

**Discussion Paper for Legislative Council
Panel on Planning, Lands and Works**

Special Meeting on 13 June 2001

Flood Control and Prevention Strategy and Measures

1. INTRODUCTION

This paper covers the topics of flood control and prevention strategy and measures, the flooding events that occurred in the period from 7.6.2001 to 11.6.2001 and compensation for losses arising from such events.

2. FLOOD CONTROL AND PREVENTION STRATEGY AND MEASURES

In recent meetings of the Panel, Members have been provided with information on this topic. Relevant extracts from notes issued to Members in early May this year are attached at Annex A.

3. FLOODING IN THE NEW TERRITORIES FROM 7.6.2001 TO 11.6.2001

3.1 INTRODUCTION

A trough of low pressure brought torrential rain to the South China coastal areas. The rain bands reached Hong Kong in the early hours of 7th June and periods of exceptionally heavy rainfall have occurred in various areas of the territory from the 7th to the 11th of June 2001 resulting in serious flooding. Although very intense rainfall occurred over Kowloon and Hong Kong Island, it was generally for only short periods of time and therefore flooding in these areas was mostly limited to localized ponding. In the New Territories, however, the very intense rainfall persisted for longer which, together with the high tide, resulted in extensive flooding in the lowlying areas of Northern and North Western New Territories. Serious cases also occurred at Belvedere Garden in Tsuen Wan and in villages near Tai Po.

3.2 SUMMARY OF EVENTS

The events on each day are summarized below. At various times, flood warning systems were actuated to warn local residents in lowlying areas of the possibility of flooding. At no time was there any overflow from the Shenzhen Reservoir in the period and all of the completed village flood protection schemes functioned well. None of the flooding is considered to be attributable to KCRC's West Rail works.

3.2.1 7th June 2001

Amber Rainstorm Signal 0500 to 2005 hrs.
Special Flood Announcement in Northern NT : 0420 to 1535 hrs.
High Tide at 0915 a.m. (2.7 mPD at Tsim Bei Tsui)
Rainfall mainly in the NWNT and NNT from 0500 to 0800 hrs.

| | | | |
|--------------------|---|--------------|--|
| NWNT max intensity | : | 59 mm/hour | |
| 24 hour total | : | 257 mm | |
| NNT max intensity | : | 51.5 mm/hour | |
| 24 hour total | : | 198 mm | |

Flooding Complaints

| | | | | |
|------------------|---|--------|---|----------------|
| Hong Kong Island | : | 1 no. |) | |
| Kowloon | : | 2 no. |) | total : 36 no. |
| New Territories | : | 33 no. |) | |

3.2.2 8th June 2001

Amber Rainstorm Signal 0425 to 0820 hrs.
1415 to 1630 hrs.
Red Rainstorm Signal 0820 to 1415 hrs.
High Tide at 0950 a.m. (2.7 mPD at Tsim Bei Tsui)
Rainfall mainly in Kowloon, Hong Kong Island, Sai Kung, Sha Tin and Tai Po from 0500 to 0900 hrs.

Flooding Complaints

| | | | | |
|------------------|---|--------|---|----------------|
| Hong Kong Island | : | 17 no. |) | |
| Kowloon | : | 11 no. |) | total : 31 no. |
| New Territories | : | 3 no. |) | |

3.2.3 9th June 2001

Amber Rainstorm Signal 0415 to 0930 hrs.
Red Rainstorm Signal 0930 to 1330 hrs.

Special Announcement of Flooding in Northern NT 0425 to 1330 hrs
High Tide at 1030 a.m. (2.8 mPD at Tsim Bei Tsui)

Rainfall mainly in the NWNT and NNT from 0400 to 1200 hrs.

NWNT max intensity : 94 mm/hour

24 hour total : 242 mm

NNT max intensity : 85 mm/hour

24 hour total : 265 mm

Flooding Complaints

Hong Kong Island : 5 no.)

Kowloon : 2 no.) total : 130 no.

New Territories : 123 no.)

3.2.4 10th June 2001

Amber Rainstorm Signal 0805 to 1340 hrs.

Special Announcement of Flooding in Northern NT 0820 to 1340 hrs.

High Tide at 1115 a.m. (2.6 mPD at Tsim Bei Tsui)

Rainfall mainly in the NWNT and NNT from 0500 to 1340 hrs.

NWNT max intensity : 73 mm/hour

24 hour total : 159 mm

NNT max intensity : 73 mm/hour

24 hour total : 194 mm

Flooding Complaints

Hong Kong Island : 0 no.)

Kowloon : 0 no.) total : 32 no.

New Territories : 32 no.)

3.2.5 11th June 2001

Amber Rainstorm Signal 0720 to 1035 hrs.

1330 to 1524 hrs.

Red Rainstorm Signal 1035 to 1330 hrs.

High Tide at 1145 a.m. (2.6 mPD at Tsim Bei Tsui)

Rainfall mainly in parts of Lantau and Yuen Long/Kam Tin/Tsuen Wan

24 hour total exceeding 150 mm

Flooding Complaints

Hong Kong Island : 6 no.)

Kowloon : 1 no.) total : 30 no.

New Territories : 23 no.)

3.3 ***SUMMARY OF THE MAJOR FLOODING EVENTS***

3.3.1 North West New Territories

Widespread flooding occurred on 7.6.2001, 9.6.2001 and 11.6.2001. This was generally in low-lying areas and blackspots which are susceptible to flooding as a consequence of the sort of exceptionally heavy rainfall which occurred. The flooding caused serious traffic disruption and some residents needed to be evacuated by the Fire Services Department.

In a particular case on 7.6.2001, Pok Wai Village was flooded. At present, construction work is in progress under PWP Item 98CD by Drainage Services Department to protect this village against flooding. Although the works are not yet complete, the contractor should have had in place an arrangement to reduce the flooding effect by the operation of temporary pumps however this arrangement failed because the contractor's stand-by staff were not on site until too late. On 8.6.2001, the contractor met the villagers and reached the following agreements :-

- Communication channel for the villagers to contact the contractor will be improved;
- The contractor will arrange stand-by staff to be stationed on site overnight to deal with emergency situation during the wet season; and
- The contractor to handle issues in relation to insurance and claims.

The arrangements worked well during subsequent periods of heavy rain on the following days.

Details and timing of the major flood control projects in North West NT that will substantially reduce the risks of such widespread flooding in future are shown on the attached drawing DLD1164K.

3.3.2 North New Territories

Extensive regional flooding occurred in the lowlying areas and blackspots on 9.6.2001 and 10.6.2001 resulting in serious traffic disruption and necessitating the emergency evacuation of some residents by the Fire Services Department.

One of the areas worst hit by flooding was in the flood plain of River Indus near Tin Ping Shan, Sheung Shui, where river training works are taking place under PWP item 53CD by the Territory Development Department. As the river training works have not yet been completed, the discharge of flood water in the area still relies on some of the existing river course and diversion works which did not have enough capacity to cope with this extremely heavy rainfall. The reason for flood water building up so quickly could be attributed to the high tide and the antecedent rainfall from 5-8.6.2001 in the area which had increased the catchment soil saturation and the runoff ratio.

There are major projects in hand to substantially reduce the risks of such widespread flooding in future. Details and timing are shown on drawing DLD1162E for the Shenzhen river and DLD1163H for the Northern N.T.

3.3.3 *Belvedere Garden, Tsuen Wan*

Flooding resulted from a catchpit becoming totally blocked by boulders and debris being washed down from a landslip on a natural hillside upstream. The catchpit had been inspected and found clear earlier in the morning before the heavy rainfall commenced. After the catchpit was cleared the flooding subsided. However it is probable that debris remains within the culvert downstream of the catchpit which may have reduced its capacity. This debris will be cleared when the periods of heavy rain cease and it is safe to enter the culvert.

Investigations will be undertaken on potential improvements to mitigate against a re-occurrence.

3.3.4 *Villages at Kau Lung Hang and Yuen Leng*

On 10.6.2001, lowlying areas and blackspots were flooded due to the very heavy rainfall. Drainage improvement works to widen and straighten the existing natural watercourses which drain the area have been included in PWP item 4112CD – Drainage Improvement in Northern New Territories – Package A. Construction is scheduled to start in 2005 for completion in 2008. The PWSC on 30 May this year endorsed the funding application for employment of consultants to carry out detailed investigation and design of the proposed drainage improvement works.

3.4 *CONCLUSION*

To fully investigate the exact circumstances of each flooding case requires longer time, however it can be concluded that this type of widespread flooding in the NWNT and NNT areas is, regrettably, not unexpected having regard to the exceptionally heavy rainfall occurring during this period. An extensive programme of major flood protection works is underway and improvements to the situation will progressively result as the works are completed. For the North and North West New Territories, we have already spent \$2.7 billion on river training and village flood protection. This has completed the training the lower reaches of the major rivers and the construction of 19 village flood protection schemes protecting 26 villages. The work that is presently in progress is worth a further \$2.1 billion and includes two major contracts for widening and training the middle reaches of the River Indus which will be complete by 2003 and will alleviate the situation in Sheung Shui.

In recent Drainage Master Plan Studies for the areas, we identified and have put in place whatever first aid and short term measures were found to be feasible but it will be necessary to complete the major projects before any significant improvement to flood protection standards can be obtained.

4. **COMPENSATION FOR LOSSES ARISING FROM FLOODING**

If losses arise from flooding which is attributable to contractors undertaking construction work, then the contractor would be held responsible for dealing with requests for compensation. The Government will arrange necessary emergency social support services to the residents affected by the flooding.

Drainage Services Department
June 2001

AN OVERVIEW OF THE FLOOD CONTROL AND PREVENTION STRATEGY

Development of the Strategy

In 1990, the Government completed the phase I of the Territorial Land Drainage and Flood Control Strategy Study. Based on the recommendation of the Study, the Government endorsed a set of flood protection standards such that all new stormwater facilities have to be designed to withstand a severe flood event as described below:

| | <u>Return Period¹</u> |
|--|---|
| • Urban drainage trunk systems | 200 |
| • Urban drainage branch systems | 50 |
| • Main river and rural drainage channels | 50 |
| • Village flood protection scheme | 50 |

2. The definition of a flood event is based on the combination of rainfall intensity and tide levels. For a drainage basin, the downstream of the catchment is under influence of the sea. The capacity of the drainage network will be reduced if the tide level is high, as the high tide prevents the free discharge of flood water to the sea. This is a natural phenomenon and occurs to every drainage network within the tidal zone. We have always taken this into account and a high tide level is used in all our designs.

3. For urban areas, a 200 years protection standard is specified for the trunk drain such that adequate protection is provided against extensive regional flooding in the urban area. For the branch networks, a protection level of 1 in 50 years is provided for cost-effectiveness consideration, bearing in mind that the catchment area served by a branch drain is relatively small.

4. Regarding the design of main river and rural drainage channels as well as village flood protection schemes, a protection level of 50 years return period is provided to achieve cost-effectiveness based on considerations such as land requirement, social and economic impacts of flooding.

5. The above strategy serves to provide general guidelines for desired

¹ "Return Period" means the average number of years within which a certain severity of a flood event will occur once statistically. It indicates the probability of occurrence of a certain flood severity. A larger return period represents a more severe event and a rarer occurrence, but there is always the chance that it will occur in any one year.

flood protection standards for new stormwater drainage infrastructure. They are subject to appropriate adjustment with regard to site constraints and characteristics of individual catchments.

6. The Government also completed in 1993 the phase II of the Territorial Land Drainage and Flood Control Strategy Study. The Study provided Government with concrete plans and tools needed to make the strategy more effective in the five most flood prone basins, namely the Yuen Long, Tin Shui Wai, San Tin, Ganges and Indus Basins in the New Territories. The principal output from the Study provided a rational framework for managing the drainage systems in each basin, implementing structural and non-structural flood mitigation measures and responding to requests for development.

7. In 1994, the Government completed the West Kowloon Drainage Master Plan (DMP) study to investigate and resolve the drainage problems in the area. Since then, the Government has carried out seven more DMP studies to cover the following areas:

- a) Yuen Long, Kam Tin, Ngau Tam Mei and Tin Shui Wai
- b) Northern Hong Kong Island
- c) Tsuen Wan, Kwai Chung and Tsing Yi
- d) Tuen Mun and Sham Tseng
- e) Northern New Territories
- f) Sha Tin and Tai Po
- g) Sai Kung, East Kowloon and Southern Lantau

8. The above studies comprehensively examined the adequacy of the drainage systems and developed drainage improvement measures to meet the required flood protection standards and future development needs. They have taken into consideration a number of constraints and factors including social and economic pressures, financial and legal constraints, geographical and environmental conditions, institutional and management constraints as well as known development plans when formulating the required drainage improvement measures.

Drainage Improvement Measures in the New Territories

9. In the New Territories, the capacities of some existing rivers are inadequate and need to be improved to cope with the rapid development and changes in land use. River channels are the primary choice for drainage networks in the New Territories where the catchment areas to be drained are large and the river channel can more easily blend with the natural environment. Providing a box culvert in place of an open river channel will require a much larger land intake because of the need to compensate the corresponding

reduction in the flow area for conveying the floodwater and to construct the supporting walls and deckings. Box culverts will be used when the drainage basin is small. Box culvert will also be used in urban areas when the decked area is required for other land use purpose.

10. Being constrained by the natural topography and existing development, existing villages in some low-lying areas are still susceptible to flooding even after the construction of river channels. Village flood protection schemes are therefore required. The scheme is to protect the low-lying village by constructing a perimeter bund to prevent the ingress of floodwater from outside and installing a floodwater pumping station to discharge the stormwater collected within the bunded area to the nearby river channel.

11. Based on the above strategy, we have completed improvement to about 10 km downstream sections of the major river channels in the Yuen Long and Kam Tin areas in the North-western New Territories. Construction works for about 9 km midstream sections of the river channels in Yuen Long, Kam Tin and Ngau Tam Mei areas have also been in progress since 1999. In the Northern New Territories, Stages I and II works of the Shenzhen River Regulation Project have been completed. Corresponding improvement works for the River Beas and River Indus have also been in progress. In addition to the river training works, 19 village flood protection schemes have also been constructed and are now in operation.

12. Planning and design for further improvements to midstream and upstream sections of the river channels and tributaries and further village flood protection schemes in the New Territories are actively underway. Some are now ready for construction, subject to approval of funding, works could commence in end 2001/early 2002.

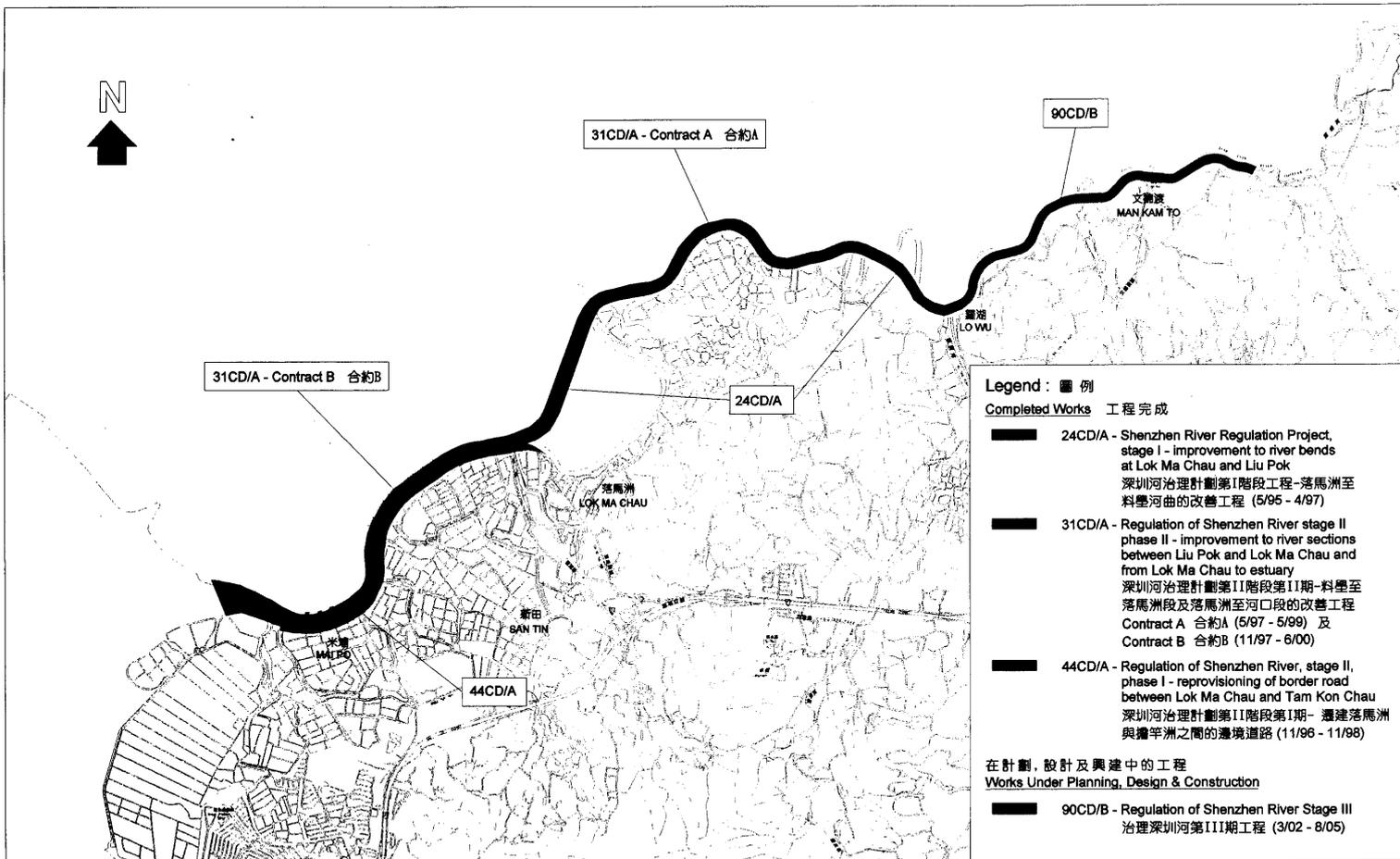
Drainage Improvement Measures in Urban Areas

13. In urban areas like the West Kowloon, Northern Hong Kong Island, Tsuen Wan and Kwai Chung, the stormwater drainage systems were built many years ago. There is a need to upgrade the flood protection level to the current flood protection standard. However, conventional drainage improvement works involving road opening works for the installation of new drains of larger size are always subject to constraints due to the presence of congested underground utilities, traffic diversion problems and public concern over the nuisances and inconveniences resulting from the construction activities. In this regard, a combination of the following alternatives will be explored in order to minimise these impacts:

- (a) the application of no-dig technology to minimise road opening works;
- (b) the provision of underground storage tanks for floodwater to reduce peak flows and hence reduce the extent of conventional drainage improvement works in the urban areas;
- (c) the construction of tunnel systems to collect rain water from upland areas for discharge directly into the sea. By employing this method, less rain water would enter the old drainage systems within the urbanised districts and therefore, the flood protection level of the systems could be improved with much less requirement for the construction of conventional drainage works in busy streets, thus minimizing the disruption to the public.

14. In accordance with above strategy, we have already commenced Stage I and Stage II drainage improvement works in West Kowloon including constructing a flood storage tank of a capacity of 100,000 m³ underneath the Tai Hang Tung Recreation Ground and a 1.5 km stormwater transfer tunnel from Kowloon Tong to the Kai Tak Nullah.

15. To improve the existing drainage systems in other urban areas including Northern Hong Kong Island, Lai Chi Kok, Sham Shui Po, Tsuen Wan and Kwai Chung areas, construction of drainage tunnels of about 20 km in length to intercept and transfer stormwater from the upper catchments directly to the sea have been recommended. These tunnels aim to upgrade the flood protection standards of the lower urban areas while minimizing public disruption and avoiding practical difficulties/constraints associated with conventional drainage improvement works in heavily built-up areas. Preliminary feasibility studies for these drainage tunnels have been completed. Besides these tunnels which are under planning, we do not envisage the necessity for further drainage tunnels to meet the present planned development scenarios in Hong Kong.



Legend : 圖例

Completed Works 工程完成

- 24CD/A - Shenzhen River Regulation Project, stage I - improvement to river bends at Lok Ma Chau and Liu Pok
深圳河治理計劃第I階段工程-落馬洲至料壘河曲的改善工程 (5/95 - 4/97)
- 31CD/A - Regulation of Shenzhen River stage II phase II - improvement to river sections between Liu Pok and Lok Ma Chau and from Lok Ma Chau to estuary
深圳河治理計劃第II階段第II期-料壘至落馬洲段及落馬洲至河口段的改善工程 Contract A 合約A (5/97 - 5/99) 及 Contract B 合約B (11/97 - 6/00)
- 44CD/A - Regulation of Shenzhen River, stage II, phase I - reprovisioning of border road between Lok Ma Chau and Tam Kon Chau
深圳河治理計劃第II階段第I期-遷建落馬洲與擔竿洲之間的邊境道路 (11/96 - 11/98)

在計劃, 設計及興建中的工程

Works Under Planning, Design & Construction

- 90CD/B - Regulation of Shenzhen River Stage III
治理深圳河第III期工程 (3/02 - 8/05)

drawing title 圖則標題

**Shenzhen River Regulation Project
深圳河治理工程**

DLD 1162E

scale 比例

N.T.S.

date 日期

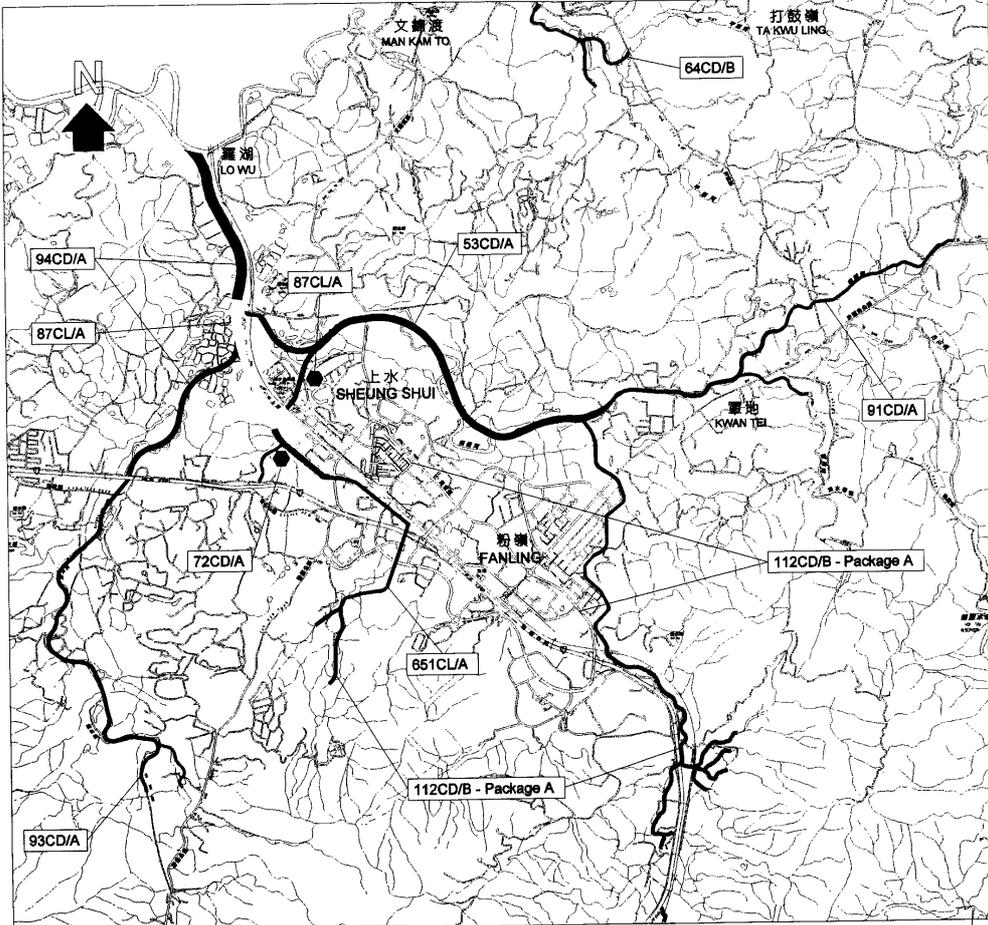
May 2001
2001年5月

office 部門

LAND DRAINAGE DIVISION
土地排水部



DRAINAGE SERVICES
DEPARTMENT
渠務署



Legend: 圖例

Completed Works 工程完成

- 87CL/A - Shek Wu Hui Development Package 4, engineering works
石湖墟發展計劃第4組工程 (3/88 - 1/90)
- 72CD/A - Village flood protection for Tsung Pak Long and Tai Tau Leng, New Territories
松柏圍及大頭嶺的鄉村防洪工程 (2/96 - 10/98)
- 94CD/A - River training works for the Lower River Indus and River Beas
下梧桐河及雙魚河的河道治理工程 (3/99 - 3/01)

在計劃, 設計及興建中的工程

Works Under Planning, Design & Construction

- 53CD/A - River training works for the Upper River Indus
上梧桐河河道治理工程 (8/99 - 12/02)
- 64CD/B - Rural drainage rehabilitation scheme - River Ganges
鄉郊排水系統修復計劃-平原河 (4/03 - 8/05)
- 87CL/A - Shek Wu Hui Development Package 4, engineering works
石湖墟發展計劃第4組工程 (9/98 - 8/01)
- 91CD/A - Rural Drainage Rehabilitation Scheme, stage 1, phase 1A - rehabilitation works at Ng Tung River
鄉郊排水系統修復計劃第1階段第1A期
- 梧桐河修復工程 (11/98 - 8/01)
- 93CD/A - Rural drainage rehabilitation scheme, stage I, phase IB - rehabilitation works at Sheung Yue River
鄉郊排水系統修復計劃第1階段第1B期
- 雙魚河修復工程 (4/99 - 7/01)
- 112CD/B - Drainage Improvement in Northern New Territories - package A - River Channel Works
新界北部雨水排放系統改善計劃-A部分-河道工程 (10/05 - 10/08)
- 112CD/B - Drainage Improvement in Northern New Territories - package A - Urban Drainage Works
新界北部雨水排放系統改善計劃-A部分-市區渠務工程 (10/04 - 4/07)
- 651CL/A - Formation and servicing of Area 36, Fanling, phase 1
粉嶺第36區土地開拓及提供公用設施工程第1期 (3/99 - 7/01)

drawing title 圖則標題

**Major Flood Control Projects in The Northern N.T.
新界北部主要防洪計劃**

DLD 1163J

scale 比例 .
N.T.S.

date 日期
May 2001
2001年5月

office 部門
LAND DRAINAGE DIVISION
土地排水部

 DRAINAGE SERVICES
DEPARTMENT
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