

Agreement No. CE 78/94
Wan Chai East and North Point Sewerage
Environmental Impact Assessment
Final Assessment Report

September 1996

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Report Authorized For
Issue By:



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1 INTRODUCTION

Project Background

Description of Study Area

- 1.1 The following description is taken from the Wan Chai East and North Point Sewerage Master Plan Study (SMP Study) Final Report¹:

"The Wan Chai East and North Point area, located on the northern part of Hong Kong Island, covers 12 square kilometres with a population of over 360,000 people. Population densities vary from 4,000 persons/hectare in Wan Chai to negligible levels in the Country Park areas. (See Figure 1.1).

The principal land use is commercial and residential development of high density in the northern coastal lowlands, and of lower density on the slopes of the range of hills comprising the centre of Hong Kong Island. Industrial development is concentrated in the Quarry Bay area of North Point although small industries are widespread throughout.

Apart from the Central and Wan Chai Reclamation proposed for construction along the northern coastline westward of Causeway Bay Typhoon Shelter, changes will be mainly concentrated on redevelopment of existing sites."

Existing Sewerage Problems

"Progressive developments have led to the overloading of sewers which, because of successive reclamations, have been laid at increasingly slack gradients. The resulting low velocities and blockages have, in turn, led to the widespread use of expedient connections of foul flows to stormwater drains. Bifurcations and local sudden reductions in pipeline diameters have also resulted in the blockage of the foul sewers.

¹ Agreement No. CE 2/92 Wan Chai East & North Point Sewerage Master Plan Study - Final Report (September 1994) Acer/John Taylor for Environmental Protection Department.

The high concentration of restaurants in the Causeway Bay area has caused problems arising from regular blockages of sewers by grease, with consequent overflows into the stormwater drains. The polluted stormwater outfalls discharge into the nearby Typhoon Shelter which, being a semi-enclosed water body, has thus become a well-known and prominent (environmental) problem area."

Sewerage Master Plan Study

- 1.2 The SMP Study was commissioned by the Environmental Protection Department (EPD) in 1992.
- 1.3 The general aim of the SMP Study was to provide a plan for the systematic and progressive improvement of the existing wastewater collection and disposal systems in the area. Implementation of this plan would allow improper or 'expedient' connections² to be corrected by providing a sustainable sewerage system of adequate capacity and velocity. This, in turn, would lead to the earliest possible improvement in environmental standards by ensuring that the presence of polluted flows in the stormwater system is minimised.
- 1.4 When implemented, the Master Plan developed during the SMP Study should provide a sustainable sewerage system which will serve the Wan Chai East and North Point area up to the year 2011 and beyond. The Master Plan also made provision for the worst case scenario for the Study Area, allowing for delays in planned population reductions and early implementation of developments which result in increases in population.

Wan Chai East & North Point Sewerage Project

- 1.5 The SMP Study was completed in August 1994 and identified works to eliminate flooding and potential flooding and works to provide adequate gradients for self-cleansing operations. These works involved re-laying the sewers in the lower reaches of both the Wan Chai East and North Point sewerage basins at steeper gradients, using a combination of open cut and trenchless techniques. Re-laying these sewers would improve hydraulic capacity and velocities to provide a sustainable sewerage system with sufficient capacity for future flow, and with pipeline at gradients suitable to avoid future siltation. New pumping facilities

² 'Expedient' connections can be from the foul water system into the stormwater drainage system, which leads to sewage flows bypassing the treatment facilities, alternatively the connections can be from the stormwater system to the foul sewers, which can lead to overloading of the treatment facilities.

would be required at North Point Screening Plant to raise flows from the resulting lower sewers to the existing screening plant facilities. It should be noted that works associated with the upgrading of Wan Chai East Screening Plant form part of the Central Western and Wan Chai West (CW3) Sewerage Project, which is a separate consultancy.

- 1.6 The SMP Study also proposed immediate works to provide the means of achieving pollution abatement at the earliest opportunity to some particular pollution problems. These works included:
- (i) repairing of leaking pipes crossing stormwater nullahs;
 - (ii) foul sewage interception in stormwater drains;
 - (iii) detailed sewerage surveys and cleaning to identify expedient connections and blockages leading to overflows and to devise interception works;
 - (iv) removal of existing sediments and grease.
- 1.7 Binnie Consultants Ltd, in association with MVA Asia Ltd and Llewelyn Davies (HK) Ltd, has been appointed by Drainage Services Department to review, develop and implement the works originally outlined in the SMP Study. This involves:
- (i) the Adoptive Review of the SMP Study;
 - (ii) Environmental Impact Assessment and Traffic Impact Assessment Studies;
 - (iii) Detailed Design, Construction and Commissioning of the works.
- 1.8 The EIA Study has proved to be an important and integral part of the Project, particularly in view of the location of the proposed works within the busy and congested urban areas of Wan Chai and North Point.
- 1.9 In the EIA Study, we have sought to identify practicable means to reduce any potential adverse construction and operational phase environmental impacts on sensitive receivers in the Study Area to acceptable levels, in order to ensure that these essential works can progress to schedule as required by the Drainage Services Department.
- 1.10 The results and recommendations of our EIA Study have been incorporated into the Project planning and design process and, together with the results of detailed engineering investigations, have contributed to significant modification of the sewerage works originally proposed in the SMP Study.

EIA Study Approach

- 1.11 Our general approach to the EIA Study has been to identify all significant environmental impacts and constraints so that the findings can be translated into environmentally acceptable designs, construction methods and operational procedures for the various facilities proposed.
- 1.12 The EIA Study has been carried out in close and continuing liaison with the engineering design team. As each environmental issue has arisen during the study phase, its impact on the engineering of the scheme has been discussed and any feasible adjustments incorporated into the design or construction programming. In a similar manner, the engineering team has been regularly advising the EIA Study team on the engineering constraints and design criteria to which the team has had to work.
- 1.13 In this report, the EIA Study team has independently assessed the environmental implications of the latest design option.

EIA Study Objectives

- 1.14 The objectives of the EIA Study have been as follows:
- (i) to describe the proposed Project and associated works together with the requirements for carrying out the proposed Project;
 - (ii) to identify and describe the elements of the community and environment likely to affect or be affected by the construction and future operation of the Project, and/or likely to cause adverse impacts upon the proposed Project, including both the natural and man-made environment;
 - (iii) to identify and quantify emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;
 - (iv) to identify and quantify any potential losses or damage to flora, fauna and natural habitats;
 - (v) to propose the provision of practical and cost-effective infrastructure or mitigation measures so as to minimise pollution, environmental disturbance and nuisance during construction and operation of the Project;
 - (vi) to identify, predict and evaluate the residual environmental and cumulative effects expected to arise during the construction and operational phases of the Project in relation to sensitive receivers and potential affected uses;

- (vii) to identify, assess and specify practicable, effective and enforceable methods, measures and standards to be included in the detailed design, construction and operation of the Project which are necessary to mitigate these impacts and reduce them to acceptable levels;
- (viii) to investigate the extent of side effects of proposed mitigation measures that may lead to other forms of impacts;
- (ix) to identify constraints and cost implications associated with the mitigation measures recommended in the study;
- (x) to identify any additional studies necessary to fulfil the requirements of the EIA; and
- (xi) to design and specify the environmental monitoring and audit (EM&A) requirements necessary to ensure the implementation and the effectiveness of the environmental protection and pollution control measures adopted.

Purpose of Report

1.15 The purpose of this Final Assessment Report is to:

- (i) provide the results of the assessment of impacts, the identification of environmental impact mitigation measures and associated residual impacts;
- (ii) prescribe the specification for detailed design, construction and operation requirements of the proposed project;
- (iii) provide with the impacts summary, the study findings, conclusions, recommendations and a mechanism for implementation; and
- (iv) describe the agreed schedules and programmes for monitoring and audit requirements (presented separately in the EM&A Manual).

Structure of Report

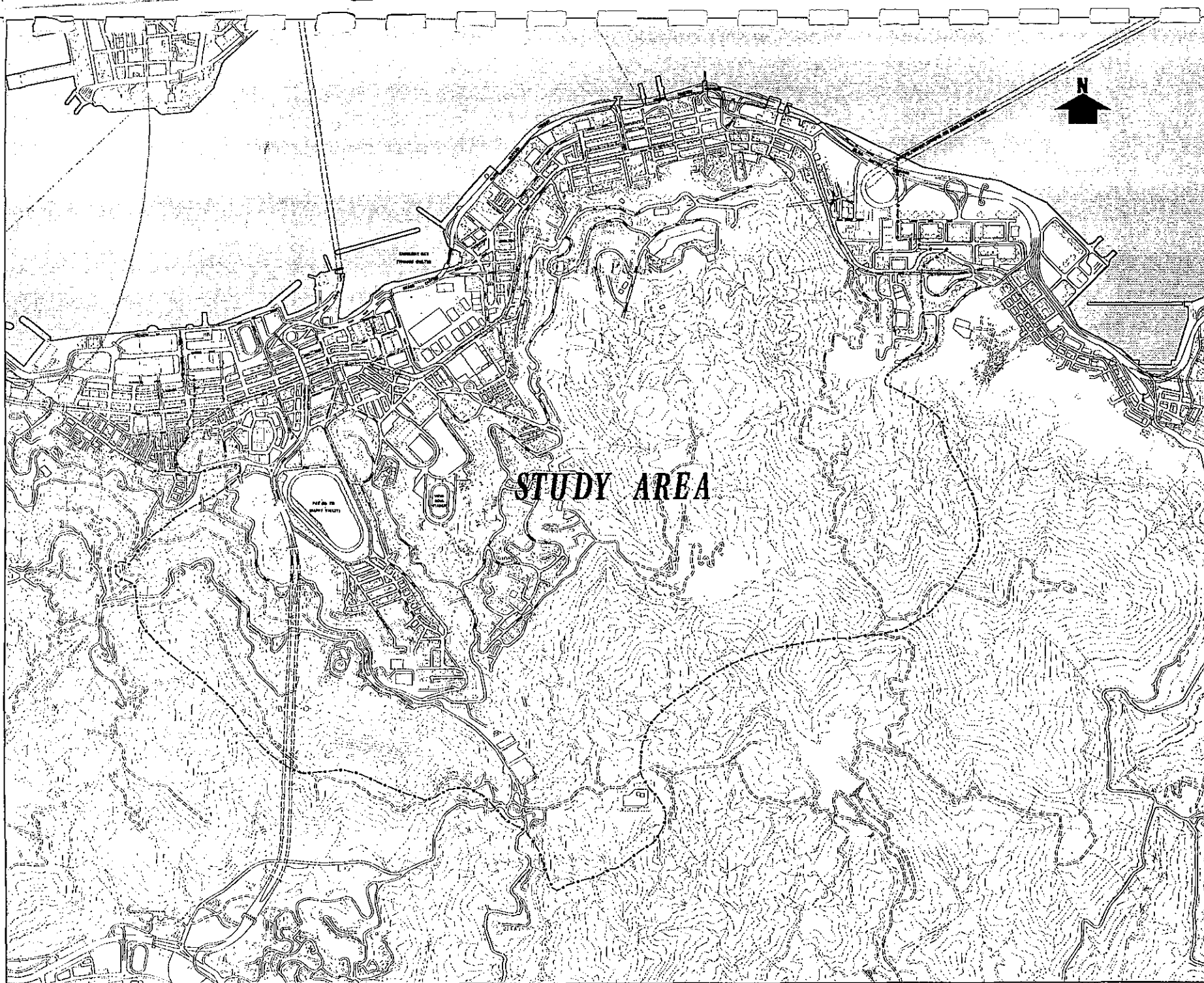
1.16 The structure of this Final Assessment Report is as follows:

Section 1: this provides a general introduction to the Study

Section 2: describes the main features of the Project, provides an outline description of the Study Area, and briefly describes other major infrastructure developments in the vicinity

- Section 3: describes the applicable environmental legislation
- Section 4: describes the existing environment, land uses, ecology and sensitive receivers
- Section 5: identifies noise sensitive receivers, and describes the approach to, and findings of, the construction and operational noise impact assessment; construction phase noise monitoring is recommended.
- Section 6: identifies air sensitive receivers, and outlines the approach to the air quality impact assessment of construction dust and operational phase odour
- Section 7: identifies water quality sensitive receivers and describes the initial findings of the water quality impact assessment
- Section 8: outlines the approach to the construction waste and spoil management studies
- Section 9: briefly outlines traffic as a project constraint
- Section 10: presents the impacts summary and recommendations
- Appendix A: gives details of the odour measurement at North Point Screening Plant
- Appendix B: presents the clauses for pollution control recommended for inclusion in the construction contract

1.17 The EM&A Manual is presented as a separate document.



LEGEND :

----- Study Boundary

PROVISIONAL
NOT FOR CONSTRUCTION

revision	date	description	initial
	designed	checked	drawn
initial	SJC	DPL	EC
date	27/5/96	27/5/96	27/5/96
approved			

REB

project
**WAN CHAI EAST &
NORTH POINT
SEWERAGE**

figure title
Study Area

figure no. 1.1 scale NTS

drawn
**DRAINAGE
SERVICES
DEPARTMENT**

consultant
2 ENGINE CONSULTANTS LIMITED 寶尼
寶尼工程顧問有限公司
BURNING AND ASSOCIATES

2 WAN CHAI EAST & NORTH POINT SEWERAGE AND ASSOCIATED PROJECTS

Introduction

- 2.1 This section provides details of the works required under the Wan Chai East and North Point Sewerage Project as well as information about other infrastructure projects within the Study Area.

Wan Chai East & North Point Sewerage

Existing Situation

- 2.2 The Study Area conveniently splits into two foul sewerage catchment areas: Wan Chai East and North Point. The existing disposal system is made up of two elements: a foul sewer system which collects polluted domestic and industrial flows and a storm water drainage system designed to disperse rainwaters.
- 2.3 At present, all foul and surface water flows pass to Victoria Harbour by gravity, with the majority of the foul flows being screened at the Wan Chai East or North Point screening plants to remove solids and grit before discharge.

Future Situation

- 2.4 Treated effluent will be discharged by gravity flow to facilities provided under SSDS. While the strategy for treatment and disposal of foul flows under the Strategic Sewage Disposal Scheme Stage III/IV has not yet been finalised, it is likely that the foul flows will be collected and treated at Stonecutters Island sewage treatment works. The treatment process(es) and level of treatment will be subject to the findings and recommendation of the current SSDS EIA Study.

SMP Study Objectives

- 2.5 The Wan Chai East & North Point Sewerage Master Plan Study was commissioned by the Environmental Protection Department (EPD) in 1992 and completed in August 1994. The objectives of the SMP Study were:
- (i) to examine and assess the inadequacies of the sewerage and drainage systems within the Wan Chai East and North Point area;

- (ii) to examine the extent of improper connections of domestic and commercial sewage and industrial effluent to stormwater drains and water courses, to assess the total extent of the pollution problem and to recommend general and specific solutions to ensure proper collection, treatment and disposal of all wastewaters from the area;
- (iii) to develop a Sewerage Master Plan for the Wan Chai East and North Point area, and a prioritised programme of works for the implementation of its recommended solutions, via the Public Works Programme;
- (iv) to evaluate and recommend 'first aid' measures for early implementation;
- (v) to provide a computerised inventory of the sewerage system networks to enable Government to carry out rapid assessments of the impact of developments;
- (vi) to review environmental issues resulting from the construction and operation of any sewerage works and recommend aspects to be addressed during construction.

SMP Study Findings

2.6 The principal findings of the Study were that:

- (i) the majority of foul sewage flows from the Wan Chai East and North Point areas enter the harbour after preliminary treatment at the two existing screening plants. However, substantial flows also enter the harbour directly from one foul sewage outfall in Watson Road;
- (ii) a large part of the foul sewerage system suffers from inadequate capacity and insufficient gradients to maintain self-cleansing flow conditions;
- (iii) significant quantities of foul sewage pollute the stormwater drains through overflows and expedient connections;
- (iv) both foul and storm systems are in reasonably good physical condition; and
- (v) although heavy metals, indicating the presence of industrial pollution, are present in both foul and storm systems, amounts of daily discharge are relatively low.

- 2.7 The SMP Study found that the total foul sewerage system comprises over 92 km of pipelines which discharge about 112,700 m³ of sewage per day into Victoria Harbour. Of this amount approximately 31,000 m³ of sewage, i.e. about 28% of the total flow in the foul system, is discharged untreated through the Watson Road outfall. In addition, approximately 10,700 m³ of sewage, being about 9% of the total sewage flow, is discharged through the stormwater system.
- 2.8 The SMP Study calculated that a total of some 20 tonnes of BOD is discharged to Victoria Harbour every day and of this, nearly 3 tonnes per day, representing 15% of the total, flows through the stormwater system. Some 70% of the pollution load in the stormwater system enters the harbour from only three outfalls. The most polluted of these three contains nearly 40% of the pollution load in the stormwater system and discharges into Causeway Bay Typhoon Shelter.
- 2.9 Based on the surveys undertaken, the SMP Study found few major problems with the fabric of foul and storm systems although instances exist of badly executed service crossings through nullahs causing structural damage and flow constrictions.
- 2.10 The SMP Study estimated that sediment deposits in depths up to 400 mm affect approximately 21 km or nearly 23% of the foul sewerage system. This represents a major hydraulic restriction to sewage flows.

SMP Study Proposals

- 2.11 The SMP Study identified works to eliminate flooding and potential flooding and works to provide adequate gradients for self-cleansing operations. These works would involve re-laying the sewers in the lower reaches of both the Wan Chai East and North Point sewerage basins at steeper gradients, using a combination of open cut and trenchless technology techniques. Re-laying these sewers would improve hydraulic capacity and velocities to provide a sustainable sewerage system with sufficient capacity for future flow, and with pipeline at gradients suitable to avoid future siltation. New pumping facilities would be required at North Point Screening Plant to raise flows from the resulting lower sewers to the existing screening plant facilities.
- 2.12 The study also proposed immediate works to provide the means of achieving pollution abatement at the earliest opportunity to some particular pollution problems. These works included:
- (i) closure of the existing Watson Road foul sewerage outfall;

- (ii) repairing of leaking pipes crossing stormwater nullahs;
 - (iii) foul sewage interception in stormwater drains;
 - (iv) detailed sewerage surveys and cleaning to identify expedient connections and blockages leading to overflows and to devise interception works;
 - (v) removal of existing sediments and grease.
- 2.13 Items (i), (ii) and (iii) above have already commenced under Drainage Services Department (DSD)'s minor works and maintenance programme.

Description of Proposed Works

- 2.14 The SMP Study proposals for sewerage works in the Wan Chai East and North Point basins are shown on Figures 2.1 and 2.2 respectively. These proposals have been partly superseded by the Draft Preliminary Report¹.
- 2.15 A review of the SMP proposals and existing data has been conducted to identify where works could be combined or reduced, and where additional improvement works should be carried out. Information obtained from the additional surveys of critical foul and stormwater sewers, and computer remodelling of the sewerage system will be used to further fine tune the proposed works.
- 2.16 The recommended Project currently comprises the following main components:
- (i) On-line replacement of sewers in the Wan Chai East and North Point areas to replace existing sewers of insufficient hydraulic capacity (Priority 1 sewers) and insufficient self-cleansing capacity (Priority 2 sewers). On-line construction will generally entail open cut trenching methods.
 - (ii) Off-line construction of new sewers in the Wan Chai East and North Point areas to augment the existing system. Off-line construction will generally entail trenchless construction methods with connection to the existing system. This form of construction is necessary where the traffic or environmental impacts of open cut construction would be unacceptable. Deep tunnel construction is recommended at the downstream end of the system, whereas comparatively shallow microtunnelling is proposed where short lengths of trenchless excavation are needed along or to cross critical roads, and where deep tunnelling would not be feasible or economical.

¹ Agreement No. CE 78/94, Wan Chai East and North Point Sewerage: Draft Preliminary Report (May 1996). Binnie Consultants Limited for Drainage Services Department.

- (iii) A new inlet pumping station at the North Point Screening Plant lifting flows from the new deep sewers in North Point. This will involve reprovisioning of the existing administration building at the North Point Screening Plant and decommissioning of the existing screw pumping station.
- 2.17 Overall layout plans showing the recommended works for the Wan Chai East and North Point areas are shown in Figures 2.3 and 2.4 respectively. The overall construction periods for the various works as extracted from the latest works programme are as follows:

Advanced Works	mid 1997 - mid 1999
Wan Chai East Sewerage Works	end 1997 - mid 2002
North Point Pumping Station	end 1997 - mid 2002
North Point Sewerage Works	end 1997 - mid 2001

Other Major Infrastructure Projects within and adjacent to the Study Area

Proposed Infrastructure Projects

- 2.18 There are a number of on-going and future projects in, or adjacent to, the Study Area of which the following may affect the Wan Chai and North Point basins:²
- (i) Central and Wan Chai Reclamation;
 - (ii) Central and Wan Chai Reclamation Development (including the North South Link Investigation - Canal Corridor);
 - (iii) Central, Western and Wan Chai West Sewerage;
 - (iv) Catchment 'M' Sewerage Mitigation Measures;
 - (v) Integration of North Point and Central Cross Harbour Mains Supply Zones - Remaining Works);
 - (vi) Improvement of Fresh Water Supply to North Point Low Level Area;
 - (vii) Territorial Development Strategy - Urban Area Feasibility Studies;
 - (viii) the Extension to the Hong Kong Convention and Exhibition Centre;

² Agreement No. CE 78/94 Wan Chai & North Point Sewerage: EIA Study - Final Inception Report (September 1995) Binnie Consultants Ltd for Drainage Services Department.

- (ix) Royal Hong Kong Jockey Club Redevelopment in Happy Valley;
 - (x) Public Housing Development at Woodside, Quarry Bay;
 - (xi) Rehabilitation of Mount Butler Quarry;
 - (xii) MTRC Quarry Bay Extension;
 - (xiii) Other major commercial and residential developments in the Project area having an impact on the Project.
- 2.19 Although the rehabilitation of Mount Butler Quarry is expected to provide an area for residential development with an expected maximum of 300 persons, the population in the North Point Study Area is expected to remain fairly static between 1991 and the design horizon of 2011.
- 2.20 The Housing Authority has indicated that there are no plans for new public housing developments within the North Point basin and no clearance or redevelopment for the existing estates is planned. In addition, discussions have taken place with the Planning Department to examine recent trends within the area. Major known committed developments are all for commercial expansion.

Planned and Committed Highway Improvement Projects³

- 2.21 Information on road improvement projects and associated traffic schemes likely to impact on the Study Area was obtained from the Transport Department and Highways Department. However, the list is not an exhaustive representation of all road works being undertaken or to be undertaken within the Study Area.
- 2.22 There are also some short term *ad hoc* road improvement schemes requested by Transport Department as a result of ongoing transport studies and traffic condition monitoring. These projects are normally of short duration. Most of these currently planned short term road works will be completed before the commencement of the Wan Chai & North Point Sewerage construction works.
- 2.23 Integration of the sewerage works with all of the planned/proposed road works and any future short term road improvement schemes is of prime importance to avoid serious disruption and public nuisance to the road users. Table 2.1 shows the programme for major roadworks between 1995 and 2000.

³ Agreement No. CE 78/94 Wan Chai East & North Point Sewerage: Draft Adoptive Review (September 1995) Binnie Consultants Ltd for Drainage Services Department.

Cumulative Impacts

- 2.24 In this Final Assessment Report, we have identified construction noise and operational phase odour as potential environmental impacts to be generated from implementation of the Wan Chai East & North Point Sewerage Project. Control of construction noise impact, which in most cases will be intense but short term, will be enforced by licensing and Contract clauses. Odour at the pumping station will be achieved by the installation of a deodorising system and good housekeeping practice.

Table 2.1
Planned and Committed Highway Improvements and Road Works
(Source: Highways Department)

Project	Date
1. Stubbs Road Widening & Improvements (Queen's Road East to Tai Hang Road)	1996/1997
2. Reconstruction of Lockhart Road (except W/B Lane from Fenwick Street to Arsenal Street)	Stage I (completed) Stage II (January 1997)
3. Reconstruction of Gloucester Road W/B Service Road	April 1999
4. Rehabilitation of Hennessy Road between Arsenal Street & Canal Road East & Queensway between Rodney Street & Arsenal Street	Starts from October 1994
5. Reconstruction of Victoria Road & Gloucester Road from Hing Fat Street to Marsh Road	Starts from September 1995
6. Central/Wanchai Bypass and Island Eastern Corridor Link	1996-2000
7. Reconstruction of Causeway Bay Flyover and Associated widening of Victoria Park Road	1997-1999
8. O'Brien Road Footbridge Extension	1997-1998
9. Western Harbour Crossing	Complete by 1996
10. Modifications to Junction of Percival Street, Russell Street and Matheson Street	April 1996 to June 1996
11. Reconstruction of Stewart Road between Gloucester Road and Lockhart Road	December 1996 to March 1997
12. Construction of Percival Street footbridge across Gloucester Road	June 1996 to December 1997

Note: The above dates are subject to change.

- 2.25 All construction projects have the potential to raise local and air-borne dust levels, and to impact adversely on environmental conditions. The projects outlined above may all impact on background noise levels, air quality and water quality during the construction and operation of the sewerage project. The extent of these impacts on the sensitive receivers in the Study Area will depend on the efficacy of the mitigation measures incorporated into each project.
- 2.26 Given the localised and short term nature of most of the works, and the often high noise and odour levels experienced within the Study Area, the overall contribution of the Wan Chai East & North Point Sewerage Project to existing environmental conditions is unlikely to be significant.

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- LEGEND :
- Study Area Boundary
 - And Sewerage District Boundary
 - Proposed Priority 1 Works
 - Proposed Priority 2 Works
 - Section Of Priority 1 Works To Be Constructed Between March 1997 And January 2002 Using Open Cut Techniques

Project title

Agreement No. CE 78194
WAN CHAI EAST AND NORTH POINT
SEWERAGE EIA

Figure title

SWP UPGRADING PROPOSALS :
WAN CHAI EAST

Plan register no.

D02/Amo/mph/mph/SEWAGE/2714/ASCOMP2

Figure no.

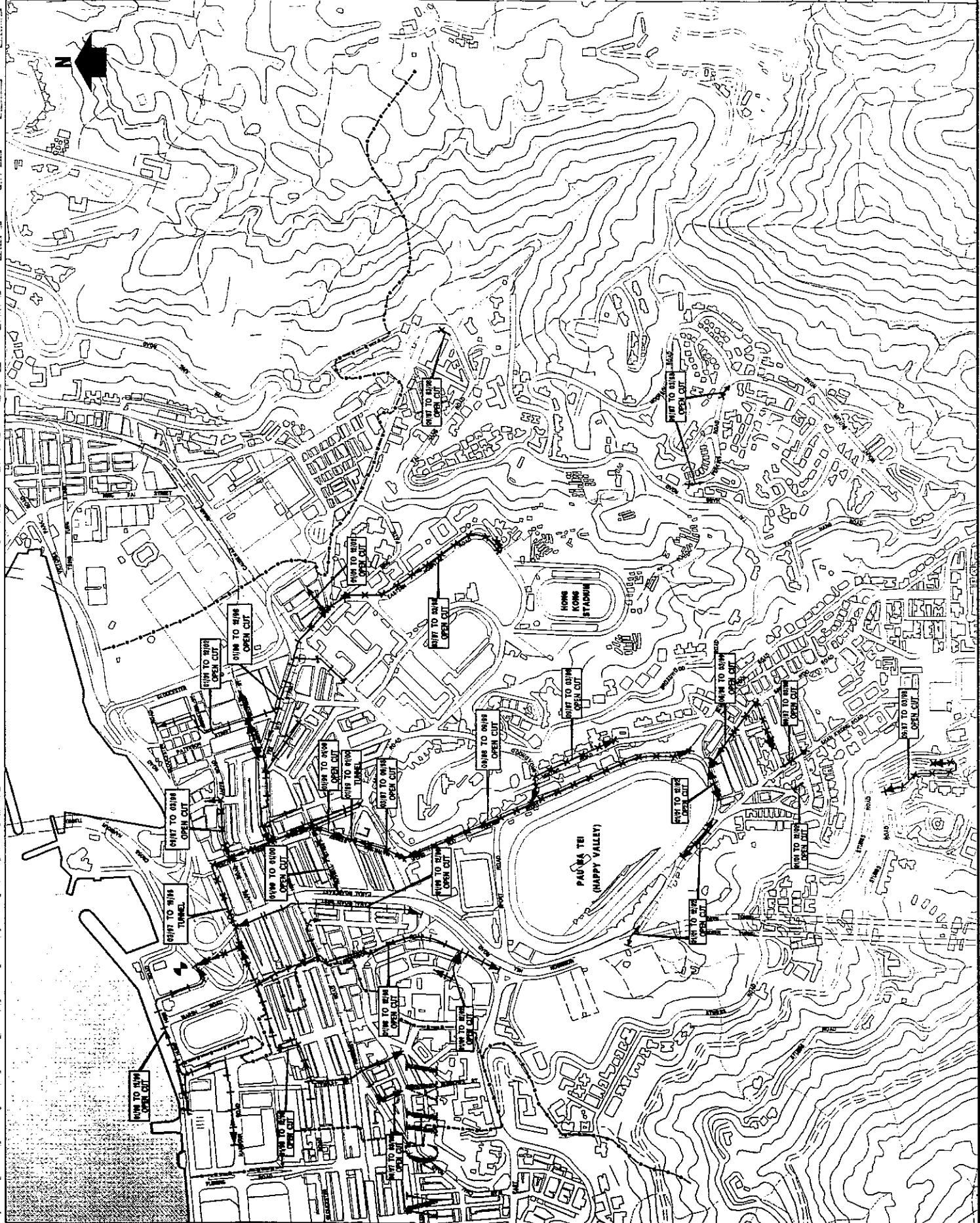
2.1

Scale

NTS

**DRAINAGE
SERVICES
DEPARTMENT**

BINIE CONSULTANTS LIMITED
寶尼工程顧問有限公司
CONSULTING ENGINEERS



LEGEND :

Study Area Boundary
And Sewerage District
Boundary

Proposed Priority 1
Works

Proposed Priority 2
Works

Section Of Priority 1
Works To Be
Constructed Between
March 2002 And
January 2002 Using
Open Cut Techniques

Project No.

Agreement No. CE 78/84
WAN CHAI EAST AND NORTH POINT
SEWERAGE EIA

Figure title

SMP UPGRADING PROPOSALS :
NORTH POINT

Plan register no.

BCL2/Planning/Infrastructure/ENR/2014/NDMP/3

Scale

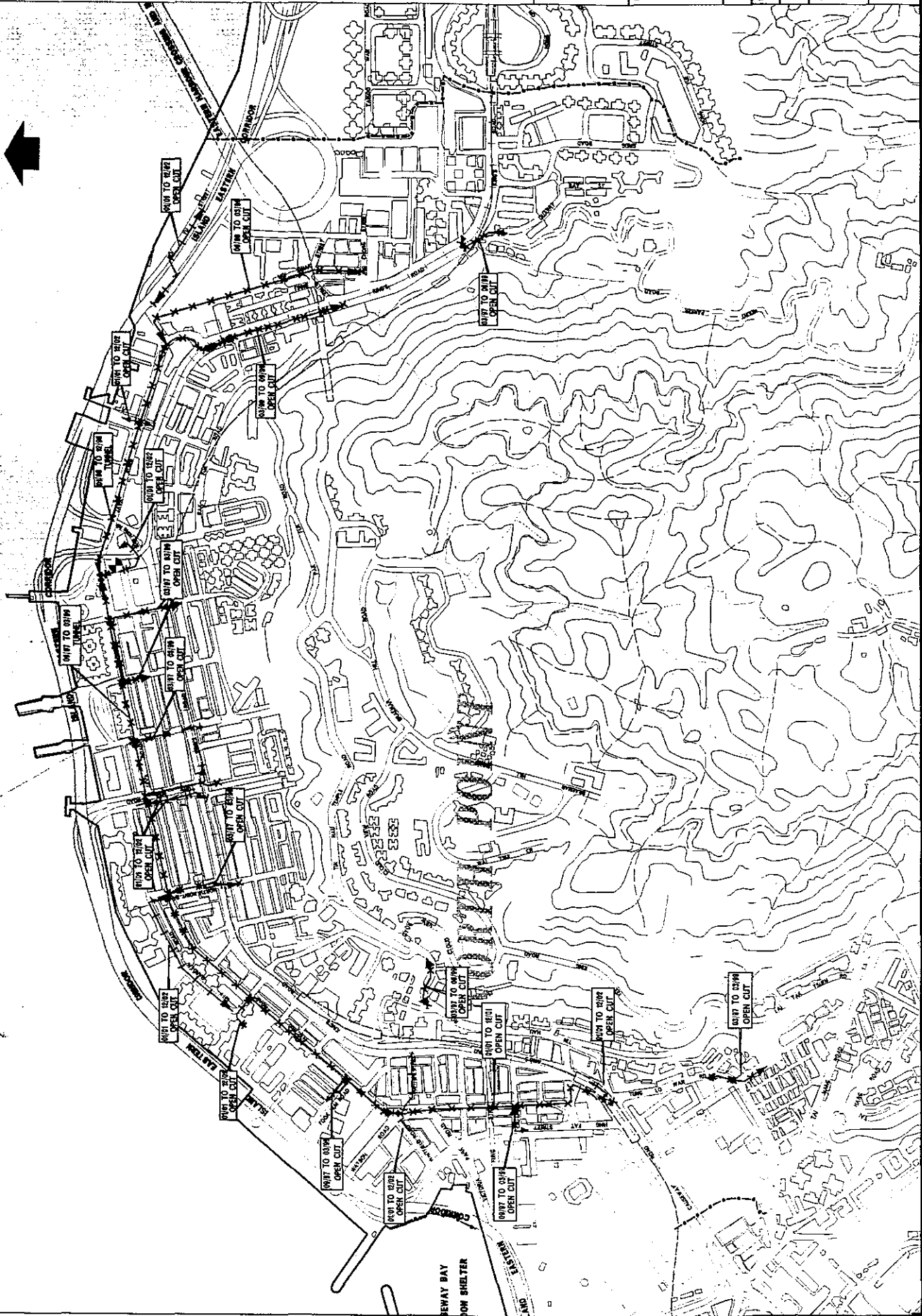
Figure No. 2.2

NTS

Sheet

**DRAINAGE
SERVICES
DEPARTMENT**

ARVE CONSULTANTS LIMITED
香港工程師有限公司
CONSULTING ENGINEERS

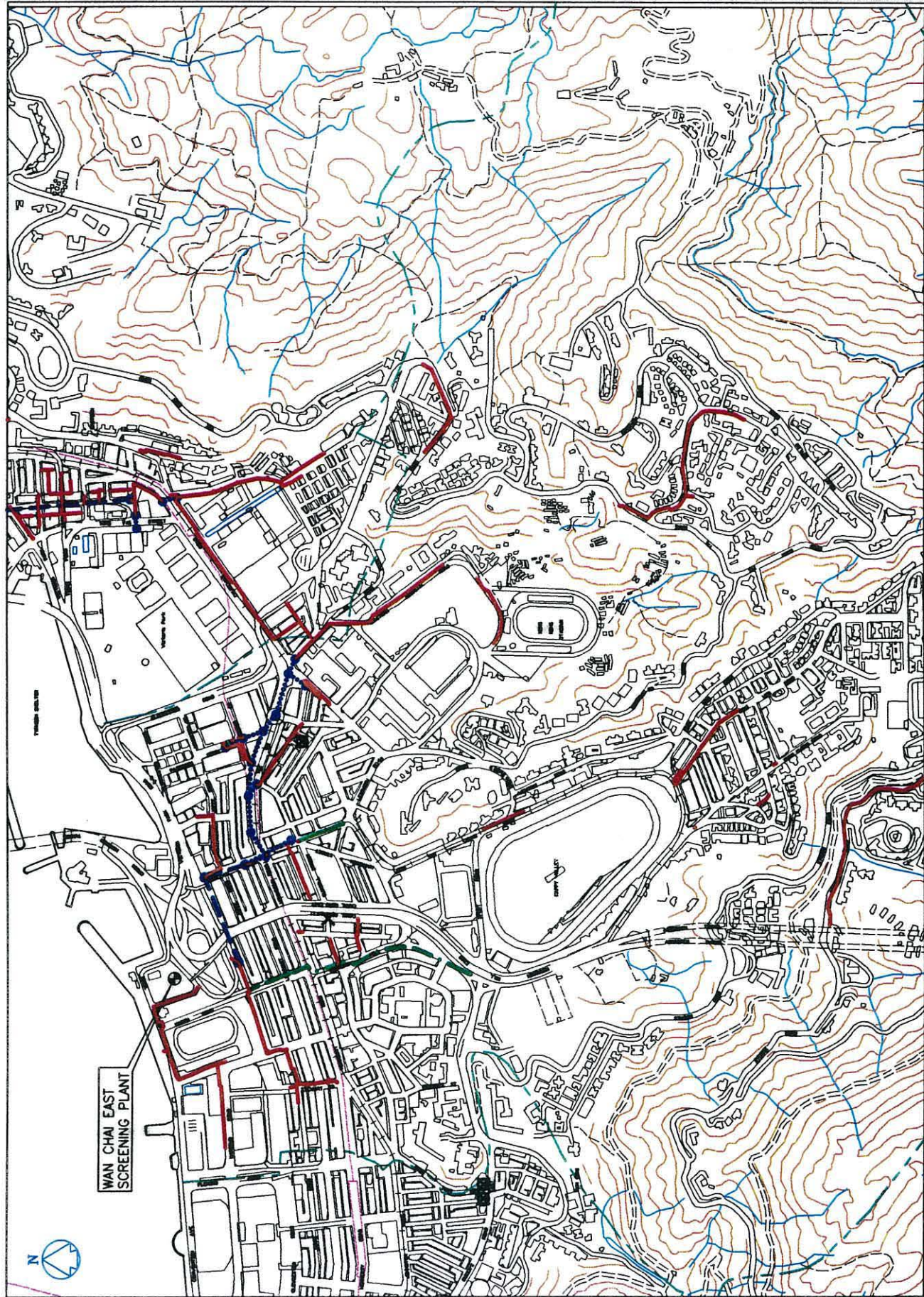


SEWAY BAY
LOW SHELTER

LEGEND

- Deep Tunnel & Shaft
- Open Cut
- Shallow Tunnel & Shaft
- DWF
- Catchment Boundary
- Market Interceptor
- DWF Interceptor

WAN CHAI EAST
SCREENING PLANT



ISSUE FOR FINAL PRELIMINARY REPORT					
revision	date	description	checked	drawn	checked
1	24/4/96	24/4/96	DPL	LC	DPL
2	24/4/96	24/4/96	DPL	LC	DPL
3	24/4/96	24/4/96	DPL	LC	DPL
4	24/4/96	24/4/96	DPL	LC	DPL
5	24/4/96	24/4/96	DPL	LC	DPL
6	24/4/96	24/4/96	DPL	LC	DPL
7	24/4/96	24/4/96	DPL	LC	DPL
8	24/4/96	24/4/96	DPL	LC	DPL
9	24/4/96	24/4/96	DPL	LC	DPL
10	24/4/96	24/4/96	DPL	LC	DPL

project

Wan Chai East & North Point
Sewerage

drawing title

Recommended Works
Wan Chai East

figure no. 2.3

scale NTS

DRAINAGE
SERVICES
DEPARTMENT

DESIGN CONSULTANTS LIMITED
香港工程師學會有限公司



LEGEND

- Deep Tunnel & Shaft
- Open Cut
- Shallow Tunnel & Shaft
- Catchment Boundary
- Market Interceptor
- DWF Interceptor

ISSUE FOR FINAL PRELIMINARY REPORT			
NO.	DESCRIPTION	DATE	STATUS
1	DESIGNED	24/4/96	DESIGNED
2	CHECKED	24/4/96	CHECKED
3	APPROVED	24/4/96	APPROVED

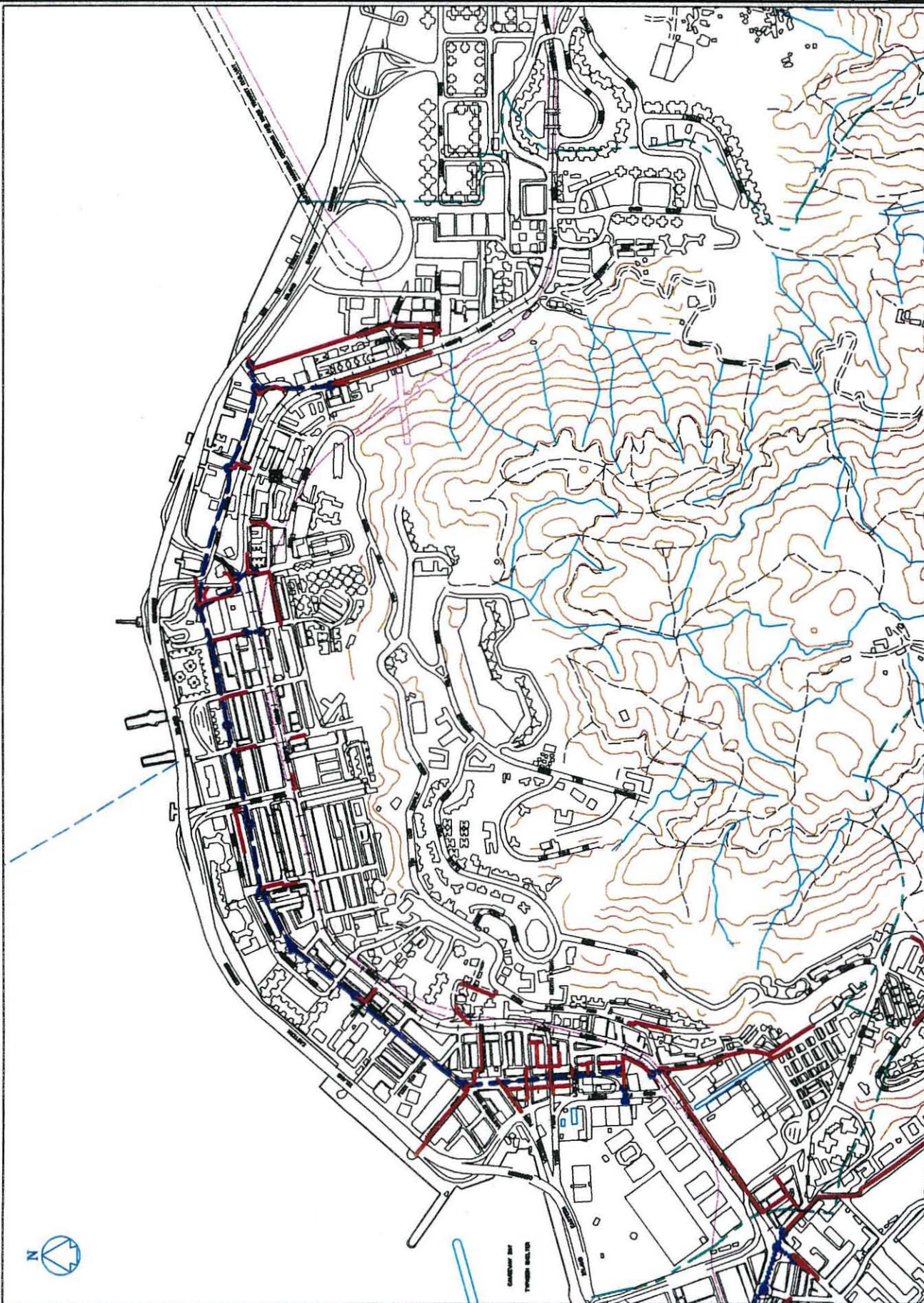
Van Chai East & North Point Sewerage

Recommended Works North Point

Figure No. 2.4 NTS

Drainage Services Department

Drainage Services Department



3 ENVIRONMENTAL LEGISLATION AND PLANNING GUIDELINES

Introduction

- 3.1 One of the Hong Kong Government's overall policy objectives on environmental planning, as outlined in the 1989 *White Paper on Pollution in Hong Kong*, is:

"to avoid creating new environmental problems by ensuring the consequences for the environment are properly taken into account in site selection, planning and design of all new developments".

- 3.2 This section highlights the relevant environmental legislation and guidelines which are currently applicable to the proposed project.

Hong Kong Planning Standards and Guidelines

- 3.3 The *Hong Kong Planning Standards and Guidelines (HKPSG) Chapter 9: Environment* provides guidance for including environmental considerations in the planning of both public and private developments.

- 3.4 The *HKPSG* specifies the Government's overall policy objective for environmental planning to be:

"to seize opportunities for environmental improvement as they arise in the course of urban redevelopment"; and to ensure that,

"adequate and suitably sited environmental facilities are provided to ensure proper handling and disposal of all wastes and waste water arising from proposed developments."

- 3.5 The environmental suitability of a site for certain land use is governed by such factors as:

- (i) natural environmental characteristics including topography, climate, hydrological and hydrographical characteristics, vegetation, wildlife and habitat, and soil conditions;
- (ii) the nature, distribution and consequences of the residuals including aerial emissions, wastes, sewage or noise generated by land uses in the development area;
- (iii) the capacity of the environment to receive additional developments; and
- (iv) existing land uses.

Noise

- 3.6 *HKPSG* states that "The basic role of planning against noise is to provide an environment whereby noise impacts on sensitive uses are maintained at acceptable levels."
- 3.7 Noise control legislation in Hong Kong comes under the *Noise Control Ordinance [Cap 400]* of 1988 regulations and associated Technical Memoranda (TM). The following TM have been issued on:
- (i) *The Assessment of Noise from Places other than Construction Sites, Domestic Premises or Public Places* (1988)
 - (ii) *Noise from Construction Works other than Percussive Piling* (1996)
 - (iii) *Noise from Construction Work within Designated Areas* (1996)
 - (iv) *Noise from Percussive Piling* (1988)
- 3.8 The most recent environmental legislation on noise control, the *Noise Control (Construction) Regulation* and the associated *TM on Noise from Work within a Designated Area*, is designed to control noise from the use of specified powered mechanical equipment and the carrying out of prescribed construction work on construction sites within a designated area during restricted hours.
- 3.9 Noise Sensitive Receivers (NSRs) are defined by the *HKPSG* and *Noise Control Ordinance* as follows:
- (i) all domestic premises, including temporary housing accommodation
 - (ii) hotels and hostels
 - (iii) offices
 - (iv) educational institutions, including kindergartens, nurseries and all others where unaided voice communication is required
 - (v) places of public worship and courts of law
 - (vi) hospitals, clinics, convalescences and homes for the aged, diagnostic rooms and wards

- (vii) amphitheatres and auditoria, libraries, performing arts centres and Country Parks

3.10 The appropriate Acceptable Noise Level (ANL) for a particular NSR is dependent on the character of the area in which the NSR is located, and the time of day under consideration. The Area Sensitivity Rating (ASR) is a function of the type of area within which the NSR is located and the degree of the effect on the NSR of particular Influencing Factors (IFs). IFs include any industrial area, major roads (ie. those with a heavy and generally continuous flow of vehicular traffic) and the area within the boundary of Hong Kong International Airport. Table 3.1 shows the Area Sensitivity Ratings given by the *Noise Control Ordinance*.

Table 3.1
Area Sensitivity Ratings

Type of Area containing NSR	Degree to which NSR is affected by IF	Not Affected	Indirectly Affected	Directly Affected
(i) Rural area, including Country Parks or village type developments		A	B	B
(ii) Low density residential area consisting of low-rise or isolated high-rise developments		A	B	C
(iii) Urban area		B	C	C
(iv) Area other than above		B	B	C

Notes:

'Country Park' means an area that is designated as a country park pursuant to section 14 of the *Country Parks Ordinance*.

'Directly Affected' means that the NSR is at such a location that noise generated by the IF is readily noticeable by the NSR and is a dominant feature of the noise climate of the NSR.

'Indirectly Affected' means that the NSR is at such a location that noise generated by the IF, whilst noticeable at the NSR, is not a dominant feature of the noise climate of the NSR.

'Not Affected' means that the NSR is at such a location that noise generated by the IF is not noticeable at the NSR.

'Urban Area' means an area of high density, diverse development including a mixture of such elements as industrial activities, major trade or commercial activities and residential premises.

Construction Noise

- 3.11 There are no statutory criteria for noise from construction work other than percussive piling generated during the daytime hours of 07:00-19:00, Monday to Saturday, excluding public holidays. However, EPD normally recommends 75 dB(A) $L_{eq}(30 \text{ min})$ as the acceptable noise level during daytime hours at the facade of residential sensitive receivers and 70 dB(A) at schools (65 dB(A) during examinations) as outlined in the ProPECC paper (PN 2/93) on *Noise from Construction Activities - Non-Statutory Controls*.
- 3.12 Noise restrictions are imposed during the evenings (19:00-23:00), night-time (23:00-07:00) and all day on Sunday and public holidays. For construction activities during these hours, a Construction Noise Permit (CNP) is required from the Environmental Protection Department (EPD). The CNP application will be assessed in accordance with the Basic Noise Levels (BNLs) given in the *TM on Noise from Construction Works other than Percussive Piling* and *Noise from Construction Works within Designated Area*, as shown in Tables 3.2 and 3.3.

Table 3.2
Basic Noise Levels for General Construction Noise (dB(A))

Time Period	ASR	A	B	C
All days during the evening (19:00-23:00), and general holidays (including Sundays) during the daytime and evening (07:00-23:00)		60	65	70
All days during the night-time (23:00-07:00)		45	50	55

Table 3.3
**Basic Noise Levels for Construction Noise
due to Specified Equipment and Processes (dB(A))***

Time Period	A	B	C
All days during the evening (19:00-23:00), and general holidays (including Sundays) during the daytime and evening (07:00-23:00)	45	50	55
All days during the night-time (23:00-07:00)	30	35	40

- * Specified equipment include: hand held breakers, concrete lorry mixers, dump trucks, concrete vibrators, bulldozers.
Specified processes include: erection or dismantling of formwork or scaffolding, loading and unloading or of rubbles, wooden blocks, steel bars, wood or scaffolding material and hammering.

- 3.13 Noise criteria applied to control the noise from percussive piling is detailed in the *TM on Noise from Percussive Piling*. Any percussive piling requires a CNP from

EPD. When considering the issue of a CNP, EPD compares the corrected noise level (CNL) with the Acceptable Noise Level (ANL) for the area. Table 3.4 shows the ANLs for percussive piling.

Table 3.4
Acceptable Noise Levels for Percussive Piling

NSR Window Type or Means of Ventilation		ANL (dB(A))
(i)	NSR (or part of NSR) with no windows or other openings	100
(ii)	NSR with central air conditioning system	90
(iii)	NSR with windows or other openings but without central air conditioning system	85

Note: 10 dB(A) is deducted from the ANLs shown above for NSRs such as hospitals, medical clinics, education and other NSRs considered to be particularly sensitive to noise.

- 3.14 The CNL relates to the tonality, impulsiveness and intermittency of the noise. In the event that the CNL exceeds the ANL, EPD will impose restrictions on the permitted hours of piling operation in accordance with Table 3.5.

Table 3.5
Permitted Hours of Percussive Piling Operation

Amount by which CNL exceeds ANL	Permitted hours of operation on any day not being a general holiday
more than 10 dB(A)	08:00-09:00 and 12:00-13:00 and 17:00-18:00
between 1 dB(A) and 10 dB(A)	08:00-09:30 and 12:00-14:00 and 16:30-18:00
no exceedance	07:00-19:00

- 3.15 The information required in an application for a CNP includes:
- (i) a map (preferably 1:1000 scale) showing precise details of the site location, site limits and nearby noise sensitive receivers, e.g. residential buildings, schools, hospitals;
 - (ii) location of any stationary powered mechanical equipment on site or, in the case of an application for a percussive piling permit, the piling zone or actual pile locations;

- (iii) details of time period (time of day, duration in days/weeks/months) for which the CNP is required;
 - (iv) a description, including two photographs and identification codes, and number of units of each item of powered mechanical equipment to be used or, in the case of piling, details of the piling method and pile type including number of units;
 - (v) details of any particularly quiet items of equipment or piling methods, special noise control measures to be employed on site, or any other information thought to be relevant.
- 3.16 During daytime works, EPD recommends that the advice in EPD's *Practice Note ProPECC PN2/93* on construction noise abatement practice is followed.

Operational Noise

- 3.17 HKPSG states that noise levels from a new fixed source should be 5 dB(A) below the relevant ANL presented in the *TM on The Assessment of Noise from Places other than Construction Sites, Domestic Premises or Public Places* or the prevailing background noise level, whichever is lower. The ANL from the TM for a given NSR is presented in dB(A) in Table 3.6 below.

Table 3.6
Acceptable Noise Levels during Operations

Time Period	ASR	A	B	C
Day (07:00-19:00) and Evening (19:00-23:00)		60	65	70
Night (23:00-07:00)		50	55	60

Air Quality

- 3.18 The principal legislation regulating air emissions in Hong Kong is the *Air Pollution Control Ordinance (APCO) [Cap 311]* of 1983 and its subsidiary regulations. Technical Memoranda have been issued on:
- (i) *Specifying Air Quality Objectives for Hong Kong* (Table 3.7);
 - (ii) *Issuing Air Pollution Abatement Notices to Control Air Pollution from Stationary Pollution Processes*.

Other subsidiary regulations issued are as follows:

- A1 - Furnaces, Ovens and Chimneys (Installation and Alteration) Regulations.
- B1 - Dust and Grit Emission Regulations.
- C1 - Smoke Regulations.
- D1 - Appeal Board.
- E1 - Air Control Zones (Declaration and Consideration) Order.
- F1 - Specified Processes.
- G1 - Specification of Required Particulars and Information.
- H1 - Consolidation Statement of Air Quality Objectives.
- I1 - Fuel Restriction
- J1 - Vehicle Design Standards (Emission) Regulations.

The whole of the Territory has been divided into Air Control Zones.

- 3.19 HKPSG states that "Air quality is affected by such factors as the emission rate of air pollutants, the separation distance between emission sources and receptors, topography, height and width of buildings as well as meteorology."
- 3.20 New environmental legislation entitled *Air Pollution Control (Construction Dust) Regulations* is currently under consultation. These regulations are to control the dust emission from construction sites by a notification and permit procedure.

Table 3.7
Air Quality Objectives

Pollutant	Concentration (µg/m³)					Health effects of pollutant at elevated ambient levels
	Average Time					
	1hr ¹	8hrs ²	24hrs ²	3mths ³	1yr ³	
Sulphur Dioxide	800		350		80	Respiratory illness; reduced lung function; morbidity and mortality rates increase at higher levels.
Total Suspended Particulates (TSP)	500 ⁴		260		80	Respirable fraction has effects on health.
Respirable Suspended Particulates ⁵ (RSP)			180		55	Respiratory illness; reduced lung function; cancer risk for certain particles; morbidity and mortality rates increase at higher levels.
Nitrogen Dioxide	300		150		80	Respiratory irritation; increased susceptibility to respiratory infection; lung development impairment.
Carbon Monoxide	30000	10000				Impairment of co-ordination; deleterious to pregnant women and those with heart and circulatory conditions.
Photochemical Oxidants as ozone	240					Eye irritation; cough; reduced athletic performance; possible chromosome damage.
Lead				1.5		Affects cell and body processes; likely neuro-psychological effects, particularly in children; likely effects on rates of incidence of heart attacks, strokes and hypertension.

Notes: Concentrations measured at 298°K (25°C) and 101.325 kPa (one atmosphere)

- 1 Criteria not to be exceeded more than 3 times per year
- 2 Criteria not to be exceeded more than once per year
- 3 Arithmetic means
- 4 There is no exceedance allowance for 1 hr TSP. This figure is used as a target level for limiting fugitive dust emissions generated by construction activities.
- 5 Suspended particles in air with a nominal aerodynamic diameter of 10 μm or smaller

Construction Dust

- 3.21 During the construction phase of the project, an hourly average TSP limit of 500 $\mu\text{g}/\text{m}^3$ is recommended by EPD for assessing construction dust impacts. This limit is not statutory, but nonetheless has been used in many construction works in Hong Kong as a contractual requirement.
- 3.22 The HKPSG recommends that any open storage areas should be located at least 100 m from any air sensitive receiver.

Odour

- 3.23 There is no current legislation for odour. The evaluation and measurement of odour is both subjective and fraught with technical difficulties.
- 3.24 The Brief states that:
- "In case of odour impact from pumping station and treatment works, any odour prediction at a receptor equal to or exceeding 5 odour units based on a prediction averaging time of five seconds shall be considered an indication of odour nuisance. For odour monitoring, the odour strength should not exceed two units at the site boundary."
- 3.25 An odour level of 2 is assumed to equate to a Dilution Factor of 2, which means that the odour must not exceed a level twice that of its detection threshold.
- 3.26 Odour intensities for other construction contracts in Hong Kong¹ have been categorised into the classes shown in Table 3.8.

¹ Contract No. EP/SP/21/94, West Kowloon Transfer Station Tender Documents (December 1994) ERM Hong Kong *et al* for Environmental Protection Department.

Table 3.8
Odour Intensity Categorisation

Odour Units	Category	Description
0	Not detected	No odour perceived or an odour so weak that it can not be readily characterised or described
1	Slight	Slightly identifiable odour
2	Moderate	Moderately identifiable odour
3	Strong	Strongly identifiable odour
4	Extreme	Extremely identifiable odour

Water Quality

- 3.27 The principal legislation for controlling water pollution in Hong Kong is the *Water Pollution Control Ordinance (WPCO)* [Cap 358] of 1981 which allows for gazettal of Water Control Zones (WCZ) within which the discharge of liquid effluents and the deposit of matter into any water bodies, public sewers and drains are controlled. The WPCO is applicable for construction site discharges as well as for discharges during the operational phase.
- 3.28 The Water Control Zone for Victoria Harbour falls into Phase III which was declared on 1 April 1996.
- 3.29 The water quality objectives for Victoria Harbour (Phase III) WCZ have been published in L.S. No. 2 to Gazette No. 7/1996 (L.N. 83 of 1996). The water quality objectives for Victoria Harbour (Phase III) WCZ are set out in Table 3.9.

Table 3.9
Statement of Water Quality Objectives
(Victoria Harbour (Phase III) Water Control Zone)

Water Quality Objective	Part or Parts of Zone
A. AESTHETIC APPEARANCE	
(a) There should be no objectionable odours or discolouration of the water.	Whole zone
(b) Tarry residues, floating wood, articles made of glass, plastic, rubber or of any other substances should be absent.	Whole zone
(c) Mineral oil should not be visible on the surface. Surfactants should not give rise to a lasting foam.	Whole zone
(d) There should be no recognisable sewage-derived debris.	Whole zone
(e) Floating, submerged and semi-submerged objects of a size likely to interfere with the free movement of vessels, or cause damage to vessels, should be absent.	Whole zone
(f) The water should not contain substances which settle to form objectionable deposits.	Whole zone
B. BACTERIA	
The level of <i>Escherichia coli</i> should not exceed 1,000 per 100 mL, calculated as the geometric mean of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days.	Inland waters
C. COLOUR	
Human activity should not cause the colour of water to exceed 50 Hazen units.	Inland waters
D. DISSOLVED OXYGEN	
(a) The level of dissolved oxygen should not fall below 4 mg per litre for 90% of the sampling occasions during the whole year; values should be calculated as the annual water column average (see Note). In addition, the concentration of dissolved oxygen should not be less than 2 mg per litre within 2 m of the seabed for 90% of the sampling occasions during the whole year.	Marine waters
(b) The level of dissolved oxygen should not be less than 4 mg per litre.	Inland waters
E. pH	
(a) The pH of the water should be within the range of 6.5-8.5 units. In addition, human activity should not cause the natural pH range to be extended by more than 0.2 unit.	Marine waters
(b) Human activity should not cause the pH of the water to exceed the range of 6.0-9.0 units.	Inland waters
F. TEMPERATURE	
Human activity should not cause the daily temperature range to change by more than 2.0°C.	Whole zone
G. SALINITY	
Human activity should not cause the salinity level to change by more than 10%.	Whole zone
H. SUSPENDED SOLIDS	
(a) Human activity should neither cause the suspended solids concentration to be raised more than 30% nor give rise to accumulation of suspended solids which may adversely affect aquatic communities.	Marine waters
(b) Human activity should not cause the annual median of suspended solids to exceed 25 mg per litre.	Inland waters
I. AMMONIA	
The un-ionized ammoniacal nitrogen level should not be more than 0.021 mg per litre, calculated as the annual average (arithmetic mean).	Whole zone

Table 3.9
Statement of Water Quality Objectives
(Victoria Harbour (Phase III) Water Control Zone) (cont'd)

Water Quality Objective	Part or Parts of Zone
J. NUTRIENTS	
(a) Nutrients should not be present in quantities sufficient to cause excessive or nuisance growth of algae or other aquatic plants.	Marine waters
(b) Without limiting the generality of objective (a) above, the level of inorganic nitrogen should not exceed 0.4 mg per litre, expressed as annual water column average (see Note).	Marine waters
K. 5-DAY BIOCHEMICAL OXYGEN DEMAND	
The 5-day biochemical oxygen demand should not exceed 5 mg per litre.	Inland waters
L. CHEMICAL OXYGEN DEMAND	
The chemical oxygen demand should not exceed 30 mg per litre.	Inland waters
M. TOXIC SUBSTANCES	
(a) Toxic substances in the water should not attain such levels as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms, with due regard to biologically cumulative effects in food chains and to interactions of toxic substances with each other.	Whole zone
(b) Human activity should not cause a risk to any beneficial use of the aquatic environment.	Whole zone

Note: Expressed normally as the arithmetic mean of at least 3 measurements at 1 m below surface, mid depth and 1 m above the seabed. However in water of a depth of 5 m or less the mean shall be that of 2 measurements (1 m below surface and 1 m above seabed), and in water of less than 3 m the 1 m below surface sample only shall apply.

3.30 The *TM on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* was issued in 1991. Under the provisions of this TM, all discharges must be licensed. Tables included within the document identify standards related to effluent flow rates ranging from <10 m³/day to 6,000 m³/day, providing guidance on a case-by-case basis. To illustrate this, standards for selected discharges to the inshore waters of Victoria Harbour Water Control Zones are shown in Table 3.10.

Construction Site Discharges

3.31 Advice on the handling and disposal of construction site discharges, including site runoff and contaminated wastewaters, is provided in the ProPECC Paper (PN1/94) on *Construction Site Drainage*.

Waste Oil

3.32 The disposal of waste oil and other chemicals is controlled by the regulations for chemical waste control under the Waste Disposal Ordinance. Waste oil and other chemicals must be disposed of at the Government Chemical Waste Treatment Centre at Tsing Yi.

Table 3.10
Standards for Effluents discharged into the Inshore Waters¹
of Victoria Harbour WCZ

Flow rate (m ³ /day) Determinant	≤10	>10 to ≤200	>1000 to ≤1500	>3000 to ≤4000	>5,000 to ≤6,000
pH (pH units)	6-9	6-9	6-9	6-9	6-9
Temperature (°C)	40	40	40	40	40
Colour (lovibond units) (25 mm cell length)	1	1	1	1	1
Suspended solids	50	30	30	30	30
BOD	50	20	20	20	20
COD	100	80	80	80	80
Oil & Grease	30	20	20	20	20
Iron	15	10	2.7	1	0.6
Boron	5	4	1.1	0.4	0.2
Barium	5	4	1.1	0.4	0.2
Mercury	0.1	0.001	0.001	0.001	0.001
Cadmium	0.1	0.001	0.001	0.001	0.001
Other toxic metals individually	1	1	0.25	0.1	0.1
Total toxic metals	2	2	0.5	0.2	0.1
Cyanide	0.2	0.1	0.05	0.02	0.01
Phenols	0.5	0.5	0.13	0.1	0.1
Sulphide	5	5	2.5	1	0.5
Total residual chlorine	1	1	1	1	1
Total nitrogen	100	100	80	50	50
Total phosphorus	10	10	8	5	5
Surfactants (total)	20	15	10	10	10
<u>E Coli</u> (count/100 ml)	5000	5000	5000	5000	5000

Note: All units in mg/L unless otherwise indicated; all figures are upper limits unless otherwise indicated
1 "Inshore waters" means all coastal waters where the water depth is less than 6 m at mean low tide, or that are within 200 m of the mean low water mark, whichever position is further from the shore.

Ecology

Country Parks and 'Special Areas'

- 3.33 Country Parks are areas designated under the *Country Parks Ordinance [Cap 208]* of 1976 for provision of informal outdoor recreation and conservation of landscape, wildlife and historical features. 'Special Areas' of Government land may be gazetted for "the safeguarding of botanical, zoological, landscape and/or historical significance" under the *Country Park Special Areas Regulations* (1989). No new developments can be carried out in Country Parks and Special Areas without the approval of the Director of Agriculture and Fisheries. It should be noted that although the Tai Tam Country Park lies within the Study Area, it will not be affected by any of the proposed works.

Conservation

- 3.34 There are various legislative and regulatory controls in place for the conservation of species and protection of the environment. Table 1.2 from *HKPSG's Chapter 9: Environment* highlights "ecologically sensitive areas such as Sites of Special Scientific Interest (SSSI) and areas with other particular vegetation and wildlife habitat characteristics" as Environmental Factors influencing Land Use Planning. The various legislative, regulatory and landuse planning controls for conservation are set out in Section 3 of *HKPSG's Chapter 10: Conservation*.
- 3.35 The *HKPSG* also highlight the need for care to be taken in planning and implementation of civil engineering construction works to avoid, minimise or ameliorate the occurrence of pollution from silt, oil and other sources on water bodies in unspoilt areas designated for conservation and in SSSI. Planning protection will be provided under the *Town Planning Ordinance [Cap 131]*.

Wild Animals

- 3.36 Wild animals are protected by the *Wild Animals Protection Ordinance [Cap 170]* (1980), which fall under the Authority of the Director of Agriculture and Fisheries. The latest version of Cap 170 is the Second Schedule of the *Wild Animals Protection Ordinance [Cap 170]* which was revised in 1992. Protected wild animals listed under the Schedule include mammals, all wild birds, reptiles, amphibians and an insect.

Rare and Endangered Plant Species

- 3.37 Various species of plants are protected under the Forestry Regulations of the *Forestry and Countryside Ordinance [Cap 96]* (1950) and *Animals and Plants (Protection of Endangered Species) Ordinance [Cap 187]* (1976). The *Forestry and Countryside Ordinance [Cap 96]* and *Forestry Regulations [Cap 96 Sub. leg. A]* were revised in 1993. The *Animals and Plants (Protection of Endangered Species) Ordinance [Cap 187]* has been revised in 1995.

Tree Preservation

- 3.38 *Works Branch Technical Circular 24/94 (Planning, Environment and Lands Branch Circular 3/94) on Tree Preservation* states that:

"The need to preserve trees must be borne in mind particularly by those in charge of engineering, architectural and landscape projects There are many projects such as ... service reservoirs, formation works and the like where virtually all trees and shrubs within the works area boundary may have to be destroyed. In these cases care should be taken to minimise the extent of the works area and thereby maximise the number of trees to be preserved."

- 3.39 According to *Lands Administration Office Instruction Section D-12 on Tree Preservation*, Government projects in particular should make "every effort to preserve as many trees as possible and in general, permission to lop or cut down any tree will not be granted unless good cause is shown". Agriculture and Fisheries Department keeps the *Register of Unusual Trees*.

Solid Waste

- 3.40 Disposal of chemical, household, street, trade and livestock waste is controlled by the *Waste Disposal Ordinance [Cap 354]* of 1980. This legislation covers all aspects of the production, storage, collection and disposal, including the treatment, reprocessing and recycling of waste. In 1989, the formulation of a strategic Waste Disposal Plan for Hong Kong was founded on this legislation.
- 3.41 Construction waste generated during the construction phase should be sorted on site into inert and non-inert fraction for reuse and recycling as far as practical. Non-inert fraction containing no more than 20% by volume of inert content can be disposed of at landfills, whilst the inert fraction should be delivered to public dumps or other reclamation sites. Inert material means soil, rock, asphalt, concrete, brick, cement plaster/mortar, building debris, aggregates, etc.

- 3.42 Handling and disposal of chemical wastes including oils and grease are covered by the Waste Disposal (Chemical Waste) (General) Regulations. Design of oil/fuel storage facilities is covered by the *Code of Practice for Oil Storage Installations*, 1992 issued by the Building Authority and the handling of chemical spillages on land is regulated by the Fire Services Department.
- 3.43 The guideline ProPECC 3/94 *Contaminated Land Assessment and Remediation* has been prepared by EPD to recommend ways in which to dispose of contaminated land.
- 3.44 Dredging and dumping for land formation is controlled under the *Foreshore and Sea Bed (Reclamations) Ordinance [Cap 127]* (1985) and the *Dumping at Sea [Cap. 466]* respectively. The former provides for the control of reclamation and use of foreshore and seabed. The latter prohibits dumping at sea without a licence.

Road Excavation

- 3.45 Excavation in unleased lands, which includes the public road network, are controlled by the *Crown Lands Ordinance [28]* (1972).
- 3.46 Section 8 of the Ordinance stipulates that "a person shall not make or maintain any excavation in unleased land, except under and in accordance with an excavation permit issued under this section" and that "the Authority may issue an excavation permit authorizing the making of excavations in unleased land".
- 3.47 According to the Crown Lands Ordinance, the Highways Department is the Controlling Authority for the Issuing of Excavation Permits within the public highway network.
- 3.48 The Conditions of Permit, which are intended to reduce disruption to the public, cover the following areas:
- (i) specifications for the works including backfilling and reinstatement;
 - (ii) safety requirements;
 - (iii) inconvenience minimisation;
 - (iv) reprovision of vehicular and pedestrian facilities;
 - (v) environmental controls of site noise and cleanliness;

- (vi) general obligations including the cover to services;
- (vii) care of existing services; and
- (viii) notification of excavation proposals to other concerned parties.

Each permit stipulates an expiry date.

- 3.49 Road openings are not permitted on newly completed or reconstructed roads for a given period of time. The normal restriction period on newly completed or reconstructed roads is 5 years for carriageways and 1 year for footways after completion of Works. A restriction period of 1 year is also applicable for newly resurfaced flexible roads.
- 3.50 The opening restrictions are strictly applied and are not lifted except under exceptional or emergency circumstances. If a utility undertaker wishes to lay services during the restriction period, it will have to choose an alternative routing where there is no restriction or to employ no-dig construction techniques.

4 LAND USE, ECOLOGY AND SENSITIVE RECEIVERS

Introduction

- 4.1 The purpose of this section is to review current land use and potential changes in land use in the Study Area, to identify sensitive receivers and potential impacts on ecology.
- 4.2 The land use, population and employment assumptions of the SMP Study are presented in SMP Discussion Paper No. 3 *Population and Land Use*¹. These assumptions have been updated in the Draft Adoptive Review Report for the Wan Chai East & North Point Sewerage Project (September 1995).

Existing Land Use

- 4.3 The Study Area is very varied (see Figure 1.1). It consists broadly of a section of Victoria Harbour, a strip of highly developed land on the north coast of the island, which runs east-west, with marine frontage on the Harbour, moving southwards through residential areas which become progressively less developed, rising up to rural areas including Tai Tam Country Park.
- 4.4 The major elements and features of the area which set the environmental context include:
- (i) The waterfront working areas such as the Wan Chai and North Point ferry piers, the cargo working and paper recycling areas and Causeway Bay Typhoon Shelter, which also serves as a marina.
 - (ii) The Cross Harbour Tunnel and the Eastern Harbour Crossing which attract traffic travelling to and from Tsim Sha Tsui and Kowloon.
 - (iii) A road network which includes a local network as well as strategic routes carrying through traffic along the Island East Corridor and from the south of the Island through the Aberdeen Tunnel.
 - (iv) Busy commercial and business areas including offices, hotels, conference facilities, shops and restaurants.
 - (v) Small scale industrial areas including workshops, garages, and furniture and other miscellaneous manufacturing units.

¹ Agreement No. CE 2/92, *Wan Chai East & North Point Sewerage Master Plan Study Discussion Paper No.3: Population and Land Use* (undated) Acer/John Taylor *et al* for Environmental Protection Department.

- (vi) Densely populated residential areas many of which are high-rise such as those in North Point and around Happy Valley.
 - (vii) Noise sensitive areas including churches, schools, hospitals and a proposed hospital unit.
- 4.5 The Study Area is very busy and crowded throughout the week with many people visiting the main shopping areas in Causeway Bay. It is therefore extremely sensitive to traffic hold ups and disruption. There are a number of sports and recreation facilities such as Happy Valley Race Course, Victoria Park and the Hong Kong Stadium. These venues host regular public events and traffic disruption during these would be a major problem².
- 4.6 As indicated in Section 2, the Study Area can be divided into two distinct geographical areas, or basins: Wan Chai East sewerage basin and North Point sewerage basin.

Wan Chai East

- 4.7 The Wan Chai East sewerage basin includes the districts of Wan Chai East, Causeway Bay, Morrison Hill, Happy Valley, So Kon Po, Leighton Hill and Caroline Hill. Figure 4.1 shows the existing and future land uses in the Wan Chai East area.
- 4.8 The basin covers an area of approximately 7 sq.km, with a population of around 125,000. The majority of the resident population is located in the lowland coastal areas of Wan Chai and Causeway Bay. The basin contains mainly residential developments, with some commercial developments in the north-west of the basin. Much of the land adjacent to the Harbour has been gained by reclamation and is consequently flat. The area has been redeveloped extensively over the last decade and is presently characterised by the intermixture of domestic and commercial developments.

² Agreement No. CE 2/92, Wan Chai East & North Point Sewerage Master Plan Study: Environmental Review - Final Report (March 1995) Acer/John Taylor for Environmental Protection Department.

- 4.9 Much of the development in Wan Chai continues to be a mixture of commercial and residential uses, with high rise office buildings and residential tower blocks, concentrating mainly in the northern reclamation areas. Causeway Bay, in the east of the basin, is noted for its restaurants and extensive shopping facilities, and is continuing to develop along similar lines to Wan Chai as the demand for office and commercial space spreads eastwards from Central and Wan Chai. To the south of these areas, around Happy Valley and Jardine's Lookout, private developments predominate. The Morrison Hill area comprises commercial/residential developments but is largely given over to Government/Institutional and Community (G/IC) uses such as schools, hospitals and recreational areas.
- 4.10 The majority of residential developments in the lowland areas are classed as R1, the most dense form of housing, with R2 and R3 developments in Happy Valley and on the slopes towards Tai Hang and Jardine's Lookout.
- 4.11 The Study Area also includes numerous, recreational open spaces, both Urban Council and private. These include Happy Valley, Victoria Park, So Kon Po Recreation Ground and the Government Stadium.
- 4.12 Noise levels and air quality in the lowland areas are influenced by heavy road traffic. Away from the Harbour front, there are fewer major transport corridors, consequently, the overall density of road traffic is not as high and this leads to generally lower ambient noise levels and improved air quality.

North Point

- 4.13 The North Point basin covers an area of approximately 5 sq.km, and has a population of some 237,000 people. The area contains mainly residential developments, with a small proportion of commercial and industrial developments. Existing and future land uses identified in the area are shown in Figure 4.2.
- 4.14 The industrial development in the Study Area is concentrated in and around Quarry Bay, although it is not as dense as some other areas of Hong Kong. Housing is generally R1 type, the most dense; developments of R2 and R3 residential areas located on the hill slopes of Braemar Hill. There are two public housing estates located in the basin and a private sector scheme to the west of Kornhill.
- 4.15 A high proportion of the proposed works are located in the heart of the business and commercial areas of Wan Chai and North Point, so the potential for short-term disruption to the area is high.

- 4.16 The SMP programme envisaged construction of all works to be completed by the end of 2002. The revised project programme schedules completion of all works for October 2001.

Future Land Use

- 4.17 The SMP Study generally adopts the zonings of the Outline Zoning Plans (OZPs), and Outline Development Plans (ODPs) in deriving land use assumptions. The planning data derived from these sources has been supplemented by information from relevant Government departments and related documents.
- 4.18 The following committed projects were identified in addition to commitments already identified in plans:
- (i) residential development at Woodside;
 - (ii) commercial development on six sites in Wan Chai, Causeway Bay and Quarry Bay;
 - (iii) hotel developments on five sites, comprising 1,318 rooms;
 - (iv) comprehensive development on the eastern part of Central and Wan Chai Reclamation; and
 - (v) clearance of 19 squatter areas and one cottage area.
- 4.19 At the time of the SMP study, there was no confirmed planning intention for the after-use of the ex-quarry at Mount Butler.
- 4.20 Land use changes since the issue of the SMP Discussion Paper No. 3 have been identified from:
- (i) OZP amendments;
 - (ii) approved Section 16 applications; and
 - (iii) meetings and discussions with the District Planning Officer, Housing Department, Hospital Authority and Urban Services Department.

Residential

- 4.21 Most residential sites within the Study Area are expected to remain in their existing use. However, the plot ratios of some of these uses may increase in the long term through private redevelopment. Such redevelopment usually results in an increase of population on individual sites. The Territorial Development Strategy includes a nominal allowance for redevelopment in the base growth data, but does not attempt to quantify specific redevelopments unless these are large and committed.
- 4.22 In addition to redevelopment within the residential category, large-scale residential development projects have been identified on four sites which are currently used for non-residential uses. The details of these projects are presented in Table 4.1.

Table 4.1
Large-scale Residential Development Projects within the Study Area
not identified in the SMP Study

Location	Existing Use	Details of Development (m ²)
Caroline Hill, Causeway Bay	E&MSD workshop	Private, GFA=55,660
Electric Road, North Point	GSD Warehouse	Private, GFA=49,240
Tsat Tsz Mui Road, North Point	Vacant Bus Depot	Private, 784 flats
Woodside, Quarry Bay	Vacant	HOS, 1,750 flats

- 4.23 The clearance of squatters and cottage areas mentioned in SMP Discussion Paper No. 3 has progressed to programme. Owing to topographical constraints, no large-scale development is expected on these sites after clearance. Therefore, the SMP assumptions remain valid.
- 4.24 It is proposed that 90 houses will be built on the ex-quarry site at Mount Butler.

- 4.25 The planned uses on that part of the Central and Wan Chai Reclamation which lies adjacent to the Study Area have remained almost unchanged since the completion of the SMP Study. The proposals are mainly for commercial and residential development as well as some community facility provision.
- 4.26 A redevelopment scheme by the Land Development Corporation on Wan Chai Road/Tai Yuen Street was gazetted on 19 May 1995. Since the site is just outside the Study Area, the scheme was not directly considered by this review.
- 4.27 There will be substantial redevelopment of the Leighton Hill area. Under the Woodside Development, there will be about 1,750 flats and an expected population of 5,700 for the Home Ownership Scheme. A similar number of flats are expected for Sandwich Class Housing.

Commercial

- 4.28 With Hong Kong emerging as an international business and tourist centre, there is a trend towards commercial development in many parts of the Territory. Commercial development in the Study Area is mainly along the MTR line with nodes of concentration around stations at Wan Chai, Causeway Bay and Quarry Bay. This commercial development is mainly in the form of office and retail complexes. Some hotels also exist at these nodes. Previously, some of these sites have been used as flattened factories, domestic buildings, G/IC facilities, hotels or theatres.
- 4.29 Details of major commercial development projects within the Study Area not considered by SMP Discussion Paper No. 3 and their gross floor area (GFA) are shown in Table 4.2.

Government Facilities

- 4.30 Two new Government facilities are proposed including the redevelopment of the Causeway Bay Police Station site and the proposed new Oil Street Government offices near the North Point Police Station.

Industrial

- 4.31 The trend of relocating local factories to South China and Asia Pacific Rim countries has caused a reduction in manufacturing industry floorspace within the Study Area. Many industrial sites have been converted into commercial use through Section 16 approvals. Among the 11 commercial development projects mentioned in Table 4.2, five were previously used for industrial purposes. They are concentrated in North Point (near the junction of King's Road and Healthy Street East) and Quarry Bay (around Taikoo Place and Westlands Road).

Table 4.2
Major Commercial Development in the Study Area
not identified in SMP Study

Location	Previous Use	Proposed Total Non-Domestic GFA (m ²)
Lee Theatre, Causeway Bay	Theatre	29,331
Lee Gardens, Causeway Bay	Office and hotel	83,822
179-205, Electric Road & 1-27, Wang On Road	Residential	47,605
Electric Road	Warehouse of GSD	61,000
14 Fortress Hill Road, Fortress Hill	Residential & GIC	90,363
Tsat Tsz Mui Road, North Point	Bus Depot	59,738
625, King's Road, North Point	Industrial	27,871
633-635, King's Road	Industrial	24,132
661-665, King's Road	Industrial	51,060
Taikoo Place, Quarry Bay*	Industrial	62,355
25, Westlands Road, Quarry Bay	Industrial	34,950
	Total	572,227

Notes: 61,000 estimated figure

* including redevelopment of SCMP Building

Other developments

Public Markets

- 4.32 There will be a new public market in the Study Area in addition to the ten mentioned in the SMP Study. This will be located in Sun Chun Street at Tai Hang.

Hospitals

- 4.33 No new hospitals are planned within the Study Area. However a Section 16 application for an extension of Hong Kong Sanatorium and Hospital was recently approved. The proposed GFA of the extension is 3,857 m². The extension will primarily be used as x-ray and operation rooms. No floorspace is reserved for in-patients.

Sensitive Receivers

- 4.34 *Hong Kong Planning Standards and Guidelines (HKPSG)* identifies the land uses categorised in Table 4.3 as sensitive to noise, air and water pollution. Additional air sensitive uses have been identified in the *TM for Issuing Air Pollution Abatement Notices to Control Air Pollution from Stationary Polluting Processes*.

Table 4.3
Noise, Air and Water Sensitive Uses¹

Uses	Noise Sensitive	Air Sensitive	Water Sensitive
All domestic premises including temporary housing accommodation	✓	✓	
Hotels and hostels	✓	✓	
Offices	✓	✓	
Factory		✓	
Shop, shopping centre		✓	
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	✓	✓	
Places of public worship and courts of law	✓	✓	
Hospitals, clinics, convalescences and homes for the aged - diagnostic rooms - wards	✓	✓	
Amphitheatres, and auditoria, libraries, performing arts centres and Country Parks	✓	✓	
Active recreational areas		✓	
Bathing waters and other contact recreational facilities			✓
Aquaculture and fisheries			✓
Agriculture			✓
Typhoon shelters, marinas and boat parks			✓
Water gathering grounds			✓
Nature reserves and Sites of Special Scientific Interest			✓

Notes:

- ¹ Uses as defined in *HKPSG Chapter 9: Environment* and the *TM for Issuing Air Pollution Abatement Notices to Control Air Pollution from Stationary Polluting Processes*.

- 4.35 The improvement works will consist of a limited number of major facilities and an extensive programme of sewer reconstruction. The major environmental effects will arise from the sewer reconstruction works. Most of the sewer reconstruction will be located on existing roads and be close to environmentally sensitive uses.
- 4.36 The environmental effects of these works can be characterised as involving short term and localised effects. The severity of the effects will be determined by the nature of the sensitive uses in any particular locality. Some of the works will take place in predominantly industrial areas and this reduces the potential for adverse impacts. Practicable measures have been identified during the EIA Study to mitigate those situations where impacts are likely to be severe.
- 4.37 We have based our identification and classification of the sensitive uses/receivers in the Study Area likely to be affected by the sewerage rehabilitation works on those selected in the SMP Study Environmental Review³. The worst affected noise sensitive receivers are restricted to the first two rows of buildings on either side of the construction works. The sensitive receivers are listed in Tables 4.4 and 4.5 and can be identified in Figures 4.1 and 4.2. The location and characteristics of the sensitive receivers have been reassessed during our field work in the Wan Chai East and North Point areas, the latest information on the completion of advance works, and further data on construction method.

³ Agreement No. CE 2/92, Wan Chai East & North Point Sewerage Master Plan Study: Environmental Review - Final Report (March 1995) Acer/John Taylor for Environmental Protection Department.

Table 4.4
Summary of the Sensitive Receivers in Wan Chai East Basin

Location	Description of sensitive receivers	Abundance	Method of sewer construction
Gloucester Road	<ul style="list-style-type: none"> - High rise commercial/residential buildings - Mixture of old/new style buildings - Busy traffic - Very noisy and dusty 	Very few	Trenchless/Open cut
Percival Street	<ul style="list-style-type: none"> - Mixture of high/low rise buildings - High background noise levels 	Few	Trenchless/shallow tunnel/refurbishment/open cut
Jaffe Road and Canon Street	<ul style="list-style-type: none"> - Mixture of high rise commercial and residential buildings - Lies within shopping area in Causeway Bay - Busy traffic - High background noise levels 	Many	Open cut
Tung Lo Wan Road	St. Paul Convent School St. Paul's Hospital St. Mary Church Residential <ul style="list-style-type: none"> - Cathay Mansion - Both school and hospital are 7 storeys - Residential building is 12 storeys - Background noise is not high 	Medium	Open cut
Eastern Hospital Road	So Kon Po Recreation Ground Tung Wah Eastern Hospital Buddhist Wong Fung Ling College & Buddhist Wong Cheuk Um Primary School TWGH School and Eye Hospital Sir Ellis Kadoorie School Chinese International School Ho Tung Technical School For Girls St. Mary's Church College Shing Kwong Church <ul style="list-style-type: none"> - 5 to 8 storeys buildings with set back - Low traffic flow - Quiet environment 	Medium	Open cut
Yee Wo Street	<ul style="list-style-type: none"> - High rise residential buildings - Noisy background 	Very few	Shallow tunnel
Hennessy Road	<ul style="list-style-type: none"> - High rise buildings - Very busy traffic - Noisy background 	Medium	Open cut/shallow tunnel
Jardine's Bazaar	<ul style="list-style-type: none"> - 6 to 10 storeys old style residential buildings - High background noise levels 	Medium	Open cut
Pennington Street	<ul style="list-style-type: none"> - 3 storeys church - Low rise residential buildings - High background noise levels 	Medium	Open cut
Matheson Street	<ul style="list-style-type: none"> - 6 storeys high residential with shops on ground floor - Old style residential buildings - Noisy background 	Medium	Open cut
Sing Woo Street	<ul style="list-style-type: none"> - Mixture of modern high rise and very old low rise residential buildings - Busy traffic - Background noise levels are high 	Medium	Open cut

Table 4.4
Summary of the Sensitive Receivers in Wan Chai East Basin (cont'd)

Location	Description of sensitive receivers	Abundance	Method of sewer construction
Wong Nai Chung Road	<ul style="list-style-type: none"> Temple St. Paul's Primary Catholic School St. Paul's Secondary School Race Course Residential - 10 to 15 storeys - Quiet environment 	Many	Refurbishment only
Shan Kwong Road	<ul style="list-style-type: none"> - Quiet environment - High rise residential buildings - Low traffic flow 	Medium	Open cut
Tai Hang Road	<ul style="list-style-type: none"> True Light Middle School Residential - Background noise levels are high - Busy traffic 	Few	Open cut
Perkins Road	<ul style="list-style-type: none"> - High rise residential buildings - Quiet environment 	Few	Open cut
Russell Street	<ul style="list-style-type: none"> - 7 storeys high rise residential buildings with shops on the ground floor - Old style buildings - Noisy background 	Many	Open cut
Stubbs Road	<ul style="list-style-type: none"> Hong Kong Adventist Hospital Residential - Villa Monte Rosa - High rise buildings - Heavy traffic flow - High background noise levels 	Few	Open cut
Burrows Street	<ul style="list-style-type: none"> - A mixture of low and high rise residential buildings - High background noise levels 	Few	Open cut

Table 4.5
Summary of the Sensitive Receivers in North Point Basin

Location	Description	Abundance	Method of construction
Tung Lo Wan Road to Tong Shui Road	<ul style="list-style-type: none"> - High rise and new style residential buildings - Busy traffic - High background noise levels Belilios Public School	Medium	Open cut/Shallow trench/trenchless
Java Road (from Tong Shui Road to Tong Chong Road)	<ul style="list-style-type: none"> - Mixture of high/low rise residential buildings - Very busy traffic - Noisy environment Madam Chan Wai Chow Memorial School Hong Kong Funeral Home North Point Government School King's Road Playground	Few	Trenchless
Electric Road	<ul style="list-style-type: none"> - Temple located due east of Watson Road - High/low rise residential buildings - Mixture of old and new style buildings - Very busy traffic - Noisy environment Temple Fukien Middle School Public Library and Market Police Station Hotel <ul style="list-style-type: none"> - City Garden Hotel - Newton Hotel 	Medium	Trenchless
Java Road	<ul style="list-style-type: none"> - Comprises high/low rise residential buildings, public housing estate which are 11 storeys high and several playground and government institutions - Busy traffic - Noisy background. There are some industrial buildings in this area. 	Medium	Trenchless
Hoi Chak Street	<ul style="list-style-type: none"> - High rise residential buildings - Not very busy traffic - Fairly quiet environment Canossa College	Fairly few	Open cut
Hei Wo Street	<ul style="list-style-type: none"> - Old style low rise residential buildings - Not very busy traffic - Noisy environment 	Many	Open cut
Tong Shui Road	<ul style="list-style-type: none"> - Old style low rise residential buildings - Not very busy traffic - Noisy environment 	Many	Trenchless
Dragon Road	<ul style="list-style-type: none"> - Quiet environment Tin Hau Temple	Medium	Open cut

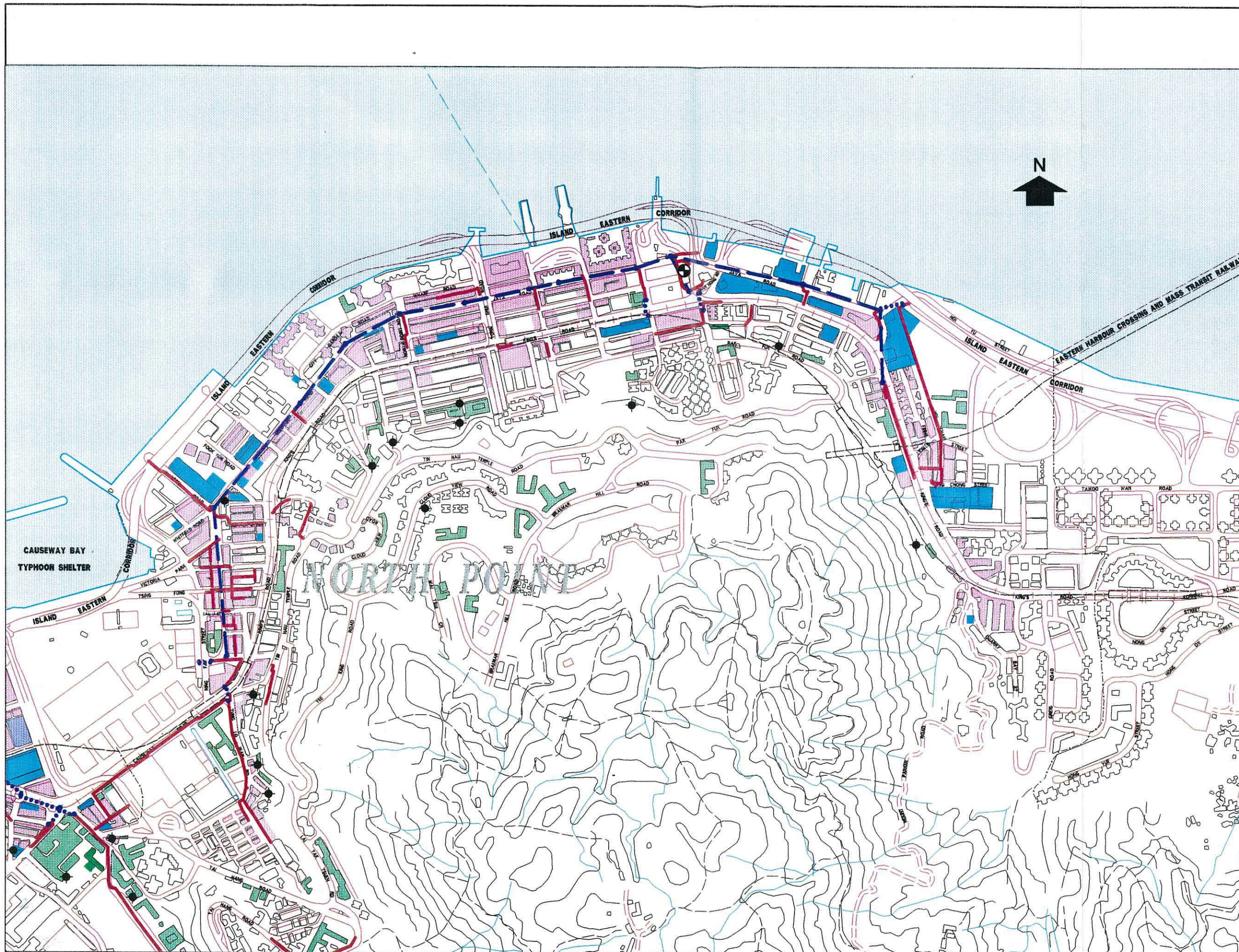
- 4.38 Causeway Bay Typhoon Shelter is the main water sensitive receiver.
- 4.39 In view of the high densities of residential, commercial and industrial land uses in the area, we have selected representative sensitive receivers for air and noise modelling purposes, in consultation with the Environmental Protection Department.

Ecology

- 4.40 Given the largely urban nature of the areas affected by the works, ecology is not regarded as a key environmental issue for this project.
- 4.41 The Tai Tam Country Park lies within the Study Area but will not be affected either directly or indirectly by the proposed works.
- 4.42 As highlighted in Section 3, the preservation of trees is important. A tree survey was undertaken as part of the Engineering Design process and the results are shown in Figures 4.3 and 4.4. The sewerage works have been planned to avoid damage to, or removal of, existing trees. If it becomes essential to remove any trees, transplanting or compensatory planting will be undertaken in consultation with Urban Services Department and Agriculture & Fisheries Department.

Summary

- 4.43 The general pattern of land use in the Study Area is likely to change over the next few years. Several large-scale commercial and residential development projects are proposed. The residential developments are concentrated in North Point and Quarry Bay while the commercial projects are concentrated in Causeway Bay, North Point and Taikoo Place.



- Legend :**
- Study Area Boundary & Sewerage District Boundary
 - Deep Tunnel & Shaft
 - Open Cut
 - Shallow Tunnel & Shaft
 - Dry Weather Flow Channel
 - Residential
 - School
 - Hospital
 - Commercial
 - Hotel
 - Temple/Church/Mosque, etc.
 - Screening Plant

revision	date	designation	initial
designed	checked	drawn	checked
initial			
date			
approved			

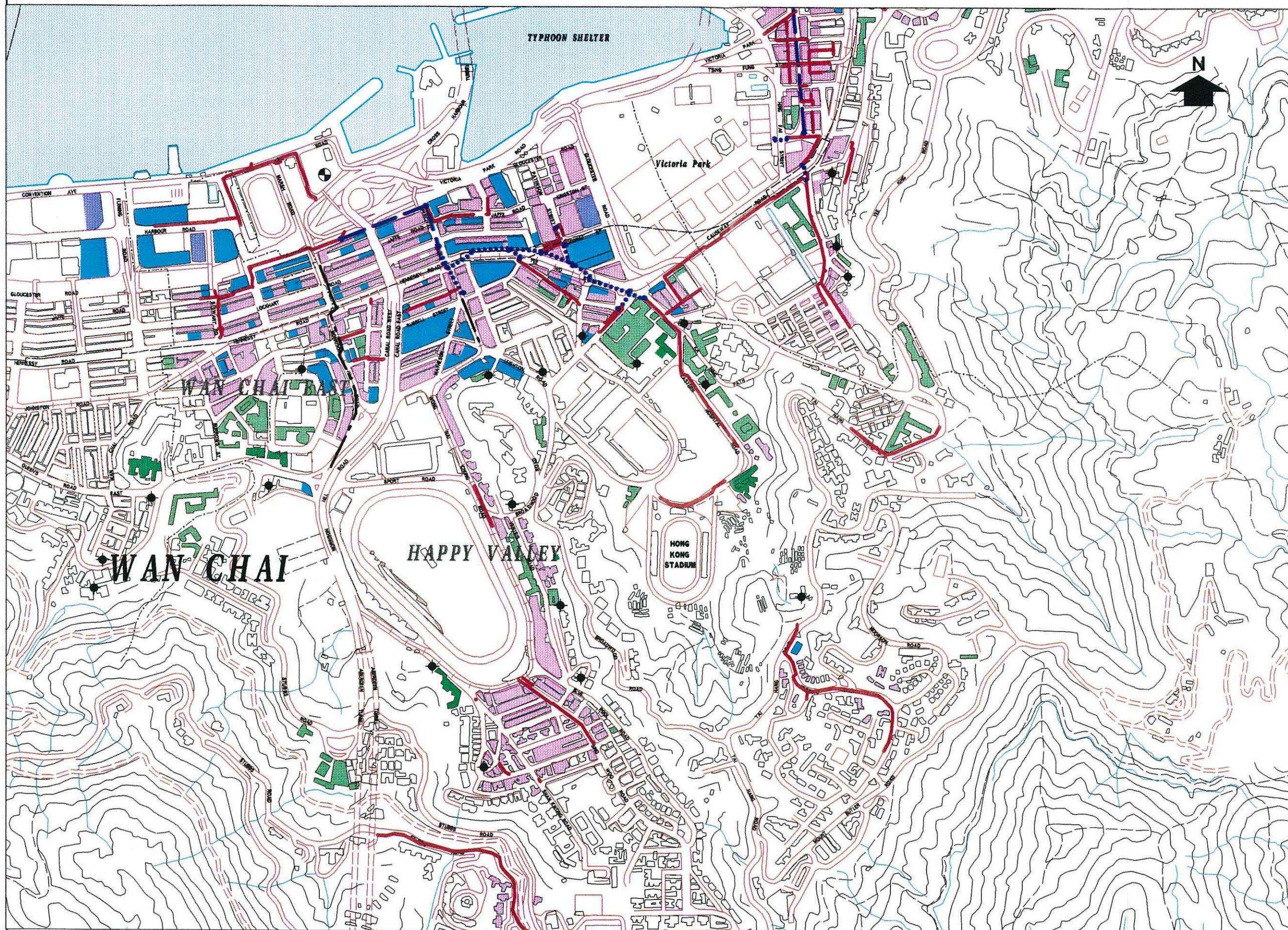
project
WAN CHAI EAST & NORTH POINT SEWERAGE

drawing title
**Environmentally Sensitive Receivers
Wan Chai East**

figure no.	4.1	scale	1 : 10 000
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client
DRAINAGE SERVICES DEPARTMENT

consultant
BEINKE CONSULTANTS LIMITED 寶尼工程顧問有限公司



Legend :

- Study Area Boundary & Sewerage District Boundary
- Deep Tunnel & Shaft
- Open Cut
- Shallow Tunnel & Shaft
- Dry Weather Flow Channel
- Residential
- School
- Hospital
- Commercial
- Hotel
- Temple/Church/Mosque, etc.
- Screening Plant

revision	date	designation		initial
		designed	checked	checked
initial				
date				
approved				
project				
WAN CHAI EAST & NORTH POINT SEWERAGE				
drawing title				
Environmentally Sensitive Receivers North Point				
figure no.		scale		
4.2		1 : 10 000		
client				
DRAINAGE SERVICES DEPARTMENT				
BINIE CONSULTANTS LIMITED 賓尼 賓尼工程顧問有限公司 ENGINEERS AND ARCHITECTS				

LEGEND

- Deep Tunnel & Shaft
- Open Cut
- Shallow Tunnel & Shaft
- DWF Channels
- Catchment Boundary
- Tree Location

revision	date	description	initial
1		checked	checked
2		checked	checked
3		checked	checked
4		checked	checked
5		checked	checked
6		checked	checked
7		checked	checked
8		checked	checked
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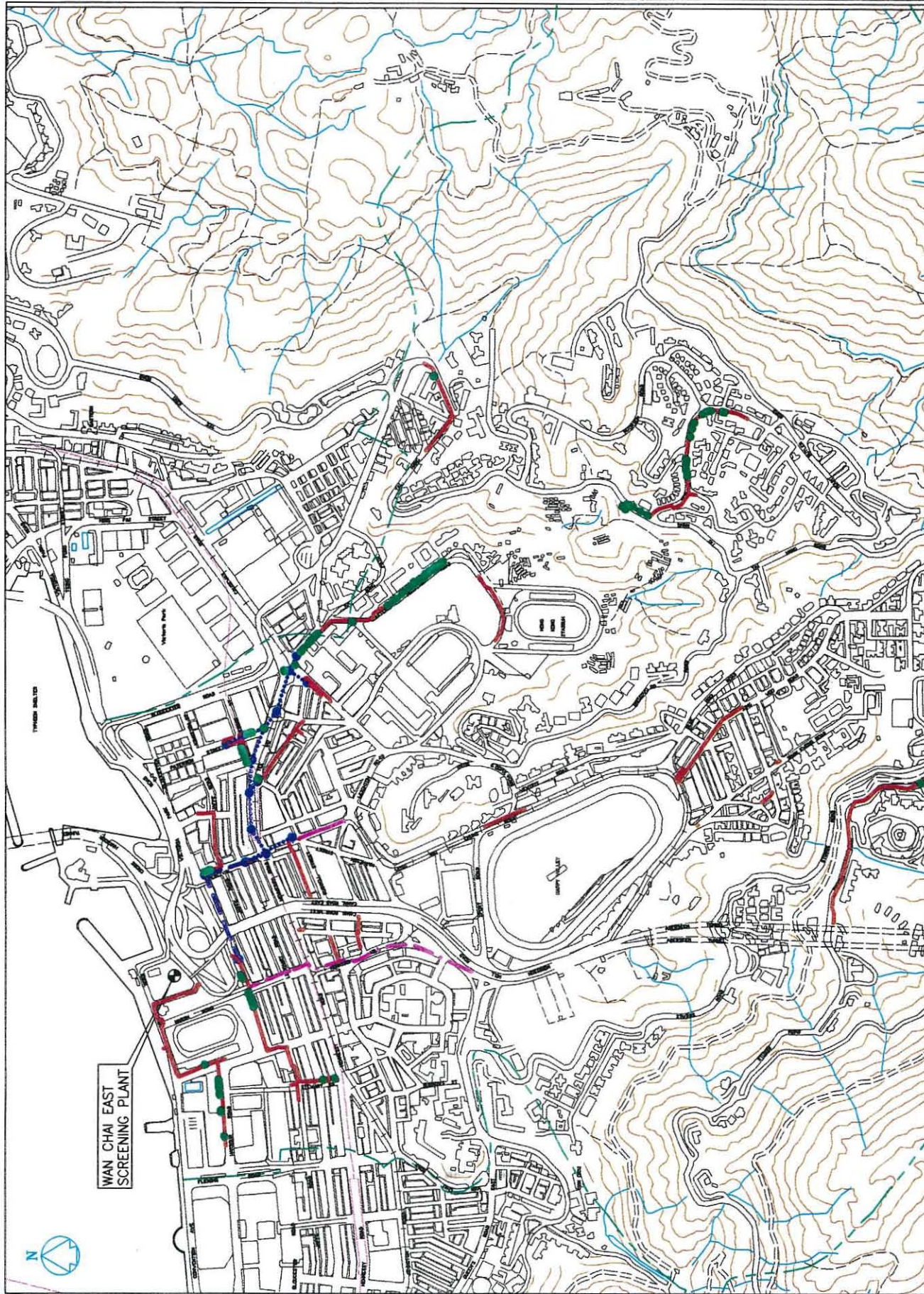
project
Wan Chai East & North Point
Sewerage

drawing title
Tree Locations
Wan Chai East

figure no. 4.3
scale N.T.S.

client
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HONGKONG ENGINEERS LIMITED



WAN CHAI EAST
SCREENING PLANT

0m 100m 200m 300m 400m
SCALE 1:10000

The map shows a coastal area with a proposed screening plant (red line) and a water treatment plant (blue line). The screening plant is located near the North Point area, and the water treatment plant is located further inland. The map includes contour lines, roads, and buildings. A north arrow is located in the bottom left corner.

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project
Wan Chai East & North Point
Sewerage

drawing title
Tree Locations North Point

drawing no.	4.4	scale	N.T.S
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**DRAINAGE
SERVICES
DEPARTMENT**

consultant

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ENGINEERS AND SCIENTISTS

5 NOISE IMPACT ASSESSMENT

Introduction

- 5.1 Construction noise will be an environmental issue throughout the implementation of the Wan Chai East & North Point Sewerage Project.
- 5.2 All construction work has the potential to generate noise and its impact will vary depending on the nature and extent of the activity, working hours and proximity to noise sensitive receivers (NSRs). Most of the works will be located within densely populated areas and are likely to be within some 3 to 20 m of residential or other sensitive uses.
- 5.3 This assessment is divided into: the assessment of potential noise impacts during the construction phase and recommendations for short term noise control; and the identification of any potential operational noise impact and requirements for long term noise reduction measures.
- 5.4 Although the worst affected noise sensitive receivers have been identified based on the existing land use and on site surveys, the type of development within the Study Area is likely to change over the course of the next few years, if the current trend of converting old mid-rise residences to commercial centres at Wan Chai East continues. Notable examples include the redevelopment currently being undertaken at Russell Street and Yee Wo Street.
- 5.5 Construction noise is a constraint on the Project, given the close proximity of NSRs. Impacts will be intense but localised and short term in duration.
- 5.6 Detailed recommendations on the mitigation and monitoring of construction noise are presented within this Final Assessment Report and the accompanying Environmental Monitoring & Audit Manual.

Summary of IAR Noise Assessment

- 5.7 The Final Initial Assessment Report (IAR) for this EIA was issued in May 1996. The noise impact assessment concluded that there will be construction noise impacts associated with both trenchless and open cut construction methods for the relaying/upgrading of sewers within the Study Area. The noise levels, if unmitigated, will exceed the statutory or recommended noise criteria at distances up to 300 metres away from the construction works. Most of the existing noise sensitive receivers are located within just 3 to 10 metres of the proposed works.

- 5.8 The IAR concluded that the construction noise impact cannot be adequately mitigated by the distance between the works and the sensitive receivers. Extensive noise mitigation measures were proposed, including noise enclosures around and above the shafts and active areas of the open cut sections, and noise barriers. Nevertheless, it was predicted that the maximum noise reduction which can be offered by the proposed mitigation measures is just 15 dB(A). This is insufficient to reduce the noise to an acceptable level.
- 5.9 Recommendations were made to minimise noise exceedance by measures such as location of shafts as far as possible from noise sensitive receivers.
- 5.10 The construction noise impact associated with the construction of the Pumping Stations at North Point Screening Plant was predicted to be acceptable.
- 5.11 With erection of a temporary noise barrier during the initial stages of excavation for the underground pumping station, the only operational noise impact arising from the Wan Chai East & North Point Sewerage Project will be from the operation of the new pumping station. In the IAR, this impact was predicted to be insignificant.

Design Modifications

- 5.12 The Draft Preliminary Report (DPR)¹ was published in May 1996 by the Design Team. This report proposed construction methods suitable for the implementation of works recommended in the Sewerage Master Plan (SMP) Study. Engineering investigations, EIA and TIA studies have led to significant modifications to the works proposed in the SMP.
- 5.13 The DPR presents the preferred construction methods for various locations with details on each method. The layout and equipment proposed for the new pumping station at North Point Screening Plant and the recommended construction method is described.
- 5.14 The noise impact presented in this section is based on the latest recommended design and construction methods presented in the DPR.

¹ Agreement No. CE 78/94 Wan Chai East and North Sewerage Draft Preliminary Report: Issue 2, May 1996. Binnie Consultants Limited for Drainage Services Department.

Objectives

5.15 The objectives of this final noise impact assessment are to:

- (i) describe the limitation of working hours for certain activities based on the current noise standards;
- (ii) identify the worst affected NSRs in view of the current information and standards;
- (iii) provide further details on construction method and the likely locations and size of jacking /receiving pits;
- (iv) suggest suitable tender clauses incorporating feasible and extensive noise control measures.

Worst Affected Noise Sensitive Receivers

- 5.16 From the findings of the IAR, the worst affected NSRs during the construction phase will be concentrated around works to be carried out above ground.
- 5.17 The NSRs include the first row of buildings (residences, educational establishments, hospitals, hotels, temples and churches) closest to open cut sites, tunnelling shafts, and the excavation for the proposed pumping station. As the second row of buildings will be substantially screened from the works by the first row of buildings, they are not considered to be 'worst affected'. The first row of buildings is expected to offer up to 10 dB(A) noise reduction to the second row of building, depending on the size of the gaps between these buildings which can affect the screening effect.
- 5.18 The locations of the most affected NSRs at Wan Chai East and North Point are shown in Figures 5.1 and 5.2 respectively.
- 5.19 For the operational phase, the NSRs are concentrated near the proposed pumping station. The worst affected NSRs and their horizontal distances from the proposed pumping station are presented in Table 5.1.

Table 5.1
Distances of Worst Affected NSRs from Pumping Station

NSRs	Horizontal Distance between Notional Noise Source and NSR (m)
Healthy Gardens	106
Madam Chan Wai Chow Memorial School	148
North Point Estate	134
Ruby Court	114

Baseline Noise Environment

- 5.20 Both Wan Chai East and North Point are urban areas, with several major roads where traffic and community noise dominate the noise environment. Examples of heavy traffic noise are areas along Gloucester Road, Yee Wo Street, while community noise is dominant in the evening and weekends along Russell and Matheson Streets.
- 5.21 Conversely, there are quiet areas around at the back streets of both Wan Chai and North Point. The Happy Valley area and Caroline Hill area (near the Hong Kong Stadium) are especially quiet with semi-high rise and low rise buildings.
- 5.22 On Friday 12th January - Saturday 13th January 1996, ambient noise monitoring was carried out near the Tung Wah Hospital, at Eastern Hospital Road. The hospital is situated within the Caroline Hill Road area which has no major noise source. The location of this hospital is shown on Figure 5.3.
- 5.23 The hospital is constructed on a podium and most of the wards have been fitted with fixed windows and air conditioning, ie. 'indirect' noise mitigation measures.
- 5.24 Monitoring was carried out on the roof top level, with hourly Leq measurements recorded over a 24 hour period. Figure 5.4 presents the variation in noise level.
- 5.25 Monitoring was carried out using integrating sound level meters which satisfy the requirements for International Electrotechnical Commission Publications IEC 651:1979 (Type 1) and 804:1985 (Type 1).
- 5.26 Measuring conditions, including time and date of measurement, location of site, height of site from ground and data on predominant noise sources, calibration data, wind direction and relative humidity were recorded.

- 5.27 Existing noise monitoring data is available for the location marked 'C' on Figure 5.3. This data was obtained from the report on *Baseline Monitoring for Wanchai Reclamation: Phase I Reclamation & West Bridge (Noise & Water Quality Monitoring)*². The data is shown in Figures 5.5a to 5.5c.

Noise - Construction Phase

Noise Assessment Criteria

- 5.28 Table 5.2 gives the relevant noise assessment criteria based on the TMs applicable for this project.
- 5.29 The Study Area for this Project is entirely within the Designated Area as defined in the new *TM on Noise from Construction Work in Designated Areas*. The use of hand held breakers, lorries, dump trucks and vibratory pokers will be very restricted between 19:00 to 07:00 in view of the much lowered noise criteria.
- 5.30 The Acceptable Noise Level (ANL) due to Percussive Piling is 85 dB(A) for NSRs (or parts of NSRs) with windows or other openings but no central air conditioning.

² *Baseline monitoring for Wanchai Reclamation: Phase I: Reclamation & West Bridge (Noise and Water Quality Monitoring)*. (September 1994) CES for Territory Development Department.

Table 5.2
Noise Assessment Criteria for Construction Noise
other than Percussive Piling

Period of day	Type of noise sensitive receivers	Noise* Assessment Criteria	Noise Assessment Criteria** (specified processes and equipment within Designated Area)
07:00-19:00 Mondays to Saturdays except general holidays	all	75 dB(A)	/
19:00-23:00 all days and 07:00-19:00 Sundays and general holidays	Area Sensitivity Rating (ASR) 'C'	70 dB(A)	55 dB(A)
23:00-07:00	ASR 'C'	55 dB(A)	40 dB(A)
19:00-23:00 all days and 07:00-19:00 Sundays and general holidays	ASR 'B'	65 dB(A)	50 dB(A)
23:00-07:00	ASR 'B'	50 dB(A)	35 dB(A)
07:00-19:00 all day	Schools during examinations	70 dB(A)/ 65 dB(A)	EPD's Practice Note ProPECC PN 2/93

* Daytime criteria based on EPD's Practice Note ProPECC PN 2/93, evening and night time criteria based on *Technical Memorandum on Noise from Construction Work Other Than Percussive Piling* (1996)

** Evening and night time criteria based on *TM on Noise from Construction Work in Designated Area* (1996). Specified equipment include: hand held breakers, concrete lorry mixers, dump trucks, concrete vibrators, bulldozers. Specified processes include: erection or dismantling of formwork or scaffolding; loading and unloading of rubble, wooden blocks, steel bars, wood or scaffolding material; hammering.

5.31 The permitted hours of operation for percussive piling are determined by the extent of exceedance of the ANL. Table 5.3 lists the hours of permitted operation on each day as described in the *TM on Noise from Percussive Piling*.

Table 5.3
Criteria for Permitted Hours of Percussive Piling

Amount by which CNL exceeds ANL	Permitted hours of operation on any day not being a general holiday
more than 10 dB(A)	0800 to 0900 AND 1230 to 1330 AND 1700 to 1800
between 1 dB(A) and 10 dB(A)	0800 to 0930 AND 1200 to 1400 AND 1630 to 1800
no exceedance	0700 to 1900

5.32 Piling is not permitted on public holidays, including Sundays.

Data Sources

5.33 The sound power levels for the equipment used in this assessment are derived from the following sources:

- (i) *TM on Noise from Construction Work other than Percussive Piling;*
- (ii) *TM on Noise from Percussive Piling;*
- (iii) *TM on Noise from Construction Work in Designated Area;*
- (iv) *BS 5228: Part 1: 1984 Noise Control on Construction and Open Sites.*

Items (i) to (iii) are part of the *Noise Control Ordinance (Chapter 490)*.

Assessment Methodology

5.34 A total sound power level per activity is obtained by summing logarithmically all the individual sound power levels of the associated equipment.

5.35 The methodology for assessing noise levels due to stationary sources and mobile sources not on any fixed routes uses the following equation:

$$\text{Predicted noise level} = \text{Total sound power level} - 20 \log_{10} D - 8 \text{ dB(A)}$$

where D is the intervening distance in metres between noise source and the NSR.

- 5.36 The methodology for assessing the noise levels due to percussive piling uses the following equation:

$$\text{Predicted noise level} = \text{Total sound power level} - 23.27 \log_{10} D - 5.269 \text{ dB(A)}$$

where D is the intervening distance in metres between noise source and the NSR.

- 5.37 A +3 dB(A) correction is made to each predicted noise level to account for the facade reflection at the NSR.

Construction Scenarios

Open Cut Method

- 5.38 The following sections present the potential noise impacts from sewerage works using both open cut and trenchless construction methods and from works associated with the redevelopment of the pumping station at North Point Screening Plant.
- 5.39 The concrete road surface in Wan Chai East and North Point will be opened by diamond-disc cutting. At certain locations whole slab bays may need to be removed. The road surface spoil will be carried away using a breaker mounted excavator, while hand excavation will be carried out to a depth of about 1.5 m from ground level. Below 1.5 m depth, sheet piling will be installed. The depth of the trench and ground conditions will determine the type and closeness of the piles. Since the working area is limited along road sides, the excavated material will be disposed of elsewhere instead of being stockpiled around the site. External fill will be imported for reinstatement.
- 5.40 Table 5.4 presents the equipment list and their associated sound power level for the Open Cut works. The list excludes percussive piling for the installation of sheet piles.

Table 5.4
Equipment List and Sound Power Levels -
Open Cut Method (Excluding Percussive Piling)

Type of Powered Mechanical Equipment	No. of Units	Sound Power Level dB(A)	Total Sound Power Level dB(A)
Activity - Surface Breaking			
Hand-held breaker (silenced, pneumatic)	2	110	113.2
Air compressor (silenced)	1	100	
OR			
Excavator mounted breaker	1	122	122.0
Activity - Excavation and Laying of Pipes			
Excavator or hydraulic crane	1	112	115.2
Water pump (electric, submersible)	2	88	
Generator (silenced)	1	100	
Lorry	1	112	
Activity - Backfilling			
Excavator or backhoe	1	112	118.4
Dump truck	1	117	
Vibratory compactor	1	105	
Activity - Road Reinstatement			
<i>Asphalt surface</i>			
Asphalt paver	1	109	114.8
Road roller	1	108	
Lorry	1	112	
OR			
<i>Concrete surface</i>			
Concrete lorry mixer	1	109	114.5
Hand-held vibratory poker	1	113	

- 5.41 All the worst affected NSRs are located within 3 to 10 metres of the construction works. Table 5.5 presents the noise levels which would be experienced at NSRs at 3 and 10 metres away from open cut works respectively, excluding piling, if no noise mitigation measures were used.

Table 5.5
Unmitigated Noise Levels (L_{eq}) at NSRs -
due to Open Cut Method

Activity	Distances (m)	
	3	10
Surface breaking	(h) 98.7 dB(A)	88.2 dB(A)
	(e) 107.5 dB(A)	97.0 dB(A)
	(e) 107.5 dB(A)	97.0 dB(A)
Trench excavation and Pipe Laying	100.7 dB(A)	90.2 dB(A)
Backfilling	103.9 dB(A)	93.4 dB(A)
Road reinstatement	(a) 100.3 dB(A)	89.8 dB(A)
	(c) 100.0 dB(A)	89.5 dB(A)
	(c) 100.0 dB(A)	89.5 dB(A)

(h) Using hand-held pneumatic breaker
(a) Asphalt paving

(e) Using excavator mounted breakers
(c) Concrete reinstatement

- 5.42 It can be seen from the unmitigated noise levels shown in Table 5.5 that the predicted noise levels at both distances will exceed the acceptable noise levels stated in Table 5.2.

Sheet Piling

- 5.43 The noise levels caused by percussive piling during the installation of the sheet piles depend on the type of piling machine and the intervening distance between the piling location and the NSRs.
- 5.44 One diesel hammer driving steel pile is assumed to be operating at any one time throughout the piling process, which corresponds to a sound power level of 132 dB(A).
- 5.45 Based on the methodology for assessing the distance correction detailed earlier, assuming the piling unit is operating at 3 m from any NSR, and applying a facade correction of +3 dB(A), the noise level due to piling is 114 dB(A). Based on the Assessment Criteria in Table 5.3, the exceedance above the ANL is more than 10 dB(A). The permitted hours of percussive piling are therefore 0800 to 0900, 1230 to 1330 and 1700 to 1800 hours on any day not being a general holiday.

Noise Control Measures for Open Cut Works

- 5.46 Unless the Contractor selects powered mechanical equipment with a view to reducing the intensity or duration of noise, it may be very difficult to obtain the necessary CNP under the *Noise Control Ordinance*. This could have serious

implications for the planning and programming of the works. The Contract will specify the need for the Contractor to employ a professional noise specialist to assist with noise planning and obtaining the necessary Construction Noise Permits (see Appendix B). The following direct mitigation measures are recommended to control the noise levels caused by open cut works:

- (i) The Contractor should minimize the use of powered mechanical equipment on site.
- (ii) Works should be scheduled such that activities located within close proximity of particularly sensitive buildings (e.g. hospitals, residences) are minimised and, where possible, carried out during least-sensitive periods. Commercial buildings are not noise sensitive.
- (iii) Where possible, excavations near schools should be scheduled for the evening to reduce noise impact, subject to constraint of noise impact on other nearby NSRs.
- (iv) Works should be scheduled to avoid construction close to schools during examination periods.
- (v) The works near residential areas should be scheduled to avoid the period between 23:00-07:00 hours. At some locations, traffic constraints only rule out peak hour works, which means the work can often be carried out between 09:00-16:00 hours, during the day. Works between 19:00 - 07:00 hours should be minimized whenever possible.
- (vi) Where possible, haulage and movement of spoil should be restricted to the day time only.
- (vii) Equipment which is not in use should be turned off or throttled down. Proper maintenance should be exercised to ensure the equipment is not emitting excessive noise. Equipment which is emitting excessive noise could indicate mechanical problems as well as noise impact.
- (viii) Road surface breaking should be restricted to daytime only. If the use of excavator mounted breakers instead of hand held ones can reduce the duration of the road surface breaking process significantly, then the greater noise may be justifiable over a shorter construction period.
- (ix) Silenced models of mounted breakers are available. The Contractor should use silenced equipment whenever possible, including silenced generators, electrical air compressors and ventilation fans.

- (x) If measures (i) - (ix) do not achieve the required noise reduction, the Contractor should:
- (a) construct a gap free barrier with a surface mass density of at least 20 kg/m² around the active part of the site (i.e. where powered mechanical equipment is in use) to screen all the noise sources from stationary and preferably all quasi-stationary equipment from the sight of the ground floor; **and**
 - (b) provide additional noise reduction in the form of enclosures with a surface mass density of at least 20 kg/m² around the major noise sources of items of stationary equipment. Following enclosure, the noise sources of the equipment should not be visible from the top or other sides by the sensitive receivers.

Sound absorptive material should be used for lining the inside of the enclosure. Forced ventilation should be provided to avoid over heating of the equipment.

- 5.47 Table 5.6 presents the residual impacts of noise generated from open cut works following implementation of the proposed noise control measures. The effects of equipment scheduling e.g. avoiding concurrent use of particularly noisy equipment, is not reflected in these figures.

Table 5.6
Residual Noise (L_{eq}) Impact following Implementation of
Proposed Noise Control Measures - Open Cut Method

Activity	Distances (m)	
	3	10
Surface breaking (h)	81.7 dB(A)	71.2 dB(A)
(e)	90.5 dB(A)	80.0 dB(A)
Trench excavation and Pipe Laying	83.7 dB(A)	73.2 dB(A)
Backfilling	86.9 dB(A)	76.4 dB(A)
Road reinstatement (a)	83.3 dB(A)	72.8 dB(A)
(c)	83.0 dB(A)	72.5 dB(A)

(h) Using hand-held pneumatic breaker

(e) Using excavator mounted breakers

(a) Asphalt paving

(c) Concrete reinstatement

- 5.48 The partial enclosure is expected to provide a -10 dB(A) reduction while the barrier is expected to provide approximately -7 dB(A). It can be seen that the noise levels at close distance are expected to be well above the ANLs for all times, even after proposed mitigative measures.
- 5.49 In view of the high residual impact associated with the open cut works, it is recommended that the works are scheduled for the day time as far as practicable. It is unlikely that the construction noise can be further mitigated by direct technical measures unless much quieter equipment is employed than that listed in this assessment.
- 5.50 In view of the short duration of open cut works, indirect technical measures such as air conditioning are not justified. The impact is probably more positively controlled by completing the required works early.
- 5.51 Difficulties in obtaining CNPs for night works are inevitable. However, as this is an infrastructure project which is essential to community well being, further negotiating on the permit conditions may be possible.

Areas Requiring Special Attention

- 5.52 For many NSRs adjacent to the open cut works, the works can be scheduled for off peak hours, rather than evening or night time. However, there are a number of roads where, because of traffic constraints, works will have to be carried out during either the evening or night time, using the open cut method.
- 5.53 This would have posed a significant noise problem had all the works recommended in the SMP been implemented.
- 5.54 The latest scope of works proposed by the Design Team suggests that only the residences along Stubbs Road, Perkins Road and areas surrounded by Hing Fat Street/Ngan Mok Street/Electric Road are likely to be affected by night time open cut works.
- 5.55 The noise environment of all of these areas is very quiet in the evening and night time. Excessive noise is likely to result in noise complaints being lodged. It is therefore recommended that road surface breaking be scheduled outside the hours of 23:00 - 07:00 and that additional care and vigilance on the part of the Contractor is given to applying noise control measures in these areas.

Trenchless Method

- 5.56 Trenchless methods describe a number of different sewer construction technologies which do not involve the cutting of a trench when replacing old sewers, either along the existing alignment or at a line parallel to it.
- 5.57 The areas of tunnel shafts will be determined by the size of the tunnel. A minimum of 4 m outer diameter is required even in a congested urban setting. Sides of the shafts will be effectively supported by either sheet piles or minipiles. The purpose of the shafts is for the installation of tunnel boring equipment down to the required level and for the retrieval of the same upon completion of the works. After the completion of works, the shafts will either be incorporated as manholes and wet wells, or reinstated.
- 5.58 Two different tunnelling methods have been proposed. Shallow tunnelling is used for the construction of the following pipelines:
- (i) Above the water table 1500 mm minimum diameter with the pipes installed behind a man-entry open shield by pipe jacking;
 - (ii) Below the water table by 1800 mm diameter pipelines, the man-entry sized pipes are installed by pipe jacking behind a slurry excavation/face support system.
- 5.59 The typical minimum working site areas for micro-tunnelling or pipejacking installations in roads are as follows:-
- | | | |
|-----------------|----------------------------|------------|
| Microtunnelling | (600 mm diameter and less) | 25 m x 5 m |
| Microtunnelling | (900 mm diameter) | 30 m x 5 m |
| Pipejacking | (1,200 mm diameter) | 35 m x 6 m |
| Pipejacking | (1,800 mm diameter) | 40 m x 7 m |
- 5.60 The construction will be carried out 24 hours a day, 7 days a week. The machine can be used at depths more than 3-4 metres. Shallow tunnelling will be applied where the downstream hydraulic gradient or depth constraints preclude the use of deep tunnelling.

- 5.61 Where hydraulic gradients and depth are not constraints, deep tunnelling up to 15 m in depth will be applied. Figure 5.1 shows that much of the deep tunnelling will be carried out at North Point along Java Road and Electric Road.
- 5.62 Deep tunnels will be 1.8 to 2.0 m in diameter. Open face excavation under compressed air either by hand or by mechanical equipment is the most likely method of excavation for deep tunnel works in both Wan Chai and North Point. The construction will be on a continuous, 24-hour basis.
- 5.63 The deep tunnel sewers will be installed using segmental linings.
- 5.64 The works will be carried out at depths ranging from 10 to 15 metres, hence the noise coming from the tunnel boring machine is considered sufficiently screened by the ground.
- 5.65 The main noise sources include the construction of shafts, which will involve sheet piling, and the ancillary equipment at ground level within the working areas surrounding the shafts.
- 5.66 Table 5.7 lists the equipment associated with the construction of shafts and the ancillary equipment exposed at ground level, excluding percussive piling. None of the activities listed will be concurrent.

Table 5.7
Equipment List and Sound Power Levels -
Trenchless Method (Excluding Percussive Piling)

Type of Powered Mechanical Equipment	No. of Units	Sound Power Level dB(A)	Total Sound Power Level dB(A)
Activity - Surface Breaking for Shaft			
Hand-held breaker (silenced, pneumatic)	2	110	113.2
Air compressor (silenced)	1	100	
OR			
Excavator mounted breaker	1	122	122.0
Activity - Excavation of Shaft			
Excavator	1	112	115.2
Water pump (electric, submersible)	2	88	
Generator (silenced)	1	100	
Lorry	1	112	
Activity - Pipe Jacking			
Material hoist (electric)	1	95	117.1
Slurry Water pump (electric, submersible)	2	88	
Generator (silenced)	1	100	
Lorry	1	112	
Excavator or hydraulic crane	1	112	
Air compressors	4	100	
Activity - Backfilling			
Excavator or backhoe	1	112	118.4
Dump truck	1	117	
Vibratory compactor	1	105	
Activity - Road Reinstatement			
<i>Asphalt surface</i>			
Asphalt paver	1	109	114.8
Road roller	1	108	
Lorry	1	112	
OR			
<i>Concrete surface</i>			
Concrete lorry mixer	1	109	114.5
Hand-held vibratory poker	1	113	

- 5.67 Table 5.8 presents the predicted unmitigated noise levels likely to be experienced at sensitive receivers located 3 and 10 metres away from the works.

Table 5.8
Unmitigated Noise Levels (L_{eq}) at NSRs - Trenchless Method

Activity		Distances (m)	
		3	10
Surface breaking	(h)	98.6 dB(A)	88.2 dB(A)
	(e)	107.4 dB(A)	97.0 dB(A)
Excavation of Jacking Pit		100.6 dB(A)	90.2 dB(A)
Pipe Jacking		102.5 dB(A)	92.1 dB(A)
Backfilling		103.8 dB(A)	93.4 dB(A)
Road reinstatement	(a)	100.2 dB(A)	89.8 dB(A)
	(c)	99.9 dB(A)	89.5 dB(A)

(h) Using hand-held pneumatic breaker

(e) Using excavator mounted breakers

(a) Asphalt paving

(c) Concrete reinstatement

- 5.68 From the predicted noise levels, it can be seen that noise mitigation measures are required.

- 5.69 Table 5.9 presents the residual impact of noise generated from trenchless works following implementation of the proposed noise control measures.

Table 5.9
Residual Noise (L_{eq}) Impact following Implementation of Proposed Noise Control Measures - Trenchless Method

Activity		Distances (m)	
		3	10
Surface breaking	(h)	81.6 dB(A)	71.2 dB(A)
	(e)	90.4 dB(A)	80.0 dB(A)
Excavation of Jacking Pit		83.6 dB(A)	73.2 dB(A)
Pipe Jacking		85.5 dB(A)	75.1 dB(A)
Backfilling		86.8 dB(A)	76.4 dB(A)
Road reinstatement	(a)	83.2 dB(A)	72.8 dB(A)
	(c)	82.9 dB(A)	72.5 dB(A)

(h) Using hand-held pneumatic breaker

(e) Using excavator mounted breakers

(a) Asphalt paving

(c) Concrete reinstatement

- 5.70 As for the open cut method, the residual impact for trenchless works also exceed that of the ANLs at all times. Similarly, the same type of vigilance and care should be exercised when applying for CNPs.

Sheet Piling

- 5.71 Sheet piling will be necessary to provide a supporting wall for the construction of the jacking/reception pits used in the trenchless method. The impact and the permitted hours of operation have been outlined earlier in this section.

Noise Control Measures for Trenchless Construction

- 5.72 The jacking/receiving shafts can be considered as more or less stationary noise sources. Some form of partial enclosure over the noisy ancillary equipment, such as power rams and jacking machines, and the shaft itself, with the access facing towards non-noise sensitive buildings or areas will be suitable for controlling the propagation of noise. The enclosure should be constructed of sufficiently heavy material (20 kg/m²). Sound absorptive material should be used to line the inside of the enclosure. Forced ventilation should be provided to avoid over heating of equipment, when necessary.
- 5.73 The trenchless method is a non-stop working method. Noise will therefore be emitted on a 24-hour basis. One of the major concerns will be the control of mobile equipment noise. This includes noise from dump trucks and concrete lorry mixers. Use of this equipment should be scheduled for day time as far as possible.
- 5.74 Another form of noise which may cause a nuisance at night time is the movement warning buzzer of the gantry hoist. If safety conditions permit, a sound of less annoying character and volume should be selected, or else a visual warning should be installed.
- 5.75 Other recommendations for noise control measures are similar to those for open cut method as presented in Section 5.46 except for items (iii), (v) and (vi), which are not applicable as construction by the trenchless method will be continuous.

Refurbishment at Wong Nai Chung Road

- 5.76 Refurbishment works will be carried out along Wong Nai Chung Road. This involves mainly the repair of old manholes and sewers. No trenches will be opened up.

- 5.77 Suitable refurbishment methods include internal lining, where a new "soft" folded pipe is threaded along the inside of the old sewer, which will expand to fill the inner perimeter of the old pipe on flushing. The new pipe will harden by a chemical reaction. The entire process is inaudible at ground level.
- 5.78 The works are unlikely to cause significant noise impact as the likelihood of the use of powered mechanical equipment is minimal.
- 5.79 The residences, churches and schools along this road have therefore been removed from the list of NSRs.

Open Cut or Trenchless Method: Comparison of Noise Impact

- 5.80 The major difference in noise impact between that caused by open cut works and the trenchless (tunnelling) approach is that the location of the worst affected NSR is likely to change as the open cut works progresses along the street, whereas the worst affected NSRs near the jacking pits of the trenchless construction method will always be the same ones until the work is complete. In view of the temporary nature of open cut work relative to each NSR, their associated noise impact should not be over-emphasized if they are scheduled for day time with all appropriate noise control measures applied.

Construction Noise: North Point Screening Plant Pumping Station³

- 5.81 The construction of the pumping station will involve diaphragm walling and the use of powered mechanical equipment. Figures 5.6 to 5.7 show the latest layout proposed for the pumping station. The existing pump house will be demolished and six fixed speed centrifugal pumps installed in the new pumping station.
- 5.82 Table 5.10 shows the construction activities and equipment likely to be required for the construction of the pumping station. None of the construction activities will be concurrent.

³ Works and associated noise impacts from the modification of the Wan Chai East Screening Plant are investigated in the Central Western and Wan Chai West Sewerage Project EIA, which is a separate consultancy.

Table 5.10
Equipment List and Sound Power Levels -
Pumping Station Construction

Type of powered mechanical equipment	No. of Units	Sound Power Level dB(A)	Total Sound Power Level dB(A)
Activity - Excavation			
Pneumatic breaker	1	122	122
Air compressor	1	109	
Activity - Demolition of old pump house/administration building			
Pneumatic breakers	2	125	126
Air compressors	2	112	
Bulldozers	2	118	
Activity - Spoil removal			
Material hoist	1	95	115
Water pumps	2	88	
Lorry	1	112	
Excavator	1	112	
Activity - Reinforcement, formwork and concreting			
Bar bender	1	90	119
Concrete lorry mixer	1	109	
Lorry	1	112	
Welding machine	1	100	
Vibratory poker	2	113	
Electric saw	1	108	
Concrete pump	1	109	
Water pump	2	88	
Activity - Diaphragm Walling			
<i>Either:</i>			
Mobile crane	1	112	114
Silenced generator	1	100	
Electric submersible water pump	1	85	
Concrete lorry mixer	1	109	
<i>or:</i>			
Silenced generator	1	100	113
Mobile crane	1	112	
Piling, diaphragm wall, bentonite filtering plant	1	105	
Electric submersible water pump	1	85	

5.83 The results for the re-development of the pumping station are shown in Table 5.11.

Table 5.11
Construction Noise Assessment -
Pumping Station (Excluding Percussive Piling) (L_{eq})

NSR	SWL	Hori. Dist. (m)	Vert. Dist. (m)	Actual Dist. (m)	Distance Correction dB(A)	Unmitigated CNL dB(A)	Noise Reduction Required dB(A)	Mitigated CNL dB(A)
Activity: Demolition of administration building/existing pump house								
Healthy Gardens	126	106	0	106	48.5	80.5	-10	70.5
Madam Chan Wai Chow Memorial School	126	148	0	148	51.4	77.6	-13	64.6
North Point Estate	126	134	0	134	50.5	83.5	-10	73.5
Ruby Court	126	114	0	114	49.1	79.9	-5	74.9
Activity: Excavation								
Healthy Gardens	122	106	0	106	48.5	76.5	-5	71.5
Madam Chan Wai Chow Memorial School	122	148	0	148	51.4	73.6	-10	72.1
North Point Estate	122	134	0	134	50.5	79.5	-5	74.5
Ruby Court	122	114	0	114	49.1	75.9	-5	70.9
Activity: Reinforcement, formwork and concreting								
Healthy Gardens	119.0	106	0	106	48.5	73.5		
Madam Chan Wai Chow Memorial School	119.0	148	0	148	51.4	70.6	-5	65.6
North Point Estate	119.0	134	0	134	50.5	71.5		
Ruby Court	119.0	114	0	114	49.1	72.9		
Activity: Spoil removal								
Healthy Gardens	115	106	0	106	48.5	69.5		
Madam Chan Wai Chow Memorial School	115	148	0	188	51.4	66.6	-2	64.6
North Point Estate	115	134	0	104	50.5	67.5		
Ruby Court	115	114	0	114	49.1	68.9		
Activity: Diaphragm Walling								
Healthy Gardens	114/113	106	0	106	48.5	68.5/67.5		
Madam Chan Wai Chow Memorial School	114/113	148	0	148	51.4	65.6/64.6	-1/0	64.6
North Point Estate	114/113	134	0	134	50.5	66.5/65.5		
Ruby Court	114/113	114	0	114	49.1	67.9/66.9		

- 5.84 The predicted noise levels due to percussive piling are compared with the noise criteria for percussive piling as stipulated in the *TM on Noise from Percussive Piling* in Table 5.12.

Table 5.12
Comparison between ANLs and Predicted Noise Levels (L_{eq}) from Piling Works

Noise Sensitive Receivers	Acceptable Noise Levels due to Percussive Piling (Assuming all windows at NSRs are openable) (dB(A))	Predicted Noise Levels due to Percussive Piling (dB(A))
Healthy Gardens	85	73.6
Madam Chan Wai Chow Memorial School	75	70.2
North Point Estate	85	71.2
Ruby Court	85	72.9

- 5.85 The permitted period for percussive piling is thus 0700-1900 hours for days which are not public holidays or Sundays.

Noise Control Measures for Pumping Station Construction

- 5.86 From the assessment results in Table 5.11, the construction of the pumping station is not expected to create a significant noise impact. The excavation noise will only require a temporary barrier of at least 7 kg/m² surface mass density which can provide a noise reduction of 10 dB(A). During demolition of the existing administration building and pump house, the noise level at the school may exceed the ANL by 2 to 3 dB(A) even after installation of barrier. However, the noise impact can be further reduced by limiting the equipment to one breaker and one air compressor during school hours. The demolition works are not expected to last very long in view of the size of the existing plant. Excavation works to be carried out underground will not be exposed to the NSRs, hence there will be no noise impact at the NSRs resulting from this activity.

Noise - Operational Phase

Data Sources

- 5.87 The only operational noise from the Project will result from the North Point Screening Plant pumping station. The station will house at least six fixed speed centrifugal pumps below ground level.

- 5.88 Table 5.13 shows the noise assessment criteria to be applied during the operational stage of the Project. The criteria is based on the Chapter 9 of *Hong Kong Planning Standards and Guidelines*, concerning the environment.

Table 5.13
Noise Assessment Criteria during Operation Phase

Time Period	ASR 'B'
Day (07:00-19:00 and Evening (19:00-23:00)	60 dB(A)
Night (23:00-07:00)	50 dB(A)

- 5.89 Pumping stations are considered as fixed noise sources. Madam Chan Wai Chow Memorial School is not affected by operational noise at night.

Assessment Methodology

- 5.90 Noise monitoring was carried out at the existing pump room on 6 October 1995. With one screw pump and two fans running, $L_{eq}(A)$ for 5 minutes was 87 dB(A) at a distance of 2 metres from the pump and 2 metres from each fan. With the fans turned off, the $L_{eq}(A)$ for the same period was 86.5 dB(A). All the fans and pumps run at a steady rate. The new pumps to be installed are fixed speed centrifugal pumps. The sound power level of these new pumps is not yet available. The assumption has been made that they will produce a similar noise level to the existing pumps.
- 5.91 Sound power levels of the pumps have been estimated using the same equations in Section 5.35. It is estimated that each pump will have a sound power level of 101 dB(A).
- 5.92 For the new pumping station, there will be 4 duty and 2 standby pumps. One of the standby pumps may be used to carry flow during peak flow conditions. At maximum operation, therefore, there will be no more than 5 pumps running.
- 5.93 The equation for calculating the predicted noise levels is the same as in Section 5.35.

Results

- 5.94 The operational noise levels at the facades of the sensitive receivers are shown in Table 5.14. Unless later data show that the sound power level of each new pump is above 101 dB(A), no noise control measures will be required.

Table 5.14
Predicted Operational Noise (L_{eq}) from
North Point Screening Plant

Noise Source	SWL	Hori. Dist. (m)	Vert. Dist. (m)	Actual dist. (m)	Distance Correction dB(A)	CNL1*	Barrier* Correction dB(A)	CNL2	Predicted Noise Level dB(A)
NSR: Healthy Gardens									
	109.0	106	0	106	48.5	63.5	-15	48.5	48.5
NSR: Madam Chan Wai Chow Memorial School									
	109.0	148	0	148	51.4	60.6	-15	45.6	45.6
NSR: North Point Estate									
	109.0	134	0	134	50.5	61.5	-15	46.5	46.5
NSR: Ruby Court									
	109.0	114	0	114	49.1	62.9	-15	47.9	41.9

Note: Each pump room consist of a maximum of 6 pumps with a sound power level of 101 dB(A) working simultaneously.

* The predicted noise level include the facade correction of +3 dB.

** Barrier correction for the enclosure effect of the pump room.

- 5.95 Operational noise levels from the North Point Screening Plant as calculated during the noise impact assessment are within the acceptable noise levels at the nearest sensitive receivers.

Noise - EM&A

Construction Noise

- 5.96 In view of the potentially high construction noise levels, monitoring of noise levels at appropriate NSRs throughout the construction phase is recommended. The purpose of the monitoring is to ensure that construction takes place with a minimum of adverse impact on nearby NSRs and in compliance with the *Noise Control Ordinance* and its associated Technical Memoranda.

- 5.97 As construction will be carried out in sections, it is recommended that baseline monitoring is carried out prior to construction at the nearest sensitive receivers to the new section of work and at any other locations considered necessary, in agreement with EPD.
- 5.98 The monitoring locations should be based on the following criteria:
- (i) Locations close to the major site activities which are likely to have noise impacts;
 - (ii) Locations close to the sensitive receivers (normally at a point 1 m from the exterior of the facade of the NSR).
- 5.99 Impact monitoring should be undertaken at the nearest NSRs on a frequent, random basis and also on receipt of construction noise related complaints.

Operational Noise

- 5.100 No monitoring of operational noise is required as predicted noise levels from the North Point Screening Plant are well within the relevant noise criteria at the nearest NSRs.
- 5.101 The full details of the recommended EM&A programme including the agreed schedules and programmes for monitoring and audit, responsibilities of key staff and actions to be taken in the event of complaints or exceedances are presented in the EM&A Manual.

Summary

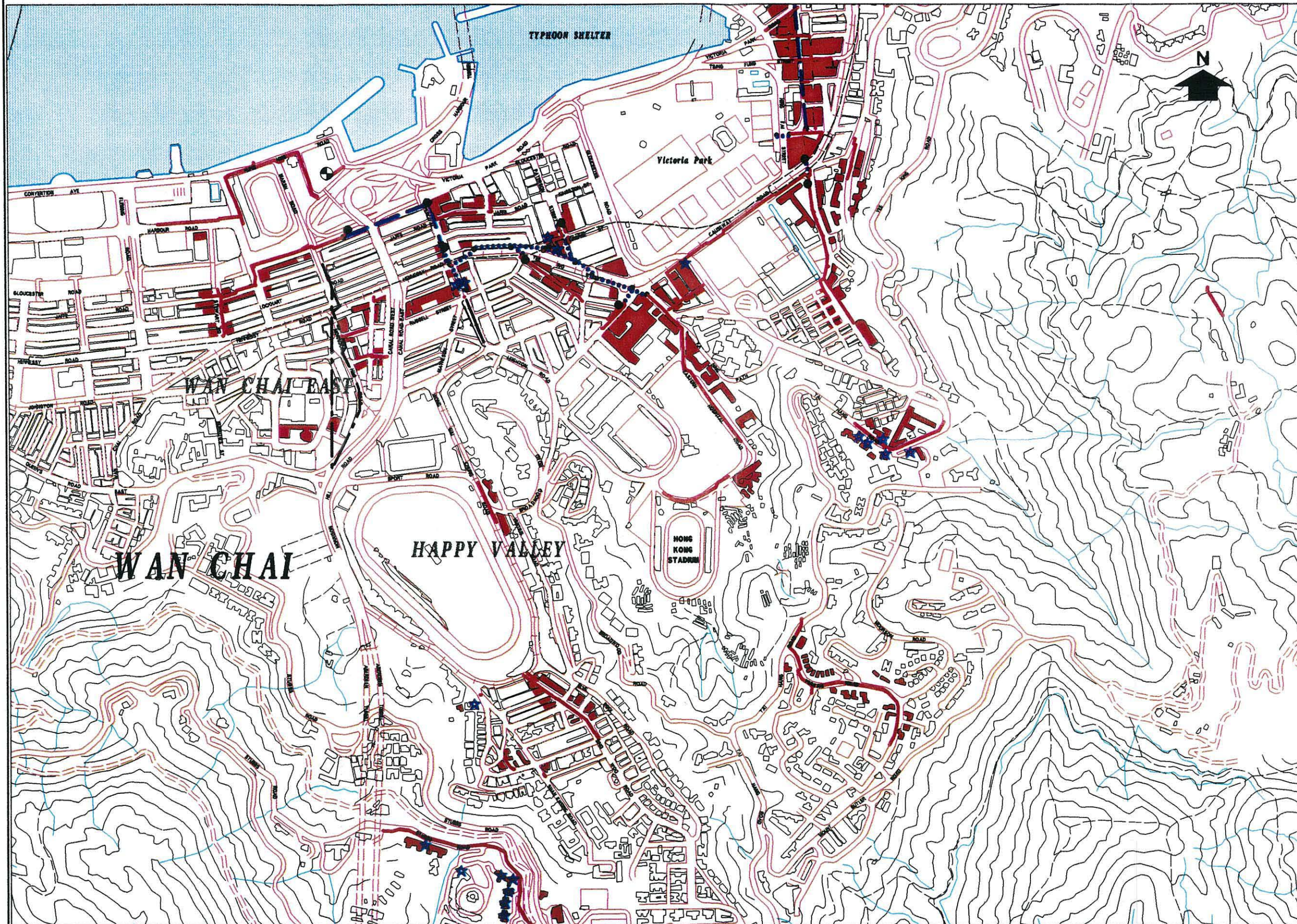
Construction Noise

- 5.102 The noise impact assessment indicates that without stringent mitigation the open cut works, the construction of jacking/production shafts and the operation of ancillary pipe jacking equipment at working areas surrounding the shafts are likely to generate short term exceedances of the noise criteria. Even with very substantial noise control measures, noise exceedance is expected throughout the day. The Contractor will be made aware of noise as a serious constraint to progress of the works. The Contractor should obtain the services of a professional noise specialist to assist with noise planning and obtaining the necessary Construction Noise Permits. The recommended noise control measures are to be implemented throughout the construction period at active construction sites.

- 5.103 Works associated with construction of the pumping station at the North Point Screening Plant is not expected to generate a significant noise impact. The most significant impact will be at Madam Chan Wai Chow Memorial School during the demolition of the existing pump house and the administration building. It is recommended that a temporary noise barrier be erected around the active part of the site and kept in place throughout the works. A reduction in the amount of equipment operated during the demolition period during school hours is also recommended.
- 5.104 Details of the recommended construction phase noise monitoring programme are presented in the EM&A Manual.

Operational Noise

- 5.105 The only source of operational noise is the pumping station at North Point Screening Plant. No exceedance of operation noise assessment criteria is expected.
- 5.106 No noise control measures are required for operational stage.



Legend :

- Deep Tunnel & Shaft
- Open Cut
- Shallow Tunnel & Shaft
- Dry Weather Flow Channel
- ⊕ Existing Screening Plant
- Worst Affected Sensitive Receiver
- ★ Affected by Night Time Works

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designed	checked	drawn	checked
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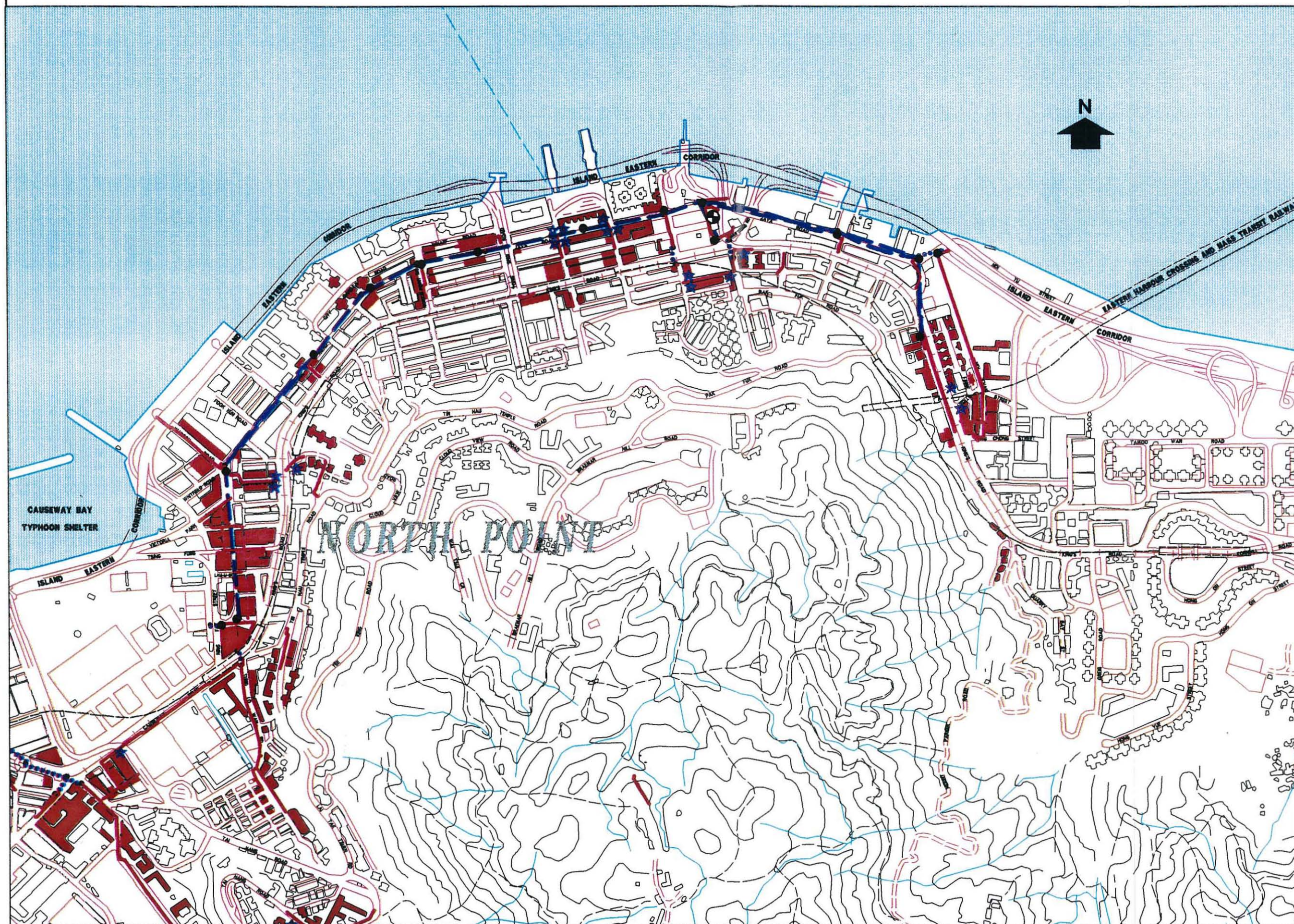
project
WAN CHAI EAST & NORTH POINT SEWERAGE

drawing title
Worst Affected Sensitive Receivers Wan Chai East

figure no. **5.1** scale **1 : 10 000**

client
DRAINAGE SERVICES DEPARTMENT

consultant
BURNS CONSULTANTS LIMITED 寶尼



Legend :

- Deep Tunnel & Shaft
- Open Cut
- Shallow Tunnel & Shaft
- - - Dry Weather Flow Channel
- Existing Screening Plant
- Worst Affected Sensitive Receiver
- ★ Affected by Night Time Works

revision	date	designation			initial
		designed	checked	drawn	
initial					checked
date					
approved					

project
**WAN CHAI EAST &
NORTH POINT
SEWERAGE**

drawing title
**Worst Affected
Sensitive Receivers
North Point**

figure no. **5.2** scale **1 : 10 000**

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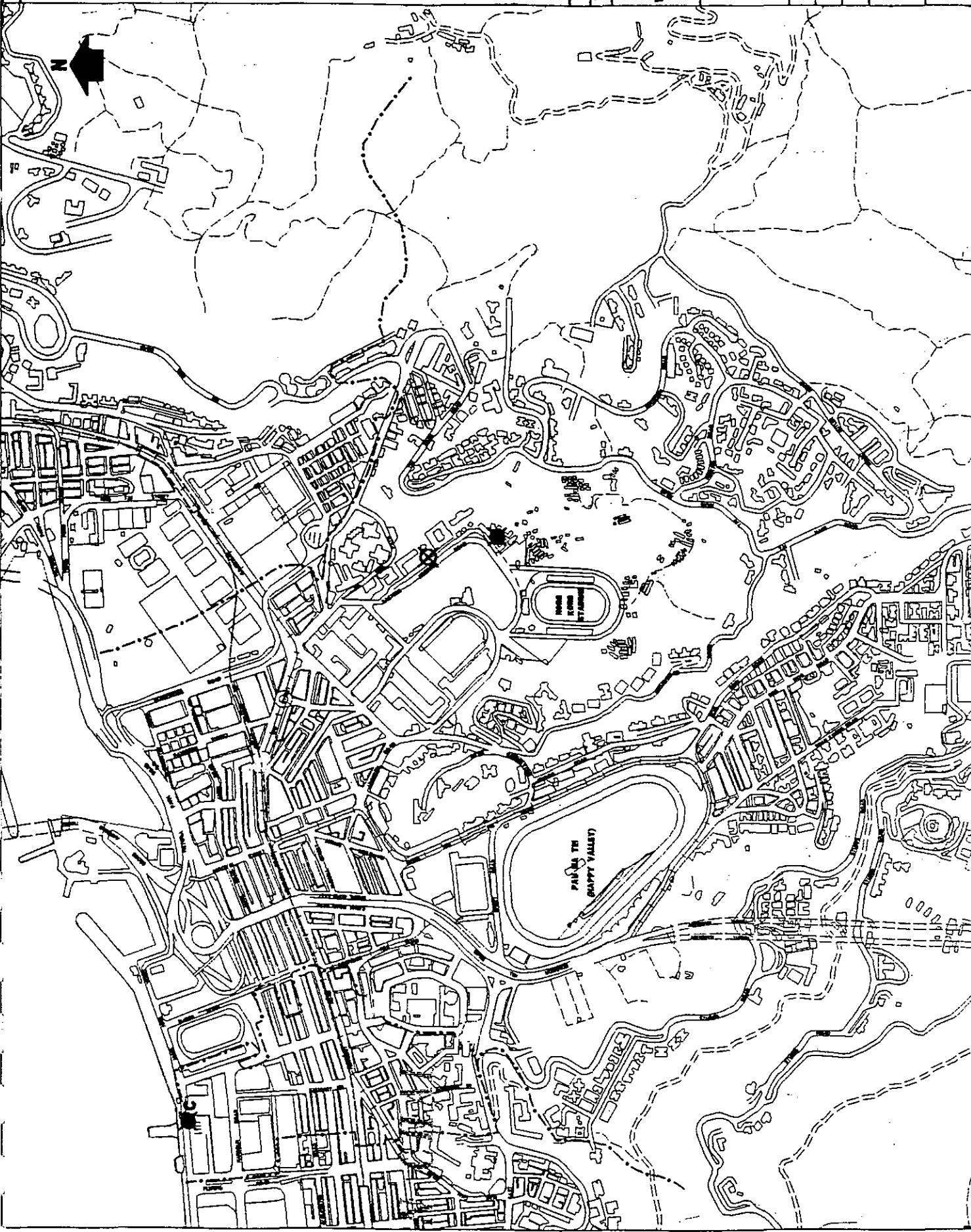
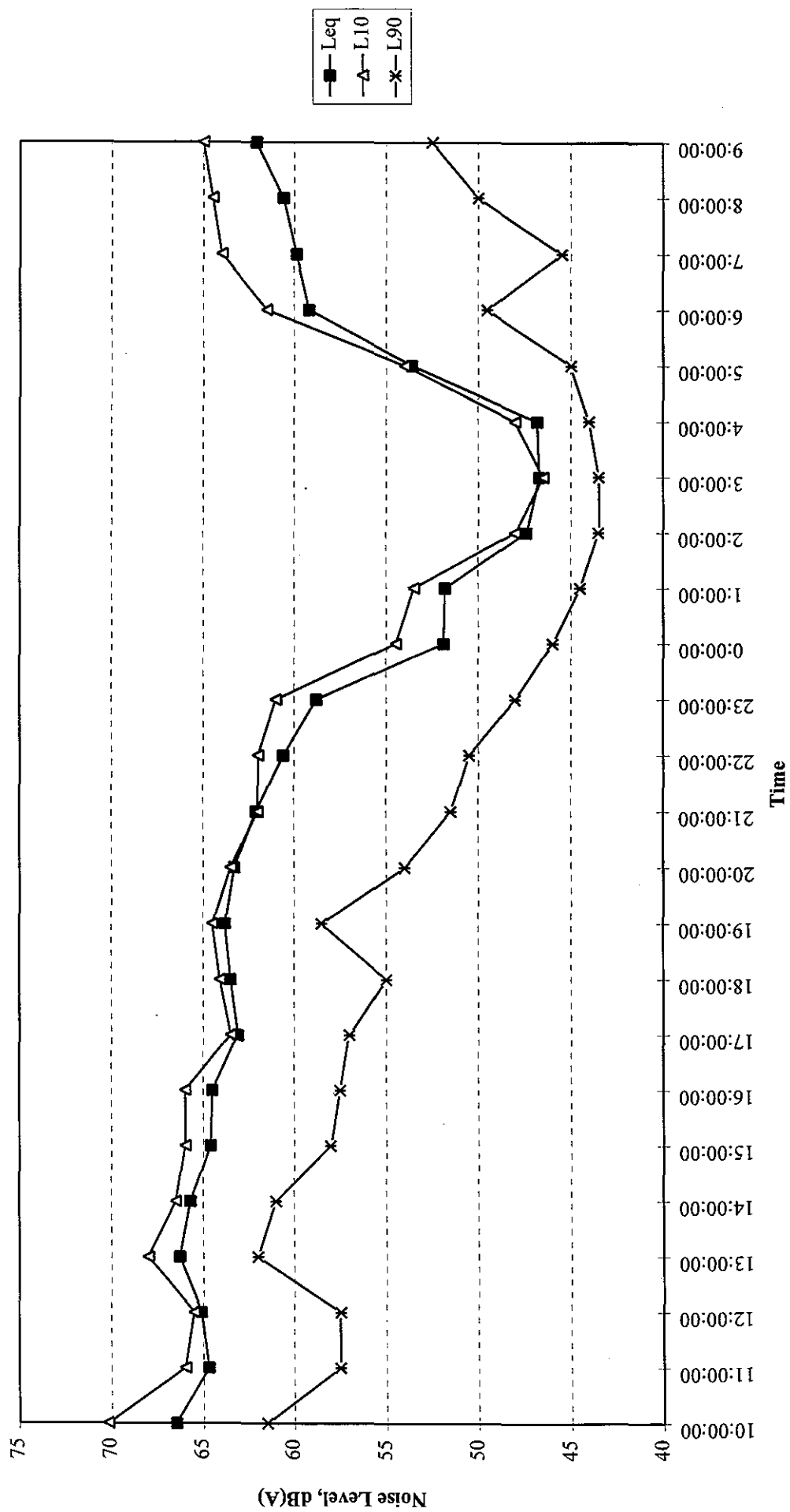
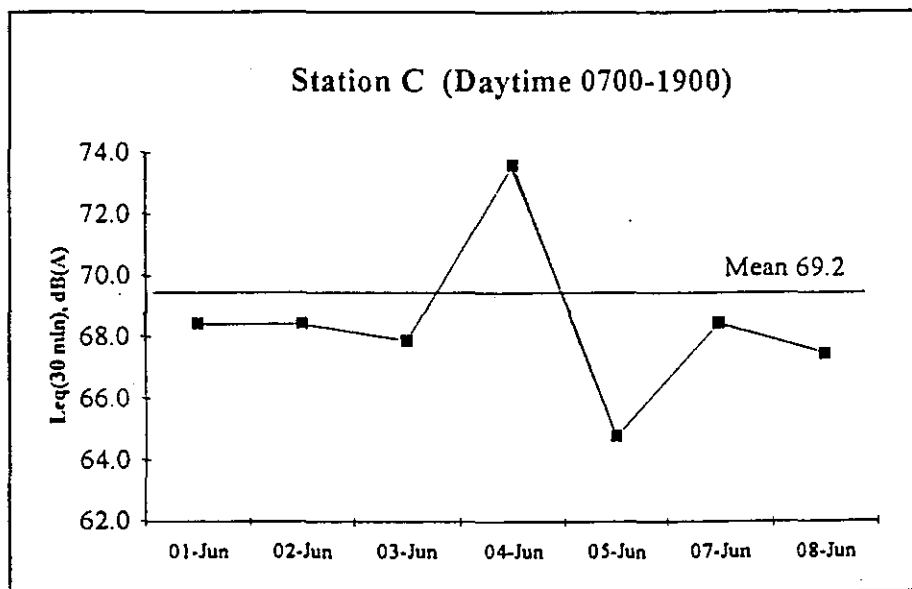


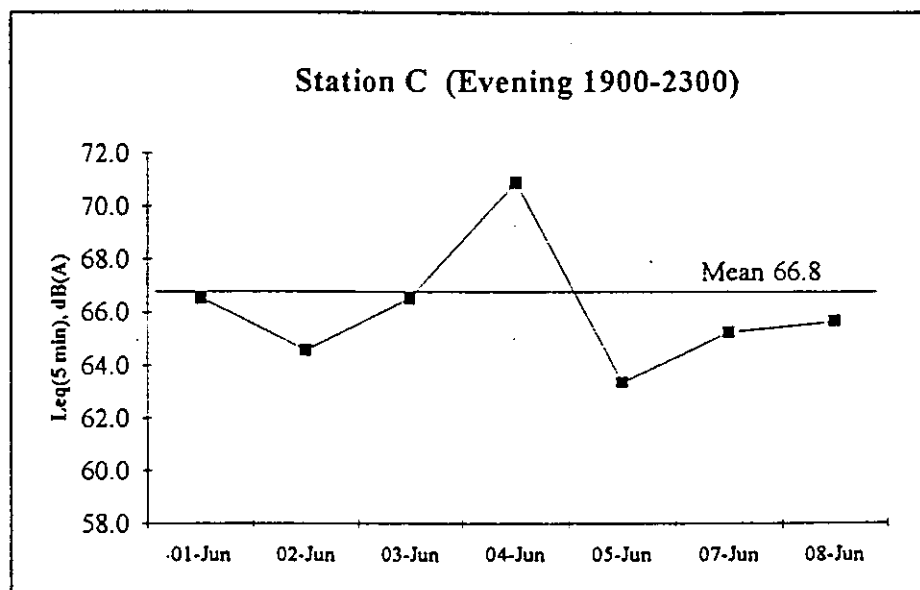
Figure 5.4 Variation of Baseline Noise Level over a 24-hour Period.





Source : CES (Asia) Ltd 9604\report\albase.fir

<p>Agreement no. CE 78/94 WAN CHAI EAST AND NORTH POINT SEWERAGE</p> <p>Baseline Noise Levels at Station C - Daytime</p>	 <p>BINNIE CONSULTANTS LIMITED 賓尼工程顧問有限公司 CONSULTING ENGINEERS</p>	<p>Date NOV. 95</p>	
			<p>Figure No. 5.5a</p>



Source : CES (Asia) Ltd 9604\report\albase.f in

Agreement no. CE 78/94
WAN CHAI EAST AND
NORTH POINT SEWERAGE

Baseline Noise Levels at
Station C - Evening



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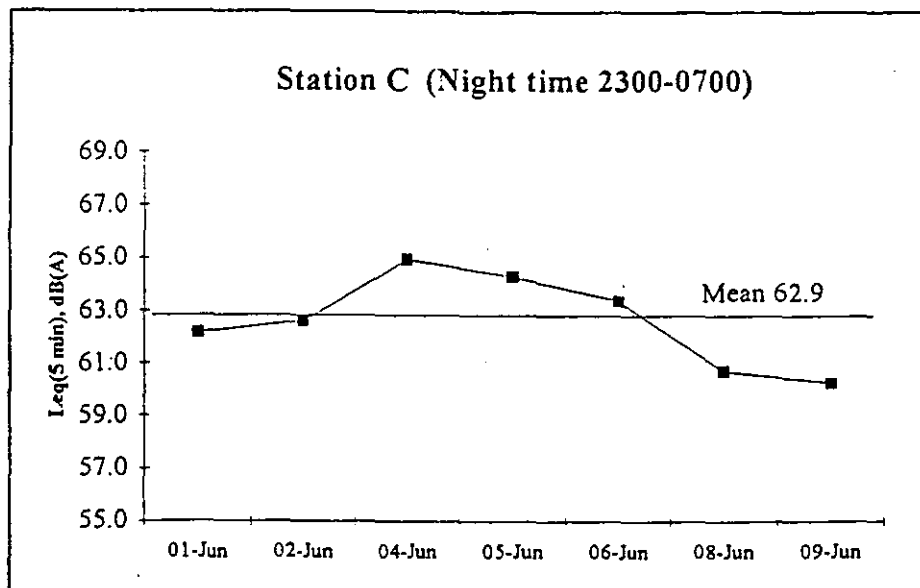
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Figure No.

5.5b



Source : CES (Asia) Ltd 9604\report\albase\fin

<p>Agreement no. CE 78/94 WAN CHAI EAST AND NORTH POINT SEWERAGE</p> <p>Baseline Noise Levels at Station C - Night-time</p>	 <p>BINNIE CONSULTANTS LIMITED 賓尼工程顧問有限公司 CONSULTING ENGINEERS</p>	<p>Date</p> <p>NOV. 95</p>	
			<p>Figure No.</p> <p>5.5c</p>

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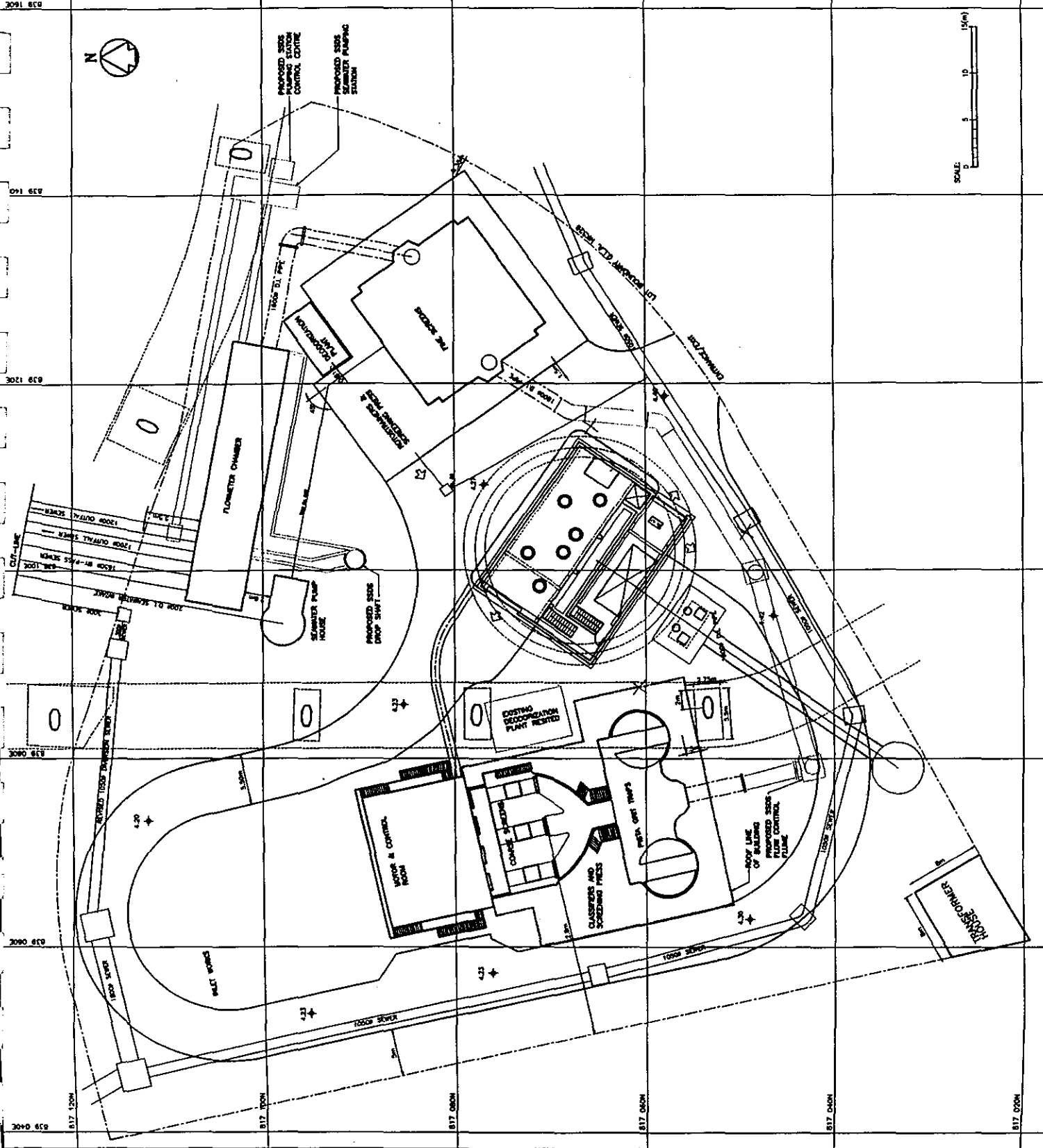
**NORTH POINT SCREENING PLANT
REVISED SITE LAYOUT**

5.6	NTS
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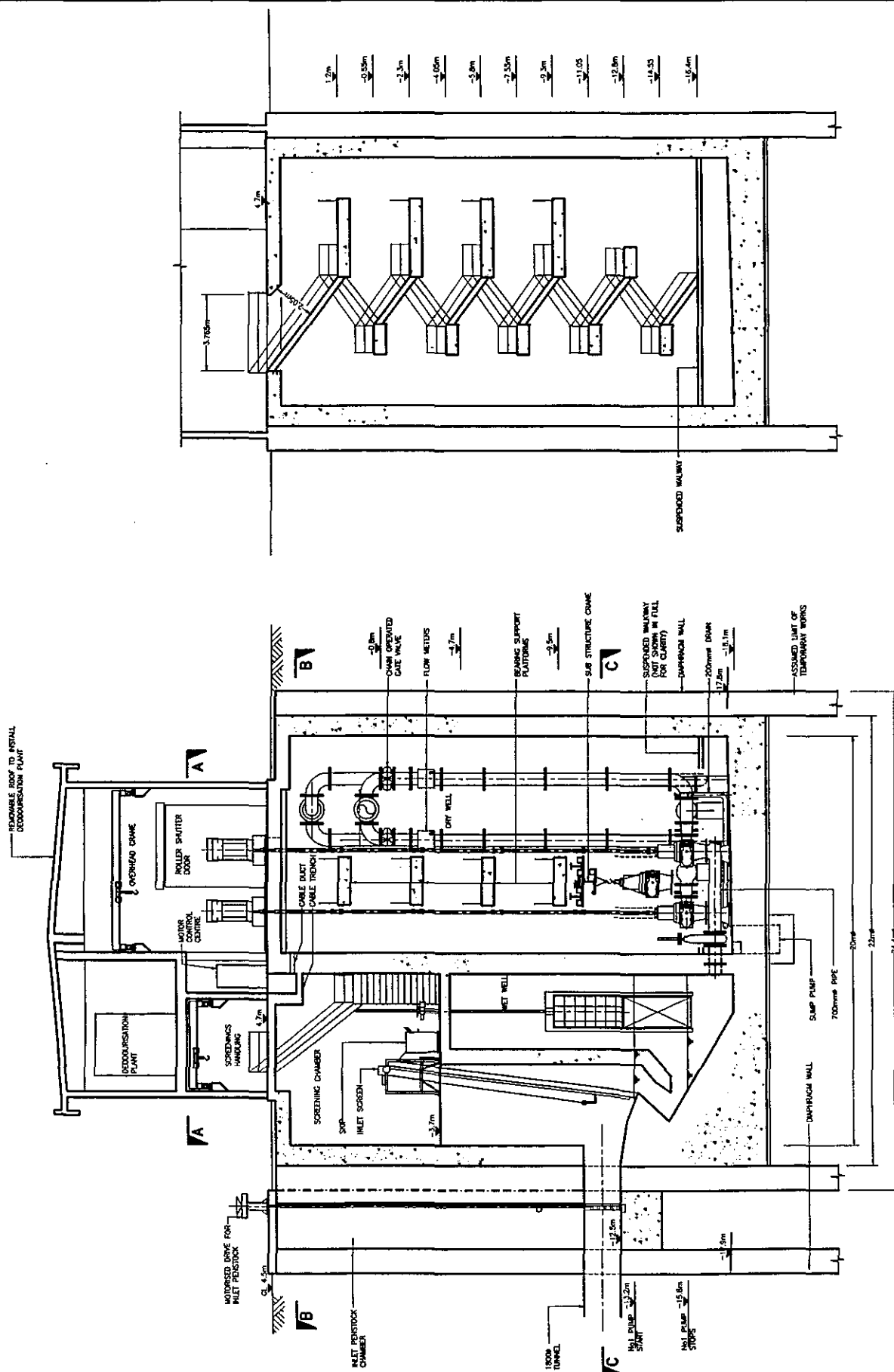


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 實尼



SECTION THROUGH STAIRWAY
SECTION B-B



~~SECTION A-A~~

SCALE:

MACRODURAME X:\0957\0503.DWG PLOT SCALE 1:100 A1

**DRAFT PRELIMINARY DRAWING
NOT FOR CONSTRUCTION**

number	date	description		debit	credit	balance
		debit	credit			
initial			RCE			RCE
date			5/96		5/96	5/96

**Wan Chai East & North Point
Sewerage**

NORTH POINT PUMPING STATION SECTIONS

5.7 NTS



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6 AIR QUALITY

Introduction

6.1 This section presents the assessment of air quality impacts generated by the construction and operational phases of the Wan Chai East & North Point Sewerage Project.

6.2 Major potential sources of air pollutants have been identified as follows:

- (i) the permanent pollutant source of odour emissions¹ from the new sewage lift pumping station at North Point Screening Plant, during the operational phase,
- (ii) the temporary sources of dust generated during trench excavation and filling, transportation of excavated materials and odour generated from cleaning or sealing and/or removal of old sewers during the construction phase.

6.3 The screening plant will be equipped with appropriate deodorising equipment. Little construction dust will be generated. The nuisance from construction vehicle and plant emissions is likely to be negligible because it is anticipated that the number of these vehicles and plant will be small.

Air Quality Assessment Criteria

6.4 As detailed in Section 3, the principal legislation regulating air emissions in Hong Kong is the *Air Pollution Control Ordinance (APCO) [Cap 311]* of 1983 and its subsidiary regulations. The whole of the Territory has been divided into Air Control Zones.

6.5 The Hong Kong Air Quality Objectives (AQO) stipulate maximum acceptable concentration of air pollutants. The AQOs for one, 24 hour and annual concentrations of Total Suspended Particulates (TSP) and Respirable Suspended Particulates (RSP) are shown in Table 6.1.

¹ Works and associated air quality impacts from modification of the Wan Chai East Screening Plant are investigated in the Central Western and Wan Chai West Sewerage Project EIA.

- 6.6 There is no statutory criteria for maximum levels of odour in Hong Kong. The composition of sewage odours is complex and primarily a function of the type of waste constituent and the biological decomposition process. The types of odorous components emitted may include hydrogen sulphide, ammonia, skatoles, indoles, methylamines, mercaptans, organic acids and alkyl sulphides.²

Table 6.1
Air Quality Objectives for TSP and RSP

Pollutants	Concentration ($\mu\text{g}/\text{m}^3$)		
	Averaging Time		
	1 hour ¹	24 hour ²	1 year ³
Total Suspended Particulates (TSP)	500 ⁵	260	80
Respirable Suspended Particulates (RSP) ⁴	-	180	55

Notes: Concentrations measured at 298K(25°C) and 101.325 kPa (one atmosphere)

- 1 One hour criteria not to be exceeded more than 3 times per year.
- 2 24 hour criteria not to be exceeded more than once per year.
- 3 Arithmetic means.
- 4 Suspended particulates in air with a nominal aerodynamic diameter of 10 micrometer (μm) or smaller.
- 5 This control limit has no statutory basis but is used as a target level for limiting fugitive dust emissions generated by construction activities.

- 6.7 The most characteristic odour component of stale or septic sewage is that of hydrogen sulphide (H_2S) which is produced by the anaerobic decomposition of organic compounds containing nitrogen and sulphur. H_2S is often detectable after all other components have been diluted below their detectability thresholds. For this reason, H_2S levels can often be used as a guide to possible odour nuisance.³

² *Wastewater Engineering Treatment, Disposal, Reuse* 3rd edition (1991) Metcalf and Eddy; McGraw Hill International Edition.

³ *Agreement No. CE 45/89 Strategic Sewage Disposal Scheme: Site Investigations & Engineering Studies, Stages II, III & IV: Final Environmental Assessment Report* (January 1993) AB₂H Consultants for Drainage Services Department.

6.8 The Brief states that:

"In case of odour impact from pumping station and treatment works, any odour prediction at a receptor equal to or exceeding 5 odour units based on a prediction averaging time of five seconds shall be considered an indication of odour nuisance. For odour monitoring, the odour strength should not exceed two units at the site boundary."

Air Sensitive Receivers

6.9 The nearest air sensitive receivers that will be exposed to the construction and operational air impacts from the Project have been tabulated in Table 4.4 for Wan Chai East Basin and Table 4.5 for North Point Basin. The nearby odour sensitive receivers (OSRs) to the North Point Screening Plant for the odour assessment are shown in Table 6.2 and Figure 6.1.

Table 6.2
Odour Sensitive Receivers (OSRs) in North Point

Odour Sensitive Receivers	Description	Number of floor	Distance between New Pumping Station and OSRs (m)
OSR1	North Point Estate (Public Housing)	10 floors on one floor podium	177
OSR2	Elementary School	4 floors classroom on one floor assembly hall	160
OSR3	Healthy Gardens	23 floors on 4 floor podium	128
OSR4	Healthy Gardens	23 floors on 4 floor podium	71
OSR5	Ruby Court	12 floors on one floor podium	74
OSR6	Healthy Village	20 floors	178

Baseline Air Quality

Existing Conditions

- 6.10 The Study Area is located within the Victoria Harbour airshed. EPD's latest data from air quality monitoring station at Central/Western has been used to estimate the baseline TSP and RSP levels in the Wan Chai and North Point area. Based on the 1995 records⁴, the maximum 24-hr TSP and RSP levels are approximately 180 $\mu\text{g}/\text{m}^3$ and 150 $\mu\text{g}/\text{m}^3$ respectively which are below the daily AQO. The baseline TSP monitoring data for Wanchai Reclamation Phase I has indicated an even lower TSP concentration⁵. The annual average TSP and RSP levels are approximately 90 $\mu\text{g}/\text{m}^3$ and 60 $\mu\text{g}/\text{m}^3$ which are above the annual AQO.

The North Point Screening Plant

- 6.11 A site visit to the North Point Screening Plant took place on 7 October 1995.
- 6.12 Figure 6.2 illustrates the schematic diagram of the flowing operation of the North Point Screening Plant. Sewage is collected from the catchment area and transported via the sewers to the Screening Plant. Normally, the sewage passes through the hand raked screen and is lifted via the screw pumps to the classifiers where the sewage passes through coarse screens to remove grit and large material. The coarsely screened sewage is then passed through fine screens and discharged to Victoria Harbour via the outfall between North Point and Lee Yu Mun.
- 6.13 The units that generate the odour are the coarse screening room and the fine screening room where coarse sludges and fine sludges are separated and placed into open containers (skips) for external disposal to landfill. Both screening rooms are fully enclosed and two biofilter units are installed. These two deodorising units are just one year old with a manufacturing specification of 99.5% removal rate efficiency for a typical gas level. Thus, the ambient odour level around the screening plant is low.

⁴ *Environment Hong Kong 1995 (A Review of 1994)* (1995) Environmental Protection Department.

⁵ *Baseline Monitoring for Wanchai Reclamation Phase I: Reclamation & West Bridge (Air Quality Monitoring)* (1995). CES for Territory Development Department.

- 6.14 Despite the high efficiency of the deodorising unit, odour was detected at the plant at one stage of the operating cycle. During the process of removing the full skip from the fine screen room, the door of the room remains open for around 30 minutes until the skip is picked up by the disposal truck. The truck then left the screening plant with the uncovered skip of sewage screenings exposed. As there was no cover on top of the skip, odour dispersed freely. The site supervisor has now confirmed that rolling screens on top of the skips have been installed. This is expected to significantly reduce the levels of odour released during the transportation of the screenings.

Future Conditions

- 6.15 As outlined in Section 2, extensive construction and infrastructure development works are currently being planned or undertaken in the Study Area. These projects all have the potential to decrease the air quality in the Study Area over the period (1996-2002) in which the Wan Chai East and North Point Sewerage Project is being implemented.

Air Quality - Construction Phase

Dust

- 6.16 The magnitude of the dust impacts from any construction site depends largely on the following criteria:
- (i) proximity of dusty processes to the sensitive receivers; and
 - (ii) the degree of dust emission from any individual process in any day.
- 6.17 In general, the types of construction activities which have the potential to generate moderate to high levels of dust on construction sites are:
- (i) excavation,
 - (ii) handling and removal of dusty material,
 - (iii) wind erosion of any dry materials,
 - (iv) movement of vehicles on site,
 - (v) concrete batching plant,
 - (vi) blasting.

For this project, no concrete batching plant will be needed.

- 6.18 Although the construction programme of this project is very long (approximately five years), the relaying of the pipes will be conducted street by street. Only small working areas will be required at any time: a typical open cut dimension could be 100 m by 3 m. Thus the quantity of the excavated material is unlikely to be large enough to cause a dust nuisance.
- 6.19 It is anticipated that most of the excavated material will be wet. Consequently its handling and removal will not generate a lot of dust. Excavated material will not be stockpiled but will be taken away from the site. Backfill material will be imported. Therefore, the dust impact associated with the wind erosion of the dry materials is expected to be minor.
- 6.20 Because of the relatively small working areas, it is anticipated that the total number of trucks required during construction will be very limited. Very little dust impact associated with the movement of vehicles on site is anticipated. Any material dropped on sealed roads will need to be cleaned up immediately and any construction plant and equipment must be kept clean when travelling over sealed roads. Plant and equipment likely to deposit any material outside of the workings will need to be washed regularly.
- 6.21 Provided that appropriate dust control measures are implemented including covering the loads of trucks carrying spoil and other potentially dusty materials away from the site, very little dust impact is anticipated during the construction phase.
- 6.22 Bentonite slurry and similar grouts used in trenchless technology are particularly prone to causing both water and, when spills dry out, air pollution. Bentonite should be carefully handled and the Contractor should have separation/recycling facilities off site and tanker the spent bentonite away for processing.
- 6.23 Appendix B presents recommended contract clauses relating to dust suppression measures to be included in the Tender Specifications for the Contractor. These clauses are designed to keep dust emissions very low under all conditions.
- 6.24 Construction dust is usually quantitatively assessed using the Fugitive Dust Model (FDM). The FDM assumes dispersion over a flat terrain, hence it is very difficult to apply to the high rise urban environment of Wan Chai and North Point. In view of the limited potential for dust generation and the difficulties of using the FDM in this context, quantitative assessment of construction dust will not be undertaken as part of this EIA Study and is not necessary.

Odour

- 6.25 There is a potential for odour nuisance during sewer cleaning, overpumping and the excavation and removal of spoil and rubble including old and broken concrete sewerage.
- 6.26 During sewer cleansing, the sewers will be jetted with high pressure hoses and loose materials such as grit, sand and grease will be dislodged and flushed downstream to the screening plant. Builder's rubble and similar materials which cannot easily be removed from the sewerage system may have to be dug out and trucked away for disposal to landfill. All trucks leaving the site should have their loads covered.
- 6.27 Good site practice will ensure that spills of sewage or other contaminated materials are minimised, mixed immediately with a suitable disinfectant and quickly cleared up, minimising the potential for odour generation. Any substantial spills will need containment and may need to be tankered away for disposal.
- 6.28 Overpumping allows sewage to be pumped from the section of sewerage above the one being replaced to a section downstream. Submersible pumps can be used with a generator. There can be a problem of odour if overpumping is not continuous as there may be a buildup of septic sewage in the upstream section. However, if pumping is continuous, the potential for the release of odour is minimised.
- 6.29 Odour management, including the use of odour neutralisation systems such as odour neutralizer, may be one of the odour controls. The odour neutralizer works by spraying via a high pressure nozzle system on the area with odour problems. The neutralizer absorbs malodour.

Air Quality - Operational Phase

- 6.30 The only significant operational phase air quality impact from the Project is likely to be odour generated by operation of the new sewage pumping station.

- 6.31 As outlined above, the principal odour generated from sewage treatment is hydrogen sulphide (H_2S) due to the anaerobic decomposition of substances containing nitrogen and sulphur. The production of odours at sewage treatment plants depend on a number of parameters namely temperature, sewage strength, velocity of sewage flow, pH, dissolved sulphide concentration and flux of H_2S . For this assessment, the concentration of H_2S will be employed as a representative odour level. If H_2S levels are kept at low levels all other substances are at levels way below their odour threshold.

Odour Concentration

- 6.32 As the threshold concentration of H_2S is 0.00047 ppm, EPD's recommended odour limits are equivalent to H_2S concentration at the sensitive receiver and the site boundary of $3.27 \mu g/m^3$ and $1.31 \mu g/m^3$ respectively.

Emission of H_2S

- 6.33 The rate of change of H_2S gas release from the wet well of the pumping station can be estimated from Pomeroy's equation as follows:⁶

$$R_{sf} = \frac{0.69 (su)^{3/8} j[DS]}{d_m} \dots\dots (6.1)$$

where,

R_{sf}	=	depletion of sulphide in the stream due to escape of H_2S , mg/l-hr
d_m	=	mean hydraulic depth (defined as the cross-sectional area of the stream divided by its surface width),m
s	=	slope of the energy grade line of the stream, m/m
u	=	stream velocity, m/s
j	=	proportion of dissolved sulphide present as H_2S
[DS]	=	dissolved sulphide concentration in the wastewater, mg/l

⁶ Design Manual: Odour and Corrosion Control in Sanitary Sewerage Systems and Treatment Plants (1985) United States Environmental Protection Agency.

- 6.34 According to the latest engineering data of the new pumping station, the following data are used for the worse case scenario, i.e. the maximum flow during the morning peak flow condition being assumed:

$$d_m = 0.71 \text{ m}$$

$$s = 1/700 = 0.0014 \text{ m/m}$$

$$u = 1.87 \text{ m/s}$$

- 6.35 Based on the survey report⁷ and Design Manual (Figure 2-3)⁸, the following data are used:

$$j = 0.95 \text{ for pH of the sewage being } 5.17$$

$$[DS] = 0.2 \text{ mg/l}$$

- 6.36 With the above parameters, the maximum rate of H_2S emitted from the sewage pipe during the peak morning flow is estimated to be 0.02 g/m^3 per hour.

- 6.37 It is planned to provide a ventilation system inside the wet well chamber. Ventilation will be provided to change air in the wet well 14 times per hour. The rate of H_2S emitted from the pumping station through the ventilation system has been estimated by using the following equation:

$$\text{Rate of } H_2S \text{ vented outside the PS} = (R_{sf} \times \text{ventilation rate}) / \text{ventilation volume.}$$

- 6.38 Based upon these sewage characteristics and the ventilation rate above, the predicted rate of H_2S released from the pumping station will be $7.8 \times 10^{-5} \text{ g/s}$.

⁷ Report on Pollutant Load Survey, Wan Chai East and North Point Sewerage Master Plan Study (Contract No. 1017/Part B), Ref No 921029e20382 (1993). Acer Consultants (Far East) Ltd.

⁸ Design Manual: Odour and Corrosion Control in Sanitary Sewerage Systems and Treatment Plants (1985). USEPA.

Odour Modelling Methodology

6.39 The Industrial Source Complex Short Term Model (ISCST2) has been used to model the concentration of H_2S at OSRs. The following assumptions have been used for the odour modelling:

- (i) According to the latest pumping station layout available at this stage, the odour source height (i.e. location of the wet well ventilation exhaust) would be 3 m above the ground level (see Figure 5.7 and Figure 5.8).
- (ii) Since the mechanical ventilation system has not been finalized yet, the exit velocity and the exit diameter have been assumed to be 3m/s and 0.8m respectively, which are typical for extraction fans suitable for this type of application.
- (iii) The following conversion has been used to adjust the average hourly concentration to three minute average⁹:

$$C_{1hr} = C_{3min} \left(\frac{t_{3min}}{t_{1hr}} \right)^p \dots\dots (6.2)$$

where C_{1hr} = odour concentration for the one hour averaging time
 C_{3min} = odour concentration for the 3 minute averaging time
 t_{3min} = three minute averaging time
 t_{1hr} = one hour averaging time
 p = the power law exponent

Then three minute average is converged to 5 sec average by means of the following factor based on R.A. Duffee, et al (1991):

$$C_{5sec} = C_{3min} cf \dots\dots (6.3)$$

where C_{5sec} = odour concentration for the 5 sec averaging time
 cf = correction factor

For the calm situation (i.e. D stability Class), the power law exponent, p , is assumed to be 0.2 and the correction factor, cf , is assumed to be 20. Thus, the conversion factor which is used to change the results from 1-hour averaging period to 5-second average is 37.

- (iv) Urban mode for point source and 1-hr concentration has been used.

⁹ Odour Modelling - Why and How, in Derenzo, D.A. and Gnyp, A. *Recent Developments and Current Practices in Odour Regulations, Control and Technology* (1991). Air and Waste Management Association, Pennsylvania. Duffee, R.A., Martha A. O'Brien and Nes Ostojic.

- (v) The latest year (1994) of meteorological data in terms of wind direction, wind speed, temperature and stability from the Central weather station has been used.
- (vi) The recommended guideline of 5 odour units per 5 seconds has been used to assess the output data.

Modelling result

- 6.40 The results of the unmitigated and mitigated odour modelling runs due to the new pumping station are summarized in Table 6.3. Figure 6.3 shows the odour modelling results under unmitigated conditions. Without mitigation, the odour modelling predicts that the odour levels for OSR1, OSR2, OSR3 and OSR6 are below 5 odour units, and therefore comply with the EPD's odour criteria. It is predicted that the odour level at the primary school and the proposed welfare complex will comply with the EPD's odour criteria.

Table 6.3
Predicted Odour Concentration Levels at Sensitive Receivers
in North Point (20m above ground level)

Odour Sensitive Receivers	Distance between the source and OSRs (m)	Maximum Odour Level (OUs)	
		Unmitigated	Mitigated**
OSR1	177.3	2.6	0.0
OSR2	159.9	3.2	0.0
OSR3	128.1	4.4	0.0
OSR4	70.9	9.5*	0.02
OSR5	74.4	8.5*	0.02
OSR6	177.7	0.2	0.0

Note * represents exceedance of EPD's odour criteria (SOUs)
 ** represents 99.8% efficiency of the deodouring unit

- 6.41 However, the odour levels for OSR4 and OSR5 at the height from 0 to 30m above ground are predicted to exceed the odour guideline as shown in Figure 6.3 and Figure 6.4. Consequently, odour mitigation will be required.

- 6.42 It is anticipated that on activated carbon or a biofilter odour removal unit similar to the one that has been operational for one year at the North Point Screening Plant will be installed. In order to assess the effectiveness of the existing deodourising unit, two monitoring points were identified for measuring the H_2S concentration before and after the use of the deodourising unit as shown in Figure 6.2. The first measuring point inside the fine screen room was to measure the H_2S concentration prior to deodourising. The second point was at the vent of the deodourising unit. The difference between these two measured levels indicate efficiency of the deodourising unit. This measured efficiency has been used to calculate the mitigated odour level at the sensitive receivers.
- 6.43 Monitoring was conducted by Hong Kong Productivity Council (HKPC). The method of measurement is shown in Appendix A. The monitoring results show that the gas removal efficiency of the deodourising unit is 99.8%. Thus the mitigated odour level at OSR4 and OSR5 is 0.01 odour units, and complies with the EPD's odour monitoring criteria.

Mitigation Measures

- 6.44 The odour assessment has concluded that odour controls are needed as prevention measures against the possibility of odour nuisance. Mitigation in terms of preventing H_2S emission can be achieved by installation of deodorisation units and good housekeeping practice.

Biofilter

- 6.45 The existing deodourising unit that has been operational at the North Point Screening Plant is a biofilter with a manufacturing specification of 99.5% gas removal rate efficiency. Biofilters achieve odour removal by the use of micro-organisms grown on an inert packing media. Odorous air passes through a soil, peat or composite bed, where odour is removed under the influence of enzymes produced by micro-organisms in the soil. Insitu monitoring has been carried out on the unit which indicates that the gas removal efficiency can reach as high as 99.8%.

Activated Carbon

- 6.46 An alternative type of deodorising unit uses activated carbon as the adsorbent for air pollutants. The odour efficiency of activated carbon is about 95% to 99.9%.
- 6.47 Biofiltration is preferred to activated carbon in Hong Kong's sewage plants because of the more reliable performance at high humidity and the relatively low capital and operational costs. Most of the water consumed by the biofilters can be recycled.

- 6.48 Particular attention should be paid on the location and direction of ventilation exhausts so that they should not be allowed to face any sensitive receivers directly. Consideration should be given to the location of windows and doors at the sensitive receivers and the direction of prevailing winds¹⁰.

Good Housekeeping

- 6.49 The pumping station will be designed to avoid accumulation of sludge deposits. Good housekeeping practices at the pumping station can help prevent odourous emissions. The following are some of the key practices:

- (i) Weekly inspection of the wet wells should be conducted to check the level of the accumulation of odourous grease, oil and scum. If the accumulation of these substances is excessive, more frequent removal and inspection are required.
- (ii) To reduce the rate of accumulation of odour-producing organic debris, regular cleaning and flushing of screens and other sewage handling equipment is required.
- (iii) Screenings and grit stored on site should be kept in closed containers or skips with rolling screens on top and disposed of as soon as possible.
- (iv) Sludge deposits in wet wells and channels should be regularly removed because sludge left in the pump and pipes can produce odourous gas.
- (v) The deodourisation and ventilation systems should be regularly inspected to ensure efficient operation.

- 6.50 It is recommended that during the operational phase, routine odour monitoring is carried out at the North Point Screening Plant. This would involve a daily walkover survey around the site boundary by the Plant Manager or a delegated member of staff. Additional monitoring will be undertaken at times of received complaints.

- 6.51 Any exceedance of the 2 Odour Unit limit will be recorded by the Plant Manager, who will make appropriate adjustments to the operation of the deodorization system.

¹⁰ *Dispersion of Odours, Odour Control - A Concise Guide* (1980). Warren Spring Laboratory. Keddie, A.W.C.

Summary

- 6.52 Construction dust and odour generated during the sewerage works and construction of the pumping station can and should be kept under control. For dust, given the scale of the construction activities and the proximity of the nearest sensitive receivers, effective mitigation measures will be needed to ensure that deterioration of air quality is kept to a minimum.
- 6.53 During the operation of the new pumping station, odour could cause significant impact to the sensitive receivers in the vicinity if mitigation measures are not applied. The principal odour source is H_2S emitted from the sewage in the wet well. To reduce this adverse impact, a biofilter or similar odour control method will be installed at the North Point Screening Plant. Insitu testing of a biofilter unit at the North Point Screening Plant has shown that the gas removal rate efficiency is 99.8%. Thus, odour levels at all sensitive receivers are expected to comply with the EPD's odour criteria.



5-⊕ LOCATION OF SENSITIVE RECEIVER

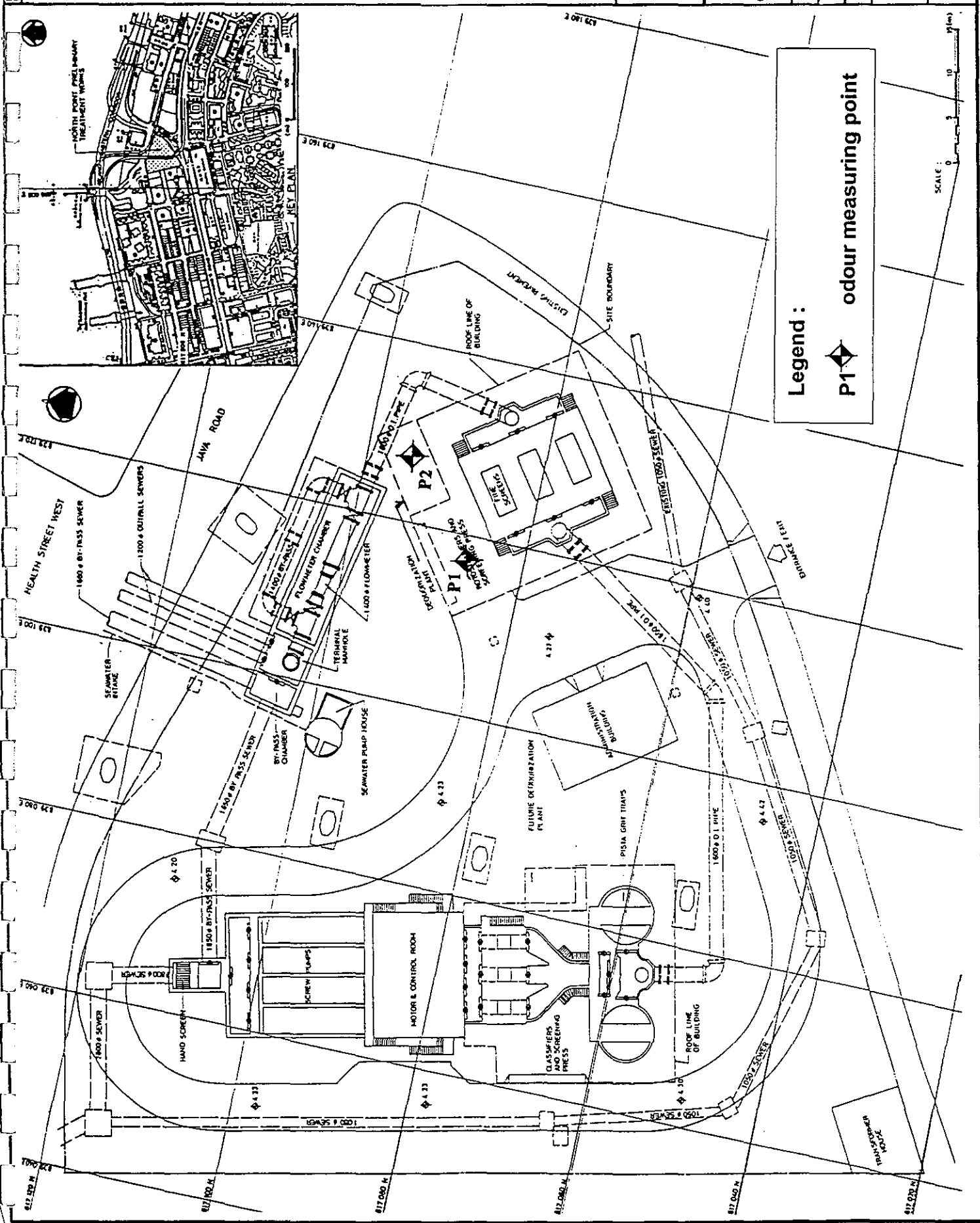
Agreement no. CE 78/94
WAN CHAI EAST AND
NORTH POINT SEWERAGE

 BINNIE CONSULTANTS LIMITED
賓尼工程顧問有限公司
ENGINEERS AND SCIENTISTS 賓尼

Title :

NORTH POINT SCREENING PLANT: ODOUR SENSITIVE RECEIVERS

Figure No. 6.1	Revision 0
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Prepared YWL	Checked PS
Date MAY. 96	Scale 2000



8 WASTE & SPOIL MANAGEMENT

Introduction

- 8.1 This section examines the sources of wastes arising from the sewerage works and construction and operation of the sewage pumping station.

Waste - Construction Phase

Impact Assessment

- 8.2 The construction methods and programme for the works are detailed in the engineering Draft Preliminary Report¹. These are subject to change during the Detailed Design Phase.
- 8.3 As the working procedures and schedules have become defined, we have carried out the construction waste impact assessment with reference to the *Waste Disposal Ordinance [Cap 354] (1980)* and the subsequent Waste Disposal Plan.²
- 8.4 Careful calculation of waste quantities and the speed of their generation will allow us to formulate plans for efficient removal and disposal with the aims of minimal disruption to traffic flow and maximum environmental protection.

Sources of Construction Waste

- 8.5 Waste materials will be produced throughout the construction phase. The main sources of solid waste arisings are likely to be:
- (i) surplus excavated spoil and rock;
 - (ii) damaged, used and surplus construction materials;
 - (iii) bentonite slurry or similar grouts and surplus excavated materials with a high clay/water content;
 - (iv) sewage sediments and old sewer pipes (concrete waste).

¹ Agreement CE 78/94, Wan Chai East and North Point Sewerage: Draft Preliminary Report (May 1996). Binnie Consultants Limited for Drainage Services Department.

² Waste Disposal Plan for Hong Kong (1989) Environmental Protection Department.

Spoil Materials

- 8.6 The majority of material excavated during open cut works, tunnelling and excavation of the shafts for the trenchless works and the deep shaft for the pumping station at North Point Screening Plant is expected to consist of road and footpath making materials, such as concrete, cement, and tar or macadam based materials, which are inert, and also soil material. Some of these types of material are likely to be suitable for use in a reclamation project or public dump and this would be the preferred disposal option. Due to space limitations, excavated material will need to be taken off-site. It is expected that the Contractor will sieve the excavated soil to remove boulders and debris unsuitable for use as backfilling material at his own site remote from the works. The sieved material will then be brought back as imported backfill material.
- 8.7 Demolition at North Point Screening Plant of the existing administration building and pump house and other works will generate construction wastes such as timber and building debris.
- 8.8 Materials such as glass, steel or other metals will be taken to landfill. It should be noted that at the strategic landfill sites, construction waste must contain no more than 20% inert material by volume. Inert materials such as rock, soil, sand and debris will be sorted before disposal as much as possible and used at other building sites if this can be arranged. Dry concrete waste will be sorted out from other wastes and recycled for reuse or sorted for disposal at public dumps.
- 8.9 The identification of final disposal sites for spoil created by the construction work will be considered during the detailed design stage of the project.
- 8.10 All vehicles leaving the site carrying solid waste should have their loads covered, and be routed, so far as possible, to avoid sensitive receivers in the area.

Municipal Waste

- 8.11 Solid and liquid wastes will be generated by the construction workers during the construction period. The maximum number of onsite staff is estimated to be about 35, with around ten workers at each of the shaft or open cut work sites at any one time. If the quantity of municipal waste generated estimated to be 1.29 kg/employee/day³, then the total generation will be around 45 kg/day. Temporary waste facilities will need to be set up by the Contractor. Municipal waste will be collected in black refuse bags and delivered to, and disposed of at, an approved landfill.

³ *Monitoring of Municipal Solid Waste 1991, 1992 (1993), Environmental Protection Department.*

Chemical Waste

- 8.12 The chemical wastes likely to be generated during the construction period are lubricants, oil and solvents. Lubricants and waste oil are likely to be generated from the maintenance of vehicles and mechanical equipment. Used lubricants will be collected and stored in individual containers which are fully labelled. The containers will be stored in a designated secure place. If these wastes cannot be recycled, then they will be treated as chemical waste and sent to the Chemical Waste Treatment Centre at Tsing Yi.
- 8.13 Layers of sawdust or equivalent material should be laid underneath or around any construction plant or equipment that leaks oil. The polluted clean up materials should be replaced with fresh material on a regular basis. Any polluted materials should be disposed of in an acceptable manner
- 8.14 All the empty chemical cans/drums/bottles will be collected for reuse or disposal. Chemical waste will not be allowed to discharge into stormwater drains either by direct discharge or as contaminants carried in surface water runoff from the Site.
- 8.15 The volume of chemical waste generated is predicted to be minimal.

Bentonite Slurry

- 8.16 Substantial volumes of bentonite or other slurries will be required during tunnelling/pipe jacking works and construction of the associated deep shafts. In addition, construction of the deep shaft for the new pumping station at North Point Screening Plant will involve diaphragm walling and curtain grouting below the diaphragm wall to bedrock. A slurry collection, separation and recycling system for spent bentonite or other grouts with a high clay/water content should be operated by the Contractor, offsite.

Sewage

- 8.17 Domestic sewage generated from Site toilets, washing facilities and any temporary canteen provided for construction workers will be collected separately and discharged to foul sewer.

Sewer Sediments and Grease

- 8.18 Considerable problems were experienced during the sewer surveys carried out during the SMP with sediments, silts and grease.⁴ These deposits in the sewers often resulted in surcharged conditions.

⁴ Agreement No. CE 2/92, Wan Chai East & North Point Sewerage Master Plan Study - Final Report (September 1994). Acer/John Taylor for EPD.

- 8.19 The presence and depths of sediments were recorded during closed circuit television (CCTV), manhole and flow surveys. The results showed that some 21 km length of foul sewers were affected by silt and that sediment depths worsened towards the coastal reclamation sites.
- 8.20 Grease is also a major cause of blockages in Hong Kong sewers and the problem is particularly prevalent in the restaurant area of Causeway Bay, which has a high density of eating establishments. Grease traps, where installed, are often poorly maintained by the owners, resulting in wastewater flowing through overflows and bypasses rather than through the trap.
- 8.21 The first stage of removal of silt and debris would be by means of dragging a mandrel through the pipeline followed by high pressure hose cleaning equipment. This will flush the accumulated sludge through the system to the screening plant where screenings will be removed and ordinarily disposed of to landfill. Any silt and debris remaining in the section of sewer being cleaned will be removed using suction tankers.
- 8.22 During the SMP investigation work, however, sediments were frequently found to contain appreciable amounts of sand and gravel indicating their source as being street cleaning and building sites. The results of metal analysis of samples taken from foul sewers indicated that the sediments are Class C materials ("heavily contaminated, and a source of contamination. Disposal must be to specified containment sites and be carried out in accordance with specified removal transport and discharge procedures") as defined in the Contaminated Spoil Management Study⁵. Discharge of such sediments to the marine environment is not allowed except under a special licence. The sediments will be dewatered and disposed of to landfill in the same manner as sewage screenings.

Wood

- 8.23 Wooden materials, such as wooden boards for formwork, may be used during the construction phase. Wooden waste should be sorted out from other waste. On-site incineration of wooden waste should be strictly prohibited both from a safety and a smoke nuisance aspect. In order to minimise waste, the Contractor should identify wooden waste which can be used and/or recycled.

⁵ Contaminated Spoil Management Study - Draft Final Report. Vol.1 (1990) Mott MacDonald (HK) Ltd & Dredging Research Ltd for EPD.

7 WATER QUALITY

Introduction

- 7.1 One of the mission statements in EPD's publication *Environment Hong Kong 1995*¹ is:

"To safeguard the health and welfare of the community from adverse environmental effects associated with the improper handling and disposal of wastes, including achieving water quality objectives for marine and fresh waters such that various conservation goals for them can be met."

- 7.2 The Wan Chai & North Point Sewerage Project is part of the Government's overall plan to improve the quality of Hong Kong's waters. This section outlines how the sewerage works and modification of North Point Screening Plant² can be undertaken in ways which minimise adverse effects on water sensitive receivers in the Study Area and emphasises the importance of the proposed works as a step forward in the Government's long term strategy to reduce the pollution of Victoria Harbour.

Water Quality Assessment Criteria

- 7.3 The Study Area is located within the Victoria Harbour (Phase III) Water Control Zone (WCZ). Phase III was declared on 1 April 1996.
- 7.4 The geographical extent of Victoria Harbour (Phase III) WCZ is shown in Figure 7.1. The main areas within the WCZ include Kennedy Town, Shek Tong Tsui, Sai Ying Pun, Sheung Wan, Central District, Wan Chai, Happy Valley, Causeway Bay, North Point and Quarry Bay.
- 7.5 The standards for discharges of effluents into Victoria Harbour (Phase III) WCZ are presented in the *TM on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters*, Tables 1, 6, 9a and 9b.

¹ *Environment Hong Kong 1995: A Review of 1994* (1995) Environmental Protection Department.

² Works and associated water quality impacts from modification of the Wan Chai East Screening Plant are investigated in the Central Western and Wan Chai West Sewerage Project EIA, a separate consultancy.

Water Quality Sensitive Receivers

- 7.6 Sensitive receivers have been identified using definitions given in *Hong Kong Planning Standards and Guidelines (HKPSG)*. The water quality sensitive receivers/uses are:
- (i) typhoon shelter in Causeway Bay;
 - (ii) water intake points for domestic and industrial uses; and
 - (iii) sensitive biological uses in Victoria Harbour.
- 7.7 The Causeway Bay Typhoon Shelter is classified by EPD as being in the lowest quality category. This category describes the present condition of the typhoon shelter waters as heavily polluted by organic wastes, high levels of inorganic nitrogen, high *E. coli* counts and very high Biochemical Oxygen Demand (BOD) levels in the bottom layers and sediments.
- 7.8 Toilet flushing and industrial cooling systems in the Study Area are affected by the quality of water at the intake points which are located along the shore of Victoria Harbour. Measures should be taken to ensure that the water quality at the intake of the Wan Chai Salt Water Pumping Station should not be adversely affected during the construction or as a result of the proposed works. Seawater quality at the intake should at all times comply with the Water Quality Objectives for Flushing Purposes by the Water Supplies Department.
- 7.9 To date, the poor water quality, general paucity of dissolved oxygen and high levels of nutrients, are likely to have had significant impacts on the biodiversity of Victoria Harbour.

Baseline Water Quality

Existing Conditions

- 7.10 Victoria Harbour provides a well-protected deep water port for one of the busiest seaways in the world, and also serves as the receiving water for wastewater generated from an urban population of over 4 million located in the main urban areas of Kowloon and Hong Kong Island.

- 7.11 The SMP Study calculated that about 81,700 m³ of sewage is discharged from the Wan Chai East and North Point foul sewerage basins to Victoria Harbour every day after preliminary treatment at two screening plants which are situated in Wan Chai East and North Point respectively. Screened wastewater is discharged offshore through marine outfalls. In addition, approximately 31,000 m³ of untreated sewage is discharged to the harbour via the Watson Road outfall and a further 10,700 m³ of untreated sewage is discharged via 'expedient' connections into the stormwater system. Thirteen of the 15 stormwater outfalls in the Study Area were found to discharge a pollution load of 12 to 1,020 kg BOD/day into Victoria Harbour.
- 7.12 Serious faecal pollution is a characteristic of Victoria Harbour.³ Bacterial counts (*E. coli*) in excess of 10⁴ per 100 mL have been recorded. In addition, oxygen depletion in stratified layers and severe nutrient enrichment have combined to create a long standing water pollution problem.

Future Conditions

- 7.13 The Wan Chai East & North Point Sewerage Project is designed to improve the quality of waters discharged into Victoria Harbour from this area in two main ways:
- (i) by identifying the extensive foul sewage flows in the stormwater drainage system and reconnecting/connecting the flows to the sewerage system;
 - (ii) by ensuring that the Watson Road outfall is decommissioned.

Measures have been taken to close the Watson Road Outfall and thus some water quality improvements have already been achieved. However, the outfall still provides an emergency overflow when the foul sewerage system is surcharged. Complete sealing of the outfall can only be undertaken when the capacity of the system is increased, and thus the problem of surcharging is solved, following implementation of the proposed sewerage improvement works.

- 7.14 Closure of the 'expedient' connections should ensure that all sewage flows pass through the existing North Point and Wan Chai East screening plants where flows will be screened and dewatered prior to discharge into the harbour through existing outfalls. This will lead to further improvement in water quality in the area, as well as facilitating the connection of the Wan Chai and North Point sewerage systems to Stage III of the Strategic Sewage Disposal Scheme (SSDS).

³ *Marine Water Quality in Hong Kong for 1993 (1994)* Environmental Protection Department.

- 7.15 Treated effluent will be discharged by gravity flow to facilities provided under SSDS. While the strategy for SSDS Stage III/IV has not been finalized, it is likely that sewage flows from the northern side of Hong Kong Island will be collected and discharged after screening and degritting at the existing screening plant into the SSDS deep tunnel system. The flows will then be treated at Stonecutters Island sewage treatment works. The treatment process(es) and level of treatment will be subject to the findings and recommendation of the current SSDS EIA Study. Following implementation of SSDS, sewage will no longer be discharged into the harbour.
- 7.16 Sewerage works and pumping station improvements under the Wan Chai East & North Point Sewerage Project will be constructed in parallel with sewerage projects elsewhere in the Victoria Harbour catchment and the first stage of SSDS.
- 7.17 SSDS Stage I involves the provision of deep tunnel sewers to collect sewage from Kowloon between Tsuen Wan and Kwun Tong, and from Shau Kei Wan and Chai Wan, and to transfer this to Stonecutters Island for primary treatment and discharge via an interim outfall to Victoria Harbour. Construction of the first stage of SSDS commenced during 1994 and will, when completed, provide proper treatment for the first time for the sewage generated in the area. These works will result in significant improvement to the water quality of Victoria Harbour.^{4,5}
- 7.18 However, construction and sewer cleaning activities themselves have the potential to adversely impact on the water system of this area. Potential construction and operational impacts on Victoria Harbour are discussed below.

Water Quality - Construction Phase

- 7.19 Potential impacts on water quality as a result of sewerage works are identified to be:
- (i) construction site runoff and infiltration water;
 - (ii) bentonite slurry from the use of trenchless techniques;
 - (iii) washwater, sewer sediments and grease from sewer cleansing and replacement;
 - (iv) sewage effluent from construction workforce.

⁴ Agreement No. CE 45/89 Strategic Sewage Disposal Scheme: Site Investigations & Engineering Studies Stage I - Final Environmental Impact Assessment Report (January 1992) AB₂H Consultants for Drainage Services Department

⁵ Environment Hong Kong 1995: A Review of 1994 (1995) Environmental Protection Department.

- 7.20 Construction site runoff has the potential to impact on the waters of Victoria Harbour by increasing the suspended solids loading and potential for sediment deposition. If unrestrained, site runoff may carry suspended solids containing toxic contaminants such as fuels, oils, lubricants and concrete. Accidental spillage of chemicals and other contaminants may also be carried in stormwater drains. Any adverse impact on the water quality should be avoided.
- 7.21 Open trenches will collect surface runoff water following rainstorm events as well as from any groundwater which infiltrates the trenches or jacking pits.
- 7.22 Bentonite slurry is particularly liable to cause both water pollution, and air pollution when spills dry out.
- 7.23 Sewage effluent is characterised by higher suspended solids and BOD, nutrients and bacterial count than stormwater. Sewage discharges both from site toilets and sewer cleansing washwaters should be rigorously controlled both in relation to the potential health implications for construction workers and any member of the public accidentally coming into contact with contaminated materials, and to prevent any accidental discharge into the stormwater drainage system.

Mitigation Measures

Construction runoff

- 7.24 It is important that proper site management and good site practices in relation to runoff and drainage control are routinely and diligently carried out to ensure that construction activities do not cause high loadings of suspended solids to enter the nearby storm drain system. The control is of particular importance when the construction works are close to storm drains or open channels.
- 7.25 To protect surface runoff from possible contamination, it is important that:
- (i) surface water is collected and settled;
 - (ii) sediment traps or settlement tanks are used;
 - (iii) solids in the sediment traps are cleared out regularly;
 - (iv) oil interceptors have a bypass; and
 - (v) the extent of open working areas is minimised.

- 7.26 The main impacts of concern will be disposal of potentially contaminated infiltration and runoff water from construction works areas. Lubricants and waste oil are likely to be generated from the maintenance of vehicles and mechanical equipment. Used lubricants and other chemicals should be collected and stored in individual containers which are fully labelled. The containers should be stored in a designated secure place. If these wastes cannot be recycled, then they should be treated as chemical waste and sent to the Chemical Waste Treatment Centre at Tsing Yi.
- 7.27 Layers of sawdust or equivalent material should be laid underneath or around any construction plant or equipment that leaks oil. The polluted clean up materials should be replaced with fresh material on a regular basis. Any polluted materials should be disposed of in an acceptable manner
- 7.28 Open trenches will collect surface runoff water following rainstorm events as well as from any groundwater which infiltrates the trenches or jacking pits. It will be necessary to remove this water from the trenches so that the works can continue. Normally, the water would be removed from the trench using a submersible pump. As the trench water is likely to contain high levels of silt, it may be necessary to provide a settlement tank so that levels of suspended solids in the discharged water comply with the *TM on Standards for Effluent Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* (TMES). Where possible, the effluent should be discharged to the storm drainage system in preference to foul sewer.

Bentonite slurry

- 7.29 Bentonite slurry and similar grouts used in trenchless technology are particularly prone to causing both water and, when spills dry out, air pollution. Bentonite should be carefully handled and the Contractor should have separation/recycling facilities off site and tanker the spent bentonite away for processing.

Sewage

- 7.30 There will be a main site office where site staff will meet prior to being taken to the appropriate temporary site. Facilities at the site office would include office accommodation for the resident supervisory staff, Contractor's staff and the trenchless techniques support staff; washrooms/showers; toilets, and possibly a canteen. At each works site there should be adequate provision of chemical toilets and handwashing facilities.

- 7.31 Sewage generated from toilets, washing facilities and any temporary canteen provided for staff should be separately collected. The foul water effluent from the site office should be directed to a foul sewer either directly or indirectly by means of pumping facility which is approved by the Engineer.
- 7.32 All waste generated should be properly handled and disposed of. The estimated workforce based in the main site office is about thirty, with about 10 workers at each of the temporary sites. The quantities of domestic waste will be relatively small.
- 7.33 In general, any discharge of effluent from construction sites must comply with TMES. Advice on the handling and disposal of construction site discharges, including site runoff and contaminated wastewaters, is provided in the ProPECC Paper (PN1/94) on *Construction Site Drainage*.
- 7.34 Overpumping is used during on-line sewerage works to pump sewage from the section above the one being replaced to a section downstream of the works. Submersible pumps are often used. Pumps must have sufficient overpumping capacity to ensure that no surcharging and flooding of the upstream sewers occurs. In addition, there can be odour problems if overpumping is not continuous as there may be a buildup of septic sewage in the upstream sewer.

Sewer Sediments and Grease

- 7.35 Considerable problems were experienced during the sewer surveys carried out during the SMP with sediments, silts and grease.⁶ These deposits in the sewers often resulted in surcharged conditions.
- 7.36 The presence and depths of sediments were recorded during CCTV, manhole and flow surveys. The results showed that some 21 km length of foul sewers were affected by silt and that sediment depths worsened towards the coastal reclamation sites.
- 7.37 Grease is also a major cause of blockages in Hong Kong sewers and the problem is particularly prevalent in the restaurant area of Causeway Bay, which has a high density of eating establishments. Grease traps, where installed, are often poorly maintained by the owners, resulting in wastewater flowing through overflows and bypasses rather than through the trap.

⁶ Agreement No. CE 2/92, *Wan Chai East & North Point Sewerage Master Plan Study - Final Report* (September 1994). Acer/John Taylor for Environmental Protection Department.

- 7.38 The first stage of removal of silt and debris would be by means of dragging a mandrel through the pipeline followed by high pressure hose cleaning equipment accompanied by suction tankers for removal of material.
- 7.39 Sediments were frequently found to contain appreciable amounts of sand and gravel indicating their source as being street cleaning and building sites. Like sewage screenings, the sediments will be dewatered and disposed of to landfill.
- 7.40 No sewage or washwater from sewer cleansing should be allowed to flow to any stormwater drain, storm culvert, open channels or nullah.
- 7.41 Appendix B presents recommended contract clauses relating to removal of waste materials (including suspended and dissolved material) and discharge to sewers and drains. These clauses should be included in the Tender Specifications for the Contractor.

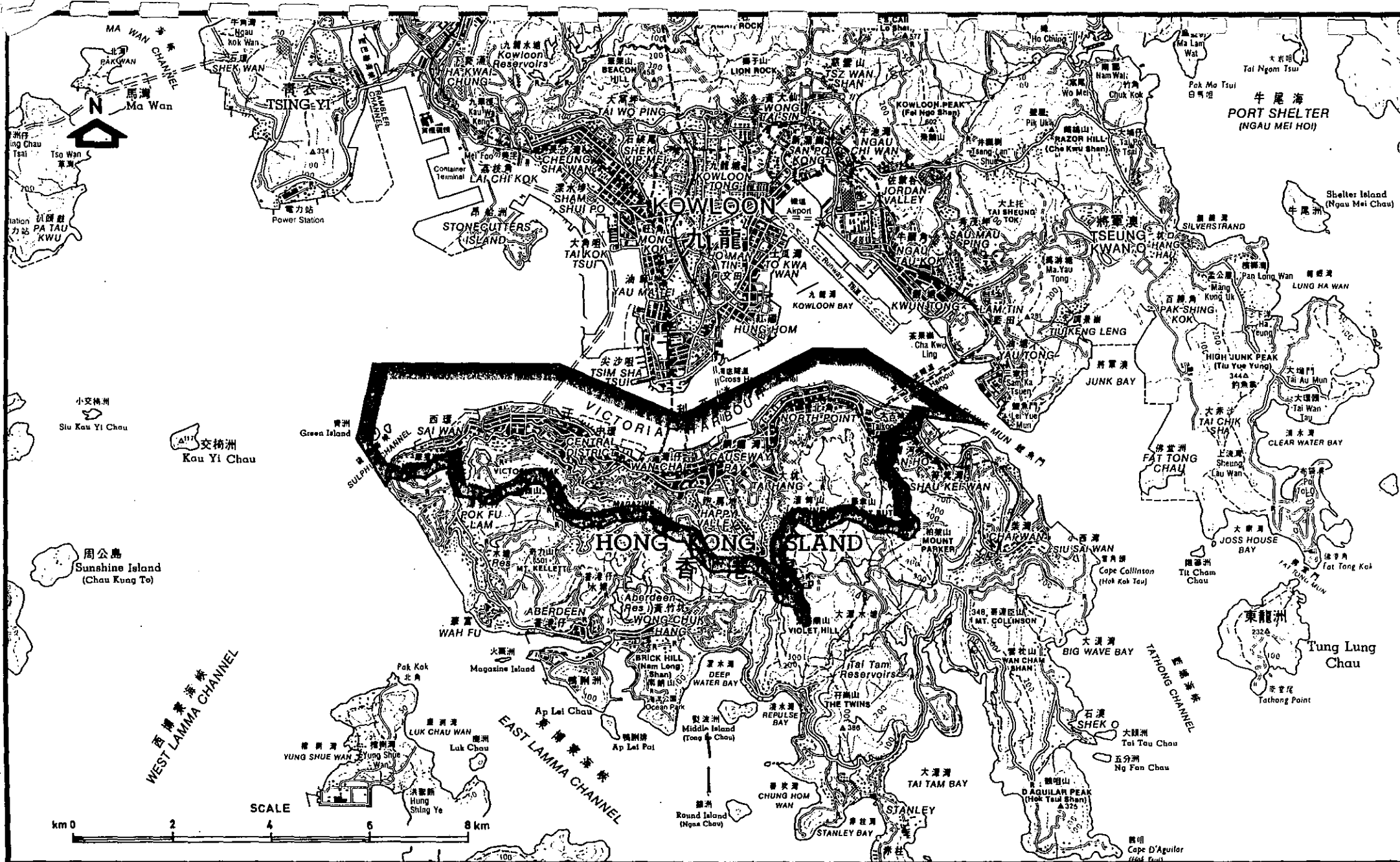
Water Quality - Operational Phase

- 7.42 The implementation and operation of the Wan Chai East and North Point Sewerage programme will make a major contribution to the Government's ongoing programme of improving the water quality in the Victoria Harbour area specifically and Hong Kong's Territorial Waters generally.
- 7.43 As a result of the sewerage and associated works, prior to the implementation of the Strategic Sewage Disposal Scheme, there will be a systematic and progressive increase in foul flows through the screening plants at Wan Chai East and North Point. This is due to the improved interception of polluted stormwater flows and diversion of all flows to the screening plants prior to discharge. The screened sewage will be discharged into Victoria Harbour via the two existing outfalls, namely the Wan Chai East outfall and the North Point outfall. For the sake of improving the water quality of Victoria Harbour in the long run, it is the Government's intention to replace all the existing outfalls in Victoria Harbour by SSDS as the ultimate sewage disposal solution for the urban area.
- 7.44 It should be noted that the screening plants at North Point and Wan Chai East and the marine outfall at North Point have adequate design capacity to cater for the additional flow generated by the improved interception of foul water, therefore there will be no deterioration in water quality over that previously allowed for from these sources.

- 7.45 The capacity of the Wan Chai East outfall has been reviewed under the Central Western and Wan Chai West Sewerage Project. Whilst the Wan Chai East outfall has been designed to accommodate the total flow from the catchment, the capacities of the Wan Chai East screening plant and outfall will require upgrading to cater for additional foul flows resulting from the proposed decommissioning of the Wan Chai West screening plant. The Wan Chai West screening plant and outfall will be kept in operation until the trunk and associated sewerage works within the Wan Chai West drainage basin have been completed and the Wan Chai East screening plant and outfall have been enlarged to take the additional flows.
- 7.46 Improvements to the existing sewer system, including larger pipe diameters, will provide excess capacity and thus prevent undesirable overflow and flooding of streets during heavy rainfalls.
- 7.47 Interception and treatment of screened sewage flows under SSDS Stage III/IV, of which this Project is a vital preliminary stage, will ultimately lead to a long awaited and significant improvement in water quality in Victoria Harbour.

Summary

- 7.48 The Wan Chai East & North Point Sewerage Project is designed to provide the two drainage basins with a sewerage system with sufficient capacity and velocity to ensure that the system functions efficiently, even under conditions of heavy rainfall, and that all foul flows are collected and treated at the two screening plants prior to discharge.
- 7.49 Closure of the Watson Road outfall has already achieved limited water quality improvements in Victoria Harbour. Correction of 'expedient' connections will ensure that the presence of polluted flows in the stormwater system is minimised and lead to further improvements in water quality.
- 7.50 The adverse water quality impacts associated with the proposed works will be limited to the construction stage which is relatively short term in nature. No adverse impact is expected if the recommended mitigation measures are carried out properly.
- 7.51 The ultimate, long term goal of the Government to achieve substantial improvement in the quality of the waters in Victoria Harbour will not be accomplished until the SSDS is fully implemented. However, the Wan Chai East & North Point Sewerage Project, with its localised improvements in water quality, represents an important step forward towards this objective.



The area edged grey on map is designated as a Water Control Zone under Section 4(1)(a) of the Water Pollution Control Ordinance Cap. 358.

維多利亞港(第三期)水質管制區 VICTORIA HARBOUR (PHASE THREE) WATER CONTROL ZONE

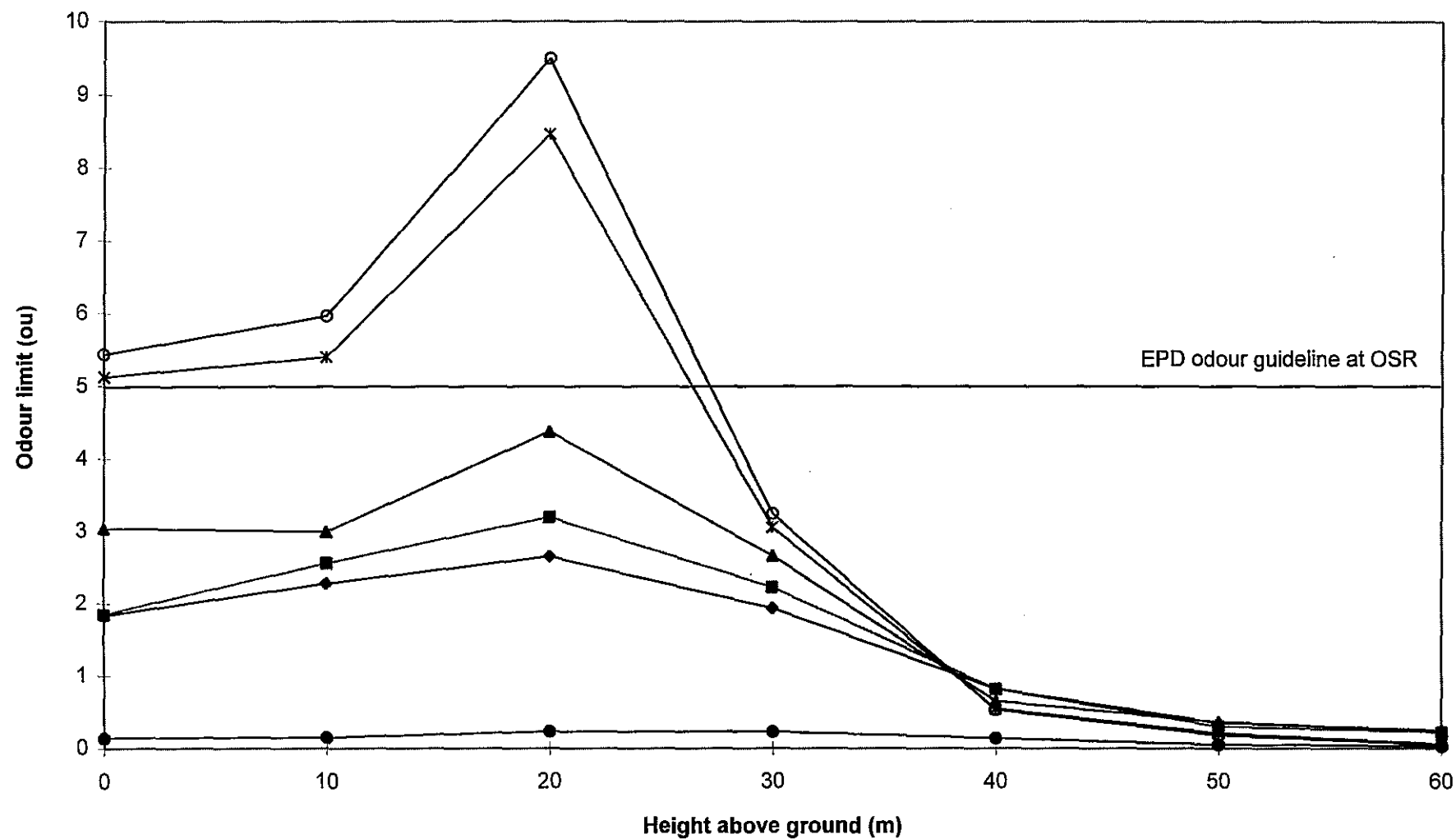
Figure No. 7.1

PLANNING, ENVIRONMENT
AND LANDS BRANCH
GOVERNMENT SECRETARIAT



<p>Agreement no. CE 78/94</p> <p>WAN CHAI EAST AND</p> <p>NORTH POINT SEWERAGE</p>		<p>Title :</p> <p>NORTH POINT SCREENING PLANT:</p> <p>PREDICTED ODOUR EMISSION (UNMITIGATED) FROM NEW PUMPING</p> <p>STATION</p> <p>(5 second H₂S, 20 m above ground)</p>		<p>Figure No.</p> <p>6.4</p>	<p>Revision</p> <p>0</p>
		<p>Reference</p> <p>WC&NP</p>	<p>File Name</p> <p>00040957.B05</p>		
		<p>Prepared</p> <p>YWL</p>	<p>Checked</p> <p>PS</p>		
		<p>Date</p> <p>MAY. 96</p>	<p>Scale</p> <p>5000</p>		

Figure 6.3
NORTH POINT SCREENING PLANT :
PREDICTED ODOUR EMISSION (UNMITIGATED) FROM NEW PUMPING
STATION



Old Sewer Pipes

- 8.24 The sewer pipes which are to be replaced are mainly made of concrete. During excavation and removal of the sewers, they are likely to be broken up. As concrete waste, the sewers will be transported away from the Site for disposal at public dumps.

Calculation of Construction Waste Arisings

Sewer Pipes

- 8.25 Until the detailed design work has been completed, it is not possible to provide accurate estimations of the quantity of waste that will be produced. The initial calculations of waste arisings from the construction works (Table 8.1) have been calculated by the engineering design team. It should be noted that the estimates are a minimum.

Table 8.1
Estimate of the Volume of Excavated Spoil Waste
Arising from the Construction Phase

	Wan Chai East	North Point
Open cut works	41,250 m ³	37,500 m ³
Trenchless Works		
• shallow tunnels	3,329 m ³	400 m ³
• deep tunnels	865 m ³	6,313 m ³
• shafts	<u>8,626 m³</u>	<u>8,613 m³</u>
	12,820 m ³	15,326 m ³

Silt and Débris

- 8.25.1 The volume of silt and debris to be removed has been estimated based on the information provided in the SMP and on the assumption that approximately 10% of the cross-sectional area of the pipes is occupied by sludge. It was therefore estimated that sewer cleaning will result in approximately 470 m³ of sludge and debris being generated.

North Point Pumping Station

- 8.26 Construction of the new pumping station at North Point will involve excavation of a shaft approximately 25 m in diameter and 25 m deep, the preferred construction method using a diaphragm wall. Since no backfilling will be required during construction, the volume of excavated material can be easily calculated using the formula.

$$V = \pi r^2 h$$

where

V	=	volume of material
h	=	depth of the shaft
r	=	radius of the shaft

- 8.27 The volume of excavated material is calculated as 12,272 m³. It is very likely that a large quantity of this material will be suitable as fill material for other works, however this will only be determined once the excavation work is underway.
- 8.28 At the time of writing, no plans for the future of the equipment associated with the existing pumping station have been drawn up. One possibility might be to use the archimedean screw pumps at another site thereby eliminating them as scrap material. After decommissioning, it is proposed that the old pumping station will to be backfilled and other facilities built on the site, however due to the timing, it would not be possible to use the excavated material from the new pumping station as backfill for the old one.
- 8.29 Appendix B presents recommended contract clauses relating to removal of solid and liquid waste materials for inclusion in the Tender Specifications for the Contractor.

Waste - Operational Phase

- 8.30 Works under the Project are designed to ensure that sewage from the catchment areas is more efficiently collected and delivered to the Wan Chai East and North Point Screening Plants for treatment. This will mean that the flows through the screening plants will increase.
- 8.31 The Waste Disposal Plan identifies "screenings and grit" from sewage screening and treatment works as a "difficult and special" waste which requires special handling, treatment and disposal arrangements. Screenings and grit are usually collected in drums before disposal at landfill. These wastes will be transported and delivered to landfill for disposal.

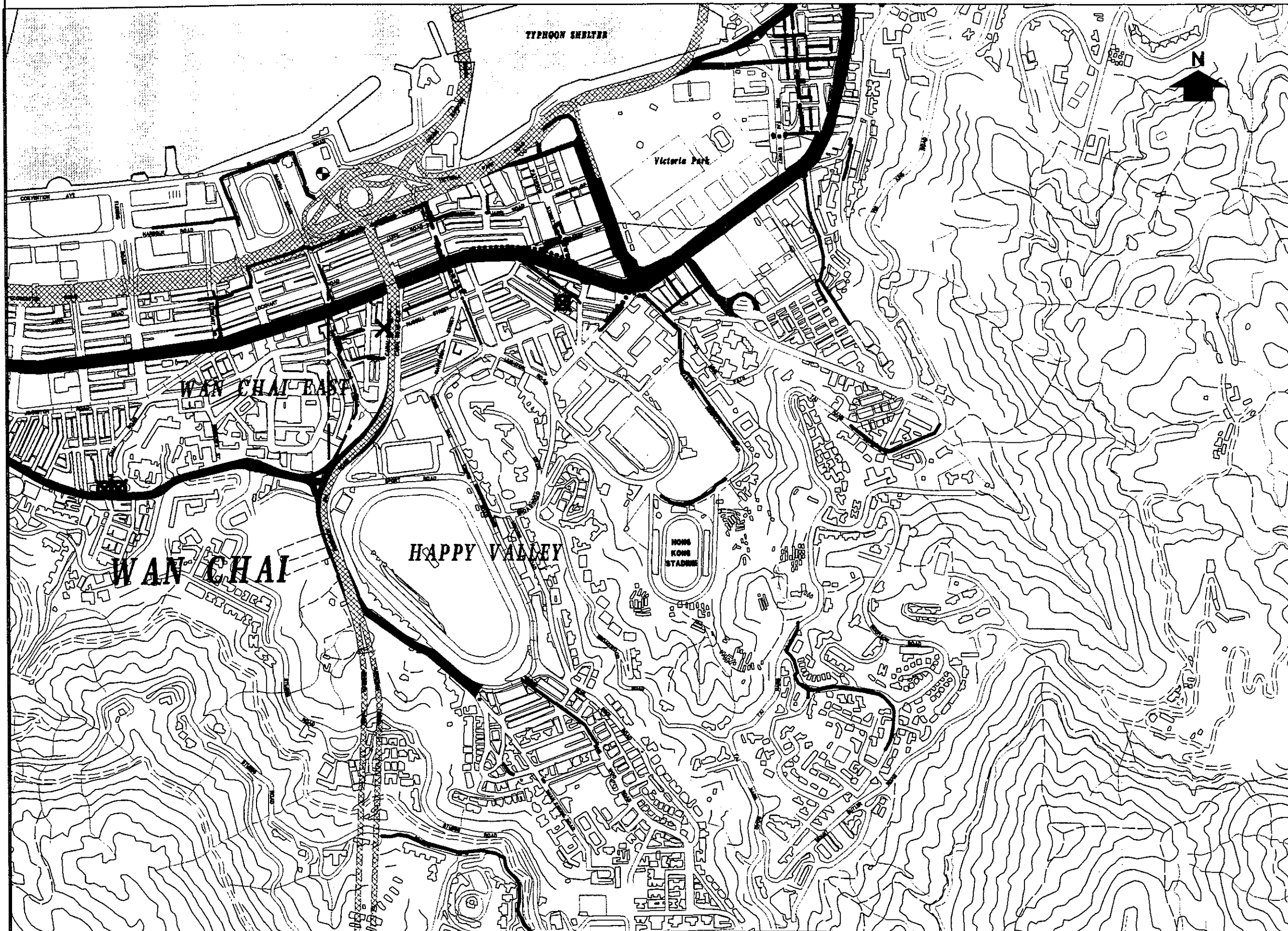
Summary

- 8.32 Waste will be produced during the construction period. The waste should be minimised and materials should be recycled as far as practicable to minimise the disposal requirements.
- 8.33 Provided that there is strict control of wastes from construction works and all arisings are stored, transported and disposed of using approved methods as described previously, no significant adverse environmental impacts are predicted. Thus, it is not expected that waste will have any serious environmental impact.

9 TRAFFIC AND TRANSPORT ISSUES

- 9.1 Traffic is one of the major constraints on the construction phase of the Wan Chai East and North District Sewerage Project. The economic cost of major traffic disruption in the area would be significant.
- 9.2 The importance of traffic issues has been recognised in the Brief, which has outlined the requirement for a separate Traffic Impact Assessment:
- "to assess the traffic impact on the existing road network as arising from the construction of the proposed sewerage system and to prepare necessary remedial measures to mitigate the likely disruption to traffic during construction."
- 9.3 Temporary deterioration in traffic conditions is inevitable during road works and maintenance of the existing traffic level of service is almost impossible. The aims of any traffic mitigation measures are therefore to:
- (i) avoid major impact on existing road users; and
 - (ii) minimise vehicle and pedestrian safety problems.
- 9.4 The Traffic Impact Assessment carried out under this Project proposes traffic management schemes for each area of the sewerage works. Each length of sewer to be upgraded has been examined taking into account traffic constraints. This has affected selection of the construction method and timing as well as proposed sewer alignments and shaft locations for sewers to be constructed using trenchless techniques.
- 9.5 On all major roads, commonly known as 'Red Routes', the restrictions/constraints imposed by Highways Department on road works include 'No Day Time Excavation Restrictions'. Figures 9.1 and 9.2 show the locations of 'no day time excavation' restrictions in relation to the proposed works. The *Red routes and pink routes* day-time excavation restrictions will limit all road opening works to night time only. The widely distributed nature of residential development within the Study Area further restricts the road excavation work, in particularly machine driven road breaking works, at noise sensitive spots to between 2100-2300 hours.
- 9.6 There are various 5-year road opening restrictions imposed by the Highways Department on newly constructed or reconstructed carriageway and pavement around the area. These prevent excavation of the road surface for a period of 5 years from completion of road reconstruction. The currently imposed road opening restrictions are shown on Figures 9.3 & 9.4 in relation to the proposed works.

- 9.7 The full findings and recommendations of the Traffic Impact Assessment for the Wan Chai East and North Point Sewerage Project will be submitted in a separate report.



Legend :

- Deep Tunnel & Shaft
- Open Cut
- Shallow Tunnel & Shaft
- Dry Weather Flow Channel
- X Market Interceptor
- ⊗ DWF Interceptor
- Red Route
(No daytime excavation restriction)
- Other Primary Traffic Routes

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		SLC	DPL	LC
initial	date	24/4/96	24/4/96	24/4/96
approved	REB			

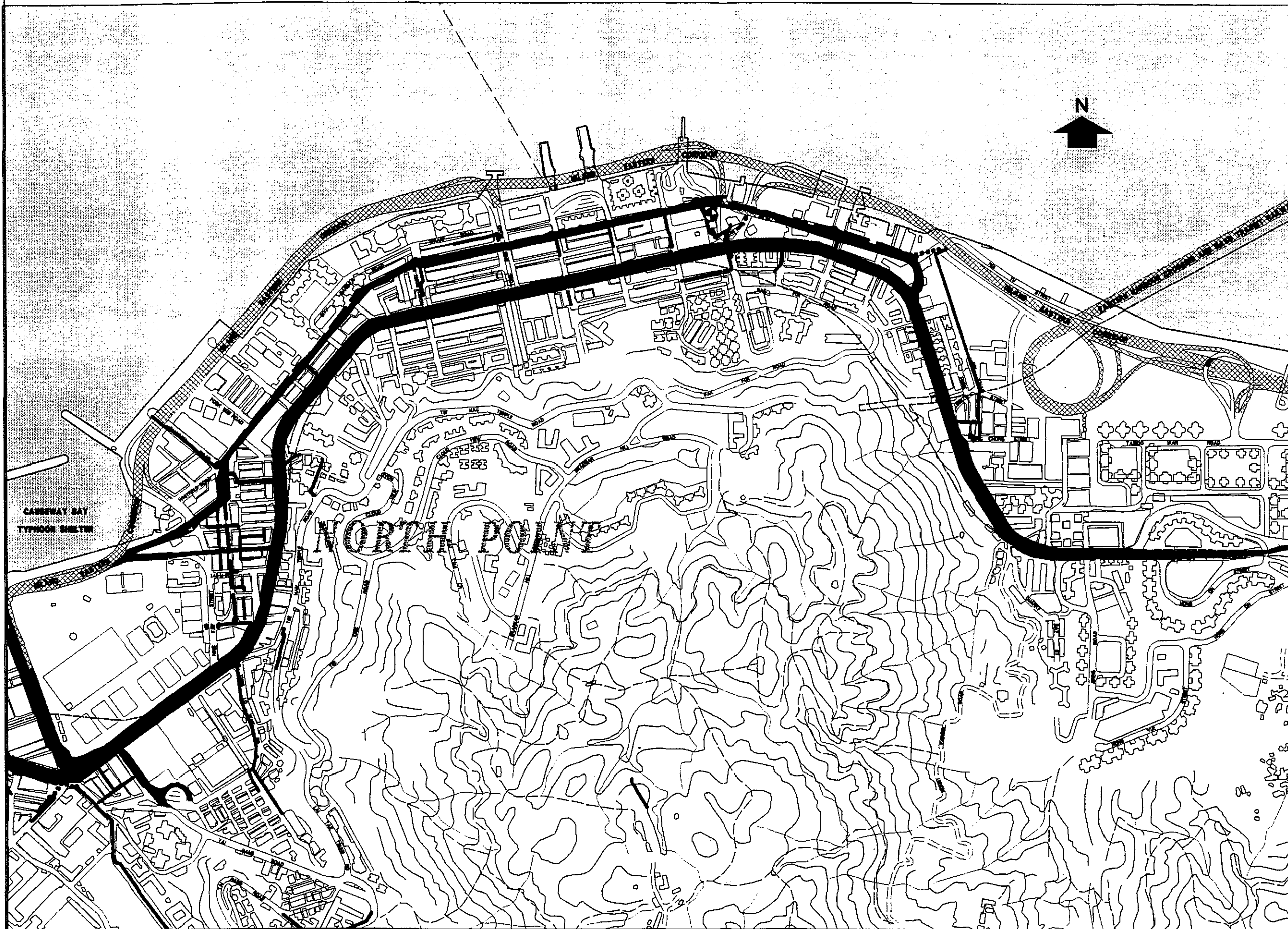
project
WAN CHAI EAST & NORTH POINT SEWERAGE

drawing title
Red Routes and Other Primary Traffic Routes Wan Chai East

figure no. **9.1** scale **1 : 10 000**

client
DRAINAGE SERVICES DEPARTMENT

consultant
BECHTEL CONSULTANTS LIMITED 寶尼工程顧問有限公司



Legend :

- Deep Tunnel & Shaft
- Open Cut
- Shallow Tunnel & Shaft
- Dry Weather Flow Channel
- Market Interceptor
- DWF Interceptor
- Red Route
(No daytime excavation restriction)
- Other Primary Traffic Routes

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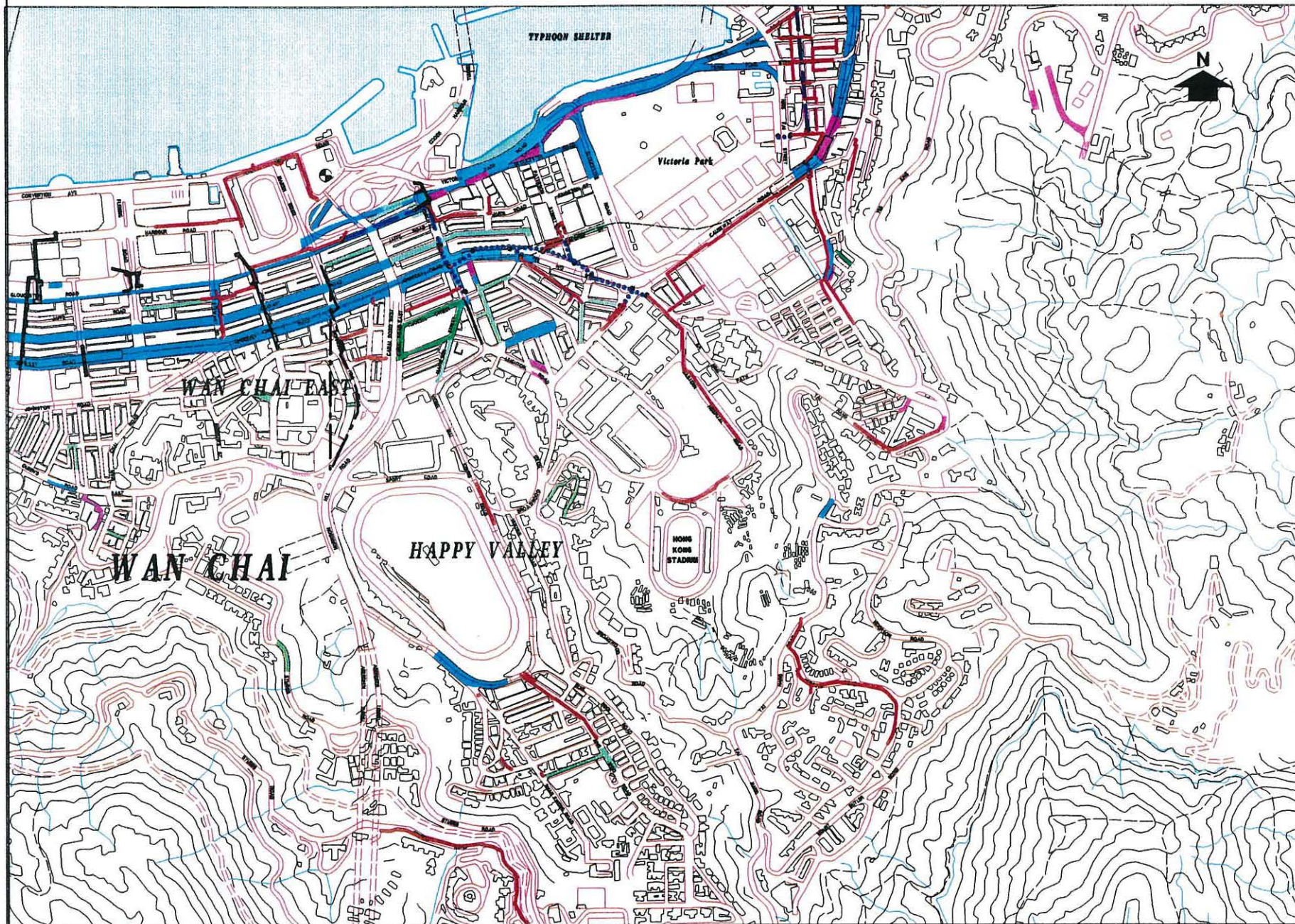
project
WAN CHAI EAST & NORTH POINT SEWERAGE

drawing title
Red Routes and Other Primary Traffic Routes North Point

figure no. **9.2** scale **1 : 10 000**

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DRAINAGE AND SEWERAGE



Legend :

- Deep Tunnel & Shaft
- Open Cut
- Shallow Tunnel & Shaft
- Dry Weather Flow Channel

Road Opening Restrictions Expire On

- 1996
- 1997
- 1998

revision	date	ISSUE FOR FINAL PRELIMINARY REPORT				initial
		designed	checked	drawn	checked	
initial	SLC	DPL	LC	DPL		
date	24/4/96	24/4/96	24/4/96	24/4/96		
approved	REB					

project
WAN CHAI EAST & NORTH POINT SEWERAGE

drawing title
5-year Road Opening Restriction Wan Chai East

figure no. **9.3** scale **NTS**

drawn by
DRAINAGE SERVICES DEPARTMENT

drawn by
HOUSE CONSULTANTS LIMITED 寶尼

Legend :

- Deep Tunnel & Shaft
- Open Cut
- Shallow Tunnel & Shaft
- Dry Weather Flow Channel

Road Opening Restrictions Expire On



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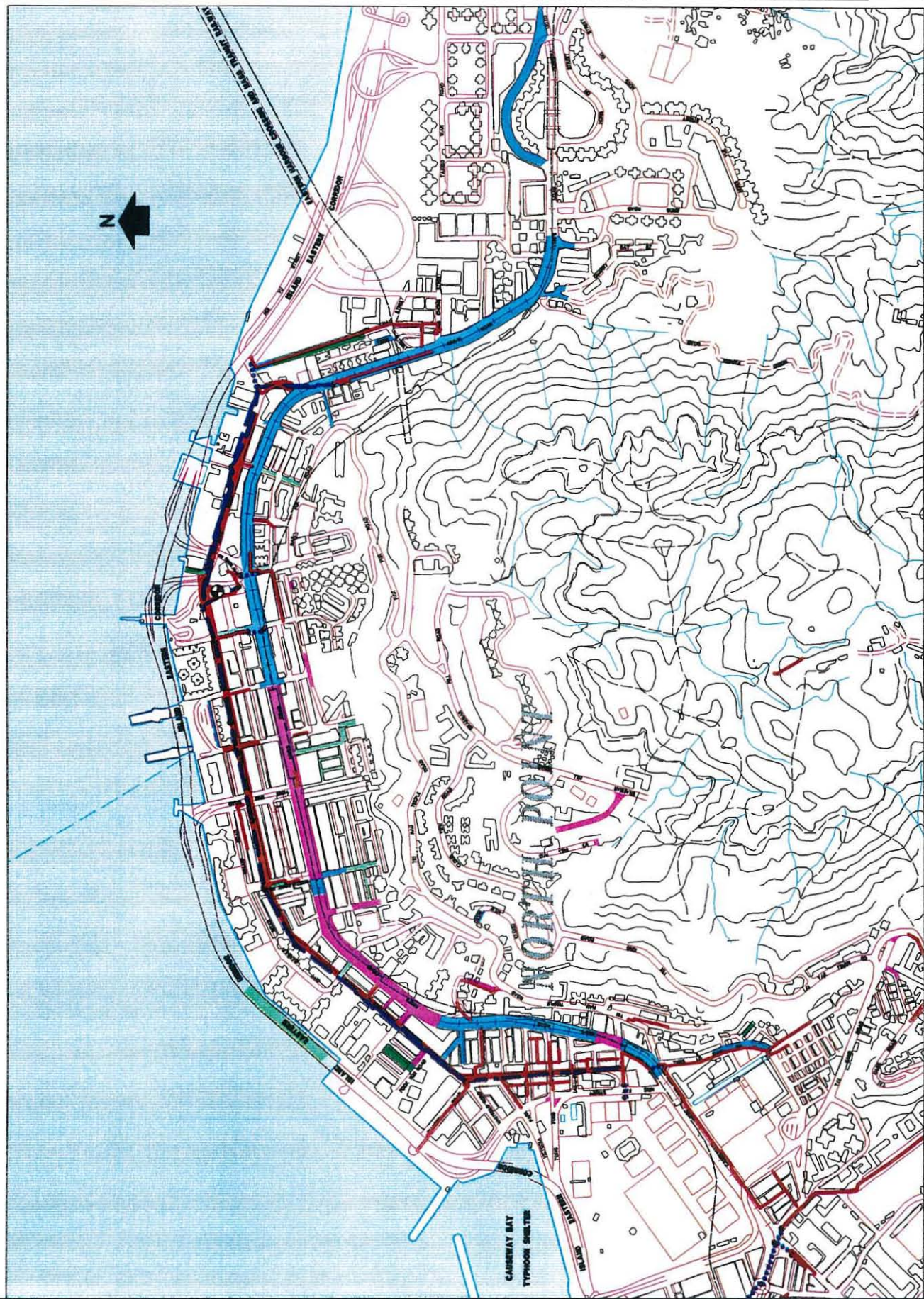
WAN CHAI EAST & NORTH POINT SEWERAGE

5-year Road Opening Restriction North Point

9.4 MTS

DRAINAGE SERVICES DEPARTMENT

WILLIS TOWERS WATSON LIMITED 威立士工程顧問有限公司



10 IMPACTS SUMMARY AND RECOMMENDATIONS

Introduction

EIA Study Requirements

10.1 The requirements for the Wan Chai East & North Point Sewerage EIA Study are detailed in Section 6.6 of the Consultancy Brief. The purpose of this EIA Study Report is detailed in Section 1 and can be summarised as to:

- (i) provide an assessment and evaluation of the environmental impacts and cumulative effects arising from the proposed Project;
- (ii) define measurable environmental parameters and environmental features likely to be affected by the proposed Project and identify baseline, construction and operational phase environmental monitoring programmes;
- (iii) define the environmental audit requirements for compliance and post-project audits.

Detailed Environmental Studies

- 10.2 The scope of this EIA Study Report incorporates the results of detailed investigations of all key issues, namely: construction and operational phase noise; construction and operational phase air quality; construction and operational phase water quality impact; construction waste and spoil management.
- 10.3 Background studies to identify, collect and analyse existing information relevant to the EIA Study have been undertaken. Where necessary, environmental surveys, site investigations and baseline monitoring have been carried out on site.
- 10.4 Potential short- and long-term impacts of the Project on sensitive receivers have been predicted and quantified, using mathematical models where appropriate, and assessed relative to the *Hong Kong Planning Standards and Guidelines* and other statutory requirements.
- 10.5 Practicable, effective and enforceable methods, measures and standards to mitigate adverse impacts to acceptable levels have been proposed.
- 10.6 An Environmental Monitoring & Audit Manual has been developed. This Manual is to be used as a guideline for environmental monitoring and audit during the construction and post-project operational phases.

Purpose of Impacts Summary

- 10.7 This Section summarises the findings of the detailed EIA Study. The summary is intended to provide an overall appreciation of the key issues associated with the Project. The potential impacts identified during the EIA Study have been presented in approximate order of relative importance.

Noise

- 10.8 Wan Chai East and North Point is an urban area with a population of over 360,000 people. The principal land use is high density commercial and residential development. In addition, there are many hotels, schools, hospitals, temples and churches.
- 10.9 The area is subject to high ambient noise levels as it is crossed by a congested and heavily trafficked road network; traffic is often the dominant noise source.
- 10.10 The noise impact assessment has identified Noise Sensitive Receivers (NSRs) within the Study Area which are likely to be worst affected by noise generated from the proposed sewerage works and from construction and operation of the new pumping station at North Point Screening Plant.

Construction Impacts - Sewerage Works

- 10.11 There will be construction noise impacts associated with both open cut and trenchless construction methods for the relaying/upgrading of sewers within the Study Area.
- 10.12 Most of the worst affected NSRs are located within just 3 to 10 metres of the proposed works.
- 10.13 Open cut works will impact on a series of NSRs as the sewerage works progress along a particular length of road. Trenchless works will affect NSRs located adjacent to the tunnel shafts on a 24-hour basis.
- 10.14 Several lengths of sewer will be refurbished (Wong Nai Chung Road); the noise impacts from these particular works are expected to be negligible.

Impact Mitigation - Sewerage Works - Recommendations

- 10.15 It is essential that construction noise is mitigated, especially where, due to traffic constraints, open cut works have to be carried out during the evening or night time. If the Contractor fails to select powered mechanical equipment with a view to reducing the intensity or duration of noise, it may be very difficult to obtain the necessary licences under the *Noise Control Ordinance* for works within restricted hours. This could have a serious impact on the planning and programming of the works. It is recommended that the Contractor employs a professional noise specialist to assist with noise planning and obtaining the necessary Construction Noise Permits.
- 10.16 We strongly recommend that the following direct mitigation measures are employed:
- (i) The Contractor should minimise the use of powered mechanical equipment on site.
 - (ii) Works should be scheduled such that activities located within close proximity of particularly sensitive buildings (eg. hospitals, residences) are minimised and, where possible, carried out during least-sensitive periods. Commercial buildings are not noise sensitive.
 - (iii) Where possible, excavations near schools should be scheduled for the evening to reduce noise impact, subject to the constraint of noise impact on other nearby NSRs.
 - (iv) Works should be scheduled to avoid construction close to schools during examination periods.
 - (v) Works near residential areas should be scheduled to avoid the period 23:00-07:00 hours. Works between 19:00-07:00 hours should be minimised wherever possible.
 - (vi) Where possible, haulage and movement of spoil should be restricted to the daytime only.
 - (vii) Equipment which is not in use should be turned off or throttled down.
 - (viii) Road surface breaking should be restricted to daytime only.
 - (ix) The Contractor should use silenced equipment wherever possible, including silenced generators, electrical air compressors and ventilation fans.

- (x) If measures (i) - (ix) do not achieve the required noise reduction, the Contractor should:
 - (a) construct a gap free noise barrier with a surface mass density of at least 20 kg/m^2 around the active part of the site (ie. where powered mechanical equipment is in use) to screen all the stationary and quasi-stationary equipment from ground floor view; **and**
 - (b) provide additional noise reduction in the form of enclosures with a surface mass density of at least 20 kg/m^2 around items of stationary equipment. Following enclosure, the equipment should not be visible from the top or the sides by the sensitive receivers.

Sound absorptive material should be used for lining the inside of the enclosures.

- 10.17 The latest scope of works suggests that only the residences along Stubbs Road, Perkins Road and areas surrounded by Hing Fat Street/Ngan Mok Street/Electric Road are likely to be affected by night time open cut works. As the noise environment in these particular areas is quiet at the evening and night time, it is recommended that road surface breaking is scheduled outside the period 23:00-07:00 hours and that additional care and vigilance is given by the Contractor to applying noise control measures.

Construction Impacts - North Point Screening Plant

- 10.18 Redevelopment of the pumping station at North Point Screening Plant will involve demolition of the existing administration building, excavation of a deep shaft, construction of the new pumping station and decommissioning/demolition of the existing pumping station.
- 10.19 Redevelopment of the site is not expected to generate a significant noise impact: most of the works will be carried out below ground level.

Impact Mitigation - North Point Screening Plant - Recommendations

- 10.20 In order to avoid noise impacts on nearby NSRs, we recommend that the Contractor constructs a temporary noise barrier of at least 7 kg/m^2 surface mass density around the active part of the construction site. The barrier should be kept in place throughout the works.
- 10.21 During demolition works, it is recommended that the use of powered mechanical equipment is minimised during school hours, particularly during examination periods.

Operational Impacts

- 10.22 The only operational noise from the Project will result from operation of the North Point Screening Plant pumping station. The pumping station which is designed to minimise noise emissions will house motors at ground level and six fixed speed centrifugal pumps below ground level.
- 10.23 The pumps are assumed to each have a sound power level of 101 dB(A). Provided that the roller shutter doors are kept closed at all times, the predicted noise levels will not exceed the acceptable noise levels at the nearest NSRs.

Impact Mitigation - North Point Screening Plant - Recommendations

- 10.24 Unless later data indicates that the pumps have higher sound power levels, no noise control measures will be required.

Air Quality

- 10.25 Air and odour sensitive receivers within the Study Area have been identified and the potential for air quality impacts from the sewerage works and operation of the redeveloped pumping station at North Point Screening Plant have been evaluated.

Construction Impacts

- 10.26 The main air quality impacts due to construction activities are associated with dust generated during trench excavation and filling, transportation of excavated materials and odour associated from cleaning or sealing and/or removal of old sewers.
- 10.27 Only small working areas will be required at any time. Most of the excavated materials will be wet. Excavated material will not be stockpiled but used as backfill material for other sections of trench. Provided that appropriate measures are implemented, the dust impacts are expected to be minimal.
- 10.28 The nuisance from construction vehicle and plant emissions is likely to be negligible because it is anticipated that the number of these vehicles and plant will be small.
- 10.29 There is a limited potential for odour nuisance during sewer cleaning, overpumping and the excavation and removal of spoil and rubble including old and broken sewer pipes.

Impact Mitigation - Recommendations

- 10.30 We recommend that vehicles carrying spoil and other potentially dusty materials to or from the site have their loads covered.

- 10.31 Construction plant and equipment travelling over sealed roads must be kept clean. Any materials spilled onto sealed roads should be cleaned up immediately. In particular, bentonite slurry and similar grounds used in trenchless technology should be carefully handled.
- 10.32 Spills of sewage or other contaminated materials must be minimised, mixed immediately with a suitable disinfectant and quickly cleared up. Any substantial spills will need containment and may need to be tankered away for disposal.
- 10.33 Odour problems can occur if overpumping is interrupted and there is a buildup of septic sewage. If overpumping is continuous, the potential for odour release is minimised.

Operational Impacts

- 10.34 The only significant operational phase air quality impact is likely to be odour generated during operation of the new North Point Screening Plant pumping station.
- 10.35 Without appropriate mitigation measures, odour levels at nearby sensitive receivers are predicted to exceed EPD's stipulated odour limit.

Impact Mitigation - Recommendations

- 10.36 Odour mitigation at the North Point Screening Plant will be achieved by installation of an activated carbon or other appropriate unit similar to the biofilter unit installed at the existing pumping station. In situ monitoring during the EIA Study indicated that the gas removal efficiency can reach 99.8%.
- 10.37 In addition, we recommend that particular attention is paid to the location and direction of pumping station ventilation exhausts relative to both the location of windows and doors at nearby sensitive receivers and the direction of prevailing winds.
- 10.38 We recommend that the following good housekeeping practices are regularly and routinely carried out at the pumping station:
- (i) weekly inspection of the wet wells should be conducted to check the level of the accumulation of odourous grease, oil and scum. If the accumulation of these substances is quick, more frequent removal and inspection are required;

- (ii) regular cleaning and flushing of screens and other sewage handling equipment is required to control the rate of accumulation of odour-producing organic debris;
- (iii) grit stored on site should be kept in closed containers or skips with a rolling screens on top. Grit should be disposed of as soon as possible;
- (iv) sludge deposits in wet wells and channels should be regularly removed;
- (v) deodorization and ventilation systems should be regularly inspected to ensure efficient operation.

10.39 It is recommended that during the operational phase, routine Odour monitoring is carried out at the North Point Screening Plant. This would involve a daily walkover survey around the site boundary by the Plant Manager or a delegated member of staff. Additional monitoring should be undertaken at times of received complaints. Any exceedance of the 2 Odour Unit limit should be recorded by the Plant Manager, who should make appropriate adjustments to the operation of the deodorization system.

Water Quality

10.40 The Study Area lies within the Victoria Harbour (Phase III) Water Control Zone. The potential impact of the Project on water sensitive receivers has been assessed.

Construction Impacts

10.41 Sources of potential impact on water quality during the sewerage works have been identified as: construction site runoff and infiltration water; bentonite slurry; washwater, sewer sediments and grease from sewer cleansing and replacement; sewage effluent from the workforce.

10.42 Site runoff may carry suspended solids and contaminants such as fuels, oils, lubricants and concrete. Open trenches will collect surface runoff water as well as groundwater. Bentonite slurry is particularly prone to spillage and requires careful handling.

10.43 Sewage discharges both from site toilets and sewer cleansing washwaters must be rigorously controlled both in relation to the potential health implications for construction workers and any member of the public accidentally coming into contact with contaminated materials.

10.44 Discharges of runoff containing high levels of suspended solids or other pollutants into the stormwater drainage system should be prevented.

- 10.45 Measures should be taken to ensure that the water quality at the intake of the Wan Chai Salt Water Pumping Station should not be adversely affected during the construction or as a result of the proposed works. Seawater quality at the intake should at all times comply with the Water Quality Objectives for Flushing Purposes by the Water Supplies Department.

Impact Mitigation - Recommendations

- 10.46 It is important that proper site management and good site practices in relation to runoff and drainage control are routinely and diligently carried out in order to avoid adverse water quality impacts. This control is of particular importance where the works to be carried out close to storm drains or open channels.
- 10.47 Chemicals should be stored in fully labelled containers in a secure place and disposed of appropriately.
- 10.48 Layers of sawdust or similar material should be laid underneath or around any equipment that leaks oil. The materials should be replaced regularly and polluted materials disposed of in an acceptable manner.
- 10.49 Surface runoff and water in trenches should be collected/intercepted and settled prior to discharge. Where possible, the effluent should be discharged to the stormwater drainage system rather than to foul sewer.
- 10.50 Bentonite and similar grouts should be carefully handled. The Contractor should have separation/recycling facilities off site and tanker the spent bentonite away for processing.
- 10.51 Foul water from site toilets and other facilities should be collected and disposed of to foul sewer.
- 10.52 Pumps used for overpumping must have sufficient capacity to ensure that no surcharging of the upstream sewers occurs.
- 10.53 Sewer sediments and grease must be handled and disposed of with due care. Like sewage screenings, the sediments should be dewatered and disposed of to landfill.

Operational Impacts

- 10.54 Closure of the Watson Road outfall by DSD has already achieved some water quality improvements in Victoria Harbour.

- 10.55 There will be further systematic and progressive increase in foul flows through the screening plants at Wan Chai East and North Point. This is due to the improved interception of polluted stormwater flows, and diversion of all flows to the screening plants prior to discharge.
- 10.56 The screening plants at North Point and Wan Chai East and the marine outfall at North Point have adequate design capacity to cater for the additional flow generated by improved interception of foul water, therefore there will be no deterioration in water quality over that previously allowed for from these sources.
- 10.57 The Wan Chai East Screening Plant and outfall will be enlarged under the Central Western and Wan Chai West (CW3) Sewerage Project prior to the proposed decommissioning of the Wan Chai West Screening Plant. The works and associated impacts are covered in the CW3 EIA Report.
- 10.58 Improvements to the existing sewer system, including larger pipe diameters, will provide excess capacity and thus prevent overflow and flooding of streets during heavy rainfalls.
- 10.59 Interception and treatment of screened sewage flows, of which the Wan Chai East & North Point Sewerage Project is a vital preliminary stage, will ultimately lead to a long awaited and significant improvement in water quality in Victoria Harbour.

Waste & Spoil Management

- 10.60 The sources, types, quantities and disposal methods for wastes and spoil generated from the construction and operational phases have been identified.

Construction Impacts

- 10.61 Solid wastes will include: surplus excavated spoil and rock; damaged, used and surplus construction materials; bentonite and similar materials with a high clay/water content; sewage sediments and old sewer pipes (concrete waste).

Impact Mitigation - Recommendations

- 10.62 We recommend that suitable inert materials from excavations (concrete, tar or macadam based materials and soil material) are used for backfill or on other building sites, wherever possible. Alternatively, dry concrete waste, including old sewer pipes, can be sorted out from other wastes and recycled for reuse or disposal at public dumps.

- 10.63 Glass, steel and other metals should be recycled or disposed of to landfill. Timber should be reused, wherever possible.
- 10.64 As recommended above, bentonite and similar materials should be collected, separated and recycled. Chemical wastes should be collected and disposed of at Tsing Yi Chemical Waste Treatment Centre. Foul water from site toilets and other facilities should be collected and disposed of to foul sewer. Sewer sediments and grease must be handled and disposed of with due care. Like sewage screenings, the sediments should be dewatered and disposed of to landfill.
- 10.65 Vehicles transporting wastes, especially potentially dusty materials, should have their loads covered and, so far as possible, be routed to avoid sensitive receivers.

Operational Impacts

- 10.66 Screenings and grit from sewage screening plants require special handling, treatment and disposal. In line with current practice, screenings and grit from the redeveloped North Point Screening Plant will be collected in drums and delivered to landfill.

Ecology

- 10.67 No major ecological impacts are predicted. The sewerage works will take place in urban areas of Wan Chai East and North Point, within the road reserve. A tree survey has been carried out as part of the Engineering Design Process. The sewerage works have been planned to avoid damage to, or removal of, existing trees. If it is essential to remove any trees, transplanting or compensatory planting will be undertaken in consultation with Urban Services Department and Agriculture & Fisheries Department.

Environmental Monitoring & Audit

- 10.68 It is inevitable that the works associated with the Wan Chai East & North Point Sewerage Projects will impact on the existing environment. Where potentially adverse impacts from the construction and operation of the Project have been identified in the EIA Study, a series of mitigation measures have been set out to prevent these impacts, or at least to reduce them as far as possible to within acceptable levels. Most of these mitigation measures are which may be termed 'good construction practice'.

- 10.69 An Environmental Monitoring & Audit Manual has been developed as part of the EIA Report. We recommend that construction noise is monitored at appropriate NSRs throughout the construction phase. The purpose of the monitoring is to ensure that construction takes place with a minimum of adverse impact on nearby NSRs and in compliance with the relevant noise criteria.

Conclusion

- 10.70 The Wan Chai East & North Point Sewerage Project is an integral and essential part of Drainage Services Department's on-going programme to improve Hong Kong's sewerage and sewage treatment facilities.
- 10.71 Provided that the requirements of this report and the Environmental Monitoring & Audit Manual are carried out, particularly with respect to stringent construction noise control and the careful handling and disposal of site runoff and other materials contaminated with suspended solids or other pollutants, the works can be implemented with a minimum of impact on the environment to the ultimate benefit of current and future residents and workers in the Wan Chai East and North Point area.

END OF TEXT

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APPENDIX A

Odour Measurement of Hydrogen Sulphide at North Point Screening Plant

Appendix A

Odour Measurement of Hydrogen Sulphide at North Point Screening Plant

Introduction

An odour assessment was required for Wan Chai East and North Point Sewerage to evaluate the environmental impacts to the nearby residents caused by the operation of screening plant. Emission of H_2S from the screening plant was the study parameter. Two separate sampling locations were selected for the measurement of hydrogen sulphide levels. The monitoring had been conducted by Hong Kong Productivity Council (HKPC).

Time Schedule and Locations of Measurement

The time schedule of the stack measurement is shown in Table A1.

Table A1
Time Schedule of the Stack Measurement

Date	Sampling Location	No. of Sample	Testing Method
2.2.96	Inside the Screening Collection Room near the skip for screening collection, P1	1	NIOSH P&CAM 126
	Outlet of the biofilter installed adjacent to the Screening Collection Room, P2	1	

The plan for the sampling locations is shown in Figure 6.2.

Methodology of the Test

The standard testing method NIOSH P&CAM Method 126 revised on 1/1/75 was employed for the measurement. Hydrogen sulphide in air was collected and absorbed by an alkaline cadmium sulphate solution. The sampled solution was then analyzed by UV-Visible spectrophotometric method.

Results of the Measurement

The results of the hydrogen sulphide measurement are summarized in Table A2.

Table A2
Results of Hydrogen Sulphide Measurement

Date	Time	Location	Concentration of H ₂ S	
			ppm	µg/m ³
2.2.96	9:21 - 11:21	Inside the Screening Collection Room, P1	0.182	261 ¹
	9:28 - 11:28	Outlet of the biofilter, P2	< 0.00043 ²	< 0.57

¹ The concentration of hydrogen sulphide in µg/m³ is corrected at the condition of 25°C and 760 mmHg atmospheric pressure

² The concentration of hydrogen sulphide detected below the detection limit, the detection limit for this measurement was 0.00043 ppm.

The result shows that the H₂S removal efficiency of the biofilter is 99.8%.

APPENDIX B

Recommended Pollution Control Contract Clauses

5 RECOMMENDED POLLUTION CONTROL CLAUSES

5.1 Avoidance of Nuisance

- (i) All construction works are to be carried out in such a manner as to cause as little inconvenience as possible to nearby residents, property and to the public in general, and the Contractor shall be held responsible for any claims which may arise from such inconvenience.
- (ii) The Contractor shall be responsible for the adequate maintenance and clearance of channels, gullies etc.
- (iii) Water shall be used to prevent dust rising and the Contractor shall take every precaution to prevent excavated materials from entering into the public drainage system.
- (iv) The Contractor shall carry out the Works in such a manner as to minimize adverse impacts on the environment.
- (v) The Contractor shall ensure that no vehicle or mobile plant leaves the Site with waste or debris on it that may drop or be deposited on public roads or private rights of way.
- (vi) The Contractor shall provide a fully mechanised road washer/sweeper or other appropriate equipment and personnel for washing and cleaning of the streets within the vicinity of all active work sites.
- (vii) The Contractor shall sweep and keep clean at all times the streets and pavements adjacent to the Site and remove all spillages of mud, waste, litter and debris from whatever source.

5.2 Noise Pollution Control

Throughout the development of the project, the Contractor shall consider construction noise to be a serious constraint. All equipment shall be chosen so as to reduce the intensity or duration of noise. Without careful choice of equipment and acoustic mitigation the Contractor is warned that the necessary licences needed under the *Noise Control Ordinance* may be difficult to obtain. This will have a serious effect on the planning and programming of the works.

To comply with Noise Control Ordinance

- (i) The Contractor shall comply with and observe the *Noise Control Ordinance* and its subsidiary regulations in force in Hong Kong.

The Acceptable Noise Levels (ANLs) for various construction equipment and processes at different time of the day and the requirement for applying Construction Noise Permit (CNP) for works outside 07:00 to 19:00 on week days and all day on a general holiday are documented in the following Technical Memoranda (TM):

- (a) *TM on Noise from Percussive Piling;*
- (b) *TM on Noise from Construction Works Other Than Percussive Piling;*
- (c) *TM on Noise from Construction Works in Designated Areas.*

Copies of these TM are available from the Environmental Protection Department (EPD).

Non-statutory Noise Control

- (ii) In addition to the requirements imposed by the *Noise Control Ordinance*, to control noise generated from equipment and activities for the purpose of carrying out construction work other than percussive piling during the time period from 07:00 to 19:00 hours or any day not being a general holiday (including Sundays), the following requirements shall all be complied with:
 - (a) The noise level measured at 1 m from the most affected external facade of the nearby noise sensitive receivers from the construction work alone during any 30 minute period shall not exceed an equivalent sound level (Leq) of 75 dB(A).
 - (b) The noise level measured at 1 m from the most affected external facade of the nearby schools from the construction work alone during any 30 minute period shall not exceed an equivalent sound level (Leq) of 70 dB(A) [65 dB(A) during school examination periods].

The Contractor shall liaise with the schools and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the contract.

Provision of Construction Noise Monitoring Equipment and Noise Monitoring Team

- (iii) The Contractor shall be responsible for providing a noise specialist who can fulfil the environmental monitoring and audit requirements as stipulated in the Environmental Monitoring and Audit (EM&A) Manual, under the supervision of the Resident Site Engineer.

The noise specialist should have an acoustics, physics, mechanical engineering or environmentally related degree, or be able to demonstrate knowledge of three years experience in designing noise control measures. Experience in designing temporary noise enclosures for outdoor use would be especially valuable.

- (iv) The Contractor shall be responsible for providing suitable noise monitoring equipment for the fulfilment of the EM&A requirements including, but not limited to, the following:
- (a) An approved integrating sound level meter to IEC 651 : 1979 (Type 1) and 804 : 1985 (Type 1) and the manufacturer's recommended sound level calibrator for the exclusive use of the Engineer at all times. The Contractor shall maintain the equipment in proper working order and provide a substitute when the equipment is out of order or otherwise not available.
 - (b) The sound level meter, including the sound level calibrator, shall be verified by the manufacturer every two years to ensure it performs to the same level of accuracy as stated in the manufacturer's specifications. That is to say at the time of noise measurements, the equipment shall have been verified within the last two years.

Should the above sub-clauses (i), (ii) and (iv) be violated, construction shall stop and shall not recommence until appropriate measures acceptable to the Engineer that are necessary for compliance have been implemented.

Any stoppage or reduction in output resulting from compliance with this clause shall not entitle the Contractor to any extension of time for completion or to any additional costs whatsoever.

- (c) All surface breaking, open cut works and use of haulage traffic should be scheduled for daytime or off traffic peak levels outside 23:00 - 07:00 whenever feasible;
- (d) If the use of excavator mounted breakers instead of hand held ones can reduce the duration of the road breaking process significantly, the greater noise may be acceptable for such a short period. Specially designed brackets with vibration damping properties are available from construction plant manufacturers for reduction of mounted breaker noise. The use of excavator mounted breakers should however be restricted to day time only;
- (e) Idle equipment should be turned off or throttled down. Noisy equipment should be properly maintained and used no more often than is necessary;
- (f) Construction plant and the associated silencing measures should be properly maintained and operated;
- (g) Plant known to emit noise strongly in one direction should, where possible, be orientated so that the noise is directed away from nearby sensitive receivers. An example is the exhaust noise from compressors and fans;
- (h) For areas requiring night time open cut works between 23:00 to 07:00, the Contractor should give prior notice to the nearby worst affected noise sensitive receivers so that good communication and relations are established.

If measures (a) - (h) do not achieve the required noise reduction, it is recommended that:

- (i) A gap free barrier with a surface mass density of at least 20 kg/m² should be constructed around the active part of the site, screening all major noise sources of operating equipment from the line of sight of any ground floor receivers; **and**
- (j) A double shelled ½" plywood enclosure with the larger outer shell separated from the inner shell by an air gap that is at least 100 mm wide. The inner surface of the enclosure should be lined with sound absorptive damping material such as leaded vinyl and polyurethane. The surface mass density requirements are the same as that for the barrier. The noise sources of the equipment should not be visible by the sensitive receivers from the top or any other sides after the enclosure is erected.

Provision of Construction Noise Monitoring Equipment and Noise Monitoring Team

- (iii) The Contractor shall be responsible for providing a noise specialist who can fulfil the environmental monitoring and audit requirements as stipulated in the Environmental Monitoring and Audit (EM&A) Manual, under the supervision of the Resident Site Engineer.

The noise specialist should have an acoustics, physics, mechanical engineering or environmentally related degree, or be able to demonstrate knowledge of three years experience in designing noise control measures. Experience in designing temporary noise enclosures for outdoor use would be especially valuable.

- (iv) The Contractor shall be responsible for providing suitable noise monitoring equipment for the fulfilment of the EM&A requirements including, but not limited to, the following:
- (a) An approved integrating sound level meter to IEC 651 : 1979 (Type 1) and 804 : 1985 (Type 1) and the manufacturer's recommended sound level calibrator for the exclusive use of the Engineer at all times. The Contractor shall maintain the equipment in proper working order and provide a substitute when the equipment is out of order or otherwise not available.
 - (b) The sound level meter, including the sound level calibrator, shall be verified by the manufacturer every two years to ensure it performs to the same level of accuracy as stated in the manufacturer's specifications. That is to say at the time of noise measurements, the equipment shall have been verified within the last two years.

Should the above sub-clauses (i), (ii) and (iv) be violated, construction shall stop and shall not recommence until appropriate measures acceptable to the Engineer that are necessary for compliance have been implemented.

Any stoppage or reduction in output resulting from compliance with this clause shall not entitle the Contractor to any extension of time for completion or to any additional costs whatsoever.

Noise Mitigative Measures

- (v) Before the commencement of any work, the Engineer may require the methods of working, equipment and sound-reducing measures intended to be used on the Site to be made available for inspection and approval to ensure that they are suitable for the project.
- (vi) The Contractor shall devise, arrange methods of working and carry out the Works in such a manner so as to minimize noise impacts on the surrounding environment, and shall provide experienced personnel with suitable training to ensure that these methods are implemented.
- (vii) The Contractor shall ensure that all plant and equipment to be used on site are properly maintained in good operating condition with regular oiling and greasing, and that noisy construction activities shall be effectively sound-reduced by means of silencers, mufflers, acoustic linings or shields, acoustic sheds or screens or other means to avoid disturbance to any nearby noise sensitive receivers.
- (viii) Notwithstanding the requirements and limitations set out in clause (ii) above and subject to compliance with clauses (vi) and (vii) above, the Engineer may upon application in writing by the Contractor, allow the use of any equipment and the carrying out of any construction activities for any duration provided he is satisfied with the application which, in his opinion, to be of absolute necessity and adequate noise insulation has been provided to the educational institutions to be affected, or of an emergency nature, and not in contravention with the *Noise Control Ordinance* in any respect.
- (ix) The following noise control measures are recommended:
 - (a) Noisy equipment and activities should be sited by the Contractor as far from the close proximity of sensitive receivers as is practical. Prolonged operation of noisy equipment close to residences during night time or early morning should be avoided except in the cases of the tunnel shafts and working areas surrounding the shafts;
 - (b) Noisy plant or processes should be replaced by silenced alternatives where possible. Silenced diesel and gasoline generators and power units, as well as silenced and super-silenced electric air compressors, can be readily obtained;

- (c) All surface breaking, open cut works and use of haulage traffic should be scheduled for daytime or off traffic peak levels outside 23:00 - 07:00 whenever feasible;
- (d) If the use of excavator mounted breakers instead of hand held ones can reduce the duration of the road breaking process significantly, the greater noise may be acceptable for such a short period. Specially designed brackets with vibration damping properties are available from construction plant manufacturers for reduction of mounted breaker noise. The use of excavator mounted breakers should however be restricted to day time only;
- (e) Idle equipment should be turned off or throttled down. Noisy equipment should be properly maintained and used no more often than is necessary;
- (f) Construction plant and the associated silencing measures should be properly maintained and operated;
- (g) Plant known to emit noise strongly in one direction should, where possible, be orientated so that the noise is directed away from nearby sensitive receivers. An example is the exhaust noise from compressors and fans;
- (h) For areas requiring night time open cut works between 23:00 to 07:00, the Contractor should give prior notice to the nearby worst affected noise sensitive receivers so that good communication and relations are established.

If measures (a) - (h) do not achieve the required noise reduction, it is recommended that:

- (i) A gap free barrier with a surface mass density of at least 20 kg/m^2 should be constructed around the active part of the site, screening all major noise sources of operating equipment from the line of sight of any ground floor receivers; **and**
- (j) A double shelled $\frac{1}{2}$ " plywood enclosure with the larger outer shell separated from the inner shell by an air gap that is at least 100 mm wide. The inner surface of the enclosure should be lined with sound absorptive damping material such as leaded vinyl and polyurethane. The surface mass density requirements are the same as that for the barrier. The noise sources of the equipment should not be visible by the sensitive receivers from the top or any other sides after the enclosure is erected.

5.3 Dust Suppression Measures

- (i) The Contractor shall undertake at all times to prevent dust nuisance as a result of his activities.
- (ii) The Contractor shall at his own cost, and to the satisfaction of the Engineer, install effective dust suppression equipment and take such other measures as may be necessary to ensure that at the Site boundary and any nearby sensitive receiver the concentration of air-borne dust shall not exceed the *Hong Kong Air Quality Objectives*.
- (iii) In the process of material handling, any material which has the potential to create dust shall be treated with water or sprayed with wetting agent.
- (iv) Where dusty materials are being discharged to vehicle from a conveying system at a fixed transfer point, a three-sided roofed enclosure with a flexible curtain across the entry shall be provided. Exhaust should be provided for this enclosure and vented to a fabric filter system.
- (v) Any vehicle with an open load carrying area used for moving materials which have the potential to create dust shall have properly fitting side and tail boards. Materials having the potential to create dust shall not be loaded to a level higher than the side and tail boards, and shall be covered by a clean tarpaulin. The tarpaulin shall be properly secured and shall extend at least 300 mm over the edges of the side and tail boards.
- (vi) Stockpiles of sand and aggregate greater than 20 m³ shall be enclosed on three sides, with walls extending above the pile and 2 metres beyond the front of the pile. In addition, water sprays shall be provided and used both to dampen stored materials and when receiving raw material.
- (vii) The Contractor shall frequently clean and water the site to minimize the fugitive dust emissions.

5.4 Removal of Waste Material

- (i) The Contractor shall be aware of, and comply with, the *Waste Disposal Ordinance*, the *Public Health Ordinance*, the *Municipal Services Ordinance* and the *Water Pollution Control Ordinance*.

- (ii) The Contractor shall not permit any sewage, wastewater or effluent containing sand, cement, silt or any other suspended or dissolved material to flow from the site onto any adjoining land or allow any wastewater or refuse to be deposited anywhere within the site or onto any adjoining land and shall have all such matter removed from the site.
- (iii) The Contractor shall be liable for any damages caused to adjoining land through his failure to comply with clause 5.4 (i).
- (iv) The Contractor shall segregate all inert construction waste material suitable for reclamation or land formation and shall dispose of such material at such public dumping area(s) as may be specified from time to time by the Director of Civil Engineering Services.
- (v) All non-inert construction waste material deemed unsuitable for reclamation or land formation and all other waste material shall be disposal of at a public landfill.
- (vi) The Contractor shall register as a Chemical Waste Producer.

5.5 Discharge to Sewers and Drains

- (i) The Contractor shall be aware of, and comply with, the *Buildings Ordinance*, *Water Pollution Control Ordinance*, and the *Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters*.
- (ii) If any office, site canteen or toilet facility is erected, foul water effluent shall be directed to a foul sewer or to a sewage treatment facility either directly or indirectly by means of pumping or other means approved by the Engineer.

END OF TEXT

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