MTRC Contract No. M1016-09

ECOLOGICAL MONITORING AND ADAPTIVE MANAGEMENT ADVICE SERVICES FOR LOK MA CHAU AND WEST RAIL WETLANDS

HABITAT CREATION AND MANAGEMENT PLAN LOK MA CHAU ECOLOGICAL ENHANCEMENT AREA

Issue 16

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Ecological Monitoring and Adaptive Management Advice Services for Lok Ma Chau and West Rail Wetlands

Habitat Creation and Management Plan
Lok Ma Chau Ecological Enhancement Area
(Issue 16)

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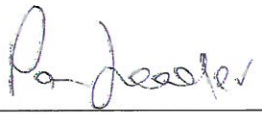
Prepared by:	**Paul LEADER**	
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EXECUTIVE SUMMARY

Background

According to Condition 2.10 (b) of the current EP (FEB-06/129/2002/G), a Five-yearly Review of the HCMP is required. This report should "include both qualitative and quantitative review of management objectives and targets, together with measures necessary to accomplish any revised objectives and targets that are set." The review (Management Review Report (MRR; AEC 2013)) was prepared in August 2013, and circulated to the Environmental Protection Department, the Agriculture, Fisheries and Conservation Department and members on the Environmental Committee; it was finalized and approved in October 2013.

The current issue of the HCMP (Issue 16; 2013) aims to incorporate the recommendations of the MRR (AEC 2013). Key elements of the HCMP are summarized here.

Ownership & Management Responsibilities of the EEA

No change is proposed to the ownership and management responsibilities of the EEA.

Management Objectives of the EEA

No change is proposed in the total area, habitats and total areas of habitats to be managed (but there is some change proposed to the distribution of habitats).

Following a systematic review of target species in the MRR (AEC 2013), the EEA is now proposed to be managed and maintained for a target list which comprises two mammal species (including one additional species for conservation purposes), 30 bird species (including 8 additional species for conservation purposes), three herpetofauna species and the diversity and general abundance of dragonfly species.

Table 1 *Target List for LMC EEA*

Common Name	Scientific Name	Current Conservation Status^	
		Fellowes *et al.* 2002	IUCN 2013
Mammal			
Eurasian Otter	*Lutra lutra*	RC	NT
Leopard Cat*	*Prionailurus bengalesis*	-	-
Bird			
Japanese Quail	*Cotumix japonica*	LC	NT
Eurasian Wigeon*	*Anas penelope*	RC	-
Eurasian Teal	*Anas crecca*	RC	-
Little Grebe*	*Tachybaptus ruficollis*	LC	-
Black-faced Spoonbill	*Platalea minor*	PGC	EN
Cinnamon Bittern*	*Ixobrychus cinnamomeus*	LC	-
Black-crowned Night Heron*	*Nycticorax nycticorax*	(LC)	-
Chinese Pond Heron	*Ardeola bacchus*	PRC (RC)	-
Grey Heron	*Area cinerea*	PRC	-
Great Egret	*Ardea alba*	PRC (RC)	-
Intermediate Egret*	*Egretta intermedia*	RC	-
Little Egret	*Egretta garzetta*	PRC (RC)	-
Great Cormorant	*Phalacrocorax carbo*	PRC	-
Greater Spotted Eagle	*Aquila clanga*	GC	VU
Eastern Imperial Eagle	*Aquila heliaca*	GC	VU
Eurasian Coot	*Fulica atra*	RC	-

Common Name	Scientific Name	Current Conservation Status^	
		Fellowes *et al.* 2002	IUCN 2013
Black-winged Stilt	*Himantopus himantopus*	RC	-
Greater Painted-snipe	*Rostratula benghalensis*	LC	-
Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	LC	-
Pintail Snipe	*Gallinago stenura*	-	-
Swinhoe's Snipe	*Gallinago megala*	LC	-
Common Snipe	*Gallinago gallinago*	-	-
Pallas's Grasshopper Warbler	*Locustella certhiola*	LC	-
Zitting Cisticola	*Cisticola juncidis*	LC	-
Red-billed Starling	*Spodiopsar sericeus*	GC	-
White-cheeked Starling*	*Spodiopsar cineraceus*	PRC	-
White-shouldered Starling*	*Sturnia sinensis*	(LC)	-
Bluethroat	*Luscinia svecica*	LC	-
Yellow-breasted Bunting*	*Emberiza aureola*	RC	EN
Japanese Yellow Bunting	*Emberiza sulphurata*	GC	VU
Herpetofauna			
Chinese Bullfrog	*Hoplobatrachus chinensis*	PRC	-
Burmese Python	*Python bivittatus*	PRC	VU
Chinese Soft-shelled Turtle	*Pelodiscus sinensis*	GC	VU
Dragonfly (Diversity and General Abundance)			
Dragonfly (Diversity and General Abundance)	n/a	n/a	
Total Number of Mammal Target		**2 mammal species**	
Total Number of Bird Target		**30 bird species**	
Total Number of Herpetofauna Target		**3 herpetofauna species**	
Dragonfly (Diversity and General Abundance)		**Dragonfly (diversity and general abundance)**	

^ IUCN 2013: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; and
Fellowes *et al.* (2002): GC = Global Concern; RC = Regional Concern; LC = Local Concern; PGC = Potential Global Concern; PRC = Potential Regional Concern; letters in parentheses indicate that the assessment is based on the restrictedness in breeding and/or roosting sites rather than in general occurrence.

* indicates new target species following the MRR but which were not originally impacted by the Project, and for which no numerical target is required under the EP.

No numerical targets are set for mammal target species.

Numerical targets are required for bird target species which were impacted by the Lok Ma Chau Spur Line (species without an asterisk in Table 1 above), for which the EEA should support a density per ha of target species twice that of commercial fishponds (i.e. the Control Areas) in order to demonstrate that the predicted potential impacts to these species due to the Spur Line have been compensated for at the EEA. No numerical targets are set for bird conservation target species (those marked with an asterisk).

There are no target levels for herpetofauna targets and diversity and general abundance of dragonflies.

As of 1st January 2006, the EEA is divided into three Management Compartments, which are managed for different faunal targets.

- Compartment A is managed at a relatively low intensity, for which the major targets include the establishment of an egretry and Eurasian Otter;
- Compartment B is managed relatively intensively with regular drain-down and provision of trash fish to attract large waterbirds; and
- Compartment C is managed for a suite of marsh and reedbed fauna including amphibians, dragonflies and bird species requiring marsh vegetation. This compartment will be kept free of fish as far as possible.

Management Requirements of the EEA

In order for the EEA to perform for the target species, several key elements are to be managed; these include the structural components for water management (i.e. the arterial pipe system, the uPVC pipe system and the mobile pump system), water quality and water capacity management, fish stocking (winter stocking, spring stocking and herbivorous fish stocking) and vegetation management (tree/shrubs, bund and emergent vegetation). In addition, a number of undesired plant and animal species have been identified. Access to the EEA is strictly controlled.

Monitoring Requirements of the EEA

The following monitoring items are required for the EEA:

- Mammal: infra-red cameras and small mammal live trapping;
- Bird: weekly tower and transect count at EEA, and weekly transect count at the CAs; weekly counts of Black-faced Spoonbills at MPNR, and roost count and nest box monitoring where a roost/nesting is known;
- Herpetofauna: night time surveys during the wet season at the EEA;
- Dragonfly: transect survey during the wet season at the EEA;
- Vegetation (Compartment C): once a year in the late dry season;
- Vegetation (all compartments): twice a year;
- Tree/Shrub: annual monitoring;
- Fish stock status: once every two months at all stocked ponds;
- Fish size: 50 random sample from each consignment;
- Water quality: once per month prior to the monthly site meeting;
- Water capacity: twice per month

Adaptive Ecological Monitoring

The following adaptive ecological management items are required for the EEA:

- Weekly review of condition of the EEA;
- Weekly review of wildlife monitoring activities in the EEA;
- Monthly joint inspection visit;
- Monthly works progress meeting

Implementation of the MRR

The following items are required to comply with the recommendations of the MRR (AEC 2013):

- Re-locate the reedbed from Pond 22 to Pond 14;
- Provision of a larger area of lily for target species;
- Re-profile pond bottoms to facilitate water management of the site;

- Comply with the requirements of the EP, and apply for a VEP where necessary.

Reporting Requirement

The following reporting requirements are required for the EEA:

- Quarterly report;
- Annual report;
- Update of HCMP where necessary;
- Biannual meeting with the Environmental Committee

GLOSSARY

Boundary Fence
The Frontier Closed Area (Mai Po to Ma Tso Lung section) was opened as of 15th February 2012 and as result the EEA and adjacent ponds are no longer in a restricted area. In order to prevent unauthorized access by the public, a boundary fence to delineate the site is now under construction. The proposal, location and design of the fence was agreed with AFCD.

Control Area
Control Area refers to a selected site to which the performance of the EEA for target species would be compared. Two Control Areas are monitored (Mai Po San Tsuen and San Tin) that are considered to represent typical commercial fishponds in the Deep Bay area (***Figure 3***).

Conservation Status
Conservation status as noted in the tables of the report follows that of Fellowes *et al.* (2002) and IUCN Red List of Threatened Species except stated otherwise. The following abbreviations are used in this report for IUCN Listing: CR = Critically Endangered; EN = Endangered; VU = Vulnerable, and Fellowes *et al.* (2002) listing: GC = Global Concern; RC = Regional Concern; LC = Local Concern; PGC = Potential Global Concern; PRC = Potential Regional Concern; any letters in parentheses indicate that the assessment is based on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.

Ecological Compensation Area (ECA)
Provision of a fishpond area of no less than 27.1 ha was required under EP-129/2002 (Figure 7) prior to the operation of the Lok Ma Chau Station. The total area and mix of habitats required was revised in EP-129-2002/D (Figure 7) to include 29.65 ha of fishponds, 0.2 ha of marshland and 0.7 ha of reedbed; and further revised to 26.2 ha of fishponds, 0.2 ha of marshland and 0.7 ha of reedbed in Clause 2.8 of the EP No. FEP-06/129/2002F (Figure 3). In addition, Clause 2.9 of the same EP stated that a marshland of not less than 4.9 ha is to be provided at specified location (Figure 4 of the EP).ECA is also referred to as Ecological Enhancement Area under Condition 2.4 of the EPs.

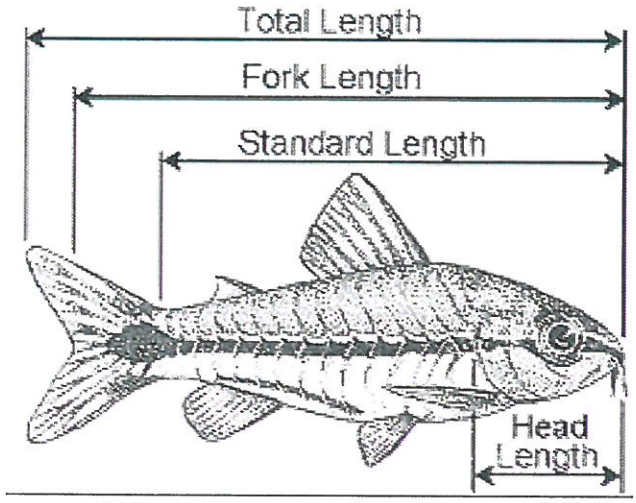
Ecological Enhancement Area (EEA)
A variation of Ecological Compensation Area; see above.

Environmental Committee (EC)
An advisory committee set as required under Condition 2.8 of the Environmental Permit No. EP-129-2002/G issued on 19 December 2005.

Frontier Closed Area (FCA)
The Frontier Closed Area was previously known as the Boundary Closed Area before 2006, and is an area bordering Hong Kong and China. A Closed Area Permit is required for anyone wishing to enter these areas. With the opening of the FCA (the Mai Po to Mai Tso Long section was opened in 15 February 2012), access to the EEA is no longer controlled by the Closed Area Permit.

Fish Size

Fish size refers to body measurement of a fish. The standard length of a fish is used when assessing the size of the fish at EEA, as shown in the figure below.



IEA (Initial Enhancement Areas)

An area of no less than 15 ha required under EP-129/2002 (Figure 6) that was provided prior to the commencement of site formation works of the Lok Ma Chau Station. The area was subsequently incorporated into the EEA

LMC EEA (Pond 1)

LMC EEA Pond 1 refers to the pond west of Pond 2. This former fishpond is managed to compensate for the ecological loss due to the construction and operation of the LMC Public Transport Interchange, and is currently managed and maintained by AFCD.

Management Compartment

A management compartment refers to an area within the LMC EEA for which management objectives are defined. The LMC EEA is divided into three management compartments (*Figure 2*).

Primary Target

A primary target refers to a target species within a particular Management Compartment of the EEA where habitat conditions or management actions are optimal for that species.

Secondary Target

A secondary target refers to a target species of the EEA in relation to the management action of a particular Management Compartment. Management measures within a particular Compartment will not aim to maximize the condition of the habitats for that species, but are anticipated to be of benefit.

Target Level

Target level refers to the requirement by which the performance of the EEA should be maintained in order to demonstrate that the EEA functions as designed and that the impacts of the Lok Ma Chau Spur Line project are fully mitigated.

Target Species

Species identified during the EIA process as species of importance potentially impacted by the construction and operation of the Lok Ma Chau Spur Line project, and for which mitigation measures are required.

Trash Fish

Trash fish refers to fish of low market value that are often discarded and rarely consumed as human food; this largely refers to Tilapia spp.

1 INTRODUCTION

1.1 Project Background

1.1.1.1 The Environmental Impact Assessment for the Sheung Shui to Lok Ma Chau Spur Line was approved in 2002, and an Environmental Permit (EP-129/2002) for the construction and operational of the Project was issued. The EP has since been revised and the current version is EP No. FEP-06/129/2002/G.

1.2 Requirement of the Environmental Permit

1.2.1.1 According to EP-129/2002 a total area of 27.1 ha of fishponds and an area of not less than 4.9 ha of marshland would be enhanced/provided prior to the operation of the LMC Station at locations specified in Figures 6, 7 and 8 respectively of the EP (No. EP-129/2002). Since operation of the LMC Station in 2007, these requirements are now superseded by EP No. FEP-06/129/2002/G, which states that habitats to be provided should include "not less than 26.2 hectares of fishponds, 0.2 hectares of marshlands and 0.7 hectares of reedbed as indicated in Figure 3 ..." of EP No. FEP-06/129/2002/G, and "a marshland of not less than 4.9 hectares at locations indicated in Figure 4" of EP No. FEP-06/129/2002/G. These areas are shown in ***Figure 1***.

1.2.1.2 According to Condition 2.10 (b) of the current EP, a Five-yearly Review of the HCMP is required and should include "both qualitative and quantitative review of management objectives and targets, together with measures necessary to accomplish any revised objectives, and target that are set". These should be "prepared in consultation with stakeholders including, but not limited to relevant Government Departments and the Advisory Council on the Environment" (Condition 2.10 (c)) and be submitted for the Director's approval.

1.2.1.3 Condition 2.10 (b) of the Environmental Permit stated that a Five-yearly Review programme for the approved HCMP should be undertaken. This report should "include both qualitative and quantitative review of management objectives and targets, together with measures necessary to accomplish any revised objectives, and targets that are set." The Lok Ma Chau Spur Line has been in operation for five years since 2007; hence, a Management Review Report (MRR) was prepared and submitted to the Environmental Protection Department, the Agriculture, Fisheries and Conservation Department and members on the Environmental Committee in August, and was finalized and approved in October 2013.

1.2.1.4 In view of the findings, evaluation and assessment of the management practices in the approved HCMP (Issue 11; 2006) and the subsequent proposed changes in the Management Review Report (MRR) (AEC 2013), there is a need to update the HCMP to incorporate the proposed changes.

1.3 Location and area of the Lok Ma Chau Ecological Enhancement Areas (EEA)

1.3.1.1 The location of the Lok Ma Chau EEA and the Lok Ma Chau Spur Line and Station are shown in ***Figure 1***.

1.4 Purpose of the Habitat Creation and Management Plan

1.4.1.1 The Habitat Creation and Management Plan (HCMP) serves as a blueprint for the management and maintenance measures and monitoring required for the EEA, to mitigate for the ecological impacts arising from the operation of the Lok Ma Chau Spur Line as identified in the approved EIA (BBV 2002) and to further enhance the ecological opportunities of the site as identified in the MRR (AEC 2013).

1.4.1.2 This HCMP details specifications for the habitats and ecological functions to be provided by the EEA and defines management, monitoring and reporting requirements for these habitats, and the resources requirement for its implementation. Management, ecological monitoring and audit are subject to the ongoing requirement to review these on an annual basis in accordance with the requirements of the Environmental Permit.

1.5 Content of the HCMP

1.5.1.1 Content of the HCMP includes:

- Details of the management objectives of the EEA, including faunal targets and habitat condition targets (**Sections 3 - 4**);
- Monitoring methodology of the targets and habitat attributes (**Section 5**);
- Specific Measures Required for the Implementation of the MRR (**Section 8**);
- Reporting requirement (**Section 9**);
- A summary of habitat requirements and associated management measures required by target species (**Appendix 1**); and
- A summary of reasons for removal and additions to the target species list as identified in the Management Review Report (**Appendix 2**).

2 OWNERSHIP AND MANAGEMENT RESPONSIBILITIES OF THE EEA

2.1.1.1 The EEA is owned by the HKSAR Government. The management and maintenance of the EEA is a requirement of the Environmental Permit for the operation of the Lok Ma Chau Spur Line. With the exception of Ponds 1A and 1B, the EEA is managed and maintained by MTRC under License (***Figure 1***).

2.1.1.2 Ponds 1A and 1B remain under direct Government ownership and have been monitored by Agriculture, Fisheries and Conservation Department (AFCD) from September 2006 onwards (***Figure 2***). Since the management of Ponds 1A and 1B is undertaken by the Government and is governed under a separate EP, the management of these ponds is not within the scope of this document.

3 MANAGEMENT OBJECTIVES OF THE EEA

3.1 Habitat Area

3.1.1.1 According to Condition 2.8 of the current EP, habitats to be provided should include "not less than 26.2 hectares of fishponds, 0.2 hectares of marshlands and 0.7 hectares of

reedbed", and Condition 2.9, "a marshland of not less than 4.9 hectares". The habitats to be provided, managed and maintained in the EEA are provided in ***Figure 1***.

3.2 Faunal Targets

3.2.1 List of Faunal Targets

3.2.1.1 The mitigation objective for the EEA is the provision of suitable habitat for the target species of ecological importance regularly occurring within and adjacent to the Spur Line and Lok Ma Chau Station site rather than the restoration of specific habitats of intrinsic ecological value. Accordingly, the habitat target for the mitigation area is the enhancement, creation and maintenance of the habitat listed in ***Section 3.1*** above.

3.2.1.2 Numbers of target wildlife species will be a reflection of habitat factors, such as water conditions, food availability and freedom from disturbance. Accordingly, other targets have been set that reflect the habitat requirements of the target species. Such targets include the increase in shallow feeing areas, water quality, fish stocks and vegetation status and distribution. These habitat-related targets are described in ***Section 3.3***.

3.2.1.3 Following a systematic review of target species in the MRR (AEC 2013), the EEA is managed and maintained for a target list which comprises two mammal species, 30 bird species, three herpetofauna species and diversity and general abundance of dragonfly species (***Table 1***).

Table 1 *Target List for LMC EEA*

Common Name	Scientific Name	Current Conservation Status^	
		Fellowes *et al.* 2002	IUCN 2013
Mammal			
Eurasian Otter	*Lutra lutra*	RC	NT
Leopard Cat*	*Prionailurus bengalesis*	-	-
Bird			
Japanese Quail	*Cotumix japonica*	LC	NT
Eurasian Wigeon*	*Anas penelope*	RC	-
Eurasian Teal	*Anas crecca*	RC	-
Little Grebe*	*Tachybaptus ruficollis*	LC	-
Black-faced Spoonbill	*Platalea minor*	PGC	EN
Cinnamon Bittern*	*Ixobrychus cinnamomeus*	LC	-
Black-crowned Night Heron*	*Nycticorax nycticorax*	(LC)	-
Chinese Pond Heron	*Ardeola bacchus*	PRC (RC)	-
Grey Heron	*Area cinerea*	PRC	-
Great Egret	*Ardea alba*	PRC (RC)	-
Intermediate Egret*	*Egretta intermedia*	RC	-
Little Egret	*Egretta garzetta*	PRC (RC)	-
Great Cormorant	*Phalacrocorax carbo*	PRC	-
Greater Spotted Eagle	*Aquila clanga*	GC	VU
Eastern Imperial Eagle	*Aquila heliaca*	GC	VU
Eurasian Coot	*Fulica atra*	RC	-
Black-winged Stilt	*Himantopus himantopus*	RC	-
Greater Painted-snipe	*Rostratula benghalensis*	LC	-
Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	LC	-
Pintail Snipe	*Gallinago stenura*	-	-
Swinhoe's Snipe	*Gallinago megala*	LC	-
Common Snipe	*Gallinago gallinago*	-	-
Pallas's Grasshopper Warbler	*Locustella certhiola*	LC	-
Zitting Cisticola	*Cisticola juncidis*	LC	-
Red-billed Starling	*Spodiopsar sericeus*	GC	-
White-cheeked Starling*	*Spodiopsar cineraceus*	PRC	-

Common Name	Scientific Name	Current Conservation Status^	
		Fellowes *et al.* 2002	IUCN 2013
White-shouldered Starling*	*Sturnia sinensis*	(LC)	-
Bluethroat	*Luscinia svecica*	LC	-
Yellow-breasted Bunting*	*Emberiza aureola*	RC	EN
Japanese Yellow Bunting	*Emberiza sulphurata*	GC	VU
Herpetofauna			
Chinese Bullfrog	*Hoplobatrachus chinensis*	PRC	-
Burmese Python	*Python bivittatus*	PRC	VU
Chinese Soft-shelled Turtle	*Pelodiscus sinensis*	GC	VU
Dragonfly (Diversity and General Abundance)			
Dragonfly (Diversity and General Abundance)	n/a	n/a	
Total Number of Mammal Target	**2 mammal species**		
Total Number of Bird Target	**30 bird species**		
Total Number of Herpetofauna Target	**3 herpetofauna species**		
Dragonfly (Diversity and General Abundance)	**Dragonfly (diversity and general abundance)**		

^ IUCN 2013: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; and
Fellowes *et al.* (2002): GC = Global Concern; RC = Regional Concern; LC = Local Concern; PGC = Potential Global Concern; PRC = Potential Regional Concern; letters in parentheses indicate that the assessment is based on the restrictedness in breeding and/or roosting sites rather than in general occurrence.

* indicates new target species following the MRR (AEC 2013) but which were not originally impacted by the Project, and for which no numerical target is required under the EP.

3.2.2 Target Levels

Mammal Target Level

3.2.2.1 Due to the difficulty of detection of this, largely nocturnal, species, there are no numerical targets for Eurasian Otter.

3.2.2.2 There is no target level for Leopard Cat since it is not a species originally impacted by the Project. However, the number of sightings of the species will be reported to facilitate long-term management of the EEA.

Bird Target Level

3.2.2.3 Numerical targets are required for bird target species (except those marked with an asterisk in ***Table 1***) to demonstrate that the predicted potential impact to these species have been compensated for at the EEA. Accordingly, in order to demonstrate that targets have been achieved, it is necessary to demonstrate that the EEA supports a density per ha of the target species twice that of commercial fishponds.

3.2.2.4 In order to demonstrate that numerical targets are achieved, densities of target species in the EEA are compared those in representative areas of commercial fishponds monitored concurrently with and monitoring of the EEA. The groups of fishponds selected as Control Areas are at Mai Po San Tsuen and San Tin and are shown in ***Figure 3*** and ***Table 2***.

Table 2 *Control Areas of commercial fishponds for monitoring of bird numbers.*

Location	Number of fishpond	Area (ha)
Mai Po San Tsuen	15	21.22
San Tin	46	60.22
Total	61	81.44

3.2.2.5 The method for calculating the numerical targets for birds is provided in ***Appendix 3***.

Herpetofauna Target Level

3.2.2.6 There are no target levels for herpetofauna targets (Chinese Bullfrog, Burmese Python and Chinese Soft-shelled Turtle). However, the number of sightings of these species will be reported to facilitate long-term management of the EEA.

Dragonfly Diversity & General Abundance

3.2.2.7 There are no target level for dragonfly diversity and general abundance. However, the number of species and abundance of each species will be reported to facilitate long-term management of the EEA.

3.3 Management Compartments

3.3.1.1 Due to the large number and diversity of faunal targets, as of 1st January 2006, the EEA was divided into three Management Compartments; reflecting management practices and the habitat and faunal targets in these different units (***Figure 2***).

3.3.2 Habitat Requirement of Target Species

3.3.2.1 The definition of favourable habitat condition is varies between species; and details are provided in ***Appendix 1*** and summarized in ***Table 3***. All habitats listed should be provided, managed and maintained in the EEA.

Table 3 *Management Compartments for Target Species*

Common Name	MC^	Habitat#						
		Deep Water	Shallow Water	Bare, Muddy Margins	Emergent/ Marsh Vegetation	Bare or sparsely vegetated bunds	Vegetated Bunds	Trees/Channels
Mammal								
Eurasian Otter	A, b	F	F	F	F			B
Leopard Cat*	b, c			F	F	F		F
Bird								
Japanese Quail	b, c						F, R	
Eurasian Wigeon*	a, b, c	F	F, r	f	F, R			
Eurasian Teal	a, B, C	F	F, r	f	F, R	f, r		
Little Grebe*	a, b, c	F, R	F, R		F, R, B			
Black-faced Spoonbill	B		F	F		R		
Cinnamon Bittern*	b, c				F, R, B			
Black-crowned Night Heron*	a, b		F	F	F, R			R, B
Chinese Pond Heron	A, B, C		f	f	F, r			R
Grey Heron	A, B		F		f	R		R
Great Egret	A, B		F		F	R		R
Intermediate Egret*	a, b, c		F	F	F, R	R		R
Little Egret	A, B, c		F	f	F	r		R
Great Cormorant	A, B	F	f					R
Greater Spotted Eagle	a, B, c		F		F	F		R
Eastern Imperial Eagle	a, B, c		F		F	F		R
Eurasian Coot	a, b, C	f	f					f, r
Black-winged Stilt	a, B, C		F	F	F, b	R, B		
Greater Painted-	C			F	F, R, B			

Common Name	MC^	Habitat#						
		Deep Water	Shallow Water	Bare, Muddy Margins	Emergent/ Marsh Vegetation	Bare or sparsely vegetated bunds	Vegetated Bunds	Trees/Channels
snipe								
Pheasant-tailed Jacana	C				F, R, B			
Pintail Snipe	C			f	F, R			
Swinhoe's Snipe	C			f	F, R			
Common Snipe	b, C			F	F, R			
Pallas's Grasshopper Warbler	b, C				F, R		F, R	
Zitting Cisticola	B, c				F, R		F, R	
Red-billed Starling	A, B			F	f	F		F, R, B
White-cheeked Starling*	a, b			F	f	F		F, R, B
White-shouldered Starling*	a, b, c			F	f	F		F, R, B
Bluethroat	C			f	F, R		F, R	
Yellow-breasted Bunting*	c				F, R	f	F, R	
Japanese Yellow Bunting	b, c				f, r	F	f, r	f, R
Herpetofauna								
Chinese Bullfrog	b, C		F, R, B		F, R, B			
Burmese Python	b, c		F, B	F, B	f, r		f, r	f, r
Chinese Soft-shelled Turtle	a, b	r	F	R, B				
Dragonfly (Diversity and General Abundance)								
Dragonfly	C				F, R, B		f, r	

* indicates new target species following the MRR (AEC 2013) but which were not originally impacted by the Project, and for which no numerical target is required under the EP.

^ where capital letters refer to primary target and small letters refer to secondary target.

where F = foraging, R = loafing/roosting, B = breeding; capital letters refer to the main habitat of the respective activity

3.3.3 Compartment A (Ponds 2A & 2B)

3.3.3.1 These ponds will be managed at a relatively low intensity and water levels will be permitted to fluctuate naturally except when a particular management measure is required to address a particular issue. Limited fish stocking will be undertaken in late winter. Bunds and some islands will be wooded. The compartment has incorporated elements to attract the establishment of an egretry and for Eurasian Otter; hence, the reduction of disturbance (human and dogs) is of prime importance to this compartment. A list of primary and secondary target species is provided in ***Table 4***.

Table 4 *Primary and Secondary Targets for Management Compartment A*

Group	Primary Target	Secondary Target
Mammal	Eurasian Otter	-
Bird	Chinese Pond Heron Grey Heron Great Egret Little Egret Great Cormorant Red-billed Starling	Eurasian Wigeon Eurasian Teal Little Grebe Intermediate Egret Greater Spotted Eagle Eastern Imperial Eagle Eurasian Coot Black-winged Stilt White-cheeked Starling White-shouldered Starling
Herpetofauna	-	Chinese Soft-shelled Turtle

3.3.3.2 Hence, the habitat condition and management actions should be implemented:

Habitat Condition

- Minimize disturbance (human/dog) by providing a dog-prove fence design & controlled access (particularly unauthorized access).;
- To be managed at a relatively low intensity and water levels allowed to fluctuate naturally (except when problems of potential flooding and water quality arise);
- Manage and maintain the fruiting tree/shrub for starling species;
- Manage and maintain a secure site for roosting and/or breeding egrets.

Overview of Required Management Action

- Implement wet and dry season routine grass cutting;
- Management and maintenance of nest boxes for starlings;
- Management and maintenance of the site boundary fence to reduce human and dog intrusion;
- Manage the tree cover under the annual tree monitoring of the EEA.

3.3.4 Compartment B (Ponds 3-11, 13)

3.3.4.1 Ponds in this compartment will be managed relatively intensively with regular drain-down and the provision of trash fish to attract large waterbirds, notably Great Cormorant, Grey Heron, Great Egret, Little Egret and Black-faced Spoonbill. Fish stocks will be maintained by stocking with trash fish following drain-down and refilling. Hence, water level management, particularly during the wintering and migratory season, will be critical in this compartment. A list of primary and secondary target species is provided in ***Table 5***.

Table 5 *Primary and Secondary Targets for Management Compartment B*

Group	Primary Target	Secondary Target
Mammal	-	Eurasian Otter Leopard Cat
Bird	Eurasian Teal Black-faced Spoonbill Chinese Pond Heron Grey Heron Great Egret Little Egret Great Cormorant Greater Spotted Eagle Eastern Imperial Eagle Black-winged Stilt Zitting Cisticola Red-billed Starling	Eurasian Wigeon Japanese Quail Little Grebe Cinnamon Bittern Black-crowned Night Heron Intermediate Egret Eurasian Coot Common Snipe Pallas's Grasshopper Warbler Japanese Yellow Bunting White-cheeked Starling White-shouldered Starling
Herpetofauna	-	Chinese Bullfrog Burmese Python Chinese Soft-shelled Turtle

3.3.4.2 The following habitat condition and management actions are required:

Habitat Condition

- Shallow water available for Black-faced Spoonbills and ardeids;

- At least one fish pond with fish of suitable size (mean size of 10cm) available (i.e. drained or partially drained) for target species at all times during the migratory and wintering period;
- Repeated stocking with trash fish during the winter months to maintain the same pond in a suitable condition for large waterbird targets for extensive periods of time;
- Minimize disturbance to roosting ardeids and Black-faced Spoonbills during day-to-day management and monitoring activities;
- Management and maintenance of trees for raptors and starlings;
- Management and maintenance of nest boxes for starlings;
- Management and maintenance of refugia and areas of short grass (20 – 40 cm) at bunds between Ponds 9/10, 10/11 and 12/15;
- Maintenance of bankside and emergent vegetation on selected ponds to provide refuges for fish and appropriate conditions for invertebrates which will themselves provide food for birds;
- Maintenance of floating platforms for breeding Black-winged Stilt and partial drain-down the ponds if breeding is confirmed;
- Ponds with recently flooded grasses for duck species during the winter period.

Overview of Required Management Action

- Implement wet and dry season routine grass cutting;
- Manage the tree cover under for the annual tree monitoring of the EEA;
- Management and maintenance of nest boxes for starlings;
- Regular provision of fish during the wintering period;
- Implement the water management objective regarding water control system, water quality, and water carrying capacity as outlined in ***Section 4.1***;
- Implement the fish stocking management objective as outlined in ***Section 4.2***;
- Identify areas of temporary access where a roosting and/or a breeding site for target species, particularly Black-faced Spoonbill and egretry, is located.

3.3.5 Compartment C (Ponds 12, 14-22)

3.3.5.1 Marsh and reedbed areas with a variety of shallow water microhabitats managed for amphibians, dragonflies and bird species requiring marsh vegetation (Greater Painted-snipe, *Gallinago* snipe, Pheasant-tailed Jacana and wetland passerines). Ponds will generally be kept free of fish as far as possible in order to benefit amphibians and invertebrates. Pond 12 will primarily function as a reservoir for other ponds within Compartment C although extensive emergent vegetation will be permitted to grow in the shallow margins around the pond to provide habitat for certain target bird species. Primary targets include reedbed and/or marsh species, Eurasian Teal, White-shouldered Starling and Chinese Bullfrog. A list of all target species is provided in ***Table 6***.

Table 6 *Primary and Secondary Targets for Management Compartment C*

Group	Primary Target	Secondary Target
Mammal	-	Leopard Cat
Bird	Eurasian Teal Eurasian Coot	Eurasian Wigeon Japanese Quail

Group	Primary Target	Secondary Target
	Black-winged Stilt Greater Painted-snipe Pheasant-tailed Jacana Pintail Snipe Swinhoe's Snipe Common Snipe Pallas's Grasshopper Warbler Bluethroat	Little Grebe Cinnamon Bittern Black-crowned Night Heron Intermediate Egret Little Egret Greater Spotted Eagle Eastern Imperial Eagle Zitting Cisticola White-shouldered Starling Yellow-breasted Bunting Japanese Yellow Bunting
Herpetofauna	Chinese Bullfrog	Burmese Python Chinese Soft-shelled Turtle
Dragonfly	Dragonfly diversity & abundance	-

3.3.5.2 The following habitat condition and management actions are required:

Habitat Condition

- Shallow water (less than 20cm) and/or exposed wet mud is available for target species during the migratory and wintering season, and also for breeding marsh species;
- Marsh ponds are free of fish (other than temporary stocking of selected species for vegetation and pest control) and invasive pests (especially Apple Snail);
- Management and maintenance of refugia and areas of short grass (20 – 40 cm) at selected areas.

Overview of Required Management Action

- Implement wet and dry season routine grass cutting;
- Undertake mechanical rather than hand removal of vegetation on bunds in Compartment C;
- Replace the requirement of wet season weeding in Compartment C with mechanical removal (using a mini-backhoe) at selected ponds in March (i.e. at the end of the dry season and prior to the breeding season)

3.3.5.3 In addition to the above compartment specific habitat condition targets, the following management actions should be implemented:

- Undertake an annual tree monitoring for the EEA;
- Routine weeding of climbers such as *Mikania* along the new site boundary fence.

4 MANAGEMENT REQUIREMENTS

4.1 Water Management

4.1.1 Arterial Pipe System

4.1.1.1 ***Figure 6*** shows the locations of the arterial pipe system. To effectively utilize the underground arterial pipe system, it is important to have all the associated facilities in

good working conditions. Hence, the condition (and number) of the following should be inspected and reported once per quarter:

- Large mobile pumps (6" inlet/outlet);
- Suction hoses and delivery hoses;
- Electric supply panels.

4.1.1.2 In addition, the following items should be at stand-by prior to the onset of pond drain-down for the attraction of migratory and wintering target species:

- A minimum of two functional large mobile pumps (6" inlet/outlet) and the required associated suction hoses and delivery hoses;
- All electric supply panels.

4.1.1.3 Any malfunctioning part of this system is to be reported to MTRC and restored to proper condition within one month. Where appropriate, the large mobile pumps are to be reviewed and upgraded with the aim of increasing pump capacity such that draining 10cm of water per day (as recommended in the MRR (AEC 2013)) can be achieved.

4.1.2 **uPVC Pipe System**

4.1.2.1 ***Figure 6*** shows the locations of the uPVC pipe system. The positions (height of outlet pipes) and condition of the uPVC pipes should be checked by the Wetland Maintenance Contractor on a weekly basis. Any vegetation or debris obstructing the proper functioning of these pipes is to be cleared on a weekly basis.

4.1.2.2 The Ecological Consultant should inspect all uPVC pipes on a monthly basis and after any flooding, heavy rainfall (such as red or black rainstorm warnings), lowering of typhoon Signal No. 8 unless local condition proves to differ significantly from elsewhere in the SAR where these warnings are issued.

4.1.2.3 Any damage to the uPVC pipes are to be reported to MTRC and the Ecological Consultant and restored to proper condition within two weeks.

4.1.3 **Mobile Pump System**

4.1.3.1 As a back-up, a minimum of six working mobile pumps with a minimum capacity of 900L/min (as in 3" or 4" pump) should be stored on-site at all times. The condition of the stand-by small pumps and all associated electric wires and pipes with these pumps are to be monitored by the Wetland Maintenance Contractor and reported to MTRC and the Ecological Consultant on a monthly basis.

4.1.3.2 All malfunctioned pumps or insufficient quantities of associated wires and pipes are to be repaired and provided within two weeks.

4.1.4 **Water Quality**

4.1.4.1 A suitable storage facility for lime is to be provided on-site. Such facility should be kept dry such that the quality of stored lime is not affected. A minimum of 2,000 kg of lime is to be maintained on-site at all times.

4.1.5 **Water Capacity**

4.1.5.1 The water capacity of the site should be reviewed on a monthly basis and throughout the dry season. Should water capacity fall below 40% of the overall water carrying capacity at the EEA, the site condition should be reviewed and appropriate action to conserve water on-site should be devised by the Ecological Consultant and implemented by the Wetland Maintenance Contractor.

4.1.5.2 The condition of the water level markers is to be monitored once every two weeks. These markers should be cleaned and cleared of vegetation/other obstruction on a monthly basis.

4.2 Fish Stock Management

4.2.1 **Winter Stocking (Trash Fish)**

4.2.1.1 Fish (such as Tilapia) should be stocked repeatedly during the winter months to provide food for large waterbird targets. Frequency and quantities to be stocked should be determined taking into account fish stock already present on-site, pond condition and bird numbers.

4.2.1.2 Winter stocking should comprise fish of a mean length of 10 cm or less based on standard length of a sample of 50 fish per consignment) of which 95% should be smaller than 15 cm, and should not comprise any highly invasive fish species (such as catfish, snakehead and Climbing Perch).

4.2.2 **Spring Stocking (Breeding Fish)**

4.2.2.1 All ponds drained or partially drained during the winter months should be re-stocked before the end of April each year. Fish stocked in spring should have a mean length of at least 20 cm based on standard length of a sample of 100 fish. 95% of the fish stocked should be species which are known to breed in local fishponds and should not comprise any fish species which are highly invasive (such as catfish, snakehead and Climbing Perch).

4.2.3 **Herbivorous Fish**

4.2.3.1 Ponds with extensive unwanted emergent vegetation should be stocked with large herbivorous fish species. These should be stocked together with summer trash fish stocking.

4.2.3.2 Herbivorous carp species, particularly large individuals, should be transferred from any draining pond to other ponds.

4.3 Vegetation Management

4.3.1 **Tree/Shrub Management**

4.3.1.1 Tree/shrub management at the EEA should involve minimal horticultural practices. All management should be driven by the following objectives:

- Maintaining tree/shrub at specific locations for target species (i.e. Greater Spotted Eagle, Eastern Imperial Eagle, ardeid species, and starling species);

- Identifying hazardous trees or tree parts which might pose a safety concern for the site/workers; this relates particularly to trees or tree parts along major access road, areas used by staff and visitors, or in the vicinity of power lines;
- Identifying tree/shrub management measures required for the facilitation of management or monitoring activities;
- Identifying factors which might be harmful to tree growth (such as diseases or unwanted climbers).

4.3.1.2 Annual management measures required for trees and shrubs at the EEA should follow the survey findings from the annual tree survey (***Section 6.1.3***). More frequent review and management measures might be required at selected locations (such as locations with unwanted and fast-growing species).

4.3.1.3 All marked tree/shrubs in the annual tree/shrub review should be removed; any tree/shrub management measures undertaken should be supervised by a Certified Arborist.

4.3.1.4 Unwanted, weedy species include *Acacia* spp., *Leucaena leucocephala* and, in some locations, *Melia azedarach*. Any seedlings, saplings or trees of *Leucaena leucocephala* at the EEA should be removed as a normal vegetation management practice during monthly grass cutting (see below).

4.3.2 **Bund Vegetation Management**

4.3.2.1 Routine grass cutting at the entire site (except for refugia areas marked in ***Figure 4***) should be undertaken as described in sections below. Areas marked in ***Figure 4*** should be maintained; these include:

- Herbaceous vegetation over 40cm in height;
- Herbaceous vegetation over 20cm but less than 40cm in height;
- Herbaceous vegetation less than 20cm in height.

4.3.2.2 Wet season (April to September inclusive) grass-cutting:

- Cut once a month before the 15th of each month: Ponds 2 – 11, 13;
- Cut once a month after the 15th of each month: Ponds 12, 14 – 22.

4.3.2.3 Dry season (October to March inclusive) grass-cutting:

- Cut once a month before the 15th of each month: Ponds 2 – 11, 13;
- Cut once in October, December and February: Ponds 14, 16 – 17;
- Cut once in November, January and March: Ponds 12, 15, 18 – 22.

4.3.2.4 Any unwanted climbers e.g. *Mikania* (including along the site boundary fence) should be removed on a monthly basis.

4.3.2.5 The bunds should be checked for areas of bare ground where vegetation fails to establish on a routine basis (monthly). Hydroseeding may be considered if erosion is of concern.

4.3.3 Emergent Vegetation Management

4.3.3.1 Mechanical weeding (using a mini-backhoe or similar) of areas where unwanted vegetation is rampant should be undertaken at the end of the dry season (such as March).

4.3.3.2 Routine manual removal of highly aggressive species should be undertaken on a monthly basis. These include:

- *Typha angustifolia* (including root removal),
- *Phragmites australia* (Compartment C only, including root removal),
- Parrot Feather *Myriophyllum aquaticum* (careful removal by hand or using hand nets)

4.4 Undesired Animal Management

4.4.1 Feral Dogs

4.4.1.1 Feral dogs regularly appear on site and are undesirable as they have direct adverse impacts on other wildlife (including mammals) and also may cause extensive disturbance. All sightings and locations of feral dogs on site are to be logged.

4.4.1.2 The dog trap (on loan from AFCD) should be checked on a daily basis when baited and set. In addition, the effectiveness of the site boundary fence in excluding dogs from entering the site should be monitored on a weekly basis by the Ecological Consultant based on the number and location of dog sightings. The site boundary fence should be maintained according to ***Section 4.7.1***.

4.4.2 Red Imported Fire Ant

4.4.2.1 Treatment of Fire Ant nests is to be undertaken on a routine basis (once every two weeks) by the Wetland Maintenance Contractor using approved treatment method.

4.4.2.2 No treatment is permitted if rain is forecasted within the next four days.

4.4.2.3 Adequate stock (for two months' application) of the approved treatment (bait or pesticide) should be maintained on-site at a safe location. Sufficient warning against potential health hazard of these materials should be placed at strategic locations near the maintained stock.

4.4.3 Golden Apple Snail

4.4.3.1 Manual removal of Apple Snails (adult, juvenile and egg masses) on a daily basis in the wet season (April to September) and weekly in the dry season (October to March) in all marsh areas (Compartment C; ***Figure 2***). All collected apple snails (adult and juvenile) are to be disposed off-site in a sealed container or plastic bags.

4.4.3.2 In the event of heavy infestation the following procedure is to be followed:

- Partial drain down over a period of about four days so that about 50% of the pond bottom is shallow water);

- Hand removal of all adult and large juvenile Apple Snails until most have been removed;
- Off-site disposal of all snails collected;
- Hand removal of all egg masses (these can be placed in standing water or pushed into wet mud to destroy them);
- Full drain-down of the pond with final check for Apple Snails and further removal as required;
- Refilling with fish-free water from Pond 12.

4.4.3.3 When re-profiling of ponds where a flat bottom to the pond/land is maintained, excavate a small ditch at a location closest to the arterial pump system (***Figure 5***) from which the pond/land can be drained more effectively.

4.4.4 ***Dimorphopterus spinolae***

4.4.4.1 Reeds at the EEA and the Clean-up Reedbed are to be checked for presence of the species on a monthly basis from May to September. Remedial actions are to be devised and undertaken should significant die-off of reed be observed in an infested reedbed.

4.4.4.2 The reedbed will be re-located following the conclusion from the MRR (AEC 2013). See ***Section 8.1***.

4.5 Control of Access

4.5.1.1 Access to the EEA is limited to authorised personnel. Warning signs are placed at access points and at strategic locations (such as at gates and bunds between the EEA and other potential access points) to deter pedestrian trespassers.

4.5.2 Vehicular Access

4.5.2.1 Lockable gates at vehicular access points prevent vehicular access to the EEA by other than authorised personnel. Vehicular gates within the EEA are to be locked at all times. Access from the Boundary Road is controlled by the Hong Kong Police.

4.5.2.2 Vehicular access is restricted to bunds with grasscrete tracks (***Figure 5***) unless otherwise authorized. The chains across these bunds should be replaced and locked (or hooked to the posts using karabiners) at all times (***Figure 5***).

4.5.3 Access for Site Contractors and Other Maintenance Works

4.5.3.1 Access should be restricted to between 0900 and 1800 in the months between April and September and between 1300 and 1700 in November to March, with the exception of ecological monitoring works which require access outside of these hours (i.e. bird monitoring, night-time herpetofauna monitoring, and winter roost count).

4.5.3.2 Unless otherwise authorized and management activities described in **Sections 4.4** above, no removal or trapping of wild animals is allowed.

4.5.3.3 Temporary access restrictions might be required upon reviewing the usage of the site by wildlife (such as breeding birds).

4.6 Avian Influenza & Botulism

4.6.1 Bird Flu Prevention Guideline

4.6.1.1 The following procedures should be followed as a standard procedure:

- Physical contact with wild bird and their excreta should not be undertaken except when carrying out bird trapping or permitted bird surveys;
- Wash hands thoroughly with detergent hand rub or wet tissue (with alcohol) upon physical contact with wild bird, feather or excreta;
- All staff entering the wetlands from October to March should sign in and out on the log book and should wash hands using the disinfectant kit at the EEA entrance(s) before leaving the site.

4.6.2 Handling of Sick or Dead Birds

4.6.2.1 Physical contact with sick or dead birds should not be undertaken unless with sufficient protective gear and by trained personnel. Collection of dead birds should be undertaken by authorized persons only.

4.6.2.2 The number and species of sick or dead birds should be monitored, particularly during the migratory and wintering months and periods of warm weather during the dry season. Records of sick or dead birds should be reported to MTRC promptly and should massive die-offs or sick birds be present, the following protocol against avian influenza and botulism should be adopted:

- During a disease outbreak, sick or dead birds should be collected daily by AFCD staff until the outbreak has abated;
- Close liaison with WWFHK staff at Mai Po Nature Reserve in the event of any disease outbreaks;
- Minimize bird attraction to the EEA should there be any unusually high numbers of sick or dead birds tested positive for AIV.

4.6.3 Wetland Avian Flu Warning Classifications and Response Actions

4.6.3.1 A 3-level response to outbreak or incident of bird flu confirmation are classified as follows; and details are provided in ***Appendix 4***:

- **Incident**: one or more isolated case of confirmed avian flu in birds. Management and monitoring activities at the EEA will not be affected. Daily inspection for any sick or dead birds is to be undertaken;
- **Outbreak**: several cases in quick succession but localized occurrence in birds. Management activities of the EEA are suspended. Access to the EEA is restricted to essential staff. All persons entering should wear sufficient personal protective gear;
- **Epidemic**: large scale die-off of birds in Hong Kong and Shenzhen region at several locations. No entry to the EEA is permitted.

4.7 Structural Management

4.7.1 Site Boundary Fence

4.7.1.1 The boundary fence (***Figure 5***) should be checked on a monthly basis against damage and other conditions which might affect the effectiveness of the fence in exclusion of unauthorized access and intrusion by dogs.

4.7.1.2 Any damage to the fence should be reported to the MTRC and Ecological Consultant, who should device remedial measures against the potential threat (human or dog intrusion) to the EEA.

4.7.2 Bird Tower

4.7.2.1 The bird tower is to be inspected by registered personnel on a regular basis according to the 38F of the Construction Sites (Safety) Regulations (CSSR).

4.7.2.2 The tower is to be cleaned on a weekly basis to maintain hygiene.

4.7.3 Bund (including Grasscrete Track)

4.7.3.1 The conditions of these should be inspected at a minimum on a monthly basis. Damage to these structures should be rectified prior to the onset of the wet and dry seasons.

5 MONITORING METHODOLOGY (FAUNA TARGETS)

5.1 Mammal

5.1.1 Eurasian Otter and Leopard Cat

5.1.1.1 Monitoring of Eurasian Otter *Lutra lutra* and Leopard Cat *Prionailurus bengalensis* is primarily camera-based. A minimum of five sets of camera traps should be deployed at all times. These should be set up in semi-permanent positions (i.e. they may be moved occasionally for operational reasons or in response to previous survey findings). Cameras should always be in place in Compartment A where Eurasian Otter is a primary target species and artificial holts have been constructed. However following the construction of the new boundary fence, additional cameras should also be located in Compartments B and C, to monitor the effects of the fence on both wild mammals and domestic dogs.

5.1.1.2 Cameras should be fixed at an appropriate height to maximize the chances of obtaining photographs of small mammals. The infra-red monitors have an effective range of up to 8m for animals within this size range. Cameras should be checked and memory cards changed once every two weeks.

5.1.2 Small Mammal (Non-target)

5.1.2.1 Since small mammal is not a target species of the EEA, monitoring activities can differ according to the particular objective of the study. It is recommended in the MRR (AEC 2013) to investigate small mammal usage (abundance and diversity) of the EEA. Monitoring of small mammal usage of the site should be undertaken by means of live trapping (and/or marking). Exact details are subject to discussion and approval from the relevant Government Departments upon application for a special permit to trap live

animals. A preliminary design of the monitoring is provided in Appendix 9 of the MRR (AEC 2013) and re-provided here as ***Appendix 5***.

5.2 Bird

5.2.1.1 ***Table 7*** outlines the bird species to be monitored at the LMC EEA and the CAs (MPST & ST; ***Figure 3***). Target levels are described in ***Section 3.2.2***.

Table 7 Weekly Monitoring Requirements for Bird Targets at LMC EEA and CAs

Species	Count Methodology	
	LMC EEA^	Control Areas (MPST & ST)
Japanese Quail	Transect (A, B, C)	Transect
Eurasian Wigeon*	Transect (A, B, C)	Transect
Eurasian Teal	Transect (A, B, C)	Transect
Little Grebe*	Transect (A, B, C)	Transect
Black-faced Spoonbill	Tower count (A, B) & Transect (C)†	Transect & MP roost count
Cinnamon Bittern*	Transect (A, B, C)	Transect
Black-crowned Night Heron*	Transect (A, B, C)	Transect
Chinese Pond Heron	Transect (A, B, C)	Transect
Grey Heron	Tower count (A, B) & Transect (C)†	Transect
Great Egret	Tower count (A, B) & Transect (C)†	Transect
Intermediate Egret*	Tower count (A, B) & Transect (C)†	Transect
Little Egret	Tower count (A, B) & Transect (C)†	Transect
Great Cormorant	Tower count (A, B) & Transect (C)†	Transect
Greater Spotted Eagle	Tower count (A, B) & Transect (C)†	Transect
Eastern Imperial Eagle	Tower count (A, B) & Transect (C)†	Transect
Eurasian Coot	Transect (A, B, C)	Transect
Black-winged Stilt	Transect (A, B, C)	Transect
Greater Painted-snipe	Transect (A, B, C)	Transect
Pheasant-tailed Jacana	Transect (A, B, C)	Transect
Pintail Snipe	Transect (A, B, C)	Transect
Swinhoe's Snipe	Transect (A, B, C)	Transect
Common Snipe	Transect (A, B, C)	Transect
Pallas's Grasshopper Warbler	Transect (A, B, C)	Transect
Zitting Cisticola	Transect (A, B, C)	Transect
Red-billed Starling	Transect (A, B, C)	Transect
White-cheeked Starling*	Transect (A, B, C)	Transect
White-shouldered Starling*	Transect (A, B, C)	Transect
Bluethroat	Transect (A, B, C)	Transect
Yellow-breasted Bunting*	Transect (A, B, C)	Transect
Japanese Yellow Bunting	Transect (A, B, C)	Transect

* indicates new target species following the MRR (AEC 2013) but which were not originally impacted by the Project, and for which no numerical target is required under the EP.

^ A, B, C refers to Management Compartment A, B and C respectively.

† Due to location of Pond 11, monitoring of bird usage of this pond is included in the transect count.

5.2.2 Tower Count

5.2.2.1 Monitoring should be conducted by a single observer using a tripod-mounted telescope and binoculars. Tower count survey is required on a weekly basis. During each survey (circa 07.00 – 10.00), five counts of relevant target bird species at the ponds in Compartments A and B should be undertaken. Only birds actually using the EEA shall be counted and flying birds except foraging raptors should be ignored.

5.2.3 Transect Count

5.2.3.1 Transects are required at the EEA to supplement tower counts and in the CAs to count all target species on a weekly basis. During each survey the surveyor should visit each pond. All target bird species, all waterbirds, species of conservation importance (following Fellowes *et al.* 2002) and any other unusual bird species should be recorded (to pond) and enumerated. Each pond should be surveyed from at least two bunds to ensure that most cryptic species are recorded (whilst taking care to avoid double counting).

5.2.3.2 If it is considered that birds have already been counted on other ponds, these should be ignored. If ponds contain large numbers of birds, these should be surveyed at a distance if possible to avoid disturbing birds and to further reduce the possibility of double counting. In general, flying birds should not be recorded unless they are clearly foraging and associated with the habitat. For transects surveys at the EEA, the Clean-up Reedbed should be counted using the same methodology.

5.2.3.3 Areas of dense vegetation within the marsh ponds in the EEA should be walked through to flush skulking species. This aspect of the transect surveys should be suspended during the wet season if there are any concerns regarding disturbance to breeding birds.

5.2.4 Trapping

5.2.4.1 Bird trapping is not required as a routine monitoring protocol. However, for cryptic target bird species, including Greater Painted-snipe, Bluethroat and Pallas's Grasshopper Warbler, this may provide more systematic data regarding numbers, distribution and habitat utilization. If such information is required, trapping will be undertaken using mist nets operated by experienced personnel holding a valid permit to trap birds for scientific purposes (issued by AFCD under Section 15 of the Wild Animals Protection Ordinance Cap 170). At times when such species are meeting targets, trapping is unlikely to be necessary but remains an option should the situation change or for other reasons.

5.2.5 Mai Po Nature Reserve Black-faced Spoonbills Roost Count

5.2.5.1 Surveys are conducted covering the whole of Mai Po Nature Reserve, during which time all spoonbills present are counted. The timing of the counts should coincide with the periods when high numbers of spoonbills are likely to be present, such as dawn, the middle part of the day or over the high tide period.

5.2.5.2 Counts should be conducted once per week from mid-October to the end of May.

5.2.6 Roost Count

5.2.6.1 Winter Ardeids Roost Monitoring: roost count should be undertaken once per month between November and March in early morning (before sunrise) or at dusk. The number or percentage of ardeids roosting at the EEA should be recorded and the location of the roost mapped.

5.2.6.2 Egretry Monitoring: should an egretry become established within the EEA, egretry monitoring should be undertaken twice per month between April and July. All nests should be counted and mapped, and the species using that nest identified.

5.2.7 Nest Box

5.2.7.1 Monitoring of nest boxes should comprise confirmation of nest box occupancy, the identification of species using the box, the number of broods and chicks hatched. Since all bird nests are protected by law under Cap 170, personnel undertaking the monitoring should be sufficiently trained to ensure that the nests are not unduly disturbed.

5.2.7.2 Nest boxes should be checked approximately once every two weeks during the breeding season by means of photographic records obtained by less obtrusive means such as endoscope.

5.2.7.3 Nest boxes should be cleaned and maintained prior to the wet season each year.

5.2.7.4 A special permit is required if ringing of the chicks is to undertaken (see above).

5.3 Herpetofauna

5.3.1.1 Two night-time (18.00 to 22.00 h) surveys per month should be conducted during March to August within the EEA. During surveys a fixed route should be walked and all reptiles and amphibians observed or heard should be identified, and their abundance recorded. Habitat use and breeding activity should be recorded where possible and data should be recorded to individual ponds.

5.4 Dragonfly

5.4.1.1 Dragonflies should be surveyed within the EEA twice per month from April to August during which a fixed survey route should be followed. All dragonfly species observed should be identified and counted, and signs of breeding recorded (such as presence of exuviae).

6 MONITORING METHODOLOGY (HABITAT CONDITION)

6.1 Vegetation Monitoring

6.1.1 Marsh Floristics

6.1.1.1 Monitoring of marsh areas should be undertaken once per year in the late dry season (December to February) so that the data is available prior to undertaking any late dry season (March) mechanical weeding. The following should be undertaken:

- record and map unvegetated areas;
- record and map the dominant vegetation types in each marsh pond;
- record and map presence and location of unwanted exotic species (even where not dominant).

6.1.1.2 Dominant vegetation type is defined as a species or species mix making up 50% or more of the vegetation cover.

6.1.2 Vegetation Cover

6.1.2.1 Monitoring of vegetation cover should be conducted twice yearly (end of wet and dry season) and should map the distribution of the following habitat parameters:

- woody vegetation (trees and shrubs);
- herbaceous vegetation over 40cm in height in terrestrial areas;
- herbaceous vegetation over 20 cm but less than 40cm in height in terrestrial areas;
- herbaceous vegetation less than 20cm in height in terrestrial areas;
- bare ground;
- emergent vegetation in ponds and whether reed (*Phragmites*) or other;
- open water in ponds.

6.1.3 Trees and Shrubs

6.1.3.1 Annual tree survey and monitoring of all existing tree species (including planted or naturally established young/semi-mature trees and seedlings) should be undertaken. The following parameters should be recorded:

- All tree specimens (including young/semi-mature trees, sapling and seedlings) should be recorded and their locations mapped in a layout plan

- All tree specimens should be identified, numbered and assessed by recording their overall height, DBH, crown spread, growth form (seedlings/saplings (≤ 1.5m) and young/semi-mature trees (> 2m)), health condition (good/fair/poor) and any further remarks should be noted (e.g. any potential tree hazard on the major access road/area due to tree failure resulting from structural/ health defects).

6.1.3.2 Tree density, species and form (young/semi-mature trees, saplings and seedlings) within LMC EEA, and a forecast of the tendency of tree growth and space occupied by tree crown spread should be used in formulating the management protocol in the following 6 months (e.g. removal of specific exotic tree seedlings and reducing tree height and spread for tree groups in front of the bird tower in Pond 2).

6.1.3.3 Shrub species within the LMC EEA are to be identified; the approximate locations and numbers of shrubs (both planted and naturally established) should be mapped and recorded.

6.2 Fish Stock Management

6.2.1 Fish Stock Status

6.2.1.1 Throw and drag-netting should be carried out every two months at each stocked pond. A fishing throw-net with a mesh size of 30 mm, a diameter of 4.22 m and a surface area of about 14 m^2 should be used to catch larger fish and a drag net of mesh size < 10 mm should be used to sample smaller fish and shrimps. Five randomly-placed replicates with each net should be conducted in each pond. Fish should be identified to species and the weight and length (standard length) recorded (if fish length is greater than 10 cm) and then released back into the pond.

6.2.2 Fish Size

6.2.2.1 When fish are stocked during the winter months as food for birds, a random sample of 50 specimens from each consignment should be measured prior to stocking to ensure that fish size accords with stocking requirements.

6.3 Water Management

6.3.1 Water Quality

6.3.1.1 Water quality should be measured in each pond once before the Monthly Site Meeting (***Section 7.3.1***) for the following parameters:

- Temperature
- pH
- Salinity
- Dissolved oxygen

6.3.2 Water Capacity

6.3.2.1 Water level readings should be taken from all ponds twice monthly (one of which prior to the Monthly Site Meeting; ***Section 7.3.1***), using the water level markers that are required to be placed in suitable locations in all ponds.

6.4 Other Habitat Condition & Ecological Monitoring Items

6.4.1.1 Subject to site condition, management requirement and other potential concern, additional monitoring items might be required to address particular issues. These are provided in ***Appendix 6.***

7 ADAPTIVE ECOLOGICAL MANAGEMENT

7.1 Weekly Review of Conditions in the EEA

7.1.1.1 The Ecological Consultant should conduct on at least a weekly basis an inspection visit to the EEA to verify the maintenance works of the Wetland Maintenance Contractor and to confirm that the EEA is being operated correctly. Inspection visits should focus, in particular, the following:

- The Wetland Maintenance Contractor's management activities and progress in the implementation of maintenance works, plantings etc. during the previous week;
- Condition of the EEA; in particular where active management (e.g. fish stocking, drain-down, refilling) is underway, has recently been competed or may be required to commence shortly;
- Any reportable incidents during the previous week: including human disturbance, adverse weather events, damage to the EEA, leakages and water quality problems;
- Opportunities presented for changes to or refinement of the management regime to better meet mitigation targets.

7.1.1.2 The progress of the Wetland Maintenance Contractor is to be updated to the Corporation's Representative on a weekly basis.

7.2 Weekly Review of Wildlife Monitoring Activities in the EEA

7.2.1.1 The Ecological Consultant should review on a weekly basis the wildlife monitoring activities. This review should cover the following:

- Monitoring data on utilisation of the EEA and the Control Areas by target bird species, together with any observations of note;
- Monitoring data of other wildlife monitoring activities (including Black-faced Spoonbill roost counts, camera trapping of otters and other mammals, mammal traps, bird nest boxes, herpetofauna and dragonfly etc.).

7.3 Monthly Management Inspection and Prescriptions for the EEA

7.3.1 Monthly Joint Inspection Visit

7.3.1.1 Monthly management inspection (at the beginning of each month) and ad-hoc inspection with the Wetland Maintenance Contractor and the Corporation's Representative at the EEA.

7.3.1.2 The Ecological Consultant shall be responsible for issuing instructions in the form of "Works Programme" for the EEA as follows:

- Instructions to the Wetland Maintenance Contractor (through MTRC) covering monthly management and maintenance requirements, including routine management activities such as drain-down and refilling, stocking, vegetation management and response to events such as adverse weather, fires or other damage to habitats and equipment.

7.3.1.3 Prescriptions should be issued within one week after the monthly management inspection, but where appropriate may be issued more frequently. Prescriptions issued and their implementation should be described and explained in the Quarterly Report.

7.3.2 Monthly Works Progress Meeting

7.3.2.1 The Ecological Contractor shall attend the monthly wetland works progress meeting with the Wetland Maintenance Contractor and the Corporation's Representative.

8 IMPLEMENTATION OF THE MRR

8.1 Revised Management Objectives and Monitoring Methodology

8.1.1.1 The changes to the management and monitoring objectives relative to the previous HCMP (AEC 2006), and the reasons for these changes, are provided in ***Appendix 2***, while revised management objectives and monitoring methodologies are provided in ***Sections 3 - 6*** and are not repeated here.

8.2 Habitat Changes

8.2.1.1 Included in the scope of the MRR (AEC 2013) was 'a review of and recommendation of necessary changes in the habitat structure and management measures with a view to maintaining and enhancing the overall ecological value of the LMC EEA...' (Section 1.3.1.1 (e)). The implementation measures required for the changes proposed are detailed below.

8.2.2 Relocate Reedbed in Pond 22 to Pond 14

8.2.2.1 The reasons for relocating the reedbed in Pond 22 to Pond 14 were noted in the MRR (Section 5.4.5 AEC 2013; reprovided here as **Appendix 8**) as a reduction in the chance of pest infestation in the reedbed in Pond 22 from the Clean-up Reedbed and to increase the area of lily (see below). Pond 14 has slowly become a reedbed and in terms of the establishment of a reedbed in Pond 14 this measure requires relatively little effort to implement. The following is required:

- Removal of all plant species other than *Phragmites*;
- Reprofile Pond 14 such that the pond is divided into smaller cells with uPVC pipes inbetween for water level adjustment.;
- Maintaining water depth of at least 30 to 50 cm.

8.2.3 Provision of a Larger Area of Lily

8.2.3.1 The provision of a larger area of lily is required following the MRR (Sections 3.3.13 and 3.3.14) with specific regard to Eurasian Coot and Pheasant-tailed Jacana as both species demonstrate a clear preference for existing areas of this habitat within the EEA. Changes to the distribution of lily correspond with the proposal to relocate the reedbed (see ***Section 8.2.2*** above). For Pheasant-tailed Jacana in particular, the larger area will help reduce disturbance to this species and may encourage breeding.

8.2.3.2 The MRR recommends turning Ponds 20, 21 and 22 into lily ponds with their internal bunds narrowed and lowered such these are submerged in the summer to form one large pond. Additional submerged bunds should also be considered to enable the cells formed as a result to be drained to facilitate the removal of Apple Snails. Deep areas within each cell should be formed to encourage Apple Snails to concentrate during draindown in a manner described in Section 5.7.3.14 of the MRR.

8.2.3.3 Removal of existing unwanted vegetation will be required prior to re-profiling these ponds including the removal of reeds in Pond 22 and of lotus in Ponds 20 and 21. Both species will readily re-grow from rhizomes or seeds so complete removal will be difficult. To achieve this, the following steps are recommended:

- Drain-down of Ponds 20, 21 and 22 in the early dry season;
- Removal of the wooden boardwalk in Pond 22, and any other unwanted plant species from the ponds;
- Reprofiling of the ponds in the early wet season;
- Refilling with water from a fish free pond (such as Pond 12);
- Transplant and/or planting of lilies;

- Continuous removal of unwanted plant species after re-flooding.

8.2.3.4 As noted in Section 5.4.5.4 of the MRR, once Ponds 20, 21 and 22 have been re-profiled, the current access gate from the Clean-up Reedbed at Ponds 20 and 21 should be removed to minimise disturbance to the new lily pond with access to Compartment C relocated to the gate.

8.2.4 Re-profile Pond Bottoms

8.2.4.1 Re-profiling of the bottoms of ponds is required to ensure that the deepest part of each of the ponds in Compartment B is within reach of the arterial pipe system. This is required to facilitate complete and efficient drain-down of ponds. Re-profiling of commercial fishponds is required on a regular basis (due to bund erosion and siltation), and is undertaken at Lok Ma Chau when required (most recently with Ponds 3 and 4 in late 2013). Re-profiling of the pond bottom can be carried out in conjunction with this work. The number of ponds to be reprofiled depends on site conditions; however, it is proposed that no more than two ponds should be reprofiled in the same year. Re-stocking of ponds with fish is required for ponds within Compartments A and B; stocking should be undertaken in the early spring as far as possible.

8.2.5 Variation to the Environmental Permit

8.2.5.1 The proposed changes to the habitats in Ponds 14 and 22 will require a Variation to the EP (VEP) as implementing these changes would mean than the location of habitats within the EEA does not accord with the current EP which states that Pond 22 should be reedbed and Pond 14 marsh. However, given that the EP also requires a review of the habitat structure of the EEA (as undertaken in the MRR (AEC 2013)), and that the changes proposed are minimal, obtaining a VEP for these items is considered to accord with the intentions expressed in the EP conditions.

9 REPORTING REQUIREMENT

9.1 Report Submission

9.1.1 Quarterly Report

9.1.1.1 The followings should be reported on a quarterly basis:

- Summary of field data collected;
- Performance in respect of target level achievement;
- An interpretation of the data with respect to action and limit levels for ecological attributes (see ***Appendix 7***);
- Site photograph records (including camera trapping results and site photos).

9.1.1.2 The monthly field monitoring data and report from the PTI pond (Ponds 1A and 1B, managed by AFCD) should be included as an appendix to the report.

9.1.2 Annual Report

9.1.2.1 The Annual Report should include a review and summary of the information collected from the ecological monitoring programme; any proposed modification of the programme, site activities and wetland management actions; recommendations for

remedial or other action(s) to be taken and assessment of the degree of success of the active HCMP.

9.1.3 **Update of HCMP**

9.1.3.1 Subject to the findings of the Annual Report, the HCMP should be reviewed and modification(s) to the document made such that the management of the EEA can be improved, and/or set alternative wetland targets. This is to be agreed with the relevant Government departments (EPD/AFCD).

9.2 Biannual Meeting with Environmental Committee

9.2.1.1 The followings should be presented to the Environmental Committee (EC) on a biannual basis:

- Monitoring results;
- Adaptive management works that have been carried out;
- Any other ecological concern or opportunities arisen.

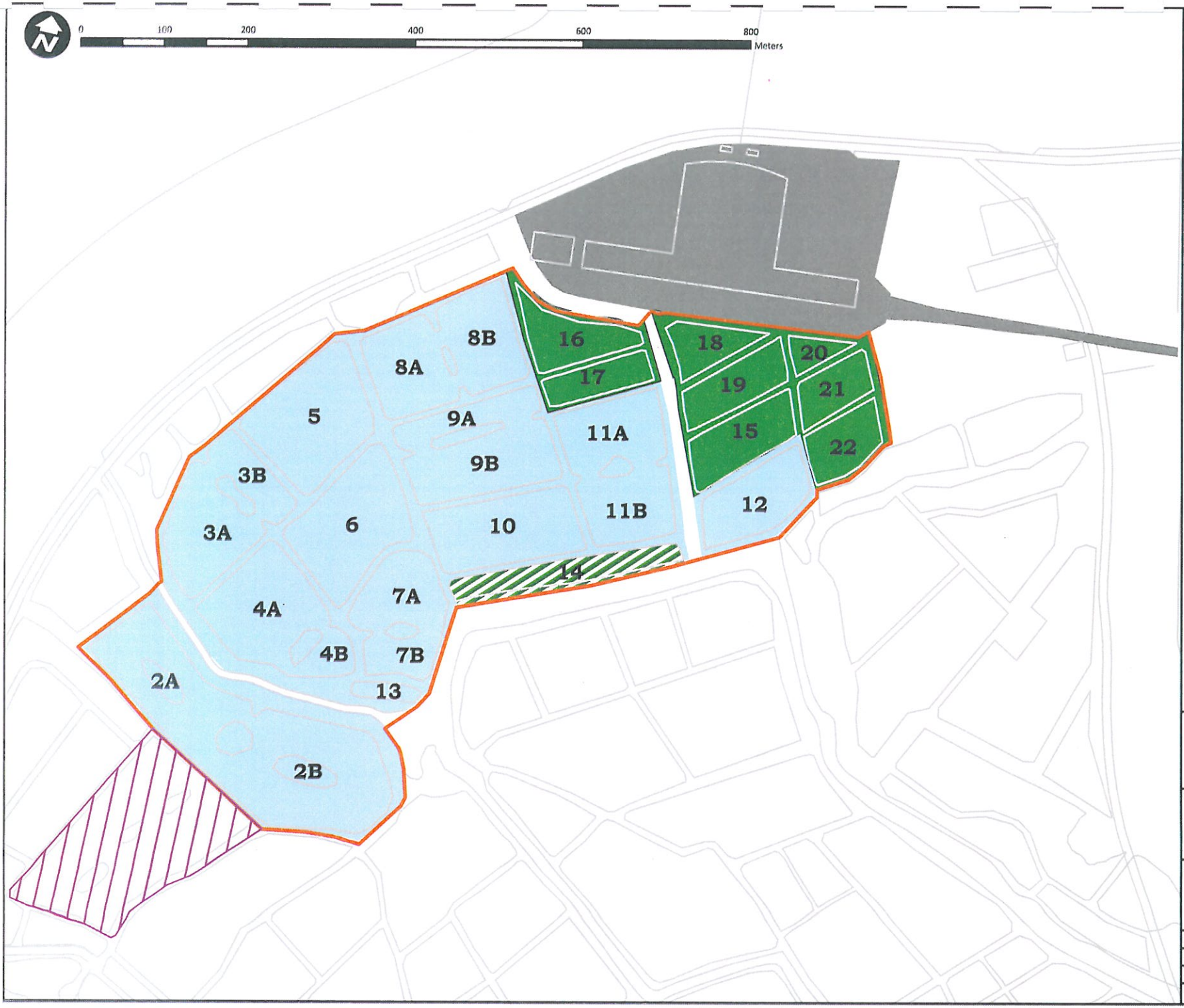
10 REFERENCES

AEC. 2006. Contract No. LGSA-010. Ecological Monitoring and Technical Support for Wetland Compensation Area at Lok Ma Chau. Habitat Creation and Management Plan Issue No. 11. Asia Ecological Consultants Ltd., Hong Kong.

AEC. 2013. MTRC Contract No. M1016-09C. Ecological Monitoring and Adaptive Management Advice Services for LMC/WR Wetlands. Corporation' Representative's Instruction No. M1016-09D/EI/003. LMC Wetland – Management Review Report. AEC Ltd., Hong Kong.

BBV. 2002. Sheung Shui to Lok Ma Chau Environmental Impact Assessment. Final Report, Issue 2. Binnie, Black and Veatch Hong Kong Ltd., Hong Kong.

Fellowes, J.R., Lau, M.W.N., Dudgeon, D., Reels, G.T., Ades, G.W.J., Carey, G.J., Chan, B.P.L., Kendrick, R.C., Lee, K.S., Leven, M.R., Wilson, K.D.P. and Yu, Y.T. 2002. Wild animals to watch: terrestrial and freshwater fauna of conservation concern in Hong Kong. Memoirs of The Hong Kong Natural History Society 25:117-123.



Legend

- LMC EEA boundary
- LMC EEA (Pond 1)
- Non-Wetland
- Fishpond
- Marsh
- Reedbed

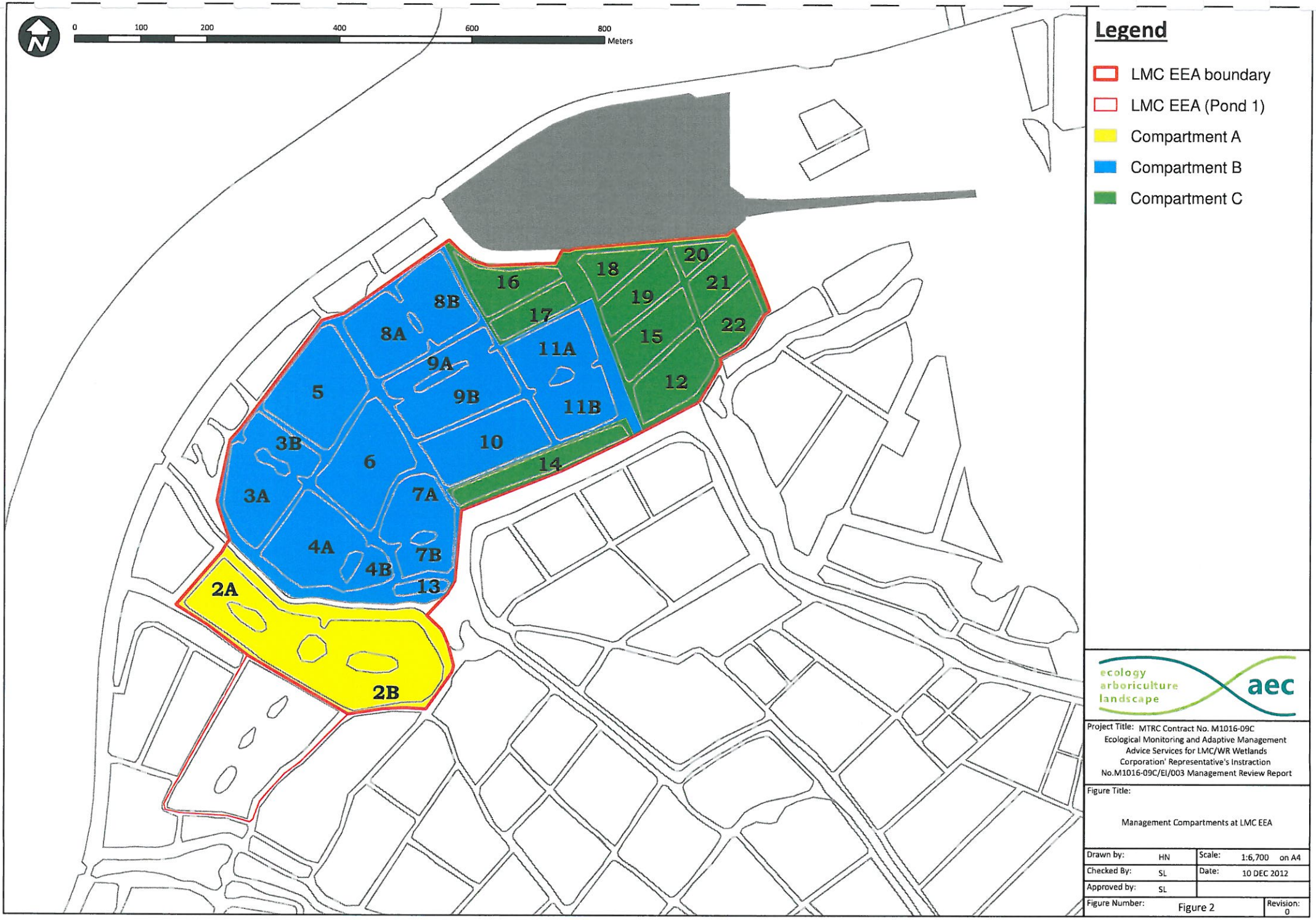
ecology arboriculture landscape aec

Project Title: MTRC Contract No. M1016-09C
Ecological Monitoring and Adaptive Management Advice Services for LMC/WR Wetlands
Corporation' Representative's Instruction No.M1016-09C/EI/003 Management Review Report

Figure Title:

Habitat to be managed at LMC EEA

Drawn by:	LNY	Scale:	1:6,000 on A4
Checked By:	SL	Date:	20 DEC 2013
Approved by:	SL		
Figure Number:	Figure 1	Revision:	0



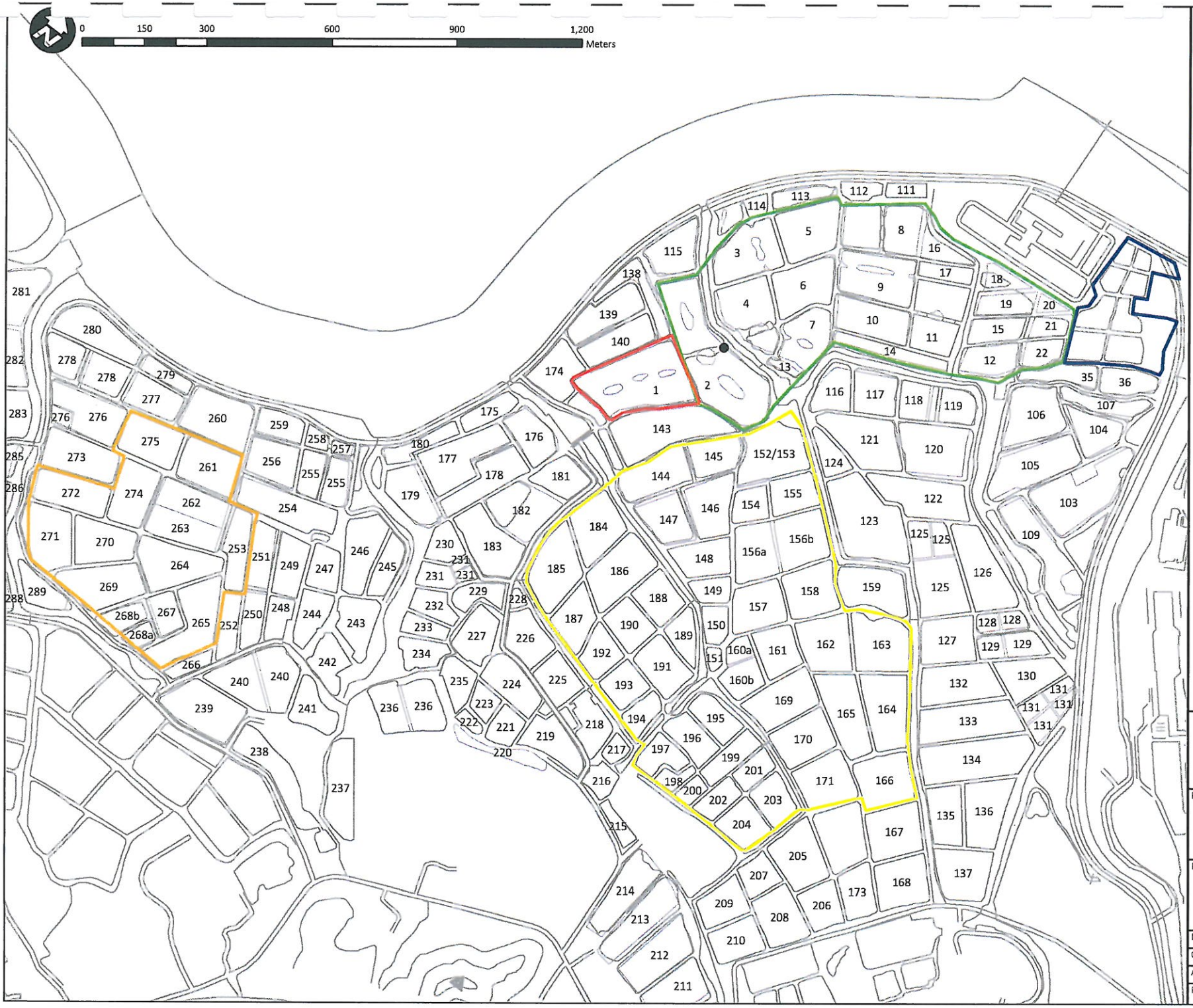
ecology arboriculture landscape aec

Project Title: MTRC Contract No. M1016-09C Ecological Monitoring and Adaptive Management Advice Services for LMC/WR Wetlands Corporation' Representative's Instraction No.M1016-09C/EI/003 Management Review Report

Figure Title:

Management Compartments at LMC EEA

Drawn by:	HN	Scale:	1:6,700 on A4
Checked By:	SL	Date:	10 DEC 2012
Approved by:	SL		
Figure Number:	Figure 2	Revision:	0



Legend

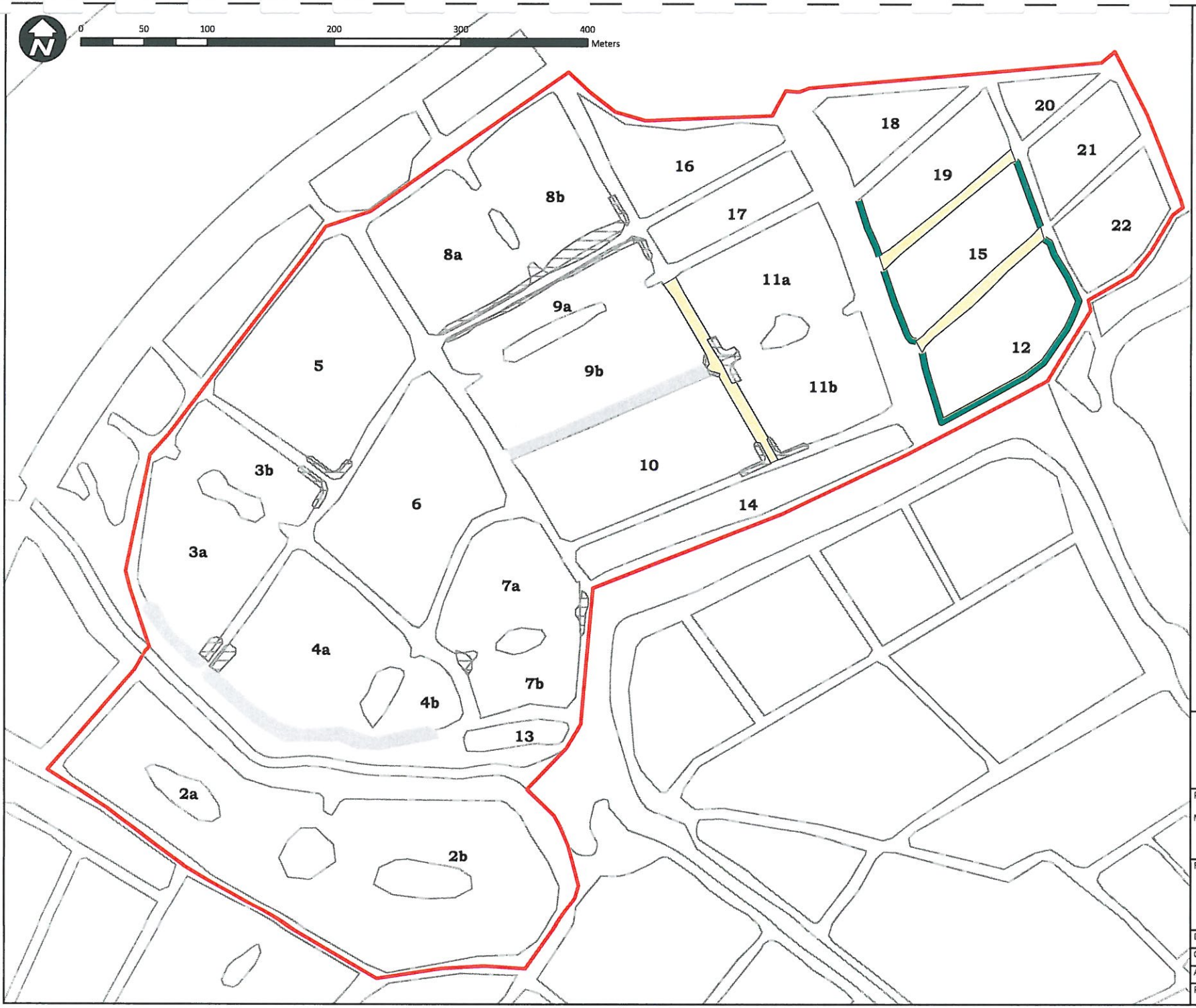
- LMC EEA (Pond 1)
- Lok Ma Chau Ecological Enhancement Area
- San Tin Control Area
- Mai Po San Tsuen Control Area
- Clean-up Reedbed
- Observation Tower Location

ecology arboriculture landscape aec

Project Title: MTRC Contract No. M1016-09C Ecological Monitoring and Adaptive Management Advice Services for LMC/WR Wetlands Corporation' Representative's Instraction No.M1016-09C/EI/003 Management Review Report

Figure Title: Monitoring Areas

Drawn by:	LNY	Scale:	1:12,000 on A4
Checked By:	SL	Date:	5 Mar 2013
Approved by:	SL		
Figure Number:	Figure 3	Revision:	0



Legend

- Long Grass
- Short Grass
- Refugia Area
- Refugia Area with 1m Access
- LMC EEA boundary

ecology arboriculture landscape aec

Project Title:

M1016-09C Ecological Monitoring & Adaptive Management Advice Services for LMC/WR Wetlands Corporation's Representative's Instruction No. M1016-09C

Figure Title:

Location of Refugia Areas

Drawn by:	PT	Scale:	1:4,000 on A4
Checked By:	SL	Date:	19 Dec 2013
Approved by:	PJL		
Figure Number:	Figure 4	Revision:	0

Legend

- Site boundary fence
- LMC EEA boundary
- LMC EEA (Pond 1)
- Post and Chain Barrier
- Grasscrete track

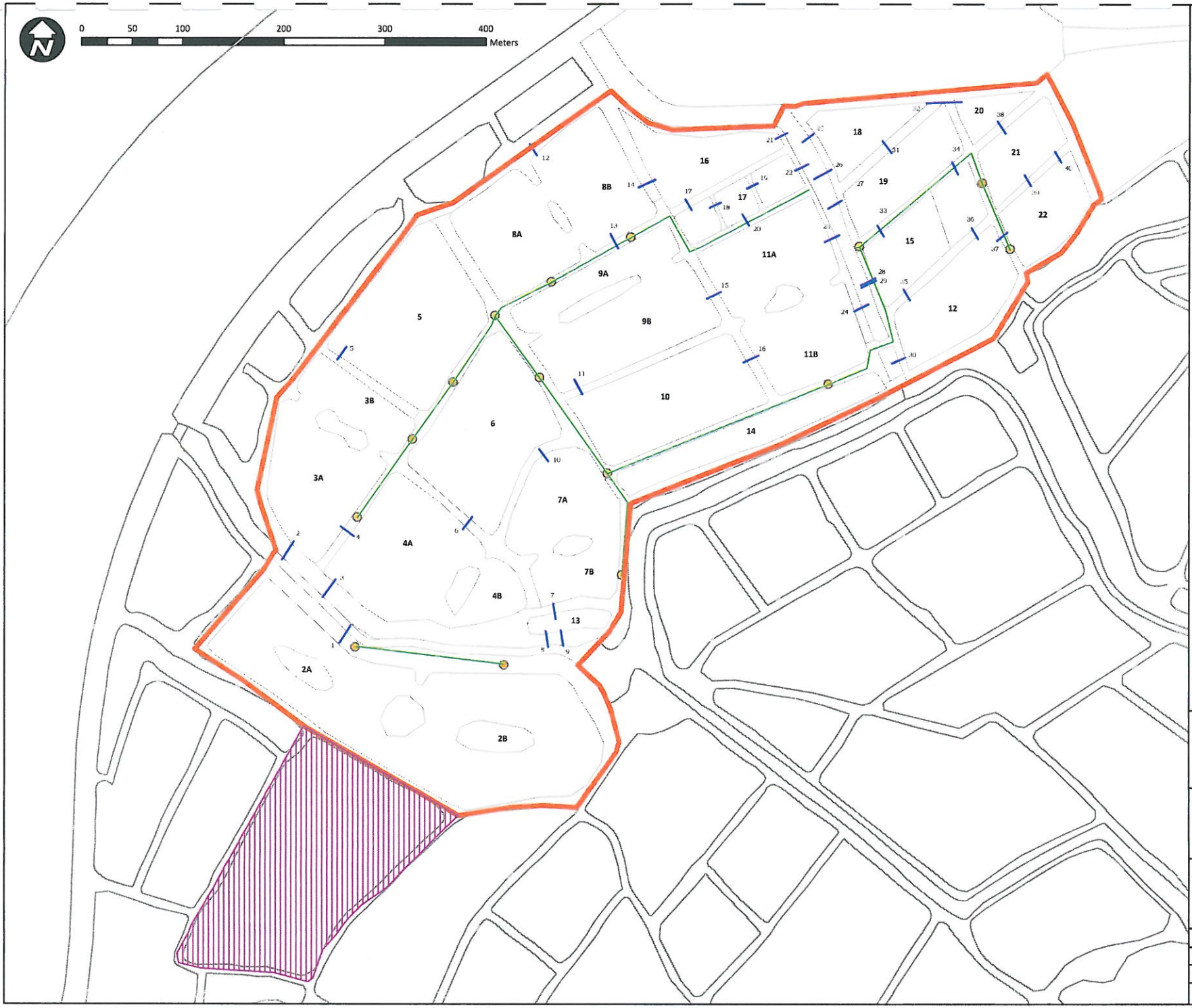
ecology arboriculture landscape aec

Project Title: MTRC Contract No. M1016-09C
Ecological Monitoring and Adaptive Management Advice Services for LMC/WR Wetlands Corporation' Representative's Instraction No.M1016-09C/EI/003 Management Review Report

Figure Title:

Locations of Site Boundary Fence, Grasscrete Tracks & Chain Barriers

Drawn by:	PT	Scale:	1:5,000 on A4
Checked By:	SL	Date:	30 DEC 2013
Approved by:	SL		
Figure Number:	Figure 5	Revision:	0



Legend

- LMC EEA boundary
- LMC EEA (Pond 1)
- uPVC pipe
- Arterial pipe
- Pipe with catchpit incorporating valve pit type I depending in location in the system

ecology arboriculture landscape aec

Project Title: MTRC Contract No. M1016-09C Ecological Monitoring and Adaptive Management Advice Services for LMC/WR Wetlands Corporation' Representative's Instraction No.M1016-09C/EI/003 Management Review Report

Figure Title: Water Control System

Drawn by:	PT	Scale:	1:4,812 on A4
Checked By:	SL	Date:	20 DEC 2013
Approved by:	SL		
Figure Number:	Figure 6	Revision:	0

A1. Summary Of Habitat Requirements And Associated Management Measures Required By Target Species

A1.1. Mammal Targets

A1.1.1. Eurasian Otter *Lutra lutra*

A1.1.1.1. Eurasian Otter is a species impacted by the Lok Ma Chau Spurline. It is a primary target species in Compartment A and a secondary target species in Compartment B.

A1.1.1.2. Eurasian Otters are restricted to the Deep Bay area in Hong Kong where they are rare (Reels 1996). This species is considered to be "Regionally Threatened" by Fellowes *et al.* (2002). The species was once considered a Vulnerable species under the IUCN (between 2000 and 2004 (Ruiz-Olmo *et al.* 2008)), but was re-evaluated in 2004 and 2008 and it is now considered a Near Threatened species. In the absence of data concerning the home ranges of this species in southern China, it is not clear how many individuals are present and whether those recorded at Lok Ma Chau are the same as those at Mai Po San Tsuen.

A1.1.1.3. Eurasian Otters feed largely on fish and amphibians. As is shown in BBV (2002b), in Hong Kong otters are known to make use of fishponds, *gei wai* and river channels. The former are probably largely used for feeding, whilst the latter appear to provide important movement corridors. This species will benefit from the appropriate management of river channel fringes by providing cover, prevention of burning of vegetation (the traditional way in which rank grassland along river channels is cleared by fish farmers), together with the provision of appropriate natural and artificial sites for holt formation. Otters will also be able to take advantage of the habitat provision (including food available) in marsh areas.

A1.1.1.4. Within the EEA, management of the river channel will be undertaken with a view to the requirements of this species. Tree and shrub vegetation will be retained on the banks and large expanses of rank grassland will be cleared (by cutting). Artificial holts are provided on the bund on the east side of Pond 2B and on the island between Pond 2A and 2B. This island has also been planted with woody vegetation to provide cover for otters.

A1.1.1.5. There is no numerical target for the species due to scarcity of records. There is no particular additional management measures proposed for the species in the MRR. However, the following was noted in the MRR:

- Evaluate usage of the artificial holts by the species, and/or construct an additional holt for the species;
- Evaluate, if any, impacts of the site boundary fence on the usage of the species;
- Exclude dogs from entering the site;
- Employ no-glow camera traps.

A1.1.2. Leopard Cat *Prionailurus bengalesis*

A1.1.2.1. Leopard Cat qualifies as a conservation target species based on the importance of the EEA for the species. It is a secondary target in Compartments B and C.

A1.1.2.2. Leopard Cats are known to utilize a wide range of habitats, including plantation, shrubland, forests and suburban areas such as agricultural fields. This species is a small ambush predator, can swim and is a good climber. They are carnivorous and their primary prey consists of small terrestrial vertebrates but they are also known to attack aquatic prey, birds and bats. At the EEA, the species is often seen on scarcely vegetated bunds or in lower branches on trees near water in Compartments A and C.

A1.1.2.3. There is no numerical target for the species and no particular management measures proposed. However, the effect of the site boundary fence on the usage of the site by this species should be evaluated.

A1.2. Bird Targets

A1.2.1. Japanese Quail *Coturnix japonica*

A1.2.1.1. Japanese Quail is an impacted species by the Lok Ma Chau Spurline. It is a secondary target in Compartments B and C.

A1.2.1.2. A scarce passage migrant and winter visitor to Hong Kong (Carey *et al.* 2001), with anecdotal information suggesting a decline in numbers in recent years. In recent years the majority of records have come from low-lying grassy areas in the northern New Territories where it has favoured areas of dry, short (< 30 cm) vegetation, often broken up by small unvegetated areas, in areas such as abandoned agriculture or filled fishponds. Fishpond bunds covered with short grass are used occasionally, but are not primary habitat for this species. Areas of tall, dense grass are generally avoided.

A1.2.1.3. Management of vegetation on the bunds will provide suitable habitat for this species within the EEA. If uncontrolled, *Panicum maximum* (the dominant grass species on site) will become too tall and dense for this species. Hence, regular cutting of *P. maximum* to provide areas of short grass (10 – 30 cm tall) and also to encourage the growth of shorter grasses such as *Paspalum distichum* is required. However, since fishpond areas are not primary habitat for this species it is likely to continue to be of irregular occurrence. In recognition of this, Japanese Quail is a secondary target species in Compartment B.

A1.2.2. Eurasian Wigeon *Anas penelope*

A1.2.2.1. Eurasian Wigeon is included as a conservation target since EEA supports relatively high numbers of the species. It is a secondary target species in Compartments B and C.

A1.2.2.2. Eurasian Wigeon is listed as of Regional Concern by Fellowes *et al.* (2002). It is a dabbling duck which feeds on aquatic vegetation and grazes on short grass on land. There are no particular management measures proposed for this species but management actions undertaken for Eurasian Teal and maintenance of shorter grass areas on bunds are expected to benefit this species.

A1.2.3. Eurasian Teal *Anas crecca*

A1.2.3.1. Eurasian Teal is an impacted species by the Lok Ma Chau Spurline. It is a primary target in Compartments B and C, and secondary target in Compartment A.

A1.2.3.2. Eurasian Teal are winter visitors to Hong Kong and are present between September and April. Though there are occasional records from other wetland sites; the majority of Common Teal are found in Deep Bay. Within Deep Bay favoured habitats are intertidal creeks amongst mangroves, *gei wai* and well-vegetated ponds, especially those with abundant growth of the facultative wetland grass *Paspalum distichum*. A common denominator in these preferences is the presence of mud or shallow water feeding areas in proximity to cover. More open wetland habitats such as active fishponds, intertidal mudflats and Deep Bay itself are less favoured by Eurasian Teal than most other duck species in Hong Kong – it is probably not co-incidence that this species is a frequent prey item for raptors including Greater Spotted and Eastern Imperial Eagles.

A1.2.3.3. Diet of Eurasian Teal has not been studied in Hong Kong; however elsewhere in its range it is considered to be omnivorous, filtering invertebrates and seeds from water or soft mud whilst either walking or swimming. Seeds are often particularly important in winter (Cramp and Simmons 1977).

A1.2.3.4. The species has clearly benefited from the management measures such as the creation of shallow pond areas with emergent vegetation and limited supplementary feeding with suitable food (grains etc.). This would not only benefit Eurasian Teal but other duck species, which would in turn be beneficial to Greater Spotted and Eastern Imperial Eagles.

A1.2.4. Little Grebe *Tachybaptus ruficollis*

A1.2.4.1. Little Grebe is included as a conservation target since EEA supports relatively high numbers of the species. It is a secondary target species in Compartments A, B and C.

A1.2.4.2. Little Grebe is listed as a species of Local Concern by Fellowes *et al.* (2002). The majority of the population, which is present all year, occurs on freshwater ponds in the Deep Bay area (Carey *et al.* 2001).

A1.2.4.3. This species occurs on ponds throughout the EEA but requires emergent vegetation on which to anchor its floating nest. Since the provision of emergent vegetation is an existing management measure for Chinese Pond Heron, there is no additional management measure for this species.

A1.2.5. Black-faced Spoonbill *Platalea minor*

A1.2.5.1. Black-faced Spoonbill is an impacted species by the Lok Ma Chau Spurline. It is a primary target in Compartment B.

A1.2.5.2. Black-faced Spoonbills are tactile foragers. Foraging takes place in turbid water bodies with a flat or gradually sloping fine sediment bottom with water depths from 5 – 23 cm. (Yu and Swennen 2001). In Hong Kong these requirements are met in the intertidal mudflats in Deep

Bay, as well as in fishponds and *gei wai*. The relative importance of intertidal areas and fish ponds and *gei wai* is influenced by tidal regime and pond management, with the latter habitats being particularly important during adverse weather and when ponds are drained for harvesting (Anon 2001, Yu and Swennen 2001). Black-faced Spoonbills largely feed on small prey items, especially shrimps *Palaemonetus* spp. and Mosquito Fish *Gambusia affinis*, but larger prey items such as tilapia *Oreochromis mossambicus* are also eaten, especially when these are readily available in partially drained ponds (Leader 1998, Yu and Swennen 2001).

A1.2.5.3. Management of ponds in the EEA has demonstrated that Black-faced Spoonbills are readily attracted to ponds in the EEA. Stocking alone attracted birds; attraction increased when ponds were partially drained or maintained at a low level which permitted birds to wade over most of the pond. In addition, birds regularly took advantage of bunds and islands which were largely cleared of vegetation as daytime roosting and loafing sites.

A1.2.5.4. Human disturbance is also an important limiting factor with regards to Black-faced Spoonbill numbers; and most birds will leave the EEA completely if disturbed. Hence reducing access to the site during the dry season remains an important management tool. Access to the main site in the mornings should be limited to essential works during the months October to March (inclusive). In addition the partial drain down of Pond 4 has been successful in not only attracting other target species but also in providing an undisturbed area (birds roosting or foraging in Pond 4 cannot see people accessing the site along the main track) suitable for roosting large waterbirds including Black-faced Spoonbills.

A1.2.6. Cinnamon Bittern *Ixobrychus cinnamomeus*

A1.2.6.1. Cinnamon Bittern is included as a conservation target since EEA supports relatively high numbers of the species. It is a secondary target species in Compartments B and C.

A1.2.6.2. Cinnamon Bittern is listed as of Local Concern by Fellowes *et al.* (2002) on account of a declining population and occurrence at a small number of sites. While there is no evidence of breeding in Hong Kong (Carey *et al.* 2001), small numbers of the Cinnamon Bittern records over the summer do occur. At EEA, the species has been regularly recorded over the summer since 2010, including a pair displaying in 2013.

A1.2.6.3. It is anticipated that management measures for other species such as Pallas's Grasshopper Warbler would benefit the species. Thus, there are no particular management measures proposed for the species.

A1.2.7. Black-crowned Night Heron *Nycticorax nycticorax*

A1.2.7.1. Black-crowned Night Heron is included as a conservation target since EEA supports relatively high numbers, particularly as a day roost, of the species. It is a secondary target species in Compartments A and B.

A1.2.7.2. Unlike other colonial heron species in Hong Kong, Black-crowned Night Heron is largely nocturnal and is not attracted in large numbers to drained ponds during the day. Since the

EEA already attracts a number of the species using the site as a day roost, management measures for the species include the continued provision and maintenance of suitable daytime roost sites, minimizing disturbance to roost areas and undertake night time surveys at times of pond drain down.

A1.2.8. Chinese Pond Heron *Ardeola bacchus*

A1.2.8.1. Chinese Pond Heron is an impacted species by the Lok Ma Chau Spurline. It is a primary target in all compartments.

A1.2.8.2. Chinese Pond Herons are found in Hong Kong throughout the year. Habitat utilisation has been studied in Hong Kong by Young (1994) who showed that birds breeding at the Mai Po Village egretry fed mainly around fishponds. Individuals typically forage solitarily along the edges of open water areas or areas within sparse or short vegetation. They utilise open areas such as intertidal mudflats or drained down ponds less than larger Ardeid species in Hong Kong. Chinese Pond Herons breed colonially, either on their own or with other Ardeid species. Nests are often placed in bamboos, especially *Bambusa eutuldoides*. Breeding adults largely forage within 3 km of their colonies (Young and Cha 1995).

A1.2.8.3. Unlike the other target species of ardeids (and Black-faced Spoonbills), Chinese Pond Herons are not attracted in large numbers to drained-down ponds, neither do they make extensive use of *gei wai* (BBV 2002a). Rather, this species is a solitary feeder which typically finds much of its prey in shallow water either in or on the edge of areas of emergent or pondside vegetation. Chinese Pond Herons eat small fish, but also feed extensively on invertebrates and amphibians. Within the EEA therefore, provision for this species must focus on creating suitable shallow water conditions with emergent vegetation where a range of small prey species is available.

A1.2.8.4. Management measures include the creation of suitable shallow water conditions with emergent vegetation where a range of small prey species including invertebrates and amphibians is available. The establishment of mats of *Ipomoea aquatica*, which is known to be favoured as a feeding habitat for the species, should only be adopted should there is a clear mechanism to control spread into other ponds. In addition, measures to establish roosting habitat between Ponds 2A and 2B is to be encouraged so as to provide suitable conditions for the species during both the breeding and non-breeding season.

A1.2.9. Grey Heron *Ardea cinerea*

A1.2.9.1. Grey Heron is an impacted species by the Lok Ma Chau Spurline. It is a primary target in all Compartments A and B.

A1.2.9.2. Grey Heron is listed as of Potential Regional Concern by Fellowes *et al.* (2002). Grey Herons have bred in Hong Kong, but this species is primarily a winter visitor (Young and Cha 1995). Habitat utilisation has been studied in Hong Kong by Young (1994) who noted that this species is predominantly a crepuscular feeder in Hong Kong and primarily uses *gei wai* as a daytime roost; but also utilises fish ponds for feeding. Grey Herons usually feed by wading

for fish, preferentially selecting those 10 – 16 cm in length (Cramp and Simmons 1977). As one of the larger target species they can wade in water up to c. 70 cm depth.

A1.2.9.3. Management of ponds in the EEA has demonstrated that Grey Herons are readily attracted to ponds in the EEA. Stocking alone attracts birds; attraction increases when ponds are partially drained or maintained at a low level which permits birds to wade over most of the pond. In addition, birds regularly take advantage of bunds which are largely cleared of vegetation as daytime roosting and loafing sites.

A1.2.10. Great Egret *Ardea alba*

A1.2.10.1. Great Egret is an impacted species by the Lok Ma Chau Spurline. It is a primary target in all Compartments A and B.

A1.2.10.2. Great Egrets are one of the scarcer breeding Ardeids in Hong Kong, but numbers are much greater in winter (Young and Cha 1995). Habitat utilisation has previously been studied in Hong Kong by Young (1994) showed that whilst this species feed on drained ponds and *gei wai*, intertidal mudflats are typically more important as feeding habitat. However, management of the EEA has shown that Great Egret is strongly attracted to stocked and partially drained-down ponds.

A1.2.10.3. Habitat management measures in the EEA which included the creation of larger areas of shallow water with emergent vegetation and more wooded bunds and islands are, therefore, expected to provide additional feeding and loafing habitat for this species and thus reduce the dependence upon stocking and drain-down events.

A1.2.11. Immediate Egret *Egretta intermedia*

A1.2.11.1. Intermediate Egret is included as a conservation target since EEA supports relatively high numbers of the species. It is a secondary target species in all Compartments.

A1.2.11.2. Intermediate Egret is a non-breeding visitor, which occurs in relatively small numbers in the Deep Bay. This species appears to prefer ponds with extensive emergent vegetation; though they are also attracted to drained ponds.

A1.2.11.3. No management measures specific to this species are proposed; though measures to attract Chinese Pond Herons will also benefit this species.

A1.2.12. Little Egret *Egretta garzetta*

A1.2.12.1. Little Egret is a species impacted by the Lok Ma Chau Spurline. It is a primary target species in Compartments A and B, and a secondary target species in Compartment C.

A1.2.12.2. Little Egrets are found in Hong Kong throughout the year. In Hong Kong this species feed primarily in fishpond and intertidal mudflat areas. Little Egrets feed opportunistically on fish remaining when ponds are drained and are often the most abundant Ardeid species in such feeding concentrations. Breeding birds typically forage within 3 km of egretries (Young 1994), which may be situated either in bamboos or a variety of tree species.

A1.2.12.3. Management measures included stocking of ponds with small prey items such as Mosquito Fish *Gambusia affinis* and creation of larger areas of islands and associated shallow waters to increase the area of ponds where water is less than *c.*50cm depth, and establishment of marshland in Compartment C. Additional measures proposed include summer drain-down of ponds in Compartment B, encourage roosting and breeding on-site by use of decoys, monitoring the winter roost and reviewing the drain-down protocol in particular with the use of mobile pumps for the final stages of drain-down..

A1.2.13. Great Cormorant *Phalacrocorax carbo*

A1.2.13.1. Great Cormorant is a species impacted by the Lok Ma Chau Spurline. It is a primary target species in Compartment A (large stocked ponds providing feeding areas and trees providing loafing and potential roosting sites) and in Compartment B (stocked and periodically drained-down ponds providing feeding areas and bare bunds providing daytime loafing areas).

A1.2.13.2. Great Cormorants are winter visitors to Hong Kong and are economically important as some of the large numbers of this fish-eating species which occur in Deep Bay feed in commercial fishponds. Studies of the wintering ecology of Great Cormorants and measures to reduce their impact on commercial fisheries including diversionary feeding and wiring ponds to prevent cormorant access have been sponsored by AFCD.

A1.2.13.3. Great Cormorants in Hong Kong roost communally. There are currently two roosts in the Deep Bay area: at Mai Po NR and at Nam Sang Wai. Cormorants disperse to feed; either in Deep Bay itself or on fishponds. They use both active and inactive ponds, but avoid small ponds, especially those surrounded by trees or adjacent to sources of human activity. They readily take advantage of fish concentrations, including the provision of "trash fish" (usually tilapia) to divert feeding pressure from commercial ponds.

A1.2.13.4. Great Cormorants feed by catching fish whilst swimming (usually underwater). Accordingly, they will utilise ponds when they are full or partly full of water. During the day, when not feeding some birds return to the night time roosts whilst others use daytime loafing sites; usually isolated trees or tree lines or bare bunds or banks, especially those which isolated from disturbance and ground predators by being surrounded by water.

A1.2.13.5. Management measures included stocking ponds with fish, and provision of trees and bare bund for daytime loafing and roosting. The species is known to utilize ponds which are at their normal depth (1.5m) or partially drained to approx. 50cm.

A1.2.14. Greater Spotted Eagle *Aquila clanga*

A1.2.14.1. Greater Spotted Eagle is a species impacted by the Lok Ma Chau Spurline; it is a secondary target species in all Compartments.

A1.2.14.2. Greater Spotted Eagles are a winter visitor to Hong Kong and are present from late October to early April. Their distribution in Hong Kong is restricted to the Deep Bay area, with the notable exception that they roost at night in hills to the south; with most birds apparently

roosting in the Castle Peak area during winter 2000-01 (Carey *et al.* 2001, BBV 2001b). The pattern of occurrence was related to the presence of abundant waterbirds on ponds (especially wild ducks). Despite the presence of large numbers of waterbirds (including ducks) the intertidal zone is not utilised. Trees are required for daytime loafing or hunting perches, but in comparison with Imperial Eagle, this species is less likely to occur in extensive open active fish pond areas

A1.2.14.3. Management measures for this species were identical to those for Eastern Imperial Eagle (see below). Further, improvement measures to enhance the site for Eurasian Teal and other duck species were considered to provide an indirect benefit to this species.

A1.2.15. Eastern Imperial Eagle *Aquila heliaca*

A1.2.15.1. Eastern Imperial Eagle is a species impacted by the Lok Ma Chau Spurline.; it is a secondary target species in all Compartments.

A1.2.15.2. Eastern Imperial Eagle is a winter visitor to Hong Kong and is present from late October to early April. Their distribution in Hong Kong is restricted to the Deep Bay area, with the notable exception that they roost at night in hills to the south. The pattern of occurrence was related to the presence of abundant waterbirds on ponds (especially wild ducks), with a secondary factor being an avoidance of developed and disturbed areas. Despite the presence of large numbers of waterbirds (including ducks) the intertidal zone is not utilised. Trees are required for daytime loafing or hunting perches, but ponds surrounded by continuous lines of large trees (as at parts of Nam Sang Wai) are avoided.

A1.2.15.3. Management measures included the provision of a broken line of trees (large isolated trees in Compartment B) for daytime loafing and hunting perches, and habitat enhancement to attract larger congregations of ducks, notably Eurasian Teal.

A1.2.16. Eurasian Coot *Fulica atra*

A1.2.16.1. Eurasian Coot is a species impacted by the Lok Ma Chau Spurline. It is a secondary target species in all compartments since fishpond habitat is not a primary habitat for the species.

A1.2.16.2. Eurasian Coot is considered a common winter visitor (Carey *et al.* 2001), but the numbers of this species have declined drastically since a peak in the early 1990s' declining from a peak of 3245 in winter 1992-93 to 260 in winter 2003-04. Of this the vast majority occurred in Deep Bay and it was always rare within fishpond habitats, when they favoured ponds with extensive emergent vegetation.

A1.2.16.3. Management measures for this species at LMC EEA include the provision of marshes and reedbed to increase the habitat suitable for the species. Additionally, increasing areas with emergent vegetation, particularly lilies in Compartment C will benefit the species.

A1.2.17. Black-winged Stilt *Himantopus himantopus*

A1.2.17.1. Black-winged Stilt is is a species impacted by the Lok Ma Chau Spurline. It is a primary target species in Compartments A and B and a secondary target species in Compartment C.

A1.2.17.2. Black-winged Stilts are recorded in Hong Kong throughout the year. They are restricted to fresh or brackish water habitats, favouring large disused fishponds in the Deep Bay area and bloodworm ponds in Long Valley. Until 2003 they had not been known to breed in the territory; the small numbers present in summer were considered to be non-breeding individuals or early returning migrants (Carey *et al.* 2001). However, in 2003, breeding was observed in Hong Kong for the first time. Breeding has occurred in the EEA in 2009 (one pair), 2010 (one pair) and 2011 (three pairs). Black-winged Stilts feed predominantly on aquatic invertebrates, especially insects. Food is taken by wading in open water and invertebrates are taken from on and below the water surface and from aquatic vegetation (Cramp and Simmons 1983).

A1.2.17.3. Management measures included the creation of shallow open water areas overlaying soft mud with sparse or no aquatic vegetation. In addition, the provision of elevated and/or floating islands provides breeding sites that are protected from ground predators and nests being flooded out, and partial drain-down of ponds if breeding occurs to provide suitable foraging habitat.

A1.2.18. Greater Painted-snipe *Rostulata benghalensis*

A1.2.18.1. Greater Painted-snipe is a species impacted by the Lok Ma Chau Spurline and is a primary target species in Compartment C.

A1.2.18.2. This species is a passage migrant and winter visitor, with a small breeding population: extremely localised and much-declined (Carey *et al.* 2001). Although formerly once widespread, this species is largely restricted to freshwater agricultural land and in recent years is known to have bred at just four sites (the EEA, Long Valley, Kam Tin and Mai Po). Greater Painted-snipe prefers areas with low, dense herbaceous vegetation and shallow water (0-10cm). It is an especially vagile species and is able to make use of suitable ephemeral wetlands, it is also regularly forced to abandon suitable habitat as it dries out during the dry season. However, areas of suitable habitat that contain even small areas that remain wet in the dry season tend to support relatively high numbers and often have birds throughout the year.

A1.2.18.3. Management measures included the creation of marshes with low, dense herbaceous vegetation and shallow water (<10cm), and water level management through the winter to ensure some habitat is retained for the species. Additional measures included reviewing (and where necessary adjusting) vegetation management and exotic species control measures during the wet season to reduce disturbance to the species.

A1.2.19. Pheasant-tailed Jacana *Hydrophasianus chirurgus*

A1.2.19.1. Pheasant-tailed Jacana is a species impacted by the Lok Ma Chau Spurline. It is a primary target species in Compartment C and a secondary target species in Compartment B.

A1.2.19.2. Pheasant-tailed Jacana is a scarce passage migrant, mainly in autumn, much decreased but previously bred (Carey *et al.* 2001). Breeding was last recorded in Hong Kong in 1974, and since then the status of this species has changed and it is now a scarce passage migrant,

with almost no midsummer records. This bird tends to favour freshwater or brackish wetlands that have extensive marginal and emergent vegetation.

A1.2.19.3. Management measures included the creation of marshes with extensive marginal and emergent vegetation. Additional measures included enlarging the establishment of areas with emergent vegetation, particularly that of lilies, in Compartment C, controlling access to the bunds of lily ponds before and during breeding season if the species is recorded, and controlling the spread and infestation of marshland with Golden Apple Snail.

A1.2.19.4. Pheasant-tailed Jacana is relatively sensitive to disturbance and appears to require relatively large areas of lilies or other floating vegetation for breeding. Additional measures to encourage birds to remain during summer and to breed include the merging of marsh ponds to form larger contiguous lily areas and adjusting management and monitoring regime to reduce disturbance where appropriate.

A1.2.20. Pintail Snipe *Gallinago stenura*

A1.2.21.1. Pintail snipe is a species impacted by the Lok Ma Chau Spurline. It is a primary target species in Compartment C.

A1.2.21.2. This is a common passage migrant, most common in autumn, and an uncommon winter visitor. It is very similar in appearance to Swinhoe's Snipe and is generally only separable from that species by examination in the hand (Carey *et al.* 2001). The preferred habitat for this species in Hong Kong is wet agricultural areas, especially recently abandoned or inactive areas of wet agriculture.

A1.2.21.3. Management measures included the creation of marsh areas, and any areas where the water levels are managed for Greater Painted-snipe.

A1.2.21. Swinhoe's Snipe *Gallinago megala*

A1.2.21.1. Swinhoe's Snipe is a species impacted by the Lok Ma Chau Spurline. It is a primary target species in Compartment C.

A1.2.21.2. Swinhoe's Snipe is a common passage migrant, most common in autumn in Hong Kong. It is very similar in appearance to Pintail Snipe and is generally only separable from that species by examination in the hand (Carey *et al.* 2001). The preferred habitat for this species in Hong Kong is wet agricultural areas, especially recently abandoned or inactive areas of wet agriculture.

A1.2.21.3. Management measures recommended in the HCMP included the creation of marsh areas, and any areas where the water levels are managed for Greater Painted-snipe.

A1.2.22. Common Snipe *Gallinago gallinago*

A1.2.22.1. Common Snipe is a species impacted by the Lok Ma Chau Spurline. It is a primary target species in Compartment C and a secondary target in Compartment B.

A1.2.22.2. Common Snipe is a passage migrant and winter visitor to Hong Kong. It requires marsh vegetation with muddy margins for feeding and, in Hong Kong, is much more abundant in freshwater than brackish water areas. Most feeding occurs at night and dense marshland areas are utilised for roosting during the day. Edges of fishponds are used by Common Snipe, but these are not a major habitat for this species (Carey *et al.* 2001).

A1.2.22.3. Management measures included the creation of marsh areas. In addition, the shallow ponds with emergent vegetation created for Chinese Pond Herons were considered to be beneficial for the species. In addition, the provision of recently cut reedbed during the dry season, particularly in the autumn, is anticipated to benefit the species.

A1.2.23. Pallas's Grasshopper Warbler *Locustella certhiola*

A1.2.23.1. Pallas's Grasshopper Warbler is a species impacted by the Lok Ma Chau Spurline. It is a primary target in Compartment C.

A1.2.23.2. Pallas's Grasshopper Warbler is an autumn migrant to Hong Kong, with the vast majority of records occurring in September and the first ten days of October. This species occur in any wetland habitat, but most notably in areas of abandoned or inactive wet agriculture (Carey *et al.* 2001). However, it is a highly cryptic species, making it extremely difficult to monitor accurately.

A1.2.23.3. Management measures included the provision of marsh areas, areas of long-grass along the bunds in Compartment C during autumn, and reedbed within the EEA, while the Clean-up Reedbed is also beneficial to the species.

A1.2.24. Zitting Cisticola *Cisticola juncidis*

A1.2.24.1. Zitting Cisticola is a species impacted by the Lok Ma Chau Spurline. It is a secondary target in Compartments B and C.

A1.2.24.2. Zitting Cisticola is a common winter visitor and passage migrant in Hong Kong and a rare breeding species. It favours areas of grass, especially in lowland wetland areas such as active and disused fishponds. Small numbers breed in Hong Kong, primarily in the Deep Bay area and the northeast New Territories (Carey *et al.* 2001).

A1.2.24.3. Management measures included the provision of fringe areas, such as the interface between the freshwater marsh and the reedbed, and retain areas of long grass throughout the year in Compartments B and C. The species is also anticipated to benefit from the relocation of Pond 22 to Pond 14.

A1.2.25. Red-billed Starling *Sturnus sericeus*

A1.2.25.1. Red-billed Starling is a species impacted by the Lok Ma Chau Spurline. It is a primary target species in Compartment A and a secondary target in Compartment B.

A1.2.25.2. Red-billed Starling is primarily a winter visitor to Hong Kong, occurring in large flocks in the northwest New Territories. In addition, small numbers have bred in the vicinity of the EEA in

recent years. The wintering population in Hong Kong is considered probably to be of international importance for this species (Carey *et al.* 2001). Red-billed Starlings are omnivores and feed around fishponds, wet agricultural areas (especially where these are contaminated by effluent from pig farms), edges of reedbeds and both natural and artificial drainage channels. They readily take advantage of spilled food provided for fish or ducks. Much food is obtained on the ground but they also frequently feed in trees where they consume insects and fruit (though their gape size is too small to permit them to take most fruits of Melia azedarach, the most frequent fruiting tree around fishponds).

A1.2.25.3. Management measures included short to medium term provision of artificial food (i.e. 'waste' biscuits used by fish farmers as fish food) during the winter months, while medium to long term measures included planting of trees which produce suitable-sized fruits such as *Sapium sebiferum*, *Ficus superba*, *Ficus microcarpa* and *Celtis tetranda*, and the provision of nest boxes with appropriate hole size for this species.

A1.2.26. White-cheeked Starling *Sturnus sericeus*

A1.2.26.1. White-cheeked Starling qualifies as a conservation target species based on the importance of the EEA for the species. It is a secondary target in compartment A and B.

A1.2.26.2. White-cheeked Starling is largely a winter visitor to Hong Kong. They are regularly found in flock mixed with other starling species in the Deep Bay area; this species particularly favours wet agricultural land but also regularly seen at fish ponds (Carey *et al.* 2001), though in recent years small numbers have bred in the northwest New Territories in summer.

A1.2.26.3. Management measures for this species would, in any case, largely mirror those already adopted for Red-billed Starling and no additional measures is considered necessary.

A1.2.27. White-shouldered Starling *Sturnia sinensis*

A1.2.27.1. White-shouldered Starling is a conservation target of EEA because of the significant numbers using the nest boxes provided for its use within EEA in previous years. It is a secondary target in compartment A, B and C.

A1.2.27.2. White-shouldered Starling occurs throughout the year in Hong Kong; It was listed by Fellowes *et al.* (2002) as of Local Concern as a breeding species due to its localized and declining breeding population. Since then numbers have increased, largely because it has readily adopted nest boxes provided for its use within the EEA (Carey *et al.* 2011).

A1.2.27.3. Management measures included continued provision and maintenance of nest boxes suitable for White-shouldered Starlings in all Compartments and monitoring of nest box use.

A1.2.28. Bluethroat *Luscinia svecica*

A1.2.28.1. Bluethroat is a species impacted by the Lok Ma Chau Spurline and is a primary target in Compartment C.

A1.2.28.2. Bluethroat is a winter visitor and spring migrant to Hong Kong, with most records occurring between the middle of November and late April. They were frequently found in wet agricultural areas and adjacent freshwater ditches and shrublands, and also reedbeds (Carey *et al.* 2001), but this is a cryptic and relatively mobile species, making it difficult to monitor accurately.

A1.2.28.3. Management measures included the provision of densely vegetated areas within the EEA and within the Clean-up Reedbed. No additional measure is considered necessary for the species.

A1.2.29. Yellow-breasted Bunting *Emberiza aureola*

A1.2.29.1. Yellow-breasted Bunting is included as a conservation target of EEA because of the increasing conservation concern over the plight of the species. This is a secondary target in compartment C.

A1.2.29.2. Yellow-breasted Bunting is a common passage migrant and scarce winter visitor in Hong Kong (Carey *et al.* 2001). In Hong Kong this species is mostly restricted to open country, wet and dry farmland, grassland in abandoned areas and landfill sites and the edges of reedbeds (Carey *et al.* 2001).

A1.2.29.3. No management measures specific for this species are proposed; though measures proposed for other species such as Burmese Python, Pallas's Grasshopper Warbler, Zitting Cisticola etc. would benefit the species.

A1.2.30. Japanese Yellow Bunting *Emberiza sulphurata*

A1.2.30.1. Japanese Yellow Bunting is a species impacted by the Lok Ma Chau Spurline and is a secondary target in Compartments B and C.

A1.2.30.2. This species is a scarce and irregular spring passage migrant (Carey *et al.* 2001), anecdotal evidence suggests that this species has declined since the 1990s. Records in Hong Kong have come from widespread areas but about half are from the Deep Bay area, the species occurs in a wide range of habitats including overgrown landfill sites, well vegetated fish pond bunds, in Horsetail Trees *Casuarina equisifolia* with an extensive understorey of Common Lantana *Lantana camara*, in the edges of mangroves, agricultural land, and shrubland edges.

A1.2.30.3. Management measures included the provision of a mosaic of habitats in the form of marsh, well-vegetated bunds and reedbeds. However, given its wide variety of habitats and the sporadic nature of its occurrence in Hong Kong, the species is unlikely to be regular within the EEA.

A1.3. Herpetofauna Targets

A1.3.1. Burmese Python *Python bivittatus*

A1.3.1.1. Burmese Python is impacted by the Lok Ma Chau Spurline and is a primary target in Compartment B (refugia areas) and a secondary target in Compartment A.

A1.3.1.2. This species was considered a sub-species of *P. molurus* until 2009 when it was recognized as a full species (Jacobs *et al.* 2009). It is locally common in Hong Kong and prefers shrubland, woodland and the edges of mangroves. (Karsen *et al.* 1998).

A1.3.1.3. Management measures included the provision of well-vegetated bunds and island between Ponds 2A and 2B, around the western and northern portion of Compartment B, and retaining patches of longer grass and other herbaceous vegetation as refugia for this species and other less vagile taxa away from areas where routine-grass cutting is required.

A1.3.2. Chinese Soft-shelled Turtle *Pelodiscus sinensis*

A1.3.2.1. Chinese Soft-shelled Turtle is impacted by the Lok Ma Chau Spurline and is a secondary target in Compartments A and B.

A1.3.2.2. Chinese Soft-shelled Turtle is rare and localised in Hong Kong with a natural population restricted to fishponds around Deep Bay (Karsen *et al.* 1998). This species prefers ponds, reservoirs, slow-flowing lowland rivers and muddy places (Karsen *et al.* 1998); they are hard to detect as they spend much time buried in the mud but they also wander on land and will bask on mudbanks or floating logs. Eggs are buried in the mud banks of a pond.

A1.3.2.3. It was considered that by maintaining fishpond habitats within the EEA, this would provide suitable conditions for this species. However, whilst it continues to be recorded in small numbers in the EEA, there is no evidence of increasing numbers or successful breeding. Reducing disturbance to the species by the site boundary fence may benefit the species; it is also considered appropriate to review the habitat conditions in ponds where the species is noted, with a view to determining whether further management measures would be beneficial.

A1.3.3. Chinese Bullfrog *Hoplobatrachus chinensis*

A1.3.3.1. Chinese Bullfrog is impacted by the Lok Ma Chau Spurline and is a primary target in Compartment C.

A1.3.3.2. Chinese Bullfrog is a large frog species thought to be in marked decline locally and in drastic decline regionally. It is a species closely associated with areas of wet agriculture, and breeds in ponds and marshes. Chinese Bullfrogs feed on insects and small frogs and rodents (Karsen *et al.* 1998). They will benefit from provision of permanent and, particularly, seasonal marsh habitat (from which predatory fish are absent), with good development of emergent and/or edge vegetation and variable, but generally shallow, depth. Presence of prey items such as odonate larvae and other frog species will also encourage establishment of this species.

A1.3.3.3. Management measures include the provision of marsh habitat, notably small seasonal ponds. As with the preceding species, a review of habitat conditions of ponds where this

species is observed is proposed with a view to determining whether additional management measures would be beneficial.

A1.4. Dragonfly Targets

A1.4.1. Dragonfly Diversity

A1.4.1.1. Overall dragonfly diversity is a target for the EEA but there are no species level targets for this group. Though not specified in the HCMP, dragonflies are a secondary target in Compartment C.

A1.4.1.2. Management measures included the provision of small seasonal ponds which dry out during the season preventing the establishment of fish populations and removal of fish species from the marsh ponds, particularly during the wet season. Where these small seasonal ponds are present, monitor exuviae emergence by means of exuviae traps.

Appendix 2 . Summary Table Showing Comparison of the Requirement as listed in Approved HCMP (Issue 11, 2006) and Current Proposed Changes, and Relevant Section in the MRR

	Approved HCMP (Issue 11, 2006)				Section in HCMP	Section in Current Document	MRR				Section in Current Document
Management Compartment	Three management compartments: Compartment A: Ponds 1 & 2 Compartment B: Ponds 3 to 11 Compartment C: Ponds 12 to 22					2.1.2	Three management compartments: Compartment A: Ponds 1 & 2 Compartment B: Ponds 3 to 11 & 13 Compartment C: Ponds 12, 14 to 22				
Target Species											
Mammal	One mammal target: **Eurasian Otter**.				3.2.1 – 3.2.3	2.3.1	Two mammal targets: **Eurasian Otter** and **Leopard Cat**				
	Target Level: No numerical requirement due to scarcity of sightings.							**Propos ed MC**	**Proposed Changes to Management Measure**	**Target Level**	
	Management Compartment: A						**Eurasian Otter**	A	• Continue the use of infra-red cameras; • Provision of another otter holt; • Monitor the effectiveness of site boundary fence against feral dogs	(No change proposed)	3.2.1
	Management Measure: • Use of infra-red cameras; • Provision of an otter holt at Pond 2; • Planting of the island between Ponds 2A and 2B for shelter						**Leopard Cat**	C	• Use of infra-red cameras; • Undertake small mammal survey.	no numerical requirement due to species not impacted by the project and its inclusion is only a conservation initiative taken by the EP holder	3.7.3
Bird	**Twenty-six** target species:						**Twenty-seven** target species:				
		MC	**Management Measures**	**Target Level**				**Propos ed MC**	**Proposed Changes to Management Measure**	**Target Level**	
							Proposed Retentions (22 species) & Removals (4 species)				
	Great Cormorant	A, B	• Fish stocking; • Provision of trees and bare bund for daytime loafing and roosting; • Provide ponds with water level between 1.5m and 50cm.	Double the density of CAs	3.3.5 – 3.3.10	2.4.2	**Great Cormorant**	A, B	• Carry on all existing measures; • No additional measures proposed.	(No change proposed)	3.3.2
	Grey Heron	A, B	• Stocking of fish of approx. 10 – 16cm in length; • Partial draining of pond for foraging; • Clear vegetation on bunds for daytime roosting and loafing.	Double the density of CAs	3.3.11 – 3.3.14	2.4.3	**Grey Heron**	A, B	• Carry on all existing measures; • Minimize disturbance of the species during day-to-day management and monitoring activities.	(No change proposed)	3.3.3
	Great Egret	A, B	• Fish stocking; • Pond drain-down; • Provision of shallow water with emergent vegetation (for foraging) and wooded bunds and islands (for daytime loafing and roosting).	Double the density of CAs	3.3.15 – 3.3.17	2.4.4	**Great Egret**	A, B	• Carry on all existing measures; • Summer drain-down of ponds within Compartment B; • Monitor the winter roost.	(No change proposed)	3.3.4
	Little Egret	A, B, c	• Stocking with small prey items such as Mosquito Fish; • Creation of larger areas of under 50cm in depth by increasing areas of islands and associated shallow water zones; • Planting of island between Ponds 2A and 2B with bamboo for attraction of to breed (egretry) and roost; • Establishment of marshland in Compartment C.	Double the density of CAs	3.3.18 – 3.3.21	2.4.5	**Little Egret**	A, B, c	• Carry on all existing measures, except measure to stock with Mosquito Fish; • Summer drain-down of ponds within Compartment B; • Deploy egret decoys to encourage establishment of an egretry at Pond 2; • Monitor the winter roost.	(No change proposed)	3.3.5
	Chinese Pond Heron	A, B, C	• Creation of suitable shallow water conditions with emergent vegetation; • Creation of mats of *Ipomoea aquatica*; • Establishment roosting habitat between Ponds 2A and 2B;	Double the density of CAs	3.3.22 – 3.3.26	2.4.6	**Chinese Pond Heron**	A, B, C	• Carry on all existing measures, except measure to establish mats of *Ipomoea aquatica* due to suitable habitat condition already exists and aggressiveness of the species; • Measures undertaken for Little Egret are anticipated to assist in attracting this species.	(No change proposed)	3.3.6

	Approved HCMP (Issue 11, 2006)				Section in HCMP	Section in Current Document	MRR				Section in Current Document
			• Provide suitable conditions for the species during both wet and dry season.								
Bird	**Black-faced Spoonbill**	a, B	• Fish stocking; • Partially draining ponds; • Clearing vegetation along bunds and islands for daytime roosting and loafing.	Double the density of CAs	3.3.27 – 3.3.30	2.4.7	**Black-faced Spoonbill**	B	• Carry on all existing measures; • Include a size requirement for fish to be stocked (mean length of less than 10cm in 50 random samples); • Minimize disturbance of the species during day-to-day management and monitoring activities.	(No change proposed)	3.3.7
	Eurasian Teal	A, b, c	• Creation of shallow pond areas with emergent vegetation; • Creation of the marshland; • Supplementary feeding with suitable duck food (grains etc.) in Compartment A.	Double the density of CAs	3.3.31 – 3.3.34		**Eurasian Teal**	a, B, C	• Carry on all existing measures, • Move the feeding station to Compartment B instead of Compartment A; • Made a primary target at Compartments B (aquatic grasses and feeding station) and C (aquatic grasses).	(No change proposed)	3.3.8
	Greater Spotted Eagle	a, b, c	• Measures identical to that for Eastern Imperial Eagle; • Measures to attract Eurasian Teal are anticipated to benefit the species.	Double the density of CAs	3.3.35 – 3.3.38	2.4.9	**Greater Spotted Eagle**	a, B, c	• Ensure site attraction for Eurasian Teals; • Ensure continued presence of large isolated trees in Compartment B; • Made a primary target in Compartment B.	(No change proposed)	3.3.9
	Eastern Imperial Eagle	a, b, c	• Provision of trees which do not form a continuous line for daytime loafing and hunting perches; • Measures to attract large congregation of ducks, notably Eurasian Teal.	Double the density of CAs	3.3.39 – 3.3.41	2.4.10	**Eastern Imperial Eagle**	a, B, c	• Ensure site attraction for Eurasian Teals; • Ensure continued presence of large isolated trees in Compartment B; • Made a primary target in Compartment B.	(No change proposed)	3.3.10
	Eurasian Hobby	a, b, c	• No particular management measure recommended due to large home range of breeding birds and unpredictability of migrant birds; • Overall provision of increased habitat diversity through provision of marshes, reedbeds and other habitats expected to increase the number of preferred prey items (such as swallows, dragonflies and bats) of the species.	Double the density of CAs	3.3.42 – 3.3.45	2.4.11	**Eurasian Hobby**	n/a	Proposed to be removed as a target species on the following grounds: • The species is of causal occurrence in the entire Deep Bay and did not technically meet the requirement to be included as a target species; • Species included on precautionary ground based on observation of hunting activities over fishponds which was a major habitat loss of the project; • The EEA does not offer suitable habitat for breeding and is very far from known or suspected breeding sites.	n/a	3.3.11
	Japanese Quail	b	• Provision of bunds with short grass by controlling the growth of the dominant grass species on-site, i.e. *Panicum maximum*; • Encourage the growth of shorter grasses such as *Paspalum distichum*.	Double the density of CAs	3.3.46 – 3.3.48	2.4.12	**Japanese Quail**	b, c	• Secondary target in Compartment B and C; • Increase the area of short grass by additional planting of short grass species (such as *Paspalum distichum*) on selected bunds (such as between Ponds 9/10, 10/11 and 12/15); • Include monitoring of short grass area (20-40cm).	(No change proposed)	3.3.12
	Eurasian Coot	a, b, c	• Provision of marshes and reedbed to increase the habitat suitable for the species.	Double the density of CAs	3.3.49 – 3.3.50	2.4.13	**Eurasian Coot**	a, b, C	• Carry on all existing measures, • Increase areas with emergent vegetation, particularly lilies in Compartment C; • Made a primary target in Compartment C.	(No change proposed)	3.3.13
	Pheasant-tailed Jacana	b, C	• Creation of marshes with extensive marginal and emergent vegetation; • Establishment of areas with Prickly-leaved Lotus in Ponds 15 and 21.	Double the density of CAs	3.3.51 – 3.3.56	2.4.14	**Pheasant-tailed Jacana**	C	• Carry on all existing measures, • Increase areas with emergent vegetation, particularly lilies; • Control of Golden Apple Snails; • Control access to the bunds of the lily pond(s) before and during breeding season if the species is recorded.	(No change proposed)	3.3.14
	Greater Painted-snipe	C	• Creation of marshes with low, dense herbaceous vegetation and shallow water (<10cm); • Water level management throughout winter to ensure some habitat is retained for the species.	Double the density of CAs	3.3.54 – 3.3.56	2.4.15	**Greater Painted-snipe**	C	• Carry on all existing measures, • Review vegetation maintenance and exotic species control schedule during the wet season to reduce disturbance to this species.	(No change proposed)	3.3.15
	Black-winged Stilt	A, B, c	• Creation of shallow open water areas overlaying soft mud with sparse or no aquatic vegetation; • Provision of elevated islands in Ponds 2, 3 and	Double the density of CAs	3.3.57 – 3.3.59	2.4.16	**Black-winged Stilt**	a, B, C	• Carry on all existing measures, • Long term provision of floating islands with bare gravel; • Partial drain-down of ponds if breeding occurs to provide suitable foraging habitat.	(No change proposed)	3.3.16

	Approved HCMP (Issue 11, 2006)				Section in HCMP	Section in Current Document	MRR				Section in Current Document
			9 would provide breeding sites which are protected from ground predators and nests being flooded out.								
Bird	Pintail Snipe	C	• Creation of marsh areas; • Areas managed for Greater Painted-snipe is anticipate to benefit the species.	Double the density of CAs	3.3.60 – 3.3.61	2.4.17	Pintail Snipe	C	• Carry on all existing measures; • No additional measures proposed.	(No change proposed)	3.3.17
	Swinhoe's Snipe	C	• Creation of marsh areas; • Areas managed for Greater Painted-snipe should to benefit the species.	Double the density of CAs	3.3.62 – 3.3.63	2.4.18	Swinhoe's Snipe	C	• Carry on all existing measures; • No additional measures proposed.	(No change proposed)	3.3.17
	Common Snipe	b, C	• Creation of marsh areas; • Areas managed for Chinese Pond Heron should benefit the species.	Double the density of CAs	3.3.64 – 3.3.65	2.4.19	Common Snipe	b, C	• Carry on all existing measures; • Provision of recently cut reedbed during the dry season particularly in the autumn.	(No change proposed)	3.3.18
	Richard's Pipit	c	• Clearance of vegetation from the internal bunds within the EEA; • Management to drain pond for other species is anticipated to benefit the species.	Double the density of CAs	3.3.66 – 3.3.67	2.4.20	Richard's Pipit	n/a	Proposed to be removed as a target species on the following grounds: • Species originally included based on predicted impact to Long Valley; an impact which did not materialize; • Species not considered of particular conservation concern based on current knowledge of the species; • Management practices for the species compromised the ecological value of the site for other target bird species.	n/a	3.3.19
	Bluethroat	C	• Provision of densely vegetated areas within the EEA and Clean-up Reedbed.	Double the density of CAs	3.3.68	2.4.21	Bluethroat	C	• Carry on all existing measures; • No additional measures proposed.	(No change proposed)	3.3.20
	Stejneger's Stonechat	a, b, c	• Provision fringe areas, such as the interface between freshwater marsh and reedbed, the drier raised shrub and tree-planted area around the Station; • More vegetated bund.	Double the density of CAs	3.3.69 – 3.3.70	2.4.22	Stejneger's Stonechat	n/a	Proposed to be removed as a target species on the following grounds: • Species not considered of particular conservation concern based on current knowledge of the species; • A very common and widespread passage migrant and winter visitor which is not wetland-dependent.	n/a	3.3.21
	Pallas's Grasshopper Warbler	C	• Provision of marsh areas and reedbed within the EEA.	Double the density of CAs	3.3.71	2.4.23	Pallas's Grasshopper Warbler	b, C	• Carry on all existing measures; • Retain long grass along the pond bunds in Compartment C during the autumn; • Move reedbed from current location (Pond 22) to Pond 14.	(No change proposed)	3.3.22
	Zitting Cisticola	b, c	• Provision fringe areas, such as the interface between freshwater marsh and reedbed; • Retain areas of long grass along vegetated bunds or islands.	Double the density of CAs	3.3.72-3.3.73	2.4.24	Zitting Cisticola	B, c	• Carry on all existing measures; • Manage/retain areas of long grass during the wet season in Compartment B; • Made a primary target species in Compartment B; • May also benefit by the relocation of reedbed.	(No change proposed)	3.3.23
	Japanese Yellow Bunting	b, c	• Provision of a mosaic of habitats in the form of marsh, well-vegetated bunds and reedbeds.	Double the density of CAs	3.3.74	2.4.25	Japanese Yellow Bunting	b, c	• Carry on all existing measures; • No additional measures proposed.	(No change proposed)	3.3.24
	Red-billed Starling	A, b	• Provision of artificial food (i.e. 'waste' biscuits used by fish farmers as fish food) during the winter months; • Planting of trees which produce suitable-sized fruits such as *Sapium sebiferum, Ficus superba, Ficus microcarpa* and *Celtis tetranda*.	Double the density of CAs	3.3.75 – 3.3.77	2.4.26	Red-billed Starling	A, B	• Carry on all existing measures; • Provision of nest boxes with appropriate hole size to attract the species to breed on-site to enhance the ecological value of the site for the species.	(No change proposed)	3.3.25
	Black-naped Oriole	a	• Planting of the island between Ponds 2A and 2B; • Additional tree planting on the eastern bund of Pond 2A to create a dense wooded area.	Double the density of CAs	3.3.78 – 3.3.79	2.4.27	Black-naped Oriole	n/a	Proposed to be removed as a target species on the following grounds: • Species originally included based on the small and declining breeding population in Hong Kong. But the species has ceased breeding in Hong Kong since 2008; • Species is now only a scare passage migrant in the Deep Bay area.	n/a	3.3.26

	Approved HCMP (Issue 11, 2006)	Section in HCMP	Section in Current Document	MRR				Section in Current Document
	(blank)			**Proposed Additions (8 species)**				
Bird	(blank)			**Eurasian Wigeon**	B, C	Reasons for inclusion: • A species of conservation concern (Regional Concern by Fellowes *et al.* 2002); • EEA supports significant numbers of the species (up to 18.0% of the Deep Bay population). Management Measures proposed: • Maintain short-grass areas of bunds for more regular cutting • Provide ponds with well-vegetated margins.	No numerical target	3.7.5
	(blank)			**Cinnamon Bittern**	b, c	Reasons for inclusion: • A species of conservation concern (Local Concern by Fellowes *et al.* 2002); • Potential breeding at or near EEA. Management Measures proposed: • None proposed but management action for other target species (Burmese Python, Pallas's Grasshopper Warbler, Zitting Cisticola) would benefit the species.	No numerical target	3.7.12
	(blank)			**Little Grebe**	a, b, c	Reasons for inclusion: • A species of conservation concern (Local Concern by Fellowes *et al.* 2002); • EEA supports significant numbers of the species (up to 17.9% of the Deep Bay population based on annual peak count). Management Measures proposed: • None proposed but management action for Chinese Pond Heron (provision of emergent vegetation) and Black-winged Stilt (floating platform) would benefit the species.	No numerical target	3.7.10
	(blank)			**Black-crowned Night Heron**	a, b	Reasons for inclusion: • A species of conservation concern (Local Concern as a breeding species by Fellowes *et al.* 2002, though the species is not known to breed in the Deep Bay area); • EEA supports significant numbers of the species (average peak count of 20.4% of the Deep Bay population). Management Measures proposed: • Continued provision and maintenance of suitable daytime roost sites; • Minimize daytime disturbance to the roost areas.	No numerical target	3.7.13
	(blank)			**Intermediate Egret**	a, b, c	Reasons for inclusion: • A species of conservation concern (Regional Concern by Fellowes *et al.* 2002); • EEA supports significant numbers of the species (peak counts ranging from 70 to 348 birds) though a Deep Bay population count is not available, Carey *et al.* (2011) noted that the peak count at Mai Po Nature Reserve in 2007 was of263 birds. Management Measures proposed: • None proposed; measures to attract Chinese Pond Heron will benefit the species.	No numerical target	3.7.15
	(blank)			**White-cheeked Starling**	A, b	Reasons for inclusion: • A species of conservation concern (Potential Regional Concern by Fellowes *et al.* 2002); • EEA supports significant numbers of the species (between 23.1 – 161.1% of the Deep Bay population). Management Measures proposed: • None proposed in addition to the measures for Red-billed Starling.	No numerical target	3.7.18
	(blank)			**White-shouldered Starling**	A, B, c	Reasons for inclusion: • A species of conservation concern (Local Concern based on	No numerical target	3.7.19

	Approved HCMP (Issue 11, 2006)			Section in HCMP	Section in Current Document	MRR				Section in Current Document
								declining breeding population by Fellowes *et al.* 2002) and a breeding summer visitor to Hong Kong; • EEA supports significant numbers of the species (peak count of 210 birds in 2009 equals the highest count of the species ever recorded in Hong Kong (Carey *et al.* 2011)). Management Measures proposed: • Provision and maintenance of nest boxes; • Monitor the use of nest boxes by the species.		
						Yellow-breasted Bunting	c	Reasons for inclusion: • Increasing conservation concern over the species • Regularly recorded at the EEA in small numbers Management Measures proposed: • None proposed; measures to attract other species such as Burmese Python, Pallas's Grasshopper Warbler, Zitting Cisticola etc. would benefit the species.	No numerical target	3.7.20
Reptile	Two reptile species: **Burmese Python & Chinese Soft-shelled Turtle**					Two reptile species retained: **Burmese Python & Chinese Soft-shelled Turtle**				
	Burmese Python	a, B	• Provision of well-vegetated bunds and islands between Ponds 2A and 2B, around western and northern portion of Compartment B; • Retain patches of long grass and other herbaceous vegetation as refugia.	no numerical requirement due to scarcity of sightings	3.4.1 – 3.4.3	2.5.1	**Burmese Python**	n/a	• Provision of regufia away from areas where routine grass cutting occurs.	n/a	3.5.2
	Chinese Soft-shelled Turtle	a, b	• Maintain fishpond habitats within EEA; • Protection from illegal harvesting as a by-catch of fisheries management.	no numerical requirement due to scarcity of sightings	3.4.4 – 3.4.5	2.5.2	**Chinese Soft-shelled Turtle**	a, b	• Carry on all existing measures; • Minimize disturbance to the species by erection of site boundary fence against unwarranted human access and dogs. • Review habitat conditions in ponds where the species is noted and review findings for possible further actions.	(No change proposed)	3.5.3
Amphibian	One amphibian species: **Chinese Bullfrog**			no numerical requirement due to scarcity of sightings	3.4.6	2.6.1	**One retention: Chinese Bullfrog**				
	Management Compartment: C Management Measure: • Provision of marsh habitat, notably seasonal pools at one or more ponds at Pond 16, 18 and 20; • Provision of well-vegetated fringes at fishponds.						**Chinese Bullfrog**	C	• Carry on all existing measures; • Removal of fish species on a 'as-seen' basis from the marsh ponds; • Review habitat conditions in ponds where the species is noted and review findings for possible further actions.	(No change proposed)	3.4.1
Dragonfly	No specific dragonfly species target Management Compartment: not specified			no numerical requirement	n/a	2.7.1	**Dragonfly diversity**	c	• None proposed but removal of fish species particularly during the wet season from the marsh pond proposed under Chinese Bullfrog is anticipated to benefit the group.		3.6
Habitat Condition Target	• Extending the period during which drained ponds are available by draining pond sequentially throughout the winter period; • Draining ponds more slowly so that fish and other food is available over a longer period; • Maintaining some ponds with shallow water suitable for Black-faced Spoonbills and ardeids to wade for an extended period; • Recontouring ponds so that the pond base has a shallow slope, thus providing a larger feeding area when ponds are drained; • Repeating stocking of some ponds in Compartment B with trash fish during the winter months to permit the same pond to be drained (or partially drained) more than once per season.			no numerical requirement	3.5.5	2.1.3	**Habitat Condition Target**	n/a	**Compartment A** • Minimize disturbance (human/dog) by providing a dog-prove fence design & controlled access (particularly unauthorized access) for Eurasian Otter and roosting egrets; • To be managed at a relatively low intensity and water levels allowed to fluctuate naturally (except when problems of water quality arise); • Manage and maintain the fruiting tree/shrub for starling species, and secure roost site for wintering and/or breeding egrets.		5.4.7.2
	• Clearance of vegetation (including trees, shrubs, herbs, and rank grass) from internal bunds to reduce the inhibitory and enclosure effect of ponds;			no numerical requirement	3.5.6	2.1.3			**Compartment B** • Shallow water available for Black-faced Spoonbills and ardeids; • At least one fish pond with fish of suitable size (mean size of 10cm) available (i.e.		5.4.7.3

	Approved HCMP (Issue 11, 2006)		Section in HCMP	Section in Current Document	MRR			Section in Current Document
	• Linkage of ponds to increase overall pond size and to create island areas from former bund sections which form roost areas free from ground predators and disturbance; • Formation of new islands in Pond 2 to increase the extent of shallow water areas and to provide secure roosting and nesting sites.						drained or partially drained) for target species at all times, particularly in the migratory and wintering period; • Repeated stocking of Compartment B with trash fish during the winter months to permit the same pond to be attracting targets for extensive period of time; • Management and maintenance of trees for raptors and starlings (nest boxes); • Management and maintenance of refugia and areas of short grass (20 – 40 cm) at selected areas; • Maintenance of bankside and emergent vegetation on selected ponds to provide refuges for fish and appropriate conditions for invertebrates which will themselves provide food for birds; • Maintenance of floating platforms for breeding Black-winged Stilt; • Ponds with recently flooded grasses for duck species during the wintering period.	
	• Enhancement and maintenance of a total of 29.65 ha of fishponds; • >20% of the fishpond area (excluding bunds) consists of shallow water (i.e. <50cm depth); • Vegetation cover >50% of the land area is established on 20-30% of the area of fishpond bunds and islands; • Vegetation cover >10cm in height is <5% on 70-80% of the area of fishpond bunds and islands; • Compartment B is maintained under a drain-down regime to maximize fish availability to target fish species of waterbirds; • 20-30% of the fishpond area is maintained as shallow ponds (with or without supplementary fish stocking) to suitable long-term feeding conditions for target species of waterbirds; • Emergent and pond-side vegetation is maintained over 10-20% of pond areas and 20-30% of pond-sides respectively; • Undesirable invasive species and exotic species are <10% of vegetation cover.	no numerical requirement	3.5.7	2.1.3			**Compartment C** • Shallow water (less than 20cm) and/or exposed wet mud is available for target species during the migratory and wintering season, and also for breeding marsh species; • Marsh ponds are free of fish and invasive pests (such as Apple Snail); • Management and maintenance of refugia and areas of short grass (20 – 40 cm) at selected areas. • Management Action • Implement wet and dry season routine grass cutting; • Undertake mechanical rather than hand removal of vegetation on bunds in Compartment C; • Replace the requirement of wet season weeding in Compartment C with mechanical removal (using a mini-backhoe) at selected ponds in March (i.e. at the end of the dry season and prior to the breeding season)	5.4.7.4
Monitoring Methodology								
Mammal	**Eurasian Otter** • Use of infra-red auto-trigger camera (camera trap); • Provision of an otter holt at Pond 2; • Planting of the island between Ponds 2A and 2B; • Management of the river channel		7.2.12 – 7.2.14	4.2.1	**Eurasian Otter & Leopard Cat** • No change proposed. **Other Mammals** • Undertake a small mammal inventory survey by live trapping			4.2.1
Bird	**LMC EEA** • <u>Twice weekly tower count for the following species at Ponds 2 to 11 & transect for Ponds 12 to 22</u>: Great Cormorant, Grey Heron, Grey Egret, Little Egret, Black-faced Spoonbill, Greater Spotted Eagle and Eastern Imperial Eagle • <u>Combination of tower count and transect count at all ponds</u>: Eurasian Teal, Eurasian Coot, Pheasant-tailed Jacana, Black-winged Stilt • <u>Full site transect only</u>: Chinese Pond Heron, Japanese Quail, Pintail Snipe, Swinhoe's Snipe, Common Snipe, Richard's Pipit, Stejneger's Stonechat, Zitting Cisticola, Red-billed Starling, Black-naped Oriole. • <u>Site Transect or Trapping</u>: Greater Painted-snipe • <u>Trapping</u>: Bluethroat, Pallas's Grasshopper Warbler • <u>Utilize all sightings</u>: Eurasian Hobby, Japanese Yellow Bunting **Control Areas** • <u>Weekly tower count at MPST CA & Full Site Transect only at ST CA</u>: Great Cormorant, Grey Heron, Grey Egret, Little Egret, Black-faced Spoonbill, Eurasian Teal, Greater Spotted Eagle and Eastern Imperial Eagle, Eurasian Hobby, Pheasant-tailed Jacana, , Black-winged Stilt • <u>Full site transect only</u>: Chinese Pond Heron, Japanese Quail, Pintail Snipe, Swinhoe's Snipe, Common Snipe, Richard's Pipit, Stejneger's Stonechat, Zitting Cisticola, Red-billed Starling, Black-naped Oriole.		7.2.2 – 7.2.11 & 7.2.22 – 7.2.24	4.2.2	Bird monitoring method has been reviewed once after reviewing the monitoring methodologies undertaken between 2002 and 2005. Rationale for proposing change is provided in ***Appendix 9*** of the current report, while the monitoring protocol after the review in 2008 is appended in ***Table 22*** of the current report and repeated here for ease of reference: **LMC EEA & Control Area** • <u>Tower count (twice weekly at EEA, weekly at MPST CA) at Ponds 2 to 11 & transect for Ponds 12 to 22</u>: Great Cormorant, Grey Heron, Grey Egret, Little Egret, Black-faced Spoonbill, Greater Spotted Eagle and Eastern Imperial Eagle • <u>Weekly full site transect only (For ST CA, covers all species under Tower Count above)</u>: Chinese Pond Heron, Eurasian Teal, Eurasian Hobby, Japanese Quail, Eurasian Coot, Pheasant-tailed Jacana, Greater Painted-snipe, Black-winged Stilt, Pintail Snipe, Swinhoe's Snipe, Common Snipe, Richard's Pipit, Bluethroat, Stejneger's Stonechat, Pallas's Grasshopper Warbler, Zitting Cisticola, Japanese Yellow Bunting, Red-billed Starling, Black-naped Oriole. Further proposed changes to the bird monitoring method: **LMC EEA:** • Reduce the tower count frequency from twice a week to once a week. • Continue weekly full site transect. • Monitoring of additional target species as: tower count at Ponds 2 to 11 & transect at Ponds 12 to 22 (Intermediate Egret); & site transect only (Eurasian Wigeon, Little Grebe, Black-crowned Night Heron, White-cheeked Starling, White-		4.2.2

	Approved HCMP (Issue 11, 2006)	Section in HCMP	Section in Current Document	MRR	Section in Current Document
	• Site Transect or Trapping: Greater Painted-snipe • Roost Count at Mai Po Nature Reserve: Black-faced Spoonbill • Mai Po Reedbed: Bluethroat, Pallas's Grasshopper Warbler • Utilize all sightings: Eurasian Hobby, Japanese Yellow Bunting			shouldered Starling). • Include nest box monitoring as an optional item. **Control Areas** • No change proposed except for including monitoring of additional target species. • Alternative monitoring method at MPST CA proposed (full site transect only) in the event of inaccessibility or safety issue regarding the tower at the site.	
Herpetofauna	**LMC EEA & Control Areas** • Daytime Survey (herpetofauna): Twice per month from April to November. • Night-time Survey (herpetofauna & amphibians): Twice per month from March to August.	7.2.21	4.2.4	**LMC EEA:** • Discontinue all daytime surveys since both remaining herpetofauna targets (Chinese Soft-shelled Turtle & Chinese Bullfrog) are detectable during both day and night-time surveys. • No change is proposed for night time survey. **Control Areas** • Discontinue all daytime and night-time surveys due to existence of large database for reference.	4.2.4
Dragonfly	**LMC EEA & Control Areas** • Site transect: Once per month in March, and between September and November, and twice per month between April and August. • Exuviae emergence (LMC EEA): Eight traps placed in Ponds 2, 7, 14, 17 and four traps placed in Pond 13 at EEA. • Exuviae emergence (CAs): Exuviae observed during transect collected, identified and enumerated.	7.2.17 – 7.2.20	4.2.5	DRAGONFLY **LMC EEA:** • Discontinue the use of exuviae emergence traps due to existence of large database for reference; • Reduce monitoring frequency to twice per month during April to August. **Control Areas** • Discontinue dragonfly surveys at all CAs due to existence of large database for reference.	4.2.5
Butterfly	**LMC EEA & Control Areas** • Undertaken concurrently with dragonfly surveys.			**LMC EEA & Control Areas** • Discontinue all butterfly surveys since the group has never been a target species and the EEA is not managed for the attraction of butterfly species.	
Aquatic & Benthic Invertebrate	**LMC EEA (only)** • Aquatic invertebrate: sampled once per year (at the end of the wet season (August/September)) in Compartment A and B; and twice per year (end of wet season and end of dry season (March/April)) in Compartment C by means of sweep netting. • Benthic invertebrate: sampled frequency followed that of aquatic invertebrate by means of obtaining core samples using cylindrical benthic cores.	7.2.24 – 7.2.30	4.2.6	**LMC EEA (only)** • Discontinue routine monitoring of aquatic and benthic invertebrate sampling due to existence of large database for reference. • Monitoring to be undertaken in response to specific events or as required only.	4.2.6
Fish Stock	**LMC EEA (only)** • Random fish check during stocking (winter months): 50 specimen of each stocking is net-weighed and measured prior to release into the pond. • Fish stock in pond: bi-monthly fish survey in each pond using throw and drag-netting.	7.2.31	4.2.7	**LMC EEA (only)** • Random fish check during stocking (winter months): discontinue weighing of sampled fish due to existence of large database for reference; monitoring to be undertaken in response to specific concerns or as required only. • Fish stock in pond: no change proposed.	4.2.7
Habitat	**LMC EEA (only)** • Undertaken at six-monthly interval at the end of wet season (September) and end of the dry season (March).	7.2.32	4.2.8	**LMC EEA (only)** • Combine monitoring of habitat and vegetation cover due to extensive overlap in monitoring items and requirements.	4.2.8
Vegetation Cover	**LMC EEA (only)** • Undertaken at six-monthly interval at the end of wet season (September) and end of the dry season (March). • Mapping of the following items: tree/woody plants, vegetation >10cm in height, vegetation <10cm in height, vegetation-free areas.	7.2.33	4.2.9	**LMC EEA (only)** • Combine monitoring of habitat and vegetation cover due to extensive overlap in monitoring items and requirements; • Refine the items to be mapped as: woody vegetation, herbaceous vegetation over 20cm in height, herbaceous vegetation between 20 and 40cm in height, herbaceous vegetation less than 20cm in height, bare ground, emergent vegetation in ponds (reed or other species), open water in ponds.	4.2.9
Microhabitat Structure & Floristics of Marsh Areas	**LMC EEA (only)** • Undertaken twice-yearly in marsh areas (Compartment C); • Plant species diversity: monitored by means of transects and sampling quadrats. These data are collected: identify and total number of plant species, percentage cover of bare ground, leaf litter cover and coverage by each species following the Domin cover scale, and the tallest height of each plant species;	7.2.34 – 7.2.37	4.2.10	**LMC EEA (only)** • Reduce monitoring to once per year (December to February) to inform management practices; • Refine monitoring items to reflect management need: record and map unvegetated areas, record and map the dominant vegetation types in each marsh pond, and record and map presence and location of unwanted exotic species (even when not dominant).	4.2.10

	Approved HCMP (Issue 11, 2006)	Section in HCMP	Section in Current Document	MRR	Section in Current Document
	• Habitat characteristics of the following items: % of each habitat, % of open water, % of shallow water (0-30cm), % of medium depth water (30-100cm), % of deep water (>100cm), % of open bare wet mud, % of bare dry mud, % cover of plant species in deep water, % cover of plant species in medium depth water, % cover of plant species in shallow water, % of plant species in dry area, % of undesirable and exotic species.				
Pedology	**LMC EEA (only)** • Pond sediment of each ponds is monitored once a year (early wet season); • A HOKLAS accredited laboratory will measure these parameters: volatile solids, redox potential, pH, total nitrogen, total oxidized carbon, total phosphorus and total reactive phosphorus.	7.2.38	4.2.11	**LMC EEA (only)** • Discontinue routine pedology monitoring due to existence of large database available for reference; • Monitoring to be undertaken in response to specific event/circumstance only.	4.2.11
Water Quality	**LMC EEA (only)** • In-situ water quality monitoring: undertaken in each pond once per month & at ponds after refilling. These parameters are measured: temperature, pH, salinity, turbidity and dissolved oxygen; • Routine laboratory testing of water samples by a HOKLAS accredited laboratory: every six months (end of wet and end of dry seasons). Collected water samples are measured in terms of: ammoniacal nitrogen, biochemical oxygen demand, total oxidized nitrogen, total phosphorus and total reactive phosphorus. • Water level: weekly.	7.2.39 & Table 6.1	4.2.12	**LMC EEA (only)** • In-situ water quality monitoring: Discontinue routine monitoring of turbidity due to limited usage of the data in informing routine management activities; • Routine laboratory testing of water samples: Discontinue due to existence of large database available for reference. Monitoring to be undertaken in response to specific event/circumstance only. • Water level: Reduce frequency to twice per month or every two weeks.	4.2.12
Review of wildlife and habitat monitoring programme and consequent adaptive management	**LMC EEA (only)** • Findings of the wildlife and habitat monitoring programme to be reviewed on a weekly basis.	7.2.42 – 7.2.43	4.2.13	**LMC EEA (only)** • No change is proposed.	4.2.13
Adaptive Management Supervision, Issue of Prescriptions for the EEA & Reporting	**LMC EEA (only)** • Weekly Review of Conditions in the EEA: weekly review of the performance of the implementation of construction works, plantings, contractor's management activities and any reportable incidents. • Weekly Review of Wildlife Monitoring Activities Undertaken: weekly report of utilization of the EEA and the CAs by target species and from other wildlife surveillance works (such as camera traps); • Weekly Inspection and Review of the EEA & CAs: a weekly inspection site visit to verify conditions of the reports from the contractor; • Issue of Prescriptions for the EEA (Adaptive Management Advice): prescriptions of instructions covering management and maintenance requirements to the contractor and to the monitoring team regarding monitoring of the issued instructions to the contractor on a four-week period, more frequent if required. • Reporting: Monthly Monitoring Report which will form part of the EM&A Report to be submitted to the Environmental Committee. In addition, the ecological consultant is required to review the information collected to date and propose modifications to the HCMP on an annual basis.	7.3	4.2.13 & 4.2.14	**LMC EEA (only)** • Weekly Review of Conditions in the EEA: construction works and plantings have been long completed and no longer necessary. • Weekly Review of Wildlife Monitoring Activities Undertaken: No change is proposed, though this item is effectively identical with the "Review of wildlife and habitat monitoring programme and consequent adaptive management" above. The physical production of a report is considered redundant and has ceased. • Weekly Inspection and Review of the EEA & CAs: No change is proposed though in practice this can be combined with a routine day-time survey (such as bird survey). • Issue of Prescriptions for the EEA (Adaptive Management Advice): No change is proposed. • Reporting: Reduce reporting frequency to an annual basis, while reporting to the Environmental Committee on a six-monthly basis is on-going and takes the form of a meeting.	4.2.14
Management Strategies & Measures					
Water Management System					
Water Control System	**LMC EEA (only)** • Measure water levels and adjust sluice height or pump: weekly and/or within 24 hours of heavy rainfall (defined as 100mm of rainfall within 24 hours in the northwest New Territories). • Condition of water control structures and watercourses: monthly and after lowering of typhoon signal no. 3; • Clear sluices: weekly, and after flooding/heavy rainfall and lowering of typhoon signal no. 3.	Table 6.1	5.2.1	**LMC EEA (only)** • Measure water levels and adjust sluice height or pump: no change is proposed though actual data collection of water level is considered unnecessary and has ceased. • Condition of water control structures and watercourses: no changes proposed to the monitoring frequency but it is proposed to change the requirement to after lowering of typhoon signal no. 8 or any other local adverse weather; • Clear sluices: no changes proposed to the monitoring frequency but it is proposed to change the requirement to after lowering of typhoon signal no. 8 or any other local adverse weather.	5.2.1
Water Quality	**LMC EEA (only)**	Table	5.2.2	**LMC EEA (only)**	5.2.2

	Approved HCMP (Issue 11, 2006)	Section in HCMP	Section in Current Document	MRR	Section in Current Document
	• Water Quality: monitoring undertaken on a weekly basis (evaluated under "Water quality and hydrology of pond" above). No specific requirement regarding management measure to ensure remedial measures to adjust pH of water is stated.	6.1		• Water Quality: monitoring frequency evaluated under "Water quality and hydrology of pond" above. For pH adjustment measures, propose to provide a suitable storage facilities on-site and to maintain an on-site supply of 2,00kg of lime/peanut residue.	
Water Budget	(not addressed in the HCMP under review)	n/a	5.2.3	**LMC EEA (only)** • Review the water carrying capacity of the site; • Upgrade the uPVC pipe connection between Ponds 22 and 12; • Set minimum dry season capacity of 40% as trigger level for management review of water levels throughout EEA.	5.2.3
Management of Fish Stock	(not addressed in the HCMP under review)	n/a	5.3	**LMC EEA (only)** • Winter stocking should comprise fish individuals of a maximum mean length of 10cm (standard length) in 100 random fish sample; • Spring stocking should comprise fish species with a minimum mean length of 10cm (standard length) in 100 random fish sample, comprise 95% of species which are known to breed in local pond condition, and completed no later than end of April; • Large fish such as Grass Carp and Big-headed Carp should be rescued from a pond scheduled to be drained, and be transferred to a deeper water pond	5.3
Habitat and Vegetation Management					
Tree/Shrub Management	**LMC EEA (only)** • Control of shrub/tree on internal bunds in Compartments A and B to reduce enclosure effect; • Minimum pruning of trees along the two drainage channels, along the entire boundary of the EEA for screening purposes and to provide food and shelter for target fauna species; • Planting of native species along access tracks and around the material store for screening; • It was also noted that the core objective of planting was to provide shelter for fish and feeing areas for target wildlife, not to create high botanical diversity or complex microhabitats.	5.6	5.4.2	**LMC EEA (only)** • Carry on all existing measures; • Provide an annual review of tree management for the EEA to account for the increasing need to manage the tree/shrubs on-site for particular wildlife.	5.4.2
Bund Vegetation Management	**LMC EEA (only)** • Maintain short vegetation on bunds (<10cm) by cutting once per month in the wet season, and to encourage the growth of *Paspalm distichum*; • Maintaining refugia in selected location for herpetofauna and smaller birds; • Hydroseed locations of bare areas on pond bunds to help stabilize these areas.		5.4.3	**LMC EEA (only)** • (no changes proposed; though the requirement to monitor and maintain an area of short grass (between 20 to 40cm) for Japanese Quail applies)	5.4.3
Emergent Vegetation Management	**LMC EEA (only)** • Allow 20-30% of bankside vegetation (those which extends from the bund sides into the fringes of ponds) at Ponds 1, 2, 5, 7, 8 and 12; • Allow 10-30% of Ponds 1, 2, 4, 5, 7, 8 and 15 to be covered by emergent vegetation; • Use of Grass Carp as a control measure against emergent vegetation in ponds where emergent vegetation is not designed.		5.4.4	**LMC EEA (only)** • Carry on all existing measures; • Implement wet and dry season routine grass cutting programme in all compartments; • Undertake mechanical rather than hand removal of vegetation on bunds in Compartment C; • Remove the requirement for wet season weeding in Compartments A and B; • Replace the requirement of wet season weeding in Compartment C with mechanical removal (using a mini-backhoe) every March (i.e. at the end of the dry season and prior to the breeding season) for target waterbirds.	5.4.4
Structural Management	**LMC EEA (only)** • Condition of path/bund: inspection every six months and after any flood events and lowering of typhoon signal no. 3; • Condition of bunds: inspection monthly and after any flood events.	Table 6.1	5.5	**LMC EEA (only)** • (no changes proposed).	5.5
Access					
Control of Access	**LMC EEA (only)** • A permit from the Hong Kong Police is required to access the site due to the entirety of the site situates within the Frontier Closed Area. Hence, access to the EEA is limited to authorized personnel; • Lockable gates at vehicular access points to prevent vehicular access to the EEA by other than authorized personnel; • Warning signs erected at these points and at potential access points to deter trespassers.	5.7	5.6	**LMC EEA (only)** • Implementation of a site boundary fence (after opening of the FCA in Feb 2012); • No other changes proposed.	5.6
Management of Undesired Animal Species					
Feral Dog	**LMC EEA (only)** • All dog sightings are recorded; • Use of dog trap (on loan from AFCD), to be maintained and checked on a daily basis.	5.9.12	5.7.1	**LMC EEA (only)** • (no changes proposed).	5.7.1
Red Imported Fire Ants	**LMC EEA (only)** • Check for RIFA nests on a regular basis during the dry season. Observed RIFA nest be treated with "Justice" bait and re-checked after 2-3 weeks; • No control measures are allowed during the wet season due to difficulty in spotting the nests and	5.9.13 – 5.9.15	5.7.2	**LMC EEA (only)** • Treatment of Fire Ant nests to be undertaken on a 'as-seen' basis or at a minimum of once every two months by the wetland contractor during both wet and dry season. No treatment is allowed if rain is forecasted within the next four days. Method of treatment to be approved by the ecological consultant;	5.7.2

	Approved HCMP (Issue 11, 2006)	Section in HCMP	Section in Current Document	MRR	Section in Current Document
	potential of bait being washed off into the water bodies.			• Maintain an adequate stock of the approved bait/treatment on-site at all times.	
Golden Apple Snail	(not addressed in the HCMP under review)	n/a	5.7.3	**LMC EEA (only)** • In the long run, re-profile pond bottoms such that a deeper trench is created which will facilitate pond drain-down and hand removal of Apple Snail.	5.7.3
Dimorphopterus spinolae	(not addressed in the HCMP under review)	n/a	5.7.4	**LMC EEA (only)** • Re-locate the reedbed to Pond 14 to minimize chances of cross-infestation with the Clean-up Reedbed; • Allow Pond 14 to be naturally colonized by reeds.	5.7.4
Management of Avian Diseases					
Avian Influenza and Botulism	**LMC EEA (only)** • A protocol for monitoring incidences of disease agreed with AFCD in operation, including vigilance in checking for sick or dead birds on-site, collection of faecal samples from large waterbirds and/or cloacal swabs for analysis by HKU or AFCD, close liaison with WWF HK staff at Mai Po Nature Reserve regarding outbreaks of diseases, and minimizing bird attraction to the site should any unusually high numbers of sick of dead birds tested positive for AIV be reported.	5.9.16 – 5.9.19	5.7.5	**LMC EEA (only)** • Remove the routine requirement to undertake faecal sample and cloacal swab samples from large waterbirds for analysis by HKU and/or AFCD. Monitoring to be undertaken in response to specific events or as required only.	5.7.5

A3 Target Achievement Calculation Method

A3.1 Data Collection

A3.1.1 Data is collected either from tower counts or on transects; the method used is dependent on the species and the site, and detailed in **Section 5** of the HCMP (Issue 16; AEC 2013).

A3.1.2 The area of the site used in calculations includes not only the surface area of the fishponds, but also the intervening bunds, which are considered integral to the ecological function of the wetland, and are the primary habitat for many of the species recorded. The areas used for calculation are provided in **Section 3.1** and **Table 2** of the HCMP (Issue 16; AEC 2013).

A3.2 Abundance at LMC, MPST and ST

A3.2.1 The weekly value for Lok Ma Chau is calculated as follows:

$$Ab_{LMC} = MeanTC + Trans$$

where Ab_{LMC} = Weekly Abundance at LMC, MeanTC = Mean Tower Count, and Trans = Site transect total

A3.2.2 The weekly abundance for Mai Po San Tsuen (Ab_{MPST}) and San Tin (Ab_{ST}) is the total number of individuals recorded on the weekly site transect.

A3.3 Density at LMC, MPST and ST

A3.3.1 The density is the abundance divided by the area of the site. Hence,

$$D_{LMC} = \frac{Ab_{LMC}}{Area} \qquad D_{MPST} = \frac{Ab_{MPST}}{Area} \qquad D_{ST} = \frac{Ab_{ST}}{Area}$$

A3.3.2 For the overall Control Area density, the **abundances** at MPST and at ST are added and this is divided by the **total area**. This is not the same as the average of the densities at each control area, and takes into account the fact that ST is a larger site than MPST.

$$D_{CA} = \frac{Ab_{MPST} + Ab_{ST}}{Area}$$

A3.4 Weekly Calculation of Achievement of Targets

A3.4.1 Achievement of targets is assessed by the ratio of the density at LMC to the density in the Control Areas. For bird species (except for the conservation targets, marked with an asterisk in **Table 2** of the HCMP (Issue 16; AEC 2013)), targets are achieved if this value is 2 or above.

$$\text{Target Ratio} = \frac{D_{LMC}}{D_{CA}}$$

A3.5 Annual Calculation of Targets

A3.5.1 A long-term running average is calculated for the mean density during the preceding year. Weekly densities are calculated as described above; the annual target level is calculated from the mean of these densities,

$$\text{Annual Target Ratio} = \frac{Target\ Ratio_{Wk\,1} + Target\ Ratio_{Wk\,2} + \cdots + Target\ Ratio_{Wk\,n}}{n}$$

A3.6 Conservation Targets

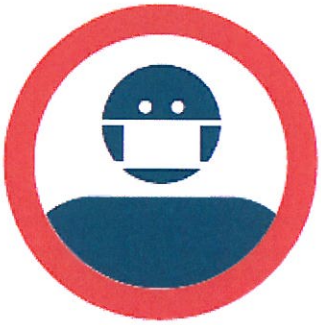
A3.6.1 Since these species were not impacted by the project, no numerical target will be set for these species. The numbers of each target record will be reported for management decision.

Wetland Avian Flu Warning
濕地禽流感警告

Level I : INCIDENT
一級戒備：個別事件級別

- Bird With H5N1 Encountered
  個別雀鳥受到 H5N1 感染
- No Entry Permitted without Authorization
  未有受權，不得內進

Avoid touching birds, bird nests, eggs, feathers and droppings
避免接觸雀鳥、鳥巢、鳥蛋、羽毛及雀鳥糞便



Wear protective gears, if necessary
如有須要，載上保護裝備

Wash hands before leaving
離開前洗手

Sign in and out on logbook
進入或離開前簽寫日誌

MTR

Dec 2013

Wetland Avian Flu Warning
濕地禽流感警告

Level II : OUTBREAK
二級戒備 : 爆發級別

- Several Cases of Birds with H5N1 Encountered
  多隻雀鳥受 H5N1 感染
- Keep Away From Wetland
  遠離濕地
- No Works Allowed
  不得內進工作
- No Entry Permitted without Authorization
  未有受權，不得內進

MTR

Dec 2013

Wetland Avian Flu Warning
濕地禽流感警告

Level III : EPIDEMIC
三級戒備：疫症級別

- Large Scale Die-off of Birds with H5N1
  大規模雀鳥受到 H5N1 感染
- Keep Away From Wetland
  遠離濕地
- No Works Allowed
  不得內進工作
- No Entry Permitted
  不得內進

MTR

Dec 2013

Appendix 5. Proposed Methodology for Undertaking Small Mammal Live Trapping at LMC EEA

A5.1 Background

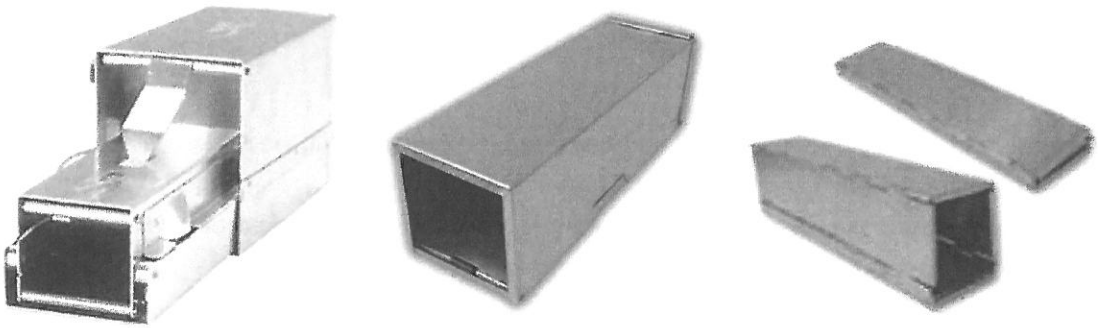
A5.3.1. Due to their size and behaviour, small mammals (less than 25cm in length) can be difficult to observe in the field and despite being photographed via the infra-red cameras on-site, identification can problematic.. As noted in Section 3.6.1.3 and Table 16 of the main report photographs of small mammals obtained between 2007 and 2008 were reviewed and eight species identified.

A5.3.2. In an attempt to provide a comprehensive understanding of the small mammal community within the EEA live trapping is proposed.

A5.2 Live trapping / Marking

A5.2.1. Live trapping of small mammals is favoured because it is an effective, efficient, and benign technique for detecting the presence and estimating the abundance of most small mammal species. Box traps (e.g. Longworth traps (Longworth Scientific Instrument Co., Ltd.) or Sherman traps (H.B. Sherman Traps, Tallahassee, Florida), see **Figure A1**) of at least two different sizes (e.g. Longworth trap 13.8cm x 6.4cm x 8.4cm, Sherman small non-folding trap 17.0cm x 5.4cm x 6.5cm or Sherman large folding trap 23.0cm x 7.7cm x 9.1cm) with appropriate bait provide an effective means for trapping small terrestrial mammals unharmed.

Figure A1. *Examples of traps used, from left to right, Longworth trap, Sherman non-folding trap and Sherman folding trap.*



Note: Traps are not shown to scale.

A5.3 Trap Location and Bait

A5.3.1. Six traps of mixed sizes are proposed to be laid along a transect (such as along the bund between Ponds 11/17 and along Streamcourse B) at. 20m intervals depending local conditions. Traps will be labeled for ease of reference. Traps should be place within 2m of suitable habitat features (for example under logs, at burrows, the bases of trees and runways). No traps should be set in exposed or open areas, partly because small mammals tend to avoid open habitats where they are exposed to predation and partly to reduce of heat-stress if an animal is trapped. All set traps should be covered with vegetation for insulation and camouflage.

A5.3.2. Traps should be baited with suitable food. A bait commonly used contains a mixture of peanut butter and bird seed (containing sunflower seeds or similar) but other baits can be used (such as peanut butter, sweet potato and chopped deep fried dough stick). Bait for each trap should be placed in a small piece of folded plain paper to improve efficiency of baiting and avoid fouling the trap mechanism. Trap locations should be marked/flagged by tying bright-coloured or fluorescent strings/small pieces of cloth to the substrate (e.g. branch) 1m above the trap. All markers used in the field should be removed at the end of the survey season.

A5.3.3. Food, water and bedding (such as grasses and other soft material obtained from the site) should be provided and traps checked regularly (see **Section A5.4** below) to ensure that the caught individual can survive during the interval between checks.

A5.3.4. Traps should be opened in a large transparent plastic bag to prevent any trapped animal from escaping. All trapped animals should be identified to species. All trapped animals should be marked by cutting a patch of fur near the base of the tail, weighed, photographed and released.

A5.4 Monitoring Frequency

A5.4.1. Traps should be set between June and September. Traps should be set for a minimum of three days in a row on a monthly basis. Traps should be checked at least every 12-hours (and more frequently if the weather is hot), and the traps must be checked before the day-time temperature rises in order to minimise stress to trapped animals.

A6 Other Ecological and Habitat Condition Monitoring

In the event where additional ecological and habitat condition monitoring is required, the monitoring methodologies should follow sections below. The following items are covered in this appendix:

- Dragonfly emergence at the EEA;
- Dragonflies at the CAs;
- Butterflies at the EEA and CAs;
- Herpetofauna at the CAs;
- Aquatic invertebrates at the EEA;
- Benthic invertebrates at the EEA;
- Pedology at the EEA;
- Water quality in the event of pollution or other conditions of concern

A6.1 Monitoring of Dragonfly Emergence at the EEA

A6.1.1 Exuviae emergence traps should be set up in Ponds 2, 7, 13, 14 and 17. Eight traps are to be used in each pond except for the small Pond 13 where four traps are to be used. The traps should be inspected twice per week between April and September and collect all exuviae for subsequent laboratory identification and counting. Habitat use and breeding activity shall be recorded, as well as evidence of breeding success in the form of final instar larval exuviae, which shall be collected and identified.

A6.1.2 The survey periods detailed above have been amended slightly following review of the pattern of dragonfly activity in the EEA during 2002-04 (AEC 2003, AEC 2004). Proposed trials with exuviae traps and screens were detailed in Issue 9 of the HCMP and the use of traps is now incorporated in the long-term monitoring methodology.

A6.2 Monitoring of Dragonfly Species at the CAs

A6.2.1 Dragonflies are surveyed during the period from March to November covering the main period of emergence and activity. Transect surveys are undertaken once per month during March and September to November and twice per month during the peak period of dragonfly emergence in April to August. Survey duration is approximately 6 hours, commencing at 08.00 hours.

A6.2.2 During the surveys a fixed survey route is followed. All dragonfly species observed are identified and all sexually mature male and ovipositing female individuals counted. Dragonfly exuviae are also recorded qualitatively. Habitat use and breeding activity is recorded, as well as evidence of breeding success in the form of final instar larval exuviae, which are collected and identified.

A6.3 Monitoring of Butterfly Species at the EEA and CAs

A6.3.1 All butterfly species at the EEA shall be identified and numbers are estimated quantitatively. Butterfly survey should be undertaken at the same time and frequency as dragonfly survey in the EEA and at the two Control Areas.

A6.4 Monitoring of Herpetofauna Species at the CAs

A6.4.1 Herpetofauna surveys focus on breeding amphibians and the reptile community. Two half day day-time surveys (primarily aimed at detecting reptiles are to be conducted each month during April to November. Surveys will take place during 10.00 – 14.00 hours, the peak period of reptile activity. Two half day night-time surveys (primarily aimed at detecting breeding amphibians) are to be conducted each month during the period from March to August. Night time surveys are undertaken during 18.00 to 22.00 hours and focus on the detection of vocalising amphibians. During the surveys a fixed survey route is walked. All reptiles and amphibians observed or heard are identified, and their abundance estimated. Habitat use and breeding activity are recorded.

A6.5 Monitoring of Aquatic Invertebrates

A6.5.1 Sweep-netting is used to sample aquatic species in the water column and clinging to vegetation at the water-bund interface. The sweep-net is a D-shaped net of 30 cm diameter with a 1 mm mesh. Each sample comprises two 2-metre sweeps of the net from which all captured specimens are removed. The first sweep is carried out at the water surface and the second as close to the pond bed as possible. Each set of sweeps is taken along the water-bund interface. Five randomly located replicate samples are taken from each pond.

A6.5.2 The number of each macro-invertebrate species is ascertained for each replicate sample for all taxa groups. A total dry weight biomass is determined for each of the above groups.

A6.5.3 The number and species of any fish captured incidentally during the sampling are also recorded.

A6.5.4 Review of invertebrate sampling data collected since 2002 demonstrates that invertebrate diversity in stocked fishponds is relatively low but this does not adversely affect their function in providing habitat and food for birds. Accordingly, more invertebrate sampling should be conducted in the marsh and reedbed areas (where there is less baseline data and where higher diversity can be predicted). Aquatic invertebrates should be monitored as required in the pond in question. However, should monitoring data from one year is required, monitoring should be undertaken once per year at the end of the wet season (August/September) at each fish pond in the EEA and twice per year at the end of the wet season and the end of the dry season (March/April) in marsh and reedbed areas.

A6.6 Monitoring of Benthic Invertebrates

A6.6.1 Cylindrical benthic cores 10 cm in diameter and 10 cm depth are taken from the substrate at the

base of the ponds to obtain quantitative data on benthic invertebrate populations. Five randomly located replicate cores are collected from each pond shallows. Core contents are bagged and stored in a cooler for subsequent sorting. Samples are analysed as for sweep netting.

A6.6.2 Review of invertebrate sampling data collected since 2002 demonstrates that invertebrate diversity in stocked fishponds is relatively low but this does not adversely affect their function in providing habitat and food for birds. Accordingly, more invertebrate sampling should be conducted in the marsh and reedbed areas in Compartment C (where there is less baseline data and where higher diversity can be predicted). Aquatic invertebrates will be sampled in each pond once per year at the end of the wet season (August/September) and twice per year (at the end of the wet season and the end of the dry season (March/April) in marsh and reedbed areas. Benthic invertebrates should be monitored as required in the pond in question. However, should monitoring data from one year is required, monitoring should be monitored once per year at the end of the wet season (August/September) in each fish pond in the EEA and twice per year at the end of the wet season and the end of the dry season (March/April) in marsh and reedbed areas.

A6.7 Pedology Monitoring

A6.7.1 If instructed, pond sediment will be monitored in each pond yearly in the early wet season. At least three sediment samples shall be collected from each pond and sent to a HOKLAS accredited laboratory for analysis. The following parameters shall be monitored:

- Volatile solids (per cent organic matter content)
- Oxidation/Reduction (Redox) potential (mV)
- pH
- Total nitrogen (mg N/kg)
- Total organic carbon (mg/kg)
- Total phosphorus (mg/kg)
- Total reactive phosphorus (mg/kg)

A6.8 Laboratory Water Quality Monitoring of Fishponds

A6.8.1 In the event of specific event/circumstance where detailed analysis of water quality is required, three samples from the pond(s) in question are to be collected and sent to a HOKLAS accredited laboratory for analysis. However, in the event that one year of monitoring is required, one water sample from each pond being managed as a stocked pond to be taken every six months (end of the wet season and end of the dry season). The following parameters shall be monitored:

- Ammoniacal nitrogen (mg/L)
- Biochemical oxygen demand (mg O 2 /L)
- Total oxidized nitrogen (mg/L)

- Total phosphorus (mg/L)
- Total reactive phosphorus (orthophosphate) (mg/L)
- Turbidity (mg/L)

A6.8.2 If pollution of the water supply is suspected in any fish ponds, reedbeds or marshlands in the EEA, and if instructed by the Representative form MTRC, additional water sample will be taken and sent to a HOKLAS accredited laboratory for analysis which shall include monitoring the water quality parameters listed in Section A6.8.1 and also the parameters additional to those checked during routine monitoring, such as:

- % Volatile Solids (%)
- Ammonia-N (mg/L)
- Biochemical Oxygen Demand (mg O2/L)
- Chemical Oxygen Demand (mg O2/L)
- Flouride (mg/L)
- MBAS (mg/L)
- Hydrogen Sulphide (mg/L)
- Oil and Grease (mg/L)
- Sulphide (mg/L)
- TOC (mg/L)
- Total Aluminum (ug/L)
- Total Antimony (ug/L)
- Total Arsenic (ug/L)
- Total Barium (ug/L)
- Total Beryllium (ug/L)
- Total Boron (ug/L)
- Total Cadmium (ug/L)
- Total Chromium (ug/L)
- Total Copper (ug/L)
- Total Cyanide (ug/L)
- Total Iron (ug/L)
- Total Lead (ug/L)
- Total Manganese (ug/L)
- Total Mercury (ug/L)
- Total Molybdenum (ug/L)
- Total Nickel (ug/L)
- Total Oxidized Nitrogen (mg/L)
- Total Phosphorus (mg/L)
- Total Reactive Phosphorus (mg/L)
- Total Silver (ug/L)
- Total Solids (mg/L)
- Total Suspended Solids (mg/L)
- Total Thallium (ug/L)
- Total Vanadium (ug/L)
- Total Zinc (ug/L)

Appendix 7 Event and Action Plan for Ecological Issues at LMC EEA

Ecological attribute	Action Level	Limit Level	Action Plan / Contingency Plan (where appropriate)
Habitats			
Proportion of EEA consisting of wetland habitats	< 90% with surface water, hydric soils and vegetation dominated by obligate or facultative wetland plants	< 75% with surface water, hydric soils and vegetation dominated by obligate or facultative wetland plants	Adjust water management to increase wetland area / regrade to enlarge ponds area
Proportion of ponds under an active drain-down regime in Compartments A & B	< 70% of ponds under an active drain-down regime with conditions suitable for fish stocking	< 50% of ponds under an active drain-down regime with conditions suitable for fish stocking	Bring ponds into active management regime by manipulation of water levels and water quality and fish stocking
Proportion of shallow water in ponds in Compartments A & B	< 20% of the fishpond area (excluding bunds) consists of water < 50 cm depth	< 10% of the fishpond area (excluding bunds) consists consists of water < 50 cm depth	Lower water levels in short term / regrade bunds in long term
Vegetation cover			
Percentage of bunds with vegetation cover	< 20% of internal bunds with vegetation cover	< 10% of internal bunds with vegetation cover	Planting or hydro-seeding
	>30% of internal bunds with vegetation cover > 10 cm height	>50% of internal bunds with vegetation cover > 10 cm height	Cutting
Percentage of pond sides with vegetation cover in Compartments A & B	< 20% of pond sides with vegetation cover	< 10% of pond sides with vegetation cover	Planting or hydro-seeding
	> 40% of pond sides with vegetation cover	> 50% of pond sides with vegetation cover	Cutting or stocking with herbivorous fish
Percentage of ponds with vegetation cover in Compartments A & B	< 10% of pond area with vegetation cover	< 5% of pond area with vegetation cover	Planting or hydro-seeding
	> 20% of pond area with vegetation cover	> 30% of pond area with vegetation cover	Cutting or stocking with herbivorous fish
Percentage of undesirable / exotic plant species	> 10% of vegetation in ponds / on pond sides or on bunds	> 20% of vegetation in ponds / on pond sides or on bunds	Cutting or stocking with herbivorous fish
Plant community composition & structure			
Proportion of wetland plants in Compartment C	< 80% of vegetation facultative or obligate wetland plants	< 60% of vegetation facultative or obligate wetland plants	Amend vegetation management regime / Planting
Numbers of Target Bird Species			
Numbers of target bird species	Performance target for any species not met for	Performance target for any species not met in	Review adaptive management regime /

Ecological attribute	Action Level	Limit Level	Action Plan / Contingency Plan (where appropriate)
	any three consecutive months	any twelve month period	accelerate attraction measures e.g. stocking / drain-down
Abundance / diversity of invertebrate			
Species richness and diversity of aquatic invertebrates	Numbers or diversity < 75% sample in previous comparable season in any pond / marsh / reedbed area	Numbers or diversity < 50% sample in previous comparable season in any pond / marsh / reedbed area	Adjust water quality / vegetation cover / adjust drain-down regime
Species richness and diversity of benthic invertebrates	Numbers or diversity < 75% sample in previous comparable season in any pond / marsh / reedbed area	Numbers or diversity < 50% sample in previous comparable season in any pond / marsh / reedbed area	Adjust water quality / adjust drain-down regime
Fauna and flora			
Species richness and diversity of dragonflies	Numbers or diversity < 75% of previous wet season	Numbers or diversity < 50% of previous wet season	Adjust water and vegetation management regime / use experience to adjust EEA design
Species richness and diversity of reptiles and amphibians	Numbers or diversity < 75% of previous wet season	Numbers or diversity < 50% of previous wet season	Adjust water and vegetation management regime / use experience to adjust EEA design
Hydrology			
Per cent surface water	Surface water is present over <90% of the pond area except during programmed drain-down periods	Surface water is present over <75% of the pond area except during programmed drain-down periods	Pumping to redistribute water
Wet and dry season surface water level for Ponds	Water level in pond between 70 cm and 20 cm < lowest point on bund	Water level in pond between 40 cm and 10 cm < lowest point on bund	Pumping to redistribute water
Dry season water capacity	Water capacity < 40%	Water capacity < 30%	Conserve water; no discharge off-site until water capacity reaches above Action Level.
Water Management			
Mean salinity	Salinity > 1 pp thousand	Salinity > 3 pp thousand	Water mixing / drain and refill; review causes of problem, prepare and implement contingency plan if problem persists

Ecological attribute	Action Level	Limit Level	Action Plan / Contingency Plan (where appropriate)
Mean pH – Compartments A and B	pH outside range 6.0 – 8.5	pH outside range 5.5 – 9.0	Lime/ add peanut residue / mix water / drain and lime
Mean pH – Compartment C	pH outside range 3.5 – 6.5	pH outside range 3.0 – 7.0	Lime/ add peanut residue / mix water / drain and lime
Mean dissolved oxygen	Dissolved oxygen < 1.0 mg/l	Dissolved oxygen < 0.5 mg/l	Amend fertilisation and stocking regime / pump & mix water / aeration
Mean ammonia concentration	< 0.1 mg/l	< 0.3 mg/l	Avoid fish stocking until restored, water mixing
Mean total oxidised nitrogen concentration	< 0.1 mg/l	< 0.3 mg/l	Avoid fish stocking until restored, water mixing, water changing
Mean total phosphorus concentration.	< 0.5 mg/l	< 1.0 mg/l	Avoid fish stocking until restored, water mixing, water changing
Mean orthophosphate concentration	< 0.01mg/l	< 0.03 mg/l	Avoid fish stocking until restored, water mixing, water changing

redundant due to the growth of trees and shrubs which shade out Mikania (e.g around Pond 2) or the frequent cutting of grass on pond bunds, the establishment of the new site boundary fence will very likely be covered by climbers such as Mikania if not controlled. Accordingly, the need for weeding in Compartments A and B should be retained.

5.4.4.5 Within Compartment C, wet season weeding is routinely neglected as a management activity. This is primarily because it is not prioritised by the wetland contractor (presumably because it is very time consuming) and to a lesser degree because there is a conflict between the disturbance generated by wet season weeding and breeding/summering waterbirds (particularly Greater Painted-snipe and Pheasant-tailed Jacana), which at times requires that the contractor is directed to cease wet season weeding in certain ponds. However, in extreme years (e.g. 2012) no wet season weeding is undertaken, even in those ponds for which an instruction to cease weeding has *not* been instructed, primarily due to the contractor providing insufficient resources to address this management requirement.

5.4.4.6 In light of the potential conflict with breeding waterbirds, it is proposed that wet season weeding be dropped and replaced with the mechanical weeding (using a mini-backhoe or similar) of areas of unwanted vegetation at the end of the dry season (such as March, when water levels are lowest (*Section 5.2.3*)), with the exception of *Typha angustifolia*, which should be removed on a routine basis.

5.4.4.7 The ultimate purpose of site management is to provide suitable habitats for the target species (***Table 29***). The habitat target conditions outlined in **Section 2.1.3** should be reviewed .

5.4.4.8 However, habitats within the EEA have matured and a review is required for items not fully addressed in the HCMP. These are discussed in **Sections 5.4.5 - 5.4.4**, while a revised proposed habitat condition target for each compartment is summarized in **Section 5.4.7**.

5.4.5 **Re-locate the reedbed from Pond 22 to Pond 14**

5.4.5.1 Reasons for proposing to relocate the reedbed from Pond 22 to Pond 14 are two-fold: to reduce the chance of pest infestation in the reedbed in Pond 22 from the Clean-up Reedbed, and to increase the area of lily with the aim of providing more habitat for certain target species but especially Pheasant-tailed Jacana (see ***Section 3.3.14*** above).

5.4.5.2 As noted in ***Section 3.3.22***, the number of Pallas's Grasshopper Warbler, a largely reedbed species, dropped in years where the reeds in Pond 22 were cut to remove the beetle *Dimorphopterus spinolae*, which results in a massive die-off of reeds when present in high numbers. Pond 22 is adjacent to the Clean-up Reedbed (minimum distance 30m), which is where the beetle was first noted on site in 2009. The beetle can burrow into the soil and re-emerge in subsequent years making it difficult to remove completely and recolonisation from the Clean-up Reedbed likely to occur on a regular basis. To avoid this, it is proposed to move the location of the reedbed to Pond 14, which is currently supporting a large and extensive area of healthy reeds (see also ***Section 5.7.4*** on detailed discussion of *D. spinolae*) and convert Pond 22 to lily ponds.

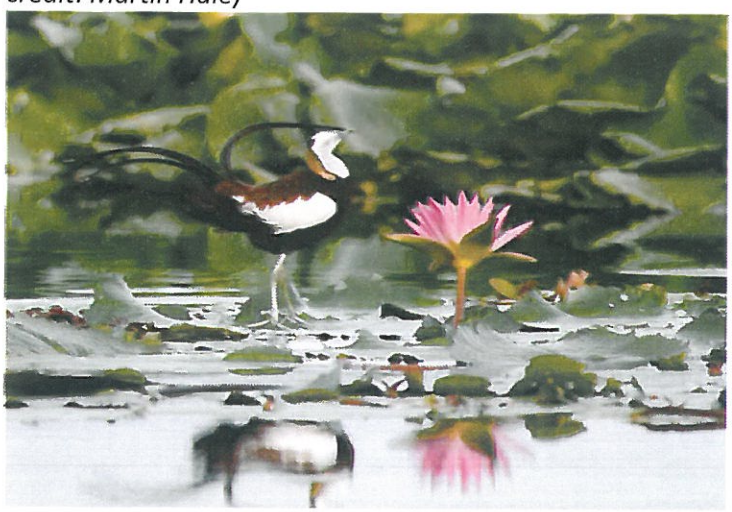
Plate 20 Reed beetle (*Dimorphopterus spinolae*) taken from Pond 22 (24th June 2011).

Plate 21 Infested reeds at Pond 22 (photo taken on 24th June 2011).

5.4.5.3 In recent years numerous, Pheasant-tailed Jacanas including long-staying individuals,, have been recorded in the winter and spring (including birds in breeding plumage ***Plate 22***). As discussed in ***Section 3.3.14***, in order to encourage this species to breed within the EEA, it is recommended to increase the area of lilies (*Nymphaea*). Currently, Pond 15 and about one-third of Pond 21 is planted with lilies. In order to create an area with the least disturbance for the species, it is proposed to turn Ponds 20, 21 and 22 into lily ponds, with their internal bunds narrowed and lowered such that these are submerged in the summer to form one large pond.

5.4.5.4 There is currently an access gate from the Clean-up Reedbed and the bund between Ponds 20 and 21. Given that this bund would be removed and that access at this location would become undesirable should Ponds 20, 21 and 22 be converted to one large lily pond, this gate should be removed and access to Compartment C should be from the gate at Pond 18 that connects to the station site.

Plate 22 *Pheasant-tailed Jacana in full breeding plumage (photo taken in 2011 at Pond 15; credit: Martin Hale)*



5.4.5.5 The proposed relocation of the reedbed from Pond 22 to Pond 14, may require a Variation to the EP (VEP) as the location of the reedbed to be provided on-site is marked in Figure 3 of the current EP (attached here as ***Appendix 1***). ***Table 33*** and ***Table 34*** list the advantages and disadvantages of two options: keeping the current reedbed location at Pond 22, and relocating the current reedbed to Pond 14.

Table 33 Pros and Cons of Keeping the Current Reedbed Location

Pros	Cons
Keeping the Current Locations (Reedbed at Pond 22; Marsh at Pond 14)	
1. **No VEP** is required.	1. **Issue with Reedbed Beetle *Dimorphopterus spinolae:*** On-going infestation from the Clean-up Reedbed highly likely
2. **Saves costs in re-profiling marsh ponds** including the reedbed.	**2. Impact on Reedbed species:** As noted ***in Sections 3.3.20*** and ***3.3.22***of the Draft Management Review Report, numbers of reedbed species (particularly Pallas's Grasshopper Warbler *Locustella certhiola*, which is one of the bird target species) are noted to have dropped significantly at years when the reeds at Pond 22 were cut in the summer to manage numbers of the reed pest.
	3. Need to Rectify Pond 14: According to the current EP (Figure 4), Pond 14 is a marsh habitat. The pond was reprofiled and planted with marsh vegetation as an element of the original design, and reeds were planted in subsequent year for habitat diversification. The combination of soil compaction which has reduced levels within the pond and lack of a uPVC pipe system in Pond 14 results in operational water depths which are too deep for marsh vegetation reeds have colonized most of the pond. Should the relocation of reedbed within the site be not feasible, then measures to return Pond 14 to marsh are required.. This would involve importing topsoil (preferably free from reeds and other unwanted species) to raise the level and re-profile the pond, provision of some uPVC pipes for water circulation, provision of a system of pipes to facilitate transfer of water from other ponds to/from this pond, and replanting of the entire pond with suitable plant species.

Table 34 Pros and Cons of Relocating the Current Reedbed to Pond 14

Pros	Cons
Relocating the Reedbed to Pond 14 and the Marsh to Pond 22	
1. **Issue with Reedbed Pest *Dimorphopterus spinolae:*** This pest species is noted to have a limited dispersal ability (<50m; Chan *et al.* 2008) and Pond 14 is located far from the Clean-up Reedbed (over 300m). This pond was not affected at times when Pond 22 was, and remained healthy.	1. **VEP is required**.
2. **No requirement to convert Pond 14 back to a marsh:** This would have two major advantages: (1) cost-saving, and (2) provides a healthy reedbed.	

Pros	Cons
Relocating the Reedbed to Pond 14 and the Marsh to Pond 22	
3. **Opportunity to Enhance the marsh area for other target species:** As noted in Section 3.8.3 of the draft Management Review Report, there is much merit ecologically to provide larger area of lily *Nymphaea* for a number of target species in particular Pheasant-tailed Jacana, a species that once bred in Hong Kong has become regular on-site since habitat modification but appears to be deterred from breeding on-site due to the relatively small area of *Nymphaea* present. Furthermore, the control of Apple Snails requires the drain-down of marsh and lily ponds on a near annual basis which can negatively affect the numbers of target species which preferentially use lily ponds.	

5.4.5.6 In view of the anticipated requirement to apply for a VEP, this issue was discussed in some length at the 24th EC Meeting. The EC Members welcomed the proposal in view of the potential ecological benefit of moving the reedbed and the creation of a larger area of lily pond which would be especially beneficial for Pheasant-tailed Jacana; and were supportive to the proposed change, irrespective of the need to apply for a VEP.

5.4.6 Habitat area to be provided after the proposed changes

5.4.6.1 The areas to be provided following implementation of the changes proposed above are detailed in ***Table*** 35. Given that Pond 22 is currently only 0.6 ha in size, part of the reedbed area is provided in Pond 14 to comply with the EP requirement, while Pond 14 is approx. 0.7 ha. The EP requirement is met under both the current and proposed changes to the reedbed location.

Table 35 Proposed Habitat Areas in Comparison with the Habitat Requirement under Current EP

	EP Requirement	After Adopting Proposed Changes
Fishpond	26.2	26.2
Marshland	5.1*	5.1
Reedbed	0.7	0.7

* including 0.2 ha under Clause 2.8 and 4.9 ha under Clause 2.9

5.4.7 Proposed Revised Habitat Condition Target

5.4.7.1 While the three Management Compartments will be retained and managed broadly according to the intentions listed under **Section 2.1.2** above, the EEA has matured and some further refinement of the habitat conditions is required to better suit the revised target list and at the current condition of the site.

5.4.7.2 **Compartment A (Ponds 1-2)**: primary targets include Eurasian Otter, larger piscivorous birds (but excluding Black-faced Spoonbill), starling species and Chinese Soft-shelled Turtle. Hence, the habitat condition and management actions should be implemented: