

Executive Summary -EIA

**Proposed Development at
Fung Lok Wai , Yuen Long
Lot 1457 R.P. in D.D. 123**

Reference	R037-1.08
Client	Mutual Luck Investment Limited
Date	July 2008

CH2M HILL Hong Kong Limited
In association with

RPS
ADI Ltd.
Archaeological Assessments
MVA Hong Kong Limited

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1. INTRODUCTION

1.1 Background

- 1.1.1 The project proponent – Mutual Luck Investment Limited (MLI) proposes to develop a residential development and a Wetland Nature Reserve (“WNR”) (hereafter collectively called the “Project”) at the existing fishponds at Lot 1457RP in DD 123 Fung Lok Wai, Yuen Long (the “Site”). The location of the Project is shown at Figure 1–1. The total site area is about 80.1 ha.
- 1.1.2 The Project is located to the south of the Inner Deep Bay, between Yuen Long Industrial Estate and Hong Kong Wetland Park. Immediately south of the Project is Ng Uk Tsuen. Ya Kai Shan is located to the immediate southwest, screening the Project from the sight of Wang Chau and Yuen Long Town, which are 1.5 and 2 km south of the Project respectively. Yuen Long Industrial Estate is 1.45 km southeast of the Project. The tall buildings of Tin Shui Wai New Town dominates the landscape of the area.
- 1.1.3 The Subject Site lies within the Wetland Conservation Area of which about 43 ha of the Site is designated as a Mai Po Inner Deep Bay Ramsar Site since September 1995.
- 1.1.4 The Project is a Designated Project according to Item P of Part I Schedule 2 of the EIA Ordinance since it involves a residential development other than New Territories exempted house within Deep Bay Buffer Zone 1 and 2.
- 1.1.5 MLI submitted a project profile (No. PP-091/2000) on 26th May 2000 for an Environmental Impact Assessment (EIA) Study Brief under section 5(1)(a) of the EIA Ordinance. A Study Brief (No. ESB-055/2000) was issued by the Authority to MLI under section 5(7)(a) of the EIAO in July 2000.
- 1.1.6 CH2M Hong Kong Limited is appointed by MLI as the lead consultant to carry out this EIA in association with RPS, Asia Ecological Consultant, ADI Ltd, Archaeological Assessments and MVA Hong Kong Limited.

1.2 Historical Land Use of the Site

- 1.2.1 The earliest useful map indicated that the area of Fung Lok Wai was swamp and marsh in the early 1900’s. The area was then reclaimed for brackish water rice cultivation. During the period between 1938 and 1945, the Deep Bay area was transformed into gei wais. By 1974, the area was converted to deep water fish ponds as fish farming was then a profitable business. These fish ponds remain up to the present, however many of them have been abandoned as a result of severe competition from the cheap fish imports from mainland China.

1.3 Ecological Importance of Fish Ponds

- 1.3.1 Fresh water fish farming was once an important agricultural activity in Deep Bay area supporting the livelihoods of many local people. These fish ponds, it so happened, also served as an extensive area of wetland habitat that are of ecological importance to birds, in particular to migratory birds on their migratory path as a refuelling station.
- 1.3.2 The Fish Pond Study identified that the traditional aquaculture management practices adopted in the fish ponds within Deep Bay were of particular ecological value to wetland birds when the ponds were drained at harvest time. These water birds feed on trash fish that are of no commercial value and which are bi-product of traditional aquaculture management practices.

- 1.3.3 However, with the continual decline of the fish farming industry in Hong Kong throughout the past decades, many of the fish ponds in Deep Bay area are abandoned. With the absence of active management, the ecological value of fish ponds to birds will be lost. Therefore, there is an imminent need to conserve these fish ponds together with the traditional aquaculture management practices in order to conserve the ecological value of this important wetland habitat in Deep Bay.

1.4 Project Objective

- 1.4.1 The objective of the Project is to develop a sustainable model for the conservation of the existing fish ponds together with the traditional aquaculture management practices with value creation stemming from the development of a residential complex.
- 1.4.2 Three major principles are proposed to be upheld in the design of the Project:
- (1) No net loss of wetland;
 - (2) Sustainability;
 - (3) Wise use of the wetland.
- 1.4.3 These principles are embedded in the physical design of the Project and the proposed operation of the Wetland Nature Reserve:

No net loss of wetland

The Project will comply with the “no-net-loss in wetland” principle as stipulated in the notes of the Approved Lau Fau Shan and Tsim Bei Tsui OZP No. S/YL/LFS/7. The fishponds will be re-profiled and enlarged through removal of some pond bunds to result in a habitat more suitable and sympathetic to wetland birds. A corollary in doing so (enlargement and removal of pond bunds) also resulted in complying with the “no net loss in wetland” principle as there will be a slight overall increase in water body area and the enhanced profile and management of the fish ponds will enhance the ecological value of the fish ponds. The residential development site will be restricted to occupy only 5% of the Site at the southern edge.

Sustainability

The enhanced fish ponds and habitats created will form a dedicated Wetland Nature Reserve. The Proponent will be responsible for the creation, enhancement and management of the Wetland Nature Reserve during the construction phase and shall provide an undertaking to take sole responsibility for management until a successor, such as an independent Foundation, is identified to the satisfaction of EPD or its agent.

Wise use of wetland

The long-term management of the fish ponds in the Wetland Nature Reserve ensures the preservation of the cultural practice of aquaculture in-situ, which is consistent with concepts of “wise use” fore-shadowed in Article 3.1 of the Ramsar Convention. It also provides opportunities for ongoing research into sustainable fish production and wildlife conservation.

1.5 Project Description

The Project comprises a total site area of approximately 80.1 ha with the following main components:

- 148,000 m² GFA residential development and a resident’s club house on approximately 4 ha site area; and

- the remaining site area of approximately 76.1 ha will be developed into a Wetland Nature Reserve comprising enhanced and managed fishponds, marsh complex, a potential alternative egret and facilities ancillary to the WNR.
- Vehicular access for the Project will be via the existing Fuk Shun Street at the southern side of the Site.

1.5.1 The Project is scheduled to be completed with population intake in the third quarter of 2016.

The Residential Portion

1.5.2 The approximately 4 ha residential land will be formed by filling fishponds at the southern part of the Site whilst the WNR will be established to its immediate north.

1.5.3 The development parameters of the proposed residential development are tabulated below:

Total Site Area (approximate)	80.1 ha
Proposed Plot Ratio	0.185
Proposed Residential GFA	148,000 m ²
Design Population	8,490
Proposed No. of Flats	Not more than 2860

The Wetland Nature Reserve

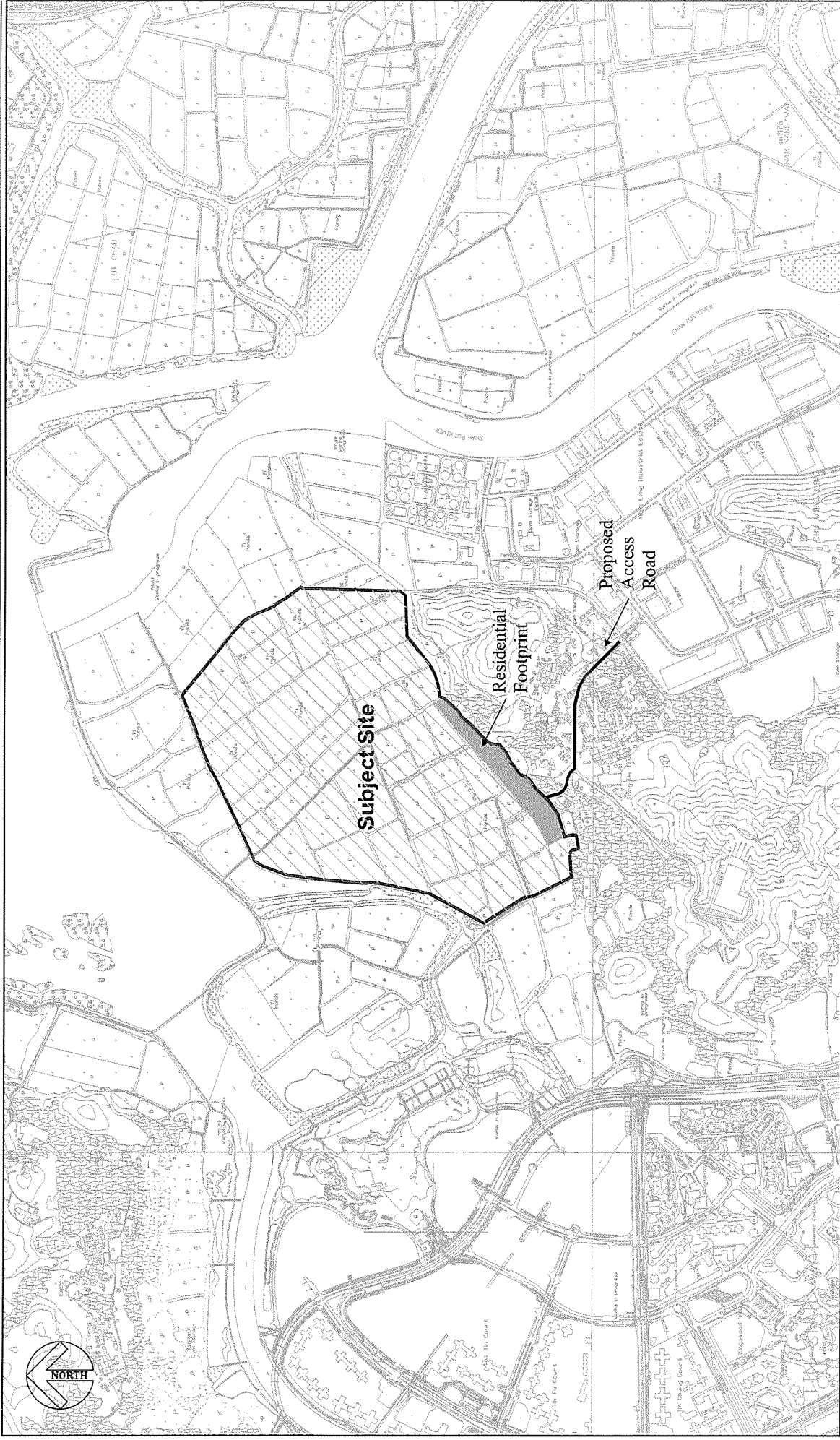
1.5.4 The proposed Wetland Nature Reserve (WNR) will comprise three key elements:

- A large expanse of retained, but ecologically enhanced, fishponds;
- An area of marshland complex; and
- A potential alternative egret

1.5.5 The Project will comply with the “no-net-loss in wetland” principle as stipulated in the notes of the Approved Lau Fau Shan and Tsim Bei Tsui OZP No. S/YL/LFS/7. The fishponds will be reprofiled and enlarged through removal of some pond bunds to result in a habitat more suitable and sympathetic to wetland birds. A corollary in doing so (enlargement and removal of pond bunds) also resulted in complying with the “no net loss in wetland” principle as there will be a slight overall increase in water body area and the enhanced profile and management of the fish ponds will enhance the ecological value of the fish ponds.

The Access Road

1.5.6 The Project access will be via Fuk Shun Street which is currently a substandard road. Improvement works to upgrade the road to 7.3m wide single 2-lane road with 2m wide footpaths on both sides of the road is proposed.



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Title: The Proposed Development

Project: EIA for Proposed Development at Fung Lok Wai, Yuen Long at Lot 1457 R.P. in D.D. 123

Scale: NTS

Figure: 1-1

2. KEY ELEMENTS OF THE FUNG LOK WAI WETLAND NATURE RESERVE

2.1 Ecological Baseline

- 2.1.1 In accordance with the requirements of EIA Study Brief (ESB-055/2000) issued by EPD under the terms of the Environmental Impact Assessment Ordinance in 2000, ecological investigations were undertaken at Fung Lok Wai, including 12 months of fauna surveys between January and December 2001.
- 2.1.2 The outcomes of these investigations indicate that the most valuable habitat components of Fung Lok Wai are wetlands. In particular the block of *Aquaculture Ponds* that, along with adjacent fish ponds, form an extensive wetland area embedded within the broader Deep Bay Area. An egretty present in the small *Fung Shui Woodland* in the southern part of the Assessment Area (defined by the study brief) at the time of the surveys was also considered to be a feature of high ecological value. More recent inspections indicate that this egretty has subsequently been abandoned. Figure 2-1 indicates the habitats present with the EIA Assessment Area. In the period since the completion of the baseline surveys, bird activity at Fung Lok Wai is likely to have declined due to reduction in fish farming activities at Fung Lok Wai and the abandonment of the egretty.
- 2.1.3 The importance of these habitats derives primarily from the resources they provide for plant and animal species of conservation importance and in particular wetland birds such as herons and egrets.
- 2.1.4 Some aspects of traditional aquaculture practice on site, such as periodic draining of ponds, have increased the attractiveness of fish ponds to birds. On the other hand the small and uniformly steep sided form of the ponds limits their potential. With more sympathetic management the value of fish ponds for nature conservation purposes at Fung Lok Wai could be significantly higher.

2.2 Identified constraints

- 2.2.1 Analysis of these baseline data indicated three constraints on the proposed development:
- At the time of ecological investigations in 2001, the location of the egretty (now abandoned) in the southern part of the assessment area could result in flight line interference of birds attempting to access food resources within Fung Lok Wai;
 - Accessing the site from the west adjacent to the Hong Kong Wetland Park, as originally proposed, will require additional construction work and, potentially, create disturbance to the egretty (now abandoned). Access from the south would only require slight widening of Fuk Shun Street but will not require land resumption; and,
 - It is desirable to maintain linkages between all the wetland habitats within the Fung Lok Wai assessment area, including the mosaic of wet agriculture land in the southern part of the Assessment Area.

2.3 Considerations Affecting the Development Design

- 2.3.1 The Site has a long planning history back to 1980's. The initial development proposal was to develop the site for low density residential houses and a golf course.
- 2.3.2 Realizing the ecological importance of the Site to wildlife, in particular to birds, the land owner subsequently made various applications to the Town Planning Board for the permission of a development comprising low density houses on about half of the site and a nature reserve on the remaining half in the early 1990's. These applications were all rejected by the Board.

- 2.3.3 The development proposal then further evolved to be more sympathetic to the ecological value of the Site. A revised development scheme comprising apartments development on a development footprint of only 5% (i.e. 40,000m²) of the Site with plot ratio of 0.185 plus a 76 Ha (95% of the Site) Wetland Nature Reserve was proposed to the Town Planning Board in 1999. This proposal was accepted by the Board. As a consequence, the Site was rezoned to “Other Specified Uses – Comprehensive Development and Wetland Enhancement Area” with a maximum gross floor area of 148,000m² in 1999.
- 2.3.4 In this EIA, a range of development options have been examined and several key decisions have been made based on the findings of the studies.

Building Height

- As required by the EIA Study Brief, developments of different height limits were specifically examined. Three development options for the residential portion (Figure 2–2a to c) are studied:
 - Option 1A – all buildings not more than 18 storeys (8 blocks of 14-18 storeys, 7 groups of low-rise buildings of 4-8 storeys including a resident’s club house erected on 40,000m² residential site area i.e. 32.8% Site Coverage);
 - Option 1B – all buildings not more than 15 storeys (9 blocks of 15 storeys, 7 groups of low-rise buildings of 4-10 storey including a resident’s club house erected on 40,000m² residential site area i.e. 34.4% Site Coverage); and
 - Option 1C – all buildings not more than 10 storeys (29 blocks of 7-10 storeys, 27 4-storey terrace houses and a resident’s club house erected on 60,000 m² residential site area i.e. 34% Site Coverage).
- Of the three development scenarios, Options 1A and 1B are considered preferable because:
 - (1) Only Options 1A and 1B can meet the criteria of “no net loss in wetland”;
 - (2) Option 1A and 1B have relatively smaller development footprint with less permanent habitats loss and the smaller disturbance zone to the adjacent habitats;
 - (3) Taller buildings will not materially increase obstructions to bird flight as most flights occur at low altitudes. Analysis of the flight patterns of bird species within the Assessment Area showed that most flights occur at low altitudes and there is no material difference regarding the impacts of varying heights of buildings on bird flights;
 - (4) It is important to maintain gaps between buildings to allow visual access by birds through the building gaps to the wetland habitats in front of the buildings.
- Option 1A and 1B are also the preferred options from both landscape and visual perspectives:
 - (1) Larger degree of visual access to the wooded hill sides to the south of the development site thus preserving the link between the fishponds and their landscape context.
 - (2) The building profile responds to the form of the existing topography to a greater degree than the Option C creating a development which is both visually interesting and visually permeable.
 - (3) The stepped height profile of Option 1A mirrors the line of the ridgeline to the south creating a dynamic relationship with the existing landscape context whilst Option 1B has a lower maximum building height profile.

Building Location

- An abandoned egretty was found near Shing Uk Tsuen during the four seasons survey. To minimise the impacts on birds’ flight paths particularly on the herons and egrets associated with the egretty, the location of the proposed residential development area was moved approximately 150m eastwards of its original position. This move dramatically reduces potential interference with flight lines associated with the egretty. It also has an additional benefit of retaining the linkage between the Fung Lok Wai wetlands and the adjacent

wetlands lying to the south and south-west of the Site. The Shing Uk Tsuen egret, however, was subsequently found abandoned after the survey.

Creation of a Potential Alternative Egret

- Although the residual impact from the construction and operation of the proposed residential development on Shing Uk Tsuen egret (present during the survey period but subsequently abandoned) is expected to be minimal with the shifting of the residential development eastward, as a precaution a potential alternative egret is proposed to be established within the Wetland Nature Reserve (WNR, Figure 2-3).

Building Design

- To minimise the possibility of bird collision, the extent of reflective surfaces will be limited through, for example, use of low reflectivity glass and façade finishes.

Development Access

- The preferred access to the site is via the existing Fuk Shun Street to the south, which better suits the new location of the residential development and will have no ecological impact.

2.4 Design Principles of the Wetland Nature Reserve

2.4.1 Two main principles are to be achieved:

- **No net loss of area** will be achieved through reconfiguration of fishponds to create larger ponds and the creation of a complex of freshwater marsh habitats. This is primarily to cater to many wetland birds which prefer larger, less enclosed waterbodies to the small ponds which typify most aquaculture practices. Through the reconfiguration of the pond bunds, there will be a slight overall increase in waterbodies area upon the completion of the WNR. The removal of some bunds is predicted to have low or negligible impact on flora or fauna as their intrinsic ecological value is low and no Species of Conservation Importance were found to be reliant on them. The complex of freshwater marsh habitats proposed will provide a range of additional habitats for birds and other flora and fauna, including dragonflies adding to biodiversity.
- **Functional enhancement** will be achieved through enhancement of both the ponds and the approach to aquaculture management. The carrying capacity of fishponds is limited by the uniform design of ponds and management that is not specifically targeted at conservation. Modifications to both will significantly improve foraging opportunities for birds and other fauna. To ensure ongoing functional replacement, key ecological indicators, including birds, will be monitored to guide management of the reserve.

2.4.2 Out of the proposed 76.1 ha Wetland Nature Reserve, thirty-seven (approximately 61.7 ha) of the existing fishponds will be modified and enhanced to increase their value for Species of Conservation Importance, particularly birds recorded regularly on the site (Figure 2-3).

2.4.3 These existing smaller size fish ponds will be consolidated through bund removal to create 18 enlarged ponds with an average size of about 2.6 Ha which will be enhanced to improve their attractiveness to wildlife, particularly birds through creation of shallows and muddy islands and cutting back of vegetation and another 3 rain fed ponds where the water level is allowed to fluctuate seasonally for water birds.

2.4.4 The balance of ponds measuring an area of approximately 14.4 ha adjacent to the development area will be converted into a complex of freshwater marsh habitats.

2.4.5 A potential alternative egret will be constructed in a part of the WNR that is as remote as possible to minimise disturbance. The design of this egret draws on information gathered about the key features of egrets within the New Territories which indicates, for example, that it should be constructed with mature specimens of species such as Figs (*Ficus spp.*), *Celtis sinensis* and bamboo (*Bambusa spp.*).

2.4.6 Whilst the Wetland Nature Reserve and the residential development is being constructed some of the fishponds will be managed according to a temporary regime which is intended to boost their immediate value to feeding birds. This will involve:

- Correcting the pH of the water;
- Stocking those ponds that are fish depleted with “trash fish” species;
- Periodically draining down designated ponds according to a pre-determined schedule; and,
- Re-correcting pH and re-stocking as required.

2.5 Operational Management of the Wetland Nature Reserve

2.5.1 Following the completion of the WNR and the residential development the 18 enhanced and enlarged fish ponds will be managed according to traditional commercial aquaculture procedures involving stocking, rearing, harvesting and periodic set-aside for maintenance and recovery with several key differences:

- The management of the 18 enlarged fish ponds for active production will be coordinated. It will also facilitate a more effective approach to their *adaptive management*.
- Ponds in production will be drained down annually for a longer fixed period of 20 days.
- Approximately 25% of these ponds will be “set-aside” for production according to a 5 yearly schedule. This will provide opportunity for maintenance works and allow for control of diseases or undesirable species.
- Whilst most fish selected for farming will be those typical of commercial aquaculture operations, the composition and proportions of these species will be varied to benefit feeding wildlife to achieve HCMP targets.

2.5.2 Water levels within the marsh complex will be managed according to broad habitat requirements – i.e. permanent or seasonal inundation. Within the permanently inundated marsh areas, levels will still be allowed to fluctuate (within bounds) to facilitate the periodic exposure of muddy areas.

2.6 Timing of construction

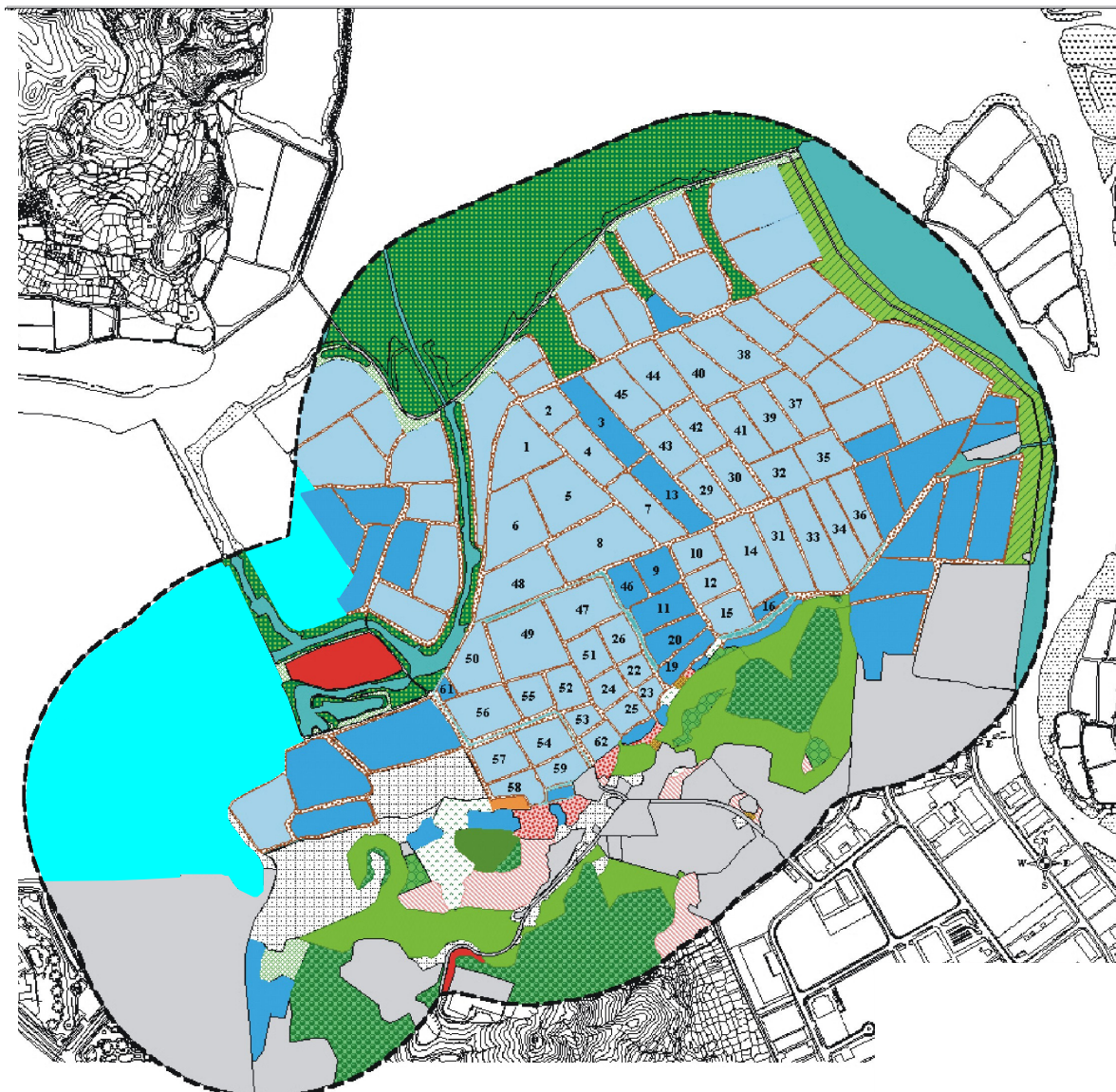
2.6.1 WNR construction works will be staged to minimise disturbance of the site. Ponds in the northern part of the site (Sectors 1 and 2, Figure 2–4) will be enhanced first followed by construction of the freshwater marsh complex and, finally, enhancement of the remaining southern ponds (Sector 3). To minimise disturbance impacts site formation works for the development area are programmed to occur concurrently with those of the adjacent freshwater marsh creation area. The same machinery can be used to prepare both areas reducing overall construction time and minimising the need for temporary soil storage.

2.6.2 Calculation of expected water levels within ponds indicates that during construction works of the WNR (which will be undertaken during the dry season) water can be retained within the site (through transfer between ponds) thus avoiding the need for discharge to Deep Bay.

2.6.3 The overall timing of works within the development area and the WNR is illustrated in Figure 2–5.

2.7 Management of the Wetland Nature Reserve

- 2.7.1 Upon the completion of the construction of the WNR, the Development Site will be sub-divided into two portions: the WNR portion and the residential portion. The operation and management of the WNR will be independent from the management of the residential development. The WNR will be managed by the proponent until a designated successor, such as an independent Foundation, is identified to the satisfaction of EPD or its agent. The residential development, which will be under strata-titled ownership will be independently managed by the property manager appointed by the owners of the residential development. The residents in the residential development will not have privilege over the general public for access to the WNR nor the liability of its maintenance.
- 2.7.2 The Wetland Nature Reserve is designated as “Private Land Zone” under the Ramsar Conservation Strategy and Management Plan as it is under private ownership. Adjacent to it is a band of Public Access Zone”. The proposed Wetland Nature Reserve can be integrated with the “Public Access Zone” forming a logical extension of this zone. Whilst conservation is the prime objective of the Wetland Nature Reserve, limited public access will be allowed on a restricted basis so as not to create disturbance to birds. Occasional guided tours and some educational facilities can be contemplated. Picnicking and similar activities will not be allowed within the Wetland Nature Reserve.
- 2.7.3 Responsibility for the management of the WNR rests with the project proponent until a designated successor such as an independent Foundation is identified to the satisfaction of EPD or its agent. Subject to the necessary agreements from relevant government authorities, an independent, non-profit Foundation will be established to take over the long-term management of the WNR. Similar in form to a Conservation Trust, the Foundation will provide guidance and resources on strategic and day-to-day management of the reserve.
- 2.7.4 The ongoing management paradigm for the WNR will be *Adaptive Management*. As new data come to light and understanding about wetland conservation improves through research, management of the WNR will be modified to further the objectives identified.
- 2.7.5 The proponent or its designated successor will implement the Habitat Creation & Management Plan (HCMP) submitted with the EIA report. Experienced ecologists will be employed as the Reserve Manager for the day-to-day management of the WNR and experienced fish farmers will be employed for the operation of the fish ponds under the supervision and guidance of the Reserve Manager to fulfill the conservation objectives of the WNR. The HCMP will be reviewed, on an annual basis on its effectiveness.
- 2.7.6 Every five years a more detailed process of review will commence which will focus on: evaluating the extent to which the HCMP is achieving its conservation objectives; and the performance of site management staff and contractors. In light of the outcomes of this performance review the HCMP will be revised in consultation with the relevant authorities.



LEGEND

- Intertidal forested wetlands
- Permanent rivers, streams and creeks
- Ditches and drainage channels
- Aquaculture pond (actively managed)
- Aquaculture pond (unmanaged)
- Pond bunds
- Reedbed
- Permanent freshwater marsh and pools
- Seasonally flooded (wet) agricultural la
- Dry agricultural land
- Inactive agricultural land
- Orchard
- Fung-shui* woodland
- Semi-natural secondary woodland
- Plantation woodland
- Grassland
- Grassland-shrubland mosaic
- Landscaped area
- Recreated Wetland
- Wasteland
- Developed Area
- Assessment Area

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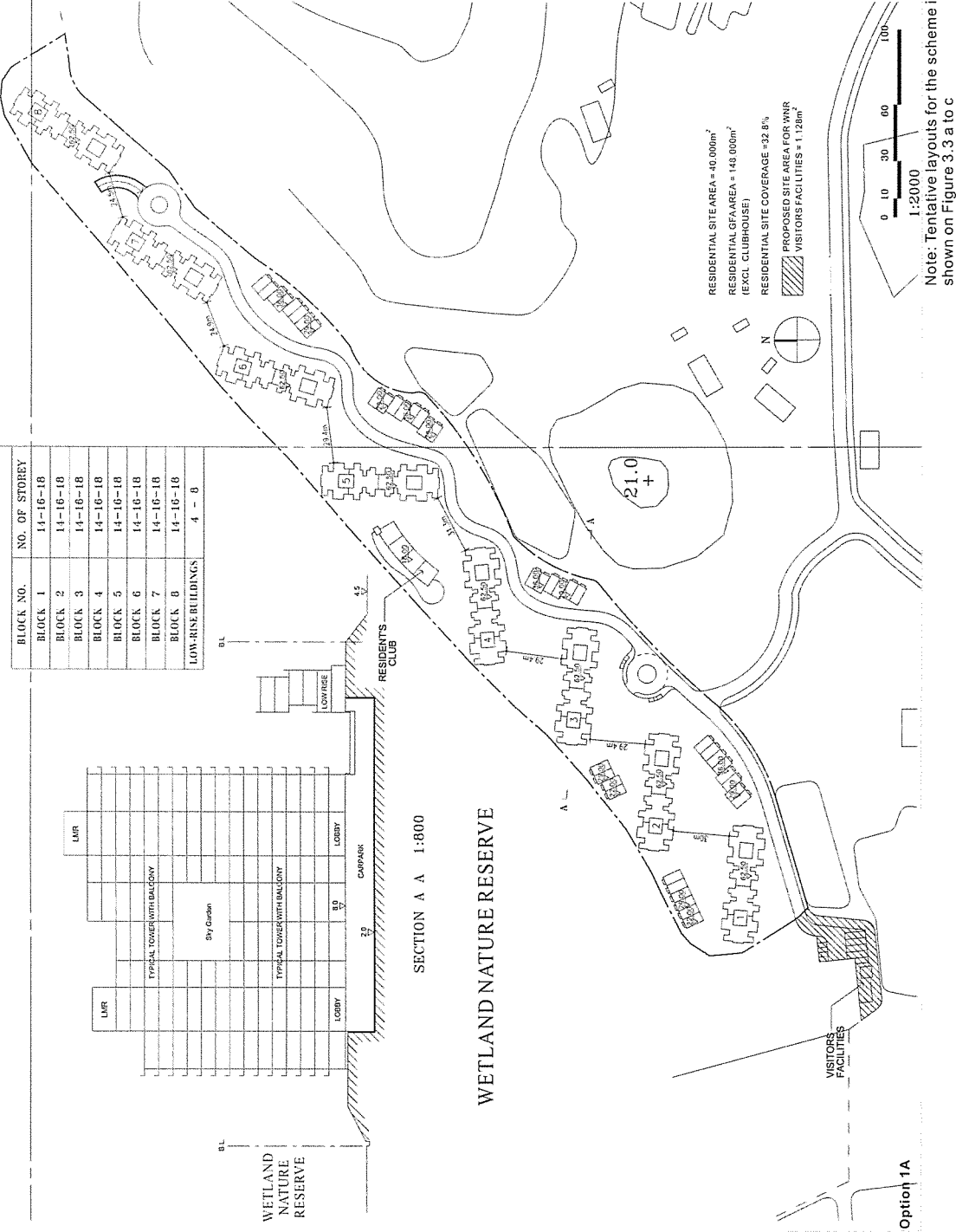
Title: Baseline Habitat Map

Project: EIA for Proposed Development at Fung Lok Wai, Yuen Long at Lot 1457 R.P. in D.D. 123

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Scale: NTS

Figure: 2-1



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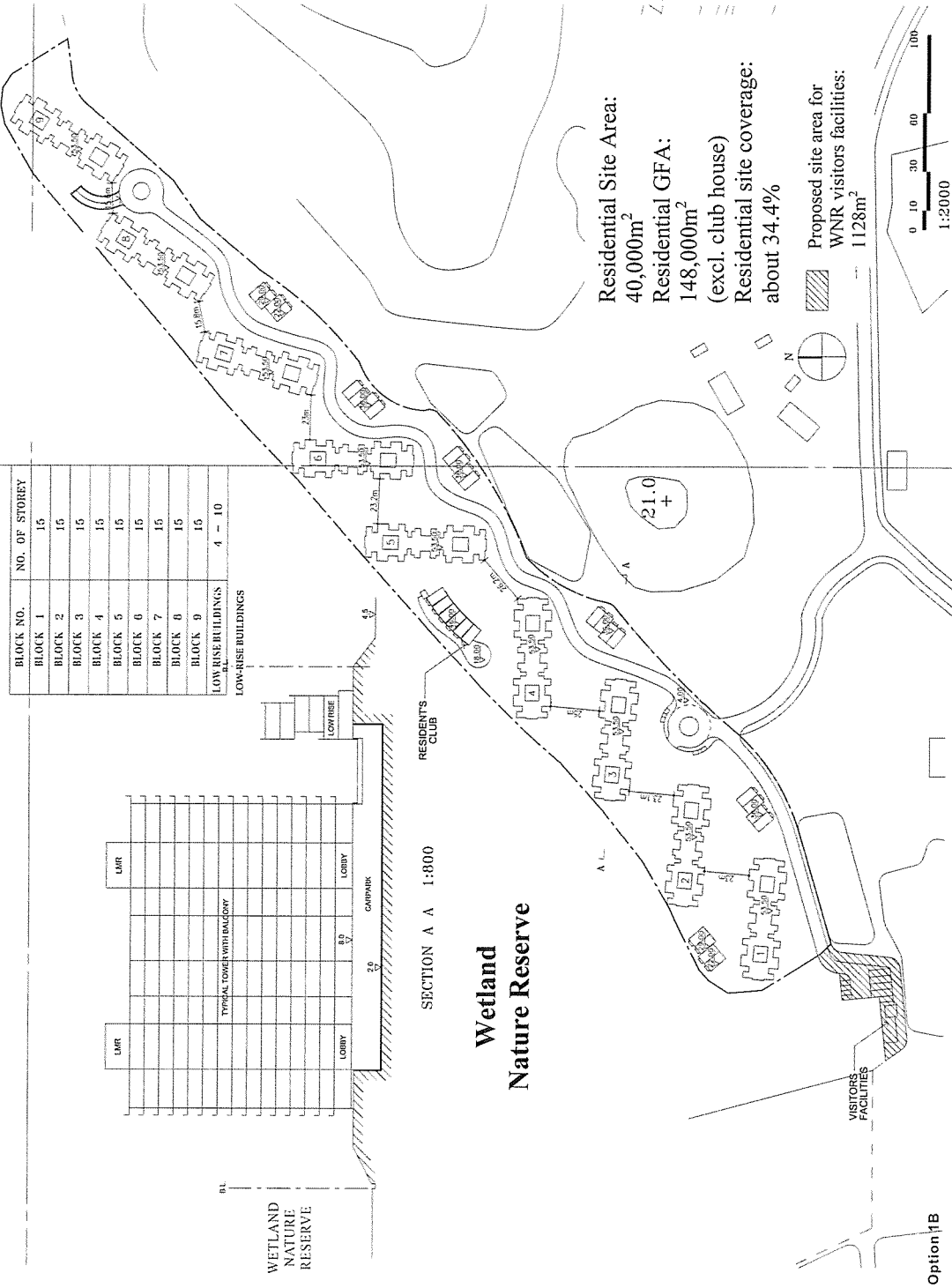
Title: The Three Building Height Scenario – Option 1A

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Scale: NTS

Figure: 2-2a



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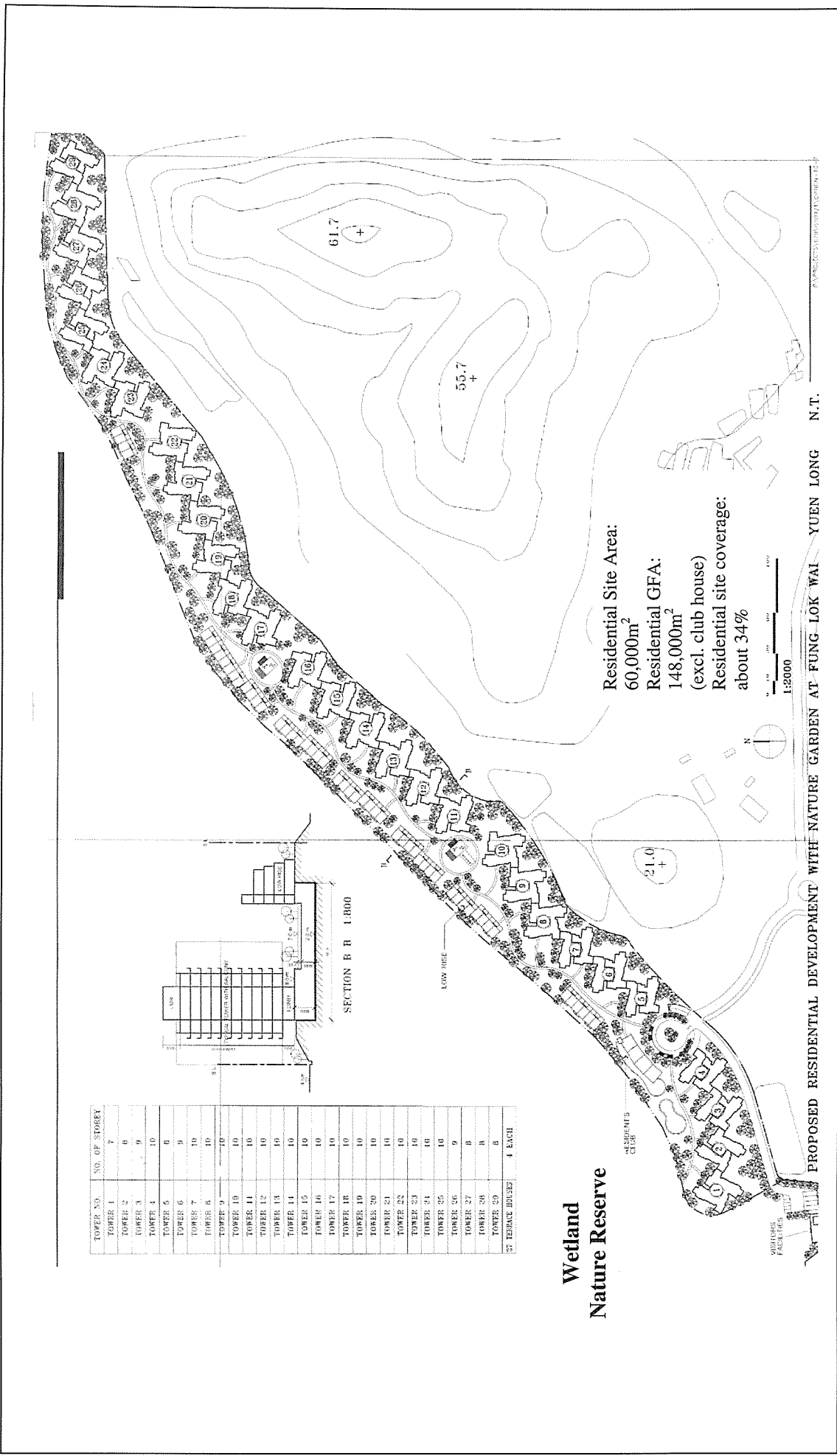
Title: The Three Building Height Scenario – Option 1B

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Scale: NTS

Figure: 2-2b



TOWER NO.	NO. OF STOREY
TOWER 1	7
TOWER 2	8
TOWER 3	9
TOWER 4	10
TOWER 5	8
TOWER 6	9
TOWER 7	10
TOWER 8	10
TOWER 9	10
TOWER 10	10
TOWER 11	10
TOWER 12	10
TOWER 13	10
TOWER 14	10
TOWER 15	10
TOWER 16	10
TOWER 17	10
TOWER 18	10
TOWER 19	10
TOWER 20	10
TOWER 21	10
TOWER 22	10
TOWER 23	10
TOWER 24	10
TOWER 25	10
TOWER 26	9
TOWER 27	8
TOWER 28	8
TOWER 29	8
TOWER 30	8
TOWER 31	8
TOWER 32	8
TOWER 33	8
TOWER 34	8
TOWER 35	8
TOWER 36	8
TOWER 37	8
37 TERRACE HOUSES	4 EACH

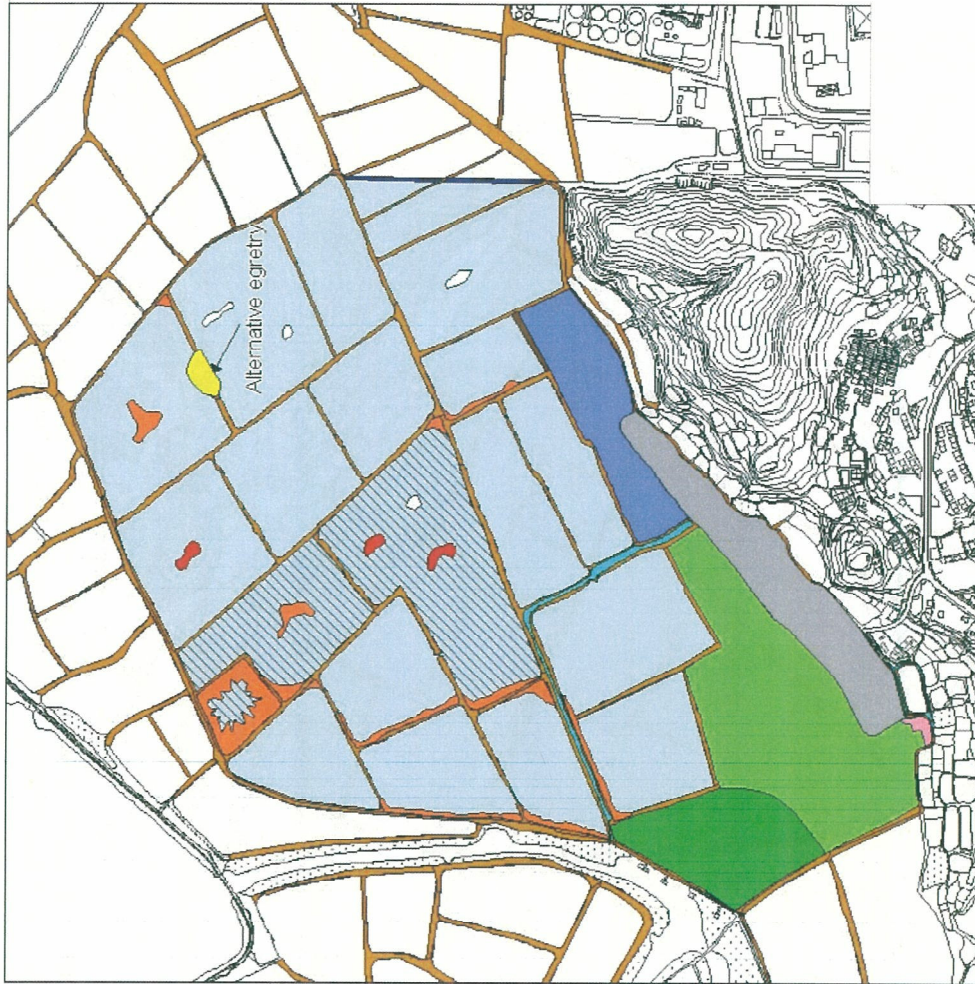
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Title: The Three Building Height Scenario – Option 1C

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Scale: NTS
Figure: 2-2c



LEGEND

- Development Area
- Visitor and Reserve Management Facilities
- Enhanced Fishpond
- Natural Rain Fed Pond
- Paspalum Grass
- Phragmites Reeds
- Unvegetated Muddy Shallows
- Storage Pond
- Permanent Marsh
- Seasonal Marsh
- Drainage Ditches

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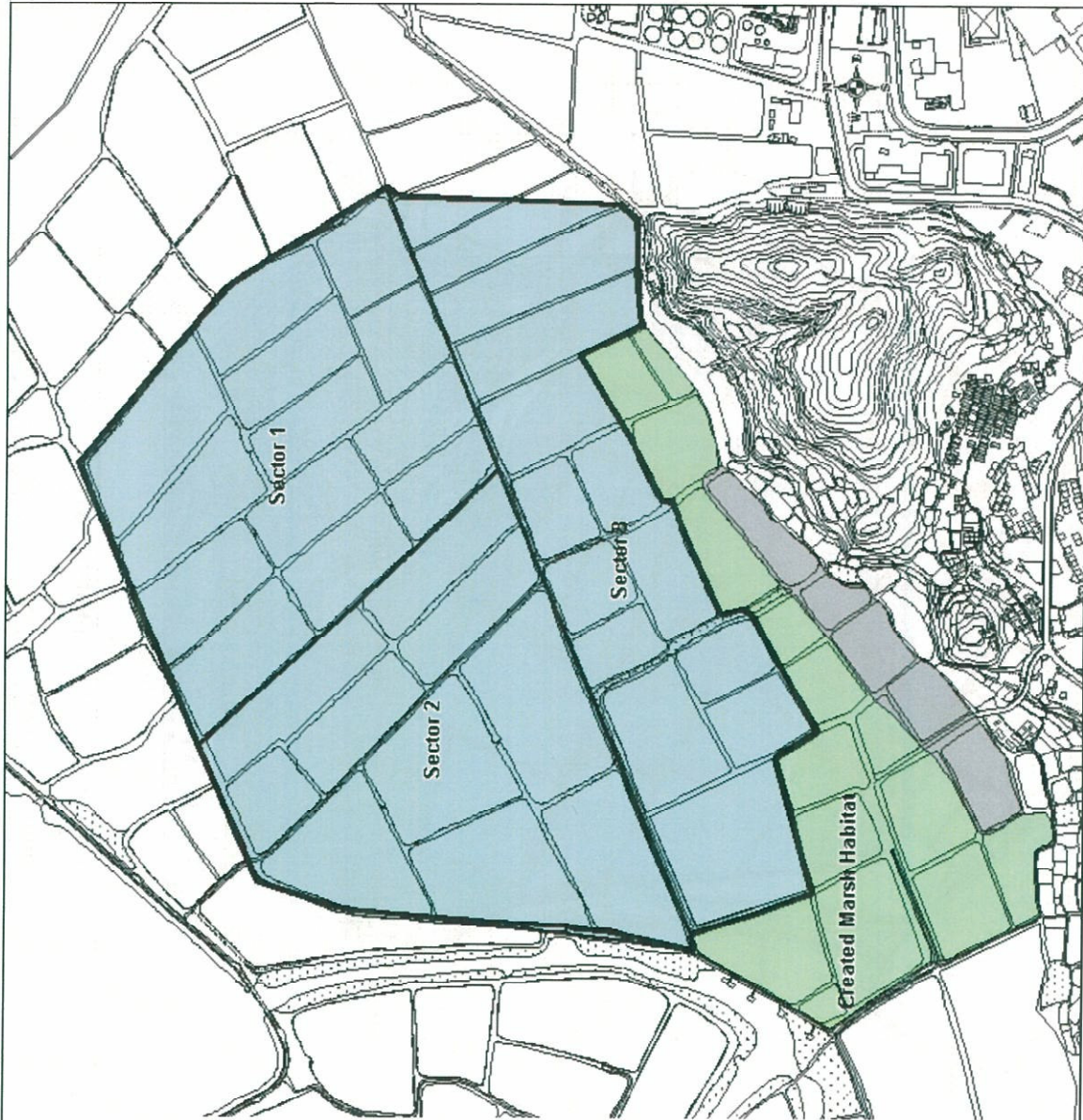
Title: Proposed Layout of the WNR

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Project: EIA for Proposed Development at Fung Lok Wai, Yuen Long at Lot 1457 R.P. in D.D. 123

Scale: NTS

Figure: 2-3



LEGEND

- Development Area
- Created Marsh Habitat
- Enhanced Fish Ponds

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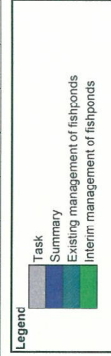
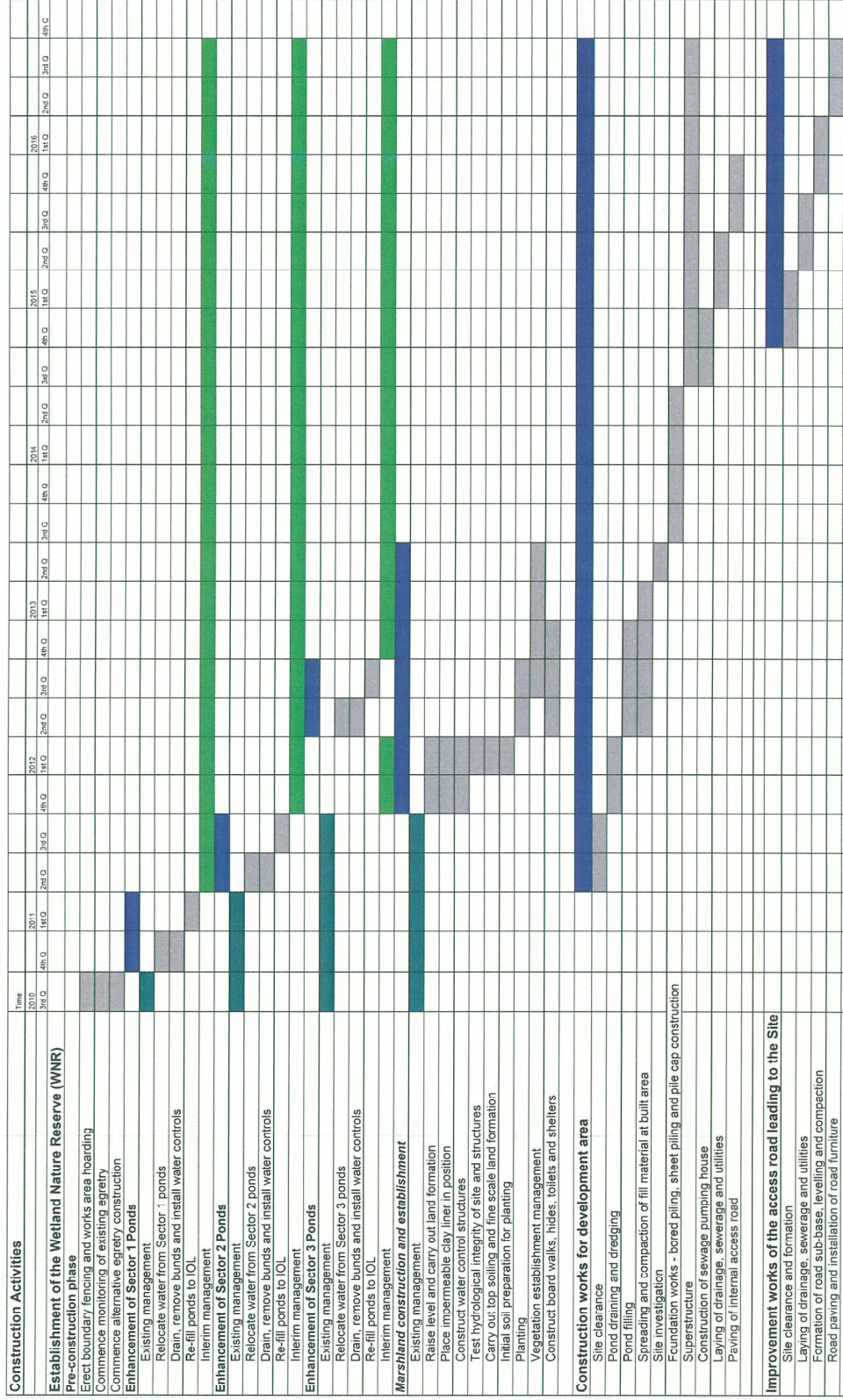
Title: Construction sectors within the WNR

Project: EIA for Proposed Development at Fung Lok Wai, Yuen Long at Lot 1457 R.P. in D.D. 123

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Scale: NTS

Figure: 2-4



* It is intended that construction activities involving heavy machinery within the WNR will, to the extent possible, be conducted during the dry season

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	Project: EIA for Proposed Development at Fung Lok Wai, Yuen Long at Lot 1457 R.P. in D.D. 123	Scale: NTS
		Figure: 2-5

3. SUMMARY OF FINDINGS OF EIA STUDY OF THE PROJECT

3.1 Objectives of the EIA Study

- 3.1.1 The main objectives of the EIA study are to identify and assess the potential environmental impact associated with the construction and operation of the project, and, if necessary, to propose cost-effective mitigation measures to eliminate, or minimise such impacts to acceptable levels.
- 3.1.2 The environmental issues addressed in the EIA include:
1. To describe the proposed project and associated works together with the requirements for carrying out the proposed project;
 2. To identify and describe the elements of the community and environment likely to be affected by the proposed project and/or likely to cause adverse impacts to the proposed project, including both the natural and man-made environment;
 3. To identify and quantify all environmental sensitive receivers, emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;
 4. To identify and quantify any potential losses or damage to flora, fauna and wildlife habitats;
 5. To identify any negative impacts on sites of cultural heritage and to propose measures to mitigate these impacts;
 6. To identify and quantify any potential landscape and visual impacts and to proposed measures to mitigate these impacts;
 7. To propose the provision of infrastructure or mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction and operation of the project;
 8. To identify, predict and evaluate the residual (i.e. after practicable mitigation) environmental impacts and the cumulative effects expected to arise during the construction and operation phases of the project in relation to the sensitive receivers and potential affected uses;
 9. To identify, assess and specify methods, measures and standards, to be included in the detailed design, construction and operation of the project which are necessary to mitigate these environmental impacts and reducing them to acceptable levels;
 10. To investigate the extent of side-effects of proposed mitigation measures that may lead to other forms of impacts;
 11. To identify constraints associated with the mitigation measures recommended in the EIA study;
 12. To identify, within the study area, any individual project(s) that fall under Schedule 2 and/or Schedule 3 of the EIA Ordinance; to ascertain whether the findings of this EIA study have adequately addressed the environmental impacts of those projects; and where necessary, to identify the outstanding issues that need to be addressed in any further detailed EIA study; and
 13. To design and specify the environmental monitoring and audit requirements, if required, to ensure the implementation and the effectiveness of the environmental protection and pollution and pollution control measures adopted.

3.2 Implementation Schedule of the Project

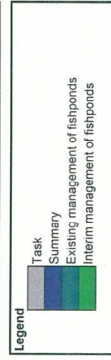
3.2.1 Figure 3–1 shows the tentative construction programme of the Project. Construction activities are planned to commence in the 3rd quarter of 2010 for completion in the 3rd quarter of 2016. i.e. a total of 6 years.

3.2.2 The construction programme consists of the following three main phases: -

1. First phase (3rd quarter of 2010 to 2nd quarter of 2013) - establishment of the Wetland Nature Reserve (WNR). Key construction activities to be carried out include:
 - Relocating water from Sector 1, Sector 2 and Sector 3 ponds at different phases;
 - Draining, removing bunds and installing water controls at Sector 1, Sector 2 and Sector 3 of the WNR at different phases;
 - Re-filling ponds at Sector 1, Sector 2 and Sector 3 of the WNR;
 - Selective felling and vegetation management at Sector 1, Sector 2 and Sector 3 of the WNR at different phases;
 - Land formation and water control structures construction of the Marshland area;
 - Habitat creation of the Marshland area;
 - Constructing facilities of the Marshland area, such as board walks, hides, toilets and shelters.
2. Second phase (2nd quarter of 2011 to 3rd quarter of 2016) - construction works for development area. Key construction activities to be carried out are listed below:
 - Site clearance for the construction works for development area;
 - Pond draining and dredging at built area;
 - Delivery of fill material by trucks to the site;
 - Spreading and compaction of fill material at built area;
 - Foundation and superstructure works for buildings;
 - Construction of sewage pump house;
 - Laying of drainage, sewerage and utilities;
 - Paving of internal access road.
3. Third phase (4th quarter of 2014 to 3rd quarter of 2016) – widening works of the access road leading to the Project site. Key construction activities include:
 - Site clearance and formation for the widening of the Access Road leading to the site;
 - Laying of drainage, sewerage and utilities;
 - Formation of road sub-base, levelling and compaction;
 - Road paving and installation of road furniture.

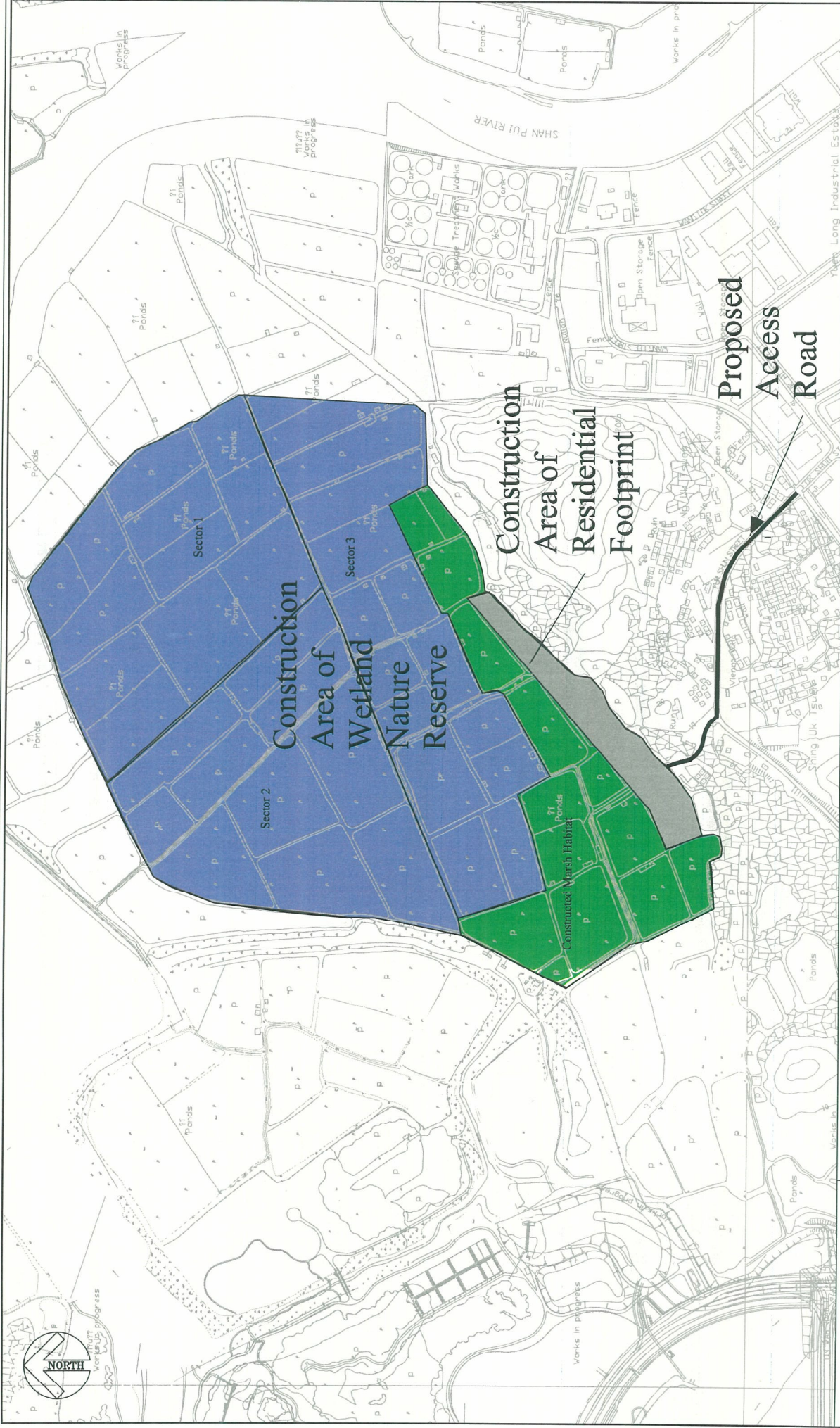
3.2.3 Figure 3–2 sets out the indicative boundary of the various site portions.

Construction Activities	2010		2011		2012		2013		2014		2015		2016		2017		2018	
	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q
Establishment of the Wetland Nature Reserve (WNR)																		
Pre-construction phase																		
Erect boundary fencing and works area hoarding																		
Commence monitoring of existing egretty																		
Commence alternative egretty construction																		
Enhancement of Sector 1 Ponds																		
Existing management																		
Relocate water from Sector 1 ponds																		
Drain, remove bunds and install water controls																		
Re-fill ponds to IOL																		
Interim management																		
Enhancement of Sector 2 Ponds																		
Existing management																		
Relocate water from Sector 2 ponds																		
Drain, remove bunds and install water controls																		
Re-fill ponds to IOL																		
Interim management																		
Enhancement of Sector 3 Ponds																		
Existing management																		
Relocate water from Sector 3 ponds																		
Drain, remove bunds and install water controls																		
Re-fill ponds to IOL																		
Interim management																		
Marshland construction and establishment																		
Existing management																		
Raise level and carry out land formation																		
Place impermeable clay liner in position																		
Construct water control structures																		
Test hydrological integrity of site and structures																		
Carry out top soiling and fine scale land formation																		
Initial soil preparation for planting																		
Planting																		
Vegetation establishment management																		
Construct board walks, hides, toilets and shelters																		
Construction works for development area																		
Site clearance																		
Pond draining and dredging																		
Pond filling																		
Spreading and compaction of fill material at built area																		
Site investigation																		
Foundation works - bored piling, sheet piling and pile cap construction																		
Superstructure																		
Construction of sewage pumping house																		
Laying of drainage, sewerage and utilities																		
Paving of internal access road																		
Improvement works of the access road leading to the Site																		
Site clearance and formation																		
Laying of drainage, sewerage and utilities																		
Formation of road sub-base, levelling and compaction																		
Road paving and installation of road furniture																		



* It is intended that construction activities involving heavy machinery within the WNR will, to the extent possible, be conducted during the dry season

CH2M HILL Hong Kong Limited in association with RPS ADI Ltd. Archaeological Assessments MVA Hong Kong Limited	Title: Tentative Construction Programme for the Project		CH2M HILL Hong Kong Limited	
	Project: EIA for Proposed Development at Fung Lok Wai, Yuen Long at Lot 1457 R.P. in D.D. 123		Scale: NTS	Figure: 3-1



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Title: Indicative Boundary of Various Site Portions

Project: EIA for Proposed Development at Fung Lok Wai, Yuen Long at Lot 1457 R.P. in D.D. 123

Scale: NTS

Figure: 3-2

3.3 Air Quality Impact

Construction Phase

- 3.3.1 The main concern for air pollution during the construction phase of Development is fugitive dust (TSP) emissions associated with unloading of fill materials from dump trucks for pond filling, vehicle movements on unpaved haul roads, wind erosion on exposed ground and stockpiling areas, and handling of excavated material and construction debris.
- 3.3.2 As the topsoil beneath the ponds are of high moisture content, dust emission is not considered a problem during pond dredging at the residential portion, re-profiling of pond bunds, and the partial filling of ponds during the establishment of WNR if mitigation measures (identified below at 3.3.7) are properly implemented.
- 3.3.3 As the access road of the Project will rely on existing Fuk Shun Street, the limited site clearance works and junction improvement works to widen the road will be constructed section by section. The volumes of excavated spoil are expected to be low. The number of vehicle trips during construction is expected to be very small and vehicle movements will be on existing paved roadways. The construction works for access road is anticipated to cause insignificant dust emission impacts when the construction mitigation measures are implemented and through the Environmental Monitoring & Audit programme.
- 3.3.4 As the sewers will be constructed section by section simultaneously with the widening of access road, the volumes of excavated spoil are expected to be low. For the two sewerage options of the Project, the number of vehicle trips during construction are both expected to be very small and for most areas, vehicle movements will be on paved roadways. Only minimal movement of vehicles on unpaved roads will be required.
- 3.3.5 Critical periods of fugitive dust emissions will be during land formation for the marshland (Stage A) (i.e. 4th quarter 2011 to 1st quarter 2012) and site formation for the residential portion of the Project when fill material have to be imported and handled for ponds filling, spreading and compaction (Stage B) (i.e. 2nd quarter 2012 to 4th quarter 2012). For the prediction of the worst-case dust impact, all the major activities in each of the 2 aforesaid scenarios have been modelled in the EIA study and were assumed to be in concurrent operation.
- 3.3.6 Those existing village huts scattered around the Project, mostly at the southern side of the Site, are identified as Air Sensitive Receivers (ASRs).
- 3.3.7 With the implementation of a series of practicable dust control measures such as frequent watering, enclosure of dust emission sources and establishment and use of vehicle wheel and body washing station at exit points, etc., a minimum dust control efficiency of 75% is achievable. The mitigated results revealed that the dust levels would be within the hourly and daily TSP limits of 500 $\mu\text{g}/\text{m}^3$ and 260 $\mu\text{g}/\text{m}^3$ respectively. Assuming that the dust generating activities are taking place concurrently, the predicted highest hourly and daily average dust concentration will be 256 $\mu\text{g}/\text{m}^3$ and 154 $\mu\text{g}/\text{m}^3$ respectively.
- 3.3.8 It is also an obligation of the Contractor(s) to comply with the *Air Pollution Control (Construction Dust) Regulation* during the construction phase to mitigate dust emissions by use of practicable measures as suggested in the EIA report.
- 3.3.9 Implementation of these measures can be enforced by incorporating them as contractual clauses. An Environmental Monitoring and Audit (EM&A) program is also recommended to further check the implementation of the dust mitigation measures and compliance with the dust criteria.
- 3.3.10 As any exposed surface and stockpiled material will be covered by impervious sheet or immediately filled by filling materials during the construction phase, the potential odour nuisance pose by the exposed pond sediment during dredging and pond filling is considered to be minimal.

Operational Phase

- 3.3.11 There are no air and odour emission sources within the Development, except potential odour nuisance from a proposed pump house. However, with implementation of proper enclosure and ventilation system to divert the odour emission to odour scrubbing device (e.g. enclosed concrete structure and activated carbon filter at the air vent of the pump house), no insurmountable odour impact is anticipated. Further discussion are presented in Section 8.8.6.
- 3.3.12 A minimum setback distance of 125m is provided between the closest existing local distributor Fuk Shun Street and the proposed development. With reference to the Hong Kong Planning Standard and Guidelines (HKPSG), a buffer distance of not less than 5m shall be provided. In this regard, sufficient buffer distance will be provided and the buffer requirements as recommended in the HKPSG could be met. The operational air quality impact arising from the vehicular emission is considered insignificant.
- 3.3.13 Given the remoteness of the chimneys located in the YLIE and the YLSTW from the Development (about 400m and 500m away from the Subject Site respectively), the operational air quality impact arising from the chimney emissions from the YLIE and the odour from the YLSTW are also considered to be insignificant.”

3.4 Noise Impacts

Construction Phase

- 3.4.1 Construction works of the Project could be a cause for construction noise on nearby noise sensitive receivers. Hence the potential cumulative noise impacts of the construction of the access road, the residential portion and the WNR have been assessed in accordance with general acoustic principles and guidelines given in Para. 5.3 and 5.4, Annex 13 of the EIAO TM.
- 3.4.2 Construction noise is controlled under the Noise Control Ordinance (NCO), which prohibits the use of powered mechanical equipment (PME) during the restricted hours (7 p.m. to 7 a.m. on normal weekdays and any time on a public holiday, including Sunday) without a valid Construction Noise Permit (CNP) granted by the Authority.
- 3.4.3 Percussive piling is controlled similarly by a noise permit system and described in the NCO and the “Technical Memorandum On Noise From Percussive Piling” (TM3) which restrict the number of hours during which piling can be conducted. No percussive piling may be carried out in the territory without a valid CNP issued by the Authority. In order to minimize the noise impact of the construction activities, percussive piling will not be used in the foundation works.
- 3.4.4 The future Contractor undertaking the construction work will be subject to this statutory requirement and hence the impact was not predicted in this restricted period. Rather, the impact during the non-restricted periods (i.e. between 07:00 to 19:00 on Monday to Saturday) has been the focus of the assessment.
- 3.4.5 Based on a tentative construction programme and a reasonably developed set of equipment inventory, cumulative construction noise impacts have been conservatively predicted.
- 3.4.6 Results indicated that the unmitigated cumulative noise impact could exceed the relevant noise limit of $L_{eq(30min.)}$ 75 dB(A) by 3 - 15 dB(A) at sensitive receivers situated in close proximity to the site. In view of this, a series of progressive mitigation measures have been recommended to alleviate the impact. These include: -
- Use of quiet/silenced equipment and working method;
 - Use of temporary noise barriers and machinery enclosures;
 - Good site practice and noise management, etc.

3.4.7 A further prediction based on the assumption of use of these mitigation measures has revealed that the noise impact could be mitigated to acceptable levels at all sensitive receivers. Required noise mitigation measures can be incorporated as contractual obligations for the contractor in carrying the works. An EM&A programme has also been recommended for checking the implementation of the recommended noise control measures and compliance with the statutory noise criteria.

Operational Phase

3.4.8 No electricity sub-station is likely to be built in the subject site. Only small-scale transformer room(s) may be found at the proposed development. Although the information such as design, specification and location of the transformer room(s) was not yet available, since the transformer room is likely to be enclosed inside concrete structure, its noise impact is considered minimal.

3.4.9 Sewage pump house at the residential portion of the Project is the only major noise source identified to be of concern to the future noise sensitive receivers. Based on conservative assumptions of the possible noise power levels for the sewage pump house, the noise impact was evaluated and has been found to be acceptable if a minimum setback of 150m (or less for smaller pumps) is observed. The pumps should be housed inside a concrete structure with openings facing away from any NSRs.

3.4.10 Subject to the selected sewerage option and the final design of the MLP, the sewerage pump house is tentatively proposed to be housed inside a concrete structure near the car-park area for the visitors with openings at the southern side facing away from any NSRs. The pump house will have a setback distance of more than 150m from the residential block and any of the nearby NSRs.

3.4.11 The detailed information of the exact design and the plant list will be submitted to the Authority for approval prior to the commencement of the construction works of the pump house..

3.5 Water Quality

3.5.1 The assessment has been conducted in accordance with the requirements given in Clause 3.5.2 of the EIA Study Brief. The criteria and guidelines as presented in Annexes 6 and 14 of the EIAO TM have been adhered to in the study.

Construction Phase

3.5.2 The establishment of the WNR will involve creation of marshland and re-profiling and landscaping of the ponds.

3.5.3 The construction of the residential portion of the Project requires ponds draining, dredging and filling at 6 fishponds at the southern boundary of the site.

3.5.4 The key concern in water pollution during the construction phase of the project relates to the possible discharge of surface runoff contaminated by suspended solids released as a result of the site formation and pond filling works. Control in water pollution shall be achieved through implementation of the Best Management Practices (BMPs) to avoid contact of pollutants with rainfall or runoff and measures to abate pollutants in the stormwater runoff. The guidelines for handling and disposal of construction site discharges as detailed in EPD's ProPECC Note PN1/94 "Construction Site Drainage" should be followed. Mitigation clauses targeted to minimise water pollution arising from construction site runoff, construction site wastewater, oils and solvents etc. are recommended for implementation through inclusion as contract clauses.

3.5.5 Through transferring the pond water within the subject site, the need of discharging pond water into the surrounding water bodies during the construction of the Project can be avoided.

Operational Phase

- 3.5.6 Water for use in the WNR will be provided by direct rainfall supplemented by run-off from the residential development and catchments A and B via a ditch running along the southern border of the development area. Water will drain into the storage pond at the eastern end of the proposed WNR.
- 3.5.7 The run-off from residential site will pass through traps to remove oil and grease, and sand and gravel filters to reduce silt loads and particulate organic matter prior to discharge into the ditch and the storage pond. As runoff water from the catchments and development area will be stored for long periods before entering the wetland area any remaining silt that is present will be able to settle out in the water. This will further significantly reduce pollutant levels (from the residential runoff and catchments A and B). Regular maintenance, e.g. periodic de-silting will be required. It is believed that the quality of the water discharge will be better than that of the baseline situation as well as the upstream water quality.
- 3.5.8 Foul water, on the other hand, will be discharged to the public sewer.
- 3.5.9 The water levels of the fishponds inside the wetland nature reserve will be managed and controlled by the conservation manager. During normal operation, the wetland nature reserve will be self-contained and pond water will not be discharged to the surrounding. Water will only be discharged when there is overflow.
- 3.5.10 The fishponds comprising the WNR will be interconnected with adjustable sluices to allow the circulation of water to reduce the likelihood of overflow upon heavy storm. In wet season, though unlikely, excess water will be drained and discharged to the Tai River under the management of conservation manager.

3.6 Potential Problem of Biogas

- 3.6.1 As the residential footprint is planned to build on the existing fishpond area, under anaerobic conditions, the pond mud left *in-situ* can generate potential biogas risk.
- 3.6.2 With the TOC and SOD contents of the pond mud *in-situ* sampled, the potential methane flux from the Development based on half-lives of 2 and 5 years are estimated. Even under the extreme worst case scenario (100% of TOC is biodegradable), the results are well below with the guide value stipulated in EPD's Landfill Gas Hazard Guidance Note and the maximum "safe" rate of gas emission derived from the *Department of the Environment (1993), Landfill Completion. Waste Management Paper No. 26A*.
- 3.6.3 Generic gas precautionary measures for the below ground structures of Development and precaution measures to be taken prior to entry into any below ground services or confined space within the Development are recommended.
- 3.6.4 With the incorporation and implementation of the recommended precautionary measures. The potential biogas hazard posed to the Development is considered to be minimal.

3.7 Sewerage and Sewage Treatment Implications

- 3.7.1 With reference to the Review of Yuen Long and Kam Tin Sewerage and Sewage Treatment Requirements, and taking into consideration the existing and committed sewerage facilities in the vicinity of the proposed Development, three sewage disposal strategies for the Project have been investigated:

Strategies A1 and A2 (Eastern Option) – will provide a new sewer to convey the sewage from the Project to Yuen Long Sewage Treatment Works (YLSTW) via local roads e.g. Fuk Shun Street. The Government is currently reviewing two effluent disposal schemes for the existing YLSTW including the effluent export scheme, and the upgrading of YLSTW to tertiary

treatment. It is identified that YLSTW will have adequate spare capacities to cater for the additional sewage discharged from the subject site under either of the proposed schemes being reviewed by the Government.

Strategy B (Western Option) – will provide a new sewer to discharge sewage to San Wai Sewage Treatment Works via the existing Tin Wah Road Sewage Pumping Station (TWRSPS) and Ha Tsuen Sewage Pumping Station (HTSPS).

- 3.7.2 The three proposed strategies are all considered technically feasible.
- 3.7.3 The difference between Strategies A1 and A2 is in the proposed alignments of the proposed sewers connecting to YLSTW. For Strategy A1, new sewers are proposed to connect to YLSTW directly from the new pumping station on-site in the subject site via existing local road, Fuk Shun Street and the local road next to Leon Court. The approximate length of the sewer is about 1,356m. Strategy A2 is to build an approximately 581 m long new sewer connecting to existing sewer in Fuk Hi Street from the subject site via Fuk Shun Street. As evaluated in the Sewerage Impact Assessment (SIA), no upgrading works on existing sewers are considered necessary.
- 3.7.4 Strategy B involves the laying of an approximate 940m new sewer beneath planned/existing carriageway on the western side of the subject site. Wayleave from the Government is required. The Sewerage Impact Assessment conducted has found that upgrading of the existing sewage pipes with length of 948.8m at Tin Wah Road is apparently necessary to convey the flow from the FLW Development to TWRSPS. As an alternative to minimize interruption to the operation of the existing sewerage, it is also feasible to lay a new sewer alongside the existing one at Tin Wah Road to convey the flow. The sewerage upgrading works at Tin Wah Road will be programmed in such a way as to maintain the normal function of the existing sewer and normal traffic on the road.
- 3.7.5 In broad terms, these strategies involve the installation of an on-site sewage pumping plant within the Development and the provision of new sewers to discharge the sewage discharged from the Development to the nearby sewage treatment work or pumping stations.
- 3.7.6 Subject to the selected sewerage option and the final design of the MLP, the sewerage pump house is tentatively proposed to be housed inside a concrete structure near the car-park area for the visitors with openings at the southern side facing away from any Noise Sensitive Receivers. It will be equipped with 2 duty and 1 standby sewage pump to raise the sewage head by about 9m. Given its proven reliability and ease of inspection and maintenance, electrically operated vertical spindle non-clog dry well sewage pump will be used and the total designed capacity of the pump house is 186 l/s. The feasible discharge point of overflow bypass is either through Tai River to the West or Shan Pui River to the East.
- 3.7.7 From implementation point of view, Strategy A2 is more preferable than the other two, and the proposal has no adverse impact on the existing sewerage system.

3.8 Waste Management

- 3.8.1 The waste streams that will be generated during the construction and operational phase of the Project are identified and evaluated in terms of their nature, type, quality, quantity, and associated environmental impacts. Opportunities for reduction in waste generation from conventional construction method through recovery, reuse or recycling are identified.
- 3.8.2 Construction methods aim at minimizing construction and demolition waste will be used. External walls pre-fabricated in factories and fitted with finishes, windows and glazings will be delivered to site and installed floor by floor. This will substantially reduce the amount of concreting on site. Metal formwork will also be used for all in-situ concreting where necessary. This method of construction will basically eliminate the use of timber formwork on site and thus reduce substantially timber and concrete waste. The project manager to be in charge of this Project has ample experience in this method of construction which has been proved to result in far less C&D wastes, cleaner and tidier construction sites and buildings of higher quality.

- 3.8.3 The waste management implications and potential environmental impacts associated with the handling, transport, and disposal of the identified waste types are evaluated and addressed. An EM&A programme is recommended to be in place during the construction phase to check the waste generated from the construction site are being managed in the accordance with the recommended procedures.
- 3.8.4 With the recommendations implemented, no waste related regulatory non-compliance and unacceptable environmental impacts are expected to arise from the handling, storage, transport and disposal of construction waste arising from the proposed residential and wetland nature reserve development.
- 3.8.5 The nature of the historical uses of the site and the findings of the sediment sampling results confirm that land contamination should not be a concern.

3.9 Cultural Heritage Impact Assessment

- 3.9.1 Upon the completion of the Project, a large portion of the Site will be preserved as fish ponds, the existing fish pond landscape features will therefore be largely conserved. As the preserved fish ponds will be managed following traditional aquaculture management practices, the cultural heritage of traditional fish farming will also be conserved at the same time.
- 3.9.2 The findings and recommendations of the Cultural Heritage Impact Assessment include:

Historical Buildings and Structures Survey

Findings and Assessment

- i. There were no cultural heritage resources located in the Study Area. All structures were identified as modern squatter structures with no cultural heritage features
- ii. The three villages highlighted in the study brief were found to contain 93 cultural heritage resources
- iii. A number of graves were identified on the hill behind the village of Ng Uk Tsuen (outside of the Study Area)
- iv. A fung shui wood was identified behind the village of Ng Uk Tsuen (outside of the Study Area)

Recommendations

- i. The Study Area contained no cultural heritage resources, thus, no mitigation measures are required
- ii. The cultural heritage resources outside the Study Area were found to warrant no further mitigation measures based on the following factors:
 - Adequate screening from the development site through existing woodlands, topographical setting and modern structures
 - Sufficient distance from the development site
 - Orientation away from the development site

Historical Landscape Features

Findings and Assessment

- 3.9.3 The assessment has found that although the basic pattern of the bunds was retained, the bunds have been extensively changed in size and shape.

Recommendations

- 3.9.4 In order to retrieve information concerning the composition of the bunds it is recommended that a brief recording exercise with methodology agreed with the Antiquities and Monuments Office be carried out during site formation.

3.10 Landscape and Visual impact assessment

Construction Phase

Construction Phase Landscape Impacts

Landscape Resources – Options 1A and 1B

- 3.10.1 In general the impact on LRs within the Study Area will be largely negligible. Further many will generally benefit from by the creation of WNR and fishpond enhancement as these works would improve the quality of the resource including their ecological value. This enhancement includes the establishment of plantation woodland with a moderate beneficial impact. The main impacts on the landscape resources of the area are due to the loss of approximately 4 hectares of fishponds (LR 8) and a lesser extent the loss or modification of the existing landform (LR 1) due to the proposed creation of the WNR which will result from the removal of some fishpond bunds. Despite these losses being relatively small compared to the overall area of the resource the fish ponds are important to the landscape area of the region and so this has informed the design of the proposals leaving the largest possible area intact. The impacts to these resources will range from moderate to slight adverse with the impact on the other landscape resources within the Study Area being largely negligible.

Landscape Character – Options 1A and 1B

- 3.10.2 The growth to maturity of the tree and shrub planting proposed as part of the marsh habitat and the landscape buffer planting on the periphery of the development will serve to encourage a greater sense of landscape and visual integration with the development's context. This planting will also serve to soften the transition between the verticality of the proposed built environment and the surrounding coastal plain. The planting proposals will also alleviate some indirect impacts on the Ng Uk Tsuen Village Cluster (V1) and the Kai Shan Range (NUA 1) and benefit the local character ranging from slight to moderate adverse impact with full establishment of the proposed mitigation measures. The impact on the landscape character of the village cluster will be restricted to the northern periphery of the settlement. Impacts on the character of the existing Fishponds (AGR 2) will also be partially alleviated through the implementation of the proposed mitigation measures resulting in a moderate adverse impact. The landscaping associated with the proposed landscape buffer and the establishment of the WNR would also have a slight beneficial impact on the adjacent areas of the Hong Kong Wetland Park (OS1).

Visual Amenity – Options 1A and 1B

- 3.10.3 Many of the views for the identified VSRs share a number of common characteristics which include their expansive nature, the viewing distance and in many cases an elevated viewing position resulting in slight to moderate/significant adverse impact. In this situation the proposed primary mitigation measures such as the location of the development platform and form of the built structure including the adoption of a stepped building height, incorporation of sky gardens (Option 1A) and view corridors take precedence over the proposed soft landscape mitigation measures although these measures serve an important role in further mitigating the predicted adverse impacts.
- 3.10.4 These shared characteristics mean that for many VSRs Options 1A and 1B would appear similar. It may be argued that despite the Option 1B adopting a 15 storey maximum height the flat roofline (contrasting with the organic forms of the adjacent landscape), the introduction of an additional block, the omission of sky gardens and the reduced view corridors ensure that the proposals have a similar level of visual prominence. Given this the predicted visual impacts particular for the VSRs to the north, east and west of the application site are similar to those predicted for Option 1A.

3.10.5 The main differences between Options 1A and 1B would be apparent in views from within the villages of Ng Uk Tsuen (VSR 6) and Shing Uk Tsuen (VSR7). The reduced height of Option 1B would reduce the visibility of the proposals in views from within the village however in many instances these views are largely interrupted by existing features such as the adjacent village houses and the intervening vegetation. In views from the northern periphery of the village it is considered that the reduced height of Option 1B is balanced to an extent by the wider view corridors of Option 1A which allow greater albeit framed visual access to the fishpond area to the north. The predicted visual impacts for Options 1A and 1B when viewed from the edge of the villages (approximately 10 houses would be affected) would be significant to moderate adverse although these impacts would affect a relatively small number of VSRs. Whilst the predicted visual impacts for VSRs with a view of the proposals for Option 1A would be slight to moderate adverse and Option 1B slight adverse. Again due to the characteristics of the existing views from within the villages these impacts are limited to a relatively few VSRs.

Landscape Planning and Development Control Review

3.10.6 A review of the future proposals for the Study Area as represented in the Outline Zoning Plans reveals that the proposed schemes for both Options 1A and 1B will fit into the future landscape of the Study Area. Further the proposed marsh habitat planned for the area to the north of the development site will form a continuation of the HKWP proposals contributing to a more coherent landscape framework.

Residual Impacts

3.10.7 Overall the proposed development at Fung Lok Wai for both Options 1A and 1B would in terms of residual landscape and visual impacts be *'acceptable with mitigation'* that is to say *'there would be some adverse effects, but these can be eliminated, reduced or offset to an extent by specific measures'*.

3.11 Fisheries Impact Assessment

3.11.1 The Project involves the construction of the Wetland Nature Reserve comprising enhanced and enlarged fishponds, rain fed ponds for water birds and a complex of freshwater marshlands and the construction of residential development. The design principles of no net loss of area and functional enhancement of wetland habitats are to be achieved through the reconfiguration of pond bunds to create larger & functionally enhanced ponds which are more preferred by birds and to create land for residential development. Through the pond bunds reconfiguration, there will be a slight increase in the area of water body within the Site. As the WNR is designed for more diversified ecology and only a portion of the WNR is proposed as fishpond habitat, there will be a loss of fishponds for fish production (permanent loss of 20.8 ha. of active commercial fishponds and approximately 5.4 ha. of inactive ponds). Those ponds that remain, however, will be enhanced to increase their ecological values, primarily for bird Species of Conservation Importance. They will continue to be managed in largely traditional manner within which fish production will still be a key objective. The establishment of the Wetland Nature Reserve will ensure that this enhanced management regime is implemented in the long term. In this respect the fish production and fishponds will be more sustainable than comparable ponds elsewhere within Deep Bay.

3.11.2 The long-term management of these ponds ensures the preservation of the cultural practice of aquaculture in-situ, which is consistent with concepts of "wise use" fore-shadowed in Article 3.1 of the Ramsar Convention. It also provides opportunities for ongoing research into sustainable fish production and wildlife conservation.

3.11.3 Off-site impacts are not predicted as the likelihood of adverse impacts on water quality of neighbouring ponds, estuarine and marine receiving environments is considered to be very low during either construction or operation phases.

3.12 Ecological Impact Assessment

Evaluation of impacts

Habitat loss

- 3.12.1 The proposed development at Fung Lok Wai will result in no permanent habitat loss to ecologically valuable habitats in the Wetland Conservation Area (WCA). The actual operation phase footprint (i.e. land directly and permanently lost by the project) will be approximately 4.0 hectares (primarily aquaculture ponds and a very small area of drainage ditch. This change in habitat use will occur as a result of the land used for the construction of residential blocks, associated structures and access roads and storage areas for materials and equipment etc. However the temporary loss of water body is compensated by re-profiling the ponds in the WNR area. This creates ecologically enhanced and enlarged ponds, and recreated marshland habitat. Consequently there is no net loss of water body area or ecological function. No additional habitat loss is anticipated as a result of the construction of either sewerage strategy or the preferred (southern) access route.
- 3.12.2 An integral component of the proposal is the development of a Wetland Nature Reserve (WNR) on the remaining 76.1 hectares of the site. The WNR works will involve permanent and temporary habitat loss of aquaculture ponds (fishponds that are actively managed, those that are currently unmanaged, and the intervening bunds) and ditches and drainage channels for the transformation of approximately 14.4 Ha of aquaculture ponds to freshwater marsh and the enhancement (through enlargement) of 61.7 hectares of aquaculture ponds..
- 3.12.3 No habitats will be lost in their entirety or in any significant proportion except the bund habitat. However, the bund habitats on site have been comprehensively surveyed and assessed to be of low to moderate ecological value. The vast majority of Species of Conservation Importance at the site are wetland species that are not dependant on the bunds or the species they support.

Disturbance

- 3.12.4 The construction and, to a lesser extent, operation of the Residential Development is expected to cause disturbance through noise and vibration. The species most likely to be affected by disturbance impacts are birds, particularly flock feeding waterbirds, larger herons and birds of prey.
- 3.12.5 An assessment of the predicted impacts of disturbance on each Species of Conservation Importance that regularly occurs in significant numbers has been carried out. The assessment is based on a combination of literature review, analysis of field survey data and experience of the study team and previously accepted assessment criteria. Disturbance impacts have been calculated by defining distance from the edge of the disturbance source to the furthest point of:
- An *avoidance zone* –Where a particular species is precluded from using the area; and
 - A *zone of reduced density* – Where the numbers of a species are lower than they would be in the absence of disturbance either because it occurs in lower numbers (more tolerant individuals) and/or for a shorter period of time (for example during periods of reduced human activity). In this analysis, it is assumed that the overall utilisation of the zone of reduced density is 50% of that in undisturbed areas (0% utilisation at the border with the avoidance zone rising to 100% utilisation at the border with the undisturbed areas).
- 3.12.6 These distances have been estimated for construction and operation phase impacts and for disturbance impacts, particularly within the fishpond area and proposed freshwater marsh, which are considered to be of greatest value to the identified Species of Conservation Importance. The predicted disturbance impacts have been calculated on the assumption that there will be low level visual human disturbance and that basic mitigation measures, including the creation of wetland habitats with reedbeds and the planting of trees and bamboo as screening will be implemented.

Fragmentation – flight line obstruction

- 3.12.7 Comparison of alternative development options indicated that it was possible to reduce the potential impact of the residential development on flightlines associated with the now abandoned egret, that was present at the time of the baseline surveys, by shifting the Development Area eastwards. In anticipation of potential impacts of the development on flightline activity and to mitigate for these impacts the Proposed Development Area was moved eastwards 150m away from the egret location, leading to a reduction in flightline intersection. In addition to this, the creation of a potential alternative egret site is proposed.
- 3.12.8 Although the ecological effects of Options 1A and 1B are considered to be similar in most respects, it is predicted that Option 1B will result in slightly greater habitat fragmentation than Option 1A. The larger number of buildings in Option 1B is expected to restrict the sightlines of birds to a slightly higher degree than would be the case in Option 1A. The difference is, however, slight, particular in light of the abandonment of the egret which will result in reduced levels of flight activity.

Other potential impacts

- 3.12.9 Other potential effects of the construction and operation of the development on important habitats and species were considered, including pollution, soil compaction and hydrological disruption. It is envisaged, however, that if appropriate mitigation is implemented that these effects will not result in significant impact to important habitats or species.

Habitat Compensation

- 3.12.10 The aim of habitat compensation will be to replace habitats of intrinsic ecological value that will be lost or degraded. Compensation may be carried out through replacement of important habitats to be lost or the enhancement of existing habitats (i.e. by raising the ecological value of the habitat and thereby its carrying capacity for target species). Consequently there is no net loss of water body area or ecological function.

Compensation for direct habitat loss

- 3.12.11 The removal of terrestrial bund habitats of low ecological value and replacement with further wetland area and shallow to result in a design more suitable and sympathetic to wetland birds also resulted in no net loss in water body area. It is predicted that pond enlargement and marsh habitat creation will increase the area of open water by approximately 4.4 ha (achieved through the removal of pond bund) which will more than compensate for the area of fishpond lost under the development footprint.

Compensation for functional habitat loss

- 3.12.12 In addition to direct habitat loss, the construction and operation of the Residential Development and WNR will also cause disturbance which reduces the capacity of areas affected to support sensitive species, particularly bird species. The EcIA includes calculations of the overall land requirements to compensate for disturbance effects for species considered to be most sensitive to disturbance impacts or that are particularly numerous at the site. It is considered that compensation for these species will also fully off-set potential impacts on other, less sensitive Species of Conservation Importance.
- 3.12.13 The level of compensation required during both construction and operation phases has been calculated separately on the basis of the area of permanent habitat loss arising from the proposed Residential Development, plus the wetland area lost within the exclusion zone and reduced density zones due to disturbance effects.

- 3.12.14 Compensation will be achieved through the establishment of the WNR on the remaining 95% (76.1 ha) of the site. The capacity of aquaculture ponds retained within the WNR to support sensitive species will be enhanced through pond enlargement and the approach to aquaculture management. At the present time the carrying capacity of aquaculture ponds is limited by their uniform design and management that is not specifically targeted at conservation. Modifications to both will significantly improve foraging opportunities for birds and other fauna. To ensure ongoing functional replacement, key ecological indicators, including birds, will be monitored to guide management of the reserve.
- 3.12.15 A complex of freshwater marsh habitats will also be established within the WNR to provide a range of additional habitats for birds and other flora and fauna, including dragonflies. Detailed design principles of the WNR are provided within the EcIA and WNR construction works will be staged to minimise the disturbance of the site.
- 3.12.16 The project proponent will be responsible for the creation, enhancement and management of the Wetland Nature Reserve during the construction phase and shall provide an undertaking to take sole responsibility for management until a successor, such as an independent Foundation, is identified to the satisfaction of EPD or its agent. Subject to the necessary agreements from relevant government authorities, an independent, non-profit Foundation will be established to take over the long-term management of the WNR. Similar in form to a Conservation Trust, the Foundation will provide guidance and resources on strategic and day-to-day management of the reserve.

4. OVERALL CONCLUSION

- 4.1.1 All key environmental issues related to the construction and operation of the Project are identified and assessed in accordance with the requirements of the EIA Study Brief. Practicable and cost-effective mitigation measures are recommended where necessary to minimise the identified impacts to acceptable levels. An EM&A programme is also recommended for checking the implementation of sufficient mitigation measures with respect to key environmental concerns identified for the construction phase.
- 4.1.2 In conclusion, with the implementation of the recommended environmental mitigation measures, the construction and operation of Project should not cause any unacceptable environmental impact on the surrounding sensitive uses.