

EXECUTIVE SUMMARY

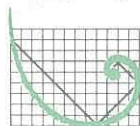
Civil Engineering Department

Backfilling of South Tsing Yi and  
North of Lantau MBAs - Final  
Environmental Assessment :  
*Executive Summary*

5 January 1996

CONSULTING SERVICES BY ENVIRONMENTAL RESOURCES MANAGEMENT

ERM-Hong Kong, Ltd  
6/F Hechy Tower  
9 Chatham Road, Tsimshatsui  
Kowloon, Hong Kong  
Telephone (852) 2722 9700  
Facsimile (852) 2723 5660



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Reference c1280/c1428

For and on behalf of ERM-Hong Kong, Ltd

Approved by: *[Signature]*

Position: *Deputy Managing Director*

Date: *8th January 1996*

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# Backfilling of South Tsing Yi and North of Lantau MBAs Final Environmental Assessment

## - Executive Summary -

### INTRODUCTION

This Executive Summary presents the main findings and recommendations of the Final Environmental Impact Assessment (FEIA) study, for the proposed Backfilling of South Tsing Yi and North of Lantau Marine Borrow Areas (MBAs).

### BACKGROUND

Sand from Marine Borrow Areas (MBAs) south of Tsing Yi and north of Lantau (*Figure 1*) has been excavated for various projects, including CT7, CT8 and the North Lantau Expressway - Tai Ho Section. Since these sand resources have now been exhausted, in accordance with the policy of the Fill Management Committee (FMC), it is proposed to backfill the MBAs to restore the originally muddy seabed to as close as possible to pre-dredging conditions, without causing unacceptable environmental impacts. The restoration is expected to produce several benefits, including potential reinstatement of the natural hydrodynamic regime, recolonization by a benthic community similar to that which existed prior to sand dredging, and provision of routine and emergency ship anchorage. Backfilling also provides additional disposal capacity, above capacity supplied by the open sea marine disposal sites at East of Ninepins and South Cheung Chau, for uncontaminated fine marine sediments.

The objective of this Feasibility Study/EIA is to design an environmentally acceptable Operations Plan for the proposed backfilling at the South Tsing Yi and North of Lantau MBAs, and to provide information on the nature and extent of environmental impacts and cumulative effects arising from the backfilling projects and potentially concurrent activities. The Study was designed to determine operational conditions and requirements, including the optimum backfilling levels and rates for the MBAs, to minimise spoil loss and impacts to sensitive receivers.

### THE PROPOSED PROJECT

The Feasibility Study/EIA assesses backfilling of MBAs at South Tsing Yi and North of Lantau (*Figure 1*). Background and engineering requirements for the two MBAs are described below. Additional backfilling specifications are provided in the Operations Plan.

The South Tsing Yi MBA is located south of the south-eastern tip of Tsing Yi Island. It occupies an area of approximately 1 km x 2.7 km, and can be subdivided into northern and southern MBAs. The northern MBA contains remaining sand resources in the northwestern portion and has been partially backfilled in the southeastern and southwestern portions. Sand resources in the southern MBA have not yet been excavated. Indicative calculations by the Civil Engineering Department's Geotechnical Engineering Office (CED GEO) have estimated that backfilling from -34mPD to -25mPD in the northern MBA will require 15.7 Mm<sup>3</sup> of material of which at least 50% will probably be grab-dredged material. Once sand has been exhausted from the southern MBA,

backfilling will proceed to the level of -25mPD and require an additional 26.2 Mm<sup>3</sup> of either grab- or trailer-dredged material. Therefore, total capacity is estimated at 41.9 Mm<sup>3</sup>.

The North of Lantau MBA has been dredged to a maximum level of approximately -38 mPD. The natural sea bed level along the northern margin slopes from -30 to -40mPD. The northern boundary of the MBA would not therefore be able to contain mobile trailer-dredged material, and for this reason the area can only be used for the disposal of uncontaminated grab-dredged material. A recent bathymetric survey for this MBA shows that the depth of the area varies from -12mPD to -40mPD. Indicative calculations by CED GEO have estimated the total capacity of the site to be 7.0 Mm<sup>3</sup>.

## STUDY FINDINGS AND RECOMMENDATIONS

The Feasibility Study/EIA conducted assessments in the areas of water quality, ecology, noise and air quality which are summarized below.

### *Water Quality*

Evaluation of impacts to water quality and water sensitive receivers was undertaken through modelling of suspended sediment (SS) plumes, sediment deposition, sediment erosion, dissolved oxygen (DO) and nutrients. Modelling exercises focused on thirteen scenarios developed to assess non-cumulative effects (backfilling at both MBAs simultaneously), cumulative effects (backfilling at both MBAs in conjunction with other dredging/disposal projects) and validation of the model.

Non-cumulative effects simulating concurrent backfilling at both MBAs were modelled using rates of disposal of 50,000 to 200,000 m<sup>3</sup> of trailer-dredged material at the South Tsing Yi MBA and a rate of 10,000 m<sup>3</sup> of grab-dredged material at the North of Lantau MBA. Predicted elevations in suspended sediment concentrations were found to be acceptable in comparison to both the Water Quality Objectives (WQOs) and the sensitive receivers' specific criteria at all sensitive receivers for all scenarios except the highest rate of backfilling (200,000 m<sup>3</sup> day<sup>-1</sup>) during the worst case seasonal/tidal conditions. Due to non-compliance at this highest rate of backfilling, an additional scenario was performed to determine the effects at a lower rate of backfilling (100,000 m<sup>3</sup> day<sup>-1</sup>). All predicted elevations in SS concentrations for the rate of 100,000 m<sup>3</sup> day<sup>-1</sup> were found to be in compliance with the exception of concentrations at the Kennedy Town Water Intake where the specific criterion was exceeded by 0.9 mg l<sup>-1</sup>. Due to the marginal nature of this exceedance, the fact that it will occur only during the worst case seasonal/tidal conditions and for less than four hours during the tidal cycle, and its compliance with the site-specific WQO, this concentration is considered acceptable. Should environmental monitoring observe any SS concentrations at or above this level at the Kennedy Town Water Intake, additional mitigation measures shall be considered.

Cumulative effects from concurrent backfilling at both MBAs and dredging at South Tsing Yi and West Sulphur Channel were modelled using the maximum backfilling rates at North of Lantau and South Tsing Yi MBAs plus rates representing dredging of surficial marine sand and alluvial sand at South Tsing Yi MBA and sand dredging at West Sulphur Channel. Cumulative scenarios

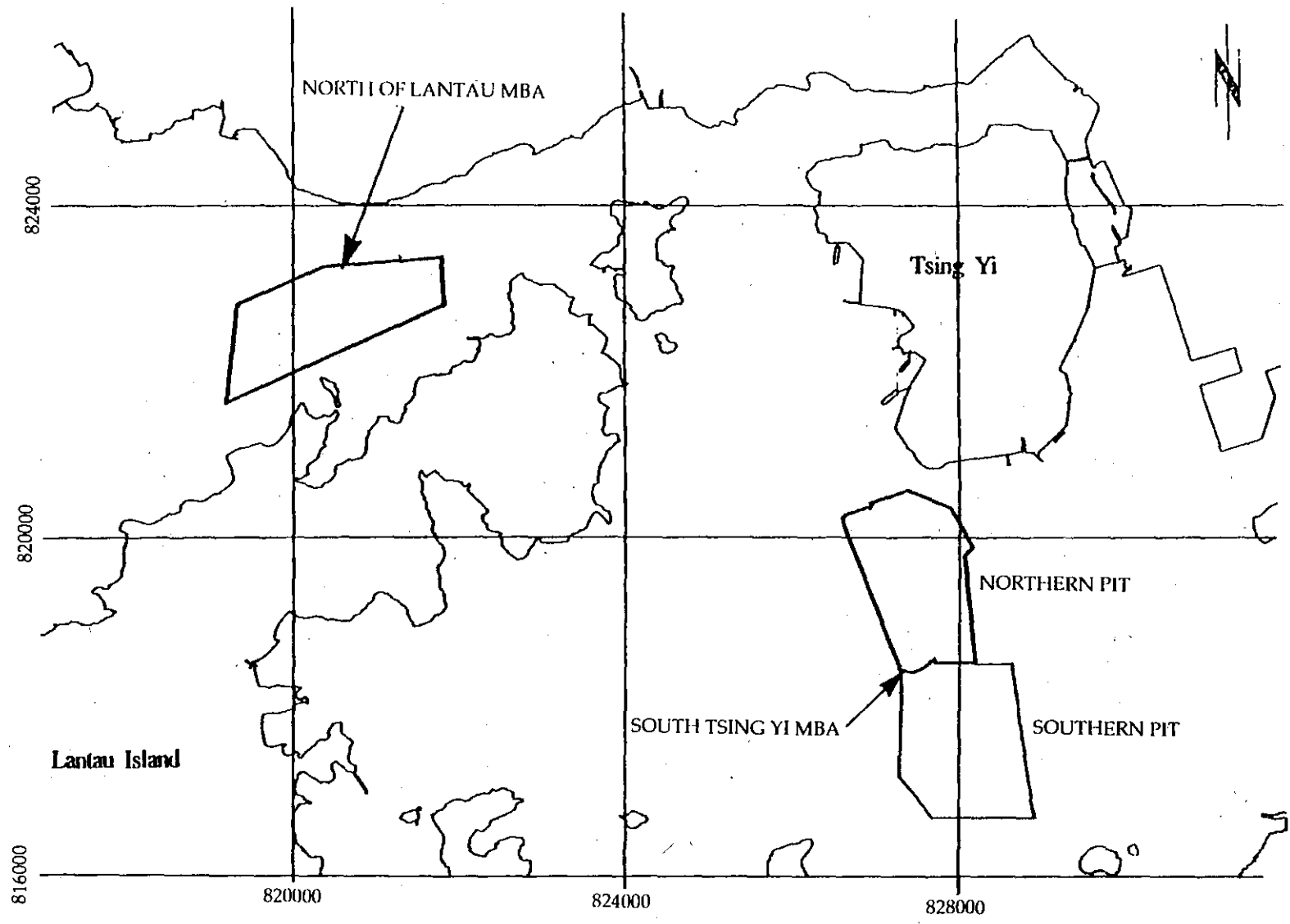


FIGURE 1 - LOCATION OF THE SOUTH TSING YI AND NORTH OF LANTAU MARINE BORROW AREAS (MBAs)

ERM Hong Kong  
 6th Floor,  
 Hecny Tower  
 9 Chatham Road  
 Tsimshatsui, Kowloon  
 Hong Kong



resulted in elevations of suspended sediment concentrations ranging from 2-65 mg l<sup>-1</sup> and indicated that it is unlikely that compliance with WQOs can be achieved under worst-case cumulative scenarios.

Results of the validation scenario demonstrate both that the WAHMO modelling approach is valid and appropriate for this Study and that previously observed elevated concentrations at the Ma Wan Fish Culture Zone were not caused by backfilling at the South Tsing Yi MBA.

Losses of sediment due to long-term erosion from both MBAs was also assessed. Studies of erosional effects have determined that both trailer- and grab-dredged material will be stable (ie, will not erode) under wave and current action at backfill levels at or below -24mPD. Studies of the North of Lantau MBA have determined that while there may be limited erosion of soft surface material at levels above -25mPD, the majority of the deposited spoil will be stable under all but the most extreme storm conditions at backfill levels of up to -16mPD.

The modelling assessment of dissolved oxygen showed that for the worst case non-cumulative scenario, the DO deficit would be less than 4% saturation, and for the cumulative scenarios, DO deficits of up to 10% were predicted. As these concentrations are not sufficiently depressed to cause non-compliance with the WQOs, all scenarios were found to be acceptable in terms of DO. The assessment of nutrients found that there are unlikely to be exceedances of nutrient WQOs for backfilling operations alone.

#### *Ecology*

Previous studies in the South Tsing Yi area have shown that benthic assemblages in the MBA are typical of soft bottom communities in Hong Kong waters. Similarly, the grab survey results in the North Lantau MBA for this EIA have shown that the soft bottom benthic species recorded are commonly found in the waters of Hong Kong. Since species assemblages at these MBAs are typical of soft bottom benthic communities in Hong Kong waters and do not contain rare or unique species, the potential impacts to benthic fauna are considered acceptable.

Predicted elevations in suspended sediment (SS) concentrations within the areas of the sediment plumes, generated during backfilling operations alone, are not expected to result in exceedance of acute tolerance levels for fish and invertebrate larvae in potential spawning and nursery grounds off the north coast of Lantau. However, cumulative impacts arising from concurrent backfilling activities and other dredging/disposal projects, in conjunction with high ambient SS levels, may result in SS concentrations exceeding the natural range in some nursery areas for brief periods.

Suspended sediment concentrations associated with backfilling at the two MBAs (non-cumulative scenario), are not predicted to cause unacceptable impacts to capture fisheries, mariculture zones or fish fry collection areas. However, concurrent backfilling and dredging activities and/or high levels of ambient SS may require mitigation, particularly at the Ma Wan Fishery. Mitigation measures which reduce the sediment concentrations in the water column (as described in the Environmental Monitoring and Audit (EM&A) Manual) would serve to reduce impacts to fisheries resources.

The results of the sediment plume modelling (non-cumulative and cumulative scenarios) indicate that the predicted reductions in DO concentrations would not result in noncompliance with the specified WQOs for DO, and thus no unacceptable DO related impacts on the identified marine ecological resources are anticipated. Similarly, from the results of nutrient modelling, impacts on marine ecological resources arising from nutrient release are not expected.

The MBAs are not located within areas of frequent *Sousa chinensis* sightings and thus do not represent areas of preferred feeding habitat for *Sousa*. Potential changes in water quality and feeding habitat associated with backfilling operations are therefore expected to have minimal effect on *Sousa*. The potential for impacts to *Sousa* arising from collisions with vessels is also considered minimal. Based on dolphin sensitivity to underwater noise, potential noise impacts on *Sousa* during the backfilling operations may be of concern. However, it is anticipated that noise impacts associated with material placement will be insubstantial and impacts associated with increased vessel traffic will be minimal in the context of typical vessel traffic in the waters of the Study Area. In summary, unacceptable impacts to *Sousa* during the backfilling operations are not predicted primarily because the areas near the MBAs do not represent preferred *Sousa* habitat.

Overall no insurmountable impacts to ecological sensitive receivers have been identified from the EIA. Furthermore, potential environmental benefits associated with the proposed backfilling include restoration of the MBAs to soft bottom benthic conditions existing prior to the initiation of sand dredging activities. It is anticipated that recolonisation of the restored substrate by benthic communities similar to those in undisturbed areas near the MBAs will be rapid, given the large natural seasonal variation experienced in this area and the rapid recolonisation of disposed sediments observed at the East Sha Chau disposal sites.

#### Noise

The detailed noise assessment predicted that backfilling operations at the South Tsing Yi MBA will not lead to exceedances of the recommended daytime noise limit or the Noise Control Ordinance (NCO) night-time criteria at any nearby sensitive receivers. Backfilling activities at the North of Lantau MBA during night-time (2300-0700) hours, however, could lead to significant exceedance of the relevant NCO night-time criteria. No significant impacts were predicted for daytime or evening hours at the North of Lantau MBA.

Full compliance with the night-time noise criterion at the North Lantau MBA could be achieved by restricting such night-time dumping operations temporally (eg, prohibition of night-time operations or at most one dredger or one barge/tug boat combination during any 5-minute period) or spatially (eg, restricting night-time dumping operations to a maximum of two dredgers or two barge/tug boat combinations in any 5-minute period south of the 823000N Hong Kong grid reference line).

Further analysis has indicated that cumulative impacts are unlikely to arise in practice due to the large distances between noise sources and receivers. Therefore, additional mitigation measures designed specifically to reduce the noise levels from cumulative impacts are not considered necessary for night-time

operations. As a result, no insurmountable, residual noise impacts have been predicted for either the proposed South Tsing Yi or North of Lantau MBA backfilling operations.

#### *Air Quality*

The detailed assessment predicted no exceedances of the Air Quality Objectives (AQOs) from backfilling operations at the South Tsing Yi or North of Lantau MBAs. Thus no significant or insurmountable air quality impacts to the local or regional air quality are anticipated. Even with the addition of cumulative impacts, it is not likely that air quality impacts would lead to exceedances of the AQOs at the nearby air sensitive receivers. As a result, no mitigation measures or EM&A requirements have been recommended for these backfilling operations.

#### OPERATIONS PLAN

The information compiled from assessment of water quality, ecology, noise and air impacts has been used to assemble an Operations Plan for the proposed backfilling which, in combination with additional mitigatory measures achieved by plant maintenance and working methods, will prevent unacceptable adverse impacts to sensitive receivers. The key features of the Operations Plans for the South Tsing Yi and North of Lantau MBAs are highlighted below:

##### *South Tsing Yi:*

- Backfilling at rates less than or equal to 100,000 m<sup>3</sup> day<sup>-1</sup> trailer-dredged material;
- Backfilling to a level of -25mPD;
- Areas of grab-dredged material to be placed at northern end of MBA and between northern and southern MBA to prevent migration of disposed material along the seafloor;
- Backfilling prohibited during the dredging of surface marine sands from the southern South Tsing Yi MBA;
- No more than 2 trailers or barges in operation at any one time within the MBA;
- Only one dredging or dumping vessel working in the fairway at any one time;
- Vessels must be highly maneuverable and self-propelled and must remain in motion during disposal.

##### *North of Lantau:*

- Backfilling at rates less than or equal to 10,000 m<sup>3</sup> day<sup>-1</sup> grab-dredged material;
- Backfilling to a level which will restore the natural seabed (ca. -25mPD);
- No more than 20% of the gazetted area to be affected by backfilling operations at any one time;
- Night-time backfilling operations prohibited north of Hong Kong grid reference line 823000N;
- Night-time backfilling operations restricted to no more than two dredgers or two barge/tug boat combinations in any 5 minute period south of Hong Kong grid reference line 823000N;



## **ADDITIONAL MITIGATION MEASURES**

Mitigation measures in the form of plant maintenance and working methods to reduce water quality impacts are provided in the EM&A Manual. This manual also specifies water quality and noise monitoring programmes which will identify any exceedances of the Water Quality Objectives, the Noise Control Ordinance and the applicable Trigger, Action and Target (TAT) levels. The EM&A Manual also provides an Action/Event Plan which prescribes specific remedial actions in the event of TAT level exceedances.

In addition to the EM&A Manual, a preliminary Cumulative Effects Assessment Manual (CEAM) has been developed to provide a supplemental tool for identifying, managing and mitigating the environmental impacts of backfilling in conjunction with concurrent dredging/disposal projects. The preliminary draft version of the CEAM, which is issued as a separate document to this FEIA, is indicative of the predictive cumulative assessment approach that would be adopted. The precise methodology, which will interact closely with the EM&A programme, will be refined prior to use and will subsequently be validated and updated in parallel with the implementation of the EM&A programme.

## **OVERALL CONCLUSIONS**

The detailed assessment of environmental consequences arising from the proposed backfilling activities at the South Tsing Yi and North of Lantau MBAs indicates that there are unlikely to be any unacceptable or insurmountable residual environmental impacts with the implementation of the proposed Operations Plan in the absence of other concurrent projects. The presence of other active dredging/disposal projects within the vicinity of the MBAs may require the application of additional mitigatory measures, eg reduction of disposal rates for the backfilling operations, to ensure that impacts associated with backfilling do not exceed acceptable levels.