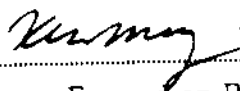


**Agreement No. CE 79/96  
Yuen Long Bypass Floodway  
Feasibility Study**

**Ref. 0136/EIA/3 Issue 2**

**Environmental Impact Assessment Study  
Final Executive Summary**

**June 1998**

Report Authorized For Issue By:	 For and on Behalf of Binnie Consultants Limited
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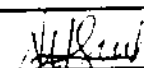

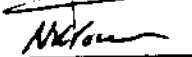
**Danish Hydraulic Institute  
Earthasia Limited**

**For  
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NT North Development Office  
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6 Tung Lo Wan Hill Road  
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	Name	Signature	Date
Prepared	A.H. Sewell		10.6.98
Checked	R.C. Deacon		10 June 98
Reviewed	N.R. Townsend	 /	10 / 6 / 98

## 1 INTRODUCTION

### 1.1 Background

1.1.1 Serious flooding has occurred in and around Yuen Long Town at least seven times over the last fifteen years. Government studies including the Northwest New Territories (NWNT) Base Strategy Studies, TELADFLOCCOSS I and II and the NWNT Village Flood Protection Study have identified the major causes of flooding and recommended appropriate mitigation measures. The studies identified that the capacity of the Yuen Long Nullah drainage system was inadequate mainly due to rapid urban growth over the last 20 years which has reduced the flood plain storage capacity and increased runoff volumes. In addition Yuen Long Town has been built at a relatively low level and the drainage design standards and methods used at the time were less rigorous than present design requirements. The studies recommended the construction of a Bypass Floodway as the most cost-effective option for providing additional drainage capacity to cater for present needs and to provide additional capacity for new development in the area to the south of Yuen Long.

1.1.2 The Yuen Long Bypass Floodway (YLBF) will therefore be designed to divert part of the flows entering the Yuen Long drainage system from the south of Yuen Long into the Kam Tin River, which is at present being channelised, to reduce the risk of flooding in Yuen Long Town.

### 1.2 Scope of the Study

1.2.1 The EIA forms part of the Yuen Long Bypass Floodway Feasibility Study and addresses the environmental impacts of the preliminary design. Figure 1.1 shows the study area and the preliminary design alignment.

1.2.2 The EIA study initially reviews the environmental significance of four alignment option routes in conjunction with engineering and planning constraints and demonstrates that the chosen alignment is the most favourable.

1.2.3 The remainder of the EIA addresses the environmental impacts of the preliminary design and considers water quality, ecology, noise, air, waste management and landscape and visual issues in respect of the construction and operation phases. The assessment is based on the requirements of established planning standards and guidelines. Mitigation measures have been recommended to reduce the potential impacts to within the established standards and guidelines. An Environmental Monitoring and Audit programme has been formulated and will be carried out to ensure that impacts are kept within environmental legislation and guidelines.

## 2 PROJECT DESCRIPTION

- 2.0.1 The project involves construction of a 3.8km long trapezoidal channel extending from the Yuen Long Main Nullah in the south to the Kam Tin River in the north. The southern alignment follows the toe of the Yuen Long Highway embankment until just south of Castle Peak Road where it veers northeast before crossing the road in a box culvert. North of Castle Peak Road the alignment trends north passing under Route 3 (through a preconstructed box culvert) then makes a reverse curve eastward, hugging the toe of the Route 3 embankment before discharging into the Kam Tin River just to the north of the Route 3 flyover. Where land resumption is to be minimised through existing villages a 1 in 1 side slope, fully concrete lined channel has been adopted. However, where land resumption is not considered as critical a 1 in 2 or 1 in 1.5 fully grasscrete lined channel has been adopted. The downstream portion of the channel after the inflatable dam will be fully concrete lined however as it is within the tidal range and grasscrete is therefore inappropriate. For ecological mitigation purposes, offline engineered wetland/marsh areas have been incorporated into the channel design to the north of the site. An access road will be provided along one side of the channel and regular crossing points constructed to maintain access. In the grasscrete sections, a concrete maintenance track will be provided along the base of the channel adjacent to the low flow channel.
- 2.0.2 An inflatable dam and pumping station will be positioned at the downstream end of the YLBF just prior to connection with the Kam Tin River. This will be used to prevent saline, heavily polluted and sediment rich waters from the Kam Tin River backing up into the YLBF and depositing residues in the channel. During low flow conditions the dam will be inflated and low flows in the YLBF will be pumped over the inflatable dam and into the downstream section of the YLBF which will pass into the Kam Tin River.
- 2.0.3 Construction of the YLBF is programmed to commence in March 2001 and will be completed in December 2003. Construction will generally be carried out from the downstream end to the upstream to facilitate simple draining of the works site. However, it is anticipated that construction of the Castle Peak Road box culvert will commence early in the project due to the problems associated with traffic diversion and utilities within this area. Connection with the Kam Tin River will not be made until the end of the project to ensure that tidal waters do not enter the new channel.

### 3 PREDICTED IMPACTS AND MITIGATION

#### 3.1 Water Quality

- 3.1.1 Water sensitive receivers potentially impacted by the works include fish ponds in the northern area, lotus ponds immediately south of Castle Peak Road, Yuen Long Creek, various small streams bisected by the proposed floodway, Kam Tin River and Inner Deep Bay. Key potential environmental impacts during the construction phase arise from construction site runoff and discharge, release of pollutants through sediment removal and sewage discharge and other waste from the construction work force. Construction site runoff has the potential to contain increased suspended sediment loads from erosion of stockpiles, runoff from site surfaces and concrete slurries. Removal of sediment can release nutrients and bacteria into adjacent watercourses. Similarly, sewage and canteen effluent discharge from the construction work force can increase the organic load of nearby watercourses. Fuel oil and grease from construction vehicles and works areas could also be washed into watercourses.
- 3.1.2 The EIA recommended a range of specific mitigation measures aimed at, where possible, avoiding potentially polluted discharges, otherwise containing and treating runoff and effluent prior to discharge. In general terms these measures included: carrying out the works in the dry season and the provision of sediment traps/settlement ponds, oil interceptors and associated bunds to contain and treat site runoff prior to discharge into watercourses. It will also ensure immediate disposal and correct handling of chemical spills. No runoff, waste water or chemicals will be allowed to enter fishponds. Proper sewage facilities and grease traps for canteen discharge were also recommended in respect of the construction work force. The EIA concluded that with the implementation of such measures potential impacts could be kept to within acceptable levels.
- 3.1.3 During the operation phase the EIA identified the main potential impacts of an unmitigated predominantly concrete lined channel as being:
- hydraulic changes from creating an artificial (concrete) channel resulting in increase in transport of surface runoff and pollution downstream; and
  - increased pollution discharge due to removal of vegetation in the region of the floodway which previously acted as an infiltration area allowing stream water and road runoff some preliminary treatment before discharge into one of the concrete lined channels in the area.

3.1.4 The main mitigation measure recommended in the EIA for these potential impacts involves sensitive environmental design of the floodway channel through the use of grasscrete for the flooring and sides of the channel as much as possible instead of concrete, thus enabling a base for vegetative growth. Growth of vegetation in the channel provides a mechanism for natural treatment of polluted water flowing down the channel through infiltration and absorption.

3.1.5 With the implementation of these mitigation measures residual water quality impacts of the project both during construction and operation phases are expected to be negligible.

### 3.2 Ecology

3.2.1 Construction of the Yuen Long Bypass Floodway will result in the loss of, and disturbance to, a number of different habitats along the 3.8km alignment of the floodway. The unmitigated Project which assumes a worst case scenario involving a concrete lined, ecologically sterile nullah along the entire length of the floodway would result in the following impacts:

- loss of 3 ha of village-type habitat through an already blighted area  
*low habitat value*  
*low impact significance*
- loss of 4ha of abandoned agricultural land habitat, already blighted and fragmented but providing a feeding ground for herons and egrets  
*low to medium habitat value*  
*medium impact significance*
- loss of 0.1ha of stream/riparian habitat through an already blighted area  
*low habitat value*  
*medium impact significance*
- loss of 1ha of lotus pond habitat causing fragmentation of remaining lotus ponds  
*medium habitat value*  
*medium to high impact significance*
- loss of 9ha of fish pond habitat already blighted and fragmented by Route 3 construction works  
*low to medium habitat value*  
*low impact significance*

3.2.2 Mitigation measures proposed to reduce impacts to acceptable levels comprise the following:

- (i) Amendment to the alignment of the YLBF north of Route 3 so that it runs closer to the highway (Figure 3.1). This avoids fragmentation of the active fishponds north of the floodway and moves the works further away from a *fung shui* knoll biodiversity locus located northwest of the Project area.
- (ii) Use of grasscrete for lining the sides and base of the channel (from ch 1+340 to ch 3+545 creating 6.8ha of dry grasscrete). This allows percolation to the groundwater, enables growth of grasses sedges and reeds which in turn provides a habitat for invertebrates (insects) and higher fauna (birds)  
*medium habitat value*
- (iii) Creation of offline marshland type habitat through the use of submerged grasscrete (marshcrete) making use of the swathe of land between Route 3 and the YLBF and a fish/duck pond immediately south of the Route 3 box culvert (Figure 3.2). The marshcrete (watered in part by recirculation of a proportion of the pumped flows from the low flow pumping station and also from local runoff) would be planted with selected saline tolerant and pollution tolerant wetland grasses, reeds and sedges creating 3ha of marshland habitat.  
*medium to high habitat value*
- (iv) Tree planting of over 2500 trees along the channel banks and adjacent to the access roads and footpaths with species selected for their attractiveness to the local flora and fauna  
*medium habitat value*

3.2.3 The grasscrete and marshcrete total habitat area resulting from the Project will be 9.8ha of medium and medium to high ecological habitat. This contrasts with the loss of 14ha of largely low to medium value habitat which is considered to require mitigation and 3.1ha of low value habitat which is considered not to require any mitigation. It is considered that the increased value of the created habitat (in conjunction with the landscaping trees and improved ecological linkage) at least balances/compensates for the value of the site's original habitats. Thus, with the implementation of the proposed mitigation measures it is considered that the residual ecological impact of the Project is negligible. The mitigation measures including; re-alignment, grasscreting, marshcreting and tree planting, not only result in negligible ecological impacts but will also lead to a general habitat enhancement along the entire 3.8km Project corridor.

### 3.3 Waste Management

- 3.3.1 The EIA identified sources, volumes, quality and timing of wastes arising from the construction activities and recommended a construction waste management strategy in accordance with current legislative requirements.
- 3.3.2 During the construction phase approximately 420,000 m<sup>3</sup> of surplus excavated material will be generated of which 102,000 m<sup>3</sup> can be re-used on site for filling and landscaping. The remainder will need to be disposed of at public filling areas or re-used as fill material in other earth-filling projects. The EIA recommended that in order to maximise re-use of materials and minimise the cumulative impact of waste products on the environment, on-site facilities should be set up for the separation of recyclable materials from construction and demolition waste and domestic waste to facilitate easy collection by recycling companies.
- 3.3.3 Provided that there is strict control of wastes from construction works and all arisings are stored, transported and disposed of using approved methods no significant impacts are predicted. Similarly routine maintenance of the floodway is unlikely to give rise to unacceptable impacts.

### 3.4 Air Quality Impacts

- 3.4.1 The air quality impact assessment noted that the main adverse impact on air quality arising from the construction of the YLBF is the generation of dust from trucks transporting material over dirt haul roads. Other dust sources including loading, unloading, stockpiling, wind erosion and top soil removal were considered to be relatively minor.
- 3.4.2 Assessment using the Fugitive Dust Model (FDM) showed that under the worst case scenario the Hong Kong Air Quality Objectives would be exceeded at all sensitive receivers without mitigation measures. However, by watering the haul road on an hourly basis during dry weather thereby achieving a 95% reduction in haul road dust emissions, the resultant FDM output showed that compliance with AQOs at all sensitive receivers can be achieved.
- 3.4.3 The EIA recommended a suite of specific mitigation measures in addition to those noted above, to ensure that construction dust impacts would be within acceptable limits.



3.4.4 The key potential air impact during the operational phase is odour nuisance from polluted water entering the channel. Odour nuisance can be mitigated through routine maintenance of the channel through the removal of odorous sediments. Furthermore, it is expected that there will be a progressive reduction in pollutant levels as the Livestock Waste Control Scheme is progressively implemented.

### **3.5 Noise Impacts**

3.5.1 The construction noise assessment showed that noise from the use of powered mechanical equipment on site and the haulage of fill material offsite could exceed EPD's recommended maximum noise level for day-time construction work when construction activities occur in close proximity to noise sensitive receivers (NSRs).

3.5.2 However, the assessment concluded that by employing a range of standard noise mitigation measures including use of quiet plant and working methods, reducing the number of equipment, restricting the number of works and the use of substantial noise barriers to protect the closest residences and schools, noise levels can be reduced to compliant levels at the NSRs.

3.5.3 During the operational phase noise associated with the Drainage Services Department (DSD) maintenance vehicles passing along the channel base and access roads and the pumping station at the downstream section of the site is not expected to create a nuisance to the nearby NSRs.

### **3.6 Landscape and Visual Impacts**

3.6.1 The Landscape Impact Assessment concluded that the YLBF will be compatible with lowlying landform of the rural area and as a water body it will provide an opportunity for landscape improvement of the rural area when landscape treatment is implemented on the embankments. Some potential undesirable impacts will result due to loss of agricultural land and some fishponds.

3.6.2 The Visual Impact Assessment identified that the YLBF will result in visual impacts on nearby visual receptors including; adjacent village settlements, Yuen Long Highway, Pok Oi Hospital, Route 3 and the proposed West Rail. The main visual impacts arise from the concrete portion of the channel which is incompatible with the surrounding visual context. Mitigation measures recommended to reduce the landscape and visual impacts and to enhance the existing landscape and visual environment include:

- Soft landscaping such as tree and shrub planting and hydroseeding should be implemented in the areas including the peripheral site area, the proposed embankment slopes, footpath sides and access road sides.

- The affected fishponds adjacent to the subject site to the north should be restored to fishponds after the completion of the construction works.
- Reprovisioned public 'Open Space' to compensate for 'Open Space' affected by the YLBF may focus on recreational opportunities.
- The exterior of the pumping station, handrailings and parapets should be chosen so as to minimize visual impact.
- Tree and shrub planting around the pumping station should be used to soften the visual impacts of the pumping station.
- Landscaping should be located in the peripheral site areas and the adjacent affected areas including the wetland areas directly to the north and south of Route 3.
- The protected plant species and very large *Ficus microcarpa* should be preserved.
- Existing top soil should be retained for use in landscaping mitigation measures.

3.6.3 Implementation of these mitigation measures will ensure that the landscape and visual impacts of the proposed floodway will be minimized.

### 3.7 Environmental Monitoring and Audit

3.7.1 To ensure that the mitigation measures recommended in the EIA are implemented and that the resultant environmental impacts of the works are acceptable an environmental monitoring and audit (EM&A) programme will be carried out during project implementation. Details regarding the scope, management structure and implementation of the EM&A programme have been presented in the EM&A Manual accompanying the EIA Study Report. It is envisaged that the EM&A Manual will be reviewed during the detailed design and periodically throughout the project implementation to ensure that it remains relevant and effective in respect of changing site conditions.

#### **4 CONCLUSION**

- 4.0.1 With the implementation of the recommended mitigation measures and monitoring of the environmental conditions at sensitive receivers, in accordance with the proposed Environmental Monitoring and Audit Manual, the impact on water quality, ecology, air quality and noise will be reduced to within established environmental guidelines and standards. This will result in the construction and operation of the Yuen Long Bypass Floodway being implemented in an environmentally acceptable manner.

**END OF TEXT**

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**Legend**

- Existing and Future Watercourses

Item	Code	Description	Scale	Unit	Quantity	Value	Percentage
1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
2	2.1	2.1	2.1	2.1	2.1	2.1	2.1
3	3.1	3.1	3.1	3.1	3.1	3.1	3.1
4	4.1	4.1	4.1	4.1	4.1	4.1	4.1
5	5.1	5.1	5.1	5.1	5.1	5.1	5.1
6	6.1	6.1	6.1	6.1	6.1	6.1	6.1
7	7.1	7.1	7.1	7.1	7.1	7.1	7.1
8	8.1	8.1	8.1	8.1	8.1	8.1	8.1
9	9.1	9.1	9.1	9.1	9.1	9.1	9.1
10	10.1	10.1	10.1	10.1	10.1	10.1	10.1

AGREEMENT NO. CE 79/96

**PROJECT**  
YUEN LONG BYPASS FLOODWAY  
FEASIBILITY STUDY

**EXECUTIVE SUMMARY**

**LOCATION PLAN**

Scale: 1:11,000  
Date: N.T.S.

BERNICE CONSULTANTS LIMITED  
NEW TERRITORIES NORTH  
DEVELOPMENT OFFICE  
Territory Development  
Department Hong Kong

BERNICE CONSULTANTS LIMITED  
BERNICE CONSULTANTS  
ENGINEERS AND SCIENTISTS



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 NOTES:  
 1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.  
 2. ALL LEVELS ARE IN METRES ABOVE MEAN SEA LEVEL (MSL).  
 3. GRID LINES ARE 100 METRE METRIC GRID.

- LEGEND:
- PROPOSED SITE LIMIT
  - DIRECTION OF FLOW
  - NEW CHANNEL
  - PROPOSED SLOPE
  - EXISTING SLOPE
  - ARE TO BE FILLED TO ADJUST CHANNEL LEVEL
  - ENGINEERED RE-EMBANKMENT
  - LEFT OF RIGHT OF TEMPORARY OCCUPATION
  - PROPOSED LEVEL
  - EXISTING LEVEL (OBTAINED FROM SITE VISIT)
  - VEHICULAR CROSSING
  - PEDESTRIAN CROSSING
  - P.L. TOP OF ROAD LEVEL
  - P.A. TOP OF FOOTPATH LEVEL
  - TEMPORARY BRIDGE
  - PERMANENT CONSTRUCTION



AGREEMENT NO. CE 79/96

Contract No.	Area (sq.m)	Rate	Total
101	1000	100	100000
102	2000	200	400000
103	3000	300	900000
104	4000	400	1600000
105	5000	500	2500000
106	6000	600	3600000
107	7000	700	4900000
108	8000	800	6400000
109	9000	900	8100000
110	10000	1000	10000000

YUEN LONG BYPASS FLOODWAY  
 FEASIBILITY STUDY

EXECUTIVE SUMMARY

ENVIRONMENTAL  
 MITIGATION MEASURES  
 REVISED CHANNEL ALIGNMENT

Page No. 3.1  
 Scale 1:500

新界北拓展處  
 NEW TERRITORIES DEVELOPMENT OFFICE

拓展署  
 Territory Development Department Hong Kong

POWER CONSULTANTS LIMITED  
 電力工程師有限公司  
 Incorporated in Hong Kong

