KOWLOON–CANTON RAILWAY CORPORATION
EAST RAIL EXTENSIONS

CONTRACT NO. EGSA-023
ENVIRONMENTAL SUPPORT SERVICES

LOK MA CHAU STATION
HABITAT CREATION AND MANAGEMENT PLAN

Issue 7

Report Authorized For Issue By:	For and on Behalf of Black & Veatch Hong Kong Limited

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February 2003

DOCUMENT CONTROL			**EGSA-023 Environmental Support Services**	
AMENDMENT RECORD				Prepared by: **BVHKL**
Habitat Creation and Management Plan for Lok Ma Chau Station			Client: KCRC – East Rail Extensions	Initial: **WYC**
				Date: **February 2003**
Pages	Date	Issue No	Description	Initials
Appendix 2.1	20/11/2000	2	Water budget updated for marsh area	LS
All	18/09/2001	3		
30-34	12/11/2001	4	Description of water contents modified	LS
Figs. 4.1 & A3.3	12/11/2001	4	Figures showing fish pond layout without jetties	LS
Table 2.1	23/11/2001	4	Definition of target values	LS
All text & App 3.7	27/12/2001	5	Changes based on comments (Spur Line report)	LS
All	19/08/2002	6	Re-written to reflect up to date situation. Only 3 appendices are in the document. Issue for approval.	WYC
All	12/02/2003	7	Amend to incorporate responses to comments on HCMP	WYC

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APPENDICES

1. INTRODUCTION

1.1 Background

1.1.1 On 6th April 2002 an Environmental Permit was issued for the Lok Ma Chau Spur Line under the terms of the Environmental Impact Assessment Ordinance, Cap. 499, Section 10(1). Condition 2.4 of the Environmental Permit stated that:

"No later than one month before commencement of construction of Lok Ma Chau Station of the project, the Permit Holder (Kowloon-Canton Railway Corporation (KCRC)) shall submit to the Director (of Environmental Protection) for approval the HCMP (Habitat Creation and Management Plan) for the "initial enhancement areas" and the "ecological compensation areas" as described in Conditions 3.22 and 3.23 below. The HCMP shall be prepared and finalized in accordance with the draft HCMP contained in Appendix A4.2 of the EIA Report. The HCMP shall provide the detailed specifications for the habitats and ecological functions to be provided at Lok Ma Chau and to define the long-term management and ecological monitoring and audit requirements on these habitats."

1.1.2 Black and Veatch Hong Kong Ltd. (BV) and Asia Ecological Consultants Ltd. (AEC) have been commissioned by the Kowloon-Canton Railway Company (KCRC) to prepare this HCMP. In accordance with Conditions 3.22 and 3.23 of the Environmental Permit the HCMP is prepared in two parts.

1.1.3 This document, Part A of the HCMP, covers the Initial Enhancement Areas (IEA) as defined in Condition 3.22 which states the following:

"Not less than 15 hectares of fishponds in Lok Ma Chau (hereinafter be referred to as "initial enhancement areas") as indicated in Figure 6 attached to this Permit shall be established as conforming to the criteria set out in the HCMP before the commencement of site formation works for the Lok Ma Chau station....These measures shall include, but not (be) limited to the following:-

(a) reprofiling of pond levels to create shallow feeding habitats;
(b) fish stocking; and
(c) management of water levels."

1.1.4 The accompanying document, Part B of the HCMP, covers the Ecological Compensation Areas (ECA) as defined in Condition 3.23 which states the following:

"Prior to the operation of the Lok Ma Chau station, the Permit Holder shall enhance and manage not less than 27.1 hectares of fishponds (hereinafter be referred to as "ecological compensation areas) as indicated in Figure 7 attached to this Permit. The ecological compensation areas shall be established as conforming to the criteria set out in the HCMP....These measures shall include, but not (be) limited to the following:-

(a) enlarging small fishponds to reduce enclosure effects;
(b) reprofiling of fishpond bunds to provide shallow sloping margins to increase feeding opportunities and the availability of fish and invertebrate prey to birds;
(c) establishment of marginal emergent vegetation; and
(d) manipulating fish stocking, feeding/fertilising regime and drain-down to optimise food availability for birds."

1.1.5 Note that all of the IEA lies within ECA.

1.2 Description of the Spur Line

1.2.1 The Spur Line is an extension to the northern end of the existing East Rail system. The major components of the project are:

- Lok Ma Chau Station: consisting of an island platform, two tracks and two concourse levels, one for arriving and one for departing passengers, KCRC public facilities, staff facilities, and plant and support facilities.
- Immigration and Customs Facilities for Lok Ma Chau Station.
- A two level footbridge linking Lok Ma Chau and Huanggang Stations.
- A permanent track of 7.4 km in total length between Lok Ma Chau and Sheung Shui Stations, in both tunnel and on viaduct, with short sections at grade and on open ramp.
- Environmental mitigation measures as documented in the EIA, including ecological mitigation (through habitat creation, restoration and enhancement) and landscaping works.
- Diversion of the Dongjiang Raw Water Mains near the existing Sheung Shui Station.

Figures 1.1a, 1.1b and 1.2 show the horizontal alignment of the track and the outline of the Lok Ma Chau Station complex together with the Study Area covered by the EIA and the boundary of the ECA. Figure 1.3 shows the proposed layout for the ECA and the boundary of the IEA which is the subject of Part A of the HCMP.

1.2.3 The construction of the Spur Line is programmed to start in September 2002 for completion in mid 2007.

1.3 Purpose of the Habitat Creation and Management Plan

1.3.1 Part A of the Habitat Creation and Management Plan (HCMP) provides the detailed specifications for the habitats and ecological functions to be provided by the IEA and defines the management and monitoring requirements for these habitats during the station and railway construction period. The recommendations and specifications given in this document and the accompanying appendices accord with those in the contract documentation and the Environmental Monitoring and Audit (EM&A) Manual. It also provides details of ecological monitoring to be undertaken in the larger area which will form the ECA during the construction period. Such ecological monitoring will, of necessity, be constrained by railway and station construction activities.

1.3.2 Thus Part A of the HCMP includes:

- a summary of the current condition of the IEA, including its current ecological characteristics and importance and physico-chemical conditions that may affect habitat restoration and enhancement measures;
- definition of the target species requiring mitigation in the IEA during the construction period and the target habitats to be created or enhanced for them;
- a summary of the specific habitat requirements and associated management measures required by target species;
- detailed design drawings and specifications for the habitats (e.g. vegetation composition and structure and water regimes) and associated structures (e.g. topography, water courses for water supply and drainage and water control structures), with underlying design calculations where appropriate;
- management prescriptions and required actions to maintain the long-term ecological value and functions of the mitigation areas;

- a detailed monitoring programme for habitat attributes and target species; and

- an implementation programme for the HCMP during the construction period.

1.4 Description of the IEA

IEA Location and Boundaries

1.4.1 The IEA comprises the area of fishponds indicated in Figure 1.3.

Ownership

1.4.2 The IEA is owned by Government, and occupied by KCRC under Licence. Previously, the entire area was owned by Government and was used for commercial fish farming activities.

Existing Habitats

1.4.3 The area is made up of fishponds, which were in commercial use until late 2000, together with fishpond bunds and drainage channels. The ponds themselves are largely unvegetated, whilst the bunds and channel sides are dominated by adventitious grass species. Some trees are present, notably *Melia azedarach*, *Macaranga tanarius*, *Ficus microcarpa*, *Hibiscus tiliaceus* and *Celtis tetranda* especially along the drainage channel which passes through the west of the site (Watercourse A in Figure 1.2). Shortly before the occupiers of the land were cleared by Government more extensive planting of fruit trees and herbaceous plants was undertaken on some bunds. Most of this planting failed but several bunds are now dominated by stands of the perennial herb *Canna indica* which were planted at this time.

Recent land use changes and habitat management

1.4.4 Commercial fish farming activities ceased at the end of 2000 when the occupiers were required to vacate the land. At this time most fish were removed from the ponds and, in association with fish removal, some ponds were partially drained. Subsequently, during 2001, the partially drained ponds received some recharge from rainwater. In addition, several ponds became more acidic and vegetation (largely grasses) grew up on the pond bunds.

1.4.5 Commencing in October 2001 initial management activities were undertaken in the IEA by KCRC with the following objectives:

- To demonstrate the pattern of response to drain-down of ponds by waterbirds, in particular those species of Conservation Importance which were identified in the EIA as key species, the needs of which require to be accommodated in the habitat management measures detailed in this HCMP;
- To compare utilisation of the proposed Lok Ma Chau mitigation area by species of Conservation Importance and other avifauna with utilisation of other similar areas of habitat;
- To enhance experience in practical fishpond management techniques. The latter included the restoration of degraded ponds by re-establishment of appropriate water conditions (including pH, dissolved oxygen and salinity), as well as techniques of water management designed to minimise losses to the system.
- To examine the most appropriate forms of drain-down regime to create suitable feeding conditions for the key target species.

1.4.6 These management activities were reported in BV (2002a), and continued until April 2002.

Adjoining land use

1.4.7 The IEA is bounded by the Lok Ma Chau Station site and the remainder of the area which will form the ECA) to the east and by active commercial fishponds to the south and southwest. In the north it adjoins a single row of former fishponds which were reinstated following channelisation works on the Shenzhen River and which are now subject of wetland restoration trials being undertaken by Agriculture, Fisheries and Conservation Department.

Topography and Watercourses

1.4.8 A detailed site topographical survey was carried out for the preparation of this HCMP. Spot height measurements and extrapolated contours that were measured indicate that the average base levels of the existing fishponds are typically 0.5 – 1.0 mPD, whilst bund heights vary between 3.0 – 4.0 mPD. Water depths were measured as a part of the management and monitoring measures undertaken during winter 2001-2002. Except where ponds were drained-down as a part of the management activities, lowest levels were reached in early May. Most ponds, when full, had water depths of approximately 1.5 m; the deepest was 2.0 m (Table 1.1).

Table 1.1
Water depths (when full) of fishponds in the IEA February – July 2002
(Source: AEC unpub. data)

Pond No.	Max. depth (m)	Date	Min. depth (m)	Date
1	1.74	5 April	0.30*	4 February
2	1.68*	15 March	0.00* **	2 April
3a	2.03	27 June	1.79	9 May
3b	n.a.	-	n.a.	-
4	0.67	12 June - 25 July	0.37	9th & 14 May
5	(no standing water)	-	-	-
6a / 6b	1.48	15 March	1.29	9 May
7	1.35	27 February	0.38*	3 May
8a	1.44	12 June	1.18	9 May
8b	1.29	12 June	1.01	9 May

* Following drain-down.
** Marker not placed in the shallowest part of the pond; true depth c. 0.4 m greater.

1.4.9 A watercourse flows through the site and discharges to the Shenzhen River (see Figure 1.2). This watercourse is tidal and flows into the Shenzhen River via an open outfall. The watercourse is maintained by Drainage Services Department and has an invert level of about 0.0 – 0.5 mPD. There are no water control structures on this watercourse within the vicinity of the mitigation area.

1.4.10 The watercourse currently has a large catchment in part draining the San Tin area. No data are available on flow rates or water levels in the watercourse. However, recent observations have shown that the watercourse to the south of the site does run full, and overtopped the bank into the channel in June 2001. This situation should ease with the construction of the San Tin Eastern Main Drainage Channel (San Tin EMDC). In the wet season/normal flow periods, observations suggest that the watercourse level is of the order of +1 to 1.5mPD. This may change after construction of the San Tin EMDC.

1.4.11 Sluices which formerly interconnected some ponds or connected some ponds with the watercourses were mostly in disrepair when KCRC took control of the site. All these sluices were blocked with soil in order to retain water in the ponds as an interim measure prior to the long term water management system being installed.

Soils

1.4.12 The following account of the soils of the study area is based on Grant (1960, 1986). The soils around the fishponds of Lok Ma Chau are predominantly from the Mai Po Association. These soils are mainly found around the Mai Po, San Tin and Sheung Shui areas. They are similar to the soils of the Chik Nai Ping Association; these are soils derived from Tai Mo Shan porphyry material and imperfectly drained. Soils of the Mai Po Association tend to be sandier than the Chik Ni Ping, particularly at the base of the soil profile. Mai Po Association soils are formed over alluvial and colluvial material from rocks of the Lok Ma Chau formation and metamorphosed Pat Sin rock as well as Tai Mo Shan porphyry.

1.4.12 In the fishpond area the soils are Mai Po Poorly Drained, Mai Po Very Poorly Drained and Mai Po Saline, in addition to a large amount of undifferentiated alluvium. The soils tend to exhibit strong sharp horizon changes likely to be associated with the level of the water table. It has been noted that the pH of the soils decreases with depth to as low as 2.6. The soil tends to be clayey at the surface and become coarser in texture with depth.

1.4.13 The soils are acid sulphates due to the sulphate of the sea water which is broken down to sulphur which combines with iron, which was commonly deposited in sediments in the Deep Bay area, to form iron sulphides. Percentages of sulphur can be up to 3% of the total dry matter.

1.5 Existing Ecological Interest

Habitat Evaluation

1.5.1 The ecological value of the current habitats was detailed in the *EIA Final Report* (BV 2001a). This Report described baseline studies conducted during May 2000 to May 2001 which reviewed habitat changes and described the status of the following taxa groups: plants, mammals, birds, reptiles, amphibians, dragonflies and butterflies. In addition to general surveys, detailed studies were conducted into the occurrence of Greater Spotted Eagles *Aquila clanga* and Imperial Eagles *Aquila heliaca* and the use of fishponds by Black-faced Spoonbills *Platalea minor*. Subsequent to the completion of the EIA Report a study of the distribution of Eurasian Otter *Lutra lutra* was conducted during October 2001 to April 2002 (BV 2002b).

1.5.2 At the time of the surveys undertaken by ERM (ERM 1999), the majority of the area consisted of active fishponds. Subsequently, at the time of the baseline studies, they were inactive, whilst, as noted above during winter 2001-02 they received initial habitat management measures, primarily to enhance their attractiveness to target species of large waterbirds.

1.5.3 As was detailed in BV (2002a), these recent changes in management status have had a significant effect on the number of large waterbirds present in the IEA area. However, these recent changes in status do not alter fundamentally the evaluation of their potential as wildlife habitats. Thus, as is indicated in Table 1.2, both the active and inactive fish ponds within the Lok Ma Chau and nearby San Tin areas are considered to be of moderate to high ecological value.

Table 1.2
Ecological evaluation of fishponds within 500 m of the Spur Line and Station area at San Tin and Lok Ma Chau (Source: BV 2001a)

	Active fishponds		Inactive fishponds	
Criteria	**San Tin**	**Lok Ma Chau**	**San Tin**	**Lok Ma Chau**
Naturalness	Man-made habitat, currently subject to limited human disturbance.	Man-made habitat, currently subject to limited human disturbance.	Man-made habitat, currently subject to limited human disturbance.	Man-made habitat, currently subject to limited human disturbance.
Size	Small.	Small.	Small.	Small.
Diversity	Low habitat diversity but high in terms of wildlife recorded.	Low habitat diversity but high in terms of wildlife recorded.	Low habitat diversity but high in terms of wildlife recorded.	Low habitat diversity but high in terms of wildlife recorded.
Rarity	The habitat is not rare but some of the species supported are rare locally or globally, notably some avifauna.	The habitat is not rare but some of the species supported are rare locally or globally, notably some avifauna.	The habitat is not rare but some of the species supported are rare locally or globally, notably some avifauna.	The habitat is not rare but some of the species supported are rare locally or globally, notably some avifauna.
Re-creatability	Readily-re-creatable.	Readily-re-creatable.	Readily-re-creatable.	Readily-re-creatable.
Fragmentation	Heavily fragmented.	Slightly fragmented.	Heavily fragmented.	Slightly fragmented.
Ecological Linkage	Part of the wider fishpond habitat of the Deep Bay area and serves similar function to those located at Mai Po Nature Reserve.	Part of the wider fishpond habitat of the Deep Bay area and serves similar function to those located at Mai Po Nature Reserve.	Part of the wider fishpond habitat of the Deep Bay area and serves similar function to those located at Mai Po Nature Reserve.	Part of the wider fishpond habitat of the Deep Bay area and serves similar function to those located at Mai Po Nature Reserve.

	Active fishponds		Inactive fishponds	
Criteria	**San Tin**	**Lok Ma Chau**	**San Tin**	**Lok Ma Chau**
Potential Value	High ecological potential if managed properly to enhance wildlife use.	High ecological potential if managed properly to enhance wildlife use.	High ecological potential if managed properly to enhance wildlife use.	High ecological potential if managed properly to enhance wildlife use.
Nursery/ breeding ground	Part of the wider Deep Bay fishponds habitats that provide an important breeding/nursery ground for the prey of birds and other animals, notably tilipia and chironomids	Part of the wider Deep Bay fishponds habitats that provide an important breeding/nursery ground for the prey of birds and other animals, notably tilipia and chironomids.	Part of the wider Deep Bay fishponds habitats that provide an important breeding/nursery ground for the prey of birds and other animals, notably tilipia and chironomids.	Part of the wider Deep Bay fishponds habitats that provide an important breeding/nursery ground for the prey of bird and other animals, notably tilipia and chironomids.
Age	No information is available.	No information is available.	No information is available.	No information is available.
Abundance/ Richness of Wildlife	High.	High.	High.	High.
Conclusion	**High Ecological Value**	**High Ecological Value**	**Moderate to High Ecological Value**	**Moderate to High Ecological Value**

1.5.4 The only other habitat present is a watercourse with associated riparian vegetation which includes dense grassland and both native and exotic tree species. The value of the watercourse itself is reduced because it is highly polluted. However, evidence from elsewhere in the Lok Ma Chau area suggests that watercourses may form important corridors for the movement of Eurasian Otters (BV 2002b). In addition, tree species along the watercourse may provide roosting and hunting perches for birds (notably ardeids and raptors) whilst fruiting trees provide a winter food source for birds.

1.5.5 Existing vegetation was studied during June 2000 (wet season) and March 2001 (dry season) (BV 2001a). The vegetation is highly modified as a consequence of commercial fish farming and other agricultural activities and primarily comprises rank grassland along bunds, together with remnant patches of crops and ornamental herbs, especially *Canna indica*. Planted or naturally dispersed trees are found on some bunds; these are largely the widely planted native *Hibiscus tiliaceus* and the naturalised exotic *Melia azedarach*, with smaller numbers of the native (but planted) *Ficus microcarpa* and the native, probably naturally established, *Celtis*

tetranda. Some planted fruit trees are also present. Some semi-natural vegetation occurs along the edges of ponds, especially where these are adjacent to drainage channels. However, no protected species or species considered to be rare by Corlett *et al.* (2000) were found.

Areas of Important Habitat

1.5.6 The majority of the IEA consists of fishponds, which are all of high ecological value. These artificial habitats are however readily re-creatable and there is considerable scope for their ecological enhancement (see below).

Species of Conservation Importance

1.5.7 A list of Species of Conservation Importance that occur within the San Tin and Lok Ma Chau fishpond areas is provided in Table 1.3 below. This corresponds with the list of Species of Conservation Importance contained in the EIA Final Report (BV 2001a). The assessment of conservation importance is based on the recent review of the global list of bird species of conservation concern (BirdLife International 2000) and the recent review of terrestrial species of conservation importance in Hong Kong (Fellowes *et al.* 2002).

1.5.8 The Key Target Species for the ECA are those which are shown as being of regular occurrence in the Lik Ma Chau area.

Table 1.3
Species of Conservation Importance that occur within 500 m of the Spur Line and Station area at San Tin and Lok Ma Chau (Sources: BV 2001a, BV 2002a, BV 2002b). Species found to be of only irregular occurrence in the area during the 2000-2001 baseline study or during studies during winter 2001-2002 but recorded previously in the area and listed in BV (2001a) are shown in brackets.

Common name	Lok Ma Chau	San Tin
MAMMALS		
Regionally Important Species		
Eurasian Otter *Lutra lutra*	√	√
BIRDS		
Globally Threatened Species		
Black-faced Spoonbill *Platalea minor*	√	
Greater Spotted Eagle *Aquila clanga*	(√)	(√)
Imperial Eagle *Aquila heliaca*	√	(√)
Japanese Yellow Bunting *Emberiza sulphurata*	(√)	

Common name	Lok Ma Chau	San Tin
Regionally Important Species		
Black-winged Stilt *Himantopus himantopus*	√	√
Common Teal *Anas crecca*	√	√
Eurasian Coot *Fulica atra*	(√)	√
Great Cormorant *Phalacrocorax carbo*	√	√
Chinese Pond Heron *Ardeola bacchus*	√	√
Great Egret *Egretta alba*	√	√
Grey Heron *Ardea cinerea*	√	√
Little Egret *Egretta garzetta*	√	√
Red-billed Starling *Sturnus sericeus*	√	√
Restricted Range in Hong Kong		
Greater Painted-snipe *Rostratula benghalensis*	(√)	
Northern Hobby *Falco subtle*	(√)	(√)
Black-naped Oriole *Oriolus chinensis*	(√)	(√)
Declining in Hong Kong		
Pheasant-tailed Jacana *Hydrophasianus chirurgus*	(√)	
Bluethroat *Luscinia svecica*	(√)	√
Common Snipe *Gallinago gallinago*	√	√
Common Stonechat *Saxicola torquata*	√	√
Locally Important Species		
Japanese Quail *Coturnix japonica*	(√)	
Pallas's Grasshopper Warbler *Locustella certhiola*	(√)	(√)
Pintail Snipe *Gallinago stenura*	(√)	√
Richard's Pipit	√	√
Swinhoe's Snipe *Gallinago megala*	(√)	
Zitting Cisticola *Cisticola juncidis*	√	√
REPTILES & AMPHIBIANS		
Burmese Python *Python molurus*	(√)	
Chinese Soft-shelled Turtle *Pelodiscus sinensis**	√	
Chinese Bullfrog *Rana rugulosa*	√	
Total number of Species of Conservation Importance regularly recorded	**17**	**16**

* A single individual of the species was recorded in the ICA in November 2001 (BV 2001a). Inclusion of this species on the list of those occurring on a regular basis as this mud-dwelling fishpond turtle is difficult to detect.

2. MITIGATION OBJECTIVES

2.1.1 The mitigation objective for the ECA is the provision of suitable habitat for the key 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 areas is the enhancement, creation and maintenance of at least 27.1 ha of fishponds and 4.9 ha of marshland in Favourable Condition for these target Species of Conservation Importance.

2.1.2 Within this overall target for the ECA, the objective for the IEA (i.e. the area of habitat to be provided and managed in advance of and during station construction) is to ensure that there is no net decrease in the numbers of large waterbirds using the area during the construction period. These large waterbird species are the species for which the Lok Ma Chau area is considered to be of greatest conservation importance (in both a Hong Kong and international context) and which are most vulnerable to direct and indirect habitat loss (the latter through disturbance) during the station construction period. These target large waterbird species are listed in Table 2.1.

Table 2.1
Large waterbird species forming the primary target of habitat enhancement and management measures in the IEA

Common name	*Scientific name*	*Conservation status*
Great Cormorant	*Phalacrocorax carbo*	Regionally important
Grey Heron	*Ardea cinerea*	Regionally important
Great Egret	*Egretta alba*	Regionally important
Little Egret	*Egretta garzetta*	Regionally important
Chinese Pond Heron	*Ardeola bacchus*	Regionally important
Black-faced Spoonbill	*Platalea minor*	Globally threatened

2.1.3 The numbers of these target waterbird species are the measure of success of the IEA. However, these numbers will be a reflection of habitat factors, such as water conditions, food availability, and freedom from disturbance. Accordingly, other more targets have been set that reflect the habitat requirements of the target species. Such targets include the increase in shallow feeding areas, benthic composition, water quality, fish stocks and vegetation status and distribution. These habitat-related targets are described in Section 2.4.

2.1.4 The definition of Favourable Condition of the habitat is dependent on the target species for mitigation and their specific requirements. These are described below.

2.2 Targets for Large Waterbird Species

2.2.1 Appropriate numerical targets in respect of faunal use of the ECA were discussed extensively in the EIA Report (BV 2001a). With respect to the large waterbird species which are the primary targets for the IEA, it was recognised that numerical targets for large waterbird use are necessary. These must demonstrate that there is no net decrease in the numbers of large waterbird species using the Lok Ma Chau area during the Spur Line and the Station construction period (as well as during the operational period) than before. During the construction period part of the previous area of fishponds will become unavailable (the construction site itself) while a part will experience a reduction in use during this period (through disturbance impacts). Accordingly, numbers of birds in the remaining area must be increased, through habitat management and enhancement, to compensate. As was stated in the EIA Report, it has been calculated that if the number of birds using the 15 ha area furthest from the station can be doubled, this doubling, together with the continued lower levels of use of the remainder of the ECA, equates to the number of birds which would have previously used the whole area.

2.2.2 The IEA area includes 15.5 ha of fishponds; so if a doubling of the number of large waterbirds using the IEA as compared with a baseline level is achieved (the baseline level being non-enhanced commercial ponds) then the target requirement will be met.

2.2.3 As is noted in paragraph 2.2.2 the target numbers of large waterbirds are to be compared with a baseline which should equate to the numbers of birds which would have continued to use the area were the Spur Line and Lok Ma Chau Station not to be constructed. However, as is discussed in the EIA Report (BV 2001a), the determination of such a baseline is problematical. Historical data for use of the Lok Ma Chau area exists in the form of Hong Kong Bird Watching Society (HKBWS) waterfowl counts; however only a part of the KCRC site is included in the HKBWS survey area (Carey 2002). Waterfowl counts were also undertaken during the Baseline Study conducted during 2000-2001 which was included in the EIA Report (BV 2001a). However, this survey was conducted during the period when commercial fish farming activities ceased and the ponds were abandoned. The data collected is not, therefore, typical of bird use of commercial fishponds in normal operation. Furthermore, setting a baseline for bird use based on a particular historical time period fails to take into account changes in bird numbers over time and may result in the setting of targets which become inappropriate as bird numbers change.

2.2.4 In order to overcome these difficulties, numerical targets for large waterbird use will be based on a direct comparison with the numbers of waterbirds using representative samples of commercial fishponds to be monitored concurrently with management (and monitoring) of the IEA. These control areas are shown in Figure 2.1 and Table 2.2.

Table 2.2
Control areas of commercial fishponds for monitoring of waterbird numbers

Location	*Number of fishponds**	*Pond area (ha)***
Pak Hok Chau	14	
San Tin	16	
Total	30	

* Exact number of ponds to be finalised once observation tower is erected.
** Pond area to be finalised once exact number of ponds is confirmed.

2.2.5 Habitat and habitat management requirements for the target large waterbird species are detailed below.

Great Cormorant

2.2.6 Great Cormorants are winter visitors to Hong Kong and are economically important as a proportion 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 are being carried out by AFCD.

2.2.7 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) in ponds at Mai Po NR to divert feeding pressure from commercial ponds.

2.2.8 Unlike the other target species 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 nighttime 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.

2.2.9 Management of ponds at Lok Ma Chau during winter 2001-2002 demonstrated that Great Cormorants could readily be attracted to ponds in the IEA when these were stocked with fish. Stocked ponds attracted this species both when they were left at their normal depth (c. 1.5 m) and when they were partially drained to c. 50 cm water depth.

Grey Heron

2.2.10 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.

2.2.11 Management of ponds at Lok Ma Chau during winter 2001-2002 demonstrated that Grey Herons could readily be attracted to ponds in the IEA. 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 which were largely cleared of vegetation as daytime roosting and loafing sites.

Great Egret

2.2.12 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) who showed that whilst this species fed on drained ponds and *gei wai*, intertidal mudflats are typically more important as feeding habitat. However, management of the IEA during winter 2001-2002 showed that Great Egret was strongly attracted to stocked and partially drained-down ponds, exhibiting a similar pattern of use to Grey Heron (including using cleared bunds as roosting and loafing sites).

2.2.13 It was also noted that whilst shortly after stocking (when large numbers of fish were available) Great Egrets fed in open water areas, small numbers persisted in feeding in emergent vegetation around ponds once the larger attraction had ceased. It is considered that these remaining birds were seeking fish sheltering in the vegetation.

Little Egret

2.2.14 Little Egrets are found in Hong Kong throughout the year. Habitat utilisation has been studied in Hong Kong by Young (1994) and Cornish (1996). These studies showed that Little Egrets in Hong Kong 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.

2.2.15 Though Little Egrets were attracted to stocked and partially drained ponds in the IEA during the winter 2001-2002 management exercises, numbers of this species were for the most part smaller than those recorded at nearby commercial fishponds and at Mai Po NR (BV 2002a). In view of the known propensity of this species to use drained-down ponds, this finding was somewhat surprising.

2.2.16 However, surveys of food availability in the stocked IEA ponds showed that, other than the stocked fish, few other food items were available. This contrasted with Mai Po NR *gei wai* where, though the density of potential prey items was lower, the diversity was much higher, including much larger numbers of small prey (BV 2002a). Since stocked fish were almost all 7 – 13 cm in length (BV 2002a) and the preferred prey size for Little Egret is 3.8 cm (Cramp and Simmons 1977) it seems likely that a lack of numbers and/or diversity of small prey was the reason for the failure to attract larger numbers of Little Egrets to the IEA.

2.2.17 Management for Little Egret should, therefore, focus on the provision of a diversity of small prey items, together with manipulation of water levels (i.e. provision of water of less than c. 50 cm depth) to make this prey available. Since this species has an important breeding population in the Deep Bay area, management for this species will include the provision of suitable feeding conditions in both the non-breeding and the breeding seasons.

Chinese Pond Heron

2.2.18 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 *Bambusa* spp. Breeding adults largely forage within 3 km of their colonies (Young and Cha 1995).

2.2.19 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 the make extensive use of *gei wai* (BV 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 IEA 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.

2.2.20 Since numbers of Chinese Pond Herons in Hong Kong are similar throughout the year, management for this species will provide suitable feeding conditions in the breeding as well as the non-breeding season.

Black-faced Spoonbill

2.2.21 Black-faced Spoonbills have been subject of a number of studies in Hong Kong (notably Anon. (1999), Melville *et al.* (1999) and Anon (2001)). In addition, when it was discovered during baseline fieldwork that Black-faced Spoonbills were utilising drained ponds at Lok Ma Chau during winter 2000-01, their use of this area was subject to additional specific survey efforts (BV 2001a).

2.2.22 Black-faced Spoonbills are tactile feeders. Feeding 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).

2.2.23 Management of ponds at Lok Ma Chau during winter 2001-2002 demonstrated that Black-faced Spoonbills could readily be attracted to ponds in the IEA. 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 which were largely cleared of vegetation as daytime roosting and loafing sites. Indeed, this species was attracted so successfully that during early February 2002 most, if not all, of the Deep Bay population was using the Lok Ma Chau fishponds.

2.3 Management of the IEA for other ECA target species

2.3.1 As is indicated in Table 1.3, the large waterbirds for which numerical targets must be met during the construction period are not the only fauna for which the ECA must make compensatory habitat provision. In respect of most of the other species, defined targets are set for the operational period of the project and are detailed in Part B of the HCMP. However, during the construction stage numerical targets are not appropriate for these species as they largely require habitats which are not the primary focus of the IEA and will not, in any case, be as susceptible to disturbance impacts from construction. However, for some of these species provision can be made in the IEA without compromising its primary objectives. Accordingly, requirements for these species, and how these requirements may be met in the IEA are detailed below.

Eurasian Otter

2.3.2 Eurasian Otter is restricted to the Deep Bay area in Hong Kong where it is rare (Reels 1996). This species is considered to be "Regionally Threatened" by Fellowes *et al.* (2002). Following its discovery in the Lok Ma Chau area during baseline fieldwork for the EIA during winter 2000-01 (BV 2001), it was surveyed in the Lok Ma Chau area during winter 2001-2002 (BV 2002b). This survey indicated that it was probable that the Lok Ma Chau area supported a population of three otters. However, in the absence of data concerning the home ranges of this species in southern China it was not clear if these individuals were moving over a larger area (for example to Mai Po NR).

2.3.3 Eurasian Otter feeds largely on fish and amphibians. As is shown in BV (2002b) in Hong Kong it is 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.

2.3.4 Within the IEA, 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).

Common Teal

2.3.5 The following is based on non-systematic observation in Hong Kong including observations at Lok Ma Chau during winter 2000-01 (BV 2001). Common 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 Common 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 Imperial Eagles.

2.3.6 Diet of Common 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).

2.3.7 In the IEA Common Teal will benefit from shallow pond areas with emergent vegetation, managed to meet the requirements of Chinese Pond Heron (see paragraph 2.2.18. Further habitat will be provided for this species in the marshland areas which are to be created (see Part B of this HCMP).

Greater Spotted Eagle

2.3.8 Habitat utilisation in the Deep Bay area was studied during winter 2000-01 (BV 2001b). 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, BV 2001b). As with Imperial Eagle, observations during winter 2000-01 showed that the most important area for this species was Mai Po, with secondary foci at Tsim Bei Tsui and Nam Sang Wai. Together these areas accounted for 86% of records (BV 2001b). In contrast to the distribution of Imperial Eagles, during this study there were no records from Lok Ma Chau; indeed there were very few records from east of Mai Po. This species is scarcer in Hong Kong than Imperial Eagle (Carey *et al.* 2001); the frequency of sightings during winter 2000-01 was approximately half that of Imperial Eagle (BV 2001b).

2.3.9 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 and the study in winter 2000-01 suggested that, in comparison with Imperial Eagle, this species is less likely to occur in extensive open active fish pond areas

2.3.10 Greater Spotted Eagles do not, technically, meet the criterion of regular occurrence in the Lok Ma Chau area required for inclusion on the list of Key Target Species for the ECA as this species was not recorded regularly there during winter 2000-01 (BV 2001a, BV 2001b). However this species is included as a Key Target Species for the reason that it is Globally Threatened (BirdLife International 2000) and has habitat requirements which can be accommodated within the mitigation area without compromising any other mitigation objectives (in fact the mitigation proposals are identical to those required for Imperial Eagle).

2.3.11 Greater Spotted Eagles will be attracted to concentrations of waterbirds, especially ducks, which will provide a source of food. They are likely to avoid areas adjacent to the LMC Station as well as the eastern part of the mitigation area where human activities associated with the presence of the Spur Line and the Boundary Crossing point will deter use.

2.3.12 The management of the IEA for large waterbirds is likely to provide some attraction for Greater Spotted Eagle, especially since, as is noted in paragraph 2.3.7, the management of shallow ponds with emergent vegetation for Chinese Pond Herons is also planned to benefit Common Teal. The latter species is an important prey species for the eagle. However, this potential attraction for eagles has to be set against the fact that, since eagles are predators on waterbirds, the attraction of eagles to the IEA, will not benefit the primary IEA target species.

2.3.13 Accordingly, whilst in the longer term, the attraction of eagles to the ECA is an important element of Part B of the HCMP, during the construction period active measures to attract eagles are not proposed. Indeed, one reason for the removal of trees from the internal bunds in the IEA is to reduce the likelihood that Greater Spotted and Imperial Eagles use the core of the IEA as a regular hunting area (and hence deter use by the target species of large waterbirds).

Imperial Eagle

2.3.14 Habitat utilisation in the Deep Bay area was studied during winter 2000-01 (BV 2001b). Imperial 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, BV 2001b). Observations during winter 2000-01 showed that the most important area for Imperial Eagles is Mai Po Nature Reserve, with Ma Tso Lung being the second most important area. Together, these two areas accounted for 66% of sightings during the study. Tsim Bei Tsui, Nam Sang Wai and Lok Ma Chau were sites of similar secondary importance, with Lok Ma Chau accounting for 8% of sightings.

2.3.15 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 large trees (as at parts of Nam Sang Wai) are avoided.

2.3.16 Imperial Eagles will benefit from the reduction in human disturbance arising from the management of the mitigation area. They will also be attracted to concentrations of waterbirds, especially ducks, which will provide a source of food. However, Imperial Eagles are likely to avoid areas adjacent to the LMC Station as well as the eastern part of the mitigation area where human activities associated with the presence of the Spur Line and the Boundary Crossing point will deter use.

2.3.17 As with Greater Spotted Eagle, the management of the IEA for large waterbirds is likely to provide some attraction for Imperial Eagle, as these will provide it with a potential source of food. However, this potential attraction for eagles has to be set against the fact that the attraction of eagles to the IEA will not benefit the primary target species.

2.3.18 Accordingly, whilst in the longer term, the attraction of eagles to the ECA is an important element of Part B of the HCMP, during the construction period active measures to attract eagles are not proposed. Indeed, one reason for the removal of trees from the internal bunds in the IEA is to reduce the likelihood that Greater Spotted and Imperial Eagles use the core of the IEA as a regular hunting area (and hence deter use by the target species of large waterbirds).

Black-winged Stilt

2.3.19 The following is based on non-systematic observation in Hong Kong including observations at Lok Ma Chau during winter 2000-01 (BV 2001a). In Hong Kong, Black-winged Stilts are restricted to fresh or brackish water habitats, favouring large disused fishponds in the Deep Bay area and bloodworm ponds in Long Valley. Black-winged Stilts are recorded in Hong Kong throughout the year, but have not been known to breed; the small numbers present in summer presumably being non-breeding individuals or early returning migrants (Carey *et al.* 2001).

Distribution on the Deep Bay area is somewhat erratic with flocks opportunistically utilising ponds which are of a suitable depth for feeding (c. 5 – 15 cm water depth) as this species rarely forages whilst swimming (Cramp and Simmons 1983). There is also some evidence that birds may move several kilometres between feeding and roosting areas in Hong Kong, with birds which roost in the Deep Bay area during the day flying to Long Valley to feed at night (BV 2001a).

2.3.20 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). Black-winged Stilts will benefit from shallow open water areas overlying soft mud with aquatic vegetation sparse or absent.

2.3.21 Black-winged Stilts will benefit from the shallow ponds and partially drained ponds, especially in spring and autumn when peak numbers occur in Hong Kong (Carey *et al.* 2001). The requirements of this species thus show a synergy with those of Chinese Pond Heron and are complementary to the focus for larger waterbird species (where the focus of management action will be in midwinter.

Common Snipe

2.3.22 Common Snipe requires marsh vegetation with muddy margins and, in Hong Kong, is much more abundant in freshwater than brackish water areas. Edges of fishponds are used by Common Snipe, but these are not a major habitat for this species (Carey *et al.* 2001).

2.3.23 Common Snipe will benefit to a limited extent from shallow ponds with emergent vegetation provided primarily to meet the needs of Chinese Pond Heron. However, the primary provision for this species will be in the marsh areas (see Part B of this HCMP).

Richard's Pipit

2.3.24 The race *A. r. richardi* of Richard's Pipit is a common passage migrant and winter visitor in Hong Kong, whilst the race *A. r. sinensis* is an upland breeding form (Carey *et al.* 2001). *A. r. richardi* occurs in flocks in the Deep Bay area in winter, favouring fish pond bunds or other areas which are bare or covered with sparse or short grass. It does not use areas of rank grassland or full ponds except around the fringes. However, it does make use of drained-down ponds once these are largely dry.

2.3.25 The cleared internal bunds within the IEA will provide suitable feeding areas for this species, as will the drier areas around partially drained ponds.

Common Stonechat

2.3.26 Common Stonechats are common passage migrants and winter visitors in Hong Kong. They are most abundant in areas of open cultivation and shrubland (Carey *et al.* 2001) but also occur in significant numbers along fishpond bunds and the fringes of reedbeds in the Deep Bay area.

2.3.27 Primary provision for this species in the ECA will be in fringe areas of the ECA, notably the interface between the freshwater marsh and the reedbed and the drier raised shrub and tree-planted area around the station itself. No explicit provision for this species is proposed in the IEA; however it will continue to utilise the areas around the drainage channel and the more vegetated bunds on the fringes of the IEA site.

Zitting Cisticola

2.3.28 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 (Carey *et al.* 2001).

2.3.29 Primary provision for this species in the ECA will be in fringe areas, notably the interface between the freshwater marsh and the reedbed, together with some bunds where patches of long grass will be retained. No explicit provision for this species is proposed in the IEA; however it will continue to utilise the areas around the drainage channel and the more vegetated bunds on the fringes of the IEA site.

Red-billed Starling

2.3.30 Red-billed Starling is a winter visitor to Hong Kong, occurring in large flocks in the northwest New Territories. 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).

2.3.31 In the ECA, this species will benefit from sparely vegetated fringes to ponds and marsh areas, especially where these are close to tree and shrub areas adjacent to the drainage channels and the station perimeter. It will also benefit from the proposed tree and shrub planting which will provide fruit and invertebrate food and shelter.

2.3.32 Red-billed Starling makes use of the trees along the river channel in the IEA and this area will be managed so that it remains suitable for this species by the retention of fruiting tree species and the clearance of some of the rank grass. This will permit Red-billed Starling to gain access to the muddy fringes of the river channel and its invertebrate food.

Burmese Python

2.3.33 The occurrence of Burmese Python in the Lok Ma Chau area was noted or inferred by ERM (1999) but it was not recorded in the baseline survey (BV 2001a) or subsequently. However, as noted in the EIA Report, because reptiles are often cryptic and difficult to survey, it is included within the list of target species for the ECA on a precautionary basis. Further, large pythons have large home ranges (one tracked on Lantau over only 24 days moved in an area of 12 ha (Karsen *et al.* 1998), so the probability of an encounter during a survey is correspondingly low.

2.3.34 Burmese Python is widely distributed in Hong Kong, but is considered to prefer shrubland, woodland and the edges of mangroves. (Karsen *et al.* 1998). Mangroves are not a habitat which is present or proposed to be present in the ECA; however it will be able to utilise the marsh area together with the interface between this and the woodland and shrubland around the station and the river channels (see Part B of this HCMP). Explicit provision for this species is not proposed in the IEA, however, this species (if present) will continue to be able to use the corridor formed by the river channel.

Chinese Soft-shelled Turtle

2.3.35 The regionally uncommon Chinese Soft-shelled Turtle was not recorded in the Lok Ma Chau area during the baseline survey but was found at Lok Ma Chau in November 2001 (BV 2001a). This species is rare and localised in Hong Kong with a natural population restricted to fishponds around Deep Bay (Karsen *et al.* 1998). Chinese Soft-shelled Turtle spends much time buried in the mud but also wanders on land and will bask on mudbanks or floating logs. Eggs are buried in the mud banks of a pond.

2.3.36 The Chinese Soft-shelled Turtle will benefit from the management of the fishponds in the IEA as these will provide suitable conditions corresponding to those which it favours in commercial fishponds but with a reduced risk of being accidentally killed during fish harvesting or pond management activities. In addition, it will benefit from the greater security and lower risk of disturbance to nesting sites.

Chinese Bullfrog

2.3.37 This large frog species is thought to be in marked decline locally and drastic decline regionally, and has therefore been rated as of Potential Regional Concern by Fellowes *et al.* (2002). It is commonly sold in food markets in Hong Kong and in southern China. It is a species closely associated with areas of wet agriculture, and breeds in ponds and marshes. The species is present but not common at Lok Ma Chau.

2.3.38 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.

2.3.39 As a marsh species, habitat provision for Chinese Bullfrog will be in the freshwater marsh area of the ECA rather than the brackish fishpond habitat of the IEA.

2.4 Habitat Requirements of Target Species

2.4.1 A summary of the habitat requirements of the target species for the IEA detailed in this section is provided in Table 2.3. All habitats listed will be provided in the IEA, however the area of emergent/marsh vegetation will be relatively limited and lacking in species and structural diversity.

Table 2.3
Summary of Habitat Requirements of Target Species of Conservation Importance (Primary target species for the IEA are shown in bold)

Key: habitat important for F = Foraging; R = Roosting/loafing; B = Breeding. Habitats of secondary importance are shown in lower case.

Species	Deep water	Shallow water	Muddy vegeta-tion free margins	Trees on bunds/ channels	Emerg-ent / marsh vegetation	Bare or sparsely vegetat-ed bunds
Amphibians		F,B	F,B		F,B	
Reptiles		F	F	f	F	F,B
Eurasian Otter	F	F	F	B	F	
Great Cormorant	F	f		R		R
Grey Heron		F		R	f	R
Great Egret		F		R	F	R
Little Egret		F	f	R	F	r
Chinese Pond Heron		f	f	R	F, r	
Black-faced Spoonbill		F	F			R
Common Teal	F	F, r	f		F, R	
Greater Spotted Eagle		F		R	F	F
Imperial Eagle		F		R	F	F
Black-winged Stilt		F	F		f	
Common Snipe			F		F,R	
Richard's Pipit			F			F
Pallas's Grass. Warbler					F,R	
Zitting Cisticola					F,R	f
Common Stonechat				f	F,R	F
Red-billed Starling			F	F, R	f	F

2.5 Habitat Condition Targets

2.5.1 2.5.1 As described in the EIA Report (BV 2001a) and as is required by the terms of the Environmental Permit the principal management activities to be conducted in the IEA are the enhancement of fishponds. Currently, when the primary target species for the IEA use fishponds in the Deep Bay area, they feed on the abundant small non-commercial fish and invertebrates (termed 'trash fish') that thrive as a by-product of the highly productive commercial fish-farming systems. These include *Gambusia affinis* (Mosquito Fish), *Macrobrachium nipponense* (a prawn) and *Oreochromis mossambicus* (a species of tilapia).

2.5.2 However, when ponds are operated commercially, these food resources are generally only readily available to birds when the ponds are drained down for fish harvesting during the winter. Drain-down for commercial harvesting tends to be concentrated in a short period during the winter, in the few weeks before Chinese New Year. Furthermore, since the purpose of drain-down of commercial ponds is to produce human food for market, the drain-down activity has the following characteristics which do not benefit birds:

- drain-down is conducted as quickly as possible (typical ponds being emptied during a period of 4 – 7 days) in order to make harvesting more efficient and to minimise losses to birds;
- most fish are of a size suitable for human food and hence too large for many of the waterbird species (especially Black-faced Spoonbill and the smaller ardeids);
- most fish are removed from the system (as food for humans) hence only the residue is available to birds;
- once drain-down and harvesting has been accomplished, a pond is either quickly refilled or, if recontouring and clearance of mud is required, allowed to dry out completely. In either case, the period when it provides feeding opportunities to fish-eating birds is minimised.

2.5.3 In addition, the following physical characteristics of commercial fishponds reduce the availability of fish and other food to waterbirds:

- commercial ponds are steep-sided and typically 1.5 – 2.0 m in depth. Of the target bird species only Great Cormorants can catch fish in these conditions;

- emergent or floating vegetation is lacking thus reducing potential niches for invertebrates which would provide additional food especially for Chinese Pond Herons.

2.5.4 Accordingly, the principal fishpond enhancement measures will include the following:

- extending the period during which drained ponds are available by draining ponds 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;
- maximising the usefulness of fish stocks to birds by stocking in a way that most fish are of a suitable size to be eaten by the target bird species;
- recontouring ponds so that the pond base has a shallow slope, thus providing a larger feeding area when ponds are full as well as a progressive increase in the feeding area when ponds are drained;
- establishment and maintenance of bankside and emergent vegetation on some ponds to provide refuges for fish and appropriate conditions for invertebrates that will themselves provide food for birds;
- repeat stocking of some ponds with trash fish during the winter months to permit the same pond to be drained (or partially drained) more than once per season.

2.5.5 In addition, the ponds' suitability for use by the target bird species will be enhanced by the following bund management activities:

- clearance of vegetation (including trees, shrubs, herbs and rank grass) from internal bunds to reduce the inhibitory effect that enclosure of ponds has on their use by some waterbirds and to provide suitable loafing and roosting areas;
- linking some ponds, both to increase overall pond size (larger ponds are favoured by some of the target species) and to create island areas from former bund sections which will form roost areas free from ground predators and disturbance.

2.5.6 Specific fishpond habitat targets for the IEA area are:

- Enhancement and maintenance of a total of 15.5 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 >10 cm in height is <5% on 70-80% of the area of fishpond bunds and islands;
- 70-80% of the fishpond area (excluding bunds) is maintained under a drain-down regime to maximise fish availability to target 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 pondside vegetation is maintained over 10-20% of pond areas and 20-30% of pondsides respectively;
- undesirable invasive species and exotic species are < 10% of vegetation cover.

3. CONSTRAINTS ON DESIGN

3.1 Engineering

3.1.1 The engineering design is principally the means to control water levels to close tolerances in this flat area. Construction must not be disruptive to the surrounding habitat. In addition, the ground in which the ponds are located comprises a significant depth of mud, such that moderate surcharge loads could cause significant short and long term settlement. This must be guarded against in the construction of the mitigation area.

3.2 Hydrology / Drainage

3.2.1 The main constraint on the design of the wetland mitigation scheme is the highly seasonal rainfall in Hong Kong. Typically there is a period of water deficit (i.e. rainfall is exceeded by evapotranspiration) from September to March, though this varies somewhat from year to year, for example in 2002 the water deficit period extended to mid-May. Permanent wetlands may be retained by storage of sufficient water to overcome the deficit period. Alternatively, the water supply may be supplemented from an external source. Such potential water sources include the local watercourses and / or underlying aquifers. However, the local watercourses are highly polluted (see 3.4.1 below) and, due to the presence of marble caverns in the underlying rocks in the Lok Ma Chau area, boreholes are not allowed in the area for engineering safety reasons. It is also possible that any underlying aquifers may be brackish. Accordingly, it will be necessary to manage the IEA in such a way that rainwater collected during the wet season is sufficient to meet dry season needs. This requires careful management of water resources.

3.2.2 There are also potential constraints on the wetland design regarding drainage options as a result of the tidal conditions of the watercourses and frequent local flooding. The top of the bunds in the area are generally at +3.5mPD and in periods of heavy rain there is flooding in the area. This will be alleviated with the construction of the San Tin Eastern Main Drainage Channel, which will protect the locality from upstream events. The ponds will not flood as frequently as has been the case to date. Rainfall intensities greater than that of the annual event will likely cause the ponds to be inundated due to high watercourse levels.

3.2.3 The outfall to the natural watercourse which provides drainage for the area is tidal. Constructing an outfall will be difficult, and the watercourse banks and bed would have to be protected from erosion. Any collapse of the bank or loss of cross section will make the area more susceptible to flooding. An outfall into this watercourse would require a flap valve. If this were to become wedged open with debris, the tidal range could send saline water into the pond system. In view of this, it is not proposed to form a fixed outlet to this drainage channel. Initially, when water is discharged to this channel from the IEA discharge will be by means of portable pumps. In the longer term all water will be need to be taken to the watercourse to the east of site (Watercourse B).

3.3 Soils

3.3.1 As described in Section 1.4 the soils present at the site consist of poorly drained marine clays. These are sufficiently impermeable to maintain wetland conditions or fishponds over the site as demonstrated by the current presence of such habitats, which are in the main solely maintained by direct rainfall inputs.

3.3.2 The soils are, however, acid sulphate soils which can lead to highly acidic conditions when these are disturbed and dried. As a consequence, when ponds which have been drained are refilled the water in the pond may become excessively acidic. Remedial measures to reduce soil acidity may be required (see Section 3.4).

3.4 Water Quality

3.4.1 Detailed information on the water quality in the drainage channels flowing through or adjoining the site is not available. However, visual inspection has shown that these are grossly polluted and carry large volumes of organic animal waste. Both for this reason and because the channel flow regime may change significantly with the construction of the San Tin East Drainage Channel (and the possible construction of a San Tin West Drainage Channel) drainage channel water has not been considered as an appropriate water source for the IEA.

3.4.2 The maintenance of the wetland's conditions and achievement of target water levels will therefore be dependent on the storage of direct rainfall and the maintenance of the quality of water within the system.

3.4.3 Rainwater is, of course, largely free from organic matter. However, it may be acidic and, given the generally acidic condition of ponds and soils, rainwater cannot, therefore, be relied on to neutralise water already in the system.

3.4.4 Monitoring conducted since autumn 2001 has shown that water already within the system (i.e. within ponds) has a tendency to become increasingly acidic. This tendency is well known to fish farmers (who take routine measures to reduce acidity as a part of their standard fish farming activities). The primary source of acidity is the acid soils of the system; this acidity may also be exacerbated by acid rainfall.

3.4.5 The following methods of reducing acidity have been identified:

- Liming: liming is a traditional method of reducing pond acidity when these have been drained, dried and recontoured. Lime is spread over the pond base prior to refilling. Liming is effective and the effect of liming can be relatively easily quantified in these circumstances. However, use of lime to reduce acidity in filled ponds is not appropriate as it is very difficult to spread and mix the lime with the water body.

- Addition of organic matter: a variety of organic matter may be used to reduce acidity. Traditional materials used by fish farmers include dead fish, pigeon faeces, peanut residue and grass cuttings. During management activities in the IEA during winter 2001-2002, both pigeon faeces and peanut residue were successfully used to reduce acidity as, inadvertently, were dead fish. (The latter were stocked in a pond which was too acid and most fish died.).

- Transfer of water: transfer of water does not reduce acidity *per se*. However, mixing of water from a pond where water quality is less acidic with one where it is more acidic will reduce acidity in the latter. Mixing of water may be considered as a management option where there is an urgent need to reduce acidity quickly or where less acid water might otherwise be lost to the system through drain-down.

3.4.6 Of these measures, it is proposed to use water mixing and addition of peanut residue in the IEA. The latter method is preferred to other techniques of adding organic matter as use of pigeon faeces entails a potential risk of transferring avian pathogens from domestic to wild bird populations, whilst use of dead fish may entail a risk of spreading botulism.

3.4.7 Liming remains suitable for reducing acidity in drained, dried and dredged ponds.

3.4.8 Acidification is also counteracted by the maintenance of a pond with an active fish and invertebrate community; in other words it is a particular problem where ponds are left inactive without fish stocks. Accordingly, whilst measures to reduce acidity may be required periodically, it is anticipated that acidification will become less of a problem over time.

3.5 Access

3.5.1 Access to IEA is from the border patrol road to the north. Within the site access will be by means of fishpond bund tracks. There is no track over the drainage channel, but Ponds 1 and 2 may be reached by a separate track from the border patrol road. A bund area to the north of Pond 9 will be utilised as a site office and equipment and materials store for the contractor managing the IEA during the construction period.

3.5.2 The site is within the Closed Border Area.

4. DETAILED DESIGN AND CONSTRUCTION METHODS

4.1 Overview

4.1.1 The primary habitat in the IEA will be fishponds and fishpond bunds, a secondary habitat will be a natural drainage channel with riparian vegetation including scattered groups of trees (see Figure 1.3).

4.1.2 The IEA area currently consists of 11 existing fishponds. Two of these Ponds (6a and 6b) are already joined and Ponds 3a and 3b and 8a and 8b will be joined to create larger ponds. (indicated by the suffixes a and b in Figure 1.3), such that there will be eight ponds the water levels of which can be manipulated independently (Ponds 1- 8 in Figure 1.3). Ponds will be joined both because larger ponds are favoured by several of the target species and in order to create islands from bund sections as the ponds are formed.

4.2 Land Form

Fishponds

4.2.1 As the area already consists of fishponds earthmoving works would be restricted to the modification of existing ponds rather than construction of new ponds. These modifications will consist of the joining of ponds to reduce enclosure effects and to provide shallow margins and islands (Figure 1.3).

4.2.2 Where ponds are joined the bund material currently separating them will be lowered and side cast to create shallow sloping margins to islands and / or shoals as well as interconnecting channels. This will create additional areas of muddy shallows that will provide suitable feeding areas for herons, egrets, spoonbills and, during low water levels, smaller wading birds. The levels to be attained on each modified bund are indicated in Figure A1 in Appendix 1. Figure 4.1 gives the pond profile for Ponds 1, 3a, 3b, 6a/6b & 8a/8b.

4.2.3 The purpose of reprofiling the selected pond bunds is to create as shallow a slope as feasible (given the properties of the bund materials) to increase the feeding area for wading birds at different water levels.

4.2.4 Because the ponds must fulfil the function of attracting and providing food for waterbirds, earthmoving activities must be phased so that they only take place on a portion of the IEA at any one time. Also the main period when the target waterbird species are present (October to April) must be avoided. Programming is detailed in Table 4.3.

4.2.5 To facilitate vehicle access to all parts of the site, for water level management and other activities, some works on the remaining bunds will be necessary. The tops of the bunds may require some vegetation clearance and strengthening with a geofabric to enable them to be used as access ways. Current practice is to use some stone fill to form the running surface and it is proposed to extend this where necessary. As with bund modification, the main period when the target waterbird species are present (October to April) must be avoided.

4.3 Soils

4.3.1 Groundwater levels may be sufficiently low during the dry season such that all of the IEA will potentially be subject to water losses through seepage. It is essential that any loss of water through seepage is kept at negligible levels. Within the entire mitigation area seepage is within acceptable levels as the long term persistence of fish ponds indicate that rainfall and water retention is adequate to maintain fish production without the requirements for external water supplies (see Section 1.4). However, this may not be the case with respect to seepage through bunds between ponds. Such seepage was identified between Ponds 1 and 2 during winter 2001-2002.

4.3.2 Where seepage is identified remodelling of the pond bund and reinstatement of the pond bund clay layer should be undertaken. Except where seepage threatens major water loss such that primary management objectives may be compromised, large-scale earthmoving works to prevent seepage should not be undertaken during the October to April period. Experience gained during winter 2001-2002 showed that an adjustment of the proposed management regime for a particular pond should provide an appropriate short-term response to such events.

4.4 Water Control System

4.4.1 The engineering inputs to the IEA ponds are principally to install a water management system and to provide access for management. The proposed water management system comprises an arterial pipe system to transfer water between ponds in the dry season when the major draining down will take place, and to allow fine control of water levels in the wet season.

4.4.2 The arterial pipe system will be progressively installed in the IEA (and then the ECA) during the enhanced wetland construction process. Construction of the arterial pipe system will commence during the wet season of 2003; during the dry season (winter) 2002-2003 mobile flexible plastic pipes will be used to move water between ponds. As the arterial pipe system is progressively installed use of mobile plastic pipes will be discontinued (though will still be available as an emergency back-up system).

4.4.3 Current practice is to drive small vehicles around the ponds, and this will be the case under the new regime. The vehicles will transport the pump and other small equipment.

4.4.4 A bridge over the watercourse to gain access to Ponds 1 and 2 will be constructed to carry a pipe to remove excess water from these ponds. The bridge superstructure, which will be constructed in timber, will be founded on minipiles. There will be no access for personnel across the bridge – Figure 4.2 refers. This bridge will be constructed during the wet season of 2003, during the winter dry season of 2002-2003 temporary flexible plastic pipes will be utilised to maintain a connection between Ponds 1 and 2 and the remainder of the system.

4.4.5 All wood structures will be designed to BS 5268 Part 2 and treated in accordance with the recommendations of BS 5268 Part 5.

4.4.6 The water management system is based on a uPVC pipe system buried in the bunds. The same uPVC pipe system will also be carried by the bridge.

4.4.7 In the dry season water must be conserved, and the operation of the ponds requires that a considerable quantity of water can be transferred from pond to pond in a relatively short time. Commercial practice for fish harvesting is to drain-down as quickly as possible, typically this takes eight to ten days, but influenced by pond size (Young and Chan 1997). Drain-down for conservation purposes is generally somewhat slower; for example, the drain-down of a *gei wai* at Mai Po takes two weeks (WWFHK undated).

4.4.8 Drain-down in the IEA will follow the latter model. During the management activities conducted during winter 2001-2002 pond drain-down was undertaken using five diesel pumps operating in parallel. Each pump had a delivery volume of 100 litres per second. Allowing for down-time during operation a delivery volume of 4500 m^3 per day was achieved (BV 2002a). This equated, on a typical pond in the IEA the reduction of a full pond (c. 1.5 m water depth) to a partially drained pond (c. 0.5 m water depth in the centre) in around 10 days. The water management regime for the IEA is based on the use of similar equipment and drain-down time, in order to meet the objective of draining down one pond approximately every two weeks during the winter period. Figure 4.3 shows the proposed drain down and fish stocking schedule for the proposed IEA.

4.4.9 Once the arterial pipe system has been installed and is operational, the pumped system would be sealed, and a portable pump brought to site and set up on the bund. A suction hose will be placed in the pond, and a delivery hose connected to the arterial system. Water will be directed through the arterial system to the appropriate manhole from which it can be directed into the receiving pond using at

delivers pipe. Prior to the arterial pipe system being operational pumps will simply be placed on pond bunds manually and connected to flexible plastic pipes as required.

4.4.10 Initially, diesel pumps will be used. In the system's final form pumps could be electric with spaces available as a back-up. Power for the pumps would come from a supply installed around the ponds, such that no generators are necessary.

4.4.11 This wet season drainage system will be brought progressively into operation in the IEA during the construction period as the arterial pump network are installed.

4.5 Water Source

4.5.1 All fishpond water will be obtained by direct rainfall and will be retained and recirculated during drain-down periods as necessary. No surface or groundwater water supplies will be used for fishpond operations.

4.6 Vegetation

Vegetation Management

4.6.1 Existing vegetation in the IEA comprises planted and naturally established trees and herbs on bunds and along the river channel and naturally established emergent vegetation on some bundsides and in some ponds (in particular in Pond 2). All of the semi-natural areas are readily re-creatable and there are no individual plant species or specimens which require special conservation measures. Figure 4.4 presents the proposed initial vegetation management regime for the IEA.

4.6.2 Vegetation will be managed in accordance with the habitat targets detailed in paragraph 2.5.6, as follows:

- Internal bunds in the IEA will be maintained with short herbaceous vegetation (less than 10 cm in height) by regular manual cutting. Existing shrubs and larger herbaceous vegetation (in particular, stands of planted *Canna indica*) will be removed and overhanging trees will be pruned to reduce enclosure of the ponds.

- Only minimal pruning of trees along the drainage channel will be undertaken as these provide food and shelter for target fauna species. Similarly, only minimal pruning will take place of trees on bunds along the northern boundary of the IEA as these trees form a screen which will reduce disturbance to birds from construction activities and use of the site office and compound.

- External bunds on the west, east and south of the IEA will be retained with their present herbaceous vegetation (mainly long grass species) which provides a habitat for passerine bird secondary target species.

- Bankside vegetation (i.e. that extending from the bund sides into the fringes of ponds will be retained along 20-30% of pond sides. Initially this vegetation will be retained along the sides of Ponds 1, 2 and 8 and the west sides of Ponds 3 and 4 where it has established naturally.

- Emergent vegetation will be retained or planted over 10 – 20% of pond areas. Naturally established *Cyperus* spp. will be retained in 20% of Pond 2. Planting or retention of naturally establishing vegetation will take place in Ponds 5 and 8.

4.6.3 This vegetation management regime will be adaptive and will be superseded by that detailed in Part B of this HCMP when the Spur Line becomes operational. In the interim, however, the following aspects will be kept under review and modified as required.

- Effectiveness of cutting to maintain short vegetation on bunds. Monitoring will be conducted to assess whether the target of maintaining this vegetation at less than 10 cm height can be maintained by cutting alone once trees, shrubs and *Canna indica* have been removed. If necessary, cultivation and reseeding and/or minimum use of appropriate weedkillers will be considered.

- Bird monitoring data will be used to assess whether the proportions of bankside and emergent vegetation should be altered.

- Short and long-term merits of permitting/encouraging natural establishment of bankside and emergent vegetation vis-à-vis planting will be evaluated. Establishment of bankside vegetation in Ponds 5 and 8 will include planting and assessing the suitability and success of species detailed in Table 4.1. Feedback from monitoring will be incorporated in revisions to the IEA and finalisation of the planting design and management regime for the ECA (see also Part B of this HCMP). The objective of planting is not to create high botanical diversity or complex microhabitats, but to meet the objectives of providing shelter for fish and feeding areas for target bird species, notably Chinese Pond Heron and secondary target bird species.

Table 4.1
Wetland plant species which may be planted/sown in the IEA

Cyperus malaccensis
Ipomoea aquatica
Paspalum distichum
Phragmites australis
Schoenoplectus littoralis

4.7 Prevention of unauthorised access

4.7.1 Access to the IEA is limited to authorised personnel. Lockable gates will be erected to prevent vehicular access to the IEA by other than authorised personnel prior to the commencement of station construction activities. In addition, warning signs and notice boards will be erected at potential access points to deter pedestrian trespassers.

4.7.2 Other than any barriers or fencing required to permit unauthorised vehicle access, fencing of the IEA is not required. However, due consideration will be given to the long-term security of the site and the possible requirement to erect permanent fencing along vulnerable boundaries.

4.8 IEA Establishment and Management Work Programme

4.8.1 The initial IEA establishment and management work programme runs for three years from 1st October 2002. The programme will be reviewed and updated on a six monthly basis and rolled forward six months until such time as it is subsumed by the ECA Management Work Programme (see Part B of this HCMP). The list of the main actions necessary for the enhancement of the fishpond habitats is provided in Table 4.2 below. Since much of the management of the IEA is adaptive, it is inevitable that there will be continuous minor adjustments to the programme. Accordingly, progress will be monitored on a weekly basis and updated on a monthly basis (see Section 6). Pond numbers referred to in the table are indicated in Figure 4.2.

Table 4.2
IEA establishment and enhancement work programme: October 2002 – September 2005

	Action	Start date	Completion date	Notes
	Preworks period;			
1	Site handover	(completed)	(completed)	
2	Erection of lockable gates to IEA	August 2002	September 2002	
3	Erect warning signs at potential access points	August 2002	September 2002	
4	Clear vegetation on internal bunds	August 2002	September 2002	Except trees requiring a felling license
5	Clear redundant structures	(July 2002)	August 2002	
6	Clear emergent vegetation in Pond 2	August 2002	September 2002	Clear c. 50% only
7	Establish site office and compound	August 2002	September 2002	
8	Update tree survey for IEA	August 2002	October 2002	For future vegetation management review
9	Establish status of utilities on site	August 2002	October 2002	Determine which electricity and telephone lines are redundant and can be removed; identify those which should be rerouted
10	Install pond gauge boards	August 2002		(Markers in place but levels to be confirmed)
11	Determine water quality in all ponds	August 2002		
12	Lower / regrade bunds to link Ponds 3a & 3b	August 2002	September 2002	
	Winter 2002-2003	**October 2002**	**April 2003**	
13	Maintain/restore water quality in all ponds	October 2002	(ongoing)	Commence restoration earlier if possible
14	Drain down ponds in rotation	November 2002	April 2003	Fortnightly cycle to be determined
15	Stock ponds with trash fish	November 2002	March 2003	As conditions and drain-down regime allow

	Action	Start date	Completion date	Notes
	Summer 2003	**April 2003**	**September 2003**	
16	Maintain/restore water quality in all ponds	(ongoing)		Except those ponds drained down to permit engineering works
17	Commence installation of water pumping system and pipe network	May 2003	September 2003	Extent of works for 2003 season to be confirmed
18	Commence installation of permanent sluices and other water control structures and fixtures	May 2003	September 2003	Extent of works for 2003 season to be confirmed
19	Commence erection of permanent fencing	May 2003	September 2003	Extent of works for 2003 season to be confirmed
20	Form permanent bridge link to Ponds 1 and 2	May 2003	September 2003	
21	Lower connecting bunds to form islands and shoals, and connection of ponds (Ponds 8a & 8b)	May 2003	September 2003	
22	Reprofiling of pond bases and bunds	May 2003	September 2003	Extent of works to be determined following assessment of bird us during winter 2002-2003; to include topsoiling where subsequent planting is proposed
23	Manage existing vegetation	May 2003	September 2003	Exact scope of work to be determined following surveys
24	Planting of vegetation on pondsides, islands and in ponds	May 2003	September 2003	Exact scope of work to be determined following survey
25	Stocking ponds with fingerlings	April/May 2003	May 2003	Start may be brought forward to March 2003 depending on availability; ponds for stocking to be determined following review of winter survey data

	Action	Start date	Completion date	Notes
	Winter 2003-2004			
26	Maintain/restore water quality in all ponds	(ongoing)		
27	Drain down ponds in rotation	November 2003	April 2004	Fortnightly cycle to be determined
28	Stock ponds with trash fish	November 2003	March 2004	As conditions and drain-down regime allow
	Summer 2004	**April 2004**	**September 2004**	
29	Maintain/restore water quality in all ponds	(ongoing)		Except those ponds drained down to permit engineering works
30	Complete installation of water pumping system and pipe network	May 2004	September 2004	Extent of works for 2004 season to be confirmed
31	Complete installation of permanent sluices and other water control structures and fixtures	May 2004	September 2004	Extent of works for 2004 season to be confirmed
32	Continue installation of permanent fencing	May 2004	September 2004	If required (to be reviewed at end of 2003 wet season)
33	Reprofiling of pond bases and bunds	May 2004	September 2004	Extent of works to be determined following assessment of bird us during winter 2003-2004; to include topsoiling where subsequent planting is proposed
34	Manage existing vegetation	May 2004	September 2004	Exact scope of work to be determined following surveys
35	Planting of vegetation on pondsides, islands and in ponds	May 2004	September 2004	Exact scope of work to be determined following survey

	Action	Start date	Completion date	Notes
36	Stocking ponds with fingerlings	April/May 2004	May 2004	Start may be brought forward to March 2003 depending on availability; ponds for stocking to be determined following review of winter survey data
	Winter 2004-2005	**October 2004**	**April 2005**	
37	Maintain/restore water quality in all ponds	(ongoing)		
38	Drain down ponds in rotation	November 2004	April 2005	Fortnightly cycle to be determined
39	Stock ponds with trash fish	November 2004	March 2005	As conditions and drain-down regime allow
	Summer 2005	**May 2005**	**September 2005**	
40	Maintain/restore water quality in all ponds	(ongoing)		Except those ponds drained down to permit engineering works
41	Complete installation of water pumping system and pipe network	May 2005	September 2005	If not completed in 2004 season
42	Complete installation of permanent sluices and other water control structures and fixtures	May 2005	September 2005	If not completed in 2004 season
43	Manage existing vegetation	May 2005	September 2005	Exact scope of work to be determined following survey
44	Planting of vegetation on pondsides, islands and in ponds	May 2005	September 2005	Exact scope of work to be determined following survey
45	Stocking ponds with fingerlings	April/May 2005	May 2005	Start may be brought forward to March 2003 depending on availability; ponds for stocking to be determined following review of winter survey data

4.9 Mitigation Measures for Wetland Construction and Establishment Works

4.9.1 During the construction of the IEA and any associated works environmental impacts must not exceed those predicted in the EIA. In particular measures must be taken to avoid or minimise the following potential ecological hazards:

- Noise and visual disturbance;
- Hydrological disruption of surface watercourses;
- Pollution of watercourses;
- Dust deposition;
- Soil compaction; and
- Soil contamination.

4.10 Contingency Measures

4.10.1 A number of measures have been included in the design, construction methods, management and monitoring proposals that aim to ensure the successful establishment and long-term sustainability of the wetland as effective compensation habitat for key target species.

4.10.2 In addition, specific contingency actions will be defined in a Contingency Action Plan. This will be prepared by the Contractor (as part of the development of the wetland construction Method Statement) before commencement of works. As a minimum, contingency measures will be prepared for potential:

- inadequate water supply
- failure of the mains pumping system (including pump and timer failure, breakage of supply pipes);
- damage to sluices and drainage structures;
- pollution of water supply;
- direct pollution of wetland cells by toxic substances (e.g. from spillages / dumping);
- invasion by exotic or other undesirable plant species;
- flooding of the site and other potential effects from storm events; and
- fire damage.

4.10.3 As described in Section 6 detailed and intensive monitoring will be carried out of the physical and ecological performance of the IEA. Monitoring will permit the adaptive management measures necessary to ensure the successful functioning of the IEA and the meeting of targets to be implemented in an timely and effective fashion. Where necessary these will include actions defined in the Contingency Action Plan.

5. MANAGEMENT STRATEGY

5.1 Management Regime Programme

5.1.1 Management actions and frequencies detailed below apply only to the IEA during the Spur Line and Station construction period. Actions and frequencies during the establishment and operational periods are covered in Part B of this HCMP.

5.1.2 KCRC's contractor will undertake the management regime with instructions to be given by the Resident Engineer or his representative. KCRC's Adaptive Ecological Management Specialist (AEMS) will be responsible for monitoring the implementation of the HCMP, reporting to KCRC and issuing appropriate advice as required. Such advice will include determining appropriate management actions on a day-to-day basis taking into account feedback from monitoring activities and reporting by the contractor and will include the necessary responses to the outcome of monitoring where it is found that Action Levels and Limits as defined in Appendix 3 are exceeded.

5.1.3 As is noted in paragraph 4.8.1, Part A of the HCMP will be reviewed and updated on a six monthly basis.

5.2 Management Actions

5.2.1 A list of standard management actions that must be undertaken for the IEA is provided in Table 5.1.

5.2.2 Note that this list of standard management actions does not include adaptive enhancement management of the IEA fishponds by stocking and drain-down. Stocking and drain-down regime will be programmed on a monthly basis. Programming will cover target water levels, drain-down dates and stocking quantities and dates. Drain-down and stocking will be monitored and adjustments will be made on a weekly basis or more frequently if required.

5.2.3 Vegetation shall only be removed by cutting and removal of roots / rhizomes by hand or machine (e.g. backhoe). The use of herbicides will not be allowed, unless deemed to be necessary (e.g. for treating some invasive species) by the Site Manager in consultation with the AEMS. Grass cuttings and other herbaceous vegetation (but not woody vegetation and any plant roots or rhizomes) may be used on-site to improve water quality where agreed by the AEMS.

5.2.4 All vegetation and associated soils removed from the IEA will be disposed of off-site at a Government approved site.

Table 5.1
Standard management actions for the IEA

	Action	Frequency	Notes
	Water Control		
W1	Measure water levels and adjust sluice heights or pump accordingly to meet target levels	Weekly and/or within 24 hours of heavy rainfall events*	Target levels to be set and reviewed monthly in accordance with adaptive drain-down regime
W2	Measure water quality to cover most critical concerns for short term management (pH, BOD, salinity)	Monthly or as directed by the resident engineer on advice from the AEMS	More frequent measurements required when active steps to adjust water quality are being taken (In addition to EM&A requirements (see Table 6.1))
W3	Inspect condition of water control structures and water courses and repair / maintain as necessary	Monthly	Also to be inspected after lowering of Typhoon Signal No. 3
W4	Inspect condition of pumps and water supply structures and repair / maintain as necessary	Every six months at start of wet and dry season	
W5	Clear catchpits / sluices	Weekly	Also after flooding / heavy rainfall and lowering of Typhoon Signal No. 3
W6	Remove sediment by jetties	As required	
	Structural maintenance		
S1	Inspect condition of paths / bunds and repair / maintain as necessary	Every 6 months	Also after any flood events and lowering of Typhoon Signal No. 3
S2	Inspect condition of bunds and repair / maintain as necessary	Weekly	Also after any flood events
	Vegetation management		
V1	Cutting or pruning and removal	According to direction of the RE or his representative on the advice of the AEMS	
V2	Removal of exotic / undesirable invasive plants (weeding)	According to direction of the RE or his representative on the advice of the AEMS	
V3	Pest control	According to direction of the RE or his representative on the advice of the AEMS	

	Action	Frequency	Notes
	Other actions		
O1	Inspect for dumping / rubbish and remove	On all visits	Consult management team regarding water pollution or toxic materials
O2	Inspect / maintain signs, gates and fences	Monthly	

* A heavy rainfall event if defined as 100 mm of rainfall in the Northwest New Territories falling within 24 hours.

6. MONITORING

6.1 General Requirements

6.1.1 The following sections define the ecological monitoring requirements for the IEA to establish that enhancement measures are implemented and enhancement targets are met. Baseline ecological monitoring in the Lok Ma Chau area has been undertaken since April 2000. Data collected during the period from April 2000 – May 2001 was presented in the EIA Report (BV 2001a). Subsequently, as well as ongoing monitoring using the same methodology as that used for the baseline monitoring, data was collected describing the results of enhancement management of fishponds in the IEA area during October 2001 – April 2002 (BV 2002a). Together, this data has been used to define Action and Limit Levels for ecological issues (see Appendix 3).

6.1.2 During the construction phase of the project ecological monitoring is required in order to ensure that the requirements of this HCMP are met, in particular in respect of use by key target species, but also in respect of other wildlife of conservation importance identified in the EIA Report and subsequent surveys. The main components of this work are:

- Monitoring of large waterbirds[1] using the IEA with particular reference to effectiveness of management measures; together with monitoring of large waterbirds at the two control areas of commercial fishponds detailed in Section 2.2 of this HCMP to demonstrate the success of the IEA enhancement measures. In addition, surveys will be conducted at Mai Po Nature Reserve to monitor wintering Black-faced Spoonbills. These surveys are necessary to validate the success of the IEA.

- Monitoring of birds within the Lok Ma Chau study area (that covered by the baseline survey detailed in BV (2001a)) to assess populations of other target bird species detailed in the EIA Report.

- Monitoring of mammals (especially Eurasian Otter *Lutra lutra*), dragonflies and herpetofauna within the IEA and the Lok Ma Chau study area; together with monitoring at the two control areas to demonstrate the success of the IEA enhancement areas and to assess populations of, and any impacts on, species of these groups from the Spur Line project.

[1] Great Cormorant, Grey Heron, Great Egret, Little Egret, Chinese Pond Heron and Black-faced Spoonbill.

- Monitoring of establishment of appropriate conditions in the IEA fishponds to support the target wildlife species detailed above. Monitoring will cover habitats and vegetation cover, plant community composition, aquatic invertebrates, benthic invertebrates, fish stocks and soil and water quality.

6.1.3 The details of the location and timing of ecological baseline monitoring and the methods used described below are complementary to those provided in the Environmental Monitoring and Audit Manual (EM & A Manual).

6.2 Habitat and Species' Attributes to be Monitored

6.2.1 Monitoring will be carried out of the ecological attributes detailed below:

Monitoring of large waterbirds using the IEA with particular reference to the effectiveness of management measures

6.2.2 The following methodology follows that used during initial management measures conducted in winter 2001-2002 (BV 2002a). As in the monitoring of that exercise, monitoring of the IEA will be conducted from a tower hide. Use of a hide will be required in order to ensure that the observer does not disturb any birds using the ponds, whilst a tower is necessary to monitor a suite of ponds from a single location. Tower hide position is shown in Figure 1.3. Monitoring will be conducted by a single observer using a tripod-mounted telescope. During each visit the observer will keep the study ponds under observation from just after dawn to mid-morning (06.30 – 09.30) to coincide with the daytime period during which most birds feed. During each survey visit the observer will conduct five sweeps during which all birds using the ponds are counted. Only birds actually using the ponds are counted (i.e. flying birds are ignored).

6.2.3 Monitoring will be conducted once per week, except for times when individual ponds are being manipulated in order to attract large waterbirds. At such times, five days' continuous observations will be conducted in order to ensure that numbers of large waterbirds are properly assessed. Manipulation (drain-down and/or stocking) will be conducted, on average once every two weeks during winter and once per month during summer.

Monitoring of large waterbirds using two control areas of commercial fishponds to assess success of the IEA

6.2.4 The monitoring methodology for the Pak Hok Chau and San Tin control areas will follow that at Lok Ma Chau and will be conducted from similar observation towers Monitoring will be undertaken once per week. As far as possible, observations will be carried out at Lok Ma Chau and the two control areas simultaneously to make the findings directly comparable. Observations during drain-down will be undertaken, although this is likely to be restricted to the winter months when most commercial fishponds are drained.

Monitoring of birds within the Lok Ma Chau study area to assess populations of other target bird species

6.2.5 This monitoring is essential to interpret numbers of the secondary target bird species using the IEA and, later, the ECA. The methodology follows that used within the Lok Ma Chau area in the Baseline Study and subsequently; this will assist in the interpretation of trends in bird numbers during the course of the Spur Line project.

6.2.6 Surveys will be undertaken within 500 m of the Spur Line and the Lok Ma Chau Station as well as throughout the IEA (part of which is more than 500 m from the railway and station). The 500 m distance has been selected as it is the maximum referred to in the EIA at which it is predicted that there will be reduced densities of birds as a result of disturbance. During each survey visit, the surveyor will visit each pond in the study area and identify to species level all birds present. Counts will be made of all waterbirds, species of conservation importance (following Fellowes *et al.* 2002) and any other unusual bird species (the same methodology as was followed in the baseline survey). Where possible, each pond will be surveyed from one point, the most accessible on the transect route, to reduce disturbance and to reduce the risk of double counting. If required, the surveyor will adjust his position (if part of the pond is out of sight, or if closer views of a bird are required in order to confirm identification). If it is considered that birds have already been counted on other ponds, these will be ignored. If ponds contain large numbers of birds (e.g. foraging egrets) these will be surveyed at a distance to avoid disturbing birds and to further reduce the possibility of double counting. Where necessary, ponds that have been found to hold large numbers of birds earlier on a visit will be revisited if there is a suspicion that birds have moved within the study area during the course of the survey. In general flying birds will not be recorded unless they are clearly foraging and associated with the habitat. An exception to this will be Black-faced Spoonbill, Greater Spotted Eagle and Imperial Eagle; all individuals of these species will be recorded, although efforts to avoid double counting will be maintained.

6.2.7 In parallel with this bird survey, the broad physical characteristics of each pond will be recorded, including information on water levels, whether it is actively managed or not, and details of any drainage activity (not drained / being drained / drained). Details of any fish harvesting (where apparent) will also be noted. Partially drained ponds which have not been harvested will be identified on the basis of numbers of larger commercial fish. For partially or fully drained ponds the extent of the exposed bottom will be recorded to the nearest 25% of the total area of the pond; whether the exposed bottom is wet or dry will also be noted.

6.2.8 This background physical data will provide an important basis for the interpretation of patterns of bird use and will also permit direct comparison with HKBWS waterfowl count data which is collected using a similar survey protocol (Carey 2002).

Monitoring of mammals (especially Eurasian Otter, dragonflies and herpetofauna within the IEA and the Lok Ma Chau study area

6.2.9 Monitoring of mammals within the IEA and the Lok Ma Chau area will focus on the use of the area by Eurasian Otter *Lutra lutra*. The monitoring technique will be camera-based and will represent an extension of the study conducted from December 2001 – April 2002 (BV 2002b), during which otters were successfully photographed. Five Trailmaster combined camera and infra-red monitor sets will be deployed. These will be set up in permanent positions at appropriate locations in the IEA and in (for security reasons) temporary positions in the larger study area. The cameras will be fixed at an appropriate height so as to maximise chances of obtaining photographs of otters as well as other mammal species such as Leopard Cat *Felis bengalensis* and Small Asian Mongoose *Herpestes javanicus*. The infra-red monitors have an effective range of 5 – 8 m for animals within this size range. Fixed cameras will be checked, and films changed, once per week; temporary cameras will be set overnight. When cameras are set, signs of fresh otter activity (such as spraints and paw prints) will be searched for and will be recorded as will any other signs of recent mammal activity. Any spraints found will be photographed, collected and analysed to determine dietary composition. Prints will be photographed and measured to determine the size and number of individuals.

6.2.10 Dragonflies within the IEA will be surveyed two times per month during the period April to August. The surveys will be half a day in duration. Each month one survey will be conducted from 08.00 to 12.00 hours, and one will be conducted from 14.00 to 18.00 hours, to take account of the different daily activity patterns of different dragonfly species. During the surveys the IEA will be walked following a fixed survey route. All dragonfly species observed will be identified and all individuals counted. Habitat use and breeding activity will be recorded, as well as evidence of breeding success in the form of final instar larval exuviae, which will be collected and identified.

6.2.11 Herpetofauna surveys within the IEA will focus on breeding amphibians and the reptile community. Four half day surveys will be conducted per month during the period from March to July. Two surveys will take place during 10.00 to 14.00 hours, the peak period for reptile activity, while the other two surveys will take place at night from 18.00 to 22.00 and will focus on the detection of vocalising amphibians. During the surveys the IEA will be walked following a fixed survey route. All reptiles and amphibians observed or heard will be identified, and their abundance estimated. Habitat use and breeding activity will be recorded.

Surveys at Mai Po to monitor wintering Black-faced Spoonbills

6.2.12 This aspect of monitoring is critical to assess the effectiveness of management measures aimed at this globally endangered species. Regular counts at Mai Po Nature Reserve, where most of the wintering spoonbills roost, will provide data on the numbers present in Hong Kong. This will permit the numbers present in the IEA to be placed in context. Numbers of this species fluctuate rapidly during the winter, and thus regular monitoring is required.

6.2.13 Surveys will be conducted covering the whole of Mai Po Nature Reserve, during which time all spoonbills present will be counted. The timing of the counts will coincide with the period when most spoonbills are likely to be present, which is generally during the middle part of the day or over the high tide period.

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

Monitoring of habitats in the IEA

6.2.15 The function of the IEA is to provide 15 ha of appropriate fishpond habitat (including fishpond bund habitat) for target waterbird species. Habitat monitoring will be conducted at six monthly intervals at the end of the wet season (September) and the end of the dry season (March) to confirm that at least 15 ha in the IEA is being managed as wetland habitat for large waterbirds.

Monitoring of vegetation cover in the IEA

6.2.16 Vegetation cover in the IEA will be monitored at six monthly intervals at the end of the wet season (September) and the end of the dry season (March). Vegetation cover will be mapped showing extent of vegetation in bunds, in ponds and on riversides. Mapping will distinguish between areas of trees/woody plants, areas of vegetation over 10 cm in height, areas of vegetation less than 10 cm in height and areas which are free of vegetation.

Monitoring of plant community composition and structure in the IEA

6.2.17 Plant community composition and structure will be monitored annually at the end of the wet season (September). The following plant community parameters will be monitored: proportion of wetland plant species in all vegetated areas; individual species frequency and percentage of cover in each wetland habitat area; mean maximum height of vegetation in each wetland habitat area and variation in vegetation height of all species in each wetland habitat area.

Monitoring of aquatic invertebrates in the IEA

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

6.2.19 Samples shall be placed in labelled containers together with preservative for transporting to the laboratory. Once in the laboratory, specimens shall be rinsed in water, placed on a white sorting tray and sorted for identification to species level using a binocular microscope. Where partial body parts are identified, only heads will be counted.

The number of each macro-invertebrate species will be ascertained for each replicate sample for all taxa groups. A total dry weight biomass shall also be determined for each of the above groups.

6.2.20 The number and species of any fish captured incidentally during the sampling shall also be recorded.

Methodology for monitoring benthic invertebrates

6.2.21 Cylindrical benthic cores 10 cm in diameter and 10 cm depth will be taken from the substrate at the base of the ponds to obtain quantitative data on benthic invertebrate populations. Five randomly located replicate cores will be collected from each pond shallows. Core contents will be bagged and stored in a cooler for subsequent sorting. Samples will be analysed as for sweep netting.

Methodology for monitoring freshwater fish

6.2.22 During stocking, a random sample of 50 specimens of each species will be wet-weighed and measured (length), prior to release into the pond. Throughout the year throw-netting will be carried out 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 will be used to catch fish in fishponds. Five randomly-placed replicates will be conducted in each pond. Fish will be identified to species and their weight and length recorded and then released back into the pond.

Review of wildlife monitoring programme and consequent adaptive management

6.2.23 The wildlife monitoring programme detailed above will be reviewed on a weekly basis by the AEMS who will use the data collected to identify necessary adjustments to the management regime (see Section 6.3, below).

6.3 Monitoring and Adaptive Management Supervision

6.3.1 The progress of the management regime detailed in Section 5 and the monitoring regime detailed in Sections 6.1 and 6.2 will be supervised by the AEMS who will report to KCRC. The AEMS will be responsible for the supervision of the HCMP monitoring programme and will be responsible for giving appropriate advice to the Resident Engineer on the adaptive management regime who will then issue the necessary instructions to the contractor.

6.3.2 The AEMS will require to undertake the following:

Weekly Review of Conditions in the IEA

6.3.3 The AEMS will review on a weekly basis the management activities undertaken by the Contractor. The review will cover the following:

- Contractor's progress in the implementation of construction works, planting etc. during the previous week.

- Contractor's management activities undertaken during the previous week.

- Any reportable incidents during the previous week: including human disturbance, interaction with the main construction contract, adverse weather events, accidental or deliberate damage to mitigation areas, leakages and water quality problems.

Weekly Review of Wildlife Monitoring Activities Undertaken

6.3.4 The AEMS will review on a weekly basis the wildlife monitoring activities undertaken. The review will cover the following:

- Monitoring team's weekly report of utilisation of the IEA and the control areas by target bird species, together with other observations logged by the monitoring team in these areas (for example disturbance, response to drain-down etc.).

- Monitoring team's report of other wildlife monitoring activities (including bird surveys of the Lok Ma Chau study area, Black-faced Spoonbill roost counts, report camera surveillance of otters and other mammals, amphibian and invertebrate surveys.

Weekly Inspection and Review of the IEA and Control Areas

6.3.5 The AEMS will conduct on at least a weekly basis an inspection visit to the mitigation and control areas to verify Reports from the Contractor and Monitoring Team and to confirm that the IEA is being operated correctly. Inspection visits will focus, in particular, on the following:

- Contractor's progress in the implementation of construction works, planting etc.

- Condition of operational mitigation areas; in particular where active management (for example fish stocking, drain-down, refilling, fertilisation) is underway, has recently been completed or may be required to commence shortly.

- Items or issues not necessarily covered within the routine management and reporting responsibilities of the Contractor and the Monitoring team; for example stochastic factors judged to be influencing utilisation of the IEA and Control areas by target waterbird species.

- Opportunities presented for changes to or refinement of the management regime to better meet mitigation targets.

Issue of Weekly Prescriptions for the IEA

6.3.6 Based on the foregoing, the AEMS will then be responsible for issuing routine prescriptions for the IEA as follows:

- Instructions to the contractor (through the Resident Engineer) covering construction and management requirements, including any variations to construction and planting programme, routine management activities such as drain-down and refilling, stocking, fertilisation, vegetation management and response to events such as adverse weather, fires or other damage to habitats and equipment.

- Instructions to the monitoring team covering the programme to monitor drain-down and other adaptive management measures as well as variations in other monitoring activities in the light of changing circumstances.

Reporting

6.3.7 The AEMS will prepare a Monthly Monitoring Report throughout the period covered by this HCMP for the IEA. This Report will include a summary of the field data collected, performance in respect of targets for primary and other target species, an interpretation of the data with respect to Action and Limit Levels for ecological attributes and recommendations for remedial or other action to be taken.

6.3.8 In addition this Monitoring Report will review the Contractor's Monthly Progress Report and will detail recommendations for the forward programming of the Contractor's management activities. These programmed management activities will cover the current six-month wet or dry season period and will be rolled forward and / or modified as required according to progress in meeting targets and management objectives.

6.3.9 This Monthly Monitoring Report will form the ecological element of the monthly EM & A Report which will be submitted to the Environmental Committee. The latter Committee will monitor environmental aspects of the Spur Line construction project on behalf of Advisory Council on the Environment (ACE).

6.3.10 On a six monthly basis the AEMS will be required to review the information collected to date from the ecological monitoring programme, the construction programme, site activities and wetland management actions and to assess the degree of success of the active HCMP. The AEMS will propose modifications to the HCMP as required to improve the management of the wetland. The information used for this purpose and the proposals made will be the basis for presentations to the Environmental Committee as required.

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KOWLOON-CANTON RAILWAY CORPORATION
EAST RAIL EXTENSIONS -
CONTRACT NO. EGSA-023
ENVIRONMENTAL SUPPORT SERVICES
LOK MA CHAU STATION
HABITAT CREATION AND MANAGEMENT PLAN

ISSUE 6
AUGUST 2002

Responses To Comments

Responses to comments from EPD on HCMP dated 14 January 2003, KCRC letter reference ERE/IF/EN102/EGSA023/002617 dated 16 January 2003.

Comments	Responses
Section 2.2.6:	
Please replace "have been sponsored" by "are being carried out".	Agree. Text will be amended.
Section 3.3:	
a. Please specify the remedial measures proposed to reduce soil acidity in the ponds?	The measures for reducing acidity in the ponds are specified in section 3.4.5.
b. Should "see Section 3.3" be "see Section 3.4"?	Agree. Text will be amended.
Section 4.2:	
Please provide more detailed specifications on the land form, water regime and vegetation cover of each pond in the HCMP so that the profile and functions of each pond in the IEA are clearly defined to achieve the set targets. Relevant information such as operating water levels of each pond as tabulated in A4.2 - Table 5.1 of the EIA report should be included in this HCMP.	Figures 4.1 and 4.4 are added to provide details on the stocking and drain down arrangement at Lok Ma Chau IEA.

Comments	Responses
Section 4.4.8:	
Please provide detailed information on the fish stocking of the ponds.	Figure 4.3 is added to provide information on stocking of ponds.
Section 4.6.2:	
Please provide more specific details on the vegetation management of each pond (e.g. in the form of a schematic diagram) to indicate the vegetation management regime in the IEA. For example, the percentages of each species of recommended wetland plants to be planted in ponds 5 and 8 would need to be specified here.	Figure 4.4 is added to show the vegetation management of each pond for the IEA.
Table 5.1:	
a. Appendix 2.1 could not be located.	This reference to Appendix 2.1 will be deleted.
b. The EM&A has stated that in-situ water quality monitoring is carried out bimonthly rather than monthly. Please check.	Water quality shall be monitored bi-monthly. However, if measures for changing pond water quality are implemented the water quality will be monitored within 2 weeks. Both the EM&A and HCMP have been amended accordingly.
Section 6.2:	
Please refer to comments on the EM&A Manual.	Please refer to responses on the comments on the EM&A. The HCMPS section 6.2 will be amended accordingly.
Figure 1.3:	
Low and maximum operating levels are missing for ponds 1, 2 and 5.	Figure 4.3 provides operating levels for all ponds.
Appendix 3:	
a) Please replace this Appendix 3 with an updated version of A4.2 - Table 6.2 of the EIA Report, to include relevant specific information for the IEA and an additional column for "Action/ Contingency Plan".	Appendix 3 is being replaced with an updated version of A4.2 – Table 6.2 of the EIA.

Comments	Responses
b) Please note that the use of "herbicides" is not desirable.	Noted. Reference to herbicides are removed from Appendix 3.
c) Please add the information about the specific fishpond habitat targets as listed in Section 6.16.66 of the construction Phase EM&A Manual in the updated version of A4.2 - Table 6.2 of the EIA Report as indicated in Item (1) above.	Appendix 3 is being replaced with an update version of A4.2 – Table 6.2 of the EIA.