REVIEW OF THE JUNE 2004 WASHOUT INCIDENT ON SLOPE NO. 10SW-D/C97 AT ADDICTION TREATMENT CENTRE, HEI LING CHAU

GEO REPORT No. 201

Fugro Scott Wilson Joint Venture

GEOTECHNICAL ENGINEERING OFFICE
CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT
THE GOVERNMENT OF THE HONG KONG
SPECIAL ADMINISTRATIVE REGION

REVIEW OF THE JUNE 2004 WASHOUT INCIDENT ON SLOPE NO. 10SW-D/C97 AT ADDICTION TREATMENT CENTRE, HEI LING CHAU

GEO REPORT No. 201

Fugro Scott Wilson Joint Venture

This report was originally produced in May 2005 as GEO Landslide Study Report No. LSR 6/2005

First published, January 2007

Prepared by:

Geotechnical Engineering Office,
Civil Engineering and Development Department,
Civil Engineering and Development Building,
101 Princess Margaret Road,
Homantin, Kowloon,
Hong Kong.

PREFACE

In keeping with our policy of releasing information which may be of general interest to the geotechnical profession and the public, we make available selected internal reports in a series of publications termed the GEO Report series. The GEO Reports can be downloaded from the website of the Civil Engineering and Development Department (http://www.cedd.gov.hk) on the Internet. Printed copies are also available for some GEO Reports. For printed copies, a charge is made to cover the cost of printing.

The Geotechnical Engineering Office also produces documents specifically for publication. These include guidance documents and results of comprehensive reviews. These publications and the printed GEO Reports may be obtained from the Government's Information Services Department. Information on how to purchase these documents is given on the second last page of this report.

R.K.S. Chan
Head, Geotechnical Engineering Office
January 2007

FOREWORD

This report presents the findings of a review of a washout failure that occurred on 21 June 2004 at slope No. 10SW-D/C97, located within the Correctional Services Department Addiction Treatment Centre at Hei Ling Chau. The washout involved a failure volume of about 0.05 m^3 and occurred at the location of a soil nail head. No casualties or damage to property were reported as a result of the incident.

The key objectives of the review were to document the facts about the incident, the site history and pertinent observations made by FSW. The scope of the review does not include any ground investigation or detailed diagnosis of the causes of the incident. Recommendations for follow-up actions are reported separately.

The report was prepared as part of the 2004/2005 Landslide Investigation Consultancy (LIC) for Hong Kong Island and Outlying Islands, for the Geotechnical Engineering Office (GEO), under Agreement No. CE 29/2003 (GE). This is one of a series of reports produced during the consultancy by Fugro Scott Wilson Joint Venture (FSW).

K C Koo
Project Director
Fugro Scott Wilson Joint Venture

Agreement No. CE 29/2003 (GE)
Study of Landslides Occurring in Hong Kong Island and Outlying Islands in 2004 and 2005

CONTENTS

1. INTRODUCTION

On 21 June 2004, a localised minor washout failure occurred at the location of a soil nail head on slope No. 10SW-D/C97 within the Correctional Services Department (CSD) Addiction Treatment Centre at Hei Ling Chau (Figure 1). Slope No. 10SW-D/C97 is located within the boundary of a secured area above dormitories and outbuildings associated with the facility. The slope was upgraded under the Landslip Preventive Measures (LPM) Programme in 2002. No casualties or damage to property were reported as a result of the incident.

Following the incident, Fugro Scott Wilson Joint Venture (FSW), the 2004 and 2005 Landslide Investigation Consultants, carried out a review of the washout failure for the Geotechnical Engineering Office (GEO) of the Civil Engineering and Development Department (CEDD), under Agreement No. CE 29/2003 (GE).

This review report documents the facts about the incident, the site history and pertinent observations made by FSW in respect to the subject slope. Additionally, relevant observations are presented from inspection of a further seven slopes located within the CSD correctional institutions at Hei Ling Chau that were contemporaneously upgraded under the LPM Programme. The scope of the review does not include any ground investigation or detailed diagnosis of the causes of the incident. Recommendations for follow-up actions are reported separately.

2. SITE DESCRIPTION

2.1 Site Description

Slope No. 10SW-D/C97 is located within the women's compound of the CSD Addiction Treatment Centre, located on the south-western coastline of Hei Ling Chau (Figure 1). The slope was upgraded under the LPM Programme in 2002.

Slope No. 10SW-D/C97 is located along the eastern boundary of the women's compound and comprises a westerly facing soil nailed cut slope about 115 m long and from 38º to 50º steep, with height varying from 2 m at the southern end to 13 m at the northern end (Figure 2). The slope face is covered by "Tensar-Mat" erosion control mat with no wire mesh, which supports a low cover of vegetation comprising mostly grass (Plate 1). Prescriptive raking drains are installed along the lower portion of the slope face. There is a 1.5 m wide berm at the slope crest, along which is a 4 m high steel mesh security fence (Plate 2).

Beyond the security fence, the local topography comprises heavily vegetated natural hillside with a slope angle of about 35º, the lower 8 m of which has been cleared and re-vegetated in association with the recent slope upgrading works. Formation of the crest berm has resulted in a maximum 1 m high 70º soil cut at the transition with the natural hillside. The upper extent of the re-vegetated area is defined by a 375 mm U-channel (Plate 3). The downslope wall of the channel has been extended upwards by about 450 mm.

The area in front of the slope toe comprises a concrete paved platform occupied by dormitories and outbuildings associated with the CSD facility, the closest located about 1 m

from the slope toe (Plate 1). A 750 mm wide covered drainage channel is located at the slope toe (Plate 4).

2.2 Water-carrying Services

According to the Slope Information System (SIS), there are no water-carrying services in the immediate vicinity of slope No. 10SW-D/C97.

3. MAINTENANCE RESPONSIBILITY

According to the Slope Maintenance Responsibility Information System of the Lands Department as of November 2004, slope No. 10SW-D/C97 is under the maintenance responsibility of the Architectural Services Department.

4. SITE DEVELOPMENT AND PREVIOUS INSTABILITIES

4.1 Site Development

The development history of the site was established from a review of the file records in the GEO, which include details of an aerial photograph interpretation (API) completed by the LPM consultants in 2001.

A cutting and terraces were originally formed at the location of slope No. 10SW-D/C97 at some time prior to 1964. Further excavation was carried out in 1979 as part of the site formation works for the CSD facility to form a 13 m high and 115 m long cut slope with face angle of 38º to 50º. The slope face was chunamed and a footpath was observed along the crest. No major modifications to the slope were observed between 1979 and 2000. The CSD facility was observed to be under re-development in the 2000 aerial photographs.

Slope upgrading works were carried out to the slope under the LPM Programme between May 2002 and November 2002 (see Section 5).

4.2 Previous Instabilities

According to the GEO landslide database, no previous landslide incidents have been recorded on slope No. 10SW-D/C97 or on features in the immediate vicinity.

According to the LPM consultants, two landslide scars about 10 m to 15 m wide were observed at the southern end of slope No. 10SW-D/C97 in the 1964 aerial photographs prior to the formation of the original slope feature in 1979.

5. PREVIOUS ASSESSMENTS AND SLOPE UPGRADING WORKS

A Stage 3 Study was completed for slope No. 10SW-D/C97 by Halcrow China Ltd

(HCL) under Agreement No. CE 40/2000 in early 2002. The subsequent slope upgrading works to the slope were completed by Fuk Shing Engineering Co. Ltd under Contract No. GE/2001/27 between May 2002 and November 2002.

Based on the GEO's records, the Stage 3 Study report was not selected for checking by District Division.

Site-specific ground investigation completed as part of the Stage 3 Study and the results of previous ground investigations at the site confirmed that slope No. 10SW-D/C97 consisted of completely to highly decomposed granite, overlain by about 2.5 m of colluvium and a thin layer of fill at the slope crest.

The slope upgrading measures design presented in the Stage 3 Study report comprises a soil nailing arrangement involving up to five rows of soil nails between 6 m and 15 m in length installed at 2 m by 2 m horizontal and vertical centres on a staggered grid in the upper portion of the slope face. The 400 mm by 400 mm soil nail heads are recessed 100 mm beneath the slope face and covered by soil filled hessian bags. In addition, the installation of prescriptive raking drains and the upgrading of the surface drainage system were recommended, as well as soft landscaping comprising hydroseeding covered by erosion control mat, with secondary planting of shrubs. The soft landscaping detail was extended to include the portion of natural hillside above the slope crest in the vicinity of a new 375 mm U-channel to be constructed as part of the works.

Upgrading works for slope No. 10SW-D/C97 were carried out between May 2002 and November 2002. According to the as-constructed drawings in the Maintenance Manual for the feature, the works included installation of 170 no. soil nails between 6 m and 15 m in length in up to five rows, 29 no. 8 m long prescriptive raking drains along the slope toe, surface drainage works, hydroseeding with erosion control mat and shrub planting. No wire mesh netting was included as part of the slope upgrading works.

No significant re-profiling of the slope face was carried out as part of the slope upgrading works. The arrangement at the soil nail heads involved the head being formed below the slope surface level to a depth of 100 mm and covered with soil-filled hessian bags prior to placement of the erosion control mat (Figure 3).

Records relating to the handing back of the works area following completion of the upgrading works indicate that seepage had been observed at the slope toe at the southern end of the feature.

In October 2003, the ArchSD conducted a Routine Maintenance Inspection of slope No. 10SW-D/C97. The inspection report recorded that no routine maintenance works were required.

6. THE JUNE 2004 WASHOUT AND POST-FAILURE OBSERVATIONS

6.1 Description of the 21 June 2004 Washout Incident on Slope No. 10SW-D/C97

The June 2004 washout (Plate 4) occurred at a soil nail head located in the central portion of the slope (see Figure 2), about 7.5 m above the slope toe. A cross-section through

this portion of the slope is presented in Figure 4. The washout was first observed by CSD staff on 21 June 2004.

The dimensions of the washout source area are of the order of 0.6 m x 0.6 m. The washout involved the soil nail head backfill material within a depth of around 0.1 m below the slope surface, exposing the nail head beneath. Debris from the washout deposited on the slope face and was carried down to the drainage channel at the slope toe.

6.2 Post-failure Observations by FSW

6.2.1 Slope No. 10SW-D/C97

FSW inspected the slope on 19 July 2004. By this time, the washout scar had been reinstated with cement mortar (Plate 5), covering the exposed nail head. The majority of debris from the incident had been cleared, with only traces present near the slope toe. No obvious signs of seepage or distress were observed on the subject cut slope.

The slope face at the location of the washout scar incorporates a shallow concavity extending from the crest to the toe of the slope (Plate 6), which is followed by the alignments of the security fence footing at the slope crest and the toe drainage channel. No obvious signs of distress or movement were observed in the general area immediately beyond the crest of the cut slope. The 375 mm U-channel located upslope from the crest berm was found to be in good condition and no signs of blockage were observed. The arrangement of this channel provides an effective cut-off from any surface runoff generated by the hillside above.

At the time of the 8 September 2004 inspection, vegetation on the slope face, mostly comprising grass, had been trimmed, providing a clear view of the condition of the erosion control mat. CSD staff in attendance at the inspection advised FSW that the most recent trimming had been carried out in early August 2004, and that trimming works were performed on an ad hoc basis according to the rate of growth of the vegetation. The general approach being employed was to keep vegetation within the compound trimmed as low as possible, both to reduce the likelihood of attracting wildlife from the adjacent natural hillside (e.g. snakes) as well as to limit areas of cover for exploitation by inmates. Trimming of the vegetation was carried out by male inmates issued with garden shears, who accessed the slope face directly on foot.

The erosion control mat covering the slope face was of a “Tensar-Mat” type comprising two layers of bonded geogrid. The outer one is a waffled grid of heavier gauge than the mesh backing layer (Plate 7). Both layers could be torn by hand with little difficulty.

The lap between adjacent strips of erosion control mat (Plate 8) was relatively uniform and about 250 mm to 300 mm in width. Laps generally appeared to have been adequately stapled to the slope face.

The erosion control mat appeared to have been cut in many locations, with loose flaps hanging down exposing the slope face (Plate 9). In a number of areas, the outer layer of the erosion control mat was completely absent, with only the finer mesh net backing layer remaining (Plate 10). At numerous locations, particularly where only the backing layer was present, the erosion control mat was torn over small areas around 100 mm in diameter

(Plate 11), which can be interpreted as the damage from pedestrian access to the slope face during vegetation trimming works.

A soil nail head below the one at which the June 2004 washout occurred, and at which the erosion control mat had also been cut was inspected in detail by FSW. A small erosion scar was observed in the upper portion of the area (Plate 12). The remains of the soil-filled hessian bags were identified, and a piece of Hessian was removed (Plate 13), which proved to have rotten and was easily broken up by hand.

Little damage or disturbance to the erosion control mat was observed at the extreme southern end of the slope (Plate 14), where the slope height reduces and the slope angle increases, probably sufficiently to prevent foot access to the slope face.

At the time of the 7 December 2004 inspection, seepage was observed from the raking drains at the southern end of the feature and at various locations of the slope toe (Plate 15).

6.2.2 Other LPM Slopes

Another seven slopes contemporaneously upgraded under the LPM Programme in 2002 and 2003, namely slopes Nos. 10SW-D/C27, 10SW-D/C28, 10SW-D/C35, 10SW-D/F55, 10SW-D/C101, 10SW-D/C102 and 10SW-D/C139 were inspected by FSW between December 2004 and March 2005 as part of the current review. These slopes are situated at various locations around the CSD facilities at Hei Ling Chau (Table 1).

CSD staff advised FSW that these features were subject to a maintenance regime involving manual trimming of vegetation at a frequency of about 6-monthly intervals, with additional work carried out on an ad hoc basis prior to periodic visiting by various dignitaries.

Slopes Nos. 10SW-D/C27, 10SW-D/C35 and 10SW-D/C139 (Plates 16, 17 and 18) incorporate a wire mesh netting lying over the erosion control mat. This appeared to have provided a barrier against trimming tools and mitigated the abrasive effects of pedestrian access, as in all cases, the erosion control mat was found to be in good condition, with no obvious signs of damage (Plates 19, 20 and 21).

The erosion control mats on slopes Nos. 10SW-D/C28, 10SW-D/C101 and 10SW-D/C102 (Plates 22, 23 and 24), which did not incorporate wire mesh netting, all showed signs of having been cut after placement (Plates 25, 26 and 27), although to a lesser extent than that observed on slope No. 10SW-D/C97 where the June 2004 landslide incident occurred. A factor in the condition of the erosion control mat for these slopes appeared to be the choice of different vegetations, as the ‘creeper’ type vegetation cover applied to the upper batter of slope No. 10SW-D/C28 and also slope No. 10SW-D/C27 (Plates 28 and 19 respectively) formed a network of stems on the erosion control mat that did not appear to be removed during vegetation trimming (underway on slope No. 10SW-D/C28 at the time of inspection by FSW in March 2005), whilst the grass cover on the lower batter of slope No. 10SW-D/C28 and slope No. 10SW-D/C102 had been trimmed down to the erosion control mat.

A further observation was made in relation to the establishment of vegetation on the

face of slope No. 10SW-D/C101 (Plates 23 and 29), which appeared to be hindered by the extensive tree cover and resulting leaf litter, as well as the gap between the erosion control mat and the underlying ground surface over significant areas. These two features probably further limited the amount of sun light reaching the slope face and reduce vegetation growth.

At the time of the inspection by FSW of slope No. 10SW-D/F55 in December 2004, which did not incorporate wire mesh netting or erosion control matting at the slope face, the majority of the slope face had recently undergone vegetation trimming (Plate 30). A small portion of the eastern end of the feature retained a dense cover of grass and creeper vegetation (Plate 31). A number of areas on the slope face were completely stripped of vegetation, exposing the topsoil below (Plates 32 and 33).

7. RAINFALL RECORDS

The nearest GEO automatic raingauge (No. N25) to the site is located at the Peng Chau Indoor Recreation Centre, Peng Chau about 4 km north of the site (Figure 1). The daily rainfall records of raingauge No. N25 for the period prior to the June 2004 washout incident are presented in Figure 5. These indicate that about 150 mm of rainfall occurred in the 24-hour period prior to the failure. Based on historical rainfall data at the Hong Kong Observatory (Lam & Leung, 1994), the corresponding return period of the rainfall recorded prior to the 21 June 2004 washout is about 7 years (Table 2).

8. DISCUSSION

The June 2004 incident on slope No. 10SW-D/C97 was a minor washout incident involving a recently upgraded soil cut slope with vegetated cover during moderate rainfall. The failure occurred at a slight surface depression on the slope face.

Inspections by FSW of the subject slope, together with seven other vegetated slopes in the vicinity of the CSD correctional institutions in Hei Ling Chau upgraded under the LPM Programme in 2002 and 2003, have facilitated an overall appraisal of the conditions of the respective features which have different slope surface protection detailing and frequency of vegetation trimming. In all the soil nailed cut slopes inspected, soil-filled hessian bags were used to cover the recessed concrete soil nail heads for the establishment of a continuous vegetated cover.

The subject slope (No. 10SW-D/C97) has undergone frequent (i.e. 2-monthly intervals) and vigorous trimming of vegetation by the inmates using bladed shears. The slope was hydroseeded and provided with erosion control mat, but no wire mesh netting. The erosion control mat has been apparently cut accidentally in numerous places and it appears to have suffered further damage as a result of frequent movement on the slope face by the maintenance personnel. The other recently upgraded slopes provided with a similar surface protection detail, namely slopes Nos. 10SW-D/C28, 10SW-D/C101 and 10SW-D/C102, also showed similar evidence of damage to the erosion control mat, but of a lesser scale, probably as a result of the reduced frequency of vegetation trimming (i.e. 6-monthly intervals).

Slopes Nos. 10SW-D/C27, 10SW-D/C35 and 10SW-D/C139, which were provided

with wire mesh netting over the erosion control mat and subjected to vegetation trimming at 6-monthly intervals showed no signs of damage to the erosion control mat and wire mesh.

The provision of steel wire mesh appears to be effective in preventing damage to the underlying erosion control mat caused by foot access and/or the vegetation trimming operations, as well as preventing vegetation trimming activities from extensively denuding the slope face. Vigorous and repeated trimming of slope vegetation at relatively short intervals can prohibit the establishment of a healthy vegetation cover with a substantial root system, together with damage to the erosion control mat and the soil-filled hessian bags caused by uncontrolled cutting during the vegetation trimming operation, which was exacerbated by the absence of wire mesh over the soil nail head, meant that the soil within the hessian bags (which were subjected to deterioration through rotting within a timeframe of less than two years in this instance) was subjected to washout in the event of surface water flow.

9. REFERENCES

Lam, C.C. & Leung, Y.K. (1994). Extreme Rainfall Statistics and Design Rainstorm Profiles at Selected Locations in Hong Kong. Royal Observatory Technical Note No. 86. 89 p.

LIST OF TABLES

Table 1 - Summary of Field Observations

Slope No.	Location	Average Slope Angle (°)	Surface Protection		Typical Frequency of Vegetation Trimming	Date of Inspection by FSW	Site Observations by FSW
			Erosion Control Mat	Wire Mesh			
10SW-D/C97	Within eastern boundary of Womens' Compound	40 - 45	✓	×	2-monthly	19 July, 8 September and 7 December 2004	- Vegetation trimming using shears completed short time prior to inspections on 8 September and 7 December 2004 - Erosion control mat cut in many locations - Erosion control mat damaged as a result of pedestrian access to slope face during trimming
10SW-D/C27	North of hospital	55	✓	✓	6-monthly	11 March 2005	- Trimming with shears recently carried out at northeastern and southwestern ends of feature where slope face angle reduces. Elsewhere, vegetation not trimmed. - No obvious damage to erosion control mat beneath mesh netting - Use of ground cover 'creeper' vegetation provides additional natural 'mesh' over mesh netting and acts as trimming boundary - Distinct lack of vegetation growing beneath stand of casuarinas at northeastern end of slope where carpet of shed needles has accumulated
10SW-D/C35	East of workshop	35 - 50	✓	✓	6-monthly	11 March 2005	- Erosion control mat and mesh netting only provided on steeper (50º) southwesterly facing portion of slope - Vegetation trimmed with shears - No obvious damage to erosion control mat beneath wire netting - Trimming of vegetation on northerly facing portion of feature inclined at around 35º resulting in exposure of bare patches
10SW-D/C139	Northeast of isolation cells at Womens' Compound	55	✓	✓	6-monthly	7 December 2004	- Vegetation trimming using shears completed short time prior to inspection on 7 December 2004 - No obvious damage to erosion control mat beneath mesh netting observed
10SW-D/C28	Southwest of canteen	40 - 45	✓	×	6-monthly	11 March 2005	- Trimming with shears in progress on upper batter at time of inspection - Use of ground cover 'creeper' vegetation provides natural 'mesh' over erosion control mat and acts as trimming boundary - Grass on lower batter not trimmed - Isolated minor damage to erosion control mat on both batters
10SW-D/C101	Southeast of staff residential quarters Blocks P, Q and R	45	✓	×	6-monthly	11 March 2005	- Vegetation on slope face mostly patchy and hindered by tree canopy shading from direct sunlight, leaf litter from tree canopy and lack of contact between erosion control mat and slope face - Large areas of exposed erosion control mat - Vegetation trimmed with shears Isolated instances of erosion control mat having been cut.
10SW-D/C102	Southeast of temple near stall residential quarters	40	✓	×	6-monthly	11 March 2005	- Vegetation on slope face generally lies in shadow of tree canopy - Vegetation trimmed with shears Isolated instances of mesh netting having been cut.
10SW-D/F55	Below Hei Ling Chau Road near Womens' Compound	35	×	×	6-monthly	7 December 2004	- Majority of the slope face had recently undergone vegetation trimming, with a small portion at the eastern end of the slope retaining a dense cover of grass and creeper vegetation - A number of areas on slope face were completely stripped of vegetation, exposing the topsoil below

Table of Contents
Table of Contents
Table of Contents
Table of Contents

Table 2 - Maximum Rolling Rainfall at GEO Raingauge No. N25 for Selected Durations Preceding the 21 June 2004 Washout and the Estimated Return Periods

Duration	Maximum Rolling Rainfall (mm)	End of Period	Estimated Return Period (Years)
5 Minutes	9.5	00:50 on 21 June 2004	<2
15 Minutes	22.5	00:55 on 21 June 2004	<2
1 Hour	72.0	00:55 on 21 June 2004	2.1
2 Hours	121.0	01:00 on 21 June 2004	6.7
4 Hours	125.5	02:05 on 21 June 2004	2.3
12 Hours	151.0	09:20 on 21 June 2004	<2
24 Hours	153.0	06:00 on 21 June 2004	<2
2 Days	155.0	09:20 on 21 June 2004	<2
4 Days	155.0	09:20 on 21 June 2004	<2
7 Days	210.5	09:20 on 21 June 2004	<2
15 Days	234.0	09:20 on 21 June 2004	<2
31 Days	282.5	05:20 on 21 June 2004	<2

Notes:
(1) Return periods were derived from Table 3 of Lam & Leung (1994).
(2) Maximum rolling rainfall was calculated from 5-minute data.
(3) The use of 5-minute data for durations between 4 hours and 31 days results in better data resolution, but may slightly over-estimate the return periods using Lam & Leung (1994)'s data, which are based on hourly rainfall for these durations.

LIST OF FIGURES

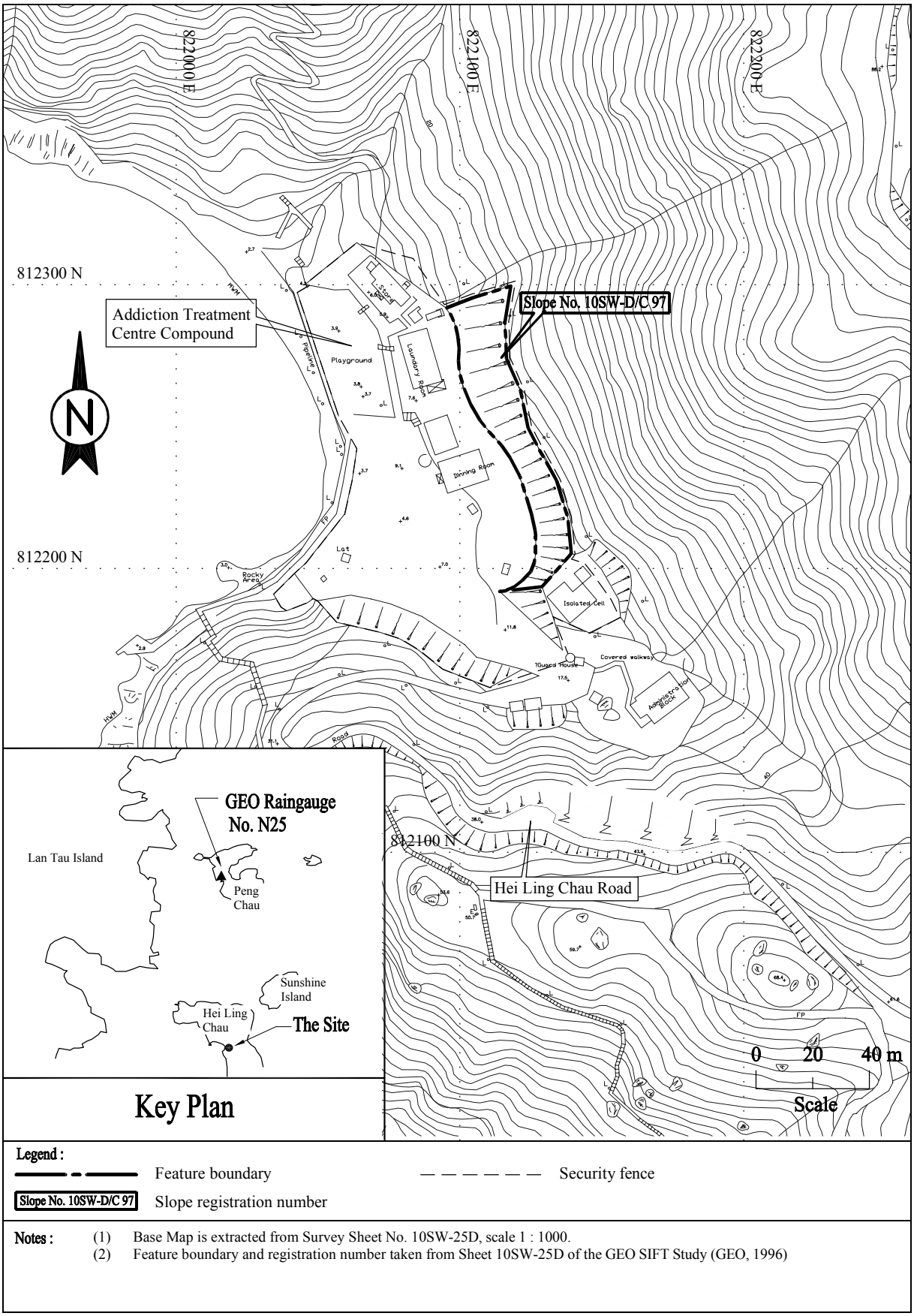


Figure 1 - Site Location Plan

Table of Contents
Table of Contents
Table of Contents
Table of Contents

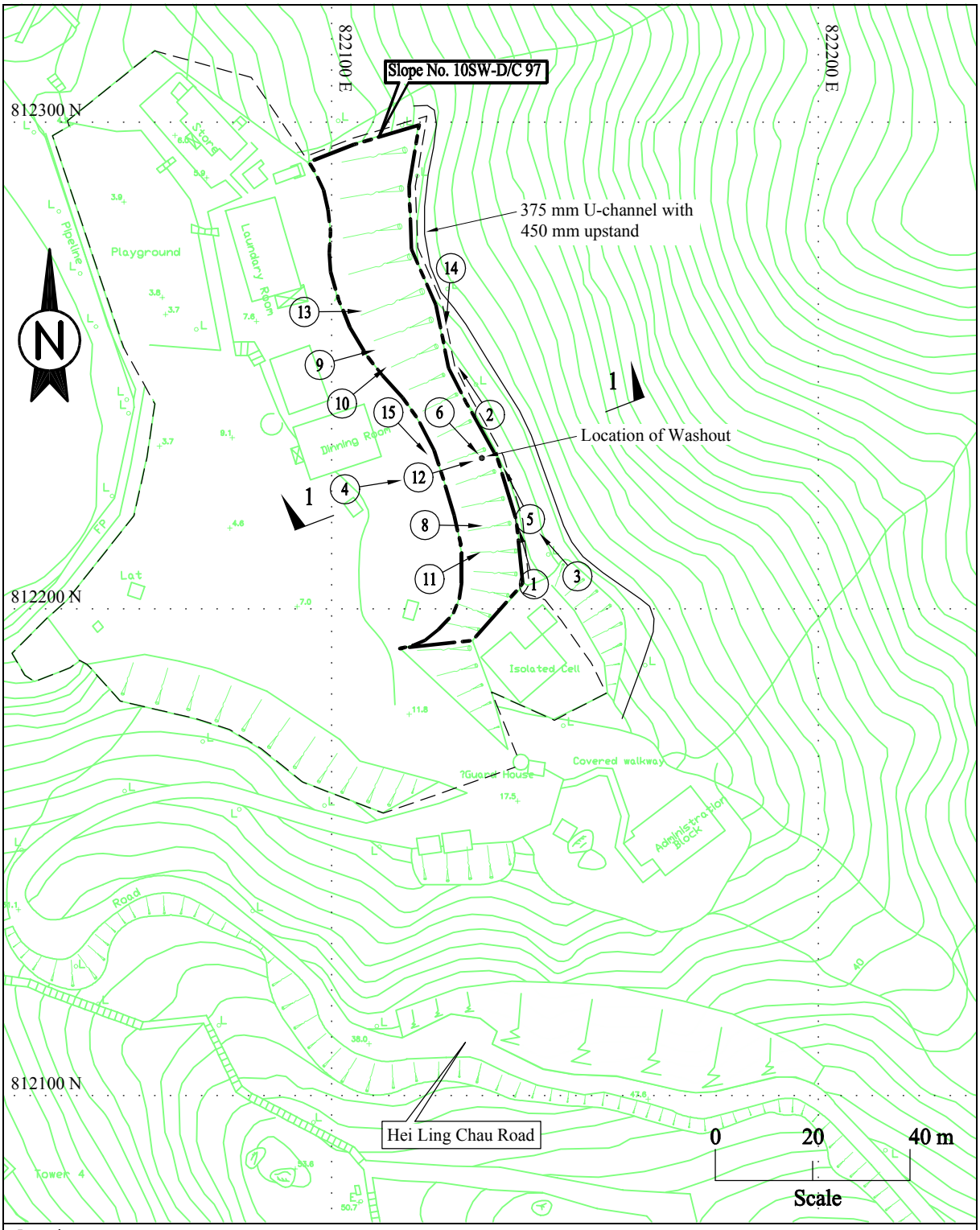
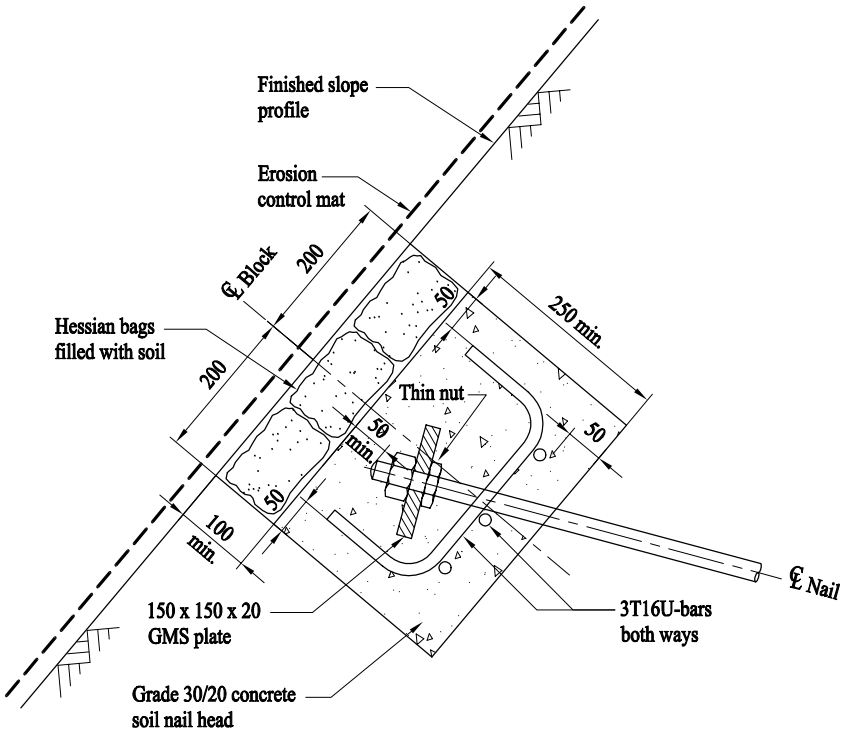


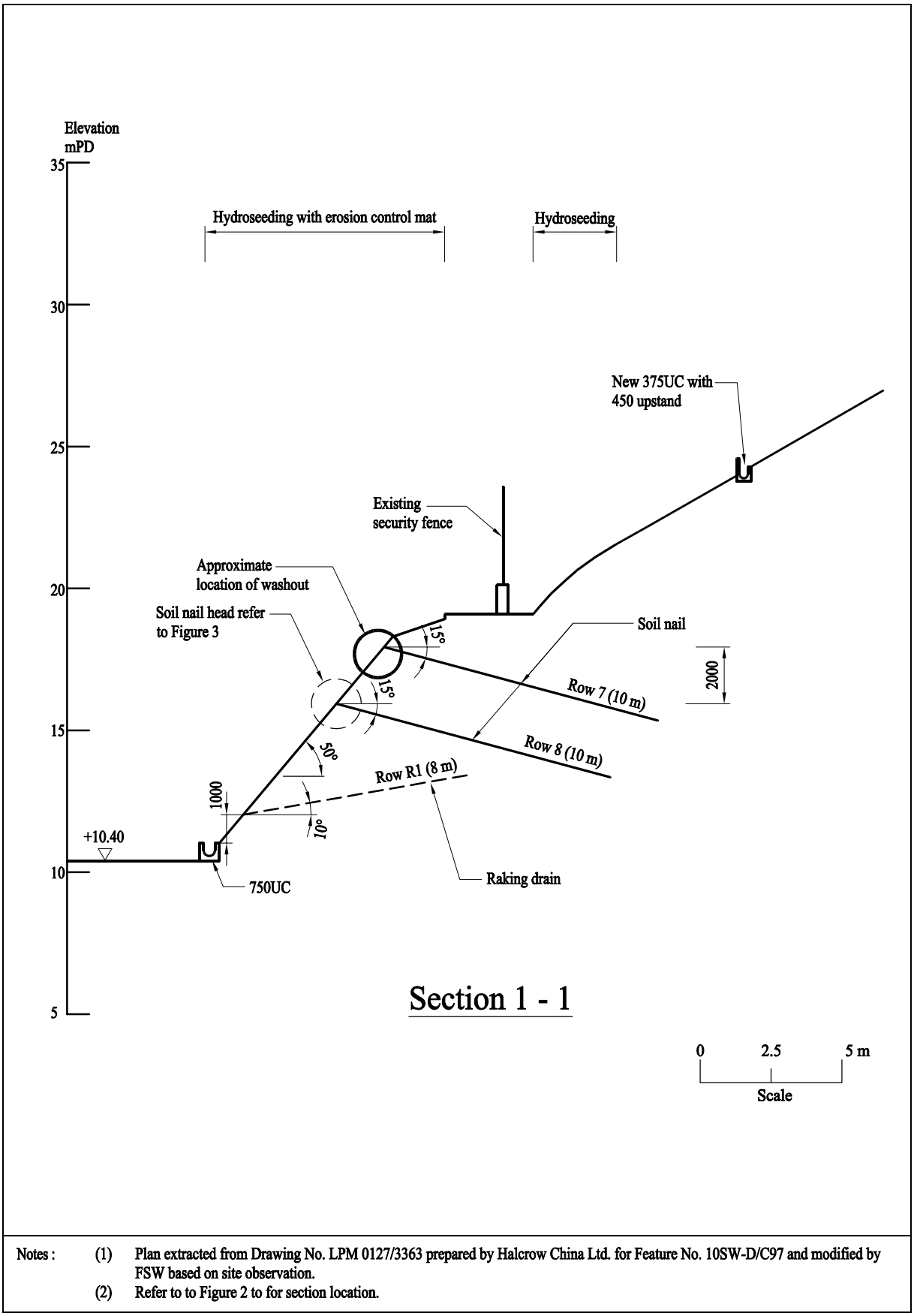
Figure 2 - Site Plan



Scale 1 : 10

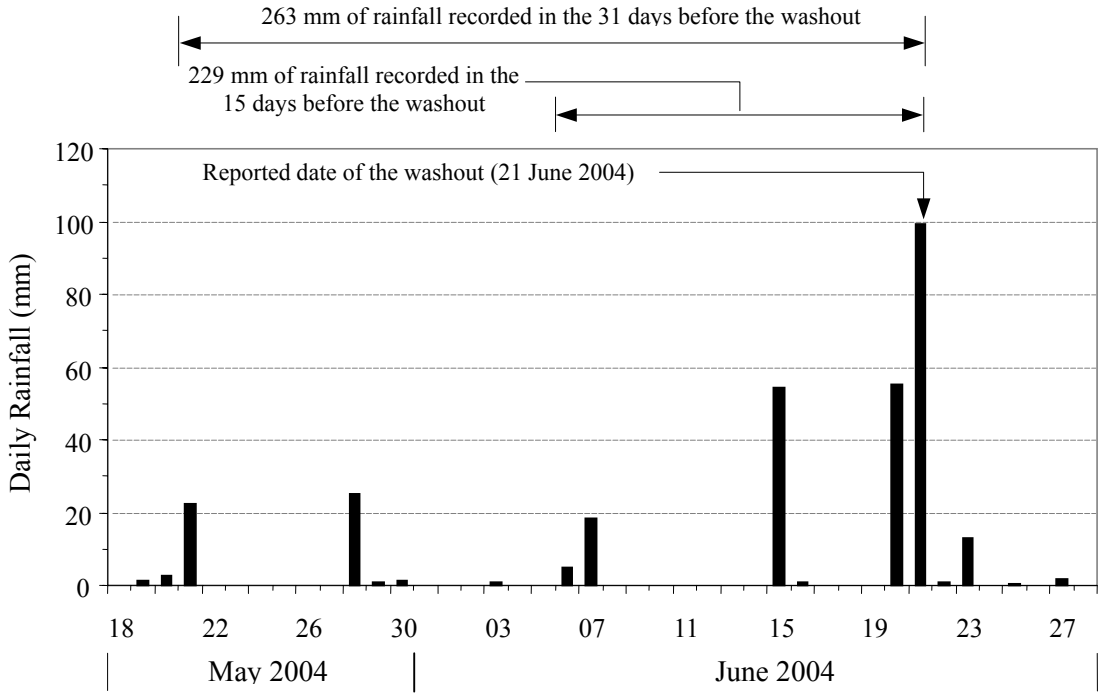
Note : Soil nail head detail extracted from Drawing Nos. LPM 0127/3363 prepared by Halcrow China Ltd.

Figure 3 - Soil Nail Head Detail for Slope No. 10SW-D/C97

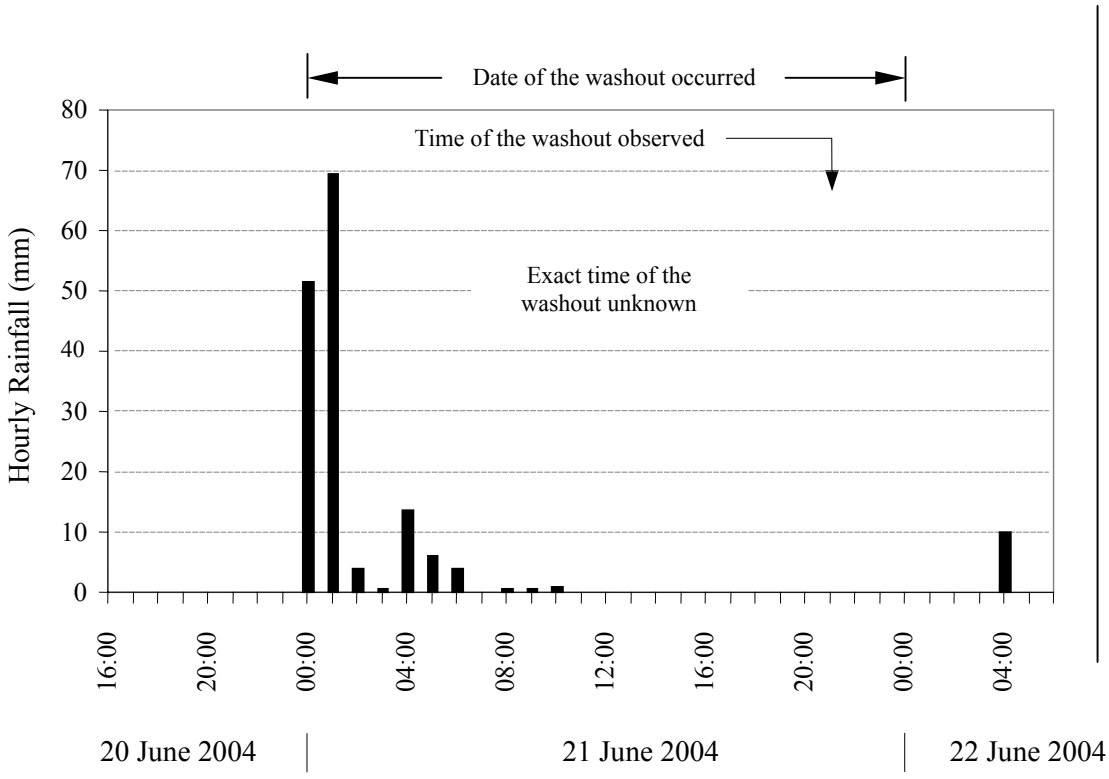


Notes :
(1) Plan extracted from Drawing No. LPM 0127/3363 prepared by Halcrow China Ltd. for Feature No. 10SW-D/C97 and modified by FSW based on site observation.
(2) Refer to to Figure 2 to for section location.

Figure 4 - Cross-section through Slope No. 10SW-D/C97 at the Washout Location



(a) Daily Rainfall Recorded between 18 May and 28 June 2004



(b) Hourly Rainfall Recorded between 16:00 hours on 20 June and 06:00 hours on 22 June 2004

Figure 5 - Rainfall Recorded at GEO Raingauge No. N25

LIST OF PLATES

Plate 1 - General View of Slope No. 10SW-D/C97 from South
(Photograph taken on 19 July 2004)

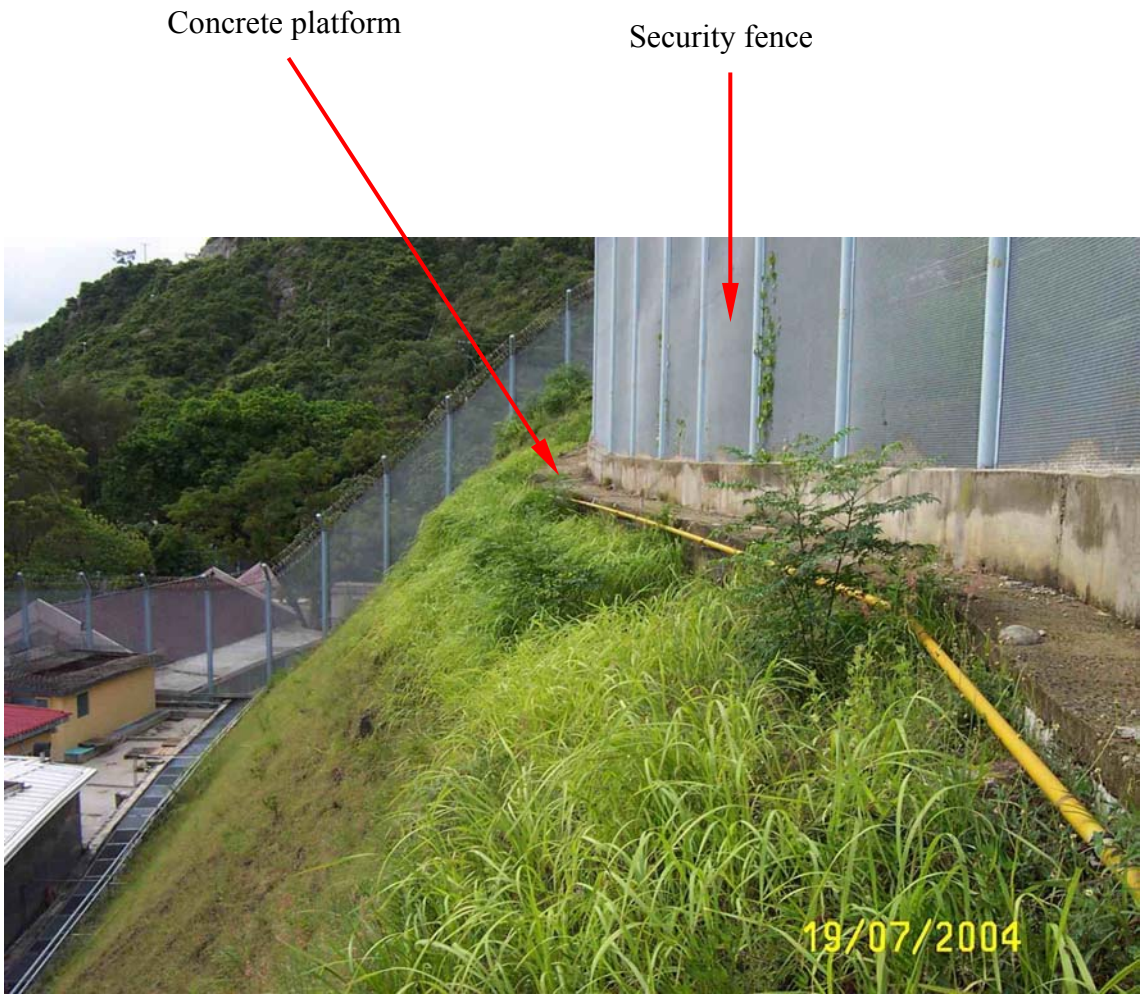


Plate 2 - General View of the Upper Portion of Slope No. 10SW-D/C97
(Photograph taken on 19 July 2004)

Table of Contents
Table of Contents
Table of Contents
Table of Contents

Plate 3 - General View of the 375 mm U-Channel Located Upslope of the Crest Berm of Slope No. 10SW-D/C97 Showing 450 mm Upstand on Channel Wall (Photograph taken on 19 July 2004)

Plate 4 - General View of the Washout Scar on Slope No. 10SW-D/C97
(Photograph taken on 19 July 2004)

Table of Contents
Table of Contents
Table of Contents
Table of Contents

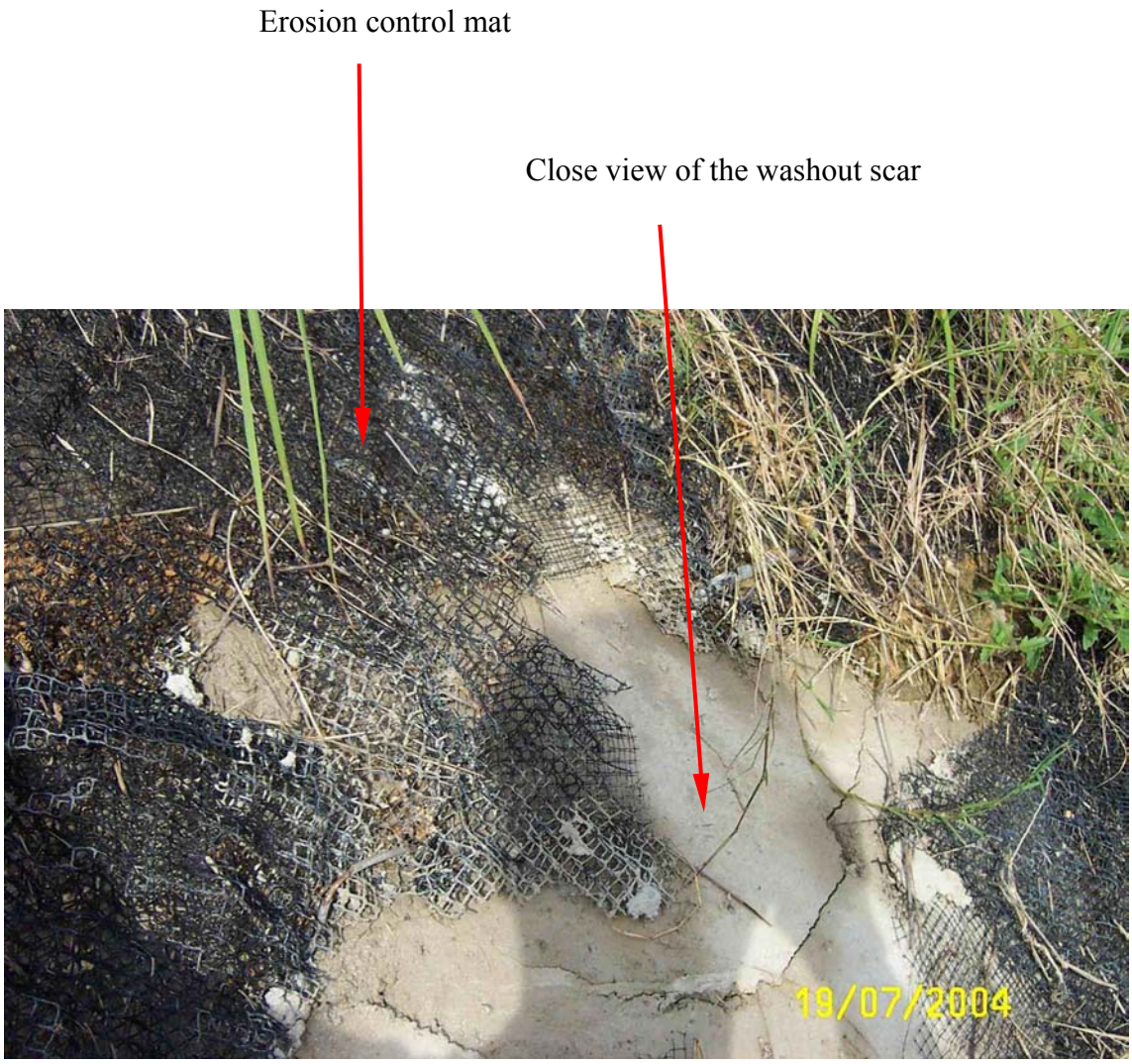


Plate 5 - Close View of the Repaired Washout Scar at Slope No. 10SW-D/C97
(Photograph taken on 19 July 2004)

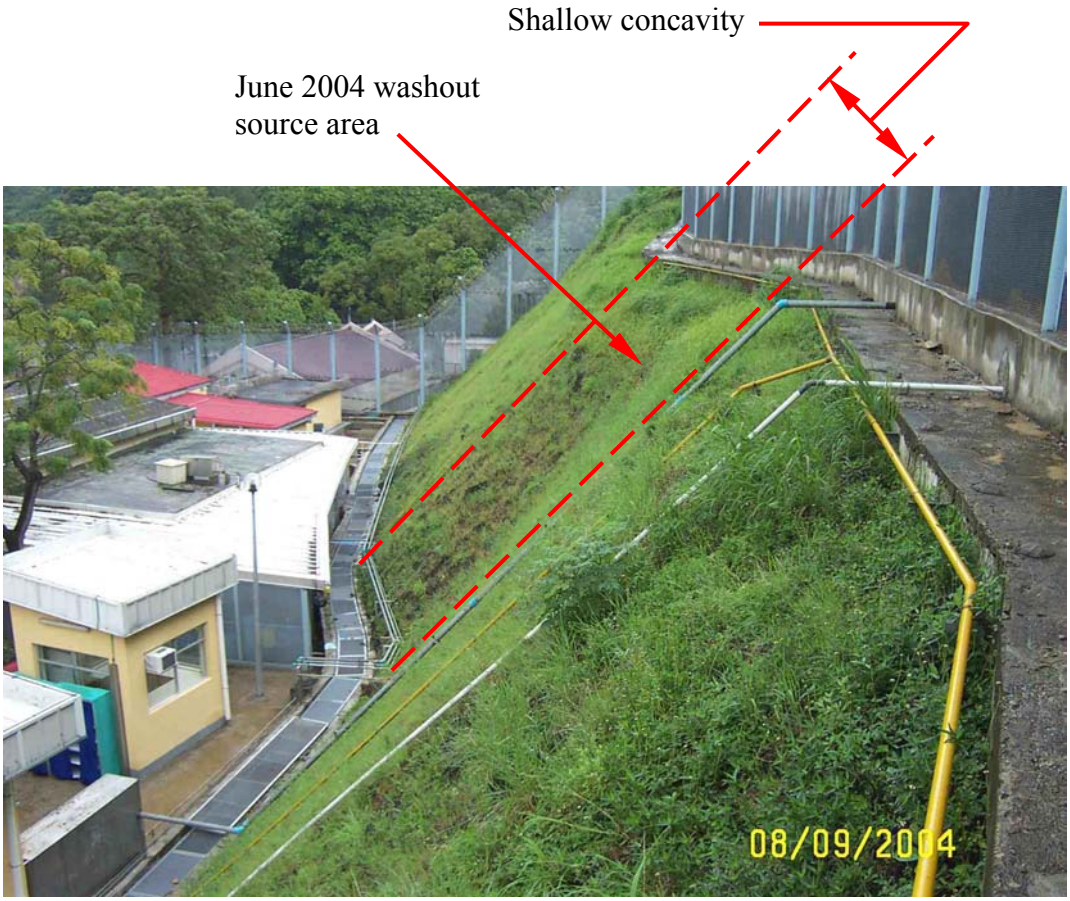


Plate 6 - View North along Crest Towards Location of the June 2004 Washout at Slope No. 10SW-D/C97 (Photograph taken on 8 September 2004)

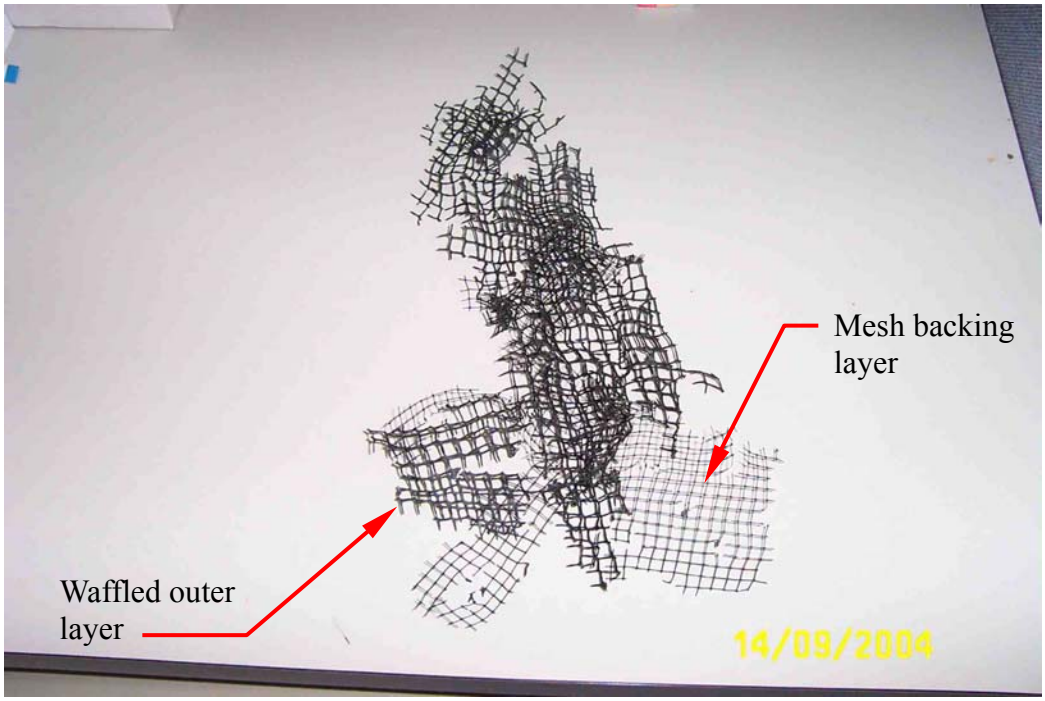


Plate 7 - Fragment of Erosion Control Mat Recovered from Toe of Slope No. 10SW-D/C 97 Showing Multiple Cuts

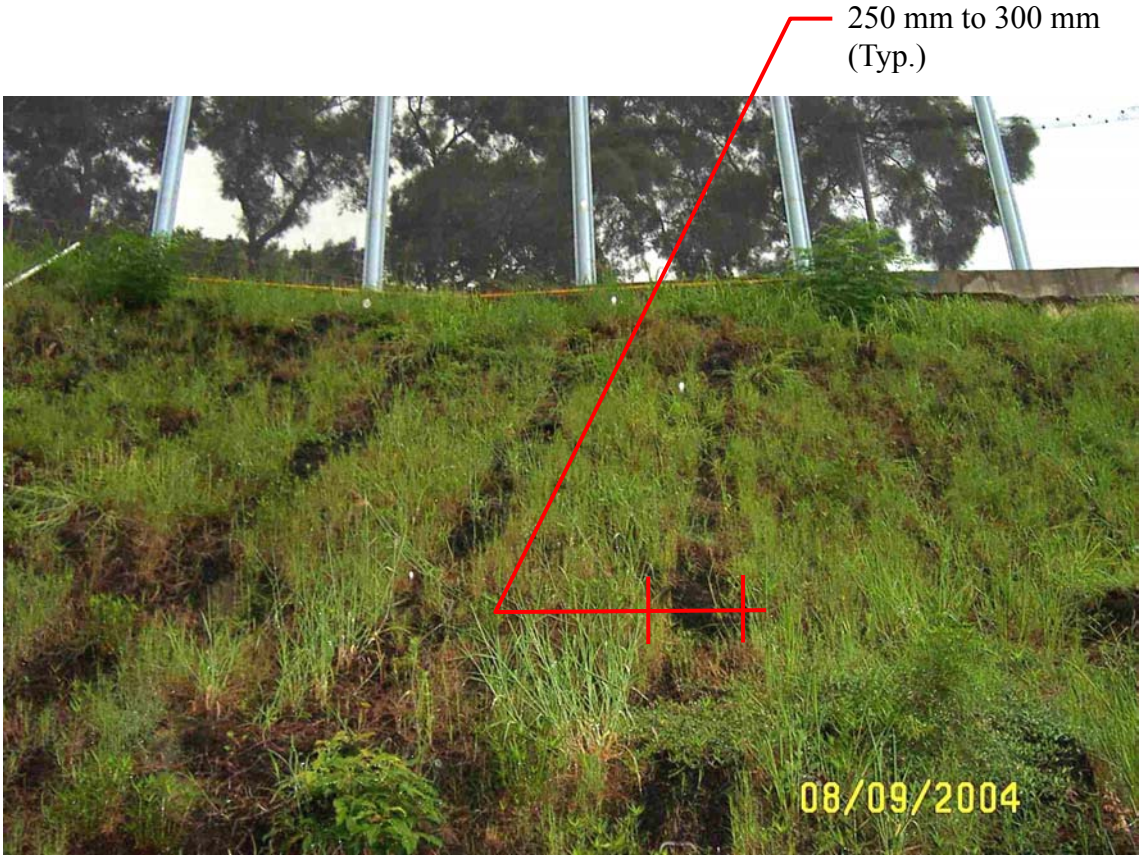


Plate 8 - General View of Central Portion of Slope Face from Toe Showing Typical Lap of Adjacent Sheets of Erosion ControlMats at Slope No. 10SW-D/C97 (Photograph taken on 8 September 2004)

Table of Contents
Table of Contents
Table of Contents
Table of Contents

Plate 9 - Example of Erosion Control Mat having been Cut and Loose Flap Hanging Down Slope Face of Slope No. 10SW-D/C97 (Photograph taken on 8 September 2004)

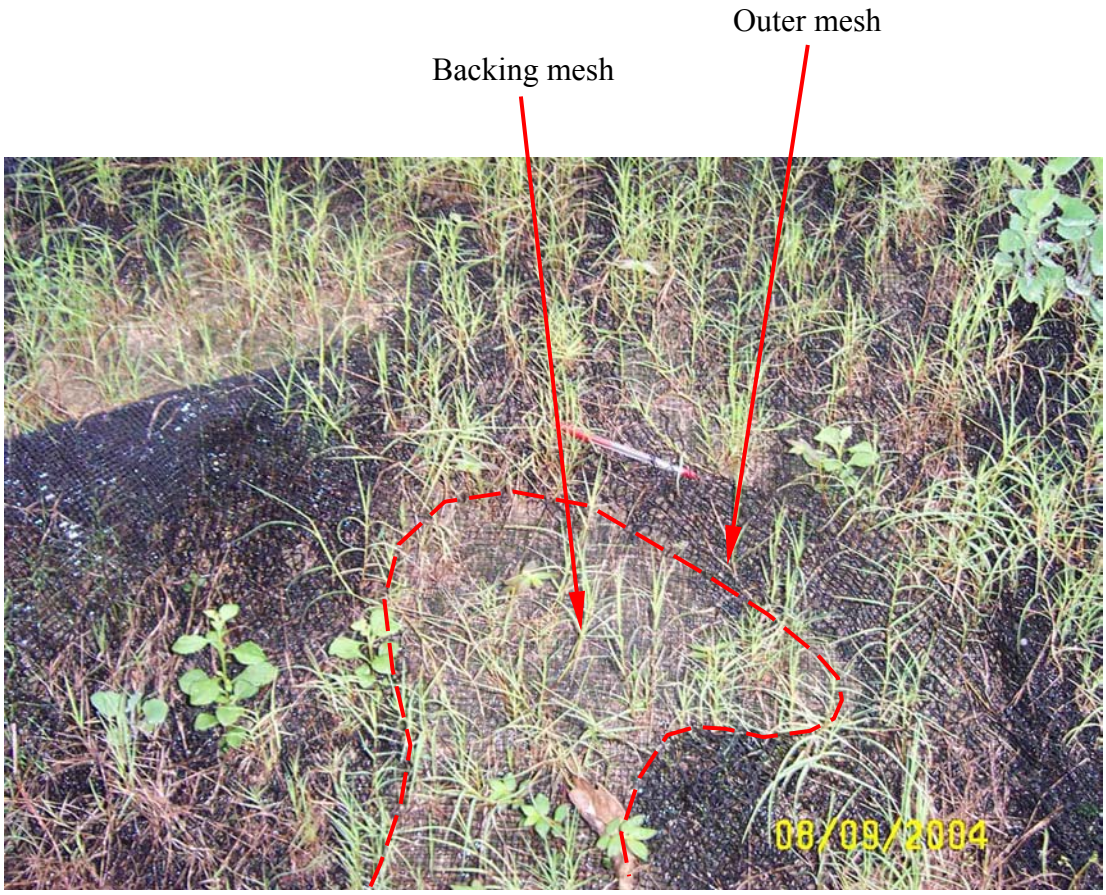


Plate 10 - Example of Location with Outer Layer of Erosion Control Mat having been Removed, Leaving only Backing Mesh in Place at Slope No. 10SW-D/C97 (Photograph taken on 8 September 2004)

Table of Contents
Table of Contents
Table of Contents
Table of Contents

Plate 11 - Example of Location where Backing Mesh has been Torn to Expose Slope Face of Slope No. 10SW-D/C97 (Photograph taken on 8 September 2004)

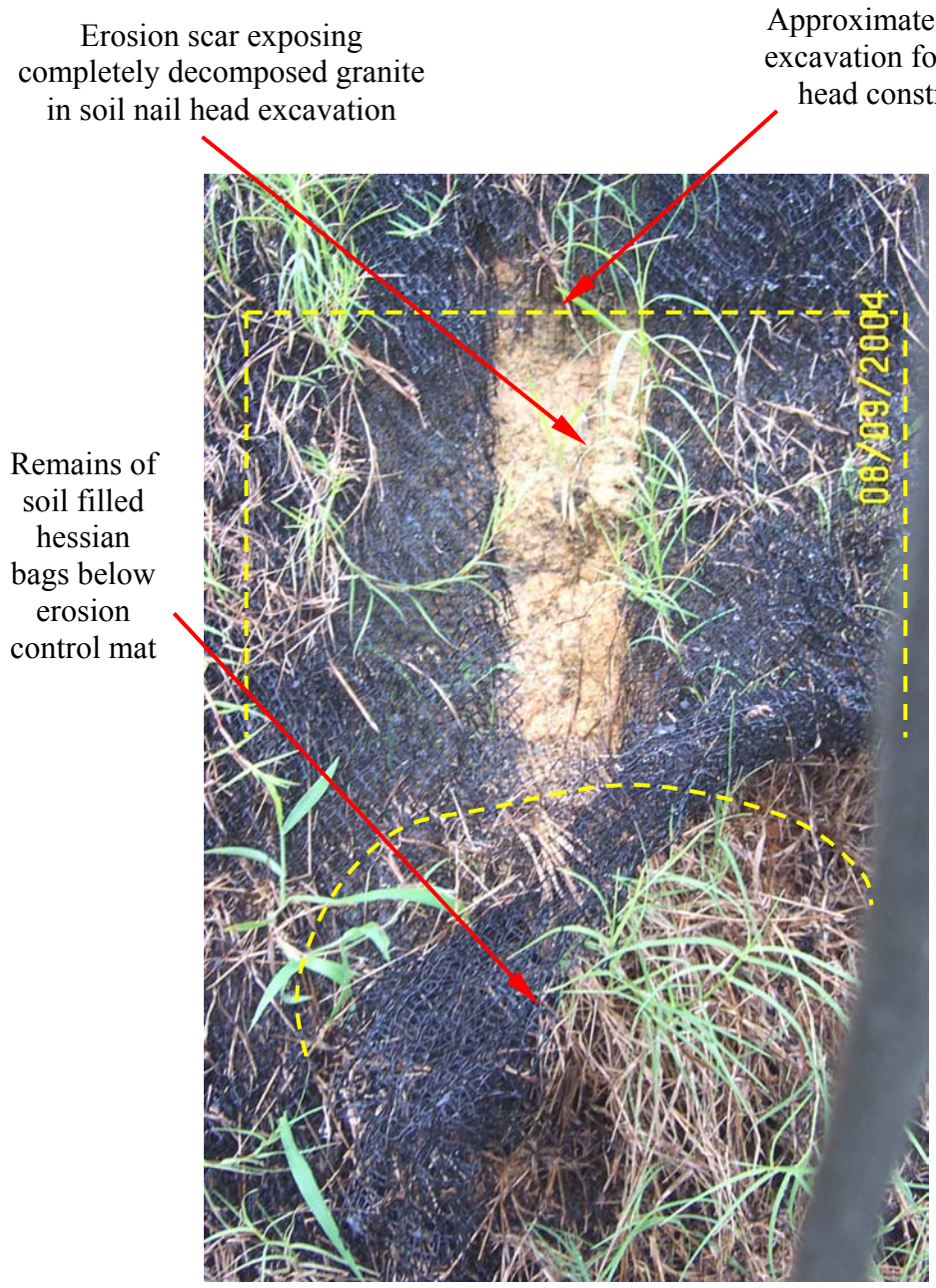


Plate 12 - Soil Nail Head below the Location of June 2004 Washout Showing Erosion Control Mat having been Cut and Erosion Scar at Slope No. 10SW-D/C97 (Photograph taken on 8 September 2004)

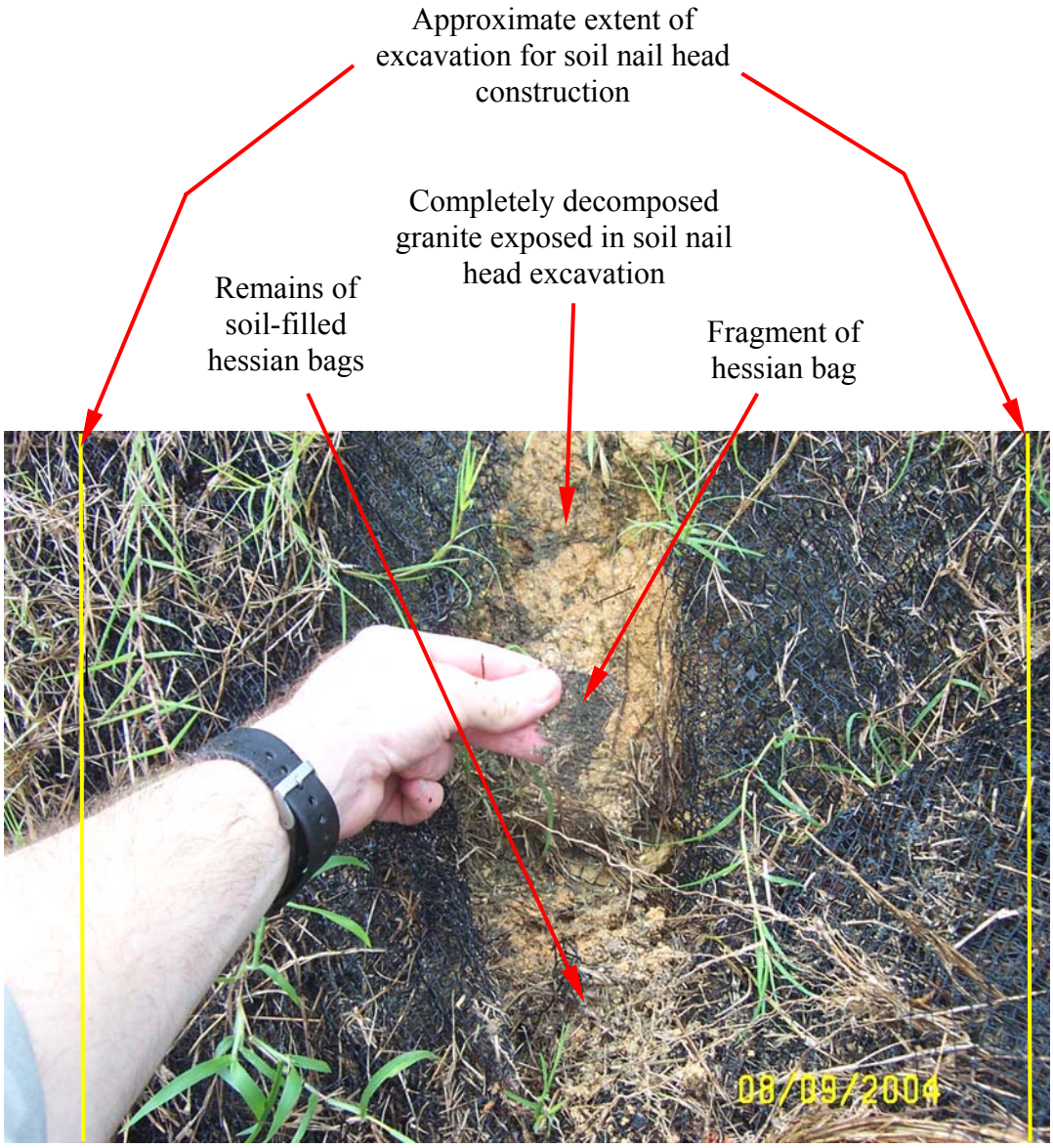


Plate 13 - Fragment of Rotten Hessian Sack Recovered from Beneath Erosion Control Mat at Slope No. 10SW-D/C97 (Photograph taken on 8 September 2004)

Plate 14 - View South Along Slope Crest Indicating Steeper Southern Portion of Slope No. 10SW-D/C97 where Little Damage to Erosion Control Mats (Photograph taken on 8 September 2004)

Table of Contents
Table of Contents
Table of Contents
Table of Contents

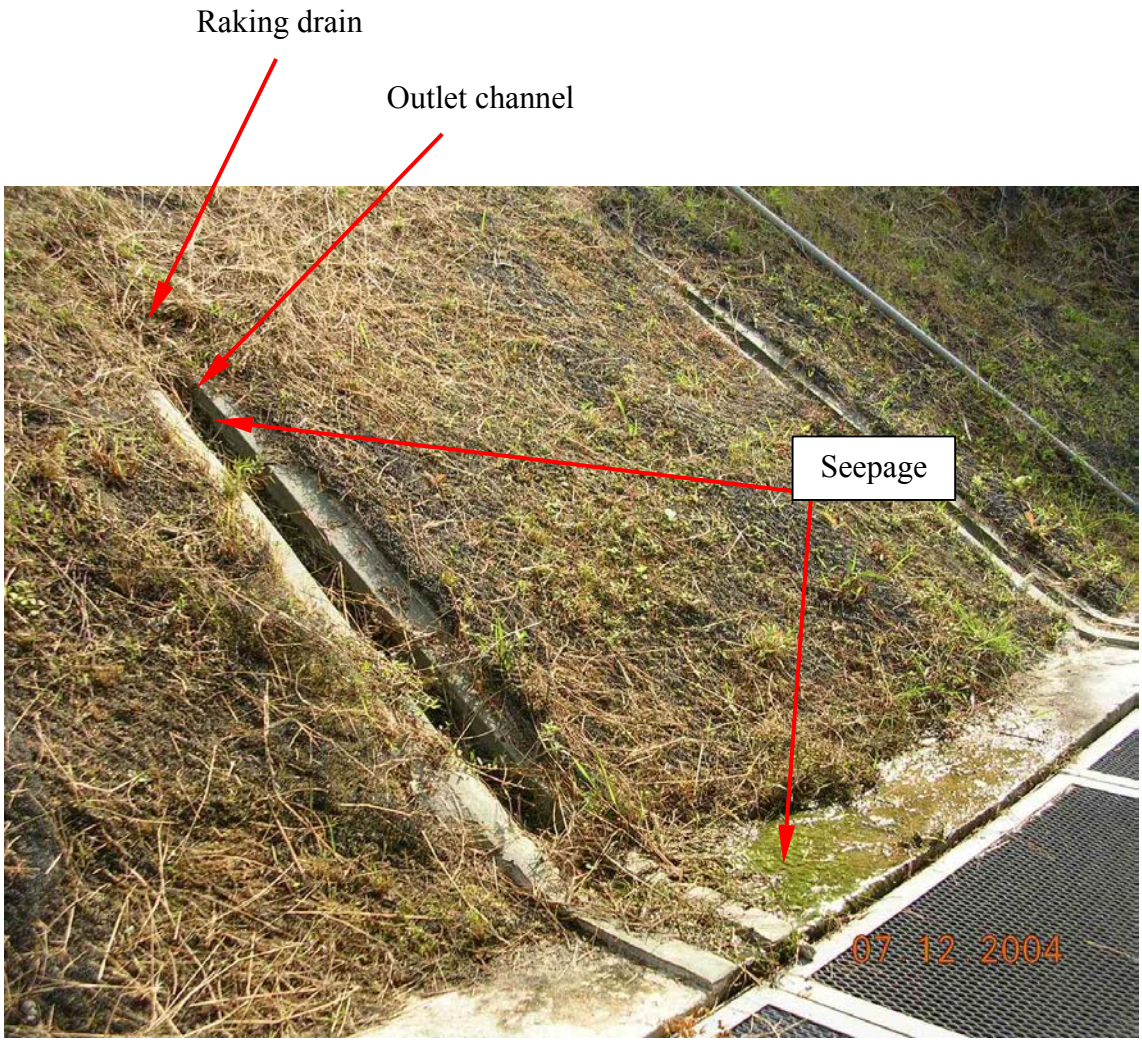


Plate 15 - Seepage at Southern End of Slope No. 10SW-D/C97
(Photograph taken on 7 December 2004)

Plate 16 - General View of Slope No. 10SW-D/C27
(Photograph taken on 11 March 2005)

Table of Contents
Table of Contents
Table of Contents
Table of Contents

Plate 17 - General View of Southwesterly Facing Portion of Slope No. 10SW-D/C35
(Photograph taken on 11 March 2005)

Plate 18 - General View of Slope No. 10SW-D/C139
(Photograph taken on 7 December 2004)

Table of Contents
Table of Contents
Table of Contents
Table of Contents

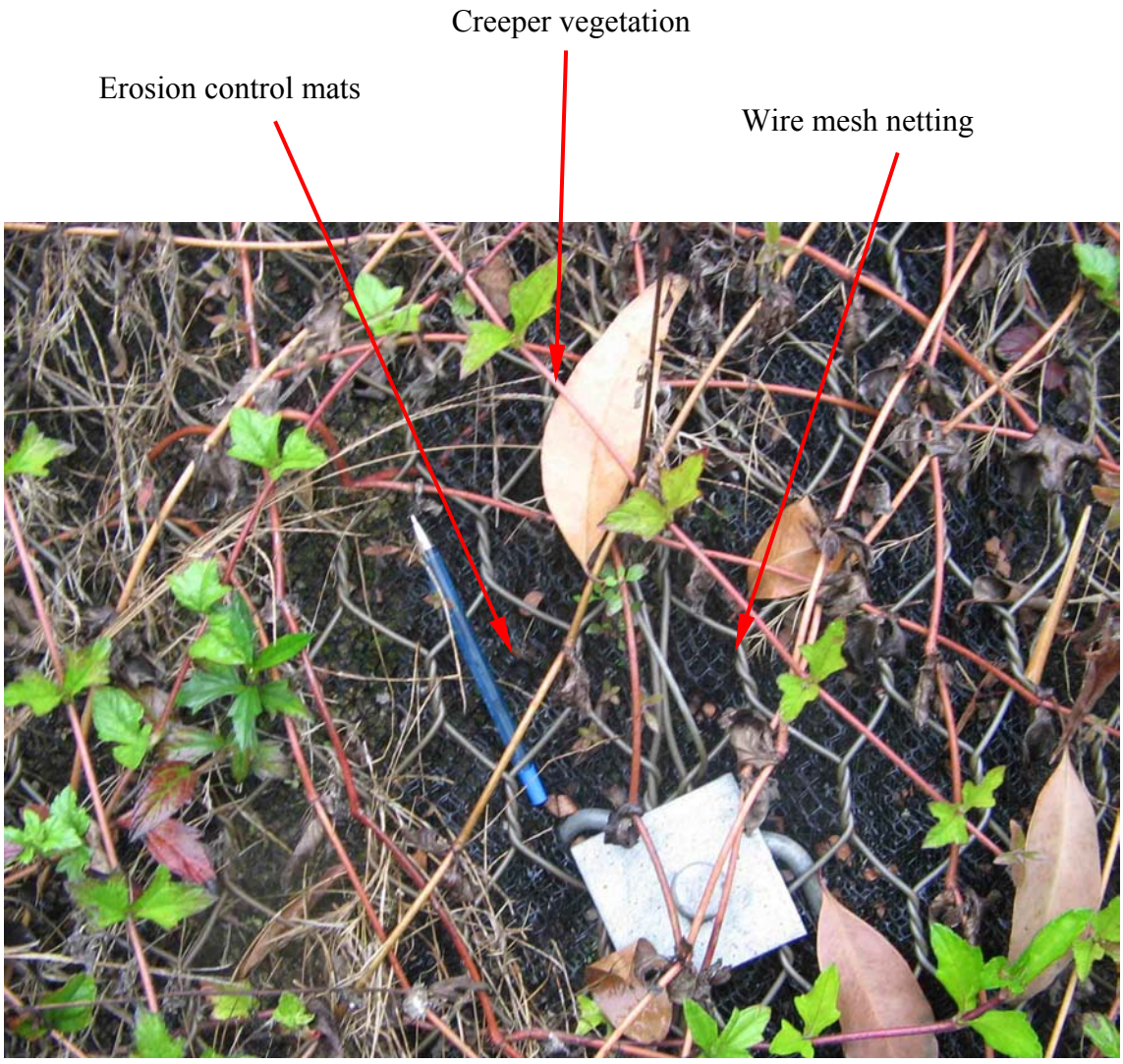


Plate 19 - Close View of Wire Mesh Netting Overlying Erosion Control Mat on Slope No. 10SW-D/C27 (Photograph taken on 11 March 2005)

Table of Contents
Table of Contents
Table of Contents
Table of Contents

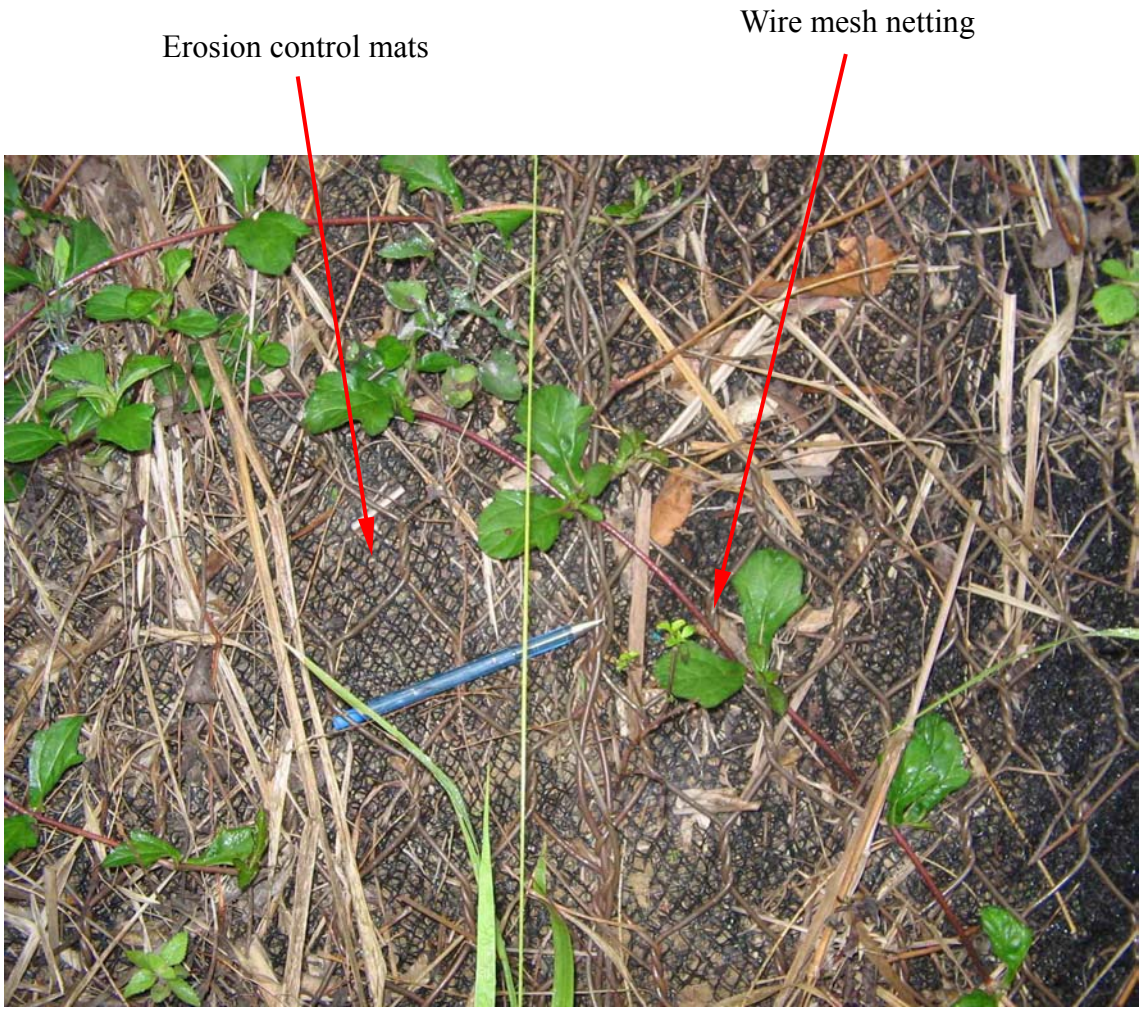


Plate 20 - Close View of Wire Mesh Netting overlying Erosion Control Mat on Southwesterly Facing Portion of Slope No. 10SW-D/C35 (Photograph taken on 11 March 2005)

Plate 21 - Close View of Wire Mesh Netting Overlying Erosion Control Mats on Slope No. 10SW-D/C139 (Photograph taken on 7 December 2004)

Table of Contents
Table of Contents
Table of Contents
Table of Contents

Plate 22 - General View of Slope No. 10SW-D/C28
(Photograph taken on 11 March 2005)

Table of Contents
Table of Contents
Table of Contents
Table of Contents

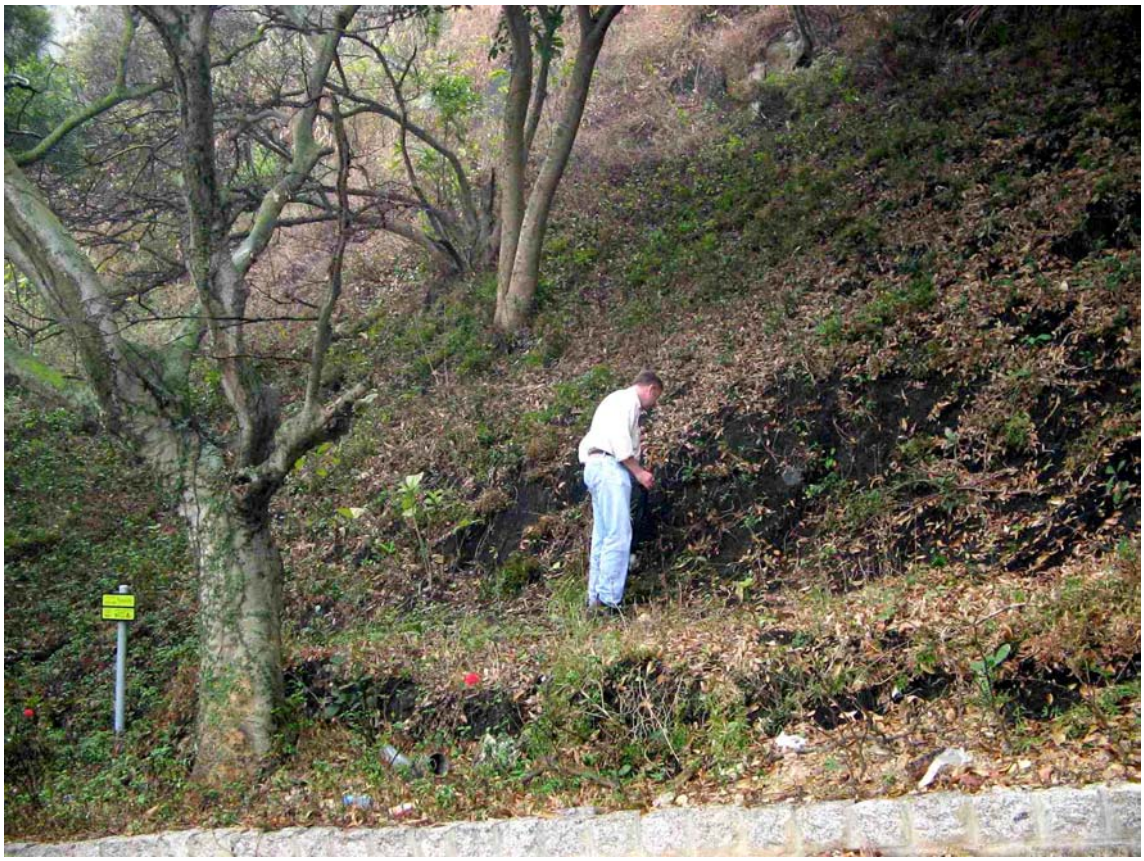


Plate 23 - General View of Southwestern Portion of Slope No. 10SW-D/C101 (Photograph taken on 11 March 2005)

Table of Contents
Table of Contents
Table of Contents
Table of Contents

Plate 24 - General View of Slope No. 10SW-D/C102
(Photograph taken on 11 March 2005)

Plate 25 - Isolated Location on Lower Batter of Slope No. 10SW-D/C28 where Erosion Control Mat has been Cut (Photograph taken on 11 March 2005)

Plate 26 - Example of Erosion Control Mat having been Cut on Slope No. 10SW-D/C101 (Photograph taken on 11 March 2005)

Plate 27 - Example of Erosion Control Mat having been Cut on Face of Slope No. 10SW-D/C102 (Photograph taken on 11 March 2005)

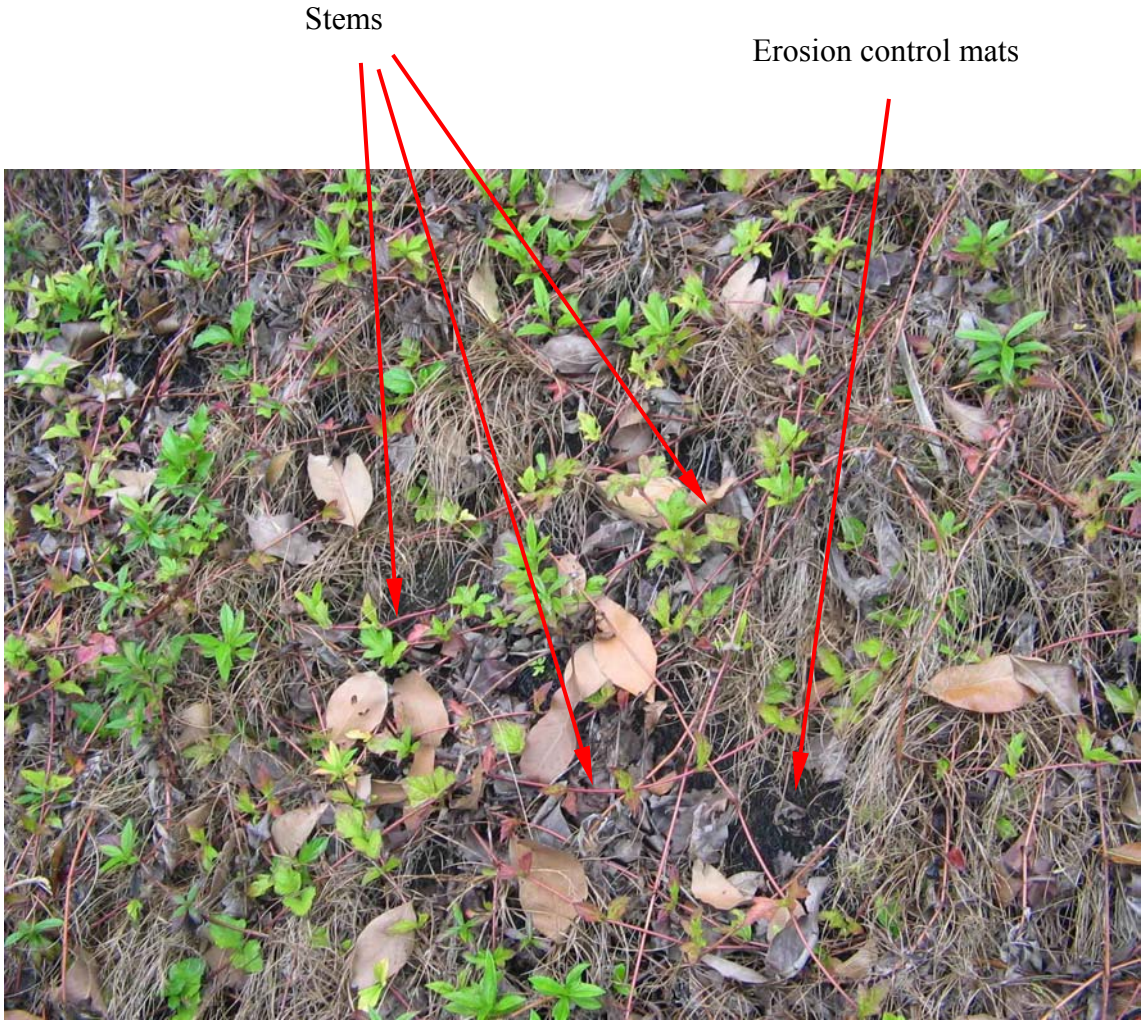


Plate 28 - Creeper Vegetation on Upper Batter of Slope No. 10SW-D/C28 forming Networks of Stems Covering Erosion Control Mat (Photograph taken on 11 March 2005)

Table of Contents
Table of Contents
Table of Contents
Table of Contents

Plate 29 - Northeastern Portion of Slope No. 10SW-D/C101 where Establishment of Ground Cover Vegetation Limited by Tree Canopy and Leaf Litter (Photograph taken on 11 March 2005)

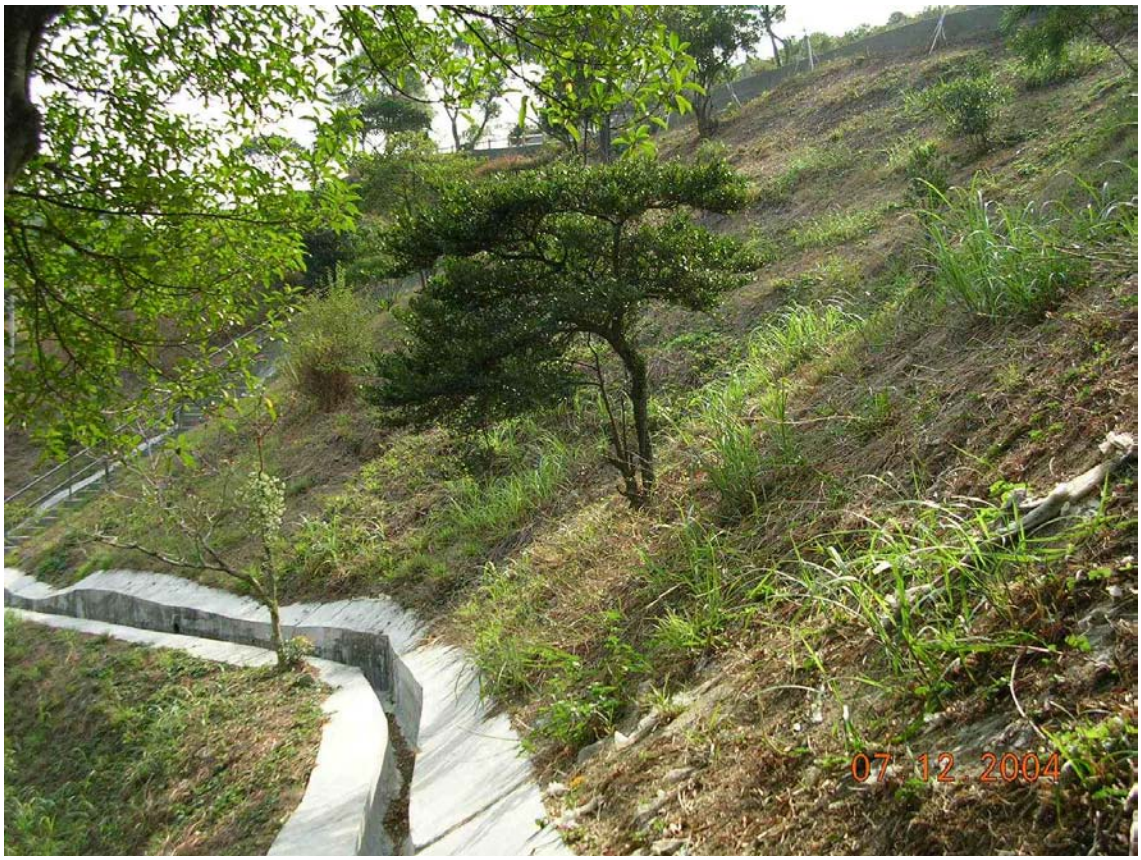


Plate 30 - General View of Slope No. 10SW-D/F55
(Photograph taken on 7 December 2004)

Plate 31 - View of Eastern Portion of Slope No. 11SW-D/F55 not Subject to Vegetation Trimming (Photograph taken on 7 December 2004)

Plate 32 - View of Area of Exposed Ground on Face of Slope No. 10SW-D/F55 following Recent Vegetation Trimming (Photograph taken on 7 December 2004)

Table of Contents
Table of Contents
Table of Contents
Table of Contents

Plate 33 - Close View of Area of Exposed Ground on Face of Slope No. 10SW-D/F55 following Recent Vegetation Trimming (Photograph taken on 7 December 2004)

GEO PUBLICATIONS AND ORDERING INFORMATION
土力工程處刊物及訂購資料

A selected list of major GEO publications is given in the next page. An up-to-date full list of GEO publications can be found at the CEDD Website http://www.cedd.gov.hk on the Internet under "Publications". Abstracts for the documents can also be found at the same website. Technical Guidance Notes are published on the CEDD Website from time to time to provide updates to GEO publications prior to their next revision.

部份土力工程處的主要刊物目錄刊載於下頁。而詳盡及最新的土力工程處刊物目錄，則登載於土木工程拓展署的互聯網網頁 http://www.cedd.gov.hk 的"刊物"版面之內。刊物的摘要及更新刊物內容的工程技術指引，亦可在這個網址找到。

Copies of GEO publications (except maps and other publications which are free of charge) can be purchased either by:

writing to
Publications Sales Section,
Information Services Department,
Room 402, 4th Floor, Murray Building,
Garden Road, Central, Hong Kong.
Fax: (852) 2598 7482

or
- Calling the Publications Sales Section of Information Services Department (ISD) at (852) 2537 1910
- Visiting the online Government Bookstore at http://bookstore.esdlife.com
- Downloading the order form from the ISD website at http://www.isd.gov.hk and submit the order online or by fax to (852) 2523 7195
- Placing order with ISD by e-mail at puborder@isd.gov.hk

讀者可採用以下方法購買土力工程處刊物(地質圖及免費刊物除外):

書面訂購
香港中環花園道
美利大廈4樓402室
政府新聞處
刊物銷售組
傳真: (852) 2598 7482

或
- 致電政府新聞處刊物銷售小組訂購 (電話：(852) 2537 1910)
- 進入網上「政府書店」選購，網址爲 http://bookstore.esdlife.com
- 透過政府新聞處的網站 (http://www.isd.gov.hk) 於網上遞交訂購表格，或將表格傳真至刊物銷售小組 (傳真：(852) 2523 7195)
- 以電郵方式訂購 (電郵地址：puborder@isd.gov.hk)

1:100 000, 1:20 000 and 1:5 000 maps can be purchased from:

Map Publications Centre/HK,
Survey & Mapping Office, Lands Department,
23th Floor, North Point Government Offices,
333 Java Road, North Point, Hong Kong.
Tel: 2231 3187
Fax: (852) 2116 0774

讀者可於下列地點購買1:100 000，1:20 000及1:5 000地質圖：

香港北角渣華道333號
北角政府合署23樓
地政總署測繪處
電話: 2231 3187
傳真: (852) 2116 0774

Requests for copies of Geological Survey Sheet Reports, publications and maps which are free of charge should be sent to:

For Geological Survey Sheet Reports and maps which are free of charge:
Chief Geotechnical Engineer/Planning,
(Attn: Hong Kong Geological Survey Section)
Geotechnical Engineering Office,
Civil Engineering and Development Department,
Civil Engineering and Development Building,
101 Princess Margaret Road,
Homantin, Kowloon, Hong Kong.
Tel: (852) 2762 5380
Fax: (852) 2714 0247
E-mail: jsewell@cedd.gov.hk

For other publications which are free of charge:
Chief Geotechnical Engineer/Standards and Testing,
Geotechnical Engineering Office,
Civil Engineering and Development Department,
Civil Engineering and Development Building,
101 Princess Margaret Road,
Homantin, Kowloon, Hong Kong.
Tel: (852) 2762 5345
Fax: (852) 2714 0275
E-mail: ykhui@cedd.gov.hk

如欲索取地質調查報告、其他免費刊物及地質圖，請致函：

地質調查報告及地質圖:
香港九龍何文田公主道101號
土木工程拓展署大樓
土木工程拓展署
土力工程處
規劃部總土力工程師
(請交:香港地質調查組)
電話: (852) 2762 5380
傳真: (852) 2714 0247
電子郵件: jsewell@cedd.gov.hk

其他免費刊物:
香港九龍何文田公主道101號
土木工程拓展署大樓
土木工程拓展署
土力工程處
標準及測試部總土力工程師
電話: (852) 2762 5345
傳真: (852) 2714 0275
電子郵件: ykhui@cedd.gov.hk

Table of Contents
Table of Contents
Table of Contents

MAJOR GEOTECHNICAL ENGINEERING OFFICE PUBLICATIONS
土力工程處之主要刊物

GEOTECHNICAL MANUALS

Geotechnical Manual for Slopes, 2nd Edition (1984), 300 p. (English Version), (Reprinted, 2000).

斜坡岩土工程手冊(1998)，308頁(1984年英文版的中文譯本)。

Highway Slope Manual (2000), 114 p.

GEOGUIDES

Geoguide 1	Guide to Retaining Wall Design, 2nd Edition (1993), 258 p. (Reprinted, 2000).
Geoguide 2	Guide to Site Investigation (1987), 359 p. (Reprinted, 2000).
Geoguide 3	Guide to Rock and Soil Descriptions (1988), 186 p. (Reprinted, 2000).
Geoguide 4	Guide to Cavern Engineering (1992), 148 p. (Reprinted, 1998).
Geoguide 5	Guide to Slope Maintenance, 3rd Edition (2003), 132 p. (English Version).
岩土指南第五冊	斜坡維修指南，第三版(2003)，120頁(中文版)。
Geoguide 6	Guide to Reinforced Fill Structure and Slope Design (2002), 236 p.

GEOSPECS

Geospec 1	Model Specification for Prestressed Ground Anchors, 2nd Edition (1989), 164 p. (Reprinted, 1997).
Geospec 3	Model Specification for Soil Testing (2001), 340 p.

GEO PUBLICATIONS

GCO Publication No. 1/90	Review of Design Methods for Excavations (1990), 187 p. (Reprinted, 2002).
GEO Publication No. 1/93	Review of Granular and Geotextile Filters (1993), 141 p.
GEO Publication No. 1/2000	Technical Guidelines on Landscape Treatment and Bio-engineering for Man-made Slopes and Retaining Walls (2000), 146 p.
GEO Publication No. 1/2006	Foundation Design and Construction (2006), 376 p.

GEOLOGICAL PUBLICATIONS

The Quaternary Geology of Hong Kong, by J.A. Fyfe, R. Shaw, S.D.G. Campbell, K.W. Lai & P.A. Kirk (2000), 210 p. plus 6 maps.

The Pre-Quaternary Geology of Hong Kong, by R.J. Sewell, S.D.G. Campbell, C.J.N. Fletcher, K.W. Lai & P.A. Kirk (2000), 181 p. plus 4 maps.

TECHNICAL GUIDANCE NOTES

TGN 1	Technical Guidance Documents

Table of Contents
Table of Contents
Table of Contents