Let's Clean Up Our Water

Chapter 3
第三章

除污淨流

Let's Clean Up Our Water



整體策略及計劃

經過過去幾十年的迅速發展，香港已成為著名的金融和通訊中心，而且是世界上人口最密集的城市之一。經濟活動和人口顯著增加，為香港帶來了每日約 250 萬立方米的污水。

為保護海洋生態環境，污水須經公共污水系統設施妥善收集和處理，然後才排放入海。透過我們在公共污水系統基礎設施方面不斷努力，本港市區所有地方和新界許多已發展的地區現已設有公共污水系統，服務全港約 95% 的住宅和收集所產生超過 98% 的污水。

為了應付日益增加的發展需求及日漸提升的生活水平，我們需要不斷擴展和改良污水系統基建設施。在 1989 年，我們完成了「污水策略研究」，並制定了有關污水收集、處理和排放的長遠策略，以達致所定的水質指標。

Overall Strategy and Programme

The rapid growth in the last few decades has transformed Hong Kong into an eminent financial and communication centre and one of the most densely populated cities in the world. The dramatic increases in economic activities and population have produced large quantities of foul water or sewage - about 2.5 million cubic metres every day.

To protect the marine environment, the sewage must be properly collected and treated, through the public sewage facilities, before its disposal to the sea. With our continuous investment in the public sewerage infrastructure, all urban areas of Hong Kong and much of the developed New Territories are now provided with a public sewerage system, serving about 95% of the households and collecting over 98% of the sewage produced.

To cope with the increasing development and the rise in the standard of living, we need to continuously expand and upgrade the sewerage infrastructure. The Sewage Strategy Study completed in 1989 established the long term strategy for collecting, treating and disposing of the wastewater generated by the community to meet the water quality objectives.

西貢污水處理廠
Sai Kung STW

該項研究建議為全港公共污水系統設施進行相當程度的改善工程，而整項策略包括兩個主要計劃：分別是「淨化海港計劃」和「污水收集整體計劃」工程。「淨化海港計劃」用以處理來自維多利亞港兩岸，佔全港七成以上的污水。透過「淨化海港計劃」第一階段，污水經收集後，會經深層隧道輸往昂船洲的中央污水處理廠，接受化學輔助一級處理，然後才排放入維多利亞海港西部水域。

在「污水收集整體計劃」下，我們將全港分為 16 區，逐一擴展及改善各集水區內的現有污水收集網絡，並擴建現有污水處理廠或加建新設施，以確保污水設施能應付目前的污水量和日後發展的需要。

The study recommended substantial improvements to the public sewerage facilities for the whole territory and the whole strategy has two main components, the Harbour Area Treatment Scheme (HATS) and the Sewerage Master Plans (SMPs). The HATS serves the urban centres around Victoria Harbour, which generate more than 70% of sewage in the territory. Under the stage I of HATS, sewage is collected and transferred to a centralized sewage treatment plant at Stonecutters Island by deep tunnels, where it will receive Chemically Enhanced Primary Treatment (CEPT) before discharge to the western harbour.

Under the SMPs, improvements to the sewerage system in the territory are being carried out on a catchment-by-catchment basis in which the territory is divided into 16 SMP areas. In each of these areas, the existing sewerage network is extended and improved, the existing sewage treatment works (STWs) are upgraded and new facilities are constructed so as to ensure sufficient capacity for conveying and treating sewage generated today and from future developments.

新工程

本署負責污水系統改善工程的設計、建造和運作。由於要應付香港迅速發展所需的先進和足夠的污水系統基礎設施，需要大量資源並且耗時興建，因此這項工作頗為繁重和艱巨。

「淨化海港計劃」第一階段於2001年12月竣工，這不僅是香港污水處理工作一個重要里程，亦標誌著我們在工程方面達到國際水平，成就卓越。現在，此計劃每日把大約140萬立方米的污水，從九龍及港島東北部輸送到昂船洲處理及排放，使維多利亞港的水質得到大大改善。政府現正進行一系列的試驗和研究，以釐訂「淨化海港計劃」餘下各階段的路向。

「污水收集整體計劃」的工程自從在1989年動工以來，進展順利。柴灣至筲箕灣以及港島南部的兩項工程已分別於1997年和2000年竣工。在新蒲崗、九龍灣及觀塘興建17公里長污水渠和修正工業區內有問題的接駁的東九龍渠務工程，亦已在2001年大致完成。而西北九龍的工程和香港仔、鴨脷洲及薄扶林的工程亦進展順利，現已分別完成了97%和80%。改善港島北部污水網絡的中西區及灣仔西的「污水收集整體計劃」和灣仔東及北角的「污水收集整體計劃」，第二階段工程亦已展開。其餘「污水收集整體計劃」的工程亦正處於不同的設計或建造階段，預計可在2013年或之前分期完成。

New Works

DSD is responsible for the design, construction and commissioning of the sewerage improvement works. This is a huge and difficult undertaking because the provision of new and adequate sewerage infrastructure to cope with the rapid development of Hong Kong requires vast resources and the new facilities take time to build.

In December 2001, the successful completion of the HATS Stage 1 marks an important milestone in sewage treatment in Hong Kong, as well as a remarkable engineering achievement by international standards. The scheme is now treating about 1.4 million cubic metres of sewage collected from Kowloon and the northeastern part of Hong Kong Island each day, bringing substantial improvement to the water quality of Victoria Harbour. A programme of trials and studies is also being implemented by Government with a view to formulating the way forward for the further stages of HATS.

SMP works, which started in 1989, are progressing well. Two SMPs, namely the Chai Wan & Shau Kei Wan SMP and the HK Island South SMP were completed in 1997 and 2000 respectively. The East Kowloon SMP, which involves the construction of about 17 km of sewers and the rectification of expedient connections in the industrial areas in San Po Kong, Kowloon Bay and Kwun Tong, was substantially completed in 2001. The North West Kowloon SMP and Aberdeen, Ap Lei Chau and Pokfulam SMP are making good progress and are now 97% and 80% completed respectively. For Central, Western & Wan Chai West SMP and Wan Chai East & North Point SMP, which serve northern Hong Kong Island, construction for the stage 2 works has commenced. The other SMPs are under various stages of design or construction, and are scheduled for completion in phases by 2013.

昂船洲污水處理廠 Stonecutters Island STW

為配合各區的發展，並達致最新的水質指標，我們繼續在各個主要的污水處理廠進行改善工程。石湖墟污水處理廠的改善工程已在2001年8月大致完成。在2002至03財政年度，我們亦展開了昂平污水處理廠興建工程。我們現正為其他污水處理廠的改善工程進行策劃和設計，包括大埔污水處理廠第5期工程、石湖墟污水處理廠和平洲污水處理廠。不過，因應近期人口及房屋需求有所增長，故污水設施及服務亦有需要增加，而環境保護署現正檢討各項「污水收集整體計劃」。

主要污水系統改善工程的工程簡介載於附錄D。

本署自1989年成立至今，進行的污水工程項目總值大約有318億元，其中「淨化海港計劃」第一階段佔82億元、「污水收集整體計劃」佔172億元及其他相關工程佔64億元。截至目前為止，已完成的工程總開支為190億元。預計在未來五年進行的工程，將耗資約60億元。在2002至03年度，我們在污水系統改善工程共耗資12億元。

污水收集系統的運作和保養

現時本港約有九成半人口其住所的排水管已接駁至公共污水收集系統，超過九成八的污水已獲收集和處理。整個系統包括約1,478公里長的污水收集網絡。我們採取預防性的保養計劃，定期檢查及清理污水渠，為這個龐大的污水系統進行保養和確保其運作妥善。在2002至03年度，我們已檢查的污水渠共長958公里，並清理其中784公里，清除淤泥10,045立方米。

Upgrading of major STWs will continue so as to keep pace with the increased development and to suit the latest water quality objectives. The upgrading works at Shek Wu Hui STW was substantially completed in August 2001. The 2002/03 financial year sees the commencement of the construction of Ngong Ping STW. The planning and design for the upgrading of other STWs such as Tai Po STW Stage 5, Shek Wu Hui STW and Peng Chau STW is well underway. However, in view of the latest population growth and housing demands, more sewerage facilities and services would be required and reviews of the SMPs are being undertaken by the Environmental Protection Department (EPD).

Brief descriptions of major sewerage projects are attached in Appendix D.

From the establishment of DSD in 1989 to now, we have been implementing sewerage projects with a total cost of about $31.8 billion, comprising $8.2 billion for HATS Stage I, $17.2 billion for SMP works and $6.4 billion for other associated works. So far, we have completed works amounting to $19.7 billion under the programme, another $5.5 billion of works is being planned for the next five years. In 2002/03, the expenditure on sewerage projects was $1.2 billion.

西九龍初級處理廠 Northwest Kowloon Preliminary Treatment Works

Operations and Maintenance of the Sewerage System

About 95% of the population is at present served by the public sewerage system with over 98% of the sewage produced being collected and treated. This system includes a sewerage network of about 1,478km in length. To maintain this extensive and comprehensive network of sewers and to ensure their proper functioning at all times, DSD has implemented a preventive maintenance programme for carrying out regular inspection and cleaning of sewers. In 2002/03, we have inspected 958km of sewers, of which 784km were cleaned, and removed 10,045m^3 of silt.

為加強排水及污水設備的管理，並改善對市民的服務，本署在1996年完成渠務記錄數碼化的工作，使更能有效地處理有關渠務記錄的查詢。我們正提高有關系統的效能，以協助規劃保養工作，及提供各種設備的統計報告，以便更有效地管理資源。

在1997年，我們裝設了「渠務投訴資訊系統」，以取代人手記錄渠務投訴個案。所有接獲的投訴，均直接輸入資料庫，使我們能更有效地監察跟進工作的進展。這個系統亦能協助確定問題的所在，方便策劃及覆核預防性保養計劃。

為進一步加強處理渠務投訴的效率，我們最近為直屬員工隊添置了「通渠隊流動電腦系統」，配合「渠務投訴資訊系統」。員工可利用個人數碼助理接收工作指示、記錄工作結果、拍攝工地相片和即場繪製草圖。當工作人員回到廠房時，可透過簡單的步驟把所收集的資料上載到「渠務投訴資訊系統」，從而大大改善了處理渠務投訴的效率和利便監察工作的進展。

過去各年接到的污水渠淤塞投訴和已處理的個案數字，載於附錄E。

作為專責渠務的政府機構，本署負責審查公共及私人發展項目對污水收集系統的影響，並按需要提供有關接駁至公共污水收集系統的意見。在2002年，我們共處理超過24,380份和污水收集有關的文件，並為新發展項目發出197項污水渠接駁工程的繳費通知書。

污水處理設施的運作和保養

本署目前負責大約218項污水處理設施的運作，其中包括約65所分布全港的污水處理廠。這些污水處理廠採用不同處理程序，清除污水中的污染物，以達到排污牌照所定的排放標準。

主要污水處理廠的分布位置載於附錄F。

To enhance the management of drainage and sewerage assets and the services to the public, DSD completed digitization of all drainage records in 1996. This has enabled us to handle requests for drainage records efficiently. The system is being further enhanced so as to assist the planning of maintenance works and generate statistical reports on assets for better management of resources.

In 1997, we installed a Drainage Complaints Information System (DCIS) to replace the manual procedures for recording drainage complaints. All complaints received are directly input into the database so that progress on the follow-up actions can be monitored effectively. This system also serves to identify black spots for planning and reviewing of the preventive maintenance programme.

With a view to enhancing the operational efficiency in handling drainage complaints, a Direct Labour Force Mobile Computing Application (DLFMCA) has been developed. With the integration of the DLFMCA and the DCIS, the workforce can make use of a Personal Digital Assistant (PDA) to receive work orders, capture work results, take site photos and make sketches on-the-spot. All captured data can be uploaded to the DCIS by a simple operation when the staff return to the depot thus greatly improving the efficiency in processing drainage complaints and facilitating the monitoring of work progress.

Number of complaints on blockage of sewers received and dealt with in past years are shown in Appendix E.

As the Drainage Authority, DSD is responsible for vetting public and private developments with respect to their impacts on the sewerage system. We also provide advice, as necessary, on their connections to the public sewerage system. In 2002,we have processed over 24,380 sets of sewerage-related submissions and issued 197 demand notes for connections for new developments.

Operations and Maintenance of Sewage Treatment Facilities

DSD is currently operating about 218 sewage handling facilities including about 65 STWs scattered over HK in which pollutants in sewage are removed by various treatment processes so as to achieve the discharge requirements as specified in the discharge licences.

Location of major STW is shown in Appendix F.

	香港 HK Island	九龍 Kowloon	離島 Outlying Island	新界 New Territories	總數 Total
污水泵房／旱流截流器 Sewage Pumping Station/Low Flow Interceptor	30	30	14	79	153
初級處理廠 Preliminary Treatment Plant	11	9	1	3	24
一級處理廠 Primary Treatment Plant	0	0	2	0	2
化學輔助一級處理廠 CEPT Plant	1	1	0	0	2
二級處理廠 Secondary Treatment Plant	2	1	11	23	37
總數 Total					**218**

就污水處理的程度來說，初級處理或稱隔濾處理，基本上是清除污水內直徑6毫米或以上的雜物及比0.2毫米大的沙礫。一級處理則包括透過沉澱作用，進一步清除污染物。在昂船洲的化學輔助一級處理廠，處理過程使用化學添加物加速沉澱，比普通一級處理廠更有效地清除污染物。二級處理是對污水的生物處理，利用細菌把有機物變成穩定的物質並加以去除。

在2002年，我們共處理污水9億2千多萬立方米，其中28.7%接受初級處理、0.4%接受一級處理、54.5%接受化學輔助一級處理、16.4%接受二級處理。

海底排放管的運作和保養

全港現時共有43條海底排放管及兩條污水排放隧道，以受監管的方式有效地排放經處理的污水。我們定期檢查和保養海底排放管，以防止它們爆裂，而致污水外溢，使接收水體受到污染。要監察排放管渠的效能，其中一個有效辦法是乘直昇機視察渠管的色素測試。年內，我們曾為28所廠房的41條排放管和排放隧道進行色素測試，並維修4處滲漏的地方。此外，全面預防性保養計劃還包括定期進行水底檢查、水文聲納探測及清理排放管。

In terms of levels of treatment, preliminary treatment or screening basically removes large particles of 6 mm in diameter and above and grit over 0.2mm in size from the sewage. In primary treatment, further removal of pollutants is carried out by sedimentation. The Chemically Enhanced Primary Treatment (CEPT) plant at Stonecutters Island makes use of chemical additives to speed up and enhance the sedimentation process and, hence, achieves higher and faster removal pollutants than the normal primary treatment plants. Secondary treatment plants provide biological treatment to sewage in which organic matters are converted to stable substances by bacterial activities.

In 2002, we have treated a total of 923 million m^3 of sewage. 28.7%, 0.4%, 54.5% and 16.4% of the sewage received preliminary treatment, primary treatment, CEPT treatment and secondary treatment respectively.

Operations and Maintenance of Submarine Outfalls

There are a total of 43 submarine outfalls and two effluent disposal tunnels built for effective discharge of treated effluent in a controlled manner. To prevent pollution of the receiving water bodies caused by the leakage of effluent through cracked submarine outfalls, inspection and maintenance of the outfalls are carried out regularly. One of the effective means adopted for monitoring the performance of the outfalls is by helicopter inspection of dye test on the outfall pipes. Dye tests on 41 effluent outfalls and tunnels at 28 plants have been carried out during the year, and 4 detected leakage were subsequently repaired. In addition, underwater inspection, hydrographic sounding survey, regular flushing and desilting of outfalls have been carried out as scheduled in a comprehensive preventive maintenance programme.

淨化海港計劃

在1989年，污水策略研究建議實施「策略性污水排放計劃」(現改稱為「淨化海港計劃」)，利用深層隧道輸送系統，把收集自維多利亞港兩岸市區的污水輸送到一或兩個中央污水處理廠處理，然後才排放入香港南部水域。

該計劃是政府用以改善維多利亞港水質的主要措施，並將會分階段推行。第一階段主要是把九龍及港島東北部的污水收集並輸送到昂船洲污水處理廠作中央處理。計劃的餘下各階段是要收集和處理來自港島北部和西南部的污水，以及把污水處理的程度提高，以符合環保標準。

淨化海港計劃第一階段在1994年年中動工，內容包括七個現有初級污水處理廠的改善工程，以及長23.6公里的深層隧道輸送系統、昂船洲大型污水處理廠和一條長1.7公里的排放隧道的建造工程。這些設施可為350萬人提供服務。

深層隧道輸送系統建於地底深處，不但提供最短的路徑，還可減少在工程期間對市民大眾、環境生態、公用設施及交通系統等各方面所帶來的干擾和不便。隧道系統包括七條深層隧道，完成的直徑由1.2至3.5米不等，深度則介乎水平線下76至143米之間，最少由30米厚的石層覆蓋。其中最短的是由葵青通往青衣的隧道，以鑽爆方法建造，其餘六條隧道則以硬石隧道鑽挖機挖掘。由於隧道建造合約在1996年12月被收回，隧道工程嚴重受阻。而工程的進展，亦受到挖掘期間遇到的惡劣的地質情況所影響。雖然困難重重，但隧道工程終於在2001年12月全部完成，而第一階段計劃亦同時全面運作。現在每日經由深層隧道輸送到昂船洲污水處理廠處理的污水約有140萬立方米，處理後才經第一階段排放口排出西面海港。

Harbour Area Treatment Scheme (HATS)

In 1989, the Sewage Strategy Study recommended the Strategic Sewage Disposal Scheme [now renamed as HATS] to collect and convey all wastewater from the urban areas surrounding Victoria Harbour through a deep tunnel conveyance system to one or two centralized sewage treatment works for treatment, before final disposal to the waters south of Hong Kong.

The scheme is a major Government initiative to clean up Victoria Harbour and is to be implemented in stages. Stage I focuses on the collection and conveyance of sewage from Kowloon and the northeastern part of Hong Kong Island to Stonecutters Island for centralized treatment, while the further stages aim at collecting and treating sewage from the northern and southwestern parts of the Hong Kong Island, as well as providing a higher level of treatment for all the sewage in order to meet the environmental standards.

Construction of HATS Stage I commenced in mid-1994. It entailed the upgrading of seven existing preliminary treatment works and construction of a 23.6 km-long deep tunnel conveyance system, a large-scale sewage treatment works at Stonecutters Island and a 1.7 km-long outfall tunnel, serving a population of 3.5 million people.

The deep tunnel conveyance system was adopted not only to allow the shortest route to be chosen but also to minimise the disturbance and nuisance to the public, the environment, utilities, transport systems, etc. during construction. The tunnel system consists of seven deep tunnels of finished diameters from 1.2m to 3.5m and depths at 76m to 143m below sea level, and has a minimum rock cover of 30m. Except for the shortest tunnel section from Kwai Chung to Tsing Yi, which was constructed by drill and blast method, hard rock tunnel boring machines (TBMs) were used for excavating the other six tunnels. Owing to the forfeiture of the original tunnel contracts in December 1996, progress of the tunnel construction had been seriously disrupted. The tunnel progress had also been affected by the adverse geological conditions encountered during excavation. Despite all these problems and difficulties, all tunnels were successfully completed in December 2001 and the Stage I system has since been commissioned and put into full operation. It is now treating about 1.4 million cubic metres of sewage collected via the deep tunnels every day at Stonecutters Island before dispersing the treated effluent into the western harbour through the Stage I Outfall.

在1997年5月已啟用的昂船洲污水處理廠採用化學輔助一級處理程序，每日可處理達170萬立方米污水。該處理廠的工作效果卓越，是現時世界上同類型污水處理廠中最有效率的處理廠。而主泵房亦是亞洲區最大的地下泵房，每秒的抽水量達31立方米。

The Stonecutters Island Sewage Treatment Works, which was commissioned in May 1997, adopts a Chemically Enhanced Primary Treatment (CEPT) process and has a capacity for treating 1.7 million cubic meters of sewage each day. It is achieving excellent performance results and is the world's most efficient plant of its kind. Its main underground pumping station is also the largest in Asia having a pumping capacity of 31 cubic metres per second.

第一階段計劃全面啟用後，海港的水質已大為改善。溶氧量的水平已上升30%，而可能會引致紅潮的營養物水平亦已減少50%。此外，我們亦觀察到（在中區及東區對開的海港）毒性的氮及大腸桿菌已顯著減少。

Since the full commissioning of Stage I, there has been extensive and substantial improvement in the harbour water quality. The dissolved oxygen levels have risen by up to 30% whilst the nutrient levels which could lead to red tide, have been reduced by up to 50%. Significant reductions in the toxic ammonia and E Coli (in the central and eastern Harbour) have also been observed.

至於淨化海港計劃的餘下各階段，1999年完成的環境影響評估報告建議，把污水作化學處理並加上消毒，然後排放出南丫島東部。但有鑑於市民對上述建議的關注，特區政府遂成立第二個國際專家小組檢討以上建議。檢討已於2000年11月完成，建議應考慮將污水處理水平提升至更高的標準，把處理後的污水排放至維多利亞港以內的範圍。就此，國際專家小組提出四個備選方案，以不同程度的中央處理設備和排放地點以配合後期淨化海港計劃的發展。

As for the further stages of the Scheme, the Environment Impact Assessment Study, completed in 1999, recommended that chemical treatment enhanced by disinfection should be adopted and the effluent be discharged to the east of Lamma Island. However, in view of the public concerns regarding the above development plan, the Government commissioned a second International Review Panel (IRP) to review the proposed scheme. The review was completed in November 2000 recommending that consideration should be given to upgrading the treatment level to a higher standard and discharging the effluent within the harbour areas. On this basis, the IRP suggested four alternative plans with different degrees of centralization of treatment facilities and locations of outfalls for further development of HATS.

對於國際專家小組的建議，我們現已開始進行一連串的研究和試驗，協助制定未來淨化海港計劃的方向。其中包括環境和工程的可行性研究（由環保署負責），研究國際專家小組建議的可行性；以規模設備測試（由本署負責），以測試密集處理污水技術對香港污水的應用；及研究採購的選擇（由本署負責）以來確定最有效率和成效的採購程序。其中小規模設備測試已於本年二月完成，而其他兩項預計於2004年年初完成。其時政府會就各個方案進行全面的公眾諮詢，為淨化海港計劃選定最好的路向。

In response to the IRP's recommendations, a series of studies and trials are now being undertaken to assist in formulating the way forward for the subsequent stages of HATS. These include the environmental and engineering feasibility studies (by EPD) to investigate the viability of the IRP's options, the pilot plant trials (by DSD) to study the application of compact sewage treatment technologies for Hong Kong sewage, and the study on procurement options (by DSD) to identify the most efficient and effective procurement arrangement for implementing the further Stages of HATS. While the pilot plant trials were completed in February 2003, the other two studies are scheduled for completion by early 2004, at which time Government will undertake a full-scale public consultation on the various options before selecting the best way forward for HATS.

沙田污水處理廠第三階段擴建工程

沙田污水處理廠第三階段擴建工程現正進行得如火如荼。這個工程項目是由我們部門內部的專家應用當代的科技所設計；而在建造過程中，我們聘用了多個專業承辦商，並集合了來自不同專業背景的技術人員進行監管，包括土木和結構工程師、機電工程師、化驗師、建築師和環境科學家。此項大型的基建項目在設計和建造過程中遇上了種種的挑戰，例如如何克服土地的限制、減少臭味散發、工地環境控制、確保地盤安全（當中涉及深達11米的深層挖掘工程）以及提昇工人對健康和福利的意識。在第三階段擴建的設施多以鑽孔樁和小型樁柱作地基。各種高度自動化並揉合了嶄新資訊科技的設備亦會在擴建部份內安裝。

在進行這項工程期間，因為開展改善工程的原故，一些現有的設施需要停止運作，這對於已經超出負荷的沙田污水廠來說，無疑是運作上的一大挑戰。由於工程需要，兩組

現有的曝氣池須關閉至2004年，我們必需在這段期間確保經處理後的污水水質並不會因此而受到影響。為此，我們的操作人員致力令經處理的污水水質維持在可接受的水平。去年，我們成功地把經處理的污水中之總懸浮固體量和氮氣總量，控制在排污牌照所規定的限量內。

Sha Tin Sewage Treatment Works Stage 3 Extension

The construction of Sha Tin Sewage Treatment Works Stage 3 Extension is now in full swing. This project is designed by our in-house experts with the use of modern technologies and its construction is carried out by various specialist contractors with supervision by professionals of different disciplines, including civil and structural engineers, E&M engineers, chemists, architects and environmental scientists. This large scale infrastructure project has faced different challenges throughout its design and construction stages, such as overcoming land constraints, reducing odour emission, tightening up environmental control on site, ensuring construction safety (there are deep excavation works up to 11 metres) and promoting welfare and health awareness among workers. The structures constructed under the Stage 3 Extension are mainly founded on bored piles and minipiles. Various sophisticated equipment, which are highly automated and incorporating the most advanced information technology, will be installed in this project.

During the implementation of the project, some of the existing facilities have to be shut down temporarily for carrying out the necessary upgrading works. This is a challenge to the operation as the existing Sha Tin Sewage Treatment Works is already overloaded. We have to ensure that the effluent quality is not impaired while two of the existing aeration tanks are required to cease operation until 2004. As such, the staff of the operational team has paid extra effort to maintain the effluent quality to the acceptable standard. Last year, we successfully controlled the total suspended solids and the total nitrogen content of the effluent within limits imposed by the discharge license.

控制總懸浮固體量的所有操作措施均按下列原則而制定：

(a) 除去污水處理程序所產生的泡沫，以減少未能從污水中清除的固體；

(b) 防止在整個污水處理程序中出現腐化，以減少由細菌所形成的泡沫；

(c) 抑制高峰流量，以防止最後沉澱池超出負荷；以及

(d) 避免曝氣程序的後段出現過多曝氣，以防止固體在最後沉澱池上升。

為控制氮氣總量，操作人員採取了下列措施：

(a) 把來自污泥脫水程序的回流，即離心分離水份，引到兩個曝氣池中分別處理。回流的氨佔全廠所處理的氨的總量 15%；以及

(b) 在曝氣池的部分位置維持高於正常的溶氧水平，以加強硝化過程和應付額外負荷的需求。

操作人員的努力，不但令過去一年的經處理污水水質得以維持，而且更勝往年。

沙田污水處理廠第三階段擴建部分將於 2004 年和 2005 年分期啟用。屆時，沙田污水處理廠將會有一番新景象，經其處理的污水水質將得以改善，而散發出來的氣味亦會減少。工程亦會令沙田污水處理廠得以配合沙田和馬鞍山區的發展，繼續服務廣大市民。

All the operational measures for controlling total suspended solids were devised according to the following principles: -

(a) to remove the foam from the sewage treatment process such that the solids loss in the effluent is reduced;

(b) to prevent septicity throughout the sewage treatment process to reduce formation of bacteria foaming;

(c) to suppress the peak flow to prevent overloading the final clarifiers; and

(d) to avoid over-aeration at the end of the aeration process to prevent solids rising at the final clarifiers.

For total nitrogen control, the staff of operational team adopted the following measures:

(a) to divert the side stream return from the sludge dewatering process, known as centrate, to two aeration tanks for separate treatment. The side stream return represents 15% of the total ammonia loading to the plant; and

(b) to maintain higher than normal dissolved oxygen level in some parts of the aeration tank to enhance nitrification as well as to meet the extra loading demand.

With the efforts from the operational team, the effluent quality in the past year is not just maintained but improved when comparing with preceding years.

The Sha Tin Sewage Treatment Works Stage 3 Extension will be commissioned by phases in 2004 and 2005. With the commissioning of the Stage 3 Extension, the Sha Tin Sewage Treatment Works will have a new image. The effluent quality will be improved and odour emission will be reduced. With the Stage 3 Extension, Sha Tin Sewage Treatment Works is able to cope with the rapid development of Sha Tin and Ma On Shan District and continues serving the community.

昂船洲污水處理廠的表現

淨化海港計劃第一階段的深層隧道在2001年年底啟用後，葵涌、青衣、九龍半島、將軍澳、筲箕灣和柴灣的污水已可輸送至昂船洲污水處理廠作污水處理。在進行過一系列的化學品劑量、電子和機械設施的調整工作後，該廠自2002年3月起已開始穩定運作。

昂船洲污水處理廠在清除污水中的有機污染物方面非常有效，是世界上最有效率的化學輔助一級污水處理廠。在2002至03年度，昂船洲污水處理廠每日平均處理1百38萬立方米的污水，並產生超過600噸污泥，其中乾固體含量為35 %。平均清除生化需氧量的效率約為70% ，而清除總懸浮固體量的效率則約為80% 。這個成績比設計值，即35% 生化需氧量和70% 的總懸浮固體量為佳。

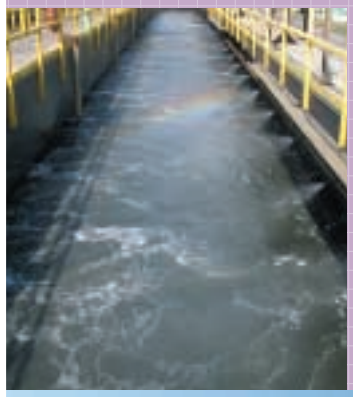
自從淨化海港計劃第一階段全面運作以來，雖然在污水排放口附近的大腸桿菌數量有輕微增加，但維多利亞港整體水質已大幅改善，其中溶氧量增加、整體大腸桿菌數量以及氮和磷的含量均已下降。

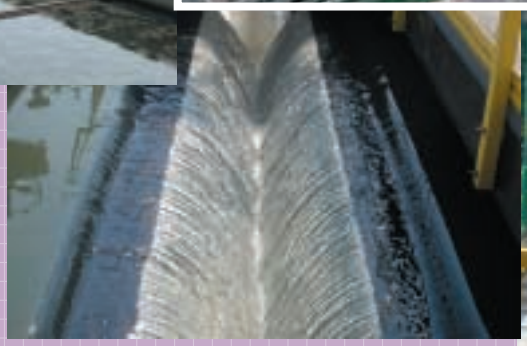
Performance of Stonecutters Island Sewage Treatment Works (SCISTW)

With the commissioning of the deep tunnels of the Harbour Area Treatment Scheme Stage 1 in late 2001, sewage arising from Kwai Chung, Tsing Yi, Kowloon Peninsula, Tseung Kwan O, Shek Kei Wan and Chai Wan are conveyed to the SCISTW for treatment. After a series of adjustments of the chemical dosing, electrical and mechanical facilities, the treatment works was put into stable operation since March 2002.

The SCISTW is very effective in removing organic pollutants from sewage and is performing as the most efficient CEPT plants in the world. In 2002/2003, the SCISTW treated an average of 1,380,000 cubic metres per day and produced over 600 tonnes of sludge with dry solids content of 35% daily. The average BOD_5 removal efficiency was around 70% while that for TSS was around 80%. These are better than the designed values of 35% for BOD_5 and 70% for TSS.

Since the full operation of the HATS Stage I scheme, there has been a significant improvement in the overall water quality in the Victoria Harbour area; including increase of dissolved oxygen, reduction of E.coli and reduction of nutrients in terms of nitrogen and phosphorus, although there is some increase of E.coli level at the vicinity of the sewage outfall.





石湖墟污水處理廠嚴格清除總氮量方面的操作經驗

石湖墟污水處理廠第一階段於1984年建成啟用，為22萬人提供污水處理服務（旱季污水流量每日6萬立方米）。第二階段工程的詳細設計工作於1995年進行，並於2001年年底完工。此階段的目標是要令石湖墟污水處理廠最終能為相等於30萬的人口提供污水處理服務（旱季污水流量每日80,000立方米），包括處理來自上水屠房的污水。我們有需要進行第二階段工程，以便提升第一階段工程的傳統活性污泥處理設施為使用經改良前置反硝化程序(MLE)的除氮設施。經改良的污水處理廠可清除進入該廠的污水中的碳質和氮質的污染物，甚至是大部分的大腸桿菌，以期達到更嚴格的排放規定，使排出后海灣的最終污染量減少。現有牌照所規定的污水條款概述如下：—

Shek Wu Hui Sewage Treatment Works Stringent TN removal operational experience

The stage I of the Shek Wu Hui Sewage Treatment Works (STW) to serve an equivalent population of 220,000 (a Dry Weather Flow of 60,000 m^3/day) was constructed and commissioned in 1984. The Stage II of the Works serving an ultimate equivalent population of 300,000 (a Dry Weather Flow of 80,000m^3/day) including the treated effluent from the Sheung Shui Slaughter House was planned for detailed design in 1995 and completed in end 2001. The Stage II of the Works was also required to upgrade the Stage I Works from a conventional activated sludge treatment plant to a nitrogen removal plant employing the Modified Ludzack-Ettinger (MLE) process. The upgraded STW is capable of removing both the carbonaceous and nitrogenous pollutants as well as the E.coli population exists in the incoming sewage in order to meet more stringent discharge requirements to minimise the pollution loading ultimately discharged to Deep Bay. The current licensed effluent conditions are summarized as follow: -

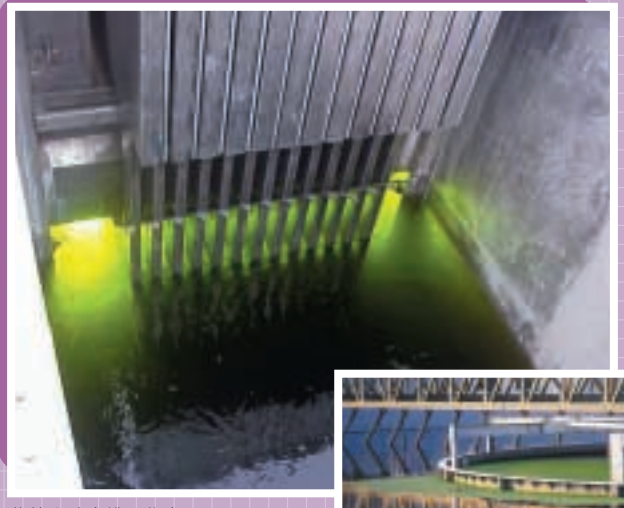
參數 Parameter	標準 Standard	標準類別 Type of Standard
生化需氧量（毫克／公升） BOD_5 (mg/L)	20/40	95百分位 / 最高 95 percentile/maximum
懸浮固體（毫克／公升） SS (mg/L)	30/60	95百分位 / 最高 95 percentile/maximum
氨氮（毫克／公升） NH_3N (mg/L)	2/4	95百分位 / 最高 95 percentile/maximum
硝酸鹽氮和亞硝酸氮（毫克／公升） NO_3N and NO_2N (mg/L)	12/24	95百分位 / 最高 95 percentile/maximum
大腸桿菌（數量／100毫升） E.coli (count/100ml)	100 1,500	（每月幾何平均數） (monthly geometric mean) 95百分位 95 percentile

污水經由直徑1,800毫米的污水渠，流入經改良的污水處理廠，然後由螺旋泵提升至污水入口設施。經過機械柵篩流入曝氣沉砂糟後，污水中的砂礫在糟內沉澱和分隔，之後再作另行處置。處理廠內共有八個一級沉澱池，用以除去可沉澱的固體和部分有機物。污水經過初級沉澱池後，被輸送到下游的生物反應池。四個生物反應池是根據 MLE 程序配置，其不曝氣的污水部分佔 33% 。在輸入曝氣區的空氣份量受到控制的情況下，生化池提供了最佳的環境給特定的微生物進行除碳和硝化程序。每個生物反應池的入水口均設有一個用以控制污泥膨脹的混合槽（生物選擇池），以防止絲狀細菌在生化反應池下游形成。在每個生化反應池內，從曝氣區出口流出的混合液，會經由水泵回流至缺氧區。在缺氧區內，經沉澱污水中的硝酸鹽會轉變成氮氣（脱硝作用）。廠內設有甲醇儲存和調配系統，在有需要時把受控份量的純甲醇放進缺氧區內，為脱硝作用提供額外的炭源。

經過生物處理過程後，污水流入八個圓形的最後沉澱池。在最後沉澱池內，混合液中的懸浮固體沉澱下來，而經淨化的經處理污水先在紫外光消毒槽消毒，然後才排放至梧桐河。

Sewage enters the upgraded STW via a 1,800mm gravity sewer and is lifted by screw pumps to the Inlet Works. After passing through the mechanical bar screens, the sewage flows into the aerated grit channels where grit particles are settled and removed for separate disposal. Eight primary sedimentation tanks are provided to remove the settleable solids and a portion of the organic load. After primary sedimentation, the sewage flow is conveyed to the downstream bio-reactors. The four bio-reactors are configured on the basis of the MLE process with an unaerated mass fraction of 33 percent, which provide optimum conditions for the growth of the specific mirco-organisms that perform the carbonaceous removal and the nitrification process in the aeration zone with air supplied at a controlled rate. A mixing chamber (bio-selector) for bulking control is provided at the inlet of each bioreactor to suppress the potential of the formation of filamentous bacteria in the down stream of the bio-reactor. In each bio-reactor, the mixed liquor from the outlet of the aeration zone is recycled by pumps to the anoxic zone. The nitrate in the settled sewage is then converted to nitrogen gas (denitrification) in the anoxic zone. A methanol storage and dosing system is installed and pure methanol will be dosed into the anoxic zone at a controlled rated in order to provide additional carbon source for denitrification, if necessary.

After the biological treatment process, the sewage enters the eight circular final sedimentation tanks. In the final sedimentation tanks, the suspended solids in the mixed liquor is settled and the purified final effluent is discharged to the River Indus after disinfection in the ultraviolet disinfection channels.



紫外光消毒槽運作中
UV lamps in operation

沉澱池
Sedimentation tanks

石湖墟污水處理廠 Shek Wu Hui Sewage Treatment Works

石湖墟污水處理廠一向有效地運作，而氨氣和大腸桿菌含量也比排污牌照所規定的為低。偶爾污水處理的效率會受異物的影響，包括可能來自附近工業區的有毒金屬以及在暴雨期間特別活躍多產的一種稱為腔輪蟲屬（輪蟲的一種）的微生物。遇到這種情況，我們會把生物反應池中的溶氧量和混合液懸浮固體量維持在高水平，以確保硝化作用的效率。在長遠改善方面，我們現正就酸鹼值控制對增強硝化作用的影響作研究，並進行生物選擇區運作的優化工作，以控制冒泡和污泥膨脹的現象。

縱然不時要應付各種突發情況，過去多年的運作經驗使我們對努力符合已收緊的污水排放標準充滿信心。此外，我們亦會繼續密切監察和控制系統的運作情況。

Generally, Shek Wu Hui STW has been operating effectively in the past year with the removal efficiency of ammonia-nitrogen and E. Coli better than that stipulated in the discharge license. There were occasions that the treatment efficiency was affected by foreign inhibitors, such as toxic heavy metal probably came from nearby industrial area, and a micro-organism called Lecane (a kind of rotifier) of which concentration was particularly high during heavy rainstorms. We managed to tackle these situations by maintaining the dissolved oxygen and MLSS levels in the bioreactors at higher levels in order to enhance the nitrification rate. For long-term improvement, a study on the effect of pH control for nitrification enhancement and the optimization of operation of the bio-reactor against foaming and bulking is being carried out.

The experience gained over the years of operation has strengthened our confidence, notwithstanding the endeavor to overcome occasionally difficult situations, in satisfying the stringent requirements of the discharge licence. With a view to maintaining the plant's operating efficiency, we shall continue to closely monitor the system operating conditions.