



淨化海港計劃第二期 諮詢文件

Consultation Document for the Harbour Area Treatment Scheme Stage 2



環境運輸及工務局
Environment, Transport
and Works Bureau



改善維港水質
需要你的意見
Let's Clean up
our Harbour
Tell us your views

我們的維港

珍貴的天然資源

全港市民以及政府為改善維港水質共同付出的努力已見成果。「淨化海港計劃」第一期於2001年年底全面啟用，每日處理140萬立方米以上的污水，從而截除600公噸以往直接排入海港的污水淤泥，令整體污染水平下降，維港水質有所改善。

然而，這並未足夠。從港島北區及西區排放出海的污水，實際上仍是未經處理；另一方面，需要處理的污水量亦隨著人口發展而不斷增加。政府一直致力改善海港一帶的水質和環境，要達到此目的，我們必須全面落实一套綜合污水系統，以高效率、符合成本效益及持續環保的方式收集及處理海港一帶的污水。

這正就是推行下一期「淨化海港計劃」的目標。港府現正就第二期計劃篩選了一個較可取的方案，以進一步改善維港水質。這計劃分兩個階段進行，共耗資約200億元，將提供額外設施，把海港一帶的污水輸往昂船洲作化學處理和消毒；在第二階段計劃落實後，更會包括生物處理。

102 「淨化海港計劃」是本港歷來最重要的環保項目之一，必須得到公眾的全力支持才能順利推展。本文件扼述「淨化海港計劃」第一期的成果，及就第二期計劃所提出的首選方案。在此我們邀請大家共同參與，為此計劃提供意見，使“香江”美譽能實至名歸。亦歡迎你到 www.cleanharbour.gov.hk 瀏覽詳細資料。

Our Harbour Our Heritage Our Asset

The combined efforts of the people and the Government of the Hong Kong SAR to improve water quality in Victoria Harbour are paying off. Stage 1 of the Harbour Area Treatment Scheme (HATS) was fully commissioned in late 2001. It provides treatment for some 1.4 million cubic metres of sewage daily and is removing 600 tonnes of sewage sludge per day that were previously discharged directly into the harbour. Overall pollution levels are down and water quality has improved.

But more needs to be done. Sewage generated on the northern and western sides of Hong Kong Island is still discharged virtually untreated into the harbour. Future population growth in the harbour area will further increase the amount of sewage requiring treatment. The Government is committed to improving the water quality and the environment of the harbour area. To do this, we must fully implement an integrated sewage system that will collect and treat all of our wastewater from the harbour area in an efficient, effective and environmentally sustainable manner.

This is where the next stage of HATS comes in. The Government has developed a preferred option for HATS Stage 2 to further improve the water quality of Victoria Harbour. It is a two-phase, around \$20 billion programme that will provide additional facilities to convey all sewage from the harbour area to Stonecutters Island for chemical treatment and disinfection, and subsequent biological treatment.





「淨化海港計劃」第一期清除了於啟德一帶水域的污水捲流
Sewage plume at Kai Tak removed by HATS Stage 1.

HATS is one of the most important environmental programmes ever undertaken in Hong Kong. It must be implemented with the full support of the community. This document sets out briefly the achievements of HATS Stage 1 and our preferred option for Stage 2. We ask you to join us in our endeavour to make our harbour once again a "Fragrant Harbour". So please provide us with your views. You are also welcome to visit www.cleanharbour.gov.hk for more details.

HATS Where are we now?

Stage 1 of HATS, comprising the Stonecutters Island Sewage Treatment Works and 23.6 km of deep tunnels, was fully commissioned in late 2001 in order to bring early improvement to our harbour water quality. The deep tunnels collect sewage from Kwai Tsing, Tseung Kwan O, parts of eastern Hong Kong Island and all of Kowloon and deliver it to Stonecutters Island for chemical treatment. As a result, we are providing treatment to 75% of the sewage (about 1.4 million cubic metres daily) in the HATS catchment.

「淨化海港計劃」

現時的進展如何?

「淨化海港計劃」第一期的設施包括昂船洲污水處理廠及全長23.6公里的深層污水隧道，已於2001年年底全面啟用，初步改善了維港水質。深層污水隧道收集來自葵青、將軍澳、港島東部份地區以及九龍各區的污水，然後輸往昂船洲進行化學處理。現時，我們每日處理「淨化海港計劃」覆蓋範圍內75%的污水(約140萬立方米)。

你知道維港兩岸地區產生多少污水嗎?

維港兩岸地區每日產生污水約185萬立方米，相等於800個奧運標準游泳池的容量或足以在一天內注滿整個石梨貝水塘。

Do you know how much sewage is being generated in the harbour area?

Around 1.85 million cubic metres of sewage is generated in the harbour area every day. It is equal to the volume of 800 standard Olympic swimming pools, or enough to fill up the Shek Lei Pui Reservoir in just one day.

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「淨化海港計劃」第一期
Harbour Area Treatment Scheme Stage 1





「淨化海港計劃」 第一期帶來甚麼改善？

第一期「淨化海港計劃」對維港的水質帶來初步的改善。昂船洲污水處理廠被譽為全球同類設施中效率最高的污水處理廠之一。透過處理第一期所收集的污水，每日截除約600公噸的污水淤泥，使其中污染物不致流入海港！

「淨化海港計劃」第一期令維港海水溶解氧(海洋生物賴以維生的要素)平均增加約10%。

昂船洲污水處理廠是全球最具效率的化學污水處理廠之一，在清除污染物方面效率極高，能夠清除：

- 70%有機污染物，以生化需氧量計；
- 80%懸浮固體；及
- 50%細菌(大腸桿菌)。

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具有優良水質的石澳泳灘
Shek O Beach has excellent water quality

此外，海港一帶的主要污染物亦普遍下降：

- 氨(對海洋生物有害)含量下降25%；
- 營養物含量——以無機氮及磷總量(過量可能增加紅潮發生的機會)來計算——分別下降了16%及36%；及
- 大腸桿菌整體含量——即是致病微生物的指標，下降約50%。

Improvements Achieved by HATS Stage 1

Stage 1 of HATS has brought about some improvements to the water quality of Victoria Harbour. The Stonecutters Island Sewage Treatment Works is widely recognized as one of the most efficient treatment plants of its kind in the world. By treating flows from the Stage 1 catchment, about 600 tonnes of sewage sludge and the pollutants that it carries are prevented from entering the harbour every day!

HATS Stage 1 has on average increased dissolved oxygen in the harbour waters (vital for marine life) by about 10%.

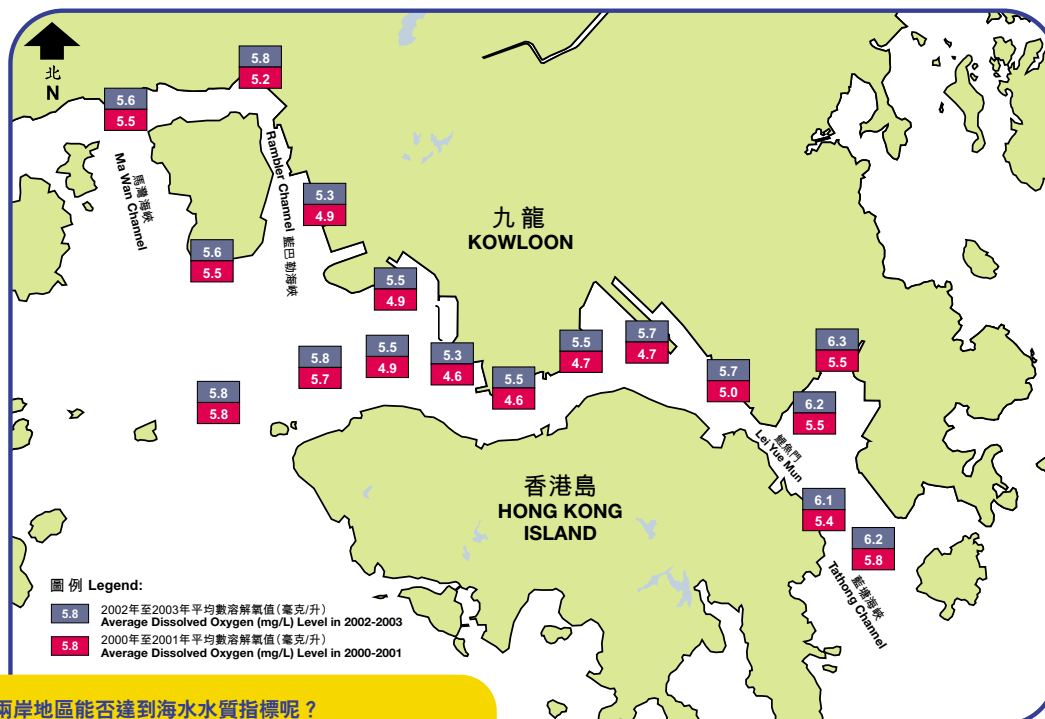
The Stonecutters Island Sewage Treatment Works is one of the most efficient chemical treatment plants in the world, removing:

- 70% of the organic pollutants in terms of biochemical oxygen demand;
- 80% of the suspended solids; and
- 50% of sewage pathogens in terms of *E.coli*.

In addition, the levels of key pollutants in the harbour area waters have generally decreased:

- ammonia (toxic to marine life) has declined by 25%;
- nutrients, in terms of total inorganic nitrogen and phosphorus (which in rich supply can increase the likelihood of red tides), have reduced by 16% and 36% respectively; and
- the overall *E.coli* level, which is an indicator of disease-causing microorganisms, has reduced by some 50%.

溶解氧值於「淨化海港計劃」第一期完成後有所增加
The Dissolved Oxygen Level has increased since the completion of HATS Stage 1



維港兩岸地區能否達到海水水質指標呢？

在「淨化海港計劃」第一期開展前，維港內溶解氧水質指標的平均達標率偏低，在2000年至2001年期間僅得65%。隨着計劃的第一期設施啟用，海港的溶解氧量平均上升了10%，以致平均達標率在2002年至2003年期間上升至97%。其他水質參數亦有類似的改善。例如，無機氮總量的達標率由2000年至2001年的76%上升至2002年至2003年的94%。然而，荃灣區泳灘水質仍未達到適宜游泳的要求。縱使我們現在的達標率已經很高，但污水量及污染量會隨著未來人口發展而增加，如果我們不展開第二期工程的話，目前的設施是不足以應付長遠的需要。

Are we achieving the Marine Water Quality Objectives in the Victoria Harbour Area?

Before the implementation of HATS Stage 1, the average compliance for the dissolved oxygen water quality objective in the Victoria Harbour 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%, resulting in an increase of the compliance rate to 97% in 2002 – 2003. Similar improvements were 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. However, the Tsuen Wan beaches are yet to meet the objective for swimming. Moreover, although we have achieved very high compliance rates recently, these will not be sustainable if we do not implement HATS Stage 2 due to the increase in sewage flows and loads as a result of future population increases.

為何需要開展 **第二期計劃**？

雖然維港中部及東部的的水質明顯好轉，甚至遠至石澳海灘的水質亦見改善，可是維港西部水域，尤其是荃灣一帶泳灘的水質，仍然受到自昂船洲污水處理廠所排放的大量廢水(經化學處理但未有消毒)所影響。此外，海港的水質亦因港島其餘地區每日排放約45萬立方米未經有效處理的污水而受到威脅。顯然，這情況是不可接受的。故推行「淨化海港計劃」第二期，以收集並妥善處理這些污水，是絕對必要的。

此外，我們亦需要及早規劃未來。現時的規劃數據顯示，整個「淨化海港計劃」污水集水區內的人口會由現時的450萬最終增至超過600萬。即使昂船

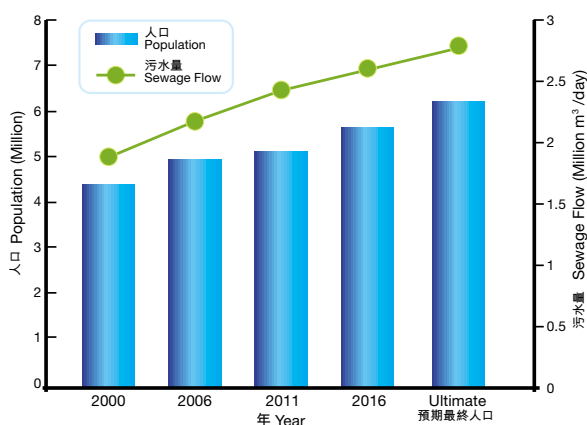
Why Stage 2?

Whilst remarkable water quality improvements have been seen at the middle and eastern areas of the harbour, with benefits reaching as far as Shek O Beach, the western harbour, notably in the area of the Tsuen Wan beaches, is still subject to the impacts of the large volume of treated effluent (without disinfection) discharged from the Stonecutters Island Sewage Treatment Works. The harbour is also affected by some 450,000 cubic metres of virtually untreated



洲污水處理廠能維持目前的超卓效率，人口增長仍會增加污水量，令污染量上升，從而影響維港水質。因此，我們需要提高污水處理水平，去除更多污染物，防止日後海港水質重新惡化。

「淨化海港計劃」覆蓋區域內的人口和污水量
Population and Sewage Generation in HATS Catchment Area



sewage that is discharged from the remaining parts of Hong Kong Island every day. Clearly, this is unacceptable. Intercepting these sewage flows for proper treatment under HATS Stage 2 is absolutely essential.

Also, we must plan for future needs. Current planning estimates show that the population in the entire HATS catchment will ultimately rise from the present 4.5 million to over 6 million. Even with the benefits of the continued exceptional efficiency of our sewage treatment works at Stonecutters Island, the inevitable increase in sewage caused by this population growth will put further stress on our harbour water quality as pollution loads rise. Therefore, we must enhance the overall treatment level in order to remove more pollutants so as to prevent deterioration in harbour water quality in the future.

你知道本港是怎樣收集和處理污水嗎？

香港每日產生污水約260萬立方米，其中185萬立方米污水來自「淨化海港計劃」覆蓋區域（包括葵青、將軍澳、九龍各區以及港島大部份地區）。除了「淨化海港計劃」第一期設施外，政府亦營運多間污水處理廠，包括位於沙田、大埔、石湖墟、元朗、西貢及赤柱的六間大型污水廠。上述六間污水廠每日以生物技術處理43萬立方米污水。藉着有效控制污染源及擴展污水渠網絡，本港河溪水質達良好或極佳級別的比率由1998年的27%增至2003年的76%，而泳灘錄得良好水質的比率亦由1988年的18%升至2003年的56%。

Do you know how sewage is collected and treated in Hong Kong?

Hong Kong produces 2.6 million cubic metres of sewage every day and 1.85 million cubic metres are from the HATS catchment (including Kwai Tsing, Tseung Kwan O, all of Kowloon and much of Hong Kong Island). Apart from the HATS Stage 1 system, the Government is also operating many other sewage treatment works, including six large treatment works at Shatin, Tai Po, Shek Wu Hui, Yuen Long, Sai Kung and Stanley. These six sewage treatment works provide biological treatment for 430,000 cubic metres of sewage every day. As a result of effective pollution source control and expansion of the sewerage network, rivers of good or excellent quality have increased from 27% in 1988 to 76% in 2003, while the beaches of good quality have gone up from 18% in 1988 to 56% in 2003.



「淨化海港計劃」

第二期包括哪些項目？

我們必須投資興建「淨化海港計劃」下一期的設施，才能保障維港水質。我們已完成多個詳盡的研究和測試，擬定第二期計劃的需要。根據研究結果，第二期計劃應包括：

- 擴建深層污水隧道網絡，以收集和輸送港島其餘地區的污水作適當處理；
- 提高現時化學處理污水的能力，由目前的170萬立方米負荷量提升至每日280萬立方米；
- 為「淨化海港計劃」處理的所有廢水進行消毒，方行排入海港；及
- 提高處理程度，為「淨化海港計劃」所有污水進行生物處理。

為什麼我們需要興建深層隧道呢？

由於維港兩岸的高密度發展，為鋪設及維修大型污水幹渠而必須進行的道路挖掘工程會嚴重影響附近路面交通。為了避免對交通及其他各種如電纜、輸氣管道、供水網絡、樓宇地基以及地下鐵路等地下設施造成影響，我們需要興建深層污水隧道(深度達至海拔以下76至150米)，將污水輸往污水處理廠進行集中處理。利用深層隧道輸送污水這個概念，於2000年為檢討海港污水處理方案時由本地及國際專家所確認。

為何需要消毒？

雖然海港的整體含菌量(大腸桿菌)下降了約50%，但維港西部及荃灣一帶的泳灘卻由於受到從昂船洲排出大量經處理而沒有消毒的廢水所影響，含菌量不跌反升，如要糾正此情況，便需要為經處理的廢水進行消毒，才排放入海港。



HATS Stage 2

What is needed?

We must invest in the next stage of HATS to make our harbour healthy. We have undertaken a comprehensive series of studies and trials to guide us towards the best way forward. These have demonstrated that Stage 2 should include:

- extension of the deep tunnel network to collect and convey sewage from the remaining parts of Hong Kong Island for proper treatment;
- expansion of the existing chemical treatment capacity from the present design level of 1.7 million cubic metres daily to 2.8 million cubic metres;
- provision of disinfection to all HATS treated flows before discharge into the harbour; and
- upgrading to biological treatment for all HATS flows.

Why do we need to construct deep tunnels?

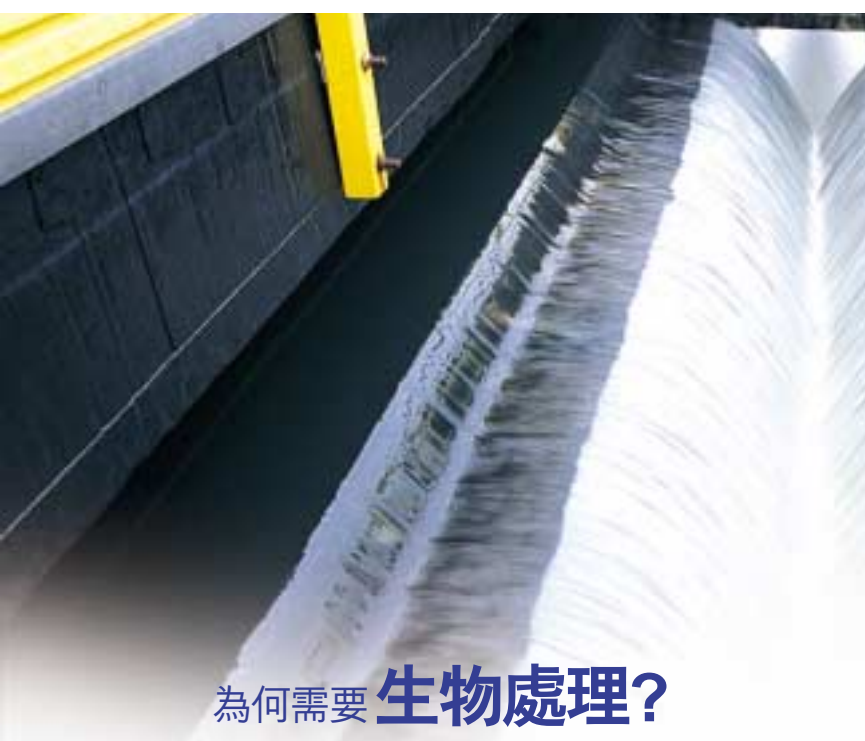
Because of the high density of developments on both sides of the harbour, excavation of roads for the installation and maintenance of sewers will lead to severe traffic disruption. To avoid traffic impacts as well as the many underground facilities such as electricity supply and communication cables, gas pipelines, water supply network, building foundations and the Mass Transit Railway, we have to build deep tunnels (at depths between 76 m and 150 m below sea level) to transfer our sewage to the sewage treatment works for centralized treatment. The deep tunnel concept was reviewed and endorsed by a panel of local and international experts in 2000.

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Why Disinfection?

Whilst the overall bacteria (*E. coli*) levels in the harbour have been reduced by some 50%, the levels in the western harbour and the beaches along the Tsuen Wan coast have increased as a result of the impacts due to the discharge of the large volume of treated effluent (without disinfection) off Stonecutters Island. Disinfection of the treated flows is necessary to improve the situation.





為何需要生物處理？

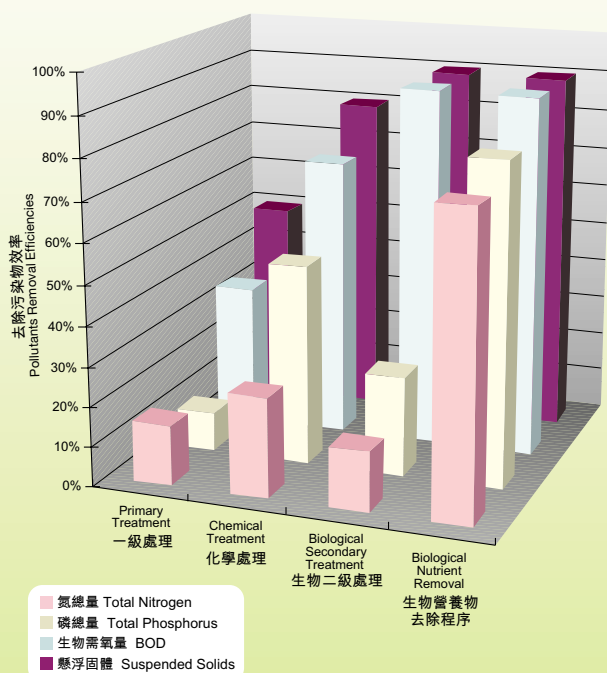
研究結果顯示，按照「淨化海港計劃」，為所有污水進行化學處理和消毒，會令海港水質符合大部分水質標準。僅能達到「大部分」標準，是因為西九龍沿岸水域，水質可能受到毗鄰昂船洲污水處理廠的排放所影響而不能達標。加上日後污染量將隨人口增長而不斷上升，這種情況更趨嚴重。採用生物處理技術，可以去除更多有機污染物、有毒氨及營養物，有助於解決這個問題。

Why Biological Treatment?

Our studies have shown that the provision of chemical treatment and disinfection to all HATS sewage flows would enable most of the water quality criteria for the harbour area to be met. We say "most" because a few criteria may not be met around the coast of West Kowloon due to its proximity to the HATS discharge outfall, especially when pollution loads continue to increase as population grows in the future. The provision of biological treatment, which can help to remove more organic pollutants, toxic ammonia and nutrients, will help to overcome this problem.

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處理水平的比較
Comparison of Treatment Levels



你知道一級處理、化學處理及生物處理有何分別？

一級處理 是通過沉澱過程，去除污水中的可沉污染物。

化學處理 是在污水沉澱前加入小量化學物，藉以提高沉澱效率，去除更多污染物。

生物處理 是藉微生物的分解去除一些易溶解而一級處理又不能有效地去除的污染物。生物處理可包括去除營養物(即導致紅潮出現的氮和磷)的額外步驟，但**去除營養物**的額外步驟，費用會很高。

Do you know the differences between primary treatment, chemical treatment and biological treatment?

Primary treatment removes the organic pollutants through the settlement of suspended solids in the sewage.

Chemical treatment adds chemicals to the sewage so that more pollutants can be removed through improved settling.

Biological treatment uses microorganisms to remove the dissolved pollutants which cannot be effectively removed through primary treatment. It can include additional steps to remove nutrients (i.e. nitrogen and phosphorus, which can lead to red tides). But the **Biological Nutrient Removal** step is very costly.

首選方案(方案甲)

關於「淨化海港計劃」第二期的收集、處理和排放污水有多個方案，我們已進行了多項研究和測試，探討四個先前由本地及國際專家建議的方案，這些方案將收集到的污水作不同程度的分散處理。研究結果顯示，雖然四個方案各有利弊，但全部都可以達到保護維港水質的目標。

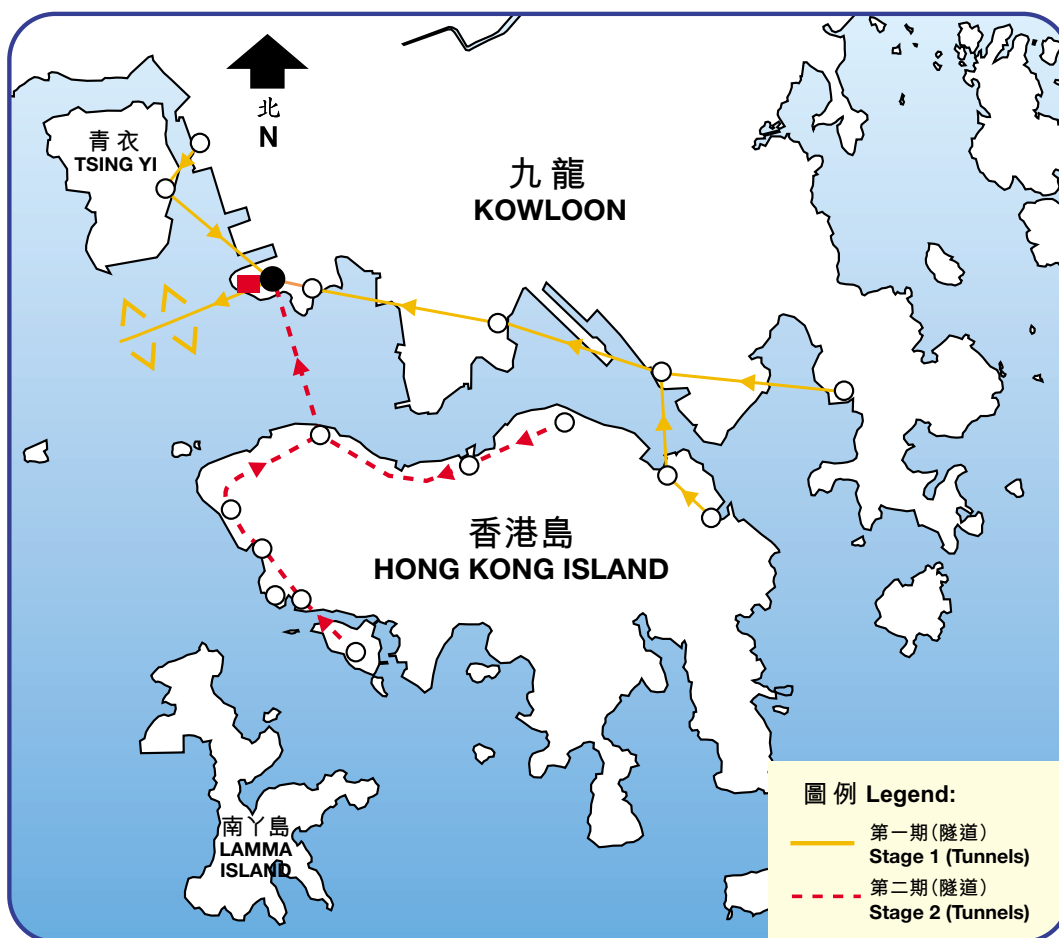
考慮過各方案的利弊後，我們認為計劃第二期較可取的方案，是擴建及改善昂船洲污水處理廠的現有設施，為來自維港兩岸所有污水提供中央化學處理；並在毗鄰的土地上，興建新的生物污水處理設施，以便最終可以有能力去除污水中的營養物。處理後的廢水經過消毒後，會經由昂船洲的排放口排入海港。

Our Preferred Option: Option A

There are many different possible configurations for the collection, treatment and disposal of sewage for HATS Stage 2. We have carried out a series of studies and trials to examine the feasibility of four options proposed earlier by a panel of local and international experts. These options involve varying degrees of decentralization. The findings show that all four options can achieve the ultimate goal of providing proper protection for our harbour, although they have different strengths and weaknesses.

Taking into consideration all these strengths and weaknesses, our preferred option for HATS Stage 2 is to expand and upgrade the existing sewage treatment works at Stonecutters Island to provide centralized chemical treatment for sewage from the whole HATS catchment, and

「淨化海港計劃」第二期首選方案
The Preferred Option for HATS Stage 2





「淨化海港計劃」第二期工程完成後，將顯著改善維港水質，以十分重要的溶解氧含量為例，會再增加10%，其他預計的水質改善包括：

- 有毒氨含量減少60%；
- 無機氮總量（營養物的一種）減少30%；及
- 磷（另一營養物）含量減少15%。

興建生物污水處理廠需要額外土地，所需要的土地面積大小視乎所採用的處理技術而定，從12公頃(採用較先進的高度密集式技術)到20公頃(採用較傳統及中度密集式的生物處理技術)不等。為善用寶貴的土地資源，這所生物污水處理廠會於地底興建，以便保留地面作其他用途。

to build a new biological treatment plant, which will allow for nutrient removal in the long term, on a site adjacent to the existing treatment plant. The effluent will then be disinfected and discharged into the harbour through the Stonecutters Island outfall.

Completion of HATS Stage 2 will improve the harbour water quality significantly, including an increase of the essential dissolved oxygen levels by a further 10%. Other projected improvements in harbour water quality:

- Reduction of toxic ammonia level by 60%;
- Reduction of total inorganic nitrogen (a nutrient) level by 30%; and
- Reduction of phosphorus (another nutrient) level by 15%.

The biological treatment plant would require additional land, ranging from 12 hectares, with the use of the most compact sewage treatment technology, to 20 hectares for a more conventional but still relatively compact, biological treatment process. To minimize the use of valuable land, the biological treatment plant would be built underground to free up the land surface for other above ground uses.

▲ 昂船洲污水處理廠位置
The Stonecutters Island Sewage Treatment Works Site



二期乙新增的生物污水處理設施範圍
New Biological Treatment Works Site for Stage 2B

一期原有及二期甲新增的污水處理設施範圍
Existing Stage 1 and Stage 2A Treatment Works Site

費用

「淨化海港計劃」是本港一項主要的基礎建設投資。已啟用的第一期的建造費用約為82億元，以最大設計流量營運的話，每年經常性費用約為3.2億元。

有關第二期工程的費用，以採納首選方案（即方案甲）計算，建造費用估計約需191億元，而營運及維修費用——即經常性費用——則估計為每年12億元。

自1991年起，港府已耗資了190億元進行污水工程，並將在未來五年繼續斥資50億元在「淨化海港計劃」以外的污水工程上。透過這些計劃，超過95%人口所產生的污水已由公共污水收集系統收集，而70%收集所得的污水則經過化學或更高等度的處理。

分階段進行

我們的評估顯示，將「淨化海港計劃」排放的所有污水進行化學及生物處理，對保護維港水質至為重要。然而，在考慮以下各項因素後，包括：

- 難以確定維港地區人口是否會按預期的高速度增長；
- 建造和營運大型生物污水處理設施的開支龐大，並且涉及額外土地；及
- 整個維港地區收集的所有污水，以化學處理和消毒，便能夠達到大部分的維港水質標準，

我們建議分兩個階段進行「淨化海港計劃」第二期工程。

另外，從落實工程的角度考慮，要在已規劃作其他用途的土地下興建一所超級規模的地下生物污水處理廠，需要處理各樣複雜的協調問題。

在**第一階段**（即「淨化海港計劃」**第二期甲工程**），我們計劃興建多條污水隧道，以便將港島北及西區的污水輸往昂船洲污水處理廠。我們也會擴建該廠，將整個「淨化海港計劃」覆蓋範圍內的所有污水，集中進行化學處理，我們同時會加快興建污水消毒設施。

Cost

The HATS programme is a major infrastructure investment for Hong Kong. The capital cost of the first stage of HATS was \$8.2 billion and its recurrent cost is some \$320 million each year at full capacity.

For HATS Stage 2, the estimated construction cost of Option A - the capital cost - is \$19.1 billion, and the estimated operation and maintenance cost - the recurrent cost - is around \$1.2 billion each year.

Since 1991, the Government has spent \$19 billion on sewerage infrastructure and will spend a further \$5 billion on other non-HATS sewerage infrastructure in the coming five years. Through these programmes, over 95% of our population is now served by public sewers and 70% of the sewage collected is now receiving chemical or higher level treatment.

A Phased Approach

Our assessments have shown that chemical and biological treatment of all HATS sewage is essential for protecting the water quality of the harbour in the long term. However, in view of the following:

- the uncertainties about a rather high rate of future population build-up in the harbour area;
- the biological treatment plant will be very expensive and require additional land allocation; and
- the provision of chemical treatment and disinfection for the whole HATS catchment will enable us to achieve most of our water quality criteria,

we propose to build HATS Stage 2 in two phases.

Moreover, from the implementation angle, building a mega-scale biological treatment plant underground with other land uses above ground would also be very complex due to the presence of many interface issues.





維港海水取樣
Marine Water Sampling at Victoria Harbour

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在**第二階段**（即「淨化海港計劃」**第二期乙工程**），我們計劃在現時的昂船洲污水處理廠毗鄰興建新的生物污水處理廠。

第二期甲工程的施工會與第二期乙工程的籌劃工作（例如環境影響評估、地質勘測及預留土地等工作）同步進行。與此同時，我們會繼續密切監察維港的水質和污水量的增幅，確保在有需要時，我們可以適時提供新的生物污水處理設施。

Under the **first phase (HATS Stage 2A)**, we will build deep tunnels to bring sewage from the northern and western areas of Hong Kong Island to the Stonecutters Island Sewage Treatment Works. The treatment works will be expanded to provide centralized chemical treatment for all sewage from the whole of the HATS catchment with fast track provision of disinfection.

Under the **second phase (HATS Stage 2B)**, we will build a new biological treatment plant on a site adjacent to the existing Stonecutters Island Sewage Treatment Works.

During the implementation of HATS Stage 2A, planning work for Stage 2B, such as undertaking environmental impact assessments, site investigations and land reservation, will be carried out in parallel. At the same time, we will continue close monitoring of harbour water quality and sewage flow increase to ensure that we can proceed with Stage 2B in a timely manner.

建造費用

以首選方案分兩階段落實「淨化海港計劃」第二期所涉及的建造費用估計為195億元，當中第二期甲佔84億元，第二期乙佔111億元，這些估計包括各項污水處理和消毒設施、污水隧道、污水泵房以及其他改善工程的建造成本。

| | 建設費用 (港幣億元) | 經常性費用總額 (港幣億元/年) |
|-----------|----------------|---------------------|
| 第二期甲 | 84 | 4.4 |
| 第二期乙 | 111 | 7.2 |
| 總額 | 195 | 11.6 |

經常性費用

「淨化海港計劃」的經常性費用將由每年3.2億元(按最大設計流量計)逐步遞增至第二期甲落成及全面運作時的每年7.6億元。當第二期乙啟用後及全面運作時，估計費用將進一步提高至每年14.8億元。

我們的研究顯示，與一步到位的建造成本比較，分階段進行工程的安排會令第二期工程的總造價略為提高約4億元；但將生物處理設施的工程分階段進行，到有實際需要時才落實啟用，每年所節省的經常性開支，卻可達到7億元以上。



Capital Cost

The total capital cost of implementing Option A in two phases is estimated to be \$19.5 billion, with Stage 2A costing \$8.4 billion and Stage 2B costing \$11.1 billion. These estimates include the costs of treatment and disinfection facilities, tunnels, pumping stations and other upgrades.

| | Capital Cost (HK\$billion) | Recurrent Cost (HK\$billion per year) |
|--------------|-------------------------------|--|
| Stage 2A | 8.4 | 0.44 |
| Stage 2B | 11.1 | 0.72 |
| Total | 19.5 | 1.16 |

Recurrent Cost

The recurrent cost of HATS will increase from \$0.32 billion to \$0.76 billion per year once Stage 2A is operating at full capacity. It is estimated to increase further to \$1.48 billion per year when Stage 2B comes into full operation.

Our studies have shown that the phased approach will increase the capital cost of HATS Stage 2 by a marginal amount of \$0.4 billion when compared with the "no phasing approach". However, the projected saving in the recurrent cost from optimizing the timing for the introduction of biological treatment can amount to more than \$0.7 billion per year.



公私營合作的安排

我們會就第二期甲及第二期乙工程的設計和施工，以及營運「淨化海港計劃」內其他新建及現有污水處理設施的方面，探討可否採用「公私營合作」的安排。其中可以考慮採用綜合了「設計、施工及營運」（即“Design, Build, Operate”）的一條龍合約形式。根據這種合約安排，污水處理廠的設計、施工，以及其後在指定期限內的營運都會由一個合適的承辦商負責。

至於在第二期甲工程中興建的深層污水隧道，我們會研究可否利用「設計及施工」（即“Design and Build”）的合約安排，規定承建商同時負責設計及施工，完工後才將隧道移交政府。

效能效益為本的合約規格要求

在較早前進行污水處理技術測試時，我們測試了三種密集式生物處理技術，這些技術從未在本港實際環境下使用，其中兩種證實能有效處理本港的污水。這項試驗不但讓我們在不同的技術中，有更多的選擇；同時也顯示了不同技術的利弊。因此，我們認為，在招標時不需要訂定第二期乙工程採用哪一種污水處理技術，但要列明對污水處理廠效能和效益的要求，才是較合適的做法。藉此安排，將可吸引更多提供不同技術的承辦商參與競投。



A Role for Public Private Partnership

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, possibly by adopting a "Design, Build and Operate" contractual arrangement. Under such an arrangement, a single contractor would be responsible for designing, building and the subsequent operation of the sewage treatment plant for a set period of time.

A "Design and Build" arrangement will be investigated for the construction of the deep tunnels for delivering the sewage to Stonecutters Island Sewage Treatment Works under Stage 2A. Under such an arrangement, a single contractor designs and builds the tunnels and then hands them over to the Government after completion.

Performance Based Specification

As part of our trials, we tested three compact biological treatment technologies, which had never been tried out under local conditions. Two were found to be viable in handling local sewage. The trials have expanded the pool of technologies open to us but they have also revealed that there are trade-offs among different technologies. Therefore, when we invite tenders, we believe that it would make more sense not to specify the treatment technology for Stage 2B, but only the performance required from the treatment plant, as this should generate more competition from different technology providers.



◆ 密集式生物處理測試設施
Compact Biological Treatment Trials Facilities

落實「淨化海港計劃」 第二期的時間表

如獲公眾的支持，第二期甲工程的設計工作可於2005年展開，以便各項主要建造工程可於2007/08年度動工。按照這個時間表，第二期甲工程中的污水處理廠會大約在2011/12年度竣工。項目中較艱巨的隧道鑽挖工程預期要到2013/14年度才能完成，屆時第二期甲計劃的效益將可全面發揮。此外，我們亦會研究加快第二期甲部份污水消毒設施的工程提前在2008/09年落成啟用，使海港水質盡快得到改善，讓荃灣區的海灘可以重新開放。至於第二期乙工程，我們會把各項籌備工作在第二期甲工程進行期間完成，以縮短落實建造所需的時間。

第二期帶來的效益

在第二期工程落成啟用後，維港水質會顯著改善。污水的處理程度經大幅提高後（即引進生物處理、去除營養物程序及污水消毒），污水中接近90%的有害污染物會得到有效處理。第二期甲及第二期乙工程會有助逐步提高海水的溶解氧（海洋生物賴以為生的要素）。第二期甲及第二期乙工程將分別使海水的溶解氧量上升5%及進一步上升5%。維港內溶解氧量的

Implementation Timetable

With the support of the community, the design of HATS Stage 2A could start in 2005 to enable the major construction works to commence in 2007/08. Such a timetable will enable us to complete the Stage 2A treatment facilities around 2011/12. The more challenging tunneling works under Stage 2A are expected to be completed by 2013/14 to bring about the full benefits of Stage 2A. Moreover, we will explore ways to expedite part of the disinfection facilities of Stage 2A for completion by 2008/09 to bring early improvement to the harbour water quality and to enable re-opening of the Tsuen Wan beaches. As for Stage 2B, with the completion of all the preparatory work during the implementation of Stage 2A, we will be able to shorten its delivery time.

Benefits

The implementation of HATS Stage 2 will lead to significant improvement in the harbour water quality. The very high levels of treatment (with biological treatment, nutrient removal and disinfection) could remove up to 90% of harmful pollutants in the sewage. Commissioning of HATS Stage 2A and 2B would incrementally increase the dissolved oxygen level (vital for marine life) in the harbour waters by 5% and a further 5% respectively. The compliance rate for the dissolved oxygen criteria will increase to 100% on completion

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水質標準，預計在第二期工程完成後，達標率會升至100%。僅第二期甲工程內的污水消毒設施，便已能消除污水中逾99.9%的大腸桿菌，使荃灣多個泳灘可以重新開放，供市民暢泳。

of Stage 2. The provision of disinfection under Stage 2A alone will remove over 99.9% of the sewage bacteria from the sewage, allowing the Tsuen Wan beaches to be re-opened for swimming.

當第二期計劃全面落實後，我們：

- 將大幅提高海港所有污水的處理程度
- 在應付海港地區發展的同時仍有能力維持理想的海洋環境
- 會有更多不同品種的海洋生物
- 能重開荃灣一帶的泳灘
- 可舉辦一年一度橫越維港的渡海泳
- 會讓海港內令人噁心的污水捲流從此消失

With the completion of HATS Stage 2, we can :

- Treat all wastewater in the Harbour area to a very high level
- Maintain a healthy marine environment whilst meeting future development needs
- See more species of marine life
- Re-open all the Tsuen Wan beaches
- Conduct annual cross-harbour swimming races
- Remove the sight of sewage plumes from the Harbour

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污染者自付原則

每一項治理污染的工程通常都所費不貲，而「污染者自付」被公認是一個釐定如何攤分費用的公平原則。要處理我們每日所產生數以百萬噸計的污水，落實「淨化海港計劃」第二期是有必要的，但在每年的營運及維修上，這計劃亦會帶來額外的開支。基於「污染者自付」原則，分階段落實「淨化海港計劃」第二期的各項設施後，排污費將需要作相應調整。



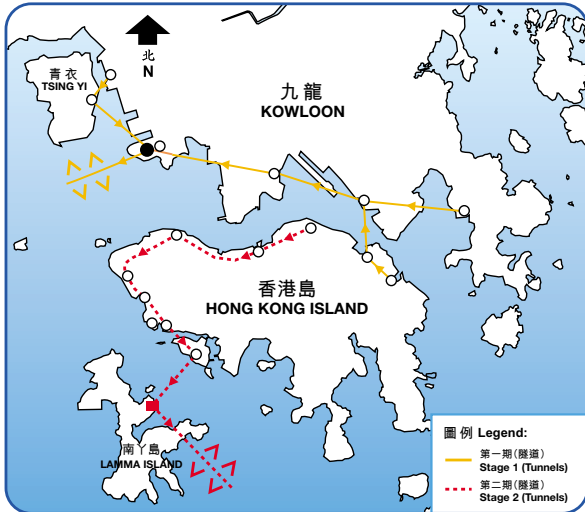
The Polluter Pays Principle

Tackling pollution comes at a cost and the "Polluter Pays Principle" has been widely accepted as a fair means of sharing out the cost. The implementation of HATS Stage 2, which is essential for handling the millions of tonnes of wastewater, will result in additional recurrent expenditure for the operation and maintenance of the scheme. In line with the "Polluter Pays Principle", adjustment of the rates for sewage charges will be necessary in conjunction with the phased commissioning of the various components of HATS Stage 2.

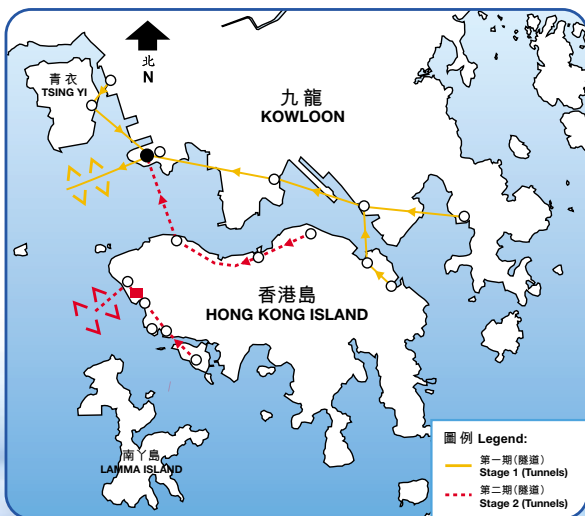
其他選址方案的評估

其他三個經評估的選址方案包括在多個人口較密集的地區興建額外的污水處理廠，以便在不同程度上將污水分散處理。

方案乙 Option B



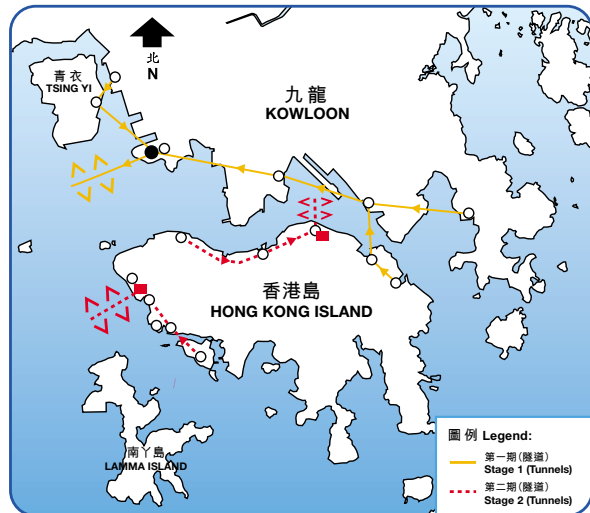
方案丙 Option C



Other Siting Options Considered

We have also considered in detail the other three siting options but do not recommend them for implementation. They involve the construction of additional sewage treatment plants in various populated areas to allow varying degrees of decentralization.

方案丁 Option D



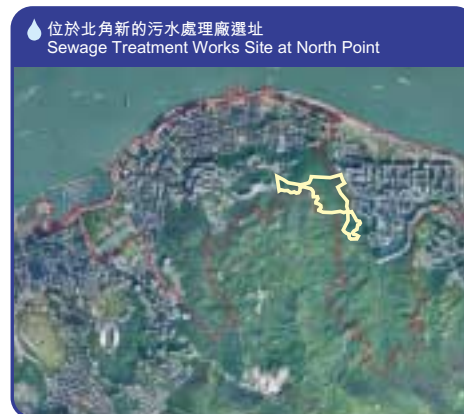
方案乙是在南丫島一個棄置的石礦場興建另一所污水處理廠；**方案丙**是在薄扶林沙灣附近開挖一個洞穴興建一所污水處理廠；**方案丁**則分別在薄扶林沙灣附近和北角開挖洞穴興建兩間污水處理廠。上述三個方案涉及的建設費用及全年經常開支均較高。它們在其他方面亦欠缺明顯優勢，特別是在施工及營運期間對毗鄰住宅區或敏感地區所產生的影響。各個方案的扼要比較載於**附件**，有關評估上述方案的詳情，可瀏覽 www.cleanharbour.gov.hk 所載的資料。

Option B includes a dedicated sewage treatment plant at the disused quarry site on Lamma Island. **Option C** includes a treatment plant inside a cavern to be excavated at Sandy Bay, Pokfulam. **Option D** includes two treatment plants inside caverns to be excavated at Sandy Bay, Pokfulam and North Point.

These three options all incur higher capital and recurrent costs. They are also less attractive in other aspects, notably in terms of construction and operation impacts on adjacent residential areas or environmentally more sensitive areas. A summary comparison of the options is at **Annex**. More information on the evaluation of these options is available at www.cleanharbour.gov.hk.

| 方案 | 簡介 | 建設費用 (港幣億元) | 經常性費用總額 (港幣億元/年) |
|-----|--|----------------|---------------------|
| 方案甲 | 所有污水於昂船洲污水處理廠處理 | 191 | 11.8 |
| 方案乙 | 污水分別於昂船洲污水處理廠及位於南丫島的新污水處理廠處理 | 192 | 11.8 |
| 方案丙 | 污水分別於昂船洲污水處理廠及建於沙灣附近一個人工洞穴內的新污水處理廠處理 | 195 | 12.5 |
| 方案丁 | 污水分別於昂船洲污水處理廠及兩個新建於沙灣附近和北角的人工洞穴內的污水處理廠處理 | 201 | 13.5 |

| Option | Description | Capital Cost (HK\$billion) | Recurrent Cost (HK\$billion per year) |
|----------|--|-------------------------------|--|
| Option A | All sewage treated at Stonecutters Island Sewage Treatment Works | 19.1 | 1.18 |
| Option B | Treatment at Stonecutters Island Sewage Treatment Works and a new plant at Lamma Island | 19.2 | 1.18 |
| Option C | Treatment at Stonecutters Island Sewage Treatment Works and a new plant in a cavern at Sandy Bay | 19.5 | 1.25 |
| Option D | Treatment at Stonecutters Island Sewage Treatment Works and new plants in caverns at Sandy Bay and Braemar Hill, North Point | 20.1 | 1.35 |



你可以**如何參與**

你的支持和意見，對於使維多利亞港的水質能回復至一個亞洲國際都會應有的水平，至為重要。

政府現就「淨化海港計劃」第二期工程提出的建議如下：

- 在第二期甲工程，擴展深層污水隧道，以便將港島餘下各區的污水收集並輸往昂船洲污水處理廠集中處理；
- 在第二期甲工程，擴充昂船洲污水處理廠現有的化學處理設施，以及增設污水消毒設施；
- 為配合第二期乙工程中要興建的生物處理設施，在昂船洲污水處理廠附近預留土地；
- 就第二期乙工程展開初步地質勘測及環境影響評估；及
- 監察水質及污水量，密切注視維港兩岸的人口發展，以確保在有需要時，能適時開展第二期乙工程。

這項規模龐大的污水工程基建項目將會為我們及我們的下一代帶來莫大裨益。我們希望市民了解就「淨化海港計劃」提出的各項建議，並聽取閣下的意見。我們更需要瞭解閣下對以下問題的意見：

- 你是否認同我們提出的首選方案，即集中在昂船洲處理污水？
- 你是否贊成分兩個階段進行第二期計劃的工程，即第二期甲及第二期乙工程？
- 你是否同意有必要保護維多利亞港的水質，即使用要支付較高的排污費用也認為物有所值呢？

How You Can Help

Your support and contribution is essential in order to return the water quality of Victoria Harbour to a standard commensurate with Hong Kong's status as Asia's World City.

The Government's recommendations for Stage 2 of HATS includes:

- extension of deep tunnels to collect sewage from the remaining parts of Hong Kong Island and transfer it to Stonecutters Island Sewage Treatment Works for centralized treatment under HATS Stage 2A;
- expansion of the existing chemical treatment facilities at Stonecutters Island Sewage Treatment Works, plus the addition of disinfection facilities, under HATS Stage 2A;
- reservation of land near the Stonecutters Island Sewage Treatment Works for a biological treatment plant to be built as part of HATS Stage 2B;
- early commencement of preliminary site investigations and environmental impact assessments for HATS Stage 2B; and
- monitoring of harbour water quality and sewage flow trends, as well as population build-up in the harbour area to ensure the timely commissioning of HATS Stage 2B when needed.

This is a major sewerage infrastructure undertaking that will bring benefits to us and our future generations. We want to be sure that you understand the proposals for HATS and would like to hear your opinions and suggestions. We are particularly keen to hear your views on the following questions:

- Do you agree with the preferred option, i.e. Option A - centralized treatment at Stonecutters Island?
- Do you agree that Stage 2 should be implemented in two phases, i.e. HATS Stage 2A and Stage 2B?
- Do you agree that protecting the water quality of Victoria Harbour is essential and that it is worth you paying higher sewage charges in line with the "Polluter Pays Principle"?



我們會就上述計劃徵詢公眾意見，並舉辦公開論壇、與關注組織進行座談，以及為社區代表安排簡介。我們會在以下網頁公布這些活動的詳情：



www.cleanharbour.gov.hk

如欲進一步了解「淨化海港計劃」的詳情，可瀏覽以上網頁。

如對上述計劃有任何意見，可於2004年10月20日前以電郵、傳真或郵寄方式提交環境運輸及工務局：

電郵地址：hats@etwb.gov.hk

傳真號碼：2838 2155

郵寄地址：環境運輸及工務局

香港中環花園道三號花旗銀行大廈十字樓

如要求將意見保密，請清楚註明。

「淨化海港計劃」是本港有史以來其中一個最重要的環保項目。毫無疑問，這是一個由世界級城市推動的世界級海港治理計劃。我們現在所作的決定，對我們下一代有深遠影響。因此，選擇一個既符合環保原則，又具彈性和符合成本效益的計劃方案是極為重要的。我們深信，只要我們群策群力，維多利亞港——這個被譽為香港作為亞洲國際都會的主要象徵——將永遠值得我們自豪。

As part of the public consultation exercise, we will organize public forums, discuss with special interest groups and brief community representatives. These events will be announced on our website:



www.cleanharbour.gov.hk

Should you need more detailed information on HATS, this too can be found on our website.

You can send us your views/comments before 20 October 2004 via:

E-mail: hats@etwb.gov.hk

Facsimile: 2838 2155

Mail: Environment, Transport and Works Bureau,
10/F., Citibank Tower,
3 Garden Road, Central, HK

If you wish your comments to remain confidential, please state this clearly in your message.

HATS is one of the most significant environmental programmes ever pursued in Hong Kong. It is truly a world-class harbour clean-up programme for a world-class city. The decisions we make today will affect us in the decades ahead, our children and our future generations. It is important that we adopt an option that is environmentally sound, flexible and cost effective. Working together, we will make Victoria Harbour an asset to be proud of – an integral part of Asia's World City – Hong Kong.



方案評估

我們根據國際專家小組就收集及處理「淨化海港計劃」第二期的污水的建議，研究了下列四個方案：

| 方案 | 簡介 |
|-----|-------------------------------------|
| 方案甲 | 所有污水於昂船洲污水處理廠處理 |
| 方案乙 | 污水分別於昂船洲污水處理廠及位於南丫島的新污水處理廠處理 |
| 方案丙 | 污水分別於昂船洲污水處理廠及建於沙灣一個岩洞內的新污水處理廠處理 |
| 方案丁 | 污水分別於昂船洲污水處理廠及兩個新建於沙灣和北角岩洞內的污水處理廠處理 |

我們根據五項主要準則，即環境、工程、社會、經濟及土地資源，評估此四個方案；比較結果詳載於下表。

四個方案的表現比較

| 準則 | 四個方案的排名 ¹ | | | |
|--------------------|----------------------|-----|-----|-----|
| | 方案甲 | 方案乙 | 方案丙 | 方案丁 |
| 環境及公眾衛生 | | | | |
| 1 水質—有害紅潮 | 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 淨化海港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 |

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¹ 排名第一者表現最佳；排名第四者表現最差。



整體而言，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概述如下：

環境方面——由於四個方案均採用非常高級別的處理程序，因此對水質和公眾衛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會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，因為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。

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。

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為大。此外，方案甲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，因此預期方案甲對公眾的影響會較低。

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。方案甲的整體建設及經常費用均較其他方案少，因此是較佳的方案。

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，方案甲因此是最佳的方案。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，方案乙較為遜色。此外，由於增撥每幅土地均須經過冗長的法定程序，因此方案甲會較方案乙、丙及丁可取。

Evaluation of the Options

Four options were proposed by an International Review Panel (IRP) for the collection and treatment of sewage for HATS Stage 2 as follows:

| Option | Description |
|----------|--|
| Option A | All sewage treated at Stonecutters Island Sewage Treatment Works |
| Option B | Treatment at Stonecutters Island Sewage Treatment Works and a new plant at Lamma Island |
| Option C | Treatment at Stonecutters Island Sewage Treatment Works and a new plant in a cavern at Sandy Bay |
| Option D | Treatment at Stonecutters Island Sewage Treatment Works and new plants in caverns at Sandy Bay and Braemar Hill, North Point |

The four 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 options are tabulated below.

Performance Comparison of the Options

| Criteria | Ranking of the Four Options ¹ | | | |
|---|--|----------|----------|----------|
| | 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 |

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¹ Ranking 1st performs the best whilst ranking 4th performs the worst.



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

Environmental Criteria – As all 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.

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.

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 will only involve 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 the public would be smaller.

Economics – Construction and operation of sewage treatment works in caverns will incur higher costs. The overall capital and recurrent costs for Option A are less than the other options and therefore it compares favourably with the other options.

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 the 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 it takes time to complete the statutory land allocation exercise for each additional piece of land, Options B, C & D would be less favourable than Option A.

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