

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

Baseline Coral Survey Plan

December 2015

Airport Authority Hong Kong

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HKIA Tower, 1 Sky Plaza Road, Hong Kong International Airport, Lantau, Hong Kong

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1 Introduction

1.1 Background

On 7 November 2014, the Environment Impact Assessment (EIA) for the proposed “Expansion of Hong Kong International Airport into a Three-Runway System” (3RS) (AEIAR-185/2014, hereafter referred to as “the Project”) was approved and an Environmental Permit (EP) (EP-489/2014) for the construction and operation of the Project was issued with conditions. Airport Authority Hong Kong (AAHK) commissioned Mott MacDonald Hong Kong Limited (MMHK) to undertake the role of Environmental Team (ET) for the Project.

The EIA of 3RS predicted that there will be direct impact on the corals communities along the northern seawall of the existing airport island. A pre-construction phase dive survey is therefore recommended in the EIA to review the feasibility of coral translocation which is identified as a precautionary measure. The recommendation has been included in EP condition 2.12 by EPD and the preliminary methodology for the pre-construction phase dive survey has been approved in the Environmental Monitoring and Audit (EM&A) Manual.

EP condition 2.12 requires a submission of a Coral Translocation Plan (CTP) no later than 3 months before the commencement of construction works at area with potential to affect coral colonies to EPD. EP condition 2.12 states that the CTP shall at least include the following information:

- i. a detailed baseline survey to be carried out before the commencement of the construction works at areas with potential to affect coral colonies to further confirm the exact number and locations of coral colonies; and*
- ii. translocation details including information of coral colonies to be translocated, recipient area, translocation methodology and monitoring of transplanted colonies.*

A Baseline Coral Survey Plan (this Plan) is therefore prepared according to section 10.6.1.4 of the updated EM&A Manual to present the details of the baseline coral surveys recommended to be conducted six months prior to the commencement of construction at areas with potential to affect coral colonies.

1.2 Objectives of the Baseline Coral Survey

The objectives of baseline coral survey include the followings:

- To review the status of coral community that will be directly or indirectly affected by the proposed land formation, daylighting locations of the pipeline diversion works at Sheung Sha Chau and associated works;
- To determine the factors to be used for assessing the need and feasibility in translocating the corals to suitable habitat(s) as a precautionary measure;
- To identify and check for the baseline conditions of the potential translocation recipient site(s) including the existing coral community and hydrographical conditions;
- To prepare for the translocation and monitoring plan if necessary for formulating the methodology for coral translocation and subsequent monitoring of the transplanted corals; and
- To develop event action plan for the post-translocation monitoring where necessary.

2 Coral Survey Methodology

The methodology for baseline coral survey will be mainly based on those listed in the approved EM&A Manual that were also adopted during the 3RS EIA study, in order to maintain consistency of the survey methodology. The methodology will be divided into the following areas and discussed in this section:

- Monitoring parameters;
- Monitoring equipment;
- Monitoring locations;
- Detailed baseline monitoring methods;
- Factors determine the need and feasibility of coral translocation; and
- Qualification of surveyors and marine ecologists.

2.1 Monitoring Parameters

Monitoring parameters including the presence of hard corals (order Scleractinia), octocorals (sub-class Octocorallia), and black corals (order Antipatharia), estimated number of colonies, number of species, coral coverage, health conditions and partial mortality (if any) will be recorded during spot-check dive survey. Other data including temperature, time, date, GPS location, water depth range, underwater visibility, substratum type (i.e. hard substratum seabed, intertidal rocky area) and presence of other invertebrates will also be recorded during spot-check dive survey.

Sub-littoral substrata and benthic organisms in the area will also be assessed during Rapid Ecological Assessment (REA) which will be carried out at locations where coral communities are identified and at potential recipient sites.

The monitoring parameters for baseline coral survey are summarized in **Table 2.1** below.

Table 2.1: Monitoring Parameters for Baseline Coral Survey

Survey Types	Monitoring Parameters
Spot-check Dive Survey	Presence of hard corals, octocorals, and black corals
	Estimated number of coral colonies
	Number of coral species
	Coral coverage
	Health condition of coral
	Partial mortality of coral
	Temperature
	Time & date
	GPS location
	Water depth range
	Underwater visibility
	Substratum type
	Presence of other invertebrates
REA	Coverage of sub-littoral substrata
	Coverage, taxon abundance of benthic organisms
	Ecological attributes of the transects

2.2 Monitoring Equipment

The equipment required for carrying out the baseline coral surveys include but not limited to the followings:

- Scuba dive equipment;
- Air tanks;
- GPS device;
- Underwater camera and video recorder;
- Hand-held depth sonar;
- Transect of 100m in length;
- Water resistant recording equipment; and
- Laminated colour-printed identification guide.

2.3 Monitoring Locations

Monitoring locations for the baseline coral survey will be conducted at the hard bottom subtidal habitats along the northern and northeast seawall of the existing airport island. The baseline coral survey will also be conducted in the vicinity of the Horizontal Directional Drilling (HDD) daylighting location/ works area at Sheung Sha Chau for the diversion work of the submarine fuel pipelines as a precautionary measure, although the diversion work will not involve any marine works and will not have any impact on the subtidal habitat around the daylighting location/ works area.

The baseline coral survey will also be conducted at the potential recipient site(s) at the western and southern coasts of Brothers Islands (i.e. Tai Mo To) for coral translocation.

The locations for baseline coral survey are presented in **Figure 1**.

2.4 Detailed Baseline Monitoring Methods

The baseline coral survey will be conducted by spot-check dive survey followed by REA should coral communities are recorded, at impact areas and potential recipient sites mentioned in **Section 2.3**, by a team of qualified surveyors and supervised by an experienced marine ecologist.

2.4.1 Spot-check Dive Survey

The spot-check dive survey will be conducted by swimming in a search pattern along pre-determined impact areas and potential recipient sites mentioned in **Section 2.3** at a density sufficient to cover any major coral areas present and to assess the type of benthos existing in the areas, recording any presence of hard corals (order Scleractinia), octocorals (sub-class Octocorallia), and black corals (order Antipatharia). Particular attention will be paid to coral colonies *Balanophyllia* sp. of conservation importance that was previously recorded during the 3RS EIA study, inhabiting on the northeastern seawall of the existing airport island.

Information including estimated number of colonies, number of species, coral cover, partial mortality (if any), temperature, time, date, GPS location, water depth range, underwater visibility, substratum type and presence of other invertebrates will be recorded during the dive survey.

Any special features encountered in the coral areas, such as non-typical reef structures, unusual coral species associations, unique or peculiar assemblages of the local incipient reef formations, and reefs that are almost completely dominated by one particular species, will also be recorded.

Representative photographs of the habitat and coral species, and other ecological features will be taken.

2.4.2 Rapid Ecological Assessment (REA)

With reference to the data collected during the spot-check dive survey, REA will be carried out at locations where coral communities were identified and at potential recipient sites identified in **Section 2.3**, to obtain semi-quantitative data on the benthic communities of the location where corals are found by standardized technique. Transects of 100m in length will be laid following the contour of the seabed at areas where corals communities are identified during the spot-check dives and also at potential recipient sites.

The REA will be conducted underwater in a two-tier approach to assess the sub-littoral substrata and benthic organisms in an area:

- Tier I assesses the relative coverage of major benthic groups and substrata; and
- Tier II provides an inventory of sedentary/ sessile benthic taxa, which will be ranked in terms of their abundance at the survey site.

The taxon categories will be ranked in terms of relative abundance of individuals, rather than the contribution to benthic cover along each transect. The ranks will be made by visual assessments of abundance, rather than quantitative counts of each taxon.

The benthic coverage, taxon abundance, and ecological attributes of the transects will be recorded in a swath of about 2m wide, with about 1m on either side of the transects.

Representative photographs of any important ecological features and corals will be taken as baseline information for future post-translocation monitoring.

2.5 Factors Determine the Need and Feasibility of Coral Translocation

The determination of the translocation will be based on a series of factors including the conservation status of the coral species (i.e. hard corals, soft corals and octocorals), the coral health conditions, the size of the communities and the ability to manage the translocation with minimal destruction of the coral communities. For example coral communities attached to large boulders but <50 cm in diameter is considered as manageable of translocation with minimal destruction of the coral communities. These factors will be reviewed and updated in the CTP upon the completion of the baseline coral survey and analysis of the data collected.

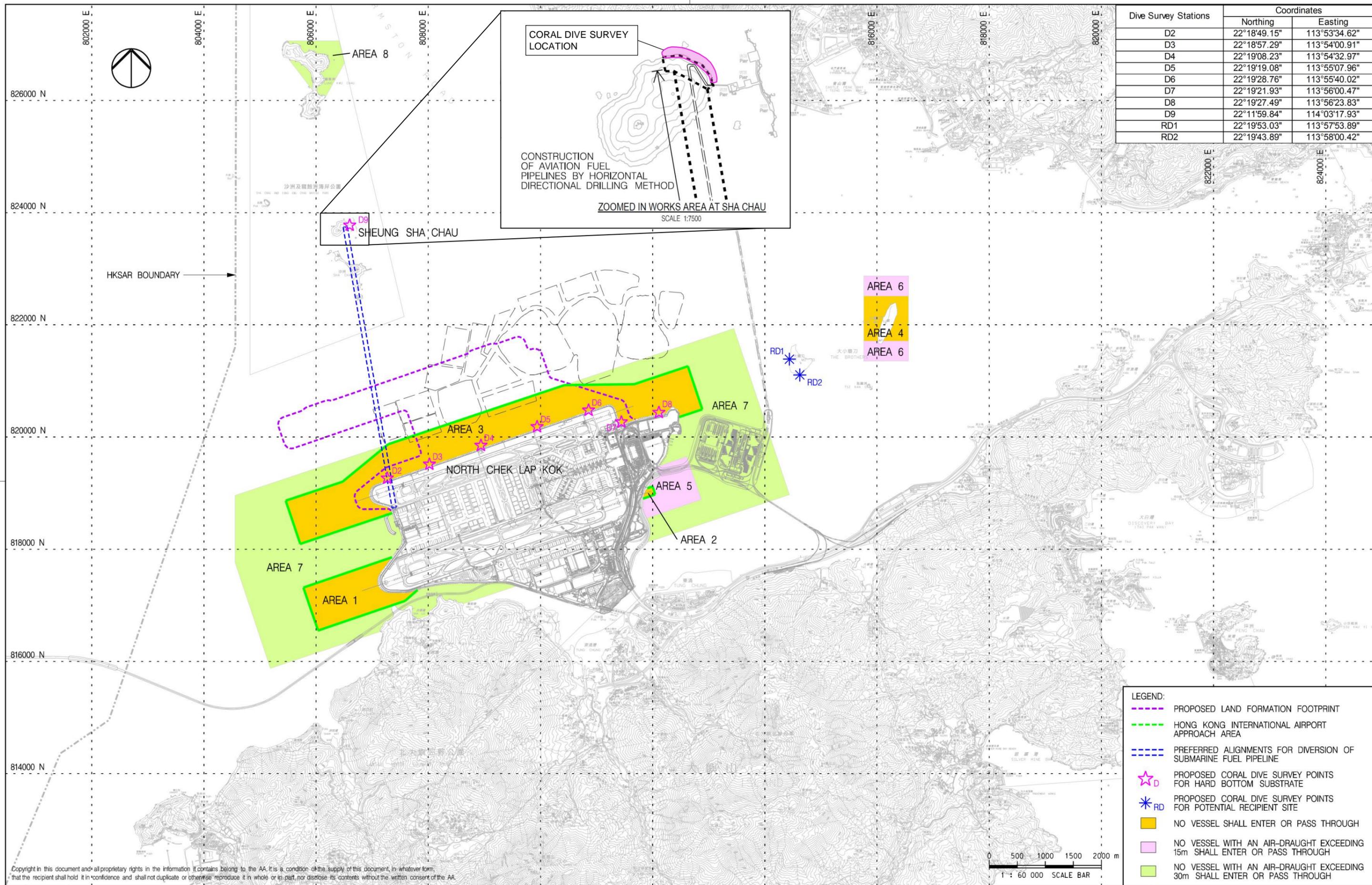
2.6 Qualification of Surveyors and Marine Ecologists

The baseline coral surveys will be conducted by a team of experienced coral surveyors supervised by a qualified marine ecologist with at least five years of coral survey experience. A qualified marine ecologists from MMHK will coordinate and overview the works and report provided by the survey team. It is proposed that the baseline coral survey will be undertaken by Oceanway Corporation Ltd. The curriculum vitae of the

personnel from Oceanway to be deployed for the dive survey and qualified marine ecologists are presented in **Appendix A**.

3 Survey Programme

The baseline coral survey will take place in November 2015. Advanced notices will be given to the Independent Environmental Checker and AAHK at least 3 days before commencement of the survey. Collected baseline condition of the coral community within the survey locations will be presented in the CTP which will be submitted at least three months before the commencement of construction works at areas with potential to affect coral colonies (tentatively in December 2015 or January 2016).



Dive Survey Stations	Coordinates	
	Northing	Easting
D2	22°18'49.15"	113°53'34.62"
D3	22°18'57.29"	113°54'00.91"
D4	22°19'08.23"	113°54'32.97"
D5	22°19'19.08"	113°55'07.96"
D6	22°19'28.76"	113°55'40.02"
D7	22°19'21.93"	113°56'00.47"
D8	22°19'27.49"	113°56'23.83"
D9	22°11'59.84"	114°03'17.93"
RD1	22°19'53.03"	113°57'53.89"
RD2	22°19'43.89"	113°58'00.42"

LEGEND:

- PROPOSED LAND FORMATION FOOTPRINT
- HONG KONG INTERNATIONAL AIRPORT APPROACH AREA
- PREFERRED ALIGNMENTS FOR DIVERSION OF SUBMARINE FUEL PIPELINE
- ☆_D PROPOSED CORAL DIVE SURVEY POINTS FOR HARD BOTTOM SUBSTRATE
- ☆_{RD} PROPOSED CORAL DIVE SURVEY POINTS FOR POTENTIAL RECIPIENT SITE
- NO VESSEL SHALL ENTER OR PASS THROUGH
- NO VESSEL WITH AN AIR-DRAUGHT EXCEEDING 15m SHALL ENTER OR PASS THROUGH
- NO VESSEL WITH AN AIR-DRAUGHT EXCEEDING 30m SHALL ENTER OR PASS THROUGH

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B	13OCT15	GENERAL REVISION	JT
C	17NOV15	GENERAL REVISION	JT
D	30NOV15	GENERAL REVISION	GC



INDICATIVE BASELINE
CORAL SURVEY LOCATIONS

Consultant's Signatures for Approval		Date
Design	JT	30NOV15
Checkers	GC / TK	30NOV15
Approver	EC	30NOV15

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM	
Drawing No.	FIGURE 1
Scale at A3	1 : 60000
Rev.	C

PAUL HODGSON

MARINE ECOLOGY SPECIALIST



Qualifications

- Degree in Electrical Engineering, Victorian University, 1983
- Higher Diploma in Electrical and Electronic Engineering, Footscray Institute of Technology, Melbourne, Australia, 1981
- Member of Marine Park Public Liaison Group in Hong Kong
- Member of the Hong Kong Underwater Association
- Past co-opted member of the Hong Kong Government Marine Parks Committee
- Past committee Member of WWF Hoi Ha Wan Marine Education Centre Committee
- Full member of the Hong Kong Marine Biology Association

Company

Oceanway Corporation Limited

Based In

Thailand, Laos and Hong Kong

PROFILE

Paul has *over 20 years' experience in marine ecological monitoring works*. He has participated in *over 100 coral surveys* and has played a key role in *developing coral restoration and preservation techniques*. The survey methodologies he developed through his extensive survey experience are *now the standard methodologies accepted by the Hong Kong Government*. Paul has also *successfully translocated over 120 tonnes of coral within one month* at Pak A. Paul continues to *develop and up-date survey techniques for coral surveys* and has recently carried out the first marine *Rapid Ecological Assessment (REA)* surveys in Chinese waters, Yang Jiang.

Damaged Coral Area Mitigation in the Hoi Ha Wan Marine Park – Coral Specialist responsible for the *supervision and training of divers* in the techniques of *coral repair* using an in-house developed adhesive. Totally *over 300 dislodged and damaged coral colonies were stabilized and relocated* to suitable areas within the Hoi Ha Wan Marine Park. Coral colonies and fragments ranging in size from 5cm² to over 1m² were involved. A total of 7 tonnes of adhesive was used to reinforce the coral area and attach the corals. Further *coral surveys* of the area indicate that the corals are growing over the adhesive and the area is recovering.

Damaged Coral Area Mitigation in the East Ping Chau Marine Park - Coral Specialist supervising and carrying out the *repair of over 700 corals* in the East Ping Chau Marine park, and *training of divers*. The *corals were stabilized and relocated* to suitable areas within the Marine Park. Coral colonies and fragments ranging in size from 5cm² to over 0.75m² were involved. Further surveys indicate that the corals are recovering and growing over the adhesive.

Coral Monitoring for Installation of Submarine Gas Pipeline from China to Tai Po – Coral Specialist, supervised divers and marine scientists to carry out *baseline, impact and final surveys of sensitive coral sites* during the installation of 20km of *undersea gas pipeline* from China to Tai Po. A total of 11 sites with *over 700 tagged corals* were used to ensure the survival of some of Hong Kong's best coral areas. This contract involves *daily surveys of impacted sites*, with the results reaching the necessary parties within the same day. *Hard, soft and black corals* are used as the *impact indicators*. *Detailed mapping and in-water coral identification* of the areas is necessary to ensure relocation of selected corals.

Harbour Area Treatment Scheme (HATS) – Field Diving Surveys – Marine Ecology Specialist, supervised and participated in carrying out *spot dives* and *REA surveys* at all planned outflow receiving areas for the HATS project. This project consisted of *13km of underwater coral survey*, final report and recommendations. Diving included areas of the Victoria Harbour and under the shipping channel at Lamma Island. The surveys were completed in less than three months. Recommendations to relocate several outflows were accepted and carried out by the authority.

Coral Colony Collection and transplantation for the City University– Marine ecology specialist, supervised and carried out coral collection and relocation for 100 colonies comprising *four species for a scientific experiment*. *Transplanted the corals* back to suitable areas after the experiment was completed. *Corals species included three hard and one gorgonian species*.

Underwater Survey in Coastal Waters of Hong Kong – Marine ecology specialist, supervised and participated in a survey of approximately *72km of sub-littoral benthic dives* to examine the communities in these areas around Hong Kong within a six month period. Areas were located in both the eastern and western waters of Hong Kong. This six month survey work was carried out with Dr. Lyndon DeVantier who identified 86 species of hard corals (30% more than was originally recorded), with one widely distributed species new to science. The survey *methodology used in this survey is now a government standard in Hong Kong*.

Coral Monitoring at Hoi Ha Wan and Yan Chau Tong Marine Parks – Marine Ecology Specialist, carried out *coral surveys* to determine the *changes in the coral communities within these two marine parks* as compared to earlier baseline studies.

RELEVANT PROJECT EXPERIENCE

Expansion of Hong Kong International Airport (HKIA) into a Three-Runway System (3RS) –Coral Specialist supervising and carrying out coral *spot check dives* and *REA surveys* in North Lantau waters. This is a mega infrastructure project, which involves formation of about 650 ha of land adjacent to the existing Airport Island for establishing the proposed 3rd runway and the associated infrastructure facilities.

Underwater Survey at North Lantau & Tsing Lung Tau – Coral Specialist supervising and carrying out approximately *3km of sub-littoral benthic survey dives*. *Spot dives* and *REA survey* was carried out in difficult conditions, strong currents and very turbid waters. Also carried out *identification of both hard and soft coral communities* in areas zoned to be reclaimed.

Underwater Survey along the proposed route of the Chek Lap Kok to Tuen Mun Link Road – Coral Specialist supervising and carrying out some of the *coral surveys* for the proposed Link Road. Works carried out involved *over 20 Spot Dives* and *4 REA dives* in very turbid and difficult conditions. The project involves the construction of a 5km road tunnel, a 1.6km viaduct, 4.2km seawalls; 35.6ha of reclamation; a toll plaza; footpaths; associated supporting infrastructure (administration building, ventilation buildings); and modification of existing roads.

Underwater Survey at Castle Peak – Coral Specialist supervising and carrying out approximately *2.2 km of sub-littoral benthic survey dives* around Angler's Beach. *Identification of both hard and soft coral communities* in areas zoned to be reclaimed with the expansion of Castle Peak Road. Both *spot dive* and *REA survey* was carried out in difficult conditions and very turbid polluted waters.

DR KATHERINE LAM

Marine Ecology Specialist



PROFILE

Katherine has *more than 20 years' experience in coral and marine ecology*, and research study, including *coral translocation and monitoring*. She has been involved in *coral transplantation projects* and the *re-establishment of corals* in areas where damage and/or other factors have destroyed corals. Most recently she studied the effect of sediment on four species of hard and one species of soft coral.

Qualifications

- Committee Member of the Hong Kong Marine Biology Association
- Post-Doctoral. Swire Institute of Marine Science, 2003
- Ph.D. Marine Ecology, Swire Institute of Marine Science. University of Hong Kong, 1998
- B.Sc. Zoology / botany, University of Hong Kong, 1993

Company

Oceanway Corporation Limited

Based In

Hong Kong

Underwater Survey at North Lantau & Tsing Lung Tau - Participated in and supervised in approximately *3km of sub-littoral benthic survey dives*. *Identification of both hard and soft coral communities* in areas zoned to be reclaimed. *Spot dives* and *REA survey* was carried out in difficult conditions, strong currents and very turbid waters.

Damaged Coral Area Mitigation - Using an in-house developed adhesive, supervised *10 divers repair over 300 dislodged and damaged coral colonies*. The *coral was stabilized and relocated* to suitable areas within the Hoi Ha Wan Marine Park. Coral colonies and fragments ranging in size from 5cm² to over 1m² were involved. A total of 7 tonnes of adhesive was used to reinforce the coral area and attach the corals. Further coral surveys of the area indicate that the corals are growing over the adhesive and the area is recovering.

Damaged Coral Area Mitigation - Supervised divers carrying out *repairs to damaged corals* in the East Ping Chau Marine Park. Totally *over 700 dislodged and damaged coral colonies were stabilised and relocated* to suitable areas within the Tung Ping Chau Marine Park. Coral colonies and fragments ranging in size from 5cm² to over 0.75m² were involved. Further surveys indicate that the corals are recovering and growing over the adhesive.

Coral Area Repair - Was the Chief Scientist for the establishment of a survey regime to *monitor for the bio-erosion of the coral community* at Coral Beach, Hoi Ha Wan in Hong Kong. The survey had to determine a means to control urchin and *Drupella rugosa* populations within the area. *Supervised the repair of over 300 badly eroded corals*. The final task was to *develop a monitoring program* for the area. This was the *first time intervention had been allowed in a marine park* in Hong Kong. The results of the *continued monitoring* indicate the project was very successful.

Effect of sedimentation on Hong Kong corals - Conducted the scientific experiment and field work including *coral collection and relocation for 100 colonies comprising four species to test the effect of sedimentation of corals*. *Transplanted the corals back to suitable areas* after the experiment was completed. Corals species included three hard and one gorgonian species.

Underwater Survey at North Lantau & Tsing Lung Tau - Participated in and supervised other divers carrying out approximately *3km of sub-littoral benthic survey dives*. *Identification of both hard and soft coral communities* in areas zoned to be reclaimed. *Spot dives* and *REA survey* was carried out in difficult conditions, strong currents and very turbid waters.

RELEVANT AIRPORT PROJECT EXPERIENCE

Hong Kong International Airport Projects

Expansion of Hong Kong International Airport (HKIA) into a Three-Runway System (3RS) – *Coral Specialist* carrying out coral *spot check dives* and *REA surveys* in North Lantau waters. This is a mega infrastructure project, which involves formation of about 650 ha of land adjacent to the existing Airport Island for establishing the proposed 3rd runway and the associated infrastructure facilities.

Underwater Survey at North Lantau & Tsing Lung Tau - Supervised and carried out approximately *3km of sub-littoral benthic survey dives*. *Identification of both hard and soft coral communities* in areas zoned to be reclaimed. *Spot dives* and *REA survey* was carried out in difficult conditions, strong currents and very turbid waters.

Field diving surveys for the HATS Project - Carried and supervised other divers carrying out *spot dives* and *REA surveys* at all planned outflow receiving areas for the HATS project. This project consisted of *13km of underwater coral survey*, final report and recommendations. Diving included areas of the Victoria Harbour and under the shipping channel at Lamma Island. It was completed in less than three months. Recommendations to relocate several outflows were accepted and carried out by the Hong Kong Government.

Underwater Survey in Coastal Waters of Hong Kong - Assisted the scientific team with approximately *72km of sub-littoral benthic survey dives* to examine the communities in coastal areas of Hong Kong. This project was completed within a six month period. Areas were located in both the eastern and western waters of Hong Kong. This six month survey work was carried out with Dr. Lyndon DeVantier who identified 88 species of hard corals (30% more than was originally recorded), with one widely distributed species new to science. The *survey methodology used in this survey is now a government standard in Hong Kong*. Data was presented in a format suitable for ArcView GIS Database entry.