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Territory Development
Department, Hong Kong

Maunsell

Agreement No. CE 59/94

Main Drainage Channels for Fanling, Sheung Shui and Hinterland

MAIN DRAINAGE CHANNELS FOR FANLING,
SHEUNG SHUI & HINTERLAND
ENVIRONMENTAL IMPACT ASSESSMENT

EXECUTIVE SUMMARY
for Final Assessment Report

October 1997

MAUNSELL CONSULTANTS ASIA LTD

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TERRITORY DEVELOPMENT DEPARTMENT

MAIN DRAINAGE CHANNELS FOR FANLING, SHEUNG SHUI & HINTERLAND ENVIRONMENTAL IMPACT ASSESSMENT

EXECUTIVE SUMMARY for Final Assessment Report

October 1997

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1 INTRODUCTION

The River Indus drains a catchment of over 7000 hectares and is the major river system that serves the North-East New Territories (Figure 1.1). Anthropogenic effects have drastically modified both the floodplain and the river system and over time this has led to increased occurrence and severity of flooding. This situation has inflicted hardship on the people living in the area and affected the successful functioning of infrastructure developments (such as roads, sewage treatment plants etc).

Urbanisation has further increased the degree and frequency of flooding events. Landfill has seriously lowered the ability of the floodplain to store waters; at present, significant flooding occurs at a much higher frequency as common rainfall levels outstrip the ability of the floodplain to store the waters. This situation has been exacerbated by changes to the river system; Previous studies including the River Indus Study (1989) and the Teladflocoss II Study in 1993 have demonstrated that the existing river systems cannot contain the flood water. Their inherent problems are:

- *Increased siltation* - Sediment load has increased in recent years due to pollution from raw livestock waste as well as soil and sub-soil runoff from development sites.
- *Chemical pollution* - Agricultural waste has been directly dumped into the river system and plant growth within the river has been stimulated by nutrient pollutants.
- *Physical* - Construction of weirs, pipelines and bridges have affected river water flow and the dumping of solid refuse has exacerbated this situation with floods pushing rubbish downstream to collect around structures such as pipes and bridge supports.

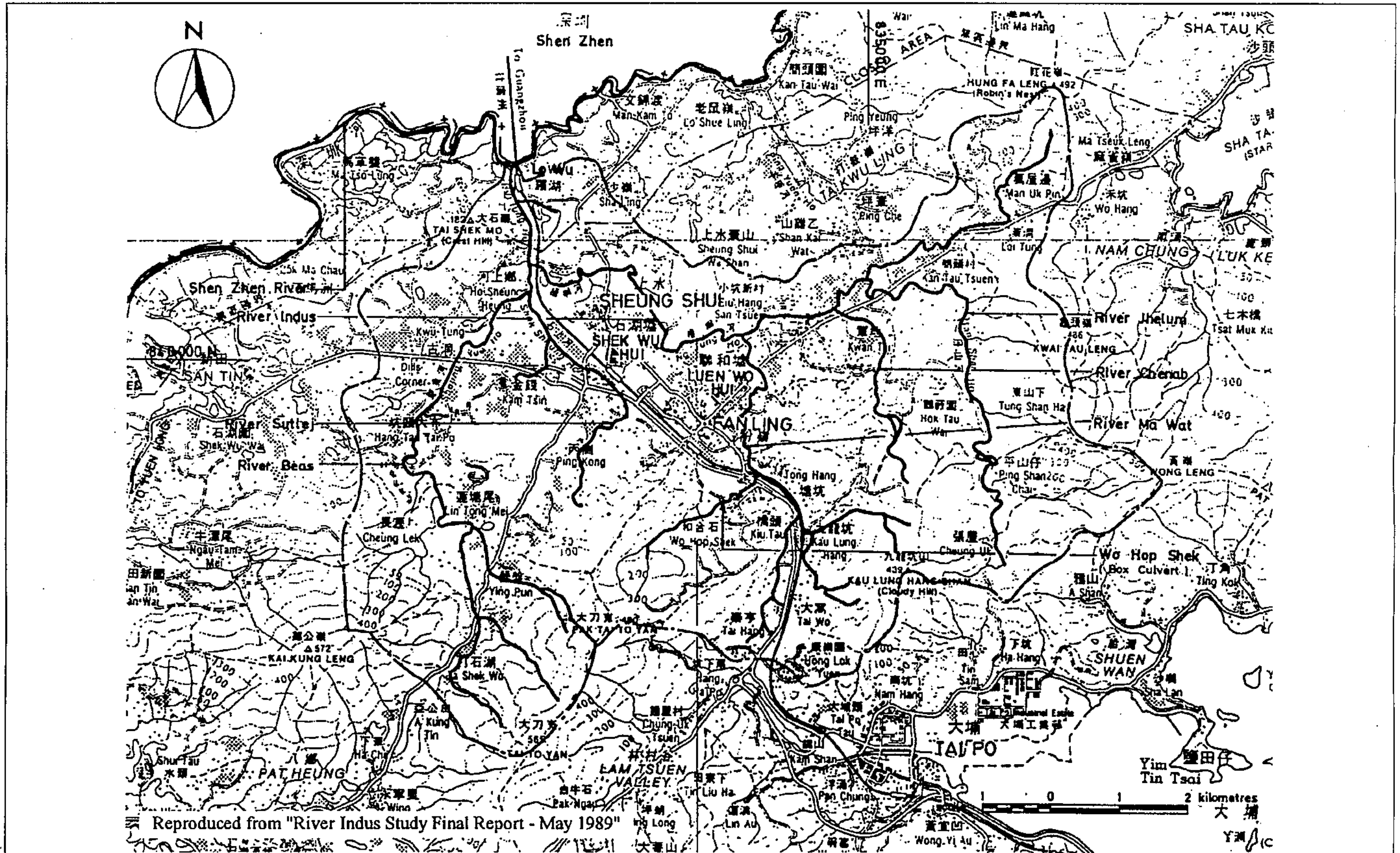
The cumulative effect of these factors has been to produce a river system that is now too narrow, too flat, too shallow and too overgrown to contain and convey the flood water.

Potential damages from floods, together with the disruption to essential services and the social upheaval caused to residents and businesses in the area have prompted the government to commission a number of studies in order to investigate the problem and to recommend solutions. Project 53CD- Main Drainage Channels for Fanling, Sheung Shui and Hinterland and Project 87CL-River Training in Area 30B are the implementation stages of the recommendations of these studies for the majority of the Indus Basin. These projects follow on from a number of other smaller schemes which have already been constructed or are being constructed aimed at resolving flooding problems in critical areas.

1.1 Options for Flood Control

The solution to the above problems have been considered in both structural and non-structural terms in previous studies. In general, river training structural measures have been determined as the most cost-effective measure due in large part to:

- The very high cost of acquiring land;
- The need for flood relief to communities that are constantly at risk from levels of damage that are considered unacceptable;



Reproduced from "River Indus Study Final Report - May 1989"

環科 CES	TITLE	CES (ASIA) LIMITED			
	Existing Land Drainage of the River Indus Basin	PROJECT NO	B080	DATE	September 1997
		DESIGNED	Suki Chung	DRAWING NO	Figure 1.1

- Implementation of non-structural methods alone would not achieve the desired flood control.

The excessive cost of land purchase generally ruled out realistic consideration of the extensive use of non-structural measures requiring large land areas, including:

- Extensive filling of low-lying land;
- Flood parks;
- Large storage ponds;
- Flood by-passes

Other non-structural measures (not requiring large land areas) relating to floodplain management to reduce the longer term flooding hazard are already in place or are being implemented. These include:

- Land management which ensures that permitted land use is consistent with the flooding hazard. The present pattern of land use shows that management within the basin takes into account the flooding hazard. New Town development is shown to be sited above existing flood levels, while on the frequently flooded plain, agricultural lands dominate. Where development is within the flood plain, it is normally on fill.

- Introduction of comprehensive sewerage provision which will improve water quality, thus making maintenance tasks easier and reducing the growth of vegetation such as water hyacinth. Ongoing Sewage Master Plans are being implemented; the plan for the north district that is applicable for the Indus Basin states that sewage will be catered for in two stages, stage 1 beginning in 1998 and finishing in 2001 and stage 2 starting in 2000 and finishing 2004.

- Afforestation - the benefits of planting, particularly in denuded areas, in terms of reducing storm water run-off and silt transportation are well known and are to be encouraged. Although not identified as a particular need for this basin, it is being carried out territory-wide where this problem occurs.

- Livestock waste control - enforcement of the Livestock Wastes Control Policy reduces sediment load and makes maintenance easier as evidenced by the improving water quality.

- Flood proofing and better informing the public regarding flooding hazards - this aids but does not solve the problems. Flood measuring and warning instrumentation has been installed.

- Implementation of Drainage Impact Assessments which ensure that development has no adverse impact on the existing drainage situation. Drainage Impact Assessments are now an integral part of most major infrastructure schemes.

1.2 The Solution

While the non-structural measures described above can assist in reducing the extent and effects of flooding, these effects alone would not achieve the desired flood control. This raises the second issue regarded as extremely important for justifying structural measures; the need to provide flooding relief with an assurance of success that is acceptable to both government and the communities at risk.

For these reasons, the River Indus Study and the Teladflocoss II Study as well as the Hydraulic Review for this project have adopted a proactive approach to the flooding problem by recommending structural improvement in the form of river training. This training will supplement other on-going structural improvements that have already been carried out or are being constructed. Project 53CD-Main Drainage Channels for Fanling, Sheung Shui and Hinterland and Project 87CL- River Training in Area 30B are thus, river training projects to protect parts of the Indus Basin from flooding.

This report summarises the final assessment of the environment impacts from the river training proposal.

2 THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

The main drainage channel alignment plan originally designed under the River Indus Study (RIS) and the revised alignment plan under this study are shown in Figure 2.1. The Main Report (FAR) summarises material already presented in the Working Paper submitted in December 1996 which identified the key issues and general solutions, the Initial Assessment Report which presented findings in more detail and focused points of concern (as presented to ACE in July 1997), and the Key Issue Report on Ecology which was submitted to SMG members in August 1997. This latter report discussed ecological implications and mitigations (the most significant key issue) at a conceptual and strategic level and these findings are included in full detail in the main report. The report also includes the final findings of the EIA study.

The key issue of this EIA is the ecology. Initial design changes were made to minimise potential ecological impacts and subsequent changes were made to mitigate for further impacts, both predictable and unpredictable. These changes have come about as a logical progression from the work of our multidisciplinary team that has included engineers, environmental specialists and landscape specialists.

Our integrated design strategy approach has comprised components that are commonly used in Integrated Catchment Management planning and the result provides the best mitigation possible for ecological impacts (both predictable and unpredictable). Significantly, our integrated design is synergistic in that it provides something more than impact minimisation and mitigation; it provides a unique opportunity for true ecological enhancement (i.e. measurable by variables such as increase in diversity).

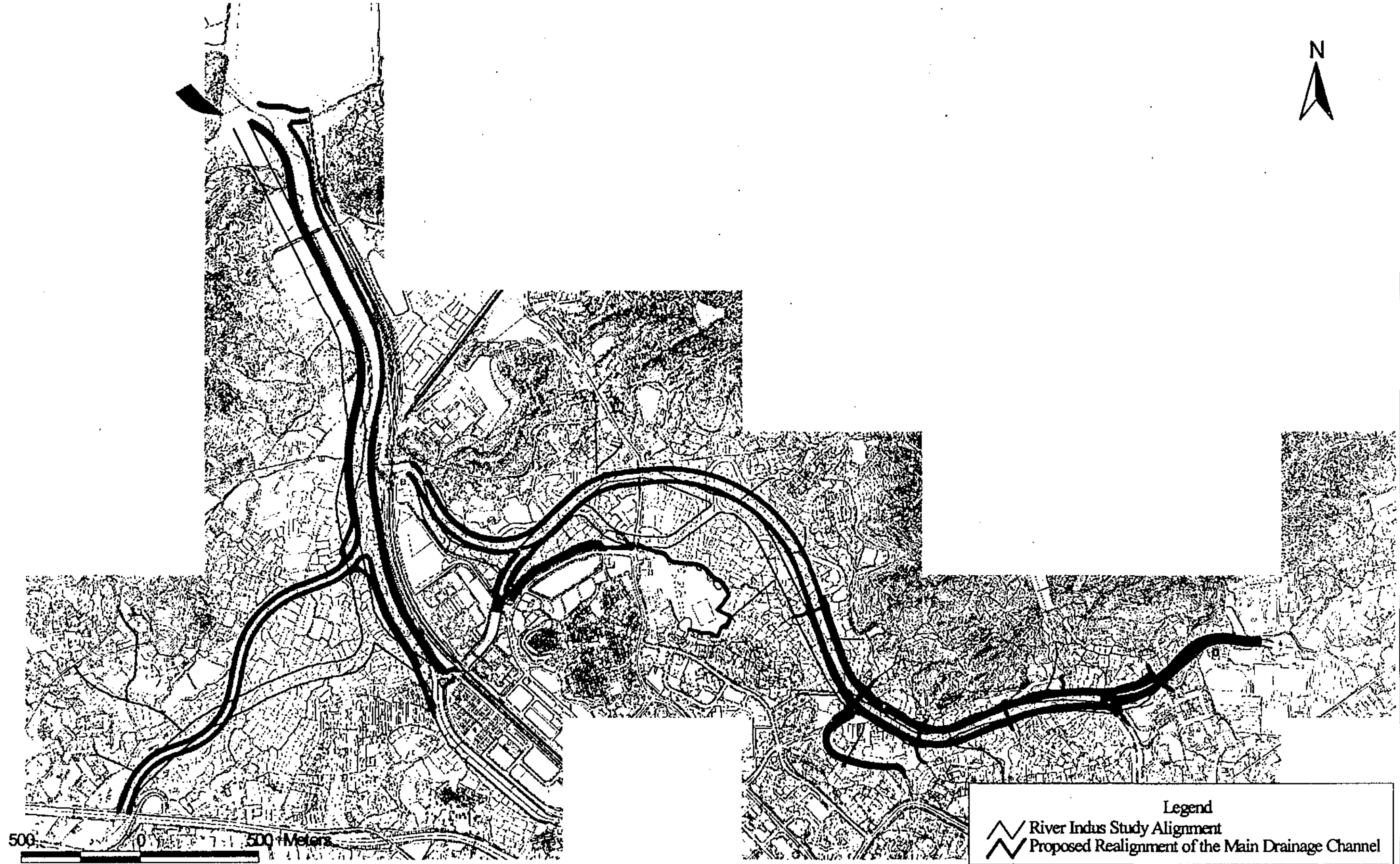
Other environmental impacts are also identified in this report, they are assessed and appropriate mitigation measures are recommended.

3 THE WORKS

3.1 Extent of the Works

The approximate extent of the works under this project includes training of:

- The Indus Major (now referred to as the Lower Indus) from Shenzhen River near Tak Yuet Lau to the outlet of Area 30B drainage channel near KCR Bridge no. 36 and the WSD pumping station



環科 CES

TITLE

The RIS Alignment Plant and the Subsequent Re-alignment Plan

CES (ASIA) LIMITED			
PROJECT NO.	B080	DATE	September 1997
DESIGNED	Fanny Lau	DRAWING NO.	Figure 2.1

- The Indus Minor including several tributaries from Gallipoli Line passing Siu Hang San Tsuen, Tin Ping Shan, Man Kam To, Sheung Shui Tsuen, splitting before Shek Wui Hui Sewage Treatment Works with the northern branch joining the drainage channel passing through KCR Bridge no. 36 and the southern branch joining the drainage channel upstream of KCR Bridge no. 35 (now referred to as the Indus Minor A)

- The River Beas from beneath North Territories Circular Road, passing Ho Sheung Heung then joining with the drainage channel in Area 30B (Project 87CL)

- The training and connection of tributaries where considered appropriate

Since the commencement of this project, several design changes have been considered:

- *Training one bank only* - This option was discarded as the DSD Stormwater Design Manual requires flood flow up to the 1 in 200 year event to be in bank. Embankment of the river system are needed to meet this requirement.

- *Flow relief channels parallel and at the side of the channel to provide flood storage* - This option was discarded due to practical reasons. Given the very large volumes of water discharging through the river system in flood conditions, the areas required would be very large and would need to be bunded. This then raises the question of safety, the status of the land and the maintenance of the area. Wherever practicable, this approach has been used; flood storage within village poldered schemes built to date are normally bunded by fences.

- *Two stage channels* - This option was considered but not pursued due to high frictional resistance to flow, large land take and increased maintenance problems with the berms, especially if planted.

Design changes have, however, been made to the alignment and channel configuration. These changes have reduced potential ecological impacts, prior to the project moving into the detailed design phase. These changes have been extremely important since they have been conducted in tandem with the land resumption plans.

3.2 Channel Construction

The channels will be constructed in short pieces and from both an environmental and logistic viewpoint the works will need to be done in as dry conditions as possible. In order to keep each sequential works area dry, the Contractor will in most areas divert the existing river away from the current construction site. This isolation of each works area has significant environmental advantages. These are fully discussed in the main report, but in brief, the isolation means that:

- disturbed sediment will not pass downstream during construction

- disturbed sediment will not leach contaminants to the river water

- contaminated sediment will be removed in as dry a condition as possible and this may mean that pre-drying before landfill will not be necessary

It should be noted that this will not be possible in areas (such as the Lower Indus section) where excavation will have to be done in the river. This situation is considered separately in terms of impacts and mitigation.

4 SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The major impacts arising from this project will be that related to ecology and the disposal of contaminated material.

4.1 Ecology

Ecological impacts have been identified as the major key issue for this project.

The project area is characterised by habitats which have been converted to agricultural, residential or light industrial uses. The area supports no plant or fish life of conservation importance, but the animal life is, in many cases unusual in Hong Kong. The butterfly, reptilian, amphibian, and avian fauna of the Beas, Sutlej and Indus' floodplain are characterised by species which are rare or uncommon in Hong Kong and regionally. The most significant impact of the project will be losses of habitats, primarily river channel and riverine and agricultural wetlands. Changes in the channel alignment and design have also been used to minimise habitat loss (residual losses of fish pond area were reduced to a total of 4.68 ha by this method). These losses can be mitigated in part by retention of abandoned meanders along the Beas and Indus Rivers, and subsequent management of those sites for conservation.

The recommendation that concrete lining of the channel banks and bottom should be minimised has also been incorporated into the project design, resulting in significant ecological advantages.

The floodplain ecosystem that currently exists is a highly complex result of a long human history that has continually reshaped the floodplain and altered its functioning. Further changes that will arise as a result of the river training project will create ecological impacts to the present, disturbed system that are extremely difficult to predict. Therefore, we split the ecological impacts arising from this project into those that are relatively predictable and those that are not.

Predictable impacts, appropriate mitigations and additional enhancements include :

- *Impact* - loss of riverine habitat; *Mitigation* - 'soft' channel lining where possible, grasscrete embankments, selected species planting along river corridor, retention of natural river segments within retained meanders; *Enhancement* - habitat mosaic along river corridor with unknown but beneficial effects for wildlife. This will become more apparent as the water quality in the systems continues to improve.

- *Impact* - loss of fish pond habitat; *Mitigation* - residual losses decreased to 4.68ha by changes in the design of the channel and the alignment. Further mitigation in the form of the creation of wet areas in the abandoned meander segments. These will impound water that is slow flowing for most of the year which will allow them to support fauna in a similar way to the fish ponds. These wet areas will cover approx. 7.1 ha, or 152% of the residual pond loss area.

- *Impact* - lower water levels in the new channel with resultant impacts on aquatic fauna;

Mitigation - replacement of weirs to ensure adequate water level

Unpredictable impacts and the mitigation 'insurance' designed to defray these unknowns, as well as additional benefits include:

- *Impact* - loss of seasonally inundated floodplain with unknown impacts on wildlife such as waterbirds; *Mitigation as a side-effect of the project* - partial regain of functioning of poldered areas as functionally separate from the flooding events. In combination with the continued irrigation of bunded fields and continued presence of fishponds, this may be sufficient to maintain the local populations. *Mitigation 'insurance'* - meander management and marshland habitat creation. *Additional Benefits* - these will not only provide areas for waterbirds, but will also result in marshland habitat being restored to the system. This will increase diversity in the area and will allow marsh-dependent species to regain a foothold in the floodplain system.

If these mitigations and recommendations are followed through, and particularly as water quality is improving in the system, we do not envisage any insurmountable residual impacts arising from this project.

The unpredictable impacts that may occur can only be practically considered within a larger study that aims to assess the cumulative impacts of wetland loss from a variety of projects of which this one is only a small part. Such an assessment on a territory-wide scale is currently being planned as part of a coming study to be commissioned by AFD.

4.2 Water Quality

The existing water quality in both the River Beas and River Indus was assessed. Livestock waste and effluent discharge from local factories and households within the Catchment were the main causes of pollution in the Rivers. The water quality of both rivers can be generally classified as poor. However, since the Waste Disposal Ordinance (Livestock Waste) was enforced, there have been a large reduction in the number of livestock farms within the Indus Basin. Also with the implementation of the Sewerage Master Plan for the North District to be in place, further deterioration of the water quality in both rivers would not be anticipated.

In fact, although water quality is still poor, results from water sampling conducted for this EIA suggest that water quality in the Indus and Beas Rivers has been improving. This is in agreement with EPD's water monitoring data. Surface sediment from the river bed was found to be contaminated to Class C, primarily by copper and zinc. Further site investigation would be required to determine the depth of contamination to estimate the amount of contaminated material for disposal. This will be included in the detailed works design stage.

Surface sediments were coarser during the wet season after flushing of finer sediments had taken place. These coarser sediments were still contaminated indicating that pollutant release during construction is possible. Elutriate tests showed that heavy metals were released into solution after disturbance suggesting that these pollutants could be released by construction activities. However, the primary construction method will counter this potential in the Upper Indus and Beas rivers, since areas will be isolated in sections with water diverted away from the construction site. Movement of contaminants downstream is not predicted to occur.

Where this primary construction method is not used, for example in the lower Indus, excavation will be conducted without water diversion. This means that excavation works along the original river may cause potential environmental impact. Therefore we strongly recommend the use of silt curtains in the construction area to retain as much suspended sediment as possible. The removal of contaminated sediment should only be carried out in the dry season. This mitigation measure should ensure that the levels of heavy metals released into the river will meet the most stringent standard for effluent discharged into inland waters as specified in the TM. As a precautionary measure, the above mitigation proposals will be reviewed after the results of the geotechnical analysis is available. In addition, intensive monitoring of water quality should be conducted upstream and downstream of the works as part of the Environmental Monitoring and Audit (EM&A) programme to detect any deterioration of water quality. Water quality monitoring parameters and requirements will be specified in the EM&A manual.

During the operational phase, there is potential for an increased sediment load to be moved towards the Deep Bay area as the river channel will convey water at higher velocities than occur at present. However, the increased load will only be a small fraction of the total sediment load as estimated during the Teladflocoss III Sedimentation Study. In addition, the installation of weirs and sediment traps will trap silt destined for downstream waters.

4.3 Disposal of Contaminated material

The project will require the disposal of a large amount of material. Dredging operations and excavations to be undertaken throughout the construction of the main drainage channels for Fanling, Sheung Shui and hinterland are likely to generate amounts of spoil in the region of 1,377,814 m^3 over 4 years. The section referred to as Area 30B will generate an additional estimated 250,850 m^3.

It is estimated that approx. 22% of the uncontaminated material can be reused on site as general fill; the amount that can be further used for embankment construction will require further geotechnical investigation which will be conducted at the detailed design stage.

Present estimates suggest that of the maximum amount of material requiring disposal, 226,330 m^3 may be contaminated material. Irrespective of the split between contaminated and uncontaminated material the same environmental issues need to be addressed. These are issues of:

- likelihood of resuspension of contaminants during construction and the method of construction to counter this
- the transport of material from the site
- the environmental acceptability of various destinations of disposal for contaminated and uncontaminated spoil.

We recommend that public dump or marine disposal be used for uncontaminated sediment, while contaminated sediment may be disposed of at contained marine mud pit sites or landfill dependent upon quantities. The exact quantities of contaminated material as well as the full nature of the contamination will not be available until after the Site Investigation has been conducted, however, due to shortage of space at landfill sites and our preliminary estimate of quantities involved, marine disposal is seen at this stage as the most likely option.

If landfill is used, we do not anticipate the need for pre-drying since both wet and dry season sampling showed no values above the 70% threshold values. The primary construction method will isolate and divert flows away from the construction site which will mean sediments will be as dry as possible before they are excavated. PAH and PCB contamination levels do not appear to be high and the elutriate tests showed that the leachates will be within the levels already operational at the landfill sites.

Trucks transporting spoil will use access points close to public roads and not in environmentally sensitive areas. Vehicles will be lined to prevent spillage from material with high moisture content and care will be taken in transferring spoil from the trucks to barges or landfill sites to ensure spillage is minimised.

4.4 Air Quality

The major potential air quality impact during the construction phase of the project will be dust arising from various construction activities. As shown by the dust dispersion modelling results, different degrees of dust reduction will be implemented at different parts of the construction area to reduce the dust impact at sensitive receivers to below the 1-hour average guideline level and 24-hour average AQO for TSP. For the general construction area, twice daily watering with complete coverage will be necessary. For construction areas close to sensitive receivers an increased watering frequency will be necessary to further reduce the dust emissions.

It is expected that the air quality related to the odorous gas emissions from the existing rivers and streams will be improved since their sources will be removed. Nevertheless, a temporary increase in odorous gas release may be experienced due to disturbance of the sediments. The odour impacts will be temporary and confined to an area close to the construction activities. With proper controls and mitigation measures the odour impacts at the sensitive receivers should be minimum.

4.5 Construction Noise Assessment

Findings of the construction noise assessment have indicated that noise levels have been predicted to exceed the non-statutory day time limit of 75 dB(A) at seven of the 23 selected representative NSRs as a result of main channel construction. None of these exceedances will be greater than 5 dB(A). However, the use of quieter equipment will ensure compliance with non-statutory daytime limits at all NSRs. In the event that this course of action is not possible, mitigation in the form of natural and man-made acoustic shielding has been recommended, and this would reduce noise levels at all NSRs to acceptable levels. Further reductions of noise impacts at NSRs could be achieved through the adoption of a sensitive plant/task scheduling and sensitive construction practices.

There will be no operational phase noise problems from the proposed infrastructure.

4.6 Landscape/Visual Issues

The major impacts to the landscape and visual amenity of the area can be summarised as:

- Loss of tree planting and other vegetation within the works area;
- Loss of meandering character of the river particularly the Indus and Beas,
- Loss of cultivated land

Recommended mitigations for these impacts include retention of some meanders (with landscaping), replanting along the top, slope and toe of the embankment, and the reprovisioning of weirs to keep water in the channels at a reasonable level.

Additional benefits of the project include the improvement of some views due to the screening of the KCR lines.

5 CONCLUSION

The key environmental issues related to the river training projects to alleviate the chronic flooding problems in the Beas and Indus catchment have been identified and assessed. Based on our assessment, we cannot predict any insurmountable problems arising from the project. Our recommendations and mitigations are capable of providing 'insurance' against unpredictable impacts that may occur as well as providing some unique opportunities for additional benefits and enhancements.

拓展署

粉嶺、上水及其腹地之
主要排水渠

環境評估研究
摘要

一九九七年十月

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1 引言

梧桐河流域廣達7,000公頃，是東北新界的主要河流系統（見附圖1.1）。過往人類在沿河附近地區的活動及發展，對梧桐河澇原及河流系統本身構成重大的改變，因而亦引致該區的水浸情況更為頻密和嚴重。水浸不單對生活於附近的居民造成滋擾，亦影響該區基本設施(如道路、污水處理廠等)的正常運作。

另一方面，梧桐河流域內的都市化亦加劇了水浸的程度及次數。在澇原上填土活動已使其保留雨水的能力減低了；現在每當降雨量比澇原可保留雨水的能力為高時，便會出現水浸情況。此外，河流系統的改變亦令水浸情況更為惡劣。早期業已完成的研究包括梧桐河研究(1989)及全港土地排水及防洪整體策略研究第二期(1993)，這些研究均認為現有的河流系統不能負荷所需的排水量。其衍生的問題包括有：

- *沉積物的增加* － 在近年因為未經處理的禽畜廢物和建築地盤排出的徑流而引致沉積物積聚；
- *化學污染* － 附近農民將農業廢物直接排進河流中，而河流中富營養的污染物亦令水中植物過度繁殖；
- *本體問題* － 在河道中築建堤堰、管道及橋樑等，均影響河水的流動；此外，棄置在河流中的廢物被河水帶往下游並在管道及橋樑的支柱上積聚，亦加劇了對河流流動的影響。

上述各種原因的累積影響，令到現有的河道狹窄、平坦、太淺及長滿植物而使到河流系統不能及時將引致水浸的雨水容納或排走。

有鑑於因水浸而引起的破壞、對基建設施的影響和對鄰近地區居民和經濟活動的滋擾，政府曾進行數項研究，分析問題成因及建議解決的方案。工程合約 53CD － 粉嶺、上水及其腹地的主要排水渠和工程合約 87CL － 第 30B 區河道浚疏工程，均為落實以往顧問研究中對改善梧桐河盤地中排水能力的建議。上述兩項工程將緊接其它已完成或正在施工的較小型的河流浚疏工程而展開，以達致改善沿河地區水浸情況的目的。

1.1 防洪方案

在過往的研究中，就解決水浸問題上已考慮了建築形式及非建築形式等方案。整體來說，採用建築形式來浚疏河流是較為合符經濟和有效的方案，其原因如下：

- 非建築形式所涉及的龐大的土地徵收費用；
- 有需要為受到水浸威脅的社區提供足夠的保護；
- 單靠實施非建築形式的方案將不能達到理想的防洪要求。

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環科 CES	TITLE 梧桐河盤地現有之土地排水系統	CES (ASIA) LIMITED			
		PROJECT NO	B080	DATE	September 1997
		DESIGNED	Suki Chung	DRAWING NO	圖 1.1

非建築形式的方案由於需要收回大量土地，其所需的龐大費用往往令政府不能廣泛採用此等方案。非建築形式的方案所需的土地包括：

- 在低窪地區進行大量的填土工序；
- 澇原公園；
- 大型的儲水池；
- 排放洪水的繞道。

其它可減低長遠水浸危險的非建築形式澇原管理方案(不需大量土地)，均已完成或正在進行階段，當中包括：

- *土地用途管理* － 以確保許可的土地用途可承受水浸的風險。現時盤地內土地用途已將水浸風險考慮在內，新市鎮發展全都位於現有水浸水位之上，而經常水浸的地區多被用作農業用途。在澇原內的新發展通常都建在填土之上。

- *建設全面性的排污設施* － 這可改善水質，並減少河中植物如水浮蓮等生長，使維修河道的工作更容易。現時區內的污水收集整體計劃正逐步實行，而在北區(包括梧桐河盤地在內)的污水收集計劃將分兩個階段進行；第一階段將在 1998 年動工，於 2001 年完成，而第二階段則將於 2000 年動工並預期於 2004 年峻工。

- *種植樹木* － 植樹可減少泥土因雨水沖擦而流失，所以應加以鼓勵。雖然在梧桐河盤地內並未有特別需要進行植樹，但在香港其它地區在有需要時亦會進行植樹的措施。

- *控制禽畜廢物* － 執行管制禽畜廢物條例，可減少排放入河中的沉積物，改善水質，使維修工作更易執行。

- *測度洪水及為公眾提供更佳有關水浸風險的訊息* － 洪水測度及警報系統已經裝置，可是，這些措施雖可幫助但不能解決水浸的問題。

- *實施排水影響評估內的建議措施* － 確保將來發展不會對現有的排水設施構成不良影響，排水影響評估現時已是大部份基建計劃中不可或缺的一環。

1.2 建議方案

雖然上述非建築形式的方案有助減少水浸的範圍及影響，但單靠這些措施並未能將水浸風險減至理想的水平。因此，為使水浸風險可以減低至政府及市民均可接受的水平，將有需要採用建築形式的防洪方案。

鑑於上述原因，在梧桐河研究、全港土地排水及防洪整體策略研究第二期及在本研究中的水理檢討中，均建議採取積極的方法，利用擴闊及加深河道來改善梧桐河的排水能力。

本河道浚疏工程包括工程合約 53CD－ 粉嶺、上水及其腹地的主要排水渠和工程合約 87CL － 第 30B 區河流浚疏工程，其將會與其它業已完成或正在施工的改善河道工程一樣，成為減少梧桐河盤地受水浸威脅的工程項目之一。

本摘要總結了建議中河道浚疏工程的環境影響評估的結果。

2 環境影響評估研究（環評研究）

在梧桐河研究中的主要河道及在本研究中建議的河道位置在附圖 2.1 中列明。本研究中的主要報告總結了在 1996 年 12 月提交的工作報告(當中認定了主要的事項和可行的解決方案)、於 1997 年 7 月提交環境諮詢委員會討論的初步評估報告(當中記錄了研究的初步結果及值得關注的事項) 及於 1997 年 8 月提交研究管理小組的主要事項報告(當中討論工程對生態的影響及緩解措施作出概念性及策略性的建議)。主要報告中亦包括了環評研究內的結果。

在本環評研究中主要事項為生態影響。在初步設計階段時已為減少對生態的影響而作出改動；其後更為緩解可預測及不可預測的生態影響而作出另一些改動。這些改動是根據研究小組內的專業人仕如工程師、環境專家及景觀專家等的意見，經商討後提出。

我們所提出的綜合設計策略包括了在「綜合集水區管理」中經常採用的方法，而建議的措施為緩解生態影響(可預測及不可預測)提供了最佳方案。值得一提的是，我們所建議的措施非但減少及緩解了工程對生態的影響，亦提供改善區內生態環境的機會(例如增加生物品種)。

在環評報告中亦估評了其它環境影響的事項，並建議合適的緩解措施。

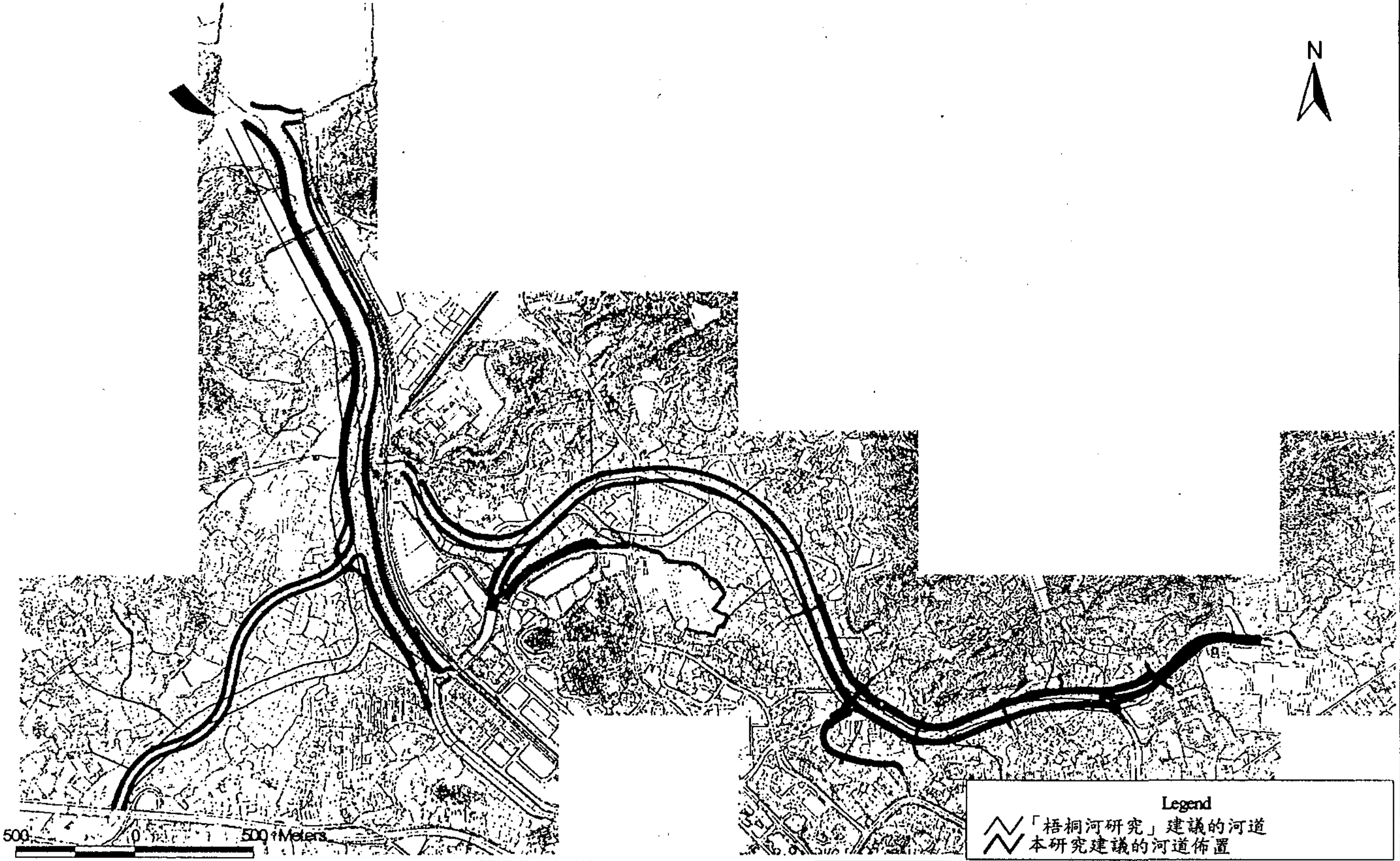
3 工程概要

3.1 工程範圍

在本工程中的施工範圍大致上可分為：

- 自深圳河近得月樓附近至第 30B 區排水渠近九廣鐵路第 36 號橋及水務署泵房之間的一段梧桐河下游；

- 由軍地(經過小坑新村、天平山、文錦渡、上水村)至石湖墟污水處理廠的一段梧桐河上游，包括其分流北至接連近九廣鐵路第 36 號橋的河道及南至上游接連近九廣鐵路第 35 號橋的河道(以下簡稱為梧桐河上游 A 段)；



環科 CES

TITLE

「梧桐河研究」建議的河道及本研究建議的河道佈置

CES (ASIA) LIMITED			
PROJECT NO.	B080	DATE	September 1997
DESIGNED	Fanny Lau	DRAWING NO.	圖 2.1

- 自新界北環迴公路下經河上鄉至第 30B 區河道之間的一段雙魚河；

- 在合適的情況下擴闊及接連沿河的支流。

在本研究進行期間，曾對以下數項的設計改動作出考慮：

- *只在河道一面進行擴闊* - 因渠務署雨水渠設計手冊內要求應付 200 年一遇大雨的河道需要在兩岸建堤，所以這方案不被接納；

- *在現有河流旁築建平行的排洪渠道以增加蓄洪量* - 由於在水浸時有大量的雨水排入河流中，如要築建此等排洪渠道則需要很多的土地。此外，亦會涉及安全、土地狀況及維修保養等問題。事實上這方案在一些可行的情況下如鄉村防洪計劃等(在村的四周建上圍板等)曾被採用，但因上述實際的可行性，本方案在此不被接納。

- *雙層河道* - 在研究中曾考慮這方案，但最終由於會對水流造成嚴重的阻力、需要很多的土地和增加維修時的困難等種種問題而並未採納。

河道的位置及設計，在進行詳細設計前已因應徵收土地範圍作出修改，以減少對生態的潛在影響。

3.2 河道的築建

河道的築建將會分成小段進行，為減少對環境造成的影響，在可能的情況下，挖掘河道的工序將會盡量不在水中進行。為避免挖掘工程在水中進行，在大部份的情況下承建商須將現有的河流改道。這施工方法對保護環境十分有利，在研究報告中已作出詳細的討論，但總括來説可歸納為以下數點：

- 施工時沉積物不會被帶往下游；

- 沉積物內的污染物不會釋入河水中；

- 受污染的沉積物將會在乾的情況下掘走，因此不需須在運往堆填區前先減少當中所含的水份。

但在某些地區(如梧桐河下游)仍需要在水中進行挖土工程，而當中的環境影響及緩解措施亦已作出評估。

4 環境影響及緩解措施的總結

建議工程的主要影響包括生態及受污染物料的棄置問題。

4.1 生態

本研究認為生態影響是主要的環境事項。

工程區域的生境已轉作農業、住宅及輕工業等用途。此區域並不存活具保護價值的植物或魚類，但某些動物卻在香港並非常見的。在澇原上的蝴蝶、爬虫類、兩棲類動物及鳥類等，均有品種是香港甚至是此區域內罕見或不常見的品種。工程所帶來最重大的影響是損失了例如河道及濕地等的生物棲息地。本研究已建議改變河道的路線及設計來減少對生態環境的影響(剩餘的魚塘損失將減少至 4.68 公頃)。這些損失可透過保存及管理沿雙魚河及梧桐河的河曲而得到緩解。

以盡量減少使用混凝土來築建排水渠的底部和其兩岸的建議，已列明在詳細設計之內，以造成有利生態的環境。

現時在澇原上的生態系統是經歷複雜的過程，受到人類經年來的活動不斷改變澇原的面積及變更其功能而形成。故因擬建工程而引起的轉變將會對現有已在改變的系統造成影響的程度將難以預測。所以我們將生態影響分成可以預測和不可以預測兩種類別。

為減少可預測影響的緩解措施和改善計劃包括：

- 河中生物的損失的影響；*緩解措施* － 盡可能使用“軟性”的設計作為鋪設新排水渠的物料、在河堤上噴草、在沿河兩岸種植特定的樹木品種、保留原有的河道。*改善* － 在河流的兩岸提供多類別的生物棲息地對野生生物會有益處。這項益處將隨著河水的水質改善而變得更為明顯。

- 魚塘的損失的影響；*緩解措施* － 透過改變河道設計使剩餘的損失可減少至 4.68 公頃，進一步的緩解措施是在河曲上建立類似濕地的棲息地。這些河曲將會儲存河水，使其可發揮類似魚塘的作用。這類濕地可補充約 7.1 公頃的存水面積，即是剩餘的魚塘損失面積的 152%。

- 因新河道中的水位將會下降，從而對水中生物構成影響；*緩解措施* － 設置堤堰以保持一定的水位。

為不可預測影響而建議的緩解措施包括：

- 因損失季節性的澇原而對野生生物如水鳥等的影響；*緩解措施* － 復得的部分積水地區加上繼續受灌溉的農田及區內其它的魚塘，應足可支持原有的生物數量。“*保險*”

措施 － 河曲的管理和設立沼澤生物棲息地。*額外益處* － 除了可以為水鳥提供棲息地之外，亦可增加河流系統內的沼澤地帶。這也可以使區內的生物品種更趨多元化及讓依賴沼澤維生的物種重獲棲息地。

如能依照上述建議實施各項緩解措施，特別是改善河中的水質；我們並不預期擬建工程會引致不可克服的環境影響。

就那不可預期的影響，只可以從全面性的研究，才可評估不同工程對濕地損失所造成的累積影響。現時漁農處正計劃進行一項全港性的有關濕地的研究。

4.2 水質

本研究對現時雙魚河及梧桐河中的水質進行評估，發現河水中污染源主要是來自區內禽畜廢物和從集水區內工廠及住宅的排放。整體來說目前在上述兩條河流中的水質均為不佳；但自從廢物處理條例(禽畜廢物)生效後，在梧桐河盤地內飼養禽畜業的數量顯著地減少。此外，預期在實施北區的污水收集整體計劃後，河中的水質將不會進一步惡化。

事實上雖然現有的水質不佳，但在本研究中所進行的水質樣本測試中顯示在梧桐河中的水質正在改善；這與環境保護署的水質監測結果吻合。在河床上的沉積物主要受到銅及鋅的污染，屬丙級受污染物。為確定受污染物的數量，有需要在詳細設計階段時進行更深入的工地土質勘察。

由於面層較幼細的沉積物會被河水沖走，所以在雨季時河床上的沉積物會較為粗糙，而在挖掘這些較粗糙的沉積物時仍有可能排放出污染物。分析結果指出在施工期間，沉積物中的重金屬有可能被釋放於河水中。但本研究已建議採用河流改道的方法，使挖掘工序盡可能在沒有河水的情況下進行，因此沉積物中的污染物將不會被帶往河流下游。

在某些情況下(如在梧桐河下游)如不能採用河水改道的方法時，在河中進行挖掘工作時有可能產生潛在的影響。因此我們建議使用隔泥網，盡可能避免沉積物被沖至河流下游；而受污染的沉積物的挖掘亦只可以在旱季期間進行，以確保釋放於河水中的重金屬濃度可以符合水質管制條例內技術備忘錄中的標準。作為一預防措施，在進行土質分析後，會檢討上述建議的緩解措施。除此之外，在施工期間須執行全面的環境監測及審核計劃，以監測在工地上游及下游的水質；而所需監測的參數將詳列於環境監測及審核手冊之內。

在運作期間，由於河中的水流速度比現時加快了，可能會有更多沉積物被沖往下游的后海灣地區；但根據全港土地排水及防洪策略研究第三期報告中指出，所增加的沉積物只佔總數量中的極少數。此外，沿河加設的堤堰將亦可減少沖往下游的沉積物。

4.3 處理受污染的物料

預期在本工程中將需要處理大量的物料，在施工的四年間，在整項工程中所挖掘的泥土及沉積物的數量約為 1,377,814 立方米；而在第 30B 區將會額外產生約 250,850 立方米的物料。

研究估計約有 22%的未受污物料將可被翻用作一般塡料，而在詳細設計階段將會進行土質分析，確定可被用作築建河堤物料的數量。

據目前估計，在需要處理的物料當中，約有 226,330 立方米屬於受污染物料。不論受污染和未受污染物料的比例如何，也是須要考慮以下的環境事項：

- 設計合適的施工方法以減少在挖掘工程時受污染物在水中懸浮；
- 考慮如何將物料運離工地；
- 處理及棄置受污染及未受污染物料對環境的影響。

研究建議將未受污染物料棄置於公眾卸泥區或海上卸泥場；而受污染的沉積物則視乎數量而決定棄置於特定的海上卸泥場或是堆塡區。需要處理物料的確實數量及受污染程度只可在完成工地土質勘察後才可確定，但根據我們的初步估計，有鑑於現時堆塡區的容量有限，所以將受污染物運往特定的海上卸泥區將會是最可行的方案。

如要在堆塡區中棄置物料，我們預期不需要預先減少泥中的水份，因從抽取的樣本中，無論在旱季或雨季時，樣本中的含水量都少於 70%的臨界值。如採用河流改道的建築方法，則物料將在全乾的情況下被挖走，所以當中所含的水份亦會很低。根據化學分析，泥中所含的聚芳烴及多氯聯苯量並不高，所以亦不會對堆塡區構成影響。

運送物料的車輛將會使用接近公路但遠離敏感地區的引路，而車輛的貨斗將會鋪上防漏物料，以防止污水自淤泥中滲漏。而將淤泥從貨車運上躉船或堆塡區時亦應小心，避免污水滲漏。

4.4 空氣質素

在施工期間主要的空氣污染源來自工程活動中所產生的塵埃，研究中的塵埃擴散模擬結果顯示，在工地不同地方採用合適的抑制塵埃措施，將可有效地使在敏感地方的總懸浮粒子濃度減低至合符一小時平均的指引水平及廿四小時平均的空氣質素指標要求。在一般工地上須每天灑水兩次，而在鄰近敏感地方的工地，則需要將灑水次數增加，以確保可抑制塵埃的產生。

研究預期在挖走河中受污染的物料之後，現有從河中所發出的氣味影響將可獲得改善。但在進行挖掘淤泥時將會造成短暫的氣味影響，但估計氣味影響只屬短暫性及只局限於接近挖泥工程的地方；如能採取合適的管理及污染控制措施，預料在敏感地方的氣味影響將會十分輕微。

4.5 建築噪音評估

建築噪音評估的結果指出，在廿三個被確認的敏感受體當中，將有七個地方的日間建築噪音超出指引標準的 75 分貝，但超標的幅度將不會多於 5 分貝。如能採用低噪音的建築機械，則預期在所有敏感地方的噪音聲級將可合符日間建築噪音的指引水平。如不能採用上述緩解措施的話，研究建議設置天然或人工的屏障，使受影響地方的噪音減低至可接受的水平。此外，如能在施工前小心安排及計劃一些高噪音的工序，將可進一步減少噪音對附近居民的滋擾。

擬建工程將不會在運作期間產生噪音問題。

4.6 景觀及視覺影響

因擬建工程而產生的景觀及視覺影響主要包括：

- 在工地範圍內損失的樹木及其它植物；
- 將河流拉直後所損失的河曲景色（尤其是雙魚河及梧桐河）；
- 農地的損失。

研究建議的緩解措施包括將部份河曲保留及加以園林設計、在河堤斜坡及堤岸上植樹、以及在河中設置堤堰，使河水可保持合適的水深。

擬建工程亦遮擋了部份九廣鐵路，改善了附近地區的景觀。

5 總結

本環評研究就擬建中為改善雙魚河及梧桐河水浸問題而進行的河道浚疏工程所帶來的環境影響作出評估，根據我們估計，擬建工程將不會引致不能克服的環境問題。研究中亦建議採取一些額外的預防措施以應付一些不可預測的影響，以及提供進一步改善區內整體生態環境的機會。