SECTION 3 : PRELIMINARY STUDY OF THE LANDSLIDE AT LUK KENG WONG UK ON 24 MAY 1998

Fugro Scott Wilson Joint Venture

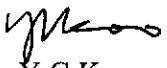
This report was originally produced in November 1999 as GEO Landslide Study Report No. LSR 14/99

FOREWORD

This report presents the findings of a preliminary study of a landslide (GEO Incident No. ME 98/5/10) which occurred on the natural hillside above village housing at Luk Keng Wong Uk in the north-east New Territories on the morning of 24 May 1998. The landslide affected about 95 m of natural terrain and approximately 9 m^3 of debris deposited in an alley between two houses and a platform in front within the village. No injuries were reported.

The key objectives of the preliminary study were to document the facts about the landslide, present relevant background information and establish the probable causes of the landslide. The scope of the study was generally limited to visual inspection, desk study, interview of witnesses and aerial photograph interpretation. Recommendations for follow-up actions are reported separately.

The report was prepared as part of the 1998 Landslide Investigation Consultancy (LIC), for the Geotechnical Engineering Office (GEO), Civil Engineering Department (CED) under Agreement No. CE 74/97. This is one of a series of reports produced during the consultancy by Fugro Scott Wilson Joint Venture (FSW). The report was written by Mr Ian Muir and reviewed by Mr Y C Koo. The assistance of the GEO in the preparation of the report is gratefully acknowledged.



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CONTENTS

1. INTRODUCTION

On the morning of 24 May 1998, a landslide occurred on a natural hillside behind village housing at Luk Keng Wong Uk, adjacent to Starling Inlet, Sha Tau Kok in the north-east New Territories. The landslide and resultant debris runout affected about 95 m length of the hillside and extended beyond a formed cut slope at the toe of the hillside, encroaching into the village area. An estimated 9 m^3 of debris was deposited in an alley between two houses and a platform in front. No casualties were reported.

Following the landslide, Fugro Scott Wilson Joint Venture (FSW), the 1998 Landslide Investigation Consultants, commenced a Preliminary Study of the failure for the Geotechnical Engineering Office (GEO). The principal objectives of the Preliminary Study were to document the main factors concerning the landslide.

This report presents the findings of the Preliminary Study, which comprised the following key tasks:

(a) brief review of relevant documents relating to the history of the site and rainfall data,

(b) preliminary aerial photograph interpretation (API),

(c) interviews with witnesses of the landslide and other concerned persons, and

(d) geological mapping, observations and measurements at the landslide site.

2. THE SITE

2.1 Site Description

The general site location is shown on Figure 1.

The village of Luk Keng Wong Uk (Figure 2) is located at about 4 mPD along the eastern toe of an isolated hill, which rises to 121 mPD. The hill forms part of the northern perimeter of the Pat Sin Leng Country Park and is bordered to the south, east and west by fish ponds and paddy fields, and to the north by Starling Inlet. The southern part of the village consists of a double row of residential buildings with the western row, at the rear, partly uninhabited. Based on a recent survey of the village by FSW, the dwelling occupancy rate is between 50% and 60%.

The landslide (Figures 2 and 3) occurred on a southeast-facing slope on natural terrain, above the residential buildings of the southern part of the village. The slopes of this part of the hill are typically inclined at between 20° and 30°. The lower third of the hillside is covered with dense vegetation, which thins progressively upslope.

The Geotechnical Area Studies Programme (GASP) Report V, North New Territories (Geotechnical Control Office, 1988), produced for regional appraisal and outline and strategic planning purposes at a scale of 1:20,000, designated the area in the vicinity of the 1998 landslide as unclassified. Above the landslide site the slope is classified as "insitu terrain" which is "generally steeper than 30° (other than those areas delineated as colluvial or unstable)". The slopes to the north and southwest of the landslide site are classified as zones of "general instability" associated with "predominantly colluvial terrain".

Observation posts, interconnected with open trenches up to 3 m deep, were noted on site and during a review of aerial photographs along the ridgeline of the hill above the landslide site.

2.2 Local Geology

According to the 1:20,000-scale geological map of Sheung Shui (GCO, 1991), the lower half of the hill comprises sandstone and siltstone of the Pat Sin Leng Formation (Lower Cretaceous). The upper half of the hill consists of slightly metamorphosed coarse ash crystal tuff of the Tai Mo Shan Formation (Upper Jurassic to Lower Cretaceous), part of the Repulse Bay Volcanic Group. The landslide site is located close to and below the boundary of the two units, mapped as the northward-dipping Tiu Tang Lung Thrust Fault (GEO, 1996). An extract from the geological map is shown in Figure 6.

Bedding is shown in the Pat Sin Leng Formation dipping at 25° towards the northeast. Debris flow deposits are mapped on the east-facing side of the hill, about 45 m to the north and 80 m to the southwest of the landslide site.

The engineering geology map of the GASP Report shows the northeastern portion of the hill as sedimentary and water-laid volcaniclastic rocks, with the rest of the slope, including the area affected, as predominantly pyroclastic rocks with some lavas, both of which form part of the Repulse Bay Volcanic Group. The lower portion of the slope at the rear of the village, and the areas to the north and southwest of the landslide site, are mapped as colluvium.

2.3 Water-carrying Services and Utilities

No search of information on water-carrying services and utilities has been undertaken as part of this preliminary study. It is unlikely that there are major water-carrying services in the vicinity of the landslide site.

2.4 Registered Slopes

Cut slope No. 3NE-C/C161 (Figure 3) is located immediately behind the village housing at the toe of the hillside. Debris from the landslide moved over part of this slope to enter the village area.

2.5 Maintenance Responsibility

According to the consultant engaged by Lands Department (LD) on the "Systematic Identification of Maintenance Responsibility of Registered Slopes In the Territory" (SIMAR) project, the hillside above the village lies within the Pat Sin Leng Country Park and comprises unallocated Government Land.

3. SITE HISTORY

3.1 General

The history of the site has been determined from an interpretation of aerial photographs as well as a brief review of relevant documentary information. The preliminary API report is given in Appendix A. Key observations are presented in the following sections.

3.2 Site Development History

The API indicated that the village housing, and the cut slope at the rear of the housing, were constructed before 1963 and that the hillside has generally not been affected by human influence, other than the observation posts and trenches mentioned previously. According to local residents, these features were constructed in the 1940's.

3.3 Previous Landslides

In 1995, the GEO compiled the Natural Terrain Landslide Inventory (NTLI), from the interpretation of high level aerial photographs dating from 1945 to 1994. A number of landslide scars were identified on the northwestern and southern parts of the hillside to the west of Luk Keng Wong Uk village. The majority of these are located on the southwest-facing slope on the southwest portion of the hill (Figure 2).

Figure 2 also shows the locations of additional landslide scars, of which some were observed on site (landslide scars Nos. 2, 3 and 4, described further in Section 4.2), and others during a review of low-level aerial photographs by FSW. Landslide scar No. 1 shown on Figure 2 is the event under study.

The API carried out as part of this study has generally confirmed the observations of the NTLI. Additional evidence for instability in the general vicinity of the 1998 scar was also noted on the 1963 photographs in the area below the 1998 landslide site, and to the north of the 1998 landslide site (Figure 2). These areas are all located on the natural terrain directly above the residential properties of Luk Keng Wong Uk. In the October 1997 photographs, other landslide scars are noted on the east-facing slopes (including landslide scars Nos. 2 and 3 shown on Figure 2). Landslide scar No. 4 is not present on this photograph and is therefore post-October 1997.

An incident was reported to the GEO on 21 August 1997 (GEO Incident Report No. ME 97/8/34) following a landslide on 12 August 1997 which led to about 6 m^3 of debris

being deposited at the toe of the slope adjacent to No. 89 Luk Keng Wong Uk village (Figure 3).

3.4 Past Assessment

No past stability assessment has been carried out for the hillside behind the village of Luk Keng Wong Uk. Under the Non-Development Clearance (NDC) Programme, the GEO inspected the village in 1994 and only part of house No. 1 was recommended for clearance under the NDC Programme.

4. THE LANDSLIDE

4.1 Initial Observations

According to a local resident, the landslide occurred following prolonged heavy rainfall on the morning of 24 May 1998, depositing debris on the platform behind village houses and along an alley between houses No. 73 and 74. Based on eye-witness accounts, the landslide occurred at about 08:00 hours.

The landslide was reported to the GEO on the afternoon of 25 May 1998 (GEO Incident No. ME 98/5/10) and inspected by the GEO on the same day. A photograph taken by the GEO (Plate 1) shows the landslide scar on the hillside above the village. Based on site sketches produced by the GEO, the source area was about 90 m on plan from the village houses and located at the top of a natural drainage line, along which the debris travelled to reach the village. The source area of the landslide was inspected by a representative of the Highways Department. The dimensions of the scar reported in the GEO Incident Report were 15 m length downslope, 3 m width and 0.3 m depth.

It was noted in the Incident Report that about 9 m^3 of debris had deposited around the village houses (Plate 2). No recorded observations regarding deposition of debris on the hillside are available.

4.2 Observations Made After the Landslide

The landslide site was inspected and mapped by FSW on 17 June 1998. The source area (Plates 3 and 4) was observed to be larger than initially reported, suggesting the possibility of enlargement since 25 May 1998. However, comparison of record photographs indicates that the overall width and upper portion (lower portion obscured by vegetation in Plate 1) were essentially unchanged. A section through the hillside at the landslide location is presented in Figure 5.

The form of the surface of rupture was an elongate spoon-shape approximately 30 m long, 10 m wide and a maximum of 1 m deep. The total volume of displaced material is estimated at about 150 m^3. The surface of rupture was located above and along the stream course, with the crown of the failure at about 55 mPD to 60 mPD. The hillside at the source area is locally inclined at an angle of about 35° to 40°, flattening to around 25° to 35°

below. Material exposed on the surface of rupture comprised highly to completely decomposed siltstone, which was overlain by about 1 m of residual soil (Plate 9). Local planar features were observed on the surface of rupture and a quantity of debris and occasional rafts of relatively intact displaced material (Plates 5 and 6) remained within the source area. Details of the geological mapping are presented in Section 5.

Debris from the landslide was channelised along the stream course below the estimated toe of the source area (about 40 mPD), before a significant portion was deposited below about 25 mPD (Plates 7 and 8) on the more gently inclined, densely vegetated ground extending to the crest of slope No. 3NE-C/C161. The stream course was deeply incised, narrow and stepped (up to 1.5 m in width and 1.5 m deep). Debris observed on the hillside comprised light orange brown, clayey, very sandy, very gravelly silt with many to occasional, angular to sub-rounded cobbles and boulders of siltstone. The debris was generally in the form of lobate, lateral and intermediate deposits. Some of the debris towards the toe of the slope appeared to have been partly eroded (Plate 10), suggesting the occurrence of secondary outwash and erosion following deposition.

The debris around the village houses had been removed by the time of the inspection by FSW. It is not certain whether this material comprised accumulated debris from the initial failure or from secondary outwash of debris deposited on the hillside. The distance from the crown of the scar to the reported toe of the debris within the village area is about 120 m. If it is assumed that the debris deposited at the toe is a result of landsliding, the travel angle of the landslide (Wong & Ho, 1996) was about 23° to 24°. However, if the toe of the landslide was located on the natural hillside above slope No. 3NE-C/C161, the travel angle was of the order of 26° to 27°.

A second site visit was made by FSW on 19 January 1999, when the seasonally less dense vegetation cover permitted a more detailed inspection of the hillside surrounding the source area. At this time, the landslide scar at the source area had been partly covered by chunam. A crack was observed above the scar, without infilling and about 12 m from the crown of the recent failure towards the ridge (Plates 11 to 13). The crack, orientated in a north-south direction and about 50 mm to 200 mm wide, could be traced laterally for 3 m to 4 m.

Evidence of past instability was also observed on the more gently inclined ground above slope No. 3NE-C/C161, where the debris had deposited over colluvium (Plate 8). The ground is hummocky in this area and minor scarps were observed within the colluvium giving a stepped appearance.

4.3 Neighbouring Landslide Scars

During the field inspection on 17 June 1998, three neighbouring pre-existing landslide scars were also examined on the eastern side of the hill (Nos. 2, 3 and 4 on Figure 2). All involved instability in the insitu weathering profile of the meta-sedimentary rock mass, as with the present failure. Landslide scar No. 2 occurred on hillside inclined at about 25° to 30° and involved a large raft of material that appeared to have slumped with limited downslope movement of about 1 m (Plate 14). The failure appeared to be shallow in nature (less than

2 m deep) and involved about 400 m^3 of material. Erosion had also occurred on the edges of the displaced mass.

Landslide scars No. 3 and 4 were smaller features, involving about 50 m^3 and 40 m^3 of material respectively and occurred on hillside inclined at about 40° to 45° (Plates 15 to 17). Both scars are shallow in nature (<1 m deep). Landslide scar No. 4 has a trail of about 20 m, whereas landslide scar No. 3 is less elongate in shape with most of the debris located close to the source.

The exact timing of the landslide events that produced these scars is unknown. Landslide scar No. 3 is first visible on the photograph from the GEO Incident Report of 21 August 1997, and scar No. 2 is first visible on the October 1997 aerial photographs. The instability that produced scar No. 4 occurred between October 1997 and June 1998.

The locations of landslide scars Nos. 2 and 4 appear to coincide with the upper parts of ephemeral stream courses, similar to the 1998 landslide. Many of the other landslide scars in the locality, mapped from API, are located within such features or depressions.

5. SUBSURFACE CONDITIONS OF THE SITE

5.1 Geology

The subsurface conditions at the site were determined using information obtained from field mapping carried out by FSW. Geological features mapped at the site are shown on Figure 4.

The general geology of the landslide site comprises weathered sedimentary rock overlain by residual soil and colluvium towards the toe of the slope. The weathered sedimentary rock was encountered along the surface of rupture as very weak to weak, red brown, mottled purple and beige, thinly bedded, highly to completely decomposed siltstone, with close to medium spaced joints. Bedding was mapped as dipping 20° to 30° towards the north-northeast (020°) in the upper portion of the scar, and 9° towards the east (095°) along the stream course below the toe of the surface of rupture. Less weathered and slightly metamorphosed siltstone was also encountered in the trench on the southwest portion of the ridgeline.

Two sub-vertical joint sets were mapped in the siltstone at or close to the landslide scar, striking southeast. A third joint set with clayey infilling was mapped dipping between 40° and 75° towards the northeast (dip direction 020° to 054°) and a fourth, generally smooth and undulating joint set, dipping at about 30° to 50° to the southeast (dip direction 100° to 140°).

The presence of adverse joint orientations in the source area indicates that relict jointing in the weathered rock mass probably contributed to the failure.

The geology observed in the immediate vicinity of the landslide site does not exhibit obvious signs of influence by the thrust fault indicated to the north-west. Nevertheless, the

presence of the thrust fault may have certain implications for the site (e.g. hydrogeology, structure and superficial deposits), which would warrant further consideration in a more detailed appraisal of the hillside.

Colluvium was identified on the more gently inclined, densely vegetated ground between the stream course and the cut slope. The colluvium was described as firm, brown, clayey, sandy, silt with gravel.

5.2 Groundwater Conditions

No groundwater seepage or erosion pipes were observed at the upper portion of the 1998 landslide scar at 55 mPD to 60 mPD during the site visit on 17 June 1998. However, some standing water and slight seepage were observed in the sides of the stream course at about 15 mPD to 20 mPD. Similar observations were made to the north of the 1998 landslide site near landslide scar No. 2.

6. RAINFALL ANALYSIS

The nearest raingauge to Luk Keng is the Hong Kong Observatory automatic raingauge No. R24 located at Sha Tau Kok, approximately 2.5 km to the north of the landslide location.

The daily rainfall records for raingauge No. R24 from 2 May to 25 May 1998 and the hourly rainfall records from 48 hours prior to the reported time of failure to 8 hours after are presented in Figure 7.

The daily rainfall records indicate that up to 14 May 1998 there had been virtually no rainfall in the area. From 15 May to 23 May 1998, 30 mm to 60 mm of daily rainfall was recorded on three separate occasions, and for the 24-hour period preceding the landslide on 24 May 1998, about 190 mm of rainfall was recorded.

The hourly rainfall records show that the landslide occurred near the peak of the rainstorm on the morning of 24 May 1998, when up to 66 mm of rainfall was recorded between 07:00 hours and 08:00 hours.

Table 1 presents the estimated return period for the maximum rolling rainfall for various durations based on historical rainfall data at the Hong Kong Observatory (Lam & Leung, 1994). The 2-hour maximum rolling rainfall (132 mm) was the most severe with a return period of about 8 years.

7. DISCUSSION

The landslide that occurred on 24 May 1998 on the hillside above the village of Luk Keng Wong Uk was triggered by rainfall. The landslide occurred in an area with a break in slope. The 1998 landslide scar was near the instability recorded in August 1997 (Section 3.3) but it is not certain whether the ground was disturbed as a result of the previous failure. The

rainfall that triggered the failure was not particularly severe, with a return period of only about 8 years.

The presence of rafts of relatively intact material in the source area, together with the exposures of planar surfaces on the surface of rupture, suggest that the initial instability involved shallow sliding failure (about 1 m deep). Considering the relatively long runout (95 m to 120 m), it is likely that the initial slide became a wet debris flow because of the effect of concentrated surface water flow, which was channelised along the stream course for about 40 m below the toe of the surface of rupture. It is not certain whether the instability involved a process of pulses of failure over a period of time.

The location of the landslide towards the top of the stream course suggests that the failure may be part of the geomorphological development of the hillside. A number of other landslides have been identified on the hillside, many of which are located within the upper portions of stream courses and depressions. The history of instability of the hillside, together with signs of distress behind the 1998 landslide site, suggests that further deterioration of the hillside is probable.

8. CONCLUSIONS

It is concluded that the landslide that occurred on 24 May 1998 on the hillside above the village of Luk Keng Wong Uk was triggered by rainfall. The rainfall was not particularly severe with a return period of only about 8 years.

The location of the landslide near the top of a stream course suggests that the failure may be part of the geomorphological development of the hillside. A number of other landslides have been identified on the hillside. The history of instability of the hillside, together with signs of distress behind the 1998 landslide site, suggests that further deterioration of the hillside is probable.

9. REFERENCES

Geotechnical Control Office (1988). Geotechnical Area Studies Programme – North New Territories. Geotechnical Control Office, Hong Kong, GASP Report No. V, 134p. plus 3 maps.

Geotechnical Control Office (1991). Sheung Shui: Solid and Superficial Geology. Hong Kong Geological Survey, Map Series HGM20, Sheet No. 3, 1:20 000 scale. Geotechnical Control Office, Hong Kong.

Geotechnical Engineering Office (1996). Geology of the Northeastern New Territories. Hong Kong Geological Survey Memoir No. 5. Geotechnical Engineering Office, Hong Kong.

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.

Wong, H.N. & Ho, K.K.S. (1996). Travel distance of landslide debris. Proceedings of the Seventh International Symposium on Landslides, Trondheim, Norway, vol. 1, pp 417 – 422.

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Table 1 - Maximum Rolling Rainfall at H.K.O. Raingauge No. R24 for Selected Durations Preceding the Landslide of 24 May 1998 and the Estimated Return periods

Duration	Maximum Rolling Rainfall (mm)	End of Period (Hours)	Estimated Return Period (Years)
5 Minutes	8.0	6:05 on 24 May 1998	< 2
15 Minutes	20.0	6:10 on 24 May 1998	< 2
30 Minutes	39.0	6:30 on 24 May 1999	< 2
1 Hour	67.0	7:55 on 24 May 1999	2
2 Hours	132.0	7:50 on 24 May 2000	8
4 Hours	182.0	8:00 on 24 May 2000	7
8 Hours	187.0	8:00 on 24 May 2001	4
12 Hours	191.0	8:00 on 24 May 2002	3
24 Hours	191.0	8:00 on 24 May 2003	< 2
48 Hours	191.0	8:00 on 24 May 2004	< 2
4 Days	232.0	8:00 on 24 May 2005	< 2
7 Days	276.0	8:00 on 24 May 2006	< 2
15 Days	337.0	8:00 on 24 May 2007	< 2
31 Days	N/A	-	-

Notes :

1 Return periods were derived from Table 3 of Lam & Leung (1994).

2 Maximum rolling rainfall was calculated from 5-minute data for durations up to 48 hours, and from hourly rainfall data for longer rainfall durations.

3 The use of 5-minute data for durations between 2 hours and 48 hours 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.

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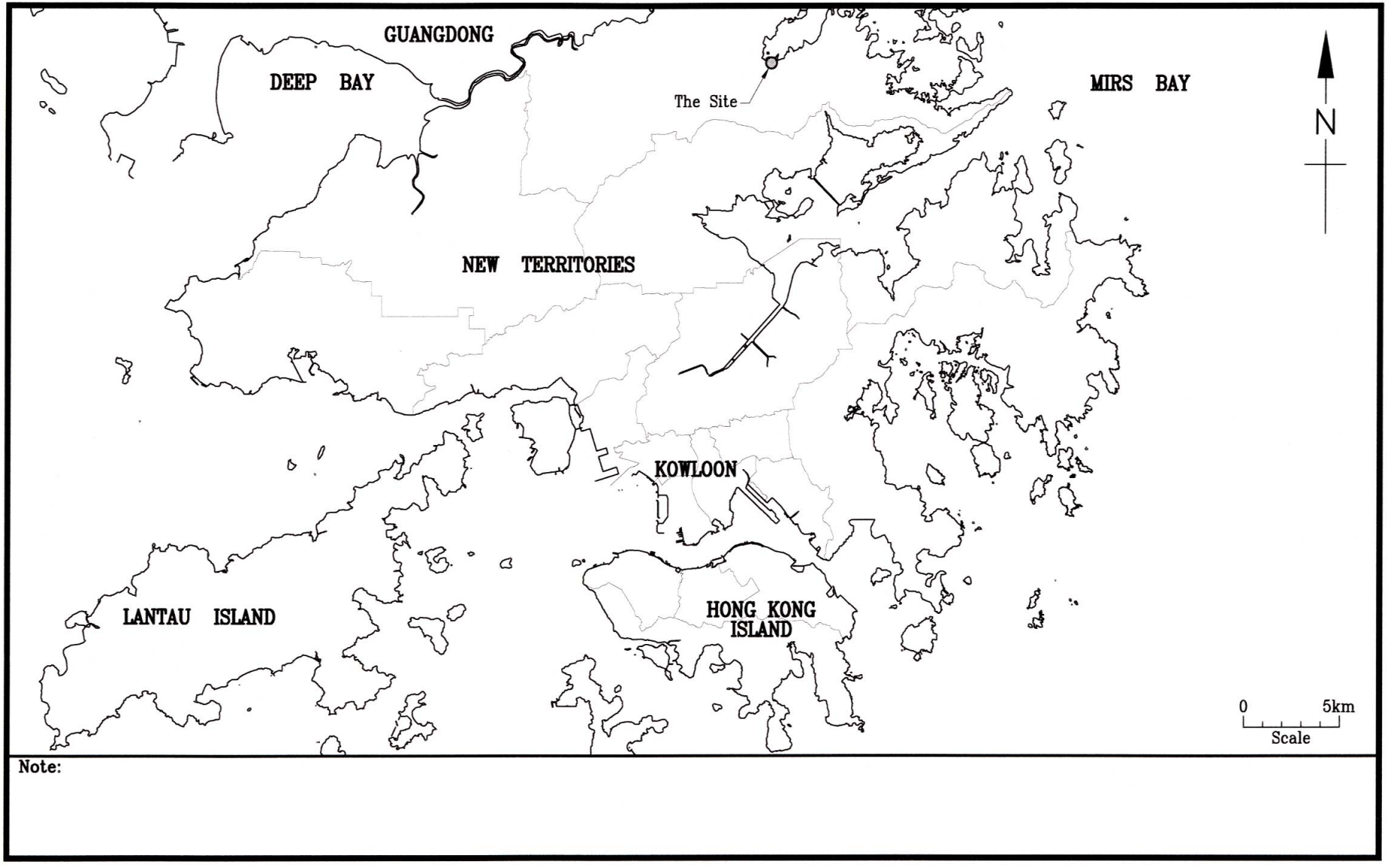


Figure 1 - Site Location Plan

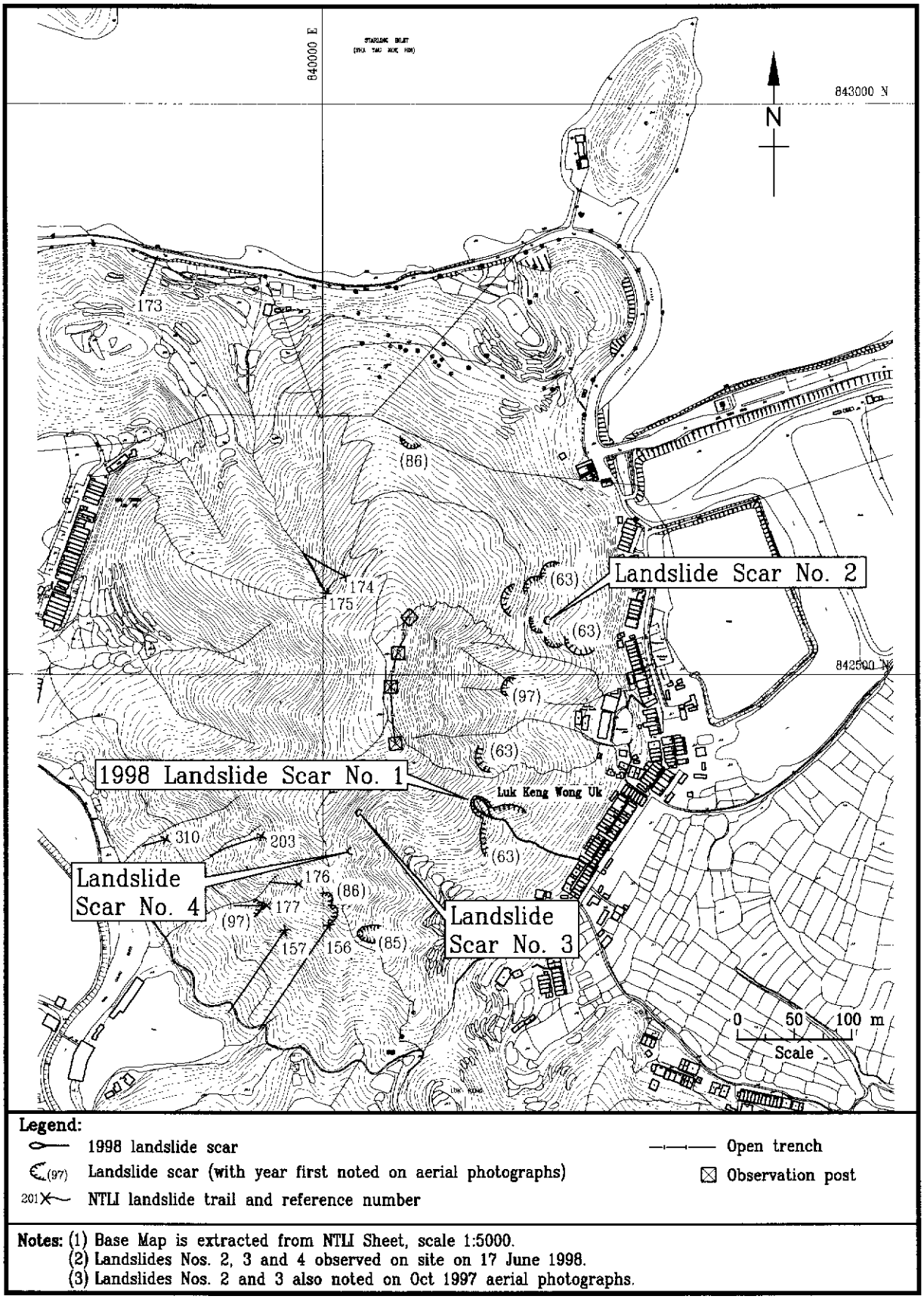


Figure 2 - General Location Plan of the Landslide at Luk Keng Wong Uk Showing Surrounding Landslide Scars

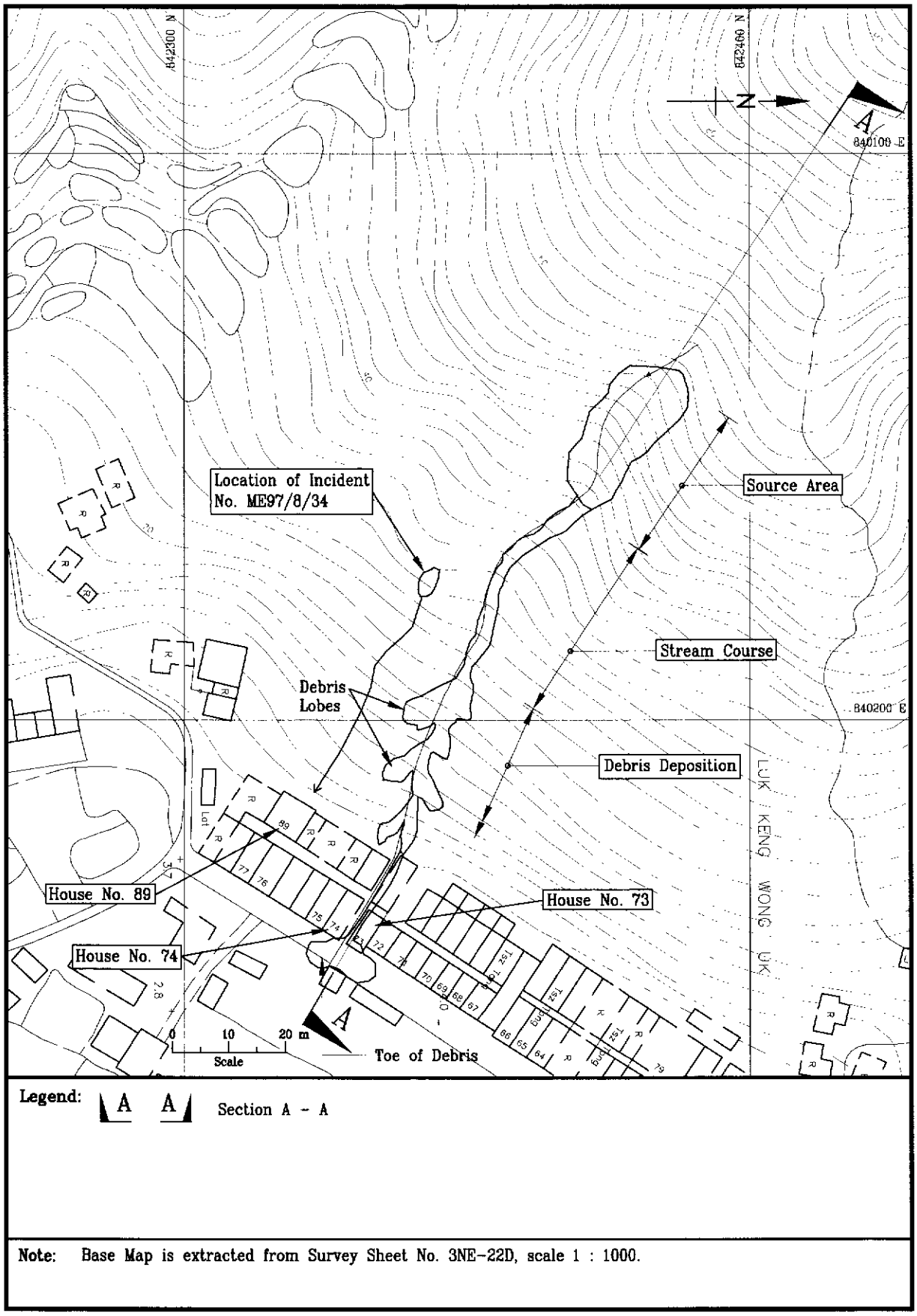
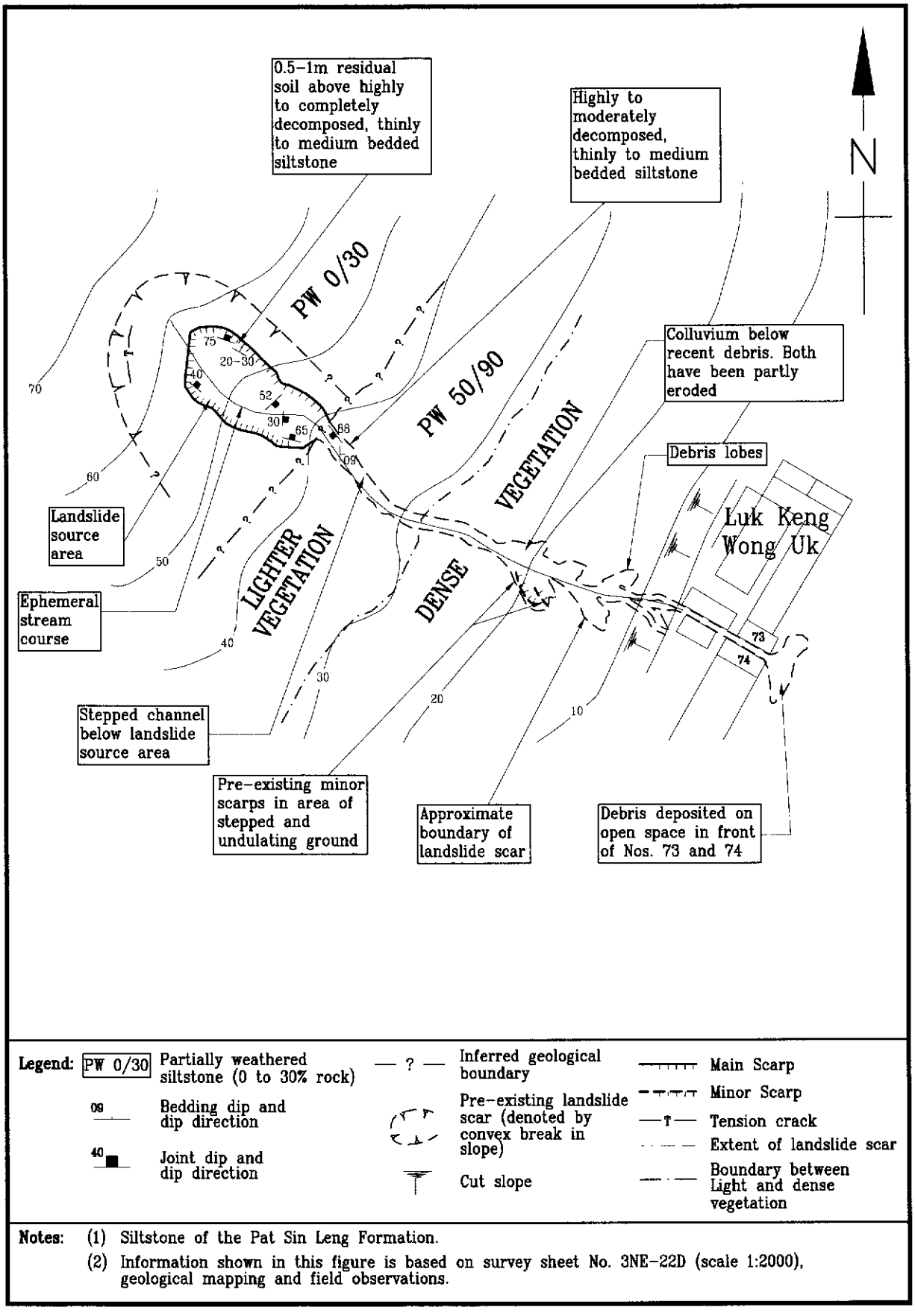


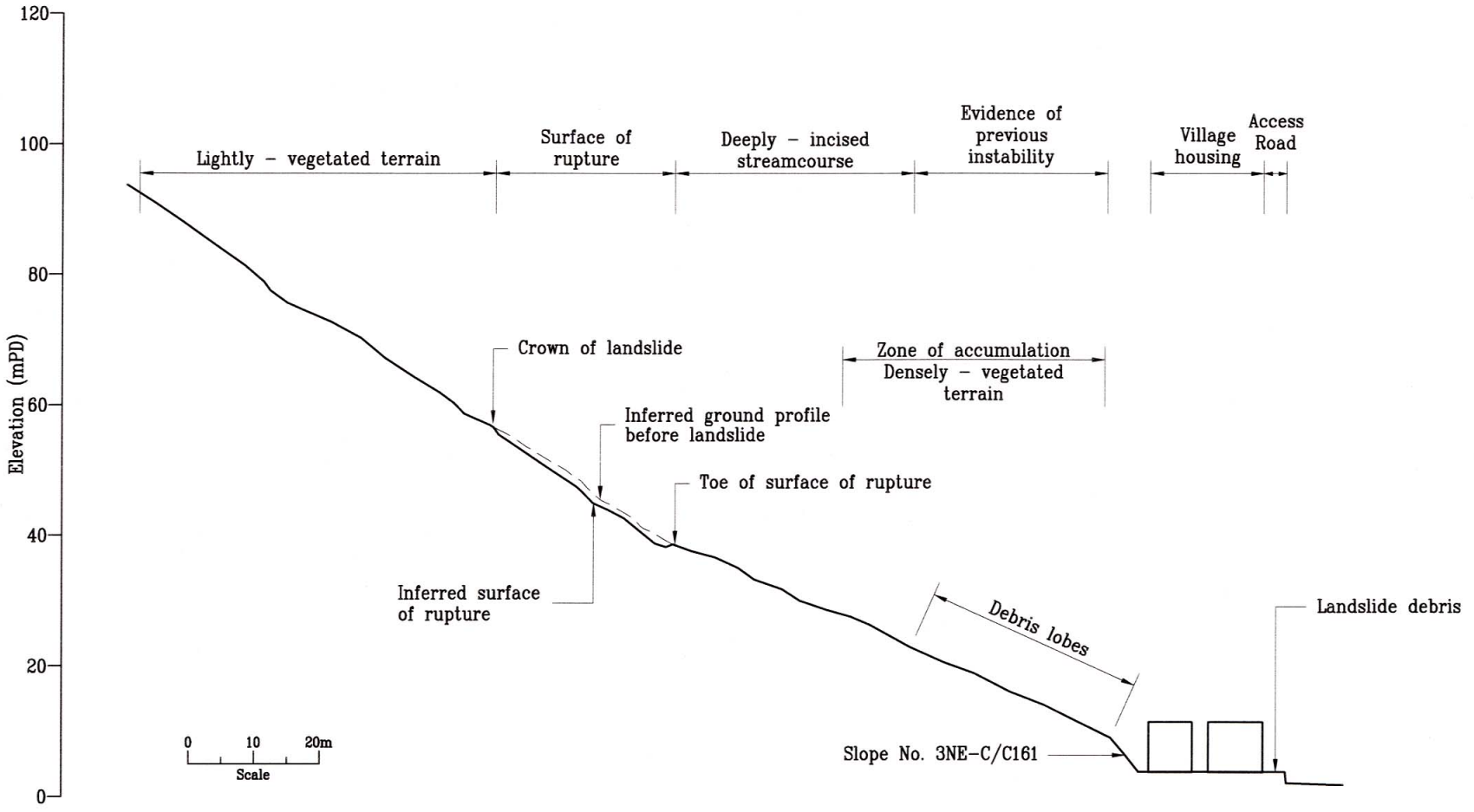
Figure 3 - Location Plan of the Landslide



Notes: (1) Siltstone of the Pat Sin Leng Formation.

(2) Information shown in this figure is based on survey sheet No. 3NE–22D (scale 1:2000), geological mapping and field observations.

Figure 4 - Geological Plan of the Landslide



Notes: (1) Scale 1 : 1000.
(2) Slope profile estimated from survey sheet No. 3NE–22D.
(3) See Figure 3 for Location of Section A–A.

Figure 5 - Section A - A through the Landslide

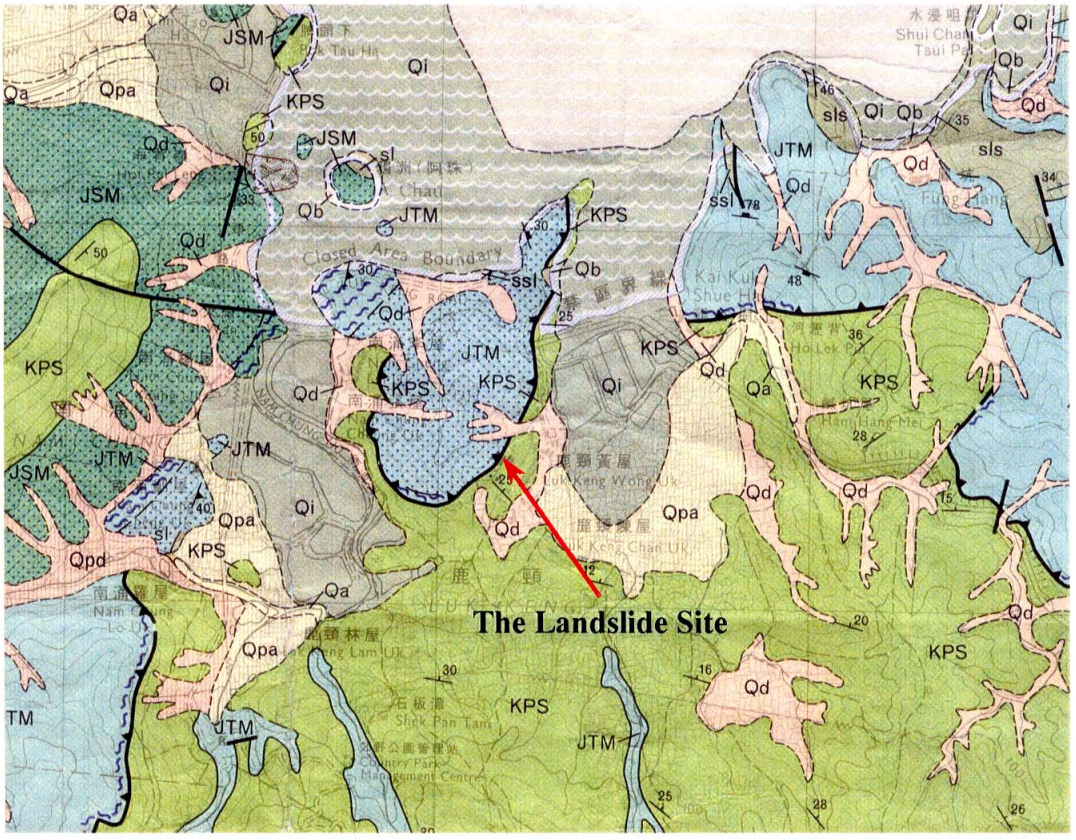
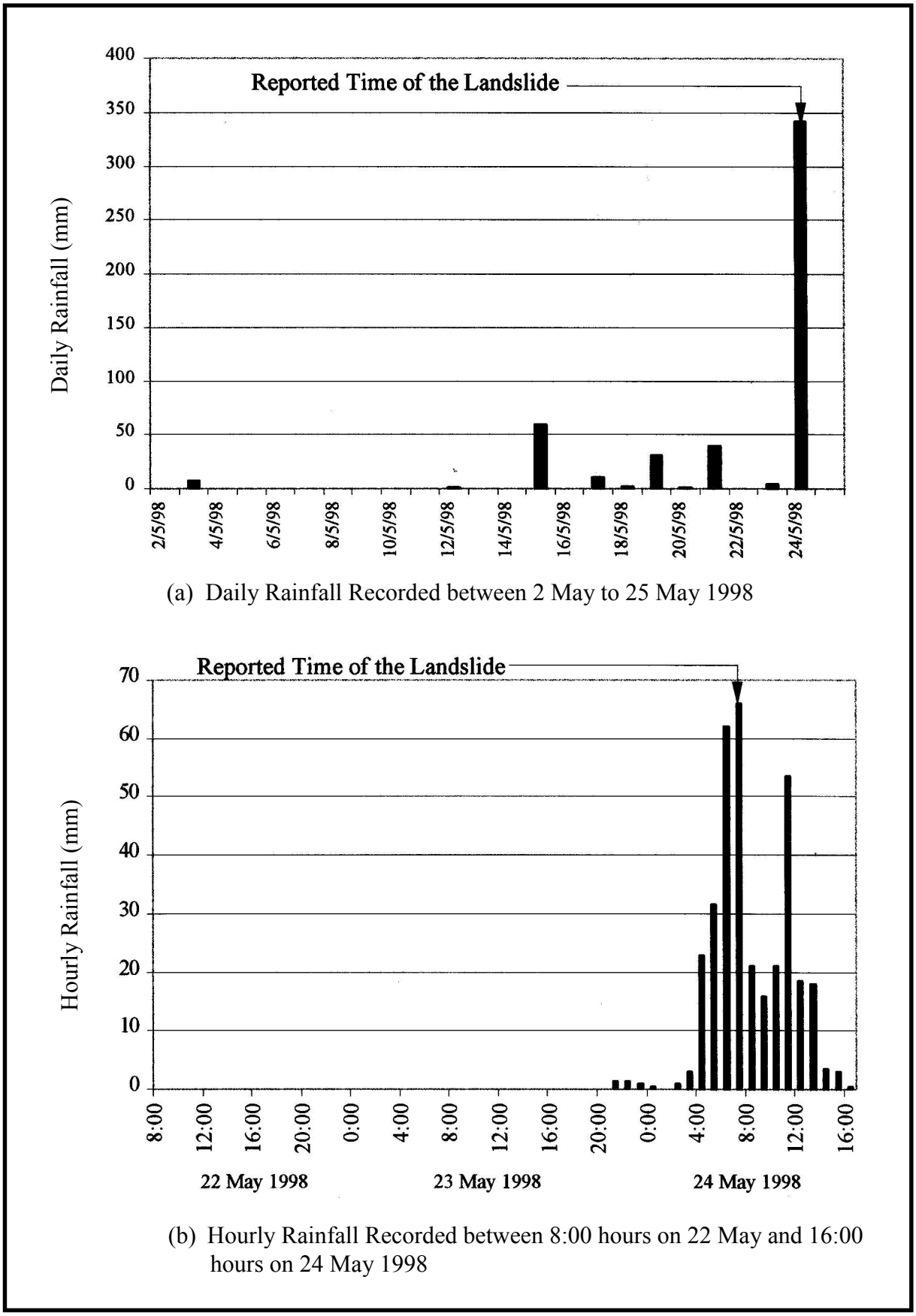


Figure 6 – Geology of the Luk Keng District



(a) Daily Rainfall Recorded between 2 May to 25 May 1998

(b) Hourly Rainfall Recorded between 8:00 hours on 22 May and 16:00 hours on 24 May 1998

Figure 7 – Rainfall Recorded at H.K.O. Raingauge No. R24

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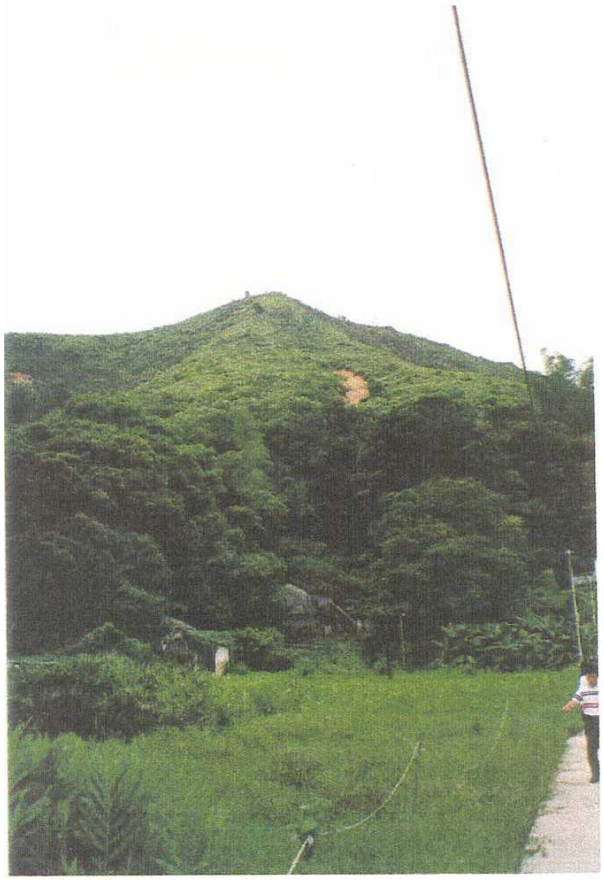

Plate 1 – View North Towards Landslide Scar. (Photograph taken on 25 May 1998)

Plate 2 – Debris Deposited Between Village Houses Nos. 73 and 74. (Photograph taken on 25 May 1998)

Plate 3 – View Looking West Towards Luk Keng Wong Uk
(Photograph taken on 17 June 1998)

Plate 4 – Landslide Scar Behind Luk Keng Wong Uk
(Photograph taken on 17 June 1998)

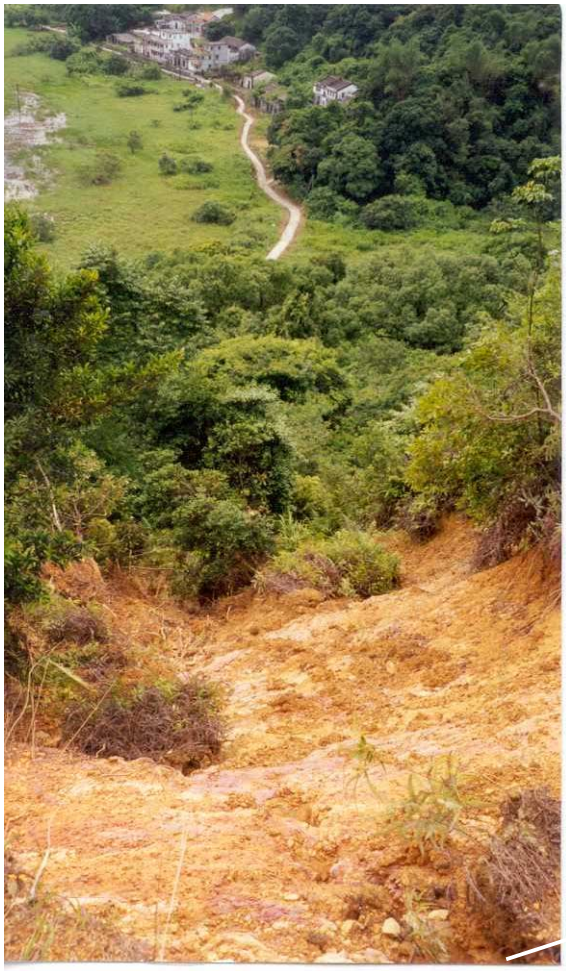

Plate 5 – View of Landslide Scar
(Photograph taken on
17 June 1998)

Plate 6 – View of Toe of Surface Rupture and Dense Vegetation Towards the Lower Portion of the Slope (Photograph taken on
17 June 1998)

Plate 7 – Ephemeral Stream Course Below the Toe of the Surface of Rupture (Photograph taken on 17 June 1998)

Plate 8 – Lower Portion of the Stream Course Showing Small Debris Lobes (Looking Upslope) (Photograph taken on 17 June 1998)

Plate 9 – Part of the Surface of Rupture
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Plate10 – Landslide Debris Overlying Colluvium in Zone of Accumulation
(Photograph taken on 17 June 1998)

Plate 11 – Top of the Landslide Scar Following the Application of Chunum Surface Protection
(Photograph taken on 19 January 1998)

Plate 12 – Tension Crack Located Above the 1998 Landslide Scar
(Photograph taken on 19 January 1999)

Plate 13 – Close-Up of Tension Crack
(Photograph taken on 19 January 1999)

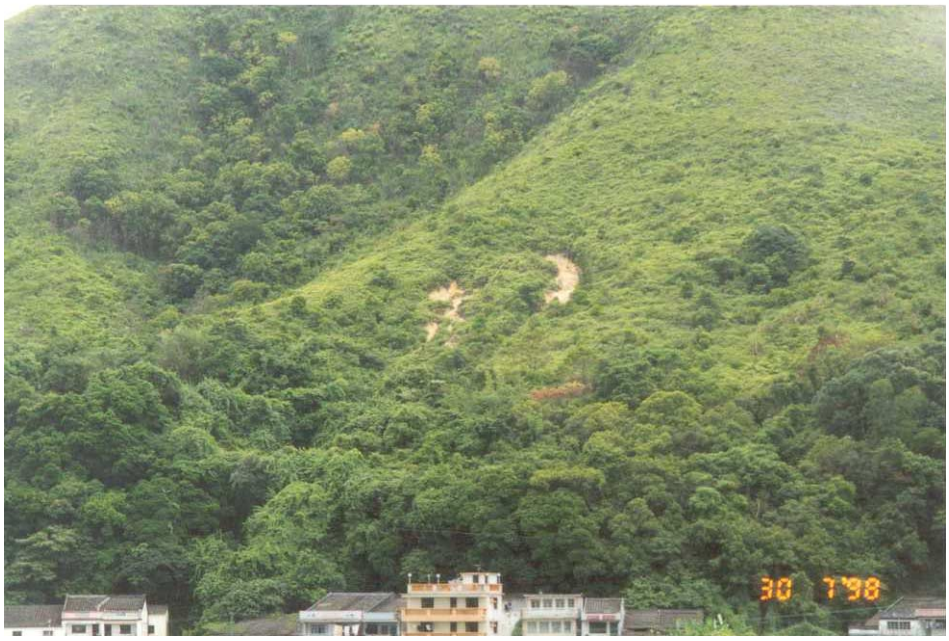

Plate 14 – View South West Towards Landslide No. 2
(Photograph taken on 17 June 1998)

Plate 15 – View of Landslide Scar No. 3
(Photograph taken on 17 June 1998)

Plate 16 – Close-Up of Landslide Scar No. 3
(Photograph taken on 17 June 1998)

Plate 17 – View of Looking Upslope Towards Landslide Scar No. 4 (Photograph taken on 17 June 1998)

APPENDIX A

AERIAL PHOTOGRAPH INTERPRETATION (API)

Preliminary Aerial Photograph Interpretation

Date	Aerial Photograph Reference No.	Observations (Refer to Figure 2)
02.63	Y10071-72	Village housing appears to be similar to the present configuration. The lower portions of the slopes at the rear of the village housing are densely vegetated, whereas the upper and middle portions of the slope appear to be covered with thin vegetation. An ephemeral stream course (no visible water) is observed at the 1998 landslide site. Two revegetated areas of shallow(?) instability are observed below, and to the southwest and northeast of the 1998 landslide site, providing possible evidence for shallow, previous instability in the area. A smaller scar is also observed to the east of the 1998 landslide site. Similar features are observed to the north of the 1998 landslide site, near to landslide scar No. 2.
08.86	A5503-04	The slope is generally more densely vegetated than in 1963. The stream course noted in 1963 is still visible in the area of the 1998 landslide site (no water visible). Possible surface erosion underneath trees behind the village housing to the north of the 1998 landslide site. One possible landslide scar is observed on the north-facing slope of the hill.
10.87	CN1199-1200	Occasional trees and thin vegetation along valleys, with denser vegetation behind Luk Keng Wong Uk.
11.93	A36449-50	Possible small erosion scar observed just above the tree line near to the 1998 landslide site.
05.94	A38321-22	No changes observed.
07.95	CN10471-72	Two small landslide scars observed on the northeast-facing slopes in the valley to the southwest of the 1998 landslide scar. A small erosion scar is also observed on the slope immediately adjacent (to the north) of the 1998 landslide site.
05.96	CN13593-94	Large areas of vegetation removed on west side of the ridge (probably due to fire). Several erosion gullies observed on the bare hillside. Stream course in the location of the 1998 landslide scar is observed (no visible water).
10.96	CN14631-32	Vegetation is denser than previously observed over the whole slope.

05.97	CN16823-24	No changes observed. There appears to be no scar in the area of the 1998 landslide site.
10.97	CN18182-83	Four landslide scars are observed on the east-facing slopes (including landslide scars Nos. 2 and 3, and a small scar at the 1998 landslide site). Two landslide scars (including No. 2) are observed in the valley to the north of the 1998 landslide site. Landslide scar No. 3 is observed towards the top of the valley to the southeast of the 1998 landslide site.
07.05 1998	CN19631-32	No changes observed. Small landslide scar still observed at 1998 landslide site.