區議會

淨化海港計劃的未來路向

目的

淨化海港計劃（計劃）第一期設施在二零零一年十二月全面投入服務後，維多利亞港(海港)的水質已顯著改善。昂船洲污水處理廠是計劃的主要設施，現時以化學方法處理 75%來自淨化海港計劃集水區的污水，每日防止約 600 公噸污泥流入海港。為應付日後污水流量的增幅，以及妥為處理餘下 25%只經隔篩便排入海港的污水，我們必須進行下一期，也是最後一期計劃（即計劃第二期）。本文件就計劃第二期的建議徵詢議員的意見。

背景

2. 「淨化海港計劃」是本港歷來最重要的環保項目之一，其主要目的為改善海港的水質。二零零零年四月，當局委託國際專家小組(專家小組)檢討計劃餘下各階段。專家小組在二零零零年十一月三十日發表報告，提出四個選址方案，該四個方案的分別在於處理設施的分散程度（以下稱為方案甲，乙，丙及丁），這四個方案全都採用生物曝氣濾池技術處理污水，以深層隧道輸送污水，並以短距離排放管排放污水。專家小組提出該四個方案時，已知道有一些尚未確定的情況有待探討，因此建議當局先進行多項試驗和研究（研究），以評估和選定計劃下一期的最終安排。研究現已完成。本文件向議員匯報這些研究結果，並重點說明如何選定和籌劃政府屬意的方案，以及計劃第二期預期帶來的益處。

建議

政府屬意的選址方案—方案甲

3. 各項研究證實全部四個選址方案對環境的影響皆可接受，而且在技術上可行。研究亦證明這些方案除了現時採用的化學處理程序外，還需要包括生物處理及消毒程序，以期持續改善海港水質。此外，即使生物處理程序採用佔地最少的污水處理技術，我們也須在現時昂船

洲污水處理廠範圍以外增撥最少 12 公頃土地，用來建造生物處理設施。在四個方案中，方案甲是政府屬意的方案，因為這個方案在費用、環境、社會或工程方面的整體表現最佳（詳細比較載於附件）。而且，由於方案甲只須在原有的昂船洲污水處理廠範圍內興建化學及消毒設施，以及在昂船洲污水處理廠附近興建地下生物污水處理設施，因此無論在建造或營運時，方案甲對附近地區的影響都是四個方案中最少的。

0/2004

分兩個階段實行計劃第二期的理據

4. 評估結果顯示，如要長遠保護海港，生物處理是不可或缺的一環。不過，由於須取得土地以建造生物處理設施，建設和經常費用不菲，而且以公私營界別合作方式建造達到所需規模而佔地較少的生物處理系統也十分複雜，我們認為分以下兩個階段實行計劃第二期是審慎的做法：

(a) 第二期甲—建造深層隧道，把港島其餘部分的污水輸往昂船洲；擴建昂船洲污水處理廠，以期最終每日可以對 280 萬立方米污水（即該處理廠現時處理量的兩倍）進行化學處理和消毒。

(b) 第二期乙—增設生物處理設施，提高除污率，以應付淨化海港計劃集水區的預算人口增長；生物處理設施會在昂船洲污水處理廠附近土地的地下建造，地面可作其他用途。

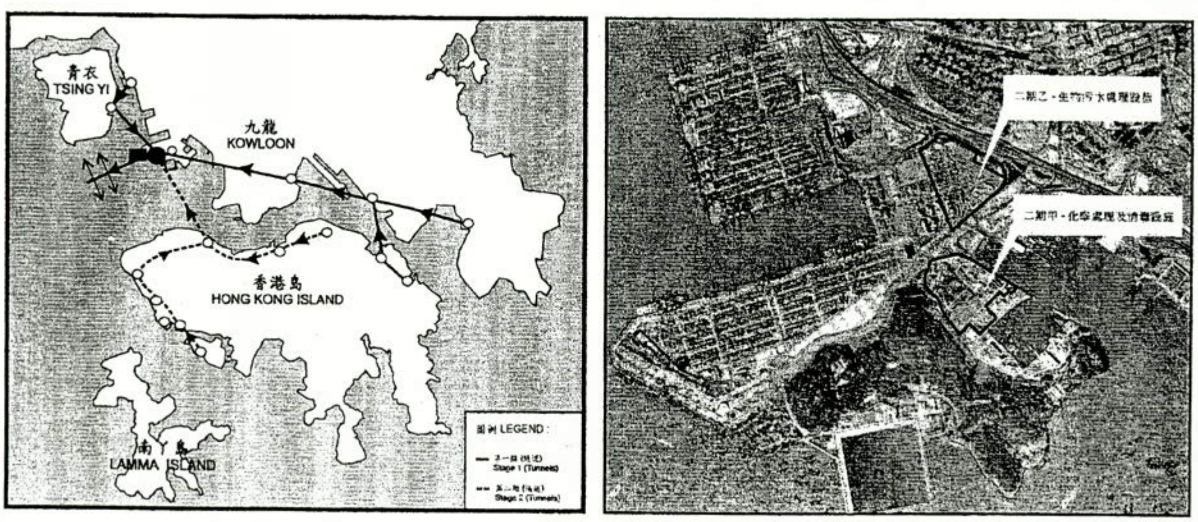

圖 1 計劃第二期政府屬意的方案

5.　根據最新的水質模擬結果，計劃第二期甲排放的所有廢水經化學處理和消毒後，可令海港大部分水域的水質達到大多數水質標準，包括溶解氧量及氨含量的標準，惟獨西九龍沿岸水域因爲與排放廢水的位置較爲接近，間中或未能達到最低溶解氧量及非離子氨含量標準[1]的要求。實行計劃第二期乙後，即使上述水域也能完全達到這兩個水質標準。我們必須指出，上述偶然未能達標的情況是基於水質模擬結果估計的，而模擬結果則以現時的人口增長推算爲依據。由於實際人口增長率可能出現變數，因此未能達標的範圍及頻率亦可能會出現變化。鑑於計劃第二期甲會顯著改善海港水質，而且上述水域即使間中或未能達標，也應該不會對環境做成不可接受的影響，因此先展開第二期甲，然後視乎實際的水質監測結果及污水流量增幅在較後時間才進行第二期乙的安排，對環境構成的風險應該可以接受。因此，從環境方面着眼，分兩個階段實行計劃第二期是務實的做法。

6.　至於財政方面，計劃第二期如分兩個階段進行，額外的建設費用爲 4 億元，與全期的 195 億元建設費用相比，金額不大(見表 1)。無論是否分階段進行計劃，經常費用總額大致相同。由於第二期乙設施的每年營運費用約需 7.2 億元，因分階段實行計劃而省回的經常費用現值，已足以抵銷額外（遞延）的建設費用。因此，假如我們不在計劃開始時馬上引進生物處理程序，而在適當時間才因應實際需要引進該等程序，應可節省不少費用，況且單單第二期甲已足以令海港大部分水域達到大多數水質標準。

表 1　按政府屬意的方案分階段進行計劃第二期所涉及的費用

計劃第二期的實行模式	建設費用(億元)	經常費用(億元／年)
不分階段實行	191	11.8
分階段實行		
第二期甲	84	4.4
第二期乙	111	7.2
總計	195	11.6

1　海底的溶解氧量通常比海面低。假如海底的溶解氧量太低，在海底棲息的生物（例如螃蟹或海蝦）或會窒息而死。假如溶解氧量接近零，海水會發出臭味。為免這種情況出現，最低溶解氧量標準定為每公升海水超過 2 毫克。假如氨含量過高，一些較敏感的海洋生物(例如魚苗)或會因此而受到傷害甚至死亡。四天平均非離子氨含量的標準定於可避免這種情況發生的水平。

7. 儘管有種種理由支持分兩個階段實行計劃，但第二期乙最終還須實行。因此，我們在第二期甲實行期間，須同時爲第二期乙進行前期工作，包括進行環境影響評估（環評）和工地勘測，以及預留生物處理設施的用地，以便日後有明顯跡象顯示海港沿岸的實際人口增長與預期相同，而水質監測結果證明有需要進行第二期乙時，該期工程便可全速施工。爲此，我們會密切監測污水流量增長及水質，以便及早決定何時展開第二期乙。

採購安排

8. 我們會探討可否採用“公私營界別合作”方式設計和建造計劃第二期甲及第二期乙設施，以及營運所有新建及現有污水處理設施。我們現時認爲第二期新處理設施可採用“設計—建造—營運”模式建造，然後與現有設施一併營運。由於隧道建成後無需怎樣營運和維修保養，我們會考慮採用“設計及建造”模式。由於技術試驗結果證實，佔地較少處理技術和傳統處理技術各有其優點和缺點，因此我們不擬訂明第二期乙應採用哪種生物處理技術，而只會訂明處理廠的效能要求。我們會在昂船洲污水處理廠附近預留足夠土地，讓具備不同生物處理技術(包括佔地較少和傳統處理技術)專業知識的投標者競投生物處理設施合約。

推行時間表

9. 我們會進行爲期四個月的公眾諮詢，以期就計劃第二期與市民達成共識。如獲社會各界支持，計劃第二期甲的工地勘測及環評工作可於二零零五年展開，使各項主要建造工程可於二零零七至零八年度動工。按照這個時間表，第二期甲的污水處理設施約在二零一一至一二年度建成，以進一步改善海港水質。第二期甲較艱巨的隧道鑽挖工程預期到二零一三至一四年度才能完成，屆時第二期甲將可全面發揮作用。爲了盡早履行重開荃灣區泳灘的承諾，我們亦會設法使第二期甲部分污水消毒設施能提前在二零零八至零九年度或之前落成。至於第二期乙，我們的目標是在第二期甲施工期間完成各項前期工作，包括環評、預留土地及土地勘測，藉此縮短第二期乙所需的時間。

淨化海港計劃的重要性及益處

計劃第一期對環境的改善

10. 計劃第一期設施全面投入服務後，昂船洲污水處理廠每日處理75%來自淨化海港計劃集水區的污水(約每日 140 萬立方米)。該污水處理廠是全球效率最高的化學處理廠之一，除污效能極高，能夠除去：

(a) 70%有機污染物（以生化需氧量計算）；

(b) 80%懸浮固體；以及

(c) 50%在污水中存在的大腸桿菌。

整體來說，該污水處理廠每日可防止 600 公噸污泥及污染物流入海港。

11. 計劃第一期展開前，海港水域的溶解氧水質指標平均達標率偏低，在二零零零至二零零一年期間只有 65%。進行計劃第一期後，海港的溶解氧量平均上升了 10%（見圖 2），二零零二至零三年度的平均達標率因而上升至 97%。其他水質參數亦同樣已見改善，例如無機氮總量的達標率由二零零零至二零零一年期間的 76%上升至二零零二至零三年度的 94%。此外，海港一帶的主要污染物含量也普遍下降：

(a) 氨(對海洋生物有害)含量下降 25%；

(b) 營養物以無機氮總量及磷計算(過量會令海藻過度繁衍)，含量分別下降 16%及 36%；以及

(c) 大腸桿菌整體含量（致病微生物的指標）下降約 50%；但海港西面局部地區及荃灣區泳灘的大腸桿菌含量則上升。

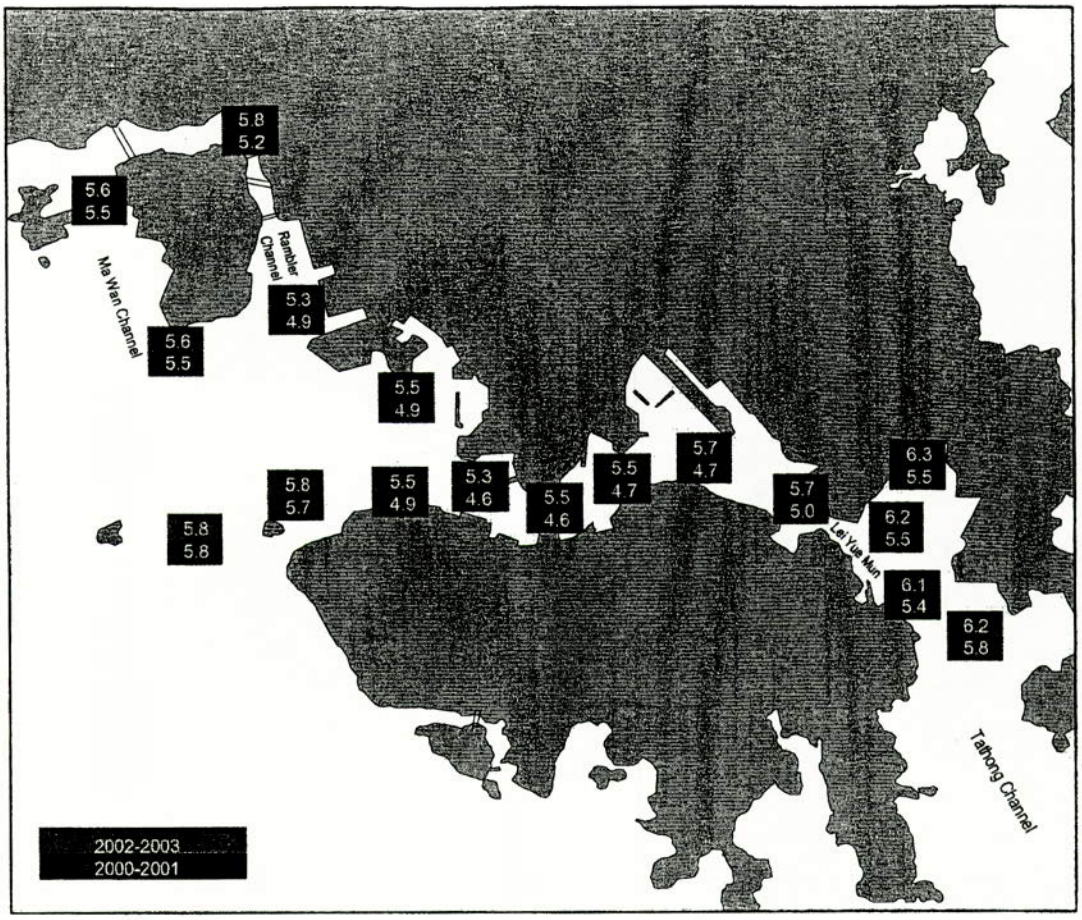

圖 2 淨化海港計劃 17 個加強水質監測站錄得溶解氧量(毫克／公升)變化圖(比較二零零二年一月至二零零三年十二月與二零零零年一月至二零零一年十二月的平均差距)

計劃第二期預期對環境的改善

12. 雖然計劃第一期已顯著改善海港水質，但假如不進行第二期工程，未來發展及人口增長會令污水量增加，水質會因而再度惡化。第二期甲設施落成啓用後，平均溶解氧量會提高 5%，而第二期乙設施落成啓用後，溶解氧量會再提高 5%。維港內溶解氧量的水質標準，預計在第二期計劃完成後會上升至 100%。第二期甲的消毒設備可除去污水中逾 99.9%的細菌，使荃灣多個泳灘可以重開。計劃第二期工程完成後，其他污染物（例如有毒氨和營養物）的含量亦會大幅下降，令海港內完全達到水質標準。

13. 總的來說，進行計劃第二期後，水質會得以改善，海洋生物的生活環境也會好轉，海港會更清潔，泳灘也可重開，更會爲舉辦大型水上活動，例如不定期舉辦的渡海泳賽等創造合適條件。

污染者自付原則

14. 治理污染的工程通常都所費不菲，而“污染者自付”原則是公認為公平分擔費用的方法。要處理本港產生的數以百萬噸計的污水，實有必要推行計劃第二期。不過，進行該計劃會在營運及維修保養方面引致額外的經常開支。基於“污染者自付”原則，計劃第二期各項設施在未來數年陸續投入服務時，排污費的收費率難免須作調整。

公眾諮詢

15. 由於有明顯需要展開計劃第二期，而這項計劃涉及龐大的資本投資和經常開支，其中頗大部分最終須由市民承擔，因此我們認為應先在社會上建立共識，然後才決定未來路向。淨化海港計劃的公眾諮詢由二零零四年六月至十月進行，為期四個月。我們會向各有關人仕（例如環保組織、學者、專業團體及社會各界代表）深入講解計劃第二期，並舉行公聽會，直接收集市民對計劃第二期建議未來路向的意見。我們會充分考慮公眾諮詢期間收集到的意見，以決定未來路向。

徵詢意見

16. 請議員就政府屬意的方案、分兩個階段實行計劃的建議及其他有關進行計劃第二期的事宜，提供意見。

環境運輸及工務局

二零零四年六月

比較專家小組
提議的四個方案

專家小組提議的四個方案，主要分別在於處理設施的分散程度。四個方案均採用深層隧道輸送污水，以及在現時採用的化學處理程序之外，增設生物處理程序，並在有需要時進行消毒。經高級處理的廢水會沿短距離排放管排入海港。這四個方案見下圖：

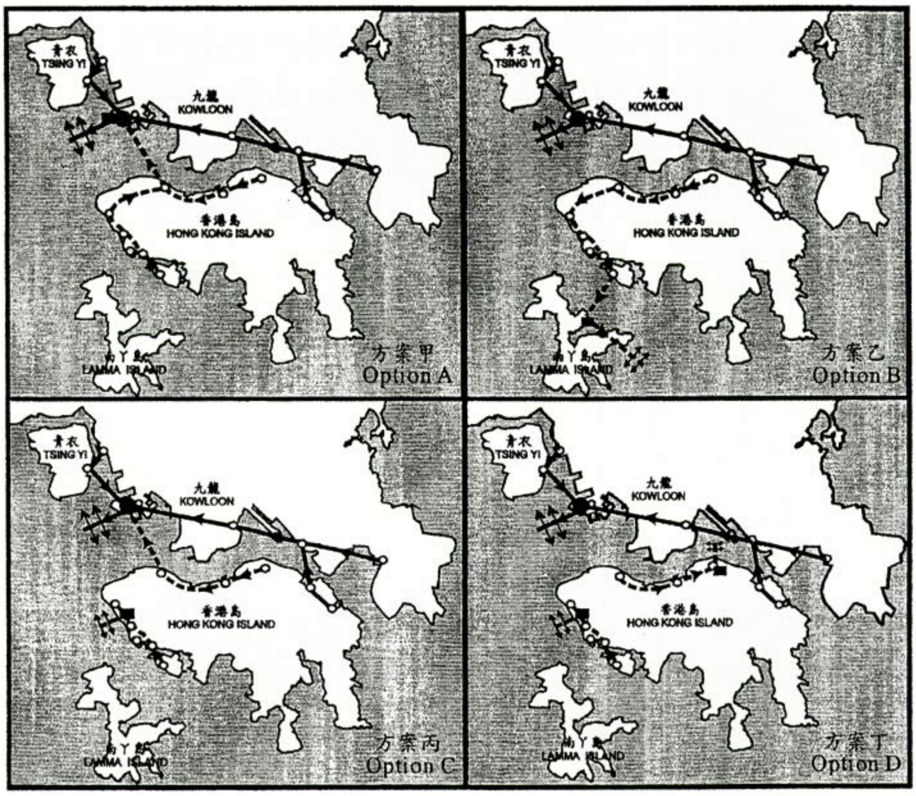

圖 3　專家小組就計劃第二期建議的四個方案

2. 就污水處理廠而言，方案甲建議擴建現有的昂船洲污水處理廠；方案乙除了建議擴建昂船洲污水處理廠外，還建議在南丫島舊石礦場興建污水處理廠；方案丙建議擴建昂船洲污水處理廠和在沙灣的岩洞興建污水處理廠；方案丁建議擴建昂船洲污水處理廠，以及在沙灣及北角寶馬山的岩洞興建污水處理廠。環境及工程可行性研究為這四個方案的污水處理廠選址見圖 4；四個方案所需的費用比較見表 3。

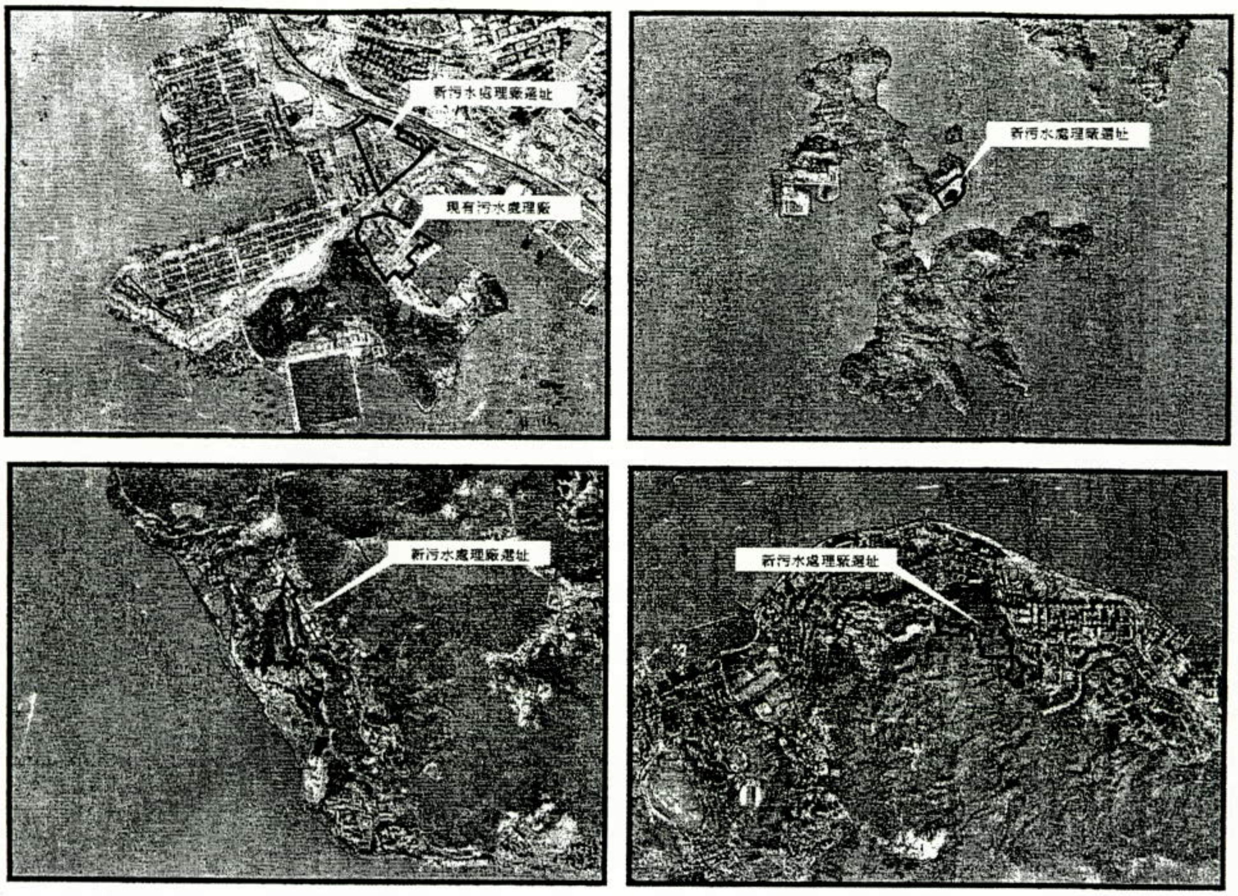

圖 4　擬於昂船洲、南丫島、沙灣及北角興建處理廠的地點

表 3　國際專家小組提議的四個方案所需的費用比較
(假設採用去除生物營養物和消毒程序)

	建設費用[2] (億元)	經常費用 (億元／年)
計劃第一期	82	3.2
計劃第二期[3]		
方案甲	191	11.8
方案乙	192	11.8
方案丙	195	12.5
方案丁	201	13.5

---

[2] 建設費用包括提升初級污水處理廠和建造隧道及新污水處理廠的費用，但不包括建造污泥焚化爐所需約 22 億元費用。由於該焚化爐除了處理淨化海港計劃的污泥外，也會焚化其他污泥，因此會包括在綜合廢物處理設施之內。

[3] 估計這些費用時，假設採取生物處理程序的所有步驟。假如現時基於防患於未然的原則而採取的脫氮程序(作為生物處理程序的一個步驟)最終無須採用，預計建設費用及每年經常費用會分別減少 19 億元及 2.7 億元。

3. 專家小組提議的四個方案按五方面的主要準則評估，即環境、工程、社會、經濟及土地資源；比較結果詳載於表 4。

表 4 專家小組提議的四個方案的表現比較

準則		四個方案的排名[4]			
		方案甲	方案乙	方案丙	方案丁
環境及公眾衛生					
1	**水質—有毒紅潮**	全部相同			
2	海洋生態	1	4	1	1
3	漁業	1	4	1	1
4	公眾衛生	全部相同			
5	**對公眾構成的危險**	1	1	3	4
6	空氣質素	1	1	3	4
7	噪音	1	1	3	4
8	陸地生態	1	1	3	4
9	景觀及視覺影響	1	4	2	3
10	廢物管理影響	2	1	3	4
工程/技術					
11	計劃系統的靈活程度	4	2	3	1
12	建造隧道／排放管的風險	3	4	2	1
13	興建污水處理廠的風險	1	2	3	4
14	營運風險	1	2	3	4
15	應付轉變的能力	1	2	3	4
社會					
16	對社區設施的影響	全部相同			
17	道路交通	2	1	3	4
18	海上交通	1	3	1	4
19	可能引起公眾關注	1	2	2	4
20	創造就業機會	全部相同			
經濟					
21	使用周期費用總額	1	2	3	4
土地資源/法定土地程序					
22	**地面資源**	1	4	1	1
23	土地用途地帶規劃	全部相同			
24	土地類別	1	2	3	4

4 排名第一者表現最佳；排名第四者表現最差。

4. 方案甲是四個方案中最佳的一個。我們按上述五項主要準則比較四個方案的結果，現概述如下：

(a) **環境方面**－由於四個方案均採用非常高級別的處理程序，因此對水質和公眾衞生的影響幾乎完全相同。不過，由於方案乙建議在生態較敏感的南面水域建造排放口，假如在施工或運作期間發生事故，對漁業和海洋生態的影響可能較其餘三個方案嚴重。另一方面，方案丙及丁建議在沙灣和寶馬山住宅區旁的岩洞興建污水處理廠，因此在空氣質素、噪音及陸地生態影響三方面都較另外兩個方案遜色。在景觀和視覺影響方面，方案乙最差，因爲該方案建議在南丫島舊石礦場的地面興建污水處理廠，而其他方案則建議在地底／岩洞內興建污水處理設施。

(b) **工程方面**－方案甲採用集中式污水處理系統，其缺點是必須興建覆蓋範圍較廣的隧道系統，而輸送系統的靈活程度亦較低。然而，方案甲在污水處理廠的建造和營運方面的風險，遠較在岩洞內興建污水處理廠的方案低，而且日後如要提升集中式污水處理系統，彈性也較大。因此，方案甲在工程方面較其他方案優勝。

(c) **社會方面**－方案丙和丁建議在住宅區附近建造岩洞，對交通的影響必定較另外兩個方案嚴重。此外，方案甲只建議在現有的污水處理廠旁興建新的污水處理設施，而其他方案則建議在新闢土地上興建新處理設施，因此方案甲對市民的潛在影響預期爲最輕微。

(d) **經濟方面**－把污水處理廠建於岩洞內，涉及高昂的建造及營運費用。如表 3 所述，方案甲的整體建設及經常費用均較其他方案低廉，因此較爲優勝。

(e) **土地資源方面**－由於方案甲所需的生物污水處理設施將在地下興建以盡量減少所需的地面面積，因此方案甲較其他方案優勝。方案乙建議在南丫島舊石礦場的地面興建污水處理設施，而其餘的方案則在地底／岩洞內興建污水處理廠。相比之下，方案乙較爲遜色。此外，由於增撥每幅土地均須經過冗長的法定程序，方案甲較其他三個方案爲佳。

District Council

Way Forward for the Harbour Area Treatment Scheme Stage 2

PURPOSE

Since the full commissioning of the Harbour Area Treatment Scheme (HATS) Stage 1 in December 2001, the water quality of Victoria Harbour has improved significantly. As a key component of HATS, the Stonecutters Island Sewage Treatment Works (SCISTW) is now providing chemical treatment to 75% of the sewage generated in the HATS catchment and stopping some 600 tonnes of sludge from entering the harbour daily. To cater for future sewage flow increase and to provide the necessary treatment for the remaining 25% of sewage currently being discharged into the harbour after screening only, we need to implement the next and final stage of HATS - HATS Stage 2. This paper consults Members on our proposal for HATS Stage 2.

BACKGROUND

2. HATS is one of the most important environmental projects ever undertaken in Hong Kong which aims to improve the water quality of Victoria Harbour. In April 2000, the Administration invited an International Review Panel (IRP) to carry out a review of further stages of HATS. In its report released on 30 November 2000, IRP proposed four siting options of different degrees of decentralization for the treatment facilities (hereafter referred to as Option A, B, C and D). These options all involve the use of Biological Aerated Filters (BAF) technology for treatment, deep tunnels for transfer and short outfalls for disposal of sewage. In proposing the four options, IRP recognized that there were several uncertainties that needed to be addressed. The IRP therefore recommended that the Administration should carry out a series of trials and studies (the Studies) to evaluate and select a final configuration for the next stage of HATS. The Studies have been duly completed and this paper provides a summary of Study findings with focus on the selection and planning of our preferred option and the expected benefits of HATS Stage 2.

THE PROPOSAL

The Preferred Siting Option – Option A

3. The Studies conclude that all the four siting options would be environmentally acceptable and technically feasible. The Studies also confirm that biological treatment and disinfection, in addition to the current chemical treatment process, should be provided in order to enhance and sustain our harbour water quality. Moreover, according to the Studies, even if the most compact sewage treatment technology is used in the biological treatment process, we will still require extra land of at least 12 hectares outside the current boundary of the SCISTW to accommodate the biological treatment facilities. Of the four options, the Government prefers Option A because it gives the best overall performance in terms of cost, environmental, social and engineering considerations (see Annex for detailed comparison). In particular, as Option A only involves the provision of new chemical treatment and disinfection facilities within the existing SCISTW and new underground biological treatment facilities at a site in the vicinity of the SCISTW, it is likely to cause the least nuisances to the surrounding developments during both the construction and operation stages.

Justification for two-phase implementation

4. Although our assessment has shown that the provision of biological treatment is essential for protecting the harbour in the long term, owing to the need to secure land for the biological treatment facilities, the substantial capital and recurrent costs involved and the complexity of building a compact biological treatment system of the scale required using the public-private partnership approach, we consider it prudent to implement Stage 2 in two phases –

(a) Stage 2A – we will construct deep tunnels for transferring sewage from the remaining parts of Hong Kong Island to Stonecutters Island and upgrade the existing SCISTW to provide chemical treatment and disinfection for an ultimate sewage flow of 2.8 million cubic metres per day, which doubles the existing flows being treated at SCISTW.

(b) Stage 2B – we will provide additional biological treatment facilities to enhance the pollutant removal rate to cater for the anticipated population build-up in the HATS catchment. These biological treatment facilities will be constructed underground on a site in the vicinity of the SCISTW so that the surface land can be used for other purposes.

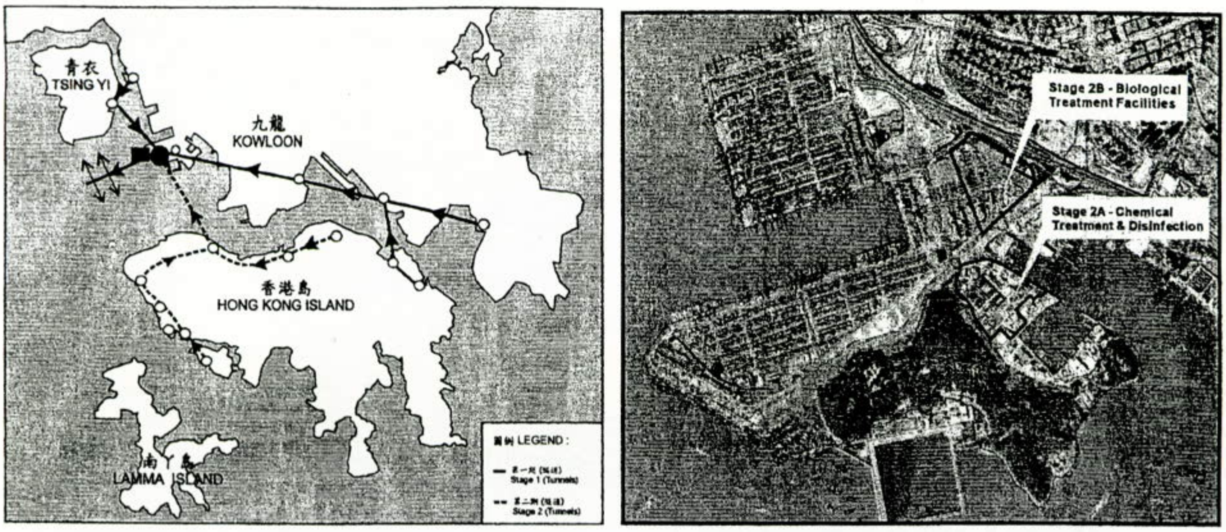

Figure 1 The Preferred Option for HATS Stage 2

5. The current water quality modelling results suggest that the provision of chemical treatment and disinfection to all HATS flows under Stage 2A would result in compliance with most of the water quality criteria, including those set for dissolved oxygen and ammonia, in most parts of the harbour area. The potential exception is that the minimum dissolved oxygen (DO) and unionized ammonia criteria[1] might not be met on an infrequent basis in the region off the coast of West Kowloon due to the proximity to the HATS discharge. Implementation of HATS Stage 2B would enable full compliance with the above two water quality criteria even in that specific locality. It is worth pointing out that the above potential occasional non-compliance has been predicted on the basis of the modelling results generated based on current population growth projections. As the actual population build-up rate can be different from the projections, the actual extent and frequency of non-compliance can also change. Given that HATS Stage 2A would result in substantial improvement of harbour water quality and that the potential occasional non-compliance in the locality in question would unlikely cause any unacceptable threats to the environment, the environmental risk of proceeding with Stage 2A first and implementing Stage 2B in the light of the actual water quality monitoring results and sewage flow build-up is clearly acceptable. Therefore, it should be a pragmatic approach to implement HATS Stage 2 in two phases from the environmental point of view.

6. Turning to the financial perspective, the additional capital cost of splitting Stage 2 into two phases is $0.4 billion, which is low compared with the overall capital cost of $19.5 billion (Table 1). The overall recurrent cost is about the same with and without phasing. Given that the annual cost of operating Stage 2B is roughly $0.72 billion, the additional (deferred) capital cost that would be incurred by a phased approach would be more than compensated for by the present value savings in

[1] The DO level at the sea bottom is usually lower than that at the surface waters. If the bottom DO level drops too low, some bottom dwelling organisms such as crabs or shrimps may suffocate and die. The odour problem may arise when the DO level approaches zero. The minimum DO criterion (> 2 mg/L) is set to avoid this. For ammonia, if the level is too high, it may cause damage / death to some sensitive marine organisms, such as fish fries. The four-day average unionized ammonia criterion is set to avoid this.

recurrent costs. As such, it is likely that substantial savings can be achieved if we can optimize the introduction of the biological treatment process in the light of the actual need instead of upfront from the outset, particularly having regard to the fact that Stage 2A alone would enable most of the water quality criteria to be met in most parts of the harbour area.

Table 1 Cost Implication for Phased Implementation of HATS Stage 2 Based on the Preferred Option

HATS Stage 2 Implementation	Capital Cost (HK$billion)	Recurrent Cost (HK$billion/year)
Without Phased Implementation	19.1	1.18
With Phased Implementation		
Stage 2A	8.4	0.44
Stage 2B	11.1	0.72
Total	19.5	1.16

7. Notwithstanding the various considerations in support of a two-phase implementation approach, Stage 2B would be required ultimately. Therefore we need to make preparations for Stage 2B in parallel with implementing Stage 2A, including undertaking the environmental impact assessments (EIA), conducting site investigations and making available the site identified for the biological treatment facilities, such that Stage 2B can move full steam ahead once there is a clear indication that the actual population in the harbour area is growing as forecast and that the water quality monitoring results demonstrate the need. To this end, we will closely monitor sewage flow build-up and water quality to allow an early decision to be made to trigger the implementation of Stage 2B in a timely manner.

Procurement Arrangement

8. For the design and construction of HATS Stage 2A and Stage 2B, together with the operation of all the new and existing treatment facilities under HATS, we will explore the "Public Private Partnership" arrangement. We currently envisage that the "Design, Build and Operate" approach can be used for providing the new treatment facilities under Stage 2 and subsequently operating them together with the existing facilities. As for the underground tunnels, as they would not require much operation and maintenance upon completion, the "Design and Build" approach will be considered. As our technology trials have confirmed that there are trade-offs between compact treatment technologies and conventional treatment technologies, we intend not to specify the biological treatment technology under Stage 2B but only the performance of the treatment plant required. In this connection, we will attempt to reserve adequate land in the vicinity of the existing SCISTW to enable tenderers with expertise in different biological treatment technologies, both compact and conventional ones, to compete for the provision of the biological treatment facilities.

Implementation Timetable

9. We will conduct a four-month public consultation exercise to foster a general consensus in the community on HATS Stage 2. With the support of the community, we will start the site investigations and EIA of HATS Stage 2A in 2005 to enable the major construction works to commence in 2007/08. Such a timetable would mean the completion of the Stage 2A treatment facilities in about 2011/12 to bring further water quality improvements. The more challenging tunnelling works under Stage 2A are expected to be completed by 2013/14 to bring about the full benefits of Stage 2A. In line with our commitment to re-opening the Tsuen Wan beaches as soon as possible, we will also explore ways to expedite the completion of part of the disinfection facilities of Stage 2A by 2008/09. As for Stage 2B, we will target at completing all the preparatory work, including the EIA, land reservation and ground investigations during the implementation of Stage 2A to shorten its delivery time.

IMPORTANCE AND BENEFITS OF HATS

Improvements due to HATS Stage 1

10. Since the full implementation of HATS Stage 1, the SCISTW has been treating 75% of the sewage (about 1.4 million cubic metres per day) in the HATS catchment. The SCISTW is one of the most efficient chemical treatment plants in the world, with very high pollutants removal efficiency, namely -

a) 70% of the organic pollutants in terms of biochemical oxygen demand;
b) 80% of the suspended solids; and
c) 50% of sewage bacteria, *E.coli*.

Overall, it is stopping 600 tonnes of sewage sludge and its pollutants from entering the harbour every day.

11. Before the implementation of HATS Stage 1, the average compliance with the dissolved oxygen water quality objective in the harbour area was low, only 65% for 2000 - 2001. With the implementation of HATS Stage 1, the average dissolved oxygen level in the harbour has increased by 10% (see Figure 2), resulting in an increase of the compliance rate to 97% in 2002 - 2003. Similar improvements have been observed in other water quality parameters, such as the total inorganic nitrogen objective, for which the compliance rate has increased from 76% for 2000 - 2001 to 94% for 2002 - 2003. In addition, the levels of key pollutants in the harbour area have generally decreased -

a) ammonia (harmful to marine life) has declined by 25%;
b) nutrients in terms of total inorganic nitrogen and phosphorus (which in rich supply can promote excessive algal growth) have dropped by 16% and 36% respectively, and

c) the overall *E.coli* level, which is an indicator of disease-causing organisms, has reduced by some 50%, although the *E.coli* level at the localized area in the western harbour and Tsuen Wan beaches has increased.

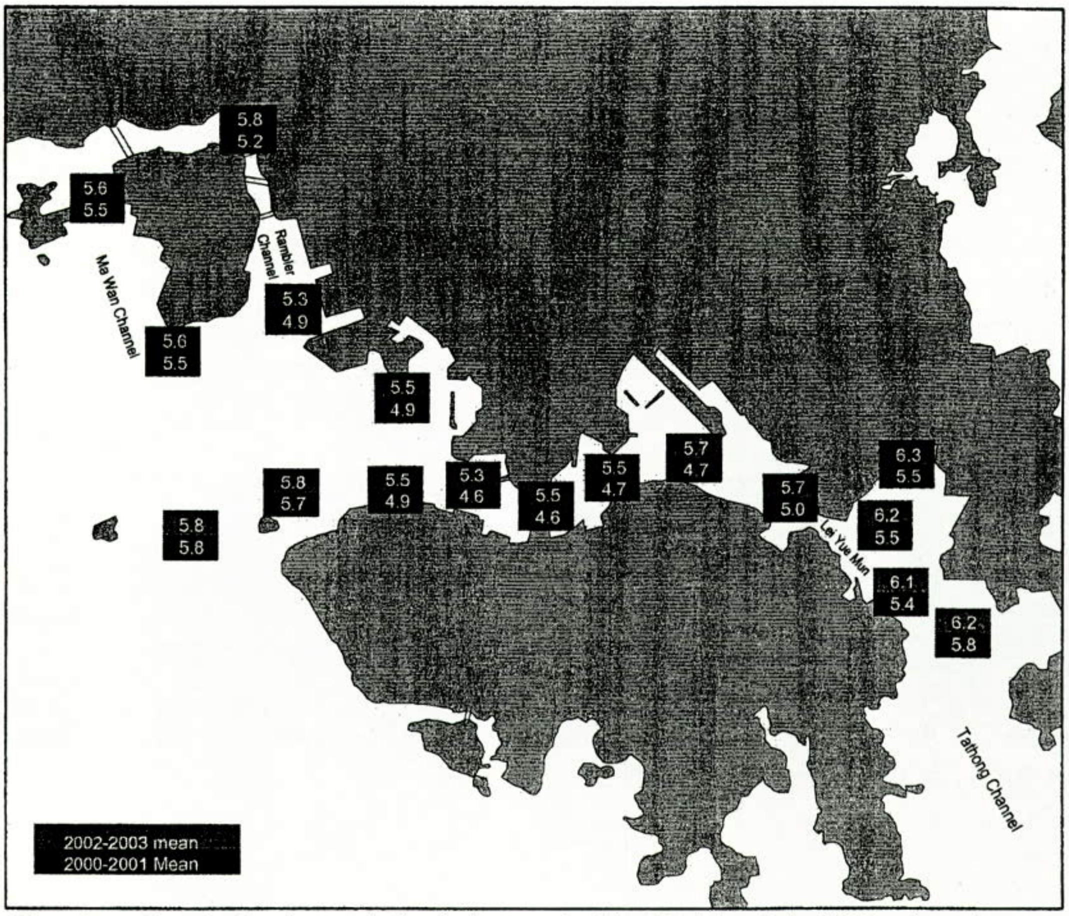

Figure 2 Map showing changes in dissolved oxygen (mg/L) at 17 stations in the HATS enhanced monitoring (comparison of mean difference between Jan 2002 – Dec 2003 and Jan 2000 – Dec 2001)

Improvements to be brought about by HATS Stage 2

12. Although HATS Stage 1 has greatly improved the water quality in the harbour, the water quality will deteriorate again as a result of the increase of sewage flow due to future developments and population growth if we do not implement Stage 2. Commissioning of HATS Stage 2A would increase the average dissolved oxygen level by 5% and commissioning of Stage 2B would increase the level by a further 5%. The compliance rate for the dissolved oxygen criteria will increase to 100% on completion of Stage 2. The provision of disinfection under Stage 2A would remove over 99.9% of the sewage bacteria from the sewage, allowing the Tsuen Wan beaches to be re-opened for swimming. Other pollutants, such as toxic ammonia and nutrients would also be reduced substantially to enable full compliance with water quality criteria in the harbour after completion of HATS Stage 2.

13. Overall, the water quality improvements from HATS Stage 2 would result in a much improved environment for marine life, a cleaned up harbour and re-opened

beaches, and would allow the real possibility of staging major water events such as ad hoc cross-harbour swimming contests.

Polluter Pays Principle

14. Tackling pollution is always costly and the "polluter pays principle" has been widely accepted as a means of sharing out the cost fairly. The implementation of HATS Stage 2, which is essential for handling the million tonnes of wastewater created by us, would result in additional recurrent expenditure for the operation and maintenance of the scheme. In line with the "polluter pays principle", adjustment of the rates of sewage charges would be inevitable with the commissioning of the various components of HATS Stage 2 in the years to come.

PUBLIC CONSULTATION

15. As there is a clear need to move forward with HATS Stage 2, and as the heavy capital investment and recurrent expenditure would ultimately require a significant contribution from the public one way or another, we consider it important to reach a consensus within the community before making a final decision on the way forward. The four-month public consultation exercise on HATS will last from June to October 2004. In-depth briefings will be provided to major stakeholders such as green groups, academics, professional bodies and community representatives. A public hearing will also be held to collect the views of the public directly on the proposed way forward for HATS Stage 2. We will take into account comments received during the public consultation exercise before finalizing the proposal.

ADVICE SOUGHT

16. Members are welcome to provide views on the preferred option, the proposed two-phase implementation approach and any other issues on the implementation of HATS Stage 2.

Environment, Transport and Works Bureau
June 2004

Comparison of the Four IRP Options

The four options proposed by the International Review Panel mainly differ by the degree of decentralization. They all involve the use of deep tunnels to convey the sewage, the provision of biological treatment and, if necessary, disinfection, in addition to the current chemical treatment process. The highly treated effluent would then be discharged into the Harbour through short outfall(s). The four options are as shown in the figure below –

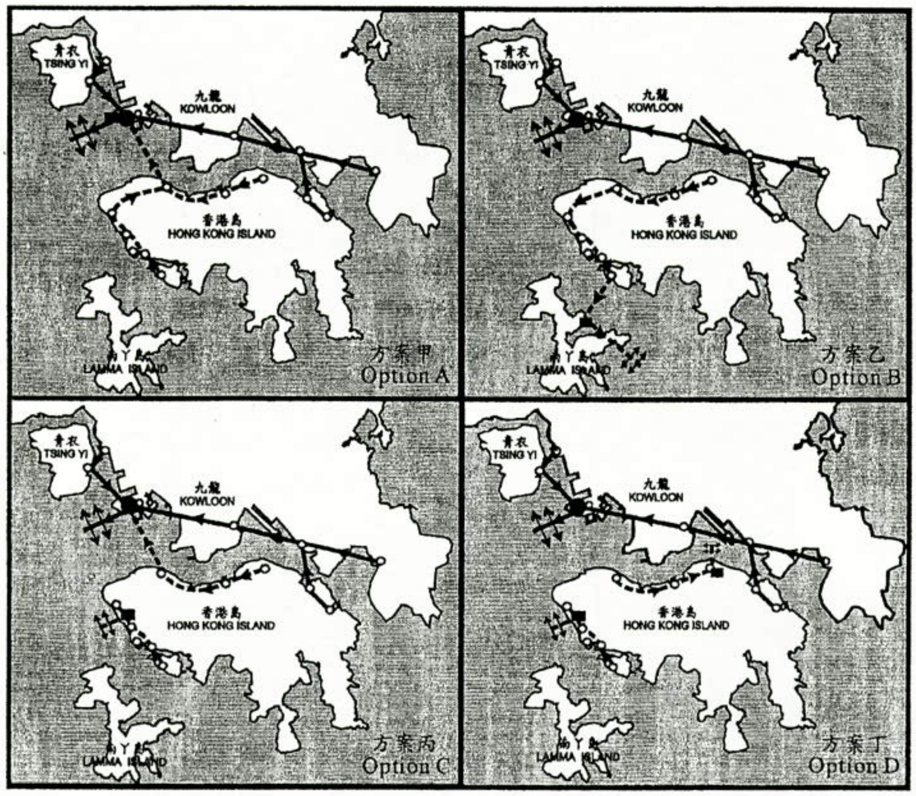

Figure 3 The Four IRP Options for HATS Stage 2

2. As far as sewage treatment works are concerned, Option A involves the expansion of the existing Stonecutters Island Sewage Treatment Works (SCISTW). Option B involves the expansion of the SCISTW and the construction of a new treatment works at the ex-quarry site at Lamma Island. Option C involves the expansion of the SCISTW and the construction of a new treatment works in a cavern to be excavated at Sandy Bay. Option D involves the expansion of the SCISTW and the construction of two new sewage treatment works in caverns to be excavated at Sandy Bay and Braemar Hill, North Point, respectively. The locations of the sewage treatment works sites for the four options identified in the EEFS are shown in Figure 4 and the cost comparisons are provided in Table 3.

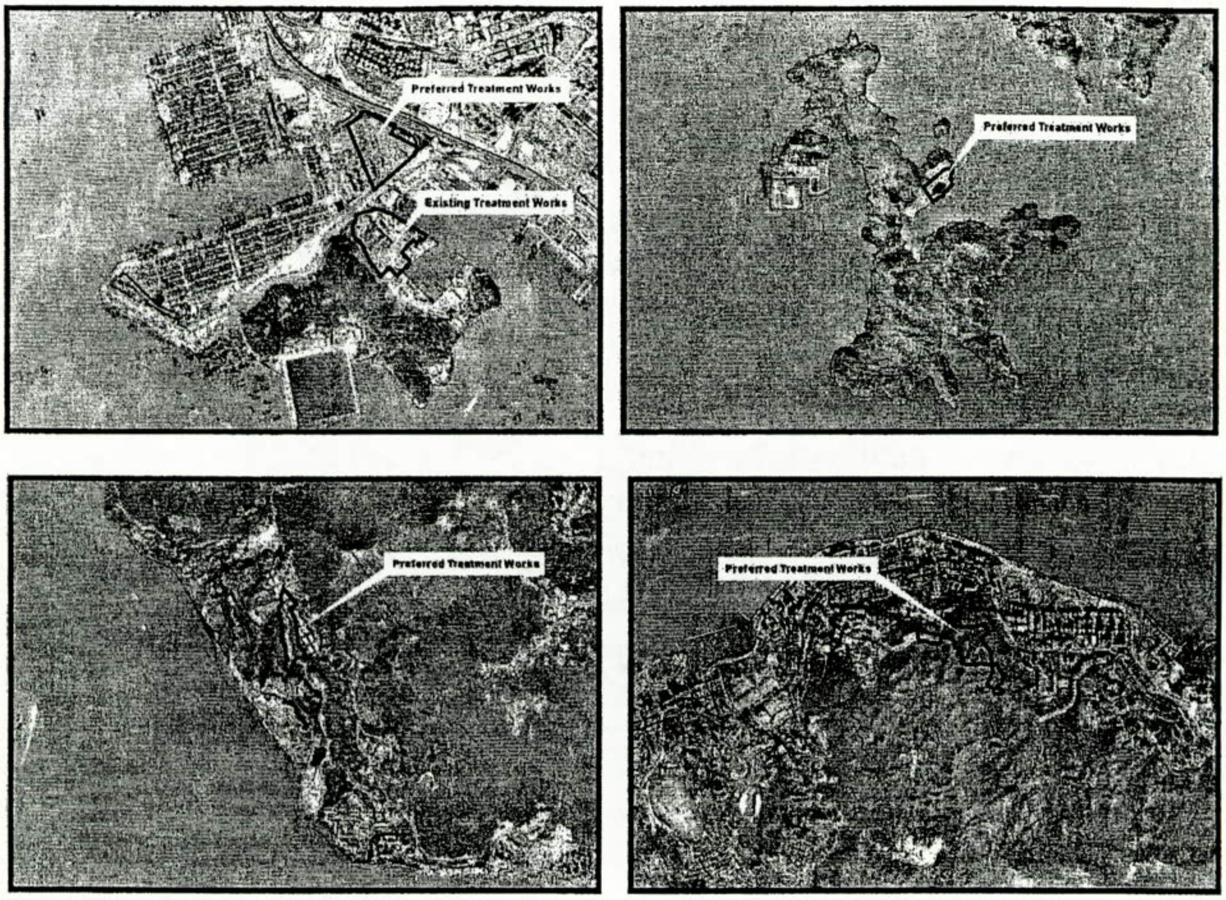

Figure 4 Treatment Works Site at Stonecutters Island, Lamma Island, Sandy Bay and North Point

Table 3 Cost Comparison of the Four IRP Options, Assuming the Provision of Biological Nutrient Removal and Disinfection

	Capital Cost[2] (HK$billion)	Recurrent Cost (HK$billion/year)
HATS Stage 1	8.2	0.32
HATS Stage 2[3]		
Option A	19.1	1.18
Option B	19.2	1.18
Option C	19.5	1.25
Option D	20.1	1.35

[2] The capital cost includes the upgrading of the preliminary treatment works, construction of tunnels and the sewage treatment works. However, this has not included the sludge incinerator which costs around $2.2 billion. The sludge incinerator will form part of the integrated waste treatment facilities to be considered in a separate exercise, as it will need to handle other sludge apart from those generated by HATS.

[3] These cost estimates assume all the steps of the biological treatment process will be provided. If denitrification, i.e. the removal of nitrogen, which is currently included as a step of the biological treatment process on the ground of following the precautionary principle is not to be provided eventually, the capital and annual recurrent cost estimates would be lowered by $1.9 billion and $0.27 billion respectively.

3. The four IRP Options have been evaluated against five main criteria, viz. environmental, engineering, social, economic and land resources factors. Results of the detailed comparison of the four IRP Options are tabulated in Table 4 below -

Table 4 Performance Comparison of the Four IRP Options

Criteria		Ranking of the Four Options[4]			
		Option A	Option B	Option C	Option D
Environment and Public Health Criteria					
1	Water Quality - Harmful Algal Blooms	All Equal			
2	Marine Ecology	1	4	1	1
3	Fisheries	1	4	1	1
4	Public Health	All Equal			
5	Hazard to the Public	1	1	3	4
6	Air Quality	1	1	3	4
7	Noise	1	1	3	4
8	Terrestrial Ecology	1	1	3	4
9	Landscape and Visual	1	4	2	3
10	Waste Management Implications	2	1	3	4
Engineering / Technical					
11	HATS System Resiliency	4	2	3	1
12	Tunnel / Outfall Construction Risk	3	4	2	1
13	Sewage Treatment Works Construction Risk	1	2	3	4
14	Operational Risk	1	2	3	4
15	Ability to Cope with Change	1	2	3	4
Social					
16	Community Facilities Impact	All Equal			
17	Road Traffic	2	1	3	4
18	Marine Traffic	1	3	1	4
19	Potential Public Concern	1	2	2	4
20	Job Creation	All Equal			
Economics					
21	Total Lifecycle Cost	1	2	3	4
Land Resources / Statutory Land Procedures					
22	Surface Land Resource	1	4	1	1
23	Land Zoning	All Equal			
24	Land Status	1	2	3	4

[4] Ranking 1st performs the best while ranking 4th performs the worst.

4. Option A is the best among the four IRP options. The general comparison of the four options against the five key criteria are summarized below -

a) **Environmental Criteria** – As all the four options have adopted a very high level of treatment, their effects on water quality and public health are almost identical. Nevertheless, as Option B requires the construction of an outfall in the more sensitive southern waters, its impact on fisheries and marine ecology would be potentially higher than the other three options, in the event of mishaps during construction or operation. On the other hand, as Options C and D require the construction of sewage treatment works in caverns adjacent to the residential areas at Sandy Bay and Braemar Hill, these two options are inferior to the other two in terms of air, noise and terrestrial ecological impacts. On landscape and visual impacts, Option B is the worst because it requires surface land for construction of treatment works at the ex-Lamma Quarry whilst the others assume the construction of underground / cavern sewage treatment facilities.

b) **Engineering Criteria** – Option A is a centralized treatment system and therefore the inherent drawbacks would be the need for a more extensive tunnel system and a comparatively lower transfer system resiliency. Nevertheless, the substantially lower construction and operational risk as compared with treatment works in caverns and the higher flexibility to cater for any future upgrading of a centralized treatment system makes Option A more favourable than the other options in terms of engineering performance.

c) **Social Criteria** – As Options C and D require the construction of caverns next to residential areas, the associated traffic impacts would inevitably be higher than the other options. Moreover, as Option A only involves the construction of new treatment facilities adjacent to an existing sewage treatment works while the other options require construction of new treatment facilities on virgin land, it is expected that the potential impacts of Option A on public would be smaller.

d) **Economics** – Construction and operation of sewage treatment works in caverns would be expensive. As detailed in Table 3, the overall capital and recurrent costs of Option A are lower than the other options and therefore it compares favourably with the other options.

e) **Land Resources** –The feasible choice of minimizing surface land take under Option A by building the biological treatment facilities underground makes it the most favourable. As Option B requires surface land at ex-Lamma Quarry for the construction of sewage treatment facilities whilst the others assume construction of underground / cavern sewage treatment works, it is inferior to the other options. Separately, as the statutory land allocation exercise for each additional piece of land will take time, Options B, C & D would be less favourable than Option A.