MAINTENANCE MANUAL **MMXX/201Y**

FEATURE NO.
7SW-C/C77
(Sub-division < >)
TAI WO HAU ROAD

CONSULTANTS LIMITED

July 201Y
LPM Division 3, GEO
Civil Engineering and Development Department

Revision Record

Revision number	Date	Description	Prepared	Checked	Approved
B	7/201Y	General revision to format	ABC	DEF	GHI
A	1/201Y	General revision to format	ABC	DEF	GHI

Foreword

Feature No. 7SW-C/C77 (Sub-division < >)* is situated along Tai Wo Hau Road, Kwai Chung at Hong Kong Metric Grid reference 825 300N, 831 100E.

Consultants Ltd. was commissioned by the Geotechnical Engineering Office, Civil Engineering and Development Department to carry out a Stage 3 Study (Stage 3 Report No. S3R xx/yyyy) on this feature under Consultancy Agreement No. CE xx/yyyy (GE).

This Maintenance Manual summarises the LPMit works carried out and the maintenance requirements of (the Government portion (Sub-division < > of)* this upgraded feature. This Manual also contains the results of the design review during construction. Depending on the outcome of the review, the design model finally adopted and therefore shown in this report may be different from that in the corresponding Stage 3 Study Report.

Approved by: _____

<Name>
Project Director
Consultants Limited

* Delete as necessary.

Contents

GCD 104	GEO CHECKING CERTIFICATE FOR ~~SLOPES AND RETAINING WALLS~~GEOTECHNICAL FEATURES	??

This maintenance manual consists of four parts:

PART 1 - GENERAL ADVICE

1.1 Slope No. 7SW-C/C77 (Sub-division < >)*, Tai Wo Hau Road, Kwai Chung for which you have maintenance responsibility has been upgraded to current standards by Landslip Prevention and Mitigation (LPMit) works carried out under the Landslip Preventive Measures Branch of the Geotechnical Engineering Office (GEO), Civil Engineering and Development Department.

1.2 The requirements for the maintenance of slopes are set out in Works Branch Technical Circular (WBTC) No. 9/96. Further technical guidance is provided in Geoguide 5 - Guide to Slope Maintenance (2003) published by the GEO.

1.3 Technical guidelines on landscape maintenance and management are given in GEO Publication No. 1/2011 – Technical Guidelines on Landscape Treatment for Slopes. Maintenance departments are recommended to maintain the landscape softworks items following the checklists given in Tables H2 and H3 of GEO Publication No. 1/2011. The use of these checklists is not mandatory. Maintenance departments are free to use other checklists which fulfil relevant requirements stipulated by Geoguide 5 in respect of maintenance of landscape softworks. Maintenance departments' attention is also drawn to the requirements of tree management and tree risk assessment where necessary, they are recommended to follow the latest guidelines issued by the Development Bureau.

1.4 Maintenance departments are urged not to replace vegetation on upgraded slopes by chunam or sprayed concrete as part of routine maintenance works. WBTC No. 25/93 includes guidelines on the 'Control of Visual Impact of Slopes'.

1.5 For the continued stability of the feature, regular maintenance including the upkeep of the landscaping works is essential and the recommendations contained in the relevant Circular/Geoguide/GEO Publication should be followed.

1.6 This manual provides information and specific advice for your future maintenance of the slope. You should follow the specific recommendations on maintenance given in Part 2 of this Manual.

1.7 Parts 3 and 4 of this Manual provide you with the construction details and other relevant information for your maintenance works.

PART 2 - RECOMMENDED MAINTENANCE

2.1 You are advised to carry out the following :

☑ Routine Maintenance Inspection to be carried out once every year/ two years* (Note 1);

☑ Engineer Inspection for Maintenance to be carried out once every five/ ten* years (Note 2);

☐ Regular Monitoring of Special Measures to be carried out once every _____ (Note 3) years for those items identified in paragraph 2.4; and

~~☑ Tree Risk Assessment and/or Monitoring of Tree Health* (Note 4) as detailed in paragraph 2.5.~~

2.2 Routine Maintenance Inspection

Routine Maintenance Inspections should preferably be carried out between October and February, and any required maintenance works should be completed before the onset of the wet season in April. These maintenance inspections should be undertaken by your Assistant Clerk of Works, Technical Officer, Works Supervisor or above, as appropriate, who should make recommendations with regard to the following maintenance items (such inspecting officers are expected to have the knowledge of and experience in recommending the list of maintenance items ~~including those related to landscape softworks~~) :

☑ clearance of accumulated debris from drainage channels and slope surface;

☑ repair of cracked or damaged drainage channels or pavements;

☐ repair of or replacement of cracked or damaged hard slope surface cover;

☐ unblocking of weepholes and outlet drainpipes;

☐ removal of any vegetation that has caused severe cracking of slope surface cover and drainage channels;

~~☐~~☑ re-grassing of bare soil slope surface areas;

☐ repair of missing or deteriorated pointing in masonry walls;

☐ removal of loose rock debris and undesirable vegetation from rock slopes or

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Note 1 Refer to Table 3.1 of Geoguide 5, 3rd Edition.
Note 2 Refer to Table 3.3 of Geoguide 5, 3rd Edition.
Note 3 Refer to Section 3.5 of Geoguide 5, 3rd Edition.
~~Note 4 Refer to Section 3.6 of GEO Publication No. 1/2011 and the latest version of Guidelines for Tree Assessment & Management Arrangement on an Area Basis and on a Tree Basis issued by Development Bureau~~

around boulders;

☐ repair of leaky exposed water-carrying services;

☐ repair of or replacement of rusted steel slope furniture;

☐ maintenance of landscape items on the slope (please refere to paragraph 1.3); ~~including:~~

- ~~☑ clearance of vegetation from drainage system (e.g. channels and weepholes);~~
- ~~☑ clearance of encroaching vegetation from access routes, which is inhibiting access;~~
- ~~☑ clearance of disruptive vegetation growth from exposed rock surfaces, concrete/masonry surface and structures, metal surfaces (e.g. handrails, fences and gates)~~ ~~* delete as appropriate~~~~;~~
- ~~☐ repair/regrading of eroded areas with compacted soil followed by planting/re-grassing and/or replanting of vegetation in areas where there is no canopy or leaf litter cover~~ ~~* delete as appropriate~~~~;~~
- ~~☐ re-grassing/re-vegetating of the bare slope surface;~~
- ~~☐ trimming of groundcover vegetation;~~
- ~~☐ pruning of trees, removal of unstable trees and/or re-planting of trees;~~
- ~~☐ thinning out of vegetation species including *(species to be specified)*;~~
- ~~☑ removal of undesirable vegetation / invasive species, such as *Leucaena leucocephala* (銀合歡), *Pueraria* (野葛類), *Cassytha* (無根藤) and *Mikania micrantha* (薇甘菊), if any, from the slope surface;~~
- ~~☐ cutting or enlargement of openings in wire mesh used to support erosion control mats;~~
- ~~☑ repair, repaint, replacement of landscape hardworks treatments to concrete surfaces and structures, masonry surfaces and structures, metal surfaces~~ ~~* delete as appropriate~~~~;~~
- ~~☐ *(others to be specified)*~~ ~~(Note 5)~~~~.~~

☐ *(others to be specified).*

In addition, a Regular Check of Buried Water-carrying Services on or adjacent to soil slopes or retaining walls should be undertaken. Where leakage is suspected from buried water-carrying services such as water pipes, water supply mains, sewers, stormwater drains or their ducting systems, prompt arrangement should be made for the investigation and repair of the services.

Where repeated maintenance works are required for a particular aspect of a slope or retaining wall, the problems should be investigated.

During routine maintenance inspections, particular note should be taken of any abnormality, such as widening or propagation of cracks, settling ground, sudden or significant increase in seepage, bulging or distortion of a retaining wall or settlement of the crest platform. If such an abnormality is noted, an Engineer Inspection for Maintenance is immediately

~~Note 5 Refer to Chapter 8 and Appendix H of GEO Publication No. 1/2011.~~

required.

The records of Routine Maintenance Inspection should be properly made and kept. Typical Routine Maintenance Inspection record sheets are attached as Appendix IV.

2.3 Engineer Inspection for Maintenance

The Engineer Inspection for Maintenance should be carried out by a geotechnical engineer professionally qualified in the Hong Kong SAR employed by you, either in-house or as a consultant.

The Engineer Inspection for Maintenance should:

- ☑ determine if Stability Assessments have previously been carried out and if so, review previous Stability Assessment reports to check whether the engineering approach used, the assumptions and the conclusions made in these reports are reasonable in light of current practice and safety standards;

- ☑ identify all visible changes and signs of distress, including landslides that have taken place at or in the vicinity of the slope or retaining wall, in particular changes since the previous Stability Assessment if this has been carried out, and any discrepancies between records and site conditions, which could have implications for stability of the slope or retaining wall, and judge whether these might be significant;

- ☑ re-assess the consequence-to-life category of the slope or retaining wall as set out in Table 3 in Appendix A to Works Bureau Technical Circular No. 13/99 and GEO Technical Guidance Note No. 15, or the latest revision of the Table promulgated by the Geotechnical Engineering Office;

- ☑ check that Routine Maintenance Inspections have been carried out and documented satisfactorily;

- ☑ assess the adequacy of routine maintenance works and supplement the list of man-made items requiring routine maintenance, as necessary;

- ☑ re-assess the required frequency of Routine Maintenance Inspections, Engineer Inspections for Maintenance and Regular Checks of Buried Water-carrying Services;

- ☑ look for and consider the implications of problems that are not explicitly included in the list of man-made items requiring routine maintenance, and bring to the attention of the owner or party required to maintain the land any immediate and obvious danger noted and, if necessary, recommend emergency measures (e.g. repair works or detailed investigations);

- ☑ identify the presence of exposed and buried water-carrying services on or in the vicinity of the slope or retaining wall (including relevant areas outside the land

boundary), check for signs of leakage of the services and recommend immediate detailed leakage checks, regular checks, repair or re-routing of the services, as necessary;

☑ check that the Regular Checks of Buried Water-carrying Services and/or Regular Monitoring of Special Measures (if required) have been carried out and documented satisfactorily;

☑ advise whether a Stability Assessment of the slope or retaining wall is necessary;

☑ recommend the necessary preventive maintenance works (Chapter 5 of Geoguide 5);

☑ prepare or update the Maintenance Manual to include all relevant information extracted from the previous Stability Assessment, and the desk study and site inspection(s) from this Engineer Inspection for Maintenance;

~~☑ assess the condition of landscape softworks with input from a landscape specialist or an arborist as necessary;~~

☑ (*others to be specified*).

The records of the Engineer Inspection for Maintenance should be properly made and kept. Typical record sheets for Engineer Inspection for Maintenance are attached as Appendix V.

For government slopes, some additional tasks in relation to the management of the slope inventory held by the respective maintenance departments should be carried out in Engineer Inspections for Maintenance. The detailed scope of such tasks is given in Appendix D to Geoguide 5.

2.4 Regular Monitoring of Special Measures

Specialist monitoring and maintenance are required for the following :

☐ permanent prestressed ground anchors;

☐ purposely designed raking drains which are not used in a prescriptive manner;

☐ permanent reinforced fill structures;

☐ *(others to be specified).*

Raking drains installed as a prescriptive measure are not considered as “Special Measures”. Regular monitoring is not mandatory. However, regular inspections and routine maintenance of all raking drains should be carried out to ensure their continued performance.

The forms and records for Regular Monitoring of Special Measures should be designed by the specialist firm that conducts the inspection.

~~2.5 Tree Risk Assessment / Monitoring of Tree Health~~

~~Tree risk assessments and consequential recommendations should follow the guidelines and checklist (Note 6) provided by DEVB and advice of an experienced arborist/tree specialist should be sought as necessary.~~

~~Monitoring of tree health and maintenance is required for the following:~~

- ~~☐ Old and Valuable Trees (OVT);~~
- ~~☐ stonewall trees;~~
- ~~☐ *(others to be specified).*~~

~~The forms and records for monitoring of tree health should follow the guidelines and checklist (Note 6) provided by DEVB and advice of an experienced arborist/tree specialist should be sought.~~

~~Note 6 Refer to the latest version of Guidelines for Tree Assessment & Management Arrangement on an Area Basis and on a Tree Basis issued by Development Bureau and other checklists provided by Development Bureau.~~

PART 3 - DESIGN & CONTRACT/WORKS DETAILS

3.1 The details of the Contract and a summary of the Landslip Prevention and Mitigation Works carried out are given in Appendix VI.

3.2 The design assumptions, parameters and stability analyses are summarized in Appendix VII.

3.3 Verification of the design geological model and records of construction review are briefly described in Appendices VIII and IX.

3.4 A summary of previous studies carried out related to the feature(s) is given in Appendix X.

3.5 The rationale for landscape design works is given in Appendix XII.

PART 4 - RECORD ~~SHEET~~S AND AS-BUILT DRAWINGS

4.1 The record ~~sheet~~s given in Appendix III provide detailed information with regard to:

- ☑ Technical information such as the dimensions of the slopes/retaining walls, surface conditions of the features, drainage details, consequence category and details of study/upgrading/improvement works;
- ☑ Maintenance schedule such as a list of items requiring routine maintenance, regular monitoring of special measures and frequency of maintenance inspections;
- ☑ Location plan and site plan showing the extent of slope/retaining wall to be maintained;
- ☑ Plan/Sections of slope/retaining wall to be maintained;
- ☑ Layout plan of water-carrying services on or adjacent to slope/retaining wall;
- ☑ Record photographs.

4.2 The following drawings are the as-constructed drawings for the slope and are given in Appendix XI :

- ☑ Drawing No. LPM/xxxx/061C
- ☑ Drawing No. LPM/xxxx/062C
- ☐ Drawing No._____
- ☐ Drawing No._____

APPENDIX I

LIST OF GEOTECHNICAL FEATURES

Appendix I

List of Geotechnical Features

Consultant's File Ref. No. _____

GEO's File Ref. No. _____

GEO Feature No.(1)	Relevant Documents Checked(2)		Memo Reference and Date of Documents Submission to Checker(3)	Memo Reference and Date of Checker's Comments(3)	Remarks
	Drg. No.	Report Title			
			For Consultants designed LPM works, "Checker" refers to the Independent Checking Engineer appointed by the Consultants (ref. Clause 6.7.6.1 of CEDD OP-11).		

Notes : (1) If GEO Feature No. is not available, provide a reference no. shown in the location plans at Appendix II.

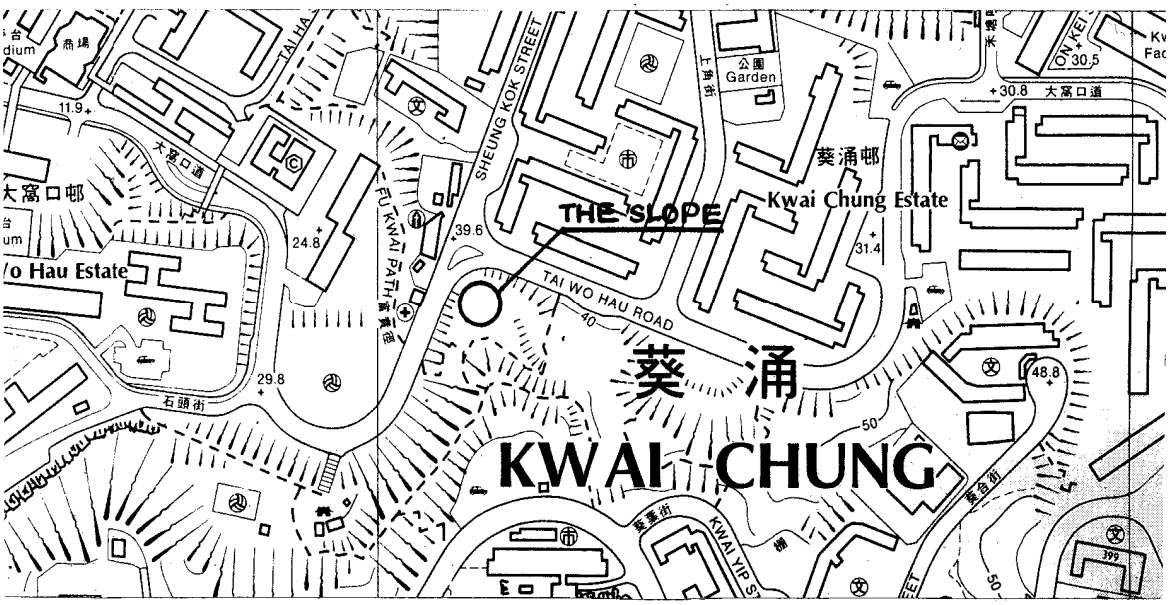
(2) Not applicable if GEO checking on the design of prescriptive measures for slope upgrading works has been waived.

(3) If GEO checking on the design of prescriptive measures for slope upgrading works has been waived, the date of documents submitted for waiving the checking requirements and the response from GEO to the application should be provided.

APPENDIX II

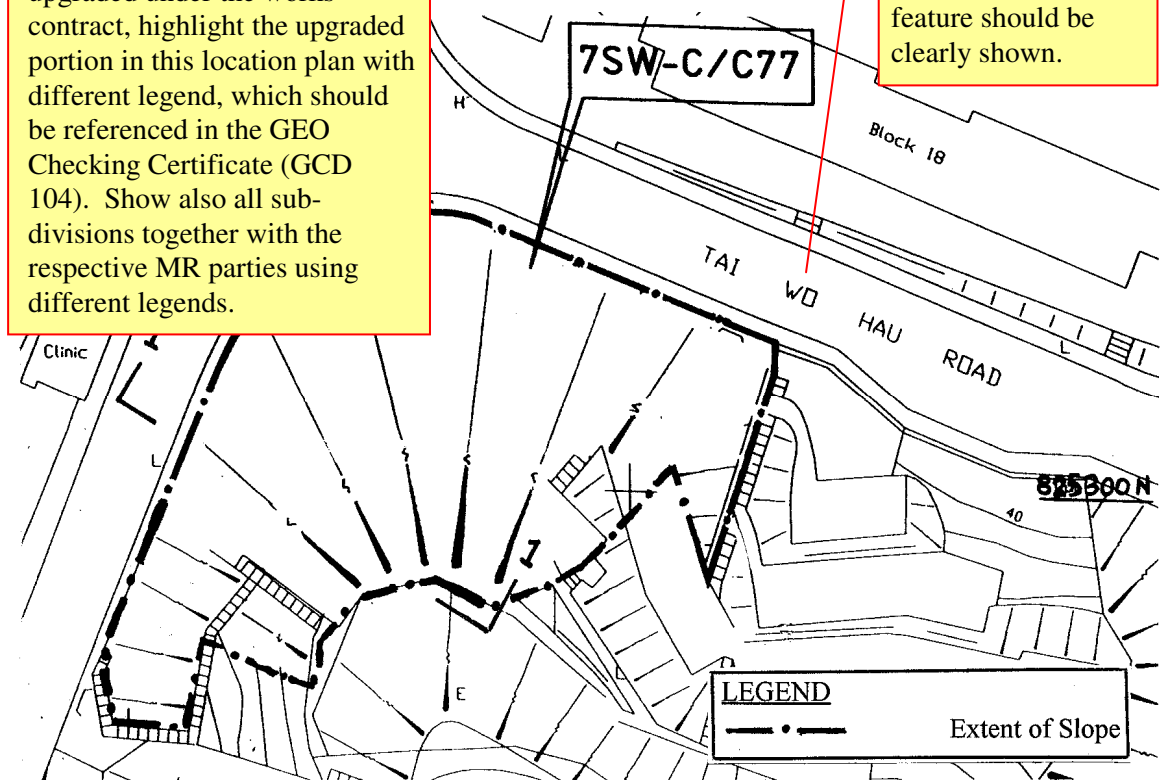
LOCATION PLAN OF GEOTECHNICAL FEATURES LISTED IN APPENDIX I

Location Plan



If only part of the feature was upgraded under the works contract, highlight the upgraded portion in this location plan with different legend, which should be referenced in the GEO Checking Certificate (GCD 104). Show also all sub-divisions together with the respective MR parties using different legends.

Site Plan



Full names of public roads adjacent to the feature should be clearly shown.

Appendix II – Location Plan of Geotechnical Features listed in Appendix I

APPENDIX III

RECORD ~~SHEET~~S OF GEOTECHNICAL FEATURES LISTED IN APPENDIX I

MAINTENANCE MANUAL **(SHEET 1 OF 9)**
PART I – BASIC SLOPE/RETAINING WALL INFORMATION

SLOPE/~~RETAINING WALL~~ (1) REFERENCE NO. 7SW-C/C77 (Sub-division < >)*

Location of Slope/~~Retaining Wall~~ (1) (address)
Tai Wo Hau Road, Kwai Chung

Map co-ordinates (1980 DATUM)	Easting 831 100 Northing 825 300	Toe Elevation (mPD)	+39.5
Maximum Height of Slope/Retaining wall (m)		20	
Overall Slope Angle of Slope/Retaining wall (°)		35°	

TECHNICAL INFORMATION (Continue on separate sheets if necessary)

Slope Portion				Retaining Wall Portion			
Material Description		Residual Soil and Completely decomposed granodiorite		Type of Wall		Dwarf Wall	
Slope Surface Cover		Hydroseeding		Location of Wall		Toe	
Max. Height (m)		20		Max. Height (m)		1	
Length (m)		100		Length (m)		11	
Average Slope Angle (°)		35°		Face Angle (°)		90°	
Berms		No.	Min. width (m)	Berms		No.	Min. width (m)
		1	2				
Drainage		Size (mm)	Spacing (m)	Drainage		Size (mm)	Spacing (m)
Weepholes				Weepholes			
Channels	At crest			Channels	At crest		
	On berm						
	At toe				At toe		
	On slope						
Down Pipes				Down Pipes			
Structural Measures (e.g. soil nail, anchor)		Soil nails.		Structural Measures (e.g. soil nail, anchor)			

TYPE AND SIZE OF SERVICES (see drawing)

On slope: 100mm dia. fresh water main at the western part of slope

At crest:

At toe: 300mm dia. fresh water main, 380mm dia. salt water main.

Note : (1) delete as necessary.

Appendix III – Record ~~Sheet~~s of Geotechnical Features Listed In Appendix I (Sheet 1 of 9)

MAINTENANCE MANUAL **(SHEET 2 OF 9)**
PART I – BASIC SLOPE/RETAINING WALL INFORMATION

SLOPE/~~RETAINING WALL~~ (1) REFERENCE NO. 7SW-C/C77 (Sub-division < >)*

INFORMATION ON CONSEQUENCE-TO-LIFE CATEGORY

What facilities will be affected if this slope or retaining wall collapses (e.g. school, market, playground, highway, country park)?

At Crest	(a) Type(s) of facility	<Refer to GEO TGN 15>
	(b) Distance	
At Toe	(a) Type(s) of facility	<Refer to GEO TGN 15>
	(b) Distance	

Consequence-to-life category of the slope or retaining wall : <Refer to GEO TGN 15>

STUDY / UPGRADING / IMPROVEMENT WORKS

(types of upgrading or improvement works, date of construction, outline of basis of most up-to-date design or findings of stability assessment, date of checking certificate issued by GEO)

The dates of commencement and completion of the construction should be the same as those entered in Appendix VI.

Notes : (1) delete as necessary.

Appendix III – Record ~~Sheet~~s of Geotechnical Features Listed In Appendix I (Sheet 2 of 9)

MAINTENANCE MANUAL **(SHEET 3 OF 9)** **PART II – MAINTENANCE SCHEDULE OF SLOPE/RETAINING WALL**
SLOPE/~~RETAINING WALL~~ (1) REFERENCE NO. 7SW-C/C77 (Sub-division < >)*
LIST OF ITEMS REQUIRING ROUTINE MAINTENANCE
(including requirements on man-made items, landscape items, etc)
MONITORING SCHEDULE FOR REGULAR MONITORING OF SPECIAL MEASURES
Type and spacing of Special Measures: Anchors/Raking Drains (see drawing for details)
Details of Monitoring: (e.g. frequency of monitoring, types of tests and acceptance criteria)
Note : (1) delete as necessary.

Appendix III – Record ~~Sheet~~s of Geotechnical Features Listed In Appendix I (Sheet 3 of 9)

MAINTENANCE MANUAL **(SHEET 4 OF 9)**
PART II – MAINTENANCE SCHEDULE OF SLOPE/RETAINING WALL

SLOPE/~~RETAINING WALL~~ (1) REFERENCE NO. 7SW-C/C77 (Sub-division < >)*

FREQUENCY OF MAINTENANCE INSPECTIONS

(a) Frequency of Routine Maintenance Inspection: _____

(b) Frequency of Engineer Inspection for Maintenance: _____

(c) Frequency of Regular Check of Water-Carrying Services (including buried services, ducting systems): _____

Guidelines on when professional advice or an immediate Engineer Inspection for Maintenance is required:

(e.g. landslide, signs of distress, new or significant increase of seepage, or change of facility in the vicinity of slope or retaining wall.)

OTHER INFORMATION

Relevant records: (e.g. ground investigation report, geotechnical report, landslide incident report and landscape design report)

INFORMATION PROVIDER

Prepared by: _____ Firm: _____

Signature: _____ Date: _____

Note : (1) delete as necessary.

Appendix III – Record ~~Sheet~~s of Geotechnical Features Listed In Appendix I (Sheet 4 of 9)

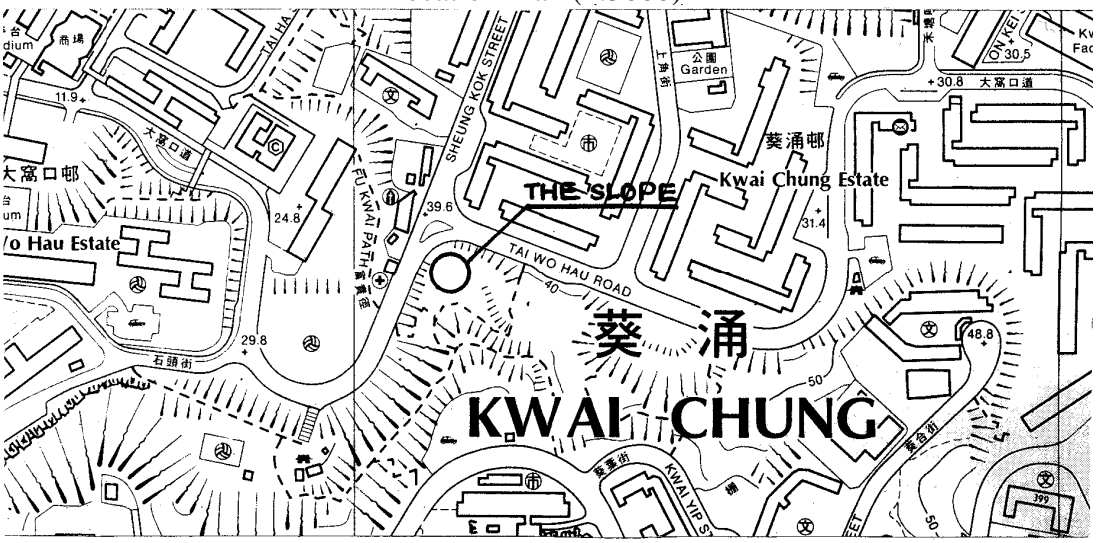
MAINTENANCE MANUAL **(SHEET 5 OF 9)**

PART III – DRAWINGS AND PHOTOGRAPHIC RECORDS

SLOPE/~~RETAINING WALL~~ (1) **REFERENCE NO.** 7SW-C/C77 (Sub-division < >)*

LOCATION PLAN AND SITE PLAN (with scale)

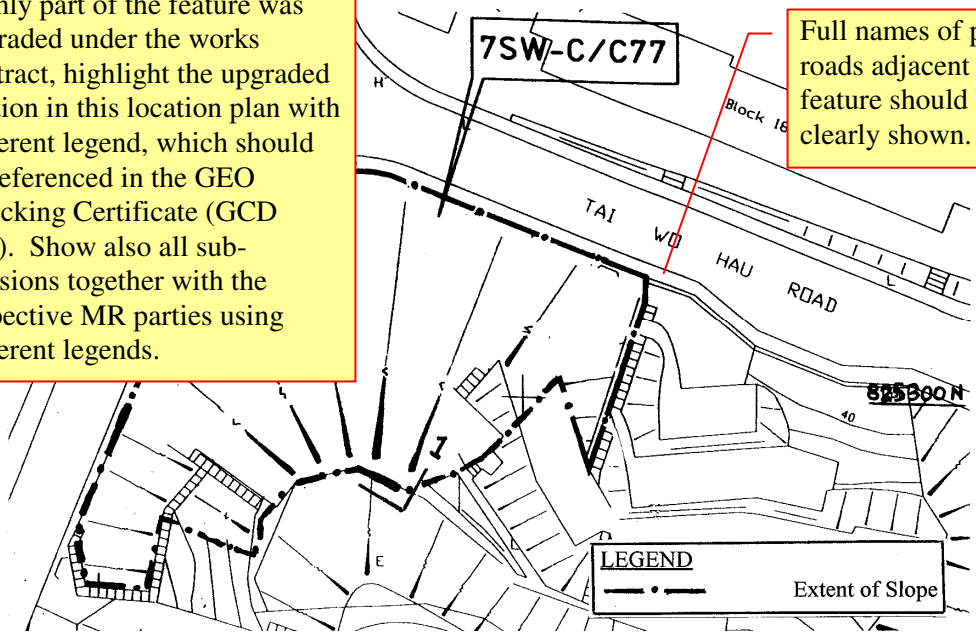
Location Plan (1:5000)



Site Plan (1:1000)

If only part of the feature was upgraded under the works contract, highlight the upgraded portion in this location plan with different legend, which should be referenced in the GEO Checking Certificate (GCD 104). Show also all sub-divisions together with the respective MR parties using different legends.

Full names of public roads adjacent to the feature should be clearly shown.



Note : (1) delete as necessary.

Appendix III – Record ~~Sheet~~s of Geotechnical Features Listed In Appendix I (Sheet 5 of 9)

MAINTENANCE MANUAL **(SHEET 6 OF 9)**
PART III – DRAWINGS AND PHOTOGRAPHIC RECORDS

SLOPE/~~RETAINING WALL~~ (1) **REFERENCE NO.** 7SW-C/C77 (Sub-division < >)*

PLAN/SECTIONS OF SLOPE/RETAINING WALL TO BE MAINTAINED

(Plan and sections based on as-built conditions. Include date of the plan, details of surface cover, surface drainage, subsurface drainage, access points, and stabilisation measures)

[Plan/Sections of Slope 7SW-C/C77]

Notes : (1) delete as necessary.

(2) All dimensions are in millimetres and all levels are in metres above Principal Datum.

Appendix III – Record ~~Sheet~~s of Geotechnical Features Listed In Appendix I (Sheet 6 of 9)

MAINTENANCE MANUAL **(SHEET 7 OF 9)**
PART III – DRAWINGS AND PHOTOGRAPHIC RECORDS

SLOPE/~~RETAINING WALL~~ (1) **REFERENCE NO.** 7SW-C/C77 (Sub-division < >)*

LAYOUT PLAN OF WATER-CARRYING SERVICES ON OR ADJACENT TO SLOPE/~~RETAINING WALL~~ (1) (with date)

[Layout plan of water-carrying services on or adjacent to slope 7SW-C/C77]

Notes : (1) delete as necessary.

(2) All dimensions are in millimetres and all levels are in metres above Principal Datum.

MAINTENANCE MANUAL **(SHEET 8 OF 9)**
PART III – DRAWINGS AND PHOTOGRAPHIC RECORDS

SLOPE/~~RETAINING WALL~~ (1) **REFERENCE NO.** 7SW-C/C77 (Sub-division < >)*

RECORD PHOTOGRAPHS (with observations and date; and with the vantage points indicated on the plans)

General View of Northern Side of the Slope (Date: 18 April yyyy)

General View of Western Side of the Slope (Date: 18 April yyyy)

Notes : (1) delete as necessary.

(2) All dimensions are in millimetres and all levels are in metres above Principal Datum.

MAINTENANCE MANUAL **(SHEET 9 OF 9)**
PART III – DRAWINGS AND PHOTOGRAPHIC RECORDS

SLOPE/~~RETAINING WALL~~ (1) **REFERENCE NO.** 7SW-C/C77 (Sub-division < >)*

RECORD PHOTOGRAPHS BEFORE WORK DONE

General View of Feature (looking south-east)

(Date: 5 December yyyy)

Notes : (1) delete as necessary.

(2) Add additional record sheets for photographs as necessary.

Appendix III – Record ~~Sheet~~s of Geotechnical Features Listed In Appendix I (Sheet 9 of 9)

APPENDIX IV

TYPICAL RECORD SHEETS FOR ROUTINE MAINTENANCE INSPECTIONS AND WORKS

RECORD OF ROUTINE MAINTENANCE INSPECTION (SHEET 1 OF ~~54~~)

SLOPE/RETAINING WALL (1) REFERENCE NO.(2)

Location of Slope/Retaining Wall (1) (address)

Date of Inspection:

Date of Last Engineer Inspection for Maintenance:

Due Date of Next Engineer Inspection for Maintenance:

Weather Condition at Time of Inspection:

Maintenance Action Item	Location Reference	Action Required		Works Completion Date
		No	Yes	
Clear drainage channels of accumulated debris				
Repair cracked/damaged drainage channels or pavements along crest and toe of slope or retaining wall				
Repair or replace cracked or damaged impermeable slope surface cover				
Remove surface debris and vegetation that has caused severe cracking of slope surface cover and drainage channels				
Remove loose rock debris and undesirable vegetation from rock slopes or boulders				
Re-vegetate bare soil slope surface				
Repair pointings in masonry walls				
Unblock weepholes and outlet drainpipes				
Repair leaky exposed water-carrying services				
Repair or replace rusted slope furniture (e.g. steel gates, boundary fences and stairs)				
Remove debris from defence measures				
Others (specify works and give details)				

Recommended Date for Completion of Above Works:

Notes: (1) Delete as necessary.

(2) Upon request, the Geotechnical Engineering Office can provide a slope or retaining wall reference number if applicable.

Appendix IV - Typical Record Sheets for Routine Maintenance Inspections (Sheet 1 of ~~5~~4)

~~RECORD OF ROUTINE MAINTENANCE INSPECTION (SHEET 2 OF 5)~~

~~SLOPE/RETAINING WALL~~ ~~(1)~~ **~~REFERENCE NO.~~** ~~(2)~~

~~Location of Slope/Retaining Wall~~ ~~(1)~~ ~~(address)~~

~~Landscape Softworks Maintenance Action Item~~	~~Location Reference~~	~~Action Required~~		~~Works Completion Date~~
		~~No~~	~~Yes~~	
~~Trimming of groundcover vegetation~~				
~~Re-vegetation of bare soil slope surface*~~				
~~Removal of unplanned vegetation on hard slope surface*~~				
~~Removal of invasive species (e.g. *Leucaena leucocephala* (銀合歡), *Pueraria* (野葛類), *Cassytha* (無根藤) and *Mikania micrantha* (薇甘菊))~~				
~~Tree pruning*~~				
~~Removal of any dead trees*~~				
~~Replacement/Enlargement of tree ring~~				
~~Provision of tree ring~~				
~~Replacement of proprietary product~~				
~~Re-planting of vegetation~~				
~~Repair or re-provision of wire mesh~~				
~~Enlargement of wire mesh opening~~				
~~Others (specify works and give details)~~				

~~Recommended Date for Completion of Above Works:~~

~~Notes: (1) Delete as necessary.~~

~~(2) Upon request, the Geotechnical Engineering Office can provide a slope or retaining wall reference number if applicable.~~

~~(3) * Input from a landscape specialist or an arborist may be necessary.~~

~~Appendix IV - Typical Record Sheets for Routine Maintenance Inspections (Sheet 2 of 5)~~

RECORD OF ROUTINE MAINTENANCE INSPECTION (SHEET ~~3~~ 2 OF ~~5~~4)

SLOPE/RETAINING WALL [1] REFERENCE NO.
SITE PLAN (Reference numbers should be assigned to locations of man-made items for which maintenance works are required. The corresponding reference numbers should be quoted in the photographic records.)
Notes: (1) Delete as necessary. (2) Add additional record sheets for site plan as necessary.

RECORD OF ROUTINE MAINTENANCE INSPECTION	**(SHEET ~~4~~ 3 OF ~~5~~4)**
SLOPE/RETAINING WALL (1) REFERENCE NO.	
Immediate Engineer Inspection for Maintenance needed (2)?	(Yes/No)
Immediate arrangement for investigation and repair of buried water-carrying services needed?	(Yes/No)

OTHER OBSERVATIONS (continue on separate sheets if necessary)

(e.g. condition of trees for which specialist advice is needed) _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Inspected by: _____ (Name of person undertaking inspection)

of _____ (Organisation)

Signature: _____ Date: _____

Due date of next inspection: _____

Received by: _____ (Name of owner or his authorised representative)

of _____ (Organisation)

Signature: _____ Date: _____

Note: (1) Delete as necessary.

(2) Defects or anomalies, such as signs of leakage, widening of cracks, settling ground, bulging or distortion of a masonry wall or settlement of the crest platform, should be reported to the owner or party responsible for the maintenance of the land.

Appendix IV - Typical Record Sheets for Routine Maintenance Inspections (Sheet ~~4~~ 3 of ~~5~~4)

RECORD OF ROUTINE MAINTENANCE INSPECTION **(SHEET ~~5~~ 4 OF ~~54~~)**
SLOPE/RETAINING WALL (1) REFERENCE NO.
RECORD PHOTOGRAPHS (with descriptions, date, and reference numbers as given on the site plan)
Notes: (1) Delete as necessary. (2) Add additional record sheets for photographs as necessary. (3) Record photographs should show in detail areas where maintenance works are required, signs of distress observed (e.g. tension cracks, bulging of wall), and be annotated with descriptions.

Appendix IV - Typical Record Sheets for Routine Maintenance Inspections (Sheet ~~5~~ 4 of ~~5~~4)

RECORD OF ROUTINE MAINTENANCE WORKS **(SHEET 1 OF 1)**

SLOPE/RETAINING WALL [(1)] REFERENCE NO.

Maintenance works arranged by: _____ (Name)

of _____ (Organisation)

Signature: _____ Date: _____

Maintenance works carried out by: _____ (Name)

of _____ (Organisation)

Signature: _____ Date: _____

Maintenance works carried out on: _____

RECORD PHOTOGRAPHS (with descriptions, date, and reference numbers as given on the site plan)

Notes:
(1) Delete as necessary.
(2) Add additional record sheets for photographs as necessary.
(3) For removal of loose rocks from rock face or clearing debris from defence measures, e.g. check dam, the estimated volume of debris removed should be recorded.
(4) Record photographs should show in detail areas where maintenance works have been carried out and be annotated with descriptions.
(5) Record photographs before and after the execution of maintenance works should be taken from the same vantage points.

Appendix IV - Typical Record Sheet for Routine Maintenance Works (Sheet 1 of 1)

APPENDIX V

TYPICAL RECORD SHEETS FOR ENGINEER INSPECTIONS FOR MAINTENANCE

RECORD OF ENGINEER INSPECTION FOR MAINTENANCE (SHEET 1 OF ~~12~~10)

SLOPE/RETAINING WALL (1) REFERENCE NO. (2)

Location of Slope/Retaining Wall (1) (address)

Date of Inspection:

Date of Last Engineer Inspection:

Due Date of Next Engineer Inspection:

Weather Condition at Time of Inspection:

REVIEW OF ROUTINE MAINTENANCE

- Have routine maintenance works been satisfactory carried out? (give details if answer is "Partially") Yes/Partially/No

  ---

- Are the maintenance record sheets used adequate? Yes/No
- Have adequate maintenance records been kept? Yes/No
- Is there adequate access to the slope or retaining wall for Maintenance Inspections? Yes/No
- Has the full extent of the slope or retaining wall to be inspected and maintained been established (i.e. check against lease document issued by the Lands Department?) Yes/No

OTHER OBSERVATIONS

(e.g. recent works adjacent to the slope or retaining wall, estimated quantities of loose rock or debris removed from rock slope or defence measures)

Note: (1) Delete as necessary.

(2) Upon request, the Geotechnical Engineering Office can provide a slope or retaining wall reference number if applicable.

Appendix V - Typical Record Sheets for Engineer Inspections for Maintenance (Sheet 1 of ~~12~~10)

RECORD OF ENGINEER INSPECTION FOR MAINTENANCE (SHEET 2 OF ~~12~~10)			
SLOPE/RETAINING WALL (1) REFERENCE NO.			
CONDITION OF SOIL SLOPE			
Items to be checked		Condition	Works Needed
Impermeable surface cover	(Yes/No)	Good/Fair/Poor	
Weepholes	(Yes/No)	Clear/Partly blocked/Blocked	
Vegetated surface	(Yes/No)	Good/Fair/Poor	
Drainage channels	(Yes/No)	Clear/Partly blocked/Blocked	
		No/Moderate/Severe Cracking	
Catchpits and sand traps	(Yes/No)	Clear/Partly blocked/Blocked	
		No/Moderate/Severe Cracking	
Associated culverts & natural drainage lines	(Yes/No)	Clear/Partly blocked/Blocked	
Stabilisation Measures	(Yes/No)	Good/Fair/Poor	
Others	(Specify)		
Questions to be asked		Remarks	Works Needed
Any recent slope failure?	(Yes/No)	Record any of these anomalies since the last inspection and note any recurrence of the same problem. If yes to any of these questions, give details of the observations and implications of the problems (continue on separate sheets if necessary).	
Any recent erosion?	(Yes/No)		
Any recent movement?	(Yes/No)		
Any tension cracks at the crest?	(Yes/No)		
Any recent seepage?	(Yes/No)		
Any other signs of distress (please specify)?	(Yes/No)		
COMMENTS (continue on separate sheets if needed)			
Note : (1) delete as necessary.			

Appendix V - Typical Record Sheets for Engineer Inspections for Maintenance (Sheet 2 of ~~12~~10)

RECORD OF ENGINEER INSPECTION FOR MAINTENANCE (SHEET 3 OF ~~12~~10)			
SLOPE/RETAINING WALL (1) REFERENCE NO.			
CONDITION OF RETAINING WALL			
Items to be checked		Condition	Works Needed
Weepholes	(Yes/No)	Clear/Partly blocked/Blocked	
Mortar joints/pointing	(Yes/No)	Good/Fair/Poor	
Drainage channels	(Yes/No)	Clear/Partly blocked/Blocked	
		No/Moderate/Severe Cracking	
Outlets of drainpipes	(Yes/No)	Clear/Partly blocked/Blocked	
Concrete facing	(Yes/No)	Good/Fair/Poor	
Others	(Specify)		
Questions to be asked		Remarks	Works Needed
Any recent wall settlement?	(Yes/No)	Record any of these anomalies since the last inspection and note any recurrence of the same problem. If yes to any of these questions, give details of the observations and implications of the problems (continue on separate sheets if necessary).	
Any recent wall cracking?	(Yes/No)		
Any recent wall tilting?	(Yes/No)		
Any recent wall bulging?	(Yes/No)		
Any recent seepage?	(Yes/No)		
Any other signs of distress (please specify)?	(Yes/No)		
COMMENTS (continue on separate sheets if needed)			
Note : (1) delete as necessary.			

Appendix V - Typical Record Sheets for Engineer Inspections for Maintenance (Sheet 3 of ~~12~~10)

RECORD OF ENGINEER INSPECTION FOR MAINTENANCE (SHEET 4 OF ~~12~~10)			
SLOPE/RETAINING WALL (1) REFERENCE NO.			
CONDITION OF ROCK SLOPE			
Items to be checked		Condition	Works Needed
Impermeable surface cover	(Yes/No)	Good/Fair/Poor	
Weepholes	(Yes/No)	Clear/Partly blocked/Blocked	
Vegetated surface	(Yes/No)	Good/Fair/Poor	
Drainage channels	(Yes/No)	Clear/Partly blocked/Blocked	
		No/Moderate/Severe Cracking	
Catchpits and sand traps	(Yes/No)	Clear/Partly blocked/Blocked	
		No/Moderate/Severe Cracking	
Associated culverts & natural drainage lines	(Yes/No)	Clear/Partly blocked/Blocked	
Stabilisation measures & protection (please specify)	(Yes/No)	Good/Fair/Poor	
Others	(Specify)		
Questions to be asked		Remarks	Works Needed
Any recent rockfall?	(Yes/No)	Record any of these anomalies since the last inspection and note any recurrence of the same problem. If yes to any of these questions, give details of the observations and implications of the problems (continue on separate sheets if necessary).	
Any loose blocks on slope?	(Yes/No)		
Any loose wedges on slope?	(Yes/No)		
Any badly fractured zone?	(Yes/No)		
Any open joints at the crest?	(Yes/No)		
Any recent seepage?	(Yes/No)		
Any other signs of instability (please specify)?	(Yes/No)		
COMMENTS (continue on separate sheets if needed)			
Note : (1) delete as necessary.			

Appendix V - Typical Record Sheets for Engineer Inspections for Maintenance (Sheet 4 of ~~12~~10)

~~RECORD OF ENGINEER INSPECTION FOR MAINTENANCE (SHEET 5 OF 12)~~		
~~SLOPE/RETAINING WALL (1) REFERENCE NO.~~		
~~CONDITION OF LANDSCAPE SOFTWORKS~~		
~~Items to be checked~~	~~Condition~~	~~Works Needed~~
~~Planned groundcover vegetation (Yes/No)~~	~~Good/Bare/Overgrown~~	
~~Proprietary products (Yes/No)~~	~~Good/Bare/Overgrown~~	
~~Unplanned vegetation on hard slope surface * (Yes/No)~~	~~None/Fair/Overgrown~~	
~~Shrubs/Trees (General condition) (Yes/No)~~	~~Healthy/Declining/Dead~~	
~~Tree ring (Yes/No)~~	~~Adequate/Undersize~~	
~~Unplanned vegetation within planted areas * (Yes/No)~~	~~No apparent problem/Invasive/ Overgrown~~	
~~Planter holes (Yes/No)~~	~~Good/Fair/Poor~~	
~~Others (Specify) ……~~		
~~COMMENTS (continue on separate sheets if needed)~~		
~~Note : * Input from a landscape specialist or an arborist may be necessary.~~		

~~Appendix V Typical Record Sheets for Engineer Inspections for Maintenance (Sheet 5 of 12)~~

RECORD OF ENGINEER INSPECTION FOR MAINTENANCE (SHEET 6 OF 12)			
SLOPE/RETAINING WALL (1) REFERENCE NO.			
CONDITION OF LANDSCAPE SOFTWORKS			
Obvious Tree Problem Observed (Notes 1 & 2) (tick more than one box and circle item# where appropriate)			
☐	severe leaning	☐	broken branch(es) hanging from tree
☐	large wound#/cracks or splits#/open cavity# on trunk(s) or branch(es)	☐	loosened bark
☐	termite#/fungal fruiting bodies#	☐	root damage
☐	dead branch(es)#/abnormal defoliation#	☐	excessive pruning
☐	Other supplementary information (please specify) ……		
Is follow-up inspection by a suitably qualified and experienced arborist (Note 3) considered necessary?		Yes/No#	
COMMENTS (continue on separate sheets if needed)			

Notes: (1) Carry out visual inspection as far as safe access is available.

(2) See *Pictorial Guide for Tree Maintenance to Reduce Tree Risks* promulgated by the Greening, Landscape and Tree Management Section of Development Bureau (DEVB, 2011c) for illustration of tree problems.

(3) Refer to http://www.trees.gov.hk/en/ for advice on qualifications and experience requirements by the Greening, Landscape and Tree Management Section of Development Bureau.

Appendix V Typical Record Sheets for Engineer Inspections for Maintenance (Sheet 6 of 12)

RECORD OF ENGINEER INSPECTION FOR MAINTENANCE(SHEET ~~7~~ 5 OF ~~12~~10)

SLOPE/RETAINING WALL (1) REFERENCE NO.

BURIED WATER-CARRYING SERVICES (including ducting systems and conduits)

- Will services adversely affect the slope or retaining wall in event of leakage? (Yes/No)
- Has there been any change to services since last Engineer Inspection for Maintenance? (Yes/No)
- Are there signs of water leakage from services? (Yes/No)
- Do any services need immediate leakage testing? (Yes/No)
- Is re-routing of services necessary and practicable? (Yes/No)
- Do any services require regular checks? (If yes, recommend frequency) (Yes/No)

If yes in any of the above items, give details of observations and/or recommendations:

(continue on separate sheets if needed)

Others

GENERAL COMMENTS

- Has Stability Assessment/upgrading works (1) been carried out? (Yes/No)
- Has the stability of the slope/retaining wall (1) previously been assessed to be adequate? (Yes/No)
- Are the engineering approach used, the assumptions and conclusions made in the previous Stability Assessment reports reasonable in light of the current practice and safety standards? (If no, give details) (Yes/No)
- Is there any change that has taken place, which could have reduced the stability of the slope/retaining wall since the last Stability Assessment/upgrading works (1)? (If yes, give details of observations?) (Yes/No)
- Has the consequence-to-life category of the slope/retaining wall changed? (If yes, from _ to ___ and update slope record for facilities type affected) (Yes/No)
- Is the frequency of Routine Maintenance Inspections satisfactory? (If no, recommend new frequency) (Yes/No)
- Is the frequency of Engineer Inspection for Maintenance satisfactory? (If no, recommend new frequency) (Yes/No)
- Has Regular Check of Buried Water-carrying Services been carried out? (Yes/No)
- Has Regular Monitoring of Special Measures (if required) been satisfactorily carried out? (Yes/No)
- Have recommendations from past Engineer Inspections been carried out? (Yes/No)
- Are surface drains adequate in size and proper in layout? (If no, consider recommending Preventive Maintenance Works) (Yes/No)

Others

Note : (1) delete as necessary.

Appendix V - Typical Record Sheets for Engineer Inspections for Maintenance (Sheet ~~7~~ 5 of ~~12~~10)

RECORD OF ENGINEER INSPECTION FOR MAINTENANCE(SHEET ~~8~~ 6 OF ~~12~~10)

SLOPE/RETAINING WALL (1) REFERENCE NO.

RECOMMENDATIONS ON ROUTINE MAINTENANCE WORKS
(show location and nature of proposed works on a plan)

RECOMMENDATIONS ON PREVENTIVE MAINTENANCE WORKS
(show location and nature of proposed works on a plan)

OVERALL STATE OF SLOPE MAINTENANCE : Class 1 / Class 2 (1)

(Refer to Tables 4.1 & 4.2 of Geoguide 5: if a slope or retaining wall has major defects affecting the function of one or more of the following items, its overall state of slope maintenance is Class 2)

- Any major defects in surface protection? (Yes/No)
- Any major defects in surface drainage system? (Yes/No)
- Any major defects in subsurface drainage system? (Yes/No)
- Any major leakage of water-carrying services? (Yes/No)
- Any major defects in special measures? (Yes/No)

Others

Note : (1) delete as necessary.

Appendix V - Typical Record Sheets for Engineer Inspections for Maintenance (Sheet ~~8~~ 6 of

~~12~~10)

RECORD OF ENGINEER INSPECTION FOR MAINTENANCE(SHEET ~~9~~ 7 OF ~~12~~10)
SLOPE/RETAINING WALL (1) REFERENCE NO.
OTHER RECOMMENDATIONS (e.g. where there is concern on the health of the trees and presence of decaying or dying trees, advice from specialist such as horticulturist may be recommended.) Frequency of Inspections (update Maintenance Manual if necessary) ◆ Frequency of Routine Maintenance Inspections: ◆ Frequency of Engineer Inspections for Maintenance: ◆ Frequency of Regular Checks of Buried Water-Carrying Services:
Name of Inspecting Engineer: _____ (Name of person undertaking inspection) of _____ (Organisation) Qualification of Inspecting Engineer: (e.g. Registered Professional Engineer (Geotechnical)) Signature: _____ Date: _____ Received by: _____ (Name of owner or his authorised representative) of _____ (Organisation) Signature: _____ Date: _____
Note : (1) delete as necessary.

Appendix V - Typical Record Sheets for Engineer Inspections for Maintenance (Sheet ~~9~~ 7 of ~~12~~10)

RECORD OF ENGINEER INSPECTION FOR MAINTENANCE(SHEET ~~10~~ 8 OF ~~12~~10
SLOPE/RETAINING WALL (1) REFERENCE NO.
RECORDS OF INFORMATION SEARCH (A list of the documents identified and reviewed, with comments on the contents, date, and places each is obtained. Some relevant sources of information are given in Appendix H of Geoguide 5 and Chapter 8.)
Notes: (1) Delete as necessary. (2) Add additional record sheets as necessary.

Appendix V - Typical Record Sheets for Engineer Inspections for Maintenance (Sheet ~~10~~ 8 of ~~12~~10)

RECORD OF ENGINEER INSPECTION FOR MAINTENANCE(SHEET ~~11~~ 9 OF ~~12~~10
SLOPE/RETAINING WALL (1) REFERENCE NO.
SITE PLAN (Reference numbers should be assigned to locations of man-made items for which maintenance works are required. The corresponding reference numbers should be quoted in the photographic records.)
Notes: (1) Delete as necessary. (2) Add additional record sheets as necessary.

Appendix V - Typical Record Sheets for Engineer Inspections for Maintenance (Sheet ~~11~~ 9 of

~~12~~10)

RECORD OF ENGINEER INSPECTION FOR MAINTENANCE(SHEET ~~12~~ 10 OF ~~12~~1(
SLOPE/RETAINING WALL (1) REFERENCE NO.
PHOTOGRAPHIC RECORDS (with descriptions, date and reference numbers as given on the site plan)
Notes: (1) Delete as necessary. (2) Add additional record sheets as necessary. (3) Record photographs should be taken from the same vantage points as the last inspection.

Appendix V - Typical Record Sheets for Engineer Inspections for Maintenance (Sheet ~~12~~ 10 of

~~12~~10)

APPENDIX VI

CONTRACT AND SUMMARY OF THE LANDSLIP PREVENTION AND MITIGATION WORKS CARRIED OUT

CONTRACT AND SUMMARY OF THE LANDSLIP PREVENTIVE WORKS CARRIED OUT **(SHEET 1 OF 1)**

SLOPE/~~RETAINING WALL~~ (1) REFERENCE NO. 7SW-C/C77 (Sub-division < >)*

SLOPE/~~RETAINING WALL~~ (1) LOCATION (ADDRESS)
Tai Wo Hau Road, Kwai Chung

SLOPE MAINTENANCE OFFICE
Highways Department

LANDSLIP PREVENTION AND MITIGATION WORKS ~~PREVENTIVE MEASURES~~ CONTRACT DETAILS

CONTRACT NO :	GE/xxxx/yy
CONTRACTOR :	XXXX Construction Company Limited
WORKS COMMENCED :	28 July xxxx
WORKS COMPLETED :	2 August yyyy
MAINTENANCE PERIOD EXPIRED ON :	2 August zzzz

Brief Description of Works Carried Out

- 50 nos. of 25 mm bar diameter 10 m long soil nails at the southwestern corner of the site;
- Soil cut slope of 20 m high with intermediate berm of 2 m wide provided at an vertical distance of 10 m; the upper soil slope cut back at 20°-34° and the lower soil slope cut back at 30°-45° ;
- 11 m long of concrete dwarf wall (1m high);
- 204 m long 300 mm wide U-channel and 53 m long 300 mm wide stepped channel;
- 24 m long 300 mm wide covered U-channel and 9 m long 450 mm wide covered U-channel;
- 6 nos. of catchpits;
- 2.0 m wide concrete footpath at slope crest and 1.8 m (average) wide concrete path at the eastern toe of the slope;
- Rockfill (Grade 200) slope of 2.0 m high with an overall gradient of approximately 20° ;
- Whole part of the cut slope surface hydroseeded;
- 155 m² of the slope area at the southwestern corner of the site protected with Tensar mat and PVC coated wire mesh;
- 34 nos. heavy standard trees planted at the toe of slope;
- 1480 nos. mixed whips planted on slope;.and
- 46 m of chain link fence;

Appendix VI - Contract ~~And~~ and Summary of the Landslip ~~Preventive~~ Prevention and Mitigation Works

Carried Out (Sheet 1 of 1)

APPENDIX VII

DESIGN ASSUMPTIONS, PARAMETERS AND STABILITY ANALYSIS

DESIGN ASSUMPTIONS, PARAMETERS AND STABILITY ANALYSIS **(SHEET 1 OF 1)**

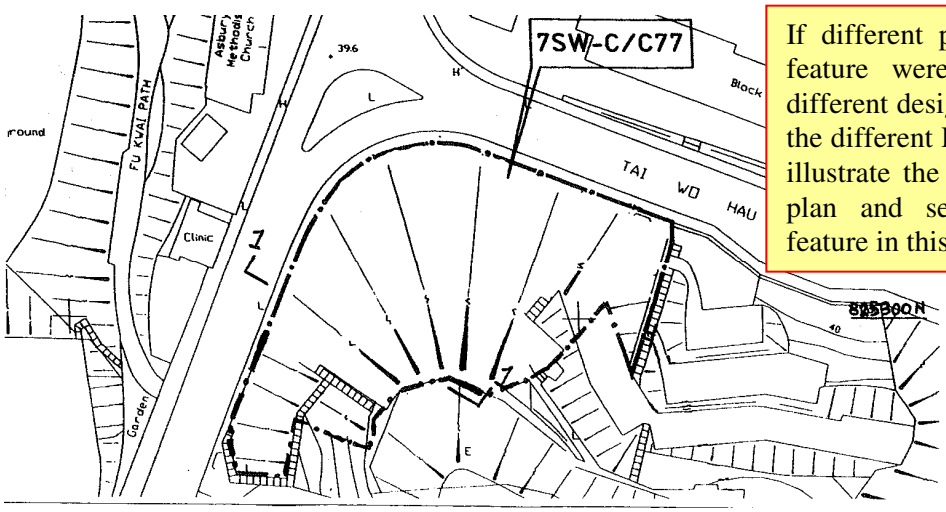
SOIL PARAMETERS

Soil Type	Bulk Weight (kN/m^3)	Cohesion (kPa)	Angle of friction (°)
Residual Soil	21	4	28
Completely Decomposed Granite	21	7	37
Highly Decomposed Granite	21	10	40

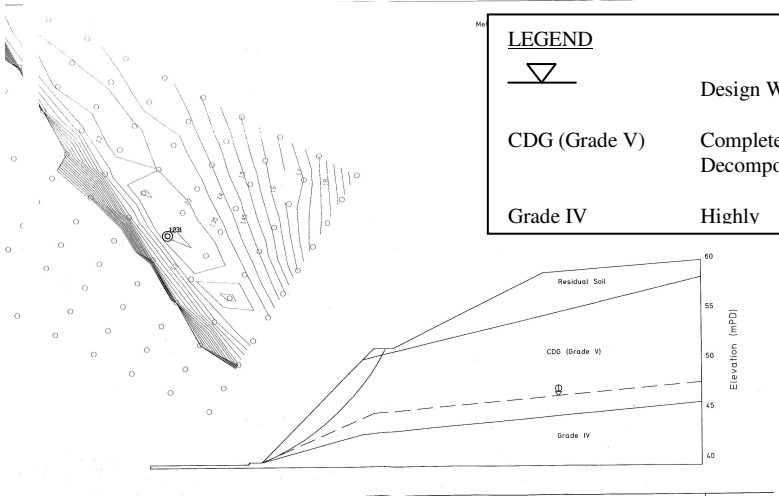
STABILITY ANALYSES

Factor of Safety	Before LPMit	After LPMit
	0.802	1.XX

PLAN



If different portions of the feature were upgraded to different design FOS's, state the different FOS's here and illustrate the extents on the plan and sections of the feature in this Appendix.



Appendix VII – Design Assumptions, Parameters and Stability Analysis (Sheet 1 of 1)

APPENDIX VIII

VERIFICATION OF THE DESIGN GEOLOGICAL MODEL

VERIFICATION OF THE DESIGN GEOLOGICAL MODEL			**(SHEET X OF Y)**
Original Design	Verification / Amendments during Construction	Date	Verified by (Name/ Post/ Qualif.)

Findings and details of verification of the design geological model (e.g. by whom, when, photographic records when the slope face is exposed etc.) (GEO Technical Guidance Note No. 2 refers)

Appendix VIII – Verification of the Design Geological Model (Sheet X of Y)

APPENDIX IX

BRIEF RECORDS OF CONSTRUCTION REVIEW

BRIEF RECORDS OF CONSTRUCTION REVIEW				**(SHEET X OF Y)**
Design Details	Construction Review	Date	Reviewed by (Name/ Post/ Qualif.)	Approved by (Name/ Post/ Qualif.)

Findings and Changes

Appendix IX - Brief Records of Construction Review (Sheet 1 of 1)

APPENDIX X

SUMMARY OF PREVIOUS STUDIES CARRIED OUT

SUMMARY OF PREVIOUS STUDIES CARRIED OUT		**(SHEET 1 OF 1)**
Type of study	LPM Consultant/GEO Division	Date
Engineer Inspection (GCO file ref. GCD 2/A1/7SW-C/C77 and GCMd 2/E1/7SW-C/C77	Binnie and Partners	January 1978
Stage 1 Study (GCO file ref. GCD 2/A1/7SW-C/C77 and GCMd 2/E1/7SW-C/C77)	Geotechnical Engineering Office	November 1981
Stage 3 Study (S3R xx/yyyy)	Consultants Ltd.	December yyyy

Appendix X - Summary of Previous Studies Carried Out

APPENDIX XI

AS-BUILT DRAWINGS

[DRAWING NO. LPM/xxxx/061C]

[DRAWING NO. LPM/xxxx/062C]

APPENDIX XII

RATIONALE FOR LANDSCAPE DESIGN WORKS

Example A1 - Landscape Softworks to a Hard Surfaced Soil Cut Slope (Roadside Environment) Sheet 1 of 2

Slope before upgrading works (2001)

Site Characteristic and Constraints

- 16 m high, 50° soil cut slope
- Existing sprayed concrete surface cover
- Extensive vegetation on 30° natural terrain above crest (i.e. constraint for cutting back the slope)
- Narrow footpath and road at the slope toe (i.e. a constraint for providing a sizeable toe planter)

Environmental Setting

- Reasonably exposed to sunlight (east-facing)
- Minimal potential shading problem, i.e. no significant overhanging trees
- Rural road at slope toe; not heavily trafficked; minimal wind effects or air pollution
- Adjacent woodland comprising exotic and native species including some small trees

Stakeholders' Views

- Support for removal of existing hard surfacing and replacement with planting
- Request to provide maintenance access and minimise future slope maintenance
- Footpath at toe to remain open during construction

Landscape Concept

- Replace existing hard surfacing with a layer of vegetation cover; allow natural dispersal of vegetation from adjacent hillside
- Provide planting at slope toe, if feasible

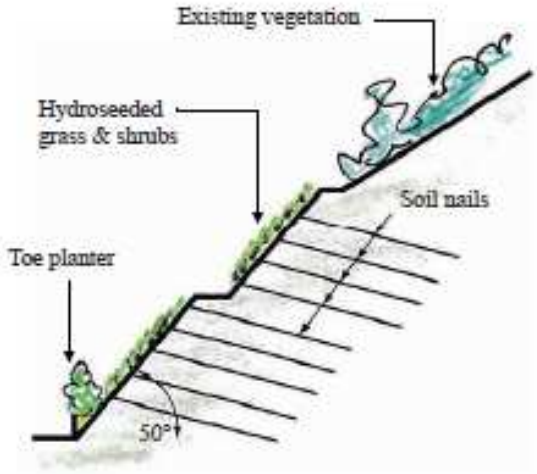
Slope Works and Landscaping Options

Option	Engineering Description (of selected option)	Landscape Considerations		
		Minimising Physical Impact	Landscape Softworks	Landscape Hardworks
1 Soil nailing (✔)	• Remove existing hard surfacing • Install soil nails • New drainage channels and maintenance access • Toe planter • Erosion control mat and wire mesh	• Retain majority of existing vegetation (i.e. least disturbance)	• Hydroseeded grass to slope surface • Groundcover plants and shrubs in toe planter	• Masonry facing to toe planter • Paint finish to exposed engineering elements and slope furniture
2 Cut back (40°)		• Considerable loss of existing vegetation and ecological habitats	• Ecological planting with pit planted larger shrubs for flatter slope area • Groundcover plants and shrubs in toe planter	
3 Retaining wall (3 m high)		• Likely loss of existing vegetation at the ends of the retaining wall • Wall surface may be visually unattractive	• Ecological planting of grass, trees and shrubs within the backfilled area • Grass and shrubs on upper portion of slope	• Masonry facing to toe planter • Paint finish to slope furniture

Example A1 **Sheet 2 of 2**

Option 1 is preferred because:

- *Lower construction cost than other options*
- *Relatively simple engineering works*
- *Least disturbance to the existing vegetation*
- *Low life-cycle cost of the landscaping works*
- *Stakeholders (District Council) preferred option*



Engineering and Landscape Works Implemented

- Soil nails and prescriptive raking drains
- New drainage system, maintenance access and handrailing
- Toe planter wall with masonry facing, groundcover plants and native shrubs
- Hydroseeded grass together with erosion control mat and wire mesh
- Painting of exposed engineering and slope furniture elements

Construction Precautions

- Protect surrounding vegetation from construction impact, dust, material spillages, etc.
- Minor adjustment of channel alignments to reduce disturbance to existing [illegible] roots and minimise visual impact

Maintenance and Sustainability

- If trees naturally disperse onto the slope, some trimming and thinning may be necessary in later years

Completed Works

Completion of construction (2005)

2 years after slope upgrading works (2007)

GCD 103

CERTIFICATE OF DESIGN AND COMPLETION
OF ~~SLOPES AND RETAINING WALLS~~ GEOTECHNICAL FEATURES

Certificate of Design and Completion of ~~Slopes and Retaining Walls~~Geotechnical Features
(to be completed by Project or Maintenance Department/Office or their Consultants)

Name of Government Department/Office : .....

Name of Consultants : .....

Agreement No. and Title : .....

Contract No. and Title : .....

.....

Appendix I: List of Geotechnical Features - Submissions and File Reference.

Appendix II: Location Plans of Geotechnical Features Listed in Appendix I

Appendix III: Record ~~Sheet~~s of Geotechnical Features Listed in Appendix I (Appendix A of Geoguide 5 refers)

Part 1 : Certificate of Design

We certify that :-

(a) we have exercised all reasonable skill and care to be expected of a professionally qualified and competent person, experienced in work of a similar nature and scope, in the performance of duties relating to the preparation, review, checking and certification of the design and amendments of design of the geotechnical feature(s) as shown and described in the submissions listed in Appendix I;

(b) the design and amendments of design shown in Appendix I complied with the relevant standards at the time when they were carried out and an in-house independent check has been undertaken and completed to confirm that they are complete, adequate, and valid, and all conditions imposed under the Geotechnical Engineering Office's checking procedures in relation to these designs and amendments of design have been complied with; and

(c) the design and amendments of design shown in Appendix I have been conveyed accurately and completely to the Engineer for the Contract for execution.

Date : ..... Signed : .....

Name : .....

Designation : .....

Part 2 : Certificate of Completion

I certify that the geotechnical works for the geotechnical feature(s) listed in Appendix I have been completed in accordance with the design and amendments of design as conveyed to me by the designer.

Date : ..... Signed : .....

Name : .....

Designation : .....

GCD103 (1/2)
~~**Date: 01/04/2010**~~

Appendix I

List of Geotechnical Features - Submissions and File Reference

Consultant's File Ref. No. _____

GEO's File Ref. No. _____

GEO Feature No.(1)	Relevant Documents Checked(2)		Memo Reference and Date of Documents Submission to Checker(3)	Memo Reference and Date of Checker's Comments(3)	Remarks
	Drg. No.	Report Title			
			For Consultants designed LPM works, "Checker" refers to the Independent Checking Engineer appointed by the Consultants (ref. Clause 6.7.6.1 of CEDD OP-11).		

Notes:

(1) If GEO Feature No. is not available, provide a reference no. shown in the location plans at Appendix II.

(2) Not applicable if GEO checking on the design of prescriptive measures for slope upgrading works has been waived.

(3) If GEO checking on the design of prescriptive measures for slope upgrading works has been waived, the date of documents submitted for waiving the checking requirements and the response from GEO to the application should be provided.

GCD103 (2/2)
~~**Date: 01/04/2010**~~

GCD 104

GEO CHECKING CERTIFICATE FOR ~~SLOPES AND RETAINING WALLS~~GEOTECHNICAL FEATURES

~~**File ref:**~~

To _____ File ref.:
(Project Office/Department)

GEO Checking Certificate for ~~Slopes and Retaining Walls~~Geotechnical Features
Checking Certificate No.: ---

Agreement No. and Title : .....

.....

Contract No. and Title : .....

.....

GCD 102/103* Certificate of Stability Assessment / Design and Completion* of ~~Slopes and Retaining Walls~~Geotechnical Features (Submitted by the Consultant / In-house Design Team*)

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1. I confirm that the stability assessment / design* of the geotechnical feature(s) included in the Certificate of Stability Assessment / Design and Completion* of ~~Slopes and Retaining Walls~~Geotechnical Features as given in GCD 102/103* has been found to be satisfactory under the Geotechnical Engineering Office's checking requirements.

2.* (Other qualifying statements, in accordance with DPN 137, to be included as
~~3.*~~ appropriate, if any)
~~4.*~~ ~~The design and completion / stability assessment* of the geotechnical feature(s) referred to in this Checking Certificate covers only certain part(s) of the geotechnical feature(s) as delineated in the location plan(s) enclosed in Appendix II of GCD 102/103*.~~

~~The geotechnical feature(s) included in this Checking Certificate has(have) been upgraded using prescriptive measures. The design and construction review of the prescriptive measures have met all the requirements and principles stated in ETWB TCW No. 13/2005 and GEO Publication No. 1/2009.~~
~~(Other qualifying statements to be included as appropriate, if any)~~

.....

Date : ..... Signed : .....

( )

Deputy Head of the Geotechnical Engineering Office
(Landslip Preventive Measures)
Civil Engineering and Development Department

* Delete whichever is not applicable.

GCD104 ~~(Rev 4)~~ (1/1)
~~**Date: 01/04/2010**~~

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