從通識科去看

中國內地和香港的水資源及水污染問題

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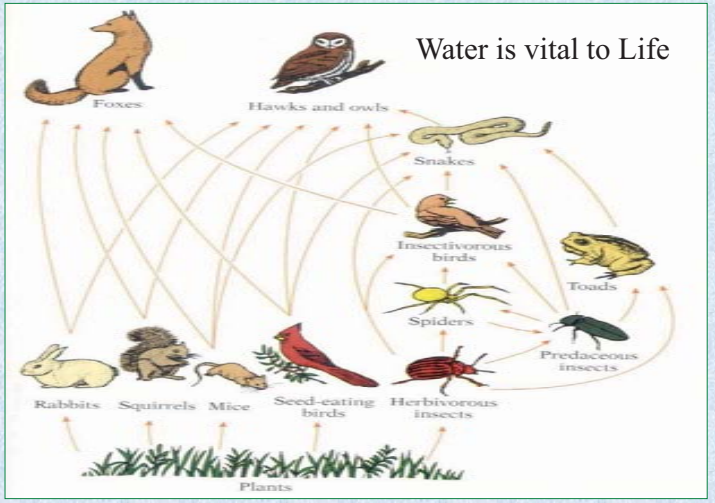
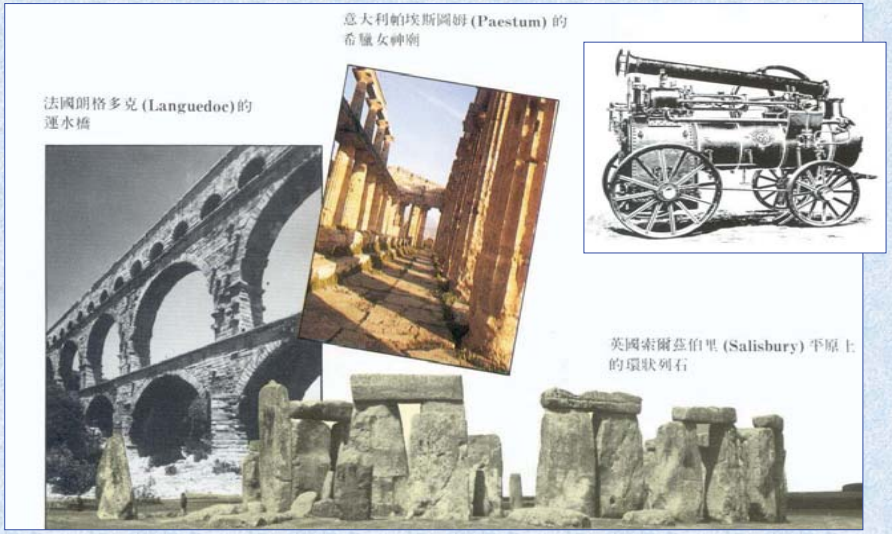
Let us begin from: How important is Water ? of vital importance:

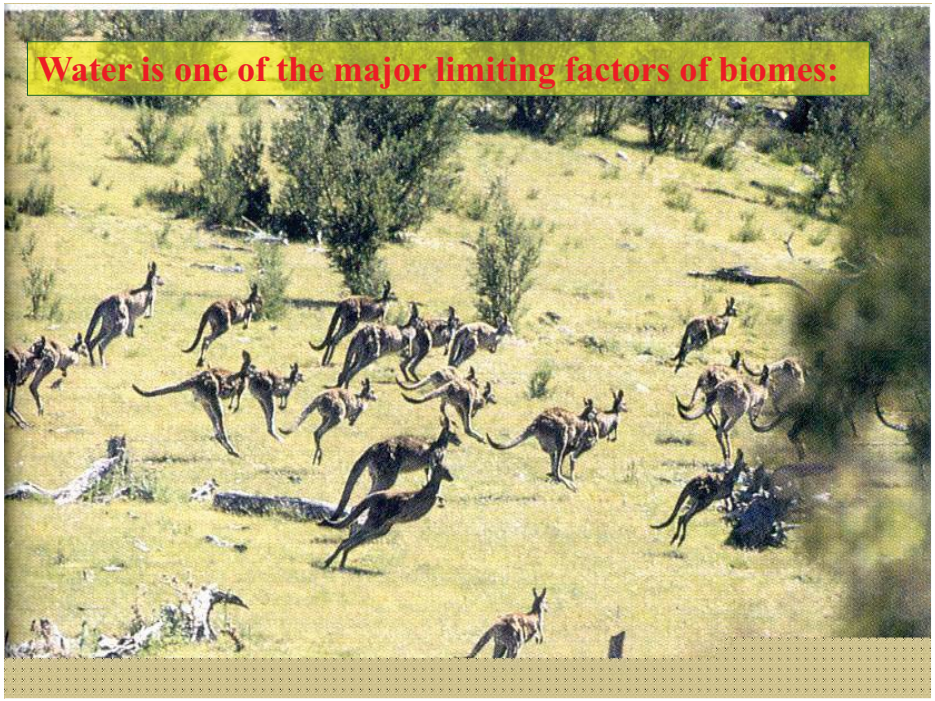


Water is closely associated with civilization:



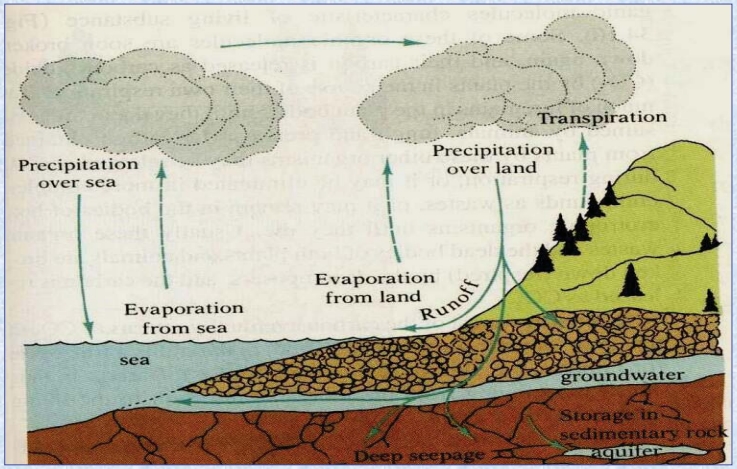
Water is essential for social and economic developments :

Water is one of the major limiting factors of biomes:

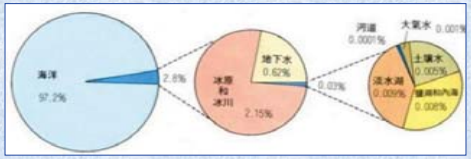


Where can we find Water?

Water transmits and transforms actively within the hydrological cycle:



How much Water do we have?



Global Water Balance: The Water Budget

	Reservation (Km^3)	Transmission (Km^3/a)	Retention (year)
Ocean	11,349,929,000 (97.5%)	418.000	3,200
Ice & Glaciers	24,230,000 (1.75%)	2,500	9,600
Groundwater	10,100,000 (0.73%)	12,000	830
Soils	25,000 (0.0018%)	76,000	0.3
Lake and ponds	219,000 (0.016%)	--	a few to a few hundred days
Rivers, streams & other runoffs	1,200 (0.0001%)	35,000	13 days
Vapor	13,000 (0.001%)	483,000	10 days
Total	1,384,517,000 (100%)	-	-

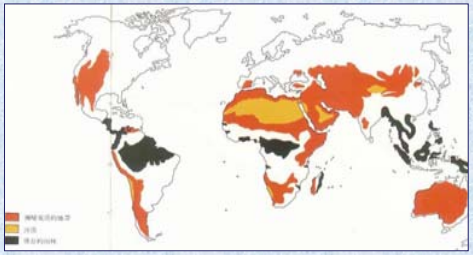
What happened with our Earth and Water ??

What are the Major Issues and Challenges:

- General water shortage (水資源不足)
- Flooding and drought (uneven distribution of water resources) (乾旱和滂滂)
- Water supplies and distribution (供應和分配)
- Water quality deterioration (水質污染)
  - ➢Point source pollution
  - ➢Non-point source pollution
- Public health and sanitary issues (公共衛生和健康)
- Global climate changes (氣候變化)

Major Threats (主要威脅):

- Deforestation (森林退減)
- Soil erosion and topsoil loss (水土流失)
- Biodiversity & Ecological deterioration (生物多樣性和生態破壞)
- Global greenhouse effects (温室效應)



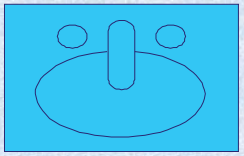
- 國際戰略研究中心： 21世紀人類最嚴峻的挑戰，就是清潔的水源嚴重不足，很多戰爭，都是由於爭奪清潔有用的水源而引起！
- 時至今日，平均每天仍有二萬伍千人因水生性疾病而死亡…
- 歷史證明，供水才是人類文明發展最重要的限制因子。
- 從前的「水源性缺乏問題」，現已蛻變成「水質性缺乏問題」、「浪費性缺乏問題」和「經濟及社會性貧乏問題」。

小結: 解決水資源問題的重要途徑有以下幾方面:

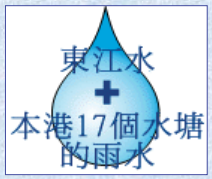
- 堅持人和自然的協調與和諧
- 重視水資源的配置、節約和保護
- 加強水資源的統一管理和科學管理
- 建立合理的水價形成機制和水權制度與水市場

Problems in Hong Kong and nearby Mainland China

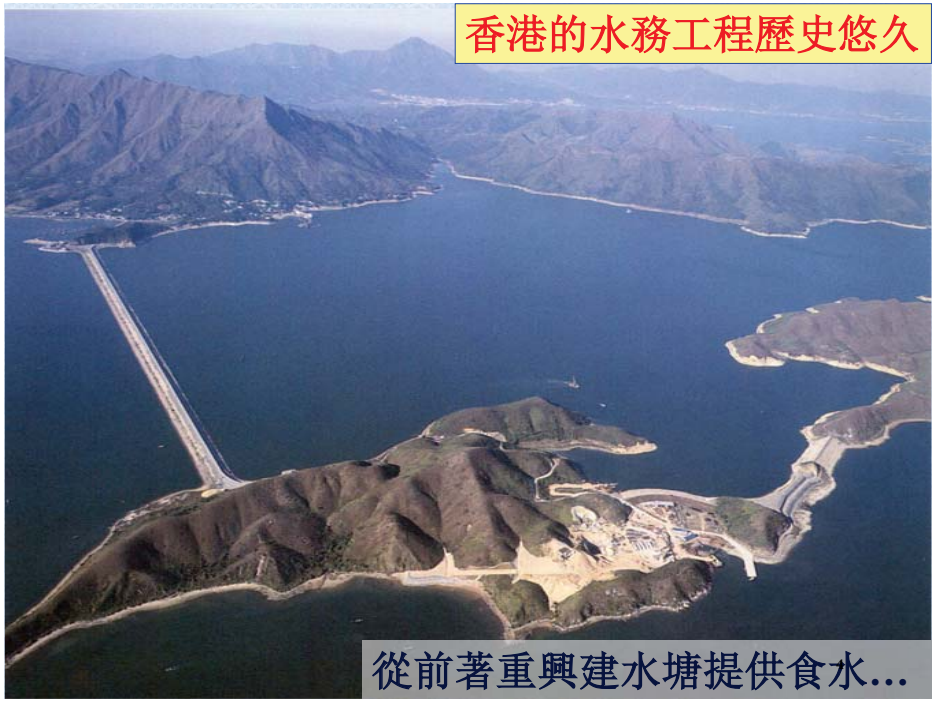
A common question : How Safe is Our Drinking Water ?
我們的飲用水安全嗎？



先要問：我們的食水從何處來？
Where does our water come from ?



香港的水務工程歷史悠久

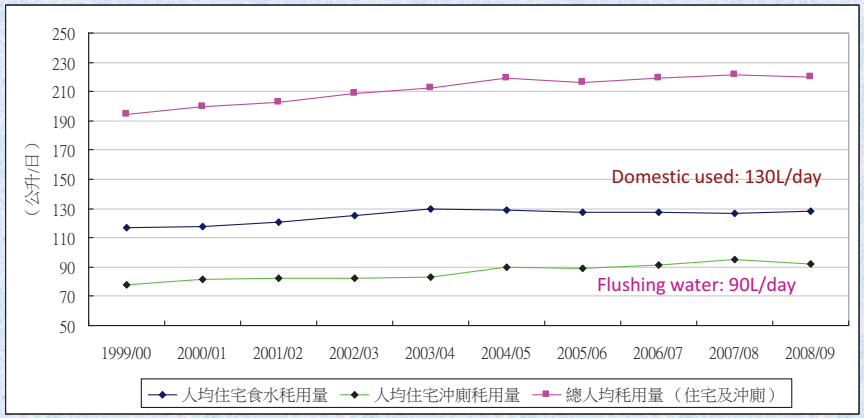


從前著重興建水塘提供食水...

可惜受到條件限制，仍未足夠香港人供水的需要 ...

Nowadays, we have 17 reservoirs,
Total carrying capacity = 586,050,000 M³

香港的人均住宅用水量
Local per capita Consumption



Due to population increase, ~80% water supplied by the Guangdong side (Dongjiang, The East River)

香港人用很多水呢！

An Analysis from Demand & Supplies

資料來源: 流動資產(2009)，恩匯; WSD: Annual Report, 2006

Challenges 挑戰:

- Water resources 水源性缺水
- Water quality 水質性缺水
- Engineering issues 工程性缺水
- Wastage 浪費性缺水

Water resources issues (水資源問題):

- High rainfall (~2000 mm pa); low retention (高降雨、低貯容)
- Large catchment; uneven distribution (水區濶大、分佈不均)
- Subtropical climate; high consumption rates (天氣潮濕、耗水龐大)
- Fast population growth; water resources development is geographically constrained (人口速增、環境阻限)

Figures:

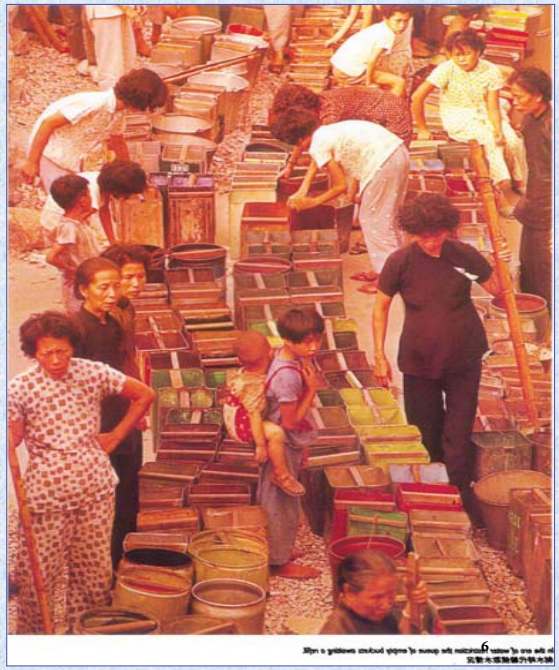
- ~60% of rainfall concentrated in June to September
- Water distribution: from 6.34 m^3 in wet areas to 0.07 m^3 in dry areas
- Most of the streams are short and steeply discharged into S. China Sea
- Water consumption increased ~3 times during the past 15 years

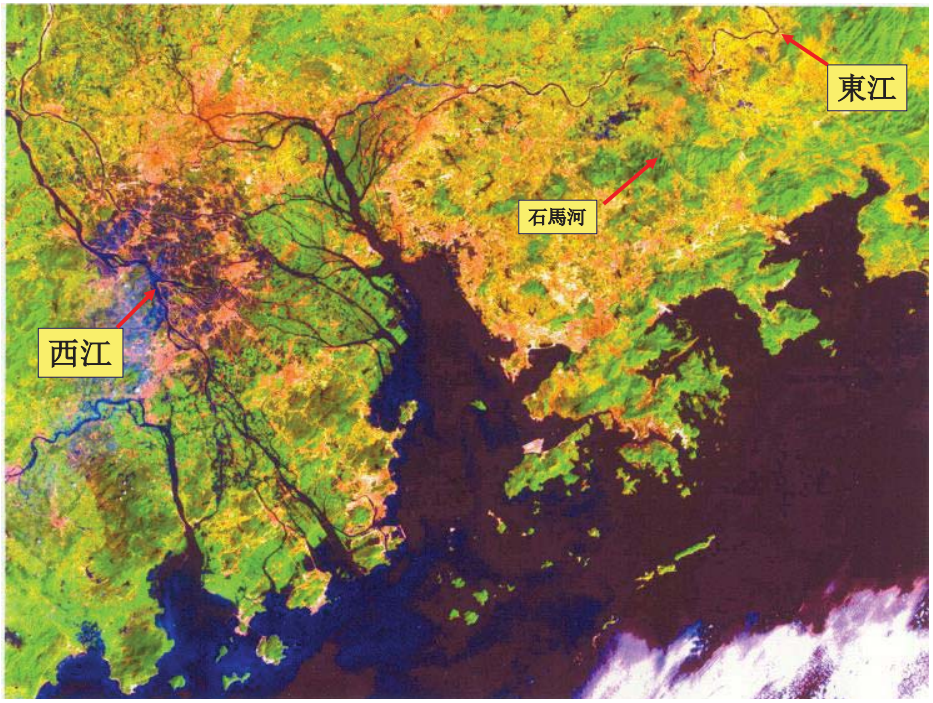
Water quality issues (水質問題):

- Strong economic strength (生產力增長): only 35% of total population of the Province, contributed to 80% of GDP
- Heavy industrial discharge (污染排放增長): while industrial discharges have been controlled in a reasonable manner, the discharges in PRD still comprise ~66% of the total industrial effluents of the Guangdong Province
- Pollution (從點源污染到面源污染): From point-sources to non-point sources – 2.5 million tones of agricultural chemicals being discharged into the S. China Sea via Pearl River per annum, comprises 60% of the total N-loading of the Pearl River Estuary (causing eutrophication and red tide problems)

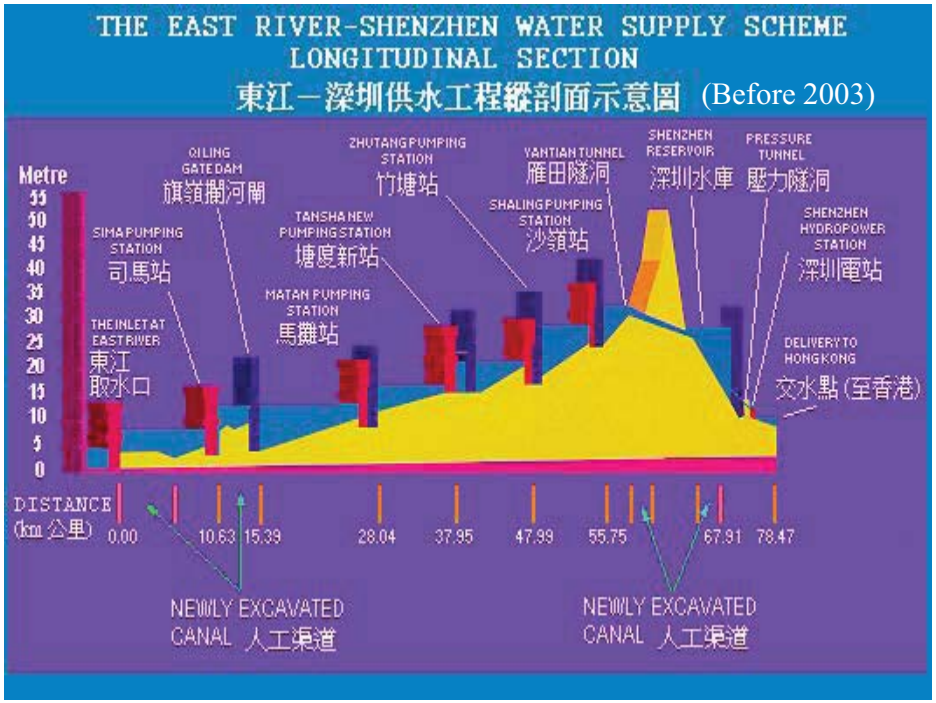
四日供水一次，
“樓下閂水喉的日子”
仍歷歷在目…

幸有
“東江之水越山來”！




東江
石馬河
西江


该工程关系到港九三百万同胞，应从政治上看问题，工程作为援外专项，由国家举办，广东省负责设计、施工。
周恩来
一九六二年十二月八日


THE EAST RIVER-SHENZHEN WATER SUPPLY SCHEME
LONGITUDINAL SECTION
東江－深圳供水工程縱剖面示意圖 (Before 2003)
Metre
55
50
45
40
35
30
25
20
15
10
5
0
QILING GATE DAM
旗嶺閘河閘
ZHUTANG PUMPING STATION
竹塘站
YANTIAN TUNNEL
雁田隧洞
SHENZHEN RESERVOIR
深圳水庫
PRESSURE TUNNEL
壓力隧洞
SIMA PUMPING STATION
司馬站
TANSHA NEW PUMPING STATION
塘廈新站
SHALING PUMPING STATION
沙嶺站
SHENZHEN HYDROPOWER STATION
深圳電站
MATAN PUMPING STATION
馬蹟站
THE INLET AT EAST RIVER
東江取水口
DELIVERY TO HONGKONG
交水點(至香港)
DISTANCE (km 公里)
0.00
10.63
15.39
28.04
37.95
47.99
55.75
67.91
78.47
NEWLY EXCAVATED CANAL 人工渠道
NEWLY EXCAVATED CANAL 人工渠道

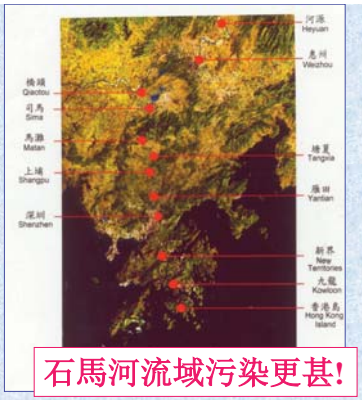

河源水庫

沿江而下，人口增多，工商業昌盛，污染自亦增加...

水土流失情況也嚴重。

惠州市

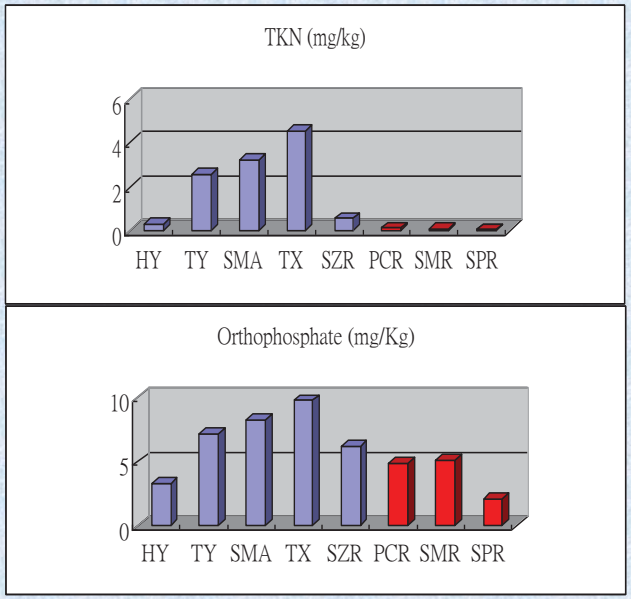
河源市



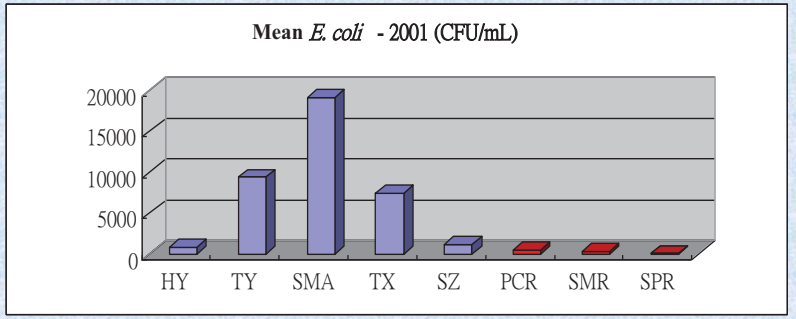
石馬河流域污染更甚!

面源污染 (non-point sources)
和鹹潮入侵更是隱憂！

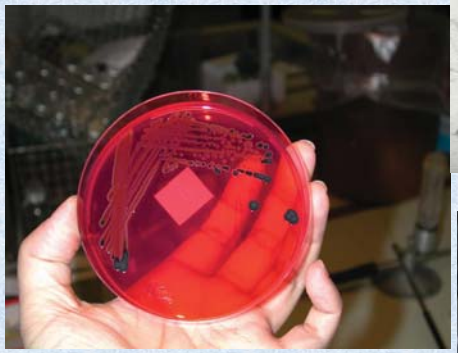
Organic nutrients in sediment samples:

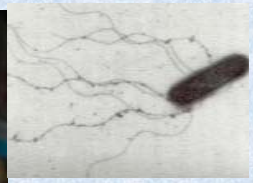


Microbiological Data:

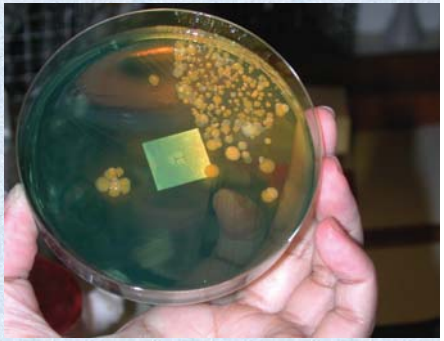


Mean (covered dry and wet seasons)
***E. coli* (O157:H7) concentrations**





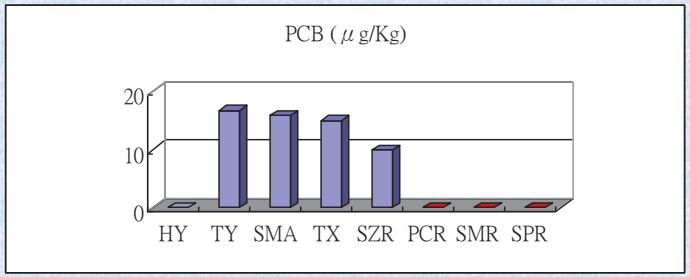
***Salmonella derby* on XLD plate**

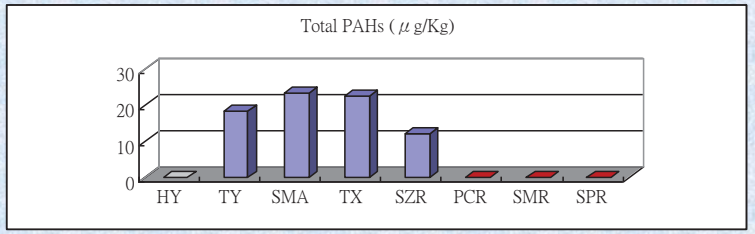


***Aeromonas* Sp. On TCBS**

***Vibrio* Spp.**

Trace organics (carcinogenic materials) in sediment samples:





2001年粵港達成協議，動用約50億元興建“封閉式管道”，以另途輸水(不入石馬河)，以保障水質。

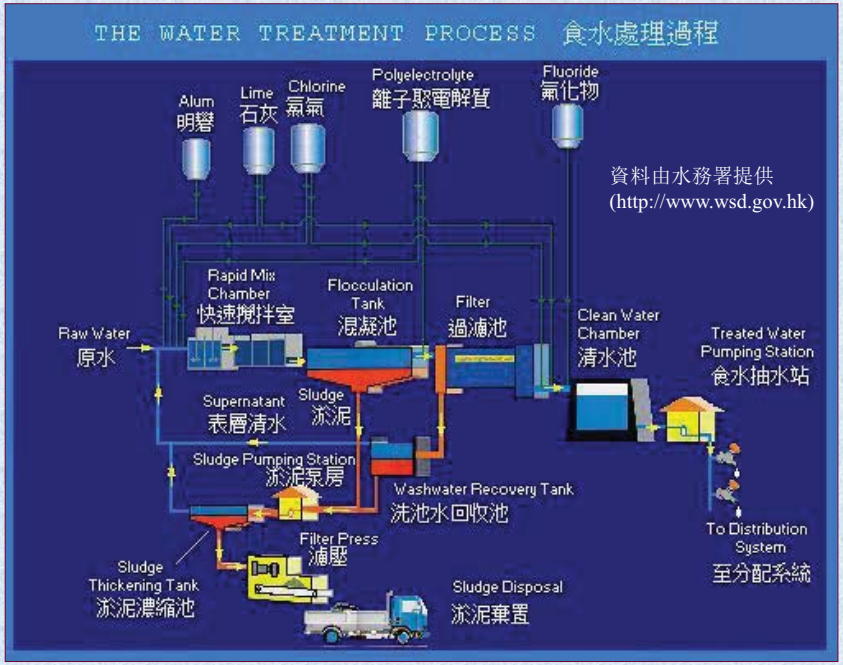
深圳水庫硝化處理廠

流入深圳水庫前、後，仍須工程處理，才交給港方的木湖抽水站。

香港人的光榮：

Hong Kong is one of the places in the world that residents can enjoy safe and high quality water. Our drinking water is 100% acceptable to WHO standards.

香港是世界上可享用最安全食水的地區之一。香港的食水水質不論在化學成份及細菌含量方面均符合世界衛生組織所建議的食水水質指引。



資料由水務署提供
(http://www.wsd.gov.hk)

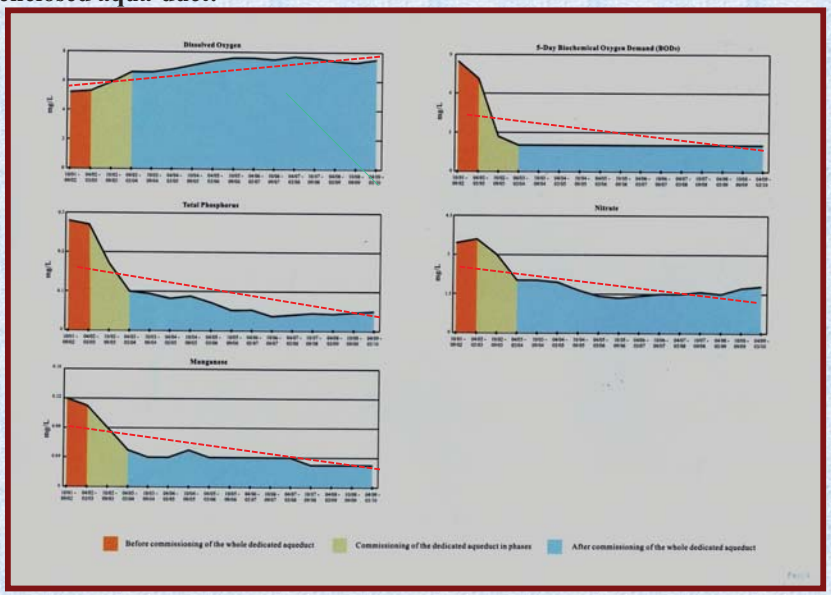
The Water Supplied Department is equipped with accredited laboratory and advanced analytical apparatus. Drinking water, must be carefully tested before distributing to local residents.

我們分別從集水區進水口、接收東江水的抽水站、水塘、濾水廠、配水庫、食水分配系統以至用戶的水龍頭處抽取多個水樣本進行化學、細菌學及生物學方面的化驗，從而有系統地監察整個濾水、供水及分配系統的水質。

由於本港的食水都經過適當的處理，而且在水質監察和控制方面相當嚴格，因此所供應的食水保證安全衛生，而且符合國際標準。

資料由水務署提供
(http://www.wsd.gov.hk)

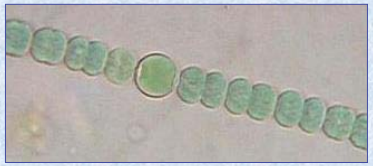
Significant improvement of water quality after the commissioning of the enclosed aqua-duct:



New issue 1: Eutrophication and Harmful Algal Blooms (Non-point-sourced Pollution)

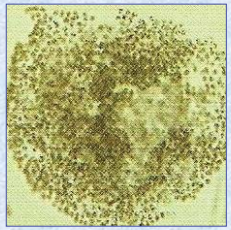
新問題 1: 藻華與富營養化的挑戰 (面源污染)

- Discoloration、awful smell and taste
- AnToxin production
- Ecological deterioration

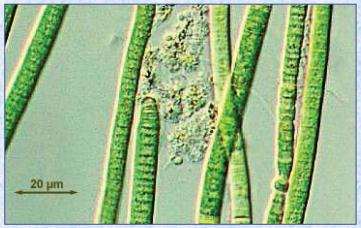


Anabaena Sp.

Anabeana pertuthate

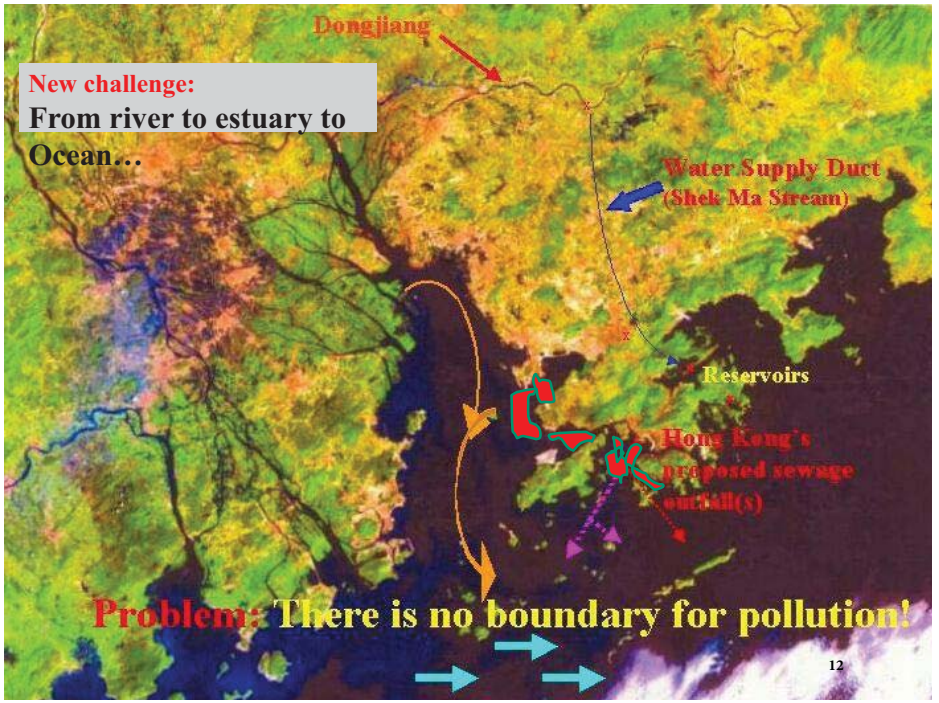


Microcystis incerta



***Oscillatoria* Sp.**

Anabaena flosaquae



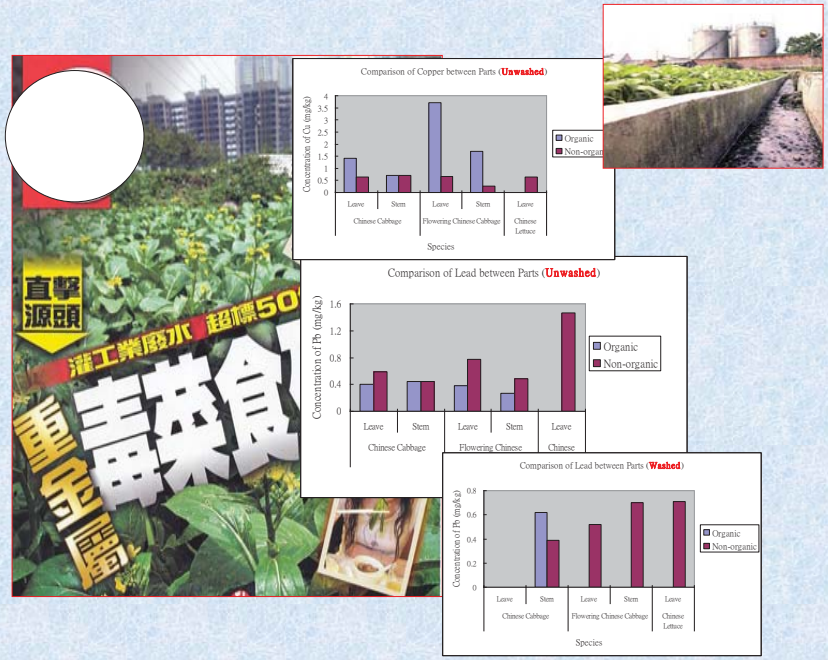
New Issus 2:
Inter-phased contamination (交叉污染問題):

CNS chinanews.com 中國新聞社
Welcome to the Web Site for China News Services

珠三角四成菜田重金屬超標

(25/March/2005)　（香港中通社三月二十五日日電）中國國 家環保總局的一項調查發現，珠三角百分四十 的農田、菜地，重金屬污染超過安全標準，其 中百分之十屬「嚴重」超標。在這些菜地、農 田種植的蔬菜含有危害人體的重金屬，以鉛、 鎘最多，其中生菜、油麥菜、白菜仔等葉菜的 受污染情況較嚴重。　　據《南方都市報》報道，國家環保總局早 前抽驗佛山、東莞、惠州、中山等地的農田、 菜地土壤，顯示珠三角土壤污染最為嚴重的是 汞（水銀），其次為鎳、銅。南海和順德的土 壤汞超標率，分別達百分之六十九和百分之三 十七點五，東莞的土壤汞超標率也達百分之二 十三點五。專家表示，在污染嚴重的農田、菜地種植 出來的蔬菜多含有重金屬，其中以鉛、鎘為最 多，主要是來自植物根系對土壤的直接吸收， 而且很難用浸泡、清洗、煮沸的方式除掉。鎘 曾在日本引起「骨痛病」，是一種潛伏期長、 能使腎臟發生病變的重金屬；過量水銀則會破 壞人的神經系統，損害腦部及腎等。　　報道又稱，按照內地供公害蔬菜重金屬的 限量標準，東莞、順德和中山田地的蔬菜重金 屬超標率，分別達到百分三十一點二、百分三 十一和百分二十二點八，其中，生菜、油麥 菜、白菜仔等葉菜含有的鉛、鎘最多。　　據悉，中國國土資源部和廣東省政府今年 將共同出資四千五百萬元，啟動珠三角四萬平 方公里的土壤環境調查。調查將對農業環境中 的五十三種化學元素做出全面勘測，專家們希 望這個結果將成為珠三角地區土地規劃和農業 產業結構調整的依據。■

Contamination of edible vegetables due to the use of polluted river water for irrigation – unfavorable trend



最近，水務署決心執行世界衛生組織(WHO)推動的食水安全計劃 (Water Safety Plan)：

- 從源頭開始管理
- 推動總水管理(Total Water Management)概念
- 加強檢查水質，更充份考慮痕量致癌物質和病原體的監察
- 資訊透明
- 公眾參與、同心合力

Opportunities 機遇:
Total Water Management 全面水資源管理（總水管理）

Facts:

- The Total Water Management (TWM) plan aims to enhance water conservation and protection and to explore new technology and other means for expanding water resources.
- In 2005, the Water Supplies Department (WSD) commissioned a study on formulating TWM strategy to serve the long-term need of water supplies in Hong Kong.
- The TWM recognizes the collaborative and partnership relation between Hong Kong and Guangdong Province.
- The TWM also stated that it is necessary to adopt proactive management measures to meet the demand and supply of quality water in integrated, multi-sectoral and sustainable manners.
- The TWM prepares Hong Kong for various uncertainties including global climate changes such that the projected water demand of different population growth scenarios in the coming two decades shall be well satisfied.
- Taking into consideration of the rapid development in Mainland China, the proposed TWM will also help Hong Kong to serve as a good partner of other municipalities in the Pearl River Delta for social, economic and environmental sustainability.

Total Water management policy in Hong Kong
香港的全面水資源管理政策 ：

Principle: Conservation and efficiency first !!

“先節後增” ！

Water conservation (節約用水):

- Public education
- Active leakage control
- Widespread use of seawater for toilet flushing
- A tiered tariff structure to encourage water saving

Water Reclamation and Recycling (水用重和循環再用)

- The use of lower quality water (e.g. treated sewage effluents) to replace high quality water for non-potable usages including toilet flushing, irrigation and street cleaning.
- The tertiary sewage treatment plants in Ngong Ping and Shek Wu Hui were commissioned in 2006.
- As noted, reclaimed water were mainly used for toilet flushing, gardening and landscaping.
- Harvesting of rainwater for water supplies is too costly – lower priority

綠色建築評級認證(BEAM PLUS)

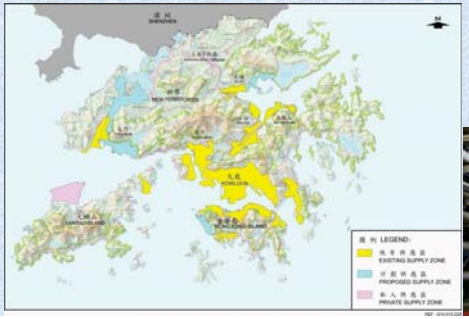
- 配合BEAM Plus綠色建築的標籤
- 將節約用水的元素加入建築物設計之中

沐浴花灑 - 用水效益級別

標稱流量 f (公升 / 分鐘)	用水效益級別	在用水效益標籤上展示的標誌
$f \leq 9.0$	第1級	1滴水點
$9.0 < f \leq 12.0$	第2級	2滴水點
$12.0 < f \leq 16.0$	第3級	3滴水點
$f > 16.0$	第4級	4滴水點

Others:

- Increase the use of seawater for toilet flushing (增加海水沖厠)
- Grey water reuse and recycling (灰水重用)
- Desalination (海水化淡)
- Water pipes maintenance & pressure management (水管維修和水壓管理)



The launching of the Fresh Water Plumbing Quality Maintenance Recognition Scheme (since July 2002)

Participation of this Scheme is voluntary.
Criteria:-

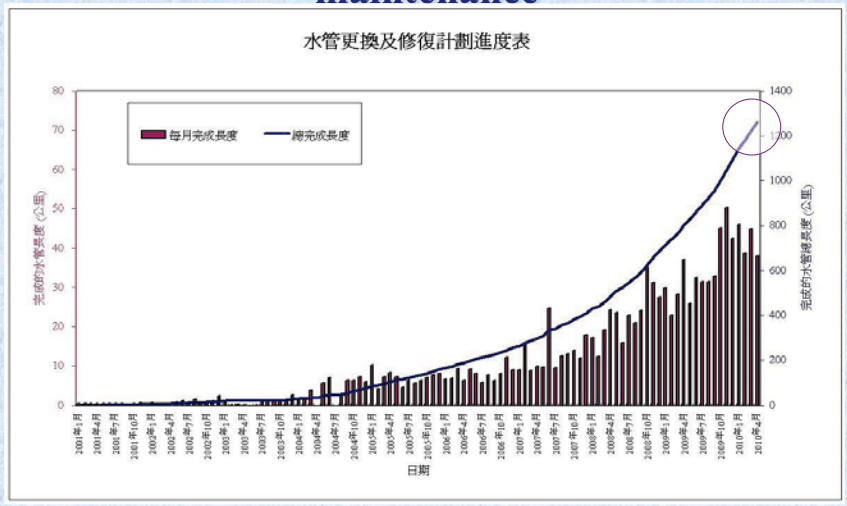
(a)The plumbing system is inspected at least once every three months by licensed plumbers or qualified building services surveyors or engineers and is found to be in good physical condition.

(b)All defects identified in the inspections are promptly rectified by licensed plumbers or qualified persons.

(c)The water tanks are cleaned at least once every three months.

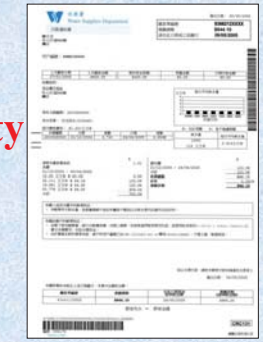
(d)Water samples are taken in accordance with the recommended procedure and tested for items specified, at least once a year for new application and at least once

水管更換及修復 - 進度
Progress of Water drains repair and maintenance



檢討水價??
Increase Water Price
Control by Water Pricing

- 應考慮以改變水價、改變耗水習慣以鼓勵減少用水
- 先節後加！ **Water conservation is the priority**

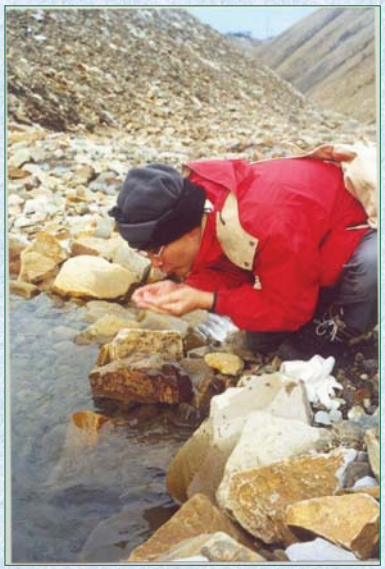


公眾參與: Public Participation

清潔食水，得來不易，
同心合力，才有一口清源可喝!

愛護水資源，
由我做起！

Think globally, act locally!

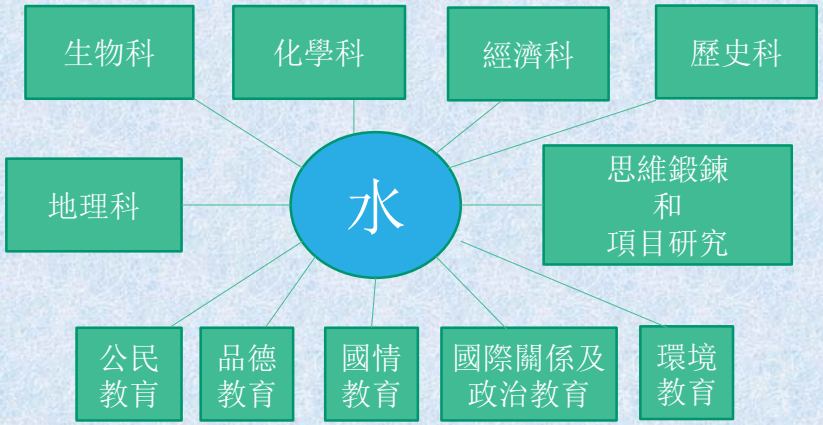


從通識科的角度去看問題:

- 水資源不足和分配 (今日香港)
- 香港的水資源供應 (香港與中國關係)
- 水質污染 (能源、科技與環保)
- 公共衛生和健康 (公共衛生)
- 氣候變化 (全球視野、可持續發展)
- 節約和循環用水 (個人成長與人際關係)

涉獵科目:

多元而綜合的學習!
Multi-disciplinary and Inter-disciplinary approaches of study



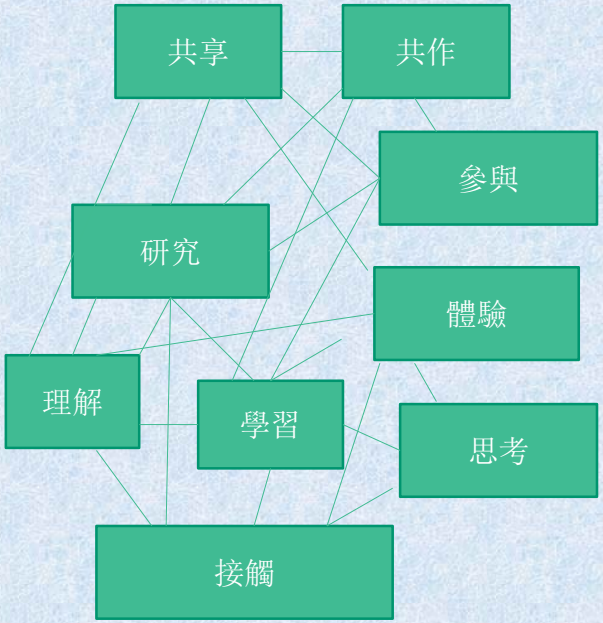
水的文化素養

科學　文學　音樂　美術

社會科學　管理　工程　公民社會　哲學

國際視野和合作　個人生活行為　社會關係和道德

生命價值和責任



快樂學習!
快樂生活!
快樂成長!