For Information
on 11 September 1998

LEGISLATIVE COUNCIL PANEL
ON ENVIRONMENTAL AFFAIRS

STRATEGIC SEWAGE DISPOSAL SCHEME ENVIRONMENTAL IMPACT ASSESSMENT STUDY

PURPOSE

1. In May 1996, the Environmental Protection Department (EPD) commissioned the SSDS-EIA Study to determine the most appropriate ultimate level of treatment and point of discharge of the sewage to be collected and treated under the Strategic Sewage Disposal Scheme. The purpose of this paper is to brief members on the outcome of the first phase of the study and outline the next steps.

BACKGROUND

2. Throughout the 1970s and early 1980s, the provision of sewerage in Hong Kong failed to keep pace with development. As a result, there was a rapid decline in water quality in the harbour. In 1987, EPD commissioned a study to determine the long-term sewage disposal strategy for Hong Kong. The study recommended implementation of the Strategic Sewage Disposal Scheme (SSDS), a comprehensive sewerage system which would collect sewage from the urban areas around the harbour using deep tunnels and dispose of it (after primary treatment) to deep oceanic currents south of Hong Kong. The SSDS was to be constructed in four stages over a ten-year period.

3. Since then, there has been much debate in the community about the treatment level to be adopted in the SSDS. In 1994, the EPD commissioned the "SSDS Stage II Options Review Study" to examine a very large number of alternative options. An International Review Panel (IRP) with three experts from the Mainland, Denmark and the USA were appointed to oversee the work of the consultants. The IRP concluded that the original SSDS proposals were basically correct. They also recommended that

a) chemically enhanced primary treatment (CEPT) should be provided as a minimum, at Stonecutters Island, and all flows should be treated there; and

b) since discharge to the harbour was not a long-term solution, an environmental impact assessment (EIA) study should be carried out to assess alternative outfall locations south of Hong Kong, and the level of treatment needed in the long-term.

CROSS-BOUNDARY LIAISON

4. The detailed arrangements of the proposed SSDS EIA Study were extensively discussed between both sides under the Sino-British Joint Liaison Group - Expert Group on Sewage Disposal during 1995. At its Fourth Meeting on 20 December 1995, the Expert Group agreed that the Study should be carried out as soon as possible. Following the commencement of the study in May 1996, both sides continued to discuss the methodology and the reports submitted by the Consultants, providing support and advice to the Consultants as necessary.

5. Following the return of sovereignty in July 1997, discussion of sewage disposal arrangements was dropped from the Sino-British Joint Liaison Group. A new Expert Group on Sewage Disposal, led by the Hong Kong and Macau Affairs Office on the Mainland side and the Planning, Environment and Lands Bureau on the Hong Kong side was set up in July 1998 to continue the discussions. A Technical Group was set up under the Expert Group to review the reports submitted by the Consultants. At its first meeting held in August 1998, the Technical Group agreed that the methodology was basically correct and the Consultants' findings were technically sound.

PROGRESS OF THE SSDS EIA STUDY

6. The SSDS EIA Consultants have now completed all the field survey work, including the wet and dry seasons marine water quality and hydrodynamics survey, the four seasons' ecological survey, wastewater characterization and whole effluent toxicity testings. A set of environmental, engineering feasibility and social economic criteria was also established for the evaluation of options. Based on this set of criteria and the near-field modelling results, the Consultants short-listed sixteen combinations of outfall locations and treatment levels (Table 1), including CEPT, secondary treatment, tertiary treatment and disinfection, for far-field water quality model simulations. A schematic of the outfall locations considered is at Figure 1. Two (either side of Lamma Island) are in Hong Kong waters while one (13km south east of Lamma Island) is in Mainland waters, in the Lema Channel.

TABLE 1. SCENARIOS SIMULATED USING THE FAR-FIELD MODEL

Scenario[1]	Outfall Locations	Treatment Levels
2a & 2b	E. Lamma outfall	CEPT without / with disinfection
3a & 3b	W. Lamma outfall	CEPT without / with disinfection
4a & 4b	S.E. Lamma outfall (Lema Channel)	CEPT without / with disinfection
5a & 5b	Both E. and W. Lamma outfall	CEPT without / with disinfection
6a & 6b	E. Lamma outfall	Secondary[2] treatment without / with disinfection
7a & 7b	E. Lamma outfall	Tertiary[3] treatment without / with disinfection
8a & 8b	W. Lamma outfall	Secondary treatment without / with disinfection
9a & 9b	W. Lamma outfall	Tertiary treatment without / with disinfection

Note: 1. The first scenario is the existing environmental condition. The rest of the scenarios are options sub-divided into (a) without disinfection and (b) with disinfection
2. Secondary treatment = Biological BOD removal
3. Tertiary treatment = Biological nutrient and BOD removal (BNR)

7. A full 3-dimensional water quality and hydrodynamic model was set up to simulate these scenarios. Results showed that :

a) For discharges leading to E. or W. Lamma outfall, disinfection would be required to meet the *E.coli* Water Quality Objectives (WQO) of the nearby bathing beaches and secondary contact recreational subzones. Moreover, the Consultants recommended that disinfection should also be provided to the S.E. Lamma outfall (Lema Channel) discharge to protect the marine mammals on a precautionary principle.

b) With CEPT plus disinfection, discharge of effluent to the two potential locations in Hong Kong waters would meet all the WQOs apart from those for total inorganic nitrogen (TIN < 0.1mg/L) in southern Hong Kong waters and dissolved oxygen (DO > 6mg/L) in Mainland waters during the wet season. Failure to meet the former is due to the high background nitrogen levels contributed by the Pearl River, and the latter due to naturally low dissolved oxygen levels in the Lema Channel during the wet season. In both cases the WQOs are not met now. The additional influence of the sewage itself would be minimal and would have no measurable ecological impact. It would increase the TIN level in southern Hong Kong waters from 0.14mg/L to 0.17mg/L and decrease the average wet season DO in Mainland waters from 4.4mg/L to 4.2 mg/L, in a limited area.

c) Similarly, with secondary treatment plus disinfection, discharge at either of the locations off Lamma Island would allow all criteria to be met, except those for TIN and DO, as above. DO would drop by about 0.1mg/L whereas the TIN would remain as in (b).

d) With CEPT plus disinfection and a discharge at the longest outfall at S. E. Lamma (Lema Channel), the DO criterion in Mainland waters cannot be met during the wet season. DO would drop by about 0.15mg/L while all other criteria for mainland waters would be met. There would be no detectable increase in nitrogen in Hong Kong waters.

e) With tertiary treatment (which reduces nitrogen) there would be no detectable increase in TIN at any location but the TIN WQO in southern Hong Kong waters would still fail to be met due to the high background TIN levels. DO would be as for secondary treatment.

f) All options would meet all the toxic substance criteria after the initial dilution except for mercury due to the high background level. The Mainland WQO for mercury is 0.05 ug/L whilst the concentration of mercury in the seawater and the sewage effluent are 0.2 ug/L and 0.4 ug/L, respectively. Discharge of treated effluent would marginally increase the concentration of mercury in the seawater from 0.2 ug/L to 0.203 ug/L after initial dilution.

g) The chemical-specific detailed risk assessment shows that none of the options pose any significant ecological or human health risk.

h) Discharges to either E. or W. Lamma outfall would be comparable in environmental, engineering, programming and cost terms. Moreover, there would be no measurable benefits in having outfalls at both eas and west Lamma.

8. Since discharges at either one of the three outfall locations combined with either CEPT or higher levels treatment plus disinfection would meet all the criteria except those compromised by background conditions, these are considered as acceptable choices, which can be categorized into four groups as shown in Table 2 and Figure 2.

TABLE 2. ENVIRONMENTALLY ACCEPTABLE OPTIONS FOR SSDS STAGE II

Option Group	Outfall Locations	Treatment Levels
1	E. or W. Lamma outfall	CEPT with disinfection
2	S.E.Lamma outfall (Lema Channel)	CEPT with disinfection
3	E. or W. Lamma outfall	Secondary treatment with disinfection
4	E. or W. Lamma outfall	Tertiary treatment with disinfection

9. The eventual choice of options will depend on cost and land implications, and an assessment of the importance of applying the precautionary principle in this case. Whilst a summary of the cost and land implications of the different options is provided in Table 3, the pros and cons of the four options are :

a) Option (1) has the benefit that the capital and operational costs are much lower. Moreover, it retains the flexibility for further upgrading to secondary or tertiary treatment.

b) Option (2) has marginally less impact on water quality than (1) but requires a much longer construction time, which means it would take a longer time to clean up Victoria Harbour. Moreover, the uncertainty of the geological conditions in the Lema Channel may increase both the construction time and cost significantly.

c) Option (3) has marginally less impact on water quality than option (2). However, apart from almost doubling the capital and running costs, it requires around 22 hectares of land at Lamma Island.

d) Option (4) requires around 28 hectares of land at Lamma Island which would necessitate some reclamation. This in turn would mean a longer construction period and a further EIA on the reclamation proposal. This is also the most expensive option in terms of capital and running costs.

TABLE 3. KEY DIFFERENCES BETWEEN THE ACCEPTABLE OPTIONS

Details and Main Criteria	**Group 1**	**Group 2**	**Group 3**	**Group 4**
Treatment Levels	CEPT + Disinfection	CEPT + Disinfection	Secondary + Disinfection	Tertiary + Disinfection
Outfall Location	E. or W. Lamma	S. E. Lamma (Lema Channel)	E. or W. Lamma	E. or W. Lamma
Marine Environment	Achieves all criteria except those where the background levels have already exceeded the WQOs			
Onshore Environment	Limited impacts	Limited impacts	Moderate	Moderate. Additional impacts from necessary reclamation
*Time for Completion (from selection of option to completion of construction)	7.5 - 8 years	8 - 10 years (depends on the actual geological conditions in Lema Channel)	7.5 - 8 years	9.5 - 10 years
Other Engineering Issues	Further geological survey is needed to determine which outfall is more appropriate	High uncertainties associated with the faults zones in Lema Channel	Further geological survey is needed to determine which outfall is more appropriate	Further geological survey and pilot studies required
*Capital Cost (not including Stage I works)	$11 billion	$13 billion	$23 billion	$26 billion
*Recurrent Cost	$0.9 billion per year	$0.9 billion per year	$2.0 billion per year	$2.3 billion per year
Land Requirement	11 ha of land at Stonecutters Island plus 6 ha of land at Lamma Quarry site	11 ha of land at Stonecutters Island plus 6 ha of land at Lamma Quarry site	11 ha of land at Stonecutters Island plus 22 ha of land at Lamma Quarry site	11 ha of land at Stonecutters Island plus 28 ha of land at Lamma Quarry site; at least 3 ha of land to be formed by reclamation

* The figures are best estimates at this stage.

NEXT STEPS

10. The evaluation of the options were detailed in the attached briefing document for member's reference. We shall seek advice from the Advisory Committee on the Environment (ACE) on the selection of the options at the end of September 1998. We also intend to brief the interested parties, including the green groups, tertiary academic institutes and professional bodies on the outcome of the consultants' findings, using the attached briefing documents shortly. It is expected that the selection of the option would be finalized by end of this year.

11. Once the option is selected, the Consultants will carry out a detailed site specific EIA for the construction and operation phases of the selected option. We plan to complete the whole SSDS EIA Study by May 1999.

LOOKING FORWARD

12. Hong Kong is only a small geographical area of the Pearl River Delta (PRD). It is essential that we work together with the Mainland to protect coastal water quality so as to maintain a healthy living environment in the region. Our coorperation in the SSDS is a good example. We will continue to work closely with our Mainland counterparts on long term measures to protect the PRD.

Environmental Protection Department
September 1998

Figure 1: Alternative Outfall Locations

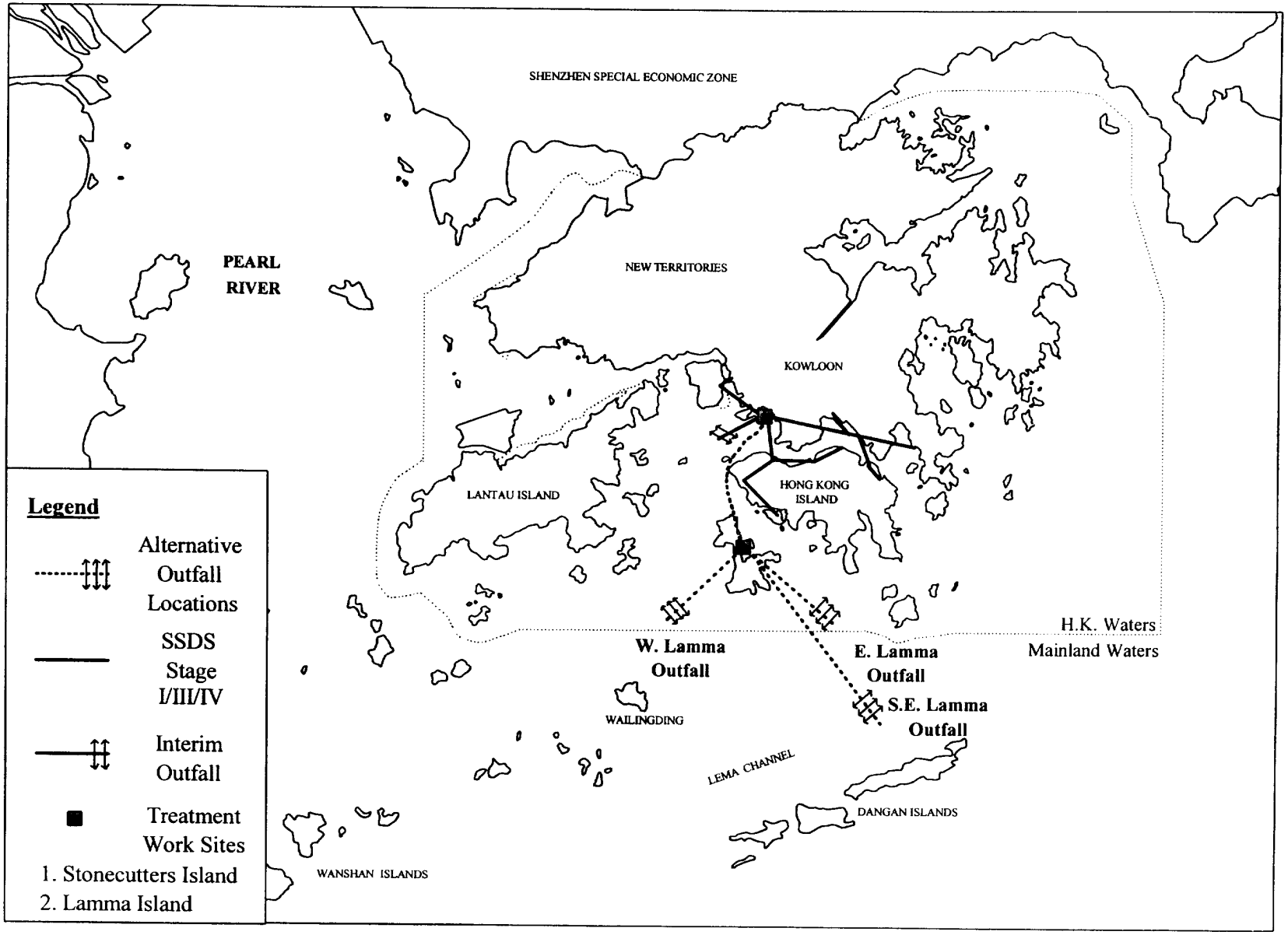
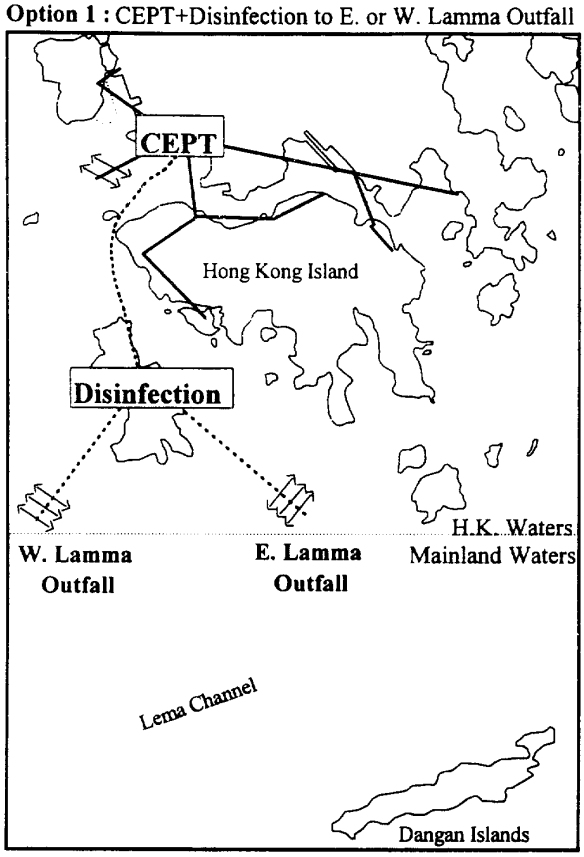
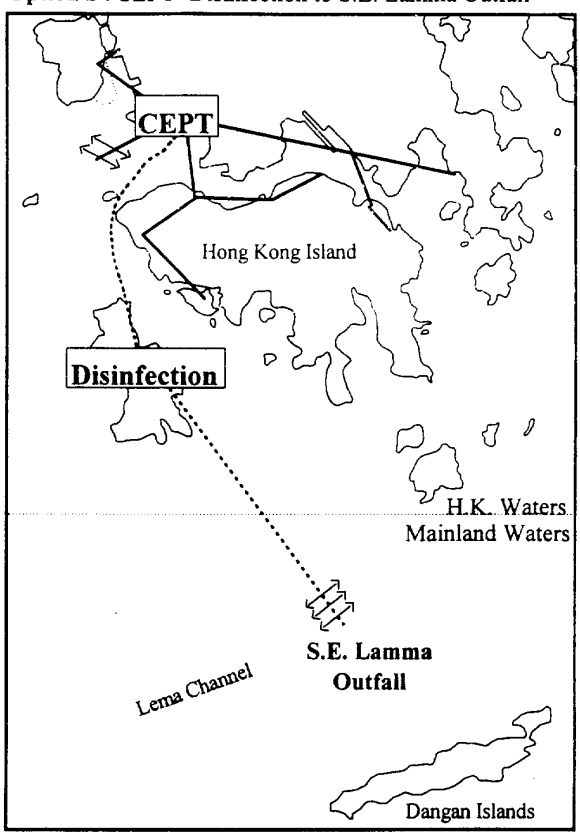


Figure 2 : Environmentally Acceptable Options for SSDS Stage II

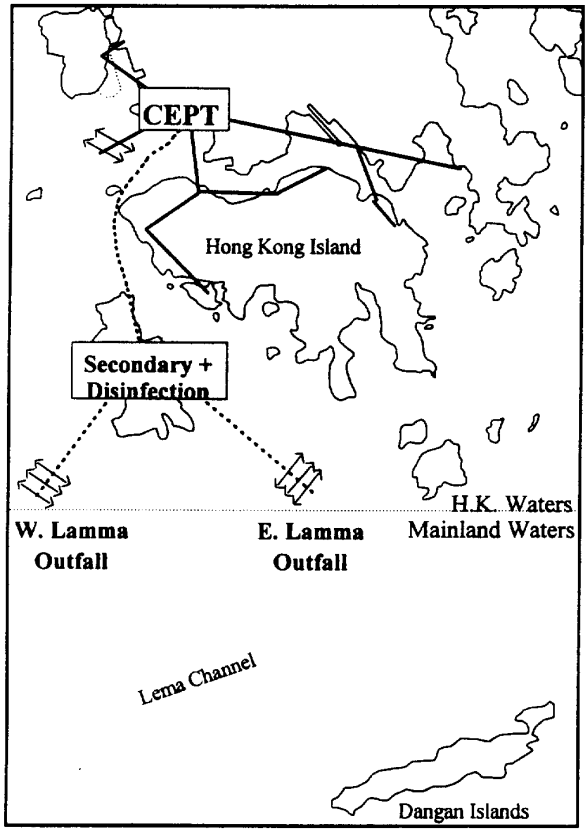
Option 1 : CEPT+Disinfection to E. or W. Lamma Outfall



Option 2 : CEPT+Disinfection to S.E. Lamma Outfall



Option 3 : Secondary+Disinfection to E. or W. Lamma Outfall



Option 4 : Tertiary+Disinfection to E. or W. Lamma Outfall