Agreement No. CE 30/2009 (GE)
Landslip Prevention and Mitigation Programme, 2009, Package D
Natural Terrain Hazard Mitigation Works
Hong Kong Island and Sai Kung –
Investigation, Design and Construction

Natural Terrain Hazard Mitigation Works at Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Project Profile

Job Ref.: 11/600/240 FHK-302009
Date: March 2014

Civil Engineering and Development Department

AEC Limited
In association with SMEC Asia Limited

Agreement No. CE 30/2009 (GE)
Landslip Prevention and Mitigation Programme, 2009, Package D
Natural Terrain Hazard Mitigation Works
Hong Kong Island and Sai Kung –
Investigation, Design and Construction

Natural Terrain Hazard Mitigation Works at Study Area 12NW-C/SA2,
Sheung Yeung, Sai Kung
Project Profile

(Issue 10)

March 2014

	Name	Signature
Prepared by:	**various**	--
Reviewed by:	**Dr. Michael LEVEN**	
Date:	**25th March 2014**	

Job Ref.: 11/600/240FHK-302009

127 Commercial Centre, Palm Springs, Yuen Long, New Territories, Hong Kong
Tel: +852 2486 2885 Email: aec@aechk.hk

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES

1 BASIC INFORMATION

1.1 Project Title

1.1.1 The Project title is Natural Terrain Hazard Mitigation Works at Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung (hereinafter referred to as "the Project"). The Project is under Agreement No. CE 30/2009 (GE) Landslip Prevention and Mitigation Programme, 2009, Package D, Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai Kung – Investigation, Design and Construction.

1.2 Purpose and Nature of Project

1.2.1 In 2010, the 10-year Extended Landslip Preventive Measures (LPM) Programme, which focused on known high-risk man-made slopes affecting major roads and developments in Hong Kong, was completed. To dovetail with the Extended LPM Programme, the Geotechnical Engineering Office (GEO) of the Civil Engineering and Development Department (CEDD) launched a rolling Landslip Prevention and Mitigation Programme (LPMitP) to deal with those man-made slopes of moderate risk and also to carry out hazard mitigation works for natural slopes. The objective of the LPMitP is to contain the landslide risks in Hong Kong within an "as low as reasonably practicable" level that is commensurate with the international best practice in risk management.

1.2.2 Under the LPMitP, natural hillside catchments are for the first time being systematically selected for detailed studies and subsequent implementation of risk mitigation works if found necessary. Following the "react-to-known-hazard" principle, the LPMitP focuses on natural hillside catchments with a history of failure and posing a known hazard to existing buildings or important transport corridors. These hillside catchments are referred to as "historical landslide catchments" (HLC).

1.2.3 The Study Area 12NW-C/SA2 (hereinafter referred to as "the Study Area") in Sheung Yeung, is located partly within the boundary of Clear Water Bay Country Park (CWBCP) and partly within the Conservation Area (CA) in Sai Kung, as shown in **Figure 1**.

1.2.4 Natural hillside landslide risk is typically dealt with by mitigation measures instead of extensive slope stabilization works. Steel flexible barriers and concrete check-dams are the two most commonly used measures for mitigation of natural hillside landslide risks. Natural terrain landslides occur as part of the on-going, natural processes of erosion and landform evolution. While the mitigation measures may not reduce the number or scale of natural terrain landslides, their provision at required locations would reduce the consequences of landslides on, for example, existing buildings or major transportation corridors.

1.3 Name of Project Proponent

1.3.1 The Project Proponent is the Geotechnical Engineering Office (GEO), Civil Engineering and Development Department (CEDD) of the Hong Kong Special Administrative Region (HKSAR).

1.3.2 Fugro (Hong Kong) Limited (FHK) is the appointed Consultant of GEO/CEDD under Agreement No. CE30/2009. AEC Ltd., in association with SMEC Asia Ltd., has been commissioned to prepare this Project Profile for permission to apply directly for an Environmental Permit (EP) under the Environmental Impact Assessment Ordinance (EIAO).

1.4 Location and Scale of Project

1.4.1 The Project includes proposed hazard mitigation works located at the lower portion of the Study Area 12NW-C/SA2 in Sheung Yeung, Sai Kung (**Figure 1**). **Figures 2** and **3** show the general location of the Works Area (approx. 9,597.3m^2) and the approximate extent of the proposed works respectively. The Works Area covers approximately 7,639.1m^2 of Clear Water Bay Country Park (CWBCP) and approximately 1,958.2m^2 of Conservation Area (CA) in the Outline Zoning Plan (OZP) for Clear Water Bay Peninsula North (OZP No. S/SK-CWBN/6). **Plates 1** and **2** shows an overview of the surrounding environment of the Study Area and views around the Works Area. **Figure 4** shows a typical cross section across the Study Area. **Appendix A** illustrates the proposed design for hazard mitigation works.

1.4.2 The proposed hazard mitigation works include the following:

- Installation of about 70 nos. soil nails with 2m spacing and 0.15m in diameters at the toe of the natural terrain
- Provision of about 375m long, 4-6 m high flexible barriers along the toe of the hillside catchments;
- Installation of about 125 nos. anchors for flexible barriers;
- Construction of about 9 nos. concrete baffles; each concrete baffle is 1m high, 0.5m wide and 0.5m long at 2m space;
- Construction of about 425m long, 600mm wide maintenance access to the flexible barriers; and
- Landscaping works

1.4.3 **Plate 4** shows the illustration of hazard mitigation works with implemented mitigation measures.

1.4.4 A flexible barrier is a tensioned steel mesh supported by erected steel posts for retaining the landslide debris. The flexible barriers will be approximately 4 to 6m tall and constructed in bays. A single layer of flexible barrier will be installed. Steel posts will be installed at intervals to support the barriers and drilling works will be required. The size of the drillholes is 150mm in diameters and the drilling depth is about 5 – 6m. Soil nails are to be installed to stabilize the hillside at the lower section of the secondary woodland. The completed soil nail heads will be approximately 800mm x 800mm per each head. A

row of baffles will be installed in the northern part and in the middle of Works Area respectively. The baffles are concrete structures comprising individual units, with a footing area of 0.5m x 0.5m and with height of 1m for each unit. The baffle units will be constructed with 2m spacing along a linear alignment. Provision of maintenance access / stairways is also required. The maintenance access will be between 600mm wide and constructed within Works Area. All the mitigation works will be conducted within the Works Area.

1.5 Number and Type of Designated Projects covered by the Project Profile

1.5.1 The Works Area of the Project falls partly within the Clear Water Bay Country Park and partly within the Conservation Area (CA). In accordance with Item Q.1.in Part I of Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO), the Project is classified as a Designated Project (DP) and an EP is required prior to commencement of the construction works.

1.6 Name and Telephone Number of Contact Person

1.6.1 All queries regarding the Project can be addressed to the Project Proponent (GEO/CEDD) or its Consultant (FHK) appointed under the above-mentioned Agreement.

Ms. Denise L K Tang (GE/PTE4)
Geotechnical Engineer/ Planning Division
Geotechnical Engineering Office
Civil Engineering and Development Department
Tel: 2762 5384
Fax: 2714 0247
E-mail: deniselktang@cedd.gov.hk

Ms. P. M. Tsoi
Senior Engineer
Fugro (Hong Kong) Limited
7/F., Guardian House
32 Oi Kwan Road
Wanchai, Hong Kong
Tel: 2894 5734
Fax: 2895 2379
E-mail: ctsoi@fugro.com.hk

2 OUTLINE OF PLANNING AND IMPEMENTATION PROGRAMME

2.1 Project Planning and Implementation

2.1.1 The proposed natural terrain hazard mitigation works in the Works Area will be implemented as part of the Agreement No. CE 30/2009 (GE). GEO/CEDD is the Project Proponent with overall responsibility for the planning, design and construction works. FHK, as the appointed Consultant of GEO, will undertake the detailed design, tendering and construction supervision of the proposed natural terrain hazard mitigation works. The proposed works will be implemented by a Contractor to be appointed by CEDD.

2.1.2 Unlike landslip preventive works at substandard man-made slopes, extensive slope stabilization will not be required for implementation of mitigation measures for containing natural hillside landslide risk. Preliminary engineering design of the proposed natural terrain hazard mitigation measures at the Works Area is shown in **Figure 3** and illustrated in **Appendix A**. It is envisaged that the proposed hazard mitigation works at the Works Area will involve the following main activities:

(a) **Site establishment**: this will involve minor earthworks, including that required for removal of slope debris and for general site clearance and erection of hoarding;

(b) **Installation of soil nails at toe of hillside**: this will involve drilling within soil/rock, followed by installation of steel bar and grouting at required locations;

(c) **Construction of flexible barriers and maintenance access**: the flexible barriers will involve the erection of tensioned wire mesh fences across posts supported on anchor foundation for mitigating hillslope landslides. The anchor foundation will be formed by drilling within soil/rock using portable drilling tools, followed by installation of anchor and grouting. The maintenance access will involve concreting and masonry laying along/ to the proposed flexible barriers;

(d) **Construction of baffles:** this will involve construction of concrete structures of height about 1m to reduce the velocity of soil debris before reaching the flexible barriers. The baffles will be constructed at 2m spacing; and

(e) **Landscaping Works:** this will involve the possible provision of aesthetic and landscape treatments to the flexible barriers, soil nails and baffles such as hydroseeding, planting of native seedlings and provide subdue colour painting to the concrete surface.

2.1.3 Public consultation with the Village Representatives of Sheung Yeung Village had been carried out and the circulation papers of the proposed mitigation works had been submitted to the District Council. No objection in principle to the proposed hazard mitigation works were received from the Village Representatives of Sheung Yeung Village and members of District Council.

2.2 Tentative Project Timetable

2.2.1 The proposed natural terrain hazard mitigation works at the Works Area is tentatively scheduled to commence in end of 2014 for completion in mid of 2017. **Appendix B** presents a tentative construction programme of the proposed works. The approximate periods required for the various construction activities are summarized in **Table 2-1**.

2.2.2 As shown in the tentative construction programme, it can be noted that some of the construction activities, such as the installation of soil nails and construction of flexible barriers and baffles may be carried out concurrently at the different catchments.

Table 2-1 Duration of Construction Activities

Item	Construction Activities	Estimated Duration (months)
1.	Site Establishment	6
2.	Installation of soil nails at toe of natural terrain	14
3.	Construction of flexible barriers and maintenance access	20
4.	Construction of baffles	11
5.	Landscaping works	5

2.3 Interactions with Other Projects

2.3.1 Implementation of the proposed hazard mitigation works at the Works Area will be integrated into the overall construction programme designed for hazard mitigation works identified under Agreement No. CE 30/2009 (GE).

2.3.2 The Works Area is located in Sai Kung, which is located at a significant distance (at more than 1,900m) away from another Study Area 12SW-A/SA1 under Agreement No. CE 30/2009 (GE) such that potential cumulative environmental impact from concurrent construction works is not a concern.

2.3.3 The proposed hazard mitigation works will not have any interactions with other on-going or planned projects in the vicinity of the Works Area. Located at more than 700m to the south of the Works Area, there is a another works area (Study Area No. 12NW-C/SA1, as shown in **Appendix C**) for which the natural terrain hazard associated with the hillside catchments above Leung Fai Tin along Clear Water Bay Road are being studied under Agreement No. CE37/2008. According to the Project Profile for the Natural Terrain Hazard Mitigation Works at Study Area No. 12NW-C/SA1 above Leung Fai Tin along Clear Water Bay Road, Sai Kung submitted under the EIAO for application of Permission to apply directly for an Environmental Permit, the construction works at Study Area No. 12NW-C/SA1 is scheduled to commence from September 2013 to November 2014. Given that the available separation distance between the Works Area and 12NW-C/SA1 is over 700m, it is not expected that there will be any significant cumulative environmental impact on nearby sensitive receivers.

2.3.4 It is not envisaged that the construction of the proposed hazard mitigation works will require any road closure. The need for any temporary traffic management measures such as temporary lane closure and/or diversion when the proposed works are carried out will be identified with the appointed Contractor.

3 MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

3.1 General

3.1.1 This section presents an outline of the major elements of the surrounding environment which might have an effect on the existing environmental condition of the Works Area and its vicinity. It also identifies the existing and planned sensitive receivers and sensitive parts of the natural environment that might be affected by the proposed Project.

3.2 Noise

3.2.1 The Works Area in Sheung Yeung is located along the western side of Clear Water Bay Road, which is a major road that begins at Ngau Chi Wan at its northern end and ends south in Tai Hang Tun. Traffic noise is the only major noise source in the vicinity of the Works Area. Traffic flow on Clear Water Bay Road near the Works Area is limited given that it is only a single two-lane road carriageway. However, on weekends and during public holidays, traffic flows and the associated traffic noise are expected to be higher due to increased number of private vehicles and enhanced public transport services, as more visitors travel to the Clear Water Bay Peninsula via Clear Water Bay Road.

3.2.2 The nearest Noise Sensitive Receivers (NSRs) from the site are located on the opposite side of Clear Water Bay Road and consist of a number of village houses situated alongside the road in Sheung Yeung which are within 300 m from the Works Area. The representative NSRs have been identified and are summarized in **Table 3-1**. **Figure 2** shows the locations of the representative NSRs.

Table 3-1 Representative Noise Sensitive Receivers

NSR	Description	Land use	Existing/ Planned NSR	No. of Storeys	Distance (m)
N1	Sheung Yeung Village House No. 1A	Residential	Existing	3	62
N2	Sheung Yeung Village House No. 10	Residential	Existing	3	47
N3	Sheung Yeung Village House No. 27	Residential	Existing	3	42
N4	Sheung Yeung Village House No. 56	Residential	Existing	3	46
N5	Hong Kong Adventist College	School	Existing	4	155

3.2.3 With reference to Section 3.1c in Annex 13 of the Technical Memorandum of the EIAO (EIAO-TM), the Clear Water Bay Country Park should also be regarded as NSRs. However, the EIAO-TM does not specify a limit for construction noise levels at Country Parks. The potential construction noise impact arising from the proposed works on the Clear Water Bay Country Park is therefore addressed qualitatively.

3.3 Air Quality

3.3.1 Vehicles travelling on Clear Water Bay Road are the major source of air pollution in the vicinity of the Works Area. No other sources of air pollution have been identified. The

level of air pollution from vehicular emissions is expected to be relatively low given the low to moderate traffic flow.

3.3.2 The average values of the annual Respirable Suspended Particulates (RSP or PM_{10}) and Fine Suspended Particulates (FSP or $PM_{2.5}$) recorded at EPD's Tai Po Station from Year 2008 to 2012 were used to calculate the 5-years average background RSP and FSP. Tai Po Station was chosen because this is the closest EPD monitoring station to the Works Area and the most recent available monitoring data from this station has been utilised as being representative of background conditions.

3.3.3 The latest 5-year average RSP and FSP data (2008 - 2012) of Tai Po air quality monitoring station are tabulated in **Table 3-2**.

Table 3-2 The latest 5-year average RSP and FSP data

Pollutant	Annual Concentration ($\mu g/m^3$)						
	2008	2009	2010	2011	2012	Average	AQOs[Note 4]
Respirable Suspended Particulates (RSP) [Note 1]	50	46	45	46	41	46	50
Fine Suspended Particulates (FSP) [Note 2&3]	-	-	-	-	28	28	35

Notes:
1. Respirable Suspended Particulates (also known as PM_{10}) are suspended particulates in air with a nominal aerodynamic diameter of 10µm or smaller.
2. Fine Suspended Particulates (also known as $PM_{2.5}$) are suspended particulates in air with a nominal aerodynamic diameter of 2.5 µm or smaller.
3. The annual FSP data at Tai Po air quality station is available upon 2012.
4. The annual concentration limits of RSP and FSP of the Air Quality Objectives (AQOs).

3.3.4 Air Sensitive Receivers (ASRs) of interest are the same as that identified from the noise perspective above (**Table 3-3**) and their locations are as shown in **Figure 2**.

Table 3-3 Representative Air Sensitive Receivers

ASR	Description	Land use	Existing/ Planned ASR	No. of Storeys	Distance (m)
A1	Sheung Yeung Village House No. 1A	Residential	Existing	3	50
A2	Sheung Yeung Village House No. 10	Residential	Existing	3	42
A3	Sheung Yeung Village House No. 27	Residential	Existing	3	40
A4	Sheung Yeung Village House No. 56	Residential	Existing	3	46
A5	Hong Kong Adventist College	School	Existing	4	154

3.4 Water Quality

3.4.1 One seasonal stream was found at the middle of the Works Area under the canopy of the secondary woodland. It generally has a steep gradient and substrate consisting of bedrock and large boulders/cobbles. A catch-pit is constructed at the end of the stream near the Clear Water Bay Road. Surface runoff from the Works Area is collected by the peripheral u-channel along Clear Water Bay Road, conveys into catch-pits and then discharged via two underground culverts across Clear Water Bay Road towards Sheung Yeung to the east of the site. The drainage water will flow through two natural streams to the east of Sheung Yeung into the conservation area to the further east and ultimately being discharged into the sea at Pan Long Wan and Sheung Sze Wan (Second Beach). During the ecological surveys conducted in May 2012 (during wet season period), the stream was found to be dry and no water flow was observed even after heavy rains. It is probable that the stream is a seasonal stream that there will only be water flow after extremely heavy rains. As such, no surface flow is expected in the dry season. Details of the ecological survey of the stream are shown in **Section 3.5**.

3.5 Ecology

Methodology

3.5.1 Ecological surveys were conducted within the Works Area from February 2012 to May 2012. The surveys consisted of the following aspects:

- Flora was surveyed once during May 2012. The dominant and notable plant species, relative abundance and growth forms were recorded. Identification of species and distribution status in Hong Kong were made with reference to Xing *et al*. (2000), AFCD (2007), AFCD (2008), AFCD (2009), AFCD (2011) and Hong Kong Herbarium (2012).

- Surveys for fauna were conducted once per month during the survey period from February to May 2012 to cover the dry and wet seasons. Wildlife including mammals, birds, herpetofauna (reptiles and amphibians), dragonflies, butterflies and stream fauna was surveyed by direct sighting and hearing of animal calls. Active searching for the potential habitats of herpetofauna, and tracks and signs of mammals (including droppings, scats, footprints, etc.) was performed.

Sites of Conservation Importance

3.5.2 According to Nos. 2 and 9 of Note 1, Appendix A, Annex 16 of TM-EIAO, the following two sites of conservation importance were identified within the Works Area (see **Figure 1**):

- Clear Water Bay Country Park (CWBCP): most of the Works Area (7,639.1m^2) falls within the CWBCP area. Works including installation of baffles, soil nails and flexible barriers will be conducted within this area. It is extremely rich in flora and supports an extensive area of mature native secondary woodland. It also supports several rare and protected plant species such as Incense Tree (*Aquilaria sinensis*). Butterflies thrive in this Country Park supported by the diverse and abundant flora (AFCD, 2012b).

- Conservation Area (CA) under Clear Water Bay Peninsula North OZP (OZP No. S/SK-CWBN/6): Part of this CA (1,958.2m^2) is located at the south of the Works Area. The CA zoning is intended to protect and retain the existing natural landscape, ecological or topographical features of the area and to separate sensitive natural environment such as

Site of Special Scientific Interest or Country Park from the adverse effects of development. The CA is a highly diverse woodland habitat with mature and rich lowland forest. Only flexible barriers will be constructed within this CA in accordance with the proposed natural terrain hazard mitigation measures.

3.5.3 Due to the limited footprint of the works, no direct impact to the area outside the Works Area is expected.

Habitats and Vegetation

3.5.4 The Works Area itself is located at the hill slope and opposite to Sheung Yeung Village. A total of six habitat types were identified within and adjacent to the Works Area, including native secondary woodland, shrubland, grassland, natural stream course, developed area and dry agricultural land. Most area within the Works Area was covered by native secondary woodland (9,259.4m^2) with a small area of developed area (337.8m^2) identified at the lower section of the man-made slopes along Clear Water Bay Road. One seasonal stream course was identified in the centre of the Works Area and near the Clear Water Bay Road. Representative photographs of habitats identified are provided in **Plate 6**. Habitat distribution within the Works Area is displayed in **Figure 5**.

3.5.5 Over 96.5% of the Works Area (i.e. 9,259.4m^2) is covered by native secondary woodland. The woodland is largely covered with a closed canopy of native trees, including some montane forest species. Dominant tree species include *Diospyros morrisiana, Machilus chekiangensis, Cinnamomum parthenoxylon, Cinnamomum camphora, Syzygium hancei* and *Castanopsis fissa.* The understory is dominated by shrubs (*Psychotria asiatica, Ardisia quinquegona, Uvaria macrophylla, and Gardenia jasminoides*), herbs (*Microstegium ciliatum, Cyrtococcum patens* and *Alpinia hainanensis*), and climbing herbs (*Mucuna birdwoodiana, Melodinus suaveolens* and *Tetracera asiatica*). The secondary woodland within Works Area supports moderate plant diversity with a total of 131 species identified during the survey. Due to the moderate plant diversity and the fact that this habitat is largely natural (although it is secondary in nature), the ecological value of the native secondary woodland is considered to be moderate to high.

3.5.6 The developed area within the Works Area with size of approximately 337.8m^2 is located at the lower section of the hillside near the Clear Water Bay Road. This habitat consists of man-made slopes. Plant species including native tree species of *Cinnamomum camphora, Machilus chekiangensis* and *Syzygium hancei*, herb species *Alocasia macrorrhizos*, *Alpinia hainanensis* and *Cyrtococcum patens*, and climbing herb species such as *Parthenocissus dalzielii* and *Wedelia trilobata* dominate in this habitat.

3.5.7 One seasonal stream was found at the middle of the Works Area under the canopy of the secondary woodland. It generally has a steep gradient and substrate consisting of bedrock and large boulders/ cobbles. A catch-pit is constructed at the end of the stream near the Clear Water Bay Road. The seasonal stream had no water flow and was dry during the ecological surveys even after heavy rains in May and June 2012. It is probable that there will be water flow only after extremely heavy rains. As no surface flow is expected in the dry season, the stream cannot support any permanent aquatic life, hence the ecological value of this seasonal stream is considered to be low. The dominant plant species include shrub species *Ardisia quinquegona*, fern species of *Pteris semipinnata*, herb species *Pandanus austrosinensis* and climbing herb species *Mucuna birdwoodiana*).

3.5.8 Approximate 547 trees were located within the Works Area. A total of 141 flora species identified within the Works Area (**Appendix D**). Five floral species of conservation importance were recorded within the Works Area, including *Artocarpus hypargyreus*, *Aquilaria sinensis, Angiopteris fokiensis, Pavetta hongkongensis* and *Ormosia pachycarpa*. The locations of the identified flora species of conservation importance is displayed in **Figure 3** and **Appendix A**.

3.5.9 A sapling of *Artocarpus hypargyreus* was recorded within the Works Area. This species is listed as Near Threatened (NT) and recorded in China Plant Red Data Book and Illustrations of Rare & Endangered Plants in Guangdong Province (AFCD 2003).

3.5.10 A total of 27 trees and at least 41 seedlings of *Aquilaria sinensis* were recorded within the Works Area. The heights of most of the seedlings range from 0.3m to 1.5m and those of the trees range from 7m to 10m. Most of the trees of *A. sinensis* were found to be in poor structural and health condition. A total of 14 trees within the Works Area were damaged. Cutting wounds were found at or near the trunk bases and some of the trees were topped at about 1.5m height. Illegal exploitation by an unknown party was also observed during the survey. This species is used medicinally as well as for ornamental purposes. Potential threats include destruction of habitats and over-exploitation, but the species is common in lowland areas in Hong Kong (AFCD 2003). This species is listed as Near Threatened (NT) and is under State protection (Category II) in China (AFCD 2003) and is classified as Vulnerable (VU) on the IUCN Red List of Threatened Species. The wild population of this species is protected by the Protection of Endangered Species of Animals and Plants Ordinance, Cap. 586 in Hong Kong.

3.5.11 Six clumps of fern *Angiopteris fokiensis* with diameter of 0.3m to 1m were recorded along the seasonal stream within the Works Area. This species can be used as ornamental plants in sheltered and wet places. Outside Hong Kong, this species is under threat because of destruction of the habitats and over-collection (AFCD 2003). This species is listed as Least Concern (LC) in China (AFCD 2003). The wild population of this species is protected under Forestry Regulations (Cap. 96A) in Hong Kong.

3.5.12 One individual of the shrub *Pavetta hongkongensis* was recorded within the Works Area near Clear Water Bay Road. *Pavetta hongkongensis* is a common shrub species found in tall shrubland and young woodland in Hong Kong (Xing *et al.* 2000). The wild population of this species is protected under Forestry Regulations (Cap. 96A) in Hong Kong.

3.5.13 Approximately 38 individuals of *Ormosia pachycarpa* in the form of seedlings to saplings were recorded within the secondary woodland within the Works Area. All of these identified individuals had DBH < 95mm. As the wood of this species is durable and strong, timber extraction occurs in other countries (AFCD 2003). This species is listed as Endangered (EN) in China (AFCD 2003) but is not protected under Cap.96A or Cap 586 in Hong Kong.

3.5.14 Except for the above five floral species of conservation importance recorded, no rare / protected plant species was recorded within the Works Area during the survey. All other plant species recorded are common and widespread in Hong Kong.

Birds

3.5.15 A total of 13 species of birds was recorded were recorded in the Works Area. Only one species recorded, Black Kite (*Milvus migrans*), is of conservation importance under EIAO and protected under Cap 170 and Cap. 586 in Hong Kong. It is also listed as Regional Concern by Fellowes *et al*. (2002); however this listing is related to breeding birds/ nests sites and this species is very common in Hong Kong. This species was recorded flying over the Works Area and likely to be an occasional visitor to the Project site; this observation is of no conservation significance. A summary of the findings is provided in **Appendix D**.

Mammals

3.5.16 Scat of Eurasian Wild pig *Sus scrofa* was recorded in the Works Area in the survey conducted in February 2012. This is a widely-distributed species in forested areas in Hong Kong. No other mammals were recorded in the survey period. A summary of the findings is provided in **Appendix D**.

Herpetofauna

3.5.17 No herpetofauna species was recorded within the Works Area during the survey period.

Butterflies

3.5.18 A total of 14 butterfly species were recorded in the Works Area. All except one butterfly species are common or very common in Hong Kong. Grass Demon *Udaspes folus*, recorded in the Works Area, was assessed as rare in Hong Kong by AFCD (Chan *et al*., 2011); however, it is widely distributed in Country Parks in Hong Kong (Lo & Hui, 2004) and it is also common in Sai Kung and Clear Water Bay area (Chan *et al.* 2012). A summary of the findings is provided in **Appendix D**.

Dragonflies

3.5.19 No dragonfly species was recorded within the Works Area during the survey.

3.6 Landscape and Visual

Baseline Review Methodology

3.6.1 A review of baseline of the existing landscape resources (LRs) and landscape character areas (LCAs) was conducted based on desktop study and field surveys conducted in May 2012 to identify available landscape elements which would contribute to landscape characters of the Assessment Area (including the Works Area and area within 100m from the boundary of the Works Area). Possible landscape elements include local topography, natural landscapes form and patterns of settlement of built features, land use, streetscapes, and any cultural, historical and/or religious identity.

3.6.2 The LCAs formed by various broadly homogenous units of similar landscape characters within the study area were mapped and annotated on a plan.

3.6.3 The sensitivity of the LRs/ LCAs were rated as ‘high’, ‘medium’ or ‘low’ and are influenced by rarity or importance, quality and condition and maturity of the landscape elements, statutory or regulatory limitations/ requirements related to the LRs/ LCAs and the ability

of the LRs/ LCAs to accommodate change, together with the significance of the change in local and regional context.

3.6.4 The visual impact assessment area was defined as the Visual Envelope (VE) which includes all areas from which the proposed scheme can be seen or the viewshed formed by natural/ manmade features such as existing ridgelines, built development or woodland. The visibility of the Project from key groups of Visually Sensitive Receivers (VSRs) was determined through site surveys and desktop study of topographical plans and aerial photographs.

3.6.5 The sensitivity of the VSRs to change was rated as 'high', 'medium' and 'low' as influenced by the value and quality of existing views, availability and amenity of alternative views, type and estimated receiver population, duration or frequency of view and degree of visibility.

3.6.6 Typical viewpoints (vantage points) were identified and photographs showing their current views were taken to demonstrate the typical views of the VSRs.

Landscape Resources (LRs) and Landscape Character Areas (LCAs)

3.6.7 The proposed natural terrain hazard mitigation works involve the construction of flexible barriers, baffles, installation of soil nails and provision of maintenance access within the Works Area. Temporary construction storage and equipment will be located on the existing flat ground at the toe of the Works Area (**Appendix A**). Most of the Works Area falls within the Clear Water Bay Country Park, while its southern part falls within Conservation Area (CA) which is established to protect and retain the existing natural landscape, ecological or topographical features of the area. The major landscape elements within the Assessment Area (i.e. the area including the Works Area and 100m from Works Area) are the extensive mosaic of terrestrial hillside landscape, developed area and very small patches of active agricultural land. Five Landscape Resources (LRs) within the Assessment Area were identified. Approximately 1,400 trees were surveyed within or close to the Works Area, among which 547 trees were located within the Works Area.

LR1 – Woodland: The woodland largely includes the extensive natural secondary woodland located on the hill slopes within the Clear Water Bay Country Park and along Clear Water Bay Road. This hillside woodland is well vegetated with continuous canopies of native species (dominated by trees *Diospyros morrisiana, Machilus chekiangensis, Cinnamomum parthenoxylon* and *Cinnamomum camphora*) and a diverse understory dominated by shrubs *Psychotria asiatica, Ardisia quinquegona* and *Uvaria macrophylla*. As described in **Section 3.5**, the woodland belongs to native secondary woodland with moderate plant diversity. A total of four tree species of conservation importance, including *Artocarpus hypargyerus*, *Aquilaria sinensis*, *Pavetta hongkongensis* and *Ormosia pachycarpa* were recorded within this woodland (details of the recorded tree species are described under **Section 3.5**). In view of its naturalness and relatively high maturity, and the presence of tree species of conservation importance, the landscape value and sensitivity to change of LR1 are considered to be high.

LR2 – Grassland: These refer to the isolated pieces of lowland grassland in Sheung Yeung. LR2 is outside of Works Area and dominated by weedy vegetation such as the exotic weedy shrub species *Lantana camera*, herb species such as *Microstegium ciliatum*, *Mikania micrantha* and *Ipomoea cairica* that are common and widespread in similar village areas in Hong Kong. LR2 is

considered a semi-natural landscape but subject to high degree of human disturbance and offers low amenity value due to its scattered pattern and disturbed nature. The sensitivity to change of LR2 is considered to be low.

LR3 – Watercourse: One seasonally dry stream falls within the Works Area and several lowland streams were located in Sheung Yeung to the east of Clear Water Bay Water outside the Works Area. The natural stream within the Works Area has a steep gradient and substrate consisting of bedrock and large boulders/ cobbles, and the stream bank were covered by very sparse vegetation dominated by common native species such as the shrub species *Ardisia quinquegona*, the fern species *Pteris semipinnata*, and herb species *Pandanus austrosinensis*. As mentioned in **Section 3.5**, six clumps of the fern *Angiopteris fokiensis* with diameters ranging from 0.3m to 1m were recorded along the seasonal stream within the Works Area. This species is listed as Least Concern (LC) in China (AFCD 2003) and its wild population is protected under Forestry Regulations (Cap. 96A) in Hong Kong. The lowland streams identified in Sheung Yeung were either overgrown with common herbs and weeds or channelized. The landscape value and sensitivity to change of LR3 within the Works Area are considered to be low due to its low floristic coverage and lack of water flow even during wet seasons.

LR4 – Agricultural land: This includes two small pieces of active and dry agricultural land located within the village environs of Sheung Yeung and to the south of the Works Area. Crops (such as *Brassica oleracea* var*. botrytis*, *Dioscorea alata* and *Musa* x *paradisiacal*) were planted by local villagers. LR4 is of low landscape value and sensitivity to change due to its man-made nature and small size.

LR5 – Developed Area: This area comprises village houses in Sheung Yeung Tsuen, residential buildings in Gospel Villa and Portofina Villa, Clear Water Bay Road and several scattered shotcrete or soil nailed slopes along Clear Water Bay Road (including some slope toe area within the Works Area). The greening element of LR5 is largely limited to some isolated tree clumps and planted roadside plantation of exotic trees *Acacia confusa* along the road and in Sheung Yeung Tsuen. LR5 is of low landscape value and sensitivity to change due to its man-made nature and low amenity value.

3.6.8 Two Landscape Character Areas (LCAs) are defined by integration of various broadly homogenous units of similar landscape characters within the Works Area. Details of each LCA are described below.

LCA1 – Hillside Landscape. The major elements of LCA1 include the extensive mosaic of terrestrial hillside landscape (including native secondary woodland) and the natural watercourse shaded within the flourishing woodland areas. LCA1 is rich in floristic diversity, together with the identification of five plant species of conservation importance (details refer to **Section 3.5**). LCA1 mainly consists of the natural hillside woodland that is well vegetated with continuous canopies of native tree and shrub species. It also forms a scenic backdrop in the area of Sheung Yeung. Hence, the landscape value and sensitivity to change of LCA1 are considered to be high.

LCA2 – Village Landscape. The major elements of LCA2 is the developed village areas in Sheung Yeung Tsuen, lowland grassland with small, disturbed stream, Clear Water Bay Road and two small and scattered pieces of dry agricultural land. Landscape elements in LCA2 mainly consist of planted roadside plantation and isolated tree clumps of self-seeded species along Clear Water Bay Road, vegetated lowland grassland and scattered tree groups in the

villages. The landscape value and sensitivity to change of LCA2 are considered to be low in view of its rather disturbed and common landscape features in the area.

3.6.9 In terms of visual aspect, the extensive wooded hillside slope within Clear Water Bay Country Park forms a scenic backdrop and is the major visual element in the Sheung Yeung area. The proposed flexible barriers, baffles and soil nailing works are located within the dense hillside woodland along Clear Water Bay Road in which the topography, existing trees and villages will screen the construction works from much of the surrounding areas. The visual envelope of the Project (i.e. a zone of visual influence which should include all areas from which the proposed slope works can be seen) is restricted to the occupants of vehicles and pedestrians using Clear Water Bay Road and residents of localized village houses of Sheung Yeung that are close to the Road. Two key Visually Sensitive Receivers (VSRs) are identified and described as below.

VSR1 – Travellers using Clear Water Bay Road: This VSR comprises transient passers-by mainly comprising occupants of vehicles, occasional pedestrians, and temporary users using the bus stops along Clear Water Bay Road. Occupants of vehicles using Clear Water Bay Road can only occasionally glimpse the proposed slope engineering work as their views are largely blocked by the hillside and roadside vegetation. Similarly, occasional pedestrians and temporary users of the bus stops along Clear Water Bay Road can only have a glimpsed view of the works, which are above the travellers' line of vision. As there are a variety of alternative views considered to be of much higher amenity value than the proposed Works Area, the sensitivity of VSR1 to visual change to the proposed slope works is considered to be low.

VSR2 – Residents of Sheung Yeung Tsuen and Gospel Villa. The village houses located immediately to the east of Clear Water Bay Road may experience a partial or full view of the proposed Works Area. However, the existing village houses are located with their ground level topographically lower than Clear Water Bay Road. In addition, most of the residents' view will be screened off by the existing trees and other dense vegetation on the slope. Hence, unless the residents are located on the top floor or roof of the village houses, the VSRs are relatively few in number. The sensitivity of VSR2 to visual change to the proposed slope works is considered to be medium.

3.6.10 Residents of Pan Long Wan and Portofino Villas are far away (>300m) from the Works Area. With the existing woodland vegetation screening off the Works Area and the separation distance, these residents can only experience a glimpsed view towards the Works Area. **Plate 7** shows the representative photos of the identified LRs and VSRs. **Figure 6** shows the locations of VSRs. **Figure 7** and **Plate 8** show the locations and photos of the vantage points within the assessed areas for which the proposed slope works are visible to the identified VSRs. **Figure 8** shows the locations of LRs and LCAs within the 100m Assessment Area.

3.7 Cultural Heritage

3.7.1 No declared monument and historical site are located within or in the vicinity of the Works Area.

4 POSSIBLE IMPACT ON THE ENVIRONMENT

4.1 General

4.1.1 The potential environmental impacts from the proposed hazard mitigation measures during the construction and operational phases are reviewed below.

4.2 Potential Environmental Impact during Construction Phase

Noise

4.2.1 A tentative construction programme of the proposed hazard mitigation measures at the Works Area in Sheung Yeung is presented in **Appendix B**. Construction of the hazard mitigation works will be carried out during Monday to Saturday between 7:00 am and 7:00 pm, the working hours will be specified in the Contract Documents. Currently, it is not envisaged that any construction works will need to be carried out outside the non-restricted hours. However, if at a later stage the appointed Contractor finds that it is necessary to carry out nighttime work, he must apply a Construction Noise Permit (CNP) and ensure full compliance with the requirements under the Noise Control Ordinance (NCO).

4.2.2 Potential noise impact on nearby NSRs during the construction phase is associated with the use of Powered Mechanical Equipment (PME) and vehicular visits for transportation of equipment. The items of PME that are likely to be required for the proposed works at the Works Area have been identified and are summarized in **Appendix E**. All the machineries will be placed within the works area. The noise impact from vehicular visits to the site is not considered significant as only up to 5 vehicle visits are expected per day, and therefore not assessed.

4.2.3 The Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM) has been referred to in identifying the Sound Power Levels (SWL) of the PME used in the assessment. Where no relevant SWL could be found in GW-TM, reference has been made to the guidance "Sound power levels of other commonly used PME" published by EPD. The assessment methodology outlined in GW-TM has been followed in predicting the construction noise levels at the representative NSRs. **Table 4-1** presents the range of the unmitigated noise levels predicted at the representative NSRs for construction works at the Works Area. Detailed assessment results are presented in **Appendix E**. While no major civil engineering works will be required for implementation of the proposed hazard mitigation measures, given the proximity of the NSRs to the work sites, it will be necessary to ensure that construction noise control measures are in place to alleviate the noise impact to acceptable levels. The construction noise mitigation measures are recommended in **Section 5**.

Table 4-1 Range of Predicted Construction Noise Levels(Unmitigated Scenario)

NSR	Description	Predicted Noise Levels, $Leq_{(30min)}$ dB(A)	EIAO-TM Noise Criterion, $Leq_{(30min)}$ dB(A)	Exceedance
N1	Sheung Yeung Village House No. 1A	63-76	75dB(A) during 0700 to 1900 hours on any day not being a Sunday or general holiday	Y
N2	Sheung Yeung Village House No. 10	66-79		Y
N3	Sheung Yeung Village House No. 27	67-79		Y
N4	Sheung Yeung Village House No. 56	66-79		Y
N5	Hong Kong Adventist College	55-68	70dB(A) (65dB(A) during examination periods) between 0700-1900 hours on normal weekdays	Y

4.2.4 Visitors to the Clear Water Bay Country Park would also be potentially impacted by the proposed works at the Works Area. However, given the transient nature of visitors to the Country Parks, no insurmountable construction noise impact is anticipated. The implementation of the noise mitigation measures recommended in **Section 5** will also reduce the noise impact on visitors to the Country Park.

Air Quality

4.2.5 There will be dust emissions from excavation works as well as gaseous emissions from construction plant and vehicles when the hazard mitigation works are carried out. The main sources of fugitive dust emissions include site excavation, drilling operation, truck movement and material handling.

4.2.6 Given the nature of proposed natural terrain hazard mitigation works, no major earthworks or open excavation will be required. Only some minor open excavation and concrete casting would be required for construction of the flexible barriers and baffles and soil nail installation. Number of construction plant on site would also be limited such that gaseous emissions from the operation of construction plant should not be a concern and the dust impact would be low.

4.2.7 However, given the proximity of nearby ASRs to the proposed work sites, it will be important to ensure that sufficient dust control measures as required in the Air Pollution Control (Construction Dust) Regulation are implemented to alleviate any potential dust emission impact on the ASRs to acceptable levels. The specific measures required are as set out in **Section 5**.

Water Quality

4.2.8 The proposed flexible barrier will be built across the stream, whilst the maintenance access and anchors will not built at the stream, as detailed in **Section 5.3**. Minimal water quality impact is anticipated however any uncontrolled site runoff and discharge from the Works Areas may enter the stream course within the Works Area as shown in **Figures 1** and **3** and affect the water quality. Suspended solids and contaminants in site runoff would be the main source of potential water quality impacts.

4.2.9 Potential sources of pollution include runoff and erosion from exposed soil surface and stockpiles, release of grouting and cement materials during rainfall, wash water from dust suppression facilities and fuel and lubricants from onsite maintenance of vehicles and equipment. Sewage generated from onsite construction workforce would also be another potential source of pollution.

Waste Management

4.2.10 The proposed hazard mitigation works at the Works Area will generate the following types of waste:

- Construction and demolition (C&D) materials: mainly comprising inert excavated materials (e.g. soil, broken concrete) generated from construction of the flexible barriers. A small quantity of non-inert C&D materials (C&D waste) that consist of timber, plastic and other solid waste would also be generated;
- General refuse mainly consists of packaging waste from construction materials and food waste from onsite workers;
- Any chemical waste such as lubricating oils generated from maintenance of construction equipment and vehicles

4.2.11 Since only some minor excavation will be required for the proposed hazard mitigation works, the Project will not generate a large quantity of C&D materials. The volume of excavated materials from the Works Area is estimated to be 1,500m^3 and shown below.

Table 4-2 Estimated Quantities of Waste Materials Generated from the Project

Type *of Waste*	**Source**	**Estimated Volume (m^3)**	**Designated Waste Handling Facilities**
Soil/rock	Drilling and excavation of foundation of flexible barriers	500	Public Fill at TKO Area 137
	Drilling and grouting of soil nails	450	
	Construction of concrete Baffles	250	
Non-inert C&D materials (C&D waste)	Site clearance	300	SENT Landfill
	Total	1,500	

Note: SENT Landfill (Southeast New Territories Landfill), TKO 137 (Tseung Kwan O Area 137 Fill Bank)

4.2.12 Where practicable, the excavated C&D materials should be reused in-situ to minimise the amount of C&D materials requiring disposal. In accordance with the requirements specified in the Development Bureau Technical Circular (Works) No. 6/2010 Trip Ticket System for Disposal of Construction & Demolition Materials (DEVB TC(W) No. 6/2010), prior agreement shall be obtained from the Public Fill Committee (PFC) through the Secretary of the PFC to request a designated disposal ground for incorporation into the tender documents for the construction works. Surplus inert C&D material may be disposed of to the Public Fill Reception Facility in Tseung Kwan O managed by CEDD, while any non-inert C&D materials (C&D waste) would require disposal at SENT landfill managed by EPD.

4.2.13 The quantities of general refuse and chemical waste arising from the proposed works in the Works Area is expected to be insignificant. Recyclable materials such as metals, papers and plastics in the general refuse (and in the construction waste) shall be segregated for recycling.

4.2.14 Provided that the wastes generated from the construction works are handled, transported, recycled as far as possible, and disposed of in accordance with the good site practices (as recommended in **Section 5**), it is not expected that the proposed works will generate any adverse environmental impact or waste management implications.

Ecology

4.2.15 The proposed landslip prevention and hazard mitigation works including installation of soil nails, flexible barriers and baffles will be carried out within the native secondary woodland within the Works Area (**Figure 5**). Some of these works may result in ecological impacts. The potential ecological impacts anticipated would be:

- Loss or disturbance of the woodland habitat;
- Loss or disturbance of individuals of the five floral species of conservation importance recorded.

4.2.16 Flexible barrier is a tensioned steel mesh supported by erected steel posts for retaining the landslide debris. The flexible barriers will be approximately 4m to 6m tall and constructed in bays. Only a single layer of flexible barriers will be installed within the secondary woodland along the toe of natural terrains within the Works Area. A section of the flexible barrier will be across the seasonal stream within the woodland whilst the maintenance access and anchors will not encroach upon the stream bed. The proposed works will also involve provision of maintenance access of around 600mm wide to the proposed flexible barriers. The locations and the footprint of the proposed works have been adjusted to avoid tree felling and no plant species of conservation importance will be affected. A minimum of 1.5m setback from any existing trees will be kept as far as possible to minimize the potential impacts on the root system. A total of around 1,835.5m^2 of the secondary woodland within the Works Area for the construction of the flexible barriers will be affected (including provision of maintenance access to the flexible barriers and 3m set back from the proposed structures). Steel posts will be installed at intervals to support the barriers and drilling works of anchor will be involved. The size of the drillholes will be only 150mm in diameter and the drilling depth is about 5 - 6 m.

4.2.17 Soil nails will be installed to stabilize the hillside in one small area (a total of around 275m^2) at the lower section of the secondary woodland within the Works Area. Drilling works will be involved with each drillhole of size around 150 mm. Each of the completed soil nail head will be 800mm x 800mm. Landscaping works will be implemented to reinstate vegetation in the area affected by soiling nailing work. It is expected that the reinstated vegetation can fully cover the soil nail heads given they are of limited sizes. A row of baffles will be at two locations within the secondary woodland area respectively. The baffles will be located at the toe of natural terrains within the Works Area. The baffles are concrete structures comprising concrete units of area 0.5m x 0.5m and with height of 1m per each unit. The baffles will be constructed at 2m spacing between each unit. A total of 155.6m^2 of the woodland within the Works Area will be affected (including 3m setback from the proposed baffles).

4.2.18 There is flexibility to adjust the exact locations for construction of flexible barriers and baffles and installation of soil nails in accordance with the findings of the topographical surveys to avoid tree felling. Tree loss and woodland loss due to these proposed hazard mitigation works will therefore be avoided or minimised. Alternative construction methods, including construction of metal staircase to "bridge over" extensive tree roots on slope (i.e. to avoid direct encroachment upon the tree roots) for the construction of the maintenance access will be adopted wherever necessary and practical. However, as the flexible barriers and the baffles will be 6m and 1m tall respectively, some canopies of the retained trees may have direct conflict with the barriers and the baffles. Thus, limited pruning of the retained trees along the alignment of the flexible barriers and baffles may be required. With proper pruning practice, the resulting impact to the trees and existing woodland habitat is expected to be low to moderate.

4.2.19 In order to minimize the impacts on the roots of the existing trees, a setback of 1.5m from trees to the steel stand posts, soil nails and baffles will be maintained as far as possible. As the steel stand posts will be scattered along the alignment and there will be 1.5m setback from the trees, the potential impacts on the root system of the existing trees is considered to be low.

4.2.20 Some of the plant species of conservation importance are located within or near the Works Areas for constructing flexible barriers. These include at least 8 seedlings and 5 trees of *A. sinensis*, and 2 individuals of *O. pachycarpa* at the Works Area of flexible barriers (locations are shown in **Figure 3** and **Appendix A**). The alignment of the proposed flexible barriers and baffles has been adjusted such that no species of conservation importance will be affected. The locations of these species have been taken into account for setting the alignment of the flexible barriers and no species of conservation importance will be close to the proposed alignment (i.e. 1.5m away from the alignment). Protection zones/ exclusion zones will be established which should include 1.5m setback from stems of mature individuals, and areas within 1m radius from the seedlings/ ferns will be preserved on site. Detail for the protection zones/ exclusion zones are shown in **Section 5.5.6** and **Plate 9**.

4.2.21 Localized trimming of the ground vegetation within the works areas of the flexible barriers with associated anchors and maintenance access, soil nailing and baffles will be needed. Due to the limited footprint of the flexible barriers, soil nails and baffles, limited opportunities for wildlife use and the fact that all the plant species of conservation importance will be preserved, potential adverse ecological impacts resulting from the possible vegetation clearance and minor excavation are considered to be low. Only a small area of a total of 2,266.1m^2 (including all proposed structures and 3m setback from the proposed structures and the soil nailing works area) of the understory of the secondary woodland will be affected. Given that the footprint of vegetation clearance is localized and very limited, the resulting impacts from vegetation clearance is considered low.

4.2.22 A seasonal stream was identified within the alignment of the proposed flexible barriers. As observed, there is no water flow even after heavy rains in May 2012. It is probable that there will be water flow only after extremely heavy rains and no surface flow is expected in the dry season. As the stream course is expected not to support any permanent aquatic life, no impact to the aquatic ecosystem is predicted. Furthermore, as the maintenance access and anchors will not be built on the stream bed and a 0.5m opening will be allowed between the stream bed and the bottom of the flexible barrier as

a wildlife passage, no impact to the stream is expected. Nevertheless, the guidelines on planning for construction works in natural streams provided in ETWB TC(W) No. 5/2005 will be followed.

4.2.23 The plan area of the entire Works Area is 9597.3m^2, in which a total area of 1,796.6m^2 will be temporarily disturbed for the construction of soil nail heads (275m^2), flexible barriers (1,370.5m^2) and baffles (151.1m^2). As detailed in **Section 5.6**, landscaping works will be provided in form of hydroseeding and planting of shrub seedlings to reinstate vegetation in all temporarily disturbed areas. There will also be a small area of permanent vegetation loss for the construction of maintenance staircase (465.0m^2) and baffles (4.5m^2). These are proposed to be mitigated by compensatory re-vegetation of the existing disturbed ground within the Works Area as far as practicable. Opportunities will also be sought for the compensatory re-vegetation on the existing disturbed area outside the Works Area.

4.2.24 One bird species of conservation importance, Black Kite, was recorded only flying over the Works Area, and the impact to this species is expected to be negligible as it is considered an occasional visitor to the Works Area. One butterfly species of conservation importance, Grass Demon, is recorded within the Works Area. Due to the high mobility of this species and the widespread of the food source of its caterpillar (leaves of Zingiberaceae) in adjacent areas, possible disturbance impacts of the Project to this species are expected to be negligible.

4.2.25 Other indirect disturbance to habitats and associated fauna adjacent to Works Areas would result from increased human activity and noise-generating construction plant. However, the Works Area mainly supports common fauna species of high mobility, and the use of the Works Area by these fauna species will be transient. Given their high mobility, the abundance of similar habitat in adjacent areas, and the fact that such impact would be temporary in nature, it is considered that the severity of disturbance impacts to local wildlife species would be negligible. With the implementation of the mitigation proposed in **Section 5.5**, the impact is expected to be minimal.

4.2.26 The potential ecological impacts resulting from construction phase activities have been evaluated according to Table 1 of Annex 8 of the EIAO-TM, and are summarized in **Tables 4-3** and **4-4** below.

4.2.27 **Table 4-3** below presents the overall impact evaluation of the native secondary woodland within the Works Area.

Table 4-3 Overall Impact Evaluation of the Native Secondary Woodland within the Works Area

Criteria	Remarks
Habitat quality	Moderate, due to the moderate plant diversity and the fact that the woodland is largely natural.
Species	Largely dominated by common and widespread plant species, with the records of five floral species of conservation importance, including *Artocarpus hypargyerus, Aquilaria sinensis*, *Angiopteris fokiensis, Pavetta hongkongensis* and *Ormosia pachycarpa*.
Size/ abundance	A total of around 2,266.1m^2 of the understory of woodland would be affected by vegetation clearance. Limited pruning of the retained trees along the alignment of the flexible barriers and baffles may be needed. Tree felling will be avoided.
Duration	Habitat loss of the understory woodland (around 469.5m^2) will be permanent where footings are installed and along maintenance access or occupied by the baffles; elsewhere vegetation will recover in time. With proper pruning, the retained trees are expected not to be affected in the long term.
Reversibility	Habitat loss of the understory woodland (around 469.5m^2) will be irreversible where footings are installed and along maintenance access or occupied by baffles; elsewhere natural regeneration will reverse effects. With proper pruning, the retained trees are expected not to be affected in the long term.
Magnitude	Minor as only localized trimming of understory vegetation and limited pruning of some canopies of retained trees. Tree felling will be avoided.
Overall impact conclusion	Low to moderate

4.2.28 **Table 4-4** below presents the overall impact evaluation of the watercourse within the Works Area.

Table 4-4 Overall Impact Evaluation of the Watercourse within the Works Area

Criteria	Remarks
Habitat quality	Low, as the watercourse is a dry seasonal stream and cannot support any aquatic life.
Species	Largely dominated by common and widespread plant species, with the record of one floral species of conservation importance, *Angiopteris fokiensis.*
Size/ abundance	A section of the flexible barrier will be across the seasonal stream within the woodland.
Duration	As the maintenance access and anchors will not be built at the stream bed and an opening of at least 0.5m will be allowed between the stream bed and the bottom of the flexible barrier as a wildlife passage, no habitat loss is expected.
Reversibility	No reversible impacts of habitat loss on the stream course are expected.
Magnitude	Negligible
Overall impact conclusion	Negligible

Landscape and Visual

Impact Assessment Methodology

4.2.29 The magnitude of change of LRs/ LCAs resulting from construction/ and or operation of the Project depends on compatibility of the Project with the surrounding landscape, duration of impacts, scale of development and reversibility of change.

4.2.30 The magnitude of visual changes depends on the compatibility of the Project with the surrounding landscape, duration of impacts, scale of development, reversibility of change, viewing distance, and potential blockage of view.

4.2.31 The degree of significance of landscape and visual impacts is derived from the combination of the magnitude of change and the sensitivity/ tolerance of the sensitive receiver(s) to the change, as shown in the evaluation matrix in **Table 4-5** below.

Table 4-5 Matrix of Significance of Landscape and Visual Impact

Magnitude of Change	**Large**	Moderate Impact	Moderate/ Significant Impact	Significant Impact
	Intermediate	Slight/ Moderate Impact	Moderate Impact	Moderate/ Significant Impact
	Small	Slight Impact	Slight/ Moderate Impact	Moderate Impact
	Negligible	Negligible Impact	Negligible Impact	Negligible Impact
		Low	**Medium**	**High**
	Sensitivity			

Landscape Impact

4.2.32 During the construction phase, temporary working platforms and scaffolding will be erected to cover the entire Works Area for the construction of flexible barriers, baffles and soil nailing works. Site hoarding will be erected along the slope toe of the Works Area and movable noise enclosure/ barriers will be erected for the use of PME (as listed in **Table 5-2)**. Tree felling will be avoided and only minimal site clearance may be required for establishment of these temporary features during construction works. The proposed alignments of the flexible barriers, baffles and installation of soil nails will fall within the natural woodland (i.e. within LR1, LR3 and LCA1). Approximately 1,400 trees are within or close to the Works Area, among which approximately 547 trees located within the Works Area. However, the proposed design for hazard mitigation works will adopt the approach of 'no tree felling' that a minimum of 1.5m setback will be maintained from any existing trees as far as practicable, and the installation of the steel posts and concrete pads of the flexible barriers, baffles and soil nails will be adjusted based on detailed topographical and tree survey to be conducted at later stage and on-site conditions to prevent loss of existing trees as far as practicable. In any densely wooded locations, the spacing of the soil nails can be adjusted horizontally and/ or vertically on site in order not to interfere with the existing tree root systems. Alternative construction methods, including construction of metal staircase to "bridge over"

extensive tree roots on slope (i.e. to avoid direct encroachment upon the tree roots) for the construction of the maintenance access will be adopted wherever necessary and practical. Potential landscape impact on LR1 (the woodland) will be limited to pruning of some of the canopies of selected existing trees to facilitate the erection of the barriers, baffles and the soil nailing work. The pruning works will be performed in accordance with the guidelines stipulated in **Section 5.6**. Localized trimming of ground vegetation within the proposed works areas will be needed, but any identified plant conservation importance (as reported in **Section 3.5**) will be located, tagged, fenced-off and protected from damage and disturbance from the proposed works. All protected plant species will be enclosed within the protection zones/ exclusion zones which should include 1.5m setback from stems of mature individuals, and areas within 1m radius from the seedlings to be preserved on site. Details for the protection zones/exclusion zones are shown in **Section 5.5.6** and **Plate 9**. As the proposed works will avoid felling of trees, and may only involve limited pruning works to existing trees and trimming of ground vegetation, the magnitude of change to LR1 and LCA1 is considered small and localized. The resulting impact on existing LR1 and LCA1 arising from the proposed works during the construction phase is expected to be 'moderate'.

4.2.33 A very short section of the flexible barrier will cross the seasonally-dry stream (LR3) in the central part of the Works Area. As evaluated in Ecology section under **Section 4.2**, this is a seasonal stream with stream flow occurring only after extremely heavy rains. This stream course is expected not to support any permanent aquatic life and with limited floristic coverage along the river bank. Furthermore, as the maintenance access and anchors will not be built on the stream bed, landscape impact to this water body is considered low. The magnitude of change to this type of landscape resources (LR3) as a result of the Project will be very small due to its seasonally dry nature and localized ground vegetation to be affected. The landscape impact on LR3 is considered to be very slightly adverse.

4.2.34 The proposed works areas located near the Clear Water Bay Road were mainly the existing paved areas. These areas will be used for temporary storage of construction equipment and materials, and their locations will be adjusted to avoid disturbance of any existing trees along the woodland edge (**Appendix A**). The magnitude of change to LR5 as a result of the Project will be negligible and the landscape impact during construction is therefore considered to be negligible. The remaining LRs including lowland grassland (LR2) and dry agricultural land (LR4) are all located outside the Works Area and will not be affected by the proposed works. The resulting landscape impact on LR2 and LR4 during construction phase is also considered to be negligible.

Visual Impact

4.2.35 Construction phase visual impacts would be resulted from minor earthworks, construction of flexible barriers, baffles, installation of soil nails, temporary working platform and access, and storage and use of construction equipment. The proposed natural terrain hazard mitigation works are tentatively scheduled to commence by the end of 2014 and to be completed by the mid of 2017.

4.2.36 Given the limited footprint of the proposed works, no significant impacts on the identified landscape resources and landscape character areas are anticipated. The proposed works will not result in any significant impacts to the visual quality and amenity available to the identified key VSRs since the proposed works will be largely screened by

the existing vegetation and closed canopy and most of the VSR1 (i.e. the occupants of vehicles and occasional pedestrians) using Clear Water Bay Road would be concentrating on driving and walking. Temporary visual impact is expected for the VSR2 (i.e. residents of localized village houses from Sheung Yeung). However, the visual impact will be localized, and only restricted to residents on the top floor or roof of the houses due to the existing topography. The magnitude of change to the visual environment is expected to be small due to the limited footprint of the proposed works. The resulting visual impacts to the identified VSR1 and VSR2 during construction are both considered as slightly adverse. Construction of the proposed slope engineering works will be appropriately programmed to further minimize the possible visual impacts to the identified VSRs and the environment. Therefore, no significant visual impacts on these VSRs are anticipated during the construction phase of the Project.

Cultural Heritage

4.2.37 No heritage site will be affected by the proposed hazard mitigation works.

4.3 Potential Environmental Impact during Operational Phase

General

4.3.1 There will be no adverse environmental impact that may arise from the proposed hazard mitigation measures at the Works Area during the operational phase.

4.3.2 The wire-mesh nets of the flexible barriers are proposed to be set-up from the ground level such that the materials, such as soil and stone, can be stopped at the barriers in the landslip. Possible ecological impacts of the Project during the operational phase would be the change in flow rate of the stream course with the set-up of flexible barriers due to the accumulation of debris at the barriers. However such impact is considered unlikely to be a significant impact as no water flow of the stream was seen during the wet season, suggesting the stream is unlikely to support any permanent aquatic life. To avoid disturbance to the stream, the maintenance access will not be built on the stream bed in order to avoid any disturbance to the stream bed. The position of the anchors will be adjusted on site and away from the stream to avoid drilling at the stream.

4.3.3 As the flexible barriers will be constructed in bays, the gaps between each bay will provide ecological pathways for the fauna.

Landscape and Visual

4.3.4 Due to the limited footprint of the Project, the proposed works will not cause significant landscape change in the landscape character areas. There will only be slightly adverse impacts on the landscape aspect (mainly from the removal of ground vegetation and limited pruning of some canopies of selected existing trees within the proposed footprint) and visual aspect due to the erection of the flexible barriers, baffles and soil nails within the woodland at the commencement of the operation phase. These impacts will progressively become negligible after the establishment of the hydroseeded grasses and planted shrubs as compensatory planting (as detailed in **Section 5**). The close proximity of the proposed works areas with the surrounding densely vegetated woodland and shrubland within Clear Water Bay Country Park will favour natural establishment of self-seeded woody plant species by providing abundant seed sources. To further minimize

the visual impact of the proposed works on the surrounding environment, the proposed concrete and steel post furniture of the flexible barriers and baffles will be painted in subdued colors so as to blend with the surrounding environment. Hence, no adverse landscape and visual impacts on the surrounding environment and identified key VSRs are anticipated in the long term with the implementation of the proposed mitigation measures in **Section 5.6**.

4.3.5 **Tables 4-6** and **4-7** below summarize the magnitude of change and the significance of impacts on the landscape resources, landscape character areas and identified key VSRs during the construction and operation phases.

Table 4-6 Magnitude of Change for LRs and LCAs Significance of Landscape Impacts during the Construction and Operation Phases

Landscape Resources/ Landscape Character Areas	Sensitivity (Low, Medium, High)	Magnitude of Change (Negligible, Small, Intermediate, Large)	Landscape Impact (During Construction)	Landscape Impact (During Operation)
LR1 – Woodland	High	Small	Moderate	Negligible
LR2 – Grassland	Low	Negligible	Negligible	Negligible
LR3 – Watercourse	Low	Small	Slight	Negligible
LR4 – Agricultural Land	Low	Negligible	Negligible	Negligible
LR5 – Developed Area	Low	Negligible	Negligible	Negligible
LCA1 – Hillside Landscape	High	Small	Moderate	Negligible
LCA2 – Village Landscape	Low	Negligible	Negligible	Negligible

Table 4-7 Magnitude of Change for Identified key VSRs and Significance of Visual Impacts during the Construction and Operation Phases

VSRs	View Distance	Potential Blockage of View (Large/ Intermediate/ Small/ Negligible)	Magnitude of Change (Large/ Intermediate/ Small/ Negligible	Sensitivity of VSRs to change	Visual Impact (During Construction)	Visual Impact (During Operation)
VSR1 – Travellers using Clear Water Bay Road	Close	Negligible	Small	Low	Slight	Negligible
VSR2 - Residents of Sheung Yeung Tsuen and Gospel Villa	Close	Negligible – Small	Small	Medium	Slight	Negligible

4.3.6 With the landscape proposal presented in **Section 5.6**, it is expected that the proposed landscaping works such as painting of the steel posts and baffles in subdued colours, and landscape treatment such as hydroseeding with shrub seed mix and planting of shrubs will match with the existing environment and have a positive impact in terms of landscape and ecological aspects in the long run.

5 ENVIRONMENTAL PROTECTION MEASURES

During the construction works, the requirements specified in EPD's "Recommended Pollution Control Clauses for Construction Contracts" will be followed. This document has covered areas of noise control, air pollution control, water pollution control and waste management. Specific control requirements during construction are reviewed and presented below.

5.1 Noise

5.1.1 As revealed from the quantitative noise impact assessment presented in **Section 4**, while the proposed works at the Works Area will not require any major civil engineering works, there could be potential construction noise impact on the nearby NSRs given their proximity to the Site. Therefore, it will be important to ensure that sufficient noise mitigation measures are implemented to alleviate the predicted noise impact to acceptable levels. The recommended construction noise mitigation measures are described below.

Good Site Practice

5.1.2 Good site practice will considerably reduce any potential noise impact from the construction works on NSRs, including the nearby village houses and visitors to the Clear Water Bay Country Park. The following measures shall be implemented during the construction phase for the proposed works in the Works Area:

- Before commencement of any construction works, the contractor shall submit to the Project engineer for approval the method of work, including the PME and sound-reducing measures intended to be used;
- The number of PME operating shall be kept to a minimum. Only well-maintained plant shall be used;
- Regular maintenance shall be provided to all plant and equipment;
- Equipment that may be in intermittent use shall be shut down or throttled down to a minimum between work periods;
- Silencer on the construction equipment to reduce noise without impairing machine efficiency, quiet plant and/or purpose-built movable noise barriers shall be used as necessary;
- No construction activities will be allowed during 7pm to 7am.

Use of Quiet PME

5.1.3 Use of quiet PME is recommended for reducing the excessive construction noise predicted at the affected NSRs. Quiet PME have been identified based on the inventory on Quality Powered Mechanical Equipment (QPME) established by EPD. It should be noted that the types of quieter PME adopted in the assessment have been selected for the purpose of the quantitative assessment only. The Contractor may use other types of PME, which have the same or lower total sound power levels (SWLs), to meet its needs.

5.1.4 The various types of PME assumed in the construction noise assessment are summarized in **Table 5-1**.

Table 5-1 List of PME to be Used for the Project

PME	ID code	SWL, dB(A)
Breaker, Hand-held, mass 10kg and < 20kg	CNP 024	108
Generator, silenced, 70dB(A) at 7m	CNP 103	95
Dump Truck, with grab, 5.5 tonne <gross vehicle weight < 38 tonnes	See Note 1	105
Drill rig, rotary type (diesel)	See Note 1	110
Lorry, with crane, 5.5 tonnes < gross vehicle weight < 38 tonnes	See Note 1	105
Grout mixer	See Note 1	90
Grout pump	See Note 1	105
Air Compressor, Air Flow <10m3/min	CNP 001	100
Shotcrete Pump	See Note 1	109

Note:
1. The Sound Power Levels (SWLs) of the PMEs presented are based on the Technical Memorandum on Noise from Construction Work Other Than Percussive Piling (TM-GW), except for those marked "See Note 1", which are based on the EPD's guidance "Sound power levels of other commonly used PME" available athttp://www.epd.gov.hk/epd/english/application_for_licences/guidance/files/OtherSWLe.pdf.

Use of Enclosure/ Temporary Noise Barrier

5.1.5 Use of movable barrier, noise enclosure and silencer are recommended to further reduce the construction noise impacts at the affected NSRs. Drilling rigs, excavator, breaker, dump truck and lorry shall be operated behind movable barriers while generator, concrete mixer, grout mixer, grout pump, agitator, air compressor and shortcrete pump shall be operated in noise enclosure. In general, movable barrier can achieve a 5dB(A) reduction for movable PME, 10dB(A) reduction for stationary PME while noise enclosure can achieve a 15dB(A) reduction for PME depending on the design of the movable noise barrier and noise enclosure. Noise barrier and noise enclosure shall be made of acoustic barrier material with a minimum of 10mm thick plywood (or 1mm thick steel outer skin) and a minimum of 50mm thick sound absorbing lining. The surface density of barrier materials shall be at least 10kg/m^2 to achieve maximum screening effect.

5.1.6 For a notional noise source of 2m high, the movable noise barrier shall be of a minimum height of 2m for N3 and 2.5m for N1, N2, N4 and N5 as indicated in **Appendix F**. The minimum length of the barrier should be such that the noise source will not be visible from the sensitive receivers. The Contractor may adopt alternative design of movable noise barrier which has demonstrated success to achieve same at least same screening effects upon approved by the Engineer.

5.1.7 A schematic configuration of the proposed noise enclosure and a sample sectional drawing showing the location of the proposed noise barrier and the identified NSRs are shown in **Appendix F**.

5.1.8 The environmental protection measures for various types of PME assumed in the construction noise assessment is proposed in **Table 5-Table 5-2**.

Table 5-2 Proposed Mitigation Measures for Different PMEs

PME	Proposed Mitigation Measures	Reduction, dB(A)[1]

PME	Proposed Mitigation Measures	Reduction, dB(A)[1]
Breaker, Hand-held, mass 10kg and < 20kg	Movable Barrier	10
Generator, silenced, 70dB(A) at 7m	Noise Enclosure	15
Dump Truck, with grab, 5.5 tonnes <gross vehicle weight < 38 tonnes	Movable Barrier	5
Drill rig, rotary type (diesel)	Movable Barrier	10
Lorry, with crane, 5.5 tonnes < gross vehicle weight < 38 tonnes	Movable Barrier	5
Grout mixer	Noise Enclosure	15
Grout pump	Noise Enclosure	15
Air Compressor, Air Flow <10m^3/min	Noise Enclosure	15
Shotcrete Pump	Noise Enclosure	15

Note:
1. The noise reductions of typical movable barrier and noise enclosure are referred to EIAO Guidance Note No. 9/2010, Preparation of Construction Noise Impact Assessment Under the Environmental Impact Assessment Ordinance, http://www.epd.gov.hk/eia/hb/materials/GN9.pdf.

5.1.9 The enclosure should either be provided with acoustic door for access purpose which should be kept closed during the construction works or should be designed with no direct line of sight from the open side to the NSRs so that all NSRs including Houses No. 35-39 will be adequately protected throughout construction period.

5.1.10 **Table 5-3** sets out the range of the mitigated noise levels predicted at the same representative NSRs for the construction works at the Works Area. Detailed assessment results are presented in **Appendix E**. As shown, the mitigated noise levels predicted at all representative residential NSRs are within the day-time noise criterion of $Leq_{(30min)}$ 75dB(A) and mitigated noise levels predicted at the representative residential NSR is within the day-time noise criterion of $Leq_{(30min)}$ 70dB(A) according to Table 1B of Annex 5 of Technical memorandum under EIAO. The mitigated noise levels predicted at the representative NSR of educational institutions (i.e. N5) are within the day-time noise criterion of $Leq_{(30min)}$ 70dB(A) (and 65dB(A) during examination periods) as set out in EIAO-TM. A maximum sound level of 75 dB(A) will be specified during the construction works as per the "Recommended Pollution Control Clauses for Construction Contracts" provided by EPD. With implementation of the noise mitigation measures, all NSRs will be adequately protected throughout the construction period.

Table 5-3 Range of Predicted Construction Noise Levels (Mitigated Scenario)

NSR	Description	Predicted Noise Levels, $Leq_{(30min)}$ dB(A)	EIAO-TM Noise Criterion, $Leq_{(30min)}$ dB(A)	Exceedance
N1	Sheung Yeung Village House No. 1A	58-67	75dB(A) during 0700 to 1900 hours on any day not being a Sunday or general holiday	N
N2	Sheung Yeung Village House No. 10	60-70		N
N3	Sheung Yeung Village House No. 27	61-71		N
N4	Sheung Yeung Village House No. 56	60-70		N
N5	Hong Kong Adventist College	50-59	70dB(A) (65dB(A) during examination periods) between 0700-1900 hours on normal weekdays	N

5.2 Air Quality

5.2.1 The dust control requirements stipulated in the Air Pollution Control (Construction Dust) Regulation shall be implemented to control fugitive dust emissions during the construction phase of the proposed hazard mitigation works at the Works Area. These dust control measures are standard measures and the most relevant dust control measures are listed below.

- Erection of hoarding of not less than 2.4m high from ground level along the Works Area that adjoins a road or other area accessible to the public, where appropriate;
- The Works area of any excavation or earth moving operation shall be sprayed with water to maintain the entire surface wet;
- All dusty materials shall be sprayed with water prior to any loading, unloading or transfer operation so as to maintain the dusty materials wet;
- Cover stockpile of dusty materials by impervious sheeting or sprayed with water so as to maintain the entire surface wet; and
- Any debris shall be covered entirely by impervious sheeting or stored in a debris collection area sheltered on the top and the 3 sides.

5.3 Water Quality

5.3.1 During project construction period, flexible barrier is proposed to be built across an existing seasonal stream within the Works Area. In order to minimise any adverse impact to the stream, its habitat and further downstream receptors, the following mitigation measures will be implemented:

- Maintenance access will be located away from the stream to avoid disturbance to the stream bed.
- A minimum separation of 0.5m shall be maintained between the stream bed and the bottom of the flexible barrier to avoid disturbance to the stream bed.
- Anchor locations will be strategically selected to avoid drilling at the stream.

5.3.2 As a general requirement, the Contractor shall comply with the Water Pollution Control Ordinance (WPCO) and its subsidiary regulations. Site runoff shall be controlled in accordance with the guidelines stipulated in EPD's Professional Persons Environmental Consultative Committee Practice Note (ProPECC PN 1/94) "Construction Site Drainage".

5.3.3 In particular, the following measures should be implemented by the Contractor:

- All surface runoff from the Works Area generated from construction works, dust control and vehicle washing etc, shall be collected and directed towards de-silting facilities for treatment before discharging into stormwater drains or natural streams.
- Channels, earth bunds or sand bag barriers shall be provided onsite to properly direct storm water to the silt removal facilities provided.
- Perimeter channels should be provided at site boundaries of Works Area where necessary to intercept storm runoff from outside the Works Area.
- No excavated material, silt, debris, rubbish, cement slurry or construction waste shall be deposited into natural stream.

- All trade effluent, foul, contaminated water, cooling water or hot water shall not be discharged into any public sewers, stormwater drains, channels, stream courses or the sea.
- Open stockpiles of construction materials should be avoided as far as practicable or, where unavoidable, should be covered with impervious sheeting such as tarpaulin or fabric during rainstorms.
- All site discharges shall comply with the terms and conditions of a valid discharge license issued by EPD.
- Portable chemical toilet facilities shall be provided on site and a licensed water collector will be appointed by the Contractor for regular collection of foul water.
- Contractor will be required to carry out regular site cleaning and tidying throughout the construction period. Regular environmental inspections will be carried out during the construction period to ensure the site cleanliness and tidiness.
- It is recommended that tool box talk on site run-off control be carried out by the Contractor to increase the awareness of the workers.

5.4 Waste

5.4.1 The Contractor shall comply with the Waste Disposal Ordinance and its subsidiary regulations and the Waste Disposal (Chemical Waste) (General) Regulation. Provided that good site practices are strictly followed, adverse environmental impacts related to waste management are not expected from the proposed works at the Works Area. The following good waste management practices are recommended:

- The Contractor shall submit to the Project Engineer for approval a waste management plan with appropriate mitigation measures;
- The possible reuse of waste materials onsite shall be investigated and exhausted by the Contractor prior to consideration of treatment or disposal off-site;
- The Contractor shall be responsible for identifying what materials could be reused or recycled, where onsite or offsite. For offsite reuse or recycling, the contractor shall arrange for the collection of the recyclable materials;
- Surplus C&D materials (inert and non-inert) generated from the proposed works requiring disposal shall be properly transported to the designated disposal facilities managed by CEDD and EPD. In order to monitor the proper disposal of C&D materials and to control fly-tipping, a trip-ticket system shall be implemented by the Contractor and monitored as a standard item in the relevant technical audit, in accordance with the requirements specified in DEVB TC(W) No. 6/2010 Trip Ticket System for Disposal of Construction & Demolition Materials;
- The Contractor shall register as a Chemical Waste Producer if chemical wastes such as spent lubricants are generated onsite. All chemical waste shall be properly handled, stored, labelled, packaged and collected in accordance with the requirements of the Waste Disposal (Chemical Waste) (General) Regulation;
- The Contractor shall ensure that a sufficient number of covered bins are provided onsite for containment of general refuse. These bins shall be emptied on a daily basis and collected waste shall be disposed of properly;

- The Contractor shall not permit any sewage, waste water or effluent containing sand, cement, silt or any other suspended or dissolved material to flow from the Works Area onto any adjoining land; and
- The Contractor shall provide toolbox talks to workers on relevant topics including site cleanliness and appropriate waste management procedures, including waste reduction, reuse and recycling.

5.5 Ecology

5.5.1 As discussed in **Section 4**, the major potential ecological impact would be the loss of the habitats and the floral species of conservation importance. The mitigation measures to be incorporated to reduce the severity of any negative impacts identified are as follows.

Avoidance

5.5.2 Approximately 547 trees have been recorded within the Works Area in a topographical survey. To avoid tree loss and loss of species of conservation importance, during the design stage of the hazard mitigation works, the findings of the topographic survey and the locations of the plant species of conservation importance have been taken into account. No species of conservation importance was found close to the proposed alignment (i.e. at least 1.5m away from the alignment) and likely to be affected by the proposed works. The proposed locations of the works have been adjusted to avoid any tree loss and loss of those species of conservation importance. As mentioned **in Section 4.2.19**, in order to minimize the impacts on the roots of the existing trees, a setback of 1.5m from trees to the steel stand posts, soil nails and baffles will be maintained as far as possible. For any existing trees located close to the proposed works, the tree trunks will be wrapped in hessian (as a form of protective wrapping) in accordance with GEO Publication No. 1/2011 to avoid mechanical damage to the tree trunks.

5.5.3 The locations of those plant species of conservation importance have been mapped, as shown in **Figure 3** and **Appendix A**, and the individuals will be tagged with eye catching tapes to avoid any damage that may be caused during the construction phase. Prior to commencement of construction works, a baseline survey will be conducted by a qualified plant ecologist to identify and update the conditions of all plant species of conservation importance within the Works Area. A detailed baseline tree survey will also be conducted in accordance with Development Bureau's Technical Circular (Works) No. 10/2013 on "Tree Preservation" to update the number, locations and conditions of all existing trees within the Works Area prior to commencement of construction works. Upon completion of the works, the species of conservation importance that will potentially be affected by the construction works will be surveyed to assess the condition.

5.5.4 Introduction and training will be provided to all site staff to ensure that every staff will fully understand the preservation method and the locations of those species of conservation importance.

5.5.5 The resident site supervisor will closely monitor the condition of those species of conservation importance and all existing trees within the Works Area during the construction period. The monitoring will be conducted on a monthly basis. The monthly monitoring reports shall include photographic records to present the updated conditions of the protected plant specimens and all existing trees within the Works Area. All the

baseline survey reports (prepared prior to commencement of construction works) and the monitoring reports (prepared over the construction phase of the Project) shall be endorsed by an Independent Environmental Checker (IEC) before submission to relevant government department(s).

5.5.6 In order to avoid any damage to those plant species of conservation importance recorded on-site, tree protection zone(s)/ works exclusion zone(s) will be established throughout the construction period to separate the identified protected plant individuals from any potential works. Protection fences of at least 1m height will be established to surround the protection zones/ exclusion zones which will include 1.5m setback from stems for the mature individuals, and areas within 1m radius from the seedlings to be preserved on site, as indicated in **Plate 9**. All the identified individuals likely to be affected by the works will be protected by the protection fences. The same protection measures will also be implemented to protect any additional individuals of protected species identified and likely to be affected during the construction period.

5.5.7 A 0.5m opening will be allowed between the stream bed and the bottom of the flexible barrier as a wildlife passage. In addition, the guidelines on planning for construction works in natural streams provided in ETWB TC(W) No. 5/2005 will be followed.

Minimization

5.5.8 In order to minimize the damage to the root system of the existing trees during the drilling works, a minimum of 1.5m setback from the existing trees will be kept as far as possible. A suitably qualified arborist will be appointed to provide on-site supervision and monitoring of any tree pruning works to ensure that no trees' canopies or tree roots will be over-pruned or adversely impacted due to malpractice of tree works. The pruned trees (either root-pruned or crown-pruned) will be closely and regularly monitored by qualified site staff during construction of the Project. For any trees deteriorate after pruning and could not be safely retained on site during construction of the Project, formal tree removal application with compensatory planting proposal(s) should be prepared in accordance with Development Bureau's Technical Circular (Works) No. 10/2013 on "Tree Preservation" and submitted to relevant authorities for approval before removal of any trees on site.

5.5.9 In order to protect the retained trees, temporary protective hessian and plank armouring around the tree trunks (as shown in **Plate 5**) will be provided by the Contractor prior to the commencement of the site clearance, demolition and construction of the slope works.

5.5.10 The Project footprint will be minimised during the construction as far as practicable. As the tree density of the proposed works areas is relatively high and some trees are with wide spread, tree pruning may be required. The need and extent of tree pruning will be determined on site by the Engineer as advised by a Certified Arborist. The tree pruning will be carried out by appropriate qualified personnel in accordance with local and international guidelines as presented in **Section 5.6.1**. Other retained trees in the close proximity of the Works Area will also be protected by providing a protective wrapping around the tree trunks as illustrated in **Plate 5**. The contractor will be required to comply with the General Specification for Civil Engineering Works (GS), which include specifications on Preservation and Protection of Trees. Reference will also be made to Development Bureau's Technical Circular (Works) No. 10/2013 on "Tree Preservation".

5.5.11 To avoid unnecessary removal of the understory vegetation, the vegetation clearance will be closely monitored by the resident site supervisor. The conditions of existing trees will be regularly monitored by suitably qualified site staff to ensure that no trees will be adversely impacted during construction works.

Compensation

5.5.12 Planting of shrubs within the soil nailing area, and hydroseeding with shrub seed mix to the area affected by vegetation clearance will be provided upon completion of works to enhance the recovery of the habitat. Details of the landscape measures proposed are discussed in **Section 5.6**.

Good Site Practice

5.5.13 Standard good site practice will be implemented to avoid and minimize the potential disturbance to the surrounding habitat include:

- Placement of equipment or stockpile in the Works Area and access routes would be selected at existing disturbed land where possible to minimize disturbance to vegetation, or at the locations most convenient to gain access to the slope area. The chosen temporary stockpiling area and access routes will be far away from the identified plant species of conservation importance;
- Construction activities will be restricted to the clearly demarcated Works Area;
- Temporary works area will be reinstated immediately after completion of the construction works;
- Open fires will be strictly prohibited on the works site;
- Waste generated from the site will be disposed of in a timely and proper manner;
- Fire fighting equipment should be provided in the Works Area before the commencement of works;
- The Resident Site Staff will monitor the proper implementation of the above mitigation measures.

5.6 Landscape and Visual

5.6.1 The proposed hazard mitigation works will be mainly carried out within the dense secondary woodland of Clear Water Bay Country Park and the Conservation Area. However, due to the limited footprint of the proposed project and the flexibility in the design which can allow adjustment of the locations and layout of proposed permanent features based on actual site conditions, tree felling of the existing trees on the slope areas, where the construction of flexible barriers, baffles or soil nailing will occur, will be avoided as far as practicable. The locations of the temporary storage of construction equipment and materials will be adjusted on-site so as to prevent any damage or disturbance to the existing trees along the woodland edge. The exact locations of the steel posts and associated structures of the flexible barriers will be adjusted to avoid tree felling. Limited pruning on some canopies of the existing trees may be required so as to facilitate the erection of the flexible barriers and baffles and installation of soil nails. Appropriate tree protection zone(s) with 1.5m setback from the trunks of the existing trees to the exact locations of the steel posts and concrete pads of the flexible barriers

should be adopted as far as possible. As mentioned in **Section 5.5**, all pruning works (either root pruning or crown pruning) will be supervised by a qualified arborist to ensure that no trees will be hard pruned or adversely impacted due to malpractice of tree works. For any trees deteriorate after pruning and could not be safely retained on site during construction of the Project, formal tree removal application with compensatory planting proposal(s) should be prepared in accordance with Development Bureau's Technical Circular (Works) No. 10/2013 on "Tree Preservation" and submitted to relevant authorities for approval before removal of any trees on site. The following guidelines should be adopted by the Contractor when undertaking the tree pruning work:

- American National Standard for Tree Care Operations (ANSI A300 (Part 1)) – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practice (Pruning));
- American National Standard for Arboricultural Operations (ANSI Z133) – Safety Requirements;
- British Standard for Tree Works (BS 3998:1989);
- "General Guidelines on Tree Pruning" (Development Bureau);
- "Pictorial Guide for Tree Maintenance" (Development Bureau);
- "Do's and Don'ts in Pruning (Fact Sheet)" (Development Bureau);
- "Do's and Don'ts in Pruning (Leaflet)" (Development Bureau).

5.6.2 Other protection measures on the existing trees and plants of conservation importance are also detailed in **Section 5.5**. Protection on the seasonal stream will follow the good site practice for monitoring of water quality impacts as outlined under **Section 5.3**.

5.6.3 The proposed Works Areas will be largely screened off by the existing hillside vegetation and roadside trees, and hoarding in a subdued colour will be erected around the wooded hillside area with proposed mitigation works facing Clear Water Bay Road during the construction period. These could minimize landscape/ visual impacts to the VSRs at road-side level during the construction period.

5.6.4 To further minimize the visual impact to the VSRs in the long term, all proposed concrete and steel post furniture of the flexible barriers and baffles shall be painted in subdued colours so as to blend these artificial structures with the surrounding environment. The landscape treatment to reduce the landscape/ visual impacts to the VSRs and the existing environment as a whole will include planting of shrubs seedlings and hydroseeding with erosion control mat at the vegetation clearance areas and proposed slope engineering works areas. An outline of the compensatory planting/ landscape proposal to enhance the greening elements is detailed in the followed section.

Proposed Landscape Plan

5.6.5 A total of about 547 trees will fall within the Works Areas. As detailed in **Section 4.2**, the exact locations of the steel posts and concrete pads of the flexible barriers and locations of the baffles will be adjusted to avoid tree felling. Only limited pruning of some canopy of selected existing trees may be required to facilitate the erection of the flexible barriers and baffles, and installation of soil nails, while localized trimming of ground vegetation within the same proposed works areas will also be needed. For any trees deteriorate after pruning and could not be safely retained on site during construction of the Project, formal tree removal application with compensatory planting proposal(s) should be prepared in accordance with Development Bureau's Technical Circular (Works) No.

10/2013 on "Tree Preservation" and submitted to relevant authorities for approval before removal of any trees on site.

5.6.6 Areas with vegetation clearance along the alignments of the flexible barriers, maintenance access and baffles will be provided to compensate for the loss of greening element underneath the tree canopy. The soil nailed area will be covered with biodegradable erosion control mat and an approximate area of 275m^2 will be hydroseeded with shrub seed mix, as well as vegetated with shrub planting. The area to be temporarily disturbed during the construction of flexible barriers and the maintenance access (1,370.5m^2 in total), and baffles (151.1m^2) will be hydroseeded with shrub seed mix. (Examples of completion of works with landscape treatment are displayed in **Plate 3**).

5.6.7 Seeds of native shrub species, including *Rhaphiolepis indica*, *Psychotria asiatica* and *Bridelia tomentosa*, will be hydroseeded with the grass mix on the soil nailing slopes. Seedlings of native shrubs, including *Ardisia crenata*, *Gardenia jasminoides*, *Litsea rotundifolia* var. *oblongifolia* and *Psychotria asiatica*, will be planted individually in the soil nailing areas. No landscape treatment is proposed at the areas for temporary storage which are largely paved with limited existing vegetation coverage. Given that the proposed works areas are in close proximity to the natural woodland which has diverse seed sources for vegetation recovery, it is anticipated that the vegetation of the affected areas (i.e. areas that will be temporarily disturbed during construction stage) will recover progressively by natural succession. The abovementioned landscape treatments aim to enhance the vegetation recovery after the completion of the proposed slope works and minimize the visual impacts to the identified VSRs and the surrounding environments. **Table 5.4** shows the details of the soft landscape treatments as landscape mitigation measures. The landscape design should follow GEO Publication No. 1/2011. In addition, opportunities will be sought to enhance the landscape and visual value of the existing disturbed area due to human disturbance by re-vegetation as far as practicable.

5.6.8 Upon completion of compensatory plantings, the appointed landscape contractor shall carry out regular monitoring and appropriate maintenance (e.g. replacement for unsatisfactory plant specimens) for the compensatory plantings during a 12-month establishment period. The monitoring reports shall be endorsed by the IEC before submission to relevant government department(s).

Table 5-4 Details of the Proposed Landscape Mitigation Measures

1. Hydroseeding with shrub seed mix will be applied at the alignments of flexible barriers and maintenance access (1,370.5m^2), baffles (151.1m^2) and soil nailing areas (275m^2). Native grass species shall be used in the hydroseeding mix as far as possible.

Hydroseeding mix	Specification
Between April and August: a. *Cynodon dactylon* b. *Paspalum notatum* c. *Chloris gayana* d. *Eragrostis curvula* (2% maximum) e. *Eremochloa ophiuroides* f. *Eremochloa ciliaris* g. *Cenchrus echinatus* h. Shrub species from the list below *Bridelia tomentosa* *Psychotria asiatica* *Rhaphiolepis indica*	Composition (%) by rate (min. seed mix in total of 30g/sq. meters)* a. 30% b. 30% c. 5% d. 2% e. 4% f. 5% g. 4% h. 20%
Between September and March: a. *Cynodon dactylon* b. *Paspalum notatum* c. *Lolium perenne* d. *Chloris gayana* e. *Eremochloa ciliaris* f. *Eremochloa ophiuroides* g. Shrub species from the list below *Bridelia tomentosa* *Psychotria asiatica* *Rhaphiolepis indica*	Composition (%) by rate (min. seed mix in total of 35g/sq. meters)* a. 30% b. 25% c. 15% d. 6% e. 2% f. 2% g. 20%

Note:
* Native grass species shall be used as far as possible. The composition of grass mix is recommendation only and the actual composition of grass seed mix may be adjusted based on the availability of nursery shock during the detailed design stage.

2. Native shrub species will be planted in the planting holes within the soil nailing areas, with total areas of approximately 275m^2.

Shrub mix	Spacing (mm)	Size (mm)	Proportion of mix	Quantity (no.)	Remarks
a. *Ardisia crenata*	1000	350(H) x 200(S)	25%	325	Potted
b. *Gardenia jasminoides*	1000	350(H) x 200(S)	25%	325	Potted
c. *Litsea rotundifolia* var. *oblongifolia*	1000	350(H) x 200(S)	25%	325	Potted
d. *Psychotria asiatica*	1000	350(H) x 200(S)	25%	325	Potted

5.7 Cultural Heritage

5.7.1 No mitigation measures are required as no heritage site will be affected by the proposed hazard mitigation works.

5.8 Severity, Distribution and Duration of Environmental Effects

5.8.1 With the implementation of the recommended mitigation measures, no adverse residual environmental impacts are anticipated from the proposed works for the Project.

5.9 Further Implications

5.9.1 No further environmental implications are anticipated for both the construction and operational phases of the Project.

6 USE OF PREVIOUSLY APPROVED PROJECT PROFILES

6.1.1 No EIA report was prepared before for a project of a similar nature. However, there are a number of relevant Project Profiles that were submitted before for application for permission to apply directly for an Environmental Permit for similar landslip preventive works, including the following, one of which is also situated in Sai Kung:

- Agreement No. CE 93/2001 (GE) *Landslide Mitigation Works at Pak Sha Wan and Tsing Shan Trail above 19 – Design and Construction, Project Profile for Pak Sha Wan Landslipe Mitigation Works* (Application No: DIR-93/2003 submitted in November 2003; EP granted in January 2004); and
- Agreement No. CE 37/2008 (GE) *Landslide Prevention and Mitigation Programme, 2008, Package J, Natural Terrain Hazard Mitigation Works, Kowloon, New Territories and Outlaying Island – Investigation, Design and Construction, Project Profile for Study Area above Leung Fai Tin along Clear Water Bay Road.* (Application No: AEP-448/2013) submitted in March 2013; EP granted in March 2013).

7 CONCLUSION

7.1.1 The potential environmental impacts arising from the Project and the proposed mitigation measures are summarised in **Table 7-1**.

Table 7-1 Summary of the Potential Environmental Impacts and Proposed Mitigation Measures

Potential Impacts	Proposed Mitigation Measures
Noise	
Construction Phase: Noise generated from the construction activities Operation Phase: No Impact	Construction Phase: Movable noise barrier Noise enclosure Use quiet PME Implement good site practice Operation Phase: Not required
Air Quality	
Construction Phase: Dust generated from the construction activities and stockpiling of soil/ rock	Construction Phase: Dust suppression measures, cover stockpiles & implement good site practice

Operation Phase: No Impact	Operation Phase: Not required
Water Quality	
Construction Phase: Potential site run-off to the stream affecting water quality Operation Phase: Potential impact to stream is avoided by not constructing maintenance access and anchor on the stream bed, with additional opening of at least 0.5m between the stream bed and the bottom of the flexible barrier for passing of wildlife along the stream.	Construction Phase: Implement good site practice to control run-off Operation Phase: Not required
Waste	
Construction Phase: 300m^3 of C&D waste and 1,200m^3 of C&D materials are estimated to be generated from the Project Operation Phase: No impact	Construction Phase: On-site sorting of waste, implement trip ticket system, implement waste management plan Operation Phase: Not required
Ecology	
Construction Phase: 2,266.1m^2 vegetation will be disturbed due to site clearance for proposed works Operation Phase: Potential impact to stream is avoided by not constructing maintenance access and anchor on the stream bed, with additional opening of at least 0.5m between the stream bed and the bottom of the flexible barrier for passing of wildlife along the stream.	Construction Phase: Compensation by re-vegetation of 1,796.6m^2 to reinstate vegetation in the areas temporarily disturbed due to the proposed works. Fence off identified plant species of conservation importance within the Works Area. Operation Phase: Not required.
Landscape and Visual	
Construction Phase： Sources of Impacts : Unsightly construction activities Localized and limited loss of vegetation Potential site run-off to the stream Impacts on Sensitive Receivers: • Moderate impacts on LR1 (Woodland) and LCA1 (Hillside Landscape) due to localized	Construction Phase Hoarding for screening, minimize the construction period as possible Compensatory planting and re-vegetation Implement tree protection measures including protective wrapping and designation of tree protection zones within Works Area Implement good site practice to control run-off

trimming and clearance of vegetation • Slightly adverse impacts on LR3 (Watercourse) as a very short section of the proposed flexible barrier will be built across the watercourse in the central part of the Works Area (without any works to be encroached upon the stream bed) • Negligible impacts on other identified LRs and LCA. • Slightly adverse impacts on both VSR1 (Travellers using Clear Water Bay Road) and VSR2 (Residents of Sheung Yeung Tsuen and Gospel Villa) <u>Operation Phase:</u> Sources of Impacts : Permanent erection of flexible barriers, maintenance access and baffles. Soil nail heads are almost invisible as they will be covered by reinstated vegetation cover Impacts on Sensitive Receivers: • Slightly adverse impacts on LR1 and LCA1 at the beginning of operation phase but the impacts will progressively become negligible after establishment of compensatory plantings • Negligible impacts on other identified LRs and LCA • Slightly adverse impacts on VSR1 and VSR2 at the beginning of operation phase but the impacts will progressively become negligible after establishment of compensatory plantings	<u>Operation Phase:</u> Proposed concrete and steel post furniture of the flexible barriers and baffles will be painted in subdued colors to reduce visual obstruction
Cultural Heritage	
No impact	Not required

8 REFERENCES

- AFCD.(2003). *Rare and Precious Plants of Hong Kong*, AFCD, Hong Kong
- AFCD. (2007). *Flora of Hong Kong Volume 1*. AFCD, Hong Kong
- AFCD. (2008). *Flora of Hong Kong Volume 2.* AFCD, Hong Kong
- AFCD. (2009). *Flora of Hong Kong Volume 3*. AFCD, Hong Kong
- AFCD. (2011). *Flora of Hong Kong Volume 4*. AFCD, Hong Kong

- AFCD. (2012a). *Check List of Hong Kong Plants 2012*. AFCD, Hong Kong
- AFCD (2012b). Clear Water Bay Country Park. Available at http://www.afcd.gov.hk/english/country/cou_vis/cou_vis_cou/cou_vis_cou_cwb/cou_vis_cou_cwb.html . Visited in October 2012.
- Carey, G.J., Chalmers, M.L., Diskin, D.A., Kennerley, P.R., Leven, M.R., Lewthwaite, R.W., Melville, D.S., Turnbull, M. and Young, L. 2001. The Avifauna of Hong Kong. Hong Kong Bird Watching Society, Hong Kong.
- Chan, A., J. Cheung, P. Sze, A. Wong, E. Wong and E. Yau, 2011. A Review of the Local Restrictedness of Hong Kong Butterflies. *Hong Kong Biodiversity, Agriculture, Fisheries and Conservation Department Newsletter* 21: 1-12
- Chan, H.S.R., Chau, W.K., Cheng, W.K., Chow, S.M., Ho, S.C.J., Kan, S.C.J., Lau, W.H.S. and Ng, K.L.E. (2012) Encyclopedia of Hong Kong Butterflies – Search for Butterflies. Hong Kong Lepidopterists' Society Limited, Hong Kong.
- Chan, S. K.F., K.S. Cheung, C.Y. Ho, F.N Lam & W.S. Tam, 2005. *A Field Guide to the Amphibians of Hong Kong*. Cosmos Books Ltd., Hong Kong.
- Country Parks Ordinance (Cap. 208)
- Development Bureau, "Do's and Don'ts in Pruning (Fact Sheet)"

  (http://www.trees.gov.hk/en/home/index.html) downloaded in May 2012.
- Development Bureau, "Do's and Don'ts in Pruning (Leaflet)"

  (http://www.trees.gov.hk/en/home/index.html) downloaded in May 2012.
- Development Bureau, "General Guidelines on Tree Pruning"

  (http://www.trees.gov.hk/en/home/index.html) downloaded in May 2012.
- Development Bureau, "Pictorial Guide for Tree Maintenance"

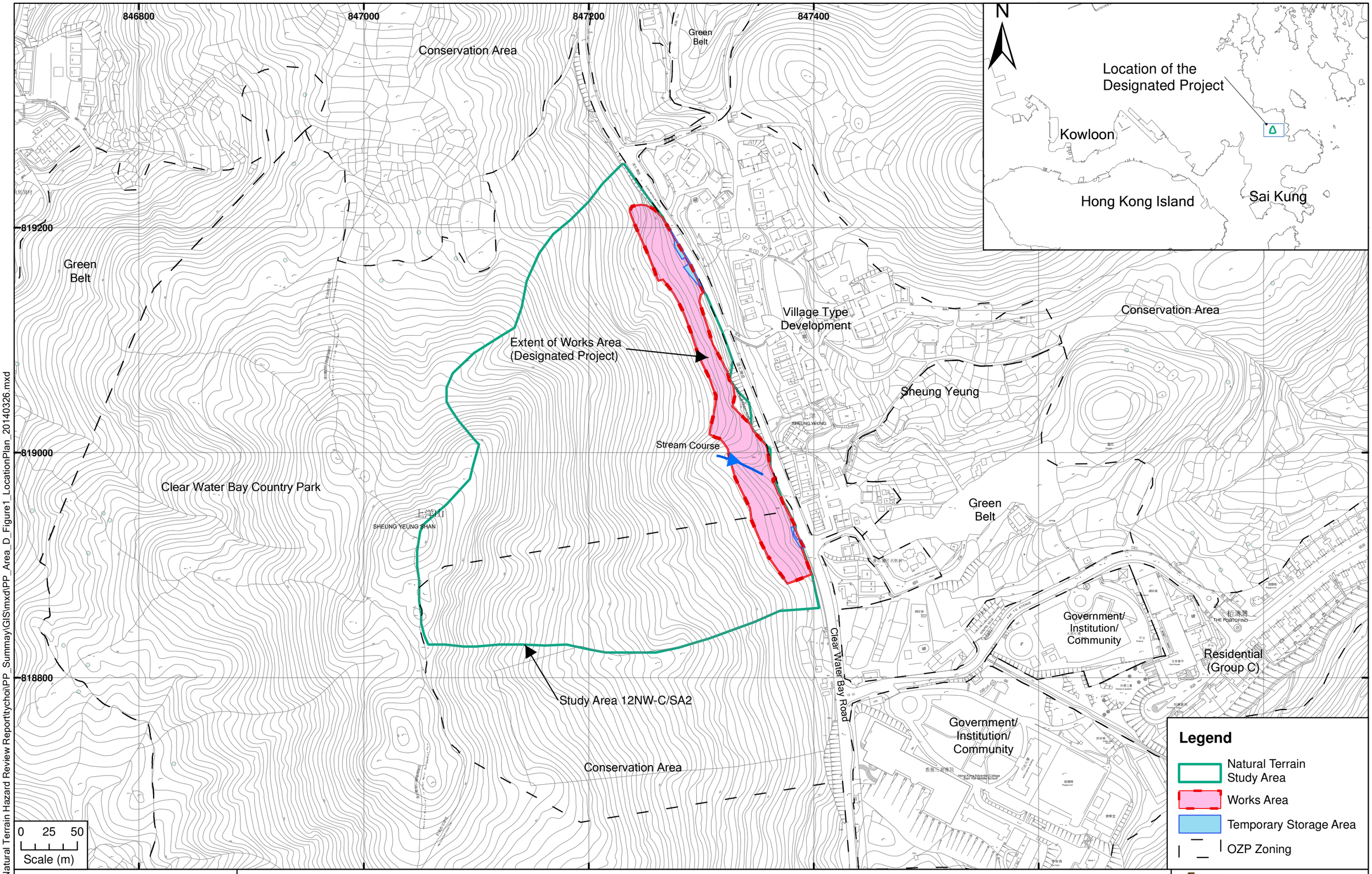
  (http://www.trees.gov.hk/en/home/index.html) downloaded in May 2012.
- Development Bureau's Technical Circular (Works) No. 10/2013 "Tree Preservation"
- Environment, Transport and Works Bureau Technical Circular (Works) No. 2/2004 – Maintenance of Vegetation and Hard Landscape Features
- Fellowes, J.F., M.W.N. Lau, D. Dudgeon, G.T. Reels, G.W.J. Ades, G.J. Carey, B.P.L. Chan, R.C. Kendrick, K.S. Lee, M.R. Leven, K.D.P. Wilson, Y.T. Yu, 2002. *Wild Animals to Watch: Terrestrial and Freshwater Fauna of Conservation Concern in Hong Kong,* Hong Kong
- Forest and Countryside Ordinance (Cap. 96) and Forestry Regulations
- Geotechnical Engineering Office No. 1/2011, Technical Guidelines on Landscape Treatment for Slopes
- Halcrow (2013). Natural Terrian Hazard Mitigation Works at Study Area No. 12NW – SA1 Above Leung Fai Tin Along Clear Water Bay Road, Sai Kung – Project Profile
- Hong Kong Biodiversity Database of Agriculture, Fisheries and Conservation Department

  (http://www.afcd.gov.hk/english/conservation/hkbiodiversity/database/search.asp)
- Hong Kong Planning Standards & Guidelines (HKPSG)
- Hong Kong Plant Database of Hong Kong Herbarium, AFCD, Hong Kong

(http://www.hkherbarium.net/Herbarium/frame.html)

- IUCN. (2012). *IUCN Red List of Threatened Species*. Version 2012.1. available at http://www.iucnredlist.org/ Visited in October 2012.
- Karsen, S., M.W.N. Lau & A. Bogadek, 1998. *Hong Kong Amphibians and Reptiles*. Provisional Urban Council, Hong Kong
- Lo, P.Y.F and Hui, W.L (2004) Hong Kong Butterflies. Agriculture, Fisheries and Conservation Department, Hong Kong.
- Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)
- Shek, C. T. 2006. *A Field Guide to the Terrestrial Mammals of Hong Kong*. Friends of the Country Parks Cosmos Books Ltd., Hong Kong.
- Tam, T. W., K.K. Leung, B.S.P. Kwan, K.K.Y. Wu, S.S.H. Tang, I.W.Y. So, J.C.Y. Cheng, E.F.M. Yuen, Y.M. Tsang, and W.L. Hui, 2011. *The Dragonflies of Hong Kong (1st edition).*AFCD. Friends of CountryParks and Cosmos Books Ltd., Hong Kong
- Town Planning Ordinance (Cap. 131)
- Wild Animals Protection Ordinance (Cap. 170)
- Xing, *et al*., 2000. Hong Kong Vascular Plants: Distribution and Status, *Memoirs of the Hong Kong Natural History Society*, No. 23. The University of Hong Kong

List of Figures



Path: P:\B090871\Natural Terrain Hazard Review Report\tychoi\PP_Summary\GIS\mxd\PP_Area_D_Figure1_LocationPlan_20140326.mxd

Project

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009,
Package D,
Natural Terrain Hazard Mitigation Works,
Hong Kong Island and Sai King -
Investigation, Design and Construction

Figure Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Location Plan of the Designated Project

Note: Base map is 1,000 scale (2006), 2 meter contour intervals; sheet 12nw22a, 22b, 17c, 17d.

FUGRO (HONG KONG) LTD

Figure 1

SCALE 1:3,000

PROJECT No. 090871

847000
847200
847400
847600
847800
819200
819000
818800
N
N1, A1
N2, A2
N3, A3
N4, A4
N5, A5
A
A
Extent of Works Area
(Designated Project)
Stream Course
Sheung Yeung
上洋
SHEUNG YEUNG
上洋山
SHEUNG YEUNG SHAN
Clear Water Bay Road
PAK TO AVENUE
0 25 50
Scale (m)

Legend

- Works Area
- Storage Area
- Stream Course
- Cross-Section
- Noise Sensitive Receivers and Air Sensitive Receivers

Path: P:\B090871\Natural Terrain Hazard Review Report\tycho\PP_Summay\GIS\mxd\PP_Area_D_Figue2_NSR_v2.mxd

Project

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009,
Package D,
Natural Terrain Hazard Mitigation Works,
Hong Kong Island and Sai King -
Investigation, Design and Construction

Figure Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Locations of the Noise and Air Sensitive Receivers

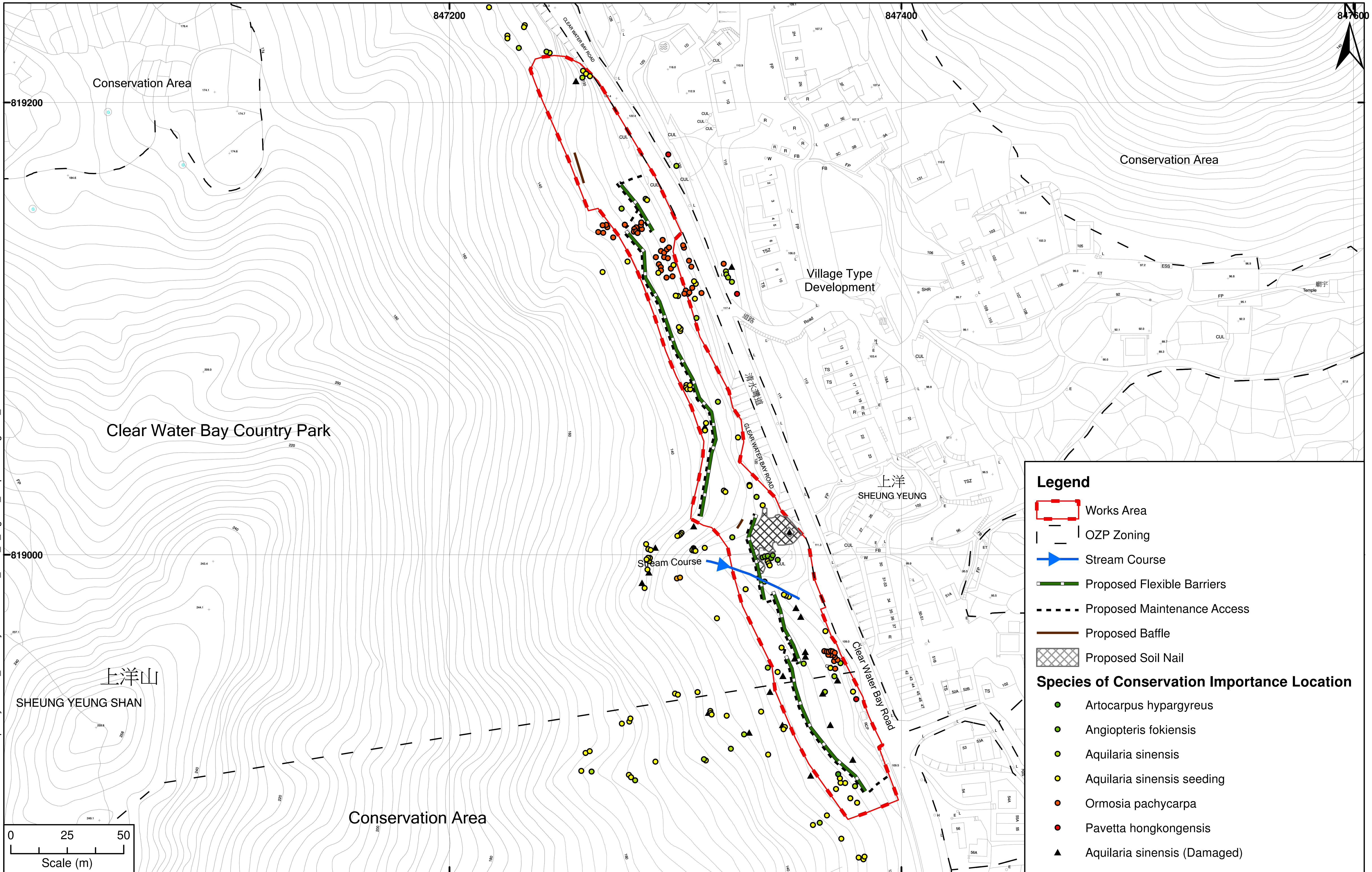
Note: Base map is 1,000 scale (2006), 2 meter contour intervals; sheet 12nw22a, 22b, 17c, 17d.

FUGRO (HONG KONG) LTD

Figure 2

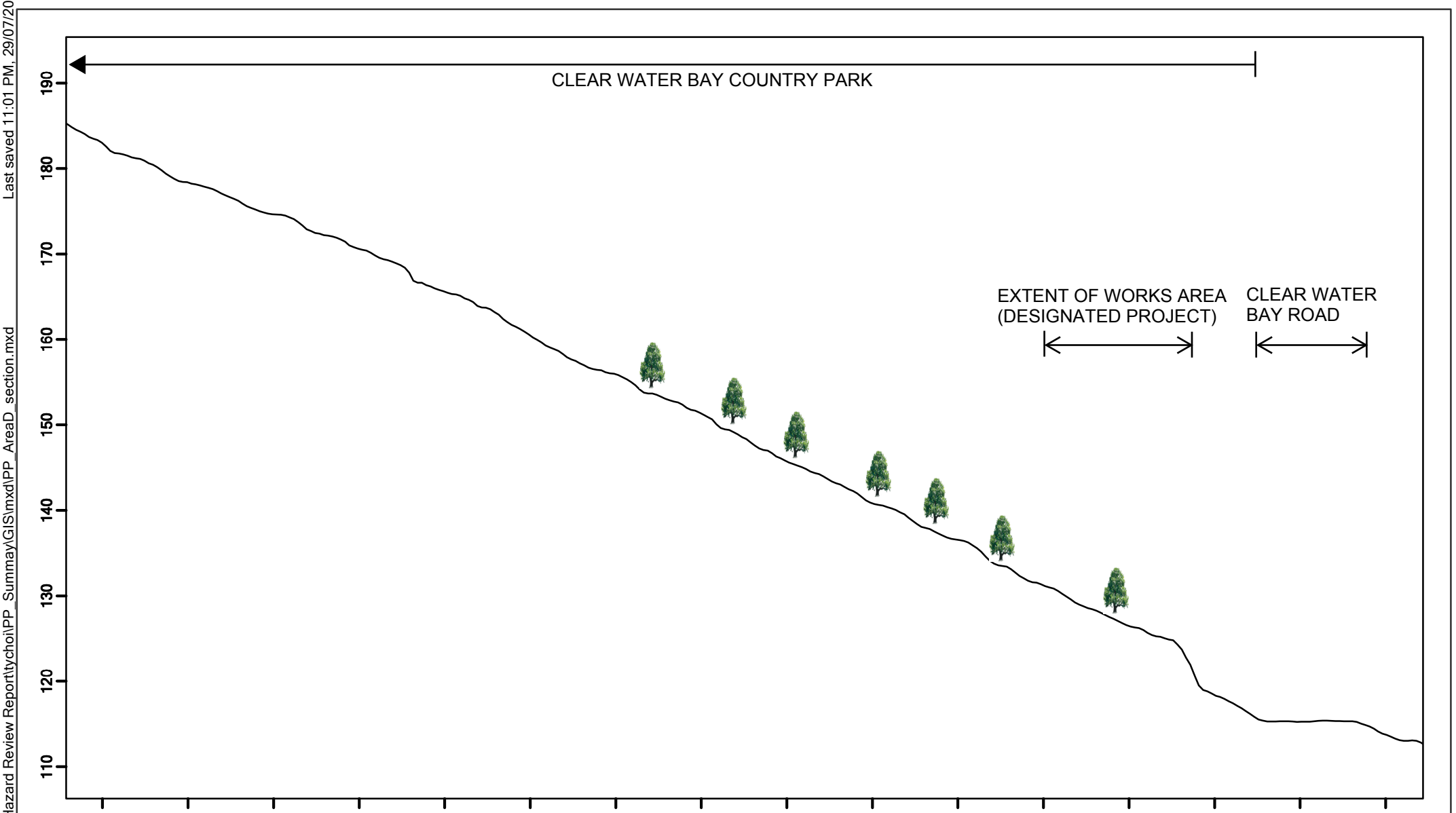
SCALE 1:2,500

PROJECT No. 090871


Conservation Area
Conservation Area
Conservation Area
Village Type Development
Clear Water Bay Country Park
上洋
SHEUNG YEUNG
上洋山
SHEUNG YEUNG SHAN
Clear Water Bay Road
CLEAR WATER BAY ROAD
Stream Course
847200
847400
847600
819200
819000
0 25 50
Scale (m)
Legend
Works Area
OZP Zoning
Stream Course
Proposed Flexible Barriers
Proposed Maintenance Access
Proposed Baffle
Proposed Soil Nail
Species of Conservation Importance Location
Artocarpus hypargyreus
Angiopteris fokiensis
Aquilaria sinensis
Aquilaria sinensis seeding
Ormosia pachycarpa
Pavetta hongkongensis
Aquilaria sinensis (Damaged)

Path: P:\B090871\Natural Terrain Hazard Review Report\tychoi\PP_Summay\GIS\mxd\PP_Area_D_Figure3_ProposedMitigation_20130919.mxd

Project	Figure Title	
AGREEMENT NO. CE30/2009 (GE) Landslip Prevention and Mitigation Programme 2009, Package D, Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction	Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung Proposed Natural Terrian Hazard Mitigation Works Note: Base map is 1,000 scale (2006), 2 meter contour intervals; sheet 12nw22a, 22b, 17c, 17d.	FUGRO (HONG KONG) LTD Figure 3 SCALE 1:1,500 PROJECT No. 090871



Job Title

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009, Package D,
Natural Terrain Hazard Mitigation Works,
Hong Kong Island and Sai King -
Investigation, Design and Construction

Drawing Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Section A-A

Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.

FUGRO (HONG KONG) LTD

Scale: 1:600

Drawn by: Date: JUL 2013 Checked: Approved:

Job No. 090871 Figure No. Figure 4

N

Extent of Works Area
(Designated Project)

Sheung Yueng

SHEUNG YUENG SHAN

Clear Water Bay Road

0 25 50 Meters

Legend

- Works Area
- Stream Course
- Native Secounday Woodland
- Developed Area

Project

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009,
Package D,
Natural Terrain Hazard Mitigation Works,
Hong Kong Island and Sai King -
Investigation, Design and Construction

Figure Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Habitats within Works Area

Note: Base map is 1,000 scale (2006), 2 meter contour intervals; sheet 12nw22a, 22b,17c,17d

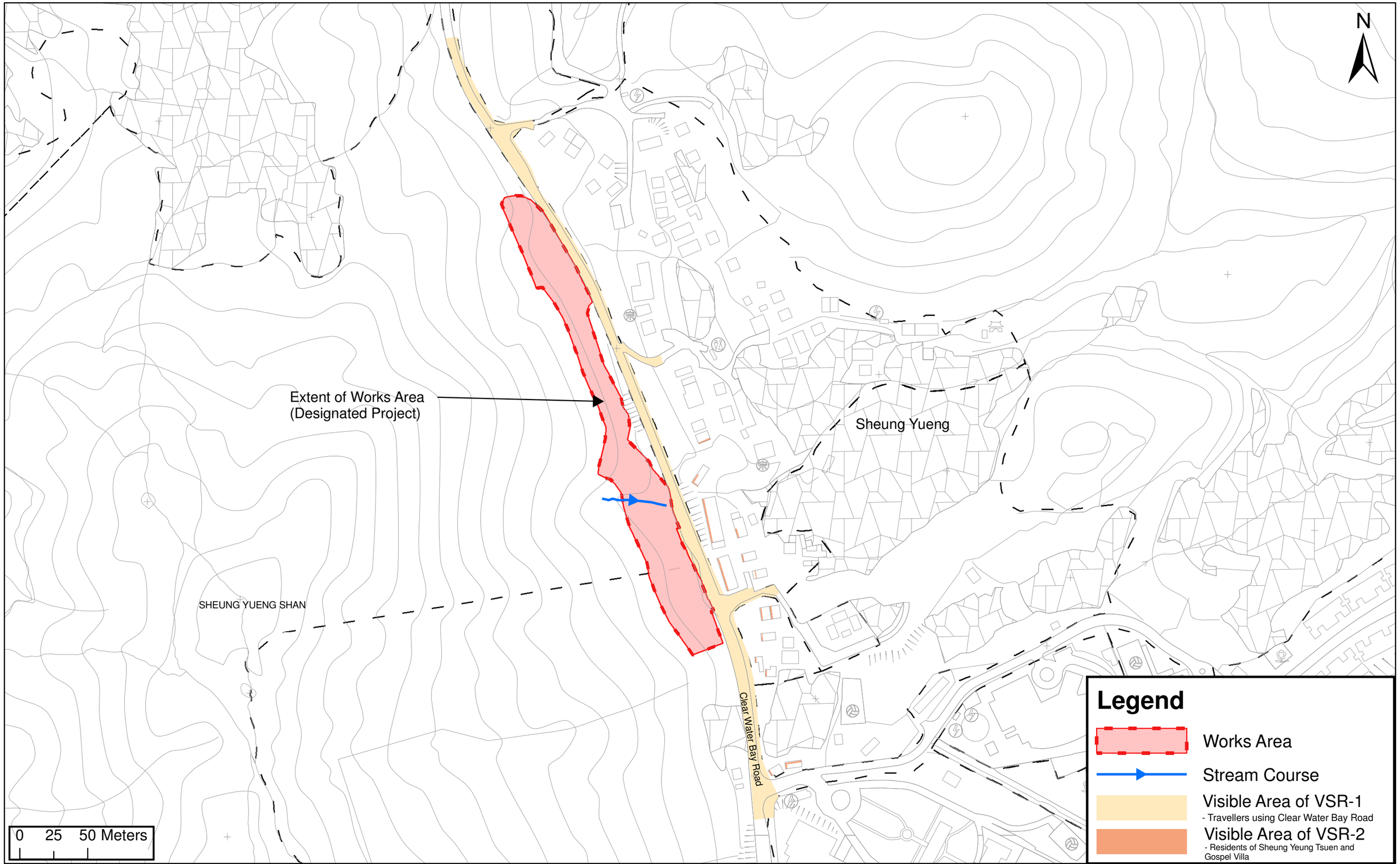
FUGRO (HONG KONG) LTD

Figure 5

Page of

SCALE 1:2500

PRJOCET No. 090871



Project

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009,
Package D,
Natural Terrain Hazard Mitigation Works,
Hong Kong Island and Sai King -
Investigation, Design and Construction

Figure Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Locations of the Visual Sensitive Receivers

Note: Base map is 1,000 scale (2006), 2 meter contour intervals; sheet 12nw22a, 22b,17c,17d

FUGRO (HONG KONG) LTD

Figure 6

Page of

SCALE 1:2500

PRJOCET No. 090871

N

VP1
VP2
VP3
VP4
VP5
VP6
VP7
VP8
VP9
VP10
VP11
VP12
VP13
VP14
VP15

Extent of Works Area
(Designated Project)

Sheung Yueng

SHEUNG YUENG SHAN

Clear Water Bay Road

0 25 50 Meters

Legend

- Works Area
- Stream Course
- Vantage Point

Project

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009,
Package D,
Natural Terrain Hazard Mitigation Works,
Hong Kong Island and Sai King -
Investigation, Design and Construction

Figure Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Locations of the Vantage Points

Note: Base map is 1,000 scale (2006), 2 meter contour intervals; sheet 12nw22a, 22b,17c,17d

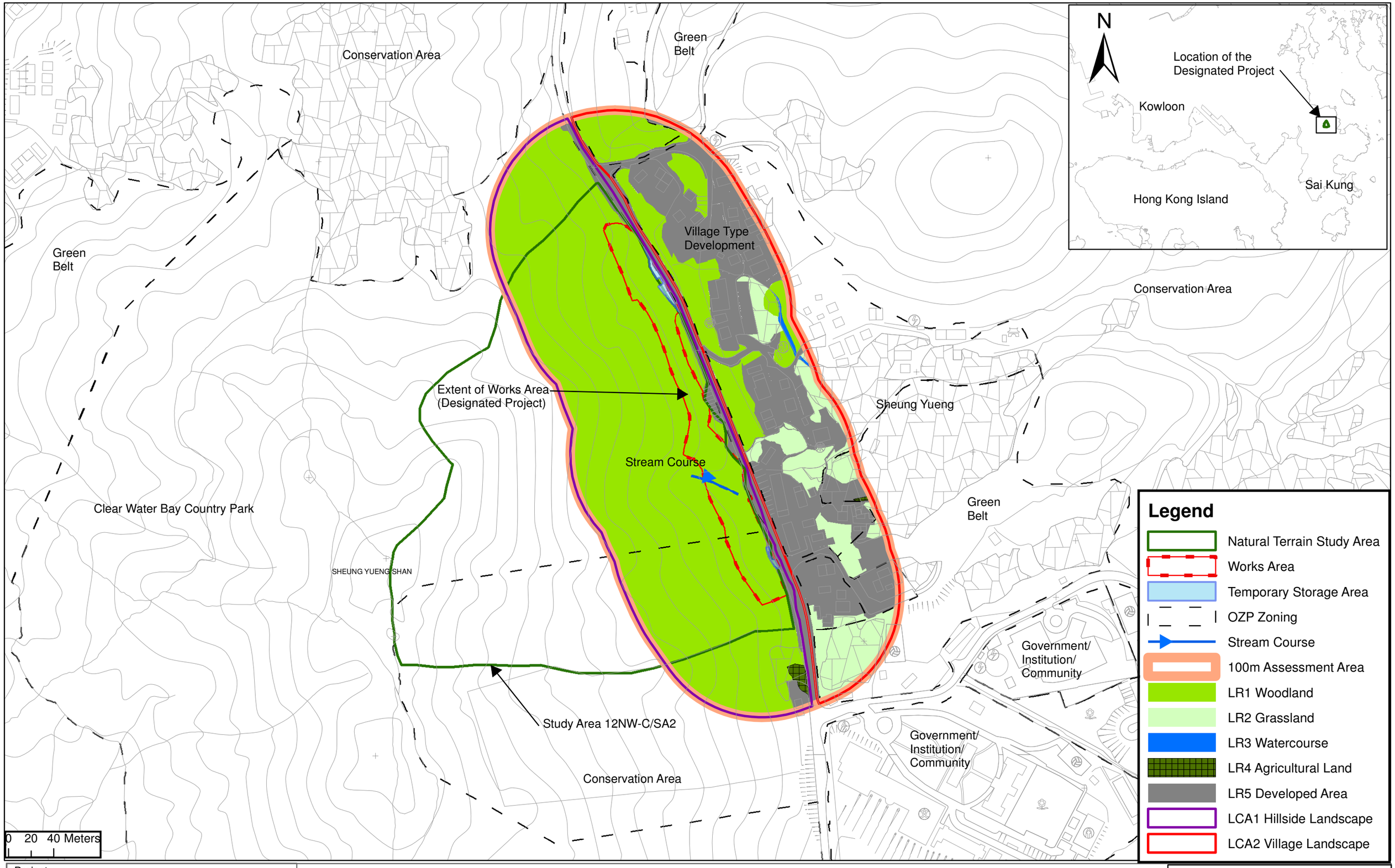
FUGRO (HONG KONG) LTD

Figure 7

Page of

SCALE 1:2500

PRJOCET No. 090871



Project

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009,
Package D,
Natural Terrain Hazard Mitigation Works,
Hong Kong Island and Sai King -
Investigation, Design and Construction

Figure Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Locations of Landscape Resources (LRs) and Landscape Character Areas (LRAs)

Note: Base map is 1,000 scale (2006), 2 meter contour intervals; sheet 12nw22a, 22b,17c,17d

FUGRO (HONG KONG) LTD

Figure 8

Page of

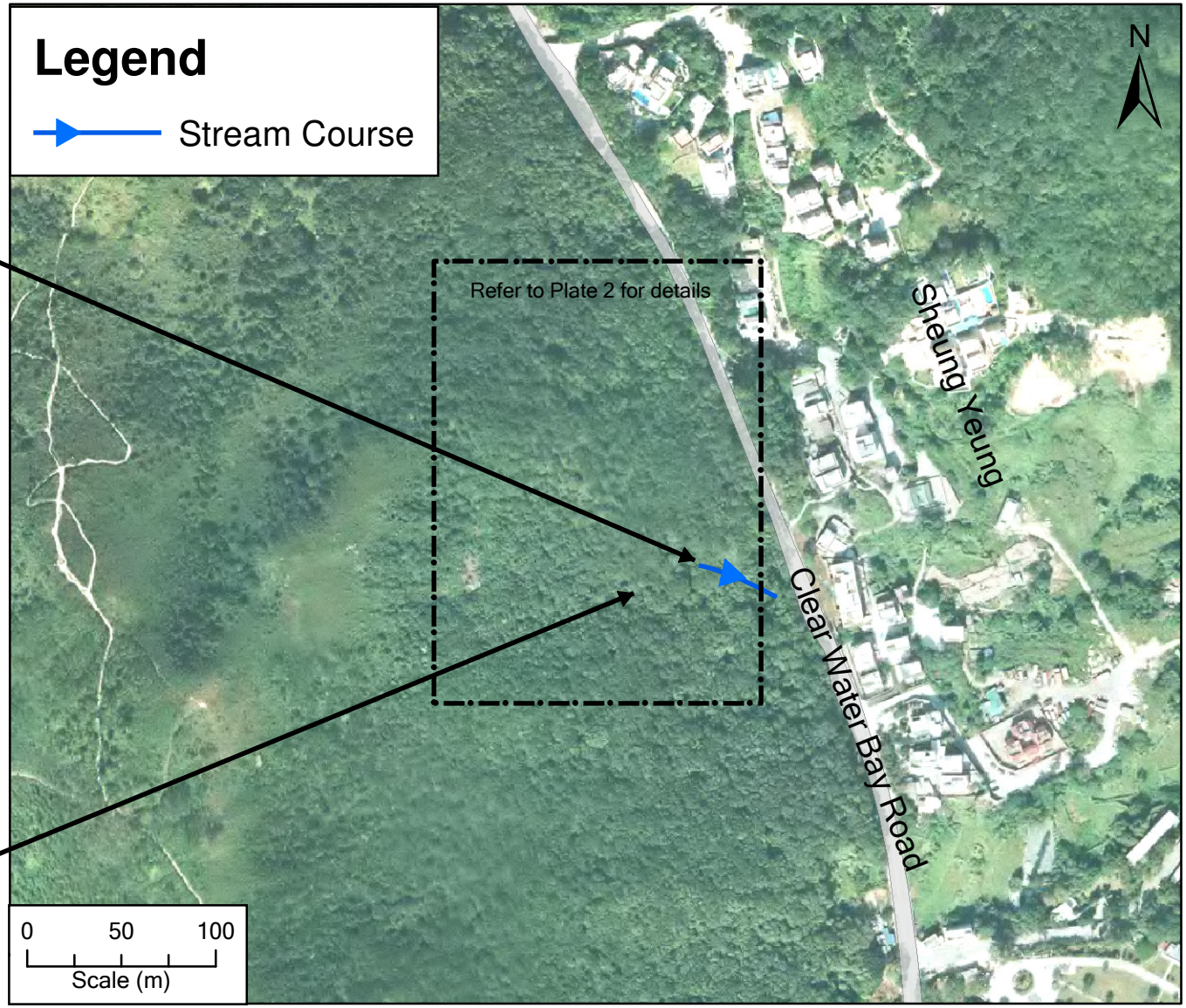
SCALE 1:3000

PRJOCET No. 090871

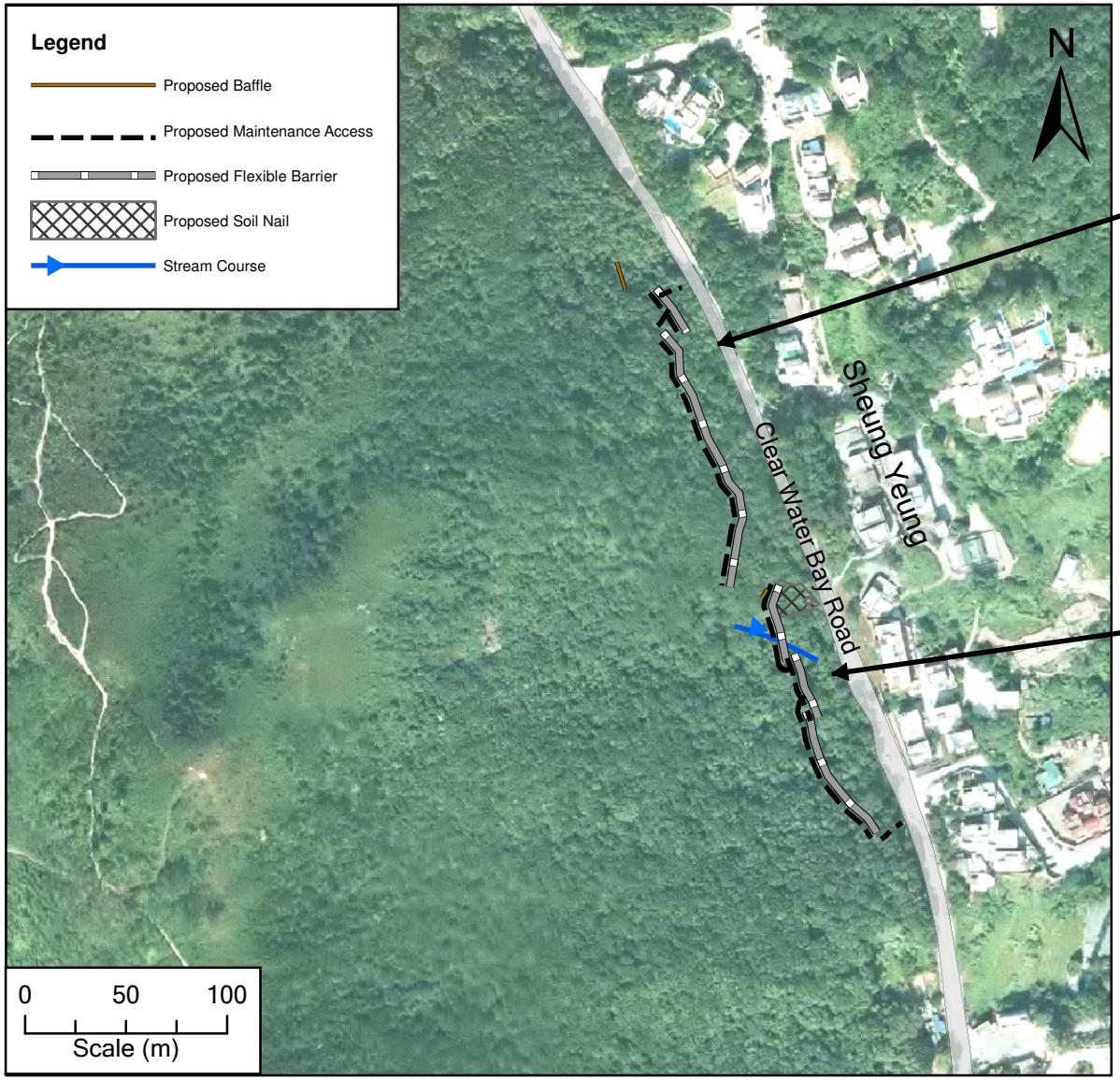
List of Plates

Streamcourse (Looking East)

Streamcourse (Looking West)



Job Title AGREEMENT NO. CE30/2009 (GE) Landslip Prevention and Mitigation Programme 2009, Package D, Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction	Drawing Title Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung Overview of the Surrounding Environment of the Designated Project Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.	FUGRO (HONG KONG) LTD Scale: 1:3,500 Drawn by: Date: JUL 2013 Checked: Approved: Job No. 090871 Figure No. Plate 1



Located to the northeast of the Study Area next to Clear Water Bay Road

General view of the Clear Water Bay Road and the flourishing woodland

Job Title

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009, Package D,
Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction

Drawing Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Approximate Location of the Proposed Alignment of the Flexible Barrier and Views around the Works Area

Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.

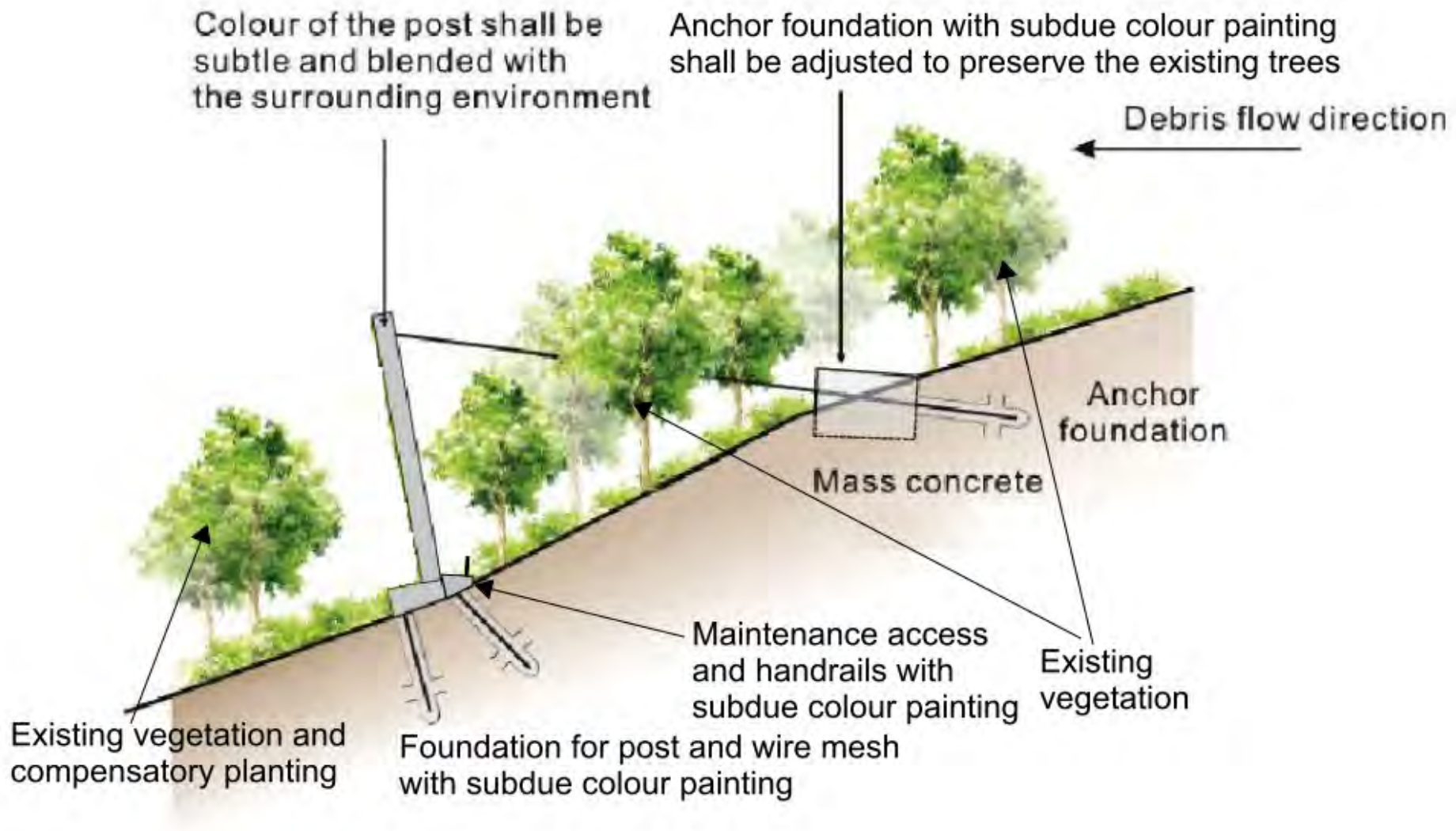
FUGRO (HONG KONG) LTD

Scale: 1:3,500

Drawn by: Date: JUL 2013 Checked: Approved:

Job No. 090871

Figure No. Plate 2



Job Title

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009, Package D,
Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction

Drawing Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Schematic Diagram of Landscape Treatment Works for Flexible Barrier

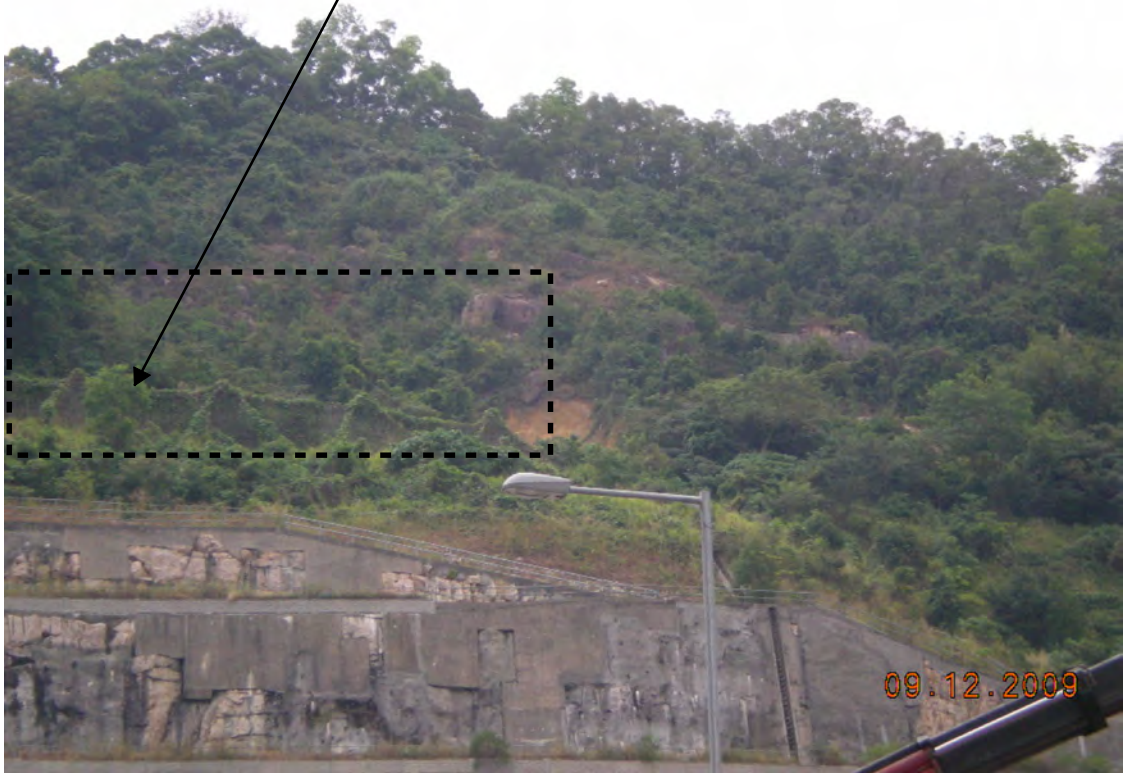
Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.

FUGRO (HONG KONG) LTD

Scale: Not to Scale

Drawn by: Date: JUL 2013 Checked: Approved:

Job No. 090871 Figure No. Plate 3



General View of the flexible barrier

Before slope upgrading works

1 year after slope works with hydroseeding and pit planting of native species seedlings

5 years after slope works

Illustrations of successful establishment of native plant species and natural dispersal of vegetation over time along Clear Water Bay Road (Source: GEO Publication No. 1/2011)

Job Title AGREEMENT NO. CE30/2009 (GE) Landslip Prevention and Mitigation Programme 2009, Package D, Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction	Drawing Title Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung Illustrations of Mitigation Measures Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.	FUGRO (HONG KONG) LTD Scale: Not to scale Drawn by: Date: JUL 2013 Checked: Approved: Job No. 090871 Figure No. Plate 4

Protective weapping around tree trunks
(Source: GEO Publication No. 1/2011)

Job Title AGREEMENT NO. CE30/2009 (GE) Landslip Prevention and Mitigation Programme 2009, Package D, Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction	Drawing Title Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung Illustration of Protective Wrapping around Tree Trunks Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.	FUGRO (HONG KONG) LTD Scale: Not to Scale Drawn by: Date: JUL 2013 Checked: Approved: Job No. 090871 Figure No. Plate 5

Native Secondary Woodland (Works Area)

Native Secondary Woodland (Works Area)

Native Secondary Woodland (Works Area)

Developed Area (Works Area)

Developed Area (Works Area)

Seasonal Stream Course (Works Area)

Job Title

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009, Package D,
Natural Terrain Hazard Mitigation Works,
Hong Kong Island and Sai King -
Investigation, Design and Construction

Drawing Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Representative Photographs of Habitats

Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.

FUGRO (HONG KONG) LTD

Scale: Not to Scale

Drawn by: Date: JUL 2013 Checked: Approved:

Job No. 090871 Figure No. Plate 6-1

		
Seasonal Stream Course (Works Area)	**Native Secondary Woodland (Area Adjacent to Works Area)**	**Native Secondary Woodland (Area Adjacent to Works Area)**
		
Grassland (Area Adjacent to Works Area)	**Developed Area (Area Adjacent to Works Area)**	**Developed Area (Area Adjacent to Works Area)**

Job Title

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009, Package D,
Natural Terrain Hazard Mitigation Works,
Hong Kong Island and Sai King -
Investigation, Design and Construction

Drawing Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Representative Photographs of Habitats

Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.

FUGRO (HONG KONG) LTD

Scale: Not to Scale

Drawn by: Date: JUL 2013 Checked: Approved:

Job No. 090871 Figure No. Plate 6-2

Shrubland (Area Adjacent to Works Area)

Stream Course (Area Adjacent to Works Area)

Stream Course (Area Adjacent to Works Area)

Dry Agricultural Land (Area Adjacent to Works Area)

Job Title

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009, Package D,
Natural Terrain Hazard Mitigation Works,
Hong Kong Island and Sai King -
Investigation, Design and Construction

Drawing Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Representative Photographs of Habitats

Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.

FUGRO (HONG KONG) LTD

Scale: Not to Scale

Drawn by: Date: JUL 2013 Checked: Approved:

Job No. 090871 Figure No. Plate 6-3

LR1 – Woodland

LR2 – Grassland and shrubland (Example of lowland grassland)

LR3 – Watercourse (Example of channelized stream)

LR4 – Agricultural land

LR5 – Developed Area (Example of village houses in Sheung Yeung)

Job Title AGREEMENT NO. CE30/2009 (GE) Landslip Prevention and Mitigation Programme 2009, Package D, Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction	Drawing Title Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung Representative Photographs of the LRs and VSRs Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.	FUGRO (HONG KONG) LTD Scale: Not to Scale Drawn by: Date: JUL 2013 Checked: Approved: Job No. 090871 Figure No. Plate 7-1

VSR1 – Travellers using Clear Water Bay Road

VSR2 – Residents of Sheung Yeung Tsuen

Job Title

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009, Package D,
Natural Terrain Hazard Mitigation Works,
Hong Kong Island and Sai King -
Investigation, Design and Construction

Drawing Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Representative Photographs of the LRs and VSRs

Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.

FUGRO (HONG KONG) LTD

Scale: Not to Scale

Drawn by: Date: JUL 2013 Checked: Approved:

Job No. 090871 Figure No. Plate 7-2

VP1 – Located at the entrance of Pan Long Wan Road

VP2 – Located to the northeast of the Project Area, with the proposed flexible barriers within the woodland

Job Title

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009, Package D,
Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction

Drawing Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Photos at the Identified Vantage Points

Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.

FUGRO (HONG KONG) LTD

Scale: Not to Scale

Drawn by: Date: JUL 2013 Checked: Approved:

Job No. 090871 Figure No. Plate 8-1

VP3 – Located to the northeast of the Works Area

VP4 – Located to the northeast of the Works Area next to Clear Water Bay Road

Job Title

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009, Package D,
Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction

Drawing Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Photos at the Identified Vantage Points

Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.

FUGRO (HONG KONG) LTD

Scale: Not to Scale

Drawn by: Date: JUL 2013 Checked: Approved:

Job No. 090871 Figure No. Plate 8-2

VP5 – Located to the east of the Works Area and opposite to the existing man-made features

VP6 - Located to the east of the Works Area and opposite to the existing man-made features

Job Title AGREEMENT NO. CE30/2009 (GE) Landslip Prevention and Mitigation Programme 2009, Package D, Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction	Drawing Title Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung Photos at the Identified Vantage Points Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.	FUGRO (HONG KONG) LTD Scale: Not to Scale Drawn by: Date: JUL 2013 Checked: Approved: Job No. 090871 Figure No. Plate 8-3

VP7 - Located to the east of the Works Area and opposite to the proposed flexible barriers within the woodland

VP8 – General view of the Clear Water Bay Road and the flourishing woodland

Job Title AGREEMENT NO. CE30/2009 (GE) Landslip Prevention and Mitigation Programme 2009, Package D, Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction	Drawing Title Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung Photos at the Identified Vantage Points Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.	FUGRO (HONG KONG) LTD Scale: Not to Scale Drawn by: Date: JUL 2013 Checked: Approved: Job No. 090871 Figure No. Plate 8-4

VP9 – Located on the footpath in Sheung Yeung, opposite to the proposed soil nailing area within the woodland

VP10 – Located at the slope toe of the existing hillside woodland and opposite to Sheung Yeung area

Job Title AGREEMENT NO. CE30/2009 (GE) Landslip Prevention and Mitigation Programme 2009, Package D, Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction	Drawing Title Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung Photos at the Identified Vantage Points Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.	FUGRO (HONG KONG) LTD Scale: Not to Scale Drawn by: Date: JUL 2013 Checked: Approved: Job No. 090871 Figure No. Plate 8-5

VP11 – Located at the slope toe of the existing hillside woodland; only the top floor and the roof of the village houses in Sheung Yueng area are above Clear Water Bay Road

VP12 – Located to the southeast of the Works Area and opposite to the proposed flexible barriers

Job Title AGREEMENT NO. CE30/2009 (GE) Landslip Prevention and Mitigation Programme 2009, Package D, Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction	Drawing Title Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung Photos at the Identified Vantage Points Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.	FUGRO (HONG KONG) LTD Scale: Not to Scale Drawn by: Date: JUL 2013 Checked: Approved: Job No. 090871 Figure No. Plate 8-6

VP13 – Located at the slope toe of the existing hillside woodland and opposite to the southern Sheung Yeung area; residents from the village houses are visually screened off from the proposed works by the roadside trees

VP14 – Located to the southeast of the Works Area and opposite to the proposed flexible barriers in the woodland

Job Title

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009, Package D,
Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction

Drawing Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Photos at the Identified Vantage Points

Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.

FUGRO (HONG KONG) LTD

Scale: Not to Scale

Drawn by: Date: JUL 2013 Checked: Approved:

Job No. 090871 Figure No. Plate 8-7

VP15 – Located to the southeast of the Works Area; the proposed works are screened by the hillside woodland

Job Title

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009, Package D,
Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction

Drawing Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Photos at the Identified Vantage Points

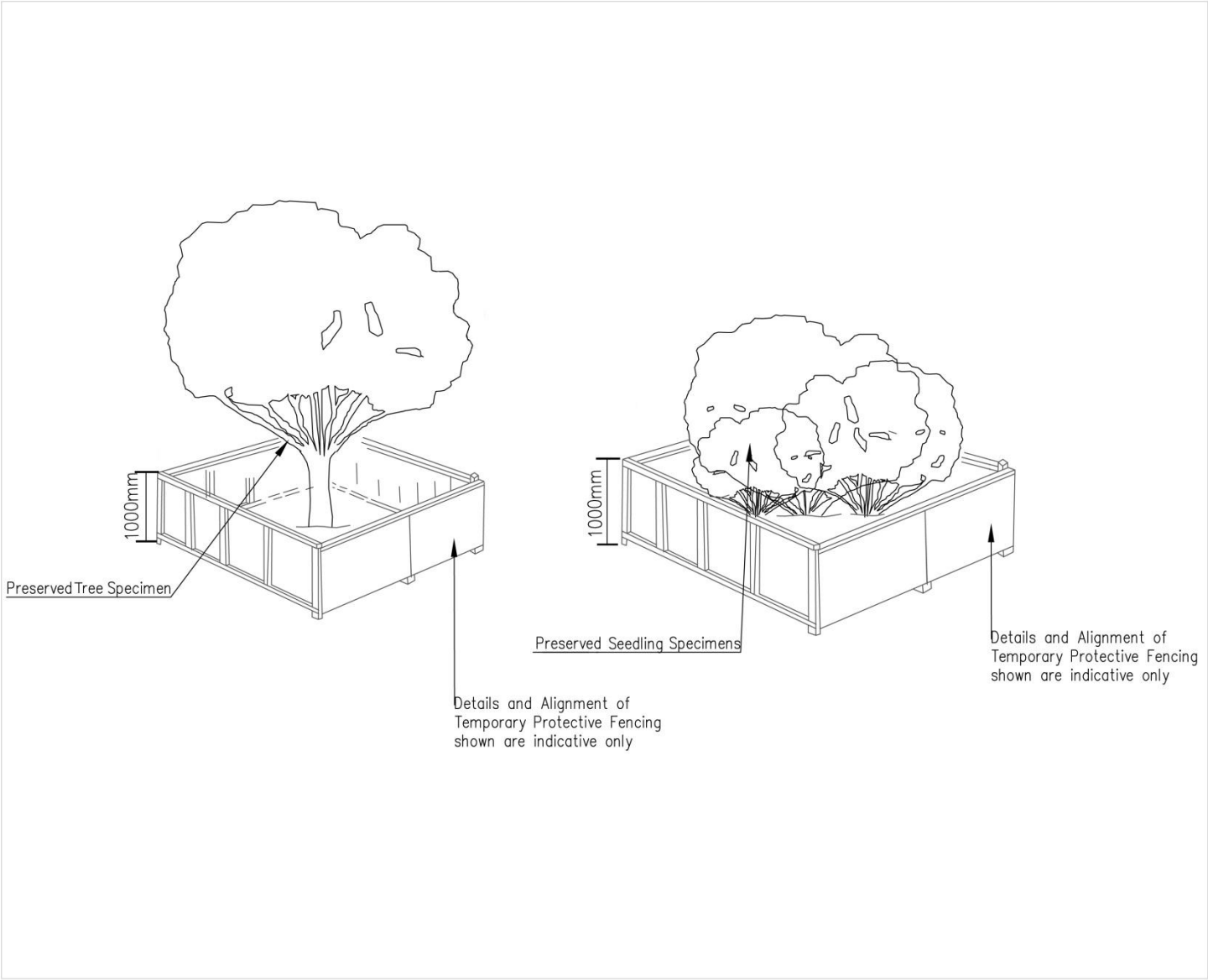
Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.

FUGRO (HONG KONG) LTD

Scale: Not to Scale

Drawn by: Date: JUL 2013 Checked: Approved:

Job No. 090871 Figure No. Plate 8-8



Job Title

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009, Package D,
Natural Terrain Hazard Mitigation Works,
Hong Kong Island and Sai King -
Investigation, Design and Construction

Drawing Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Illustration of Temporary Protective Fencing for the Protected Species

Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.

FUGRO (HONG KONG) LTD

Scale: Not to Scale

Drawn by: Date: JUL 2013 Checked: Approved:

Job No. 090871

Figure No. Plate 9

List of Appendices

Appendix A – Proposed Natural Terrain Hazard Mitigation Design

Appendix B – Tentative Construction Programme of Proposed Hazard Mitigation Works at Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung

Appendix C – Locations of the Study Area 12NW-C/SA2 and Other Concurrent Natural Terrain Hazard Mitigation Works in the Vicinity

Appendix D – Ecological Survey Data

Appendix E – Construction Noise Assessment

Appendix F – Proposed Noise Barrier and Enclosure

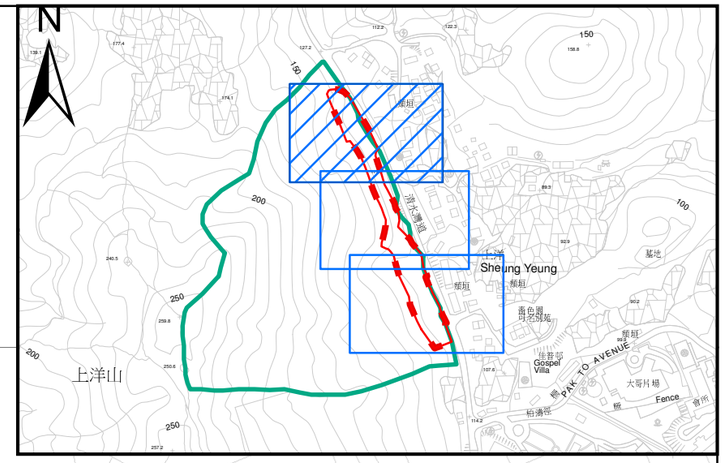
Appendix A

Proposed Natural Terrain Hazard Mitigation Design

847200

819200

Clear Water Bay Road



KEY PLAN
Scale 1:8000

Legend

- Works Area
- Storage Area
- Stream Course
- Proposed Baffle
- Proposed Flexible Barrier
- Proposed Maintenance Access
- Txxx Existing Tree

Species of Conservation Importance Location

- AH-xx Artocarpus hypargyreus
- AF-xx Angiopteris fokiensis
- AT-xx Aquilaria sinensis
- AS-xx Aquilaria sinensis seeding
- OP-xx Ormosia pachycarpa
- PH-xx Pavetta hongkongensis
- AT-xx Aquilaria sinensis (Damaged)

0 25 50
Scale (m)

Path: P:\B090871\Natural Terrain Hazard Review Report\tychoi\GIS\Area D\AreaD_proposed_ecosurvey_20140109.mxd

Project AGREEMENT NO. CE30/2009 (GE) Landslip Prevention and Mitigation Programme 2009, Package D, Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction	Figure Title Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung Layout of Proposed Natural Terrian Harzard Mitigaiton Measures Note: Base map is 1,000 scale (2006), 2 meter contour intervals; sheet 12nw22a, 22b, 17c, 17d.

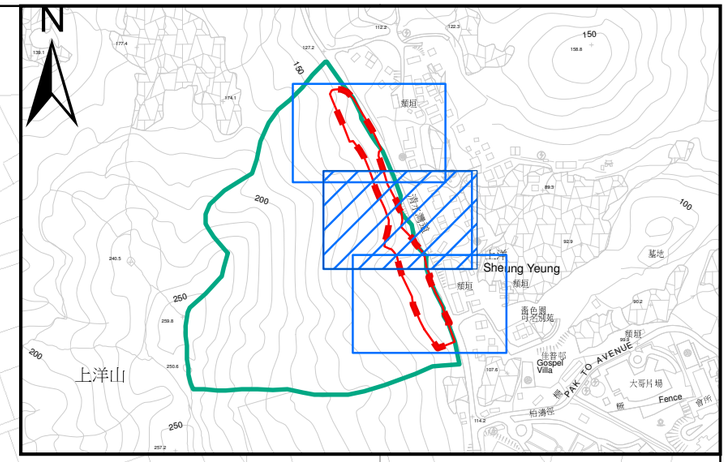
FUGRO (HONG KONG) LTD

Appendix A

Page of

SCALE 1:500 | PROJECT No. 090871

Path: P:\B090871\Natural Terrain Hazard Review Report\tycho\PP_Summary\GIS\mxd\PP_Area_D_AppA_ProposedMitigation_20140116.mxd



KEY PLAN
Scale 1:8000

Clear Water Bay Road

Stream Course

819000

0 25 50
Scale (m)

Legend

- Works Area
- Storage Area
- Stream Course
- Proposed Baffle
- Proposed Flexible Barrier
- Proposed Maintenance Access
- Existing Tree

Species of Conservation Importance Location

- AH-xx Artocarpus hypargyreus
- AF-xx Angiopteris fokiensis
- AT-xx Aquilaria sinensis
- AS-xx Aquilaria sinensis seeding
- OP-xx Ormosia pachycarpa
- PH-xx Pavetta hongkongensis
- AT-xx Aquilaria sinensis (Damaged)

Project

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009,
Package D,
Natural Terrain Hazard Mitigation Works,
Hong Kong Island and Sai King -
Investigation, Design and Construction

Figure Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Layout of Proposed Natural Terrian Harzard Mitigaiton Measures

Note: Base map is 1,000 scale (2006), 2 meter contour intervals; sheet 12nw22a, 22b, 17c, 17d.

FUGRO (HONG KONG) LTD

Appendix A

Page of

SCALE 1:500

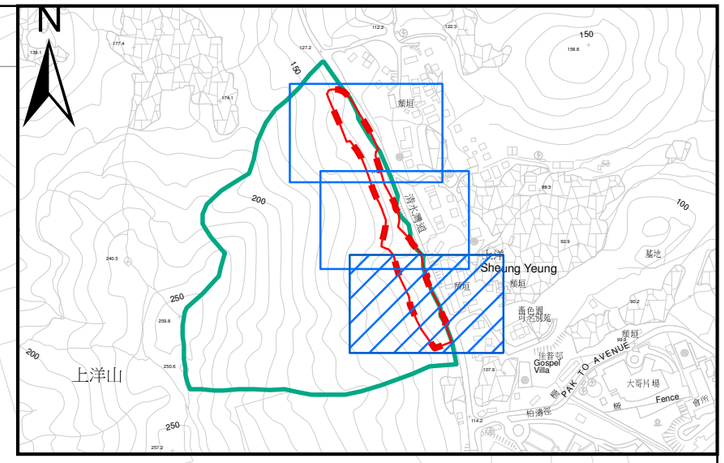
PROJECT No. 090871

819000

847400

Stream Course

Clear Water Bay Road



KEY PLAN
Scale 1:8000

Legend

- Works Area
- Storage Area
- Stream Course
- Proposed Baffle
- Proposed Flexible Barrier
- Proposed Maintenance Access
- Existing Tree

Species of Conservation Importance Location

- Artocarpus hypargyreus
- Angiopteris fokiensis
- Aquilaria sinensis
- Aquilaria sinensis seeding
- Ormosia pachycarpa
- Pavetta hongkongensis
- Aquilaria sinensis (Damaged)

0 25 50
Scale (m)

Project

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009,
Package D,
Natural Terrain Hazard Mitigation Works,
Hong Kong Island and Sai King -
Investigation, Design and Construction

Figure Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Layout of Proposed Natural Terrian Harzard Mitigaiton Measures

Note: Base map is 1,000 scale (2006), 2 meter contour intervals; sheet 12nw22a, 22b, 17c, 17d.

FUGRO (HONG KONG) LTD

Appendix A

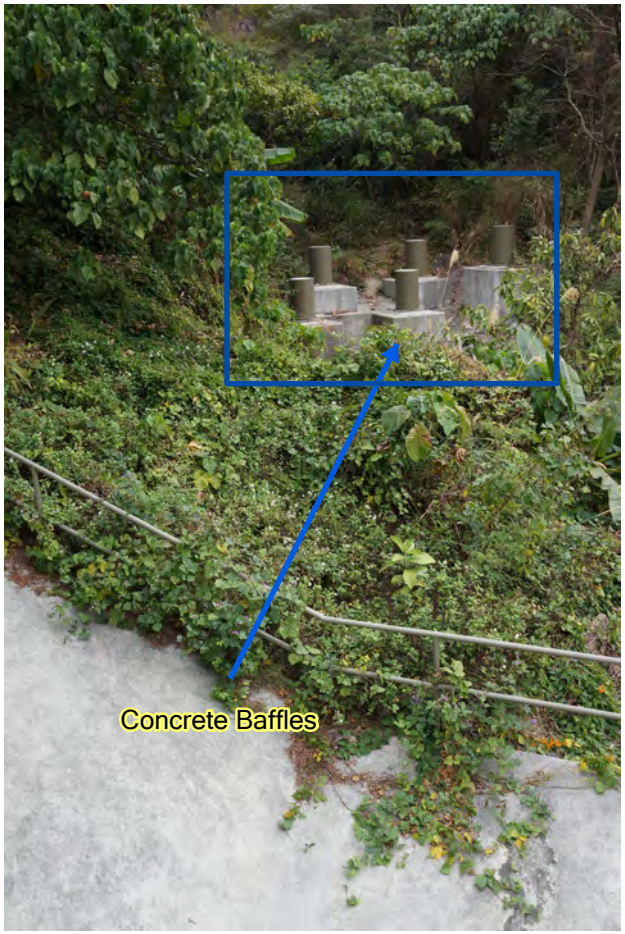
Page of

SCALE 1:500

PROJECT No. 090871

Path: P:\B090871\Natural Terrain Hazard Review Report\tychoi\GIS\Area D\AreaD_proposed_ecosurvey_20140109.mxd

Example of Concrete Baffles and Flexible Barrier with maintenance access



Example of Concrete Baffles

Job Title

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009, Package D,
Natural Terrain Hazard Mitigation Works,
Hong Kong Island and Sai King -
Investigation, Design and Construction

Drawing Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Previous Examples of Flexible Barrier and Baffles for Natural Terrain Hazard Mitigation Works

Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.

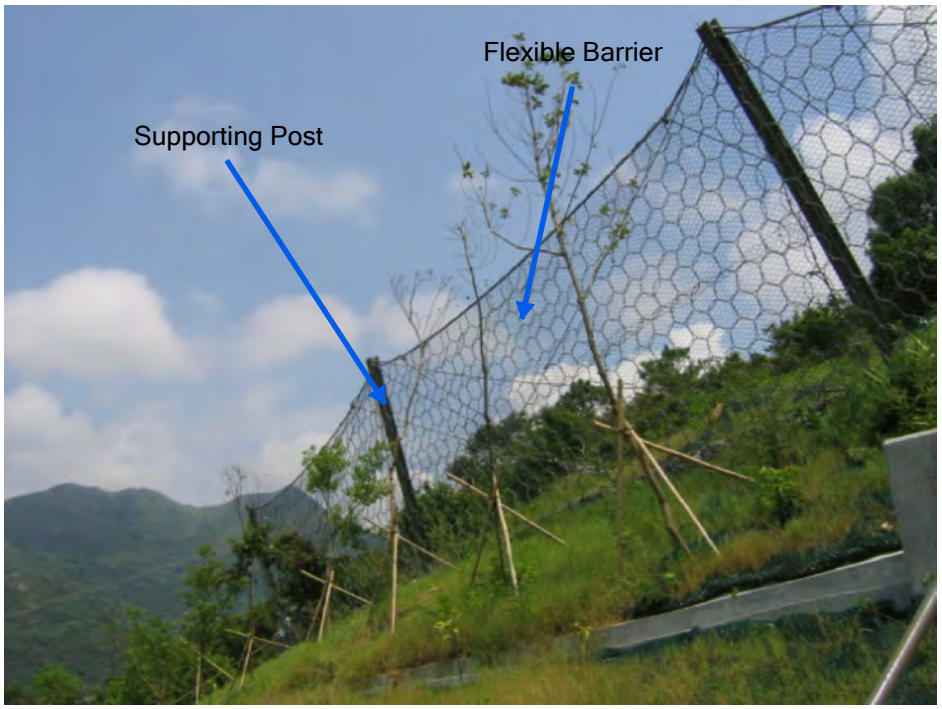
FUGRO (HONG KONG) LTD

Scale: Not to Scale

Drawn by: Date: JUL 2013 Checked: Approved:

Job No. 090871 Figure No. Plate A1

Close-up View of Flexible Barrier and Supporting Post



Details of Flexible Barrier

Job Title	Drawing Title	
AGREEMENT NO. CE30/2009 (GE) Landslip Prevention and Mitigation Programme 2009, Package D, Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction	Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung Previous Examples of Flexible Barrier for Natural Terrain Hazard Mitigation Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.	FUGRO (HONG KONG) LTD Scale: Not to Scale Drawn by: Date: JUL 2013 Checked: Approved: Job No. 090871 Figure No. Plate A2-1

View of Flexible Barriers and access with painted handrails

View of Flexible Barriers above Tung Chung Road

Job Title

AGREEMENT NO. CE30/2009 (GE)
Landslip Prevention and Mitigation Programme 2009, Package D,
Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction

Drawing Title

Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung
Previous Examples of Flexible Barrier for Natural Terrain Hazard Mitigation

Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.

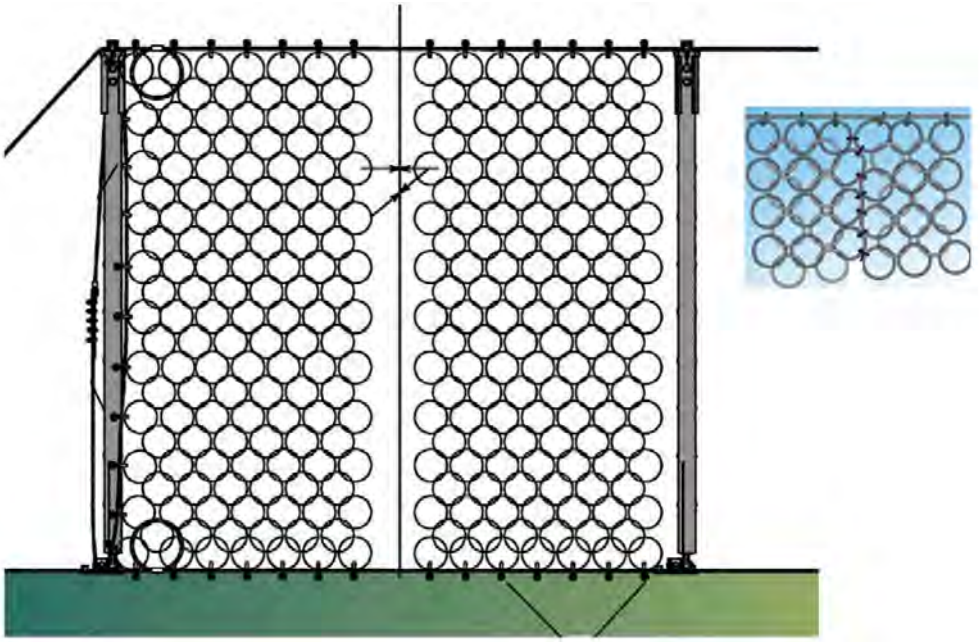
FUGRO (HONG KONG) LTD

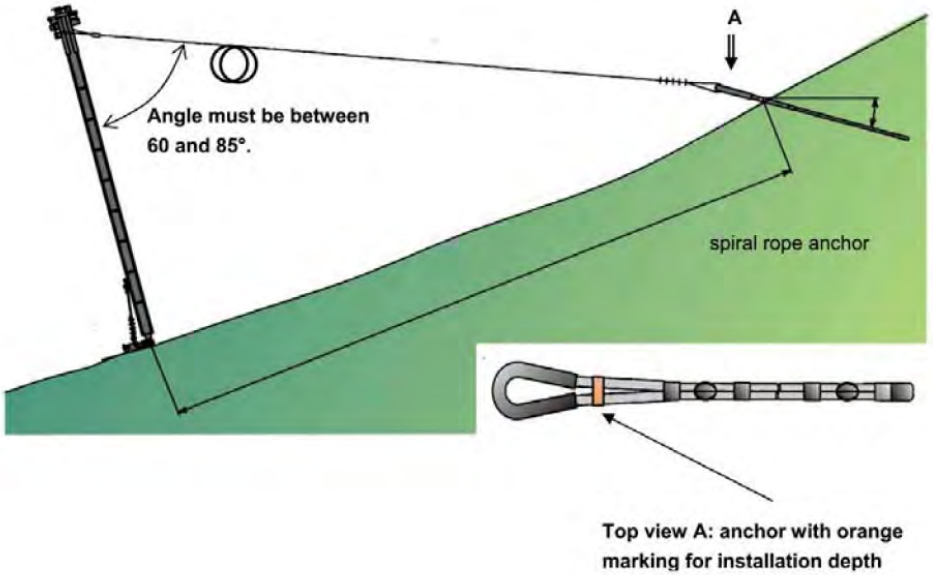
Scale: Not to scale

Drawn by: Date: JUL 2013 Checked: Approved:

Job No. 090871

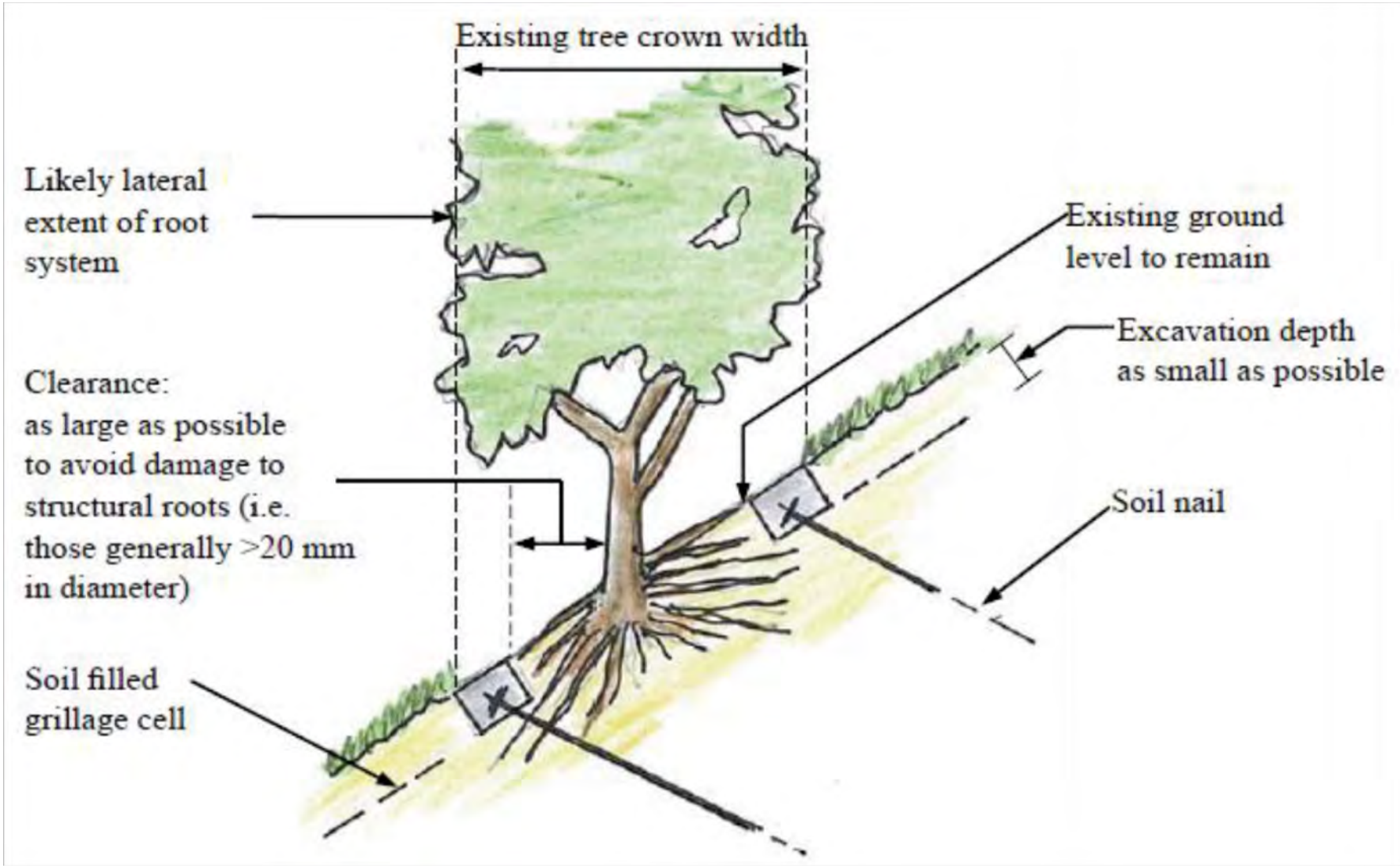
Figure No. Plate A2-2





Installation of Flexible Barrier

Job Title AGREEMENT NO. CE30/2009 (GE) Landslip Prevention and Mitigation Programme 2009, Package D, Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction	Drawing Title Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung Example of the Installation of a Flexible Barrier Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.	FUGRO (HONG KONG) LTD Scale: Not to Scale Drawn by: Date: JUL 2013 Checked: Approved: Job No. 090871 Figure No. Plate A3



Installation of Soil Nail in Vicinity of Existing Tree Roots
(Extracted from GEO Publication No.1/2011)

Job Title AGREEMENT NO. CE30/2009 (GE) Landslip Prevention and Mitigation Programme 2009, Package D, Natural Terrain Hazard Mitigation Works, Hong Kong Island and Sai King - Investigation, Design and Construction	Drawing Title Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung Example of the Installation of Soil Nails Note: Topographic base map is 1:1,000 scale (2010), 2 m contour intervals; mapsheets SHEET NUMBER.	FUGRO (HONG KONG) LTD Scale: Not to Scale Drawn by: Date: JUL 2013 Checked: Approved: Job No. 090871 Figure No. Plate A4

Appendix B

Tentative Construction Programme of Proposed Hazard Mitigation Works at Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung

Tentative Construction Programme of Proposed Hazard Mitigation Works at Study Area 12NW-C/SA2, Sheung Yeung, Sai Kung

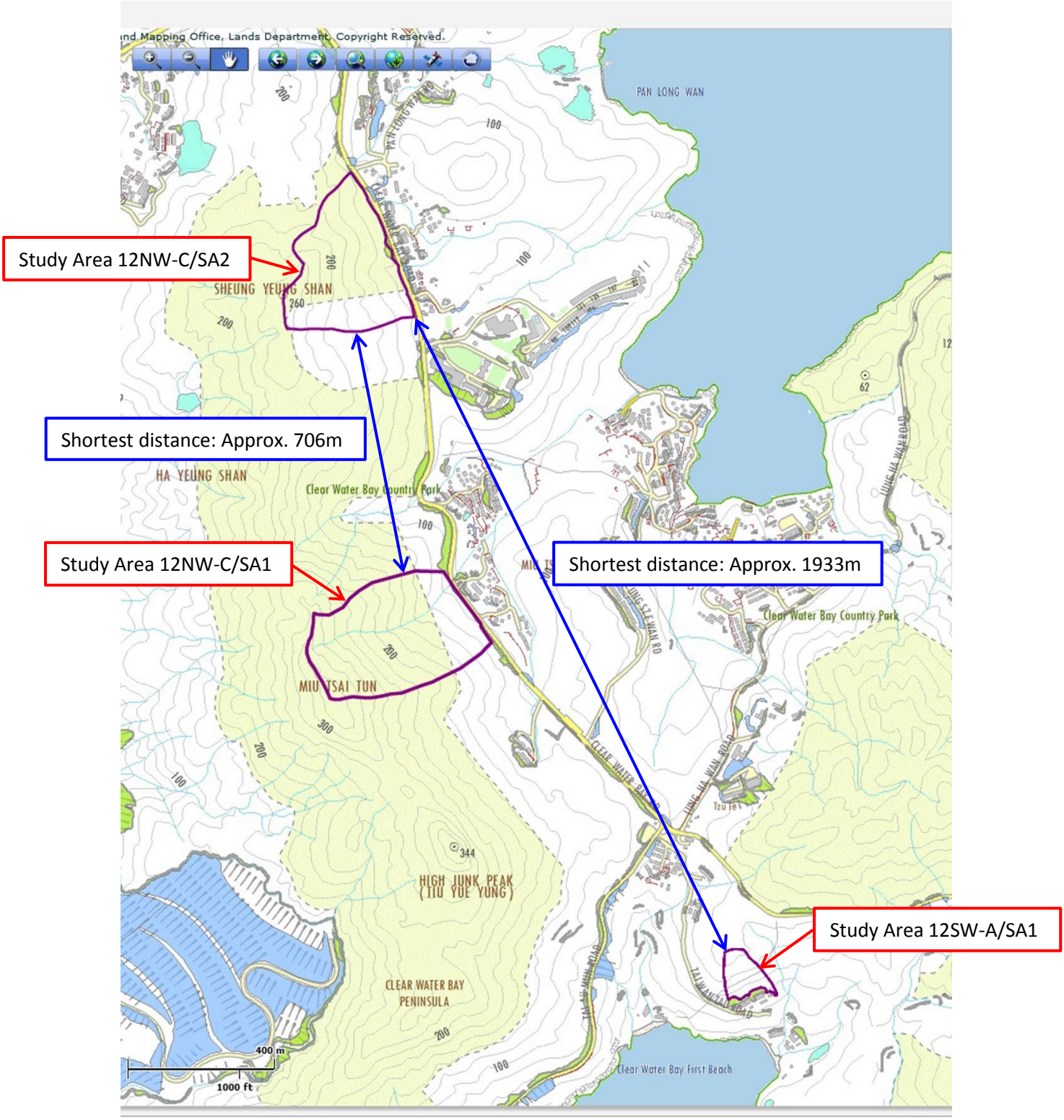
		M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30
1	Site Establishment																														
2	Installation of soil nails at toe of natural terrain																														
3	Construction of flexible barriers and masonry maintenance staircase																														
4	Construction of baffles																														
5	Landscaping Works																														

Appendix C

Locations of the Study Area 12NW-C/SA2 and Other Concurrent Natural Terrain Hazard Mitigation Works in the Vicinity

Appendix C

Locations of the Study Area 12NW-C/SA2 and Other Concurrent Natural Terrain Hazard Mitigation Works in the Vicinity



Source:
Hong Kong Slope Safety: http://hkss.cedd.gov.hk/hkss/eng/sis_map.aspx?hlc_s_id=12NW-C/SA1

Appendix D

Ecological Survey Data

Table D.1 Plant Species Recorded within the Works Area

Scientific name	Chinese Common Name	Growth form	Distribution and Status in HK^	Works Area #		
				Developed Area	Native Secondary Woodland	Watercourse
Acacia confusa	台灣相思	Tree	Exotic, Very common	*	*	
Adiantum flabellulatum	扇葉鐵線蕨	Herb	Very common		*	
Alangium chinense	八角楓	Tree	Common	*	*	
Alchornea trewioides	紅背山麻桿	Shrub	Common		*	
Alocasia macrorrhizos	海芋	Herb	Very common	**	**	**
Alpinia hainanensis	草豆蔻	Herb	Very common	**	**	*
Ampelopsis cantoniensis	廣東蛇葡萄	Climber	Very common	*	*	
Angiopteris fokiensis	福建蓮座蕨	Large herb	Restricted, Regarded as Least Concern (LC) in China (AFCD 2003), Protected by Cap 96 in Hk			*
Aporusa dioica	銀柴	Tree	Very common		**	
Aquilaria sinensis	土沉香	Tree	Common, Protected by Cap. 586 in HK		**	
Archidendron clypearia	猴耳環	Tree	Common		*	
Archidendron lucidum	亮葉猴耳環	Tree	Common	*	**	
Ardisia crenata	大羅傘	Shrub	Common		*	
Ardisia quinquegona	羅傘	Small tree	Very common		****	
Bambusa spp.	竹屬	Bamboo	Common		**	
Artocarpus hypargyerus	白桂木	Tree	Common, Regarded as Near Threatened (NT) in China (AFCD 2003)		*	
Bauhinia championii	缺葉藤	Woody climber	Common	*		

Table D.1 Plant Species Recorded within the Works Area

Scientific name	Chinese Common Name	Growth form	Distribution and Status in HK^	Works Area #		
				Developed Area	Native Secondary Woodland	Watercourse
Blechnum orientale	烏毛蕨	Herb	Very common	*	**	
Boehmeria nivea	苧麻	Shrub	Restricted		*	
Breynia fruticosa	黑面神	Shrub	Very common		*	
Bridelia tomentosa	土蜜樹	Tree	Very common	*	*	
Byttneria aspera	刺果藤	Woody climber	Very common		*	
Callicarpa kochiana	枇杷葉紫珠	Shrub	Common	*	*	
Callicarpa rubella	紅紫珠	Shrub	Restricted		*	
Castanopsis fissa	黧蒴錐	Tree	Common	*	**	
Cayratia corniculata	角花烏蘞莓	Climber	Common		*	
Cinnamomum camphora	樟	Tree	Common	***	***	
Cinnamomum parthenoxylon	黃樟	Tree	Common		***	
Citrus reticulata	桔	Small tree	Common		*	
Crassocephalum crepidioides	野茼蒿	Herb	Exotic, Common	*	*	
Cyclea hypoglauca	粉葉輪環藤	Climber	Common		*	
Cyclobalanopsis edithiae	華南青岡	Tree	Restricted		*	
Cyclosorus parasiticus	華南毛蕨	Herb	Very common	*	*	
Cymbopogon tortilis	扭鞘香茅	Herb	Very common		*	
Cynodon dactylon	狗牙根	Herb	Very common		*	

Table D.1 Plant Species Recorded within the Works Area

Scientific name	Chinese Common Name	Growth form	Distribution and Status in HK^	Works Area #		
				Developed Area	Native Secondary Woodland	Watercourse
Cyrtococcum patens	弓果黍	Herb	Very common	**	**	
Dalbergia benthamii	兩廣黃檀	Woody climber	Common		*	
Dalbergia hancei	藤黃檀	Woody climber	Common		*	
Daphniphyllum calycinum	牛耳楓	Tree	Common		*	
Desmos chinensis	假鷹爪	Woody climber	Common		*	
Dicranopteris pedata	芒萁	Herb	Very common		**	
Dimocarpus longan	龍眼	Tree	Exotic, Restricted		*	
Dioscorea bulbifera	黃獨	Climber	Common		*	
Diospyros morrisiana	羅浮柿	Tree	Very common	*	****	
Elaeocarpus chinensis	中華杜英 , 野杜英	Tree	Common		*	
Elaeocarpus decipiens	杜英	Tree	Common		*	
Embelia laeta	酸藤子	Woody climber	Very common		*	
Eurya nitida	細齒葉柃	Shrub	Very common		*	
Ficus fistulosa	水同木	Tree	Common		*	*
Ficus hirta	粗葉榕	Shrub	Common	*	*	*

Table D.1 Plant Species Recorded within the Works Area

Scientific name	Chinese Common Name	Growth form	Distribution and Status in HK^	Works Area #		
				Developed Area	Native Secondary Woodland	Watercourse
Ficus hispida	對葉榕	Tree	Very common	*	*	*
Ficus pumila	薜荔	Climber	Very common	*		
Ficus pyriformis	舶梨榕	Shrub	Common		*	
Ficus variegata var. *chlorocarpa*	青果榕	Tree	Common	*		
Gahnia tristis	黑莎草	Herb	Very common		*	
Gardenia jasminoides	梔子	Shrub	Common		**	
Glochidion eriocarpum	毛果算盤子	Shrub	Very common		*	
Glochidion wrightii	白背算盤子	Tree	Very common		*	
Ilex asprella	梅葉冬青	Shrub	Very common		*	
Ilex pubescens	毛冬青	Shrub	Very common		*	
Ilex viridis	綠冬青,亮葉冬青	Shrub/Tree	Common		*	
Ipomoea cairica	五爪金龍	Herbaceous climber	Exotic, Very common			**
Lantana camara	馬纓丹	Shrub	Exotic, Very common		*	*
Leuceana leucocephala	銀合歡	Tree	Exotic, Very common		*	
Lindsaea heterophylla	異葉鱗始蕨	Herb	Very common		*	
Liriope spicata	山麥冬	Herb	Very common		**	
Lithocarpus glaber	柯	Tree	Common		*	

Table D.1 Plant Species Recorded within the Works Area

Scientific name	Chinese Common Name	Growth form	Distribution and Status in HK^	Works Area #		
				Developed Area	Native Secondary Woodland	Watercourse
Litsea rotundifolia var. *oblongifolia*	豺皮樟	Tree	Very common		*	
Lonicera macrantha	大花忍冬	Climber	Common		*	
Lophatherum gracile	淡竹葉	Herb	Very common	*	*	
Lygodium japonicum	海金沙	Climber	Very common		*	
Lygodium scandens	小葉海金沙	Climber	Common		*	
Macaranga tanarius var. *tomentosa*	血桐	Tree	Common	*	*	
Machilus breviflora	短序潤楠	Tree	Very common		*	
Machilus chekiangensis	浙江潤楠	Tree	Very common	**	***	
Maesa perlarius	鯽魚膽	Shrub	Common		*	
Mallotus paniculatus	白楸	Tree	Very common	*	***	
Melaleuca quinquenervia	白千層	Tree	Exotic, Common		*	
Melastoma malabathricum	野牡丹	Shrub	Common	*		
Melastoma sanguineum	毛蒽	Shrub	Common		*	
Melodinus suaveolens	山橙	Woody climber	Common		**	
Microcos nervosa	布渣葉	Tree	Common		*	
Microstegium ciliatum	剛莠竹	Herb	Very common		***	****

Table D.1 Plant Species Recorded within the Works Area

Scientific name	Chinese Common Name	Growth form	Distribution and Status in HK^	Works Area #		
				Developed Area	Native Secondary Woodland	Watercourse
Mikania micrantha	薇甘菊	Herbaceous climber	Exotic, Very common		**	
Millettia dielsiana	山雞血藤	Woody climber	Very common		*	
Miscanthus sinensis	芒	Herb	Very common		**	
Mucuna birdwoodiana	白花油麻藤，勃氏黧豆	Woody climber	Common		**	
Murraya paniculata	九里香	Shrub	Exotic, Common	*		
Mussaenda pubescens	玉葉金花	Climbing shrub	Very common		**	
Nephrolepis auriculata	腎蕨	Herb	Common	*		
Ophiopogon japonicus	麥冬	Herb	Common	*	*	
Ormosia pachycarpa	茸莢紅豆	Tree	Restricted, listed as Endangered (EN) in China (AFCD 2003)		**	
Oxalis corniculata	酢漿草	Herb	Very common		*	
Oxalis debilis subsp. *corymbosa*	紅花酢漿草	Herb	Exotic, Common		*	
Paederia scandens	雞矢藤	Climber	Restricted	*	*	
Pandanus austrosinensis	露兜草	Shrub or small tree	Restricted		*	
Panicum brevifolium	短葉黍	Herb	Very common	*	*	

Table D.1 Plant Species Recorded within the Works Area

Scientific name	Chinese Common Name	Growth form	Distribution and Status in HK^	Works Area #		
				Developed Area	Native Secondary Woodland	Watercourse
Parthenocissus dalzielii	異葉爬山虎	Climber	Exotic, Regarded as Rare in Xing et al. (2000), widely planted in HK in recent years	***		
Pavetta hongkongensis	香港大沙葉	Shrub or small tree	Common, Regarded as Least Concern (LC) in China (AFCD 2003), Protected by Cap 96 in HK		*	
Phoenix loureiroi	刺葵	Shrub or small tree	Common		*	
Piper cathayanum	青蒟	Climber	Restricted		**	
Piper hancei	山蒟	Climber	Very common	**	**	
Pittosporum glabratum	光葉海桐，崖花子	Shrub	Very common		**	
Polygonum chinense	火炭母	Herb	Very common		*	
Pothos chinensis	石柑	Epiphytic climber	Very common	*	*	
Psychotria asiatica	九節	Shrub	Very common	*	****	
Psychotria serpens	蔓九節	Climber	Very common	*	**	
Pteris biaurita	狹眼鳳尾蕨	Herb	Common		*	
Pteris semipinnata	半邊旗	Herb	Very common		*	*
Pteris vittata	蜈蚣草	Herb	Very common	*	*	*
Pueraria lobata	野葛	Climber	Very common		**	**

Table D.1 Plant Species Recorded within the Works Area

Scientific name	Chinese Common Name	Growth form	Distribution and Status in HK^	Works Area #		
				Developed Area	Native Secondary Woodland	Watercourse
Rhaphiolepis indica	車輪梅	Shrub or small tree	Very common		*	
Rhodomyrtus tomentosa	桃金娘	Shrub	Very common		*	
Rhus hypoleuca	白背鹽膚木	Tree	Common		*	
Rubus reflexus	蛇泡簕	Climbing shrub	Very common		*	
Sageretia thea	雀梅藤	Climbing shrub	Very common		*	
Sapium discolor	山烏桕	Tree	Very common	*		
Sarcandra glabra	草珊瑚	Subshrub	Common		***	
Schefflera heptaphylla	鴨腳木	Tree	Very common		**	
Schima superba	木荷	Tree	Common		*	
Scleria ciliaris	華珍珠茅	Herb	Very common		*	
Scolopia saeva	廣東刺柊	Tree	Common		*	
Smilax china	金剛藤	Climbing shrub	Very common		**	
Smilax glabra	土茯苓,光葉菝葜	Climbing shrub	Very common		*	
Solanum americanum	少花龍葵	Herb	Exotic, Very common		*	
Sterculia lanceolata	假蘋婆	Tree	Very common	*	**	
Symplocos glauca	羊舌樹	Tree	Common		**	

Table D.1 Plant Species Recorded within the Works Area

Scientific name	Chinese Common Name	Growth form	Distribution and Status in HK^	Works Area #		
				Developed Area	Native Secondary Woodland	Watercourse
Symplocos lancifolia	光葉山礬	Tree	Common		*	
Syzygium hancei	韓氏蒲桃，紅鱗蒲桃	Tree	Common	**	**	
Syzygium jambos	蒲桃	Tree	Exotic, Common		*	
Tetracera asiatica	錫葉藤	Woody climber	Very common		***	
Turpinia montana	山香圓	Tree	Common		*	
Tylophora ovata	娃兒藤	Climber	Common		*	
Uvaria macrophylla	紫玉盤	Woody climber	Common	*	***	
Viola diffusa	蔓堇菜	Herb	Common		*	
Wedelia trilobata	三裂葉蟛蜞菊	Herb	Exotic, Common	***	***	
Wikstroemia nutans	細軸荛花	Shrub	Common		*	
Youngia japonica	黃鵪菜	Herb	Very common			*
Zanthoxylum ailanthoides	椿葉花椒	Tree	Regarded as Rare in Xing *et al*. (2000), restricted to several location in HK but not regarded as rare according to AFCD 2008		*	
Zanthoxylum avicennae	簕欓花椒	Tree	Common	*	*	
Zanthoxylum nitidum	兩面針	Climbing shrub	Very common		*	

^ Status follows Xing *et al*. 2000

Table D.1 Plant Species Recorded within the Works Area

[#] Code for Abundance: ****= Abundant, *** = Frequent, ** = Occasional, * = Scarce

Table D.2 Summary of Birds Recorded in the Works Area (WA) between February and May 2012.

Species	Scientific Name	Conservation status*	WA
Black Kite	*Milvus migrans*	(RC)	+
Spotted Dove	*Spilopelia chinensis*	-	+
Red-billed Blue Magpie	*Urocissa erythroryncha*	-	
Large-billed Crow	*Corvus macrorhynchos*	-	
Cinereous Tit	*Parus cinereous*	-	+
Red-whiskered Bulbul	*Pycnonotus jocosus*	-	+
Chinese Bulbul	*Pycnonotus sinensis*	-	+
Chestnut Bulbul	*Hemixos castanonotus*	-	+
Barn Swallow	*Hirundo rustica*	-	
Pallas's Leaf Warbler	*Phylloscopus proregulus*	-	
Yellow-browed Warbler	*Phylloscopus inornatus*	-	+
Common Tailorbird	*Orthotomus sutorius*	-	+
Masked Laughingthrush	*Garrulax perspicillatus*	-	
Japanese White-eye	*Zosterops japonicus*	-	+
Crested Myna	*Acridotheres cristatellus*	-	
Oriental Magpie Robin	*Copsychus saularis*	-	+
Fork-tailed Sunbird	*Aethopyga christinae*	-	+
Eurasian Tree Sparrow	*Passer montanus*	-	+
Olive-backed Pipit	*Anthus hodgsoni*	-	+
		No. of species recorded	**13**

*Conservation status follows that of Fellowes *et al*. (2002) and BirdLife International listing (2012). RC = Regional Concern

Table D.3 Summary of Mammals Recorded in the Works Area (WA) between February and May 2012.

Species	Scientific Name	Conservation status*	WA
Eurasian Wild Pig	*Sus scrofa*	-	(Scat found)
		No. of species recorded	**1**

*Conservation status follows that of Fellowes *et al*. (2002) and Shek (2006).

Table D.4 Summary of Butterflies Recorded in the Works Area (WA) between February and May 2012.

Species	Scientific Name	Commonness*	WA
Grass Demon	*Udaspes folus*	R	+
Common Bluebottle	*Graphium sarpedon*	VC	
Tailed Jay	*Graphium agamemnon*	C	+
Red Helen	*Papilio helenus*	VC	+
Common Mormon	*Papilio polytes*	VC	+
Chinese Peacock	*Papilio bianor*	C	+
Indian Cabbage White	*Pieris canidia*	VC	+
Common Grass Yellow	*Eurema hecabe*	VC	
Pale Grass Blue	*Zizeeria maha*	VC	
Dark Evening Brown	*Melanitis phedima*	UC	+
Banded Tree Brown	*Lethe confusa*	C	+
Dark-brand Bush Brown	*Mycalesis mineus*	VC	+
South China Bush Brown	*Mycalesis zonata*	C	+
Large Faun	*Faunis eumeus*	C	+
Angled Castor	*Ariadne ariadne*	C	
Rustic	*Cupha erymanthis*	VC	+
Common Sailer	*Neptis hylas*	VC	+
Colour Sergeant	*Athyma nefte*	C	+
Ceylon Blue Glassy Tiger	*Ideopsis similis*	VC	
		No. of species recorded	**14**

*Commonness follows that of Chan (2011).VC= Very Common, C= Common, R= Rare

Table D.5 List of Species of conservation importance Recorded within the Works Area

Tree Ref	Species	Common English Name	Chinese Name	Origin	Remarks
AH-01	*Artocarpus hypargyreus*	Silver-back Artocarpus	白桂木	Native	sapling
AF-1	*Angiopteris fokiensis*	Mules-foot fern	福建觀音座蓮蕨	Native	
AF-2	*Angiopteris fokiensis*	Mules-foot fern	福建觀音座蓮蕨	Native	
AF-3	*Angiopteris fokiensis*	Mules-foot fern	福建觀音座蓮蕨	Native	
AF-4	*Angiopteris fokiensis*	Mules-foot fern	福建觀音座蓮蕨	Native	
AF-5	*Angiopteris fokiensis*	Mules-foot fern	福建觀音座蓮蕨	Native	
AF-6	*Angiopteris fokiensis*	Mules-foot fern	福建觀音座蓮蕨	Native	
AS-10	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-100	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-14	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-16	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-17	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-18	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-19	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-20	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-21	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-22	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-23	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-24	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-25	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-26	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-27	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-28	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-29	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-30	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-31	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-51	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-52	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-53	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-54	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-55	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-56	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-58	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-7	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-79	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-8	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-80	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-81	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-82	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-83	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-84	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-9	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-91	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-92	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-94	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-95	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AS-96	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual

Tree Ref	Species	Common English Name	Chinese Name	Origin	Remarks
AS-99	*Aquilaria sinensis* seedling	Incense tree	土沉香	Native	seedling individual
AT-10	*Aquilaria sinensis*	Incense tree	土沉香	Native	Damaged
AT-11	*Aquilaria sinensis*	Incense tree	土沉香	Native	
AT-17	*Aquilaria sinensis*	Incense tree	土沉香	Native	
AT-18	*Aquilaria sinensis*	Incense tree	土沉香	Native	Damaged
AT-19	*Aquilaria sinensis*	Incense tree	土沉香	Native	Damaged
AT-20	*Aquilaria sinensis*	Incense tree	土沉香	Native	Damaged
AT-21	*Aquilaria sinensis*	Incense tree	土沉香	Native	Damaged
AT-22	*Aquilaria sinensis*	Incense tree	土沉香	Native	
AT-23	*Aquilaria sinensis*	Incense tree	土沉香	Native	Damaged
AT-25	*Aquilaria sinensis*	Incense tree	土沉香	Native	Damaged
AT-3	*Aquilaria sinensis*	Incense tree	土沉香	Native	
AT-35	*Aquilaria sinensis*	Incense tree	土沉香	Native	Damaged
AT-36	*Aquilaria sinensis*	Incense tree	土沉香	Native	Damaged
AT-37	*Aquilaria sinensis*	Incense tree	土沉香	Native	
AT-38	*Aquilaria sinensis*	Incense tree	土沉香	Native	
AT-39	*Aquilaria sinensis*	Incense tree	土沉香	Native	Damaged
AT-4	*Aquilaria sinensis*	Incense tree	土沉香	Native	
AT-40	*Aquilaria sinensis*	Incense tree	土沉香	Native	
AT-41	*Aquilaria sinensis*	Incense tree	土沉香	Native	Damaged
AT-43	*Aquilaria sinensis*	Incense tree	土沉香	Native	
AT-45	*Aquilaria sinensis*	Incense tree	土沉香	Native	Damaged
AT-5	*Aquilaria sinensis*	Incense tree	土沉香	Native	
AT-52	*Aquilaria sinensis*	Incense tree	土沉香	Native	Damaged
AT-6	*Aquilaria sinensis*	Incense tree	土沉香	Native	
AT-8	*Aquilaria sinensis*	Incense tree	土沉香	Native	Damaged
AT-9	*Aquilaria sinensis*	Incense tree	土沉香	Native	
AT-53	*Aquilaria sinensis*	Incense tree	土沉香	Native	
OP-10	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-11	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-12	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-13	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-14	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-15	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-16	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-17	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-18	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-19	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-20	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-21	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-22	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-23	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-24	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-25	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-3	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-32	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-33	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-34	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	
OP-35	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸荚紅豆	Native	

Tree Ref	Species	Common English Name	Chinese Name	Origin	Remarks
OP-36	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-37	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-38	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-39	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-4	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-40	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-41	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-42	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-43	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-44	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-45	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-5	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-54	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-6	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-7	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-8	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
OP-9	*Ormosia pachycarpa*	Hairy-fruited Ormosia	茸莢紅豆	Native	
PH-4	*Pavetta hongkongensis*	Hong Kong Pavetta	香港大沙葉	Native	

Appendix E

Construction Noise Assessment

Unmitigated Scenario

Study Area D - Sheung Yeung										
Works Area										
PME	**ID code**	**SWL, dB(A)**	**No. of PME**	**Total SWL, dB(A)**	**% of time**	**% on time correction, dB(A)**	**Screening, dB(A)**	**SWL, dB(A)**	**SWL, dB(A)**	**SWL, dB(A)**
1. Site Establishment										
Breaker, Hand-held, mass>10kg and <20kg	CNP 024	108	1	108	80.0%	-1.0	-	107.0	-	-
Generator, super silenced, 70dB(A) at 7m	CNP 103	95	2	98	100.0%	0.0	-	98.0	-	-
Concrete Mixer	CNP 046	96	2	99	80.0%	-1.0	-	98.0	-	-
Dump Truck, with grab, 5.5 tonne<gross vehicle weight < 38 tonnes	See Note 1	105	2	108	70.0%	-1.5	-	106.5	-	-
							Total	110.3	-	-
2. Installation of soil nails at toe of natural terrain-Drilling										
Drill rig, rotary type (diesel)	See Note 1	110	2	113	85.0%	-0.7	-	112.3	-	-
Dump Truck, with grab, 5.5 tonne<gross vehicle weight < 38 tonnes	See Note 1	105	2	108	70.0%	-1.5	-	106.5	-	-
Lorry, with crane, 5.5 tonnes < gross vehicle weight < 38 tonnes	See Note 1	105	2	108	70.0%	-1.5	-	-	-	103.5
Grout mixer	See Note 1	90	1	90	80.0%	-1.0	-	-	89.0	-
Grout pump	See Note 1	105	2	108	80.0%	-1.0	-	-	107.0	-
Agitator	See Note 1	90	2	93	80.0%	-1.0	-	-	92.0	-
Air Compressor, Air Flow <10m3/min	CNP 001	100	1	100	100.0%	0.0	-	100.0	100.0	100.0
Generator, super silenced, 70dB(A) at 7m	CNP 103	95	1	95	100.0%	0.0	-	95.0	95.0	95.0
Concrete Mixer	CNP 046	96	1	96	80.0%	-1.0	-	-	-	95.0
Shotcrete Pump	See Note 1	109	1	109	80.0%	-1.0	-	-	-	108.0
							Total	113.6	108.2	110.1
3. Construction of flexible barriers and masonry maintenance staircase										
Breaker, Hand-held, mass>10kg and <20kg	CNP 024	108	1	108	80.0%	-1.0	-	107.0	-	-
Lorry, with crane, 5.5 tonnes < gross vehicle weight < 38 tonnes	See Note 1	105	2	108	70.0%	-1.5	-	106.5	-	-
Generator, super silenced, 70dB(A) at 7m	CNP 103	95	1	95	100.0%	0.0	-	95.0	-	-
Drill rig, rotary type (diesel)	See Note 1	110	1	110	100.0%	0.0	-	110.0	-	-
							Total	113.0	-	-
4. Construction of baffles										
Lorry, with crane, 5.5 tonnes < gross vehicle weight < 38 tonnes	See Note 1	105	2	108	70.0%	-1.5	-	106.5	-	-
Generator, super silenced, 70dB(A) at 7m	CNP 103	95	1	95	100.0%	0.0	-	95.0	-	-
Excavator	QPME	103	1	103	80.0%	-1.0	-	102.0	-	-
Concrete Mixer	CNP 046	96	2	99	80.0%	-1.0	-	98.0	-	-
Drill rig, rotary type (diesel)	See Note 1	110	1	110	80.0%	-1.0	-	109.0	-	-
							Total	111.7	-	-
5. Landscaping works										
Lorry, with crane, 5.5 tonnes < gross vehicle weight < 38 tonnes	See Note 1	105	1	105	70.0%	-1.5	-	103.5	-	-
Generator, super silenced, 70dB(A) at 7m	CNP 103	95	1	95	100.0%	0.0	-	95.0	-	-
							Total	104.1	-	-

Note:
1. The Sound Power Levels (SWLs) of the PMEs presented are based on the Technical Memorandum on Noise from Construction Work Other Than Percussive Piling (TM-GW), except for those marked "See Note 1", which are based on the EPD's guidance "Sound power levels of other commonly used PME" available athttp://www.epd.gov.hk/epd/english/application_for_licences/guidance/files/OtherSWLe.pdf.

Daytime Noise Criterion	75	dB(A)	Residential Buildings
	70	dB(A)	School

Study Area D - Sheung Yeung

N1 Sheung Yeung Village House No.1A

Act No	Construction Element	SWL	Dist (m)	Façade Corr., dB(A)	Dist. Corr., dB(A)	SPL	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30
1	Site Establishment	110	62	3.0	-43.8	69.5	70	70	70	70	70	70																								
2	Installation of soil nails at toe of natural terrain-Drilling	114	62	3.0	-43.8	72.8				73	73	73	73	73	73	73	73	73	73																	
3	Installation of soil nails at toe of natural terrain-Grouting	108	62	3.0	-43.8	67.4					67	67	67	67	67	67	67	67	67	67																
4	Installation of soil nails at toe of natural terrain-Shortcreting	110	62	3.0	-43.8	69.3															69	69	69													
5	Construction of flexible barriers	113	62	3.0	-43.8	72.2									72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72		
6	Construction of baffles	112	62	3.0	-43.8	70.9															71	71	71	71	71	71	71	71	71	71	71					
7	Landscaping Works	104	62	3.0	-43.8	63.3																										63	63	63	63	63
					Total SPL, dB(A)		70	70	70	74	75	75	74	74	**76**	**76**	**76**	**76**	**76**	73	**76**	**76**	**76**	75	75	75	75	75	75	75	75	73	73	73	63	63
					Total SPL, dB(A)		66																														
					Mln		63																														
					Max		**76**																														

N2 Sheung Yeung Village House No.10

Act No	Construction Element	SWL	Dist (m)	Façade Corr., dB(A)	Dist. Corr., dB(A)	SPL	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30
1	Site Establishment	110	47	3.0	-41.4	71.9	72	72	72	72	72	72																								
2	Installation of soil nails at toe of natural terrain-Drilling	114	47	3.0	-41.4	75.2				75	75	75	75	75	75	75	75	75	75																	
3	Installation of soil nails at toe of natural terrain-Grouting	108	47	3.0	-41.4	69.8					70	70	70	70	70	70	70	70	70	70																
4	Installation of soil nails at toe of natural terrain-Shortcreting	110	47	3.0	-41.4	71.7															72	72	72													
5	Construction of flexible barriers and masonry maintenance staircase	113	47	3.0	-41.4	74.6									75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75		
6	Construction of baffles	112	47	3.0	-41.4	73.3															73	73	73	73	73	73	73	73	73	73	73					
7	Landscaping Works	104	47	3.0	-41.4	65.7																										66	66	66	66	66
					Total SPL, dB(A)		72	72	72	**77**	**78**	**78**	**76**	**76**	**79**	**79**	**79**	**79**	**79**	**76**	**78**	**78**	**78**	**77**	**77**	**77**	**77**	**77**	**77**	**77**	**77**	75	75	75	66	66
					Total SPL, dB(A)		68																														
					Mln		66																														
					Max		**79**																														

N3 Sheung Yeung Village House No.27

Act No	Construction Element	SWL	Dist (m)	Façade Corr., dB(A)	Dist. Corr., dB(A)	SPL	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30
1	Site Establishment	110	42	3.0	-40.5	72.8	73	73	73	73	73	73																								
2	Installation of soil nails at toe of natural terrain-Drilling	114	42	3.0	-40.5	76.1				**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**																		
3	Installation of soil nails at toe of natural terrain-Grouting	108	42	3.0	-40.5	70.7					71	71	71	71	71	71	71	71	71	71																
4	Installation of soil nails at toe of natural terrain-Shortcreting	110	42	3.0	-40.5	72.6															73	73	73													
5	Construction of flexible barriers and masonry maintenance staircase	113	42	3.0	-40.5	75.5									**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**		
6	Construction of baffles	112	42	3.0	-40.5	74.2															74	74	74	74	74	74	74	74	74	74	74					
7	Landscaping Works	104	42	3.0	-40.5	66.6																										67	67	67	67	67
					Total SPL, dB(A)		73	73	73	**78**	**79**	**79**	**77**	**77**	**79**	**79**	**79**	**79**	**79**	**77**	**79**	**79**	**79**	**78**	**78**	**78**	**78**	**78**	**78**	**78**	**78**	**76**	**76**	**76**	67	67
					Total SPL, dB(A)		69																														
					Mln		67																														
					Max		**79**																														

N4 Sheung Yeung Village House No.56

Act No	Construction Element	SWL	Dist (m)	Façade Corr., dB(A)	Dist. Corr., dB(A)	SPL	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30
1	Site Establishment	110	46	3.0	-41.2	72.1	**72**	**72**	**72**	**72**	**72**	**72**																								
2	Installation of soil nails at toe of natural terrain-Drilling	114	46	3.0	-41.2	75.4				**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**																		
3	Installation of soil nails at toe of natural terrain-Grouting	108	46	3.0	-41.2	70.0					70	70	70	70	70	70	70	70	70	70																
4	Installation of soil nails at toe of natural terrain-Shortcreting	110	46	3.0	-41.2	71.9															**72**	**72**	**72**													
5	Construction of flexible barriers and masonry maintenance staircase	113	46	3.0	-41.2	74.8									**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**		
6	Construction of baffles	112	46	3.0	-41.2	73.5															**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**	**74**					
7	Landscaping Works	104	46	3.0	-41.2	65.9																										66	66	66	66	66
					Total SPL, dB(A)		**72**	**72**	**72**	**77**	**78**	**78**	**77**	**77**	**79**	**79**	**79**	**79**	**79**	**76**	**78**	**78**	**78**	**77**	**77**	**77**	**77**	**77**	**77**	**77**	**77**	**75**	**75**	**75**	66	66
					Total SPL, dB(A)		68																														
					Mln		66																														
					Max		**79**																														

N5 Hong Kong Advertist College

Act No	Construction Element	SWL	Dist (m)	Façade Corr., dB(A)	Dist. Corr., dB(A)	SPL	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30
1	Site Establishment	110	155	3.0	-51.8	61.5	62	62	62	62	62	62																								
2	Installation of soil nails at toe of natural terrain-Drilling	114	155	3.0	-51.8	64.8				65	65	65	65	65	65	65	65	65	65																	
3	Installation of soil nails at toe of natural terrain-Grouting	108	155	3.0	-51.8	59.4					59	59	59	59	59	59	59	59	59	59																
4	Installation of soil nails at toe of natural terrain-Shortcreting	110	155	3.0	-51.8	61.3															61	61	61													
5	Construction of flexible barriers and masonry maintenance staircase	113	155	3.0	-51.8	64.2									64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64		
6	Construction of baffles	112	155	3.0	-51.8	62.9															63	63	63	63	63	63	63	63	63	63						
7	Landscaping Works	104	155	3.0	-51.8	55.3																										55	55	55	55	55
					Total SPL, dB(A)		62	62	62	66	67	67	66	66	68	68	68	68	68	65	68	68	68	67	67	67	67	67	67	67	67	65	65	65	55	55
						Total SPL, dB(A)	58																													
						Min	55																													
						Max	68																													

Bold indicates the predicted sound pressure level at NSR exceeds the daytime noise criterion.

Mitigated Scenario

Study Area D - Sheung Yeung										
Works Area										
PME	**ID code**	**SWL, dB(A)**	**No. of PME**	**Total SWL, dB(A)**	**% of time**	**% on time correction, dB(A)**	**Screening, dB(A)**	**SWL, dB(A)**	**SWL, dB(A)**	**SWL, dB(A)**
1. Site Establishment										
Breaker, Hand-held, mass>10kg and <20kg	CNP 024	108	1	108	80.0%	-1.0	-10.0	97.0	-	-
Generator, super silenced, 70dB(A) at 7m	CNP 103	95	2	98	100.0%	0.0	-15.0	83.0	-	-
Concrete Mixer	CNP 046	96	2	99	80.0%	-1.0	-15.0	83.0	-	-
Dump Truck, with grab, 5.5 tonne<gross vehicle weight < 38 tonnes	See Note 1	105	2	108	70.0%	-1.5	-5.0	101.5	-	-
							Total	102.9	-	-
2. Installation of soil nails at toe of natural terrain-Drilling										
Drill rig, rotary type (diesel)	See Note 1	110	2	113	85.0%	-0.7	-10.0	102.3	-	-
Dump Truck, with grab, 5.5 tonne<gross vehicle weight < 38 tonnes	See Note 1	105	2	108	70.0%	-1.5	-5.0	101.5	-	-
Lorry, with crane, 5.5 tonnes < gross vehicle weight < 38 tonnes	See Note 1	105	2	108	70.0%	-1.5	-5.0	-	-	98.5
Grout mixer	See Note 1	90	1	90	80.0%	-1.0	-15.0	-	74.0	-
Grout pump	See Note 1	105	2	108	80.0%	-1.0	-15.0	-	92.0	-
Agitator	See Note 1	90	2	93	80.0%	-1.0	-15.0	-	77.0	-
Air Compressor, Air Flow <10m3/min	CNP 001	100	1	100	100.0%	0.0	-15.0	85.0	85.0	85.0
Generator, super silenced, 70dB(A) at 7m	CNP 103	95	1	95	100.0%	0.0	-15.0	80.0	80.0	80.0
Concrete Mixer	CNP 046	96	1	96	80.0%	-1.0	-15.0	-	-	80.0
Shotcrete Pump	See Note 1	109	1	109	80.0%	-1.0	-15.0	-	-	93.0
							Total	105.0	93.2	99.8
3. Construction of flexible barriers and masonry maintenance staircase										
Breaker, Hand-held, mass>10kg and <20kg	CNP 024	108	1	108	80.0%	-1.0	-10.0	97.0	-	-
Lorry, with crane, 5.5 tonnes < gross vehicle weight < 38 tonnes	See Note 1	105	2	108	70.0%	-1.5	-5.0	101.5	-	-
Generator, super silenced, 70dB(A) at 7m	CNP 103	95	1	95	100.0%	0.0	-15.0	80.0	-	-
Drill rig, rotary type (diesel)	See Note 1	110	1	110	100.0%	0.0	-10.0	100.0	-	-
							Total	104.7	-	-
4. Construction of baffles										
Lorry, with crane, 5.5 tonnes < gross vehicle weight < 38 tonnes	See Note 1	105	2	108	70.0%	-1.5	-5.0	101.5	-	-
Generator, super silenced, 70dB(A) at 7m	CNP 103	95	1	95	100.0%	0.0	-15.0	80.0	-	-
Excavator	QPME	103	1	103	80.0%	-1.0	-10.0	92.0	-	-
Concrete Mixer	CNP 046	96	2	99	80.0%	-1.0	-15.0	83.0	-	-
Drill rig, rotary type (diesel)	See Note 1	110	1	110	80.0%	-1.0	-10.0	99.0	-	-
							Total	103.8	-	-
5. Landscaping works										
Lorry, with crane, 5.5 tonnes < gross vehicle weight < 38 tonnes	See Note 1	105	1	105	70.0%	-1.5	-5.0	98.5	-	-
Generator, super silenced, 70dB(A) at 7m	CNP 103	95	1	95	100.0%	0.0	-15.0	80.0	-	-
							Total	98.6	-	-

Note:
1. The Sound Power Levels (SWLs) of the PMEs presented are based on the Technical Memorandum on Noise from Construction Work Other Than Percussive Piling (TM-GW), except for those marked "See Note 1", which are based on the EPD's guidance "Sound power levels of other commonly used PME" available athttp://www.epd.gov.hk/epd/english/application_for_licences/guidance/files/OtherSWLe.pdf.

Daytime Noise Criterion	75	dB(A)	Residential Buildings
Study Area D - Sheung Yeung	70	dB(A)	School

N1 Sheung Yeung Village House No. 1A

Act No	Construction Element	SWL	Dist (m)	Façade Corr., dB(A)	Dist. Corr., dB(A)	SPL	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30
1	Site Establishment	103	62	3.0	-43.8	62.1	62	62	62	62	62	62																								
2	Installation of soil nails at toe of natural terrain-Drilling	105	62	3.0	-43.8	64.2				64	64	64	64	64	64	64	64	64	64																	
3	Installation of soil nails at toe of natural terrain-Grouting	93	62	3.0	-43.8	52.4					52	52	52	52	52	52	52	52	52	52																
4	Installation of soil nails at toe of natural terrain-Shortcreting	100	62	3.0	-43.8	59.0															59	59	59													
5	Construction of flexible barriers and masonry maintenance staircase	105	62	3.0	-43.8	63.9									64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64		
6	Construction of baffles	104	62	3.0	-43.8	63.0															63	63	63	63	63	63	63	63	63	63	63					
7	Landscaping Works	99	62	3.0	-43.8	57.8																										58	58	58	58	58
					Total SPL, dB(A)		62	62	62	66	66	66	64	64	67	67	67	67	67	64	67	67	67	66	66	66	66	66	66	66	66	65	65	65	58	58
						Total SPL, dB(A)	57																														
						Mln	58																														
N2 Sheung Yeung Village House No.10						Max	67																													

Act No	Construction Element	SWL	Dist (m)	Façade Corr., dB(A)	Dist. Corr., dB(A)	SPL	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30
1	Site Establishment	103	47	3.0	-41.4	64.5	65	65	65	65	65	65																								
2	Installation of soil nails at toe of natural terrain-Drilling	105	47	3.0	-41.4	66.6				67	67	67	67	67	67	67	67	67	67																	
3	Installation of soil nails at toe of natural terrain-Grouting	93	47	3.0	-41.4	54.8					55	55	55	55	55	55	55	55	55	55																
4	Installation of soil nails at toe of natural terrain-Shortcreting	100	47	3.0	-41.4	61.4															61	61	61													
5	Construction of flexible barriers and masonry maintenance staircase	105	47	3.0	-41.4	66.3									66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66		
6	Construction of baffles	104	47	3.0	-41.4	65.4															65	65	65	65	65	65	65	65	65	65	65					
7	Landscaping Works	99	47	3.0	-41.4	60.2																										60	60	60	60	60
					Total SPL, dB(A)		65	65	65	69	69	69	67	67	70	70	70	70	70	67	70	70	70	69	69	69	69	69	69	69	68.9	67	67	67	60	60
						Total SPL, dB(A)	60																														
						Mln	60																														
						Max	70																														

N3 Sheung Yeung Village House No.27

Act No	Construction Element	SWL	Dist (m)	Façade Corr., dB(A)	Dist. Corr., dB(A)	SPL	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30
1	Site Establishment	103	42	3.0	-40.5	65.4	65	65	65	65	65	65																								
2	Installation of soil nails at toe of natural terrain-Drilling	105	42	3.0	-40.5	67.5				68	68	68	68	68	68	68	68	68	68																	
3	Installation of soil nails at toe of natural terrain-Grouting	93	42	3.0	-40.5	55.7					56	56	56	56	56	56	56	56	56	56																
4	Installation of soil nails at toe of natural terrain-Shortcreting	100	42	3.0	-40.5	62.3															62	62	62													
5	Construction of flexible barriers and masonry maintenance staircase	105	42	3.0	-40.5	67.2									67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67		
6	Construction of baffles	104	42	3.0	-40.5	66.3															66	66	66	66	66	66	66	66	66	66	66					
7	Landscaping Works	99	42	3.0	-40.5	61.1																										61	61	61	61	61
					Total SPL, dB(A)		65	65	65	70	70	70	68	68	71	71	71	71	71	67	70	70	70	70	70	70	70	70	70	70	70	68	68	68	61	61
						Total SPL, dB(A)	61																														
						Min	61																														
						Max	71																														

N4 Sheung Yeung Village House No.56

Act No	Construction Element	SWL	Dist (m)	Façade Corr., dB(A)	Dist. Corr., dB(A)	SPL	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30
1	Site Establishment	103	46	3.0	-41.2	64.7	65	65	65	65	65	65																								
2	Installation of soil nails at toe of natural terrain-Drilling	105	46	3.0	-41.2	66.8				67	67	67	67	67	67	67	67	67	67																	
3	Installation of soil nails at toe of natural terrain-Grouting	93	46	3.0	-41.2	55.0					55	55	55	55	55	55	55	55	55	55																
4	Installation of soil nails at toe of natural terrain-Shortcreting	100	46	3.0	-41.2	61.6															62	62	62													
5	Construction of flexible barriers and masonry maintenance staircase	105	46	3.0	-41.2	66.5									67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67		
6	Construction of baffles	104	46	3.0	-41.2	65.6															66	66	66	66	66	66	66	66	66	66	66					
7	Landscaping Works	99	46	3.0	-41.2	60.4																										60	60	60	60	60
					Total SPL, dB(A)		65	65	65	69	69	69	67	67	70	70	70	70	70	67	70	70	70	69	69	69	69	69	69	69	69	67	67	67	60	60
						Total SPL, dB(A)	60																														
						Min	60																														
						Max	70																														

N5 Hong Kong Advertist College

Act No	Construction Element	SWL	Dist (m)	Façade Corr., dB(A)	Dist. Corr., dB(A)	SPL	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30
1	Site Establishment	103	155	3.0	-51.8	54.1	54	54	54	54	54	54																								
2	Installation of soil nails at toe of natural terrain-Drilling	105	155	3.0	-51.8	56.2				56	56	56	56	56	56	56	56	56	56																	
3	Installation of soil nails at toe of natural terrain-Grouting	93	155	3.0	-51.8	44.4					44	44	44	44	44	44	44	44	44	44																
4	Installation of soil nails at toe of natural terrain-Shortcreting	100	155	3.0	-51.8	51.0															51	51	51													
5	Construction of flexible barriers and masonry maintenance staircase	105	155	3.0	-51.8	55.9									56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56		
6	Construction of baffles	104	155	3.0	-51.8	55.0															55	55	55	55	55	55	55	55	55	55	55					
7	Landscaping Works	99	155	3.0	-51.8	49.8																										50	50	50	50	50
					Total SPL, dB(A)		54	54	54	58	58	58	56	56	59	59	59	59	59	56	59	59	59	58	58	58	58	58	58	58	58	57	57	57	50	50
					Total SPL, dB(A)		49																														
					Mln		50																														
					Max		59																														

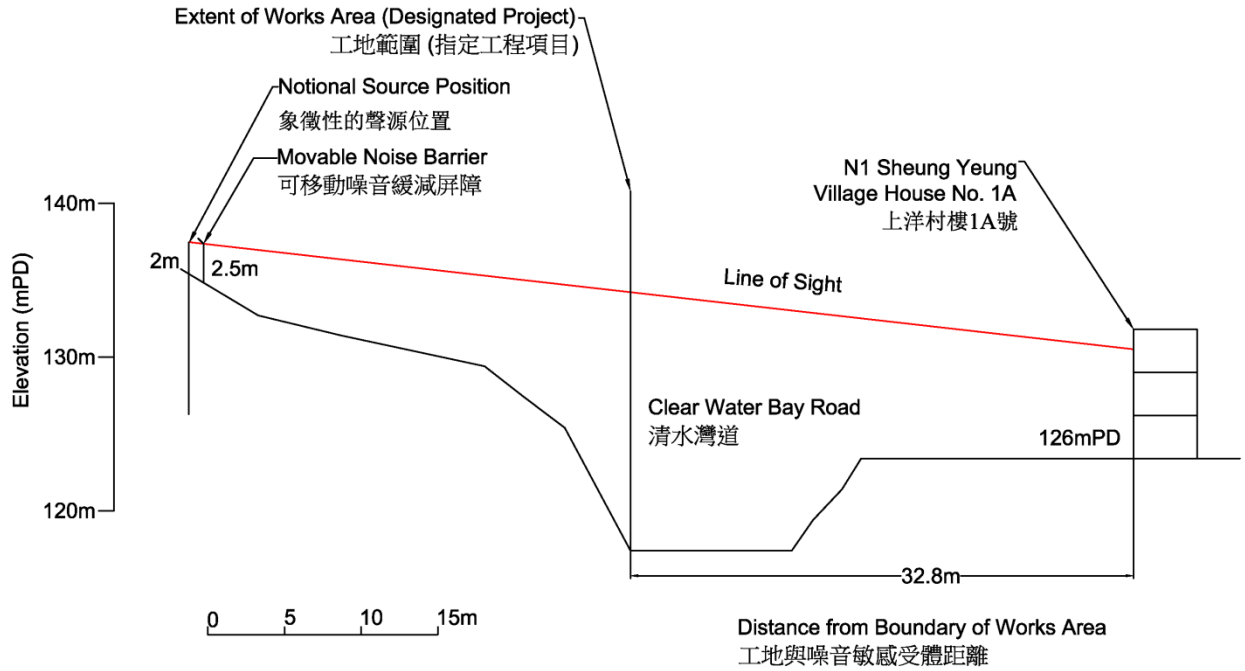
Bold indicates the predicted sound pressure level at NSR exceeds the daytime noise criterion.
Distance is distance between notional source position and NSR

Appendix F

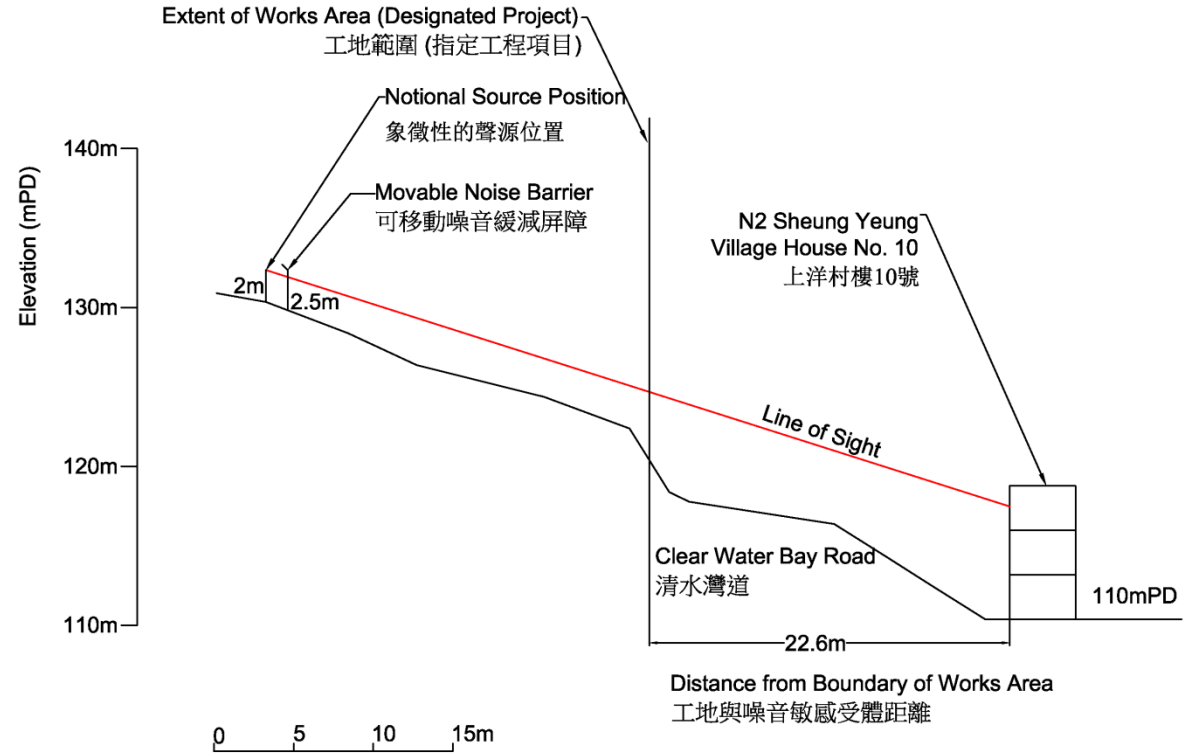
Proposed Noise Barrier and Enclosure

Cross Section of the Proposed Movable Noise Barrier

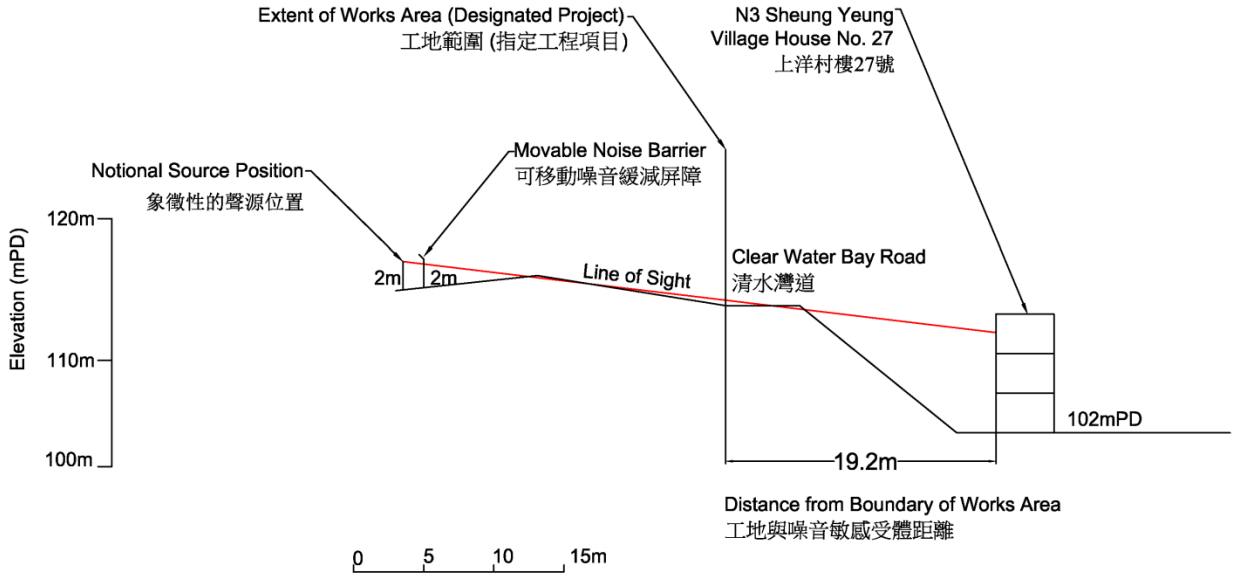
N1- Shueng Yeung Village House No. 1A



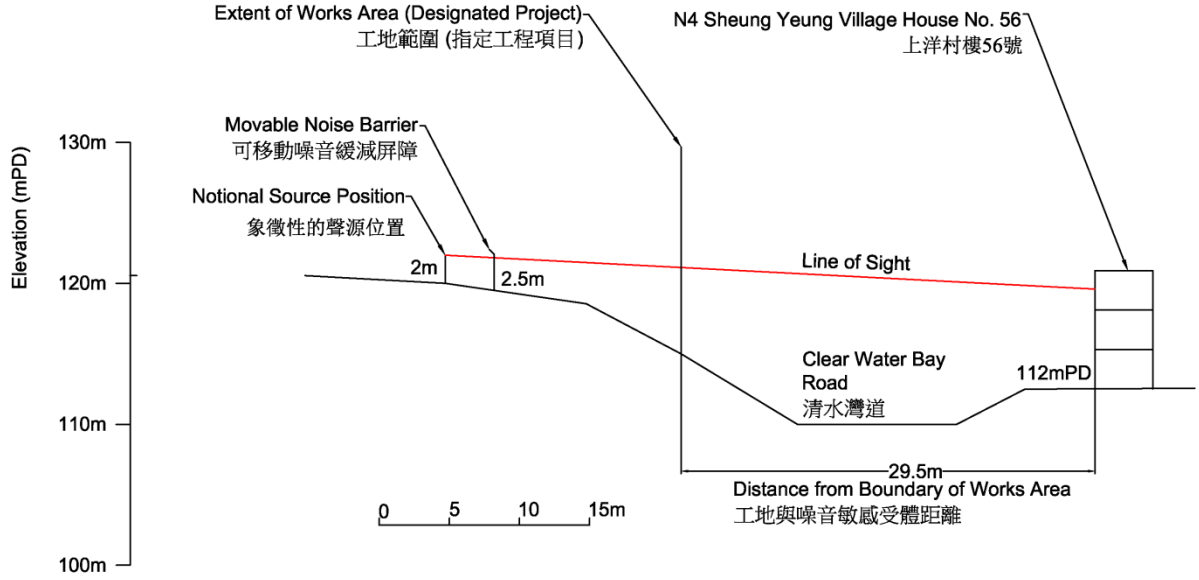
N2 – Shueng Yeung Village House No.10



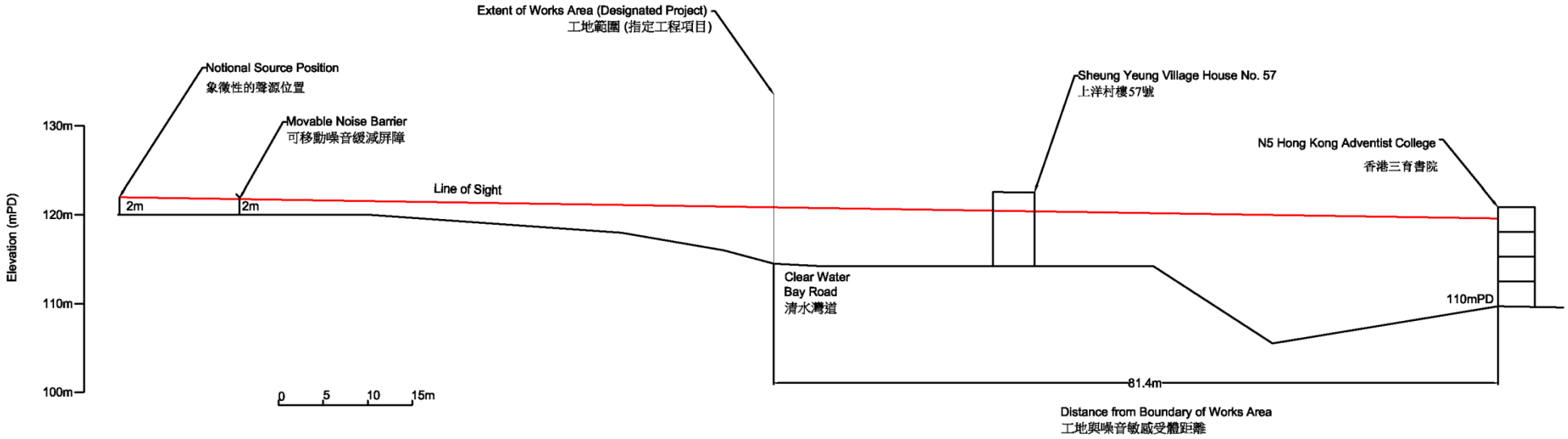
N3 – Shueng Yeung Village House No.27



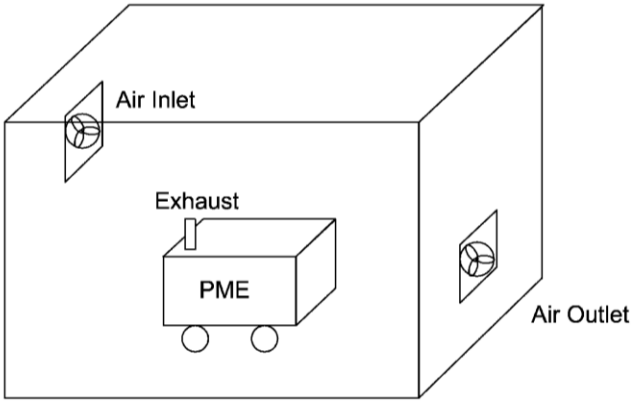
N4 – Shueng Yeung Village House No.56



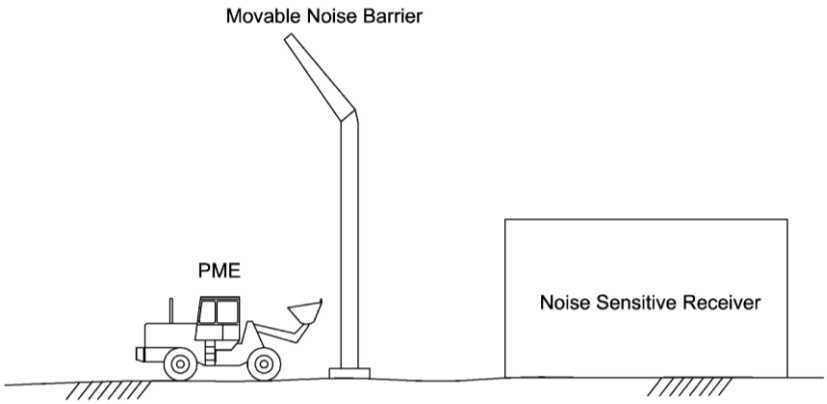
N5 – Hong Kong Adventist College



Proposed Noise Enclosure for PMEs

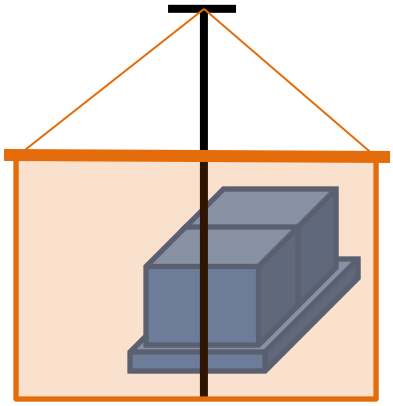


Proposed Movable Noise Barrier for PMEs



Proposed Noise Barrier for Drilling Rig

Front View



Side View