

DC/2006/11

**Drainage Improvement in South Lantau and Construction of
Mui Wo village Sewerage - Phase 1**

Construction Phase Monitoring

Report for Frog Capture Survey and Translocation

March 2009



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1 Introduction

1.1 Background

Drainage Services Department (DSD) planned the channelisation and bypass construction at Pak Ngan Heung River, Tai Tei Tong River, Luk Tei Tong River and Luk Tei Tong Marsh in Mui Wo, Lantau, under the project entitled “Drainage Improvement in Southern Lantau” (hereafter referred to as “the Project”).

The Project is a Designated Project under Environmental Impact Assessment Ordinance. The Project involves the modifications of river sections and provisions of bypass channels to improve flood control. Sections of Pak Ngan Heung River and Luk Tei Tong River, and an area within Luk Tei Tong Marsh would inevitably be modified by the proposed construction works. There would be direct impacts on lowland rivers and associated riparian habitats, which are the potential habitats of amphibians.

1.2 Frog species of conservation interest

Two amphibian species were considered of conservation interest in the EIA study for the Project – Romer’s Tree Frog *Philautus romeri* and Chinese Bullfrog *Hoplobatrachus chinensis*.

Romer’s Tree Frog is endemic to Hong Kong and protected under WAPO. Romer’s Tree Frog is a small frog only up to 2.5 cm in length. The mantle is brownish with a characteristic X-marking and a dark band between eyes. Skin is peppered with fine granules. Snout is pointed and eardrum is conspicuous. Hind legs are long and slender, irregularly barred with brownish bands. All digits have small sucker discs. The habitat requirement of Romer’s Tree Frog was studied in details by Lau (1998). The optimal habitat of Romer’s Tree Frog prefers is seasonal streams of low gradient covered by forest or plantation. This species favours streams without fishes, which prey on both adult frogs and tadpoles. Romer’s Tree Frog was previously recorded in Mui Wo area, but not during the EIA study (Metcalf and Eddy Ltd. 2005).



Photo : Romer's Tree Frog. Source:

[www.http://www.hkbiodiversity.net/html/tc/Amphibian.html](http://www.hkbiodiversity.net/html/tc/Amphibian.html)

Chinese Bullfrog is listed as a Class 2 Protected Animal of PRC. Chinese Bullfrog is the second biggest frog in Hong Kong. This frog is up to 12.5 cm or more in length. The mantle is olive-brown with scattered black spots on wrinkled skin. Underside is whitish in color, with checkered spotting on the flank. Snout is tapering. Eyes are big. Eardrum is also big and prominent. Habitats of Chinese Bullfrog include cultivated fields, ponds, streams and marshes (Chan *et al.* 2005). One individual of Chinese Bull Frog was recorded in a pond within the Luk Tei Tong Marsh during the EIA stage (Metcalf and Eddy Ltd. 2005).



Photo : Chinese Bullfrog. Source:

[www.http://www.hkbiodiversity.net/html/tc/Amphibian.html](http://www.hkbiodiversity.net/html/tc/Amphibian.html)

1.3 Condition of Environmental Permit

Amphibian skin is permeable and their capability on preventing hydration is limited. Frogs have to stay in humid environments/habitats to keep their skin moist. They are thus highly habitat-restricted and this makes their individual distribution range relatively small.

Due to their dependence on humid environments, frogs usually have high habitat-fidelity. Therefore, frogs are vulnerable to construction works in or near their habitats as they are reluctant to leave their habitats. Site formation inside their habitats may result in mortality of frogs. Those frogs that are disturbed by the work activities and leave the works areas and search for new habitats during day time may risk death due to desiccation.

Under the Project, there would be direct loss of lowland river habitats and associated riparian habitats due to channel construction. The proposed works have the potential to cause direct injury/mortality to wildlife with low mobility including the two amphibian species of conservation interest (Chinese Bullfrog and Romer's Tree Frog) that might exist within the works areas.

Despite of the low abundance of the Chinese Bull Frog and the Romer's Tree Frog were required under Condition 2.5 of the Environmental Permit No. EP-237/2005/A to protect these two frog species of conservation interest.

The mitigation measures focused on translocating the two concerned species, if any, before the commencement of the construction. Capture surveys would therefore be conducted prior to commencement of the construction works to locate any individuals of these two species within the works areas as mitigation for the potential impacts on frogs utilizing riparian habitats during the construction works in the streams, as recommended in the EIA report.

As required in Condition 2.5 of the Environmental Permit No. EP-237/2005/A, the ecologist of the Environmental Team (ET) shall conduct capture and translocation surveys of Romer's Tree Frog and Chinese Bullfrog prior to the commencement of construction of the Project. The main aim of the survey is to minimise the impacts to the frog species of conservation interest due to construction works of the Project.

Condition 2.5 of the EP-237/2005/A stipulates the following:

To avoid or mitigate the impact to fauna species of conservation interest due to construction of the Project, faunal surveys shall be carried out. The ecologist as mentioned in Condition 2.3 of this Permit shall carry out detailed capture-surveys to ascertain the presence of any fauna species, including the fish species of conservation interest such as Flagtail (*Kuhlia marginata*) and Predaceous Chub (*Parazacco spilurus*) and amphibian species of conservation interest such as Romer's Tree Frog and Chinese Bullfrog, in the works area of the Project. Fauna species of conservation interest captured during the survey shall be translocated to nearby suitable habitats outside the works areas of the Project prior to the commencement of construction of the Project. The Permit Holder shall, no later than one month before the commencement of construction of the Project, deposit with the Director four hard copies and one electronic copy of faunal survey and translocation proposal showing methodology and programme of surveys, faunal surveys results, types of fauna to be translocated, locations of the sites for translocation, methodology and implementation programme of translocation and post-translocation monitoring. Before submission to the Director, the proposal shall be certified by the ET Leader and verified by the IEC as conforming to the information and recommendations contained in the approved EIA Report (Register No. AEIAR-093/2005).

Ecosystems Limited was appointed as the Ecologist of the Environmental Team, and is responsible for undertaking the measures for protection of the concerned frog species.

It is also required in the Permit, faunal capture and translocation survey proposal shall be submitted to the Director no later than one month before the commencement of construction of the Project.

A fauna capture survey proposal has previously been submitted to EPD in August 2008.

Before submission to the Director, the proposal was certified by the ET Leader and verified by the IEC as conforming to the information and recommendations contained in the approved EIA Report (Register No. AEIAR-093/2005).

Romer's Tree Frog and Chinese Bullfrog would be captured from the works area of the Project and translocated to suitable habitats near but outside the works areas of the Project. Capture and translocation surveys would be carried out during wet season (April – October), before the construction works commence.

This Frog Capture and Translocation Survey Report is submitted under the requirement of the Condition 2.5 of the Environmental Permit (EP-237/2005/A) to provide details on

- a) the time of conducting the surveys and translocations, methodology and results of the surveys;
- b) methodology of collecting the Chinese Bull Frog and Romer's Tree Frog (including adults, tadpoles and eggs), if found, within the Project site during the surveys;
- c) procedures of transportation of the concerned frog (including adults, tadpoles and eggs), if found, from the Project site to the receptor site i.e. agricultural areas near Butterfly Hill;
- d) recommendation(s) on any follow-up actions required for protection of the translocated frogs;
- e) photos and location plans to illustrate the results of the surveys and translocations; and
- f) the qualification and experience of the qualified persons who were responsible for the survey and translocation works, as described in Conditions 2.5 of the Environmental Permit.

2 Methodology

2.1 Specialists

Ecologist formed part of the Environmental Team (ET) and was engaged to carry out the works relating to the capture-surveys. The Ecologist possessed a degree in a relevant subject and had at least 3 years experience on frog study and survey in Hong Kong. The qualification and experience of the Herpetofauna Ecologist was certified by the Environmental Team (ET) Leader and verified by the Independent Environmental Checker (IEC).

Ecosystems Limited was appointed as the Ecologist of the Environmental Team, and is responsible for undertaking the measures for protection of the concerned frog species. Two qualified ecologists from Ecosystems Ltd. (Dr. Kwok Hon Kai and Mr. Vincent Lai) with the relevant expertise qualification in terrestrial and aquatic ecology, and amphibian identification have been selected to undertake conducted the survey and translocation works. Both of them are thoroughly proficient in local ecology, field survey, wildlife capture and translocation with more than five years of relevant experiences. *Curriculum vitae* of the two specialists are provided in **Appendix A**

As Romer's Tree Frog is protected under the Wild Animals Protection Ordinance Chapter (170), a permit for the capture survey was applied from the Agriculture, Fisheries and Conservation Department (**Appendix B**).

2.2 Schedule of Surveys

The construction works in river channels and Luk Tei Tong Marsh under the Project would commence in November 2008.

The frog capture surveys were scheduled in October 2008, within wet season (April – October) and prior to the commencement of construction works in rivers and marshland as required by the EP. Some works under the Project commenced before the capture and translocation survey, but those works were site clearance or works on dry lands such as the box culvert for Pak Ngan Heung River. The capture survey would finish when no individual of the target species were caught for three consecutive days.

2.3 Recipient Site Survey

Recipient site was chosen based on the habitat requirements of the two target species. The habitat characteristics of Romer's Tree Frog have been studied in details (Lau 1998). Two criteria recommended in Lau (1998) to select potential sites for translocation of Romer's Tree Frog are (a) the presence of large area of forest or plantation; (b) the presence of suitable breeding habitats, which is shaded, slow-flowing unpolluted waters with no fish (The presence of fishes will increase tadpole mortality significantly). The habitats of Chinese Bullfrog include cultivated fields, ponds, streams and marshes (Chan *et al.* 2005).

Recipient sites for the release of the captured frogs were proposed in Environmental Mitigation Measure Report during the detailed design study for the Project (Ove Arup & Partners 2007): woodlands on the western slope of Butterfly Hill for Romer's Tree Frog, and the wet abandoned agricultural lands to the east and northeast of Butterfly Hill for Chinese Bullfrog (**Figure 3, from Drawing 24519/EM/S3/005** of the Environmental Mitigation Measure Report). These recipient sites were chosen based on the habitat requirements of the target species.

A survey for verifying and evaluating the existing conditions and suitability of the proposed recipient sites and locating alternative recipient sites was conducted on 16 October 2008 prior to the implementation of the actual capture survey.

The woodlands on the western slope of Butterfly Hill were considered suitable for release of Romer's Tree Frog. Seasonal streams would form in valley covered by woodlands in Butterfly Hill during wet season and provide the breeding habitats for Romer's Tree Frog.

The abandoned agricultural land to the northeast of Butterfly Hill was considered more suitable as the recipient site than that to the east of Butterfly Hill, as the former was wetter and away from seashore. The abandoned agricultural lands to the east of Butterfly Hill may be brackish due to tidal influence, and hence are not considered optimal amphibian habitat. Chinese Bullfrog and other frogs captured from Luk Tei Tong marsh during the survey would be released in the abandoned agricultural land to the northeast of Butterfly Hill.



Woodlands on the western slope of Butterfly Hill



Abandoned agricultural lands to northeast of Butterfly Hill



Abandoned agricultural lands to the east of Butterfly Hill

Further to those previously proposed recipient sites, it was also found during the recipient site survey that the upstream section of Pak Ngan Heung River near the waterfall and east of Pak Ngan Heung was of good water quality. The bank and bed of this river section is relatively natural. This section of river was considered suitable as recipient site for the release of frogs and tadpoles captured from stream habitats.



Upstream section of Pak Ngan Heung River



Upstream section of Pak Ngan Heung River (2)

2.4 Capture and Translocation Survey

Frog capture and translocation surveys were carried out on 28, 29 and 30 October 2008. The following works areas of The Project were covered in the capture and translocation surveys:

- Riparian habitats (including woodland) at the two sections of Pak Ngan Heung River;
- Riparian habitats at the downstream section of Luk Tei Tong River; and
- Marshland area in Luk Tei Tong to be covered by floodway bypass.

As frogs are generally nocturnal, all surveys commenced after dusk. The surveyors were equipped with head torches, hand torches/spot lights, dip nets, and boots suitable for slippery surface.

Though only Romer's Tree Frog and Chinese Bullfrog were the target species, tadpoles and other frog species if found during the survey were also collected and translocated.

Adult male frogs could be easily located by their calls during breeding season (March to May). However, as the kick-off time of the Project was in mid 2008, the breeding season of amphibians was missed. Frogs are generally quite outside the breeding season. Frogs within the survey areas were mainly located by active searching rather than acoustic search.

Romer's Tree Frog breeds in shallow water (i.e., stream pools and shallow water areas inside woodland/tall shrub) or artificial containers during the wet season (March to September). This species usually lives in litter in woodland understorey outside the breeding season.

The EIA Report indicated that the individual of Chinese Bull Frog was found in a pond during wet season.

All the potential microhabitats/hiding places, e.g., litter, of both species within the survey areas and locations with previous records were checked carefully. Tall grasses restricting the access and searching were cut down to less than 10cm in height (if necessary) in order to facilitate the survey of Romer's Tree Frog.

All frogs, tadpoles and eggs seen during the survey were captured/collected using hands and/or hand net. Suitable techniques as recommended in Chan *et al.* (2005) were used to avoid any injury on them. The surveyors would cup one hand over the frog to prevent its escape and then gently grab the frog by the waist. The health condition and length (from snout to vent for adults and from snout to tail tip for tadpoles) of each captured frog were recorded.

All tadpoles found within the survey area would be identified to species as far as possible.

Collected frogs and tadpoles were temporarily stored in plastic containers with a small amount of water for temporary storage before release to avoid mortality due to desiccation. Tadpoles and eggs, which need more water during transportation, were stored separately from adults. A few wet, dead leaves were also added to provide shelter and maintained the humidity. There were enough room for the captured frogs in the containers during transport (no 'stacking' should occur). Captured frogs and collected tadpoles/eggs were moved to the recipient site on the same night and released as soon as possible to enhance their survival rate. Care was taken during the whole handling process in order to ensure no harm to the captured individuals.

Though there was no Romer's Tree Frog or Chinese Bull Frog found within the Survey areas, individuals of other frog species were captured and translocation works were undertaken.

3 Results

Results of the capture and translocation survey between 28 and 30 October 2008 were summarised in **Table 1**. No individual of the two target species (Romer's Tree Frog and Chinese Bull Frog) was found in the survey areas for the three consecutive days, and the capture and translocation survey finished on 30 October 2008.

A total of 15 individuals of 4 frog species were captured during the survey: one from Luk Tei Tong River and 14 from Pak Ngan Heung River. No frog was found in the Luk Tei Tong marsh. No tadpoles or eggs were found during the survey. All the captured species are common in Hong Kong (Chan *et al.* 2005). Photographs and other information of each captured frog are shown in **Appendix C**. The locations of capture and release are shown on **Figures 1 – 3** in **Appendix D**.

Table 1. Number of each frog species captured from the works area of the Project

Species	Luk Tei Tong Marsh	Luk Tei Tong River	Pak Ngan Heung River
Asian Common Toad <i>Bufo melanostictus</i>	0	1	1
Asiatic Painted Frog <i>Kaloula pulchra</i>	0	0	4
Paddy Frog <i>Fejervarya limnocharis</i>	0	0	7
Gunther's Frog <i>Rana guentheri</i>	0	0	2
Total species	0	1	4
Total frogs	0	1	14

No individual of the two target species was sighted or captured during the surveys. The surveys confirmed that no Romer's Tree Frog or Chinese Bull Frog (including adults, tadpoles and eggs) was within or in the vicinity of the Project Site.

The survey result was not unexpected as the abundance of these two species in Mui Wo were very low, according to the findings of the EIA study. Only one individual of Chinese Bullfrog was recorded from a small pond within the Luk Tei Tong Marsh during the EIA study (Metcalf & Eddy Ltd. 2005). Romer's Tree Frog was once reported in Mui Wo from previous surveys conducted in the 1990's, but has not been recorded since then, including the EIA study (*ibid.*).

The finding of the EIA Report indicated no optimal habitats for Romer's Tree Frog or Chinese Bull Frog within the Project Site as well as nearby areas. These work areas are thus not considered as important habitats for these two frog species.

Romer's Tree Frog favours seasonal forested streams of gentle gradient and with no fish (Lau 1998). However as reported in the Environmental Mitigation Measure report during the detailed design study for the Project, fishes were present in sections of Luk Tei Tong and Pak Ngan Heung rivers within the survey area. The area was absent of large area of woodland.

In addition, the marsh affected by the construction of floodway bypass in Luk Tei Tong was fairly dry. The Luk Tei Tong marsh was seasonal in nature. Scattered shallow water would only form after rains during wet season. The condition of Luk Tei Tong Marsh was previously inspected during the detailed design stage of the Project in December 2005 and October 2008. The Luk Tei Tong Marsh was in general very dry and no water-filled containers were found at that time. The bypass channel alignment, i.e. the capture survey area within the marsh, was even the driest part of the marsh as demonstrated in the report for the detailed design phase.

The Luk Tei Tong Marsh was still dry when the present capture survey was conducted. There was no open water pool within the marsh. Furthermore, the surveys were conducted in late wet season. Frogs, if any, probably moved to other wet areas before the surveys commenced. All these factors contributed to the absence of Chinese Bullfrog.

Water is brackish at Luk Tei Tong River. Most frog species are known to be absent from environment with waterbodies of high salinity (Karsen *et al.* 1998). The bank of this river was lined with gabions and with little vegetation cover. This section of Luk Tei Tong River and the riparian were not considered optimal habitats for amphibian. Only one frog was captured from this river.

4 Conclusions

The surveys confirmed that no Romer's Tree Frog or Chinese Bull Frog or their tadpoles and eggs within or in the vicinity of the Project Site.

As no Chinese Bull Frog or Romer's Tree Frog was found within the Project Site during the surveys, follow-up actions required for protection of the concerned frog species are not necessary for the Project.

No post-translocation monitoring would be required, as all the recipient sites are outside the works area for the Project and the translocated frogs will be not be directly impacted by the Project. Furthermore, regular construction phase monitoring programme might also provide information on potential off-site disturbance impacts from the Project. Specific post-translocation monitoring in the recipient sites is thus not needed.

5 Reference

Chan, K.F., Cheung, K.S., Ho, C.Y., Lam F.N. and Tang, W.S. 2005. A Field Guide to the Amphibians of Hong Kong. Agriculture, Fisheries & Conservation Department, Government of Hong Kong Special Administrative Region.

Karsen, S., Lau, M.W.N and Bogadek, A. 1998. *Hong Kong Amphibians and Reptiles*. Provisional Urban Council, Hong Kong.

Lau M.W.N. 1998. Habitat use by Hong Kong amphibians: with special reference to the ecology and conservation of *Philautus romeri*. PhD Thesis of University of Hong Kong, Hong Kong.

Lau, M.W.N. and Dudgeon, D. 1999. Composition and distribution of Hong Kong amphibian fauna. *Memoirs of Hong Kong Natural History Society* 22:1-79.

Metcalf and Eddy Ltd. 2005. Agreement No. CE 49/2002(DS) Drainage Improvement in Southern Lantau Investigation – Final Environmental Impact Assessment Report. Drainage Services Department, Hong Kong Special Administrative Region.

Ove Arup & Partners Hong Kong Ltd. 2007. *Agreement DP05/2005 – Employment of Consultant for Environmental and Landscaping Detailed Design for Drainage Improvement in Southern Lantau Final Environmental Mitigation Measures Report*. Drainage Services Department, Hong Kong Special Administrative Region.

Appendix A: CVs of the Specialists

Position: Senior Ecologist, Ecosystems Ltd.
Date of Birth: 1968
Nationality: Chinese
Years with Firm: 12

Education and Professional Qualifications

PhD., Ecology and Biodiversity, University of Hong Kong, 1997
B.Sc. (Hons), Environmental Life Science, University of Hong Kong, 1992
Member of Research Group on Ground Jays, Xinjiang Institute of Ecology and Geography
Member of Egret Research Group, Hong Kong Bird Watching Society (2002-04)
Member of Oriental Bird Club
Member of Hong Kong Natural History Society

Key Qualifications

- Experience with Hong Kong EIA process including application of EIA Ordinance and Technical Memorandum on EIA Process. Experience in designing and conducting ecological studies for EIA and EM&A, reporting and project management.
 - Extensive experience in study of the terrestrial ecology of South China region (including Guangdong, Sichuan and Yunnan Provinces) and Southeast Asia. PhD research focused on ecology of woodland birds in Hong Kong, including study of related invertebrates and vegetation. Field experience in study of the ecology of both terrestrial and coastal ecosystems.
 - Broad background in life sciences and ecology as well as practical applications in environmental protection. Experience in ecological survey design, laboratory technique and data analysis. Extensive experience in field surveys and identification of various faunal taxa including birds, dragonflies, butterflies, amphibians and reptiles.
 - Languages: Cantonese (native), English (fluent), Mandarin Chinese (good).
-

Experience Record

- 1996 - to date *Senior Ecologist, Ecosystems Ltd.*
- Nov 2008 – to date **Age Structure Assessment of Wintering Black-faced Spoonbill in Hong Kong 2008-2009, AFCD**
Project manager and field surveyor. Study of age structure of the endangered bird species Black-faced Spoonbill in Mai Po Marshes Nature Reserve in winter 2006-2007. Client: AFCD.
- Oct 2008 – to date **Preliminary Study on Habitat Restoration at Lam Tsuen**
Ecology study in a rural area in Central New Territories. The purpose of the study is to establish the ecological profile of the study area, and recommend ecological measures to enhance the value of the study area as wildlife habitats. Client: Private.
- Oct 2008 – to date **Ecological Surveys at Pat Heung, New Territories, Hong Kong**
Ecology study in a rural area in Northern West New Territories. The purpose of the study is to cross-check the ecological surveys conducted for a railway project. Conducted habitat mapping and vegetation surveys, with special attention to species of conservation interest. Client: ERM.

- May 2008 – to date **Drainage Improvement in Southern Lantau and Construction of Mui Wo village Sewerage Phase 1 – Construction Phase EM&A**
 Terrestrial Ecologist for the construction phase ecological monitoring of a drainage improvement project in Mui Wo, Lantau. The monitoring programme included a capture-and-translocation programme for the endemic frog Romer's Tree Frog *Philautus romeri*. Client: Yick Hing Construction Company.
- May 2008 **Audit and Action Plan Development Palm Oil Plantation, Indonesia**, ERM-Hong Kong Ltd.
 Terrestrial Ecologist. This project included the environmental and social audit (Social Review and Biodiversity Review), development of a detailed action plan for a palm oil in Beduai District, Sekayam District and Noyan District of Sanggau Regency in Indonesia. Client: Saratoga Capital.
- April – June 2008 **CLP Power Circuit Route Selection – Ecological Baseline Survey**, Atkins China Limited.
 This project aims to collect ecological baseline data of terrestrial fauna including mammals, birds, herpetofauna, butterfly and dragonfly in habitats under and near pylons in country parks of the Central and West New Territories. Client: CLP.
- Feb 2008 – to date **Preparation of Conservation Management Plan for Rhododendron species (Ericaceae) at Ma On Shan SSSI.**
 The development of a long-term management plan for the enhancement of the wild populations of four species of Rhododendron species of conservation concern. Client: Agriculture, Fisheries and Conservation Department.
- Jan – 2008 to date **Ecological Enhancement Plan to Sau Mau Ping Estate Area**
 Monitoring of ecological enhancement measures implemented in Sau Mau Ping Redevelopment Site. The target fauna included birds and butterflies. Client: Housing Department.
- Dec 2007 – October 2008 **Salt Water Supply system for Pokfulam Area – Ecological Survey**, ARUP
 Terrestrial Ecologist for the proposed salt water supply system in the Pokfulam area of Hong Kong Island. Client: WSD.
- Dec 2007 – April 2008 **Long-term Ecological Management Plan for Ma Hang Headland Park**
 The development of a long-term management plan for the Ma Hang Headland Park in Stanley. The management plan also included measures for enhancement of the ecological value and natural sources within the park. Client: Hong Kong Housing Authority.
- Oct 2007 – to date **Hang Hau Tsuen Channel at Lau Fau Shan**, Black & Veatch
 The flood control project of a stream channel at Hang Hau village in Lau Fau Shan. Client: DSD.
- Mar 2007 – to date **West New Territories (WENT) Landfill Extensions – Feasibility Study**, ARUP
 Terrestrial Ecologist for the proposed extension of the WENT Landfill. The job included conduct of field surveys, review of relevant literature, impact assessment and recommendation of mitigation measures. Client: EPD.
- Mar – July 2007 **Eco-Garden Design in Sau Mau Ping Estate ph. 13 & 16 and 14**
 The design of an eco-garden in Central Kowloon. The job included conduct of field surveys and review of relevant literature. Client: Hong Kong Housing Authority.
- Dec 2006 – to date **Integration of Siu Ho Wan and Silver Mine Bay Water Treatment Works**, Black and Veatch
 Terrestrial Ecologist of a water treatment project in Lantau Island. The study area covered terrestrial habitats in Siu Ho Wan and Silver Mine Bay. Client: WSD.

- Dec 2006 – to date **Independent Audit on the Performance and Effectiveness of Ecological Compensatory Measures Implemented at Lok Ma Chau under the Spur Line, EPD**
 Review of the effectiveness of the mitigation measures of Spur Line Project at Lok Ma Chau and other previous examples of ecological of compensation in Hong Kong. Recommendations to room for improvement of the compensation policy in Hong Kong. Client: EPD.
- Dec 2006 – May 2008 **Review of Pond-wiring to Reduce Cormorant Predation in Commercial Fishponds in Inner Deep Bay Area, AFCD**
 Project manager and field surveyor. Review of effectiveness of pond-wiring as a measure to reduce cormorant predation on commercial fishponds in the Deep Bay area. The potential effect of pond-wiring on other waterbirds is also reviewed. Client: AFCD.
- Nov 2006 – July 2007 **Age Structure Assessment of Wintering Black-faced Spoonbill in Hong Kong 2006-2007, AFCD**
 Project manager and field surveyor. Study of age structure of the endangered bird species Black-faced Spoonbill in Mai Po Marshes Nature Reserve in winter 2006-2007. Client: AFCD.
- Jul 2006 – to date **Shenzhen River Regulation Project – Stage IV, Black & Veatch**
 Terrestrial Ecologist of the feasibility study of drainage improvement of the Shenzhen River. The project included literature review of ecological condition within and near the proposed project area, ranking of project options, initial assessment and recommendation of mitigation measures. Client: Shenzhen River Regulation Office.
- Jul – Sep 2006 **Comprehensive Development and Conservation Management, Yunnan, China.**
 Provided ecological consultancy services for proposed zoning and planning of an area near Dianchi, the largest lake in Yunnan Province and one of the ten largest lakes in China. Proposed development included residential housing, wetland park and conservation management. Client: private.
- May 2006 **Infrastructure of Centennial Campus of The University of Hong Kong, Black and Veatch**
 Terrestrial Ecologist of the preliminary study of the construction of The Centennial Building of the HKU Western Expansion. Client: Civil, Structure & Geotechnical Engineering Services of The University of Hong Kong.
- Dec 2005 **Preparation of a Comprehensive Fauna Species List for Hong Kong Streams**
 Preparation of a fauna list of local streams and relevant ecological information for education purposes. Client: Greenpower.
- Dec 2005 – Dec 2007 **Ecological Monitoring of the Extension of Kau Sai Chau Golf Course, Black and Veatch**
 Ecologist to monitoring the construction phase of the third golf course on Kau Sai Chau, Sai Kung. Client: Hong Kong Jockey Club.
- Oct 2006 – Jun 2007 **Ecological Surveys and Assessment for the Extension of HKFYG Hong Kong Jockey Club Sai Kung Outdoor Training Camp**
 Provided ecological consultancy services for proposed extension of a camp site near Tai Mong Tsai. Conducted ecological surveys and assessment on the potential impacts of the proposed project and recommended mitigation measures. Client: Hong Kong The Hong Kong Federation of Youth Groups.
- Nov 2005 – Jan 2006 **Main Arena of the 2008 Olympic Equestrian Event, Arup**
 Terrestrial Ecologist for literature review and ecological survey of avifauna and ardeid nesting colony in Penfold Park. Client: Hong Kong Jockey Club
- Oct 2005 – Sep 2007 **Environmental and Landscaping Detailed Design for Drainage Improvement in Southern Lantau, Arup**
 Terrestrial Ecologist for baseline survey and design of monitoring methodology. Conduct terrestrial fauna surveys of habitats on and around the site. Client: DSD

- Sep 2005 – Feb 2006 **Natural Terrain Hazard Mitigation Works Design in Kwai Chung, Victoria Road and Luk Keng**, Arup
Terrestrial Ecologist for ecological surveys and assessment of the slope works at Luk Keng. Key ecological issues included possible impacts to fung shui woods, CA zone, nearby Country Park, and Luk Keng Marshes. Client: CEDD.
- Sep 2005 – Jan 2006 **S16 Application for a Proposed Residential Development at Lot 379 and 380 RP in DD 186, Tao Fung Shan, Shatin**, ARUP
Terrestrial Ecologist for baseline survey and design of monitoring methodology. Conduct terrestrial fauna surveys of habitats on and around the site and impact assessment for the proposed project. Client: Private developer
- Aug 2005 **CLP Power Substation in Chung Kwai Chung**, ERM
Terrestrial Ecologist of field study of a proposed power substation in central Kwai Chung. Conduct terrestrial fauna surveys of habitats on and around the site. Client: China Light Power.
- Jul – Nov 2005 **Pilot Conservation Proposal under Public-Private Partnership for Sha Lo Tung**, Arup
Terrestrial Ecologist for ecological impact assessment study and conservation management plan for a proposed ecological park at Sha Lo Tung. Conduct terrestrial fauna surveys of habitats on and around the site. Client: Private
- Jun 2005 – Oct 2006 **CLP Power Transmission Cable Route Selection Au Tau “B” Substation to Fuk Shun Street Substation**, Black & Veatch Hong Kong Ltd.
Terrestrial Ecologist for ecological impact assessment study of selection of cable route in NWNT. Conduct terrestrial fauna surveys of habitats on and around the site. Client: China Light Power.
- Feb 2005 – Sep 2007 **NENT Landfill Extension**, Arup
Terrestrial Ecologist for ecological impact assessment study of a proposed extension of the NENT Landfill. Conduct terrestrial fauna surveys of habitats on and around the site. Client: EPD
- Feb 2005 – to date **Lantau Logistics Park Development**, Arup
Terrestrial Ecologist for ecological impact assessment study of a proposed logistic park on the north of Lantau Island. Conduct terrestrial fauna surveys of habitats on and around the site.
- Apr 2005 – Apr 2008 **Pilot Conservation Proposal under Public-Private Partnership for Shuen Wan**
Terrestrial Ecologist for ecological impact assessment study and conservation management plan for a proposed ecological park at Shuen Wan. Conduct terrestrial fauna surveys of habitats on and around the site. Client: Private
- Feb 2005 – Jul 2008 **Pilot Conservation Proposal under Public-Private Partnership for Tai Ho**
Terrestrial Ecologist for ecological impact assessment study and conservation management plan for a proposed ecological park at Tai Ho. Conduct terrestrial fauna surveys of habitats on and around the site. Client: Private
- Jan – Sep 2005 **Pilot Conservation Proposal under Public-Private Partnership for Mui Tsz Lam**
Terrestrial Ecologist for ecological impact assessment study and conservation management plan for a proposed ecological park at Mui Tsz Lam. Conduct terrestrial fauna surveys of habitats on and around the site. Client: Private.
- Nov 2004 – Apr 2006 **Drainage Improvement in Northern Hong Kong Island - Hong Kong West Drainage Tunnel**, Black & Veatch Hong Kong Ltd.
Terrestrial Ecologist for ecological impact assessment study and conservation management plan for a proposed drainage improvement project in Northern Hong Kong Island. Client: DSD.
- Sep 2004 – Oct 2005 **Ecological Assessment for S16 Application at Lamma Island**, Black & Veatch Hong Kong Ltd.
Terrestrial Ecologist for ecological study of a proposed development project. Conduct terrestrial fauna surveys of habitats on and around the site. Recommendation of mitigation measures. Client: Private.

- Aug 2004 – Dec.2004 **Ecological Assessment for S16 Application at To Fung Shan, N.T.**, PlanArch Consultants Ltd.
Terrestrial Ecologist for ecological study of a proposed development project. Conduct terrestrial fauna surveys of habitats on and around the site.
- Oct 2004 – to date **Hong Kong – Zhuhai – Macao Bridge North Lantau investigation**, Arup.
Perform literature review, impact assessment and propose mitigation for potential ecological impact. Client: Highway Department.
- Feb – July 2004 **Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities**, ERM
Terrestrial Ecologist for ecological study of a proposed gas storage station on Tai A Chau (Soko Islands). An alternative site at Black Point was also studied and surveyed. Client: China Light Power.
- Jan – Oct 2004 **West Rail Wetland Recreation Study**, ERM
Project manager and field surveyor. Conduct terrestrial fauna surveys of wetlands created in Central New Territories to compensate the loss of wetlands during construction of railway.
- Nov 2003 – Sep 2004 **Age Structure Assessment of Wintering Black-faced Spoonbill in Hong Kong 2003-2004**
Project manager and field surveyor. Study of age structure of the endangered bird species Black-faced Spoonbill in Mai Po Marshes Nature Reserve in winter 2003-2004. Client: AFCD.
- Jun 2003 – to date **Sai Sha Residential Development**, Sun Hung Kei
Terrestrial Ecologist for ecological study of a proposed residential development in Sai Sha, Sai Kung. Conduct terrestrial fauna surveys of habitats on and around the site. Client: Sun Hung Kei.
- Jul 2003 – 2004 **Drainage Improvement in Tsuen Wan and Kwai Chung – Tsuen Wan Drainage Tunnel - Investigation**, ERM-Hong Kong, Ltd.
Terrestrial Ecologist for ecological study of a flood control system for the northern New Territories. Conduct terrestrial fauna surveys of habitats on and around the site, and identify ecological resources of importance for use in EIA. Client: DSD.
- May – Aug 2003 **Shatin to Central Link – Tai Wai to Hung Hom Section**, ERM-Hong Kong, Ltd.
Terrestrial Ecologist for ecological study of a proposed railway alignment in east New Territories. Conduct terrestrial fauna surveys of habitats on and around the site to establish the ecological baseline data for impact assessment. Client: KCRC.
- Dec 2002 – Oct 2004 **Improvement in Northern New Territories – Package B: Investigation, Design and Construction**, ERM-Hong Kong, Ltd.
Terrestrial Ecologist for ecological study of a flood control system for the northern New Territories. Conduct terrestrial fauna surveys of habitats on and around the site, and identify ecological resources of importance for use in EIA. Client: DSD.
- Nov 2002 – Apr 2006 **Drainage Improvement in Northern Hong Kong Island – Hong Kong West Drainage Tunnel**, Black & Veatch Hong Kong, Ltd.
Perform literature review, impact assessment and propose mitigation for potential ecological impact. Client: HyD.
- Apr 2002 – May 2004 **EIA of Yuen Long and Kam Tin Sewerage and Sewage Disposal, Stage II: Sewers, Rising Mains and Ancillary Pumping Stations, Hong Kong**, Ove Arup and Partners Ltd.
Terrestrial Ecologist for ecological study of a proposed sewerage and sewage disposal system for the north-west New Territories. Conduct terrestrial fauna surveys of habitats on and around the site, and identify ecological resources of importance for use in EIA. Client: TDD.

- Apr 2002 – to date **Aberdeen, Ap Lei Chau and Pok Fu Lam Sewerage – Stage 1 Remainder and Stage 2**, Atkins China Ltd.
Terrestrial Ecologist for ecological assessment of a proposed renewal of the existing sewerage systems and construction of pumping stations in southern part of Hong Kong Island. It is part of the schemes recommended under the “Aberdeen, Ap Lei Chau and Pokfulam Sewerage Master Plan”. Conduct ecological surveys, assess various options and potential impacts and advise on mitigation measures. Ecosystems sub-consulted to Environmental Management Ltd. Client: DSD.
- Apr 2002 – to date **Easterly Link Road – Feasibility Study**, Ove Arup and Partners Ltd.
Assessment of various alignment options linking Deep Bay Link and Yuen Long Highway. Key ecological issues include loss of intertidal and other wetland habitats. Client: HyD.
- Apr 2002 – Apr 2003 **Shenzhen Western Corridor – Design and Construction**, Ove Arup and Partners Ltd.
Review of the findings, conclusion and recommendations of the Investigation and Planning Assignment of Shenzhen Western Corridor, and carrying out of any additional studies recommended during the Review Phase and the detailed design of the Project. Client: HyD.
- Apr 2002 – Jun 2004 **EIA and TIA Studies for Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 2 – Investigation**, Ove Arup and Partners Ltd.
Ecologist for ecological study and impact assessment of a proposed sewerage and sewage disposal system for the north-west New Territories. Client: DSD.
- Dec 2001 – Oct 2002 **Tai O – Ngong Ping STW and Sewerage EIA**, EML-Hong Kong, Ltd.
Project Manager and Terrestrial Ecologist for ecological assessment of proposed sewerage alignment from Ngong Ping to Tai O. Conduct baseline surveys at terrestrial habitats from Ngong Ping to Tai O. Client: Drainage Service Department.
- Oct 2001 – Nov 2005 **Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung, Black & Veatch HK Ltd.**
Terrestrial Ecologist for ecological study and impact assessment of a proposed golf course on Kau Sai Chau in Sai Kung. Client: The Hong Kong Jockey Club.
- Sep 2001 – Mar 2004 **Ecological Monitoring for Mangrove Cutting Works at the River Outlets of Tin Shui Wai Western Drainage and Shan Pui River Channel**
Ecologist. Monitoring of avifauna at two channel sections under management. Client: DSD.
- Aug 2001 – Oct 2002 **Shenzhen Western Corridor – Investigation and Planning, Ove Arup & Partners**
Ecologist for ecological assessment of proposed bridge/tunnel connecting Shekou and Outer Deep Bay. Conduct baseline surveys at both terrestrial and inter-tidal habitats; identify constraints, assess potential impacts and advise on mitigation measures and need for further studies. Client: HyD.
- Aug 2001 – Oct 2002 **Upgrading and Expansion Works of San Wai Sewage Treatment Works and Expansion of Ha Tsuen Pumping Station**, EML-Hong Kong, Ltd.
Project Manager and Terrestrial Ecologist for ecological assessment of proposed sewage treatment work in San Wai and expansion of Ha Tsuen Pumping Station. Conduct baseline surveys; identify constraints, assess potential impacts and advise on mitigation measures and need for further studies. Client: DSD.
- Aug 2001 – Oct 2002 **Tai O – Ngong Ping Ecological Surveys**, ERM-Hong Kong, Ltd.
Terrestrial Ecologist for ecological assessment of proposed sewerage alignment from Ngong Ping to Tai O. Conduct baseline surveys at terrestrial habitats from Ngong Ping to Tai O. Client: DSD.
- Oct – Nov 2000 **132 KV Supply Circuit from Pui O via Chi Ma Wan Peninsula via Sea Crossing towards Cheung Chau**, ERM-Hong Kong, Ltd.
Terrestrial Ecologist for survey of butterfly, dragonfly, mammal and herpetofauna for a cable installation project. Client: CLP Power Hong Kong Limited.

- Jul 2000 – Mar 2004 **Study on Wetland Compensation. Field Trials – Monitoring Works**, BBV Hong Kong Limited.
Conduct terrestrial fauna surveys for baseline and trial monitoring of fish ponds at various sites. Client: AFCD.
- Apr – Jun 2001 **Explosive Ordnance Disposal Facility, Hong Kong** - Ove Arup & Partners
Terrestrial Ecologist for ecological assessment of proposed explosives disposal facility for use by Hong Kong Police Force. Conduct baseline surveys at two sites at Cape Collinson and Tseung Kwan O; identify constraints, assess potential impacts and advise on mitigation measures and need for further studies. Client: CED.
- Oct 2000 – Aug 2005 **Planning and EIA for Further Recreational Facilities on Kau Sai Chau, Hong Kong** - Binnie Black and Veatch
Terrestrial Ecologist for ecological and fisheries study of proposed recreational facilities on the island of Kau Sai Chau, Port Shelter. Proposals include an extension to the existing public golf facilities, and hiking trails. Provided input at initial planning stage, conduct baseline surveys and assess finalized designs. Key issues include natural coastal habitats, freshwater marshes and streams. Client: Kau Sai Chau Public Golf Course Ltd.
- Aug – Oct 2000 **Additional Study on Waste to Energy Facility, Hong Kong** - Environmental Management Ltd.
Terrestrial Ecologist for ecological study of a proposed waste incineration and cogeneration plant in north-west New Territories. Conduct surveys of terrestrial fauna on and around the site, identify resources of importance, assess and evaluate ecological impacts, and compare the study site to other proposed sites in terms of ecological suitability for the development. Client: Environmental Protection Department.
- Feb 2000 – Feb 2001 **Comprehensive Feasibility Study for the Revised Scheme of South East Kowloon Development, Hong Kong** - Environmental Management Ltd.
Terrestrial Ecologist for feasibility study of a proposed major urban area redevelopment in central Kowloon. The site, a former airport, is now slated for residential and related urban development. Conducted wildlife surveys, identified ecological constraints, assessed ecological impacts and proposed mitigation measures. Client: Territory Development Department.
- Jan 2000 – Apr 2001 **EIA of Yuen Long and Kam Tin Sewerage and Sewage Disposal, Stage I: Sewers, Rising Mains and Ancillary Pumping Stations, Hong Kong** - ERM-Hong Kong Ltd.
Terrestrial Ecologist for ecological study of a proposed sewerage and sewage disposal system for the north-west New Territories. Conduct terrestrial fauna surveys of habitats on and around the site, and identify ecological resources of importance for use in EIA. Client: Territory Development Dept.
- Jan 2000 – Jun 2001 **Feasibility Study on Housing Development at Whitehead and Lee On in Ma On Shan, Hong Kong** – Binnie Black & Veatch
Terrestrial Ecologist for EIA of proposed urban development on mixed-use site including former detention centre and agricultural lands. Conducted wildlife surveys, identified ecological constraints, assessed ecological impacts and proposed mitigation measures. Client: Territory Development Department.
- Feb 1999 – Mar 2001 **South East New Territories Development Strategy Review, Hong Kong** - City Planning Consultants
Terrestrial Ecologist for a strategic-level study on development in a region of Hong Kong dominated by extensive protected areas and undeveloped land. A focus of the study is identifying opportunities to improve the effectiveness of biological conservation in the area and using this to support other objectives such as recreation and tourism. Client: Planning Department.

- Feb – Dec 1999 **Feasibility Study for Development at Cha Kwo Ling Kaolin Mine Site, Hong Kong** - EHS Consultants Ltd.
Terrestrial Ecologist for EIA of a proposed housing development in East Kowloon. Conducted fauna surveys, identified ecological constraints, assessed ecological impacts and proposed mitigation measures. Client: Civil Engineering Department.
- Nov 1998 – Apr 1999 **Further Development of Tseung Kwan O Feasibility Study, Hong Kong** - Scott Wilson (Hong Kong) Ltd.
Terrestrial Ecologist for EIA of proposed highway at Tseung Kwan O to link the New Town with eastern Kowloon. Conduct field surveys, predict impacts of project construction and operation, and develop mitigation measures. Client: Civil Engineering Department.
- Sep 1998 – Aug 1999 **Mangrove Habitat Restoration and Sheltered Boat Anchorage Provision at Tai O, Hong Kong** - Scott Wilson (Hong Kong)
Terrestrial Ecologist for EIA of coastal boat anchorage and associated formation of mangrove restoration site. Conduct baseline surveys, assess project impacts and develop mitigation measures. Provide input to mangrove restoration proposal. Client: Civil Engineering Department.
- Aug 1998 – Jul 2000 **Operation-phase Monitoring of Route 3 Highway, Hong Kong**
Avian Ecologist. Monitoring of egret sites along the alignment of a new highway in North-west New Territories. Egrets were identified as a significant ecological resource for this project by Government and project consultants. Ongoing monitoring documents changes in species use, numbers of birds, numbers of young hatched and fledged at each egret, and analyses trends in terms of past data.
- Aug 1998 – July 1999 **Development of an Ecological Monitoring Programme for the Mai Po and Inner Deep Bay Ramsar Site, Hong Kong** - Hyder Environmental Consultants Ltd.
Avian Ecologist. Development of long-term ecological monitoring programme for Hong Kong's first and China's seventh Ramsar Site. Identify and field test monitoring methodologies to enable quantification of changes in selected parameters which will direct management action. Client: Agriculture and Fisheries Dept.
- Jul 1998 – Oct 2003 **Outlying Islands Sewerage Stage 1 Phase II Package J, Hong Kong** - Maunsell Environmental Management Consultants Ltd.
Terrestrial Ecologist for EIA of sewage collection, treatment and disposal facilities for coastal community on Lamma Island, Hong Kong. Key issues include impacts to natural coastal zones. Design, conduct and analyse terrestrial field studies, assess project impacts and develop mitigation measures. Client: Drainage Services Department.
- Apr 1998 **Container Park at Mai Po Village, Hong Kong** - Allied Environmental Consultants Ltd.
Terrestrial Ecologist. Surveyed habitats and fauna of an open storage site and surroundings near Mai Po, North-west New Territories. Studies were commissioned as part of an application for continued use of the site for open storage. Client: Private.
- Mar – Sep 1998 **Engineering Investigation of Improvement to Junction of Magazine Gap Road and May Road, Hong Kong** - Urbis Ltd.
Terrestrial Ecologist for EIA of a road junction improvement scheme. Identified key ecological issues associated with the construction of a roundabout and a tunnel. Major concerns included loss of woodland habitat and impacts to associated flora and fauna of conservation importance. Identified and evaluated potential impacts and proposed mitigation measures. Client: Highways Department.
- Nov 1997 – Apr 1999 **Feasibility Study for Additional Cross-Border Links (Crosslinks Further Study) Stage 2, Hong Kong/PRC** - Mouchel Asia Ltd.
Terrestrial Ecologist for EIA of two major Hong Kong-PRC bridge links and supporting road network. Survey terrestrial habitats and fauna within the potential project impact zone, predict ecological impacts and develop practicable mitigation measures. Studies have developed an extensive

ecological baseline for areas of Hong Kong previously poorly studied. Client: Planning Department, Hong Kong Government.

Nov 1997 – Aug 1998 **Planning and Engineering Feasibility Study of Development at Anderson Road, Hong Kong** - CES (Asia) Ltd.

Terrestrial Ecologist for EIA of a site near a quarry in East Kowloon proposed for residential development. Conducted baseline fauna surveys, assessed ecological significance of the site in local and Territorial context, predicted potential impacts and proposed mitigation measures. Client: Civil Engineering Department.

Oct 1997 – Feb 1999 **Remaining Development in Tung Chung and Tai Ho Comprehensive Feasibility Study, Hong Kong** - CES (Asia) Ltd.

Terrestrial ecologist for EIA of intensified New Town development on North Lantau. Focused on habitats and species of conservation importance on and near the site including streams, freshwater marshes, ravine woodlands, fung shui woods and mangroves. Identified ecological constraints, predicted project impacts and developed mitigation measures. Client: Territory Development Department.

Sep 1997 – Mar 2001 **Shenzhen River Regulation Project Stage 2 Construction Monitoring, Hong Kong/PRC** - CES (Asia) Ltd.

Project Manager and Avian Ecologist. Avifauna monitoring during construction phase of Stage 2 Shenzhen River dredging and training works. Periodic monitoring of bird abundance, diversity and other indicators to identify and assess negative impacts from construction works. Focus on species of high sensitivity/conservation significance.

Sep – Dec 1997 **Study on Increased Population in Ma On Shan, Hong Kong** - Maunsell Consultants Asia, Ltd.

Terrestrial Ecologist for Ecological Assessment of sites along the proposed Ma On Shan Rail link. Objective of the study was to assess potential for added population in the Ma On Shan railway catchment in order to enhance its financial viability. Client: Territory Development Department.

Aug 1997 – Aug 1998 **Planning and Engineering Feasibility Study of Development near Choi Wan Road and Jordan Valley, Hong Kong** - Scott Wilson (Hong Kong)

Terrestrial Ecologist for EIA of site in East Kowloon proposed for residential development. Conducted baseline fauna surveys, assessed ecological significance of the site in local and Territorial context, predicted potential impacts and proposed mitigation measures. Client: Civil Engineering Department.

Aug – Oct 1997 **Pai Tau Hang Rezoning Application, Hong Kong** - CES (Asia) Ltd.

Terrestrial Ecologist. Surveyed fauna of a forested site in Central New Territories. Studies were commissioned as part of an application to re-zone part of the land for residential development. Client: Private.

May 1997 – Apr 1999 **Main Drainage Channels and Poldered Village Protection Schemes for San Tin, Hong Kong** - ERM-Hong Kong, Ltd.

Terrestrial Ecologist. Studied avifauna and invertebrate communities at a rural site proposed for flood-control engineering works in North-west New Territories. The project site lies in an area of key local and regional importance for wetland flora and fauna, and supports numerous protected species. Predicted impacts of project construction and operation, and proposed mitigation measures to alleviate negative project impacts. Client: Territory Development Department.

Apr – Dec 1997 **Formation & Servicing at Fanling Area 36, Hong Kong** - Maunsell Consultants Asia Ltd.

Terrestrial Ecologist. Studied bird and invertebrate communities for EIA of urban expansion project at a rural site in Central New Territories. Major issues of concern were wetland and woodland habitat loss and consequent impacts to fauna. Predicted project impacts and proposed impact avoidance and mitigation measures, including wetland protection and restoration. Client: Civil Engineering Department.

Feb 1997 – Mar 2002 **Monitoring of Main Drainage Channels for Ngau Tam Mei, Yuen Long and Kam Tin, Hong Kong**

Project Manager and Avian Ecologist. Seasonal monitoring of avifauna in rural areas undergoing flood control engineering works in North-west New Territories. The project will monitor colonial bird nesting sites, avifauna use of new drainage channels, and avifauna use of river channels abandoned under the project. Monitoring results will be analyzed to provide quantitative comparison of bird communities based on channel area, season, predominant habitat type, and adjacent land use. Client: Territory Development Department.

Feb – Apr 1997 **Kennedy Road Improvement and Queen's Lines Link, Hong Kong - ENPAC Ltd.**

Terrestrial Ecologist. Conducted wildlife surveys on site proposed for widening and rerouting of road on urban fringe of north Hong Kong Island, focusing on ecology of protected animal species. Assessed ecological significance of the site in local and Territorial context, predicted potential impacts and proposed mitigation measures. Client: Highways Department.

Dec 1996 – Jan 1997 **Relocation of 132kV Power Transmission Line, Tin Shui Wai, Hong Kong - Urbis Ltd.**

Avian Ecologist. Terrestrial ecology survey and impact assessment for relocation of a power line. Major impacts identified included encroachment upon mangroves, wetlands, river channel and Conservation Area. Identified key sensitive receivers for ecology and proposed alterations in alignment to avoid these. Client: China Light & Power Ltd.

Nov 1996 – to date **Shuen Wan Residential Development, Hong Kong - CES (Asia) Ltd.**

Avian Ecologist. Surveyed avifauna at Shuen Wan, Tolo Harbour, on a freshwater and brackish-water wetland site of documented ecological significance. Predicted potential impacts of reclamation and semi-urban residential development upon fauna using the site (particularly wetland-dependent birds), and assisted in development of alternative development strategies to minimise negative ecological impacts. Client: Private.

Nov 1996 – Jun 1998 **Construction-phase Monitoring of Route 3 Highway, Hong Kong - Woodward Clyde International**

Project Manager and Terrestrial Ecologist. Monitoring of egret sites along the alignment of a highway construction project in North-west New Territories. Egret sites were identified as a significant ecological resource for this project by Government and project consultants. Analyzed survey results to detect effects of highway construction, considered cumulative impacts of the highway project and other ongoing developments in the study area. Client: Route 3 Contractors Consortium.

Nov 1996 – Mar 1998 **KCRC Western Corridor Railway, Hong Kong - ERM-Hong Kong, Ltd.**

Avian Ecologist. Surveyed avifauna and habitats along alignment of proposed major new freight and passenger rail line to serve Kowloon, western and northern New Territories. Key ecological issues of concern were potential wetland losses and consequent impacts upon wetland-dependent wildlife, particularly waterfowl. Predicted impacts of project construction and operation, and proposed impact mitigation measures. Client: Kowloon-Canton Railway Corporation.

Nov 1996 **Lam Tsuen Road Rezoning Application, Hong Kong - CES (Asia) Ltd.**

Terrestrial Ecologist. Surveyed fauna at a rural agricultural site in Central New Territories proposed for re-zoning for residential development. Identified constraints and important features of the site including woodlands, stream and a nearby site of conservation significance for woodland plants and avifauna. Client: Private.

Nov 1996 – Dec 1997 **Main Drainage Channels for Fanling, Sheung Shui and Hinterlands, Hong Kong - CES (Asia) Ltd.**

Avian Ecologist. Surveyed avifauna and habitats along alignment of proposed drainage improvement and flood control works in Central New Territories. Assessed ecological significance of the site in local and Territorial context, predicted likely impacts of project construction and operation, and proposed impact mitigation measures. Client: Territory Development Department.

- Nov 1996 – Feb 1997 **Sham Chung 4-season Ecology Surveys**
Terrestrial Ecologist. Surveys of terrestrial fauna in Sham Chung, Sai Kung. Client: Private.
- August 1995 – to date **Ecological Monitoring of Jockey Club Kau Sai Chau Public Golf Course – Hong Kong Jockey Club.**
Terrestrial Ecologist. Conduct surveys on the Jockey Club Kau Sai Chau Public Golf Course. The fauna groups include mammal, bird, herpetofauna, butterfly and dragonfly.

Other Activities

- Jan 2005 **Asian Waterfowl Census and International Black-faced Spoonbill Counts – Zhanjiang Mangroves National Nature Reserve**
Field Surveyor. Participate in the Asian Waterfowl Census at Zhanjiang Mangroves National Nature Reserve.
- Jun – Nov 2003 **A Pilot Biodiversity Study of the Eastern Frontier Closed Area and Northeast New Territories, June – December 2003 – Kadoories Farm and Botanic Garden**
Field Surveyor. Participate in the survey of avifauna in four sites of ecological importance in the frontier closed area of Northeast New Territories. Collected data will contribute to the decision of feasibility of opening up the frontier closed area.
- Dec 2002 **Training Course for Global Environmental Facilities (GEF) Project Reserves – GEF Project Office**
Field Assistant. Participate in the training of staffs from wetland reserve of China to identification of birds in wild, and introduction of the concept and objectives of field surveys. Reserves involved included Taifeng NNR and Yancheng NNR, Jiangsu Province of PRC.
- Nov 2001 – to date **Winter Bird Atlas - Hong Kong Bird Watching Society**
Field Surveyor. Participate in the survey of distribution and abundance of local avifauna organised by Hong Kong Bird Watching Society. Count sites are on west shore of Tolo Harbor, including Tai Po Kau Nature Reserve. Collected data will contribute to local and regional conservation efforts.
- Mar – Sep 2001 **Bird Surveys in Six Country Parks - Hong Kong Bird Watching Society**
Project Manager and Field Surveyor. Participate in surveys of landbirds in country parks organized by Hong Kong Bird Watching Society and funded by AFCD. Also responsible for report write-up.
- Mar – Jun 2000 **Nest Box Survey in Country Parks of Hong Kong**
Field Surveyor. Participate in the study of bird uses of nest boxes in local country parks. Survey sites covered Central and West New Territories, Lantau and Sai Kung Peninsula.
- Jul 1998 – Oct 2002 **Waterfowl Count, Hong Kong - Hong Kong Bird Watching Society**
Field Surveyor of egret survey and Professional oversight for egret count report. Participate in monthly Waterfowl Count organized by Hong Kong Bird Watching Society. Monitoring of ardeid nesting population in all local egretries during breeding season. Monthly counts and Egret counts provide essential data on bird migration through and overwintering in Deep Bay wetlands, and dynamic of breeding population, which will contribute to local and regional conservation efforts.
- Apr – Aug 1998 **Tai Po Kau Breeding Bird Survey, Hong Kong - Hong Kong Bird Watching Society**
Field Surveyor. Participate in Breeding Bird Survey organised by Hong Kong Bird Watching Society. Study area was Tai Po Kau Nature Reserve. The 1998 survey is part of an ongoing study by the Society.

Mar 1997

Faunal Survey of Nine Forest Reserves in Tropical South China (Stage 1), PRC - Kadoorie Farm & Botanic Garden

Avian Ecologist. Participated in initial surveys at forested Nature Reserves in Guangdong Province. Studies are intended to provide ecological baseline to support management decisions at the reserves.

Publications

- Kwok, H.K. (Submitted). Seasonality of a forest bird community in Hong Kong, South China. *Hong Kong Bird Report*.
- Kwok, H.K. (In press). Foraging ecology of insectivorous birds in a mixed forest of Hong Kong, South China. *Acta Ecologica Sinica*.
- Leung, V., Lin, X.T., **Kwok, H.K.** (In press). Flora and ardeid communities of Taipa Egretty, Macau. *Acta Ecologica Sinica*.
- Kwok, H.K. (In press). Forest. In Lam, W.Y. and Wong, L.C. (eds.) *Ecology of Birds of Hong Kong. Kadoorie Farm and botanical Garden, Hong Kong*.
- Leung, V., Lin, X.T. and **Kwok, H.K.** 2008. *The Habitats of Fresh Water Wetlands of Macao*. Civic and Municipal Affairs Bureau, Macau.
- Kwok, H.K. 2007. Changes of a forest bird community in Hong Kong, South China in 10 years. *Acta Ecologica Sinica*: 27(10): 3993-4001.
- Kwok, H.K.** and Dahmer, T.D. 2006. Ecological impacts of flood control project on birds. *Acta Ecologica Sinica* 26(4): 1231-1233.
- Kwok, H.K.** and Dahmer, T.D. 2004. A second proven breeding record of Fantail Warbler in Hong Kong. *Hong Kong Bird Report 1999/2000*: 277-278.
- Kwok, H.K. 2004. *Preliminary investigation on the potential effect of overhead wires on Little Egrets Egretta garzetta, Chinese Pond Heron Ardeola bacchus and Great Egrets Casmerodius albus*. Hong Kong Bird Watching Society Technical Paper Series: 2004 TR 1. The Hong Kong Bird Watching Society.
- Ma, M. and **Kwok, H.K.** 2004. Xinjiang Ground-Jay *Podoces biddulphi* in Taklimakan Desert. *Forktail* 20: 121-124.
- Kwok, H.K.**, Wong, L.C., So, N.H. and Lui, T.H. 2002. Breeding Bird Survey, Tai Po Kau, Hong Kong, 1998. *Hong Kong Bird Report 1998*: 106-109.
- Kwok, H.K.** and Corlett, R.T. 2002. Seasonality of forest invertebrates in Hong Kong, South China. *Journal of Tropical Ecology* 18: 637-644.
- Kwok, H.K.** and Dahmer, T.D. 2002. Habitat Utilization by Little Egrets *Egretta garzetta* Breeding at Tai O Egretty. *Memoirs of the Hong Kong Natural History Society* 25: 95-103.
- Kwok, H.K. 2002. Diurnal pattern of forest bird activities in Hong Kong. *Memoirs of the Hong Kong Natural History Society* 25: 105-109.
- Kwok, H.K.** and Dahmer, T.D. 2002. Bird community on hill fire maintained grassland. *Memoirs of the Hong Kong Natural History Society* 25: 111-116.
- Kwok, H.K. 2002. Vertical stratification of forest bird community in Tai Po Kau Nature Reserve. *Memoirs of the Hong Kong Natural History Society* 25: 161-167.
- Kwok, H.K.** and Lock, N.Y. 2002. Bird community in a young lowland forest in Hong Kong. *Memoirs of the Hong Kong Natural History Society* 25: 169-174.
- Wong, L.C. and **Kwok, H.K.** 2002. *Egretty counts in Hong Kong, with particular reference to the Mai Po and Inner Deep Bay Ramsar Site – Summer 2001 report*. The Hong Kong Bird Watching Society.
- Leung, V. and **Kwok, H.K.** 2002. An ardeid roost of regional importance. *Porcupine!* 25: 13.
- Kwok, H.K.** and Dahmer, T.D. 2001. Bird communities on cultivated lands in Hong Kong. *Memoirs of the Hong Kong Natural History Society* 24: 181-188.

- Kwok, H.K. 2001. Caterpillar abundance in the canopy of a secondary forest. *Memoirs of the Hong Kong Natural History Society* 24: 189-192.
- Kwok, H.K. 2001. Seasonality of fruit abundance in a secondary forest. *Memoirs of the Hong Kong Natural History Society* 24: 193-197.
- Kwok, H.K. 2001. *Bird Surveys in Six Country Parks*. Agriculture, fisheries and Conservation Department, Hong Kong.
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- Kwok, H.K.** and Corlett, R.T. 2000. The bird communities of a natural secondary forest and a *Lophostemon confertus* plantation in Hong Kong, South China. *Forest Ecology and Management* 130: 227-234.
- Wong, L.C., **Kwok, H.K.** and Carey, G. 2000. *Egretty counts in Hong Kong, with particular reference to the Mai Po and Inner Deep Bay Ramsar Site – Summer 1999 Report*. The Hong Kong Bird Watching Society.
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Speech

- Kwok, H.K. 25 February 2009. *An Introduction to Bird Migration in Hong Kong*. Produce Green Foundation.
- Kwok, H.K. 20 June 2008. *Herpetofauna and mammal of Kau Sai Chau Public Golf Course*. Kau Sai Chau Jockey Club Golf Course.
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- Kwok, H.K. 23 March 2006. *An Introduction to Forest Ecology of Hong Kong*. Produce Green Foundation.
- Kwok, H.K. 7 October 2005. *An Introduction to Great Cormorant of Hong Kong*. Kau Sai Chau Jockey Club Golf Course.
- Kwok, H.K. 6 October 2005. *Wildlife of Kau Sai Chau Public Golf Course*. Kau Sai Chau Jockey Club Golf Course.
- Kwok, H.K. 1 April 2005. *Birds of Kau Sai Chau Public Golf Course*. Kau Sai Chau Jockey Club Golf Course.

- Kwok, H.K. 15 October 2004. *Fauna on Kau Sai Chau Public Golf Course*. Kau Sai Chau Jockey Club Golf Course.
- Kwok, H.K. 24 June 2003. *Review of Ecological Compensation in Hong Kong*. An Ecology Training Course for Developers, Planners and Engineers: Ecological Impacts of Development Projects – Assessment, Mitigation and Monitoring. Business Environment Council, Kadoorie Farm & Botanic Garden and World Wide Fund Hong Kong.
- Kwok, H.K. 12 April 2001. *An Introduction to Ardeids of Hong Kong*. Kau Sai Chau Jockey Club Golf Course.

Profession:	Ecological Consultant
Position:	Aquatic Ecologist, Ecosystems Ltd.
Primary Responsibility:	To perform aquatic fauna & fisheries surveys and to carry out ecological and fisheries impact assessment.
Years with Firm:	10
Date of Birth:	1969
Nationality:	Hong Kong SAR, China

Education and Professional Qualifications

MPhil, Coastal Ecology, University of Hong Kong, 1996
BSc, Marine Biology and Environmental Biology, Chinese University of Hong Kong, 1992
Certified Advanced Open Water Diver (PADI)
Member, Marine Biological Association of Hong Kong
Environmental Consultant, Hong Kong Underwater Association (HKUA)
Training Lecturer for Team Scientist, Reef Check
Team Scientist, Reef Check
Training Lecturer for Certificate Marine Conservation Course (HKUA & AFCD)
Organiser of HKUA marine ecological monitoring programme "Seaview"
Lecturer for Diploma Course for Ecotour Guide (Produce Green Foundation)

Key Qualifications

- Broad academic and practical experience with coastal and marine ecology, particularly invertebrates of the Hong Kong area.
 - Experience in designing and conducting field surveys and reporting for ecological and fisheries impact assessment.
 - Environmental Impact Assessment
 - Ecological Baseline Surveys and monitoring
 - Wetland enhancement and creation
 - Aquatic fauna in particular crustaceans
 - Intertidal and subtidal habitat assessment
 - Languages: Cantonese (native), English (fluent)
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Biodiversity/Ecological Training

- Lecturer for 'Hong Kong Marine Habitats' and 'Hong Kong Marine Invertebrates' in Marine Conservation Instructor Certification Course jointly organized by AFCD and Hong Kong Underwater Association, 2007.
- Lecturer for "Coastal Habitats in Hong Kong" in the "Diploma Course for Ecotour Guide" for Produce Green Foundation, 2007.
- Lecturer for 'Stream Ecology and EcolA' in "Workshop on Stream Conservation" for Rotary Centennial Institute for Wetland Conservation, 2006.
- Lecturer for 'Hong Kong Crustaceans' for Hong Kong Underwater Association, 2006.

- Speaker for “Mudflat ecology: Mangroves and associated fauna” for “Public Seminars on Marine Parks and Marine Ecology Resources” for AFCD, 2004-2008.
- Lecturer for “Mudflat Ecology (Seagrass and Mangrove Communities) in Yan Chau Tong Marine Park” in “Marine Parks Teacher Workshop” for AFCD, 2005-2006.
- Speaker for “Watch out your fingers - The dangers and funs of knowing some crabs in Hong Kong” for “Public Lecture - Wetland Exploration Series” for Hong Kong Wetland Park, 2008.

Personal Profile

Mr. Lai is the Aquatic Ecologist at Ecosystems Ltd who has broad academic background and practical experience in marine and aquatic ecology, particularly invertebrates of the Hong Kong area. He has, together with other local ecologists, published two field guides on Hong Kong intertidal communities. Since joining Ecosystems Ltd. in 1999, he has particular responsibility for all marine and freshwater ecological impact assessment and studies undertaken by the company. In addition to his responsibilities in ecology, he is the Fisheries Consultant of Ecosystems Ltd..

Mr. Lai has been invited since 2002 to provide training lectures for the participants of the activities of “Reef Check” programs, co-organised by the Reef Check Foundation and Agriculture, Fisheries and Conservation Department. The objectives of this activity are to monitor the health status of corals in Hong Kong and increase public awareness and attention on coral conservation. In addition, he has also provided lectures for AFCD public seminars and teacher workshops for several years.

Hong Kong Underwater Association (HKUA), which is the local diving federation designated and recognized by the Hong Kong Government for promotion and management of underwater activities as a sport and receiving Government subvention, invited Mr. Lai as the Environmental Consultant since 2006. He also organised, gave lectures and field trips in the first marine conservation course for diving instructors held jointly by HKUA and AFCD in 2007.

He has extensive experience with the Hong Kong EIA process including the application of EIA Ordinance and Technical Memorandum, designing and conducting ecological and fisheries field surveys and studies for EIA and EM&A, reporting, data analysis, proposing mitigation measures and project management.

Mr. Lai has also conducted coral dive surveys for a number of EIA studies in Hong Kong, including *the Feasibility Study for Lantau Logistics Park, Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung – Environmental Impact Assessment, Drainage improvements in Northern Hong Kong Island – Hong Kong West Drainage Tunnel, Feasibility Study on Housing Development at Whitehead and Lee On in Ma On Shan, Hong Kong, and Outlying Islands Sewerage Stage 1 Phase II Package J - Sok Kwu Wan Sewage Collection, Treatment and Disposal Facilities.*

In association with local and overseas benthic experts, Mr. Lai also provided services on grab or core sampling for the investigation of benthic infauna communities in various projects, including Feasibility Study for Intensification and Extension of Tseung Kwan O New Town; Tseung Kwan O Development Phase III Road P2, Construction-phase Monitoring of Main Drainage Channels for Ngau Tam Mei, Yuen Long and Kam Tin; Study on Wetland Compensation; and Ecological Monitoring for Mangrove Cutting Works at the River Outlets of Tin Shui Wai Western Drainage and Shan Pui River Channel.

Local cetaceans especially Chinese White Dolphin is the major concern in many infrastructure projects in western Hong Kong waters such as Tai O Sheltered Boat Anchorage, Shenzhen Western Corridor - Investigation and Planning, Hong Kong- Zhuhai- Macao-Bridge, and Lantau Logistics Park. Mr. Lai has conducted dolphin surveys (including land-based surveys, vessel surveys and aerial surveys by both helicopter and fixed-wing aircraft) and ecological assessment for these projects.

Mr. Lai has also conducted freshwater surveys for numerous projects in HKSAR, including Ngong Ping Sewage Treatment Works and Sewerage, Yuen Long and Kam Tin Sewerage and Sewage Disposal, Stage I: Sewers, Rising Mains and Ancillary Pumping Stations, Drainage improvements in Tsuen Wan and Kwai Chung – Tsuen Wan Drainage Tunnel, Drainage improvements in Northern Hong Kong Island – Hong Kong West Drainage Tunnel.

He has conducted a number of EM&A programmes such as Operation-phase Monitoring of Route 3 Highway, Ngau Tam Mei-Kam Tin-Yuen Long Main Drainage Channel Ecology Monitoring, Ecological Monitoring for Mangrove Cutting Works at the River Outlets of Tin Shui Wai Western Drainage and Shan Pui River Channel, Independent Checker for the implementation of Tai O Sheltered Boat Anchorage, and field trials for Study on Wetland Compensation. He also participated in the Development of an Ecological Monitoring Programme for the Mai Po and Inner Deep Bay Ramsar Site.

Experience Record

- 1999 - to date *Aquatic Ecologist, Ecosystems Ltd., Hong Kong*
- Jan 2009 **South Island Line (East) – Benthic Community Survey**
Project Manager and Marine Ecologist for a grab sampling survey in Aberdeen to investigate the benthic communities in sea areas crossed by the alignment.
- June 2008 – to date **Agreement No. CE 14/2008 (CE) Hong Kong-Zhuhai-Macao Bridge Hong Kong Boundary Crossing Facilities – Investigation, Arup**
Project Manager, Marine Ecologist and Fisheries Consultant for an EIA study involving large-scale reclamation in North Lantau waters near the Northeast corner of Airport Island. Key issues include the habitat loss of Chinese White Dolphin, the impacts to the intertidal communities and subtidal benthos. Client: Highways Department.
- June 2008 – to date **Proposed Reclamation for Boat Storage Hardstanding and Submarine Sewage Pipelines at Middle Island, Deep Water Bay – Marine Ecological Study**
Project Manager and Marine Ecologist for an ecological study, aims at collecting ecological data to support the gazettal process under Foreshore and Seabed (Reclamation) Ordinance. Client: Royal Hong Kong Yacht Club
- May 2008 – to date **Private Development in Lamma.**
Project Manager and Marine Ecologist for a private development project in Lamma Island, involving seawall construction and vessel service facilities.
- April – June 2008 **CLP Power Circuit Route Selection – Ecological Baseline Survey**
Aquatic Ecologist. This project aims to collect ecological baseline data of fauna including mammals, birds, herpetofauna, butterfly, dragonfly, fish and aquatic invertebrates in habitats under and near pylons in country parks of the Central and West New Territories.
- Mar 2008 – to date **DC/2006/11 Drainage Improvement in Southern Lantau and Construction of Mui Wo Village Sewerage Phase 1**
Ecologist in the Environmental Team of the construction phase. Provide ecological mitigation measures and monitoring during construction phase. Ecological mitigation measures include capture survey for fish and frog before the construction works. Client: DSD.
- Dec 2007 – to date **Salt Water Supply system for Pokfulam Area – Ecological Survey**
Aquatic Ecologist for the proposed salt water supply system in the Pokfulam area of Hong Kong Island. Client: Water Services Department.
- Nov 2007 – to date **Development in Yuen Long District (Stage 1) Lau Fau Shan Development PWP Item No. 705CL – Hang Hau Tsuen Channel at Lau Fau Shan, BV**
Intertidal Ecologist, Aquatic Ecologist and Fisheries Consultant for the EIA study of a drainage improvement project in Lau Fau Shan. Review existing data and information, conduct field surveys and ecological impact assessment as well as fisheries impact assessment. Client: DSD.
- June 2007 – to date **Management of Contaminated Sediments, Arup**
Marine Ecologist for a study on the potential solutions to handle contaminated sediments. Review the baseline ecological conditions, assess the feasibility of potential methods and set the criteria in field experiments. Client: CEDD.
- Apr 2007 – Apr 2008 **Preliminary Environmental Review for Border Crossing Facilities of HZMB**
Marine Ecologist for the initial review of the site selection and acceptability of the proposed BCF in Hong Kong waters. Review existing data and information, conduct initial assessment for site selection and marine ecological impacts. Client: Highways Department.

- Mar 2007 – to date **West New Territories (WENT) Landfill Extension - Feasibility Study**
Aquatic and Marine Ecologist for ecological impact assessment study of a proposed extension of the WENT Landfill. Conduct stream and intertidal fauna surveys on and around the site. Client: EPD
- Mar 2007 – to date **Redevelopment of Sau Mau Ping Estate Phases 13 & 16. Surveys and Studies for Eco-Garden Design in Sau Mau Ping Estate, ph.13 &16 and 14.**
Project Manager for a urban housing redevelopment project. Conducted surveys to establish the ecological baseline conditions of the site and its vicinity and investigated the feasibility of establishing an eco-garden, and to recommend options for the eco-garden. Client: Housing Department.
- Mar 2007 – May 2007 **Yuen Long and Kam Tin Sewerage Stage 2 and Stage 3, Design and Construction. Ecological Survey and Assessment at Shan Pui Tsuen.**
Aquatic Ecologist for a sewage treatment works project. Conduct ecological baseline surveys and assessment for a proposed pumping station sitting on Wetland Buffer Area and propose mitigation measures. Client: DSD.
- Dec 2006 – Jul 2007 **Integration of Siu Ho Wan and Silver Mine Bay Water Treatment Works – Environmental Impact Assessment Investigation**
Project Manager and Aquatic Ecologist of the EIA study of water supply improvement of the Lautau. Conduct field surveys, assess impacts and propose mitigation measures. Client: Water Services Department.
- Dec 2006 – 2008 **Review of Pond-wiring to Reduce Cormorant Predation in Commercial Fishponds in Inner Deep Bay Area**
Project Coordinator of a study to investigate and analysis the effectiveness of pond-wiring as a cormorant deferring measure. The study covered coordinated counts of cormorants and other waterbirds in Deep Bay area, field checks on the conditions of wires installed on fishponds, and analysis of the effectiveness of the wiring. Client: Agriculture, Fisheries and Conservation Department.
- Nov 2006 – to date **Independent Audit on the Performance and Effectiveness of Ecological Compensatory Measures Implemented at Lok Ma Chau under the Spur Line**
Aquatic Ecologist of a study to investigate the factors on the effectiveness of the managed wetlands at Lok Ma Chau as a compensatory measure for fishpond loss. The study also includes a review on the Hong Kong and overseas practices and regulations of ecological compensation. Client: EPD.
- Jul 2006 **Shenzhen River Regulation Project – Stage IV**
Aquatic Ecologist of the feasibility study of drainage improvement of the Shenzhen River. Client: Shenzhen River Regulation Office.
- Jul – Sep 2006 **Comprehensive Development and Conservation Management, Yunnan, China.**
Aquatic Ecologist for a private client. Provided ecological consultancy services for proposed zoning and planning of an area near Dianchi, the largest lake in Yunnan Province and one of the ten largest lakes in China. Proposed development included residential housing, wetland park and conservation management.
- May 2006 – 2007 **Infrastructure of Centennial Campus of The University of Hong Kong**
Aquatic Ecologist for an ecological impact assessment of proposed service reservoirs at the University of Hong Kong. Conduct stream surveys on and around the site. Client: University of Hong Kong.
- Jan 2006 – to date **Ecological Monitoring Programme for the Public Golf Course Extension on Kau Sai Chau**
Aquatic Ecologist on project to conduct construction phase and operation phase ecological monitoring programme for the extension of Hong Kong's first public golf course.

- Dec 2005 **Preparation of a Comprehensive Fish Species List for Hong Kong Streams**
Preparation of a fish species list of local streams and relevant ecological information for education purposes. Client: NGO.
- Dec 2005 – 2007 **Tuen Mun Chek Lap Kok Link – Preliminary Environmental Review**
Marine Ecologist and Fisheries Consultant for the Preliminary Environmental and Feasibility Study for the proposed Tuen Mun Chek Lap Kok Link connecting Route 10 to North shore of Lantau. Input on the preliminary ecological and fisheries impact assessment and route selection process. Key issues included potential impacts on Chinese White Dolphin. Client: Highways Department.
- Nov 2005 – 2007 **Drainage Improvement in Southern Lantau**
Aquatic Ecologist for ecological mitigations and design of a proposed drainage improvement, as well as establishing ecological baseline for EM&A purpose in Mui Wo, Lantau. Input on the design of the drainage channels and conduct stream fauna surveys on the site. Client: DSD.
- Sep 2005 – 2006 **Natural Terrain Hazard Mitigation Works Design in Kwai Chung, Victoria Road and Luk Keng**
Project Manager and Aquatic Ecologist for ecological surveys and assessment of the slope works at Luk Keng. Key ecological issues included possible impacts to fung shui woods, CA zone, nearby Country Park, and Luk Keng Marshes. Client: CEDD.
- Sep 2005 – Mar 2006 **Proposed residential development at To Fung Shan**
Aquatic Ecologist for ecological assessment of a S16 Application including a proposed residential development and road improvement on a Green Belt area in Tai Wai. Client: Private.
- Jun 2005 – 2007 **132kV Cable Route – Au Tau to Fuk Shun Street**
Ecologist for ecological impact assessment study of a proposed underground cable at the NWNT area. Major issues included encroachment of Wetland Conservation Area and potential disturbance to wild birds. Client: China Light and Power Co. Ltd.
- Feb 2005 – 2007 **NENT Landfill Extension**
Aquatic Ecologist for ecological impact assessment study of a proposed extension of the NENT Landfill. Conduct stream fauna surveys on and around the site. Client: EPD.
- Feb 2005 –to date **Private-Public Partnership Project at Mui Tsz Lam**
Aquatic Ecologist. Conduct stream surveys and impact assessments. Potential impacts on stream habitats and fauna is the major concern in the proposal. Client: New World Development.
- Feb 2005 – to date **Private-Public Partnership Project at Sha Lo Tung**
Aquatic Ecologist. Conduct stream surveys and impact assessments. Potential impacts on stream habitats and fauna is the major concern in the proposal. Client: Sha Lo Tung Development.
- Feb 2005 – to date **Private-Public Partnership Project at Tai Ho, Swire Property.**
Aquatic Ecologist. Conduct stream surveys and impact assessments. Potential impacts on stream habitats and fauna is the major concern in the proposal. Client: Swire Property.
- Feb 2005 – to date **Lantau Logistics Park Development**
Project Manager, & Aquatic Ecologist. Conduct stream, intertidal and dolphin ecological surveys and impact assessments. Potential impacts on Chinese White Dolphin is the major concern in marine ecology. Client: Civil, Engineering and Development Department.
- Nov. 2004 - 2005 **EIA for the Extension of Public Golf Course on Kau Sai Chau, Hong Kong**
Marine and Freshwater Ecologist for ecological and fisheries study of the extension of the public golf course on the island of Kau Sai Chau, Port Shelter. Provided input for the design of the golf course layout to avoid sensitive aquatic receivers, conduct baseline surveys and assess the ecological and fisheries impacts based upon the finalized designs. Key issues include natural coastal habitats, freshwater marshes and streams, and nearby fish culture zones. Client: Kau Sai Chau Public Golf Course Ltd.

- Sep 2004 – Oct 2005 **Ecological Assessment for S16 Application at Lamma Island**
Ecologist for ecological study of a proposed development project. Conduct vegetation surveys on and around the site. Client: Private.
- Mar. 2004 - to date **Hong Kong – Zhuhai – Macao Bridge Hong Kong Section and North Lantau Highway Connection**
Ecologist & Fisheries Consultant. Conduct impact assessments on marine and intertidal ecology as well as fisheries. Potential impacts on Chinese White Dolphin is the major concern in marine ecology. Client: Highways Department.
- Aug. 2003 – Mar. 2005 **Drainage improvements in Tsuen Wan and Kwai Chung – Tsuen Wan Drainage Tunnel**
Project Manager, & Ecologist. Conduct stream and intertidal ecological surveys and impact assessments. Client: Drainage Services Department.
- Aug. 2003 - 2006 **Drainage improvements in Northern Hong Kong Island – Hong Kong West Drainage Tunnel**
Project Manager, Fisheries Consultant & Ecologist. Conduct impact assessments on fisheries, terrestrial and marine ecology. Supervise terrestrial and marine ecological surveys. Client: Drainage Services Department.
- Apr. 2003 – Feb. 2005 **Ecological Monitoring for Mangrove Cutting Works at the River Outlets of Tin Shui Wai Western Drainage and Shan Pui River Channel: Extension 2003-2004.**
Project Manager & Ecologist. Monitoring of benthos, bird use and mangrove regeneration at two channel sections under management. Client: Drainage Services Department.
- Dec. 2002 – Mar. 2005 **Drainage improvements in Northern New Territories– Package B**
Aquatic Ecologist for ecological baseline surveys of an assessment of a proposed improvement of the existing drainage systems in northern part of New Territories. Conduct ecological surveys, and establish ecological baseline conditions. Ecosystems sub-consulted to Environmental Resources Management Hong Kong. Client: Drainage Service Department.
- Apr. 2002 – Feb. 2005 **Aberdeen, Ap Lei Chau and Pok Fu Lam Sewerage – Stage 1 Remainder and Stage 2**
Aquatic Ecologist for ecological assessment of a proposed renewal of the existing sewerage systems and construction of pumping stations in southern part of Hong Kong Island. It is part of the schemes recommended under the “Aberdeen, Ap Lei Chau and Pokfulam Sewerage Master Plan”. Conduct ecological surveys, assess various options and potential impacts and advise on mitigation measures. Client: Drainage Service Department.
- Apr. 2002 – Nov 2002 **Easterly Link Road – Feasibility Study**
Assessment of various alignment options linking Deep Bay Link and Yuen Long Highway. Key ecological issues include loss of intertidal and other wetland habitats. Client: Highways Department.
- Apr. 2002 – Jun. 2004 **EIA and TIA Studies for Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 2 – Investigation**
Aquatic Ecologist for ecological study and impact assessment of a proposed sewerage and sewage disposal system for the north-west New Territories. Client: Drainage Service Department.
- Oct. 2001 – Oct. 2002 **Ngong Ping Sewage Treatment Works and Sewerage**
Aquatic Ecologist for ecological assessment of proposed sewage treatment work in Ngong Ping, Lantau Island. Conduct field surveys; assess potential impacts and advise on mitigation measures and need for further studies. Client: Drainage Service Department.
- Sep. 2001 – Feb. 2003 **Ecological Monitoring for Mangrove Cutting Works at the River Outlets of Tin Shui Wai Western Drainage and Shan Pui River Channel**
Ecologist. Monitoring of benthos at two channel sections under management. Client: Drainage Services Department.

- Aug. 2001 – Oct. 2002 **Shenzhen Western Corridor – Investigation and Planning**
Freshwater and Marine Ecologist for ecological assessment of proposed bridge/tunnel connecting Shekou and Outer Deep Bay. Conduct field surveys including stream and inter-tidal habitat surveys, as well as dolphin surveys by helicopter and fixed-wing aircraft; identify constraints, assess alignment options and potential impacts and advise on mitigation measures and need for further studies. Client: Highway Department.
- Aug. 2001- Mar. 2003 **San Wai Sewage Treatment Work and Upgrading of Ha Tsuen Pumping Station**
Aquatic Ecologist for ecological assessment of proposed sewage treatment work in San Wai and expansion of Ha Tsuen Pumping Station. Conduct field surveys; assess potential impacts including those on dolphins in Urmston Road, and advise on mitigation measures and need for further studies. Client: Drainage Service Department.
- Jul. 2001 - Dec. 2001 **Provision of Service on Providing Biodiversity Database**
Provided biodiversity advise and technical support for development of a GIS biodiversity database. Reviewed existing biodiversity database and presented in workshops. Client: Agriculture Fisheries and Conservation Department.
- Jul. 2001 - Oct. 2001 **Tai O - Ngong Ping Ecological Surveys**
Aquatic Ecologist. Conduct fauna surveys for the EIA of the proposed sewerage works from Ngong Ping to Tai O. Client: Drainage Service Department.
- Jul. 2000 - 2003 **Study on Wetland Compensation. Field Trials – Monitoring Works**
Conduct aquatic fauna surveys for baseline and trial monitoring of fish ponds at various sites. Client: Agriculture, Fisheries and Conservation Department.
- Apr. - Jun. 2001 **Explosive Ordnance Disposal Facility, Hong Kong**
Marine and Freshwater Ecologist for ecological assessment of proposed explosives disposal facility for use by Hong Kong Police Force. Conduct baseline surveys at two sites at Cape Collinson and Tseung Kwan O; identify constraints, assess potential impacts and advise on mitigation measures and need for further studies. Client: Civil Engineering Department.
- Oct. 2000 - 2003 **Planning and EIA for Further Recreational Facilities on Kau Sai Chau, Hong Kong**
Marine and Freshwater Ecologist for ecological and fisheries study of proposed recreational facilities on the island of Kau Sai Chau, Port Shelter. Proposals include an extension to the existing public golf facilities, and hiking trails. Provided input at initial planning stage to avoid sensitive aquatic receivers, conduct baseline surveys and assess finalized designs. Key issues include natural coastal habitats, freshwater marshes and streams, and nearby fish culture zones. Client: Kau Sai Chau Public Golf Course Ltd.
- Aug. - Oct. 2000 **Additional Study on Waste to Energy Facility, Hong Kong**
Marine Ecologist for ecological and fisheries study of a proposed waste incineration and cogeneration plant in north-west New Territories. Conduct intertidal and benthic surveys of habitats on and around the site, identify resources of importance, assess and evaluate impacts to aquatic ecology, and compare the study site to other proposed sites in terms of ecological suitability for the development. Client: Environmental Protection Department.
- May 2000 **Residential Proposal for San Tin, Hong Kong**
Aquatic Ecologist for proposed residential development and ecological reserve in northern New Territories of Hong Kong. The reserve is designed to offset wetland losses due to the residential development, through a combination of wetland creation and wetland enhancement. The site is close to Mai Po and Inner Deep Bay, Hong Kong's first Ramsar site. Review prior studies, conduct baseline surveys, provide input to planning of wetland reserve. Client: private.
- Feb. 2000 - Feb. 2001 **Comprehensive Feasibility Study for the Revised Scheme of South East Kowloon Development, Hong Kong**
Marine Ecologist for feasibility study of a proposed major urban area redevelopment in central Kowloon. The site, a former airport, is now slated for residential and related urban development. Conducted benthic surveys on reclamation sites inside Kowloon Bay and next to Kai Tak runway.

Assessed and evaluated impacts to benthos and aquatic life, developed mitigation measures. Client: Territory Development Department.

- Jan. 2000 - Apr. 2001 **EIA of Yuen Long and Kam Tin Sewerage and Sewage Disposal, Stage I: Sewers, Rising Mains and Ancillary Pumping Stations, Hong Kong**
Aquatic Ecologist for ecological study of a proposed sewerage and sewage disposal system for the north-west New Territories. Conduct surveys of aquatic communities of the site, identify ecological resources of importance for use in EIA. Client: Drainage Services Department.
- Jan. 2000 - Mar. 2003 **Feasibility Study on Housing Development at Whitehead and Lee On in Ma On Shan, Hong Kong**
Marine Ecologist for EIA of proposed urban development on mixed-use site including former detention centre and agricultural lands. Conducted soft shore surveys, described coastal habitats, identified ecological constraints, evaluated development options, assessed ecological impacts and proposed mitigation measures. Client: Territory Development Department.
- Nov. 1999 - Sep. 2000 **Environmental Monitoring of Jetty Decommissioning at Gemini Beach, Hong Kong**
Project Manager. Project monitors environmental parameters, especially air and noise pollution, to assess the impact of coastal jetty decommissioning on nearby residential areas. The jetty was built for construction of Route 3 Highway. Client: Route 3 Contractors Consortium
- Jan. 1999 - 2001 **Operation-phase Monitoring of Route 3 Highway, Hong Kong**
Aquatic Ecologist. Conduct periodic sampling of aquatic fauna in stream affected by highway construction. Sampling sites include a control and impacted site along the stream. Monitoring results will indicate success of stream restoration measures undertaken as part of the mitigation measures for construction of the highway. Client: Route 3 Contractors Consortium
- Feb. 1999 - Mar. 2001 **Construction-phase Monitoring of Main Drainage Channels for Ngau Tam Mei, Yuen Long and Kam Tin, Hong Kong**
Intertidal Ecologist. Seasonal monitoring of intertidal fauna in existing and constructed drainage channels in Inner Deep Bay. Monitoring results will provide quantitative data on intertidal community recolonisation, relevant to the ecology of internationally significant conservation areas in Inner Deep Bay. Client: Territory Development Department.
- Feb. 1999 – Oct. 2003 **Outlying Islands Sewerage Stage 1 Phase II Package J - Sok Kwu Wan Sewage Collection, Treatment and Disposal Facilities, Hong Kong**
Ecology Project Manager and Intertidal Ecologist for EIA of sewage treatment and disposal provisioning for coastal community on Lamma Island. Survey intertidal communities, assess project impacts and develop impact mitigation measures. Key issues include impacts to natural coastline, intertidal and benthic communities and Fish Culture Zones. Client: Drainage Services Department.
- Feb. - Aug. 1999 **Development of an Ecological Monitoring Programme for the Mai Po and Inner Deep Bay Ramsar Site, Hong Kong**
Intertidal Ecologist on project to develop long-term ecological monitoring programme for Hong Kong's first and China's seventh Ramsar Site. Field test monitoring methodologies to enable quantification of changes in selected parameters which will direct management action. Focus on mudflat fauna sampling. Client: Agriculture and Fisheries Department.
- Feb. - Aug. 1999 **Tai O Sheltered Boat Anchorage, Hong Kong**
Aquatic Ecologist for EIA of coastal boat anchorage and associated preparation of mangrove restoration site. Conduct field surveys including intertidal survey and land-based dolphin surveys. Assess impacts to intertidal and marine ecology, assist in development of mitigation measures and monitoring protocols. Provide input to design of mangrove area. Client: Civil Engineering Department.
- Feb. - Aug. 1999 **Tseung Kwan O Development Phase III Road P2, Hong Kong**
Aquatic Ecologist for EIA of coastal road to connect Tseung Kwan O New Town Centre with eastern Kowloon road network. Conducted baseline surveys including benthic and intertidal sampling, assessed impacts upon coastal and nearshore habitats and developed appropriate mitigation measures. Client: Civil Engineering Department.

Feb. - Jun. 1999 **Feasibility Study for Intensification and Extension of Tseung Kwan O New Town, Hong Kong**

Ecology Project Manager and Intertidal and Marine Ecologist. Review existing data and conduct field surveys for feasibility study on expansion of harbour reclamation at New Town site in Junk Bay, South-east New Territories. Assess ecological impacts of construction on the site and propose mitigation measures. Client: Civil Engineering Department.

Selected Publications

- Cai, Y.X., Yam, S. W. & Lai, C. S. (in preparation) A revision and new records of the Atyid shrimps in Hong Kong. *Raffles Bulletin of Zoology*.
- Dai, A. Y., Yang, S. L. & Lai, C. S. (in submission) A revision of the genus *Clistocoeloma* in China and the descriptions of a few new species (Crustacea: Brachyura: Grapsidae). *Raffles Bulletin of Zoology*.
- Dai, A. Y., Lee, S. Y., Cai, Y.X. and Lai C. S. (in preparation) A revision of the sesarmine crabs of Hong Kong, II. (Crustacea: Brachyura: Grapsidae: Sesarinae). *Raffles Bulletin of Zoology*.
- Fong, T.C.W., V.C.S. Lai, and H.T.H. Lui 2005. *Estuarine Organisms – Mangrove, Mudflat and Seagrass Bed*. Hong Kong Discovery
- Lai, C. S. 1994. Crabs, extraordinarily diverse creatures. *Elite International Diver Newsletter* 19: 21-23 (in Chinese).
- Lai, C.S. 1996. The Feeding Ecology of *Thalamita danae* Stimpson 1858 (Brachyura: Portunidae), with a Review of the Genus *Thalamita* in Hong Kong. M.Phil. Thesis. Hong Kong University.
- Lai, C. S. 1999. New record of a sesarmine crab, *Episesarma versicolor*, for Hong Kong. *Porcupine!* 20:8-9.
- Lai, C. S. 1999. A new record of Leucosiid crab (*Ebalia malefactorix*) for Hong Kong. *Porcupine!* 20: 9.
- Lai, C. S. 2002. Crab - Tail-less Sideway Walker. *About Life*. Autumn Sep. 2002. World Wide Fund for Nature Hong Kong.
- Lai, V.C.S., T.C.W. Fong, and H.T.H. Lui 2006. *Hard Shore Organisms – Rocky Shore and Boulder Shore*. Hong Kong Discovery.
- Yau, M. L., T. D. Dahmer and V. C. S. Lai. 2000. Mangrove compensation at Tai O: Turning impacts into assets through co-ordination. Paper presented at International Association of Impact Assessment 2000 Conference, 19-23 June 2000, Hong Kong.

Appendix B:
Permit for capturing and translocation of Romer's Tree Frog

漁農自然護理署
九龍長沙灣道三〇三號
長沙灣政府合署五樓



覆函請寄交
「漁農自然護理署署長」
Please address all replies to
Director of Agriculture, Fisheries and Conservation

AGRICULTURE, FISHERIES AND
CONSERVATION DEPARTMENT

Cheung Sha Wan Government Offices
5th floor, 303 Cheung Sha Wan Road
Kowloon, Hong Kong

本署檔號 Our Ref. : AF GR CON 09/51
來函檔號 Your Ref. :
電話 Tel. No. : For enquiry, please call 2150 6922
電郵地址 E-mail Address : mailbox@afcd.gov.hk
圖文傳真 Faxline No. : (852) 2311 3731

13 August 2008

**Permission to Possess Hand Nets and to Capture and Translocate
Romer's Tree Frogs in Mui Wo, Lantau**

Permission is given to:

Hon-kai KWOK and Chi-sing LAI of Ecosystems Limited and their accredited assistants to possess hand nets and to capture and translocate Romer's Tree Frogs (*Philautus romeri*) including tadpoles and eggs for the drainage project "Contract No. DC/2006/11 Drainage Improvements in Southern Lantau and Construction of Mui Wo Village Sewerage Phase 1", subject to conditions on the reverse side of this permit.

An accredited assistant is defined as an employee of Ecosystems Limited and is designated by the permit holders to assist in the capturing and translocating Romer's Tree Frogs for the drainage project "Contract No. DC/2006/11 Drainage Improvements in Southern Lantau and Construction of Mui Wo Village Sewerage Phase 1". The accredited assistants shall carry an identification document issued by Ecosystems Limited and a copy of this permit.

The permission is given in accordance with Section 15 (except the use of any arms, gin, poison or poisoned weapon) of the Wild Animals Protection Ordinance (Cap. 170).

This Special Permit expires on **1 November 2009**.


(C. C. LAY)

for Director of Agriculture, Fisheries and Conservation

Chi-sing LAI,
Ecosystems Limited,
2/F., Kingsun Computer Bldg.,
40 Shek Pai Wan Road, Aberdeen.

**Conditions of Permission to Possess Hand Nets and to Capture and Translocate
Romer's Tree Frogs in Mui Wo, Lantau**


1. This permission does not exempt the permit holder from having to acquire any other necessary permission under the Laws of Hong Kong.
2. This permission is limited to the possession of hand nets and the capture and translocation of Romer's Tree Frogs (*Philautus romeri*) including tadpoles and eggs for the drainage project "Contract No. DC/2006/11 Drainage Improvements in Southern Lantau and Construction of Mui Wo Village Sewerage Phase 1".
3. This permission shall be limited to the capture and translocation of Romer's Tree Frogs as specified in Environmental Permit EP-237/2005/A under the Environmental Impact Assessment Ordinance and the Proposal for Fauna Capture Survey and Translocation for Construction Phase EM&A submitted to this Department on 31 July 2008.
4. This permission does not authorize the entry to any leased land or licensed area or the collection or disturbance of the flora or fauna therein, in which case the prior approval of the lessees or the licence holders would be necessary.
5. The permit holders shall handle the Romer's Tree Frogs humanely and in a manner avoiding their suffering.
6. The permit holders shall provide suitable captive environment for keeping the captured Romer's Tree Frogs.
7. The permit holders shall produce this Special Permit for inspection by any officer of this Department or police officer on demand.
8. The permit holders have to send one copy of each of the publications produced as a result of this project to this Department for record.
9. The Director of Agriculture, Fisheries and Conservation reserves the right to recall or cancel this permission at any time.

- End of Conditions -


August 2008
Agriculture, Fisheries and Conservation Department

Appendix C.
Data Sheets for the capture and translocation surveys.

Data sheets of 28 October 2008 at Pak Ngan Heung River

Data sheet for frog capture survey				
Location		Pak Ngan Heung River	Date 28 October 2008	
Weather		Clear	Temperature	24°C
Capture equipment		Hand, net	Maintenance equipment	
Information of the capture individuals				
Species	Size (mm)	Conditions (Healthy/fair/poor)	Release location	Photos
Gunther's Frog	95	healthy	Stream at Butterfly Hill	





Data sheets of 28 October 2008 at Luk Tei Tong River






Data sheet for frog capture survey				
Location		Luk Tei Tong River	Date 28 October 2008	
Weather		Clear	Temperature	24°C
Capture equipment		Hand, net	Maintenance equipment	
Information of the capture individuals				
Species	Size (mm)	Conditions (Healthy/fair/poor)	Release location	Photos
Asian Common Toad	82	Healthy	Stream at Butterfly Hill	

Data sheets of 28 October 2008 at Luk Tei Tong Marsh

Data sheet for frog capture survey				
Location		Luk Tei Tong Marsh	Date 28 October 2008	
Weather		Clear	Temperature	24°C
Capture equipment		Hand, net	Maintenance equipment	
Information of the capture individuals				
Species	Size (mm)	Conditions (Healthy/fair/poor)	Release location	Photos
Nil capture				

Data sheets of 29 October 2008 at Pak Ngan Heung River

Data sheet for frog capture survey				
Location		Pak Ngan Heung River	Date 29 October 2008	
Weather		Clear	Temperature	24.4°C
Capture equipment		Hand, net	Maintenance equipment	
Information of the capture individuals				
Species	Size (mm)	Conditions (Healthy/fair/poor)	Release location	Photos
Asian Common Toad	72	Healthy	Stream at Butterfly Hill	
Asiatic Painted Frog	42	Healthy	Stream at Butterfly Hill	
Asiatic Painted Frog	48	Healthy	Stream at Butterfly Hill	
Asiatic Painted Frog	41	Healthy	Stream at Butterfly Hill	

Paddy Frog	55	Healthy	Stream at Butterfly Hill	
Paddy Frog	61	Healthy	Stream at Butterfly Hill	
Paddy Frog	65	Healthy	Stream at Butterfly Hill	
Paddy Frog	60	Healthy	Stream at Butterfly Hill	
Paddy Frog	66	Healthy	Stream at Butterfly Hill	

Data sheets of 29 October 2008 at Luk Tei Tong River



Location		Luk Tei Tong River	Date 29 October 2008	
Weather		Clear	Temperature	24°C
Capture equipment		Hand, net	Maintenance equipment	
Information of the capture individuals				
Species	Size (mm)	Conditions (Healthy/fair/poor)	Release location	Photos
Nil capture				

Data sheets of 29 October 2008 at Luk Tei Tong Marsh

Location		Luk Tei Tong Marsh	Date 29 October 2008	
Weather		Clear	Temperature	24°C
Capture equipment		Hand, net	Maintenance equipment	
Information of the capture individuals				
Species	Size (mm)	Conditions (Healthy/fair/poor)	Release location	Photos
Nil capture				

Data sheets of 30 October 2008 at Pak Ngan Heung River Data sheet for frog capture survey

Location		Pak Ngan Heung River	Date 30 October 2008	
Weather		Clear	Temperature	25.2°C
Capture equipment		Hand, net	Maintenance equipment	
Information of the capture individuals				
Species	Size (mm)	Conditions (Healthy/fair/poor)	Release location	Photos
Asiatic Painted Frog	60	Healthy	Stream at Butterfly Hill	
Paddy Frog	65	Healthy	Stream at Butterfly Hill	

Paddy Frog	62	Healthy	Stream at Butterfly Hill	
Gunther's Frog	90	Healthy	Stream at Butterfly Hill	

Data sheets of 30 October 2008 at Luk Tei Tong River

Location		Luk Tei Tong River	Date 30 October 2008	
Weather		Clear	Temperature	24°C
Capture equipment		Hand, net	Maintenance equipment	
Information of the capture individuals				
Species	Size (mm)	Conditions (Healthy/fair/poor)	Release location	Photos
Nil capture				

Data sheets of 30 October 2008 at Luk Tei Tong Marsh

Location		Luk Tei Tong Marsh	Date 30 October 2008	
Weather		Clear	Temperature	24°C
Capture equipment		Hand, net	Maintenance equipment	
Information of the capture individuals				
Species	Size (mm)	Conditions (Healthy/fair/poor)	Release location	Photos
Nil capture				

Appendix D Figures

Figure 1 Frog capture survey areas in Pak Ngan Heung River

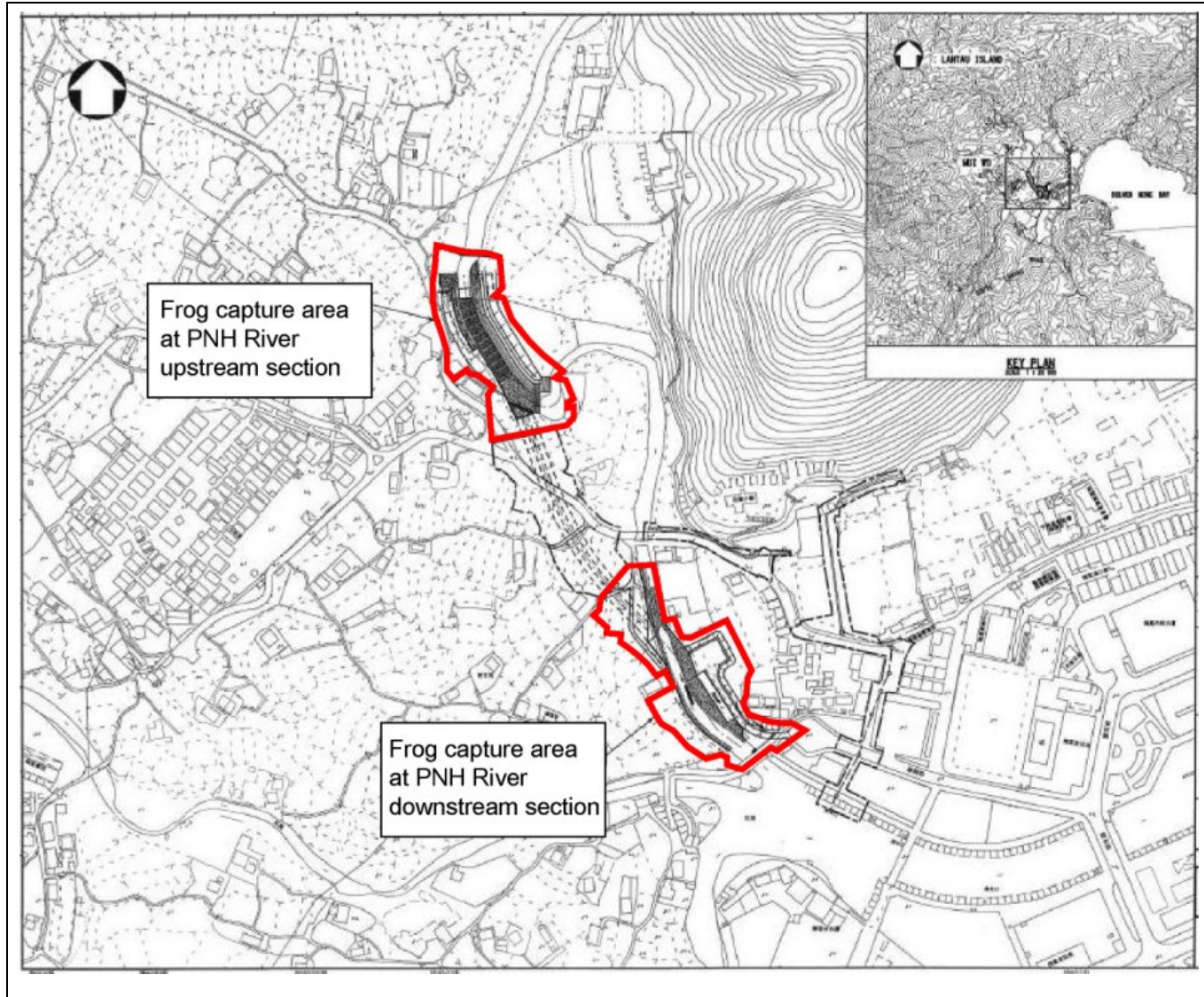


Figure 2 Frog capture survey areas in Luk Tei Tong River and Luk Tei Tong Marsh

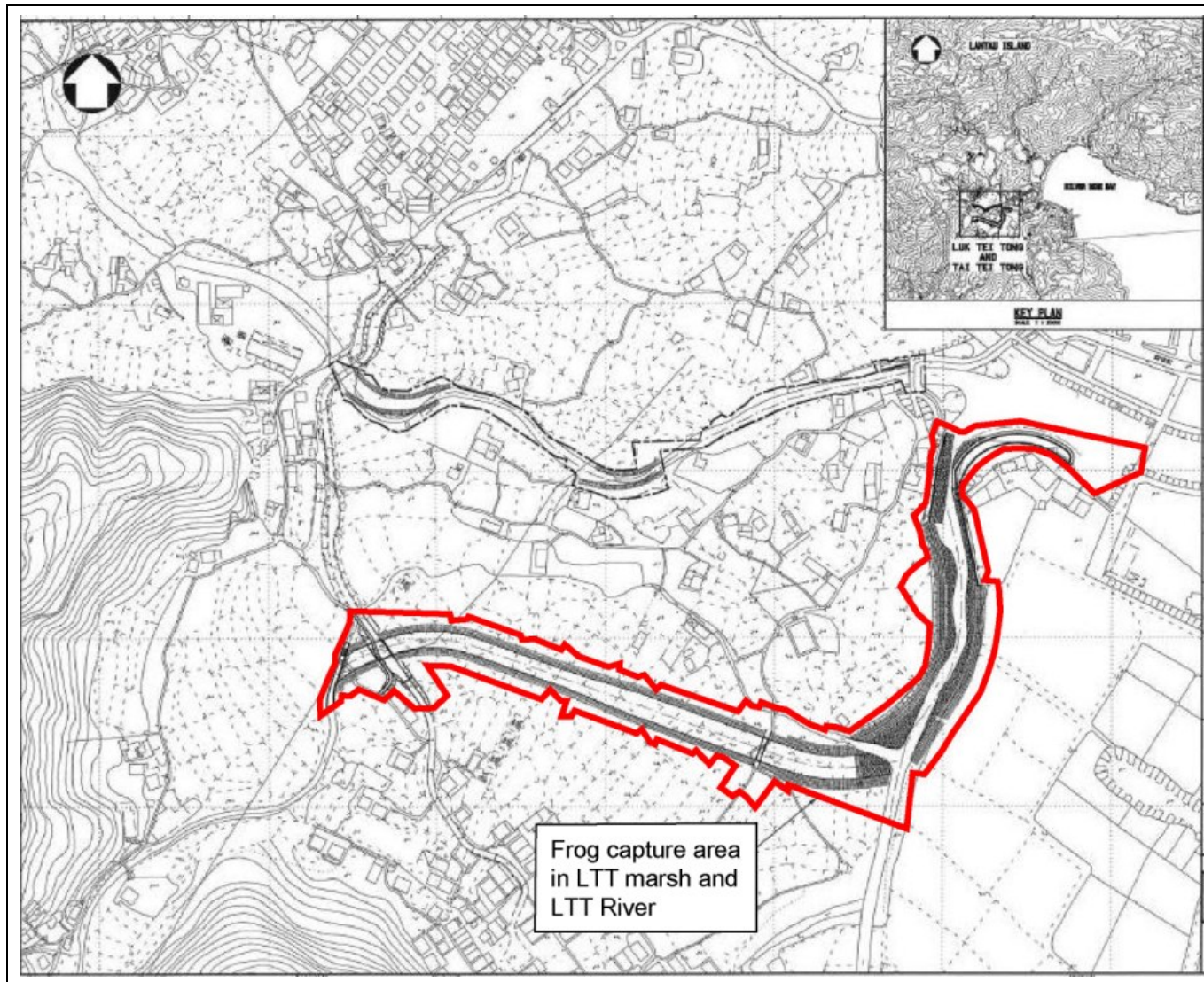
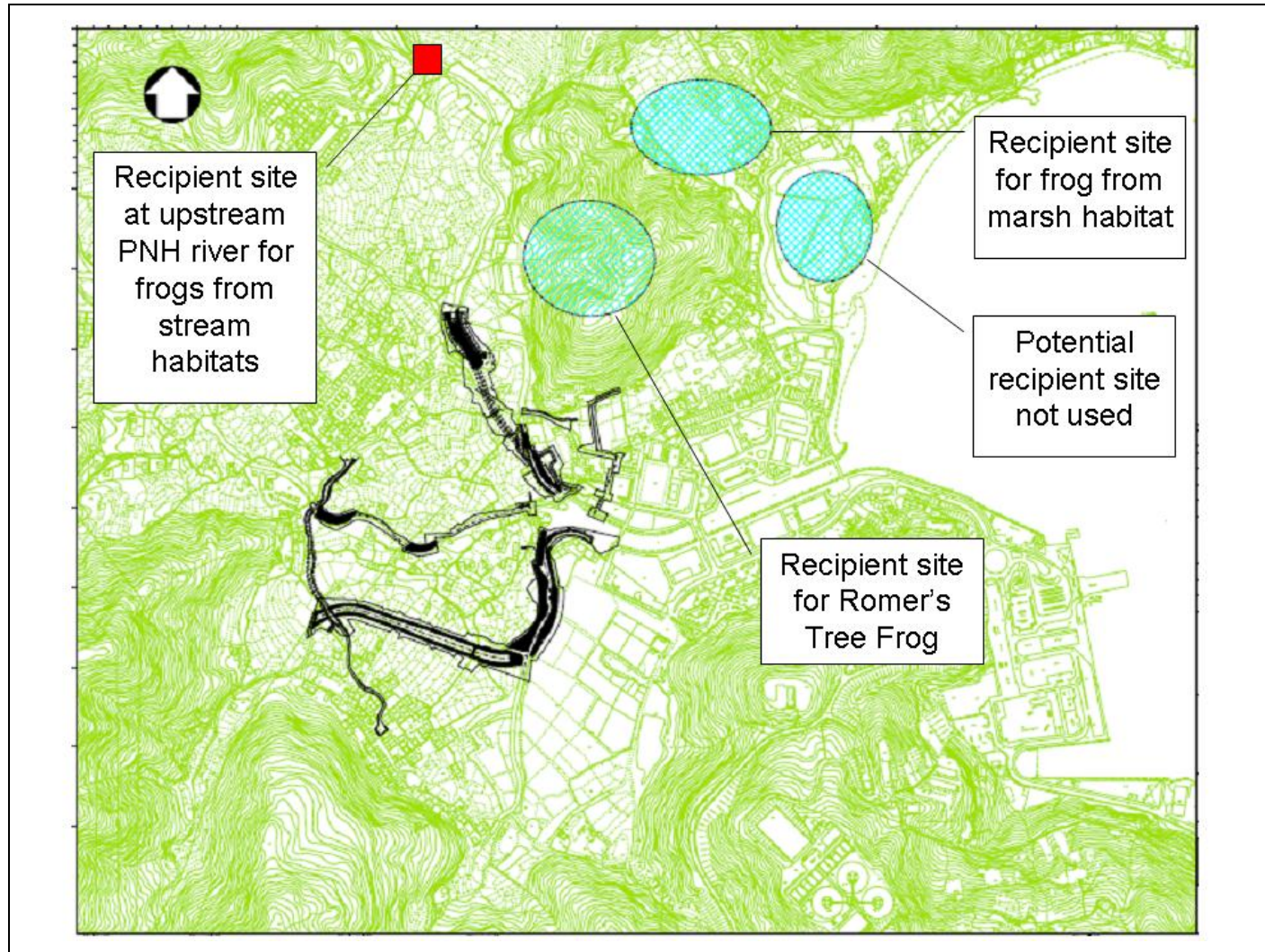


Figure 3 Recipient sites for frogs collected during the capture surveys



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