香港電燈有限公司
The Hongkong Electric Co., Ltd.

Renewable Energy by a Wind Turbine System on Lamma Island

Environmental Monitoring & Audit

Final EM&A Summary Report

April 2007

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港燈
HK Electric

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) ORDINANCE, CAP. 499

ENVIRONMENTAL PERMIT NO. EP-201/2004

RENEWABLE ENERGY BY A WIND TURBINE SYSTEM ON LAMMA ISLAND

ENVIRONMENTAL MONITORING & AUDIT

Report Title	Final EM&A Summary Report
Date	19 April 2007
Certified by	LEUNG Hip Yuen Environmental Team Leader

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EXECUTIVE SUMMARY

In November 2004, The Hongkong Electric Co., Ltd. (HEC) was granted an Environmental Permit (EP) to construct and operate the Project entitled "Renewable Energy by a Wind Turbine System on Lamma Island". The construction of the Project commenced in February 2005 and was completed in February 2006. The Project was then officially put into operation. Environmental monitoring and audits (EM&A) were performed in accordance with the EM&A Manual. This final report, prepared by the Environmental Team (ET), summarizes the EM&A findings for the Project and concludes that the Project is not having any adverse environmental impact and that the EM&A program can be terminated as recommended in the EM&A Manual.

Construction Activities Undertaken

The construction activities undertaken were mainly a small-scaled excavation, construction of the wind turbine foundation, a site platform and retaining walls, erection of a wind turbine and a high voltage distribution pillar, laying of underground distribution cables, landscaping works and installation of exhibition facilities.

Plant Availability

Since commencement of operation, the wind turbine was available for most of the time. It was manually stopped under special circumstances such as inspection, maintenance, typhoon or background noise measurement (during the noise monitoring exercises).

Environmental Monitoring

According to the EM&A Manual, no environmental monitoring was necessary during the construction phase in view of the anticipated insignificant environmental impact. During the operation phase, bird collision event monitoring was carried out at monthly intervals for a period of 12 months and noise monitoring was carried out once every 14 days for a period of 6 months as required. No dead or injured bird was found in the specified area. There was also no noise exceedance recorded.

Site Environmental Audit

Site audits were carried out on a weekly basis during the construction phase to ensure compliance with relevant legislation and requirements. The site condition was generally satisfactory and all required mitigation measures were properly implemented. During the operation phase, the newly planted vegetation was regularly inspected and its condition was generally satisfactory.

Environmental Licensing and Permitting

The following environmental license/permits were obtained for the Project.

License/Permit	Ref. No.	Valid Period		Authority/Holder	Date Issued
		From	To		
Environmental Permit	EP-201/2004	26/11/04	-	EPD/HEC	26/11/04
Construction Noise Permit	GW-RS0273-05	08/05/05	06/11/05	EPD/Excel*	06/05/05
Construction Noise Permit	GW-RS0751-05	20/11/05	29/01/06	EPD/Excel*	18/11/05

* Excel Engineering Co., Ltd.

Implementation Status of Environmental Mitigation Measures

The environmental mitigation measures as recommended in the EM&A Manual were properly implemented.

Environmental Complaints / Prosecutions

In January 2006, there was one enquiry from a citizen concerning the deteriorating environmental hygiene condition around the wind turbine site caused by tourists and it was properly handled by HEC. Besides this, no environmental complaint against the Project was received. There was no prosecution for breaches of relevant environmental legislation.

Concluding Remarks

Based on the EM&A findings, it is concluded that the Project is not having any adverse impact on the environment after the implementation of the recommended mitigation measures. In line with the EIA predictions, the Project has caused neither any adverse impact on bird species nor any unacceptable noise impact. As such, the EM&A program for the Project shall be terminated as recommended in Section 10.5 of the EM&A Manual.

1. INTRODUCTION

1.1 Background

The Hongkong Electric Co., Ltd. (HEC) is committed to providing a high quality power supply to its customers with due care for the environment. Recognizing the importance of sustainable development, HEC has proposed to install a wind turbine of 800kW capacity on Lamma Island as a demonstration project to utilize wind energy for renewable power generation in Hong Kong.

In November 2004, an Environmental Permit (EP) was granted to HEC for the construction and operation of the Project entitled "Renewable Energy by a Wind Turbine System on Lamma Island". An Environmental Team (ET) was then formed within HEC to implement the Environmental Monitoring and Audit (EM&A) program in accordance with the EM&A Manual for the Project.

The key components of the Project are outline as follows:

- Erection of a wind turbine (hub height approximately 46m and rotor blade diameter approximately 50m, overall height of the wind turbine approximately 71m);
- Small-scaled excavation and construction of the wind turbine foundation (affected area approximately 15m by 15m);
- Construction of a site platform and retaining walls (affected area approximately 25m by 60m);
- Construction of one stainless steel hut as high voltage distribution pillar (HVDP) (size approximately 4.6m length, 2.5m width, 2.8m height) for housing electrical devices;
- Underground distribution cables laying for connection to the nearby existing cable route (approximately 50m in length);
- Landscaping works and installation of exhibition facilities on renewable energy issues; and
- Operation and maintenance of the wind turbine system.

The construction of the Project commenced in February 2005 and was completed in February 2006. The Project was then officially put into operation. Environmental monitoring and audits (EM&A) were performed in accordance with the EM&A Manual. This final report summarizes the EM&A findings for the Project and concludes that the Project is not having any adverse environmental impact and that the EM&A program can be terminated as recommended in the EM&A Manual.

1.2 Project Organization

The latest management structure for the EM&A program for the Project (operation phase) is shown in Appendix A. The Permit Holder is HEC and the Engineer is her site representative. As pointed out in Section 1.5.1 of the EM&A Manual, no Independent Environmental Checker (IEC) is necessary for the Project. The key personnel contact names and telephone numbers are listed in Table 1.1.

Table 1.1 Key Personnel Contacts for the EM&A Program (Operation Phase)

Role	Contact Person	Position	Phone No.
Permit Holder	Dr. C.W. Tso	General Manager (Projects)	3143-3808
Engineer	Mr. W.M. Mak	Chief Operations Engineer	2982-6205
Environmental Team	Mr. H.Y. Leung	Environmental Team Leader	2843-3463

1.3 Construction Activities Undertaken

The overall construction program for the Project included civil works, E&M erection, landscaping works and installation of exhibition facilities. The work details can be found in the monthly EM&A reports for the construction phase. The Project area, locations of nearby air and noise sensitive receivers are shown in Figure 1.1, Figure 1.2 and Figure 1.3 respectively.

1.4 Plant Availability

Since commencement of operation, the wind turbine was available for most of the time. It was manually stopped under special circumstances such as inspection, maintenance, typhoon or background noise measurement (during the noise monitoring exercises).

1.5 Summary of EM&A Requirements

Baseline Monitoring

Only pre-site-clearance survey for Romer's Tree Frog is required, which aims at translocating the Romer's Tree Frogs in the Project area, if any, to the specified receptor site before commencement of construction. The survey was conducted on 04/01/2005 and no Romer's Tree Frog was found. The official Ecological Baseline Monitoring Report was submitted to the Authority on 18/01/2005.

Impact Monitoring

According to the EM&A Manual, no impact monitoring is necessary for the construction phase in view of the anticipated insignificant environmental impact. For the operation phase, bird collision event monitoring and noise monitoring are required to be carried out on a regular basis during the initial stage of operation, which are described in Section 2 and Section 3 of this report respectively.

Environmental Audit

Regular environmental audits including site audits are required for the Project. The details are summarized in Section 4 of this report.

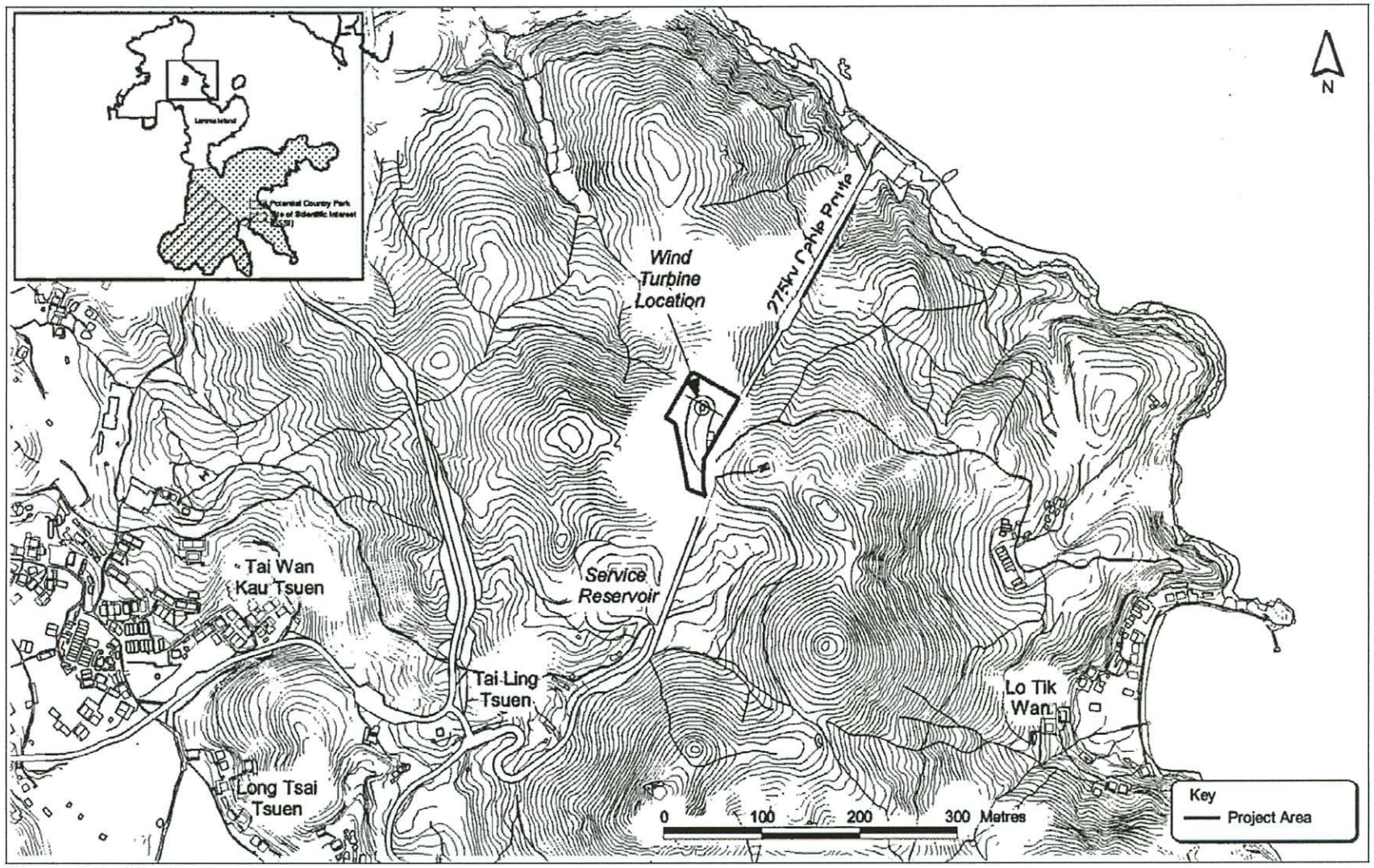


Figure 1.1 The Project Area

Figure 1.2 Locations of Air Sensitive Receivers

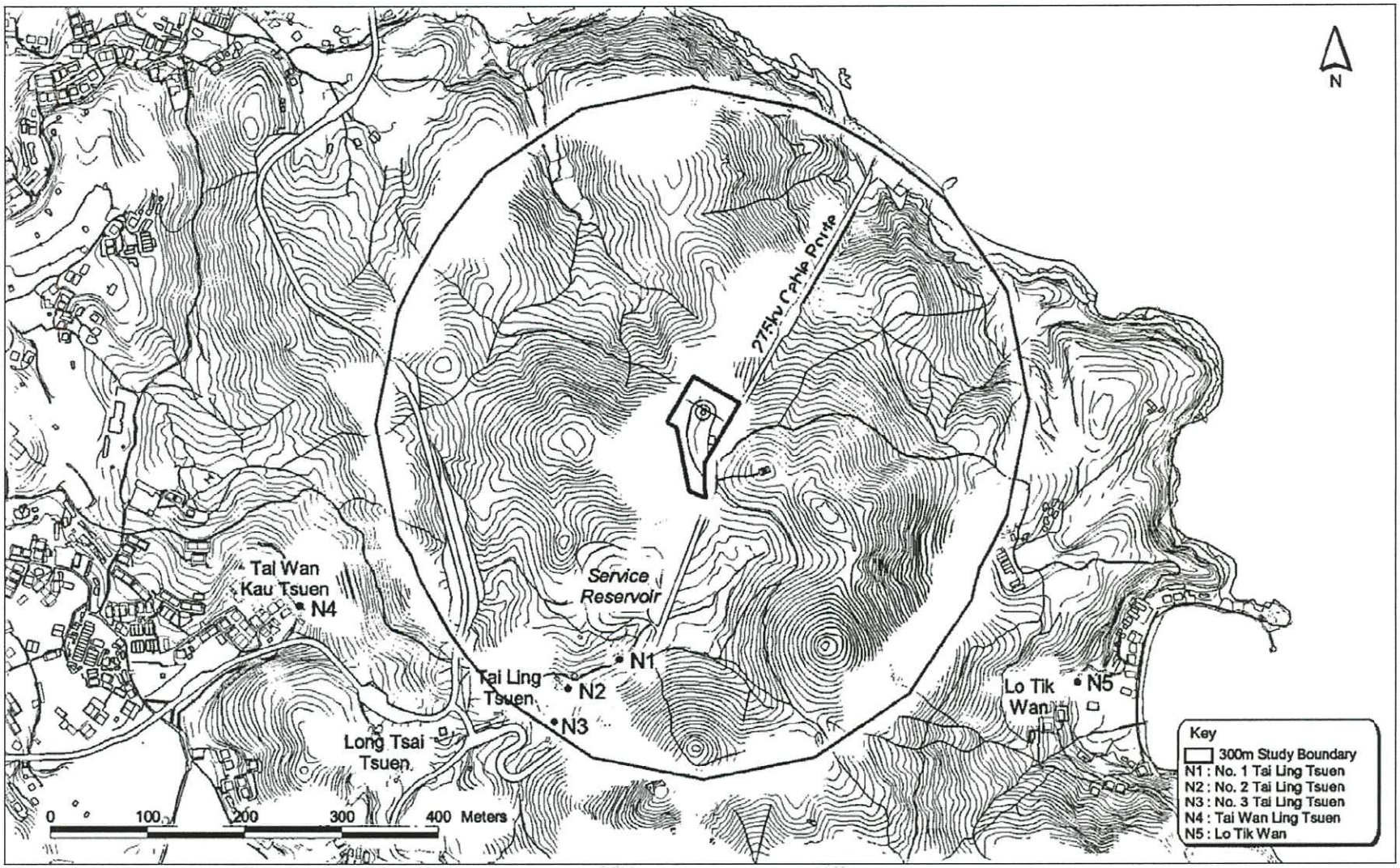


Figure 1.3 Locations of Noise Sensitive Receivers

2. BIRD COLLISION EVENT MONITORING

According to the EM&A Manual, bird collision event monitoring shall be carried out at monthly intervals during the first 12-month operation of the wind turbine. A consultant, Nature & Technologies (HK) Limited, was commissioned by HEC to carry out the bird collision event monitoring. The monitoring details can be found in the monthly EM&A reports for the operation phase. During the 12-month monitoring period, no dead or injured bird was found within an area of 50m radius around the base of the wind turbine. The summary report prepared by the consultant is shown in Appendix B. It is concluded that the wind turbine is not having any adverse impact on bird species and no further monitoring is needed.

3. NOISE MONITORING

According to the EM&A Manual, night-time noise monitoring shall be carried out once every 14 days during the first 6-month operation of the wind turbine. The noise monitoring exercises were carried out by the ET. The monitoring details can be found in the monthly EM&A reports for the operation phase. During the 6-month monitoring period, no noise exceedance was recorded. Hence it is concluded that the wind turbine is not having any unacceptable noise impact and no further monitoring is necessary.

4. ENVIRONMENTAL AUDIT

4.1 Review of Environmental Monitoring Procedures

The environmental monitoring procedures were regularly reviewed by the ET and no modification was recommended.

4.2 Assessment of Environmental Monitoring Results

All environmental monitoring results were acceptable and the event/action plans were not applicable.

4.3 Site Environmental Audit

Site audits were carried out by the ET on a weekly basis during the construction phase to ensure compliance with relevant legislation and requirements. The site condition was generally satisfactory and all required mitigation measures were properly implemented. During the operation phase, the newly planted vegetation was regularly inspected and its condition was generally satisfactory.

4.4 Environmental Licensing and Permitting

The license/permits obtained for the Project are summarised in Table 4.1.

Table 4.1 Environmental Licensing and Permitting

License/Permit	Ref. No.	Valid Period		Description	Date Issued
		From	To		
Environmental Permit	EP-201/2004	26/11/04	-	For the construction and operation of the Project.	26/11/04
Construction Noise Permit	GW-RS0273-05	08/05/05	06/11/05	For construction work at restricted hours.	06/05/05
Construction Noise Permit	GW-RS0751-05	20/11/05	29/01/06	For construction work at restricted hours.	18/11/05

4.5 Implementation Status of Environmental Mitigation Measures

The environmental mitigation measures as recommended in the EM&A Manual were properly implemented. The updated implementation schedule is shown in Appendix C.

4.6 Implementation Status of Event/Action Plans

All environmental monitoring results were acceptable and the event/action plans were not applicable.

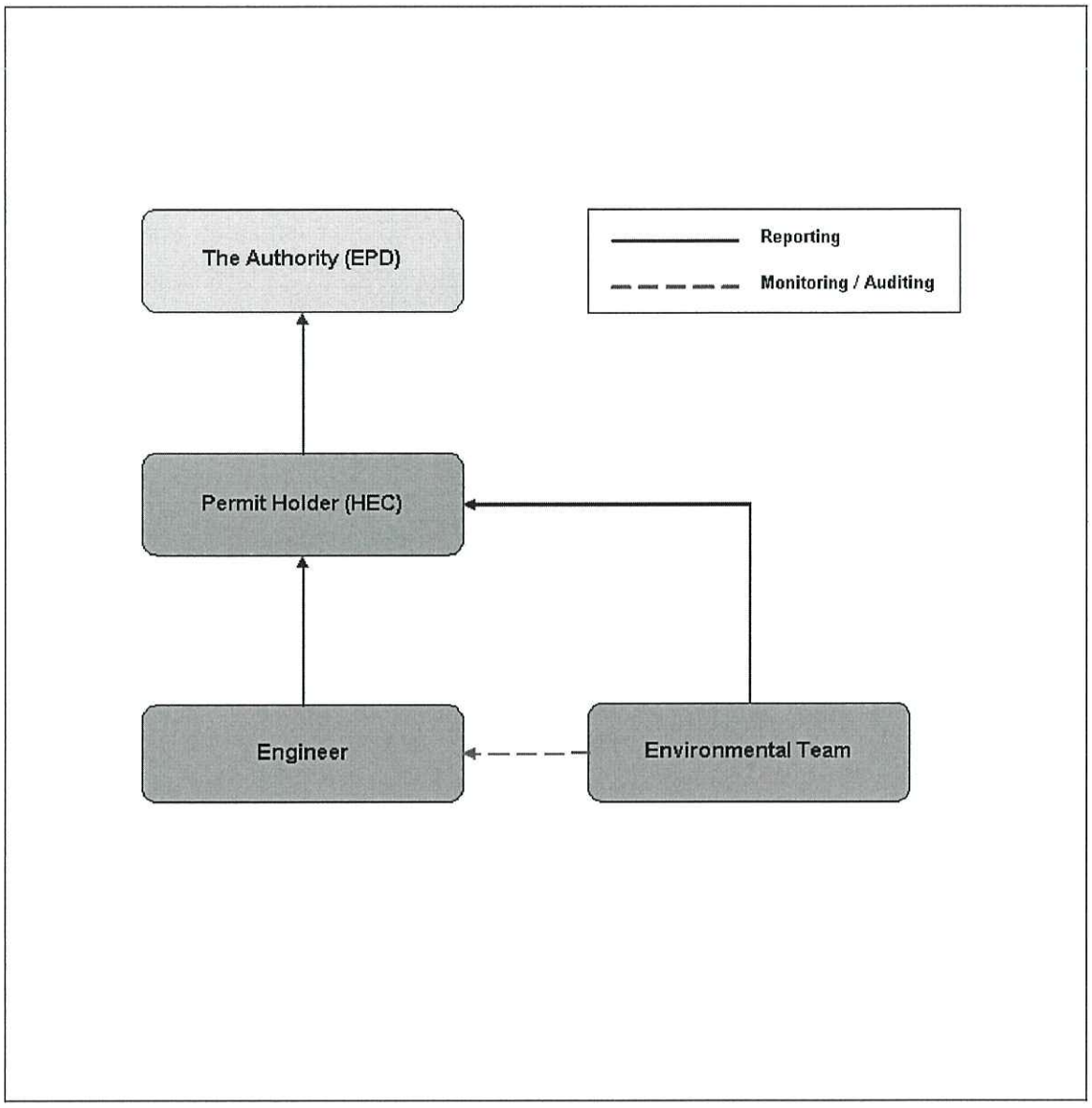
4.7 Implementation Status of Environmental Complaint Handling Procedures

In January 2006 when the Project was about the end of the construction phase, there was one enquiry from a citizen concerning the deteriorating environmental hygiene condition around the wind turbine site caused by tourists and it was properly handled by HEC. Besides this, no environmental complaint against the Project was received. The enquiry was raised by a lady who found an increasing amount of litter left by tourists around the wind turbine site and suggested that toilet facilities and additional litter bins should be provided in the vicinity of the site. In response to this enquiry, HEC has voluntarily restored the cleanliness of the concerned area and has also put forward the enquirer's suggestions to the relevant Government Department for consideration. The enquirer was satisfied with HEC's prompt response.

5. CONCLUSION

Based on the EM&A findings, it is concluded that the Project is not having any adverse impact on the environment after the implementation of the recommended mitigation measures. In line with the EIA predictions, the Project has caused neither any adverse impact on bird species nor any unacceptable noise impact. As such, the EM&A program for the Project shall be terminated as recommended in Section 10.5 of the EM&A Manual.

Appendix A: Organization Chart for the EM&A Program (Operation Phase)



Appendix B: Bird Collision Event Monitoring (Operation Phase)

This summary report was prepared by Nature & Technologies (HK) Limited which was commissioned by HEC to carry out the bird collision event monitoring.

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The Hongkong Electric Co., Ltd.

Renewable Energy by a Wind Turbine System on Lamma Island Operation Phase Bird Monitoring Final Report

(Ref. No. 3.11/055/2005)

April 2007

Client's Job No. 05/7247
Ref. No. 3.11/055/2005

Report titled
"Renewable Energy by a Wind Turbine System on Lamma Island
Operation Phase Bird Monitoring
Final Report"

Quality Assurance Log

Prepared for Submission to:
The Hongkong Electric Co., Ltd.

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Submitted on:	11 April 2007

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1. Introduction

1.1 For the purpose of providing high quality power supply to its customers with due care for the environment, The Hongkong Electric Co., Ltd. ["HEC"] has obtained government permission to build a 800kW wind turbine system as a demonstration project to utilize wind energy for renewable power generation. The wind turbine system is located at Tai Ling Tsuen (Figure 1.1) on Lamma Island, the output of which is connected to the existing power grid for supplying renewable energy to HEC's customers.

1.2 According to the environmental monitoring & audit ["EM&A"] Manual prepared in September 2004 for the project, HEC needs to conduct monthly monitoring for bird collision during the first twelve months of operation of the wind turbine system. Nature & Technologies (HK) Limited ["N&T"] is commissioned by HEC to conduct the bird monitoring.

1.3 This is the final report for the twelve months of bird monitoring from March 2006 to February 2007.

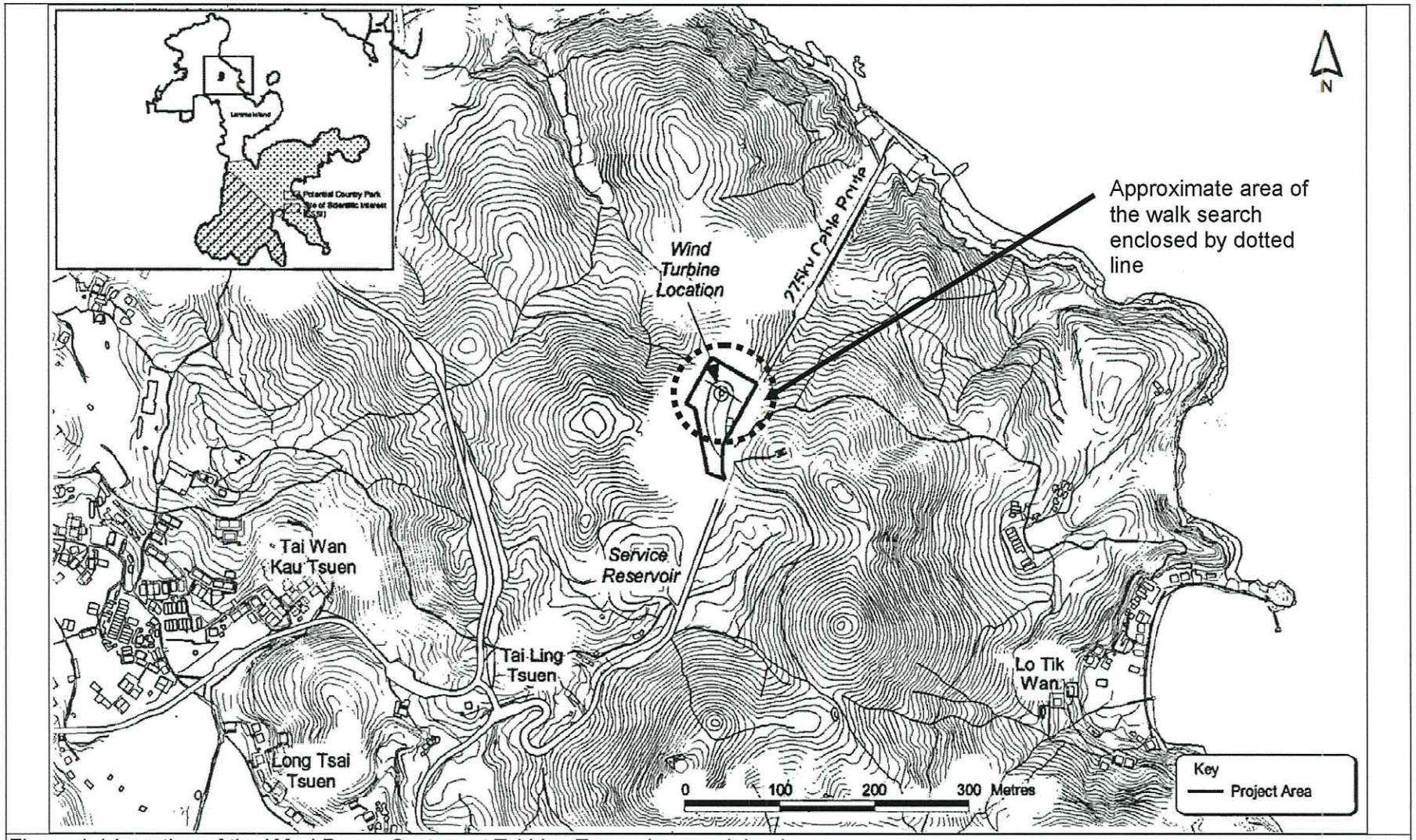

Figure 1.1 Location of the Wind Power System at Tai Ling Tsuen, Lamma Island

2. Methodology and Observations

2.1 The monitoring was conducted according to the EM&A Manual. Basically, site visit to the wind turbine system was made. A search for an area of 50m radius around the base of the wind turbine for injured or dead bird was then carried out. The search was carried out by walking around the site (as also indicated in Figure 1.1) and visual searching by eyes or binoculars for any dead or injured bird around the area. Compass and tape measure were carried so that the orientation of any object can be identified when necessary. Maximum attention has been given to safety in the walk search.

2.2 In the event that injured or dead birds are found, the birds and local aerodynamics would be examined to check if the injury or death of bird is due to collision with the wind turbine.

2.3 Site visit and search was made every month of the twelve months' monitoring period. The actual site visits were made on the following dates:

- 7 March, 2006
- 11 April, 2006
- 9 May, 2006
- 6 June, 2006
- 4 July, 2006
- 8 August, 2006
- 5 September, 2006
- 10 October, 2006
- 7 November, 2006
- 5 December, 2006
- 9 January, 2007
- 6 February, 2007

2.4 Observations on site were made and photographs were taken for every visit and search. Meteorological conditions were recorded and obtained from Hong Kong Observatory and the findings have been documented in monthly reports for the respective months.

2.5 For each monthly visit, no dead or injured bird was found.

3. Conclusions

3.1 Monitoring of the wind turbine system at Tai Ling Tsuen on Lamma Island for possible bird collision has been successfully carried out for twelve months in accordance with the EM&A Manual.

3.2 No dead or injured bird was observed within an area of 50m radius around the base of the wind turbine for the twelve months' monitoring period.

3.3 The wind turbine system has found to have caused no bird collision. As such, it is concluded that the wind turbine is not having an adverse impact on bird species and no further monitoring is needed.

Appendix C: Environmental Mitigation Measures – Implementation Schedule

EM&A Log Ref.	Mitigation Measures	Implementation Status
	NOISE – CONSTRUCTION PHASE	
1	*Good Site Practices:*	
	• Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction works;	Complied
	• Machines and plant that may be use intermittently, such as vibratory poker, should be shut down between work periods or should be throttled down to a minimum;	Complied
	• Plant known to emit noise strongly in one direction, should, where possible, be orientated to direct noise away from nearby NSRs; and	Complied
	• Mobile plant should be sited as far away from NSRs as possible.	Complied
	NOISE – OPERATION PHASE	
2	The allowable maximum sound power level of 100 dB(A) and pure tone free shall be included in the tender specification of wind turbine.	Complied
	ECOLOGY – CONSTRUCTION PHASE	
3	*Measures for Romer's Tree Frog:*	
	• Undertake one day-time and one night-time survey for the Romer's Tree Frog within the Project Area just before the construction works commence. The surveyor(s) should actively search within the Project Area paying special attention to the water bodies (i.e. abandoned containers). All recorded Romer's Tree Frog (adults and tadpoles) must be caught by hand and translocated to the stream pools of middle course of Stream S4 near Lo Tik Wan, the critical natural habitat for the Romer's Tree Frog within the Study Area, immediately after the survey. The Romer's Tree Frog surveys and translocation works shall be undertaken by a qualified ecologist with at least five years of relevant experience in faunal translocation works.	Complied
4	*Measures for Construction Run-off:*	
	• Surface run-off from the construction site should be directed into existing stream channel via adequately designed sand/silt removal facilities such as sand traps, silt traps and sediment basins. Channels, earth bunds or sand bag barriers should be provided on site to properly direct storm water to such silt removal facilities.	Complied
5	*Good Construction Practice:*	
	• Erect fences along the boundary of the works area before the commencement of works to prevent tipping, vehicle movements, and encroachment of personnel onto adjacent areas.	Complied
	• Avoid any damage and disturbance, particularly those caused by filling and illegal dumping, to the remaining and surrounding natural stream habitats.	Complied
	• Regularly check the work site boundaries to ensure that they are not breached and that no damage occurs to surrounding areas.	Complied
	• Prohibit and prevent open fires within the site boundary during construction and provide temporary fire fighting equipment in the Project Area.	Complied

EM&A Log Ref.	Mitigation Measures	Implementation Status
	• Treat any damage that may have occurred to individual major trees in the adjacent area and along the 275 kV Cable Route (used to transport the construction materials) with surgery.	No damage
	• Reinstate temporary disturbed areas immediately after completion of the construction works, i.e. through on-site tree/shrub planting. Tree/shrub species used should make reference from those in the surrounding area and/or Annex C of EIA report.	Complied
	ECOLOGY – OPERATION PHASE	
6	No mitigation measure is required. See EM&A Manual for monitoring requirements.	-
	LANDSCAPE AND VISUAL – CONSTRUCTON PHASE	
7	• Color scheme and non-reflective paints will be made to enable the proposed wind turbine to blend in well with natural surroundings and minimize the visual intrusion.	Complied
	• Selection of low rotating speed machine to minimize the visual disturbance.	Complied
	• New cut and fill slopes and other land affected by construction works would be reinstated to natural land form and topography of the natural slope as far as practical. Grading of these slopes to resemble a natural, rolling landform similar to that of adjacent topography would be carried out. Approximately 1,400 sq.m. of disturbed areas would be reinstated.	Complied
	• Appropriate landscape planting including trees, shrubs and grasses (approx. 1,400 sq.m.) will be provided to soften the ground level appearance of the proposed wind turbine site.	Complied
	• Existing soil resources on site from the cut slope will be re-used for backfilling at site as far as practicable to minimize the need to import or export soils.	Complied
	LANDSCAPE AND VISUAL – OPERATION PHASE	
8	No mitigation measure is required. See EM&A Manual for monitoring requirements.	-
	AIR QUALITY – CONSTRUCTION PHASE	
9	• Covering entirely by impervious sheet or frequently watering of the on-site stockpile of excavated materials to keep wet always before backfilling;	Complied
	• Frequent watering of exposed area or worksite of excavation to maintain surface wet, if necessary and practicable;	Complied
	• Provision of vehicle washing to remove any dusting materials from small village trucks' body and wheel at the exit of worksite;	Complied
	• Well-maintained diesel-powered mechanical equipment to avoid black smoke emissions; and	Complied
	• Shut-down of diesel-powered mechanical equipment or trucks inside the worksites when they are not in operation.	Complied
	AIR QUALITY – OPERATION PHASE	
10	N/A	-

EM&A Log Ref.	Mitigation Measures	Implementation Status
	WATER QUALITY – CONSTRUCTION PHASE	
11	*Surface Run-off:*	
	• Surface run-off from the construction site should be directed into existing stream channel via adequately designed sand/silt removal facilities such as sand traps, silt traps and sediment basins. Channels, earth bunds or sand bag barriers should be provided on site to properly direct storm water to such silt removal facilities.	Complied
	• Silt removal facilities should be maintained and the deposited silt and grit should be removed regularly, at the onset of and after each rainstorm to ensure that these facilities are functioning properly at all times.	Complied
	• During excavation in the wet season, temporarily exposed soil surfaces should be covered, e.g. by tarpaulin, and temporary access roads should be protected by crushed stone or gravel, as excavation proceeds. Intercepting channels should be provided (e.g. along the crest/edge of the excavation) to prevent storm runoff from washing across exposed soil surfaces. Arrangements should always be in place to ensure that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm.	Complied
	• Earthworks final surfaces should be well compacted and the subsequent permanent work or surface protection should be carried out as soon as practical after the final surface are formed to prevent erosion caused by rainstorms. Appropriate intercepting channels should be provided where necessary. Rainwater pumped out from trenches or foundation excavations should be discharged into storm drains via silt removal facilities.	Complied
	• Open stockpiles of construction materials (e.g. aggregates and sand) on site should be covered with tarpaulin similar fabric during rainstorms. Measures should be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system.	Complied
12	*Wastewater from Site Facilities:*	
	• The use of chemical toilets will be necessary and these should be provided by a licensed contractor, who will be responsible for appropriate disposal and maintenance of these facilities.	Complied
	WATER QUALITY – OPERATION PHASE	
13	No mitigation measure is required.	-
	WASTE – CONSTRUCTION PHASE	
14	• Excavated materials should be used as backfill as far as practicable;	Complied
	• Excavated materials should be segregated from other wastes;	Complied
	• Works activities should be limited within the site boundary; and	Complied
	• Filling and illegal dumping should be inhibited through site management and audit.	Complied
	WASTE – OPERATION PHASE	
15	No mitigation measure is required.	-