissions reduction measures.

The main mobile sources of air pollutant emissions include vehicular traffic emissions from roads along Airport island and around Tung Chung, marine traffic emissions and aircraft emissions.

4.2 Noise

4.2.1 Noise Sensitive Receivers

During the construction phase, the existing noise sensitive receivers (NSRs) in the vicinity of the Project site are summarised in **Table 4.2**. These NSRs are of interest in the assessment of potential noise impact from operation of PME.

Table 4.2: Summary of the existing NSRs

NSR	Use
Sha Lo Wan Village	Residential
San Shek Wan Village	Residential
San Tau Village	Residential
Tin Sum (west of Tung Chung Bay)	Residential
Tung Chung New Town	Residential

Planned NSRs are the noise sensitive land uses at the area for the remaining development of Tung Chung.

Given the large site area involved, numerous PME and heavy vehicle would be required for the construction work. However, it is unlikely to result in any insurmountable construction noise impact since the nearest NSRs are situated at more than 400m from the site.

During the operation phase regarding the potential noise impact from operation of ground-based fixed plant and equipment, premises such as offices and hotels which are located on the Airport island would be closest to these noise sources. However, as these premises are air-conditioned at all times, they are not considered as NSRs in accordance with the Technical Memorandum issued under section 16 of the Environmental Impact Assessment Ordinance (EIAO-TM).

With regard to aircraft noise, preliminary projection in MP2030 shows that Sha Lo Wan village is the only NSR falling within the NEF25 contour of the three-runway system at design capacity, as was the case with the 1998 published NEF25 contour for the two-runway system at design capacity. Nevertheless, more detailed aircraft noise impact assessment will be carried out according to the statutory EIA process.

4.3 Water Quality

4.3.1 Water Sensitive Receivers

This Project lies within the North Western Water Control Zone (WCZ). Potential water sensitive receivers (WSR) include:

- Gazetted and non-gazetted beaches in Tuen Mun;

- Seawater and cooling water intakes at HKIA, Tung Chung and Tuen Mun;
- Chinese White Dolphins and their habitats;
- Sha Chau and Lung Kwu Chau Marine Park;
- Fish Culture Zones;
- Tai Ho Stream and San Tau Beach Site of Special Scientific Interest (SSSI); and
- Other ecological sensitive receivers, including mangroves, seagrass and horseshoe crab nursery sites.

4.3.2 Existing Potential Water Pollution Sources

A number of point sources occur within the North Western WCZ, which includes sewage outfalls from Pillar Point, Northwest New Territories and Siu Ho Wan as well as cooling water discharges from Castle Peak Power Station, Shiu Wing Steelworks, and existing facilities on HKIA.

Diffuse sources include past dredging operations, operation of the CMP and commercial trawling activities. Part of the proposed reclamation area (approximately 40%) for the Project lies over the existing (capped) CMP. Active CMP are located to the east of the proposed reclamation area. The waters surrounding the existing Airport island is also located near the mouth of the Pearl River Estuary, which is likely to heavily influence the water quality in this area particularly during the wet season when the flow from the estuary is at its peak.

4.4 Marine Ecology

4.4.1 Ecological Sensitive Receivers

Potential ecological sensitive receivers include:

- Chinese White Dolphins and their habitats;
- Marine benthic communities;
- Intertidal habitats (seagrass beds, mangroves, mudflats, sandy shores and artificial seawalls);
- Sha Chau and Lung Kwu Chau Marine Park;
- Tai Ho Stream and San Tau Beach SSSI;
- Horseshoe crab nursery and breeding grounds;
- Coral communities (identified to the east of the existing Airport); and
- Artificial reefs in Hong Kong International Airport Approach Area (HKIAAA) and inside Sha Chau and Lung Kwu Chau Marine Park.

4.4.2 Summary of Existing Ecology of the Site

The marine ecological resources in the vicinity of the existing Airport island include soft-bottom marine benthos, hard-bottom marine benthos (corals), intertidal habitats (seagrass bed, mangroves, mudflat, sandy shores and artificial seawalls), the open sea and the associated wildlife.

4.4.3 Chinese White Dolphins

The results of CWD monitoring in Hong Kong waters by Agriculture, Fisheries and Conservation Department (AFCD) reported that 344 groups of CWDs were sighted, numbering 1,109 individuals, during the study period from April 2007 to April 2008 through systematic line-transect vessel surveys. CWDs were found widely distributed throughout Northwest Lantau, Northeast Lantau, West Lantau and Southwest Lantau, while they were rarely observed in Deep Bay, Southeast Lantau and Lamma areas. Dolphin sightings were concentrated in the waters east of Lung Kwu Chau, between Lung Kwu Chau and Black Point, near Pak Chau, around the Brothers Islands and throughout the West Lantau especially along the stretch of waters between Tai O Peninsula and Kai Kung Shan. On the contrary, dolphins generally avoided the waters off Castle Peak Bay, Lung Kwu Tan, North of the Chek Lap Kok Airport platform and the eastern end of Northeast Lantau.

Areas with frequent encounters of dolphin groups engaged in feeding activities included along the coast of West Lantau near Tai O Peninsula, Peaked Hill and Fan Lau, east of Lung Kwu Chau, at Kau Ling Chung and between the Soko Islands. All these areas could be considered important feeding areas for CWDs in Hong Kong. Areas considered to be important socializing areas for CWDs in Hong Kong include Sham Shui Kok, east of Lung Kwu Chau and north of Tai O Peninsula. Areas considered important nursery area for newborn calves include Lung Kwu Chau, near Tai O, near Peaked Hill and around the tip of Fan Lau. Areas considered important for older calves include areas just north of Tai O Peninsula, near Peaked Hill and Fan Lau, with other frequent occurrences of older calves found at east of Lung Kwu Chau, near Black Point, Tap Shek Kok and Sham Shui Kok in North Lantau, and east of Fan Lau, near Kau Ling Chung and around Soko Islands in Southwest Lantau.

4.5 Fisheries

4.5.1 Location of Sensitive Receivers

Potential sensitive receivers of fisheries impact include:

- Ma Wan Fish Culture Zone;
- Capture fisheries in the North Western Water Control Zone;
- Spawning and nursery grounds of commercial fisheries in the North Lantau Waters; and
- Artificial Reefs in HKIAAA and inside Sha Chau and Lung Kwu Chau Marine Park.

4.5.2 Existing Fisheries Resources and Fishing Operations

Fishing vessels operated in the proposed landform area include the shrimp trawler, hang trawler, sampan, gill netter and purse seiner. Hang trawler is the dominant vessels operating in the north of Chek Lap Kok, northwestern Lantau and Sha Chau and Lung Kwu Chau Marine Park. Major species of fish catch in the northern Chek Lap Kok are Croaker, Shrimp and Anchovy. Rabbitfish is the dominant species in the northwestern Lantau water and around Ma Wan, other fish species like Croaker, Scad, Shrimp, Anchovy, Crabs and Mullet are also common in the surrounding waters.

Aside from direct fisheries resources, the artificial reefs at HKIAAA and at Sha Chau and Lung Kwu Chau Marine Park are considered to be a form of fisheries resource enhancement measures as they provide habitat and marine resources, thus they are also a fisheries sensitive receiver.

4.6 Landscape and Visual

4.6.1 Sensitive Landscape Areas

The landscape resources surrounding HKIA is mainly comprised of open waters, developed/open areas, roads, artificial seawall and rocky coastline. Potential sensitive landscape areas include:

- Inshore water landscape to the north and east of HKIA; and
- Offshore water landscape to the west of HKIA.

4.6.2 Visual Sensitive Receivers

Potential visual sensitive receivers include:

- Residents of Tung Chung Town, including Yat Tung Estate, Fu Tung Estate, Tung Chung Crescent, Seaview Crescent, Coastal Skyline and Caribbean Coast;
- Sha Lo Wan Village;
- San Shek Wan Village;
- Tin Sum (West of Tung Chung Bay);
- People in Passenger Terminals;
- Visitors of Lantau North Country Park, Ngong Ping 360 Cable Car and other tourist attractions in the area; and
- Residents of Tuen Mun Butterfly Beach waterfront, including Melody Garden, Richland Garden, Pierhead Garden, Miami Beach and Marina Garden.

4.7 Cultural Heritage

4.7.1 Archaeology

Existing archaeological sites in the vicinity of the HKIA include:

- Ha Law Wan Archaeological Site on Chek Lap Kok;
- Lung Kwu Chau Archaeological Site on Lung Kwu Chau Island; and
- Sha Chau Archaeological Site on Sha Chau Island

There are no known specified sites of marine archaeology in the vicinity of the HKIA.

4.7.2 Built Heritage

There are no built heritages located within 500m of the Project.

5. Environmental Mitigation Measures

Subject to detailed assessment during the EIA study, broad mitigation measures for minimizing the potential environmental impacts during the construction and operation phases of the Project are indicated below.

5.1 Air Quality

5.1.1 Construction Phase

Notwithstanding the possible impact on air quality as mentioned in **Section 3.3.1**, provisions of dust control measures specified in Air Pollution Control (Construction Dust) Regulation, as well as Environmental Monitoring & Audit (EM&A) requirements and other relevant guidance such as the Guidance Note on Best Practicable Means for Cement Works (Concrete Batching Plant) and/or the Guidance Note on Best Practicable Means for Tar and Bitumen Works (Asphaltic Concrete Plants) issued by EPD (if an on-site concrete batching plant; bituminous surfacing materials production facilities and/or similar facilities are used), will be required for this Project. The effectiveness of these dust control measures have been well demonstrated in previous projects. Similarly for this Project, contractors shall adopt the mitigation measures established through the EIA process. Mitigation measures include but not limited to the following:

- Regular watering to suppress dust from unpaved areas, excavation, fill materials handling, active cuts and activities where dust emissions may be generated.
- Stockpiles or debris to be adequately sheltered or covered or watered.
- Ensuring minimum drop heights, maximum cover or moistening for materials transfer, loading or unloading.
- Implementation of wheel washing facilities at access roads into and out of construction sites.
- Covering of any dusty materials on vehicles leaving the sites.
- Speed control of vehicles on-site.

Emissions from operation of construction plant, vehicles and barges are temporary and will be controlled under the Air Pollution Control (Smoke) Regulations and Air Pollution Control (Motor Vehicle Fuel) Regulation. With the mitigation measures in place, the potential air quality impact on ASRs can be suppressed and compliance will be monitored as part of EM&A requirements.

5.1.2 Operation Phase

Subject to investigation, the following measures will be considered to minimise the air quality impacts during operational period on nearby air sensitive receivers:

- Locating fresh air intakes away from ground service equipment (GSE) or ancillary power unit (APU); and

- Promoting the use of electric, hybrid and liquefied petroleum gas-powered vehicles at HKIA and taking into account of future technological improvement trends of airframe/engine to reduce aircraft emissions, such as, use of alternative bio-fuels, engine efficiency gains and fuel conservation measures.

5.2 Noise

5.2.1 Construction Phase

Potential construction noise impact on NSRs can be minimised by, for example, taking into account the potential noise concern in planning the construction programme and schedule, adopting quieter powered mechanical equipment and erecting purpose-built noise barriers. Given the separation distance between the Project site and nearby NSRs, it is envisaged that potential construction noise can be adequately reduced to acceptable levels.

Subject to further studies, noise control measures to be implemented during the construction phase may include:

- Selection of appropriate plant, equipment and working methods.
- Use of silencers on construction equipment.
- Limiting the use and number of equipment operating close to the sensitive receivers.
- Use of temporary noise barriers to screen off construction equipment from the sensitive receivers.

The above control measures will be considered during the construction period to minimize any potential construction noise impact.

5.2.2 Operation Phase

Aircraft Noise

The Project Proponent would pursue a Balanced Approach to mitigate Aircraft Noise Impact in line with the specific guidance developed by ICAO. The Balanced Approach consists of identifying the noise problem at an airport and then analysing the various measures available to reduce noise using four principal elements, namely:

- Reduction of aircraft noise at source;
- Land-use planning and management;
- Noise abatement operational procedures; and
- Aircraft operating restrictions.

The goal is to address the local noise problem in the most cost-effective manner, on the understanding that the solutions need to be tailored to the specific characteristics of the airport concerned. The Balanced Approach calls for the reconciliation, as far as

practicable, of two opposite parameters: on the one hand, noise mitigation measures have to meet local requirements that can vary from one airport to another and on the other hand, the selected measures have to be universal enough to satisfy the global requirements of airlines and manufacturers who cannot modify their services or products beyond certain limits.

Fixed Plant, Ground Support Equipment and Auxiliary Power Unit

Potential noise impact from operation of fixed plant, GSE and APU is unlikely to be significant due to distance attenuation and can be largely addressed by locating and orienting noise sources away from NSRs. Nevertheless, a number of additional specific measures can be implemented to mitigate adverse noise impact, including the installation of silencers, mufflers or acoustic shields on noisy plants and equipments to further reduce noise emission where necessary.

5.3 Water Quality

5.3.1 Construction Phase

Alternative methodologies for land formation (as described in **Section 1.2.3.3**) were considered in the early planning stages for this Project, and non-dredge methods as well as a specific non-drain method have been proposed for land formation over the CMP to prevent contained pollutants or interstitial water from being released to the surrounding waters. Specifically, the well established non-dredge method using vertical wick drains has been recommended for use in reclamation outside the CMP, while the deep cement mixing (DCM) method would be adopted for reclamation within the CMP.

By adopting non-dredged methods and DCM for site formation works, the possible water quality impacts due to elevation in suspended solids level has already been reduced.

In general, mitigation measures for the marine works required for the reclamation may include:

- Adopt best practices for minimising sediment release and generation of sediment plumes during marine-based construction activities; and
- Provide silt curtains around construction plant and filling activities, if necessary.

Potential water quality impact from land-based activities would be readily mitigated through adopting good site practices as recommended in the Practice Note for Professional Persons on Construction Site Drainage (ProPECC PN1/94) and “Recommended Pollution Control Clauses for Construction Contracts” issued by EPD.

Mitigation measures for water quality impacts arising from soil and contaminants run-off from exposed surfaces or equipment and workforce sewage may include providing suitable wastewater collection, treatment and disposal facilities. Measures would also be adopted to minimize sediment re-suspension and sediment transport. Runoff generated within the construction site will be collected and treated prior to discharge.

5.3.2 Operation Phase

During the operation phase, there may be water quality impact due to accidental chemical spills, and oil and grease contamination of stormwater runoff. However, with good housekeeping and maintenance of airport facilities, and effective implementation of a contingency plan for accidental chemical spillage, it is anticipated that the potential impact will be insignificant.

Sewage generated from operation of the Airport expansion area will be connected to the existing sewerage network for proper discharge. However, treated greywater from the Airport expansion area will be reused for irrigation. If the sewerage system is found to be inadequate in capacity to cater for the additional flows, upgrading measures to increase capacity will be devised.

Stormwater will be diverted to appropriate treatment facilities before discharging to the stormwater drainage system. It will, therefore, be necessary to specify suitable measures (e.g. silt traps and oil interceptors) in the design of the stormwater system as per the current legislation and requirements to minimize the potential for stormwater impacts.

5.4 Marine Ecology and Fisheries

5.4.1 Construction Phase

Planning of mitigation measures for ecology and fisheries shall be in the priority of:

- Avoidance;
- Minimisation; and
- Compensation.

Compared to other construction methods, the adoption of DCM method for construction over CMP area and non-dredge method using vertical wick drains over the remaining area will largely avoid potential adverse impact on water quality and the associated marine ecology and fishery resources due to site formation and reclamation.

As described in **Section 5.3**, water pollution control measures will be implemented to minimise sediment release and generation of sediment plumes. These measures will also minimise the associated impacts on marine wildlife and fishery resources.

The disturbance impacts to migratory route and behaviour of fishes due to the increase in human activities and marine traffic during construction phase could be mitigated by confining the work area and speed of construction vessels.

For potential impacts on CWD, additional measures can be implemented during construction phase to mitigate the possible noise disturbance and other impacts. Generation of underwater noise will be minimised by adopting construction technologies with low underwater noise (e.g. DCM) for site formation/ reclamation and avoiding the use percussive piling. In addition, a range of mitigation measures in relatively standard use, such as dolphin exclusion zone, dolphin monitoring, silt curtains and bubble curtains

will be recommended where necessary for land formation and construction works. They are outlined as follows:

- Dolphin Exclusion Zone: A monitored exclusion zone with a diameter of up to several hundred meters can be set up around marine works area for reducing chances of any adverse impact on dolphins. The exclusion zone will be closely monitored in such a way that if dolphins are observed, marine works will be delayed until dolphins have left the exclusion zone.

- Dolphin Monitoring: Monitoring the density and behaviour of CWDs before, during and after the period of marine construction works will be recommended. This will help check if other mitigation measures implemented have been effective in minimizing disturbance to CWDs and spot-check any behavioural change in CWDs.

- Silt Curtains: To avoid the spread of suspended solids which will be re-suspended back into the water column during marine works, silt curtains can be used around work areas or locally around the operating equipment wherever necessary.

- Bubble Curtains: Based on the preliminary engineering assessments, it was identified that underwater piling would not be required for land formation and only a limited number of marine piles will be required for marine approach light structures. It will thus minimize the generation of underwater noise with high energy at frequencies that may affect the CWDs and other marine fauna. In case marine piling work is ultimately required, bubble curtains anchored to the sea bottom around piles will be recommended to reduce underwater noise.

To avoid any accidental collision with CWDs, operating speed of construction vessels will be controlled.

5.4.2 Operation Phase

Implementation of water pollution control measures described in **Section 5.3** will minimise the potential ecological impact on marine wildlife during the operation phase of the Project.

Deployment of artificial reefs at the new HKIAAA established for the Airport extension after construction shall be considered for compensating the reduction in marine sub-tidal habitat, available feeding area for dolphins and fishery resources due to reclamation. It is expected that the artificial reefs would attract fouling organisms to colonize and contribute to recreation of sub-tidal habitat. These reefs will in turn provide nursery and breeding grounds for fish, enrich fishery resources and benefit Chinese White Dolphins through reprovision of available feeding area.

Deployment of artificial reefs in the west Lantau waters where CWD were frequently encountered can be considered as a mitigation measure for both construction and operation phases. Such measure will serve to compensate the habitat for fish and CWD utilizing the proposed Project area and minimize the potential direct and indirect impacts on them during construction and operation.

Subject to investigation, establishment of new marine parks in dolphin active areas or expansion of existing marine parks will be explored. Rerouting of marine traffic will also be considered, if feasible, as compensation measures.

5.5 Waste Management

5.5.1 Construction Phase

The waste management hierarchy which puts emphasis on waste avoidance and reduction, followed by reuse and recycling will be adopted as the guiding principle in waste management.

While the footprint of this Project has already been minimised during the planning stages, this Project involves a very significant amount of reclamation and it is envisaged that the Project can be a significant receptor of fill material generated from other projects within the Hong Kong Special Administrative Region (HKSAR), thereby limiting the amount of sandfill or fill imports from outside of HKSAR, as well as providing beneficial reuse of fill 'waste' generated by other projects. The amount of materials that can be reused from other projects will be subject to the suitability of the fill material for reuse by this Project, and further detailed arrangement and scheduling of supply and demand. The materials generated from partial removal of the existing seawall at the northern boundary of HKIA may also be reused as part of the new seawall for the Airport expansion area to further minimise waste generation.

Moreover, with the adoption of non-dredge methods for land formation, the existing marine sediments on the seabed within the reclamation area will be retained as part of the land base for the proposed Airport expansion and thereby avoiding the need for disposal of significant quantities of marine sediment, with an associated significant reduction in the total volume of waste that will be generated from this Project.

In general, proper storage, handling and disposal of construction wastes and good housekeeping will be sufficient to ensure that the impact of wastes will be acceptable. Wherever possible, opportunities will be taken to reuse and recycle materials for construction of airport facilities as well as for land formation.

Should any contaminated sediment arise from the construction activities, these will be tested and categorised according to ETWB(W) No. 34/2002, and advice will be sought from the Marine Fill Committee to determine the appropriate method for disposal.

Materials classified as chemical wastes will require special handling and storage arrangements before removal for appropriate treatment at the approved Chemical Waste Treatment Facility. Provided that the handling, storage and disposal of chemical wastes are in accordance with these requirements, adverse environmental impacts are not anticipated. Moreover, chemical wastes generated from the construction works will be registered with EPD and licensed collectors will be employed for their disposal off site. Open burning for waste disposal will be prohibited.

General refuse will be properly managed to prevent intentional or accidental release to the surrounding environment. Disposal of refuse at sites other than approved waste transfer or disposal facilities will be prohibited. Effective collection of site wastes will be

required to prevent waste materials being blown around by wind, flushed or leached into the marine environment, or creating an odour nuisance or pest and vermin problem. Waste storage areas will be well maintained and cleaned regularly.

With good site control and waste management practices, it is anticipated that the waste management implications arising from construction of the Project will be insignificant.

5.5.2 Operation Phase

Waste generated during the operation phase of the Project will be properly handled as in the operation of the existing Airport. A waste management plan to be prepared for the operation phase would meet existing and future control standards where applicable.

It should be noted that waste minimisation and recycling, such as separating recyclables and reusing treated water for landscape irrigation, are already being actively implemented at HKIA with additional good practices to be further developed.

5.6 Landscape and Visual

5.6.1 Construction Phase

During construction phase, mitigation measures will be explored to minimise landscape and visual impacts as much as possible. The possible mitigation measures to be considered include:

- Avoid or minimise disturbance to significant landscape resources as part of the detailed design;
- Cover or hydroseed bare soil surfaces and stockpiles;
- Provide decorative screen hoarding;
- Floodlights used on-site shall be carefully positioned and angled to minimise illumination of non-target areas;
- Early establishment of planting areas;
- Create a ‘natural look’ for the boundary between the newly reclaimed land and the sea using rock armour and planting where appropriate; and
- Minimise the construction periods where possible.

It should be noted that as the Project will be located on newly reclaimed land to the north of the existing HKIA, there is unlikely to be a significant loss of existing trees and vegetation due to the Project. The long distance between the proposed Airport expansion area and the nearest VSRs (over 2km away) also limits the magnitude of visual impacts from construction activities.

5.6.2 Operation Phase

Measures will be adopted during detailed design of the Project to create visual compatibility of the Airport expansion area with that of the existing HKIA. These will include adopting appropriate architectural forms, colours and finishes for above ground structures to enhance the visual aesthetics of the new airport facilities and allow visual integration with the existing HKIA facilities. For VSRs in the south of HKIA, the proposed Airport expansion area would largely be screened by the existing Airport island facilities, and VSRs located in Tuen Mun are approximately 6km away with a very distance view of the proposed Airport expansion area. Other mitigation measures to be considered include:

- Provide landscape/amenity planting where applicable to enhance the landscape aesthetics of the Airport expansion area; and
- Sensitive design of lighting and lighting installations to minimise potential night time glare impacts.

5.7 Cultural Heritage

5.7.1 Construction Phase

Marine archaeological investigation (MAI) will be conducted by a qualified marine archaeologist. If any marine archaeological residue is found, possible mitigation may include avoidance of areas with significant archaeological resources for minimisation of any direct impact. Any unavoidable impacts on cultural and heritage resources will be addressed with appropriate mitigation measures identified in the EIA study.

5.7.2 Operation Phase

No mitigation measure would be required, as cultural heritage impact is not anticipated during the operation phase.

6. Previously Approved EIA Reports

No previous EIA report carried out under the EIA Ordinance exists for the proposed Project. However, reference may be made to the New Airport Master Plan Environmental Impact Assessment (12/91) and Supplement (10/92) (Register No. under Section 15(1)(f) of the EIA Ordinance: EIA-006/BC) and the following relevant approved EIA reports:

Table 6.1: Summary of relevant approved EIAs

Register No.	Title	Relevance to this Project
EIA-053/BC	Proposed Aviation Fuel Receiving Facility at Sha Chau: EIA Volumes 1 and 2	This approved EIA is located in the same water control zone as the Project and some of the identified sensitive receivers and findings particularly for water quality and marine ecological impact assessments would be relevant to this Project
EIA-106/BC	EIA Study for Disposal of Contaminated Mud in the East Sha Chau Marine Borrow Pit	This approved EIA is in close proximity to the Project and some of the identified sensitive receivers and findings particularly for water quality and ecological impact assessments would be relevant to this Project
AEIAR-032/2000	Construction of an International Theme Park in Penny's Bay of North Lantau together with its Essential Associated Infrastructures - EIA	This approved EIA is located in the same water control zone as the Project and some of the identified sensitive receivers and findings particularly for water quality and marine ecological impact assessments would be relevant to this Project
AEIAR-066/2002	Construction of Lung Kwu Chau Jetty	This approved EIA is located in the same water control zone as the Project and some of the identified sensitive receivers and findings particularly for water quality and marine ecological impact assessments would be relevant to this Project
AEIAR-089/2005	New Contaminated Mud Marine Disposal Facility at Airport East / East Sha Chau Area	This approved EIA is in close proximity to the Project and some of the identified sensitive receivers and findings particularly for water quality and marine ecological impact assessments would be relevant to this Project
DIR-126	Development of SkyCity Golf Course	This approved Direct Application is in close proximity to the Project and some of the identified sensitive receivers and findings particularly for water quality and marine ecological impact assessments would be relevant to this Project
DIR-143/2006	Proposed 132kV Submarine Cable Route for Airport "A" to Castle Peak Power Station Cable Circuit	This approved Direct Application is in close proximity to the Project and some of the identified sensitive receivers and

Register No.	Title	Relevance to this Project
		findings particularly for water quality and marine ecological impact assessments would be relevant to this Project
AEIAR-106/2007	Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities	This approved EIA is located in the same water control zone as the Project and some of the identified sensitive receivers and findings particularly for water quality and marine ecological impact assessments would be relevant to this Project
AEIAR-107/2007	Permanent Aviation Fuel Facility for Hong Kong International Airport	This approved EIA is in close proximity to the Project and some of the identified sensitive receivers and findings particularly for water quality and marine ecological impact assessments would be relevant to this Project
AEIAR-145/2009	Hong Kong – Zhuhai – Macao Bridge Hong Kong Boundary Crossing Facilities	This approved EIA is in close proximity to the Project and some of the identified sensitive receivers and findings particularly for air, noise, water quality and marine ecological impact assessments would be relevant to this Project
AEIAR-146/2009	Tuen Mun-Chek Lap Kok Link EIA Report	This approved EIA is in close proximity to the Project and some of the identified sensitive receivers and findings particularly for air, noise, water quality and marine ecological impact assessments would be relevant to this Project
AEIAR-172/2009	Hong Kong - Zhuhai - Macao Bridge Hong Kong Link Road	This approved EIA is in close proximity to the Project and some of the identified sensitive receivers and findings particularly for air, noise, water quality and marine ecological impact assessments would be relevant to this Project