

For discussion on  
18 April 2001

PWSC(2001-02)10

## **ITEM FOR PUBLIC WORKS SUBCOMMITTEE OF FINANCE COMMITTEE**

### **HEAD 705 – CIVIL ENGINEERING**

#### **Environmental Protection - Sewerage and sewage treatment 227DS - Trials and studies in relation to the way forward for the Harbour Area Treatment Scheme**

Members are invited to recommend to Finance Committee the upgrading of **227DS** to Category A at an estimated cost of \$73.6 million in money-of-the-day prices for –

- (a) testing out Biological Aerated Filters technology and, if necessary, other well-proven compact sewage treatment technologies;
- (b) assessing the environmental and engineering feasibility of four options which an International Review Panel has recommended for the future development of the Harbour Area Treatment Scheme; and
- (c) developing a contractual framework for option implementation.

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## PROPOSAL

The Director of Environmental Protection, with the support of the Secretary for the Environment and Food, proposes to engage professional services to conduct trials of Biological Aerated Filters (BAF)<sup>1</sup> technology as well as other compact sewage treatment technologies, environmental and engineering feasibility studies of four options proposed by the International Review Panel (IRP), and to develop a contractual framework for option implementation, at an estimated cost of \$73.6 million in money-of-the-day (MOD) prices.

## PROJECT SCOPE AND NATURE

2. An IRP completed a review of the Harbour Area Treatment Scheme (HATS) (formerly known as the “Strategic Sewage Disposal Scheme” (SSDS)) in 2000. We propose to carry out environmental and engineering feasibility studies, develop a contractual framework for option implementation, and invite manufacturers to offer pilot plants in Hong Kong to test out BAF technology and other compact sewage treatment technologies. These trials and studies are necessary for ascertaining whether the compact technologies and the four IRP options are viable, and for addressing the question as to whether there is any capacity constraint in Stage I of HATS. The scope of the trials and studies is as follows -

### **Compact sewage treatment technologies trials**

- (a) To test the feasibility and effectiveness of compact technologies, particularly BAF, in treating saline sewage, and to assess the reliability and operational risk, land requirements, sludge production and capital and recurrent costs of such technologies.

### **Environmental feasibility study**

- (b) To review existing information, undertake surveys, and carry out tests to characterize existing environmental conditions and the quantity, quality and toxicity of treated effluent.
- (c) To assess any capacity constraint for the Kowloon and north-east Hong Kong Island (Stage I) elements of HATS, taking into account the latest population projections, the findings of the flow reassessment study recommended by the IRP and the possible commissioning date of the remaining Hong Kong

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<sup>1</sup> This is an advanced treatment process characterized by compact size.

Island (Stage III/IV) elements of HATS, and to identify possible options to relieve any capacity constraint in Stage I.

- (d) To carry out water quality modeling and related assessments in respect of the IRP and any other treatment and discharge options found to be needed (e.g. to what extent nitrification and denitrification are required).
- (e) To undertake ecological impact and human health risk assessments of the various options.
- (f) To evaluate the potential impacts of the options on the receiving water environment, and their effectiveness in achieving the water quality objectives and meeting other relevant agreed criteria.

#### **Engineering feasibility study**

- (g) To identify specific potential sites to accommodate the various facilities under the different options, and taking into account land, engineering and other constraints, to assess the landtake implications and to prepare schematic designs for various options.
- (h) To provide updated estimates in respect of capital and recurrent costs for various options.
- (i) Taking into account other studies relating to the IRP review, to propose a list of feasible options.

#### **Feasibility study for contractual framework**

- (j) To review possible contractual arrangements, including “Design, Build, Operate” (DBO), and develop a framework that would help expedite the delivery of the project and identify the most appropriate means of operating the projects.

3. We plan to start the proposed trials and studies in November 2001 for completion in October 2003.

**/JUSTIFICATION .....**

## JUSTIFICATION

### IRP review

4. To improve the water quality of the harbour, we initiated HATS in the late eighties for the collection and treatment of sewage from the main urban areas on both sides of Victoria Harbour. Implementation was divided into four stages. Stage I was designed to convey sewage from the most densely populated and industrialized areas to a sewage treatment works at Stonecutters Island for chemically-enhanced primary treatment (CEPT)<sup>2</sup> before discharge into the western harbour via an interim outfall. We expect to commission the first stage collection systems around the end of 2001.

5. Between 1996 and 2000, an environmental impact assessment (EIA) was conducted to assess the preferred treatment level and discharge location for the subsequent stages of the scheme. The study concluded that the CEPT-effluent from Stonecutters Island should undergo a further disinfection process and then be discharged to a location east of Lamma Island. This configuration, termed the "1999 scheme", is shown at Enclosure 1. Were it to proceed now, we estimate that the 1999 scheme would be completed by 2011.

6. Public concerns raised by the delays in Stage I of the project, coupled with continued criticism of the preferred treatment level, reliance on large treatment plants and discharge arrangements for subsequent stages, led to the conclusion in 1999 that further stages of the HATS should not be implemented until Stage I had been completed and greater public understanding and consensus had been established on the way forward. In his 1999 Policy Address, the Chief Executive announced that the Government would carry out another review of the scheme. In April 2000, we invited an IRP of local, Mainland and overseas experts to carry out the review.

### IRP recommendations

7. In its final report released on 30 November 2000, the IRP recommended that consideration should be given to upgrading the treatment level to tertiary standard, and EIA work be undertaken to establish whether effluent treated to this standard could be discharged into the harbour area, removing the need for a long oceanic outfall. To achieve this, the IRP proposed four alternative

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<sup>2</sup> CEPT is the treatment technology being used in the Stonecutters Island Sewage Treatment Works (SCISTW) which was constructed under Stage I of HATS and has been in operation since May 1997. The CEPT process in SCISTW is able to achieve 90% of the effluent quality standards of conventional biological treatment plant.

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treatment and discharge options, all involving the use of BAF technology for treatment, deep tunnels for the sewage transfer system, and short outfalls for disposal. As illustrated in Enclosure 2, these options differ in the degree of centralization and the proposed outfall locations.

### Issues to be addressed by the trials and studies

8. In proposing the four options, the IRP recognized that there were several uncertainties that needed to be addressed. The Panel therefore recommended that a number of trials and studies be carried out before a final configuration for the subsequent stages of HATS is selected. To ensure that our investment in the IRP recommendations represents good value for money for Hong Kong, we agreed with the IRP that trials and studies should be undertaken to address the following important issues -

- (a) Due to the generally high saline content of Hong Kong's sewage, there is a need to test the **effectiveness of the BAF technology** in terms of organics removal, nitrification, and denitrification with local sewage. We will also test other well-proven compact sewage treatment technologies with successful large-scale application if they are compatible with the operation of existing facilities, e.g. the CEPT plant at Stonecutters Island. We will invite manufacturers to offer pilot plants to test out BAF technology or other compact treatment technologies that have been well-proven for large-scale application.

The trial data will help us identify the appropriate technology for use under HATS. The data could also be used for assessing the effectiveness of the preferred technology, the relevant recurrent costs, as well as the size of the sites where the new treatment facilities may need to be located.

- (b) The IRP indicated that CEPT plus BAF should be the preferred treatment technology, with discharges made into the harbour at various possible locations. But they drew no conclusions as to the precise effluent quality needed to meet current environmental requirements, or the long term acceptability of discharging effluent into the harbour. We therefore need to carry out a detailed water quality assessment to address these issues. Because previous studies have not focused in detail on the harbour area as a long-term discharge location, we need to compile a considerable amount of new information and undertake **environmental feasibility**

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**studies and surveys.**

- (c) The IRP recommended that we should consider new treatment facilities located within or close to certain residential areas e.g. Sandy Bay and North Point. These facilities are expected to occupy significant space even if they employ BAF technology. We need to assess the land, engineering and other constraints relating to the sites where such facilities might be accommodated, as well as the economic implications of such a semi-distributed system. A major part of the **engineering feasibility study** can only be conducted after the results from the BAF trials described above become available.
- (d) Since a long lead time is required for infrastructure projects like the HATS facilities, the IRP recommended that the Administration consider the DBO approach which may help to speed up the process. We will examine various types of contractual arrangements, including DBO, with a view to identifying the most appropriate **framework for subsequent development** in terms of speeding up the delivery time, controlling risk, and maximizing cost-effectiveness.
- (e) The Stage I system was designed in 1993. Since then, there has been a substantial increase in the anticipated sewage flow in the Stage I catchment areas due to committed and proposed residential and commercial development in the catchment areas. This may create capacity constraint problems in the Stage I system in the medium to long term. To overcome this potential constraint, the 1999 scheme suggested that the Stage I flow from the eastern Hong Kong catchments of Chai Wan and Shau Kei Wan should be transferred to the future collection tunnel on the North Shore of Hong Kong Island system. However, the IRP considered that **capacity constraints** will not exist in the foreseeable future, and recommended that we carry out a **flow assessment study** to reassess whether there are indeed likely to be any such constraints. If the IRP's assessment is right, the proposed deep tunnel between Shau Kei Wan and North Point will not be necessary.
- (f) The IRP also recommended a study be conducted to **reassess the capacity of the Stonecutters Island**

**Sewage Treatment Works (SCISTW).** The study's findings, together with information from other studies such as the flow reassessment and the trials on compact technologies recommended by the IRP, will enable assessment to be made in the proposed engineering feasibility study as to whether all the sewage from the harbour area can be treated at SCISTW.

- (g) With more detailed information available from the trials and studies, we will also update the **financial implications** of the various options and work out the likely **implementation programmes**. This would form part of the engineering feasibility study.

9. We need to engage professional services to assist with the studies outlined in paragraphs 8(a) to (d) and 8(g). Prior to the release of the IRP report, the Environmental Protection Department (EPD) had already identified the need to develop a hydraulic assessment tool to assess the performance of the HATS Stage I system to tie in with its commissioning. A small-scale study was therefore commissioned for this purpose and this will enable us to conduct a flow reassessment study as required by the IRP after the Stage I commissioning (paragraph 8(e)). We do not need additional funding for conducting the flow reassessment study. EPD will also conduct some of the work in-house, e.g. the identification and establishment of ecological and water quality standards and criteria. Reassessment of SCISTW's capacity (paragraph 8(f)) will be undertaken by the Drainage Services Department (DSD) using existing resources.

10. The trials and studies will provide the information needed to undertake a full analysis of the options and enable us, if necessary, to identify potential alternatives in case any modification of the IPR options is required. In addition, the information obtained will help to determine whether the compact technologies investigated may have a wider application in Hong Kong. A brief on the significance of the above trials and studies is set out at Enclosure 3.

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11. Without these trials and studies, it will not be possible to establish the technical and economic viability of the IRP options. We will not be able to provide the public with updated information on the costs and timetables, the associated risk, the likely benefit and the impact on the marine environment of these options. Without such information, we foresee difficulty in building public consensus on the way forward for improving the water quality in the harbour.

/Timetable .....

**Timetable**

12. The trials and studies are expected to take about two years between November 2001 and October 2003. A detailed timetable for the proposed trials and studies is as follows -

- Trials of compact sewage treatment technologies:  
Nov 2001 – June 2002
- Flow reassessment study:  
Nov 2001 – Oct 2002
- SCISTW capacity reassessment study:  
Jan 2002 – March 2002
- Environmental feasibility study:  
Nov 2001 – May 2003
- Engineering feasibility study:  
Nov 2002 – Oct 2003
- Feasibility study for contractual framework:  
Mar 2002 – Mar 2003

13. The timetable above represents the shortest reasonable time frame for the following reasons -

- (a) To obtain reliable results, trials of compact sewage treatment technologies must be carried out with sewage fully representative of SCISTW effluent under full load. Such a full load will not be available until the Stage I collection systems have been commissioned around the end of this year. The operation then has to be tested under various environmental conditions.
- (b) Similarly the flow reassessment and the SCISTW capacity reassessment studies can only be completed after the full commissioning of Stage I, when a complete set of data covering all seasonal conditions is available for analysis.
- (c) The environmental feasibility study will take 18 months from November 2001 to May 2003. The main reason for this is that a two-season marine survey is necessary, and the detailed water quality and ecological assessment work can only be done after the

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survey has been completed.

- (d) Six months is the minimum time required for finalisation of the engineering feasibility studies and evaluation of options, but this work can only be done when the results of the other studies (e.g. the environmental feasibility study) are available because those other studies will determine the limiting factors concerning plant size and operational conditions. Such information is crucial to determining the feasibility of installing treatment capacity at the IRP's indicative locations.

## FINANCIAL IMPLICATIONS

14. We estimate the capital cost of the proposed trials and studies to be \$73.6 million in money-of-the-day (MOD) prices, made up as follows –

	<b>\$ million</b>
A. Trials on compact sewage treatment technologies	14.0
B. Studies	
(a) Professional Services	40.1
(i) Environmental feasibility study	17.2
(ii) Engineering feasibility study	10.5
(iii) Feasibility study for contractual framework	8.0
(iv) Others – general project management for the above three studies	4.4
(b) Field survey (for the environmental feasibility study only)	9.3
(c) Laboratory testing and analysis (for the environmental feasibility study only)	1.7

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		\$ million
C. Contingencies		4.7
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	Sub-total	69.8 (in September 2000 prices)
D. Provision for price adjustment		3.8
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	Total	73.6 (in MOD prices)
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 A detailed breakdown of the costs of the trials and studies is given at Enclosure 4. Upon completing the trials and studies, we will consult the public with a view to forging community consensus on a preferred option for implementing the remaining stages of HATS. The estimated cost of these trials and studies of \$73.6 million, however, does not include the funding required for conducting a detailed Preliminary Project Feasibility Study and a detailed Environmental Impact Assessment Study on the preferred option.

15. We estimate that the cost of the trials on compact sewage treatment would cost about \$14 million plus \$2.2 million allowed for contingency. The estimated cost is established with reference to information collected separately from prominent vendors supplying different BAF technologies. The \$14 million base estimate has already allowed for the trials to be carried out for nine vendor-months. Should the need arise for increasing the number of trials by vendors or extending the period for conducting the trials, the additional expenses would be absorbed by the \$2.2 million contingency, thereby extending the number of vendor-months for the trials to a maximum of 12 months. It is our intention to carry out trials on technologies from at least two different vendors.

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 16. We will commission the trials and studies on a lump-sum basis, with provision for price adjustments as their duration will exceed 12 months. Payment for the field survey and laboratory test components of the environmental feasibility study will be on a reimbursable item basis because the scope and the value of these activities cannot be exactly quantified at this stage. A detailed breakdown by man-months of the estimated consultant's fees under paragraph 14B(a) to (c) above is at Enclosure 5.

17. Subject to approval, we will phase the expenditure as follows –

Year	\$ million (Sept 2000)	Price Adjustment Factor	\$ million (MOD)
2001-2002	16.5	1.02550	16.9
2002-2003	40.4	1.05627	42.7
2003-2004	12.9	1.08795	14.0
	69.8		73.6

18. The proposed trials and studies have no recurrent financial implications.

## **PUBLIC CONSULTATION**

19. The IRP presented its report on the review of HATS to the Government, the Advisory Council on the Environment (ACE), the Legislative Council Panel on Environmental Affairs (EA Panel) and the public on 30 November 2000 and 1 December 2000. The Administration presented our response to the IRP report review and decision on the way forward on 1 March 2001.

20. To increase transparency and monitor the progress of the trials and studies, a Monitoring Group chaired by the Secretary for the Environment and Food is being set up. The three local members of the IRP and four ACE members will join the group. Some other members of the public will also be appointed to the group. The Director of Environmental Protection and the Director of Drainage Services will also be members.

21. On 1 March 2001, a publication entitled "A Clean Harbour for Hong Kong" was issued to promote public awareness of measures needed to clean up the harbour, the IPR options, and the Government's responses and proposed way forward. Views from the public are welcome. We will conduct further public information and consultation programmes as the trials and studies progress to build up consensus in the community on the most appropriate way to improve our harbour water quality.

22. We consulted ACE on the way forward for the Harbour Area Treatment System on 26 March 2001. Members fully supported the Government's decision to undertake the trials and studies as recommended by the IRP. They supported, in principle, the present funding request and, thereafter, the implementation of the remaining works that will be needed to give the main urban area of Hong Kong a comprehensive and effective wastewater treatment system. They also urged the Administration to explore any means possible to expedite works on the subsequent stages of HATS.

23. We consulted the Legislative Council Panel on Environmental Affairs (EA Panel) on the proposal to conduct the trials and studies on 3 April 2001. Members noted our intention to submit the proposal to the Public Works Subcommittee for discussion on 18 April 2001. Some Members urged the Government to carry out the trials and studies as soon as possible so as to expedite the completion of the subsequent stages of HATS. At the meeting, Members also raised the following questions -

- (a) whether there would be odour problem and environmental problems due to the use of ferric chloride arising from the full-scale operation of SCISTW;
- (b) the impartiality of the companies appointed for carrying out the trials and studies and the award of the trials and studies to consultants;
- (c) whether the EA Panel will be consulted prior to commencing the second stage of the feasibility study for contractual framework;
- (d) whether there are any ways to expedite the programme for implementing HATS;
- (e) whether there is a scope for conducting some of the work under the trials and studies in-house by Government departments;
- (f) the Administration's views on the IRP's recommendations; and
- (g) the reason for the deviation in the recommendations of the IRP from those of the IRP appointed in 1995.

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24. Our response to these questions is as follows –

- (a) All potential odour sources arising from the operation of SCISTW have been covered or enclosed in buildings equipped with de-odourisation facilities. In addition, regular monitoring exercises are in place to ensure that SCISTW is, and will continue to be, operating in an environmentally-acceptable manner. The adding of ferric chloride in the sewage treatment process is not expected to pose any adverse impact on the marine ecology because chloride is a principal component of seawater while iron is not considered to be a toxic metal.
- (b) To ensure that the trials and studies on the IRP recommendation would be conducted in an objective manner, companies which were heavily involved in shaping the direction of the HATS in the past would not be invited to take part in the trials and studies.
- (c) We are seeking the funding in full for the development of a contractual framework for option implementation from Finance Committee. However, we will consult the EA Panel before proceeding with the second stage of the feasibility study for the contractual framework, which involves the development of the contractual framework.
- (d) We share Members' desire to expedite the implementation programme for HATS. Under the feasibility study for the contractual framework, a review of all possible contractual arrangements, including DBO, will be undertaken with a view to identifying ways to fast-track the delivery programme. Government might also propose ways of expediting the HATS programme as the trials and studies progress, provided that they are feasible and we have the community support for doing so.
- (e) In view of Members' suggestion, we have further reviewed the works to be covered under the trials and studies. EPD will re-deploy in-house resources through adjustment of priorities to undertake two work items originally within the scope of the trials and studies, namely "identification and establishment of ecological and water quality standards and criteria" and "preparation work in relation to community consultation". However, we would still need support

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from consultants to explain technical details and findings/recommendations of their studies during public consultation. Compared with the funding proposal that we submitted to the EA Panel (the amount of which was \$71.5 million in September 2000 prices), undertaking the aforesaid work in-house will reduce the requested funding by \$1.7 million to \$69.8 million as proposed in paragraph 14 (both in September 2000 prices). However, it is necessary to engage professional services to undertake the remaining work items as EPD and DSD do not have the necessary expertise or the manpower to undertake such work.

- (f) We agree with the IRP that incineration is the preferred option for the treatment and disposal of sludge generated under HATS. Subject to the findings of the trials and studies, we have no preference for a centralized or distributed sewage treatment system provided that the discharged effluent is treated to a suitable level. The key question is whether the community is prepared to pay more for the capital and recurrent cost of a decentralized treatment system.
- (g) Members also raised questions on why the recommendations of the 2000 IRP were different from that of the IRP appointed in 1995. As explained by Professor Donald Harleman at the meeting of the EA Panel on 1 December 2000, the 2000 IRP's recommendations "were based on the known technology in 2000 and new information that was not available a few years ago (at the time of the 1995 review)."

## **ENVIRONMENTAL IMPLICATIONS**

25. The proposed trials and studies themselves will not have any environmental implications.

26. While Stage I of the HATS will bring substantial relief to the harbour later this year, we will not be able to meet all the water quality objectives as the remaining 30% of the sewage flow (from the area from North Point through Central and round to Aberdeen) will still be entering the harbour without proper treatment. Deterioration will occur as the population grows and development on both sides of the harbour continues.

27. We must proceed as soon as possible with the proposed trials and studies so as to establish the feasibilities of the options identified by the IRP. This will help inform and guide decisions on the way forward with a view to further improving water quality at the harbour and safeguarding public health and the marine environment. The results of the proposed trials and studies will be incorporated into the statutory EIA and other project feasibility studies that will be needed for the preferred option as and when it has been selected.

## LAND ACQUISITION

28. The proposed trials and studies themselves do not require land acquisition.

## BACKGROUND INFORMATION

29. As a measure to improve water quality in the harbour, the “Sewage Strategy Study”, commissioned by the Environmental Protection Department in 1987, recommended implementation of the HATS. This is a comprehensive sewerage system intended to collect sewage from the urban areas around the harbour using deep tunnels, provide primary treatment and dispose of it to deep oceanic currents south of Hong Kong. The scheme was to be constructed in four stages over a ten-year period.

30. Works for Stage I commenced in 1994 and we expect to commission the first stage collection systems around the end of 2001. By then, Stage I will treat about 70% of the sewage from the harbour area. It will reduce the biochemical oxygen demand load in the harbour by about 50%, and the suspended solid load by about 55%. It is expected to reduce *E.coli* load by about 30%. However, to meet fully the objectives of cleaning up the harbour and improving neighbouring water bodies, further works are needed to collect and treat sewage from Hong Kong Island and to upgrade overall treatment and discharge arrangements.

31. In April 2000, we invited an IRP to carry out a review of the further stages of HATS. The IRP released its report in November 2000. In essence, the IRP -

- (a) confirmed that Stage I should be completed as soon as possible as it would provide a common base for any future development;
- (b) confirmed that the deep tunneling technology could be applied to the remaining stages of the HATS for sewage collection;

/(c) .....

- (c) responded to public suggestions of having a more distributed treatment system by describing and costing some options for doing this;
- (d) suggested that since the Stage I system was operating extremely well, it might be possible to go straight to tertiary treatment – using compact BAF technology – without secondary treatment, and do so using space at Stonecutters Island;
- (e) suggested that if this tertiary treatment could be provided, a long ocean outfall, as proposed by the 1999 scheme, can be avoided;
- (f) suggested that discharge of treated effluent via the long oceanic outfall east of Lamma would neither be viable nor be sustainable;
- (g) recommended, on the basis of the directions and concept above, four options be further investigated using BAF technology and short outfalls, summarized in the figures at Enclosure 2;
- (h) recommended a series of trials and studies to test the four options and the viability of the BAF under local conditions;
- (i) recommended upgrading of all the HATS Stage III/IV Preliminary Treatment Works (PTW) and accorded priority to building those portions of Stage III/IV tunnels that would be common in all four IRP options as soon as possible; and
- (j) recommended we should consider adopting the DBO approach so as to expedite the completion of the subsequent works.

32. A summary of the IRP's recommendations and the Administration's responses and decisions on the way forward was set out in a Brief for the Legislative Council issued to Members on 1 March 2001.

33. We estimate that the proposed studies and trials will create some 10 new jobs. These will comprise six professional staff and four technical staff, totalling 216 man-months.

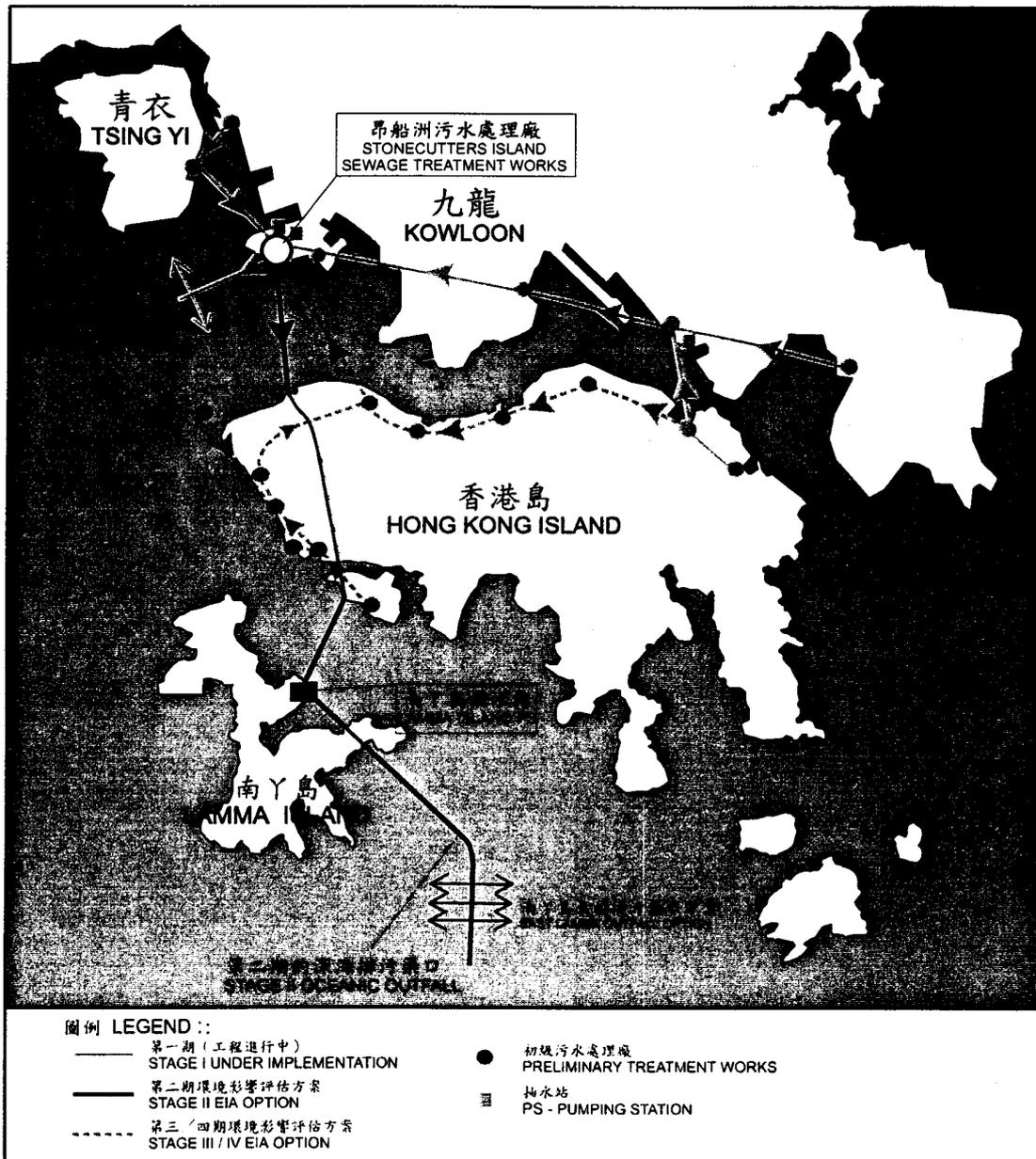
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Environment and Food Bureau  
April 2001

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一九九九年環境影響評估建議的淨化海港計劃（原來計劃）

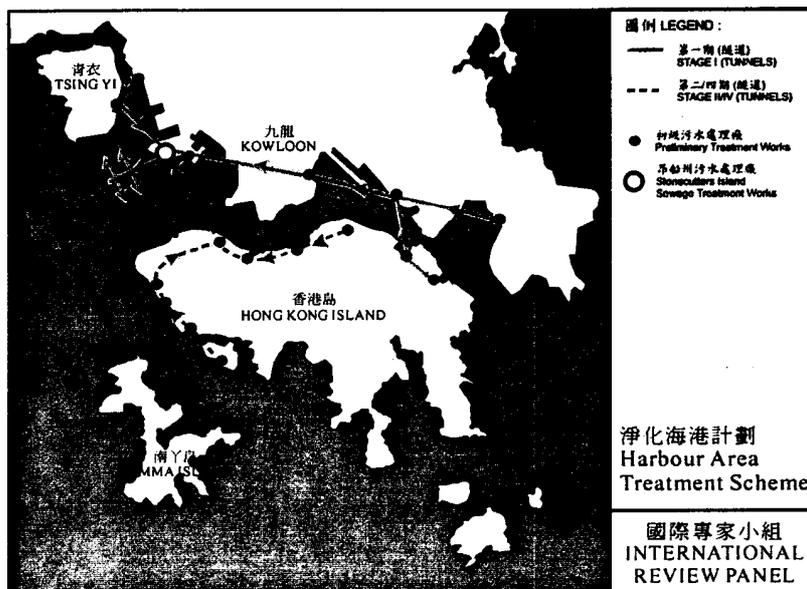
The Harbour Area Treatment Scheme as recommended by the 1999  
Environmental Impact Assessment (Original Scheme)



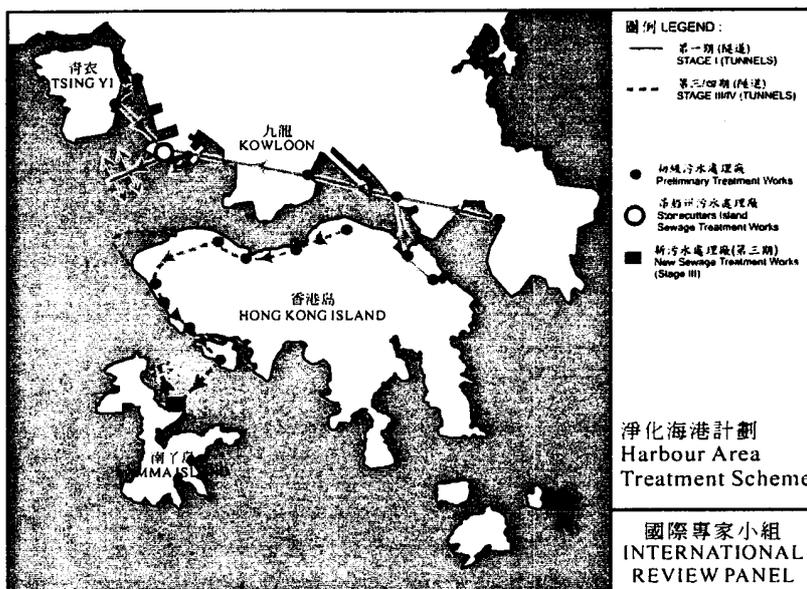
國際專家小組於二零零零年十一月建議的四個方案的示意圖

Schematic Diagrams of the four options recommended by the International Review Panel in November 2000

Option 1 第一個方案<sup>1</sup>



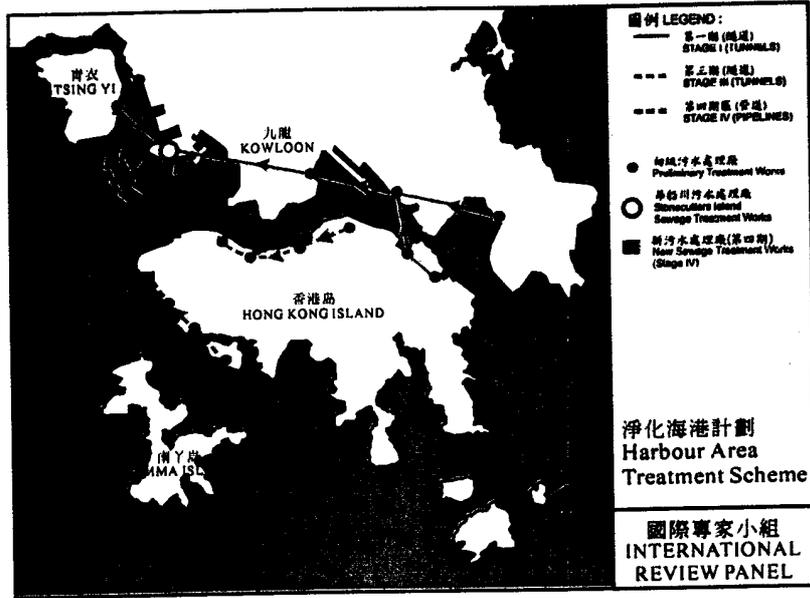
Option 2 第二個方案



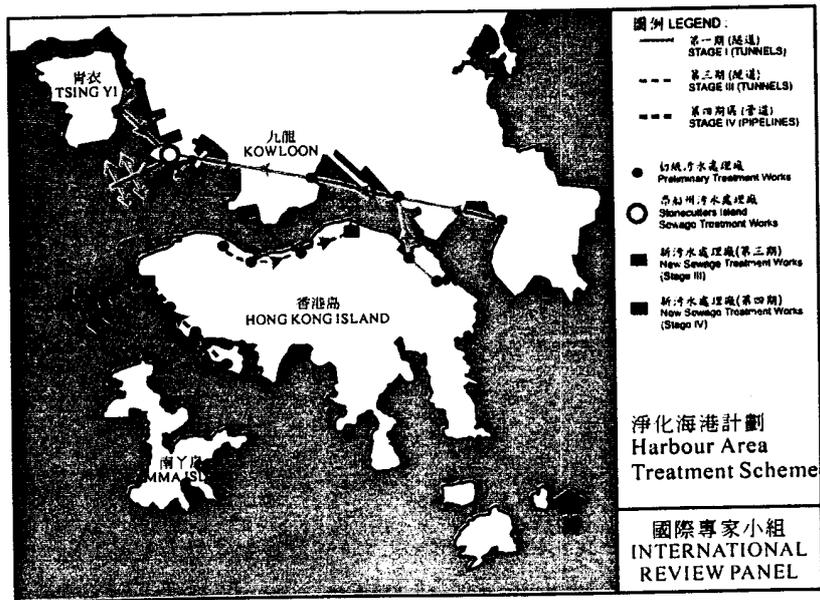
<sup>1</sup> 國際專家小組於二零零零年十一月的報告內分別把四個方案命名為 5a 至 5d 方案。

These four options are labelled option 5a to 5d respectively in the IRP report issued in Nov 2000.

Option 3 第三個方案



Option 4 第四個方案



**Detailed scope and significance of the studies and trials to examine IRP's findings/recommendations**

<b>Trials or Studies</b>	<b>Significance</b>
<b>Trials</b>	
Trials on Compact Sewage Treatment Technologies	<ul style="list-style-type: none"> <li>• There is uncertainty surrounding the effectiveness of BAF and other well-proven compact sewage treatment technologies under local conditions. It is essential to be sure of the effectiveness of BAF or other compact technology in order to determine whether all the flows can be treated at Stonecutters Island. The same information is essential for determining the feasibility of those IRP options that involve treatment at other sites in the urban area as the area of land needed is a critical factor.</li> <li>• The recurrent cost of BAF depends on its efficiency and the extent of treatment required. We need to verify the recurrent cost implication as this will have significant bearing on long term financial requirements.</li> </ul>
<b>Studies</b>	
Environmental feasibility	<ul style="list-style-type: none"> <li>• This will determine whether the receiving water environment (namely Western Harbour, West of Hong Kong Island (HKI), North East of Lamma Island, North Point) proposed by IRP could accommodate the treated effluent discharged.</li> <li>• If water quality modeling shows that BAF-treated effluent could not be discharged in the vicinity of the Harbour (including western harbour, west of HKI and North Point), then a long outfall may have to be built.</li> <li>• Apart from the above options, this water quality assessment will allow us to decide whether the options identified to relieve any Stage I capacity constraint will be environmentally-acceptable.</li> </ul>

**Enclosure 3 to PWSC(2001-02)10**

<b>Trials or Studies</b>	<b>Significance</b>
Engineering feasibility	<ul style="list-style-type: none"> <li>• This would form the basis of our further consultation with LegCo/ACE/green groups.</li> <li>• These feasibility studies are necessary because even if all the IRP options are shown to be acceptable in terms of their environmental impact, we need to verify whether there are land or other engineering constraints that might pose problems to their implementation.</li> <li>• In addition, some indication of likely land-based impacts is necessary in order to allay the concerns of residents in any area selected as a potential treatment site.</li> <li>• To make any realistic assessment of the foregoing, we have to identify whether land is available or can be created; engineering feasibility cannot be assessed unless we have a reasonably firm site; firm sites cannot be selected until we are sure of the land and operational requirements of the BAF systems in the Hong Kong context.</li> <li>• Detailed and reliable cost information is needed as the costs of the IRP options have so far not been well defined and will depend crucially upon the treatment level found to be required and the particular configuration of treatment and disposal locations eventually adopted.</li> </ul>
Feasibility study for contractual framework	<ul style="list-style-type: none"> <li>• To verify whether contractual arrangements like DBO will help reduce interface issues, and result in a more cost-effective design and speedier works delivery as suggested by the IRP.</li> <li>• If DBO could reduce recurrent cost, it would help reduce pressure on increasing sewage charges.</li> </ul>

## Enclosure 4 to PWSC(2001-02)10

### A detailed breakdown of the cost of the studies and trials in relation to the way forward for the Harbour Area Treatment Scheme

	<b>\$ million</b>
A. Compact sewage treatment technologies trials	
Setting up of pilot plants to test out different compact technologies in Hong Kong, particularly the BAF technology	14.0
B. Studies	
(a) Professional services	40.1
<i>Environmental feasibility study</i>	
(i) effluent characterization, field survey and laboratory testing programme design and supervision, data analysis, and hypothesis testing	1.0
(ii) Stage I capacity constraint assessment (with consideration to findings of the flow assessment study) and identification of possible options to relieve any anticipated capacity shortfall	1.0
(iii) water quality modeling, including assessment of cumulative impacts	8.3
(iv) ecological impact and risk assessment	6.9

\$ million

*Engineering feasibility study*

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|--|-----|
| (v) development of schematic design, taking into account the land, engineering and other constraints, and other studies relating to the IRP options, and assessment of landtake implications | 6.5 |
| (vi) review of financial implications  | 0.8 |
| (vii) development of implementation programmes   | 1.0 |
| (viii) options evaluations and comparisons, based on findings of these studies   | 2.2 |

*Feasibility study for contractual framework*

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|---|-----|
| (ix) review of possible contractual arrangements, including DBO and identification of a suitable contractual framework  | 2.0 |
| (x) development of the contractual framework, including preparation of core contract documents, comprising Instructions to Tenderers, Form of Tender, Conditions of Contract, Specifications, etc | 6.0 |

*Others*

- |  |     |
|--|-----|
| (xi) general project management (for the studies in items B(a)(i) to (a)(x)) | 4.4 |
| (b) Field survey (for the environmental feasibility study only)              | 9.3 |
| (i) water and sediment quality   | 1.3 |
| (ii) hydrodynamics   | 4.0 |
| (iii) ecology  | 4.0 |

		\$ million	
(c)	Laboratory testing and analysis (for the environmental feasibility study only)	1.7	
	(i) toxicity and bio-testing	0.6	
	(ii) water and sediment chemistry	1.1	
C.	Contingencies	4.7	
	Sub-total	69.8	(in September 2000 prices)
D.	Provision for price adjustment	3.8	
	Total	73.6	(in MOD prices)



**Notes**

1. A multiplier factor of 2.4 is applied to the average MPS point to arrive at the full staff costs including the consultant's overheads and profit, as the staff will be employed in the consultant's offices. (At 1.4.2000, MPS Pt. 38 = \$57,525 per month and MPS pt. 14 = \$19,055 per month).
2. Out-of-pocket expenses are the actual costs incurred. The consultant is not entitled to any additional payment for overheads or profit in respect of these items.
3. The figures given above are based on estimates prepared by the Director of Environmental Protection. We will only know the actual man-months and actual fees when we have selected the consultant through the usual competitive lump-sum fee bidding system.