Hong Kong Government
Water Supplies Department

Agreement No. CE 30/94

Treatment and Disposal of Waterworks Sludge from Existing Water Treatment Works

Environmental Impact Assessment
Final Executive Summary Report

October 1995

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Improvement of Sludge Treatment and Disposal Facilities at Eastern, Red Hill, Shek Lei Pui, Tai Po Road, Tsuen Wan, Silvermine Bay, Tai O and Tuen Mun Water Treatment Works

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" Checked in accordance with MWHKL QP22

Project Manager "

INTRODUCTION

The majority of water treatment works in Hong Kong currently discharge their sludge without treatment into the sea either through the stormwater drainage system or via a stream course. This method of disposal does not meet discharge standards within declared Water Control Zones established under the Water Pollution Control Ordinance (WPCO). In order to achieve the discharge standards various sludge treatment and disposal options have been examined.

The Environmental Impact Assessment (EIA) of the construction and operation of proposed developments at eight water treatment works (WTW) was commissioned by the Government of Hong Kong, Water Supplies Department in December 1994. The EIA provides a systematic examination of the likely impacts of proposed developments to provide alternative, more environmentally friendly, disposal options for sludges generated at the WTW. Figure 1.1 shows the location of the proposed development sites and sludge disposal points.

The developments are largely in response to the introduction of legislation, limiting discharges to the Water Control Zones being introduced, with a view to improving coastal water quality, and to conform with inland freshwater discharge standards.

OBJECTIVES

The main objectives of the EIA are to:

1) identify the nature and extent of environmental impacts arising from the construction and operation of the proposed works.

2) propose suitable mitigation measures to limit those impacts identified to acceptable levels.

All but one of the developments were identified for EIA as a result of the preceding 'Feasibility Study of the Treatment and Disposal of Waterworks Sludge from Existing Water Treatment Works", commissioned by WSD in July 1993. The main objective of that study was to determine the best overall sludge disposal solution for fourteen WTW in Hong Kong; Eastern, Elliot, Red Hill, Sai Wan, Aberdeen, Silvermine Bay, Tai O, Shek Lei Pui, Tai Po Road, Tsuen Wan, Tai Po Tau, Tuen Mun, Yuen Long and Yau Kom Tau. Since Sai Wan and Yuen Long are to be decommissioned in April 1995 and May 1997 respectively, sludge treatment and disposal options for these works were not required.

Evaluations of the remaining 12 sites were based on a system to identify the Best Environmental, Engineering, Cost and Programming, Solution (BEECOPS).

The BEECOPS were then subjected to an Environmental Review which identified seven sites (the EA Sites) as requiring Environmental Assessment due to potentially significant impacts, mostly from construction works but in a few cases from the completed developments.

Identified as requiring EIA by the Environmental Review are the water treatment works at:

- Red Hill;
- Tsuen Wan;
- Shek Lei Pui;
- Tai Po Road;
- Tuen Mun;
- Silvermine Bay; and
- Tai O.

Further engineering examination of WTW sites resulted in the relocation of proposed facilities at Eastern WTW from an area of low environmental value, to an area within a forested slope. Therefore, developments at Eastern WTW were also included in the EIA Study.

The EIA study treats each of the eight water treatment works sites individually as, although developments at each site are for a common purpose, local conditions vary. Site specific considerations are fundamental when examining impact significance.

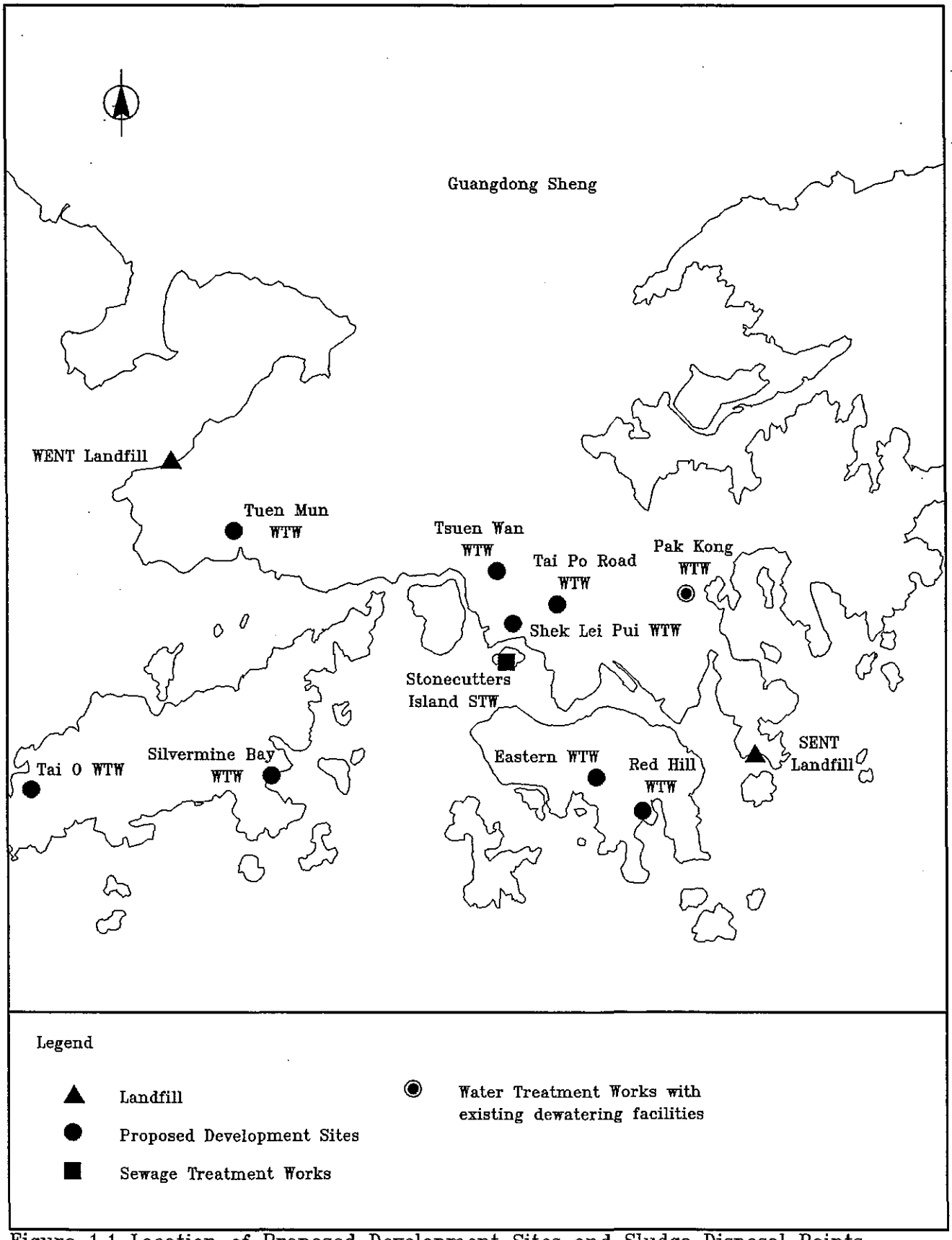

Figure 1.1 Location of Proposed Development Sites and Sludge Disposal Points

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WATER TREATMENT PROCESSES

Water treatment processes are examined in the report along with current sludge disposal methods. The majority of physical, biological and chemical contaminants are removed from raw water by sedimentation and filtration. These processes are assisted by the addition of solutions of aluminium sulphate (alum) and calcium hydroxide (hydrated lime) which cause contaminants to adhere together as "flocks". This improves the treatment processes. The resulting sludge, containing solids and organic matter removed from the raw water, must then be disposed. Current disposal methods are largely by release into nullahs, sewers or natural stream courses. This results in eventual release into the marine environment where the solids in the sludge can smother benthic marine creatures and reduce light levels by increasing turbidity. The sludge has a very low toxicity and, in the marine environment, no toxic action has been demonstrated.

Development proposals are to remove sludge solids prior to discharge to the sea by :

- **disposal to sewer** - ensuring sludge is transported by sewer to Sewage Treatment Works for sedimentation and dewatering;
- **thickening** - removing water from the sludge to allow it to be economically transported to another water treatment works for further treatment; and
- **dewatering**- removing water from the sludge to the point where it forms a clay like material (30% solid) which can be disposed of at a landfill site.

Each of these stages requires increasing levels of treatment, which in turn requires an increased level of infrastructure. Therefore, the proposed developments at sites where sewer transfer of sludge is proposed are of a smaller scale than those where sludge dewatering is the preferred option.

PROPOSED DEVELOPMENTS

The developments proposed for each site following BEECOPS evaluation are:

Eastern	Install thickeners and sludge holding tank. Tanker thickened sludge to existing press facility at Pak Kong WTW for dewatering. Sludge cake transported from Pak Kong by road to SENT landfill.
Red Hill	Install thickeners and sludge holding tank. Tanker thickened sludge to existing press facility at Pak Kong WTW for dewatering. Sludge cake transported by road from Pak Kong to SENT landfill.
Silvermine Bay	Provide thickening and dewatering on-site with enough capacity to include treatment of sludge from Tai O WTW. Sludge cake transported by barge to WENT landfill.
Tai O	Install washwater recovery facility and storage tank. Tanker unthickened sludge to Silvermine Bay WTW dewatering plant.
Shek Lei Pui	Pipe washwater to Tai Po Road for washwater recovery. Sludge transported via sewer. for treatment at SISTW* and disposal to WENT/SENT landfill.
Tai Po Road	Install washwater recovery tanks on site with enough capacity to include treatment of sludge from Shek Lei Pui WTW. Transport sludge from balancing tank via sewer for treatment at SISTW and disposal to WENT/SENT landfill.
Tsuen Wan	Install washwater recovery facility and balancing tank. Transport sludge from balancing tank through existing sludge pipe to a new sewer connection in Kwok Shui Road. Sludge treatment at SISTW and disposal to SENT/WENT Landfill.
Tuen Mun	Provide thickeners and dewatering facility for all sludge arising from Stage I-IV and Stage V works. Sludge cake transport to WENT landfill by road.

* Stonecutters Island Sewage Treatment Works

EIA APPROACH

Initially a review was carried out of: the environmental and engineering information

presented in the Feasibility Study; and, changes proposed since the study was completed. Site visits to gain first hand experience of the location, layout, and surroundings of the existing WTW, and of the proposed sites were then carried out.

Part of the EIA process involved confirmation of the appropriateness of the BEECOPS proposals. Where considered necessary alternative options were also identified. This was particularly significant in the case of Tai O WTW where a 'do-nothing' option was introduced following a review of baseline information.

The legislative background to the EIA was established and is included in the report. Legislation and official guidelines giving standards for noise and air quality standards and assessment methodologies were especially relevant to the study. Background information on issues which were highlighted as potentially significant was collected. This led to the identification of Key Issues for each site.

ENVIRONMENTAL LEGISLATION AND GUIDELINES

Air

The relevant legislation is contained in the Air Pollution Control Ordinance. With regard to dust levels, the daily Air Quality Objective (AQO) for Total Suspended Particulates (TSP) is 260 $\mu g\ m^{-3}$.

Noise

Legislation for the control of Noise is given under the Noise Control Ordinance. For general construction work, no noise restrictions are imposed during the day-time period (0700-1900, Monday to Saturday). A Construction Noise Permit (CNP) is required from EPD for work carried out during restricted hours or for percussion piling. ProPECC Practice Note PN2/93 states that noise levels at the facade of a dwelling and school, during unrestricted periods should not exceed 75 dB(A) and 70 dB(A) (65 dB(A) during examinations) respectively. These values represent the recommended criteria for the assessment of day-time construction activities.

KEY ISSUES

Key Issues are those which are likely to produce the most significant environmental impacts. Each site has been assessed individually for Key Issues as, although the proposed developments are for similar purposes, their scale, components and relation to neighbouring facilities, and therefore, their effects on the environment vary considerably.

Issues which, from earlier studies had been identified as of perceived concern but which proved not to pose significant environmental impacts were also identified. These included:

- transportation issues - sludge is mostly inert and cannot be classified as a health hazard, so no special facilities or requirements are necessary for its transportation; and

- odour - water treatment works sludge can be odorous if it has high levels of organic materials in it which are allowed to decay anaerobically. Sludge from the WTW involved in this study does not contain high levels of organic materials and is therefore, not odorous.

Key issues were further studied and quantitative techniques such as computer modelling applied to assess the extent of impact where possible.

EIA FINDINGS AND RECOMMENDATIONS

The following site specific assessments and mitigation recommendations are made in the report:

Eastern

Sludge thickening and tanker transport of thickened sludge off-site is proposed for Eastern WTW. Therefore, the scale of the development is limited. Key issues which were identified are:

- ecological damage, due to the necessary loss of tree cover;
- construction noise, due to the nearby Hong Kong Adventist Hospital; and
- fugitive dust emissions, also due to presence of the hospital.

Mitigation measures include:

- retention of as much existing vegetation as possible including an undertaking by the contractor to restrict disturbance beyond the area under development; and
- noise level monitoring during the construction process and the use of a silenced breaker at all times.

Fugitive dust modelling showed that emissions are unlikely to be a significant issue. However, as air quality is an important issue in Hong Kong, and any additional atmospheric dust is to be avoided if possible, dust suppression techniques were therefore recommended.

Red Hill

Sludge thickening and tanker transport of thickened sludge off-site is the proposal for Red Hill WTW. Therefore, the scale of the development is limited. Key issues are:

- construction noise, due to the nearby residential developments and school; and
- fugitive dust emissions, for the same reason.

Fugitive dust modelling proved that air emissions were unlikely to cause significant impacts. However, the poor access to the site was highlighted as an area of concern requiring special care by contractor's drivers. Informing local road users prior to the development, especially those at the Hong Kong International School was recommended.

Noise level modelling showed that monitoring during the construction process and use of silenced equipment should take place to prevent unacceptable impacts on nearby residential developments and the school. This would achieve a corrected noise level of < 68 dB(A) at the Hong Kong International School. Scheduling of noisy activities, in order to avoid sensitive periods such as examinations was also recommended.

Tsuen Wan

A new washwater recovery facility and balancing tank, and a new sewer connection to release the sludge for further treatment at SISTW is the proposal for Tsuen Wan WTW. This limits the scale of the development. Key issues are:

- traffic impacts, during sewer connection at Kwok Shui Road ;
- potential visual impacts, as the site is on a hill crest; and
- potential ecological impacts, due to mature vegetative covering on the borders of the proposed site.

Mitigation measures include:

- co-ordination with the factory owner and authorities over the timing of the construction of the sewer connection;
- retention of all existing vegetation including an undertaking by the contractor to restrict disturbance beyond the area under development. This prevents ecological damage and limits potential visual impacts; and
- noise level monitoring during the construction process.

Fugitive dust modelling showed that emissions are unlikely to be a significant issue. However, dust suppression techniques were recommended.

Shek Lei Pui

Development is limited to a pipeline for the transfer of sludge to the nearby Tai Po Road WTW where more space is available for sludge treatment facilities. Most of the pipeline route

is along a road belonging to the WSD thus minimising ecological damage. The road neighbours Kam Shan Country Park and is used by the public as an access route into the park. Monkeys are also found in the area.

Key issues were identified as:

- traffic/access, due to the necessary closure of a section of the WTW access road;
- ecology, due to the local monkey populations and concerns expressed by the Agricultural and Fisheries Department over the effects of the development on Kam Shan Country Park; and
- archaeology, due to the presence of graded historical structures adjacent to proposed developments.

Mitigation measures include:

- liaison with the country parks service, and posters to inform the public of the development, and suitable barriers to restrict public access to minimise impacts of the road closure and ensure public safety;
- Contractors briefed on dangers of the access roads, including the presence of the public and monkeys.

The graded structures will not be affected.

Tai Po Road

Facilities for washwater recovery, including that received from Shek Lei Pui, and a pipe connection to sewer are proposed. Key issues are:

- construction noise, due to the nearby Sir Robert Black College of Education and residential development at 2, Caldecott Road; and
- fugitive dust emissions, for the same reasons.

Noise level monitoring during the construction process and the use of silenced equipment, was recommended. This would enable the corrected noise level at the Sir Robert Black College of Education to fall below 70 dB(A). Scheduling of noisy activities, in order to avoid sensitive periods such as examinations was also recommended.

Fugitive dust modelling showed that emissions may be a significant issue therefore dust suppression techniques were recommended.

Part of the pipe route is through a sitting out area and care by the contractors to minimise disturbance during construction is recommended along with prior notice to public using the area. Some landscaping work on the site may be appropriate, post construction.

Tuen Mun

Sludge thickening facilities and a dewatering house are proposed. Key issues were identified as:

- construction and operational noise, due to the nearby high rise residential development at Grandeur Gardens;
- fugitive dust emissions, for the same reason; and
- visual impacts, for the same reason.

Mitigation measures include:

- fugitive dust control methods;
- noise level monitoring during the construction process and the use of acoustic barriers if found necessary;
- building finishes to blend with existing structures; and
- reorientation of the dewatering house to locate sludge loading bays away from the residential area.

Use of construction equipment should be controlled in order to achieve noise levels below 75 dB(A) at Grandeur Gardens Estate.

Silvermine Bay

Sludge thickening facilities and a dewatering house are proposed. Key issues are:

- traffic impacts, as the main access road to the proposed site is restricted; and
- visual impacts, as the proposed development will be visible on the skyline of Silvermine Bay.

Mitigation measures include:

- contractors briefed on dangers of narrow roads, presence of the public and tourists; and
- design of visible parts of the development to blend with existing structures.

The area was found to be within the Silvermine Bay archaeological site, so liaison with the Antiquities and Monuments Office during excavation has been proposed. Three She Oak trees worth preserving are present on the site. Careful design has enabled the works to be fitted around them.

Tai O

Washwater recovery and storage with tanker transport of sludge off-site was identified as the proposed BEECOPS option for Tai O. The BEECOPS recommendation was made given the information thought correct at the time. Tai O WTW washwater was thought to discharge into a stream running alongside Tai O Road which flows through ponds and finally to the sea.

During the preliminary design stage of this project it was found that Tai O washwater did in fact discharge on to a piece of land on the hillside some 73 m above sea level. In addition, although the rated output of Tai O WTW is 2 MLD it generally operates at 1 MLD, reducing the amount of estimated waste by half. In view of these facts an alternative 'do-nothing option' has also been considered in the Environmental Impact Assessment process.

'Do-Nothing' Option

An average of 14 m^3 of washwater/day is released from Tai O WTW onto the side of the hill below the WTW. This flow is currently dispersed and absorbed by the vegetation on the hillside below the pipe mouth. It is unlikely that any of the sludge reaches any waterways or the sea. The vegetation on the hillside does not seem to be adversely affected by the presence of the sludge.

In order to assess the possible impacts that the release of sludge might be having on the vegetation on the hillside, which was not obvious to a visual inspection, the scientific literature was searched for examples of studies into the application of WTW sludge to land.

Three major, recent, studies were identified. The studies included the treatment of land, varying from pine forest to crop growing arable land with water treatment works sludge. Their findings included:

- *no significant differences could be detected in the chemical content of the pine tissue of trees grown on control plots versus sludge - amended soils;*
- *alum sludge land application did not cause migration of metals;*
- *no effects were observed with respect to pine tree growth;*
- *nitrate levels in ground and soil water did not increase due to sludge application;*
- *phosphorus did not seem to be limiting as enough was available to buffer the sludge and provide the necessary amount for proper tree growth; and*
- *no nutrients or heavy metals were present in grains, and that concentrations in whole plants and leaves were generally not significantly increased by the sludge applications.*

The study findings suggested '*Land application of alum sludge appears to be a*

viable method (of disposal) with no apparent environmental degradation'.

This study has indicated that the existing sludge disposal facilities at Tai O are not causing significant environmental damage.

However, in order to confirm whether the current disposal method is causing any detrimental impacts to the surrounding vegetation, further investigation is required.

BEECOPS Proposal

The proposed BEECOPS option involves transfer of sludge via tanker to Silvermine Bay for dewatering. The key issues identified were:

- ecological damage, as some trees will have to be removed to provide a site for the new development;
- construction noise, due to the proximity of some of the development to the Buddhist Fat Ho Memorial College; and
- traffic issues, due to the likelihood of construction materials being brought along South Lantau Road and there being no road access to the site.

Mitigation measures include:

- tank construction adjacent to Buddhist Fat Ho Memorial College to be carried out during school holidays.

In order to establish whether continuation of the current disposal method is less environmentally friendly than the proposed BEECOPS development it is recommended that a scientific monitoring programme be undertaken at the site. Identification of the preferred option for Tai O will only be concluded following assessment of the monitoring results.

ENVIRONMENTAL MONITORING AND AUDITING

Environmental monitoring and audit shall be carried out by the project proponent at each site in order to assess the effectiveness of the mitigation measures employed during the construction phase at the various WTW.

In order to ensure compliance with relevant environmental quality objectives, an Action Plan has been developed. The Action Plan is based on Trigger, Action and Target (TAT) Levels, and provides for appropriate corrective action to minimise environmental impacts where necessary.

Environmental Audit Requirements

To ensure the implementation of the environmental mitigation measures recommended, audit of the implementation shall also be carried out by the project proponent.

前　言

目前，香港大多數濾水廠將未經處理的淤泥，經雨水渠系統或溪流排入海中。這種處置方法並不符合根據「水污染管制條例」建立之水質管制區內的排放標準。爲了達到排放標準，本研究考慮了各種淤泥處理及棄置方案。

一九九四年十二月，香港政府水務署對八個濾水廠進行了擬建工程的建設及運作的環境影響評估。這次環境影響評估，系統地研究擬建工程對環境可能產生的影響，並就濾水廠產生的淤泥，提出更能保護環境的替代處置方案。擬建工程所在地點及濾水廠淤泥處置地點見圖1.1。

建議中的工程主要是爲了響應新制訂的法例及達到法例指定的內陸淡水排污標準而進行的。該法例限制排污進入水質管制區，藉以改善沿岸水域水質。

目標

這次環境影響評估的主要目標爲：

1) 鑒定由擬建工程的建設及運作所引起的環境影響的性質及程度。

2) 提議適當的舒緩措施，把已被鑒定的影響限於可以接受的程度。

各有關工程（除其中一項）早於水務署在一九九三年七月委託進行的“現有濾水廠淤泥的處理及棄置之可行性研究”中被確定應當進行環境影響評估。該次研究的目標，是爲東區、西區、紅山、西灣、香港仔、銀礦灣、大澳、石梨貝、大埔道、荃灣、大埔頭、屯門、元朗及油柑頭全部十四個在香港的濾水廠找出最理想的總體淤泥處置方案。由於西灣及元朗濾水廠將分別於一九九五年四月及一九九七年五月停止使用，故此無需要提出這兩座濾水廠的淤泥處理及處置方案。

研究把餘下的十二個濾水廠根據一個系統作出衡量，以找出在環境、工程、成本及計劃方面的最佳方案（“最佳方案”）。

然後再對這批“最佳方案”作出初步環境評核，初步評核確定七個濾水廠地點（環境評估地點）因可能引致明顯的環境影響，需要進行環境評估。這些影響大多來自建設工程，但是在幾種情況下卻來自建成的濾水廠。

初步環境評估中指出需要進行環境影響評估的濾水廠位於：

- 紅山；
- 荃灣；
- 石梨貝；

- 大埔道；
- 屯門；
- 銀礦灣；以及
- 大澳。

由於對濾水廠廠址進行工程覆查的結果，東區濾水廠擬建工程的位置已從一個環境價值較低的地區移到一個樹木覆蓋的山坡上。因此，東區濾水廠的擬建工程亦列入環境影響評估研究範圍內。

本環境影響評估研究對該八個濾水廠進行個別研究，其理由是：雖然在各個濾水廠進行的工程都有相同的用途，但現場條件卻有所不同。對濾水廠地點的考慮在評審影響時尤其重要。

水處理過程

本報告同時研究水處理過程與現行的淤泥處置方法。原水中含有的物理、生物及化學污染物，大部份經沉澱及過濾之後已被清除。沉澱及過濾過程中加入硫酸鋁(明礬)及氫氧化鈣(熟石灰)溶液，使污染物黏合在一起，形成“絮狀物”，從而改善處理過程。經此產生的淤泥，含有從原水中清除的固體及有機物質，必須棄置。目前的棄置方法，主要是將淤泥排入河道、污水渠或天然溪流。這種方法，最終把淤泥排入海洋環境，而淤泥所含的固體物，可以使棲居海洋底層的生物窒息，還會增加海水混濁度，降低透光度。然而，淤泥所含毒性極低，海洋環境中並未發現任何毒性現象。

在排放入海前，清除淤泥固體的工程方案包括：

- **排入污水渠**—確保淤泥經污水渠送抵污水處理廠作沉澱及脫水處理；
- **濃縮**—除去淤泥所含的水份，以便以較低成本將它們運送到其它濾水廠作進一步處理；以及
- **脫水**—除去淤泥所含的水份，使其形成黏土狀物質(30%固體)，使之可棄置於堆填區。

上述各項步驟的處理水平逐步提高，因而需要的基礎設施也相應增加。因此，建議採用污水渠輸送淤泥方案的各個地點，其擬建工程的規模，比較採用淤泥脫水法的擬建工程爲小。

擬建工程

依照“最佳方案”而釐定的濾水廠的擬建工程爲：

東　區　裝置濃縮池及淤泥儲存池。用運輸車將經濃縮的淤泥運到北港污水處理廠，使用現有的壓濾機脫水。將淤泥餅從北

港經陸路運往新界東南堆填區。

紅　山　裝置濃縮池及淤泥儲存池。用運輸車將經濃縮的淤泥運到北港污水處理廠，使用現有的壓濾機脫水。將淤泥餅從北港經陸路運往新界東南堆填區。

銀礦灣　在現場設置具有足夠處理能力的濃縮及脫水設施，處理包括大澳濾水廠送來的淤泥。淤泥餅用駁船運到新界西堆填區。

大　澳　設置廢水回收設施及儲水池。用運輸車將淤泥運往銀礦灣濾水廠的淤泥脫水廠。

石梨貝　用水管把廢水輸送至大埔道濾水廠作廢水回收處理。淤泥經污水管送往昂船洲污水處理廠，最後棄置於新界西/新界東南堆填區。

大埔道　在現場闢建具有足夠容量的廢水回收池，處理包括石梨貝濾水廠送來的廢水。均衡池產生的淤泥，經污水渠送往昂船洲污水處理廠處理，最後棄置於新界西/新界東南堆填區。

荃　灣　設置廢水回收設施及均衡池，均衡池的淤泥經現有的淤泥管，送往位於國瑞路的一個新的污水渠連接處。經昂船洲污水處理廠處理後將棄置於新界東南/新界西堆填區。

屯　門　提供濃縮及脫水設施，處理由濾水廠第一期至第四期及第五期產生的全部淤泥。淤泥餅經陸路運往新界西堆填區。

環境影響評估方法

首先，檢查“可行性研究”陳述的環境及工程資料；考察自從該項研究完成以來提議的各項變更；然後進行現場視察，以便直接獲得關於現有濾水廠及擬定地點的位置、佈置及周圍環境的資料。

在環境影響評估過程中，還要確認“最佳方案”的適用性。如認爲需要，亦指出替換的方案。這種做法對大澳濾水廠特別重要，因爲在檢討基本資料之後，研究建議了一個“維持現狀”的方案。

確立這次環境影響評估的法律背景，並將其列入報告之中。列出與這次研究特別有關的噪音與空氣質素標準和評估方法的法例及

官方指引。收集具有潛在重要意義的問題的背景資料。藉此找出每個地點的關鍵問題。

環境法例及官方指引

空氣

有關的法例規定列於「空氣污染管制條例」中。在塵埃含量方面，每日空氣質素指標規定的總懸浮粒子爲260微克/立方米。

噪音

噪音管制的法律規定列於「噪音管制條例」中。對於一般建設工程，日間(星期一至星期六早上七時至下午七時)沒有噪音限制。在限制時段內進行的建設工程，以及對於撞擊式打樁工程，環境保護署要求承建商領有建築噪音許可證。「專業人士環境諮詢委員會」（ProPECC）發出的「作業須知」（PN2/93）規定，住宅及學校的立面噪音水平，在非限制時段內，分別不得超過75分貝及70分貝（考試期間不得超過65分貝）。這些數值是建議日間建築施工評估所應採用的標準。

關鍵問題

關鍵問題是指可能產生的重大環境影響。研究對每個地點都已作了關鍵問題的個別評估。雖然各個擬建工程具有相似的用途，但是它們的規模、組成與鄰近設施的關係以及它們對環境的影響程度差異頗大。

本研究並且列出曾在較早期研究中被認爲值得注意但後來證明不會對環境產生重大影響的問題。它們包括：

- **運輸問題**—淤泥大多屬於惰性，不能列爲危害健康物質，因此不必使用專用的運輸設施。

- **臭味**—如果淤泥中含有大量可經厭氧腐變的有機物質，則濾水廠淤泥可能帶有臭味。這研究所涉及的濾水廠淤泥，不含大量的有機物質，因此沒有臭味。

在可能情況下，研究對關鍵問題作深入探討，並且利用電腦模擬技術等定性技術來評估影響的程度。

環境影響評估的結果及建議

本項報告列出以下地點的特定評估及舒緩措施：

東區

建議東區濾水廠採用的方案是首先將淤泥濃縮並用運輸車把經濃縮後的淤泥運走。因此，該項工程規模有限。已確定的關鍵問題是：

- 生態損害，是由於需要去除林木障礙所致；

- 建築噪音，是由於靠近港安醫院所致；以及

- 塵埃飛揚，亦由於上述醫院的存在所致。

舒緩措施包括：

- 盡可能保存現有植物，包括承建商承諾對於發展區域以外的區域所受干擾加以限制；及

- 監測建築施工期間的噪音水平，必要時採用經靜音或消音的破碎機。

塵埃飛揚模擬試驗顯示，逃溢的塵埃不會成主要的問題。然而，由於空氣質素是香港的一個重要環境命題，如果可能，必須避免增加大氣中的塵埃量。因此建議採用減少塵埃技術。

紅山

紅山濾水廠擬採用運的方案是將淤泥濃縮，然後用運輸車將經濃縮後的淤泥運走。該項工程規模有限，涉及的關鍵問題包括：

- 建築噪音，由於接近住宅區的緣故；及

- 塵埃飛揚，原因同上。

塵埃飛模擬試驗顯示，經空氣散發不大可能造成重大的影響。但是，工地進出通道不暢通的問題應加以關注，承建商司機必須特別小心。研究建議在工程施工之前，通知當地的道路使用者，特別是香港國際學校的道路使用者。

噪音水平模擬試驗顯示，建築施工過程中應監測噪音水平，並採用經靜音或消音的儀器，以防產生對鄰近住宅區及學校不能接受的影響。這個做法將使香港國際學校所在地點的修正噪音水平低於68分貝。水務署亦建議對產生強烈噪音工程的施工作出安排，避免在敏感時期（例如考試期間）施工。

荃灣

荃灣濾水廠擬採用的方案是使用一組全新的廢水回收設施及均衡池，以及接駁一條新的污水渠，把淤泥送往昂船洲污水處理廠再加處理。這個方案將限制工程的規模。關鍵問題是：

- 在國瑞路進行污水渠連接工程時產生的交通影響；

- 潛在的視覺影響，此乃由於該地點位於山嶺所致；以及

- 潛在的生態影響，這是由於擬用地點邊界已有成長的植被所致。

舒緩措施包括：

- 與工廠業主及主管機構協調污水渠連接工程的時間安排。

- 保留現有的植被，包括承建商承諾對於發展區域以外的區域所受干擾加以限制，以防生態受到破壞及限制可能產生潛在的視覺影響；以及

- 監測建築施工過程中的噪音水平，必要時採用經靜音或消音的破碎機。

塵埃飛揚模擬試驗顯示，塵埃的飛揚不會成爲一個重要的問題。不過，仍建議採用減少塵埃技術。

石梨貝

工程限於敷設水管，以便將淤泥輸送到附近的大埔道濾水廠，該廠有更多的地方可以設置淤泥處理設施。這條水管的大部份管段是沿著屬於水務署的一條道路敷設，因此生態所受的破壞可以減至最小。這條道路鄰近金山郊野公園，是市民進出公園的通道。該地區內亦發現猴子出沒。

已確定的關鍵問題爲：

- 交通/進出方面，由於必須封閉濾水廠出入通道的一個路段所致；

- 生態方面，由於該處有猴子出沒，並且漁農處相當關注該項工程對金山郊野公園的影響；以及

- 考古學方面，由於擬建工程毗鄰地方存在受保護的歷史建築物。

舒緩措施包括：

- 與郊野公園管理處聯絡，張貼海報使市民知悉該項工程，並且設置適當的屏障以限制市民出入，把路段封閉所產生的影響減至最小，並且確保市民的安全。

- 向承建商簡述出入通道存在的危險，包括簡述市民及猴子的存在。

受保護的歷史建築物將不會受影響。

大埔道

建議興建廢水回收設施，包括接收石梨貝濾水廠送來的廢水，以及一條與污水渠連接的水管。關鍵的問題爲：

- 建築噪音，由於接近柏立基教育學院及郝德傑道二號的住宅區所致；以及

- 塵埃飛揚，原因同上。

建議監測建築施工過程中的噪音水平，必要時採用經靜音或消音的工具。這個做法可使柏立基教育學院所在地點的修正噪音水平低於70分貝。水務署亦建議對產生強烈噪音工程的施工作出安排，避免在敏感時期（例如考試期間）施工。

塵埃飛揚模擬試驗顯示，塵埃飛揚可能成爲一個重要的問題，因此建議採用減少塵埃技術。

一部份水管路線穿過一個休憩處，建議承建商應注意在建築期間把滋擾減至最小，並且向使用休憩處的市民發出預先通知。工程完成後，適宜在該地點進行一些綠化工程。

屯門

建議興建淤泥濃縮設施及一個壓濾廠，將淤泥脫水。關鍵問題爲：

- 建築及運作噪音，由於附近有偉景花園的高層住宅樓宇所致；

- 塵埃飛揚，原因同上；以及

- 視覺影響，原因同上。

舒緩措施包括：

- 塵埃飛揚的控制方法；

- 監測建築施工過程中的噪音水平，必要時採用隔音屏障；

- 採用與現有建築結構適配的建築外部裝飾；以及

- 重新確定脫水廠的位置，將淤泥裝卸區遷離住宅區。

必須管制建築施工設備的使用，使偉景花園所在地點的噪音水平處於75分貝以下。

銀礦灣

建議興建淤泥濃縮設施及一個脫水廠。關鍵問題爲：

- 交通影響，由於進出擬用地點的主要通道是出入受到限制的道路；以及

- 視覺影響，由於擬建工程的輪廓在銀礦灣的背景上明顯可見。

舒緩措施包括：

- 向承建商簡述關於狹窄道路、市民及遊人存在所帶來的危險。

- 該項工程的可見部份，採用與現有結構適配的設計。

本區位於銀礦灣考古地點的範圍內，因此，建議在挖土期間與古物及古蹟辦事處聯絡。該地有三株值得保存的木麻黃樹。經精心設計，已能繞著這些樹木佈置有關設施。

大澳

水務署提出設置廢水回收及儲存設施，用運輸車把淤泥運走。作爲大澳濾水廠的“最佳方案”。這個“最佳方案”，是根據當時認爲正確的資料提出的，當時以爲大澳濾水廠排出的廢水是排入大澳路旁的一條溪流，然後流經一些池塘，最後排入大海。

在工程的初步設計階段，發現大澳濾水廠實際上把廢水排至海拔約73米的山坡上的一片土地。除此之外，雖然大澳濾水廠的額定產水量爲每天二百萬公升，但是通常每天只產水一百萬公升，廢水排放量僅爲估計排放量的一半。由於上述事實，在環境影響評估過程中，亦曾經考慮一個“維持現狀”的代替方案。

“維持現狀”方案。

大澳濾水廠平均每天將14立方米的廢水排至濾水廠下面的山坡。目前，這些廢水由排水管口下面的山坡上的植物分散及吸收。看來任何淤泥不大可能進入任何水道或海洋。山坡上的植物似乎未因淤泥的存在而受到不良的影響。

儘管很難單憑肉眼的檢查方法來觀察淤泥排放對山坡上植物可能產生的影響，爲了評估這種影響，顧問公司已從科學文獻中找尋關於將濾水廠淤泥在陸地上應用的研究實例。

從文獻中查獲三項主要的近期研究，這些研究包括土地的處理、自松樹林以至農作物栽培可耕地使用濾水廠淤泥等不同的土地處理形式。研究結論包括：

- *在受管制的土地上生長的松樹樹木組織中的化學物含量，與在淤泥調配土壤上生長的松樹未有任何明顯的差別；*
- *加入明礬淤泥的土壤，不會引起金屬遷移；*
- *並未發現松樹生長的任何影響；*
- *加進淤泥不會增加土壤及地下水的硝酸鹽含量；*
- *含磷量看來並非限制因素，因爲已有足夠的含磷量作爲淤泥的緩衝劑，並且爲樹木的正常生長提供必需的磷；以及*

- *穀物不含有機污染或重金屬，而加進淤泥以後，並未明顯提高整株植物及樹葉所含的有機污染及重金屬濃度。*

研究結果作出的建議是：*"土壤施用明礬淤泥，看來是一種可行的（棄置）方法，不會造成環境明顯惡化"*。

這次研究顯示：大澳濾水廠現有的淤泥處置方法，並未造成嚴重的環境損害。

然而，爲了確定現行的淤泥處置方法是否對周圍植物有不利影響，仍要作進一步的調查研究。

"最佳方案"

"最佳方案"建議用槽車把淤泥運到銀礦灣脫水。查明的關鍵問題爲：

- 生態破壞：由於必須砍掉一些樹木，爲新工程提供場地；
- 建築噪音：由於工程部份設施靠近佛教筏可紀念中學；以及
- 交通問題：沒有道路可到達施工現場，建築材料可能要沿嶼南道運入。

舒緩措施包括：

- 與佛教筏可紀念中學毗鄰的水缸，應在學校放假期間建造。

爲了確定繼續採用現行的淤泥處置方法對環境的影響，是否比"最佳方案"小，建議在現場採用一套科學的監測計劃。只有在對監測結果作出評估後，才能找出適用於大澳濾水廠的優選方案。

環境監測及評審

工程主管部門必須在每座濾水廠所在地點進行環境監測及評審，以便評估在各個濾水廠建築期間所採用的舒緩措施的有效性。

爲了確保工程符合有關的環境質素指標，已經制訂一項行動計劃。這項計劃是依據「啓動、行動及目標」（TAT）水平制訂，規定在必要時採取適當的糾正行動，把環境影響減少到最低程度。

環境評審要求

爲確保建議採用的環境舒緩措施付諸實施，工程主管部門必須檢查有關措施的執行情況。

圖1.1之圖文譯文：

圖1.1 擬建工程地點及淤泥棄置地點

Legend 圖例
Landfill 堆填區
Proposed Development Sites 擬建工程地點
Sewage Treatment Works 污水處理廠
Water Treatment Works with existing dewatering facilities 目前擁有淤泥脫水設施的濾水廠

Eastern WTW 東區濾水廠
Guangdong Sheng 廣東省
Pak Kong WTW 北港濾水廠
Red Hill WTW 紅山濾水廠
SENT Landfill 新界東南堆填區
Shek Lei Pui WTW 石梨貝濾水廠
Silvermine Bay WTW 銀礦灣濾水廠
Stonecutters Island STW 昂船洲污水處理廠
Tai O WTW 大澳濾水廠
Tai Po Road WTW 大埔道濾水廠
Tsuen Wan WTW 荃灣濾水廠
Tuen Mun WTW 屯門濾水廠
WENT Landfill 新界西堆填區