REPORT ON THE RAINSTORM OF AUGUST 1982

GEO REPORT No. 26

R.R. Hudson

GEOTECHNICAL ENGINEERING OFFICE
CIVIL ENGINEERING DEPARTMENT
HONG KONG

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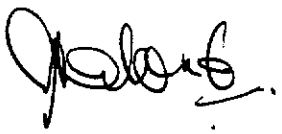
PREFACE

In keeping with our policy of releasing information of general technical interest, we make available some of our internal reports in a series of publications termed the GEO Report series. The reports in this series, of which this is one, are selected from a wide range of reports produced by the staff of the Office and our consultants.

Copies of GEO Reports have previously been made available free of charge in limited numbers. The demand for the reports in this series has increased greatly, necessitating new arrangements for supply. In future a charge will be made to cover the cost of printing.

The Geotechnical Engineering Office also publishes guidance documents and presents the results of research work of general interest in GEO Publications. These publications and the GEO Reports are disseminated through the Government's Information Services Department. Information on how to purchase them is given on the last page of this report.



A. W. Malone
Principal Government Geotechnical Engineer
April 1995

FOREWORD

This report was produced in 1982 as a permanent record of the effects of the rainstorms that occurred in the period of 15th to 19th of August 1982 with particular emphasis on the location, type and size of the more serious landslide incidents. It is a factual report and, apart from acknowledging that the landslides were caused by intense rainfall, does not attempt to explain the mechanisms and causes of failure.

The report was prepared by Mr R R Hudson under the supervision of Mr H B Phillipson, with input from various staff in the then Existing Slopes Division of the former Geotechnical Control Office. Supplementary landslide data were provided by the Agricultural and Fisheries Department, Architectural Services Department, Civil Engineering Office, Fire Services Department, the former Highways Office, Housing Department and Water Supplies Department. The Royal Observatory provided rainfall information. All contributions are gratefully acknowledged.

(Y.C. Chan)
Chief Geotechnical Engineer/Special Projects
August 1993

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CHAPTER 1

INTRODUCTION

The August 1982 rainstorm was exceptional because it occurred only eleven weeks after the severe rainstorm of May. More than 520 mm of rain fell on the five days between the 15th and 19th August, with 330 mm falling on one day alone. Five people were killed, three injured and more than 1 500 made homeless. Flooding was particularly extensive in the Tsuen Wan and Kwai Chung areas. The cost of clearance and repair work associated with landslips has been estimated to be approximately HK$35 m.

Over 800 incidents were reported to Government Departments as a result of the August 1982 rainstorm. Of these, 599 concerned flooding, 204 were landslips and the remainder were other incidents not appropriately described as either flooding or landslips.

This report has been produced by the Geotechnical Control Office (GCO) as a permanent record of the effects of the August 1982 rainstorm. The emphasis is on the damage and disruption caused by landslips, as these are the principle concern of the GCO. A landslip involves the collapse of soil or rock and is defined as :

- the failure of a man-made fill slope,
- the failure of a man-made cut slope,
- the failure of a retaining structure,
- the failure of a natural slope, or
- a rock or boulder fall.

The total number of landslips was much lower than might have been expected for such a significant rainstorm event. This may be explained in one of two ways. Either the heavy rain associated with the earlier May rainstorm initiated the failure of the majority of unstable slopes, retaining walls and boulders, or landslips that did occur in August were not reported to Government. Whilst the latter reason undoubtedly accounts for a few landslips in the more remote areas, it is considered that the former reason offers the best explanation.

A total of 150 incidents were referred direct to the GCO. Of these, 138 were genuine landslips, five involved flooding and the remainder were incidents which did not require specialist geotechnical advice. Geotechnical engineers from the GCO, including staff currently working in the Geotechnical Control Branch of the Buildings Ordinance Office, inspected these 138 landslips, and provided :

- advice on whether to evacuate residents,
- advice on immediate repair and support works, and
- advice on long term stabilisation measures.

This report attempts to give a broad picture of the effects of the August rainstorm although the bias is towards landslips, as information on these is most readily available to the GCO. It is a factual report and, apart from acknowledging that the landslips were initiated by intense rainfall, it does not attempt to explain the mechanisms of failure or whether individual landslips could have been predicted. It is intended, however, that the factual information included in this report be used to further our understanding of rain-induced failures.

CHAPTER 2

SUMMARY FACTS AND FIGURES

2.1 INCIDENTS AND DEATHS

This Chapter of the report summarises the factual information given in later Chapters. In order to make each summary as succinct as possible, most of the information has been presented in tabular form.

The Table below gives the breakdown of all incidents reported to Government Departments.

Incidents reported to Government Departments following the August 1982 rainstorm

Total number of reports made	Type of incident	Report received by
810	Flooding (599)	Highways Office (594) GCO (5)
	Landslips (204)	GCO (138)
		Housing Department (19)
		Water Supplies Department (47)
	Other (7)	GCO

Landslips in squatter areas were responsible for all five fatalities caused by the August rainstorm. The Table below gives the details.

Deaths caused by landslips in the August 1982 rainstorm

Location	Deaths	Type of landslip
Above Sung Dynasty Village, Lai Chi Kok	1 adult 1 child	Failure of a 33° natural slope
Kau Wah Keng San Tsuen, Kwai Chung	2 children	Failure of two, 3 m high, retaining walls
Yau Kam Tau, Tsing Yi	1 adult	Failure of a 2 m high retaining wall

2.2 RAINFALL

August 1982 was the wettest August since records began in 1884. Rainfall recorded at the Royal Observatory in Tsim Sha Tsui during the five days between 15th and 19th August was 522.6 mm, which is the highest five-day rainfall figure for any August on record. The actual figures were :

Rainfall during the rainstorm of August 1982 (Royal Observatory and GCO figures)		
Day and date	Rainfall at RO gauge in Tsim Sha Tsui	Maximum rainfall recorded at GCO gauge in Tsuen Wan(Cho Yiu Estate)
Sunday 15 August	29.4 mm	27.5 mm
Monday 16 August	334.2 mm	311.0 mm
Tuesday 17 August	80.2 mm	148.0 mm
Wednesday 18 August	47.6 mm	68.5 mm
Thursday 19 August	31.2 mm	26.5 mm

The Table below compares the rainfall during the August rainstorm with the rainfall during past rainstorms. This comparison has been made using the Royal Observatory's 'principal' gauge in Tsim Sha Tsui for which there are records dating back to 1884.

The August 1982 rainstorm compared to other rainstorms since 1884		
Period	August 1982 rainstorm figures	Ranking of August 1982 rainstorm
3-day	462.2 mm (16th to 18th)	10th highest (Highest = 854.9 mm)
2-day	414.6 mm (16th to 17th)	10th highest (Highest = 841.2 mm)
1-day	334.2 mm (16th)	5th highest (Highest = 534.0 mm)
24 hours	362.4 mm (ending 9 p.m. on 16th)	10th highest (Highest = 697.1 mm)

The above figures suggest that the August 1982 rainstorm was an event which could be expected to occur only once every eight years. This is a significant statistic because the May rainstorm, which occurred only eleven weeks before, was a more severe event.

There were considerable differences in rainfall across the Territory. Areas at similar elevations and only 2 kms apart experienced differences of rainfall of over 120 mm in the same 24 hour period. The highest rainfalls were recorded in Tsuen Wan, south of Yuen Long and in the Repulse Bay/Stanley area of Hong Kong Island.

There was also considerable variation in the intensity of rainfall. A maximum of 71.5 mm per hour was recorded by the GCO's automatic gauge in Stanley, which corresponds to a return period of five years. Records from the twenty GCO gauges indicate that rainfall throughout the Territory was at a peak between 0800 and 1200 on 16th August.

2.3 LANDSLIPS

The GCO has details of 204 landslips caused by the August 1982 rainstorm. The Table below shows the Territorial distribution of these 204 landslips.

Number and distribution of landslips known to the GCO, caused by the August 1982 rainstorm

Location		Hong Kong	Kowloon	New Territories
Squatter Areas		8	12	49
Permanent Buildings	Housing Estates	-	3	4
	Cottage Areas	-	-	12
	Other Buildings	4	2	11
Roads		17	2	29
Construction Sites		3	-	1
Catchwaters		4	-	43
Country Parks		-	-	-

It should be emphasised that the figures in this Table are not exhaustive. They have been compiled from the GCO's records and from information passed to the GCO by the Housing Department, Architectural Office, Water Supplies Department and the Argriculture and Fisheries Department.

It is likely that the following landslips have not been reported to the GCO and have therefore not been included in the Table :

- Minor landslips in construction sites,
- landslips in remote areas, and
- minor landslips adjacent to roads.

Landslips that were reported have been classified into five principal types, under the broad headings of man-made or natural features.

- Man-made features : Fill slopes
  Cut slopes
  Retaining walls
- Natural features : Natural slopes
  Boulders

The Table below shows the classification of the 204 genuine landslips known to the GCO together with the deaths caused by each type.

Number, type and fatal consequence of the landslips known to the GCO, caused by the August 1982 rainstorm

Type of landslip		Total number of each type	Percentage of classified landslips	Consequence: number of deaths
Fill slope failure		12	6%	-
Cut slope failure	Soil	105	54%	-
	Soil/Rock	19	10%	-
	Rock	8	4%	-
Retaining wall failure		19	10%	3
Natural slope failure		26	14%	2
Rock or boulder fall		3	2%	-
Unclassified failures		12	-	-

The twelve unclassified failures are those that could not be satisfactorily placed, by Housing Department staff, into one of the five principal groups. All these unclassified failures occurred in the cottage area of Rennie's Mill.

Each landslip has been classed as either major or minor depending on the volume of soil and rock in the failed mass. This classification is based on magnitude alone and does not relate to consequence. In general, the greatest damage was caused by the largest landslips. There was, however, one notable 'minor' incident at Yau Kam Tau on Tsing Yi Island that resulted in one death and one injury.

A major landslip is a failure in which the volume of displaced soil or rock is greater than 50 cubic metres.

Figure 1, which is included towards the end of this report, shows the geographical distribution of the major and minor landslips, caused by the August rainstorm and inspected by staff from the GCO.

The following two Tables show the number and distribution of the major and minor failures that occurred in man-made and natural features respectively.

Number and distribution of major and minor failures in man-made features, caused by the August 1982 rainstorm

Location		Fill slopes		Cut slopes		Retaining walls	
		Major	Minor	Major	Minor	Major	Minor
Squatter Areas		-	5	2	32	-	10
Perment Buildings	Housing Estates	-	-	2	5	-	-
	Cottage Areas	-	-	-	-	-	-
	Other Buildings	-	1	2	9	1	1
Roads		1	4	13	18	3	4
Construction Sites		1	-	1	1	-	-
Catchwaters		-	-	1	46	-	-
Country Parks		-	-	-	-	-	-

Number and distribution of major and minor failures in natural features, caused by the August 1982 rainstorm

Location		Natural slopes		Rocks and boulders		Unclassified	
		Major	Minor	Major	Minor	Major	Minor
Squatter Areas		4	14	-	2	-	-
Perment Buildings	Housing Estates	-	-	-	-	-	-
	Cottage Areas	-	-	-	-	-	12
	Other Buildings	1	2	-	-	-	-
Roads		2	2	-	1	-	-
Construction Sites		-	1	-	-	-	-
Catchwaters		-	-	-	-	-	-
Country Parks		-	-	-	-	-	-

It was not just the major landslips that caused damage and disruption. In certain circumstances, minor landslips were equally damaging, causing partial blockage of roads and, in squatter areas, the permanent evacuation of huts.

The Table below shows the consequence, other than death and injury, of the 138 landslips inspected by the GCO. As already mentioned, five people were killed and two injured by landslips.

Consequence, other than death and injury, of the landslips inspected by the GCO, caused by the August 1982 rainstorm

Type of landslip		Evacuation of squatter huts		Closure of part of permanent buildings		Blockage of roads	
		Perm.	Temp.	Perm.	Temp.	Total	Partial
Fill slope failure		15	-	-	1	-	3
Cut slope failure	Soil	56	5	3	1	6	10
	Soil/Rock	9	-	-	-	-	6
	Rock	-	-	-	-	2	4
Retaining wall failure		35	8	5	-	2	2
Natural slope failure		91	2	1	-	-	-
Rock or boulder fall		2	-	-	4	1	-

This Table shows that 208 squatter huts were permanently evacuated, parts of nine permanent buildings were permanently closed and eleven roads were totally blocked.

The Tables that have been presented in this Section are summaries only. Specific details can be obtained from information in the later Chapters of this report and, in particular, from Appendix 1, the comprehensive list of incidents reported directly to the GCO.

2.4 FLOODING

The Highways Office of the Engineering Development Department attended a total of 594 flooding incidents as a result of the August 1982 rainstorm. Of these, 315 were on Hong Kong Island, 103 in Kowloon and 176 in the New Territories. Despite the smaller number of reports made, the most extensive flooding was in the Tsuen Wan and Kwai Chung areas.

The Table below gives the Territorial distribution of the five flooding incidents that were referred direct to the GCO.

Number and distribution of flooding incidents referred direct to the GCO, caused by the August 1982 rainstorm

Location		Hong Kong	Kowloon	New Territories
Squatter Areas		-	1	3
Perment Buildings	Housing Estates	-	-	-
	Cottage Areas	-	-	-
	Other Buildings	-	-	-
Roads		1	-	-
Construction Sites		-	-	-
Catchwaters		-	-	-
Country Parks		-	-	-

CHAPTER 3

RAINFALL DATA

In Hong Kong, the distribution of rainfall can vary dramatically during a rainstorm event. In the August rainstorm, for example, one area received 120 mm more rainfall in a 24 hour period than an area, at a similar elevation, only 2 km away.

In order to quantify this widely varying rainfall pattern, the Royal Observatory has 165 raingauges at strategic locations around the Territory. The 'principal' gauge is outside the Royal Observatory's old headquarters in Tsim Sha Tsui, and readings have been taken from this gauge since January 1884. Weather summaries and rainfall statistics are usually based on the measurements made at this 'principal' gauge.

A few years ago, the GCO, in co-operation with the Royal Observatory, installed 20 additional raingauges. These are able to record rainfall every 15 minutes and are connected by telephone lines to an automatic recorder in the Emergency control room of the GCO. The locations of these additional gauges were selected to supplement information available from the existing Royal Observatory gauges and to provide specific information in areas where slopes were under observation.

3.1 ROYAL OBSERVATORY RECORDS

The following three paragraphs, describing the August Rainstorm, have been extracted from the Royal Observatory's Monthly Weather Summary.

> "August 1982 was the wettest August since records began in 1884. The total rainfall for the month amounted to 872.0 mm, which exceeds the previous record of 871.4 mm established in 1923. The rainfall recorded on 16 August, 334.2 mm, is the highest daily amount on record for August and the fifth highest for any month. The total rainfall for the heavy rain spell, 15-19 August, was 522.8 mm and is the highest five-day rainfall figure for August.....
>
> Thundery showers began in Hong Kong on 15 August as Severe Tropical Storm Dot landed in south China between Shantou and Xiamen. Dot dissipated over south China early on 16 August. Widespread thundery showers and heavy rain affected Hong Kong until 19 August. The rain was heaviest on 16 August and 238.3 mm of rain were recorded during the eight hour period ending at 1 p.m. This eight hour rainfall amount is the second highest on record for August ..... heavy rain

brought serious flooding and numerous landslips.....

Thunderstorm Warnings were in effect between 13 to 20 August. A Heavy Rain Warning was also issued on 16 August. No Fire Danger Warnings were issued and the Strong Monsoon Signal was not hoisted during the month."

The following daily rainfalls were recorded at the Royal Observatory at Tsim Sha Tsui from Sunday 15th August to Thursday 19th August 1982.

Rainstorm of August 1982 (R.O. gauge at Tsim Sha Tsui)	
Rainfall	Day and Date
29.4 mm	Sunday 15th August
334.2 mm	Monday 16th August
80.4 mm	Tuesday 17th August
47.6 mm	Wednesday 18th August
31.2 mm	Thursday 19th August

3.2 GEOTECHNICAL CONTROL OFFICE RECORDS

Rainfall records are also available from the automatic gauges monitored by the GCO.

During the rainstorm, the highest 3-day and 2-day rainfalls were recorded by gauge NO4 located at Cho Yiu Estate in Tsuen Wan.

Rainstorm of August 1982 (GCO gauge at Cho Yiu Estate)	
Rainfall	Day and Date
27.5 mm	Sunday 15th August
311.0 mm	Monday 16th August
148.0 mm	Tuesday 17th August
68.5 mm	Wednesday 18th August
26.5 mm	Thursday 19th August

The highest 4-day rainfall was recorded by gauge H15 in Stanley, 571.5 mm between the 16th and 19th, and the highest 1-day rainfall was recorded on the Peak, 322.0 mm by gauge H10 on the 16th.

The maximum hourly (clock hour) rainfall was 71.5 mm, recorded at two locations on the 16th August; gauge H15 in Stanley, between 0600 and 0700, and gauge No 1 in Shatin, between 1000 and 1100. From the records of all the gauges, it appears that the most intense period of rainfall during the rainstorm was between 0800 and 1200 on the 16th August.

Figure 2, which is included towards the end of this report, shows the rainfall recorded every 15 minutes by gauge NO4 in Tsuen Wan, for the period 15th to 17th of August. The maximum hourly rainfall recorded at this station was 66.0 mm, between the hours of 1100 and 1200 on the 16th.

3.3 GEOGRAPHICAL VARIATION

The intensity of rainfall varied considerably across the Territory, with maximum values recorded in Tsuen Wan, in the area south of Yuen Long and in the Repulse Bay/Stanley area of Hong Kong Island.

Figure 3 is a map, produced by the Royal Observatory, showing the distribution of rainfall for the 24-hour period ending at 3 p.m. on the 16th August. The overlay to this Figure shows the location of the 138 major and minor landslips inspected by staff from the GCO.

Figures 4 and 5 are histograms showing hourly rainfall, for the 16th August, recorded at 19 of the GCO raingauges. These Figures demonstrate the significant geographical variation in rainfall across the Territory.

3.4 COMPARISON WITH PAST RAINSTORMS

The heavy rain of 15th to 19th August 1982, recorded by the Royal Observatory at Tsim Sha Tsui, is compared here, with records of past rainstorms, measured at the same location.

(a) 4-day Total - Month of August

Rank	Period	Amount
1	23 - 26 August 1976	516.1 mm
[2]	16 - 19 August 1982	493.4 mm

Note: GCO gauge H15 in Stanley recorded 571.5 mm during the period 16th to 19th August.

(b) 3-day Total

Rank	Period	Amount
1	28 - 30 May 1889	854.9 mm
2	16 - 18 Jun 1972	652.3 mm
3	13 - 15 Jun 1959	627.5 mm
4	18 - 20 Jul 1926	587.0 mm
5	31 May - 2 Jun 1916	537.9 mm
6	10 - 12 Jun 1966	518.4 mm
7	24 - 26 Aug 1976	516.1 mm
8	16 - 18 Jun 1892	481.6 mm
9	29 - 31 May 1982	474.9 mm
[10]	16 - 18 Aug 1982	462.2 mm

Note: GCO gauge NO4 in Tsuen Wan recorded 527.5 mm during the period 16th to 18th August.

(c) 2-day Total

Rank	Period	Amount
1	29 - 30 May 1889	841.2 mm
2	19 - 20 Jul 1926	561.2 mm
3	24 - 25 Aug 1976	511.6 mm
4	11 - 12 Jun 1966	460.4 mm
5	14 - 15 Jun 1959	452.0 mm
6	17 - 18 Jun 1972	446.4 mm
7	11 - 12 Jun 1885	444.6 mm
8	1 - 2 Jun 1916	444.4 mm
9	28 - 29 May 1982	437.4 mm
[10]	16 - 17 Aug 1982	414.6 mm

Note: GCO gauge NO4 in Tsuen Wan recorded 459.0 mm during the period 16th to 17th August.

(d) 1-day Total

Rank	Date	Amount
1	19 Jul 1926	534.0 mm
2	30 May 1889	520.6 mm
3	12 Jun 1966	382.6 mm
4	15 Jul 1886	342.3 mm
[5]	16 Aug 1982	334.2 mm

Note: GCO gauge H10 on the Peak recorded 322.0 mm on 16th August.

(e) 24-hour Total

Rank	Ending hour of 24-hour period	Amount
1	6 a.m. 30 May 1889	697.1 mm
2	3 p.m. 19 Jul 1926	552.2 mm
3	11 a.m. 25 Aug 1926	416.2 mm
4	9 a.m. 31 Oct 1923	408.8 mm
5	12 noon 12 Jun 1966	401.2 mm
6	10 a.m. 29 May 1982	394.3 mm
7	4 p.m. 17 Oct 1978	379.8 mm
8	3 p.m. 9 Jun 1960	368.4 mm
9	8 p.m. 15 Jul 1886	363.8 mm
[10]	9 p.m. 16 Aug 1982	362.4 mm

Note: GCO gauge H10 on the Peak recorded 341.5 mm for the 24-hour period ending at 8 p.m. on 16th August.

Figure 6 compares the cumulative rainfall for the August 1982 rainstorm with similar records for the rainstorm events of June 1966, June 1972, August 1976 and May 1982.

The total rainfall and localised rainfall intensities recorded during the August rainstorm were lower than the equivalent figures for the May rainstorm earlier in the year. A comparison between these two rainstorms, using the records from the R.O. gauge at Tsim Sha Tsui, is shown below.

Rainstorms during 1982
A comparison of the May and August rainstorms

Interval	15 to 19 August	28 May to 1 June
max. 1 hour rainfall	68.3 mm	43.9 mm
max. 2 hour rainfall	95.1 mm	83.8 mm
max. 4 hour rainfall	134.5 mm	135.0 mm
max. 6 hour rainfall	196.8 mm	182.2 mm
max. 8 hour rainfall	238.3 mm	208.2 mm
max. 12 hour rainfall	250.7 mm	225.7 mm
max. 24 hour rainfall	362.4 mm	394.3 mm
max. 36 hour rainfall	413.3 mm	431.4 mm
max. 1 day rainfall	334.2 mm (16 Aug)	258.4 mm (29 May)
max. 2 day rainfall	414.6 mm (16 to 17 Aug)	437.4 mm (28 to 29 May)
max. 3 day rainfall	462.2 mm (16 to 18 Aug)	474.9 mm (29 to 31 May)
max. 4 day rainfall	493.4 mm (16 to 19 Aug)	653.9 mm (28 to 31 May)
max. 5 day rainfall	522.8 mm (15 to 19 Aug)	655.2 mm (28 May to 1 June)

CHAPTER 4

LANDSLIPS

The purpose of this Chapter is to illustrate the variety of landslips that occurred as a result of the August rainstorm. The Chapter is arranged so that each of the five main types of landslip is discussed. Incidents that were particularly notable, because they were good examples of typical or 'classic' failures, are discussed in detail. For continuity of text, the sketch cross-sections, and photographs associated with each notable incident, are included towards the end of the report. A reference to the appropriate sketch or photograph, where available, is included beneath the title of each incident.

It is worth mentioning one feature of many of the landslips inspected by staff from the GCO. This particularly refers to cases where roads have been formed across natural hillsides, with a small cut on the upslope and a thin veneer of fill on the downslope side. In a number of incidents, at locations of this type, the failure of the downslope edge of a road was due to water rushing over the road surface and pouring onto the slope below. The source of this water was invariably found to be a blocked natural stream or man-made channel. Occasionaly, debris from a small slip in the cutting on the upslope side deflected water flowing along the road and forced it over the road kerb and onto the slope below. In these cases, the failure below the road is more accurately described as an erosion gully, rather than a conventional failure along a discrete shear plane. However, for the purposes of this report, failures that are suspected erosion or washout features have been considered as landslips.

Plate 1 illustrates this type of erosion or washout feature. In this case, surface water collected on the road overtopped the kerb and initiated the 'failure' of the slope below.

4.1 FILL SLOPES

There were twelve fill slope failures, of which two were classifed as <u>major</u>. There were no incidents involving the liquefaction of fill material and there were no casualties. Fifteen squatter huts were permanently evacuated, part of one masonry building was temporarily evacuated and three roads were partially blocked.

The two failures that have been classified as <u>major</u> are described below.

(a) Shing Mun Road
(Incident No. NT/8/75, Figure 7)

A 2 m wide by 18 m long section of embankment, supporting the Shing Mun Road, failed on the 16th August. The cause of the failure appears to have been water discharging over the road surface from a natural stream blocked by refuse. The debris from the failure only travelled a few metres

and did not affect property. Remedial works to this embankment include the removal of the loose fill and debris, and the formation of a new embankment with properly compacted fill.

(b) Mount Butler Quarry
(Incident No. HK/8/23, Plate 2)

The cracking and subsequent structural failure of a concrete drainage channel caused extensive erosion of a large fill slope (Fill slope no. 11SE-C/FR20). It is thought that the channel broke as a result of movement of the fill slope which was supporting it. Once broken, the water collected by the channel poured onto the fill forming an erosion gully 120 m long, 15 m wide and up to 5 m deep. The debris washed out of the gully, which was substantially quarry waste of granitic origin, remained within the quarry boundaries and did not affect quarrying activities. Remedial measures to this slope include the replacement of the concrete channel with a properly buttressed steel pipe, compacting the debris and regrading the whole slope to 30°.

4.2 CUT SLOPES

Cut slope failures accounted for 68% of the landslips reported to Government Departments. This category of landslip is further divided into soil cut failures, soil/rock cut failures and rock cut failures.

4.2.1 Soil Cut Slopes

Failures of cut slopes composed entirely of soil accounted for 54% of all landslips reported to Government. Approximately half of these failures occurred in squatter areas and were small scale (i.e. the volume of displaced soil was less than 50 cubic metres). There were no casualties although disruption was extensive, including the permanent closure of parts of five buildings, the permanent evacuation of 56 squatter huts, the total blockage of five roads and the blockage of several lengths of catchwater channel.

Two soil cut failures are described below, to illustrate the range of failure sizes and their consequences.

(a) Kung Yip Street, Kwai Chung
(Incident No. NT/8/47, Figure 8, Plate 3)

The upper to middle section of a 22 m high chunammed cut slope in decomposed granite failed on 16th August. Failure occurred over a height of approximately 7 m of grade IV/V decomposed granite, standing at 45° to 50°. The cause of the failure was a rise in the groundwater table as a result of the heavy rain. Many of the weepholes through the chunam cover were blocked by

vegetation. There was a patch of no fines concrete beneath the zone where the failure took place, suggesting that minor minor movement had occurred before. The debris from the failure fell into an open space behind a factory building. There was no damage to the building.

(b) 13½ MS Castle Peak Road
(Incident No. NT/8/34, Figure 9, Plate 4)

In contrast to the Kung Yip Street failure, this failure, which occurred on 17th August, was a major failure involving more than 200 m^3 of soil. The cut was formed in decomposed granite, substantially of decomposition grade V, but with a lower layer of grade IV, 3 to 4 m thick. Prior to failure, the slope was approximately 13 m high at an overall angle of 52°. The base of the failure scar was at the boundary between the grade IV and grade V material. No seepage was observed during site inspection two days after failure, but the ground at the slope crest was still saturated. Small platforms had been cut for gardens at the crest of the slope, and it is thought that infiltration into these platforms initiated the failure. There were no casualties, but one lane of Castle Peak Road was blocked for several hours.

4.2.2 Soil/Rock Cut Slopes

Nineteen soil/rock cut failures were reported. The main areas affected were roads and, to a lesser extent, squatters. Most of the failures were minor although six roads were partially blocked and nine squatter huts were permanently evacuated.

Plate 5 shows a typical soil/rock cut slope. In this case, the soil part of the slope failed and the debris blocked one lane of Castle Peak Road.

Two notable soil/rock cut failures are described below.

(a) 5½ MS Castle Peak Road
(Incident No. NT/8/23, Figure 10, Plate 6)

Plate 6 is a distant view of the top part of the failed slope, with Castle Peak Road hidden by the trees below. The original cut slope was approximately 25 m high, with the bottom 8 m at 85° and the upper part at 60°. The near-vertical base of the slope is formed in slightly to moderately decomposed granite, with the upper part in grade IV material. There is about 2 m of grade V material at the slope crest. Failure occurred on a distinct joint plane dipping out of the face at approximately 55°. Because the rock face at the toe was so steep, the failure debris slid completely off the slope and covered both Kowloon bound lanes of Castle Peak Road. Infiltration of water through the footpath above the

slope is thought to have been the main cause of failure. The inside lane of the Kowloon bound carriageway was closed for nine weeks while remedial works were carried out.

(b) Repulse Bay Road
(Incident No. HK/8/27, Plates 7 and 8)

An irregular failure occurred in the upper 7 m of a 60°, 10 m high slope, cut into Hong Kong granite of variable weathering profile. Several large corestones of rock embedded in the soil matrix at the slope crest were broken out by the failure and fell onto the road below. No seepage was observed during the various site inspections, and it appears that failure was initiated by water infiltrating into the slope crest. One lane of Repulse Bay Road was closed for three days to allow the clearance of debris and the removal of a number of other corestones that had been undermined by the failure.

4.2.3 Rock Cut Slopes

There were a total of eight failures in rock cut slopes. Of these, five have been classified as major. This is in contrast to the May rainstorm when all 16 rock cut failures were minor. The failures affected roads, totally blocking two and causing partial blockage of four others. The rock cut failure at Shek Tau Street, Tai Wo Hau Estate (Incident No. NT/8/33), crushed three unoccupied cars.

Plate 9 shows a typical rock cut slope. In this case, failure occurred on one dominant plane and the debris partially blocked the access road to the Shek Yam Temporary Housing Area.

Two notable rock cut failures are described below.

(a) Kwai Chung Road
(Incident No. NT/8/26, Figure 11, Plate 10)

The failure involved the sliding of large blocks of granite rock on relatively shallow, 30° to 40°, joint planes with sub-vertical backing joints providing the release surface. The debris, which was substantially large blocks up to 4 m^3, blocked one and a half lanes of the Kowloon bound carriageway of Kwai Chung Road.

(b) Above Road TY1, Tsing Yi South Service Reservoir
(Incident No. NT/8/81, Plates 11 and 12)

This slope was under construction at the time of the August rainstorm. The failed area comprises hydrothermally altered, moderately decomposed, granite. Either side of the failure, there were more competent, major intrusions of granite porphyry. The failure surfaces were coated with kaolin and manganese

dioxide. The main failure plane dipped steeply at an oblique angle to the slope surface. A number of other joints acted as release surfaces, and, combined with the main plane, provided a daylighting wedge. The debris, which was substantially small blocks of fractured rock, slid to the slope toe and blocked one lane of road TY1.

4.3 RETAINING WALLS

A total of nineteen incidents relating to retaining walls were reported, two on Hong Kong Island, one in Kowloon and the remainder in the New Territories. Of these, fifteen were complete collapses, and the others were cases where the walls had not collapsed but were showing signs of severe distress. Four of the incidents have been classified as major and six incidents involved walls greater than 3 m high.

Eight walls were classified as skin walls, where the height to width ratio is very large, three walls were of substantial cross section, typically a height to width ratio of 3 to 1, and no reliable information is available for the remainder. Wall construction varied, with the majority being masonry of the random rubble type. In addition, there were failures in three mass concrete walls, one new reinforced concrete wall, one brick wall and one dressed blocked wall.

It is difficult to make definitive statements on the causes of failure of these walls. It would appear that several of the failures were due to water pressure behind walls of inadequate thickness (skin walls). Ponding of water at the wall crest and subsequent seepage through cracks in crest platforms is thought to be the main contributor to this build up of pressure. Other failures were part of a more general slope failure. In these cases, a small toe wall supporting a slope failed and caused the general failure of the slope, taking with it other retaining walls at the crest.

Three deaths and one injury were caused by the failure of retaining walls. These incidents are described in detail in Section 5.1.

Four notable failures of retaining walls are described below.

(a) 7, Chung Shan Terrace, New Territories
(Incident No. GCB 6/8, Figure 12, Plates 13 and 14)

This failure occurred in two stages. The first, at 9.00 a.m. on the 31st July 1982, involved the failure of a 3 m high masonry retaining wall with a height to width ratio of 3 to 1. This wall was supporting the road leading to Chung Shan Terrace. The second stage was during the August rainstorm, when the situation worsened and, at 4.00 p.m. on the 16th August, a recently constructed, 6 m high reinforced concrete, cantilever wall collapsed. The cause of this collapse is thought to be the undermining of the wall footing by the previous slip.

(b) 25, Lugard Road
(Incident No. GCB 6/8, Figure 13, Plate 15)

A 4.5 m high masonry wall, which supported the access road to Nos. 25 and 26 Lugard Road, collapsed at 10.00 a.m. on the 17th August. The volume of the failure has been estimated at 70 m^3 and the debris consisted of wall blocks and decomposed volcanic soil. The access road was cut and No. 25 Lugard Road was threatened by undermining.

(c) 9½ MS Castle Peak Road
(Incident No. NT/8/16, Figure 14, Plates 16 and 17)

Saturation of soil in front of a 2 m high masonry retaining wall caused a bearing failure, which in turn caused a compound slope failure. A 16 m length of Castle Peak Road was undermined and a reinforced concrete beach house was threatened at the slope toe. The saturation that initiated failure was due to water from a road gully discharging directly onto the slope supporting the wall.

(d) 19 Shung Shan Terrance, Yuen Long
(Incident No. NT/8/79)

This incident was the failure of a 0.15 m thick reinforced concrete wall, which varied in height between 1 m and 3 m. Behind the wall, the ground sloped upwards at approximately 45° for 5 m, and thereafter at 20°. There were no weepholes, and reinforcement steel at the central section was 12 mm diameter at 300 mm spacings. The wall did not collapse completely, but the upper part, above 1.5 m, rotated outwards and damaged the wall of the masonry house below. This house was permanently evacuated. The cause of failure is thought to be the build up of water pressure behind the wall because of the absence of weepholes.

4.4 NATURAL SLOPES

There were a total of 26 failures in natural slopes. Seven of these were major failures, one of which caused two deaths. The majority of these failures were in squatter areas, causing the permanent evacuation of 91 huts.

The failure of the natural slope above the Sung Dynasty Village, Lai Chi Kok (Incident No. NT/8/7), which resulted in two deaths, is described in detail in Section 5.1.

Compared to the May 1982 rainstorm, there were very few failures of natural slopes in country parks and other remote areas. This is significant, and suggests that the May rainstorm had already initiated the failure of the majority of natural slopes that were in a critical or unstable condition.

Two notable failures of natural slopes are described below.

(a) 13 MS Route Twisk
(Incident No. NT/8/39, Figure 15, Plates 18 and 19)

This incident involved two separate failures. In both cases, the crest of the failure scar was at road level on the downslope side of the carriageway. Neither failure was entirely 'natural', as there appears to be a thin layer of fill on top of the natural ground, probably end-tipped during road widening twenty-five years ago. The most dramatic features of these failures are the very long erosion scars. Vegetation has been stripped along these scars, leaving a bare, irregular gully choked with slip debris and extending more than 500 m below the road. The form of these scars is similar to other large natural slope failures that occurred in this area during the May rainstorm. It is considered unlikely that these long scars are 'failures' in the conventional sense of movement along a discrete shear plane. More probably, the slip surface is restricted to the upper parts of these scars, and the saturated debris has been sufficiently mobile to flow downslope, uprooting vegetation and scouring out the large erosion gullies. Additional mobility is provided by water flowing into the debris from existing natural drainage channels which intersect the scar.

(b) Tsin Sui Ma Tau Village
(Incident No. HK/8/32, Figure 16)

The failure of a natural slope within this squatter village caused the permanent evacuation of seven huts. The cause of failure was difficult to establish, although infiltration into a small platform at the slope crest, on which there was a part demolished abandoned hut, was certainly a contributing factor.

4.5 ROCK AND BOULDER FALLS

Only three boulder falls were reported, one on Hong Kong Island and two in the New Territories. The two in the New Territories (Incident Nos. NT/8/48 and NT/8/50) involved threats posed by boulders that had been undermined, rather than actual movement.

In the Hong Kong incident, a 0.3 m^3 boulder rolled across Belcher Street from an adjacent natural slope (Incident No. HK/8/13). The boulder was quickly removed, but the road remained closed for three days so that stabilisation works on other boulders could be carried out.

4.6 UNCLASSIFIED FAILURES

Sections 4.1 to 4.5 of this Chapter have described the five principal landslip categories.

Twelve of the incidents inspected by Housing Department staff could not be appropriately classified into one of these five categories. These incidents were all in the cottage area of Rennie's Mill and were minor, causing nuisance and disruption rather than a threat to human life.

CHAPTER 5

NOTABLE INCIDENTS

The purpose of this Chapter is to illustrate the damage caused by the August rainstorm, with the emphasis on those incidents where landslips were responsible for the damage. The Chapter is arranged so that the six main areas affected are discussed. Incidents that were notable, because they caused extensive damage or disruption, are discussed in detail with the aid of sketch cross-sections and photographs, if these are available. These sketches and photographs are included towards the end of the report but are clearly referenced beneath the title of each incident.

5.1 SQUATTER AREAS

All five deaths caused by the August rainstorm occurred in Squatter areas. Two deaths occurred as a result of the failure of a natural slope adjacent to the Sung Dynasty Village at Lai Chi Kok, and the other three followed the collapse of retaining walls in Kau Wah Keng San Tsuen near Lai Chi Kok Bay, and Yau Kam Tau on Tsing Yi Island.

A total of 69 landslips occurred in Squatter areas, eight on Hong Kong Island, twelve in Kowloon and 49 in the New Territories. The greatest concentration of landslips was at Lai Chi Kok Bay, which was also the area that experienced the most intense rainfall.

Six of the 69 landslips were classified as major, of which two were failures of cut slopes and the others were failures of natural slopes. The two incidents, which involved the collapse of retaining walls, and which caused fatalities, have been classified as minor, because the volume of displaced soil and rock was less than 50 m^3.

Landslips within areas of densely packed squatter huts caused significant damage and disruption, even though many were classified as minor. Plates 20 and 21 show minor failures which are typical of those inspected in squatter areas. Despite being minor, the safety of squatters was threatened, and recommendations were made to evacuate occupants.

As a result of the landslips within squatter areas, staff from the GCO have recommended the permanent evacuation of more than 200 huts. In addition, fifteen huts were temporarily evacuated pending the completion of adequate remedial works to the failed areas.

In addition to incidents involving landslips, a total of four flooding incidents affecting squatter areas were reported directly to the GCO. Two of these were serious, resulting in the injury of one man and the permanent evacuation of twenty huts in one case (Incident No. NT/8/36, Fu Yung Shan, Tsuen Wan), and the permanent evacuation of seventeen huts in the other (Incident No. NT/8/9, Kau Wah Keng Old Tsuen).

Three notable landslips affecting squatters are described below.

(a) Above Sung Dynasty Village, Lai Chi Kok
(Incident No. NT/8/7, Figure 17)

The failure of a 33° natural slope occurred at 11.30 a.m. on the 16th August to the east of the Sung Dynasty Village. Approximately 300 m³ of grade IV/V decomposed granite failed, demolishing one isolated squatter hut and killing a mother and her baby. Approximately one third of the debris came to rest on the roadway below, completely blocking the access to Kau Wah Keng village, and the other two thirds engulfed the squatter hut. The body of the mother was recovered during the afternoon of the 16th and the child's body was recovered on the morning of the 18th August. The debris on the road blocked the natural drainage from Kau Wah Keng and caused flooding to a depth of nearly one metre. This water was released by the evening of the 16th, following excavation of the debris.
The failure, which took place on a weathered joint sub-parallel to the ground surface, left a steep 3 m high scar at the crest. Substantial quantities of water were noted issuing from joints within the grade IV material at the base of this steep section. Water continued to emanate from these joints for at least one month after the rainstorm. The primary cause of failure would appear to be water seeping through these joints and causing a build up of pressure on the dominant weathering interface. Relatively little surface water was seen running over the crest of the failure scar during the height of the rainstorm. It is considered that the presence of the squatters at the toe of the natural slope did not contribute to the failure.

(b) Yau Kam Tau, Tsing Yi
(Incident No. NT/8/27, Figure 18, Plate 22)

The location of this incident was approximately 500 m east of the Yau Kam Tau ferry pier. It involved an unsurveyed squatter hut with two occupants, one of whom was killed and the other injured. The failure took place at 2.00 a.m. on 17th August when a 2 m high retaining wall, supporting a hillside grave, collapsed. The debris rolled down a 40° natural slope, and demolished a hut which was situated approximately 20 m away. It appears that a general slope failure took place, initiated by infiltration into the flat area supported by the wall. The vegetation between the failure and site of the hut remained relatively undamaged.

(c) Kau Wah Keng San Tsuen
(Incident No. NT/8/8, Figure 19, Plates 23 and 24)

Two children were killed when two 3 m high masonry retaining walls collapsed, demolishing the rear masonry wall of a squatter hut (No. RTW/4AA/102). The total height of the

failure was about 8 m, comprising an upper and a lower retaining wall and a section of slope below the lower wall. The collapse, which occurred at 10.30 a.m. on the 16th August, took the form of a general slope failure, starting with the failure of the lower wall. It appears that water discharging directly onto the slope at the toe caused a softening of the slender lower wall's footings, and initiated the collapse. The upper wall had a height to width ratio of 3.5 to 1, and the lower one approximately 8 to 1. Neither wall was adequately built or was provided with satisfactory drainage. It is noteworthy that the amount of debris which caused the fatalities was small, less than 1 m^3.

Most of the other landslips in squatter areas were caused by the typical hut construction activities of cutting platforms into already steep natural hillsides and inadequately supporting the excavated material.

5.2 PERMANENT BUILDINGS

Permanent buildings affected by landslips are one of three categories :

- buildings in housing estates,
- buildings in cottage areas, and
- all other buildings.

The GCO has first-hand knowledge of those landslips in the third category (all other buildings). Some information, however, has been passed to the GCO from Housing Department, who have inspected all landslips within housing estates and cottage areas.

5.2.1 Housing Estates

A total of seven landslips occurred in housing estates, according to information passed to the GCO. All of these were cut slope failures and two were major, involving more than 50 m^3 of debris. Three were in the Kowloon area (Slope Nos. 11NE-B/C156 and C9, and 11NE-A/CR57) and the remainder were in the New Territories (Slope Nos. 7SW-C/C86, C153, C155 and C311). Damage caused by these failures was not extensive.

5.2.2 Cottage Areas

Twelve landslips occurred in cottage areas, and all of these were in Rennie's Mill. No further information is available on these landslips except that all occurred between the 16th and 19th of August, they were minor and caused no casualties.

5.2.3 Other Buildings

Seventeen landslips affecting permanent buildings were reported, four on Hong Kong Island, two in Kowloon and the remainder in the New Territories. Of these, one was the minor failure of a fill slope, eleven were failures of cut slopes, two of retaining walls and three of natural slopes. Four landslips were classified as major, of which two were failures of cut slopes, one of a retaining wall and one of a natural slope.

Parts of nine buildings were permanently closed as a result of structural damage caused by landslips, and six buildings were temporarily evacuated while remedial measures were being carried out.

Details are available for one incident where the debris from the landslip buried the rear yard of a building to the height of the ground floor window sill.

(a) 45 Island Road
(Incident No. GCB/4/8, Figure 20, Plate 25)

A cut slope formed in decomposed volcanic rock failed at 3.00 a.m. on the 17th August. Before failure, the height of the slope was about 8 m. The section of slope that failed was originally 6 m high and standing at 50°. The debris from the failed area filled the space between the building and the toe of the slope to an average depth of 1.5 m but did not cause any damage to the structure.

5.3 ROADS

A total of 48 landslips affected roads, 17 on Hong Kong Island, two in Kowloon and 29 in the New Territories. Nineteen of the 48 landslips were classified as major, of which thirteen, or 68%, were failures of cut slopes. Eleven roads were totally blocked, and traffic was restricted to one lane at 25 other locations. The major roads affected were Castle Peak Road, Kwai Chung Road, Tai Po Road, Route Twisk and Road TY1 on Tsing Yi Island.

A number of notable incidents are described below.

(a) Peel Rise Squatter Area, Aberdeen
(Incident No. HK/8/16, Figure 21, Plate 26)

In this incident the debris from the failure of a soil cut slope covered the road to a depth of 1.5 m. The road was completely blocked for thirteen days, while debris removal and remedial works were undertaken. Four Squatter huts situated below the road were threatened by the landslip debris and, as a result, three of these, were permanently evacuated.

(b) Ching Cheung Road, Kowloon
(Incident No. K/8/29, Figure 22, Plates 27 and 28)

This cut slope failure was notable because it occurred on the 24th August, five days after the heavy rain. It involved the upper 22 m of a 50° cut slope formed in highly microfractured grade IV granite. The failure appears to have been caused by the delayed rise of groundwater level behind a dolerite dyke which was acting as a 'dam'. Ching Cheung Road was totally blocked by debris. Following removal of some of the debris, one westward bound lane was opened at peak traffic times. On 1st September, after the erection of a safety barrier along the central reservation, the two westward bound lanes were opened for two-way traffic. The whole road was eventually reopened on the 25th October, when remedial works to the failed area and preventive works to an adjacent unstable area, were completed.

(c) 6½ MS Castle Peak Road, Tsuen Wan
(Incident No. NT/8/25, Figure 23)

This incident involved the failure of the upper 8 m of a 17 m high cut slope (7SW-C/C205). The lower 9 m was protected by stone pitching and no distress was noted. The failed section was protected by chunam. The debris blocked both Kowloon bound lanes of Castle Peak Road. One lane was cleared after one day, and the second lane was reopened on 15th October when the majority of the remedial works were completed. It is thought that squatter farming activity was largely responsible for this failure. There were a number of ponds and flat areas at the crest of the slope which allowed direct infiltration of surface water.

(d) Shek Tau Street, Tai Wo Hau Estate, Tsuen Wan
(Incident No. NT/8/33, Figure 24, Plate 29)

This cut slope has a history of previous failures and consists of a 16 m high rock cut slope which is topped by a 15 m high soil cut. Above this, is a natural slope at 35° extending about 60 m to a salt water service reservoir. A rockfall, in the form of a wedge type failure, took place, leaving the concrete surface of the first berm overhanging. The debris completely blocked Shek Tau Street and severely damaged three cars. The cause of failure is not certain, but contributing factors are thought to be an open trench in the slope above the cut, and a leaking salt water main.

(e) Cheung Hang Road, Kau Wah Keng
(Incident Nos. NT/8/11, 66, 70, 71 and 72, Figure 25, Plates 30 and 31)

This road was affected by five separate landslips, of which two were classified as major. One of these failures occurred as a direct consequence of a minor failure further upslope. The road at the section where these failures occurred is on a rising gradient on the west of Butterfly Valley. It is about 5 m wide, with 5 m high cut slopes on one side and a 36° natural slope, with a thin veneer of fill, on the other. The debris from a minor failure in one of the cut slopes blocked the road, and as there was no provision for drainage, surface water running down the road discharged over the kerb and onto the natural/fill slope below. This formed a 2 m deep erosion gully which undercut the road. Repair work included the construction of two retaining walls.

(f) Road TY1, Tsing Yi Island
(Incident Nos. NT/8/15, 38, 44 and 81, Plates 32 and 33)

Road TY1 was affected by four landslips within one kilometre of each other. There was significant deterioration of the large failure near the Euroasia site at Chainage 2400 that was initiated by the May rainstorm (Incident No. NT/8/15). A further 4 m movement downslope was noted. Nearby, above the PEPCO Power Station, a similar failure occurred four days after the end of the rainstorm. This resulted in a movement of the slope, mainly between the first and third berms, of up to 1.5 m. This failure appeared to be controlled by relict jointing in the grade IV granite (Incident No. NT/8/44).
The other two failures were rockfalls which both resulted in the closure of one lane of Road TY1 (Incident Nos. NT/8/38 and 81, Plates 11 and 12, and Plates 34 and 35).

(g) 5½ MS Tai Po Road, near Kowloon Reservoir
(Incident No. NT/8/18, Figure 26, Plate 36)

This major failure of a decomposed granite cut slope occurred at 11.00 a.m. on the 17th August. The debris completely covered Tai Po Road to a depth of 5 m. Clearance started immediately, and at 6.00 a.m. on the 18th August, a second failure, in the smaller cut on the other side of the road, took place. On the 21st August, a 4 m high barrier was erected along the centre line of the road, and the one lane between this barrier and the lower cutting was opened to traffic.

5.4 CONSTRUCTION SITES

Only four landslips in construction sites were reported to the GCO. Three of these were on Hong Kong Island and one in the New Territories. Two were major and two minor. The two major failures were in a fill slope within the boundaries of Mount Butler Quarry and in a soil/rock cut slope within a site in South Bay Close. The Mount Butler incident has already been described (see Section 4.1), and the South Bay Close incident is described here.

(a) RBL 1044, South Bay Close, Hong Kong
(Incident No. GCB 3/8, Figure 27, Plate 37)

This failure was adjacent to a larger failure that occurred in the same slope during the May 1982 rainstorm. Failure took place at 5.00 a.m. 17th August and involved the sliding of material along a sheared zone which daylighted in the cut face. No casualties were reported.

5.5 CATCHWATERS

Water Supplies Department recorded 47 cut slope failures along catchwaters. Forty-three of these were on the Shing Mun and Tai Lam Chung catchwaters in the southern and southwestern New Territories. None of the failures involved complete blockage or major damage to catchwaters, and there were no casualties. Of the 47, the majority were failures in soil cuts, with only five in cuts described as soil/rock. One failure on the Shing Mun catchwater, which has been classified as major, resulted in blockage which was sufficient to cause overspilling from the catchwater channel. However, this did not cause any substantial damage to the catchwater or to the slope below.

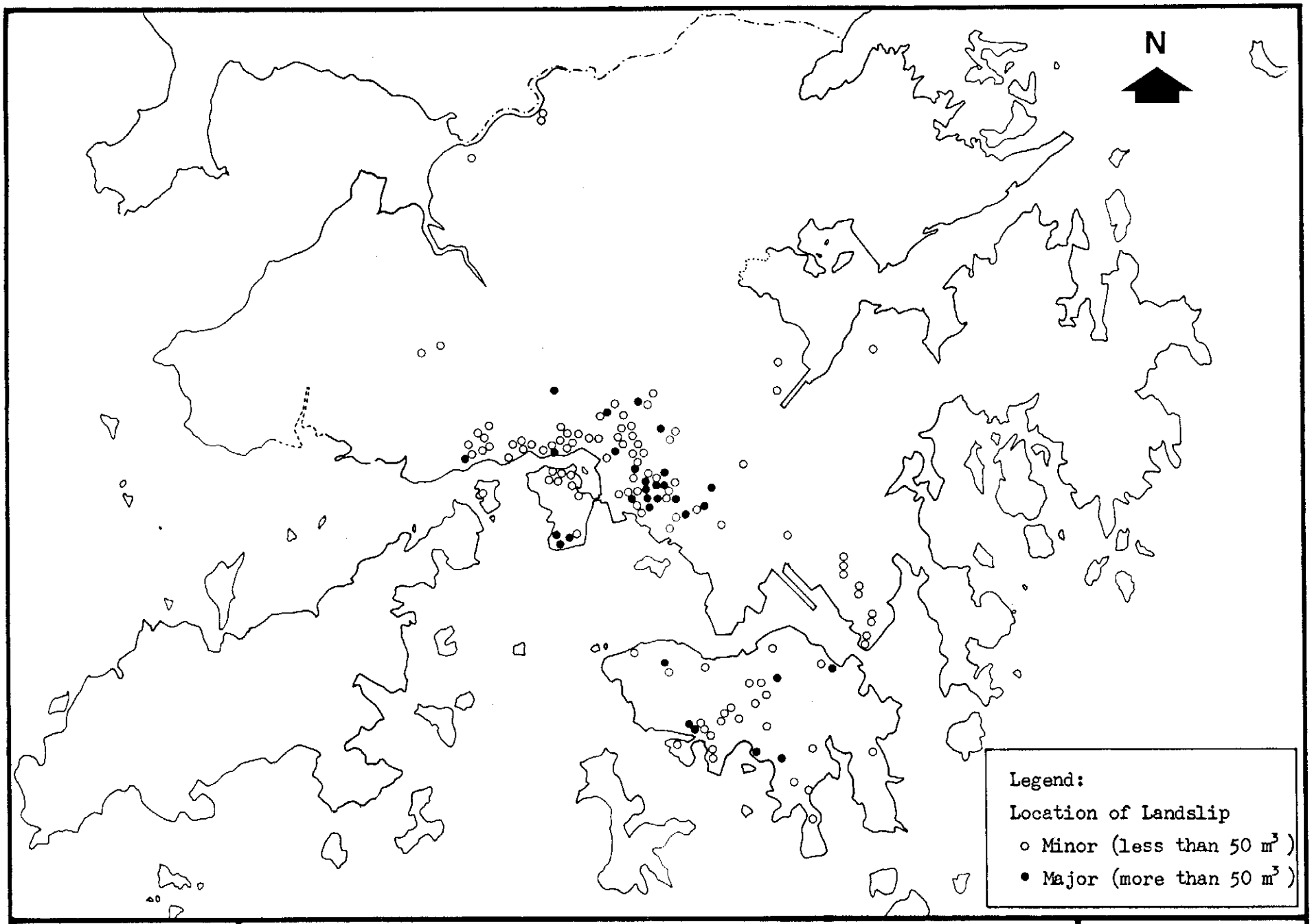
5.6 COUNTRY PARKS

The Agriculture and Fisheries Department did not record any landslips as a result of the August rainstorm in the areas under their control. As mentioned before, this rather unexpected fact is thought to be due to the intense rain experienced by these areas during the May rainstorm. This earlier rain may have been sufficient to induce the failure of all unstable slopes, leaving more stable slopes which were able to withstand the heavy August rain.

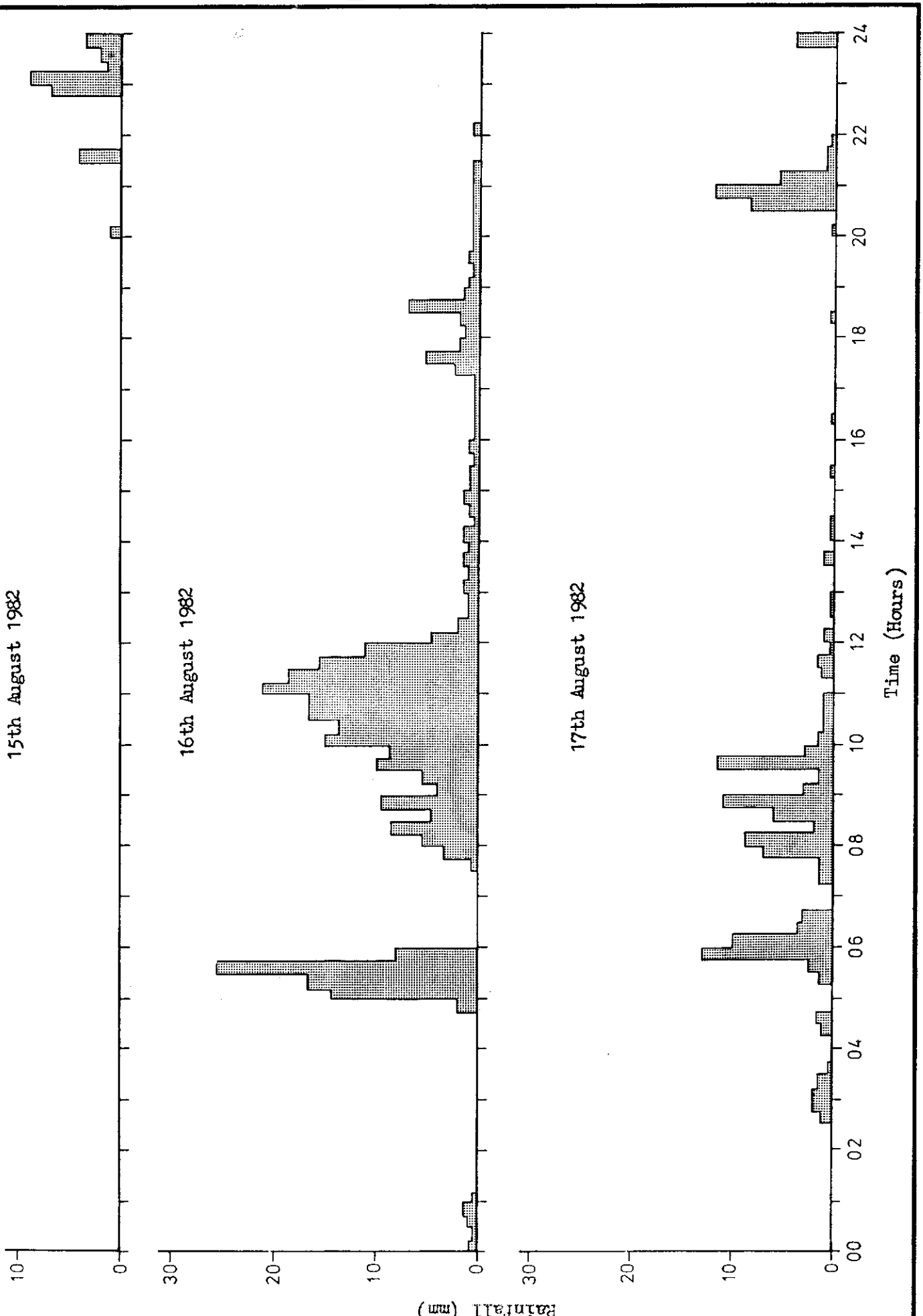
FIGURES

REPORT ON THE RAINSTORM OF AUGUST 1982

FIGURES

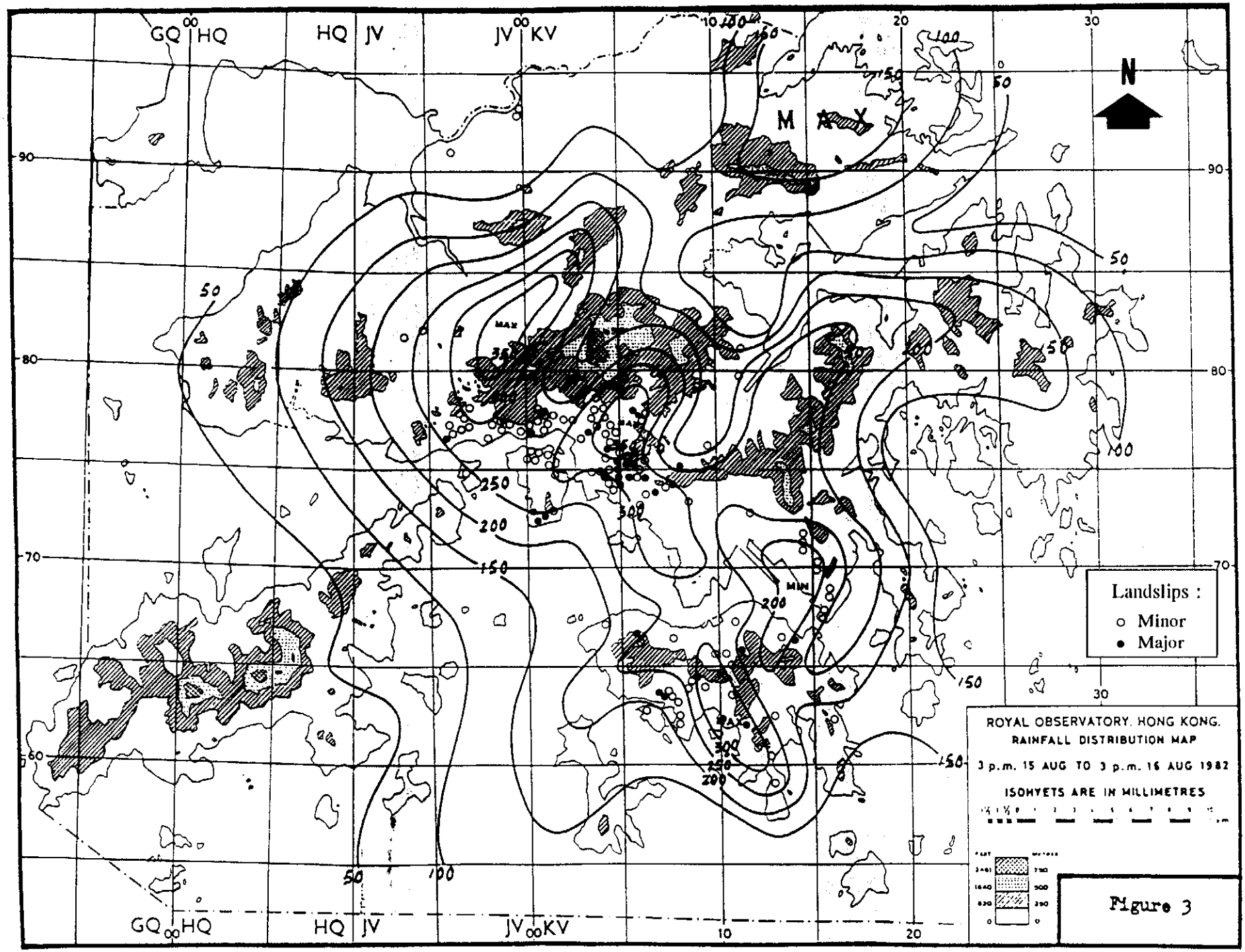


Approx. Scale 1:250 000	Rainstorm of August 1982 Locations of the 138 landslips inspected by staff from the GCO	Figure 1



15-minute rainfalls recorded by GCO raingauge NO4 in Cho Yiu Estate, Tsuen Wan, for the period 15th to 17th August 1982

Figure 2


GQ 00 HQ
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Landslips :
Minor
Major
ROYAL OBSERVATORY, HONG KONG.
RAINFALL DISTRIBUTION MAP
3 p.m. 15 AUG TO 3 p.m. 16 AUG 1982
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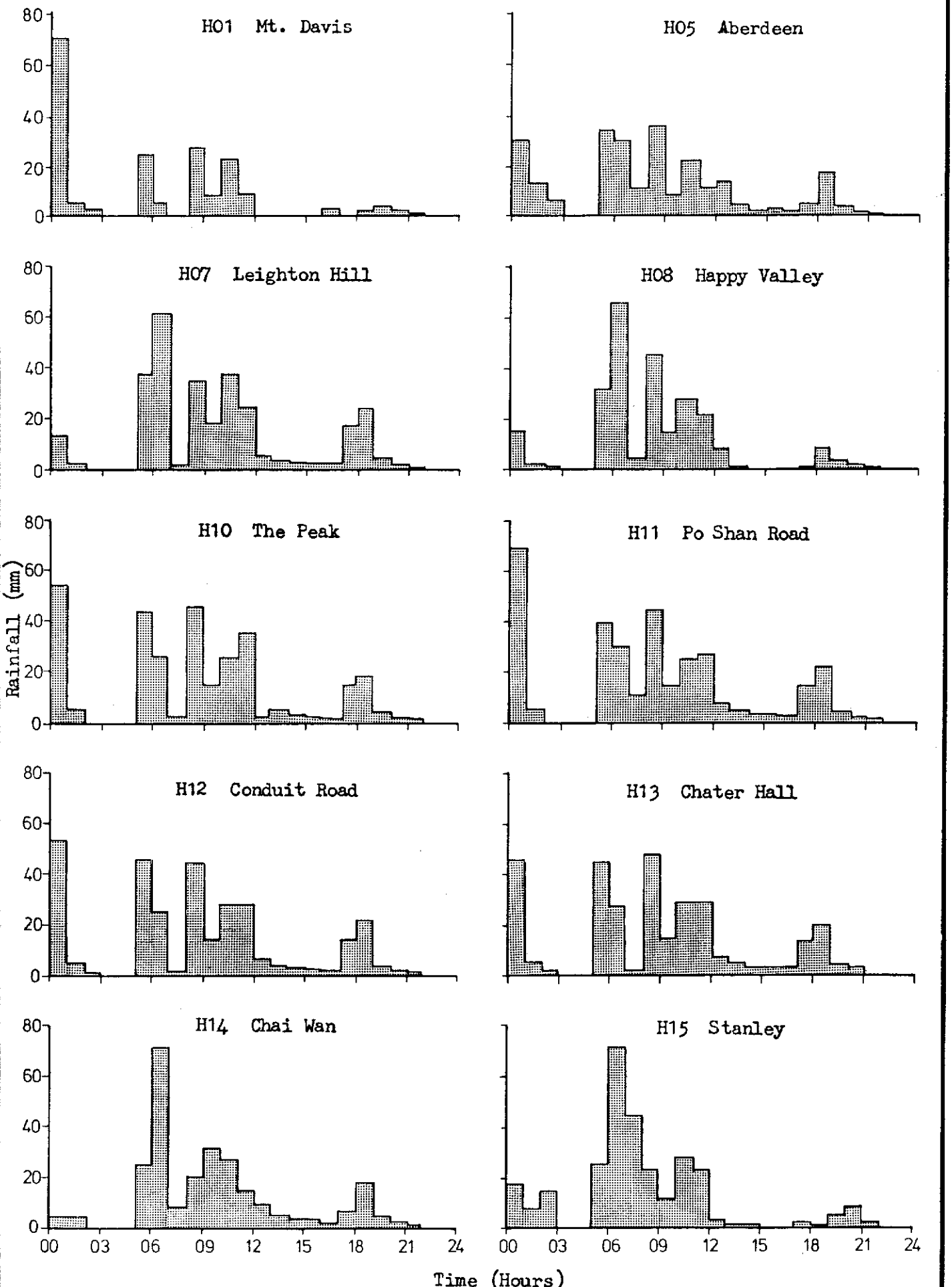
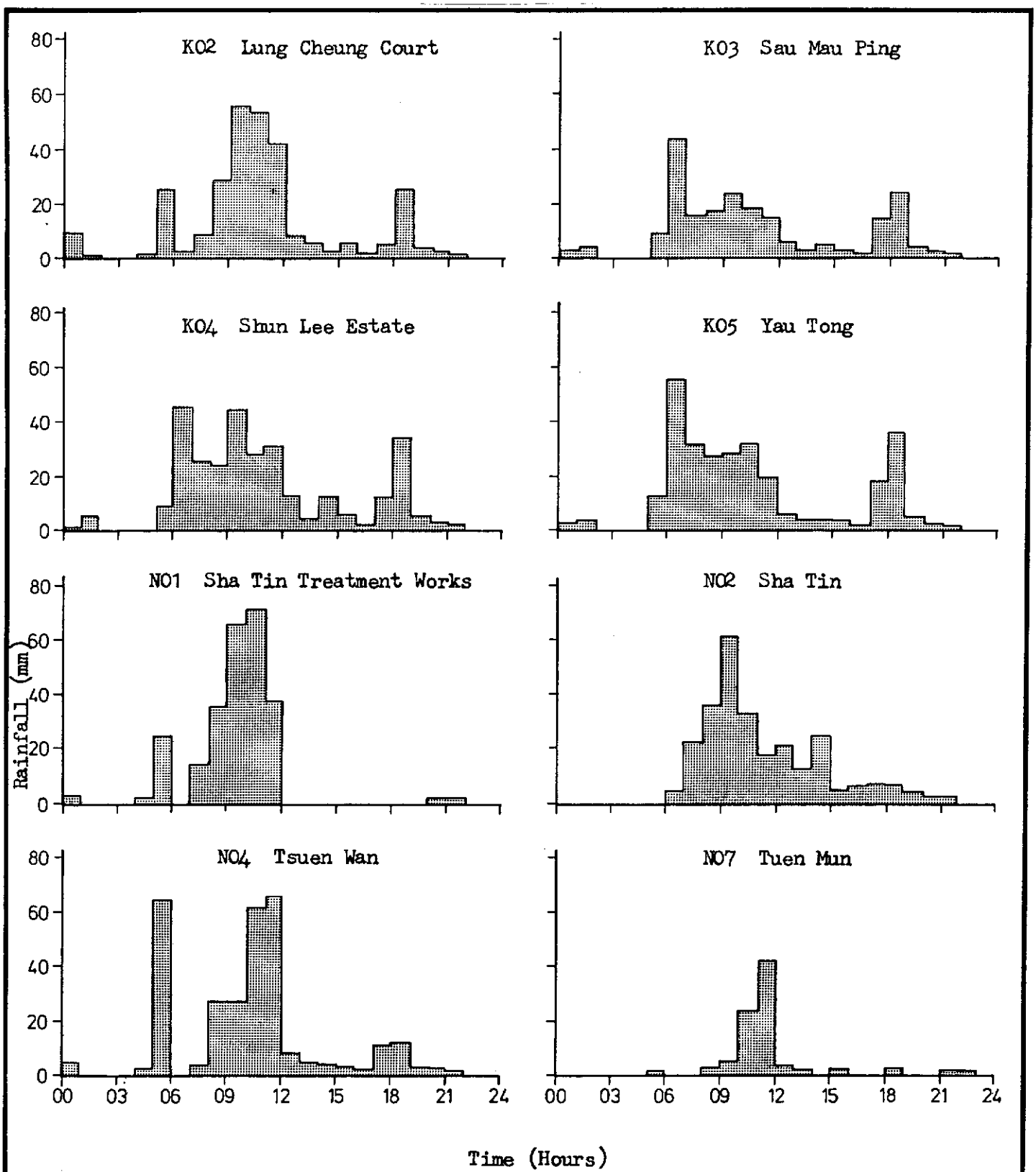
Figure 3



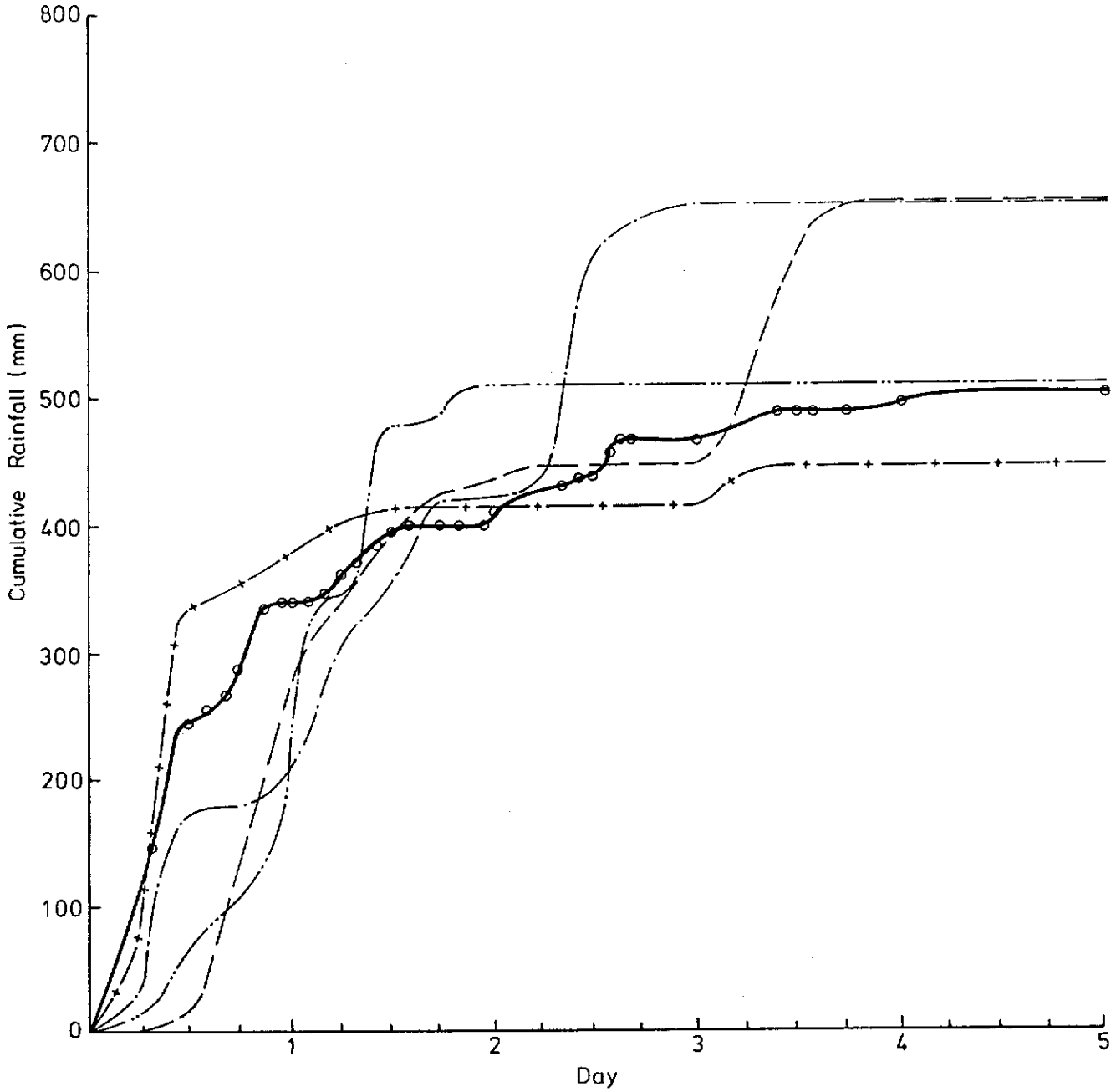
Hourly rainfalls recorded by GCO raingauges on Hong Kong Island on 16th August 1982

Figure 4



Hourly rainfalls recorded by GCO raingauges in Kowloon and the New Territories on 16th August 1982

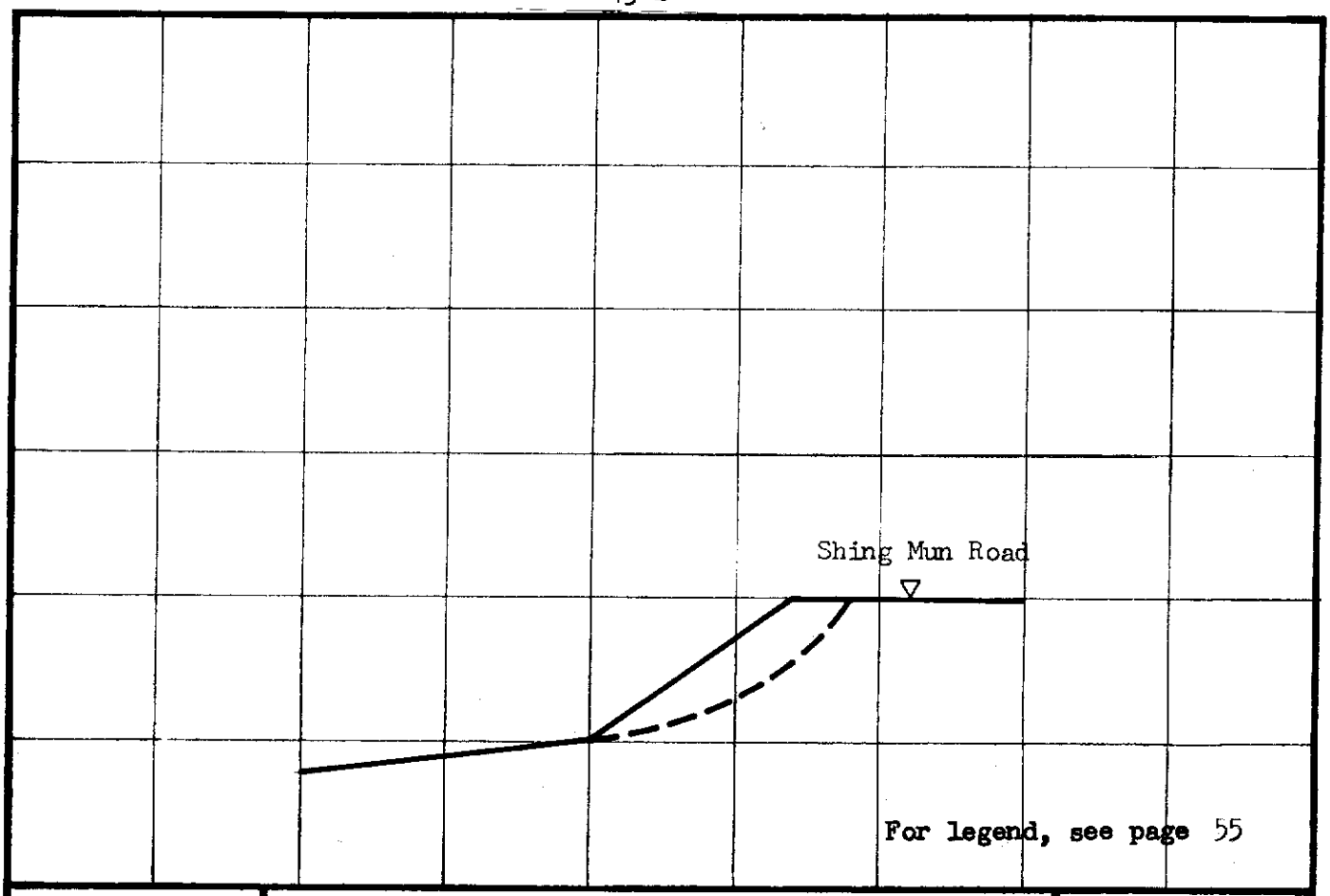
Figure 5



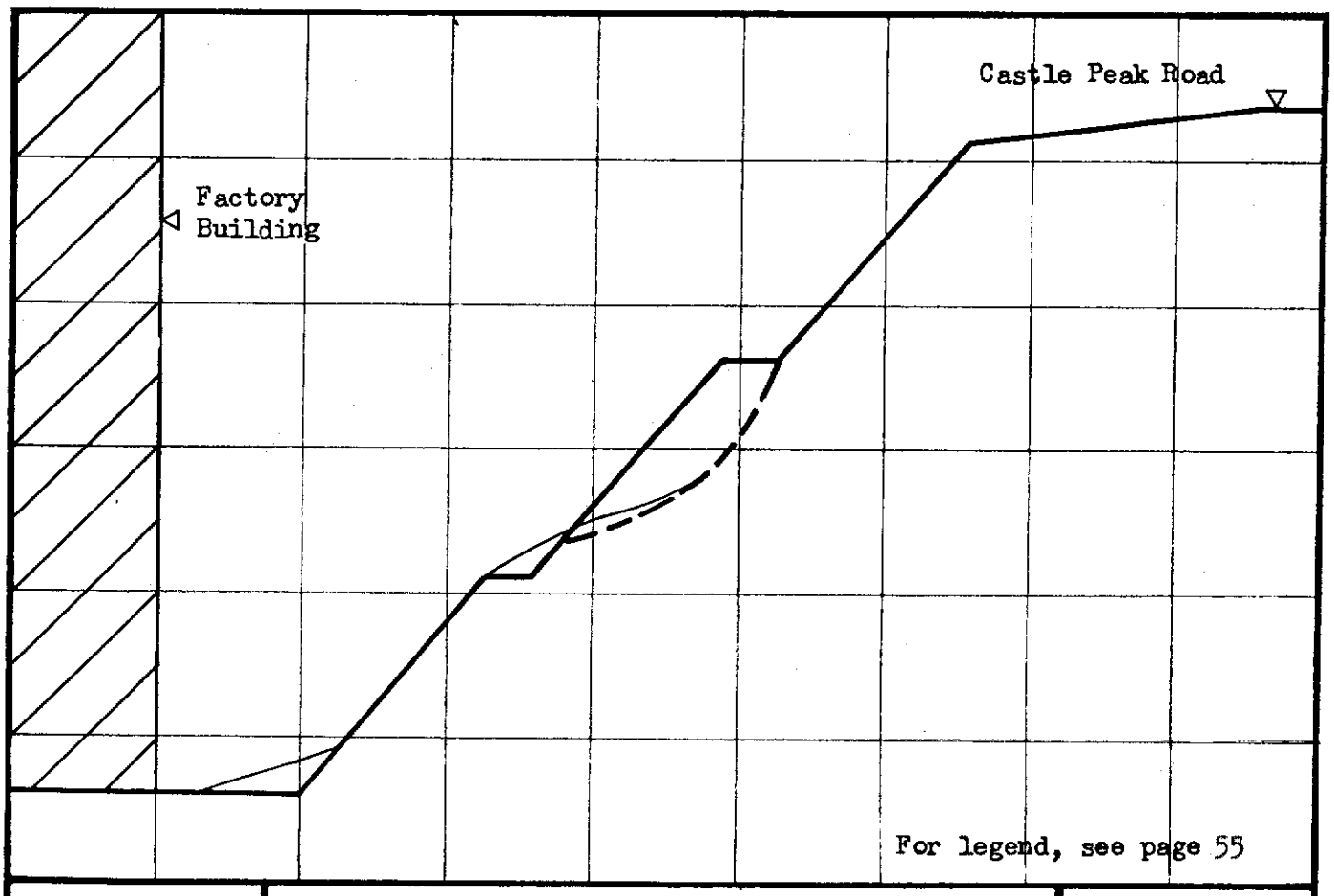
Year	Month	Symbol	Day					Previous 15 days
			1	2	3	4	5	
1966	June	—+—+—	382.6	33.7	0.7	31.4	-	416.4
1972	June	—·—·—	205.9	213.8	232.6	0.6	0.1	141.6
1976	August	—···—···—	250.3	261.3	4.5	NIL	1.4	78.5
1982	May	———	179.0	258.4	11.0	205.5	1.3	9.8
1982	August	—o—	334.2	80.4	47.6	31.2	2.3	376.7

Rainfall recorded during the August 1982 rainstorm compared to the rainstorms of June 1966, June 1972, August 1976 and May 1982

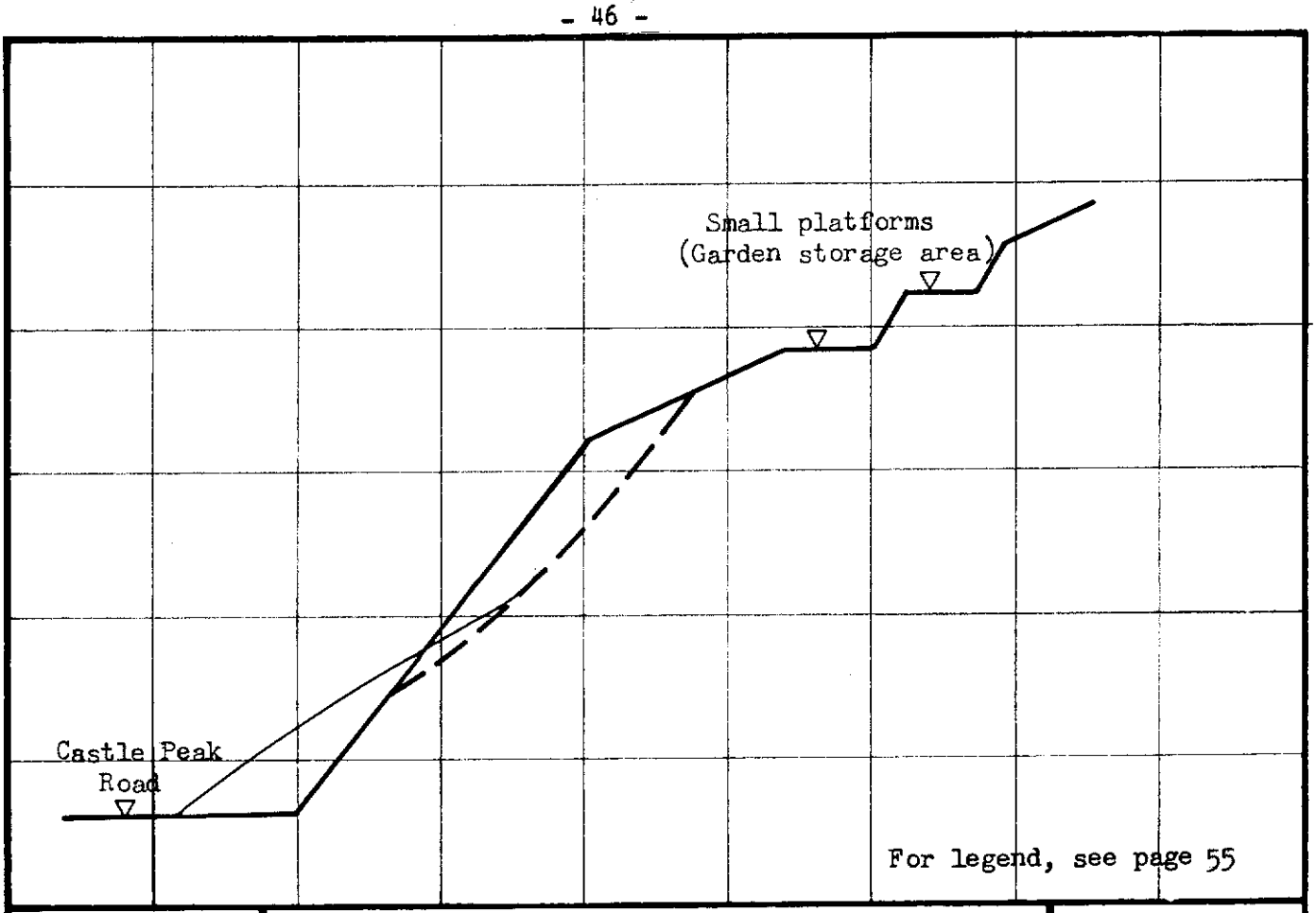
Figure 6



Sketch Section Approx. 1:250	Shing Mun Road (Incident No. NT/8/75)	Figure 7

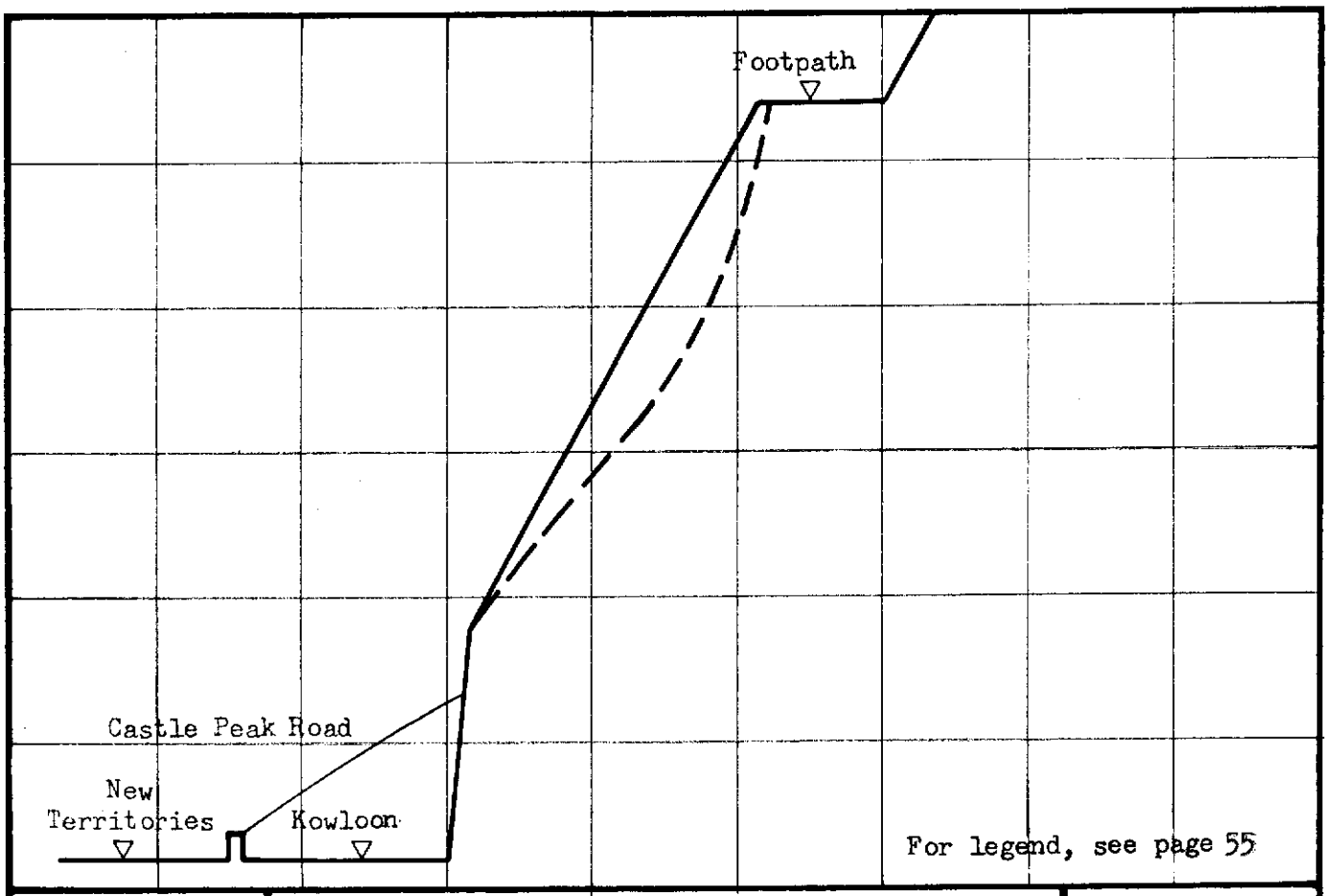


Sketch Section Approx. 1:250	Kung Yip Street, Kwai Chung (Incident No. NT/8/47)	Figure 8



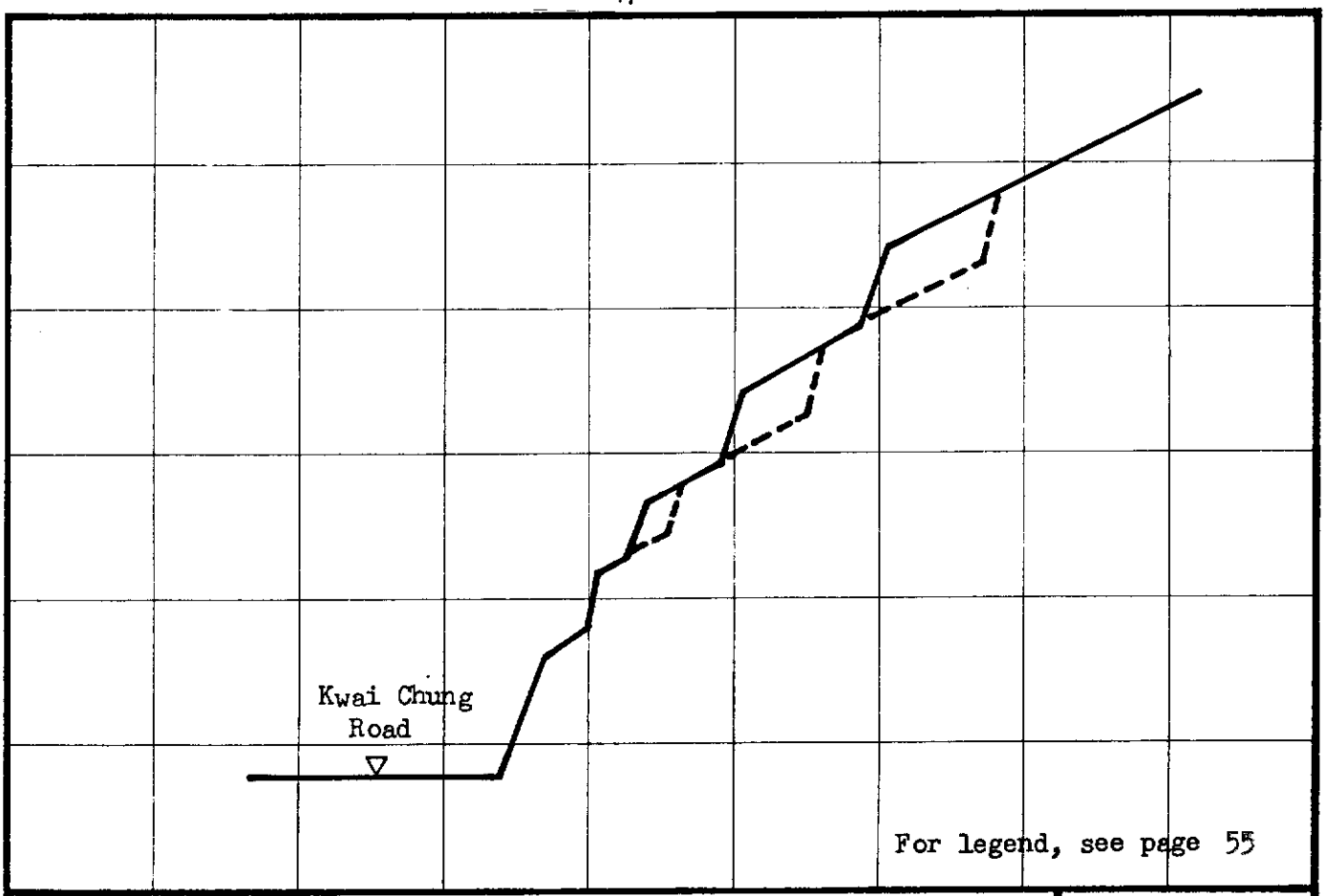
For legend, see page 55

Sketch Section Approx. 1:250	13½ MS Castle Peak Road (Incident No. NT/8/34)	Figure 9



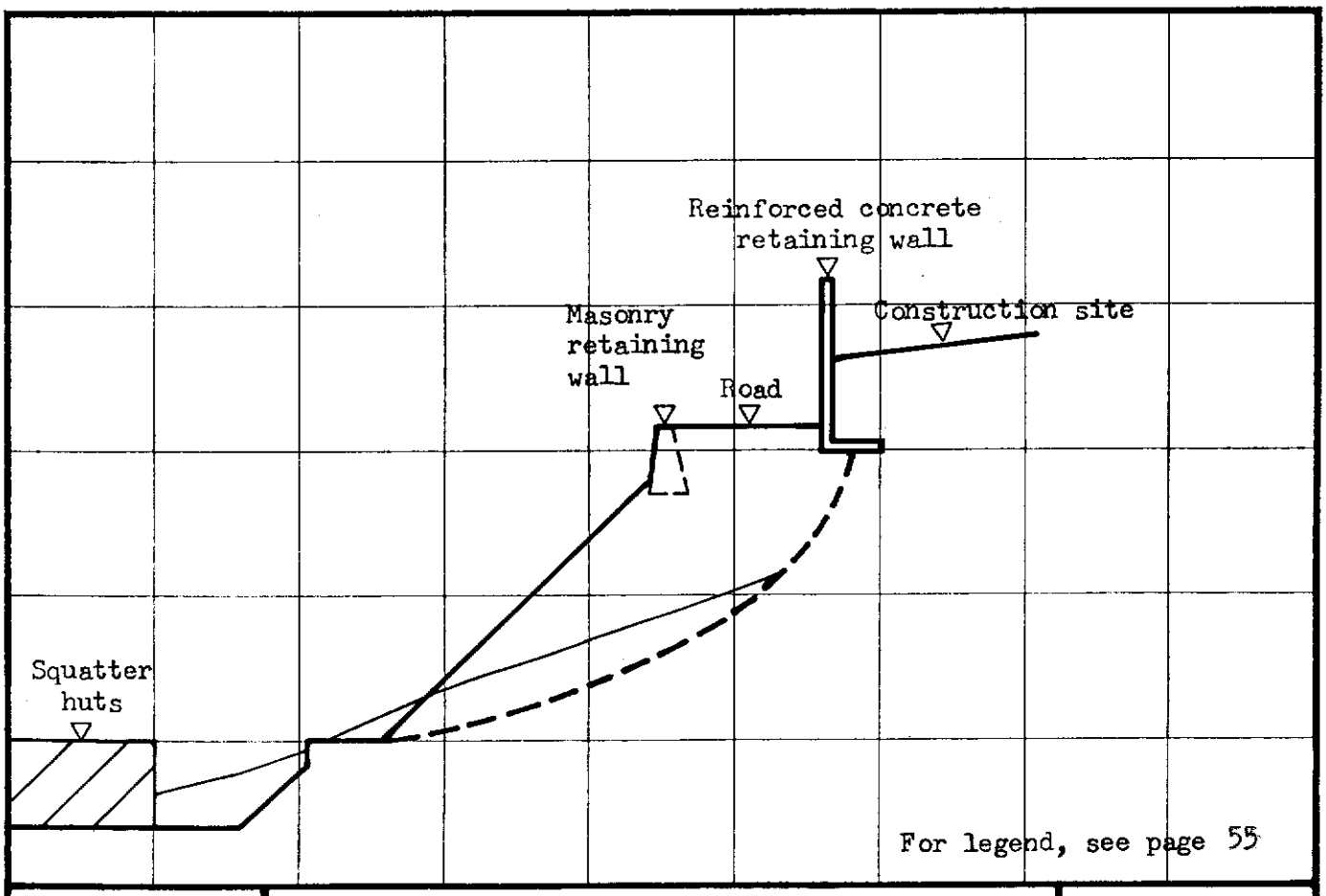
For legend, see page 55

Sketch Section Approx. 1:250	5½ MS Castle Peak Road (Incident No. NT/8/23)	Figure 10



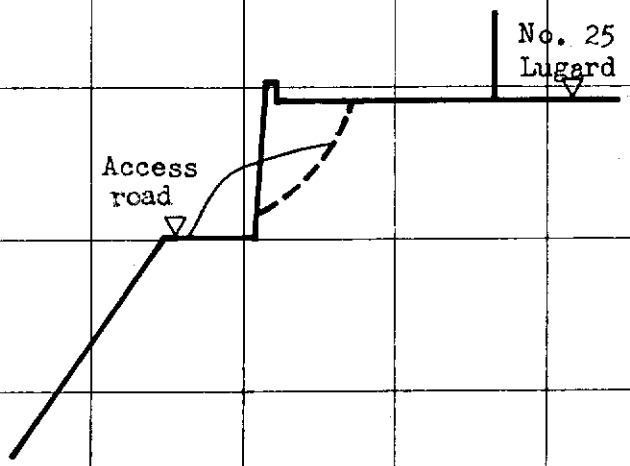
For legend, see page 55

Sketch Section Approx. 1:250	Kwai Chung Road (Incident No. NT/8/26)	Figure 11



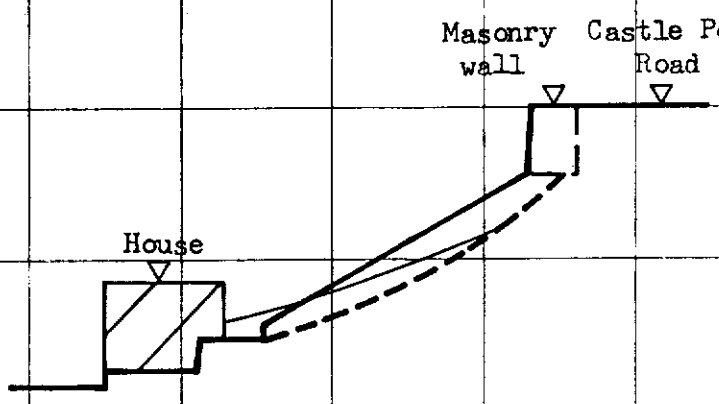
For legend, see page 55

Sketch Section Approx. 1:250	7, Chung Shan Terrace, NT (Incident No. GCB 6/8)	Figure 12



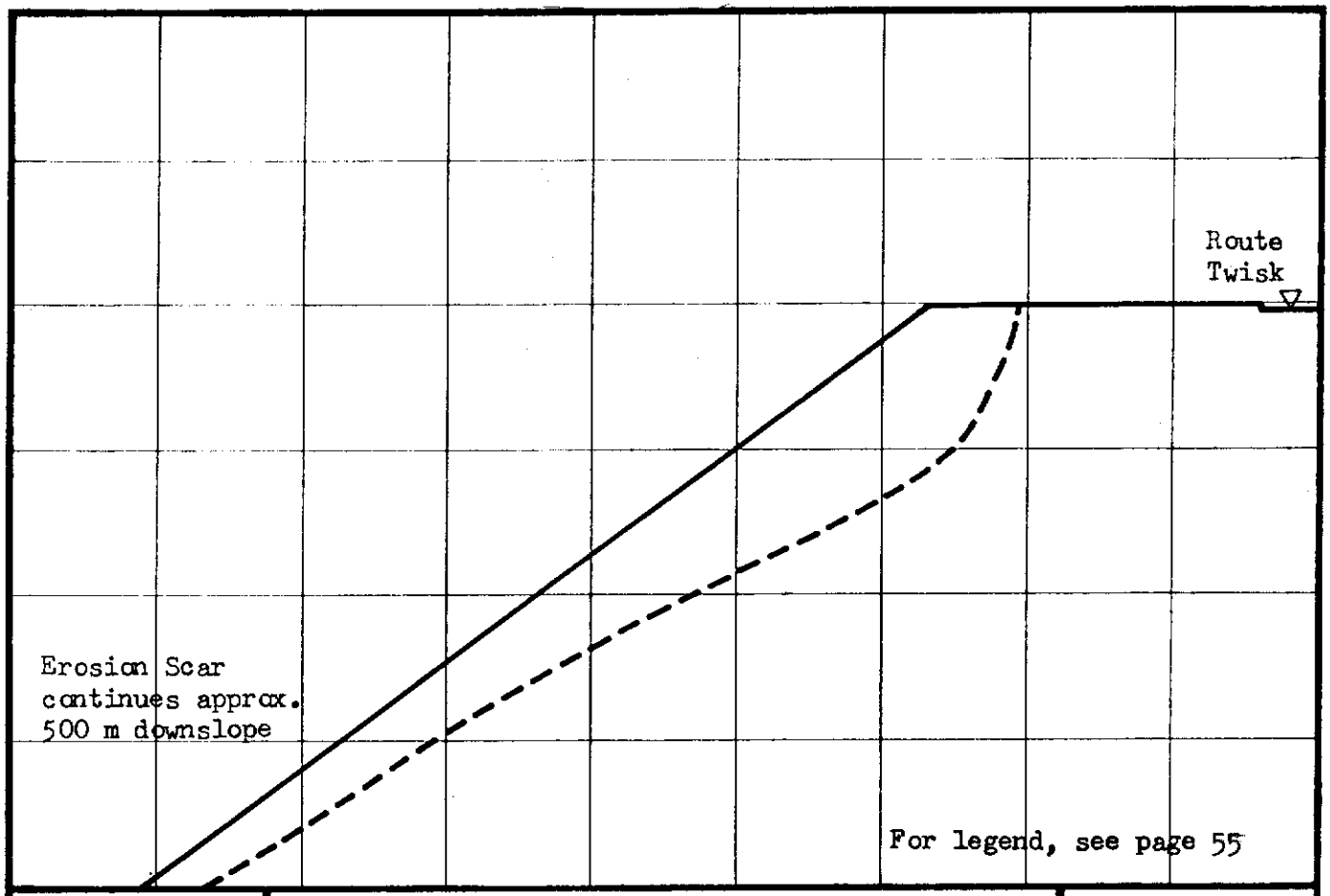
For legend, see page 55

Sketch Section Approx. 1:250	25, Lugard Road, HK (Incident No. GCB 6/8)	Figure 13



For legend, see page 55

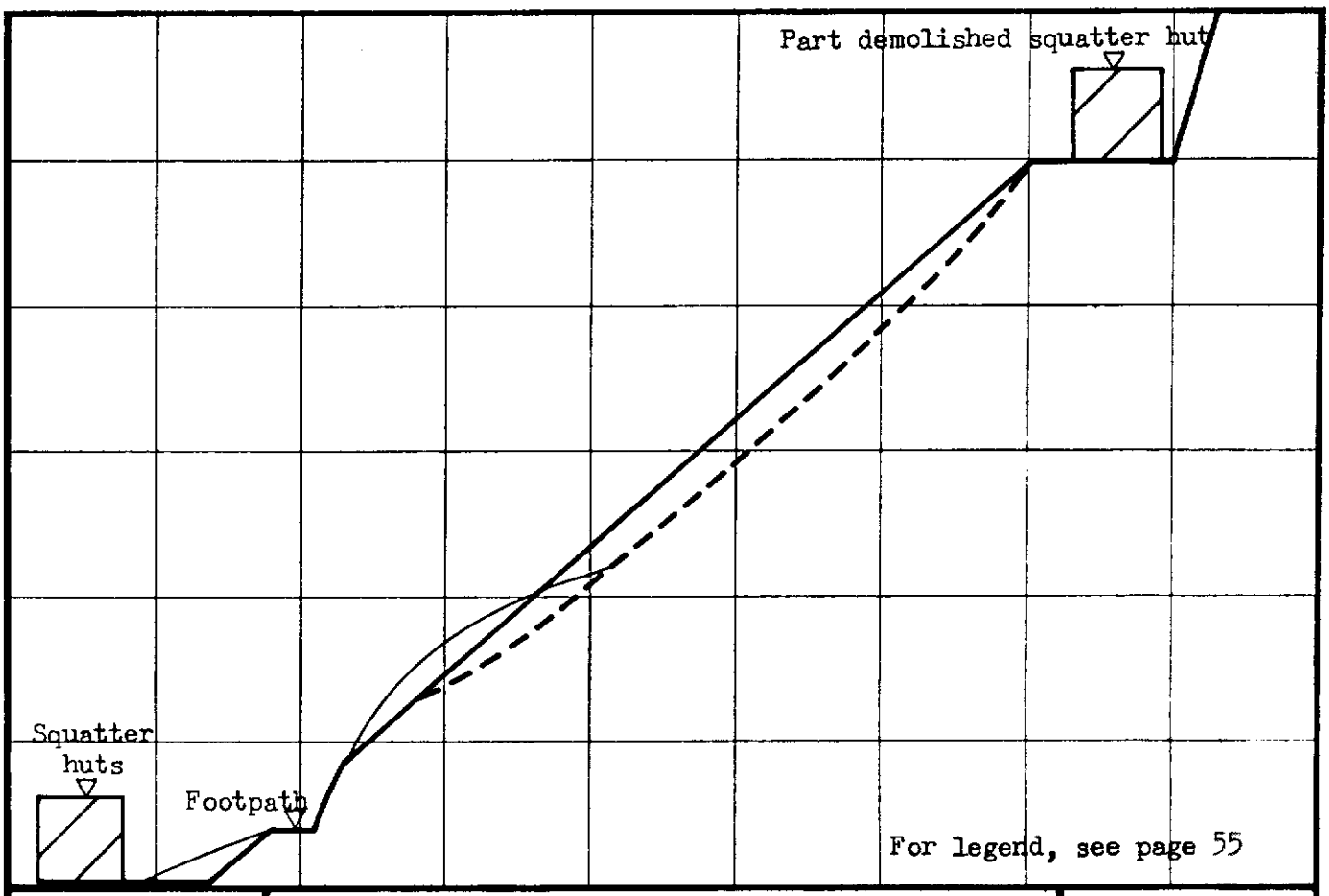
Sketch Section Approx. 1:250	9½ MS Castle Peak Road (Incident No. NT/8/16)	Figure 14



Sketch Section Approx. 1:250

13 MS Route Twisk (Incident No. NT/8/39)

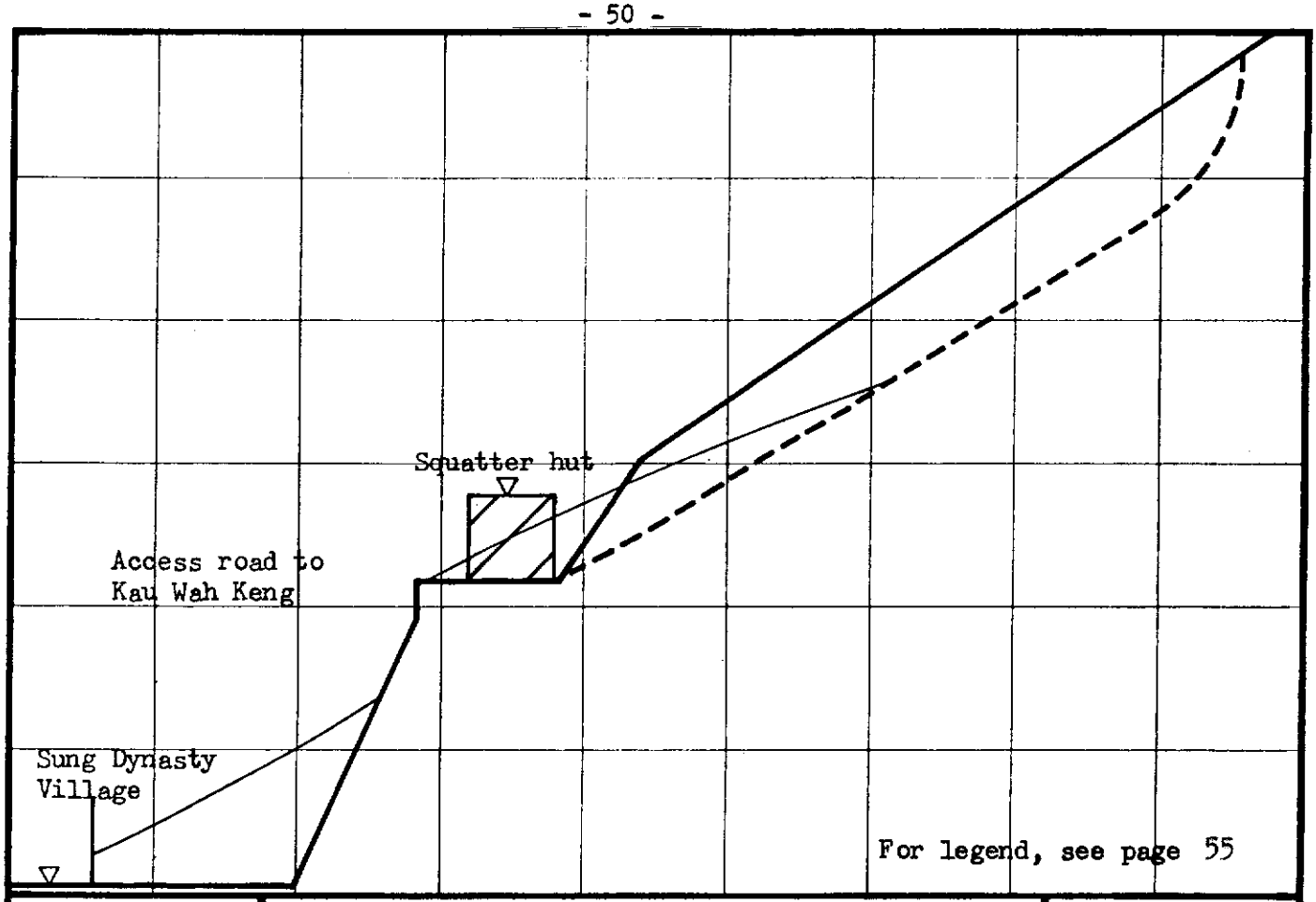
Figure 15



Sketch Section Approx. 1:250

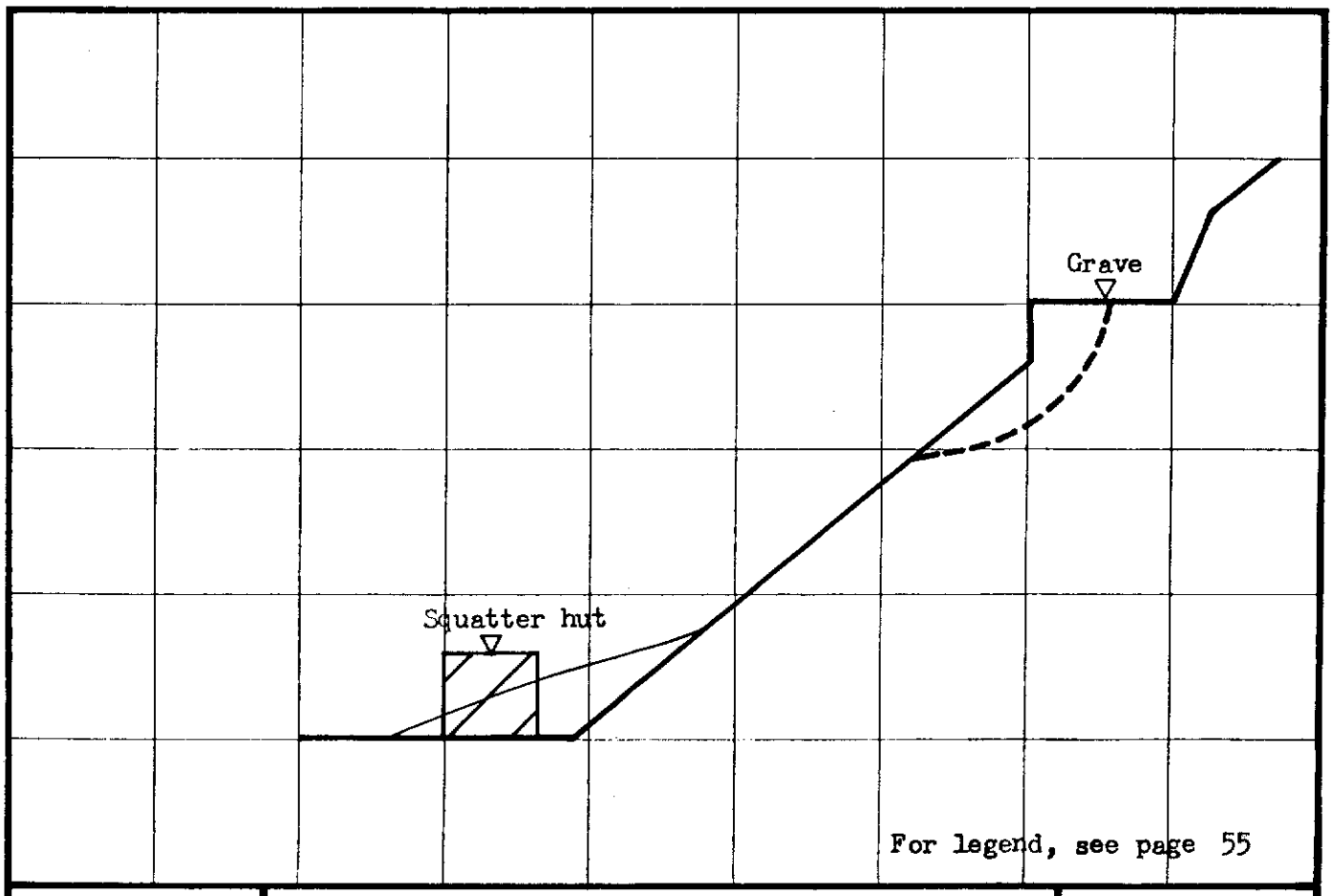
Tsin Sui Ma Tau Village (Incident No. HK/8/32)

Figure 16



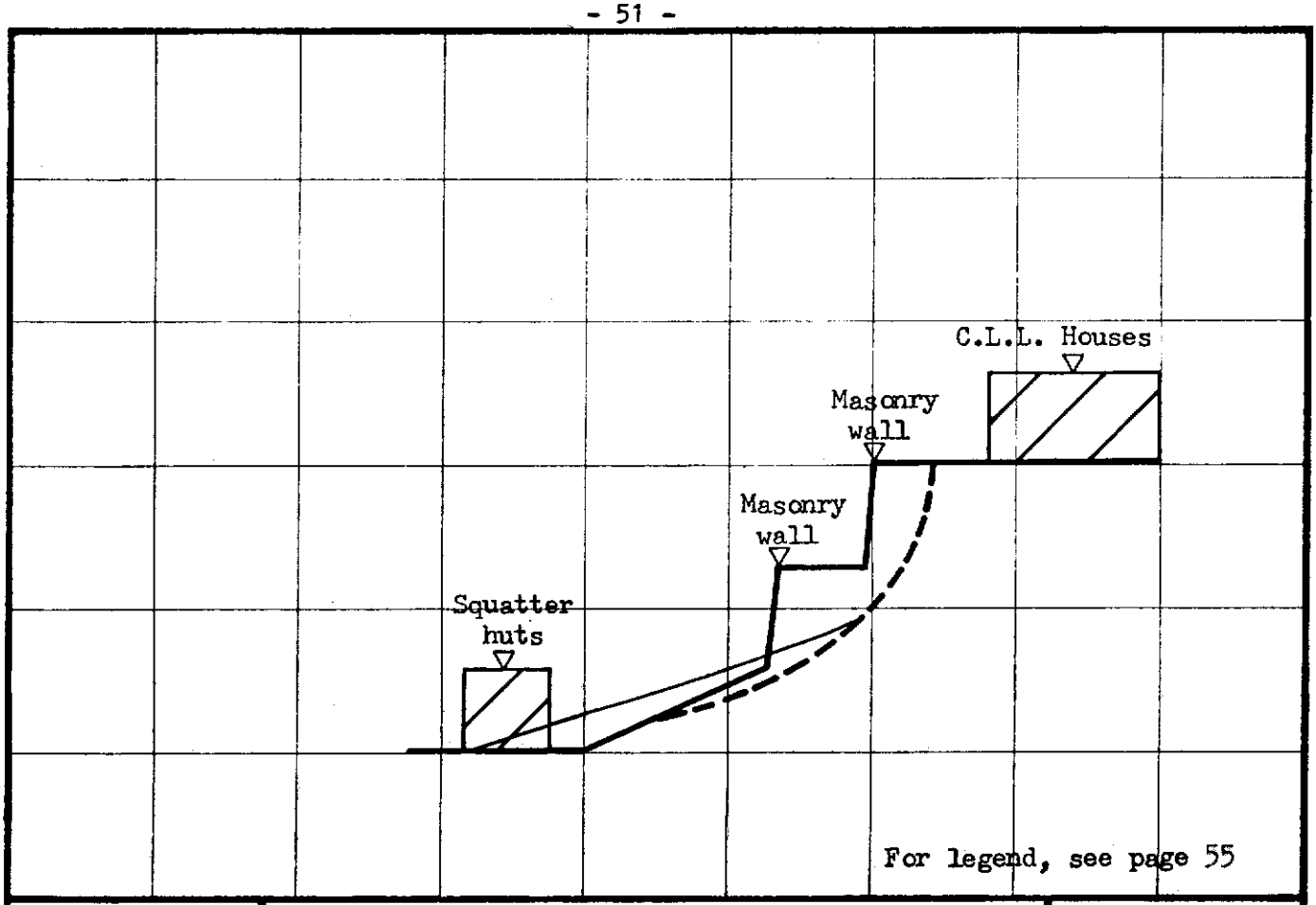
For legend, see page 55

Sketch Section Approx. 1:250	Above Sung Dynasty Village, Lai Chi Kok (Incident No. NT/8/7)	Figure 17



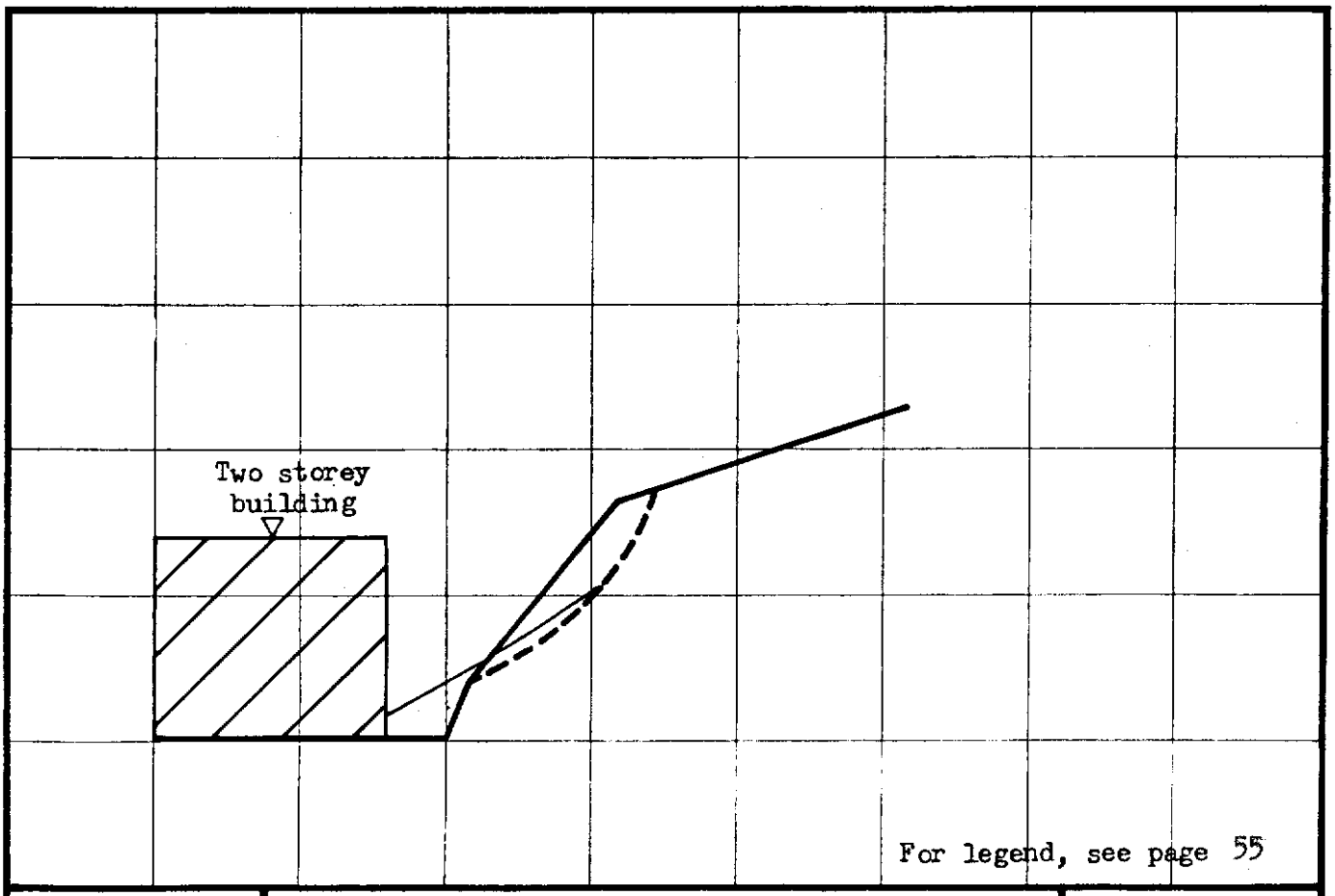
For legend, see page 55

Sketch Section Approx. 1:250	Yau Kam Tau, Tsing Yi (Incident No. NT/8/27)	Figure 18



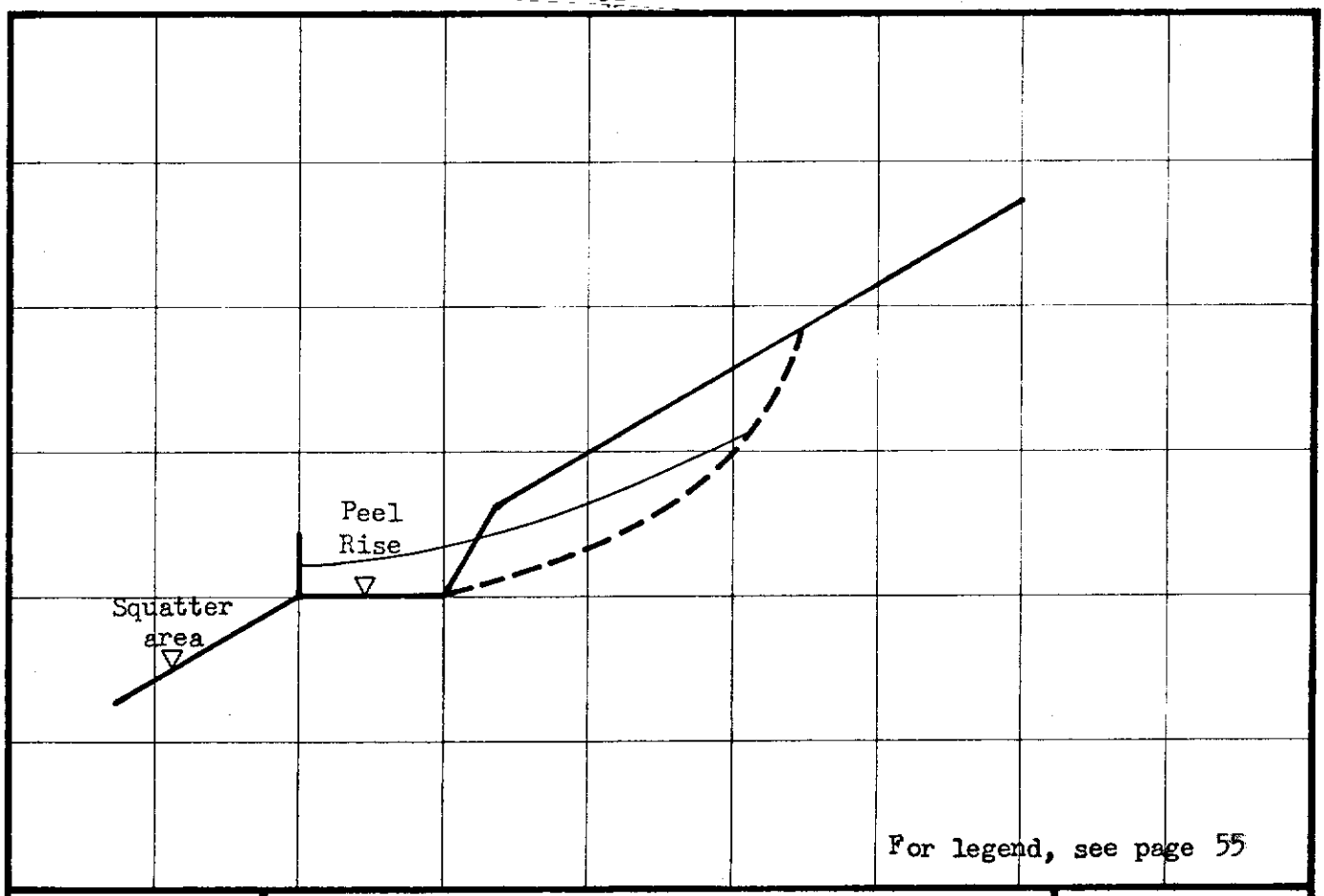
For legend, see page 55

Sketch Section Approx. 1:250	Kau Wah Keng San Tsuen (Incident No. NT/8/8)	Figure 19



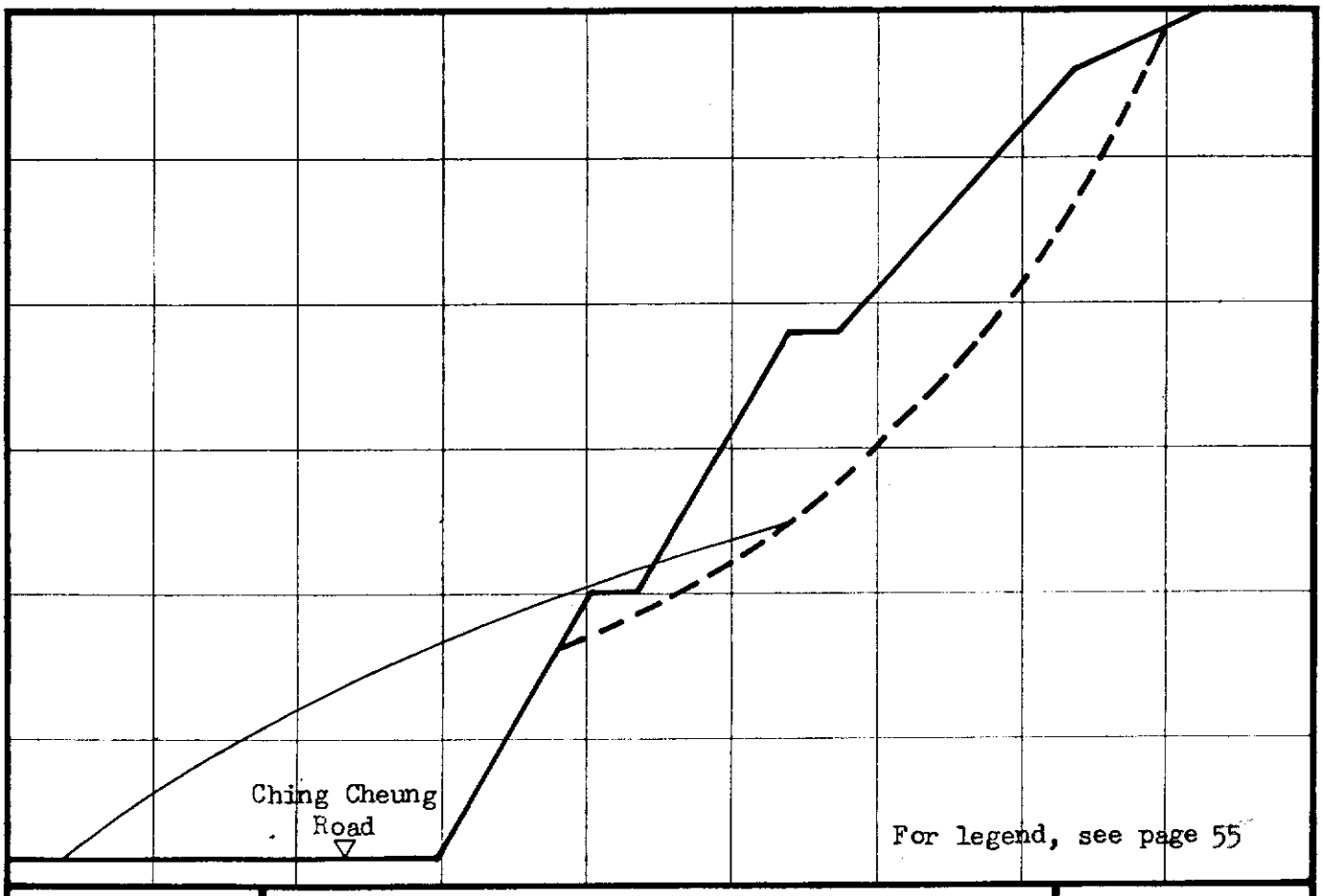
For legend, see page 55

Sketch Section Approx. 1:250	45 Island Road (Incident No. GCB/4/8)	Figure 20



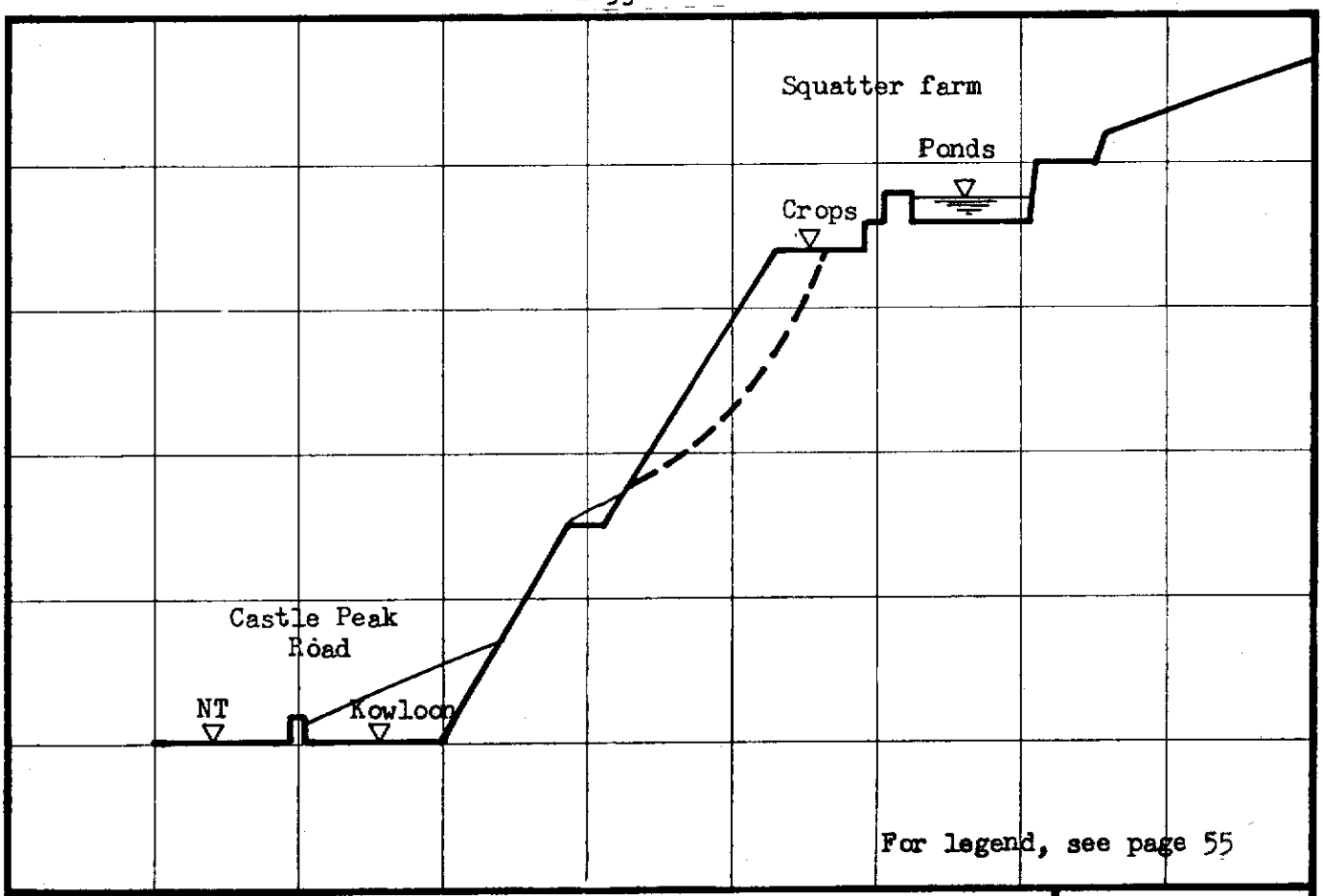
For legend, see page 55

Sketch Section Approx. 1:250	Peel Rise Squatter Area, Aberdeen (Incident No. HK/8/16)	Figure 21



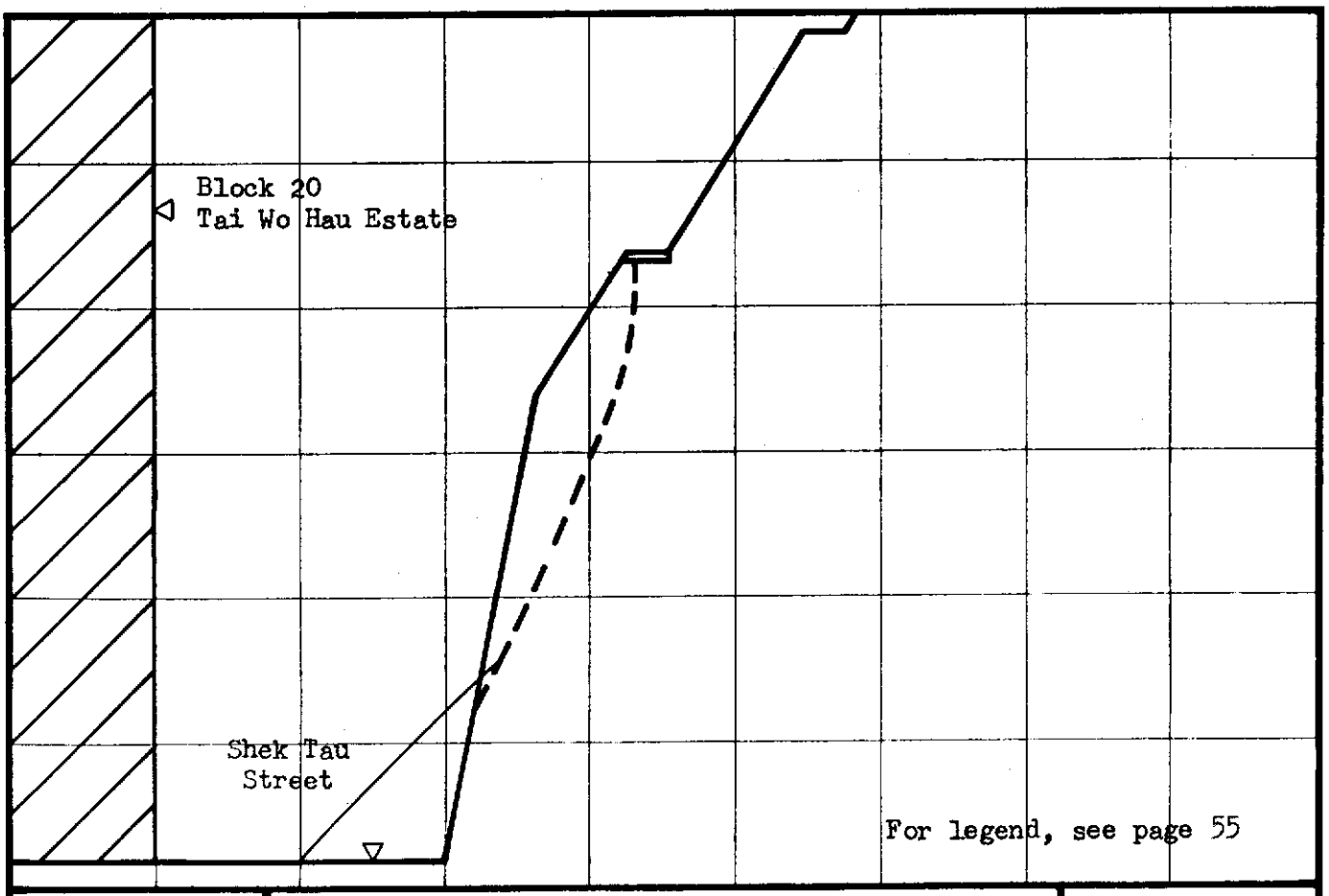
For legend, see page 55

Sketch Section Approx. 1:250	Ching Cheung Road, Kowloon (Incident No. K/8/29)	Figure 22



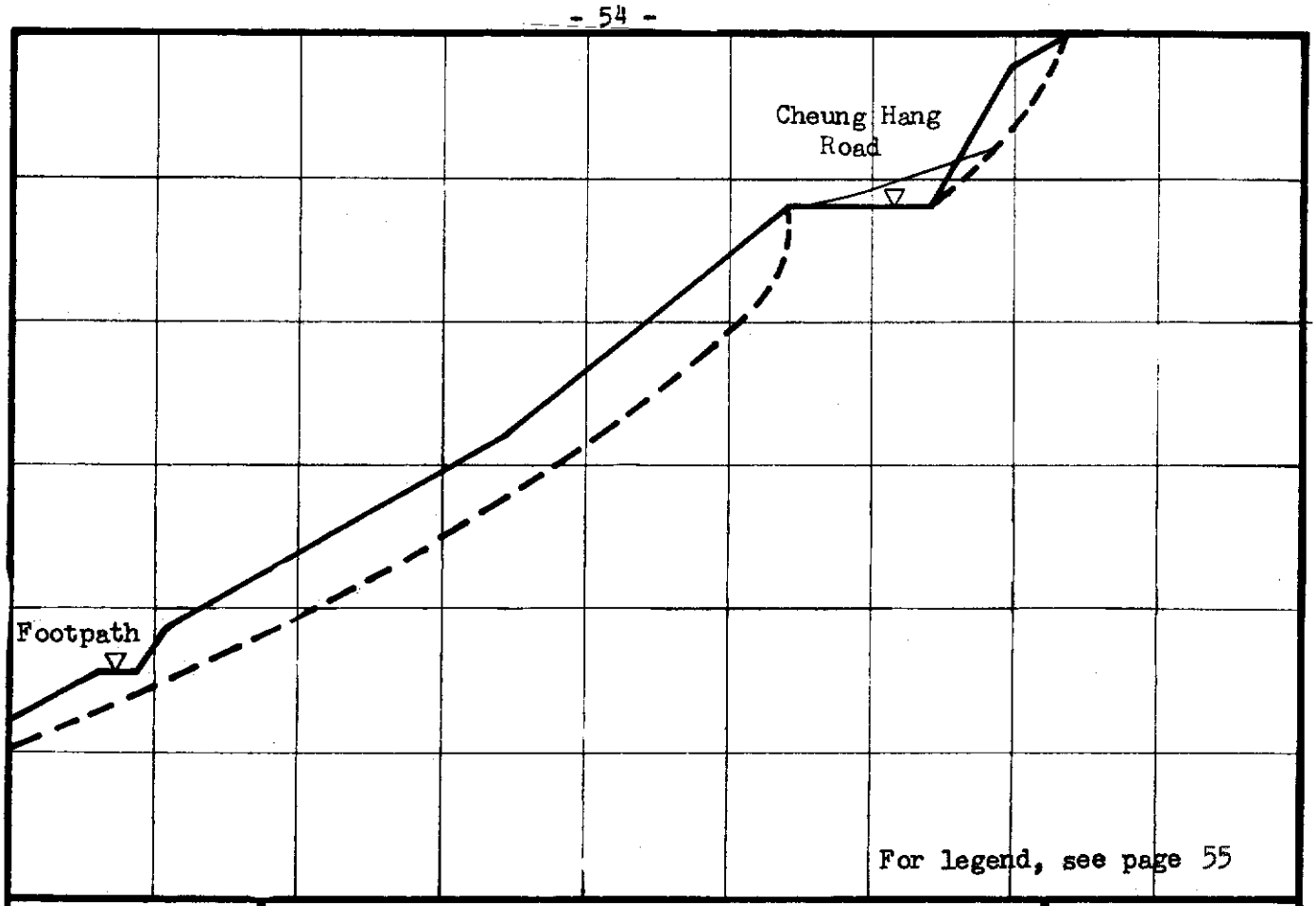
For legend, see page 55

Sketch Section Approx. 1:250	6½ MS Castle Peak Road, Tsuen Wan (Incident No. NT/8/25)	Figure 23



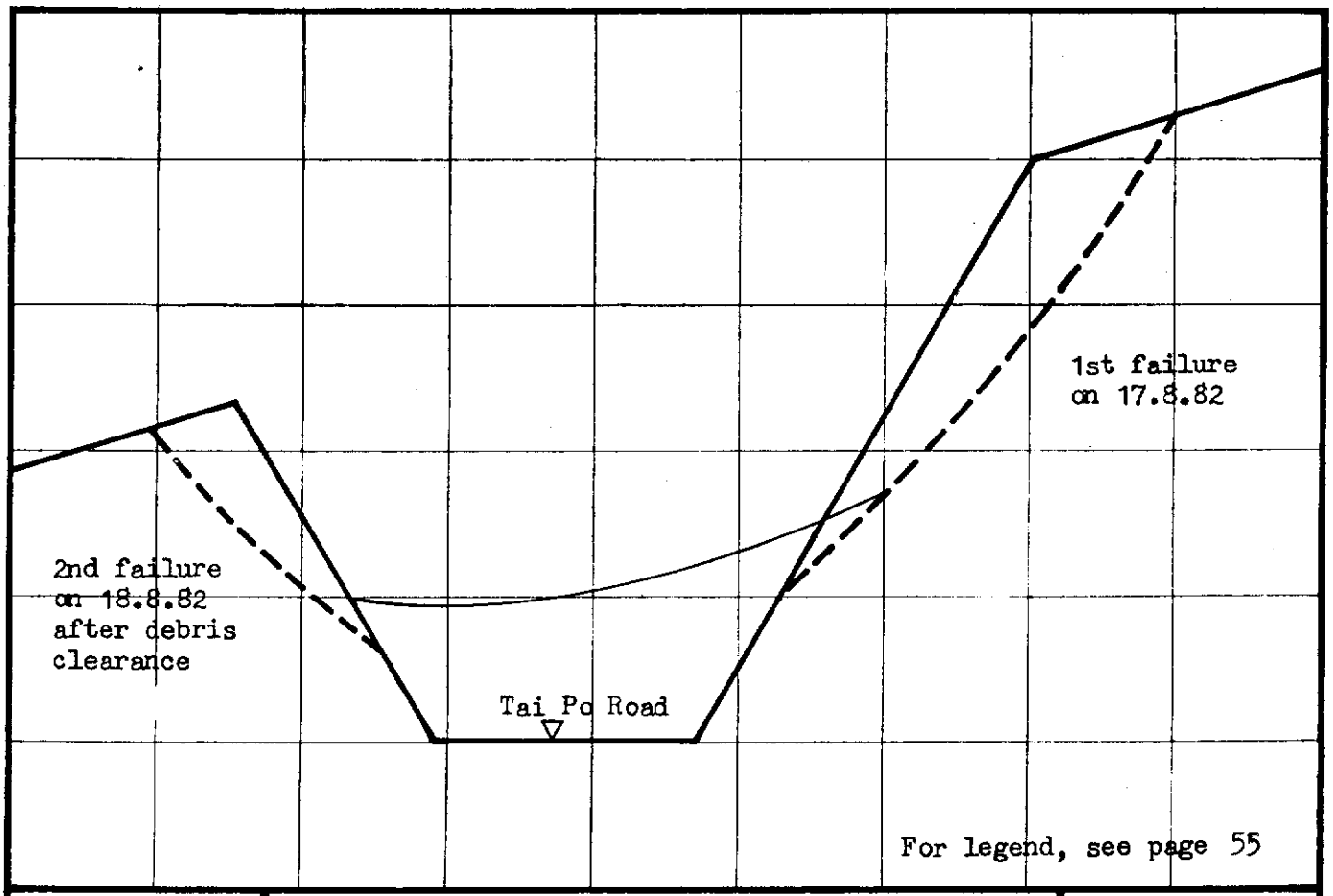
For legend, see page 55

Sketch Section Approx. 1:250	Shek Tau Street, Tai Wo Hau Estate, Tsuen Wan (Incident No. NT/8/33)	Figure 24



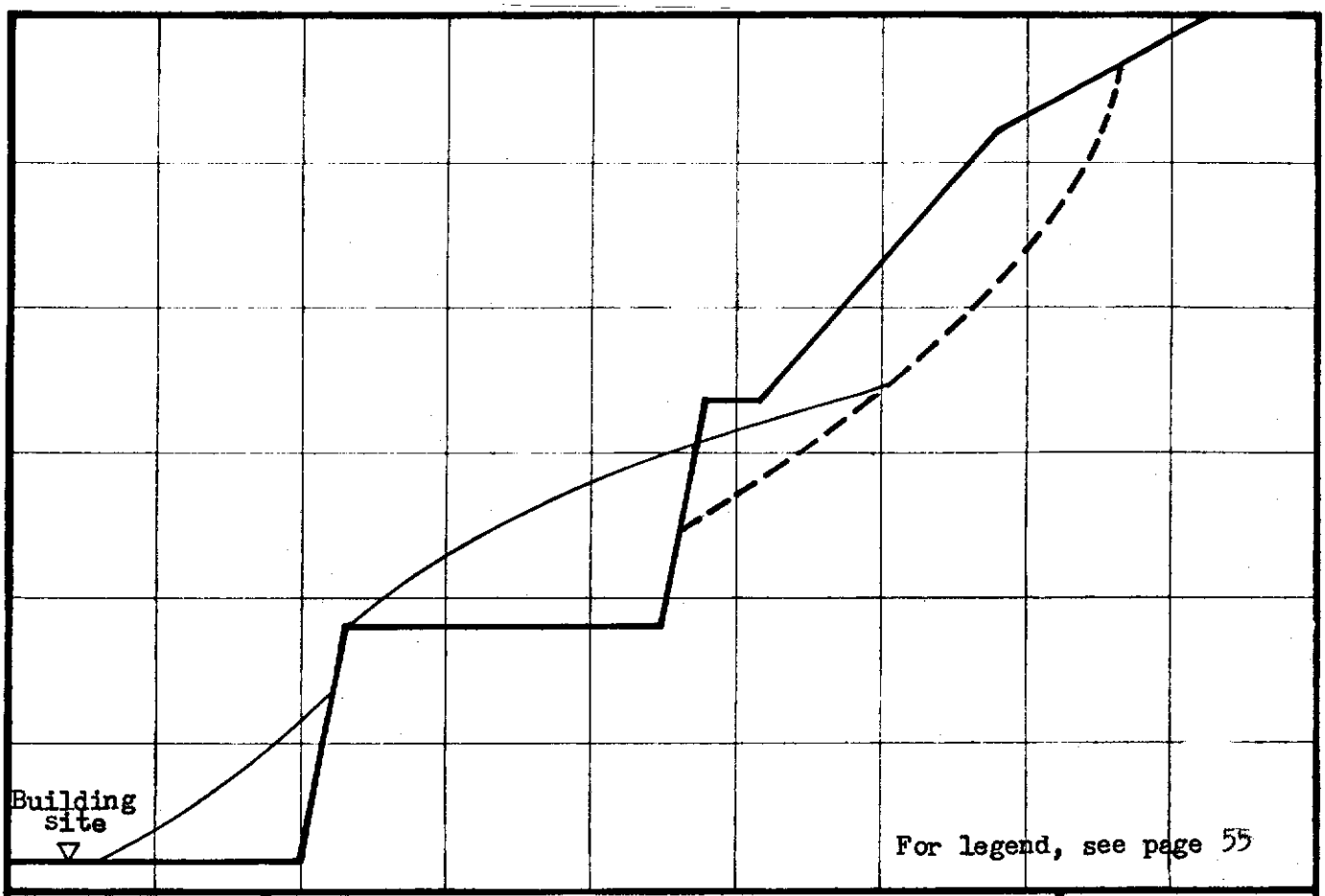
For legend, see page 55

Sketch Section Approx. 1:250	Cheung Hang Road, Kau Wah Keng (Incident Nos. NT/8/71 and 72)	Figure 25



For legend, see page 55

Sketch Section Approx. 1:250	5½ MS Tai Po Road, near Kowloon Reservoir (Incident No. NT/8/18)	Figure 26



Sketch Section Approx. 1:250	RBL 1044, South Bay Close, HK (Incident No. GCB 3/8)	Figure 27

Legend used for Figures 7 to 27.

——— Pre failure geometry

– – – – Post failure geometry

——— Extent of debris

PLATES

REPORT ON THE RAINSTORM OF AUGUST 1982

PLATES

Plate	Title	Negative No.*	Page No.
36	5½ MS Tai Po Road (Incident No. NT/8/18)	2180/20	80
37	RBL 1044, South Bay Close, HK (Incident No. GCB 3/8)	11/13.8.82	80

* Negatives available from the Existing Slopes or New Works Divisions of the GCO

20.8.82

Plate 1 : Deep Water Bay Road (Incident No. HK/8/28) : Minor failure of a fill slope

18.8.82

Plate 2 : Mount Butler Quarry (Incident No. HK/8/23) : Major failure of a fill slope

Plates 1 and 2

Plate 3 : Kung Yip Street, Kwai Chung
(Incident No. NT/8/47)

: Minor failure of a soil
cut slope (7SW-C/C208)

18.8.82

19.8.82

Plate 4 : 13½ MS Castle Peak Road
(Incident No. NT/8/34)

: Major failure of a soil
cut slope

Plates 3 and 4

Plate 5 : 5¾ MS Castle Peak Road
(Incident No. NT/8/24)

: Major failure of a soil/rock cut slope
(11NW-A/C62)

28.8.82

20.8.82

Plate 6 : 5½ MS Castle Peak Road
(Incident No. NT/8/23)

: Major failure of a soil/rock cut slope (11NW-A/C63)

Plates 5 and 6

Plates 7 and 8 : Repulse Bay Road (Incident No. HK/8/27)

: Minor failure of a soil/rock cut slope

19.8.82

19.8.82

Plates 7 and 8

27.8.82

Plate 9 : Shek Yam Temporary Housing Area (Incident No. NT/8/69) : Major failure of a rock cut slope (7SW-C/C153)

20.8.82

Plate 10 : Kwai Chung Road (Incident No. NT/8/26) : Major failure of a rock cut slope (11NW-A/C79)

Plates 9 and 10

Plates 11 and 12 : Above Road TY1, Tsing Yi South Service Reservoir (Incident No. NT/8/81)

: Major failure of a rock cut slope

20.8.82

25.8.82

Plates 11 and 12

16.8.82

16.8.82

Plate 13 and 14 : 7, Chung Shan Terrace, NT : Major failure of (Incident No. GCB 6/8) a retaining wall

Plates 13 and 14

19.8.82

Plate 15 : 25, Lugard Road, HK (Incident No. GCB 1/8) : Major failure of a retaining wall

23.8.82

17.8.82

Plates 16 and 17 : 9½ MS Castle Peak Road : Major failure of a retaining wall (Incident No. NT/8/16)

Plates 16 and 17

20.8.82

20.8.82

Plates 18 and 19 : 13 MS Route Twisk (Incident No. NT/8/39) : Major failure of a natural/ fill slope

Plates 18 and 19

Plate 20 : Nam She Hang, Shatin
(Incident No. NT/8/45)

: 1 hut permanently evacuated

23.8.82

24.8.82

Plate 21 : 481 to 482, Sham Tseng, Tsuen Wan : 2 huts permanently evacuated
(Incident No. NT/8/53)

Plates 20 and 21

20.9.82

Plate 22 : Yau Kam Tau, Tsing Yi : 1 killed and
(Incident No. NT/8/27) 1 injured

Plates 23 and 24 : Kau Wah Keng San Tsuen (Incident No. NT/8/8)

: 2 killed, 3 village type houses closed and 5 groups of huts permanently evacuated.

20.8.82

11.10.82

Plates 23 and 24

19.8.82

Plate 25 : 45, Island Road, HK : 'D' slope notice recommended
(Incident No. GCB 4/8)

18.8.82

Plate 26 : Peel Rise Squatter Area, Aberdeen : Road blocked for 13 days, 3 huts permanently evacuated and 1 hut temporarily evacuated
(Incident No. HK/8/16)

Plates 25 and 26

Plates 27 and 28 : Ching Cheung Road (Incident No. K/8/29)

: Eastward bound lanes closed for two months

24.8.82

23.8.82

Plates 27 and 28

18.8.82

Plate 29 : Shek Tau Street, Tsuen Wan
(Incident No. NT/8/33)

: Road blocked and three cars buried

Plate 29

Plate 30 : Cheung Hang Road (E)
(Incident No. NT/8/72)

: Road closed

27.8.82

27.8.82

Plate 31 : Cheung Hang Road (A)
(Incident No. NT/8/11)

: Road totally blocked by debris

Plates 30 and 31

25.8.82

20.8.82

Plates 32 and 33 : Road TY1, Ch. 2400, Tsing Yi Island
(Incident No. NT/8/15)

: One lane of road closed

Plates 32 and 33

20.8.82

20.8.82

Plates 34 and 35 : Road TY1, Ch. 1000, Tsing Yi Island
(Incident No. NT/8/38)

: One lane of road closed

Plates 34 and 35

Plate 36 : 5½ MS Tai Po Road
(Incident No. NT/8/18)

: Both lanes blocked
for four days

24.8.82

17.8.82

Plate 37 : RBL 1044, South Bay Close, HK : Construction site -
(Incident No. GCB 3/8) no casualties

Plates 36 and 37

APPENDICES

APPENDIX 1

LIST OF INCIDENTS

This list includes all incidents caused by the August 1982 rainstorm which were reported directly to the GCO

Appendix 1 : Incidents on Hong Kong Island reported directly to the GCO

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		on	from	Date	Type	Scale			
HK/8/11	30, Po Shan Road	16-8	GCO	16-8	Flooding	-	Road	-	Blocking of catchpit
HK/8/12	Plantation Road between Findley Road & Findley Path (near lamp post 1958)	16-8	H/HK	16-8	Retaining Wall (rubble)	Minor	Road	Road blocked for 1 day	
HK/8/13	7-11, Belcher Street near Sai Cheung Street, below Belcher Garden	16-8	H/HK	16-8	Boulder fall	Minor	Road	Road & 4G/F shops on opposite side of road temporarily closed	
HK/8/14	Holy Cross Path Village, Shaukiwan (# 45D)	16-8	BDD	16-8	Soil cut slope	Minor	Squatter	4 huts permanently evacuated	
HK/8/15	Nam Fung Road Village, Wong Chuk Hang	17-8	H/HK	17-8	Fill slope	Minor	Squatter	4 huts permanently evacuated	
HK/8/16	Peel Rise Squatter Area, Aberdeen	17-8	H/HK	17-8	Soil cut slope	Major	Squatter and road	Road blocked for 13 days, 3 huts permanently evacuated & 1 hut temporarily evacuated	
HK/8/17	Aberdeen Reservoir Road	17-8	H/HK	17-8	Soil/rock cut slope	Major	School and road	Road blocked, school building affected	Slope ref. 11SW-D/C54
HK/8/18	Stanley Gap Road	17-8	H/HK	17-8	Soil/rock cut slope	Minor	Road	1 lane closed for 3 days	
HK/8/19	Nam Long Shan Road (Ocean Park Access Road) - 1st site	17-8	H/HK	17-8	Fill slope	Minor	Road	1 lane of road closed	
HK/8/20	Nam Long Shan Road (Ocean Park Access Road) - 2nd site	17-8	H/HK	17-8	Fill slope	Minor	Road	1 lane of road closed	
HK/8/21	Tai Hang Road (opposite lamp post 2654)	17-8	H/HK	17-8	Soil cut slope	Minor	Road	1 lane of road closed	
HK/8/22	Green Lane, Happy Valley (opposite Wendy Apartments)	17-8	H/HK	17-8	Soil cut slope	Minor	Road	Road closed	
HK/8/23	Mount Butler quarry	17-8	H/HK	17-8	Fill slope	Major	Quarry site	Erosion of fill slope	Slope ref. 11SE-C/FR20
(HK/8/24)	Road joining Mount Austin Road & Lugard Road	7-8	Public	-	-	-	-	-	No GCO action Refer to case GCB 1/8
(HK/8/25)	Behind 45 Island Road	17-8	H/HK	-	-	-	-	-	No GCO action Refer to case GCB 4/8
HK/8/26	Tai Hang Road opposite Peace Mansion (# 152 Tai Hang Road)	17-8	H/HK	17-8	Soil cut slope	Minor	Road	1 lane of road closed	
HK/8/27	Repulse Bay Road	17-8	H/HK	17-8	Soil/rock cut slope	Minor	Road	1 lane of road closed	
HK/8/28	Deep Water Bay Road	19-8	H/HK	18-8	Fill slope	Minor	Road and footpath	Lane partially closed	Fill slope under reconstruction from previous failure

Appendix 1 : Incidents on Hong Kong Island reported directly to the GCO

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		on	from	Date	Type	Scale			
HK/8/29	Squatter area off Nam Long Shan Road	18-8	H/HK	18-8	Soil cut slope	Minor	Squatter		
HK/8/30	Tai Tam Reservoir Road	23-8	H/HK	18-8	Soil cut slope	Minor	Road	1 lane blocked	
HK/8/31	Big Wave Bay Road	23-8	H/HK	18-8	Soil cut slope	Minor	Road	1 lane blocked	
HK/8/32	Tsin Sui Ma Tau Village	17-8	H/HK	17-8	Natural slope	Major	Squatter	7 huts permanently evacuated	
HK/8/33	Bowen Drive above Kennedy Road	17-8	H/HK	-	Soil cut slope	Minor	Road and footpath	-	
HK/8/34	Ngai Choi Hang, North Point	18-8	H/HK	17-8	Soil cut slope	Minor	Squatter	-	
HK/8/35	Stanley Village Road	23-8	H/HK	-	Fill slope	Minor	Road	-	Small fill slope
HK/8/36	Nam Fung Road, Wong Chuk Hang (2nd case)	17-8	H/HK	17-8	Soil cut slope	Minor	Squatter	4 huts permanently evacuated	
HK/8/37	Behind Wong Chuk Hang Transit Centre	17-8	H/HK	17-8	Soil cut slope	Minor	Squatter	-	
HK/8/38	Behind factory at 2-10, Aberdeen Main Road	17-8	H/HK	17-8	Soil cut slope	Minor	Road	-	
HK/8/39	St. Stephen's Beach, Stanley	3-9	H/HK	August	Soil/rock cut slope	Minor	Road and car park	-	

Appendix 1 : Incidents in Kowloon reported directly to the GCO

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		on	from	Date	Type	Scale			
K/8/13	Lei Yue Mun Village	16-8	CDO	16-8	Natural slope	Minor	Squatter	2 huts temporarily evacuated by HD	
K/8/14	Wing Lok Yuen Village, Ching Cheung Road	17-8	H/K	16-8	Soil cut slope	Minor	Squatter	2 huts permanently evacuated	
K/8/15	On Lok Tsuen	17-8	H/K	16-8	Soil cut slope	Minor	Squatter	2 huts permanently evacuated	
K/8/16	Tai Shing Village	17-8	H/K	16-8	Retaining wall	Minor	Squatter	3 huts temporarily evacuated	
K/8/17	Tai Shing Village	17-8	H/K	16-8	Soil cut slope	Minor	Squatter	2 huts permanently evacuated	
K/8/18	Cheung Lung Tin	17-8	H/K	16-8	Soil cut slope	Minor	Squatter	3 huts temporarily evacuated	
K/8/19	Cheung Lung Tin	17-8	H/K	16-8	Fill platform	Minor	Squatter	5 huts permanently evacuated	
K/8/20	Lei Yue Mun	17-8	H/K	16-8	Soil/rock cut slope	Minor	Squatter	1 hut permanently evacuated	
(K/8/21)	Ping Ting Village	17-8	H/K	16-8	Mass concrete slab over refuse fill	Minor	Access road & storage area	1 storage hut permanently evacuated	Excluded from landslip statistics
K/8/22	Man Kuk Sun Tsuen	17-8	H/K	16-8	Soil cut slope	Minor	Squatter	3 huts permanently evacuated	
K/8/23	Lam Tin 1st Village	17-8	H/K	16-8	Natural slope	Minor	Squatter and power sub-station	1 hut and substation permanently evacuated	
K/8/24	Lam Tin 1st Village	17-8	H/K	16-8	Natural slope	Minor	Squatter	3 huts permanently evacuated	Further failure of area previously failed
K/8/25	Nam Shan Squatter Area	17-8	H/K	16-8	Retaining wall (mass concrete)	Minor	Squatter and footpath	5 huts temporarily evacuated	
(K/8/26)	Kam Mun Sun Tsuen	24-8	H/K	16-8	Refuse fill washout	Minor	Squatter	2 huts permanently evacuated	Excluded from landslip statistics
K/8/27	Mei Foo Sun Tsuen	19-8	H/K	16-8	Soil cut slope	Minor	Road and footpath	Slip road & footpath blocked	
K/8/28	Lam Tin 2nd Village	24-8	H/K	-	Flooding	-	Squatter	-	
K/8/29	Ching Cheung Road	24-8	H/K	24-8	Soil cut slope	Major	Road	Road blocked	

Appendix 1 : Incidents in New Territories reported directly to the GCO

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		on	from	Date	Type	Scale			
NT/8/7	Above Sung Dynasty Village, L.C.K. (Kau Wah Keng Approach Road)	16-8		16-8 (11:30 a.m. - 12:00 a.m.)	Natural slope	Major	Squatter and road	2 dead 18 huts permanently evacuated	
NT/8/8	Kau Wah Keng San Tsuen	16-8	R.H.K.P.	16-8 (10:30 a.m. - 11:00 a.m.)	Retaining wall	Major	Squatter and village type house on CLL	2 dead Closure of 3 V T Houses Permanent evacuation of 5 groups of huts	Same as incident GCB 5/8
NT/8/9	Kau Wah Keng Old Tsuen	16-8	H.D.	19-8	Flooding	-	Squatter	17 huts permanently evacuated	
NT/8/10	Cheung Hang Tsuen, Lai Chi Kok	16-8	H.D.	16-8	Natural slope	Major	Squatter	5 huts permanently evacuated	
NT/8/11	Cheung Hang Road (A), Kau Wah Keng	16-8	GCO	16-8	Rock cut slope	Major	Road	Road completely blocked	
NT/8/12	Pak Shek Village, Shatin	16-8	D.O.	16-8	Soil cut slope	Minor	Squatter	5 huts permanently evacuated	
(NT/8/13)	Ha Wo Che Estate, Lot No. 21, Shatin (Behind Chung Shing Store)	16-8	R.H.K.P.		-				Same as incident NT/8/40.
(NT/8/14)	Sun Chuen Pai Village, Tsuen Wan	16-8	Public		-				H/NT confirmed that there was no landslip.
NT/8/15	Tsing Yi TY1 CH2400	16-8	S.W.K.P.	16-8	Soil cut slope	Major	Road	One lane of road closed	Deterioration of a failure initiated in the May rainstorm (NT231)
NT/8/16	9½ MS Castle Peak Road, Tsuen Wan	17-8	H/NT		Retaining wall	Major	Road		
NT/8/18	5½ MS Tai Po Road near Kowloon Reservoir	17-8	Police	17-8	Soil cut slope	Major	Road	2 lane road completely blocked	
(NT/8/19)	Cheung Shan Estate, Tsuen Wan	17-8	H.D.		Landslip				No danger, referred direct to H/NT.
NT/8/20	10, Kau Wah Keng, Old Tsuen, Lai Chi Kok	17-8	D.L.O.	16-8	Soil cut slope	Minor	Village type house on CLL	Building temporarily evacuated	
NT/8/21	Castle Peak Road, Ting Kau	17-8	H/NT	16-8	Subsidence behind retaining wall	Minor	Road		
NT/8/22	11½ MS Castle Peak Road, Hoi Mei Wan - Sham Tseng	17-8	H/NT	16-8	Retaining wall	Minor	Road	One lane closed until completion of remedial works	Foundation of wall undermined.
NT/8/25	6½ MS Castle Peak Road, Tsuen Wan Slope Ref. 7SW-C/C205	17-8	H/NT	17-8	Soil cut slope	Major	Road	1 carriageway closed	

Appendix 1 : Incidents in New Territories reported directly to the GCO

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		on	from	Date	Type	Scale			
NT/8/23	5½ MS Castle Peak Road Slope Ref. 11NW-A/C63	17-8	H/NT	17-8	Soil/rock cut slope	Major	Road	1 carriageway closed	
NT/8/24	5¾ MS Castle Peak Road Slope Ref. 11NW-A/C62	17-8	H/NT	17-8	Soil/rock cut slope	Major	Road and Squatter	1 lane blocked 1 hut permanently evacuated	Minor failure deteriorating into a major failure 10 days after 17th August.
NT/8/26	Kwai Chung Road Slope Ref. 11NW-A/C79	17-8	H/NT	17-8	Rock cut slope	Major	Road	1½ lane blocked	
NT/8/27	Yau Kam Tau, Tsing Yi	17-8	H.D.	17-8	Retaining wall	Minor	Squatter	1 killed & 1 injured	
NT/8/28	Yau Kam Tau, Tsing Yi	17-8	H.D.	16-8	Soil/rock cut slope	Minor	Squatter	4 huts permanently evacuated	
NT/8/29	Yau Kam Tau, Tsing Yi	17-8	H.D.	16-8	Soil/rock cut slope	Minor	Squatter	1 hut permanently evacuated	Slips originally occurred in May rainstorm but deteriorated further in August 1 and August 16 rainstorms.
NT/8/30	Yau Kam Tau, Tsing Yi	17-8	H.D.	16-8	Soil/rock cut slope	Minor	Squatter	1 hut permanently evacuated	
NT/8/31	Yau Kam Tau, Tsing Yi	17-8	H.D.	16-8	Soil/rock cut slope	Minor	Squatter	1 hut permanently evacuated	
NT/8/32	155, Kau Wah Keng San Tsuen	17-8	D.L.O.	16-8	Retaining wall	Minor	CLL house and path	Closure of CLL house	
NT/8/33	Shek Tau Street, Tai Wo Hau Estate, Tsuen Wan, Slope Ref. 7SW-C/C83	18-8	H/NT	16-8	Rock cut slope	Major	Road	3 cars buried, road blocked	
NT/8/34	13½ MS Castle Peak Road	18-8	R.H.K.P.	17-8	Soil cut slope	Major	Road	Partial blockage of road	
NT/8/35	10 Tso Kung Tam, Tsuen Wan	18-8	D.L.O.	16-8	Natural soil slope	Minor	Squatter	13 huts permanently evacuated	
NT/8/36	Fu Yung Shan, Tsuen Wan, San San Village	18-8	D.L.O.	16-8	Flooding	Major	Squatter	20 huts permanently evacuated, 1 man wounded	
NT/8/37A NT/8/37B	Lo Wai Village, Tsuen Wan, (near Lung Mo Temple)	18-8	D.L.O.	16-8	a) Soil cut slope b) Soil cut slope	a)Major b)Minor	Squatter Squatter	1 hut temporarily evacuated	
NT/8/38	CH1000, Road TY1 Opposite PEPCO Power Station Tsing Yi	19-8	NW/GCO	16-8 (P.M.) 19-8	Rock cut slope	Minor	Road	1 lane closed	Refer to file GCN 2/84/35
NT/8/39	13 MS Route Twisk	19-8	H/NT	17-8	Natural slope	Major	Road		
NT/8/40	No 21 Ha Wo Che Village, Shatin	19-8	D.O.	16-8	Natural slope	Minor	Squatter	3 huts permanently evacuated	Small cut formed at toe.
NT/8/41	Kwong Fong Village, Man Hang, Shatin	19-8	D.O.	16-8	Natural slope	Minor	Squatter	3 huts permanently evacuated	
(NT/8/42)	Shung San Tsuen, Yuen Long	19-8	D.O.						Same as incident NT/8/79.

Appendix 1 : Incidents in New Territories reported directly to the GCO

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		on	from	Date	Type	Scale			
NT/8/43	Sham Tseng, Tsuen Wan C.L.L. W 5925	23-8	D.L.O.	16-8	Soil cut slope	Minor	Squatter	5 huts permanently evacuated	
NT/8/44	CH1400, Road TY1, Opposite PEPCO, Tsing Yi	21-8	S.W.K.P.	21-8	Soil cut slope	Major	Road	1 lane closed	Refer to file GCW 2/84/35.
NT/8/45	Nam She Hang, Ma On Shan, Shatin	19-8	D.O.	16-8	Natural slope	Minor	Squatter hut and footpath	1 hut permanently evacuated	
NT/8/46	Wing Yip Street, Kwai Chung Slope Ref. 7SW-C/C234	24-8	H/NT	16-8	Soil cut slope	Minor	Factory building		
NT/8/47	Kung Yip Street, Kwai Chung Slope Ref. 7SW-C/C208	24-8	H/NT	16-8	Soil cut slope	Minor	Factory building		
NT/8/48	Hon Man Tsuen, Tsuen Wan	23-8	D.L.O.	16-8	Boulders	Minor	Squatter	2 huts permanently evacuated	
NT/8/49	45 Hon Man Tsuen, Tsuen Wan	23-8	D.L.O.	16-8	Soil cut slope	Minor	Squatter	1 hut permanently evacuated	
NT/8/50	40 Yau Kam Tau, Tsuen Wan	23-8	D.L.O.	16-8	Boulder	Minor	Squatter		
NT/8/51	91 Ting Kau, Tsuen Wan	23-8	D.L.O.	16-8	Soil cut slope	Minor	Squatter		
NT/8/52	Ting Kau Beach, Tsuen Wan	23-8	D.L.O.	16-8	Natural slope	Minor	Building		Small cut at toe.
NT/8/53	481 - 482 Sham Tseng, Tsuen Wan	23-8	D.L.O.	16-8	Soil cut slope	Minor	Squatter	2 huts permanently evacuated	
NT/8/54	393 - 399 Sham Tseng, Tsuen Wan	23-8	D.L.O.	16-8	Soil cut slope	Minor	Squatter	7 huts permanently evacuated	
NT/8/55	982 - 984 Sham Tseng, Tsuen Wan	23-8	D.L.O.	16-8	Soil cut slope	Minor	Squatter	3 huts permanently evacuated	
NT/8/56	Salvation Army Camp, Ma Wan, Tsuen Wan	23-8	D.L.O.	16-8	Soil cut slope	Minor	Road		
(NT/8/57)	11, Tso Kung Tam	18-8	D.L.O.	May ?	Settlement of floor of hut	N.A.	Squatter	Permanent evacuation of 9 huts	)Incidents NT/8/57 and)NT/8/58 are not included)in the statistics)for the August)16 to 19th)rainstorm.
(NT/8/58)	Tso Kung Tam Opp. Tsuen Wan Garden	18-8	D.L.O.	May ?	Retaining wall (cracking and bulging)		Squatter	Permanent evacuation of 2 huts	
NT/8/59	26, Tso Kung Tam	18-8	D.L.O.	16-8	Retaining wall (masonry)	Minor	Squatter	1 hut permanently evacuated	
NT/8/60	Pak Tin Pa	18-8	D.L.O.	16-8	Soil cut slope	Minor	Squatter	1 hut permanently evacuated	
NT/8/61	61, Shing Mun Road, Wo Yi Hop	18-8	D.L.O.	16-8	Retaining wall	Minor	Squatter	6 huts permanently evacuated	
NT/8/62	21 Kam Wah Keng San Tsuen	26-8	D.L.O.	16-8	Soil cut slope	Minor	Squatter	2 huts permanently evacuated	
NT/8/63	23, Kau Wah Keng San Tsuen	26-8	D.L.O.	16-8	Soil cut slope	Minor	C.L.L. house	Permanent evacuation of 1 house	

Appendix 1 : Incidents in New Territories reported directly to the GCO

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		on	from	Date	Type	Scale			
NT/8/64	Cheung Hang Tsuen	27-8	H.D.	16-8	Natural slope	Minor	Squatter	2 huts permanently evacuated	
NT/8/65	Cheung Hang Tsuen	27-8	G.C.O.		Flooding	-	Squatter		Blocked stream course
NT/8/66	Cheung Hang Road (B)	27-8	H/NT	16-8	Soil cut slope	Minor	Road		
NT/8/67	Chi Kwu Wan Village, Tsuen Wan		D.L.O.	16-8	Soil cut slope	Minor	Squatter	2 huts permanently evacuated	
NT/8/68	186 - 189 Kau Wah Keng Village, Tsuen Wan		D.L.O.	16-8	Retaining wall	Minor	Squatter	4 huts permanently evacuated	
NT/8/69	Shek Yam T.H.A. Slope Ref. 7SW-C/C153			16-8	Rock cut slope	Major	Road	Access road to THA partly blocked	
NT/8/70	Cheung Hang Road C	27-8	H/NT	27-8	Rock cut slope	Minor	Road		
NT/8/71	Cheung Hang Road D	27-8	H/NT	27-8	Soil cut slope	Minor	Road	Road blocked	
NT/8/72	Cheung Hang Road E	27-8	H/NT	27-8	Natural slope	Major	Road and footpath		
NT/8/73	Cheung Hang Road F	27-8	H/NT		Unknown (complaint only)		Footpath		Excluded from landslip statistics
NT/8/74	Sheung Yat Tsuen, T.W.	27-8	H.D.	16-8	Soil cut slope	Minor	Squatter	3 huts permanently evacuated	
NT/8/75	Shing Mun Road	31-8	H/NT	16-8	Fill slope	Major	Road		Erosion due to water overflow from blocked stream course.
NT/8/76A NT/8/76B	Ki Lun Shan, San Tin, Yuen Long (2 incidents)	31-8	D.L.O.	16-8	a) Soil cut slope b) Retaining wall	a) Minor b) Minor	a) C.L.L. House b) Road		Wall showing distress.
NT/8/77	Mai Po Lung, San Tin, Yuen Long	31-8	D.L.O.	16-8	Fill platform	Minor	Squatter		
NT/8/78	Nam Hang Pai, Yuen Long	31-8	D.L.O.	16-8	Retaining wall	Minor	Squatter and footpath	3 huts permanently evacuated	Thin skin wall.
NT/8/79	19 Shung Shan Tsuen, Yuen Long		D.O.	16-8	Retaining wall	Minor	C.L.L. House	1 Masonry house permanently evacuated	
(NT/8/80)	Pak Wai Tsuen, Kam Tin, Yuen Long		D.O.	16-8	Natural slope	Minor			Excluded from landslip statistics
NT/8/81	Below S/R formation, Road TY1, Tsing Yi	18-8	GCO/NW	18-8	Rock cut slope	Major	Road and construction site	1 lane closed	Refer to file GCN 2/B4/Z3
NT/8/82	Above Castle Peak Road at Hung Fong Upper Village	18-8	H/NT	16-8	Natural slope	Minor	Road		
NT/8/83	6½ mile village	18-8	H/NT	16-8	Fill slope	Minor	Squatter	5 huts permanently evacuated	
NT/8/84	Cheung Hang Village	18-8	H/NT	16-8	Natural slope	Minor	Squatter	1 hut permanently evacuated	1 pigsty hut
NT/8/85	Lei Pui Village at Shek Pui Tsuen	18-8	H/NT	16-8	Natural slope	Minor	Squatter	24 huts permanently evacuated	Many slips on hillside.

Appendix 1 : Incidents in New Territories reported directly to the GCO

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		on	from	Date	Type	Scale			
NT/8/86	Wu Lei Hang	18-8	H/NT	16-8	Soil cut slope	Minor	Squatter	1 hut permanently evacuated	
NT/8/87	Shek Lei Hang Village	18-8	H/NT	16-8	Natural slope	Minor	Squatter	5 huts permanently evacuated	
NT/8/88	Wu Lei Hang Tsuen	18-8	H/NT	16-8	Fill slope	Minor	Squatter	1 hut permanently evacuated	
NT/8/89	Ho Pui Tsuen	18-8	H/NT	16-8	Natural slope	Minor	Squatter		
NT/8/90	Shek Yam Road behind #88	18-8	H/NT	16-8	Soil cut slope	Minor	Road		Rear access lane
(NT/8/91)	Da Chuen Ping Village	18-8	H/NT	16-8	Rubbish fill	Minor	Village house		Excluded from landslip statistics
NT/9/1	Sham Tseng (A), Tsuen Wan	1-9	H.D.	16-8	Retaining wall	Minor	Squatter	1 hut permanently evacuated	Thin wall
NT/9/2	Sham Tseng (B), Resite Village Slope Ref. 6SE-C/C63	1-9	D.L.O.	Various dates in August	Rock cut slope	Minor	Access track, steps and chicken huts	Chicken huts permanently evacuated	
NT/9/3	30 Pak Tin Pa Tsuen	1-9	H.D.	16-8	Natural slope	Minor	Squatter	4 huts covered by CLL permanently evacuated	Further landslips in the same area as failures during the May rainstorm
NT/9/4	C.L.L. 1204 San Tsuen, Tsuen Wan	1-9	D.L.O.	16-8	Soil cut slope	Minor	C.L.L. houses	2 houses permanently evacuated	
NT/9/5	R T W /4A/449 Fu Yung Shan, Tsuen Wan	1-9	D.L.O.	16-8	Soil cut slope	Minor	Squatter		10 tonne boulder to be buttressed.
NT/9/6	Kwong Pan Tin, Tsuen Wan (XRTW/40/9)	1-9	D.L.O.	16-8	Soil cut slope	Minor	Squatter	1 hut permanently evacuated	
NT/9/7	Lo Wai (XRTW/4AD/14)	1-9	H.D.	16-8	Natural slope	Minor	Squatter	1 hut permanently evacuated	
NT/9/8	Kwai Chung Public School	16-9	D.L.O.	16-8	Soil cut slope	Minor	Construction site		
NT/9/9	Shek Lei T.H.A.	16-9	D.L.O.	16-8	Soil/rock cut slope	Minor	Buildings		Recreation area of THA
NT/9/10	Cheung Hang Village, Upper Section A	16-9	D.L.O.	16-8	Retaining wall	Minor	Squatter		
NT/9/11	Cheung Hang Village, Upper Section B	16-9	D.L.O.	16-8	Natural slope	Major	Squatter		
NT/9/12	Lam Tin, Tsing Yi	21-9	H.D.	16-8	Soil cut slope	Minor	Squatter	3 huts permanently evacuated	
NT/9/13	Yau Kam Tau, Tsing Yi	21-9	H.D.	16-8	Soil cut slope	Minor	Squatter		
(NT/9/14)	Siu Lek Yuen, Shatin	19-9	D.L.O.	16-9	Soil cut slope	Minor	Squatter	9 huts permanently evacuated	Incidents NT/9/14 to NT/9/16 are not included in the statistics for the August 16 to 19th rainstorm.
(NT/9/15)	Wo Che Village, Shatin	20-9	D.L.O.	16-9	Retaining wall (rubble)	Minor	Squatter	7 huts permanently evacuated	
(NT/9/16)	3rd district, Pak Tin, Shatin	21-9	H/NT	16-9	Boulder	Minor	Squatter		

Appendix 1 : Incidents in New Territories reported directly to the GCO

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		on	from	Date	Type	Scale			
NT/9/17	Private Road Opposite Ting Kau Car Park, Ting Kau, Tsuen Wan	8-9	H/NT	16-8	Natural slope	Minor	Road above		
(NT/9/18)	31A, Khu Hang Tsuen, Tsuen Wan	9-9	D.L.O.	7-9	Soil cut slope	Minor	Squatter	1 hut permanently evacuated.	Excluded from landslip statistics.
(NT/9/19)	13½ MS Castle Peak Road	9-9	D.L.O.	16-8	Natural slope	Minor	Building		Refer to case GCB 9/8.
(NT/8/92)	Chung Shan Terrace, Kwai Chung	16-8		16-8, 17-8	Retaining wall	Major	Road and squatter	Collapse of wall following undermining by road failure on 31st July 82	Refer cases NT/8/1 and GCB 7/8.

Appendix 1 : Incidents within private lots reported directly to the GCO

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		on	from	Date	Type	Scale			
GCB 1/8	25 Lugard Road, H.K.	17-8	BOO	17-8	Retaining wall	Major	Road	Access road blocked.'D' Slope Notice recommended	
GCB 2/8	29-31 Blue Pool Road, H.K.	16-8	BOO	16-8	Soil/rock cut slope	Minor	Building	Advisory Letter recommended	Rear yard and car park of building
GCB 3/8	RBL 1044 South Bay Close, H.K.	17-8	Owner's consult.	17-8	Soil/rock cut slope	Major	Construction site	Remedial work carried out by A.P.	Access to site
GCB 4/8	45 Island Road - RBL 596, H.K.	17-8	GCO	17-8	Soil cut slope	Major		'D' Slope Notice recommended	Rear yard of building
(GCB 5/8)	Kau Wah Keng San Tsuen, N.T.	16-8	BOO	16-8	Retaining wall	Major	Building	Closure orders to 3 NTEH, permanent evacuation and clearance of squatter huts below	Refer to case NT 8/8
GCB 6/8	7 Chung Shan Terrace, N.T.	16-8	BOO	17-8	Retaining wall	Major	Squatter and village type house on CLL	Retaining wall and access road further collapsed, A.P. followed up further study	Closure already applied since the 1st slip on 31-7-82 same as NT 8/92.
GCB 7/8	Wing Lok Yuen, Ching Cheung Road behind COC petrol station, K.	17-8	GCO	17-8	Natural Slope	Major	Road	Closure order being prepared (evacuation to 7 house/ squatters and 1 pump house of hotel)	
GCB 8/8	Butterfly Valley Village, Wai Man Tsuen, K.	18-8	BOO	16-8	Fill platform	Minor	Squatter and pump house	Platform settled and access path blocked, residents of illegal extension advised to move and keep away from slip areas.	
GCB 9/8	13 m.s. Castle Peak Road, Dragonville, N.T.	18-8	GCO	17-8	Natural slope	Minor	Road	-	
(GCB 10/8)	33 To Tuen Street, Heung To Middle School, Tai Hang Tung, K.	18-8	BOO	-	Retaining wall (Complaint only)		Building	-	Further deterioration to wall which failed in May/June.
GCB 11/8	Pui Tak Conossion College, Peel Rise, H.K.	17-8	BOO	17-8	Soil cut slope	Minor	School building	'D' Slope Notice being served by D.B.	Further minor slip affecting the rear yard of a school following a previous slip on 6-7-82
GCB 12/8	Lei Tung Estate, Apleichau Site B, H.K.	17-8	HD	17-8	Natural slope	Minor	Construction site	-	

APPENDIX 2

LOCATIONS OF INCIDENTS

Incidents shown on this plan are
those reported directly to the GCO

Drawing No.

GCE 411 Location Plan of Incidents : August 1982 Rainstorm