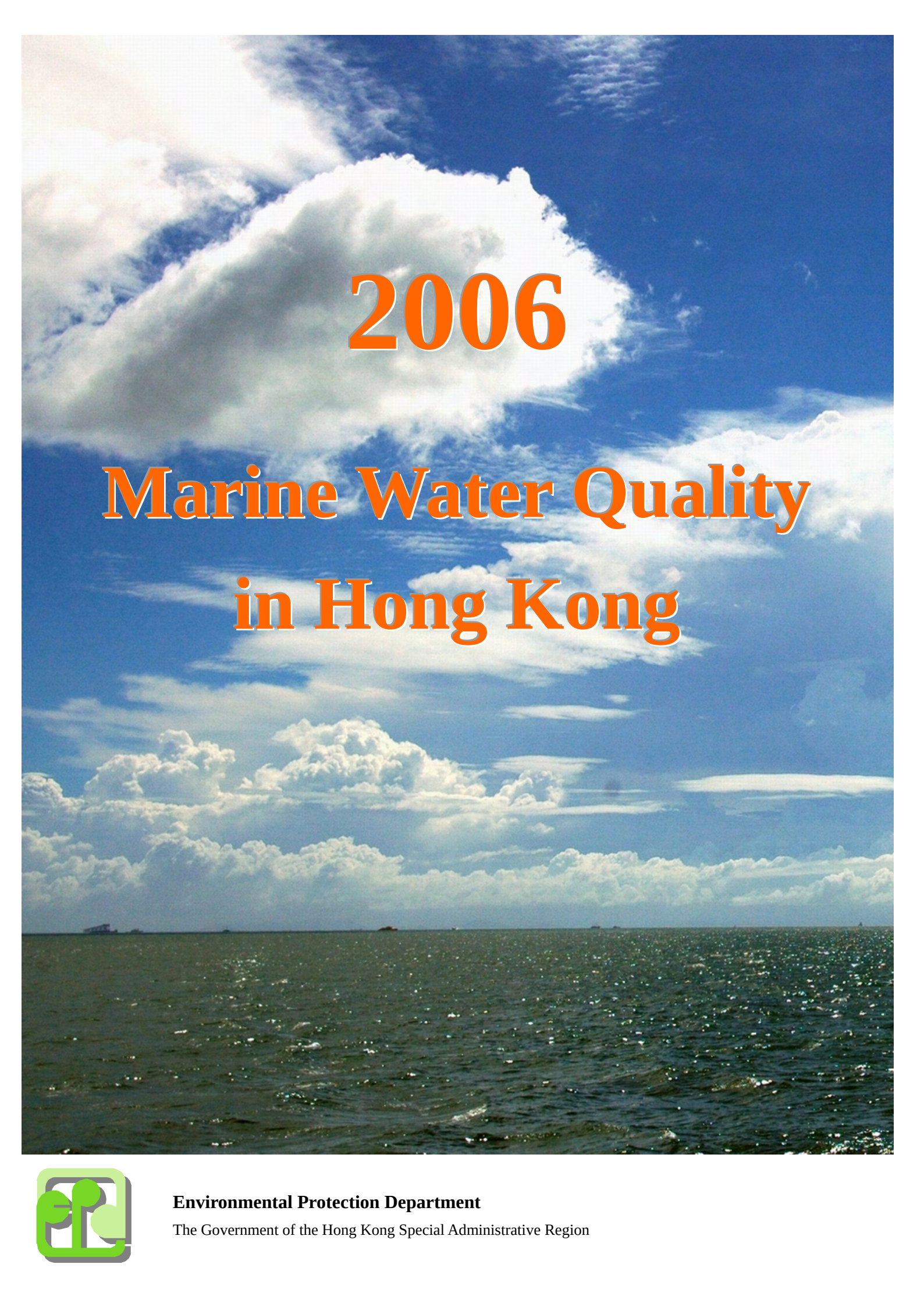




# 2006

# Marine Water Quality in Hong Kong



**Environmental Protection Department**

The Government of the Hong Kong Special Administrative Region





## Mission

**To conduct a comprehensive and scientific monitoring programme that will help safeguard the health of Hong Kong's marine environment and achieve the Water Quality Objectives.**



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## Introduction

The Environmental Protection Department (EPD) has implemented a comprehensive marine water quality monitoring programme since 1986.

The marine monitoring programme operates according to the following aims and objectives:

- o to indicate the state of health of coastal waters;
- o to assess compliance with the statutory Water Quality Objectives (WQOs);
- o to reveal long-term changes in water quality;
- o to provide a basis for planning water pollution control strategies.

The EPD conducted monitoring at 76 water quality sampling stations and 45 bottom sediment sampling stations in 2006. In addition, it also monitored 18 water and 15 sediment stations in 17 typhoon shelters, marinas and dockyard across Hong Kong. At 25 of the monitoring stations, the EPD also carried out monthly sampling of phytoplankton in the water.

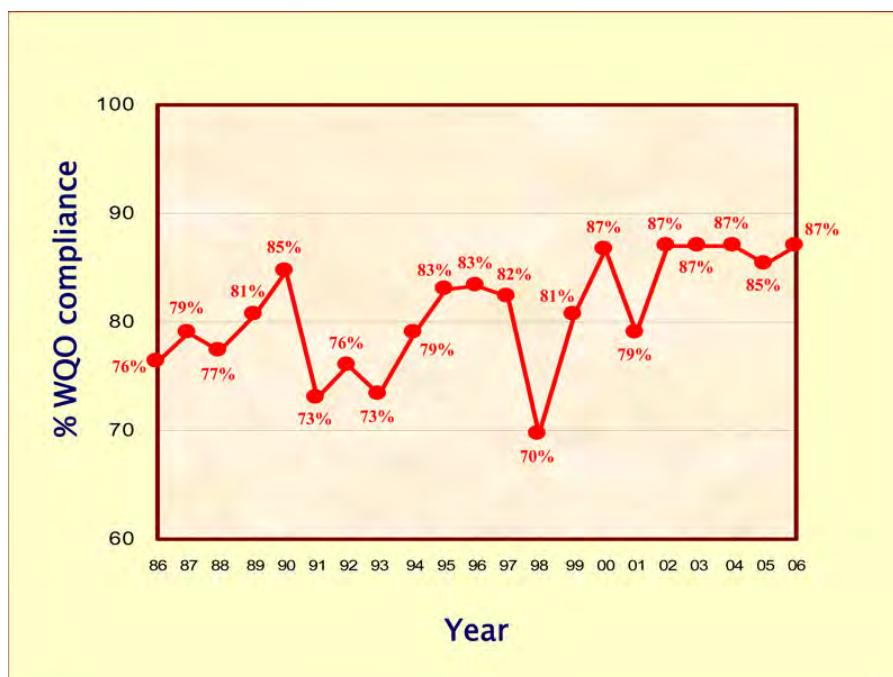
Marine monitoring was mostly conducted onboard a 26-metre vessel the *Dr. Catherine Lam*. A conductivity-temperature-depth (CTD) profiler linked to a computer-controlled rosette water sampler was used to measure field parameters and collect water samples. Bottom sediments were collected by a sediment grab. The water and sediment samples were analysed by the EPD's laboratories and the Government Laboratory for over 80 physical, chemical and biological parameters



EPD's staff collecting marine water samples

## The State of Hong Kong Marine Waters in 2006

In 2006, the marine water quality in Hong Kong was generally good and stable. The compliance with the marine WQOs in the territory reached 87%, showing an improvement over 2005 (85%) and returning to the peak level of 2002-2004.

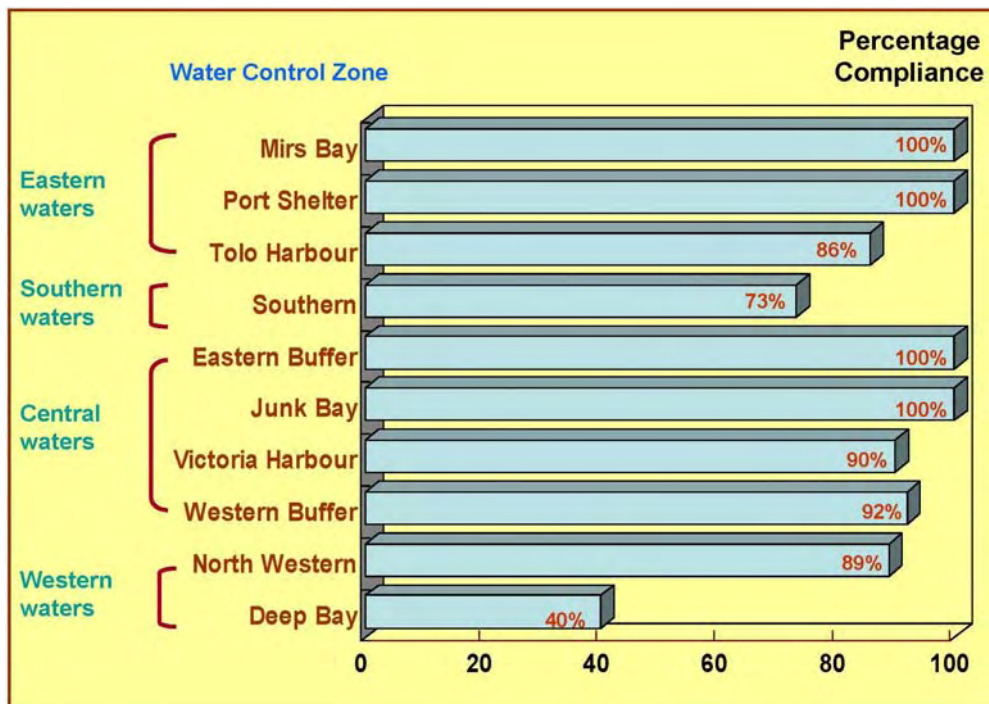


Overall compliance with the marine Water Quality Objectives  
in Hong Kong, 1986-2006

In the Eastern waters of Hong Kong, the Port Shelter and Mirs Bay Water Control Zones (WCZs) continued to enjoy excellent water quality, fully complying with the WQOs (100% compliance). Following the commissioning of Stage 1 of the Harbour Area Treatment Scheme (HATS) at the end of 2001, the water quality of eastern and central Victoria Harbour continued to improve. The average WQO compliance of the Eastern Buffer, Junk Bay and Victoria Harbour WCZs increased from 83% in 2001 to 97% in 2006. While the eastern harbour experienced a reduction in *E. coli* bacteria, the central and western harbour, as well as the Tsuen Wan beaches saw an increase in bacterial levels which persisted in 2006. This problem would be alleviated by the implementation of HATS Stage 2A under which effluent from the Stonecutters Island Sewage Treatment Works will undergo disinfection to improve the bacteriological quality of surrounding waters.

The water quality in the Tolo Harbour WCZ continued to improve in the last 10 years with a steady rise in WQO compliance from 64% in 1997 to 86% in 2006. In the Southern, Western Buffer and North Western WCZs, the water quality was largely stable with WQO compliance ranging between 73% and 93% in 2006. The water quality in the Deep Bay WCZ was very poor, with the lowest compliance (40%) in the territory, highlighting the pollution problem in the bay. While the condition in the Inner Bay remained serious, there were early signs of recovery with detectable decreases of nutrients (nitrogen and phosphate) and bacteria in the water in the last two years.





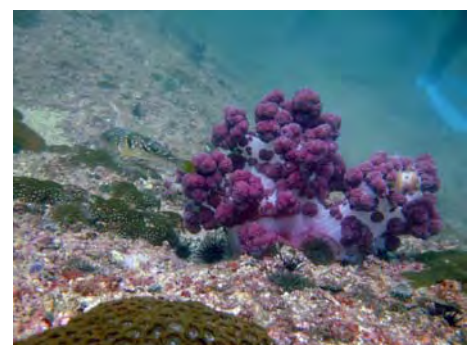
Level of compliance with the Water Quality Objectives in the ten Water Control Zones in 2006

## Eastern Waters

The eastern waters cover an area of 900 km<sup>2</sup> and include three Water Control Zones (WCZs), i.e. the Mirs Bay, Port Shelter and Tolo Harbour & Channel WCZs. There are three marine parks and 21 fish culture zones within the eastern waters.

### Mirs Bay Water Control Zone

In 2006, the Mirs Bay WCZ had very good water quality with high Dissolved Oxygen (DO) and low nutrient levels. It also achieved full compliance (100%) with the WQOs as in the previous years. In the inner Mirs Bay, the secondary contact recreation subzones within Crooked Harbour, Long Harbour and Double Haven in the bay had low *E. coli* counts (<10 cfu / 100mL) which fully complied with the WQOs. Starling Inlet which borders Shenzhen and Sha Tau Kok had a slightly higher count (39 cfu / 100mL), indicating some sewage pollution in the area. The levels of chlorophyll-*a* were largely stable in 2006, indicating no marked increase in phytoplankton in the bay.



Beautiful coral found in Mirs Bay



### *Port Shelter Water Control Zone*

The Port Shelter WCZ fully complied with the WQOs in 2006. Its water quality was stable and amongst the best in the territory with high DO (7.3 mg/L), low levels of nutrients (total inorganic nitrogen at 0.04 mg/L, orthophosphate at 0.005 mg/L) and *E. coli* bacteria (1 cfu/100mL). Sai Kung Hoi has six gazetted bathing beaches and is an ideal place for water sports and secondary contact recreational activities.



Port Shelter has excellent water quality for water sports and recreational activities

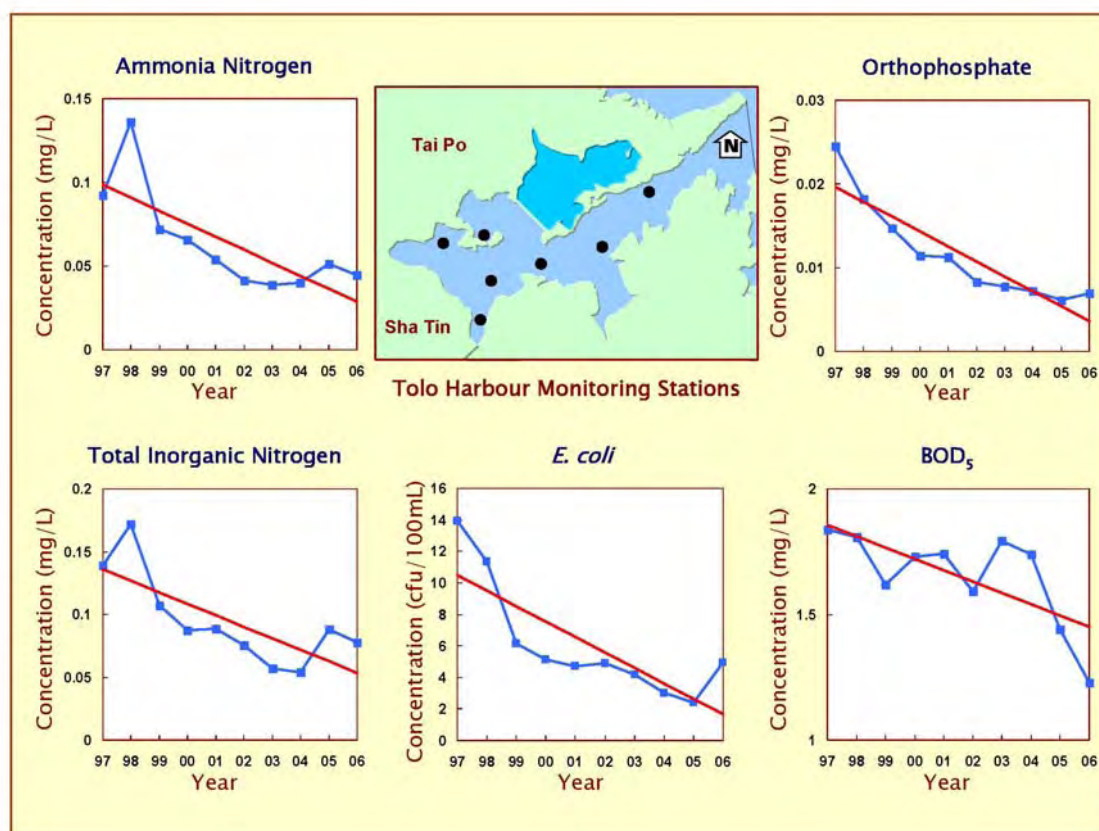
### *Tolo Harbour and Channel Water Control Zone*

The water quality of the Tolo Harbour and Channel WCZ showed further improvement with the rate of compliance with WQOs increasing from 80% in 2005 to 86% in 2006. While the levels of 5-day Biochemical Oxygen Demand (BOD<sub>5</sub>), *E. coli*, nitrogen and phosphate continued to decline, the compliance with the DO objective showed a substantial increase from 57% in 2005 to 71% in 2006. The improvements were mainly attributed to the implementation of the Tolo Harbour Action Plan which started in 1986. The plan included livestock waste control, improvements in sewage treatment, and the export of nutrient-rich effluent from the Sha Tin and Tai Po Sewage Treatment Works out of Tolo Harbour. Effective pollution control and provision of sewerage to village houses in recent years also helped reduce pollution in the Harbour. The WCZ achieved 100% compliance with the *E. coli* WQO for secondary contact recreation in 2006. Being a highly-enclosed water body with weak flushing capacity, Tolo Harbour is especially sensitive to eutrophication and algal bloom problems. In 2006, the WCZ achieved 90% compliance with the WQO for chlorophyll-*a*, as in the past five years, indicating recovery from the serious algal bloom problem which plagued the harbour in the 80s and 90s.



Fish culture zone in Yim Tim Tsai, Tolo Harbour





Water quality improvements in Tolo Harbour, 1997-2006

## Southern Waters

The Southern WCZ covers 400 km<sup>2</sup> of water stretching from Hong Kong Island south to Lantau Island facing the South China Sea. The western part of the WCZ is impacted seasonally by the flow from the Pearl River and the effect diminishes towards the eastern end.

In 2006, the Southern WCZ attained an overall 73% compliance with the WQOs, slightly higher than that in 2005 (71%). Full compliance (100%) was achieved with the WQOs for DO, unionised ammonia (NH<sub>3</sub>) and *E. coli*. As nutrients in the Southern WCZ were typically high, particularly in the summer, the compliance with the WQO for total inorganic nitrogen (TIN) was only 13%. Within the secondary contact recreation subzones, full compliance (100%) with the *E. coli* objective was achieved in 2006, indicating that they were suitable for water sport activities.



The Southern waters are at the edge of the South China Sea



## Central Waters

Within the central waters, the Victoria Harbour, Eastern Buffer, Western Buffer and Junk Bay WCZs are important navigational channels and port areas. Since the commissioning of the Stonecutters Island Sewage Treatment Works (SCISTW) under HATS Stage 1, about 75% of sewage around Victoria Harbour now undergoes chemically enhanced primary treatment, and there has been a substantial improvement in water quality since 2002.

### *Victoria Harbour Water Control Zone*

The Victoria Harbour WCZ achieved a 90% compliance with the WQOs in 2006, higher than that in 2005 (83%). This was largely due to the increase in compliance with the WQO for TIN (from 50% in 2005 to 80% in 2006). The observed increase in DO and decreases in pollutants and *E. coli* in eastern Victoria Harbour since HATS Stage 1 were largely maintained. However, the western harbour around the SCISTW outfall continued to have higher levels of *E. coli* bacteria.



One of the busiest and most beautiful harbours in the world – Victoria Harbour

### *Eastern Buffer and Junk Bay Water Control Zones*

The Eastern Buffer and Junk Bay WCZs achieved full compliance (100%) with the WQOs in 2006, the same as in 2005. The water quality improvements observed after the implementation of HATS Stage 1 were sustained.

### *Western Buffer Water Control Zone*

The Western Buffer WCZ achieved a 92% compliance with the WQOs, slightly lower than in 2005 (100%). This was due to the lower DO level at the western-most station closest to the Pearl River flow and where water stratification occurred during summer. The *E. coli* level in the zone was high due to the effluent from HATS Stage 1 which is yet to be equipped with disinfection facilities.

## Western Waters

The western waters of Hong Kong comprise the Deep Bay and North Western WCZs. Deep Bay is heavily impacted by pollution from both Hong Kong and Shenzhen. It has the ecologically important Mai Po and Inner Deep Bay Ramsar site, and areas of oyster culture. The North Western WCZ is under the influence of the Pearl River as well as local discharges, and is the home of the Chinese white dolphins.



### Deep Bay Water Control Zone

The water quality of Deep Bay was the poorest in the territory, characterised by high levels of organic and inorganic pollutants and low DO. In 2006, the WQO compliance in the Deep Bay WCZ was low at 40%. Only three of the five stations in the outer bay met the WQOs for DO and  $\text{NH}_3$ , and the whole Deep Bay WCZ failed to meet the TIN objective. On the other hand, there were early signs of recovery with 20-40% decreases in organic pollutants, nitrogen, phosphate,  $\text{NH}_3$  and *E. coli*, and an increase in the compliance with the WQOs from 20% in 2004 to 40% in 2006.



The new Hong Kong-Shenzhen Western Corridor in Deep Bay

### North Western Water Control Zone

The water quality in the North Western WCZ was largely stable in 2006, attaining an 89% compliance with the WQOs, the same as that in the previous two years. Except for the two western-most stations (nearest to Deep Bay and Pearl River) which did not meet the WQO for TIN, all other stations achieved full compliance with the WQOs. Higher nitrogen levels were a major concern; however, orthophosphate phosphorus ( $\text{PO}_4\text{-P}$ ) and total phosphorus (TP) were largely low and stable in recent years.



Western waters are the home of the Chinese white dolphin

### Sediment Quality in Hong Kong

Sediments in the sea bottom are regarded as the ultimate sink of pollutants in the marine environment and they are also home to a wide diversity of benthic organisms, many of which are of food value to man. In 2002-2006, sediments in Victoria Harbour, Junk Bay and Tsuen Wan Bay had higher levels of heavy metals, in particular copper and silver. This was related to effluents from printed circuit board, electroplating industries and photo-developing business in the 60s to 80s before pollution control legislation was in place. Mercury in the sediments was generally low except at one station in the western harbour, which may be related to discharges from dental clinics and industries



Collecting sediment samples





in the past. Among the trace organic pollutants, the levels of polychlorinated biphenyls (PCBs) in the marine sediments of Hong Kong were generally low, except for a few sites in Victoria Harbour. Eighteen congeners of PCBs were analysed and they were found to be below the reporting limits in over 90% of the sediment samples. Low and high molecular weight polyaromatic hydrocarbons (PAHs) in the marine sediments were mostly below reporting limits, except at one station in western Victoria Harbour where an elevated level of high molecular weight PAHs was found. This may be related to the contamination from the old waste incineration facilities in Kennedy Town which was decommissioned in 1994.

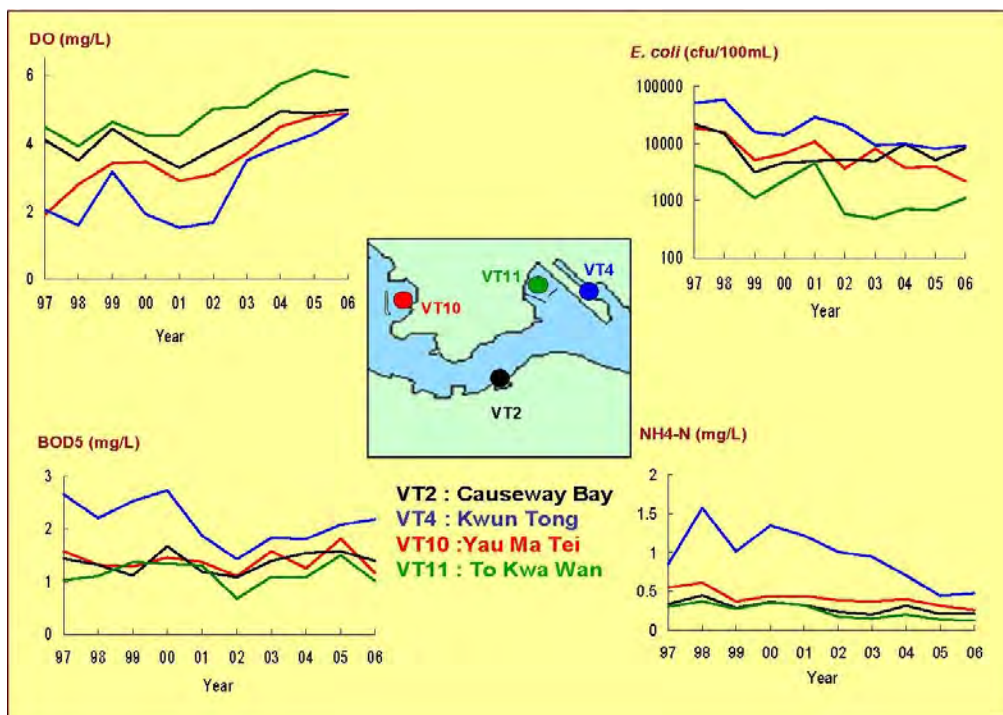
### [Typhoon Shelters in Hong Kong](#)

Typhoon shelters are located in embayments with low tidal flushing and are vulnerable to pollution from land and marine sources. The EPD monitored the water quality of 17 typhoon shelters (TSs), marinas and dockyard around Hong Kong in 2006. The Yim Tin Tsai TS and Hebe Haven TS in the Port Shelter WCZ and Hei Ling Chau TS in the outlying islands had the best water quality in the territory with high DO (7.1-7.4 mg/L) and low *E. coli* counts (1-3 cfu/100mL). The typhoon shelters in Victoria Harbour such as Kwun Tong TS, had the poorest water quality. Bottom sediments of typhoon shelters in the harbour were often contaminated by heavy metals due to historical discharges from industries. In 2002-2006, sediments in the Kwun Tong TS had the highest levels of heavy metals, i.e. cadmium and chromium, and also of total PCBs which were related to the use of PCB transformers and capacitors in the past. The Yim Tin Tsai TS had the best water quality in the territory as well as the best sediment quality.



[Aberdeen typhoon shelter](#)

There has been a substantial improvement in the water quality of typhoon shelters in Hong Kong in the last decade. Within the Victoria Harbour area, the annual DO level in the Kwun Tong TS has increased from hypoxic levels (<2 mg/L) in 1997 to above 4 mg/L in 2006 and *E. coli* decreased from 51,000 to 9,200 cfu/100mL during the same period. Other typhoon shelters such as Yau Ma Tei TS and Causeway Bay TS also showed marked reductions in pollutants, e.g. ammonia (NH<sub>4</sub>-N) and BOD<sub>5</sub> particularly after the commissioning of HATS Stage 1. Outside Victoria Harbour, Tuen Mun TS and Sai Kung TS were among the typhoon shelters which showed significant water quality improvements.



The water quality improvements in four typhoon shelters  
in Victoria Harbour, 1997-2006

The water quality improvements seen in typhoon shelters in the last decade were mainly attributed to the EPD's pollution control measures as well as the upgrading of sewage treatment facilities, enhancement of sewerage infrastructure and implementation of HATS Stage 1.

### Phytoplankton and Red Tides in Hong Kong

Phytoplankton monitoring can track the biological consequences of nutrient enrichment in the water over time and forms an essential part of eutrophication management. The EPD conducts long-term monitoring of phytoplankton monthly at 25 stations covering nine Water Control Zones (WCZs). Data from 2006 showed that diatoms constituted the major phytoplankton group in terms of species number and cell density. *Skeletonema costatum* was the most dominant species which made up 33-84% of the diatom populations in the Eastern Buffer, Victoria Harbour, Southern, North Western, Western Buffer and Deep Bay WCZs. The most abundant dinoflagellate species was *Scrippsiella* spp. comprising 23-71% of the dinoflagellates in all the WCZs. Spatially, phytoplankton densities were generally higher in Tolo Harbour & Channel than those in other WCZs.



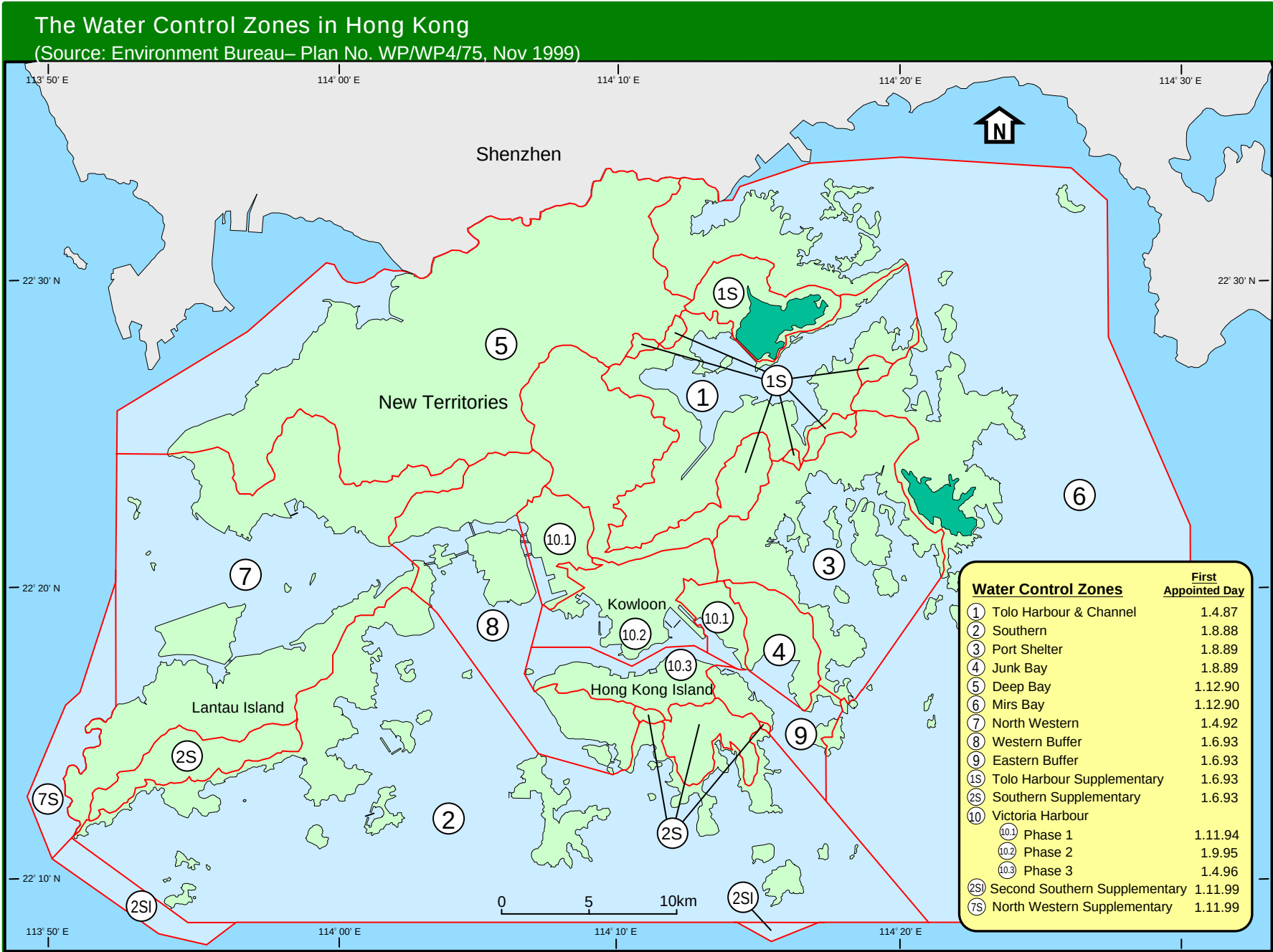
A view of phytoplankton *Thalassionema nitzschoides* under an electronic microscope



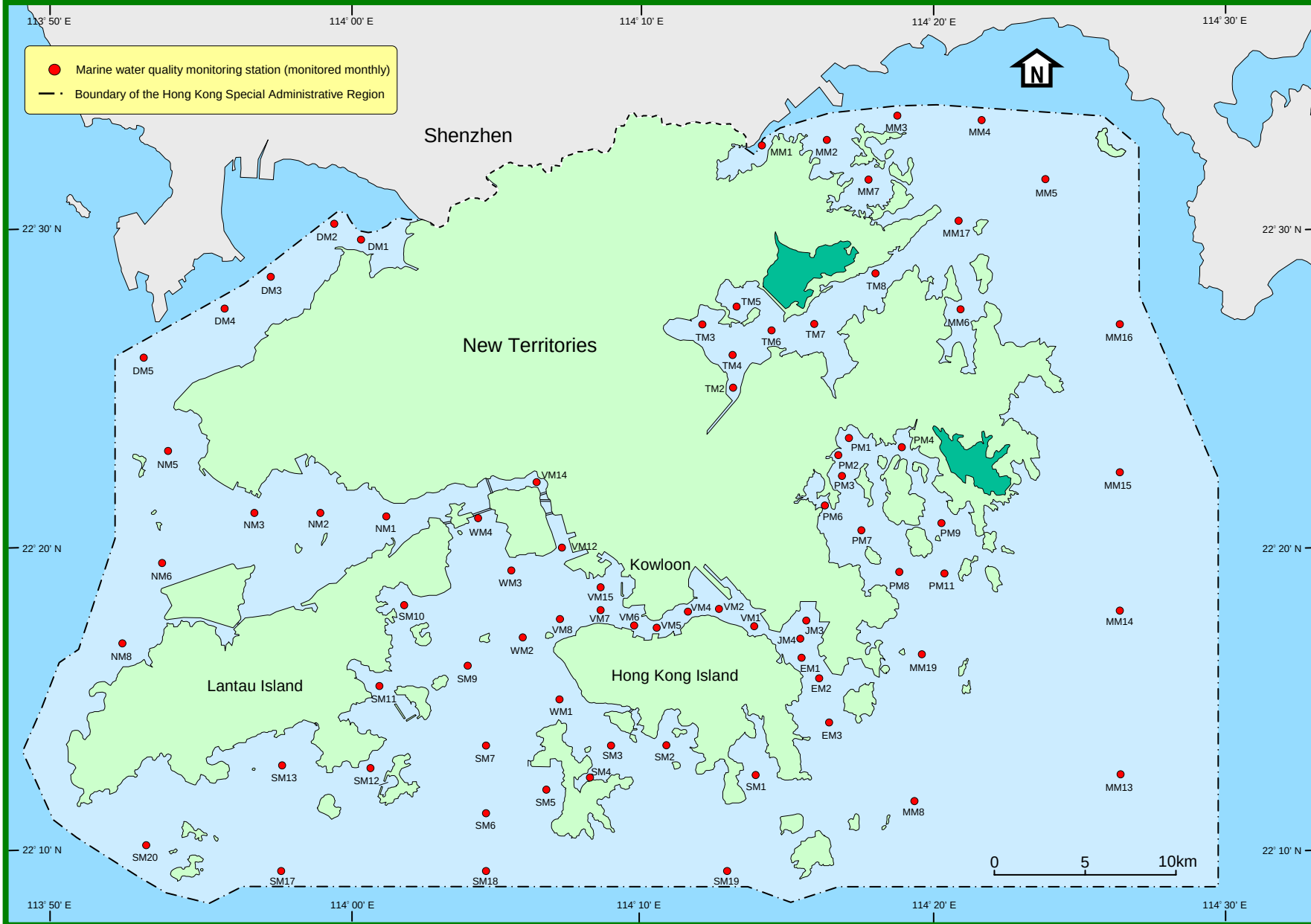
Red tides and algal blooms are natural phenomena which occur seasonally in both polluted and unpolluted waters. In Hong Kong, red tides were observed more frequently in the eastern (>70%) and southern (~17%) waters. The most common red tide species was the dinoflagellate *Noctiluca scintillans*, which accounted for ~30% of the reported red tides since the 1980s. In 2006, 12 red tides were recorded in Hong Kong waters, involving 6 species (i.e. *Noctiluca scintillans*, *Skeletonema costatum*, *Ceratium furca*, *Dictyocha speculum*, *Phaeocystis globosa* and *Cochlodinium* sp.).



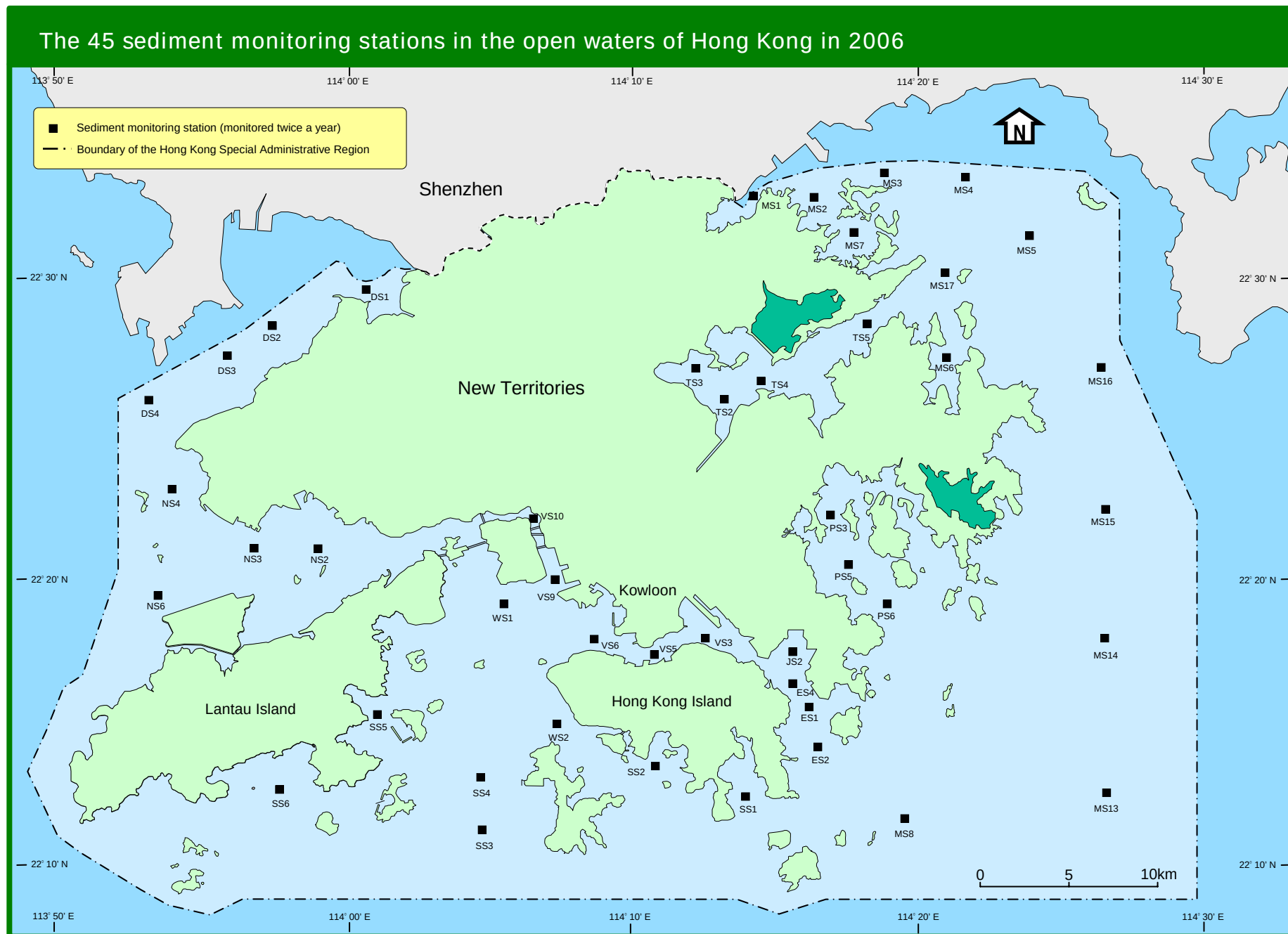
# Appendices



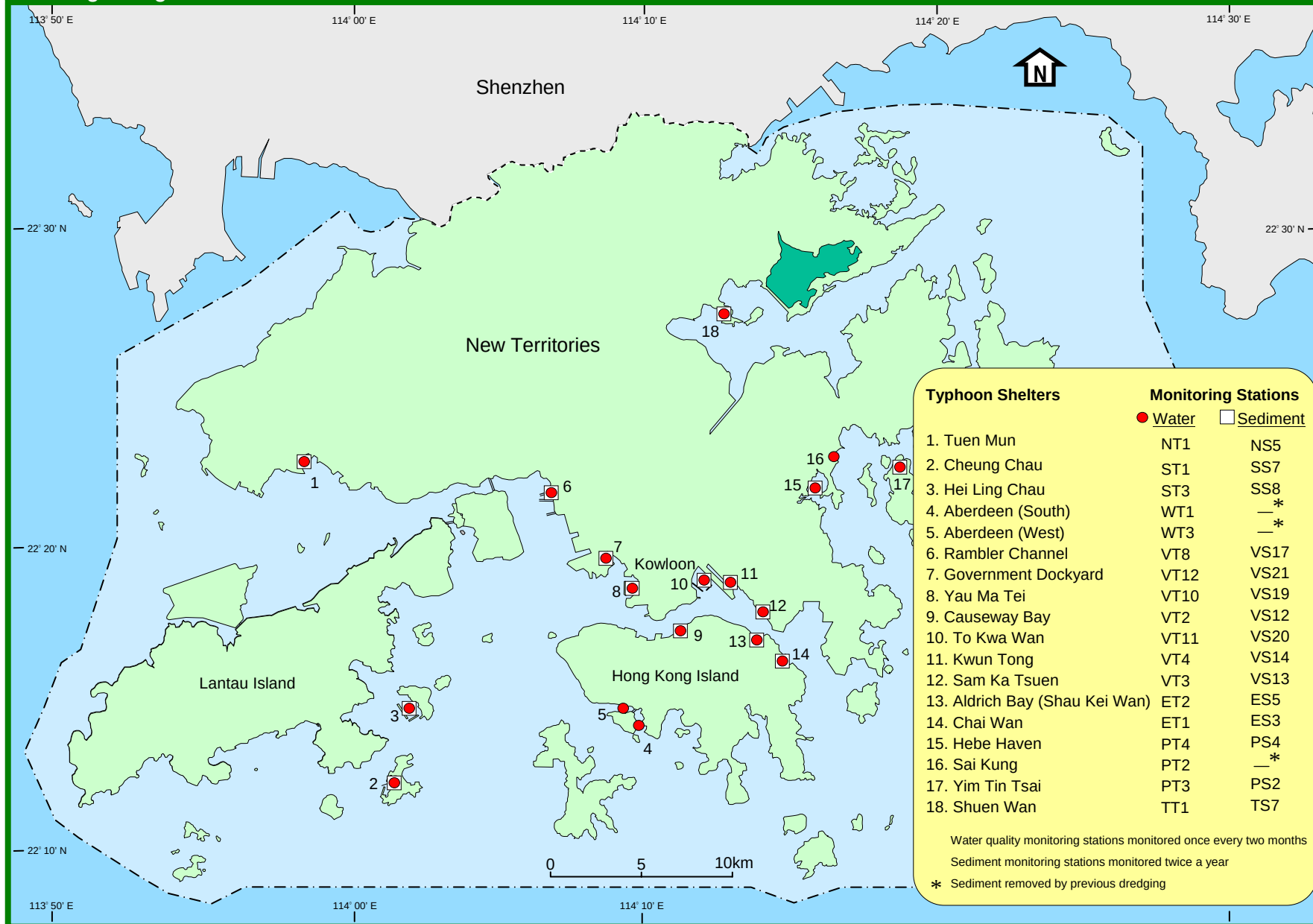
# The 76 water quality monitoring stations in the open waters of Hong Kong in 2006







# The 18 typhoon shelters and 15 sediment monitoring stations in the typhoon shelters of Hong Kong in 2006



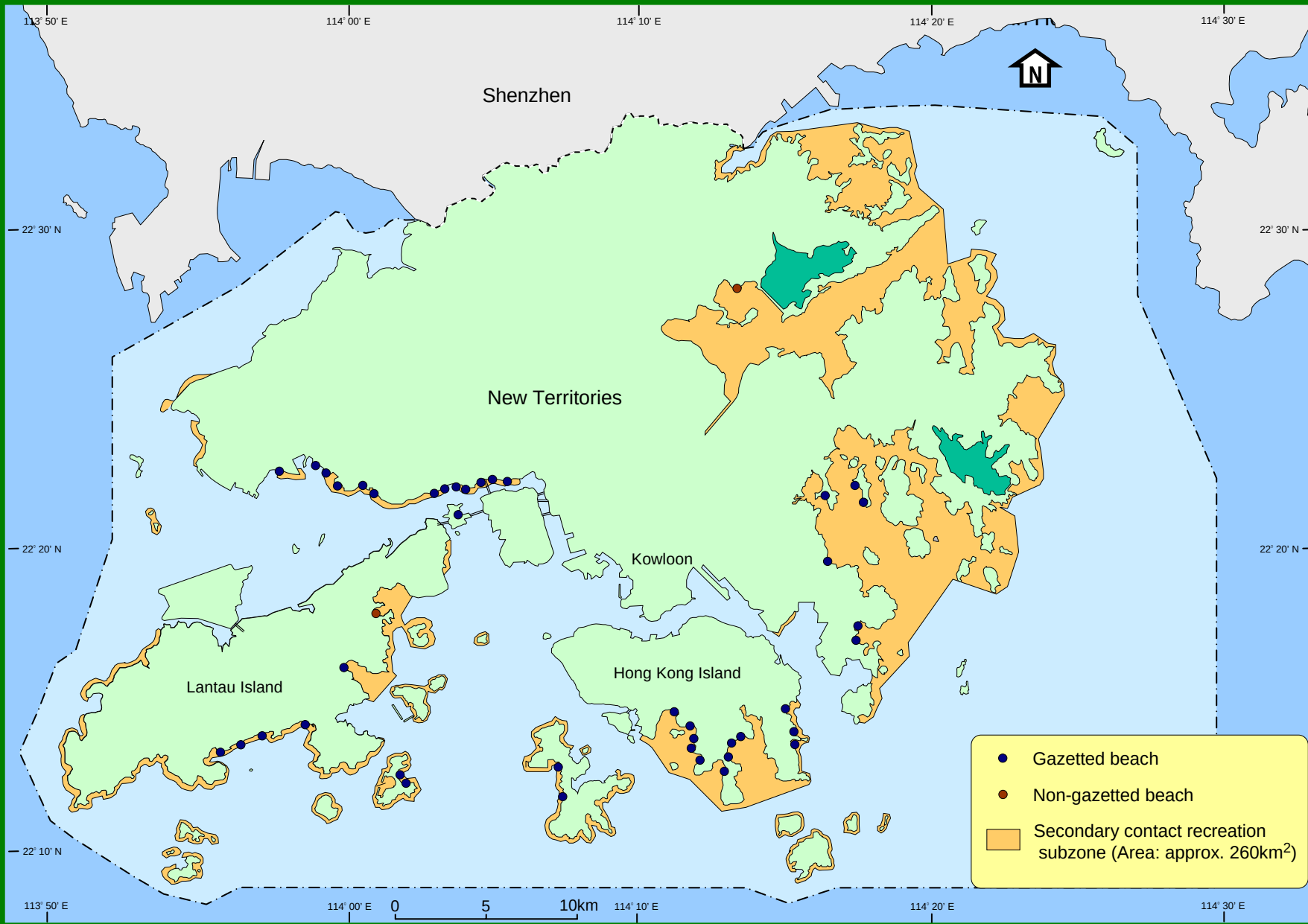
## Location of marine water and sediment monitoring stations

| Water Control Zone       | Station |          | Location      |                | Depth (m) |
|--------------------------|---------|----------|---------------|----------------|-----------|
|                          | Water   | Sediment | Latitude      | Longitude      | approx.   |
| Tolo Harbour and Channel | TM2     |          | 22° 24.744' N | 114° 13.085' E | 4         |
|                          | TM3     | TS3      | 22° 26.857' N | 114° 12.181' E | 7         |
|                          | TM4     | TS2      | 22° 25.964' N | 114° 13.176' E | 8         |
|                          | TM5     |          | 22° 27.426' N | 114° 13.456' E | 4         |
|                          | TM6     | TS4      | 22° 26.631' N | 114° 14.506' E | 12        |
|                          | TM7     |          | 22° 26.907' N | 114° 16.057' E | 11        |
|                          | TM8     | TS5      | 22° 28.392' N | 114° 18.003' E | 22        |
|                          | *TT1    | *TS7     | 22° 27.270' N | 114° 12.717' E | 6         |
| Southern Water           | SM1     | SS1      | 22° 12.738' N | 114° 13.885' E | 14        |
|                          | SM2     | SS2      | 22° 13.447' N | 114° 10.691' E | 14        |
|                          | SM3     |          | 22° 13.527' N | 114° 8.980' E  | 33        |
|                          | SM4     |          | 22° 12.758' N | 114° 8.315' E  | 11        |
|                          | SM5     |          | 22° 12.141' N | 114° 6.728' E  | 8         |
|                          | SM6     | SS3      | 22° 11.500' N | 114° 4.743' E  | 14        |
|                          | SM7     | SS4      | 22° 13.740' N | 114° 4.473' E  | 8         |
|                          | SM9     |          | 22° 16.420' N | 114° 4.024' E  | 8         |
|                          | SM10    |          | 22° 18.125' N | 114° 1.919' E  | 5         |
|                          | SM11    | SS5      | 22° 15.443' N | 114° 1.078' E  | 8         |
|                          | SM12    |          | 22° 12.861' N | 114° 0.869' E  | 7         |
|                          | SM13    | SS6      | 22° 12.957' N | 113° 57.724' E | 6         |
|                          | SM17    |          | 22° 9.211' N  | 113° 57.727' E | 12        |
|                          | SM18    |          | 22° 9.211' N  | 114° 4.746' E  | 21        |
|                          | SM19    |          | 22° 9.211' N  | 114° 13.077' E | 24        |
|                          | SM20    |          | 22° 10.448' N | 113° 52.932' E | 7         |
|                          | *ST1    | *SS7     | 22° 12.517' N | 114° 1.493' E  | 5         |
|                          | *ST3    | *SS8     | 22° 14.734' N | 114° 1.928' E  | 6         |
| Port Shelter             | PM1     |          | 22° 23.242' N | 114° 17.145' E | 6         |
|                          | PM2     |          | 22° 22.643' N | 114° 16.687' E | 8         |
|                          | PM3     | PS3      | 22° 22.156' N | 114° 16.910' E | 13        |
|                          | PM4     |          | 22° 22.940' N | 114° 18.819' E | 6         |
|                          | PM6     |          | 22° 21.102' N | 114° 16.213' E | 11        |
|                          | PM7     | PS5      | 22° 20.453' N | 114° 17.703' E | 17        |
|                          | PM8     | PS6      | 22° 19.168' N | 114° 18.745' E | 20        |
|                          | PM9     |          | 22° 20.529' N | 114° 20.196' E | 15        |
|                          | PM11    |          | 22° 19.240' N | 114° 20.163' E | 21        |
|                          | *PT2    |          | 22° 22.798' N | 114° 16.540' E | 3         |
|                          | *PT3    | *PS2     | 22° 22.790' N | 114° 18.400' E | 6         |
| Junk Bay                 | *PT4    | *PS4     | 22° 21.728' N | 114° 15.879' E | 5         |
|                          | JM3     | JS2      | 22° 17.490' N | 114° 15.657' E | 10        |
|                          | JM4     |          | 22° 16.873' N | 114° 15.378' E | 16        |
| Deep Bay                 | DM1     | DS1      | 22° 29.769' N | 114° 0.644' E  | 2         |
|                          | DM2     |          | 22° 30.454' N | 113° 59.549' E | 2         |
|                          | DM3     | DS2      | 22° 28.600' N | 113° 57.551' E | 3         |
|                          | DM4     | DS3      | 22° 27.335' N | 113° 55.937' E | 4         |
|                          | DM5     | DS4      | 22° 25.561' N | 113° 53.388' E | 8         |
| North Western            | NM1     |          | 22° 20.877' N | 114° 1.286' E  | 34        |
|                          | NM2     | NS2      | 22° 21.130' N | 113° 58.815' E | 11        |
|                          | NM3     | NS3      | 22° 21.324' N | 113° 56.783' E | 14        |
|                          | NM5     | NS4      | 22° 23.051' N | 113° 53.972' E | 20        |
|                          | NM6     | NS6      | 22° 19.281' N | 113° 53.908' E | 5         |
|                          | NM8     |          | 22° 16.695' N | 113° 51.886' E | 8         |
|                          | *NT1    | *NS5     | 22° 22.475' N | 113° 58.353' E | 4         |
| Mirs Bay                 | MM1     | MS1      | 22° 32.984' N | 114° 14.271' E | 6         |
|                          | MM2     | MS2      | 22° 32.626' N | 114° 16.648' E | 11        |
|                          | MM3     | MS3      | 22° 33.714' N | 114° 18.615' E | 16        |
|                          | MM4     | MS4      | 22° 33.817' N | 114° 21.483' E | 18        |
|                          | MM5     | MS5      | 22° 31.233' N | 114° 23.633' E | 20        |
|                          | MM6     | MS6      | 22° 27.334' N | 114° 20.997' E | 12        |
|                          | MM7     | MS7      | 22° 31.409' N | 114° 17.824' E | 13        |
|                          | MM8     | MS8      | 22° 12.021' N | 114° 19.345' E | 31        |
|                          | MM13    | MS13     | 22° 13.000' N | 114° 26.920' E | 28        |
|                          | MM14    | MS14     | 22° 17.560' N | 114° 26.920' E | 25        |
|                          | MM15    | MS15     | 22° 22.120' N | 114° 26.920' E | 24        |
|                          | MM16    | MS16     | 22° 26.670' N | 114° 26.920' E | 22        |
|                          | MM17    | MS17     | 22° 30.192' N | 114° 20.960' E | 17        |
|                          | MM19    |          | 22° 15.921' N | 114° 19.411' E | 28        |
| Western Buffer           | WM1     | WS2      | 22° 15.044' N | 114° 7.363' E  | 35        |
|                          | WM2     |          | 22° 17.074' N | 114° 5.730' E  | 13        |
|                          | WM3     | WS1      | 22° 19.203' N | 114° 5.826' E  | 20        |
|                          | WM4     |          | 22° 20.940' N | 114° 4.256' E  | 26        |
|                          | *WT1    |          | 22° 14.494' N | 114° 9.737' E  | 7         |
|                          | *WT3    |          | 22° 14.811' N | 114° 8.918' E  | 10        |
| Eastern Buffer           | EM1     | ES4      | 22° 16.506' N | 114° 15.335' E | 16        |
|                          | EM2     | ES1      | 22° 15.732' N | 114° 15.971' E | 21        |
|                          | EM3     | ES2      | 22° 14.237' N | 114° 16.144' E | 21        |
|                          | *ET1    | *ES3     | 22° 16.203' N | 114° 14.624' E | 6         |
|                          | *ET2    | *ES5     | 22° 17.078' N | 114° 13.783' E | 12        |
| Victoria Harbour         | VM1     |          | 22° 17.280' N | 114° 13.839' E | 38        |
|                          | VM2     |          | 22° 17.862' N | 114° 12.619' E | 12        |
|                          |         | VS3      | 22° 17.631' N | 114° 12.526' E | 8         |
|                          | VM4     |          | 22° 17.860' N | 114° 11.654' E | 12        |
|                          | VM5     |          | 22° 17.266' N | 114° 10.510' E | 11        |
|                          |         | VS5      | 22° 17.077' N | 114° 10.600' E | 8         |
|                          | VM6     |          | 22° 17.371' N | 114° 9.665' E  | 14        |
|                          | VM7     | VS6      | 22° 17.771' N | 114° 8.416' E  | 10        |
|                          | VM8     |          | 22° 17.564' N | 114° 7.175' E  | 11        |
|                          | VM12    | VS9      | 22° 19.757' N | 114° 7.278' E  | 14        |
|                          | VM14    | VS10     | 22° 21.935' N | 114° 6.527' E  | 11        |
|                          | VM15    |          | 22° 18.579' N | 114° 8.539' E  | 13        |
|                          | *VT2    | *VS12    | 22° 17.194' N | 114° 11.304' E | 5         |
|                          | *VT3    | *VS13    | 22° 17.448' N | 114° 14.250' E | 5         |
|                          | *VT4    | *VS14    | 22° 18.734' N | 114° 12.814' E | 6         |
|                          | *VT8    | *VS17    | 22° 21.360' N | 114° 6.867' E  | 5         |
|                          | *VT10   | *VS19    | 22° 18.590' N | 114° 9.430' E  | 5         |
|                          | *VT11   | *VS20    | 22° 18.981' N | 114° 11.814' E | 6         |
|                          | *VT12   | *VS21    | 22° 19.429' N | 114° 8.587' E  | 5         |

Note : 1. All locations are based on WGS84 datum

2. Water quality and sediment monitoring stations in typhoon shelters are marked with an asterisk \*

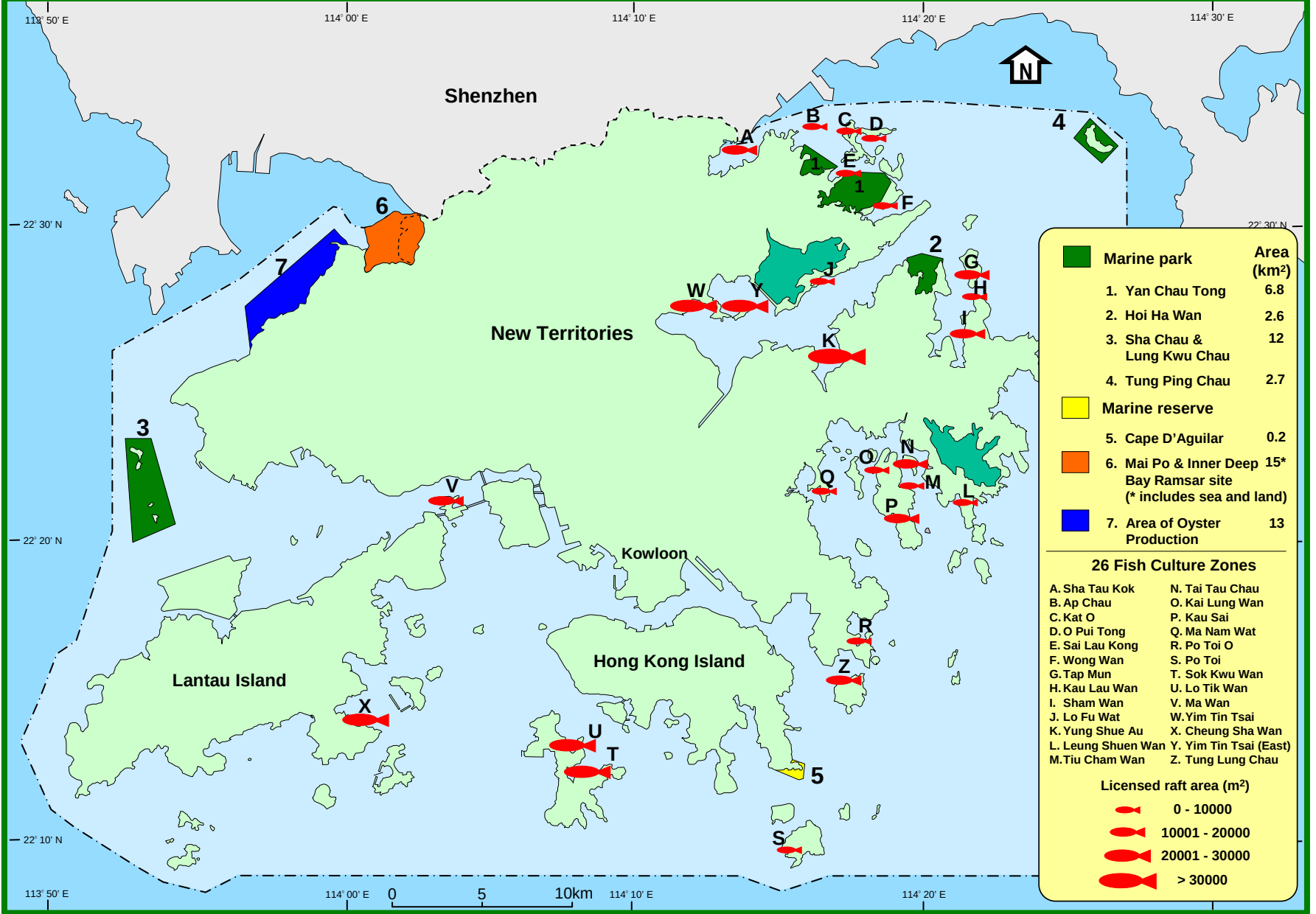
# Bathing beaches and secondary contact recreation subzones in Hong Kong in 2006

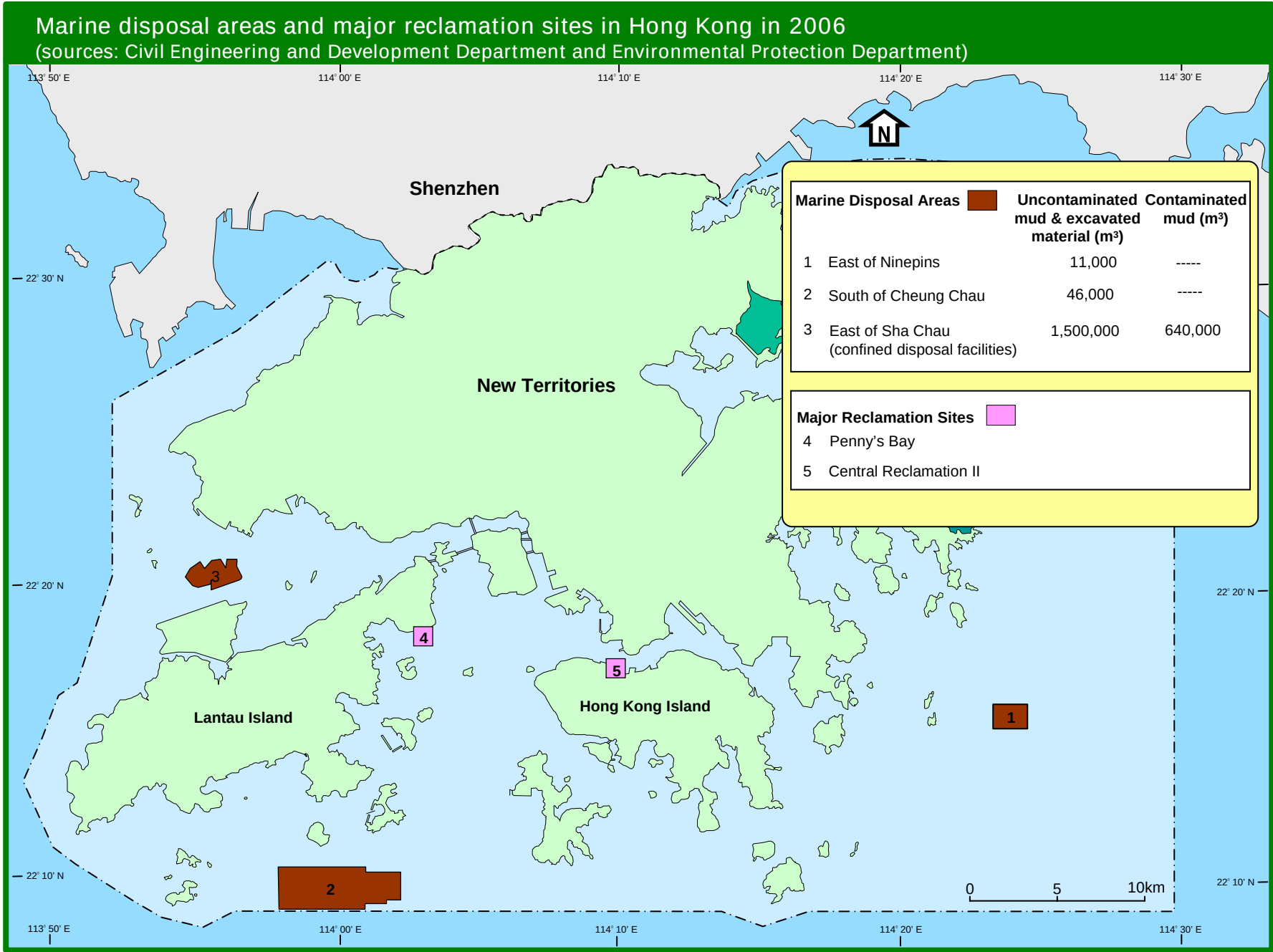


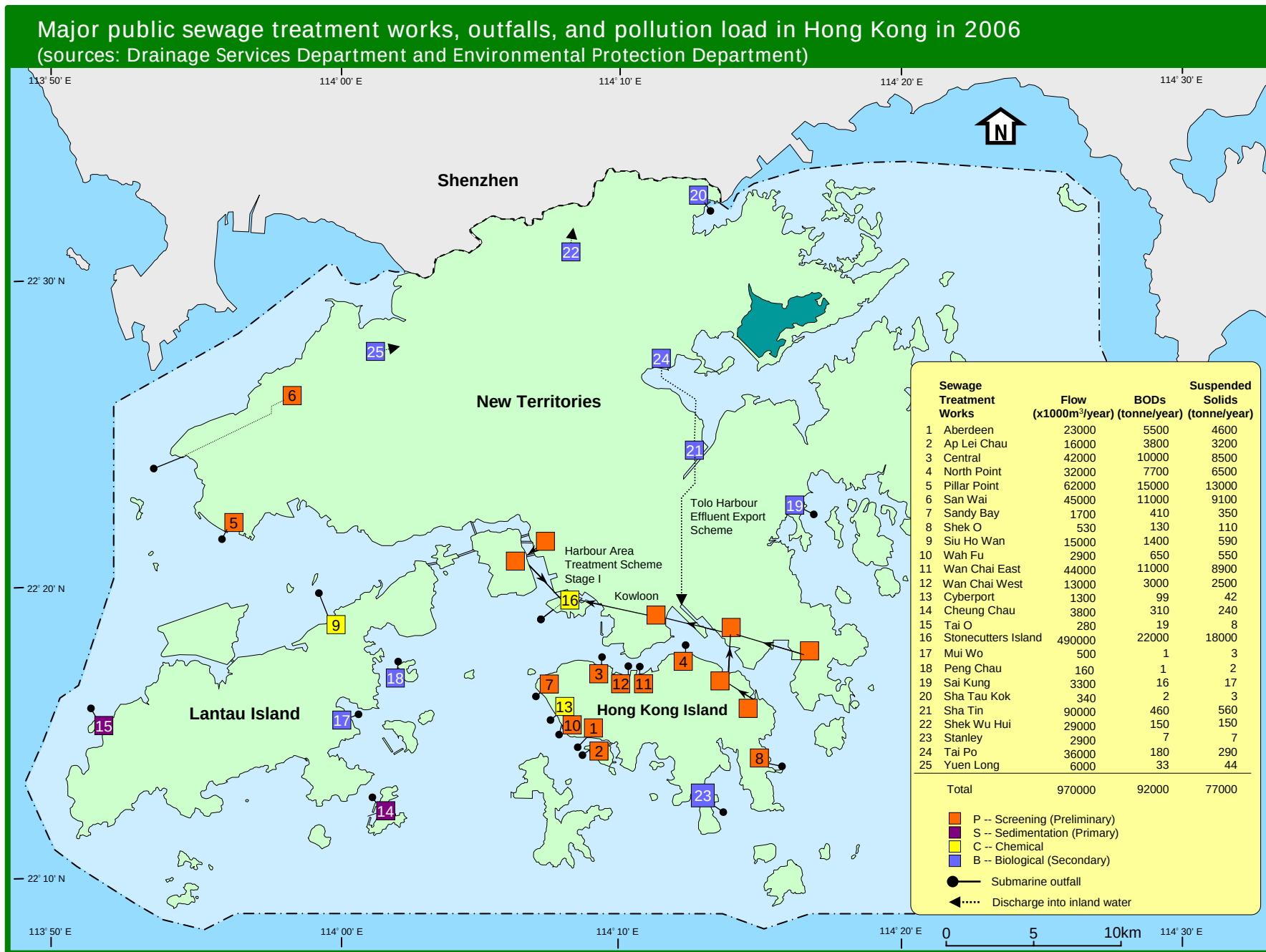


# Fish and shellfish culture zones and marine conservation sites in Hong Kong in 2006

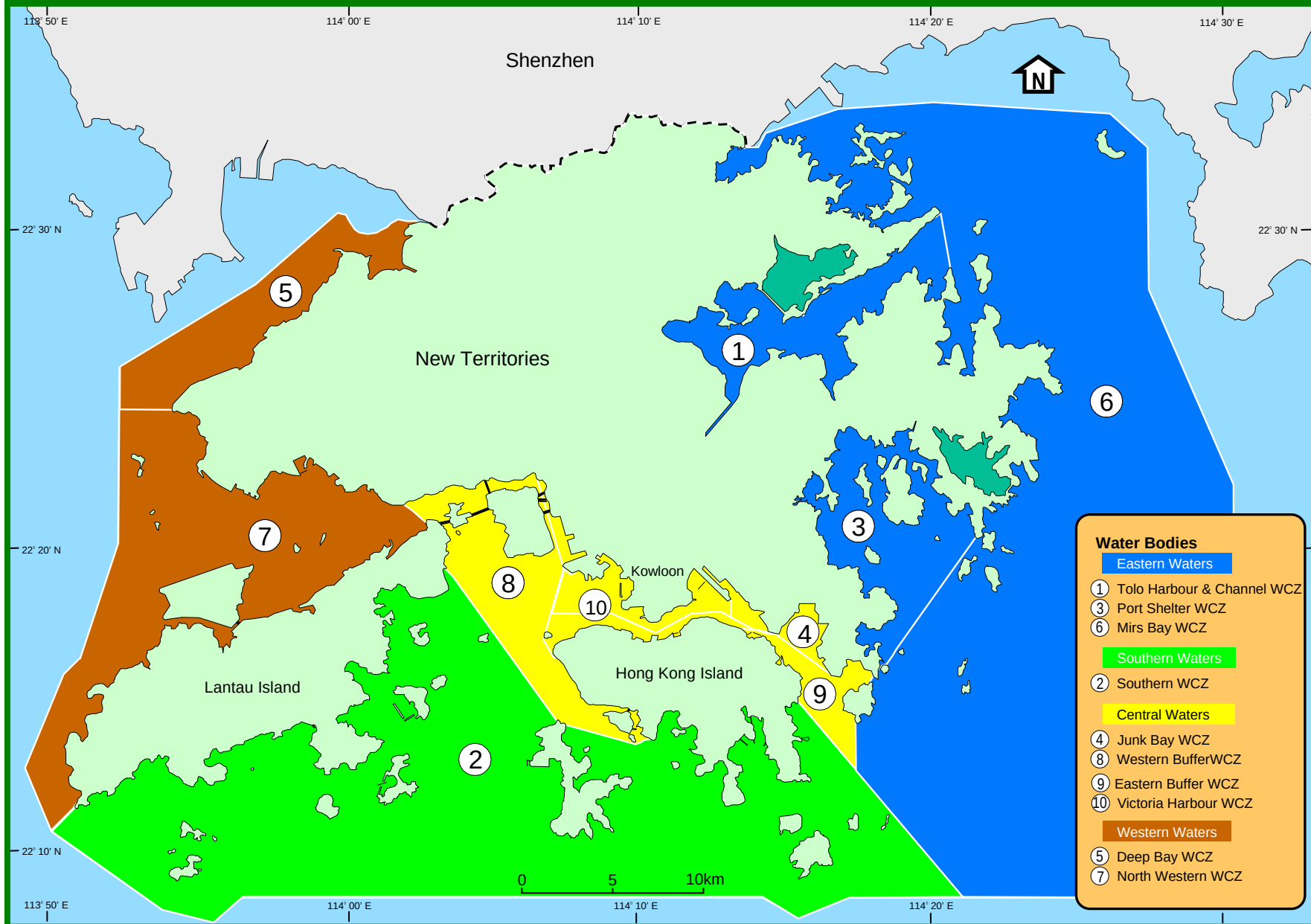
(source: Agriculture, Fisheries and Conservation Department)







# The four marine water bodies in Hong Kong – Eastern, Southern, Central and Western





## Summary of Water Quality Objectives (WQOs) for marine waters of Hong Kong

| Parameter                                     | Water Quality Objective                                                                                                                                     | Water Control Zone (WCZ) / Part(s) of zone / Subzone to which the WQO applies                                                                                           |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dissolved Oxygen (bottom)                     | Not less than 2 mg/L for 90% of samples ;                                                                                                                   | Marine waters of all WCZs except Tolo Harbour & Channel WCZ                                                                                                             |
| Dissolved Oxygen (Depth-averaged)             | Not less than 4 mg/L for 90% of samples ;                                                                                                                   | Marine waters of all WCZs except Tolo Harbour & Channel WCZ                                                                                                             |
| Dissolved Oxygen (bottom)                     | Not less than 2mg/L                                                                                                                                         | Harbour Subzone in Tolo Harbour & Channel WCZ                                                                                                                           |
|                                               | Not less than 3mg/L                                                                                                                                         | Buffer Subzone in Tolo Harbour & Channel WCZ                                                                                                                            |
|                                               | Not less than 4mg/L                                                                                                                                         | Channel Subzone in Tolo Harbour & Channel WCZ                                                                                                                           |
| Dissolved Oxygen (surface to 2m above bottom) | Not less than 4mg/L                                                                                                                                         | Harbour Subzone and Buffer Subzone in Tolo Harbour & Channel WCZ                                                                                                        |
| Dissolved Oxygen (all depths)                 | Not less than 4mg/L                                                                                                                                         | Channel Subzone in Tolo Harbour & Channel WCZ                                                                                                                           |
| Nutrients                                     | Annual mean depth-averaged total inorganic nitrogen not to exceed 0.1 mg/L                                                                                  | Marine waters of Southern WCZ and Port Shelter WCZ                                                                                                                      |
|                                               | Annual mean depth-averaged total inorganic nitrogen not to exceed 0.3 mg/L                                                                                  | Marine waters of Mirs Bay WCZ, Junk Bay WCZ, North Western WCZ (Castle Peak Subzone)                                                                                    |
|                                               | Annual mean depth-averaged total inorganic nitrogen not to exceed 0.4 mg/L                                                                                  | Marine waters of Eastern Buffer WCZ, Western Buffer WCZ, Victoria Harbour WCZ.                                                                                          |
|                                               | Annual mean depth-averaged total inorganic nitrogen not to exceed 0.5 mg/L                                                                                  | Marine waters of Deep Bay WCZ (Outer Subzone) and North Western WCZ (Whole zone except Castle Peak Subzone).                                                            |
|                                               | Annual mean depth-averaged total inorganic nitrogen not to exceed 0.7 mg/L                                                                                  | Marine waters of Deep Bay WCZ (Inner Subzone)                                                                                                                           |
| Unionised ammonia                             | Annual mean not to exceed 0.021 mg/L                                                                                                                        | All WCZs (whole zone) except Tolo Harbour & Channel WCZ                                                                                                                 |
| <i>E. coli</i>                                | Annual geometric mean not to exceed 610 cfu/100mL                                                                                                           | Secondary contact recreation subzones in Tolo Harbour & Channel WCZ, Southern WCZ, Port Shelter WCZ, Mirs Bay WCZ, Deep Bay WCZ, North Western WCZ, Western Buffer WCZ. |
|                                               | Annual geometric mean not to exceed 610 cfu/100mL                                                                                                           | Fish culture subzones in Tolo Harbour & Channel WCZ, Southern WCZ, Port Shelter WCZ, Junk Bay, Mirs Bay WCZ, Deep Bay WCZ, Eastern Buffer WCZ, Western Buffer WCZ.      |
| pH                                            | To be in the range 6.5 - 8.5, change due to waste discharge not to exceed 0.2                                                                               | Marine waters of all WCZs except Tolo Harbour & Channel WCZ                                                                                                             |
|                                               | Change due to waste discharge not to be greater than $\pm 0.5$                                                                                              | Harbour Subzone in Tolo Harbour & Channel WCZ                                                                                                                           |
|                                               | Change due to waste discharge not to be greater than $\pm 0.3$                                                                                              | Buffer Subzone in Tolo Harbour & Channel WCZ                                                                                                                            |
|                                               | Change due to waste discharge not to be greater than $\pm 0.1$                                                                                              | Channel Subzone in Tolo Harbour & Channel WCZ                                                                                                                           |
| Salinity                                      | Change due to waste discharge not to exceed 10% of natural ambient level                                                                                    | All WCZs (Whole zone) except Tolo Harbour & Channel WCZ                                                                                                                 |
|                                               | Change due to waste discharge not to be greater than $\pm 3\%$                                                                                              | Tolo Harbour & Channel WCZ                                                                                                                                              |
| Temperature                                   | Change due to waste discharge not to exceed 2°C                                                                                                             | All WCZs (Whole zone) except Tolo Harbour & Channel WCZ                                                                                                                 |
|                                               | Change due to waste discharge not to exceed 1°C                                                                                                             | Tolo Harbour & Channel WCZ                                                                                                                                              |
| Suspended solids                              | Waste discharge not to raise the natural ambient level by 30% nor cause the accumulation of suspended solids which may adversely affect aquatic communities | Marine waters of all WCZs except Tolo Harbour & Channel WCZ                                                                                                             |
| Toxicants                                     | Not to be present at levels producing significant toxic effect                                                                                              | All WCZs (Whole zone)                                                                                                                                                   |
| Chlorophyll- <i>a</i>                         | Not to exceed 20mg/m <sup>3</sup> (µg/L) calculated as running arithmetic mean of 5 daily measurements for any location and depth                           | Harbour Subzone in Tolo Harbour & Channel WCZ                                                                                                                           |
|                                               | Not to exceed 10mg/m <sup>3</sup> (µg/L) calculated as running arithmetic mean of 5 daily measurements for any location and depth                           | Buffer Subzone in Tolo Harbour & Channel WCZ                                                                                                                            |
|                                               | Not to exceed 6mg/m <sup>3</sup> (µg/L) calculated as running arithmetic mean of 5 daily measurements for any location and depth                            | Channel Subzone in Tolo Harbour & Channel WCZ                                                                                                                           |
|                                               |                                                                                                                                                             |                                                                                                                                                                         |

## Sediment Quality Criteria for the Classification of Sediments<sup>1</sup>

| Contaminants                                                   | Lower Chemical Exceedance Level (LCEL) | Upper Chemical Exceedance Level (UCEL) |
|----------------------------------------------------------------|----------------------------------------|----------------------------------------|
| <b>Metals (<i>mg/kg dry weight</i>)</b>                        |                                        |                                        |
| Cadmium (Cd)                                                   | 1.5                                    | 4                                      |
| Chromium (Cr)                                                  | 80                                     | 160                                    |
| Copper (Cu)                                                    | 65                                     | 110                                    |
| Mercury (Hg)                                                   | 0.5                                    | 1                                      |
| Nickel (Ni) <sup>2</sup>                                       | 40                                     | 40                                     |
| Lead (Pb)                                                      | 75                                     | 110                                    |
| Silver (Ag)                                                    | 1                                      | 2                                      |
| Zinc (Zn)                                                      | 200                                    | 270                                    |
| <b>Metalloid (<i>mg/kg dry weight</i>)</b>                     |                                        |                                        |
| Arsenic (As)                                                   | 12                                     | 42                                     |
| <b>Organic-PAHs (<i>µg/kg dry weight</i>)</b>                  |                                        |                                        |
| Low Molecular Weight PAHs <sup>3</sup>                         | 550                                    | 3160                                   |
| High Molecular Weight PAHs <sup>4</sup>                        | 1700                                   | 9600                                   |
| <b>Organic-non-PAHs (<i>µg/kg dry weight</i>)</b>              |                                        |                                        |
| Total PCBs                                                     | 23                                     | 180                                    |
| <b>Organometallics (<i>mg TBT/L in Interstitial water</i>)</b> |                                        |                                        |
| Tributyltin <sup>2</sup>                                       | 0.15                                   | 0.15                                   |

Footnote: 1 The table is extracted from Appendix A of WBTC (W) No. 34/2002 Management of Dredged / Excavated Sediment (<http://www.devb-wb.gov.hk>).

2 When the LCEL and UCEL for a contaminant are the same, the contaminant level is considered to have exceeded UCEL if it is greater than the value shown.

3 Low molecular weight PAHs include acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene.

4 High molecular weight PAHs include benzo[a]anthracene, benzo[a]pyrene, chrysene, dibenzo[a,h]anthracene, fluoranthene, pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, indeno[1,2,3-c,d]pyrene and

5 Total PCBs include 18 congeners: PCB 8, 18, 28, 44, 52, 66, 77, 101, 105, 118, 126, 128, 138, 153, 169, 170, 180, 187.

## Summary of marine water quality parameters

|                                                   | Parameter                                                                | Unit                              | Reporting Limit | Sampling Depth                | Standard Method / Techniques used <sup>20</sup>                                                                                     | Analysed by           |
|---------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------|-----------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| <b>Physical and Aggregate Properties</b>          | Temperature <sup>1</sup>                                                 | °C                                | 0.1             | Depth Profiling <sup>10</sup> | Instrumental (thermistor), SEACAT19+ CTD and Water Quality Profiler                                                                 | MMT/EPD <sup>15</sup> |
|                                                   | Salinity <sup>1,8</sup>                                                  | -                                 | 0.1             | Depth Profiling               | Instrumental (electrical conductivity), SEACAT19+ CTD and Water Quality Profiler                                                    | MMT/EPD               |
|                                                   | Dissolved Oxygen <sup>1</sup>                                            | mg/L<br>% saturation <sup>9</sup> | 0.1<br>1        | Depth Profiling               | Instrumental (membrane electrode), SBE23Y dissolved oxygen sensor linked to SEACAT19+ CTD and Water Quality Profiler                | MMT/EPD               |
|                                                   | Turbidity <sup>2</sup>                                                   | NTU                               | 0.1             | Depth Profiling               | Instrumental (nephelometric / infrared back scattering), OBS-3 turbidity sensor linked to SEACAT 19+ CTD and Water Quality Profiler | MMT/EPD               |
|                                                   | pH <sup>1</sup>                                                          | -                                 | 0.1             | Depth Profiling               | Instrumental (electrodeometric) SBE18 pH sensor linked to SEACAT19 + CTD and Water Quality Profiler                                 | MMT/EPD               |
|                                                   | Secchi Disc Depth <sup>2</sup>                                           | m                                 | 0.1             | ---                           | Manual                                                                                                                              | MMT/EPD               |
|                                                   | Suspended Solids <sup>2</sup>                                            | mg/L                              | 0.5             | S,M,B <sup>11</sup>           | In house method GL-PH-23, based on APHA 20ed. 2540D (weighing)                                                                      | GL <sup>18</sup>      |
|                                                   | Volatile Suspended Solids <sup>3</sup>                                   | mg/L                              | 0.5             | S,M,B                         | In house method GL-PH-23, based on APHA 20ed. 2540E (weighing)                                                                      | GL                    |
| <b>Aggregate Organic Constituents</b>             | 5-day Biochemical Oxygen Demand (BOD <sub>5</sub> ) <sup>4</sup>         | mg/L                              | 0.1             | S,M,B                         | In house method based on APHA 18ed. 5210B                                                                                           | EML/EPD <sup>16</sup> |
| <b>Nutrients and Inorganic Constituents</b>       | Ammonia Nitrogen <sup>5</sup>                                            | mg/L                              | 0.005           | S,M,B                         | In house method GL-IN-15, based on ASTM D3590-89 B (FIA)                                                                            | GL                    |
|                                                   | Unionised Ammonia <sup>5</sup>                                           | mg/L                              | 0.001           | S,M,B                         | By calculation <sup>12</sup>                                                                                                        | MMT/EPD               |
|                                                   | Nitrite Nitrogen <sup>5</sup>                                            | mg/L                              | 0.002           | S,M,B                         | In house method GL-IN-18, based on APHA 20ed. 4500-NO2- B (FIA)                                                                     | GL                    |
|                                                   | Nitrate Nitrogen <sup>5</sup>                                            | mg/L                              | 0.002           | S,M,B                         | In house method GL-IN-18, based on APHA 20ed. 4500-NO3- F & I (FIA)                                                                 | GL                    |
|                                                   | Total Inorganic Nitrogen <sup>5</sup>                                    | mg/L                              | 0.01            | S,M,B                         | By calculation <sup>13</sup>                                                                                                        | MMT/EPD               |
|                                                   | Total Kjeldahl Nitrogen <sup>5</sup><br>(soluble; soluble & particulate) | mg/L                              | 0.05            | S,M,B                         | In house method GL-IN-14 & GL-IN-15, based on ASTM D3590-89 B (FIA) & APHA 20ed 4500-N A&D (FIA)                                    | GL                    |
|                                                   | Total Nitrogen <sup>5</sup>                                              | mg/L                              | 0.05            | S,M,B                         | By calculation <sup>13</sup>                                                                                                        | MMT/EPD               |
|                                                   | Orthophosphate Phosphorus <sup>5</sup>                                   | mg/L                              | 0.002           | S,M,B                         | In house method GL-IN-16, based on ASTM D515-88 A (FIA)                                                                             | GL                    |
|                                                   | Total Phosphorus <sup>5</sup><br>(soluble; soluble & particulate)        | mg/L                              | 0.02            | S,M,B                         | In house method GL-IN-14 & GL-IN-16, based on ASTM D515-88 B (FIA) & APHA 20ed 4500-P G (FIA)                                       | GL                    |
| <b>Biological and Microbiological Examination</b> | Silica (as SiO <sub>2</sub> )<br>(soluble) <sup>5</sup>                  | mg/L                              | 0.05            | S,M,B                         | In house method GL-IN-17, based on APHA 20ed. 4500-SiO2 C&E (FIA)                                                                   | GL                    |
|                                                   | Chlorophyll-a <sup>6</sup>                                               | µg/L                              | 0.2             | S,M,B                         | In house method GL-OR-34, based on APHA 20ed. 10200H 2 (spectrophotometric)                                                         | GL                    |
|                                                   | <i>Escherichia coli</i><br>( <i>E. coli</i> ) <sup>7</sup>               | cfu/100mL                         | 1               | S,M,B                         | In house method, membrane filtration with CHROMagar Liquid <i>E. coli</i> - coliform culture <sup>14</sup>                          | EML/EPD               |
|                                                   | Faecal Coliforms <sup>7</sup>                                            | cfu/100mL                         | 1               | S,M,B                         | In house method, membrane filtration with CHROMagar Liquid <i>E. coli</i> - coliform culture <sup>14</sup>                          | EML/EPD               |
|                                                   | Phytoplankton                                                            | cell/mL                           | 1               | S                             | In house method, 10 ml settled sub-sample using plankton chamber and inverted microscope <sup>19</sup>                              | WSL/EPD <sup>17</sup> |

- Note: 1 Indicate general oceanographic conditions of marine water
- 2 Low transparency and light penetration would affect aesthetic value and photosynthesis in marine water
- 3 Indicate the amount of particulate organic matters in marine water
- 4 Indicate the amount of organic pollutants in marine water
- 5 Major nutrients (nitrogen, phosphorus, silica) promoting algal growth in marine water
- 6 Indicate the amount of algal biomass in marine water
- 7 Sewage bacteria indicate the extent of faecal pollution in marine water
- 8 Measuring and reporting of Salinity (S) is based on the Practical Salinity Scale and International Equation of State of Seawater (UNESCO Technical Papers in Marine Science No. 30 (1981) ; No. 36 (1981) and No. 45 (1985))
- 9 Percent saturation of dissolved oxygen is calculated from dissolved oxygen in mg/L based on Weiss R.F. (1970); The solubility of nitrogen, oxygen and argon in water and seawater. Deep Sea Res. Vol. 17, pp.721-735
- 10 Depth profiling - continuous measurements at downcast are processed and presented at 1m intervals from 1m below the surface to 1m above the seabed
- 11 If water depth is 6m or above, sampling is taken at three depths during upcast: S - 1m below water surface; M - mid-depth of water column; B - 1m above seabed. If water depth is 4 to 5 m, "M" is skipped; If water depth is 3m or less, "M" and "B" are skip
- 12 i) Bower C.E. and Bidwell J.P. (1978), Ionization of ammonia in seawater: Effect of temperature, pH and salinity. J. Fish. Res. Board Can. Vol.35, pp.1012-1016;
- 13 Total Inorganic Nitrogen = Ammonia Nitrogen + Nitrite Nitrogen + Nitrate Nitrogen ; Total Nitrogen = Total Kjeldahl Nitrogen (soluble & particulate) + Nitrite Nitrogen + Nitrate Nitrogen
- 14 i) DoE, DHSS & PHLS (1983); The Bacteriological Examination of Drinking Water Supplies 1982, Sec.7.8 & 7.9;
- 15 MMT/EPD - Marine Monitoring Team, Water Policy and Science Group, Environmental Protection Department.
- 16 EML/EPD - Environmental Microbiology Laboratory, Water Policy and Science Group, Environmental Protection Department.
- 17 WSL/EPD - Water Sciences Laboratory, Water Policy and Science Group, Environmental Protection Department
- 18 GL - Environmental Chemistry B Section, Environmental Chemistry & Other Scientific Services Group, Government Laboratory.
- 19 i) Lund, J.H., Kipling, C. and Le Cren, E.D. 1958. The inverted microscope method of estimating algal numbers, and the statistical basis of estimations by counting. Hydrobiologia Vol. 11, pp. 143-170.
- 20 Mention of brand names and commercial products does not constitute or imply endorsement or recommendation by the Environmental Protection Department.

Summary of marine sediment<sup>1</sup> parameters

| Parameter                                         |                                                                                                         | Unit <sup>2</sup> | Reporting Limit | Standard Method / Techniques used <sup>8</sup>                                                                                                                                                  | Analysed by          |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------|-------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Physical and Aggregate Properties                 | Particle Size Fractionation                                                                             | % w/w             | 1               | In house method, sieving and weighing ; 8 fractions : >4000 µm, <4000µm, <2000µm, <1000µm, <500µm, <250µm, <125µm and <63µm                                                                     | MMT/EPD <sup>6</sup> |
|                                                   | Electrochemical Potential <sup>4</sup>                                                                  | mV                | 1               | Instrumental, Orion Model 250A pH/Redox Meter (electrodeometric)                                                                                                                                | MMT/EPD              |
|                                                   | Total Solids (TS) <sup>3</sup>                                                                          | % w/w             | 0.1             | In house method GL-PH-22, based on APHA 20ed 2540G (weighing)                                                                                                                                   | GL <sup>7</sup>      |
|                                                   | Total Volatile Solids (TVS) <sup>3</sup>                                                                | % TS              | 0.1             | In house method GL-PH-22, based on APHA 20ed 2540G (weighing)                                                                                                                                   | GL                   |
|                                                   | Dry Wet Ratio                                                                                           | -                 | 0.01            | In house method GL-PH-22, based on APHA 20ed 2540G (weighing)                                                                                                                                   | GL                   |
| Aggregate Organic Constituents <sup>3</sup>       | Chemical Oxygen Demand (COD)                                                                            | mg/kg             | 2               | In house method GL-OR-38, based on ASTM D1252-00 A (open reflux )                                                                                                                               | GL                   |
|                                                   | Total Carbon (TC)                                                                                       | % w/w             | 0.1             | In house method GL-OR-33, based on APHA 20ed 5310 B (FIA)                                                                                                                                       | GL                   |
| Nutrients and Inorganic Constituents <sup>3</sup> | Ammonia Nitrogen (NH <sub>4</sub> -N)                                                                   | mg/kg             | 0.05            | In house method GL-IN-15, based on ASTM D3590-89 B (FIA)                                                                                                                                        | GL                   |
|                                                   | Total Kjeldahl Nitrogen (TKN)                                                                           | mg/kg             | 0.5             | In house method GL-IN-14 & GL-IN-15, based on ASTM D3590-89 B (FIA) & APHA 20ed 4500-N A&D (FIA)                                                                                                | GL                   |
|                                                   | Total Phosphorus                                                                                        | mg/kg             | 0.2             | In house method GL-IN-14 & GL-IN-16, based on ASTM D515-88 B (FIA) & APHA 20ed 4500-P G (FIA)                                                                                                   | GL                   |
|                                                   | Total Sulphide                                                                                          | mg/kg             | 0.2             | In house method GL-IN-45, based on APHA 20ed 4500-S <sup>2</sup> -D (FIA)                                                                                                                       | GL                   |
|                                                   | Total Cyanide                                                                                           | mg/kg             | 0.1             | In house method GL-IN-44, based on APHA, 20ed., 4500 CN -A&E (distillation and colorimetric)                                                                                                    | GL                   |
| Metals & Metalloids <sup>5</sup>                  | Aluminium (Al)                                                                                          | mg/kg             | 1               | In house method GL-TE-60, based on USEPA method 6010B (ICP-AES)                                                                                                                                 | GL                   |
|                                                   | Arsenic (As)                                                                                            | mg/kg             | 0.1             | In house method GL-TE-64 & GL-TE-66, based on USEPA method 6020 (ICP-MS)                                                                                                                        | GL                   |
|                                                   | Barium (Ba)                                                                                             | mg/kg             | 0.2             | In house method GL-TE-60 & GL-TE-64, based on USEPA method 6010B (ICP-AES) and USEPA method 6020 (ICP-MS)                                                                                       | GL                   |
|                                                   | Boron (B)                                                                                               | mg/kg             | 5               | In house method GL-TE-60, based on USEPA method 6010B (ICP-AES)                                                                                                                                 | GL                   |
|                                                   | Cadmium (Cd)                                                                                            | mg/kg             | 0.1             | In house method GL-TE-64, based on USEPA method 6020 (ICP-MS)                                                                                                                                   | GL                   |
|                                                   | Chromium (Cr)                                                                                           | mg/kg             | 0.2             | In house method GL-TE-60 & GL-TE-64, based on USEPA method 6010B (ICP-AES) and USEPA method 6020 (ICP-MS)                                                                                       | GL                   |
|                                                   | Copper (Cu)                                                                                             | mg/kg             | 0.2             | In house method GL-TE-60 & GL-TE-64, based on USEPA method 6010B (ICP-AES) and USEPA method 6020 (ICP-MS)                                                                                       | GL                   |
|                                                   | Iron (Fe)                                                                                               | mg/kg             | 5               | In house method GL-TE-60, based on USEPA method 6010B (ICP-AES)                                                                                                                                 | GL                   |
|                                                   | Lead (Pb)                                                                                               | mg/kg             | 0.2             | In house method GL-TE-60 & GL-TE-64, based on USEPA method 6010B (ICP-AES) and USEPA method 6020 (ICP-MS)                                                                                       | GL                   |
|                                                   | Manganese (Mn)                                                                                          | mg/kg             | 1               | In house method GL-TE-60, based on USEPA method 6010B (ICP-AES)                                                                                                                                 | GL                   |
|                                                   | Mercury (Hg)                                                                                            | mg/kg             | 0.05            | In house method GL-TE-64 & GL-TE-66, based on USEPA method 6020 (ICP-MS)                                                                                                                        | GL                   |
|                                                   | Nickel (Ni)                                                                                             | mg/kg             | 0.2             | In house method GL-TE-60 & GL-TE-64, based on USEPA method 6010B (ICP-AES) and USEPA method 6020 (ICP-MS)                                                                                       | GL                   |
|                                                   | Silver (Ag)                                                                                             | mg/kg             | 0.2             | In house method GL-TE-64, based on USEPA method 6020 (ICP-MS)                                                                                                                                   | GL                   |
|                                                   | Vanadium (V)                                                                                            | mg/kg             | 0.1             | In house method GL-TE-60 & GL-TE-64, based on USEPA method 6010B (ICP-AES) and USEPA method 6020 (ICP-MS)                                                                                       | GL                   |
|                                                   | Zinc (Zn)                                                                                               | mg/kg             | 0.2             | In house method GL-TE-60 & GL-TE-64, based on USEPA method 6010B (ICP-AES) and USEPA method 6020 (ICP-MS)                                                                                       | GL                   |
| Trace Organic Compounds                           | Polychlorinated Biphenyls (PCBs)                                                                        |                   |                 |                                                                                                                                                                                                 |                      |
|                                                   | 18 PCB congeners : PCB 8, 18, 28, 44, 52, 66, 77, 101, 105, 118, 126, 128, 138, 153, 169, 170, 180, 187 | µg/kg             | 2               | In house method GL-OR-25, based on Reference Method for the Analysis of Polychlorinated Biphenyls, Environmental Protection Series : Report EPS 1/RM/31, March 1997, Environment Canada (GC-MS) | GL                   |
|                                                   | Polyaromatic Hydrocarbons (PAHs)                                                                        |                   |                 |                                                                                                                                                                                                 |                      |
|                                                   | - Acenaphthene                                                                                          | µg/kg             | 50              | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |
|                                                   | - Acenaphthylene                                                                                        | µg/kg             | 50              | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |
|                                                   | - Naphthalene                                                                                           | µg/kg             | 60              | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |
|                                                   | - Fluorene                                                                                              | µg/kg             | 10              | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |
|                                                   | - Phenanthrene                                                                                          | µg/kg             | 5               | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |
|                                                   | - Anthracene                                                                                            | µg/kg             | 5               | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |
|                                                   | - Fluoranthene                                                                                          | µg/kg             | 5               | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |
|                                                   | - Pyrene                                                                                                | µg/kg             | 5               | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |
|                                                   | - Benzo(a)anthracene                                                                                    | µg/kg             | 3               | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |
|                                                   | - Chrysene                                                                                              | µg/kg             | 5               | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |
|                                                   | - Benzo(b)fluoranthene                                                                                  | µg/kg             | 1               | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |
|                                                   | - Benzo(k)fluoranthene                                                                                  | µg/kg             | 1               | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |
|                                                   | - Benzo(a)pyrene                                                                                        | µg/kg             | 1               | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |
|                                                   | - Dibenzo(a,h)anthracene                                                                                | µg/kg             | 5               | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |
|                                                   | - Benzo(ghi)perylene                                                                                    | µg/kg             | 1               | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |
|                                                   | - Indeno(1,2,3-cd)pyrene                                                                                | µg/kg             | 5               | In house method, GL-OR-15, based on USEPA method 610, 1984 (UV-FLUO)                                                                                                                            | GL                   |

Note: 1 Birge-Ekman (0.023m<sup>2</sup>) grab / Van Veen (0.1m<sup>2</sup>) grab / Smith-McIntyre (0.1m<sup>2</sup>) grab is employed to collect sediment samples from the top 10cm of seabed.

2 All parameters are reported on a dry weight basis unless otherwise stated.

3 Determinants are reported on a wet weight basis.

4 Electrochemical potential (Eh) is measured "on-site" at 3cm below the surface of freshly collected sediment samples (Reference : Handbook of Techniques for Aquatic Sediment Sampling. By A. Mudrock & S.D. MacKnight, 1994, CRC Press).

5 Digestion procedure for metals and metalloids in sediment follows In house method, WC-ME-2 (3.5 hours digestion in conc. HCl/conc. HNO<sub>3</sub> : 3:1 v/v)

6 MMT/EPD - Marine Monitoring Team, Water Policy and Science Group, Environmental Protection Department.

7 GL - Environmental Chemistry B Section, Environmental Chemistry & Other Scientific Services Group, Government Laboratory.

8 Mention of brand names and commercial products does not constitute or imply endorsement or recommendation by the Environmental Protection Department.

## Summary of water quality statistics for the Mirs Bay WCZ in 2006

| Parameter                              | Starling Inlet               | Crooked Island               |                              | Port Island                  | Mirs Bay North               |                              |                              |
|----------------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
|                                        | MM1                          | MM2                          | MM7                          | MM17                         | MM3                          | MM4                          | MM5                          |
| Number of samples                      | 12                           | 12                           | 12                           | 12                           | 12                           | 12                           | 12                           |
| Temperature (°C)                       | 23.5<br>(16.9 - 28.9)        | 23.2<br>(17.0 - 28.7)        | 23.1<br>(16.8 - 28.5)        | 22.7<br>(16.4 - 27.8)        | 23<br>(16.3 - 28.7)          | 22.9<br>(16.5 - 28.6)        | 22.7<br>(16.4 - 27.9)        |
| Salinity                               | 31.7<br>(28.4 - 32.8)        | 32.2<br>(28.8 - 33.0)        | 32.1<br>(28.8 - 33.1)        | 32.5<br>(29.8 - 33.4)        | 32.4<br>(29.5 - 33.3)        | 32.5<br>(29.8 - 33.5)        | 32.7<br>(30.6 - 33.5)        |
| Dissolved Oxygen (mg/L)                | 7.9<br>(6.0 - 11.0)          | 7.3<br>(5.9 - 8.9)           | 7.3<br>(6.0 - 9.0)           | 7.2<br>(5.6 - 8.6)           | 7.2<br>(5.8 - 8.5)           | 7.3<br>(5.7 - 9.0)           | 7.3<br>(5.5 - 8.9)           |
| Bottom                                 | 7.8<br>(5.3 - 11.0)          | 7.0<br>(4.6 - 9.0)           | 6.9<br>(4.2 - 9.0)           | 6.7<br>(4.1 - 8.8)           | 6.8<br>(4.8 - 8.8)           | 7.2<br>(5.1 - 9.0)           | 6.9<br>(4.7 - 8.7)           |
| Dissolved Oxygen (% Saturation)        | 113<br>(81 - 169)            | 103<br>(86 - 126)            | 102<br>(87 - 133)            | 100<br>(83 - 119)            | 101<br>(85 - 122)            | 103<br>(83 - 132)            | 102<br>(80 - 130)            |
| Bottom                                 | 110<br>(78 - 172)            | 97.3<br>(68 - 126)           | 95.4<br>(61 - 121)           | 91.5<br>(60 - 112)           | 92.9<br>(67 - 112)           | 99.2<br>(74 - 124)           | 94.3<br>(69 - 112)           |
| pH                                     | 8.2<br>(7.9 - 8.4)           | 8.1<br>(7.9 - 8.5)           | 8.1<br>(7.9 - 8.5)           | 8.1<br>(7.9 - 8.3)           | 8.1<br>(7.9 - 8.4)           | 8.1<br>(7.9 - 8.5)           | 8.1<br>(7.9 - 8.3)           |
| Secchi Disc Depth (m)                  | 1.7<br>(0.8 - 2.7)           | 2.5<br>(1.5 - 3.7)           | 3.1<br>(1.1 - 4.8)           | 3.8<br>(2.0 - 5.0)           | 2.3<br>(1.5 - 4.5)           | 3.4<br>(1.6 - 7.1)           | 4.0<br>(1.5 - 6.5)           |
| Turbidity (NTU)                        | 12.3<br>(4.1 - 25.1)         | 9.7<br>(3.7 - 20.1)          | 9.2<br>(3.3 - 17.2)          | 9.8<br>(3.2 - 24.0)          | 11.4<br>(4.3 - 25.2)         | 10.2<br>(3.6 - 20.4)         | 10.2<br>(3.2 - 21.6)         |
| Suspended Solids (mg/L)                | 5.0<br>(1.9 - 9.1)           | 2.5<br>(0.8 - 5.3)           | 1.8<br>(0.9 - 2.9)           | 1.9<br>(0.8 - 7.5)           | 4.4<br>(2.3 - 10.2)          | 2.4<br>(0.8 - 7.1)           | 2.7<br>(0.6 - 9.4)           |
| 5-day Biochemical Oxygen Demand (mg/L) | 1.5<br>(0.5 - 2.6)           | 0.9<br>(0.1 - 1.3)           | 0.9<br>(0.2 - 1.7)           | 0.5<br>(0.1 - 1.1)           | 0.7<br>(0.1 - 1.1)           | 0.5<br>(0.1 - 0.8)           | 0.5<br>(0.1 - 1.3)           |
| Ammonia Nitrogen (mg/L)                | 0.08<br>(0.02 - 0.18)        | 0.04<br>(0.01 - 0.07)        | 0.04<br>(0.02 - 0.06)        | 0.02<br>(0.01 - 0.04)        | 0.03<br>(0.02 - 0.05)        | 0.02<br>(0.01 - 0.04)        | 0.02<br>(0.01 - 0.04)        |
| Unionised Ammonia (mg/L)               | 0.004<br>(0.001 - 0.007)     | 0.002<br>(0.001 - 0.003)     | 0.002<br>(0.001 - 0.008)     | 0.001<br>( $<0.001$ - 0.002) | 0.002<br>(0.001 - 0.003)     | 0.001<br>( $<0.001$ - 0.003) | 0.001<br>( $<0.001$ - 0.002) |
| Nitrite Nitrogen (mg/L)                | 0.014<br>(0.002 - 0.051)     | 0.015<br>(0.002 - 0.064)     | 0.014<br>(0.002 - 0.083)     | 0.010<br>(0.002 - 0.040)     | 0.011<br>(0.002 - 0.046)     | 0.008<br>(0.002 - 0.029)     | 0.010<br>(0.002 - 0.036)     |
| Nitrate Nitrogen (mg/L)                | 0.03<br>( $<0.01$ - 0.10)    | 0.02<br>( $<0.01$ - 0.04)    | 0.02<br>( $<0.01$ - 0.04)    | 0.02<br>( $<0.01$ - 0.06)    | 0.02<br>( $<0.01$ - 0.05)    | 0.01<br>( $<0.01$ - 0.04)    | 0.02<br>( $<0.01$ - 0.07)    |
| Total Inorganic Nitrogen (mg/L)        | 0.13<br>(0.03 - 0.31)        | 0.07<br>(0.03 - 0.12)        | 0.07<br>(0.02 - 0.15)        | 0.05<br>(0.02 - 0.09)        | 0.05<br>(0.02 - 0.08)        | 0.04<br>(0.02 - 0.07)        | 0.05<br>(0.03 - 0.09)        |
| Total Kjeldahl Nitrogen (mg/L)         | 0.28<br>(0.19 - 0.36)        | 0.17<br>(0.14 - 0.23)        | 0.17<br>(0.12 - 0.22)        | 0.14<br>(0.11 - 0.16)        | 0.16<br>(0.11 - 0.22)        | 0.14<br>(0.12 - 0.17)        | 0.13<br>(0.10 - 0.15)        |
| Total Nitrogen (mg/L)                  | 0.32<br>(0.20 - 0.46)        | 0.21<br>(0.15 - 0.26)        | 0.20<br>(0.13 - 0.30)        | 0.17<br>(0.13 - 0.22)        | 0.18<br>(0.12 - 0.27)        | 0.16<br>(0.12 - 0.20)        | 0.16<br>(0.12 - 0.23)        |
| Orthophosphate Phosphorus (mg/L)       | $<0.01$<br>( $<0.01$ - 0.02) | $<0.01$<br>( $<0.01$ - 0.01) | $<0.01$<br>( $<0.01$ - 0.01) | $<0.01$<br>( $<0.01$ - 0.01) | $<0.01$<br>( $<0.01$ - 0.01) | $<0.01$<br>( $<0.01$ - 0.01) | $<0.01$<br>( $<0.01$ - 0.01) |
| Total Phosphorus (mg/L)                | 0.03<br>(0.02 - 0.05)        | 0.02<br>(0.02 - 0.03)        | 0.02<br>(0.02 - 0.03)        | 0.02<br>(0.02 - 0.03)        | 0.02<br>(0.02 - 0.03)        | 0.02<br>(0.02 - 0.03)        | 0.02<br>(0.02 - 0.03)        |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 0.6<br>(0.1 - 1.3)           | 0.5<br>(0.1 - 0.9)           | 0.6<br>(0.1 - 0.9)           | 0.6<br>(0.1 - 1.0)           | 0.5<br>(0.1 - 0.8)           | 0.5<br>(0.2 - 0.7)           | 0.5<br>(0.2 - 1.2)           |
| Chlorophyll-a (µg/L)                   | 7.7<br>(2.0 - 21.4)          | 4.1<br>(1.1 - 10.9)          | 3.9<br>(1.0 - 14.4)          | 2.3<br>(1.2 - 5.8)           | 2.6<br>(1.3 - 6.9)           | 2.6<br>(1.3 - 5.7)           | 2.3<br>(1.1 - 5.2)           |
| <i>E. coli</i> (cfu/100mL)             | 39<br>(3 - 4300)             | 2<br>(1 - 26)                | 1<br>(1 - 17)                | 1<br>(1 - 3)                 | 2<br>(1 - 27)                | 2<br>(1 - 54)                | 1<br>(1 - 1)                 |
| Faecal Coliforms (cfu/100mL)           | 96<br>(4 - 10000)            | 4<br>(1 - 81)                | 2<br>(1 - 110)               | 1<br>(1 - 10)                | 4<br>(1 - 120)               | 2<br>(1 - 120)               | 1<br>(1 - 2)                 |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.



## Summary of water quality statistics for the Mirs Bay WCZ in 2006 (continued)

| Parameter                              | Ninepin<br>Group<br>MM19   | Waglan<br>Island<br>MM8    | Mirs Bay<br>(South)<br>MM13 | Mirs Bay (Central)         |                            |                            | Long Harbour<br>MM6        |
|----------------------------------------|----------------------------|----------------------------|-----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
|                                        | MM14                       | MM15                       | MM16                        |                            |                            |                            |                            |
| Number of samples                      | 12                         | 12                         | 12                          | 12                         | 12                         | 12                         | 12                         |
| Temperature (°C)                       | 22.8<br>(16.9 - 27.4)      | 22.8<br>(16.9 - 27.1)      | 22.8<br>(16.2 - 27.1)       | 22.7<br>(16.2 - 27.2)      | 22.8<br>(16.6 - 27.6)      | 22.8<br>(16.5 - 27.9)      | 22.9<br>(16.4 - 28.5)      |
| Salinity                               | 32.8<br>(30.3 - 33.6)      | 32.7<br>(30.0 - 33.6)      | 32.8<br>(30.4 - 33.9)       | 32.8<br>(30.4 - 33.9)      | 32.8<br>(30.6 - 33.9)      | 32.7<br>(30.8 - 33.9)      | 32.3<br>(29.1 - 33.3)      |
| Dissolved Oxygen (mg/L)                | 7.3<br>(5.6 - 8.6)         | 7.1<br>(5.6 - 8.6)         | 7.3<br>(5.9 - 9.1)          | 7.2<br>(5.4 - 8.8)         | 7.4<br>(5.6 - 9.0)         | 7.3<br>(5.8 - 9.6)         | 7.4<br>(5.8 - 9.8)         |
| Bottom                                 | 6.7<br>(4.2 - 8.7)         | 6.6<br>(4.1 - 8.9)         | 6.7<br>(4.5 - 9.1)          | 6.8<br>(4.5 - 8.8)         | 6.9<br>(4.8 - 8.7)         | 6.8<br>(4.3 - 9.0)         | 7.2<br>(5.1 - 10.0)        |
| Dissolved Oxygen (% Saturation)        | 102<br>(81 - 119)          | 100<br>(82 - 118)          | 103<br>(86 - 122)           | 101<br>(79 - 121)          | 103<br>(82 - 128)          | 103<br>(86 - 129)          | 104<br>(88 - 146)          |
| Bottom                                 | 92<br>(60 - 116)           | 92<br>(59 - 119)           | 93<br>(63 - 119)            | 94<br>(63 - 118)           | 96<br>(68 - 117)           | 94<br>(62 - 122)           | 100<br>(74 - 143)          |
| pH                                     | 8.1<br>(7.9 - 8.4)         | 8.1<br>(7.9 - 8.3)         | 8.1<br>(7.9 - 8.3)          | 8.0<br>(7.9 - 8.3)         | 8.0<br>(7.9 - 8.3)         | 8.0<br>(7.7 - 8.4)         | 8.0<br>(7.8 - 8.1)         |
| Secchi Disc Depth (m)                  | 3.2<br>(1.5 - 6.0)         | 3.3<br>(1.5 - 7.5)         | 3.0<br>(1.3 - 5.5)          | 3.2<br>(1.5 - 6.5)         | 3.1<br>(1.5 - 7.0)         | 3.0<br>(0.8 - 7.0)         | 3.5<br>(1.6 - 5.9)         |
| Turbidity (NTU)                        | 12.3<br>(3.6 - 37.8)       | 15.7<br>(3.0 - 77.8)       | 22.2<br>(2.5 - 130.0)       | 11.0<br>(2.3 - 20.6)       | 10.3<br>(3.5 - 18.6)       | 11.0<br>(3.0 - 18.1)       | 9.8<br>(2.4 - 29.3)        |
| Suspended Solids (mg/L)                | 3.3<br>(1.0 - 13.7)        | 3.3<br>(0.9 - 15.2)        | 4.4<br>(1.1 - 19.3)         | 3.2<br>(0.8 - 10.9)        | 3.1<br>(0.7 - 11.4)        | 3.8<br>(1.1 - 7.9)         | 1.5<br>(0.6 - 4.5)         |
| 5-day Biochemical Oxygen Demand (mg/L) | 0.6<br>(0.3 - 1.0)         | 0.5<br>(0.2 - 0.9)         | 0.5<br>(0.2 - 1.0)          | 0.5<br>(0.2 - 1.6)         | 0.4<br>(0.2 - 0.8)         | 0.5<br>(0.2 - 0.7)         | 0.7<br>(0.3 - 1.6)         |
| Ammonia Nitrogen (mg/L)                | 0.02<br>(0.01 - 0.03)      | 0.02<br>(0.01 - 0.03)      | 0.02<br>(0.01 - 0.03)       | 0.02<br>(0.01 - 0.03)      | 0.02<br>(0.01 - 0.03)      | 0.02<br>(0.01 - 0.04)      | 0.03<br>(0.01 - 0.04)      |
| Unionised Ammonia (mg/L)               | <0.001<br>(<0.001 - 0.002) | <0.001<br>(<0.001 - 0.002) | <0.001<br>(<0.001 - 0.002)  | <0.001<br>(<0.001 - 0.002) | <0.001<br>(<0.001 - 0.001) | <0.001<br>(<0.001 - 0.002) | <0.001<br>(<0.001 - 0.002) |
| Nitrite Nitrogen (mg/L)                | 0.011<br>(0.003 - 0.024)   | 0.011<br>(0.002 - 0.019)   | 0.009<br>(0.002 - 0.015)    | 0.009<br>(0.002 - 0.020)   | 0.008<br>(0.002 - 0.018)   | 0.008<br>(0.002 - 0.029)   | 0.008<br>(0.002 - 0.026)   |
| Nitrate Nitrogen (mg/L)                | 0.04<br>(<0.01 - 0.14)     | 0.05<br>(<0.01 - 0.16)     | 0.04<br>(<0.01 - 0.10)      | 0.05<br>(<0.01 - 0.14)     | 0.03<br>(<0.01 - 0.09)     | 0.03<br>(<0.01 - 0.09)     | 0.01<br>(<0.01 - 0.02)     |
| Total Inorganic Nitrogen (mg/L)        | 0.07<br>(0.03 - 0.17)      | 0.08<br>(0.03 - 0.19)      | 0.07<br>(<0.01 - 0.12)      | 0.08<br>(0.02 - 0.16)      | 0.06<br>(0.02 - 0.10)      | 0.05<br>(0.02 - 0.11)      | 0.04<br>(0.02 - 0.06)      |
| Total Kjeldahl Nitrogen (mg/L)         | 0.13<br>(0.10 - 0.15)      | 0.13<br>(0.09 - 0.16)      | 0.13<br>(0.07 - 0.17)       | 0.13<br>(0.08 - 0.19)      | 0.12<br>(0.10 - 0.17)      | 0.14<br>(0.10 - 0.17)      | 0.15<br>(0.11 - 0.19)      |
| Total Nitrogen (mg/L)                  | 0.18<br>(0.12 - 0.30)      | 0.19<br>(0.10 - 0.33)      | 0.18<br>(0.10 - 0.28)       | 0.19<br>(0.09 - 0.29)      | 0.16<br>(0.10 - 0.26)      | 0.17<br>(0.11 - 0.26)      | 0.17<br>(0.12 - 0.22)      |
| Orthophosphate Phosphorus (mg/L)       | <0.01<br>(<0.01 - 0.01)    | <0.01<br>(<0.01 - <0.01)   | <0.01<br>(<0.01 - <0.01)    | <0.01<br>(<0.01 - <0.01)   | <0.01<br>(<0.01 - 0.01)    | <0.01<br>(<0.01 - 0.01)    | <0.01<br>(<0.01 - <0.01)   |
| Total Phosphorus (mg/L)                | 0.02<br>(0.02 - 0.02)      | 0.02<br>(0.02 - 0.02)      | 0.02<br>(0.02 - 0.04)       | 0.02<br>(0.02 - 0.02)      | 0.02<br>(0.02 - 0.02)      | 0.02<br>(0.02 - 0.03)      | 0.02<br>(0.02 - 0.02)      |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 0.6<br>(0.3 - 1.0)         | 0.6<br>(0.2 - 1.0)         | 0.5<br>(0.3 - 0.9)          | 0.5<br>(0.3 - 1.0)         | 0.5<br>(0.2 - 0.8)         | 0.5<br>(0.2 - 0.7)         | 0.5<br>(0.1 - 1.0)         |
| Chlorophyll-a (µg/L)                   | 2.8<br>(1.0 - 6.7)         | 2.1<br>(0.9 - 4.1)         | 2.2<br>(1.2 - 4.2)          | 2.3<br>(1.0 - 5.4)         | 2.0<br>(1.3 - 4.9)         | 2.9<br>(1.2 - 7.1)         | 2.7<br>(0.7 - 9.8)         |
| <i>E. coli</i> (cfu/100mL)             | 1<br>(1 - 1)               | 1<br>(1 - 1)               | 1<br>(1 - 1)                | 1<br>(1 - 1)               | 1<br>(1 - 1)               | 1<br>(1 - 1)               | 1<br>(1 - 12)              |
| Faecal Coliforms (cfu/100mL)           | 1<br>(1 - 3)               | 2<br>(1 - 88)              | 1<br>(1 - 8)                | 1<br>(1 - 10)              | 1<br>(1 - 1)               | 1<br>(1 - 2)               | 2<br>(1 - 73)              |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

## Summary of water quality statistics for the Port Shelter WCZ in 2006

| Parameter                              | Inner Port Shelter        |                           |                           |                            | Hebe Haven                |
|----------------------------------------|---------------------------|---------------------------|---------------------------|----------------------------|---------------------------|
|                                        | PM1                       | PM2                       | PM3                       | PM4                        | PM6                       |
| Number of samples                      | 12                        | 12                        | 12                        | 12                         | 12                        |
| Temperature (°C)                       | 23.7<br>(15.9 - 30.1)     | 23.8<br>(16.2 - 30.8)     | 23.3<br>(16.3 - 28.6)     | 23.7<br>(16.1 - 30.0)      | 23.4<br>(16.3 - 28.8)     |
| Salinity                               | 32.1<br>(28.5 - 33.4)     | 32.2<br>(28.5 - 33.3)     | 32.5<br>(29.9 - 33.4)     | 32.2<br>(29.0 - 33.5)      | 32.3<br>(29.4 - 33.3)     |
| Dissolved Oxygen (mg/L)                | 7.5<br>(6.0 - 8.9)        | 7.3<br>(5.6 - 8.7)        | 7.3<br>(5.7 - 8.5)        | 7.2<br>(6.1 - 8.8)         | 7.3<br>(5.8 - 9.0)        |
| Bottom                                 | 7.6<br>(5.7 - 9.2)        | 7.4<br>(5.6 - 9.0)        | 7.0<br>(5.2 - 8.9)        | 7.5<br>(5.9 - 8.8)         | 7.0<br>(5.6 - 9.1)        |
| Dissolved Oxygen (% Saturation)        | 107<br>(87 - 128)         | 103<br>(82 - 128)         | 103<br>(84 - 121)         | 102<br>(89 - 132)          | 102<br>(85 - 123)         |
| Bottom                                 | 108<br>(83 - 127)         | 104<br>(81 - 124)         | 97<br>(78 - 121)          | 105<br>(86 - 127)          | 97<br>(82 - 124)          |
| pH                                     | 8.1<br>(7.9 - 8.5)        | 8.1<br>(7.9 - 8.4)        | 8.1<br>(7.9 - 8.4)        | 8.1<br>(7.9 - 8.4)         | 8.0<br>(7.8 - 8.3)        |
| Secchi Disc Depth (m)                  | 2.8<br>(1.8 - 5.3)        | 2.5<br>(1.3 - 4.2)        | 2.8<br>(1.3 - 4.9)        | 2.7<br>(1.5 - 4.7)         | 2.6<br>(1.6 - 4.3)        |
| Turbidity (NTU)                        | 8.8<br>(2.1 - 17.3)       | 8.8<br>(1.2 - 16.3)       | 9.0<br>(0.9 - 17.4)       | 9.8<br>(2.0 - 19.2)        | 9.9<br>(2.0 - 25.9)       |
| Suspended Solids (mg/L)                | 2.2<br>(0.7 - 5.1)        | 2.4<br>(0.6 - 7.8)        | 2.8<br>(0.8 - 9.3)        | 4.5<br>(1.1 - 20.9)        | 3.0<br>(0.9 - 12.7)       |
| 5-day Biochemical Oxygen Demand (mg/L) | 0.8<br>(0.3 - 1.2)        | 0.7<br>(0.4 - 1.2)        | 0.6<br>(0.3 - 1.3)        | 0.7<br>(0.3 - 1.3)         | 0.6<br>(0.1 - 1.2)        |
| Ammonia Nitrogen (mg/L)                | 0.02<br>(<0.01 - 0.04)    | 0.02<br>(<0.01 - 0.04)    | 0.02<br>(<0.01 - 0.05)    | 0.02<br>(<0.01 - 0.04)     | 0.02<br>(<0.01 - 0.05)    |
| Unionised Ammonia (mg/L)               | 0.001<br>(<0.001 - 0.003) | 0.001<br>(<0.001 - 0.003) | 0.001<br>(<0.001 - 0.003) | <0.001<br>(<0.001 - 0.003) | 0.001<br>(<0.001 - 0.002) |
| Nitrite Nitrogen (mg/L)                | 0.003<br>(0.002 - 0.007)  | 0.004<br>(0.002 - 0.009)  | 0.006<br>(0.002 - 0.021)  | 0.003<br>(0.002 - 0.006)   | 0.005<br>(0.002 - 0.015)  |
| Nitrate Nitrogen (mg/L)                | 0.01<br>(<0.01 - 0.05)    | 0.02<br>(<0.01 - 0.08)    | 0.02<br>(<0.01 - 0.06)    | <0.01<br>(<0.01 - 0.04)    | 0.02<br>(<0.01 - 0.07)    |
| Total Inorganic Nitrogen (mg/L)        | 0.03<br>(0.01 - 0.08)     | 0.04<br>(0.02 - 0.10)     | 0.05<br>(<0.01 - 0.10)    | 0.03<br>(0.01 - 0.06)      | 0.05<br>(0.01 - 0.10)     |
| Total Kjeldahl Nitrogen (mg/L)         | 0.16<br>(0.11 - 0.25)     | 0.15<br>(0.12 - 0.24)     | 0.16<br>(0.12 - 0.23)     | 0.16<br>(0.13 - 0.23)      | 0.15<br>(0.13 - 0.19)     |
| Total Nitrogen (mg/L)                  | 0.17<br>(0.11 - 0.25)     | 0.17<br>(0.13 - 0.27)     | 0.18<br>(0.13 - 0.28)     | 0.17<br>(0.13 - 0.23)      | 0.17<br>(0.13 - 0.25)     |
| Orthophosphate Phosphorus (mg/L)       | <0.01<br>(<0.01 - 0.01)   | <0.01<br>(<0.01 - 0.02)   | <0.01<br>(<0.01 - 0.01)   | <0.01<br>(<0.01 - 0.01)    | <0.01<br>(<0.01 - 0.01)   |
| Total Phosphorus (mg/L)                | 0.02<br>(0.02 - 0.04)     | 0.02<br>(0.02 - 0.05)     | 0.02<br>(0.02 - 0.05)     | 0.02<br>(0.02 - 0.04)      | 0.02<br>(0.02 - 0.02)     |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 0.5<br>(0.2 - 1.0)        | 0.6<br>(0.1 - 1.1)        | 0.5<br>(0.1 - 1.2)        | 0.5<br>(0.2 - 1.2)         | 0.6<br>(0.1 - 1.1)        |
| Chlorophyll-a (µg/L)                   | 3.2<br>(1.8 - 13.0)       | 2.9<br>(1.5 - 8.7)        | 3.1<br>(1.0 - 13.7)       | 3.3<br>(1.6 - 14.6)        | 2.9<br>(0.9 - 6.8)        |
| <i>E. coli</i> (cfu/100mL)             | 1<br>(1 - 3)              | 2<br>(1 - 5)              | 1<br>(1 - 3)              | 1<br>(1 - 1)               | 1<br>(1 - 3)              |
| Faecal Coliforms (cfu/100mL)           | 2<br>(1 - 27)             | 9<br>(1 - 110)            | 3<br>(1 - 51)             | 3<br>(1 - 22)              | 3<br>(1 - 7)              |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

## Summary of water quality statistics of the Port Shelter WCZ in 2006 (continued)

| Parameter                              | Outer Port Shelter        |                            | Rocky Harbour             | Bluff Island               |
|----------------------------------------|---------------------------|----------------------------|---------------------------|----------------------------|
|                                        | PM7                       | PM8                        | PM9                       | PM11                       |
| Number of samples                      | 12                        | 12                         | 12                        | 12                         |
| Temperature (°C)                       | 23.2<br>(16.6 - 27.8)     | 23.0<br>(16.7 - 27.8)      | 23.1<br>(16.1 - 28.2)     | 23.0<br>(16.5 - 27.9)      |
| Salinity                               | 32.6<br>(30.1 - 33.5)     | 32.7<br>(29.9 - 33.6)      | 32.6<br>(29.8 - 33.5)     | 32.7<br>(30.0 - 33.7)      |
| Dissolved Oxygen (mg/L)                | 7.4<br>(5.7 - 9.6)        | 7.1<br>(5.5 - 8.6)         | 7.3<br>(5.8 - 9.3)        | 7.3<br>(5.8 - 8.8)         |
| Bottom                                 | 7.0<br>(4.4 - 8.6)        | 6.7<br>(4 - 8.8)           | 7.0<br>(4.3 - 8.9)        | 6.8<br>(4 - 8.9)           |
| Dissolved Oxygen (% Saturation)        | 104<br>(84 - 139)         | 100<br>(80 - 118)          | 102<br>(85 - 135)         | 102<br>(84 - 128)          |
| Bottom                                 | 97<br>(65 - 115)          | 92<br>(59 - 115)           | 97<br>(63 - 124)          | 93<br>(58 - 121)           |
| pH                                     | 8.1<br>(7.9 - 8.5)        | 8.1<br>(7.9 - 8.4)         | 8.1<br>(7.9 - 8.4)        | 8.1<br>(7.9 - 8.3)         |
| Secchi Disc Depth (m)                  | 3.5<br>(1.7 - 8.5)        | 3.9<br>(1.5 - 9.5)         | 3.0<br>(1.4 - 5.3)        | 3.2<br>(1.5 - 6.0)         |
| Turbidity (NTU)                        | 10.0<br>(1.9 - 22.9)      | 10.2<br>(3.2 - 21.6)       | 9.6<br>(2.8 - 17.8)       | 10.2<br>(3.5 - 19.1)       |
| Suspended Solids (mg/L)                | 2.8<br>(0.7 - 11.6)       | 2.6<br>(0.6 - 9.3)         | 2.3<br>(0.8 - 8.8)        | 2.6<br>(0.8 - 8.2)         |
| 5-day Biochemical Oxygen Demand (mg/L) | 0.63<br>(0.1 - 1.6)       | 0.57<br>(0.2 - 1.4)        | 0.66<br>(0.3 - 1.7)       | 0.54<br>(0.2 - 1.2)        |
| Ammonia Nitrogen (mg/L)                | 0.02<br>(<0.01 - 0.04)    | 0.02<br>(<0.01 - 0.04)     | 0.02<br>(<0.01 - 0.05)    | 0.02<br>(<0.01 - 0.03)     |
| Unionised Ammonia (mg/L)               | 0.001<br>(<0.001 - 0.003) | <0.001<br>(<0.001 - 0.002) | 0.001<br>(<0.001 - 0.003) | <0.001<br>(<0.001 - 0.002) |
| Nitrite Nitrogen (mg/L)                | 0.006<br>(0.002 - 0.015)  | 0.008<br>(0.002 - 0.018)   | 0.007<br>(0.002 - 0.019)  | 0.009<br>(0.002 - 0.027)   |
| Nitrate Nitrogen (mg/L)                | 0.02<br>(<0.01 - 0.06)    | 0.03<br>(<0.01 - 0.12)     | 0.02<br>(<0.01 - 0.08)    | 0.03<br>(<0.01 - 0.13)     |
| Total Inorganic Nitrogen (mg/L)        | 0.05<br>(0.01 - 0.08)     | 0.05<br>(0.01 - 0.14)      | 0.04<br>(0.01 - 0.11)     | 0.05<br>(0.01 - 0.15)      |
| Total Kjeldahl Nitrogen (mg/L)         | 0.14<br>(0.11 - 0.20)     | 0.13<br>(<0.10 - 0.19)     | 0.14<br>(0.12 - 0.18)     | 0.14<br>(0.10 - 0.17)      |
| Total Nitrogen (mg/L)                  | 0.17<br>(0.12 - 0.26)     | 0.17<br>(0.11 - 0.27)      | 0.17<br>(0.13 - 0.26)     | 0.17<br>(0.13 - 0.29)      |
| Orthophosphate Phosphorus (mg/L)       | <0.01<br>(<0.01 - 0.01)   | <0.01<br>(<0.01 - 0.01)    | <0.01<br>(<0.01 - <0.01)  | <0.01<br>(<0.01 - <0.01)   |
| Total Phosphorus (mg/L)                | 0.02<br>(0.02 - 0.03)     | 0.02<br>(0.02 - 0.03)      | 0.02<br>(0.02 - 0.02)     | 0.02<br>(0.02 - 0.03)      |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 0.5<br>(0.1 - 0.9)        | 0.5<br>(0.1 - 0.8)         | 0.5<br>(0.1 - 0.9)        | 0.5<br>(0.2 - 0.8)         |
| Chlorophyll-a (µg/L)                   | 2.5<br>(0.6 - 10.0)       | 2.3<br>(0.5 - 7.5)         | 2.4<br>(0.7 - 7.7)        | 2.8<br>(0.9 - 8.2)         |
| <i>E. coli</i> (cfu/100mL)             | 1<br>(1 - 1)              | 1<br>(1 - 1)               | 1<br>(1 - 1)              | 1<br>(1 - 1)               |
| Faecal Coliforms (cfu/100mL)           | 1<br>(1 - 2)              | 1<br>(1 - 3)               | 1<br>(1 - 7)              | 1<br>(1 - 6)               |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

## Summary of water quality statistics for the Tolo Harbour WCZ in 2006

| Parameter                              | Harbour Subzone           |                           |                           | Buffer Subzone            |                           | Channel Subzone           |                           |
|----------------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
|                                        | TM2                       | TM3                       | TM4                       | TM5                       | TM6                       | TM7                       | TM8                       |
| Number of samples                      | 12                        | 12                        | 12                        | 12                        | 12                        | 12                        | 12                        |
| Temperature (°C)                       | 23.2<br>(17.5 - 29.2)     | 23.4<br>(18.2 - 29.1)     | 23.1<br>(18.0 - 28.5)     | 23.6<br>(17.9 - 29.1)     | 22.9<br>(18.1 - 28.1)     | 23.0<br>(17.9 - 28.3)     | 22.7<br>(17.7 - 27.6)     |
| Salinity                               | 30.8<br>(25.0 - 33.3)     | 30.9<br>(26.1 - 32.5)     | 31.4<br>(26.8 - 33.3)     | 31.1<br>(26.7 - 32.7)     | 31.8<br>(27.6 - 33.3)     | 31.8<br>(27.7 - 33.3)     | 32.2<br>(29.2 - 33.6)     |
| Dissolved Oxygen (mg/L)                | 6.8<br>(3.5 - 10.3)       | 7.4<br>(5.7 - 10.4)       | 6.9<br>(4.5 - 9.5)        | 6.8<br>(4.6 - 9.9)        | 6.6<br>(5.0 - 8.3)        | 7.0<br>(5.5 - 8.6)        | 6.7<br>(5.2 - 8.3)        |
| Bottom                                 | 6.3<br>(3.5 - 9.6)        | 6.7<br>(4.7 - 8.9)        | 6.3<br>(4.3 - 8)          | 7.0<br>(4.3 - 9.8)        | 5.8<br>(3.8 - 8.0)        | 6.5<br>(4.8 - 8.6)        | 5.8<br>(3.6 - 8.7)        |
|                                        |                           |                           |                           |                           |                           |                           |                           |
| Dissolved Oxygen (% Saturation)        | 95<br>(52 - 148)          | 104<br>(79 - 140)         | 96<br>(64 - 139)          | 96<br>(67 - 145)          | 92<br>(73 - 110)          | 97<br>(80 - 117)          | 93<br>(75 - 107)          |
| Bottom                                 | 88<br>(51 - 141)          | 93<br>(68 - 119)          | 87<br>(62 - 109)          | 99<br>(64 - 143)          | 81<br>(55 - 102)          | 90<br>(69 - 113)          | 80<br>(52 - 110)          |
|                                        |                           |                           |                           |                           |                           |                           |                           |
| pH                                     | 7.9<br>(7.7 - 8.1)        | 8.1<br>(7.8 - 8.4)        | 8.0<br>(7.8 - 8.3)        | 8.0<br>(7.9 - 8.3)        | 8.0<br>(7.8 - 8.3)        | 8.1<br>(7.9 - 8.4)        | 8.1<br>(7.9 - 8.3)        |
| Secchi Disc Depth (m)                  | 2.1<br>(1.2 - 3.1)        | 1.9<br>(1.0 - 3.0)        | 2.2<br>(1.0 - 3.5)        | 2.2<br>(1.1 - 3.3)        | 2.7<br>(1.5 - 4.4)        | 2.7<br>(1.8 - 4.7)        | 3.2<br>(1.3 - 5.1)        |
| Turbidity (NTU)                        | 10.5<br>(3.2 - 28.3)      | 9.1<br>(3.3 - 16.7)       | 8.6<br>(3.0 - 15.1)       | 10.4<br>(3.1 - 31.7)      | 8.6<br>(3.4 - 15.1)       | 8.5<br>(3.3 - 13.8)       | 9.1<br>(3.6 - 15.0)       |
| Suspended Solids (mg/L)                | 2.5<br>(1.3 - 6.6)        | 3.1<br>(1.1 - 9.5)        | 1.7<br>(1.0 - 3.3)        | 2.6<br>(1.0 - 7.6)        | 2.5<br>(1.0 - 6.8)        | 1.7<br>(0.8 - 4.9)        | 2.3<br>(1.1 - 6.2)        |
| 5-day Biochemical Oxygen Demand (mg/L) | 1.9<br>(0.2 - 5.1)        | 1.9<br>(0.4 - 4.8)        | 1.2<br>(0.1 - 1.9)        | 1.2<br>(0.5 - 2.5)        | 1.0<br>(0.3 - 1.5)        | 0.8<br>(0.3 - 1.2)        | 0.7<br>(0.3 - 1.1)        |
| Ammonia Nitrogen (mg/L)                | 0.06<br>(0.01 - 0.12)     | 0.07<br>(0.02 - 0.18)     | 0.04<br>(0.02 - 0.09)     | 0.04<br>(0.01 - 0.09)     | 0.04<br>(0.01 - 0.06)     | 0.03<br>(0.01 - 0.06)     | 0.03<br>(0.01 - 0.08)     |
| Unionised Ammonia (mg/L)               | 0.002<br>(<0.001 - 0.006) | 0.004<br>(<0.001 - 0.012) | 0.002<br>(<0.001 - 0.006) | 0.002<br>(<0.001 - 0.004) | 0.002<br>(<0.001 - 0.005) | 0.002<br>(<0.001 - 0.006) | 0.001<br>(<0.001 - 0.004) |
| Nitrite Nitrogen (mg/L)                | 0.015<br>(0.002 - 0.120)  | 0.010<br>(0.002 - 0.059)  | 0.012<br>(0.002 - 0.080)  | 0.008<br>(0.002 - 0.046)  | 0.013<br>(0.002 - 0.078)  | 0.010<br>(0.002 - 0.039)  | 0.012<br>(0.002 - 0.049)  |
| Nitrate Nitrogen (mg/L)                | 0.03<br>(<0.01 - 0.15)    | 0.02<br>(<0.01 - 0.16)    | 0.02<br>(<0.01 - 0.16)    | 0.01<br>(<0.01 - 0.07)    | 0.02<br>(<0.01 - 0.13)    | 0.02<br>(<0.01 - 0.13)    | 0.02<br>(<0.01 - 0.11)    |
| Total Inorganic Nitrogen (mg/L)        | 0.11<br>(0.01 - 0.20)     | 0.1<br>(0.02 - 0.22)      | 0.08<br>(0.02 - 0.21)     | 0.06<br>(0.02 - 0.13)     | 0.07<br>(0.02 - 0.17)     | 0.06<br>(0.01 - 0.17)     | 0.07<br>(0.02 - 0.14)     |
| Total Kjeldahl Nitrogen (mg/L)         | 0.28<br>(0.15 - 0.39)     | 0.32<br>(0.15 - 0.66)     | 0.25<br>(0.12 - 0.35)     | 0.24<br>(0.17 - 0.35)     | 0.22<br>(0.12 - 0.44)     | 0.18<br>(0.13 - 0.24)     | 0.16<br>(0.11 - 0.26)     |
| Total Nitrogen (mg/L)                  | 0.33<br>(0.21 - 0.41)     | 0.36<br>(0.20 - 0.69)     | 0.28<br>(0.20 - 0.35)     | 0.26<br>(0.17 - 0.35)     | 0.26<br>(0.20 - 0.45)     | 0.21<br>(0.16 - 0.27)     | 0.2<br>(0.15 - 0.28)      |
| Orthophosphate Phosphorus (mg/L)       | <0.01<br>(<0.01 - 0.03)   | <0.01<br>(<0.01 - 0.03)   | <0.01<br>(<0.01 - 0.02)   | <0.01<br>(<0.01 - 0.01)   | <0.01<br>(<0.01 - 0.02)   | <0.01<br>(<0.01 - 0.02)   | <0.01<br>(<0.01 - 0.02)   |
| Total Phosphorus (mg/L)                | 0.03<br>(0.02 - 0.07)     | 0.03<br>(0.02 - 0.08)     | 0.03<br>(0.02 - 0.05)     | 0.03<br>(0.02 - 0.06)     | 0.03<br>(0.02 - 0.09)     | 0.03<br>(0.02 - 0.04)     | 0.03<br>(0.02 - 0.04)     |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 1.2<br>(0.2 - 1.8)        | 1.0<br>(0.1 - 1.8)        | 1.0<br>(0.2 - 1.7)        | 0.9<br>(0.1 - 1.5)        | 0.8<br>(0.3 - 1.5)        | 0.7<br>(0.2 - 1.5)        | 0.8<br>(0.3 - 1.3)        |
| Chlorophyll-a (µg/L)                   | 8.4<br>(1.9 - 19.0)       | 9.5<br>(1.6 - 22.5)       | 6.1<br>(2.6 - 15.9)       | 6.4<br>(0.7 - 17.0)       | 5.7<br>(1.1 - 13.6)       | 3.4<br>(1.0 - 6.6)        | 2.7<br>(1.1 - 4.8)        |
| <i>E. coli</i> (cfu/100mL)             | 40<br>(1 - 780)           | 10<br>(1 - 320)           | 11<br>(1 - 740)           | 3<br>(1 - 16)             | 3<br>(1 - 12)             | 2<br>(1 - 18)             | 1<br>(1 - 3)              |
| Faecal Coliforms (cfu/100mL)           | 340<br>(20 - 9600)        | 71<br>(3 - 4000)          | 66<br>(4 - 5500)          | 17<br>(2 - 89)            | 12<br>(1 - 120)           | 5<br>(1 - 60)             | 3<br>(1 - 24)             |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

## Summary of water quality statistics for the Southern WCZ in 2006

| Parameter                              | Hong Kong Island (South)         |                              |                              | East Lamma Channel           |                           |
|----------------------------------------|----------------------------------|------------------------------|------------------------------|------------------------------|---------------------------|
|                                        | SM1                              | SM2                          | SM19                         | SM3                          | SM4                       |
| Number of samples                      | 12                               | 12                           | 12                           | 12                           | 12                        |
| Temperature (°C)                       | 23.5<br>(17.4 - 27.8)            | 23.6<br>(17.4 - 28.1)        | 23.4<br>(17.0 - 26.8)        | 23.5<br>(17.4 - 27.0)        | 24<br>(17.7 - 28.1)       |
| Salinity                               | 32.5<br>(29.7 - 33.5)            | 32.2<br>(28.6 - 33.4)        | 32.5<br>(30.5 - 33.6)        | 32.6<br>(31.2 - 33.3)        | 32.0<br>(28.9 - 33.1)     |
| Dissolved Oxygen (mg/L)                | 6.9<br>(5.9 - 8.7)               | 6.7<br>(5.2 - 8.9)           | 6.8<br>(5.5 - 8.9)           | 6.3<br>(4.3 - 8.2)           | 6.4<br>(4.3 - 8.8)        |
| Bottom                                 | 6.7<br>(4.6 - 9.0)               | 6.5<br>(4.1 - 9.1)           | 6.4<br>(3.6 - 9.1)           | 6.1<br>(2.4 - 8.8)           | 6.4<br>(4.1 - 9.1)        |
| Dissolved Oxygen (% Saturation)        | 98<br>(87 - 111)                 | 95<br>(76 - 114)             | 96<br>(82 - 112)             | 89<br>(65 - 106)             | 90<br>(63 - 112)          |
| Bottom                                 | 95<br>(66 - 114)                 | 92<br>(60 - 116)             | 90<br>(52 - 117)             | 85<br>(35 - 116)             | 90<br>(60 - 116)          |
| pH                                     | 8.1<br>(7.8 - 8.5)               | 8.1<br>(7.7 - 8.5)           | 8.1<br>(7.9 - 8.4)           | 8.0<br>(7.8 - 8.2)           | 8.0<br>(7.7 - 8.4)        |
| Secchi Disc Depth (m)                  | 2.5<br>(1.2 - 3.5)               | 2.4<br>(1.2 - 3.3)           | 2.4<br>(1.6 - 3.0)           | 2.2<br>(1.5 - 3.0)           | 2.1<br>(1.5 - 2.8)        |
| Turbidity (NTU)                        | 11.4<br>(6.2 - 25.7)             | 14.3<br>(6.1 - 39.7)         | 12.5<br>(6.2 - 23.9)         | 13.1<br>(6.0 - 27.5)         | 12.5<br>(4.8 - 34.5)      |
| Suspended Solids (mg/L)                | 3.4<br>(1.4 - 8.0)               | 5.2<br>(1.8 - 13.6)          | 4.3<br>(1.7 - 10.3)          | 5.3<br>(2.6 - 15.3)          | 4.6<br>(2.0 - 17.0)       |
| 5-day Biochemical Oxygen Demand (mg/L) | 0.6<br>(0.1 - 1.0)               | 0.5<br>(0.2 - 1.1)           | 0.5<br>(0.1 - 0.9)           | 0.6<br>(0.2 - 1.5)           | 0.6<br>(0.2 - 1.4)        |
| Ammonia Nitrogen (mg/L)                | 0.02<br>(0.01 - 0.06)            | 0.04<br>(0.01 - 0.09)        | 0.02<br>( $<0.01$ - 0.05)    | 0.04<br>(0.01 - 0.11)        | 0.07<br>(0.03 - 0.16)     |
| Unionised Ammonia (mg/L)               | 0.001<br>( $<0.001$ - 0.003)     | 0.002<br>( $<0.001$ - 0.003) | 0.001<br>( $<0.001$ - 0.002) | 0.002<br>(0.001 - 0.004)     | 0.003<br>(0.001 - 0.005)  |
| Nitrite Nitrogen (mg/L)                | 0.011<br>(0.002 - 0.028)         | 0.017<br>(0.002 - 0.054)     | 0.013<br>(0.002 - 0.028)     | 0.017<br>(0.002 - 0.054)     | 0.022<br>(0.002 - 0.065)  |
| Nitrate Nitrogen (mg/L)                | 0.05<br>(0.01 - 0.17)            | 0.07<br>( $<0.01$ - 0.23)    | 0.06<br>( $<0.01$ - 0.18)    | 0.07<br>( $<0.01$ - 0.18)    | 0.09<br>(0.01 - 0.27)     |
| Total Inorganic Nitrogen (mg/L)        | 0.09<br>(0.03 - 0.21)            | 0.13<br>(0.02 - 0.29)        | 0.09<br>(0.03 - 0.22)        | 0.12<br>(0.02 - 0.21)        | 0.18<br>(0.05 - 0.38)     |
| Total Kjeldahl Nitrogen (mg/L)         | 0.14<br>(0.11 - 0.20)            | 0.17<br>(0.14 - 0.24)        | 0.13<br>(0.10 - 0.16)        | 0.18<br>(0.14 - 0.25)        | 0.21<br>(0.15 - 0.29)     |
| Total Nitrogen (mg/L)                  | 0.21<br>(0.14 - 0.37)            | 0.26<br>(0.18 - 0.45)        | 0.2<br>(0.13 - 0.37)         | 0.26<br>(0.20 - 0.34)        | 0.32<br>(0.19 - 0.52)     |
| Orthophosphate Phosphorus (mg/L)       | $<0.01$<br>( $<0.01$ - $<0.01$ ) | $<0.01$<br>( $<0.01$ - 0.01) | $<0.01$<br>( $<0.01$ - 0.01) | $<0.01$<br>( $<0.01$ - 0.02) | 0.01<br>( $<0.01$ - 0.03) |
| Total Phosphorus (mg/L)                | 0.03<br>(0.02 - 0.05)            | 0.03<br>(0.02 - 0.06)        | 0.03<br>(0.02 - 0.06)        | 0.03<br>(0.02 - 0.07)        | 0.03<br>(0.02 - 0.07)     |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 0.6<br>(0.3 - 1.1)               | 0.6<br>(0.1 - 1.4)           | 0.6<br>(0.3 - 1.1)           | 0.7<br>(0.1 - 1.2)           | 0.7<br>( $<0.1$ - 1.7)    |
| Chlorophyll-a (µg/L)                   | 2.5<br>(1.1 - 6.3)               | 2.8<br>(1.0 - 9.3)           | 2.3<br>(0.8 - 5.4)           | 2.7<br>(0.9 - 9.1)           | 3.2<br>(0.8 - 12.7)       |
| <i>E. coli</i> (cfu/100mL)             | 2<br>(1 - 34)                    | 84<br>(10 - 350)             | 2<br>(1 - 13)                | 32<br>(5 - 200)              | 110<br>(4 - 6000)         |
| Faecal Coliforms (cfu/100mL)           | 8<br>(1 - 110)                   | 180<br>(21 - 700)            | 4<br>(1 - 21)                | 73<br>(8 - 560)              | 260<br>(10 - 9400)        |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.



## Summary of water quality statistics for the Southern WCZ in 2006 (continued)

| Parameter                              | West Lamma Channel        |                           |                          |                          |                           |
|----------------------------------------|---------------------------|---------------------------|--------------------------|--------------------------|---------------------------|
|                                        | SM5                       | SM6                       | SM7                      | SM9                      | SM18                      |
| Number of samples                      | 12                        | 12                        | 12                       | 12                       | 12                        |
| Temperature (°C)                       | 24.3<br>(17.5 - 29.3)     | 24.1<br>(17.4 - 28.9)     | 24.3<br>(18.0 - 29.0)    | 24.0<br>(17.8 - 27.5)    | 23.7<br>(17.2 - 27.7)     |
| Salinity                               | 31.9<br>(25.9 - 33.5)     | 31.7<br>(26.9 - 33.5)     | 31.1<br>(26.4 - 33.2)    | 30.8<br>(26.5 - 33.0)    | 32.3<br>(29.5 - 33.5)     |
| Dissolved Oxygen (mg/L)                | 6.8<br>(4.9 - 8.3)        | 6.9<br>(4.7 - 8.7)        | 6.8<br>(5.1 - 9.3)       | 6.3<br>(4.4 - 8.0)       | 6.7<br>(4.8 - 8.6)        |
| Bottom                                 | 6.7<br>(4.3 - 8.6)        | 6.6<br>(3.5 - 9.1)        | 6.8<br>(4.9 - 9.3)       | 6.3<br>(4.1 - 8.2)       | 6.2<br>(2.3 - 9)          |
| Dissolved Oxygen (% Saturation)        | 97<br>(73 - 111)          | 98<br>(69 - 114)          | 97<br>(74 - 119)         | 89<br>(63 - 110)         | 95<br>(71 - 122)          |
| Bottom                                 | 95<br>(64 - 113)          | 94<br>(52 - 117)          | 96<br>(71 - 119)         | 89<br>(59 - 113)         | 87<br>(34 - 116)          |
| pH                                     | 8.2<br>(7.9 - 8.7)        | 8.1<br>(7.9 - 8.7)        | 8.2<br>(7.8 - 8.7)       | 8.1<br>(7.8 - 8.2)       | 8.1<br>(7.8 - 8.4)        |
| Secchi Disc Depth (m)                  | 2.3<br>(1.4 - 4.0)        | 2.3<br>(1.3 - 4.5)        | 2.0<br>(1.1 - 3.1)       | 1.5<br>(0.8 - 2.1)       | 2.2<br>(1.3 - 3.5)        |
| Turbidity (NTU)                        | 12.2<br>(6.1 - 21.8)      | 12.1<br>(5.7 - 26.4)      | 13.3<br>(5.4 - 33.9)     | 14.7<br>(6.2 - 26.7)     | 13.3<br>(5.3 - 26.2)      |
| Suspended Solids (mg/L)                | 4.7<br>(0.9 - 12.4)       | 3.4<br>(1.1 - 9.2)        | 4.8<br>(1.2 - 9.0)       | 8.0<br>(2.6 - 17.6)      | 4.3<br>(2.0 - 14.7)       |
| 5-day Biochemical Oxygen Demand (mg/L) | 0.5<br>(0.2 - 1.0)        | 0.6<br>(0.1 - 1.3)        | 0.8<br>(0.4 - 1.9)       | 0.5<br>(0.2 - 1.0)       | 0.5<br>(0.2 - 1.5)        |
| Ammonia Nitrogen (mg/L)                | 0.03<br>(0.01 - 0.07)     | 0.04<br>(0.01 - 0.11)     | 0.07<br>(0.02 - 0.14)    | 0.13<br>(0.05 - 0.19)    | 0.02<br>(<0.01 - 0.06)    |
| Unionised Ammonia (mg/L)               | 0.002<br>(<0.001 - 0.003) | 0.002<br>(<0.001 - 0.007) | 0.004<br>(0.001 - 0.009) | 0.006<br>(0.002 - 0.012) | 0.001<br>(<0.001 - 0.004) |
| Nitrite Nitrogen (mg/L)                | 0.015<br>(0.002 - 0.037)  | 0.017<br>(0.002 - 0.033)  | 0.027<br>(0.002 - 0.071) | 0.040<br>(0.007 - 0.110) | 0.014<br>(0.002 - 0.033)  |
| Nitrate Nitrogen (mg/L)                | 0.07<br>(<0.01 - 0.29)    | 0.09<br>(<0.01 - 0.27)    | 0.13<br>(<0.01 - 0.34)   | 0.17<br>(0.05 - 0.34)    | 0.07<br>(<0.01 - 0.24)    |
| Total Inorganic Nitrogen (mg/L)        | 0.12<br>(0.02 - 0.36)     | 0.15<br>(0.02 - 0.36)     | 0.23<br>(0.03 - 0.47)    | 0.34<br>(0.14 - 0.53)    | 0.11<br>(0.01 - 0.27)     |
| Total Kjeldahl Nitrogen (mg/L)         | 0.16<br>(0.13 - 0.21)     | 0.17<br>(0.12 - 0.24)     | 0.23<br>(0.13 - 0.29)    | 0.28<br>(0.16 - 0.35)    | 0.14<br>(0.11 - 0.20)     |
| Total Nitrogen (mg/L)                  | 0.25<br>(0.16 - 0.53)     | 0.28<br>(0.15 - 0.50)     | 0.39<br>(0.15 - 0.63)    | 0.49<br>(0.37 - 0.74)    | 0.23<br>(0.13 - 0.41)     |
| Orthophosphate Phosphorus (mg/L)       | <0.01<br>(<0.01 - 0.02)   | <0.01<br>(<0.01 - 0.02)   | 0.01<br>(<0.01 - 0.02)   | 0.02<br>(0.01 - 0.03)    | <0.01<br>(<0.01 - 0.01)   |
| Total Phosphorus (mg/L)                | 0.03<br>(0.02 - 0.06)     | 0.03<br>(0.02 - 0.05)     | 0.03<br>(0.02 - 0.07)    | 0.05<br>(0.03 - 0.10)    | 0.03<br>(0.02 - 0.05)     |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 0.6<br>(0.1 - 1.6)        | 0.7<br>(0.1 - 1.8)        | 0.8<br>(<0.1 - 2.0)      | 1.1<br>(0.1 - 2.4)       | 0.7<br>(0.2 - 1.6)        |
| Chlorophyll-a (µg/L)                   | 2.5<br>(1.0 - 7.6)        | 2.6<br>(1.1 - 5.1)        | 4.4<br>(1.1 - 17.7)      | 2.7<br>(1.1 - 10.2)      | 2.5<br>(1.0 - 6.2)        |
| <i>E. coli</i> (cfu/100mL)             | 1<br>(1 - 12)             | 2<br>(1 - 7)              | 17<br>(1 - 180)          | 170<br>(11 - 3000)       | 1<br>(1 - 4)              |
| Faecal Coliforms (cfu/100mL)           | 3<br>(1 - 32)             | 3<br>(1 - 22)             | 37<br>(1 - 330)          | 380<br>(34 - 8800)       | 3<br>(1 - 15)             |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

## Summary of water quality statistics for the Southern WCZ in 2006 (continued)

| Parameter                              | Lantau Island (East)     |                          | Lantau Island (South)    |                          |                           | Soko Islands              |
|----------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|---------------------------|---------------------------|
|                                        | SM10                     | SM11                     | SM12                     | SM13                     | SM17                      | SM20                      |
| Number of samples                      | 12                       | 12                       | 12                       | 12                       | 12                        | 12                        |
| Temperature (°C)                       | 24.3<br>(17.8 - 27.9)    | 24.3<br>(17.9 - 28.2)    | 24.2<br>(18.0 - 28.1)    | 24.2<br>(18.1 - 28.1)    | 23.8<br>(17.5 - 27.4)     | 24.1<br>(17.7 - 27.9)     |
| Salinity                               | 30.4<br>(24.8 - 33.0)    | 30.7<br>(25.7 - 33.0)    | 31.2<br>(24.8 - 33.1)    | 31.2<br>(24.0 - 33.2)    | 32.0<br>(28.1 - 33.5)     | 31.0<br>(22.7 - 33.2)     |
| Dissolved Oxygen (mg/L)                | 6.9<br>(5.2 - 9.9)       | 7.5<br>(5.6 - 11.3)      | 7.3<br>(6.1 - 9.2)       | 7.3<br>(6.1 - 9.2)       | 7.1<br>(5.6 - 8.7)        | 6.9<br>(5.3 - 8.2)        |
| Bottom                                 | 6.9<br>(5.1 - 10)        | 7.3<br>(4.5 - 12)        | 7.3<br>(5.8 - 9.6)       | 7.2<br>(5.8 - 9.1)       | 6.8<br>(4.3 - 9)          | 6.7<br>(5.0 - 8.4)        |
| Dissolved Oxygen (% Saturation)        | 98<br>(73 - 146)         | 107<br>(82 - 168)        | 104<br>(89 - 137)        | 105<br>(88 - 137)        | 100<br>(80 - 117)         | 97<br>(78 - 115)          |
| Bottom                                 | 98<br>(73 - 147)         | 104<br>(66 - 170)        | 103<br>(84 - 143)        | 102<br>(85 - 136)        | 96<br>(63 - 115)          | 96<br>(73 - 115)          |
| pH                                     | 8.1<br>(7.8 - 8.5)       | 8.1<br>(7.8 - 8.5)       | 8.1<br>(7.9 - 8.3)       | 8.1<br>(7.9 - 8.3)       | 8.0<br>(7.8 - 8.3)        | 8.1<br>(7.8 - 8.3)        |
| Secchi Disc Depth (m)                  | 1.2<br>(0.6 - 1.9)       | 1.5<br>(0.8 - 2.3)       | 1.5<br>(0.4 - 2.1)       | 1.5<br>(0.8 - 2.3)       | 1.8<br>(1.2 - 2.3)        | 1.4<br>(0.9 - 2.0)        |
| Turbidity (NTU)                        | 16.2<br>(4.9 - 39.8)     | 12.3<br>(4.4 - 21.5)     | 15.7<br>(4.9 - 27.7)     | 14.3<br>(5.0 - 33.7)     | 11.9<br>(5.5 - 22.7)      | 20.3<br>(7.2 - 35.1)      |
| Suspended Solids (mg/L)                | 9.1<br>(3.8 - 32.0)      | 6.0<br>(3.2 - 10.7)      | 7.8<br>(2.3 - 14.9)      | 7.4<br>(3.3 - 21.0)      | 4.3<br>(1.6 - 8.7)        | 13.4<br>(3.5 - 29.3)      |
| 5-day Biochemical Oxygen Demand (mg/L) | 0.8<br>(0.2 - 2.5)       | 0.9<br>(0.3 - 2.4)       | 0.8<br>(0.2 - 2.2)       | 0.8<br>(0.3 - 1.5)       | 0.6<br>(0.2 - 1.5)        | 0.6<br>(0.1 - 1.4)        |
| Ammonia Nitrogen (mg/L)                | 0.11<br>(0.04 - 0.19)    | 0.09<br>(0.04 - 0.17)    | 0.06<br>(0.02 - 0.14)    | 0.06<br>(0.02 - 0.12)    | 0.04<br>(<0.01 - 0.09)    | 0.04<br>(0.01 - 0.07)     |
| Unionised Ammonia (mg/L)               | 0.006<br>(0.002 - 0.013) | 0.005<br>(0.002 - 0.009) | 0.004<br>(0.001 - 0.009) | 0.003<br>(0.001 - 0.008) | 0.002<br>(<0.001 - 0.005) | 0.002<br>(<0.001 - 0.005) |
| Nitrite Nitrogen (mg/L)                | 0.038<br>(0.006 - 0.093) | 0.035<br>(0.005 - 0.091) | 0.031<br>(0.002 - 0.086) | 0.030<br>(0.002 - 0.085) | 0.021<br>(0.002 - 0.043)  | 0.027<br>(0.002 - 0.049)  |
| Nitrate Nitrogen (mg/L)                | 0.17<br>(0.04 - 0.39)    | 0.15<br>(0.03 - 0.38)    | 0.12<br>(<0.01 - 0.42)   | 0.12<br>(<0.01 - 0.42)   | 0.08<br>(<0.01 - 0.26)    | 0.13<br>(<0.01 - 0.50)    |
| Total Inorganic Nitrogen (mg/L)        | 0.32<br>(<0.10 - 0.60)   | 0.28<br>(0.09 - 0.51)    | 0.22<br>(0.03 - 0.52)    | 0.21<br>(0.03 - 0.53)    | 0.14<br>(0.02 - 0.31)     | 0.20<br>(0.02 - 0.59)     |
| Total Kjeldahl Nitrogen (mg/L)         | 0.28<br>(0.19 - 0.38)    | 0.28<br>(0.15 - 0.42)    | 0.23<br>(0.14 - 0.32)    | 0.21<br>(0.13 - 0.30)    | 0.16<br>(0.10 - 0.23)     | 0.18<br>(0.12 - 0.24)     |
| Total Nitrogen (mg/L)                  | 0.49<br>(0.33 - 0.75)    | 0.46<br>(0.32 - 0.71)    | 0.38<br>(0.22 - 0.72)    | 0.36<br>(0.20 - 0.74)    | 0.26<br>(0.14 - 0.52)     | 0.34<br>(0.17 - 0.76)     |
| Orthophosphate Phosphorus (mg/L)       | 0.02<br>(<0.01 - 0.03)   | 0.02<br>(<0.01 - 0.03)   | 0.01<br>(<0.01 - 0.03)   | 0.01<br>(<0.01 - 0.02)   | 0.01<br>(<0.01 - 0.02)    | 0.01<br>(<0.01 - 0.01)    |
| Total Phosphorus (mg/L)                | 0.05<br>(0.03 - 0.07)    | 0.04<br>(0.03 - 0.06)    | 0.04<br>(0.02 - 0.06)    | 0.03<br>(0.02 - 0.06)    | 0.03<br>(0.02 - 0.05)     | 0.03<br>(0.02 - 0.05)     |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 1.1<br>(0.1 - 2.6)       | 0.94<br>(<0.1 - 2.4)     | 0.86<br>(0.1 - 2.4)      | 0.93<br>(0.1 - 2.4)      | 0.74<br>(0.2 - 1.7)       | 0.95<br>(0.2 - 3.0)       |
| Chlorophyll-a (µg/L)                   | 7.4<br>(1.6 - 31.0)      | 9.1<br>(1.7 - 37.7)      | 7.3<br>(1.8 - 25.7)      | 5.9<br>(1.4 - 21.7)      | 3.3<br>(1.4 - 8.9)        | 3.7<br>(1.4 - 8.2)        |
| <i>E. coli</i> (cfu/100mL)             | 19<br>(1 - 310)          | 6<br>(1 - 80)            | 26<br>(1 - 580)          | 6<br>(1 - 680)           | 1<br>(1 - 4)              | 1<br>(1 - 11)             |
| Faecal Coliforms (cfu/100mL)           | 58<br>(6 - 610)          | 19<br>(1 - 190)          | 63<br>(1 - 1500)         | 14<br>(1 - 1200)         | 2<br>(1 - 6)              | 3<br>(1 - 35)             |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

## Summary of water quality statistics for the Victoria Harbour WCZ in 2006

| Parameter                              | Victoria Harbour (East)  |                          | Victoria Harbour (Central) |                          |                          |
|----------------------------------------|--------------------------|--------------------------|----------------------------|--------------------------|--------------------------|
|                                        | VM1                      | VM2                      | VM4                        | VM5                      | VM6                      |
| Number of samples                      | 12                       | 12                       | 12                         | 12                       | 12                       |
| Temperature (°C)                       | 23.2<br>(17.4 - 26.7)    | 23.5<br>(17.4 - 27.5)    | 23.6<br>(17.4 - 27.6)      | 23.7<br>(17.4 - 27.5)    | 23.6<br>(17.5 - 27.4)    |
| Salinity                               | 32.2<br>(29.5 - 33.4)    | 31.7<br>(27.8 - 33.0)    | 31.6<br>(27.4 - 33.0)      | 31.4<br>(27.3 - 32.8)    | 31.5<br>(27.3 - 32.8)    |
| Dissolved Oxygen (mg/L)                | 5.9<br>(3.2 - 7.5)       | 5.8<br>(3.4 - 7.1)       | 5.7<br>(4.1 - 7.3)         | 5.5<br>(4.3 - 7.1)       | 5.5<br>(4.0 - 6.9)       |
| Bottom                                 | 5.7<br>(1.7 - 8.0)       | 5.8<br>(2.5 - 7.4)       | 5.6<br>(3.2 - 7.2)         | 5.4<br>(3.8 - 7.3)       | 5.4<br>(2.7 - 7.2)       |
| Dissolved Oxygen (% Saturation)        | 82<br>(46 - 101)         | 81<br>(49 - 97)          | 80<br>(61 - 94)            | 77<br>(65 - 91)          | 78<br>(60 - 89)          |
| Bottom                                 | 80<br>(24 - 111)         | 81<br>(36 - 103)         | 79<br>(47 - 98)            | 76<br>(56 - 94)          | 75<br>(40 - 93)          |
| pH                                     | 7.9<br>(7.7 - 8.2)       | 7.9<br>(7.7 - 8.1)       | 7.9<br>(7.7 - 8.1)         | 7.9<br>(7.7 - 8.1)       | 7.9<br>(7.7 - 8.1)       |
| Secchi Disc Depth (m)                  | 2.1<br>(1.2 - 3.0)       | 2.0<br>(1.4 - 3.1)       | 2.0<br>(1.4 - 3.0)         | 1.8<br>(1.4 - 2.7)       | 2.1<br>(1.5 - 2.7)       |
| Turbidity (NTU)                        | 12.6<br>(6.9 - 17.6)     | 11.2<br>(5.4 - 15.0)     | 12.1<br>(5.6 - 23.4)       | 11.6<br>(6.5 - 18.5)     | 11.1<br>(5.2 - 14.2)     |
| Suspended Solids (mg/L)                | 5.5<br>(2.1 - 18.0)      | 4.2<br>(1.2 - 12.8)      | 4.9<br>(1.1 - 12.3)        | 4.6<br>(1.7 - 8.9)       | 4.5<br>(2.0 - 8.9)       |
| 5-day Biochemical Oxygen Demand (mg/L) | 0.6<br>(0.1 - 1.5)       | 0.6<br>(0.1 - 1.2)       | 0.7<br>(0.1 - 1.4)         | 1.0<br>(0.2 - 1.9)       | 0.8<br>(0.1 - 1.8)       |
| Ammonia Nitrogen (mg/L)                | 0.07<br>(0.04 - 0.13)    | 0.11<br>(0.04 - 0.20)    | 0.13<br>(0.05 - 0.23)      | 0.16<br>(0.09 - 0.30)    | 0.16<br>(0.11 - 0.25)    |
| Unionised Ammonia (mg/L)               | 0.002<br>(0.001 - 0.004) | 0.004<br>(0.001 - 0.007) | 0.004<br>(0.002 - 0.007)   | 0.005<br>(0.003 - 0.008) | 0.005<br>(0.003 - 0.007) |
| Nitrite Nitrogen (mg/L)                | 0.019<br>(0.004 - 0.067) | 0.024<br>(0.004 - 0.084) | 0.024<br>(0.006 - 0.079)   | 0.027<br>(0.009 - 0.093) | 0.027<br>(0.009 - 0.095) |
| Nitrate Nitrogen (mg/L)                | 0.08<br>(0.03 - 0.20)    | 0.10<br>(0.03 - 0.25)    | 0.11<br>(0.03 - 0.25)      | 0.12<br>(0.04 - 0.27)    | 0.13<br>(0.04 - 0.28)    |
| Total Inorganic Nitrogen (mg/L)        | 0.18<br>(0.07 - 0.29)    | 0.23<br>(0.07 - 0.40)    | 0.26<br>(0.08 - 0.44)      | 0.31<br>(0.14 - 0.50)    | 0.32<br>(0.16 - 0.51)    |
| Total Kjeldahl Nitrogen (mg/L)         | 0.24<br>(0.18 - 0.30)    | 0.29<br>(0.17 - 0.42)    | 0.34<br>(0.19 - 0.49)      | 0.40<br>(0.25 - 0.58)    | 0.38<br>(0.29 - 0.59)    |
| Total Nitrogen (mg/L)                  | 0.34<br>(0.22 - 0.49)    | 0.42<br>(0.20 - 0.64)    | 0.47<br>(0.22 - 0.69)      | 0.55<br>(0.30 - 0.83)    | 0.53<br>(0.34 - 0.73)    |
| Orthophosphate Phosphorus (mg/L)       | 0.02<br>(0.01 - 0.03)    | 0.03<br>(0.01 - 0.04)    | 0.03<br>(0.01 - 0.04)      | 0.03<br>(0.02 - 0.04)    | 0.03<br>(0.02 - 0.05)    |
| Total Phosphorus (mg/L)                | 0.04<br>(0.03 - 0.07)    | 0.05<br>(0.03 - 0.06)    | 0.05<br>(0.03 - 0.07)      | 0.06<br>(0.03 - 0.08)    | 0.06<br>(0.03 - 0.08)    |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 0.7<br>(0.3 - 1.5)       | 0.8<br>(0.3 - 1.5)       | 0.8<br>(0.3 - 1.6)         | 0.9<br>(0.3 - 1.7)       | 0.9<br>(0.3 - 1.8)       |
| Chlorophyll-a (µg/L)                   | 2.6<br>(0.8 - 6.8)       | 3.0<br>(1.0 - 8.9)       | 2.9<br>(1.0 - 9.2)         | 2.8<br>(0.9 - 8.6)       | 2.9<br>(0.9 - 10.1)      |
| <i>E. coli</i> (cfu/100mL)             | 440<br>(44 - 3400)       | 1100<br>(58 - 14000)     | 2600<br>(510 - 12000)      | 7700<br>(1900 - 22000)   | 5500<br>(650 - 33000)    |
| Faecal Coliforms (cfu/100mL)           | 940<br>(74 - 8600)       | 2600<br>(130 - 25000)    | 6500<br>(1800 - 40000)     | 19000<br>(3500 - 65000)  | 13000<br>(2500 - 100000) |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

## Summary of water quality statistics for the Victoria Harbour WCZ in 2006 (continued)

| Parameter                              | Victoria Harbour (West)  |                          | Stonecutters Island      | Rambler Channel          |                          |
|----------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                                        | VM7                      | VM8                      | VM15                     | VM12                     | VM14                     |
| Number of samples                      | 12                       | 12                       | 12                       | 12                       | 12                       |
| Temperature (°C)                       | 23.8<br>(16.9 - 27.9)    | 23.8<br>(16.9 - 27.9)    | 23.7<br>(17.6 - 27.7)    | 23.8<br>(17.2 - 27.1)    | 24.2<br>(17.4 - 28.7)    |
| Salinity                               | 30.8<br>(24.2 - 33.0)    | 30.7<br>(23.3 - 33.0)    | 31.1<br>(26.2 - 32.8)    | 30.8<br>(25.4 - 32.9)    | 28.7<br>(16.8 - 33.0)    |
| Dissolved Oxygen (mg/L)                | 5.7<br>(4.0 - 7.3)       | 6.0<br>(4.1 - 7.7)       | 5.7<br>(4.5 - 6.9)       | 5.5<br>(3.1 - 7.4)       | 6.0<br>(4.3 - 7.6)       |
| Bottom                                 | 5.5<br>(3.3 - 7.0)       | 5.8<br>(3.3 - 7.8)       | 5.5<br>(3.8 - 7.0)       | 5.3<br>(2.6 - 7.4)       | 5.9<br>(3.9 - 7.2)       |
| Dissolved Oxygen (% Saturation)        | 80<br>(60 - 107)         | 85<br>(61 - 105)         | 80<br>(67 - 93)          | 77<br>(46 - 98)          | 84<br>(61 - 108)         |
| Bottom                                 | 77<br>(48 - 98)          | 82<br>(49 - 109)         | 78<br>(55 - 91)          | 75<br>(38 - 97)          | 83<br>(57 - 104)         |
| pH                                     | 8.0<br>(7.7 - 8.3)       | 8.0<br>(7.8 - 8.3)       | 7.9<br>(7.7 - 8.0)       | 8.0<br>(7.8 - 8.3)       | 8.0<br>(7.8 - 8.4)       |
| Secchi Disc Depth (m)                  | 2.0<br>(1.2 - 2.5)       | 1.9<br>(1.0 - 2.5)       | 2.0<br>(1.3 - 2.5)       | 1.5<br>(0.5 - 2.1)       | 1.5<br>(1.0 - 2.0)       |
| Turbidity (NTU)                        | 11.5<br>(5.8 - 20.5)     | 11.9<br>(5.3 - 19.0)     | 12.4<br>(6.4 - 22.9)     | 15.6<br>(10.0 - 28.0)    | 12.6<br>(7.0 - 22.2)     |
| Suspended Solids (mg/L)                | 5.5<br>(1.8 - 11.6)      | 5.9<br>(2.1 - 11.0)      | 6.1<br>(1.8 - 13.9)      | 11.0<br>(3.1 - 19.0)     | 5.9<br>(2.9 - 12.7)      |
| 5-day Biochemical Oxygen Demand (mg/L) | 0.8<br>(0.1 - 1.2)       | 0.7<br>(0.2 - 1.1)       | 0.7<br>(0.1 - 1.7)       | 0.7<br>(0.2 - 1.6)       | 0.7<br>(0.2 - 1.2)       |
| Ammonia Nitrogen (mg/L)                | 0.21<br>(0.07 - 0.52)    | 0.17<br>(0.13 - 0.26)    | 0.18<br>(0.12 - 0.29)    | 0.18<br>(0.05 - 0.28)    | 0.16<br>(0.04 - 0.23)    |
| Unionised Ammonia (mg/L)               | 0.008<br>(0.003 - 0.018) | 0.007<br>(0.004 - 0.016) | 0.006<br>(0.003 - 0.009) | 0.006<br>(0.003 - 0.011) | 0.007<br>(0.003 - 0.014) |
| Nitrite Nitrogen (mg/L)                | 0.033<br>(0.014 - 0.053) | 0.035<br>(0.009 - 0.060) | 0.033<br>(0.010 - 0.120) | 0.036<br>(0.011 - 0.053) | 0.053<br>(0.010 - 0.100) |
| Nitrate Nitrogen (mg/L)                | 0.16<br>(0.06 - 0.38)    | 0.16<br>(0.04 - 0.40)    | 0.15<br>(0.06 - 0.36)    | 0.17<br>(0.08 - 0.37)    | 0.27<br>(0.06 - 0.64)    |
| Total Inorganic Nitrogen (mg/L)        | 0.40<br>(0.24 - 0.67)    | 0.37<br>(0.20 - 0.64)    | 0.36<br>(0.18 - 0.67)    | 0.39<br>(0.26 - 0.49)    | 0.48<br>(0.21 - 0.88)    |
| Total Kjeldahl Nitrogen (mg/L)         | 0.39<br>(0.26 - 0.61)    | 0.33<br>(0.26 - 0.41)    | 0.40<br>(0.29 - 0.57)    | 0.36<br>(0.21 - 0.59)    | 0.32<br>(0.20 - 0.43)    |
| Total Nitrogen (mg/L)                  | 0.58<br>(0.45 - 0.75)    | 0.53<br>(0.38 - 0.86)    | 0.58<br>(0.35 - 0.86)    | 0.57<br>(0.39 - 0.75)    | 0.64<br>(0.31 - 1.06)    |
| Orthophosphate Phosphorus (mg/L)       | 0.03<br>(0.01 - 0.05)    | 0.03<br>(0.02 - 0.04)    | 0.03<br>(0.01 - 0.04)    | 0.03<br>(0.01 - 0.04)    | 0.03<br>(0.01 - 0.04)    |
| Total Phosphorus (mg/L)                | 0.05<br>(0.03 - 0.08)    | 0.04<br>(0.03 - 0.06)    | 0.06<br>(0.04 - 0.07)    | 0.05<br>(0.03 - 0.08)    | 0.04<br>(0.03 - 0.06)    |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 1.1<br>(0.3 - 2.1)       | 1.1<br>(0.4 - 2.1)       | 1.0<br>(0.4 - 1.9)       | 1.2<br>(0.4 - 2.2)       | 1.6<br>(0.4 - 3.3)       |
| Chlorophyll-a (µg/L)                   | 2.6<br>(0.6 - 9.0)       | 2.7<br>(1.0 - 11.3)      | 3.5<br>(1.1 - 16.6)      | 2.1<br>(0.8 - 6.9)       | 3.4<br>(0.9 - 19.5)      |
| <i>E. coli</i> (cfu/100mL)             | 9400<br>(2600 - 57000)   | 6100<br>(350 - 21000)    | 1800<br>(590 - 11000)    | 3400<br>(1500 - 6600)    | 1300<br>(320 - 5100)     |
| Faecal Coliforms (cfu/100mL)           | 23000<br>(5400 - 180000) | 15000<br>(930 - 55000)   | 4800<br>(1300 - 23000)   | 8100<br>(4200 - 14000)   | 2800<br>(460 - 13000)    |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

## Summary of water quality statistics for the Eastern Buffer WCZ in 2006

| Parameter                              | Chai Wan                  | Tathong Channel           |                           |
|----------------------------------------|---------------------------|---------------------------|---------------------------|
|                                        | EM1                       | EM2                       | EM3                       |
| Number of samples                      | 12                        | 12                        | 12                        |
| Temperature (°C)                       | 23.4<br>(17.4 - 26.6)     | 23.4<br>(17.4 - 26.6)     | 23.3<br>(17.4 - 26.4)     |
| Salinity                               | 32.2<br>(30.1 - 33.3)     | 32.3<br>(29.1 - 33.6)     | 32.6<br>(29.1 - 33.6)     |
| Dissolved Oxygen (mg/L)                | 6.2<br>(4.3 - 7.7)        | 6.5<br>(4.7 - 8.0)        | 6.4<br>(4.3 - 8.1)        |
| Bottom                                 | 6.0<br>(3.4 - 7.9)        | 6.3<br>(3.4 - 8.2)        | 6.2<br>(2.7 - 8.2)        |
| Dissolved Oxygen (% Saturation)        | 88<br>(63 - 101)          | 92<br>(69 - 112)          | 91<br>(63 - 109)          |
| Bottom                                 | 84<br>(49 - 110)          | 88<br>(49 - 114)          | 87<br>(39 - 114)          |
| pH                                     | 8.0<br>(7.8 - 8.1)        | 8.0<br>(7.8 - 8.2)        | 8.0<br>(7.7 - 8.2)        |
| Secchi Disc Depth (m)                  | 2.2<br>(1.3 - 3.9)        | 2.1<br>(1.5 - 3.2)        | 2.3<br>(1.2 - 3.5)        |
| Turbidity (NTU)                        | 12.0<br>(4.9 - 23.3)      | 10.8<br>(4.6 - 15.9)      | 12.0<br>(5.3 - 20.2)      |
| Suspended Solids (mg/L)                | 3.9<br>(1.8 - 12.3)       | 3.9<br>(1.3 - 15.7)       | 5.0<br>(1.8 - 25.3)       |
| 5-day Biochemical Oxygen Demand (mg/L) | 0.6<br>(0.1 - 1.6)        | 0.5<br>(0.1 - 1.5)        | 0.5<br>(0.1 - 1.1)        |
| Ammonia Nitrogen (mg/L)                | 0.06<br>(0.02 - 0.14)     | 0.05<br>(0.01 - 0.09)     | 0.04<br>(0.01 - 0.09)     |
| Unionised Ammonia (mg/L)               | 0.003<br>(<0.001 - 0.006) | 0.002<br>(<0.001 - 0.004) | 0.002<br>(<0.001 - 0.005) |
| Nitrite Nitrogen (mg/L)                | 0.017<br>(0.004 - 0.047)  | 0.016<br>(0.002 - 0.058)  | 0.015<br>(0.002 - 0.055)  |
| Nitrate Nitrogen (mg/L)                | 0.07<br>(0.01 - 0.18)     | 0.07<br>(0.01 - 0.19)     | 0.06<br>(0.01 - 0.19)     |
| Total Inorganic Nitrogen (mg/L)        | 0.15<br>(0.04 - 0.30)     | 0.13<br>(0.02 - 0.32)     | 0.12<br>(0.02 - 0.33)     |
| Total Kjeldahl Nitrogen (mg/L)         | 0.20<br>(0.14 - 0.30)     | 0.19<br>(0.14 - 0.29)     | 0.17<br>(0.08 - 0.26)     |
| Total Nitrogen (mg/L)                  | 0.29<br>(0.17 - 0.47)     | 0.28<br>(0.15 - 0.48)     | 0.25<br>(0.10 - 0.48)     |
| Orthophosphate Phosphorus (mg/L)       | 0.02<br>(<0.01 - 0.03)    | 0.01<br>(<0.01 - 0.02)    | 0.01<br>(<0.01 - 0.02)    |
| Total Phosphorus (mg/L)                | 0.03<br>(0.02 - 0.05)     | 0.03<br>(0.02 - 0.04)     | 0.03<br>(0.02 - 0.03)     |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 0.7<br>(0.3 - 1.1)        | 0.6<br>(0.1 - 1.3)        | 0.6<br>(0.1 - 1.3)        |
| Chlorophyll-a (µg/L)                   | 3.3<br>(0.9 - 9.7)        | 3.3<br>(1.0 - 9.1)        | 3.0<br>(0.8 - 8.3)        |
| <i>E. coli</i> (cfu/100mL)             | 74<br>(1 - 1800)          | 21<br>(2 - 110)           | 8<br>(2 - 450)            |
| Faecal Coliforms (cfu/100mL)           | 190<br>(1 - 4900)         | 80<br>(12 - 430)          | 24<br>(3 - 790)           |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.



## Summary of water quality statistics for the Western Buffer WCZ in 2006

| Parameter                              | Hong Kong Island<br>(West) |                          | Tsing Yi<br>(South)      | Tsing Yi<br>(West)       |
|----------------------------------------|----------------------------|--------------------------|--------------------------|--------------------------|
|                                        | WM1                        | WM2                      | WM3                      | WM4                      |
| Number of samples                      | 12                         | 12                       | 12                       | 12                       |
| Temperature (°C)                       | 23.6<br>(16.8 - 27.1)      | 23.8<br>(16.9 - 27.4)    | 23.6<br>(17.0 - 27.2)    | 23.6<br>(17.0 - 27.2)    |
| Salinity                               | 31.9<br>(29.0 - 33.4)      | 30.9<br>(23.9 - 33.2)    | 31.5<br>(27.2 - 33.0)    | 31.0<br>(26.6 - 33.0)    |
| Dissolved Oxygen (mg/L)                | 6.3<br>(3.8 - 8.4)         | 6.1<br>(4.0 - 8.1)       | 5.8<br>(2.8 - 7.8)       | 5.7<br>(3.3 - 7.9)       |
| Bottom                                 | 5.9<br>(2.2 - 8.6)         | 6.0<br>(3.5 - 8.2)       | 5.7<br>(2.5 - 8)         | 5.4<br>(1.4 - 7.8)       |
| Dissolved Oxygen (% Saturation)        | 88<br>(57 - 114)           | 86<br>(59 - 113)         | 82<br>(41 - 102)         | 80<br>(49 - 110)         |
| Bottom                                 | 82<br>(32 - 116)           | 84<br>(52 - 114)         | 80<br>(37 - 111)         | 76<br>(20 - 109)         |
| pH                                     | 8.0<br>(7.8 - 8.3)         | 8.0<br>(7.7 - 8.3)       | 8.0<br>(7.8 - 8.2)       | 8.0<br>(7.8 - 8.3)       |
| Secchi Disc Depth (m)                  | 2.2<br>(1.1 - 3.4)         | 2.0<br>(1.3 - 2.5)       | 1.7<br>(1.0 - 2.3)       | 1.7<br>(0.8 - 2.5)       |
| Turbidity (NTU)                        | 12.0<br>(7.0 - 21.6)       | 12.0<br>(6.5 - 20.3)     | 13.8<br>(6.2 - 25.1)     | 14.3<br>(6.3 - 23.0)     |
| Suspended Solids (mg/L)                | 4.7<br>(2.1 - 8.5)         | 4.8<br>(1.4 - 10.3)      | 7.7<br>(2.8 - 15.0)      | 7.6<br>(3.2 - 13.0)      |
| 5-day Biochemical Oxygen Demand (mg/L) | 0.6<br>(0.3 - 1.0)         | 0.6<br>(0.1 - 1.2)       | 0.7<br>(0.2 - 1.2)       | 0.6<br>(0.1 - 1.1)       |
| Ammonia Nitrogen (mg/L)                | 0.06<br>(0.02 - 0.12)      | 0.10<br>(0.05 - 0.21)    | 0.13<br>(0.04 - 0.23)    | 0.12<br>(0.02 - 0.22)    |
| Unionised Ammonia (mg/L)               | 0.002<br>(0.001 - 0.007)   | 0.004<br>(0.001 - 0.009) | 0.005<br>(0.003 - 0.011) | 0.005<br>(0.002 - 0.010) |
| Nitrite Nitrogen (mg/L)                | 0.023<br>(0.003 - 0.038)   | 0.034<br>(0.006 - 0.057) | 0.032<br>(0.007 - 0.052) | 0.037<br>(0.007 - 0.056) |
| Nitrate Nitrogen (mg/L)                | 0.10<br>(0.02 - 0.23)      | 0.16<br>(0.03 - 0.43)    | 0.14<br>(0.04 - 0.32)    | 0.17<br>(0.05 - 0.38)    |
| Total Inorganic Nitrogen (mg/L)        | 0.19<br>(0.07 - 0.35)      | 0.29<br>(0.12 - 0.55)    | 0.30<br>(0.15 - 0.45)    | 0.32<br>(0.17 - 0.48)    |
| Total Kjeldahl Nitrogen (mg/L)         | 0.18<br>(0.12 - 0.27)      | 0.24<br>(0.17 - 0.34)    | 0.28<br>(0.18 - 0.38)    | 0.26<br>(0.18 - 0.38)    |
| Total Nitrogen (mg/L)                  | 0.31<br>(0.17 - 0.47)      | 0.43<br>(0.23 - 0.79)    | 0.45<br>(0.27 - 0.60)    | 0.47<br>(0.28 - 0.65)    |
| Orthophosphate Phosphorus (mg/L)       | 0.01<br>(0.01 - 0.02)      | 0.02<br>(0.01 - 0.03)    | 0.02<br>(0.01 - 0.03)    | 0.02<br>(0.01 - 0.03)    |
| Total Phosphorus (mg/L)                | 0.03<br>(0.02 - 0.05)      | 0.04<br>(0.02 - 0.06)    | 0.04<br>(0.02 - 0.07)    | 0.04<br>(0.02 - 0.07)    |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 0.9<br>(0.3 - 1.7)         | 1.0<br>(0.4 - 1.9)       | 1.1<br>(0.4 - 1.9)       | 1.2<br>(0.3 - 2.3)       |
| Chlorophyll-a (µg/L)                   | 2.5<br>(1.1 - 5.2)         | 2.8<br>(0.9 - 10.9)      | 2.0<br>(0.8 - 6.0)       | 2.4<br>(1.0 - 9.9)       |
| <i>E.coli</i> (cfu/100mL)              | 250<br>(22 - 1800)         | 910<br>(16 - 5400)       | 3600<br>(1100 - 15000)   | 1400<br>(200 - 8700)     |
| Faecal Coliforms (cfu/100mL)           | 520<br>(56 - 3700)         | 2000<br>(42 - 11000)     | 8600<br>(2900 - 31000)   | 3000<br>(360 - 28000)    |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

## Summary of water quality statistics for the Junk Bay WCZ in 2006

| Parameter                              | Junk Bay                 |                          |
|----------------------------------------|--------------------------|--------------------------|
|                                        | JM3                      | JM4                      |
| Number of samples                      | 12                       | 12                       |
| Temperature (°C)                       | 23.7<br>(17.4 - 27.2)    | 23.5<br>(17.4 - 26.6)    |
| Salinity                               | 31.8<br>(28.9 - 33.1)    | 32.2<br>(29.2 - 33.4)    |
| Dissolved Oxygen (mg/L)                | 6.6<br>(5.6 - 8.1)       | 6.4<br>(4.7 - 7.7)       |
| Bottom                                 | 6.4<br>(4.5 - 8.2)       | 6.2<br>(4.1 - 8.0)       |
| Dissolved Oxygen (% Saturation)        | 93<br>(78 - 119)         | 91<br>(69 - 112)         |
| Bottom                                 | 90<br>(66 - 120)         | 88<br>(58 - 112)         |
| pH                                     | 7.9<br>(7.7 - 8.3)       | 8.0<br>(7.7 - 8.3)       |
| Secchi Disc Depth (m)                  | 2.2<br>(1.2 - 3.2)       | 2.2<br>(1.5 - 3.5)       |
| Turbidity (NTU)                        | 10.0<br>(2.5 - 16.4)     | 10.9<br>(4.1 - 14.9)     |
| Suspended Solids (mg/L)                | 3.2<br>(0.9 - 8.4)       | 4.5<br>(1.6 - 19.0)      |
| 5-day Biochemical Oxygen Demand (mg/L) | 0.7<br>(0.2 - 1.7)       | 0.6<br>(0.3 - 1.8)       |
| Ammonia Nitrogen (mg/L)                | 0.07<br>(0.03 - 0.14)    | 0.06<br>(0.02 - 0.10)    |
| Unionised Ammonia (mg/L)               | 0.003<br>(0.001 - 0.005) | 0.002<br>(0.001 - 0.004) |
| Nitrite Nitrogen (mg/L)                | 0.020<br>(0.004 - 0.084) | 0.018<br>(0.003 - 0.060) |
| Nitrate Nitrogen (mg/L)                | 0.09<br>(0.02 - 0.28)    | 0.07<br>(0.01 - 0.19)    |
| Total Inorganic Nitrogen (mg/L)        | 0.18<br>(0.06 - 0.44)    | 0.15<br>(0.04 - 0.33)    |
| Total Kjeldahl Nitrogen (mg/L)         | 0.23<br>(0.13 - 0.34)    | 0.22<br>(0.14 - 0.30)    |
| Total Nitrogen (mg/L)                  | 0.34<br>(0.19 - 0.61)    | 0.31<br>(0.16 - 0.45)    |
| Orthophosphate Phosphorus (mg/L)       | 0.01<br>(<0.01 - 0.03)   | 0.01<br>(<0.01 - 0.02)   |
| Total Phosphorus (mg/L)                | 0.03<br>(0.02 - 0.05)    | 0.03<br>(0.02 - 0.04)    |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 0.6<br>(0.1 - 1.4)       | 0.6<br>(0.1 - 1.2)       |
| Chlorophyll-a (µg/L)                   | 4.8<br>(1.0 - 12.3)      | 3.6<br>(1.0 - 12.3)      |
| <i>E. coli</i> (cfu/100mL)             | 38<br>(3 - 420)          | 76<br>(4 - 300)          |
| Faecal Coliforms (cfu/100mL)           | 140<br>(18 - 740)        | 220<br>(19 - 1000)       |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

## Summary of water quality statistics for the Deep Bay WCZ in 2006

| Parameter                              | Inner Deep Bay           |                          |                          | Outer Deep Bay           |                          |
|----------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                                        | DM1                      | DM2                      | DM3                      | DM4                      | DM5                      |
| Number of samples                      | 12                       | 12                       | 12                       | 12                       | 12                       |
| Temperature (°C)                       | 25.2<br>(19.5 - 30.8)    | 25.1<br>(19.5 - 31.0)    | 24.9<br>(19.5 - 30.1)    | 24.7<br>(19.2 - 29.3)    | 24.5<br>(19.1 - 28.5)    |
| Salinity                               | 16.1<br>(5.5 - 23.5)     | 18.9<br>(7.7 - 26.4)     | 22.2<br>(10.4 - 29.0)    | 23.9<br>(14.2 - 30.8)    | 26.0<br>(13.4 - 32.2)    |
| Dissolved Oxygen (mg/L)                | 3.8<br>(1.4 - 6.7)       | 5.0<br>(2.6 - 7.5)       | 5.8<br>(3.8 - 6.8)       | 5.7<br>(4.0 - 6.6)       | 5.8<br>(4.3 - 7.3)       |
| Bottom                                 | N.M                      | N.M                      | N.M                      | 5.6<br>(3.8 - 6.7)       | 5.7<br>(3.5 - 7.3)       |
| Dissolved Oxygen (% Saturation)        | 54<br>(19 - 94)          | 68<br>(37 - 105)         | 80<br>(55 - 95)          | 78<br>(57 - 85)          | 81<br>(62 - 94)          |
| Bottom                                 | N.M                      | N.M                      | N.M                      | 77<br>(55 - 88)          | 79<br>(51 - 95)          |
| pH                                     | 7.3<br>(6.8 - 7.9)       | 7.4<br>(6.9 - 7.9)       | 7.6<br>(7.0 - 8.0)       | 7.6<br>(7.2 - 8.1)       | 7.7<br>(7.2 - 8.1)       |
| Secchi Disc Depth (m)                  | 0.3<br>(0.1 - 0.5)       | 0.3<br>(0.1 - 0.6)       | 0.5<br>(0.1 - 1.0)       | 0.5<br>(0.2 - 1.2)       | 0.8<br>(0.3 - 1.7)       |
| Turbidity (NTU)                        | 37.6<br>(16.2 - 74.6)    | 31.1<br>(15.6 - 60.4)    | 21.2<br>(13.1 - 39.2)    | 19.5<br>(11.0 - 33.0)    | 15<br>(10.0 - 21.4)      |
| Suspended Solids (mg/L)                | 58.5<br>(12.0 - 230.0)   | 29<br>(7.4 - 76.0)       | 16.9<br>(3.8 - 38.0)     | 13.5<br>(3.0 - 35.1)     | 8.3<br>(2.9 - 19.7)      |
| 5-day Biochemical Oxygen Demand (mg/L) | 3.2<br>(1.4 - 8.8)       | 2.9<br>(1.4 - 5.9)       | 1.6<br>(0.5 - 3.7)       | 0.9<br>(0.3 - 1.5)       | 0.9<br>(0.6 - 1.4)       |
| Ammonia Nitrogen (mg/L)                | 3.07<br>(0.18 - 5.90)    | 2.52<br>(0.61 - 5.10)    | 0.69<br>(0.20 - 1.40)    | 0.41<br>(0.19 - 0.76)    | 0.28<br>(0.09 - 0.61)    |
| Unionised Ammonia (mg/L)               | 0.041<br>(0.002 - 0.110) | 0.055<br>(0.004 - 0.243) | 0.013<br>(0.002 - 0.025) | 0.009<br>(0.002 - 0.016) | 0.006<br>(0.001 - 0.013) |
| Nitrite Nitrogen (mg/L)                | 0.269<br>(0.170 - 0.350) | 0.270<br>(0.140 - 0.340) | 0.188<br>(0.120 - 0.250) | 0.138<br>(0.096 - 0.215) | 0.100<br>(0.055 - 0.177) |
| Nitrate Nitrogen (mg/L)                | 0.52<br>(0.23 - 0.90)    | 0.48<br>(0.25 - 0.81)    | 0.63<br>(0.35 - 1.10)    | 0.54<br>(0.25 - 0.99)    | 0.45<br>(0.14 - 1.09)    |
| Total Inorganic Nitrogen (mg/L)        | 3.86<br>(1.16 - 6.47)    | 3.27<br>(1.33 - 5.81)    | 1.51<br>(0.89 - 2.33)    | 1.10<br>(0.80 - 1.40)    | 0.83<br>(0.47 - 1.29)    |
| Total Kjeldahl Nitrogen (mg/L)         | 3.73<br>(1.20 - 6.60)    | 3.10<br>(0.85 - 5.80)    | 0.95<br>(0.66 - 1.50)    | 0.64<br>(0.43 - 0.96)    | 0.47<br>(0.30 - 0.78)    |
| Total Nitrogen (mg/L)                  | 4.51<br>(2.12 - 7.28)    | 3.85<br>(1.57 - 6.51)    | 1.77<br>(1.21 - 2.53)    | 1.30<br>(0.96 - 1.69)    | 1.02<br>(0.59 - 1.51)    |
| Orthophosphate Phosphorus (mg/L)       | 0.35<br>(0.09 - 0.54)    | 0.29<br>(0.07 - 0.44)    | 0.11<br>(0.02 - 0.21)    | 0.06<br>(0.02 - 0.09)    | 0.04<br>(0.02 - 0.06)    |
| Total Phosphorus (mg/L)                | 0.51<br>(0.24 - 0.83)    | 0.41<br>(0.15 - 0.67)    | 0.16<br>(0.08 - 0.34)    | 0.08<br>(0.05 - 0.11)    | 0.06<br>(0.03 - 0.09)    |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 4.9<br>(1.3 - 10.0)      | 3.8<br>(0.2 - 8.9)       | 3.3<br>(0.7 - 7.6)       | 2.8<br>(0.7 - 6.3)       | 2.4<br>(0.6 - 5.6)       |
| Chlorophyll-a (µg/L)                   | 16.0<br>(1.6 - 89.0)     | 25.5<br>(1.2 - 120.0)    | 9.1<br>(1.7 - 58.0)      | 3.84<br>(1.0 - 13.0)     | 2.13<br>(1.2 - 3.9)      |
| <i>E. coli</i> (cfu/100mL)             | 2000<br>(140 - 14000)    | 1300<br>(64 - 64000)     | 120<br>(12 - 1800)       | 740<br>(150 - 2900)      | 420<br>(62 - 1500)       |
| Faecal Coliforms (cfu/100mL)           | 3400<br>(300 - 23000)    | 2100<br>(81 - 180000)    | 240<br>(22 - 3000)       | 1400<br>(270 - 4100)     | 910<br>(180 - 3700)      |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

4. NM - not measured.

## Summary of water quality statistics for the North Western WCZ in 2006

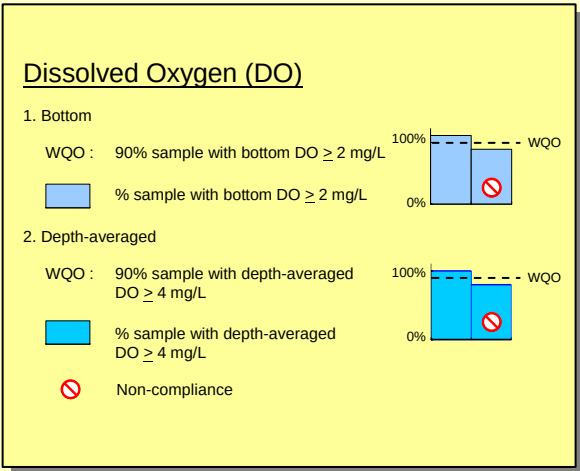
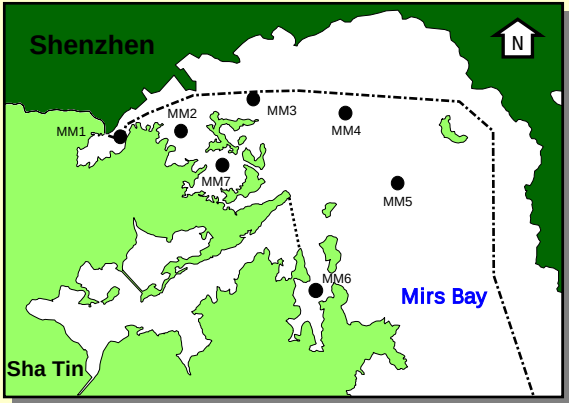
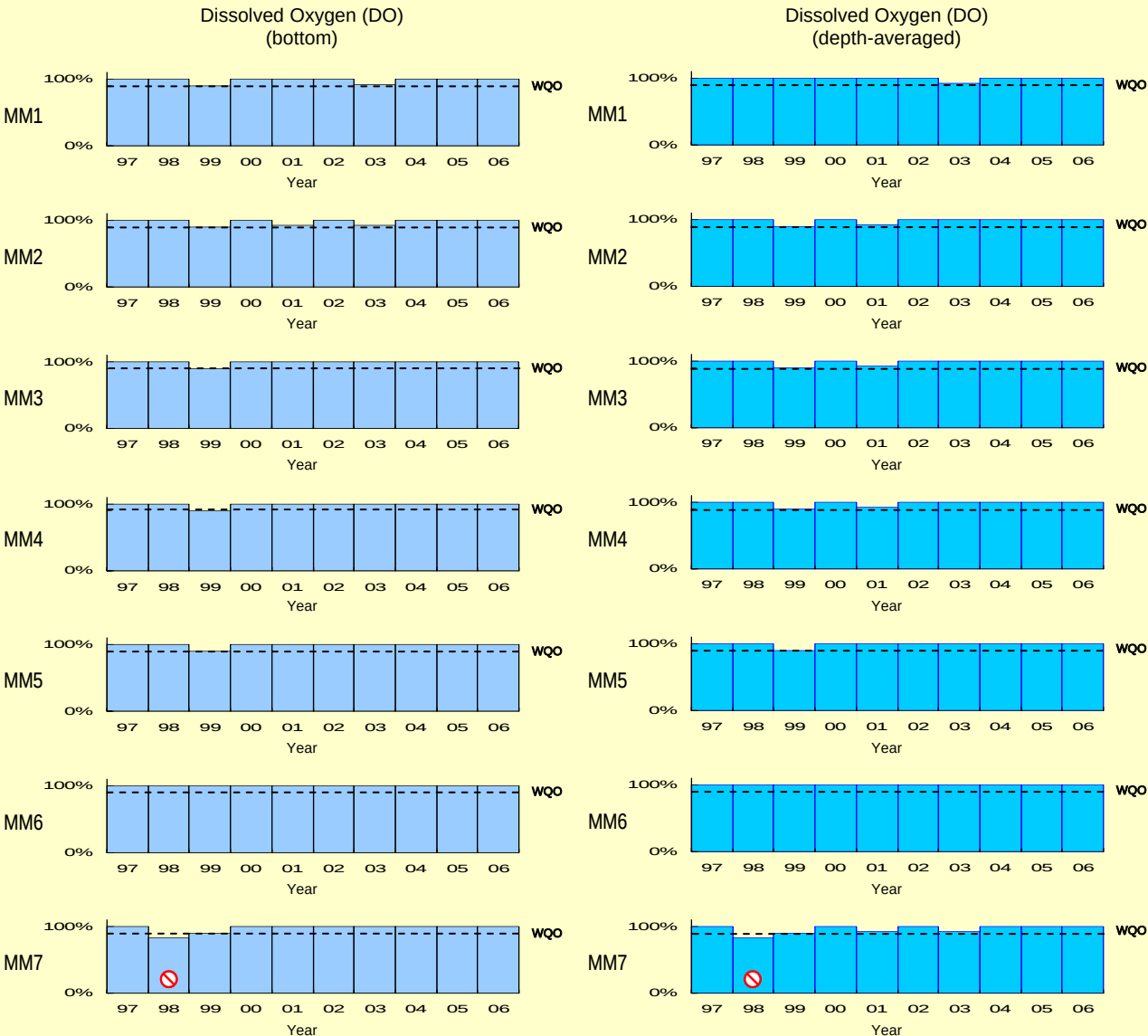
| Parameter                              | Lantau Island<br>(North)  | Pearl Island             | Pillar Point             | Urmston Road             | Chek Lap Kok             |                          |
|----------------------------------------|---------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                                        | NM1                       | NM2                      | NM3                      | NM5                      | (North)<br>NM6           | (West)<br>NM8            |
| Number of samples                      | 12                        | 12                       | 12                       | 12                       | 12                       | 12                       |
| Temperature (°C)                       | 23.7<br>(17.6 - 27.4)     | 23.8<br>(17.5 - 27.6)    | 23.7<br>(17.7 - 27.6)    | 24.0<br>(17.9 - 27.8)    | 24.0<br>(17.7 - 29.2)    | 23.8<br>(17.5 - 28.3)    |
| Salinity                               | 29.6<br>(22.2 - 33.1)     | 28.6<br>(19.0 - 33.1)    | 29.4<br>(23.7 - 33.1)    | 27.2<br>(16.4 - 32.8)    | 26.0<br>(10.5 - 33.3)    | 27.6<br>(11.9 - 33.4)    |
| Dissolved Oxygen (mg/L)                | 6.3<br>(4.4 - 8.0)        | 6.5<br>(4.9 - 8.4)       | 6.3<br>(4.4 - 8.3)       | 6.3<br>(4.3 - 8.2)       | 6.7<br>(4.8 - 8.7)       | 6.8<br>(4.8 - 8.2)       |
| Bottom                                 | 5.9<br>(2.4 - 7.9)        | 6.3<br>(3.9 - 8.4)       | 6.1<br>(3.3 - 8.0)       | 5.9<br>(3.4 - 7.9)       | 6.6<br>(4.2 - 8.6)       | 6.7<br>(4.6 - 8.3)       |
| Dissolved Oxygen (% Saturation)        | 87<br>(62 - 113)          | 90<br>(69 - 119)         | 88<br>(63 - 117)         | 87<br>(59 - 116)         | 92<br>(64 - 123)         | 94<br>(64 - 113)         |
| Bottom                                 | 82<br>(35 - 111)          | 88<br>(56 - 118)         | 85<br>(47 - 113)         | 83<br>(49 - 108)         | 92<br>(60 - 122)         | 94<br>(63 - 118)         |
| pH                                     | 7.9<br>(7.6 - 8.0)        | 7.9<br>(7.6 - 8.1)       | 7.9<br>(7.6 - 8.1)       | 7.9<br>(7.5 - 8.1)       | 7.9<br>(7.5 - 8.2)       | 7.9<br>(7.5 - 8.2)       |
| Secchi Disc Depth (m)                  | 1.6<br>(0.9 - 2.5)        | 1.7<br>(1.1 - 2.8)       | 1.5<br>(0.5 - 2.4)       | 1.4<br>(0.7 - 2.2)       | 1.2<br>(0.5 - 1.5)       | 1.3<br>(0.8 - 2.0)       |
| Turbidity (NTU)                        | 20.3<br>(6.8 - 78.7)      | 18.0<br>(5.8 - 75.3)     | 18.7<br>(8.1 - 55.8)     | 25.8<br>(11.0 - 75.3)    | 22.9<br>(8.0 - 47.8)     | 23.8<br>(9.3 - 45.5)     |
| Suspended Solids (mg/L)                | 7.4<br>(2.5 - 17.4)       | 6.4<br>(2.9 - 21.3)      | 8.1<br>(3.0 - 14.0)      | 15.7<br>(3.8 - 53.8)     | 12.6<br>(4.1 - 35.9)     | 15.8<br>(2.7 - 56.7)     |
| 5-day Biochemical Oxygen Demand (mg/L) | 0.6<br>(0.4 - 1.1)        | 0.6<br>(0.2 - 1.0)       | 0.7<br>(0.4 - 1.2)       | 0.7<br>(0.5 - 0.9)       | 0.7<br>(0.3 - 1.3)       | 0.7<br>(0.3 - 1.9)       |
| Ammonia Nitrogen (mg/L)                | 0.15<br>(0.04 - 0.27)     | 0.15<br>(0.05 - 0.27)    | 0.15<br>(0.04 - 0.27)    | 0.22<br>(0.13 - 0.37)    | 0.17<br>(0.01 - 0.50)    | 0.10<br>(0.01 - 0.35)    |
| Unionised Ammonia (mg/L)               | 0.005<br>(<0.001 - 0.010) | 0.005<br>(0.001 - 0.011) | 0.005<br>(0.001 - 0.011) | 0.008<br>(0.003 - 0.017) | 0.006<br>(0.002 - 0.022) | 0.004<br>(0.001 - 0.019) |
| Nitrite Nitrogen (mg/L)                | 0.056<br>(0.017 - 0.150)  | 0.064<br>(0.020 - 0.170) | 0.064<br>(0.018 - 0.187) | 0.091<br>(0.024 - 0.250) | 0.093<br>(0.026 - 0.200) | 0.066<br>(0.009 - 0.150) |
| Nitrate Nitrogen (mg/L)                | 0.23<br>(0.04 - 0.45)     | 0.28<br>(0.04 - 0.57)    | 0.28<br>(0.06 - 0.51)    | 0.37<br>(0.08 - 0.69)    | 0.39<br>(0.03 - 1.00)    | 0.28<br>(0.01 - 0.72)    |
| Total Inorganic Nitrogen (mg/L)        | 0.43<br>(0.17 - 0.75)     | 0.49<br>(0.18 - 0.85)    | 0.50<br>(0.22 - 0.80)    | 0.67<br>(0.29 - 1.07)    | 0.66<br>(0.09 - 1.40)    | 0.44<br>(0.06 - 1.20)    |
| Total Kjeldahl Nitrogen (mg/L)         | 0.31<br>(0.21 - 0.44)     | 0.30<br>(0.19 - 0.42)    | 0.31<br>(0.21 - 0.47)    | 0.41<br>(0.29 - 0.61)    | 0.36<br>(0.14 - 0.75)    | 0.28<br>(0.11 - 0.57)    |
| Total Nitrogen (mg/L)                  | 0.60<br>(0.29 - 0.92)     | 0.65<br>(0.28 - 1.05)    | 0.66<br>(0.33 - 0.94)    | 0.86<br>(0.41 - 1.31)    | 0.84<br>(0.22 - 1.66)    | 0.62<br>(0.15 - 1.39)    |
| Orthophosphate Phosphorus (mg/L)       | 0.03<br>(0.01 - 0.04)     | 0.03<br>(0.01 - 0.04)    | 0.03<br>(0.01 - 0.04)    | 0.03<br>(0.01 - 0.05)    | 0.02<br>(<0.01 - 0.05)   | 0.02<br>(<0.01 - 0.04)   |
| Total Phosphorus (mg/L)                | 0.05<br>(0.03 - 0.06)     | 0.04<br>(0.03 - 0.06)    | 0.05<br>(0.04 - 0.06)    | 0.07<br>(0.05 - 0.11)    | 0.05<br>(0.03 - 0.08)    | 0.04<br>(0.02 - 0.06)    |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 1.4<br>(0.5 - 3.4)        | 1.6<br>(0.5 - 4.4)       | 1.5<br>(0.3 - 3.3)       | 2.1<br>(0.3 - 5.2)       | 2.4<br>(0.3 - 7.4)       | 2.0<br>(0.5 - 6.0)       |
| Chlorophyll-a (µg/L)                   | 3.6<br>(0.8 - 19.2)       | 2.8<br>(0.8 - 10.6)      | 3.3<br>(1.0 - 7.7)       | 4.2<br>(1.3 - 17.4)      | 3.9<br>(1.1 - 12.0)      | 3.5<br>(1.3 - 14.7)      |
| <i>E. coli</i> (cfu/100mL)             | 1100<br>(340 - 2600)      | 470<br>(280 - 1900)      | 500<br>(140 - 2100)      | 900<br>(220 - 2600)      | 64<br>(2 - 1900)         | 5<br>(1 - 420)           |
| Faecal Coliforms (cfu/100mL)           | 2800<br>(1100 - 7200)     | 1100<br>(570 - 3600)     | 1300<br>(260 - 6300)     | 2300<br>(460 - 6300)     | 140<br>(8 - 3600)        | 13<br>(1 - 950)          |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

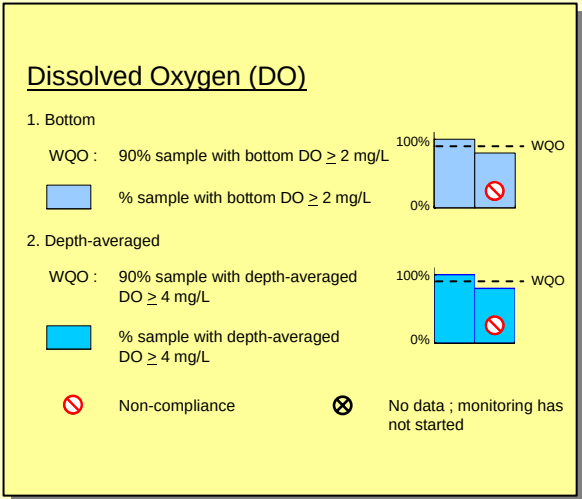
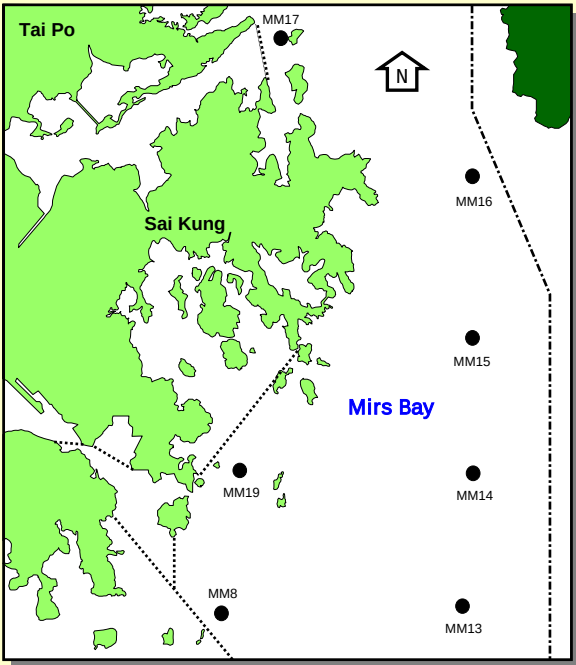
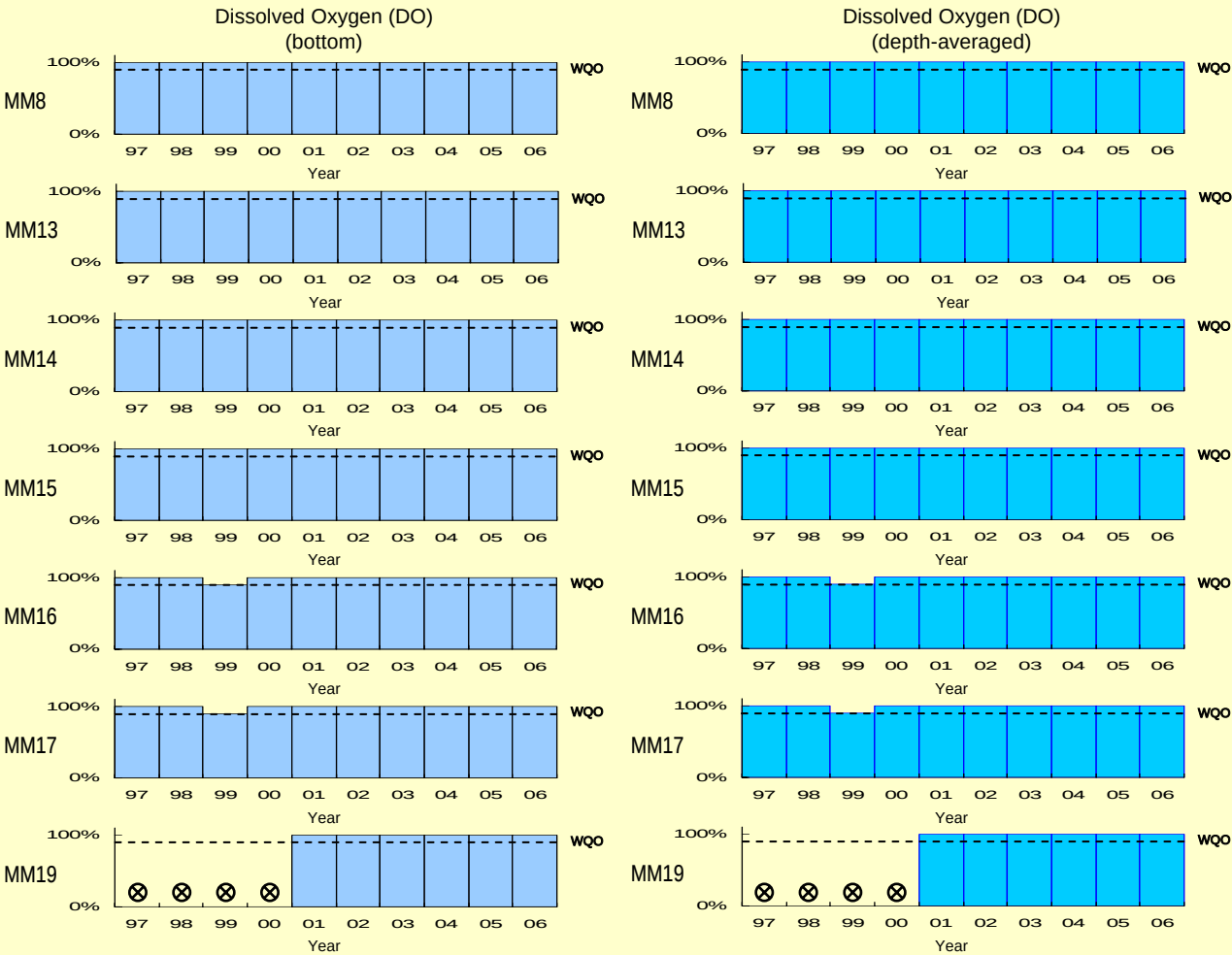
2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ

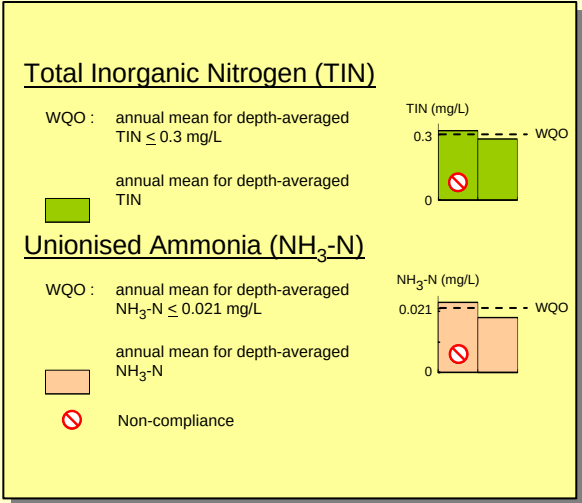
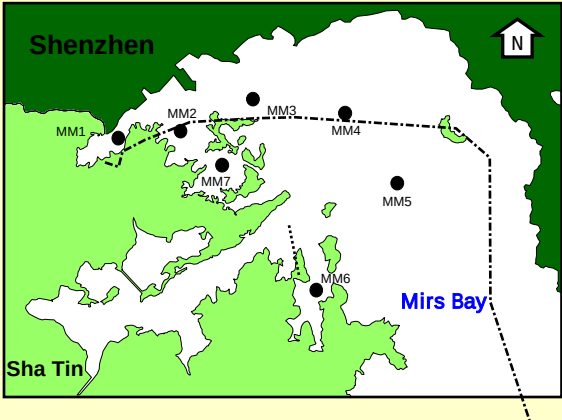
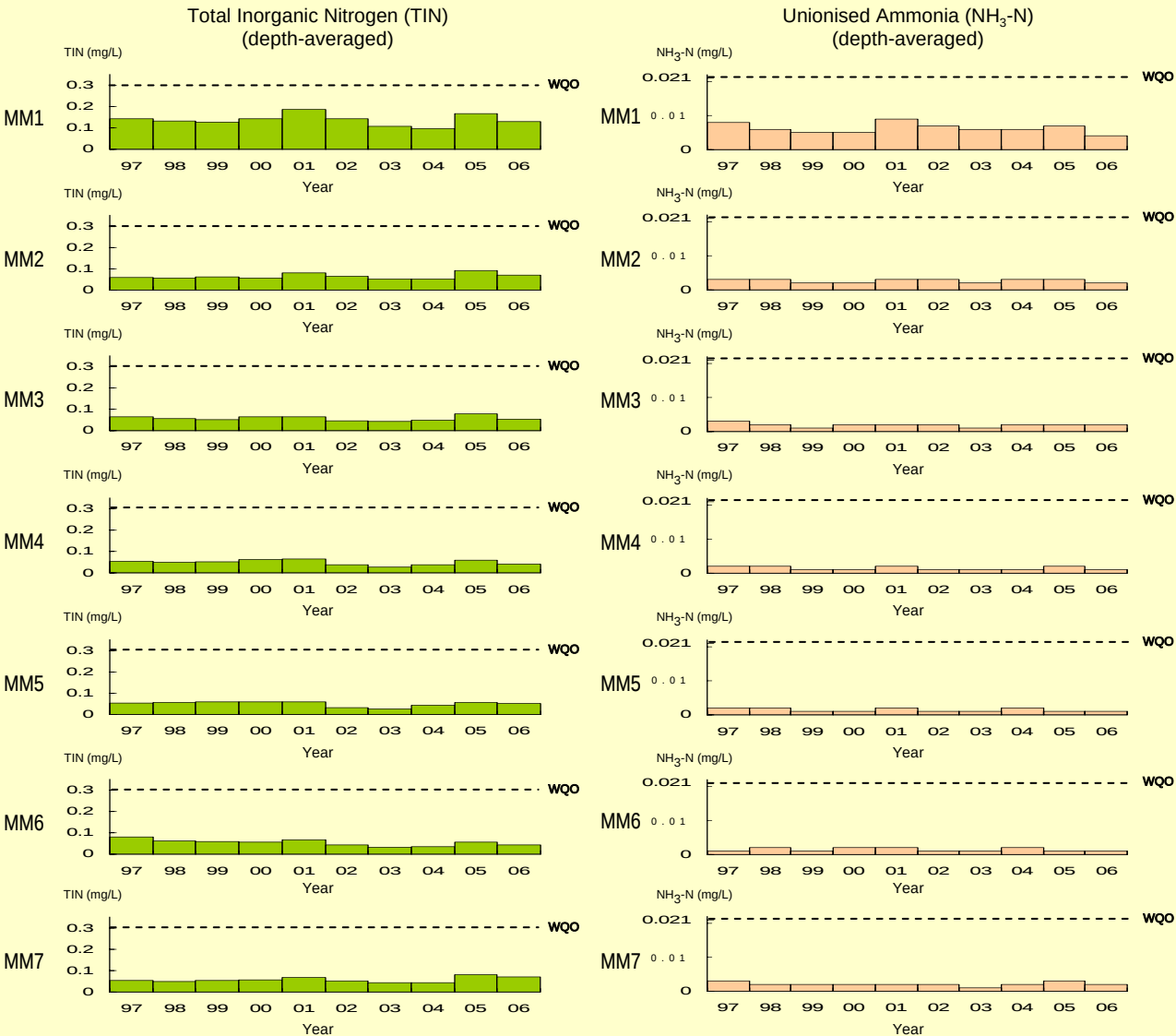


Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ (continued)

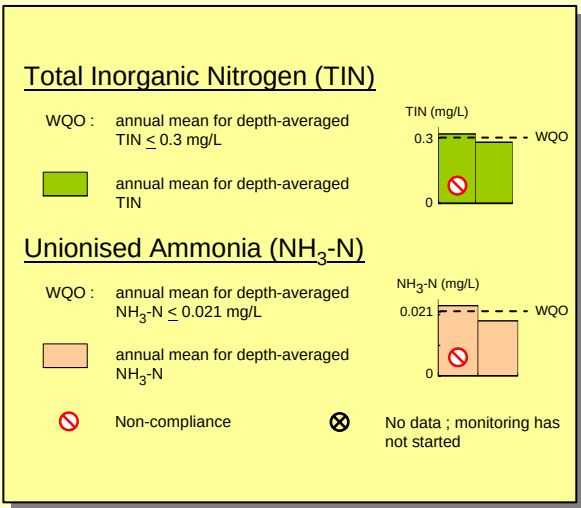
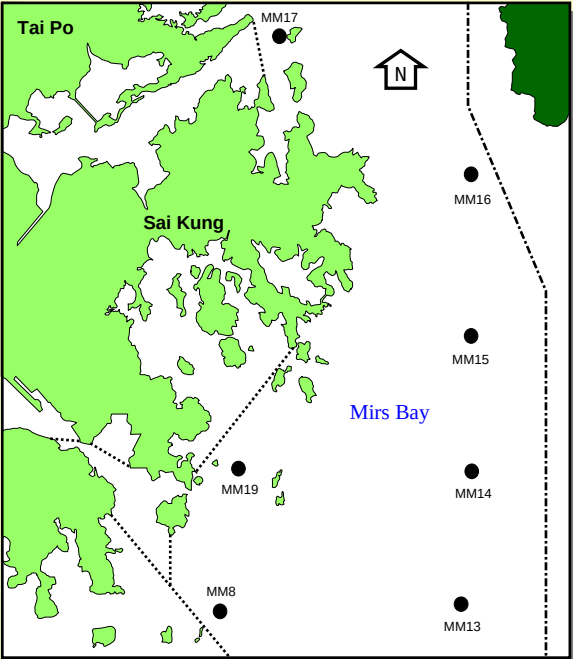
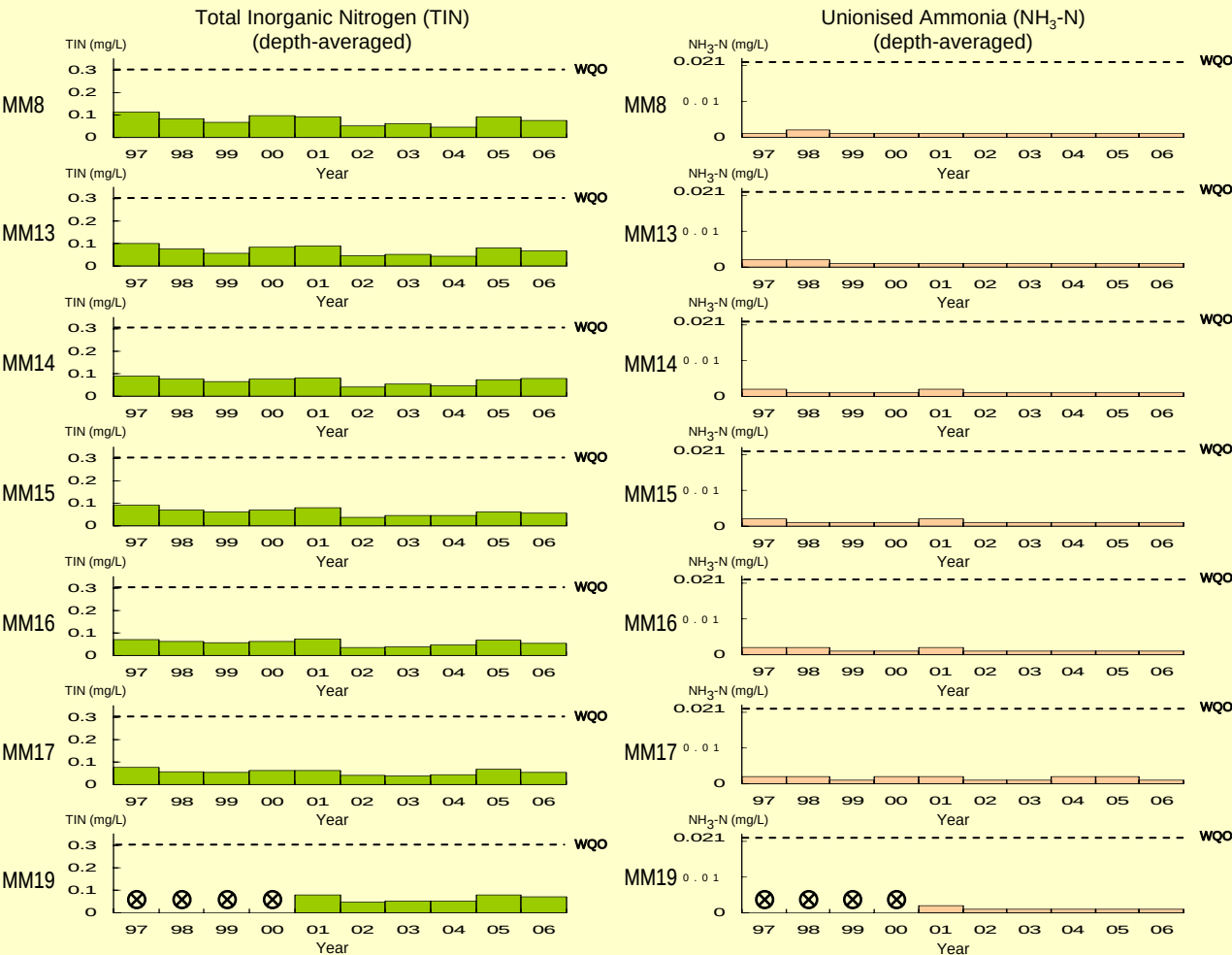




Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ (continued)

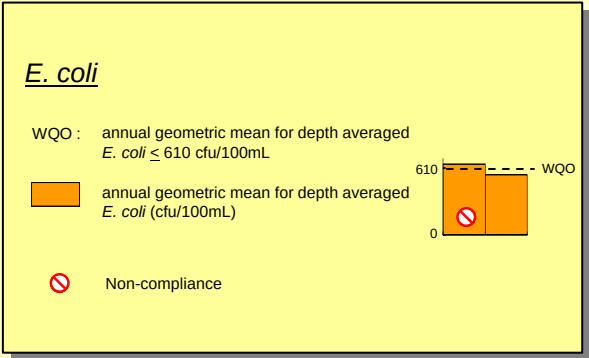
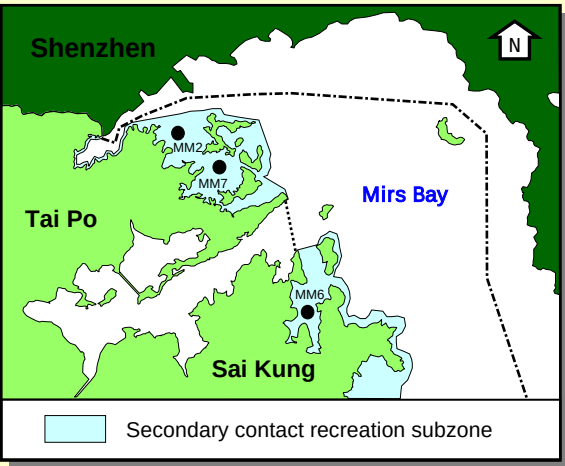
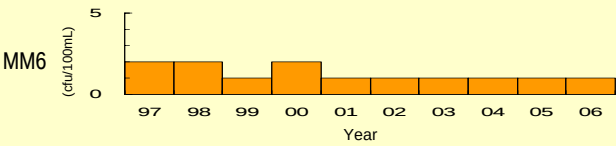
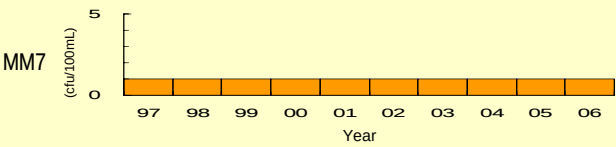
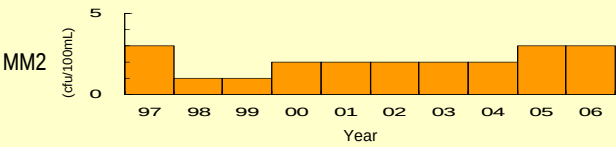


Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ (continued)

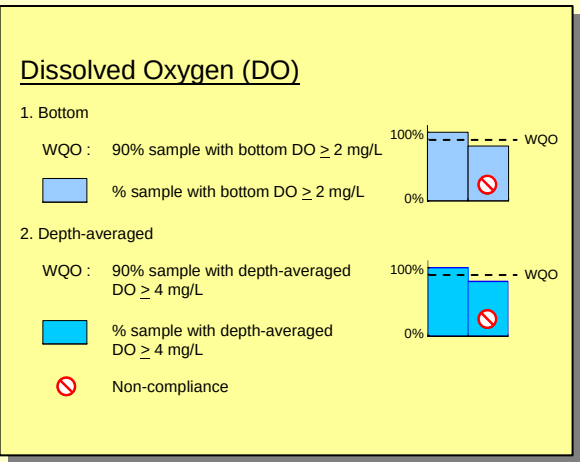
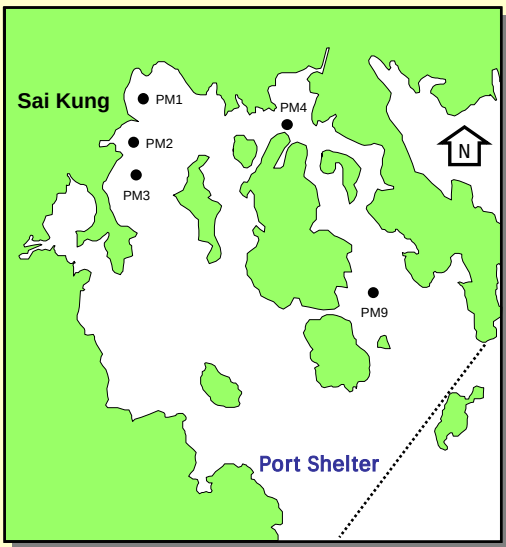
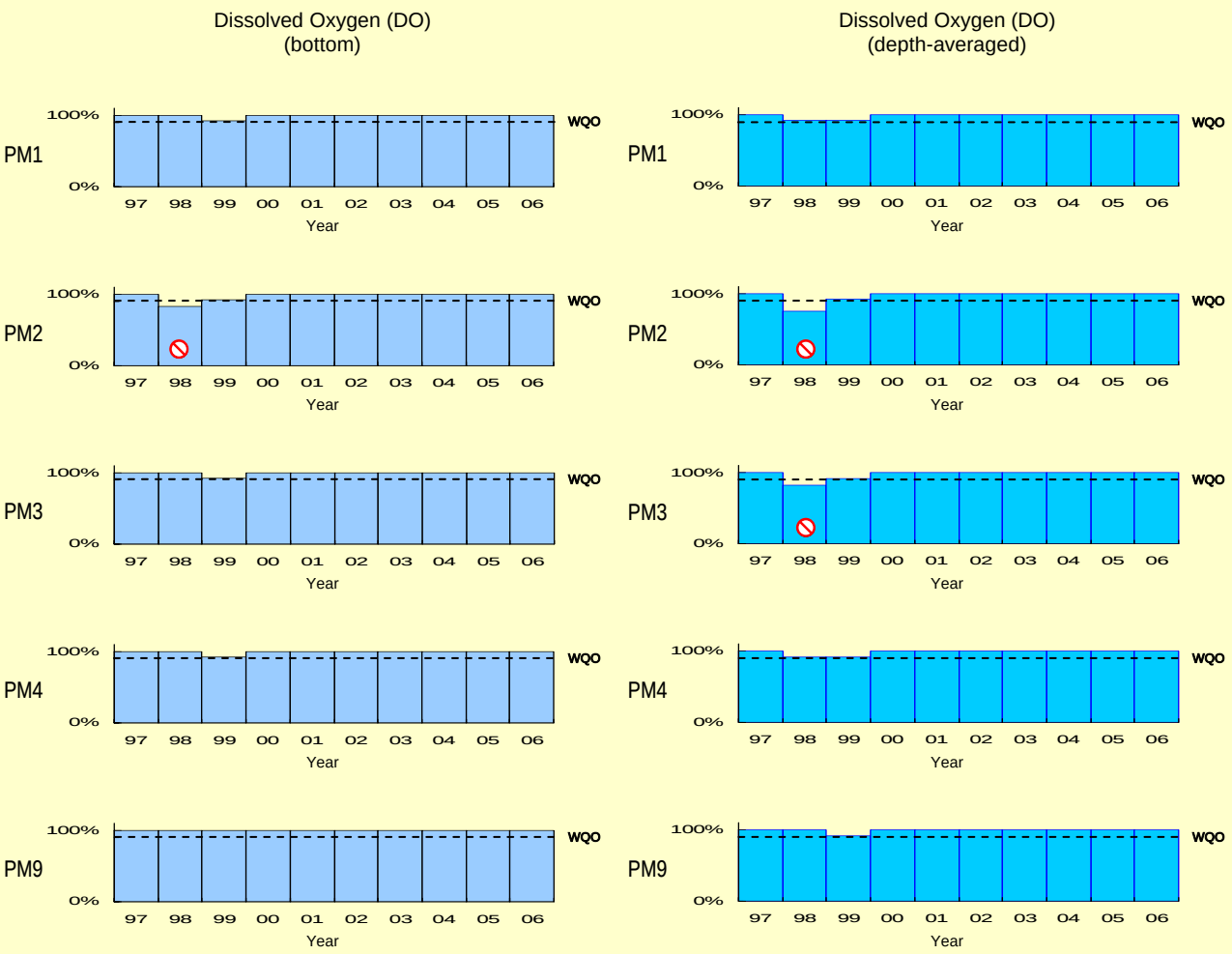


Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ (continued)

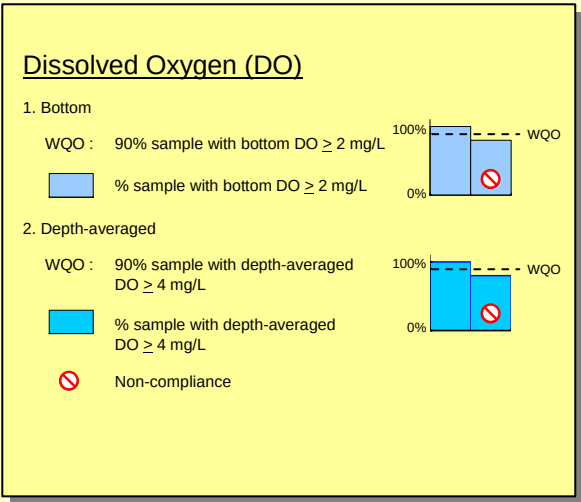
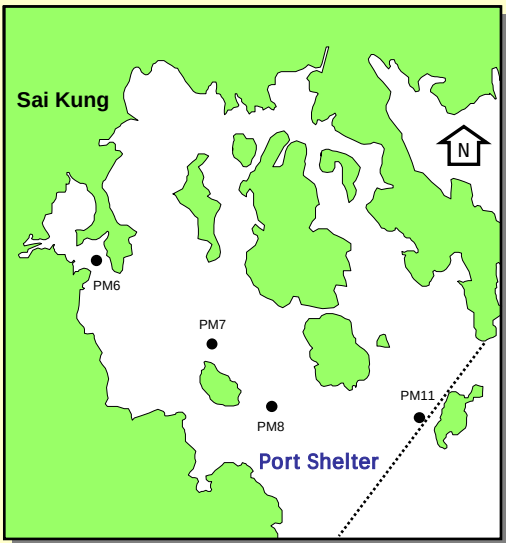
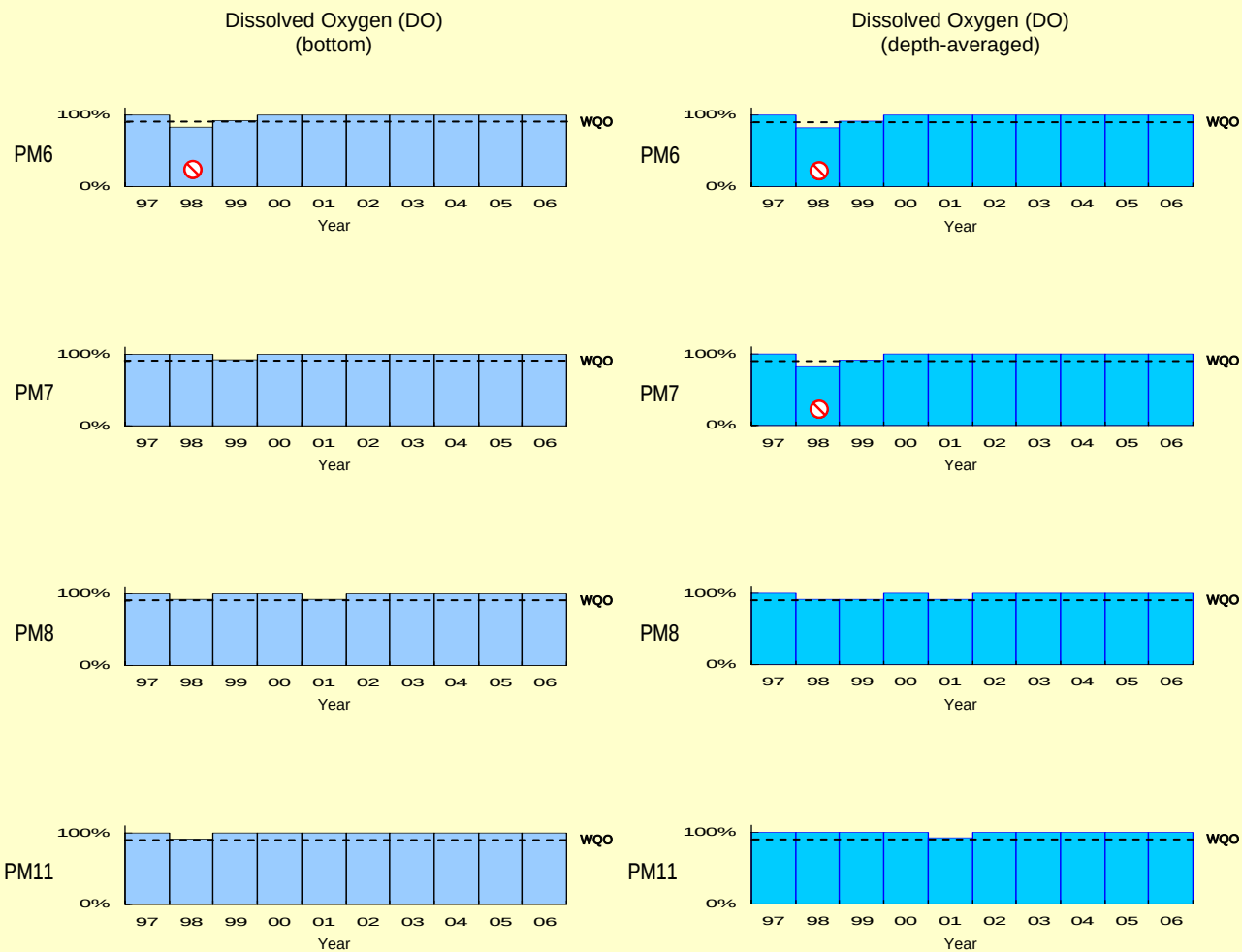
*E. coli*  
(annual geometric mean)



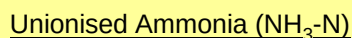
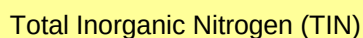
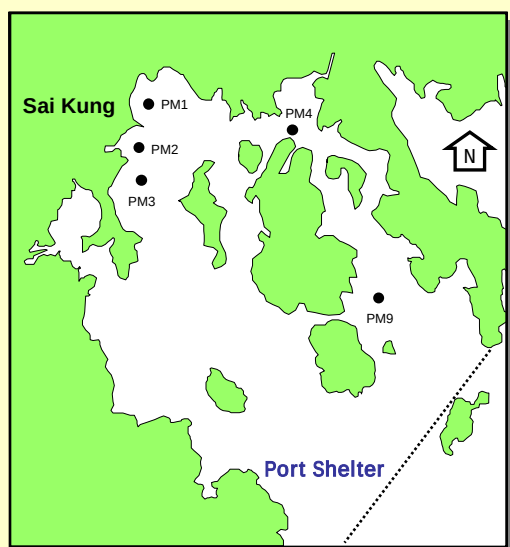
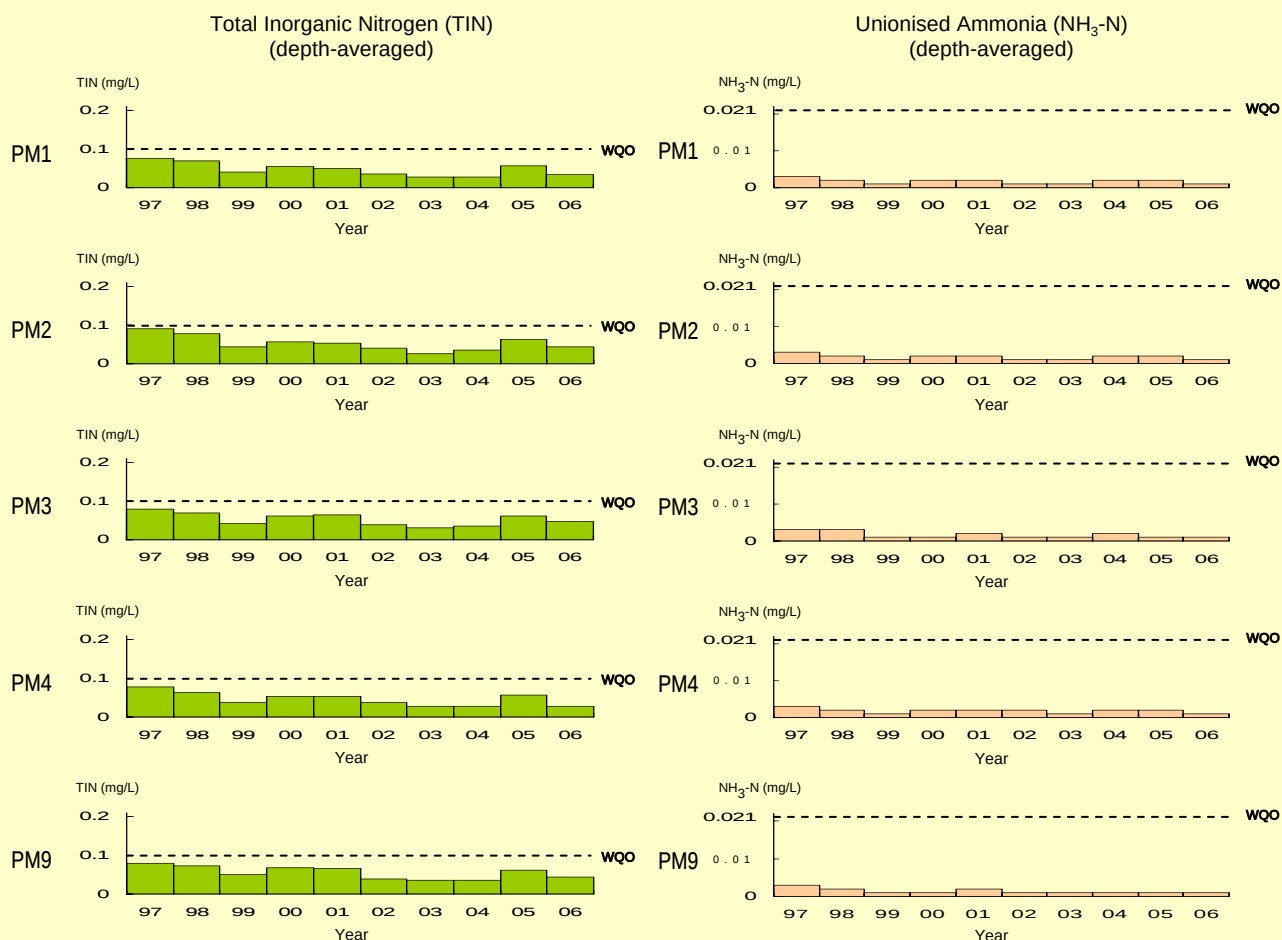
Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ



Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ (continued)

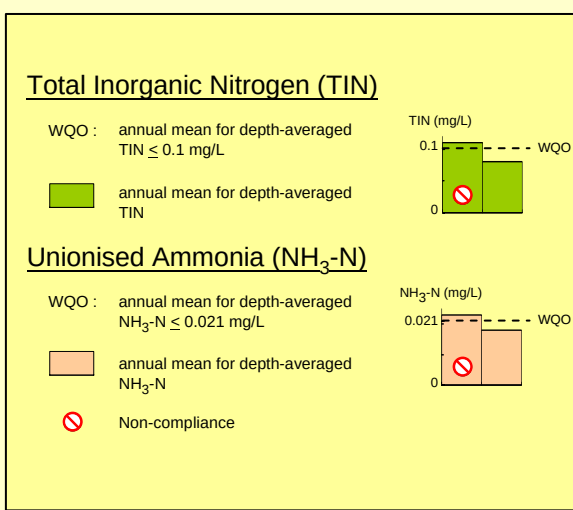
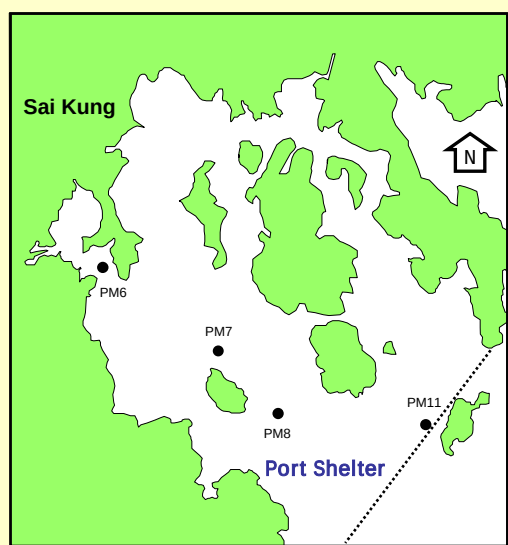
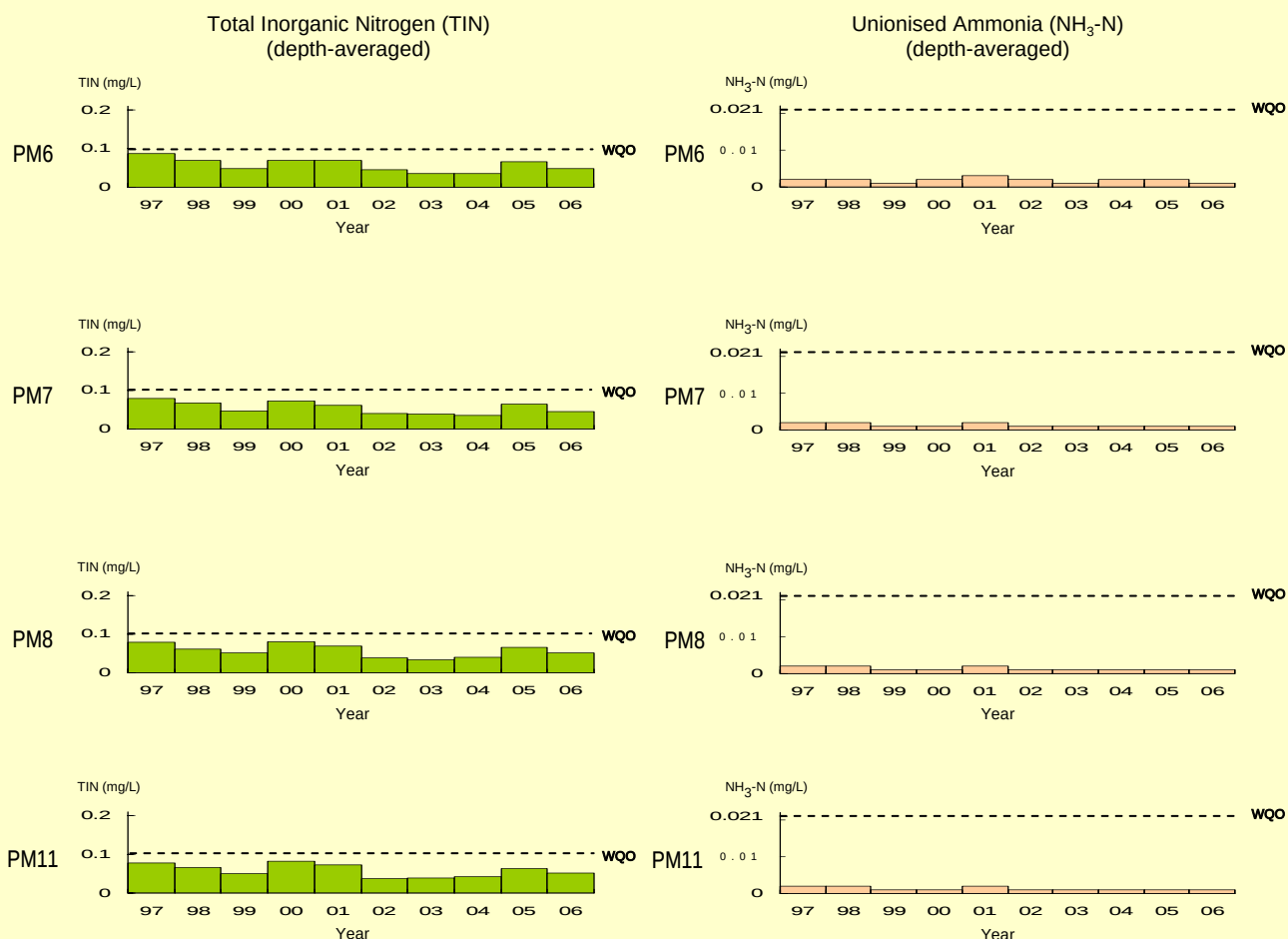


Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ (continued)



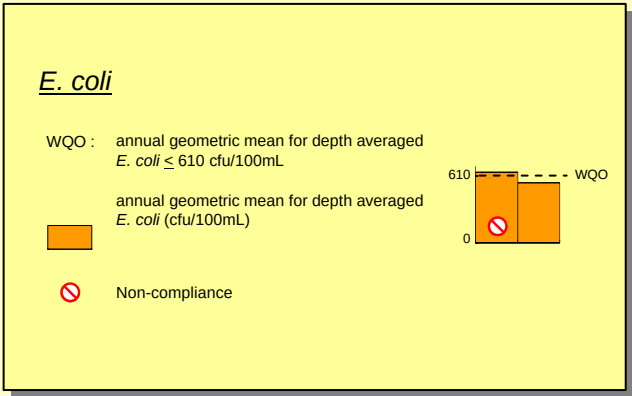
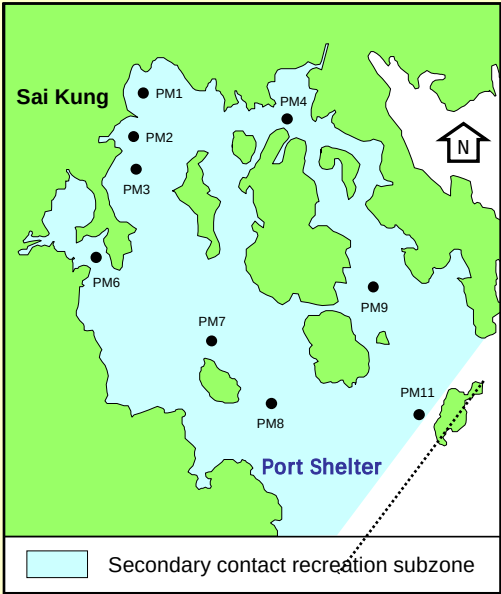
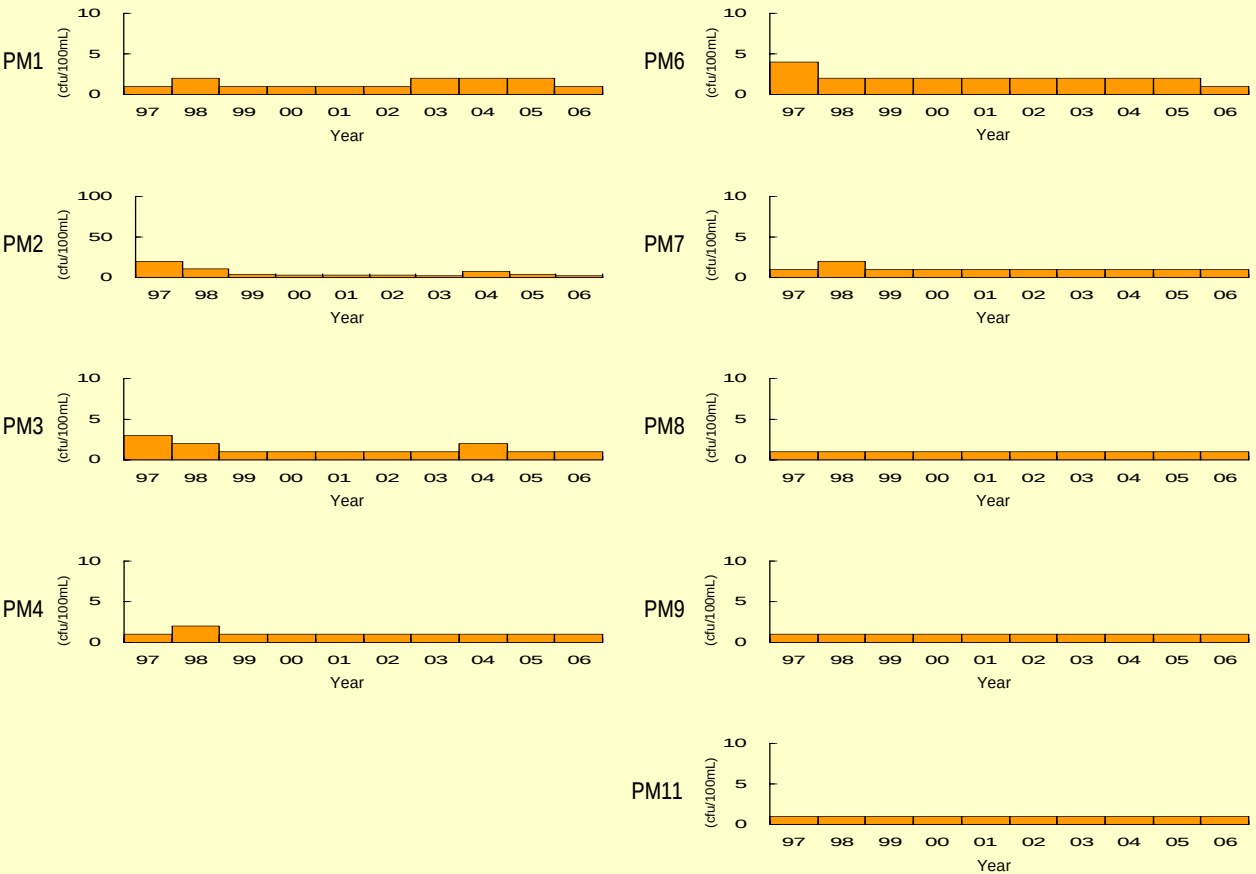


Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ  
(continued)

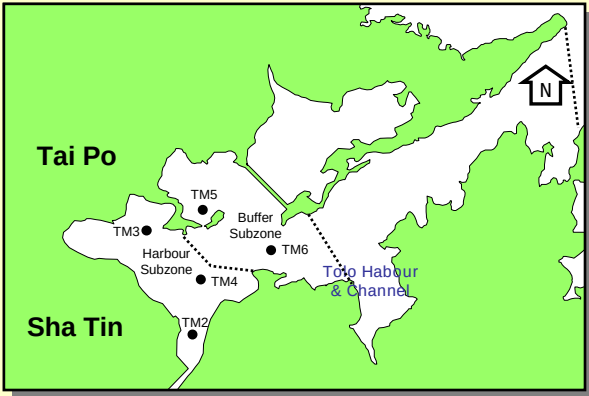
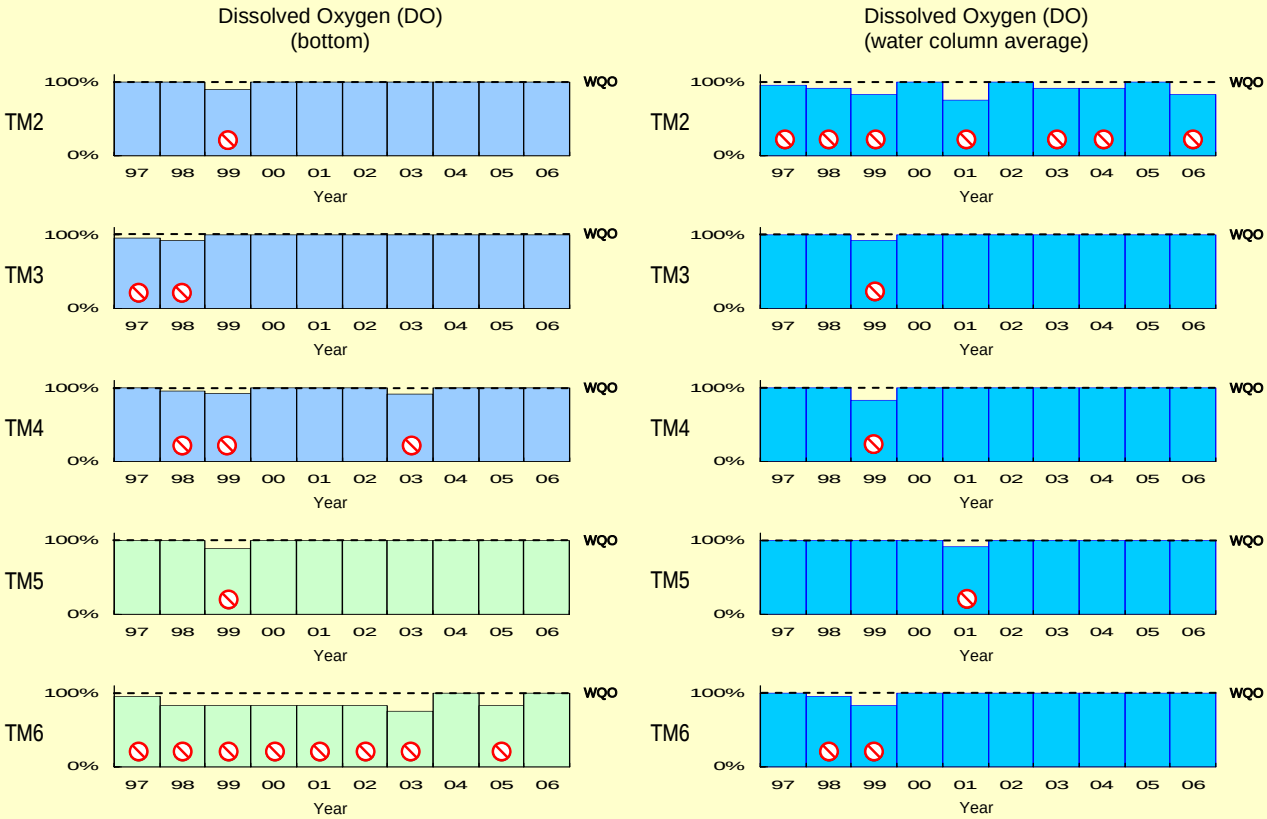


Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ (continued)

*E. coli*  
(annual geometric mean)



Levels of compliance with key Water Quality Objectives in the Tolo Harbour and Channel WCZ



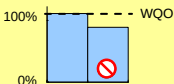
Dissolved Oxygen (DO)

Harbour Subzone (TM2 - TM4)

1. Bottom

WQO : 100% sample with bottom DO  $\geq$  2 mg/L

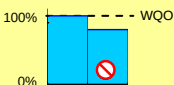
% sample with bottom DO  $\geq$  2 mg/L



2. Water column average (surface to 2m above bottom)

WQO : 100% sample with water column average DO  $\geq$  4 mg/L

% sample with water column average DO  $\geq$  4 mg/L

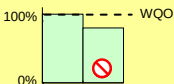


Buffer Subzone (TM5 - TM6)

1. Bottom

WQO : 100% sample with bottom DO  $\geq$  3 mg/L

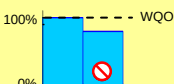
% sample with bottom DO  $\geq$  3 mg/L



2. Water column average (surface to 2m above bottom)

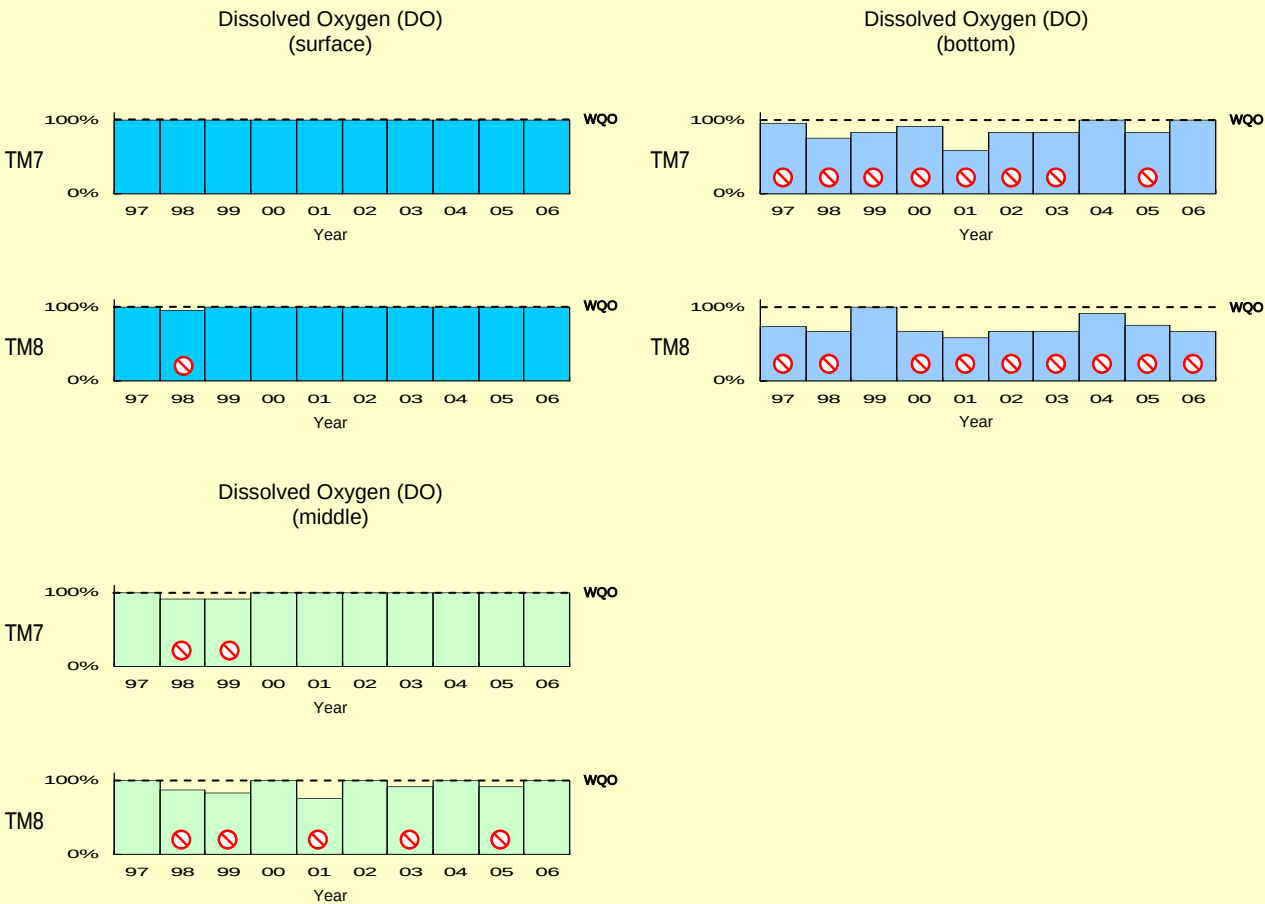
WQO : 100% sample with water column average DO  $\geq$  4 mg/L

% sample with water column average DO  $\geq$  4 mg/L



Non-compliance

Levels of compliance with key Water Quality Objectives in the Tolo Harbour and Channel WCZ (continued)



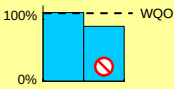
Dissolved Oxygen (DO)

Channel Subzone (TM7 - TM8)

1. Surface

WQO : 100% sample with surface DO  $\geq$  4 mg/L

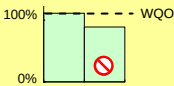
% sample with surface DO  $\geq$  4 mg/L



2. Middle

WQO : 100% sample with middle DO  $\geq$  4 mg/L

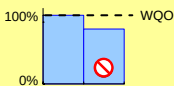
% sample with middle DO  $\geq$  4 mg/L



3. Bottom

WQO : 100% sample with bottom DO  $\geq$  4 mg/L

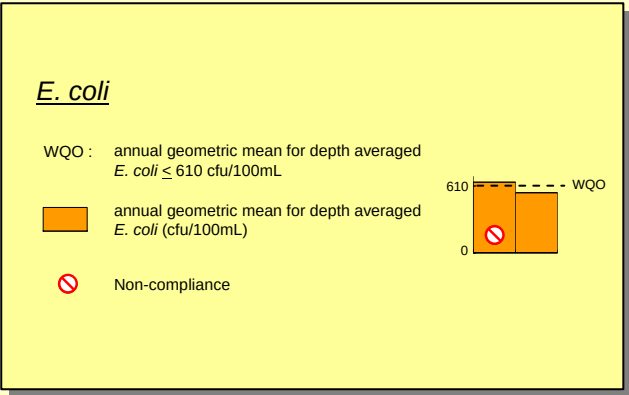
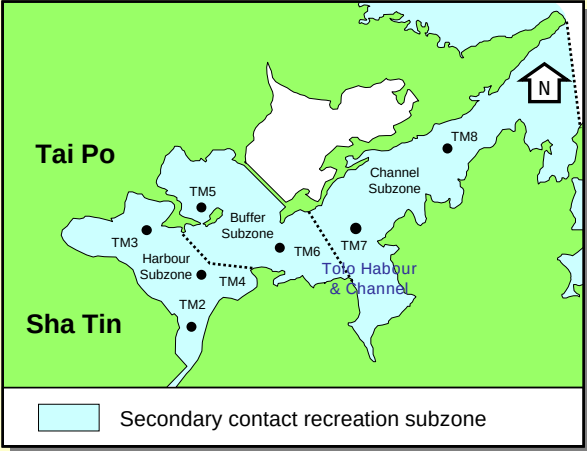
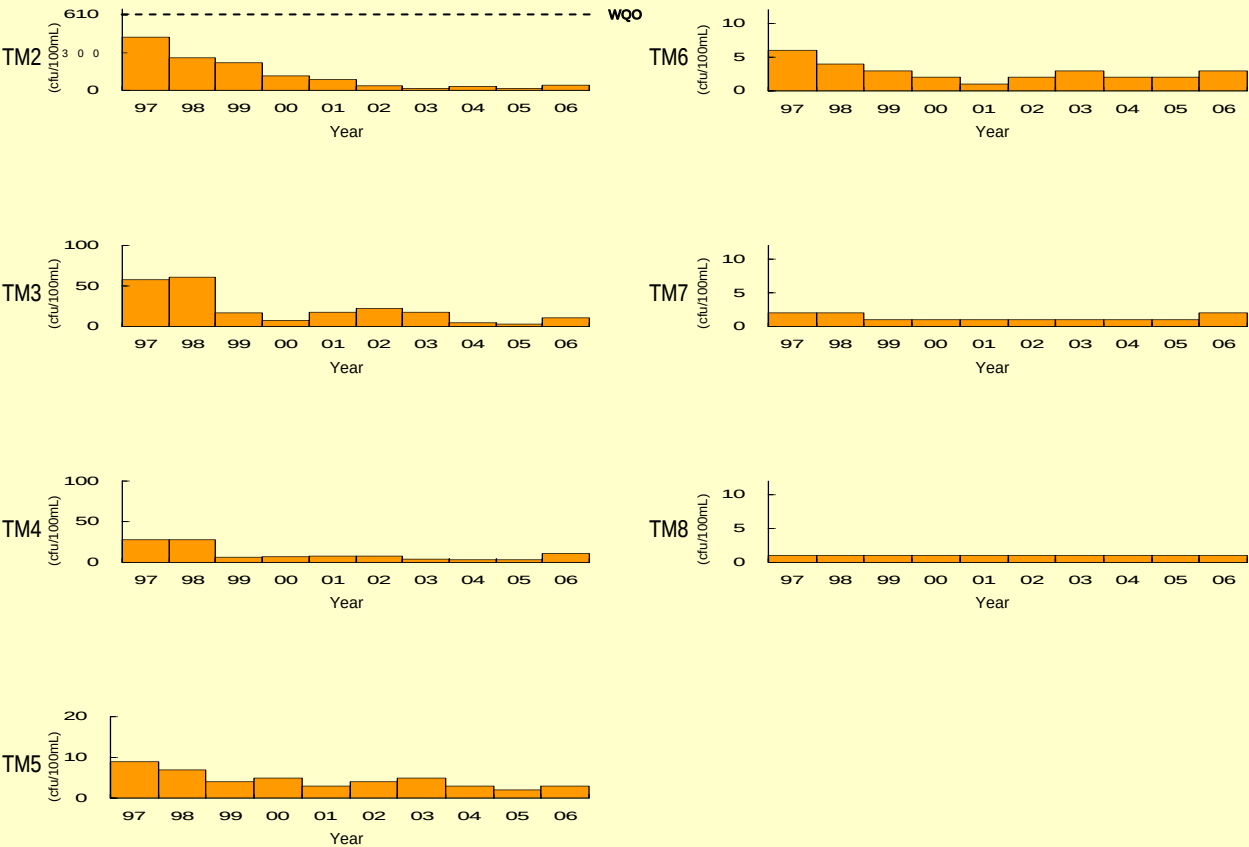
% sample with bottom DO  $\geq$  4 mg/L



Non-compliance

Levels of compliance with key Water Quality Objectives in the Tolo Harbour And Channel WCZ (continued)

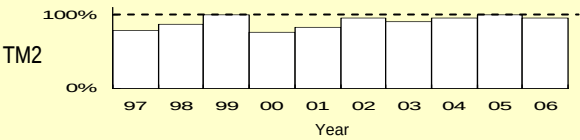
*E. coli*  
(annual geometric mean)



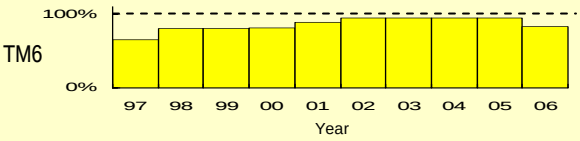
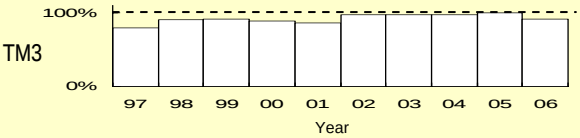
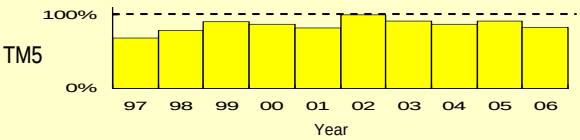
Levels of chlorophyll-*a* in the Tolo Harbour and Channel WCZ

Chlorophyll-a

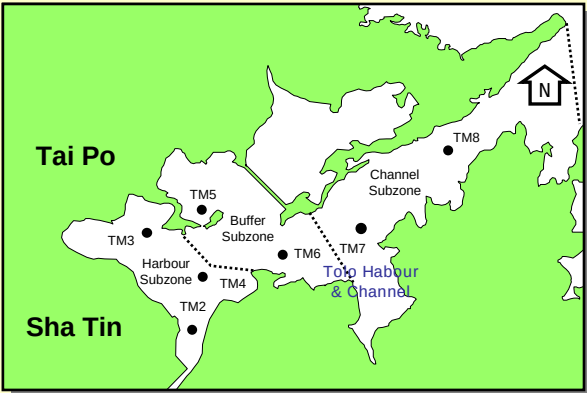
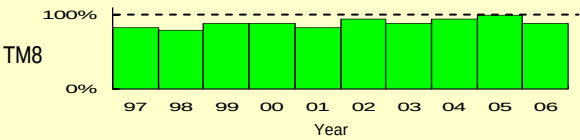
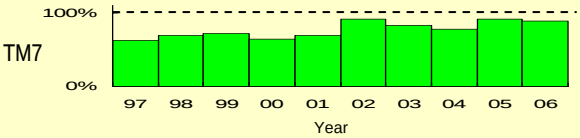
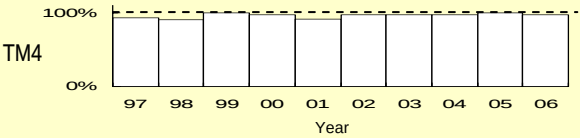
1. Harbour Subzone



2. Buffer Subzone



3. Channel Subzone



Chlorophyll-a

1. Harbour Subzone

% sample (S, M, B) with Chlorophyll-a ≤ 20 µg/L  
WQO : Chlorophyll-a ≤ 20 µg/L

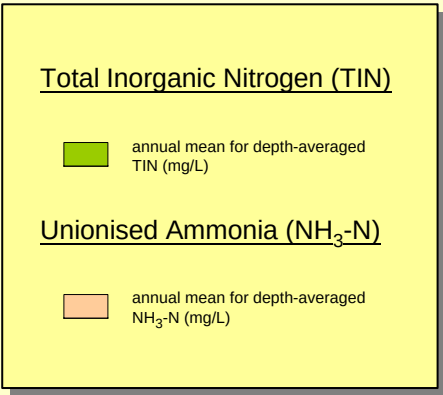
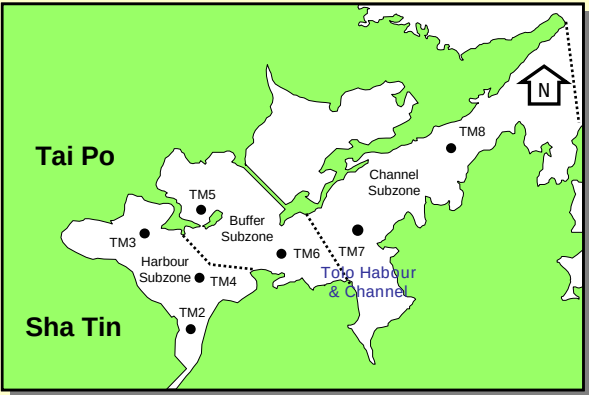
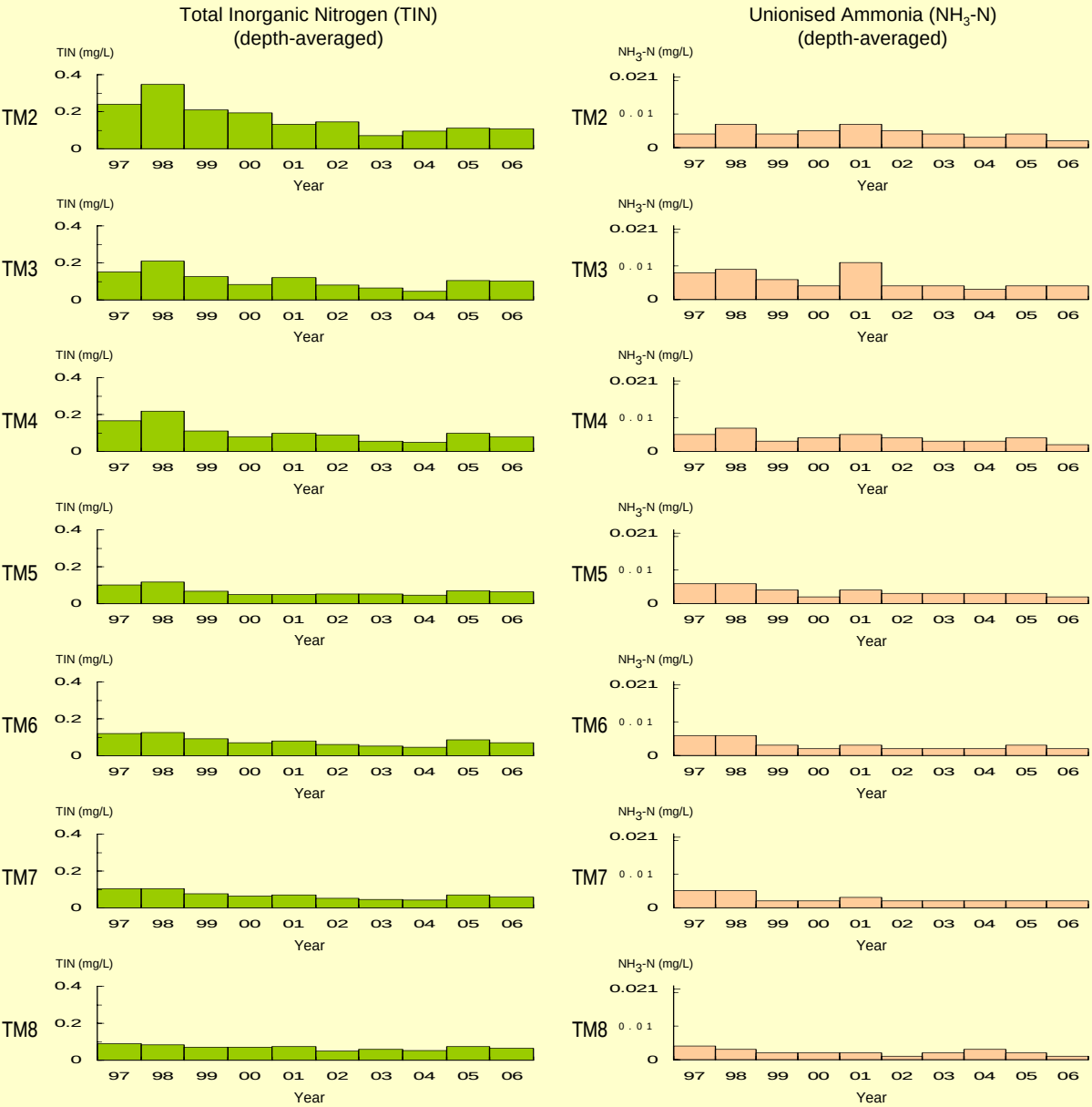
2. Buffer Subzone

% sample (S, M, B) with Chlorophyll-a ≤ 10 µg/L  
WQO : Chlorophyll-a ≤ 10 µg/L

3. Channel Subzone

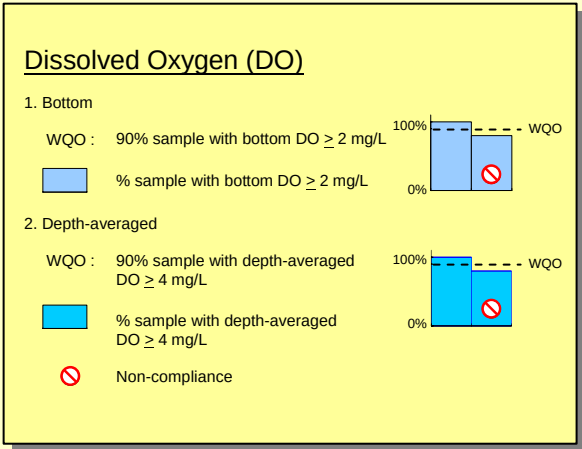
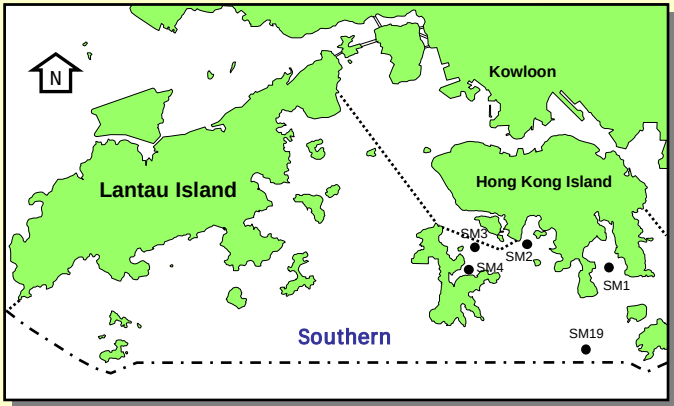
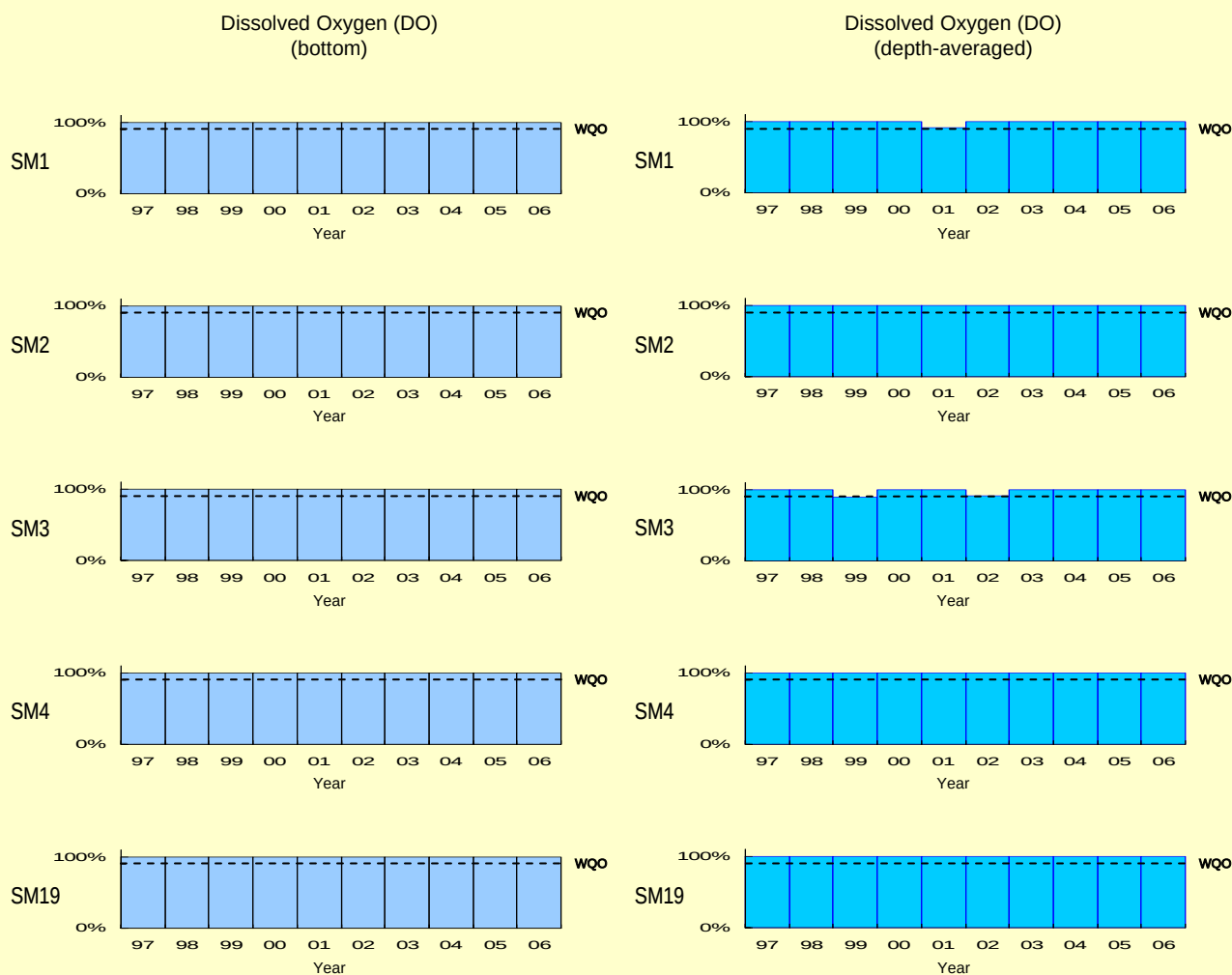
% sample (S, M, B) with Chlorophyll-a ≤ 6 µg/L  
WQO : Chlorophyll-a ≤ 6 µg/L

Levels of total inorganic nitrogen and unionised ammonia in the Tolo Harbour and Channel WCZ

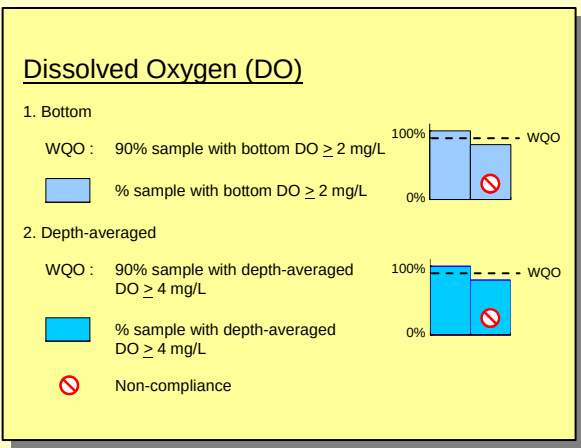
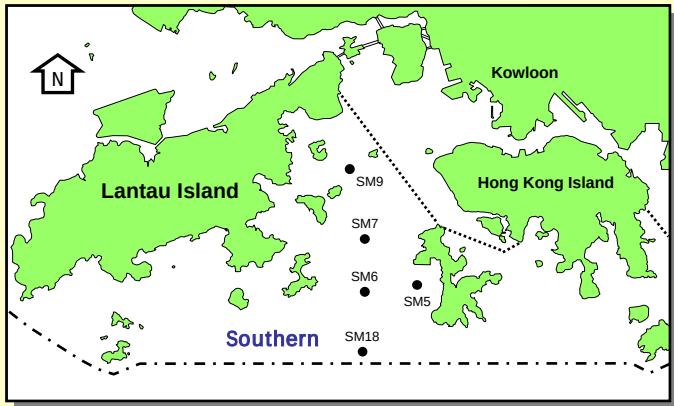
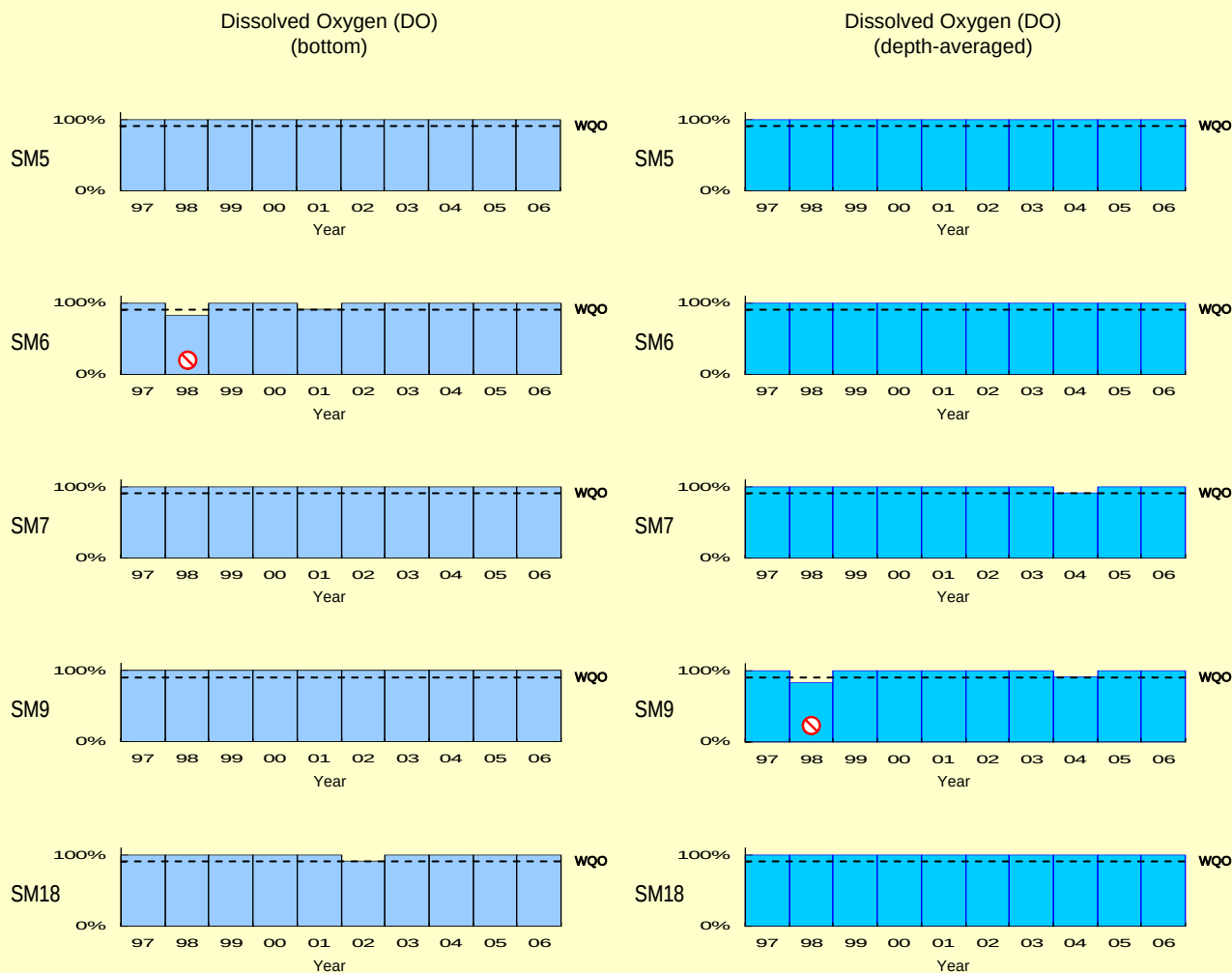




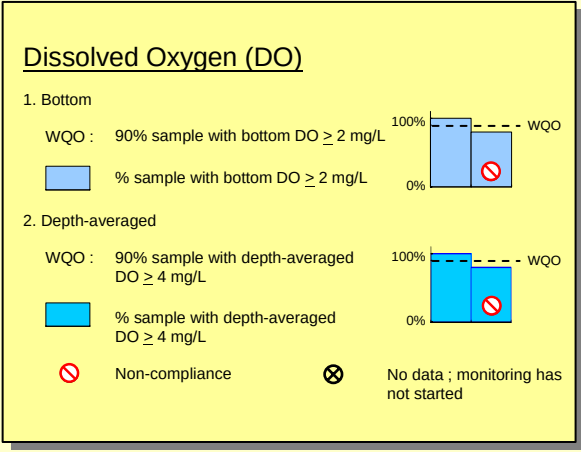
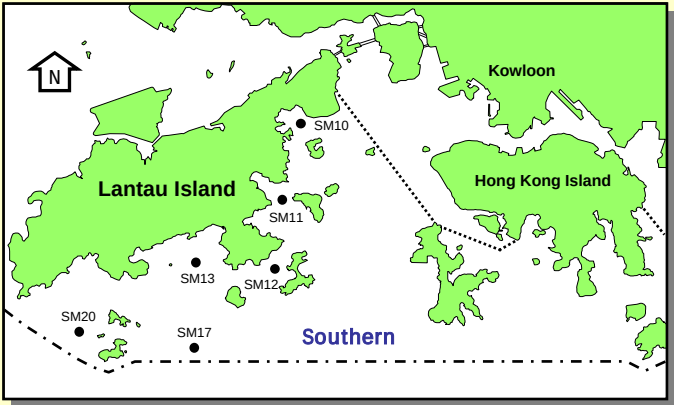
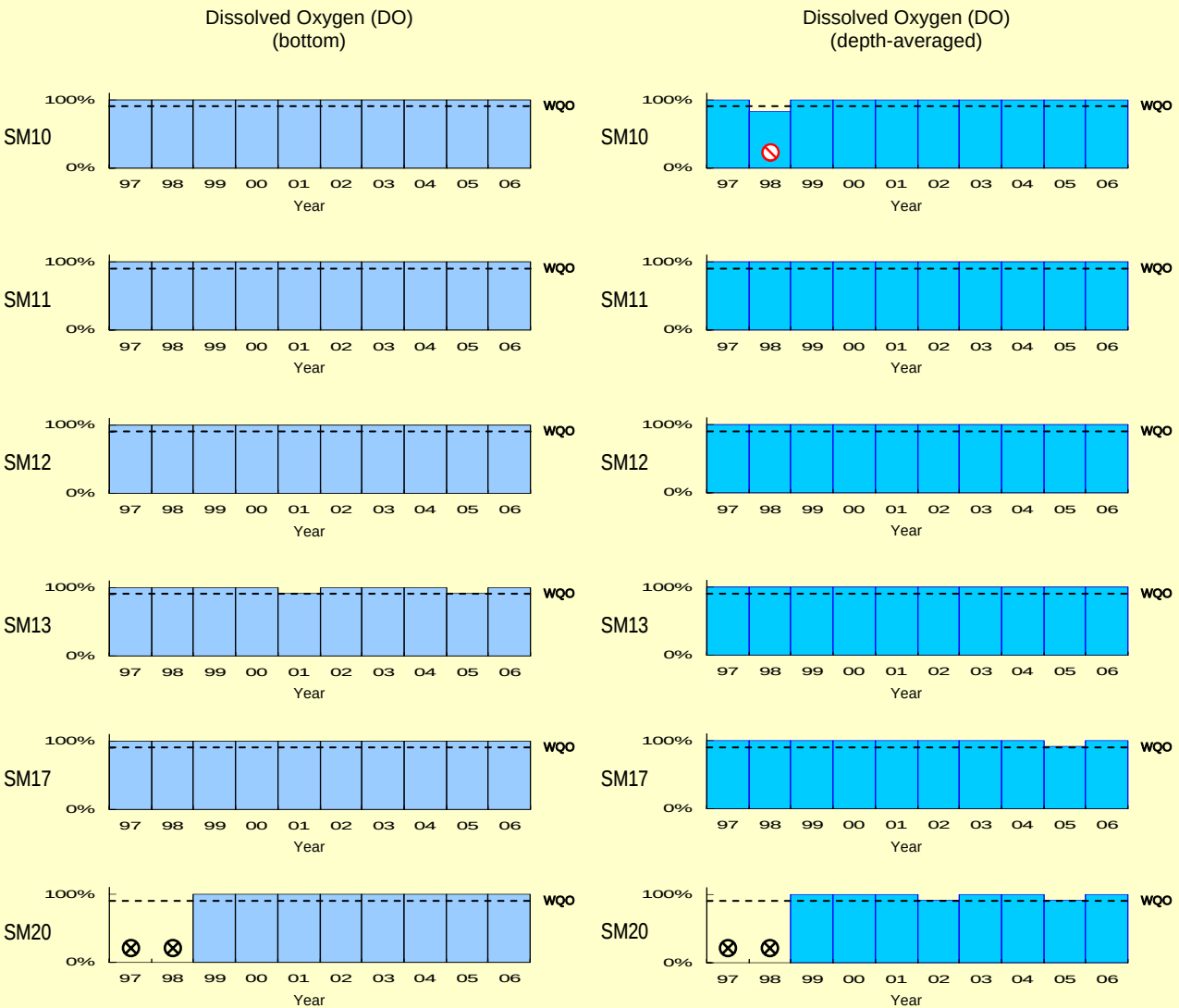
Levels of compliance with key Water Quality Objectives in the Southern WCZ



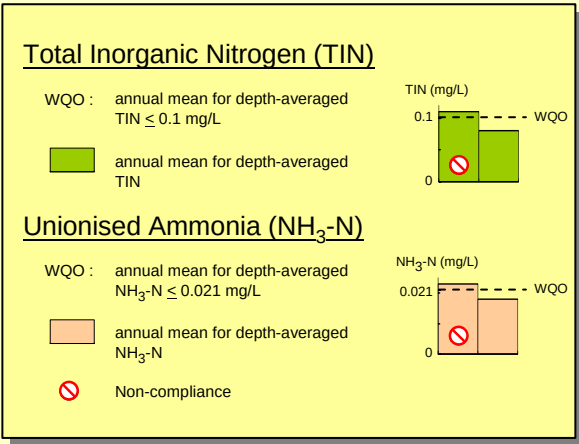
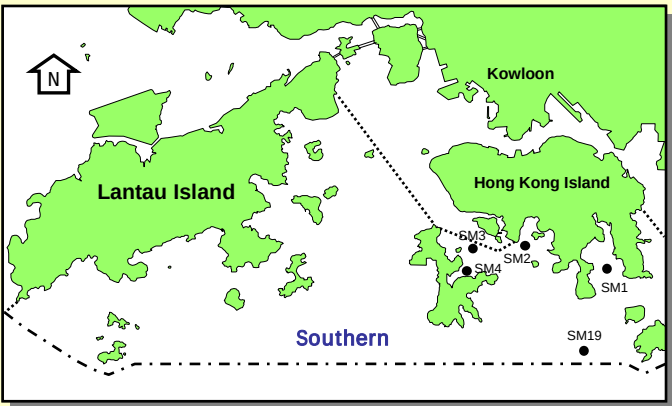
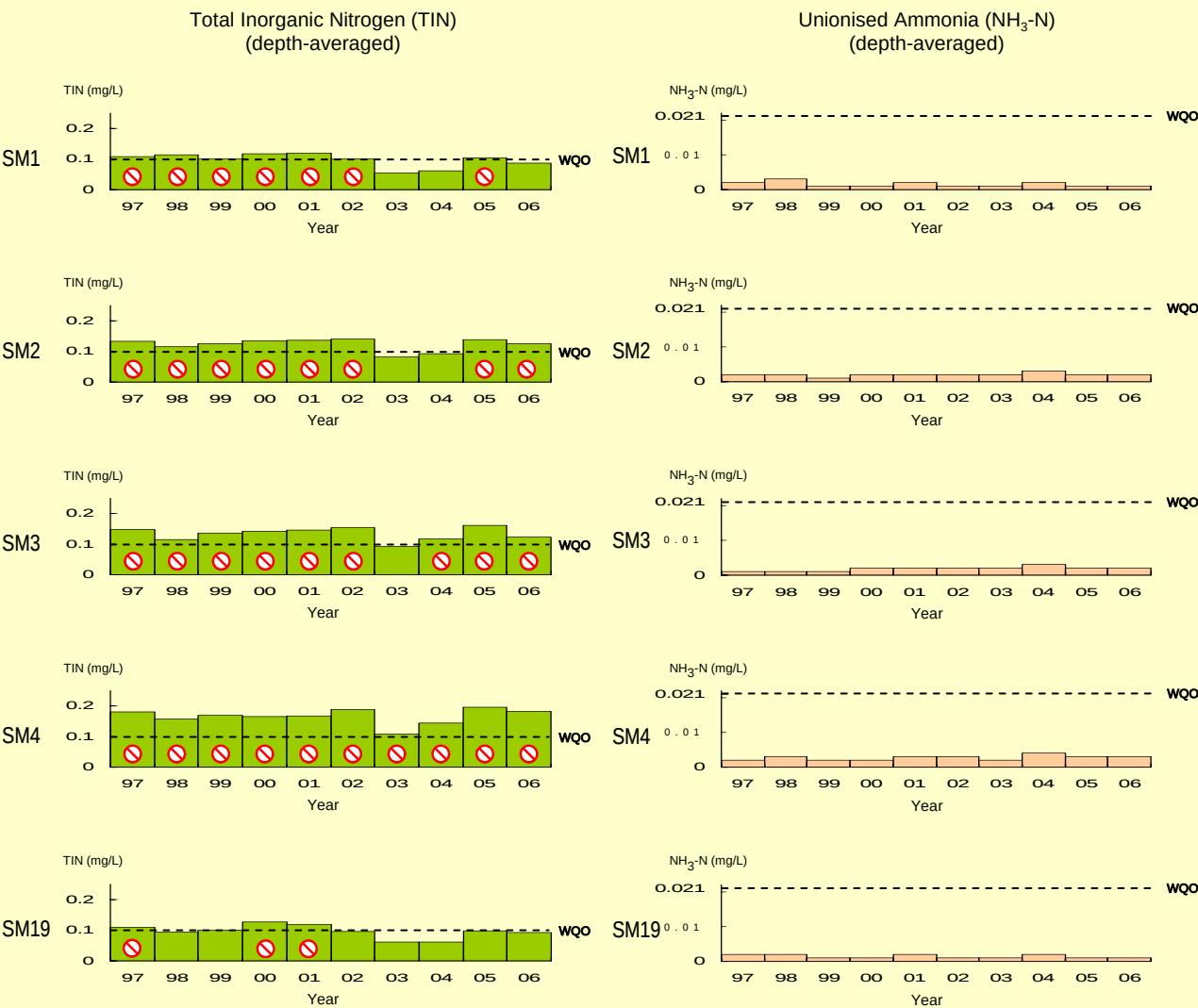
Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)



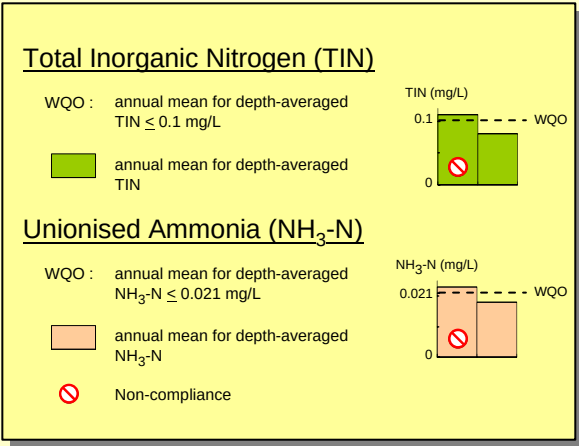
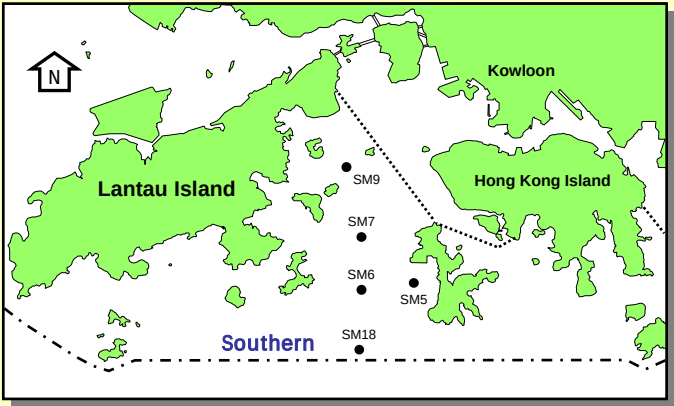
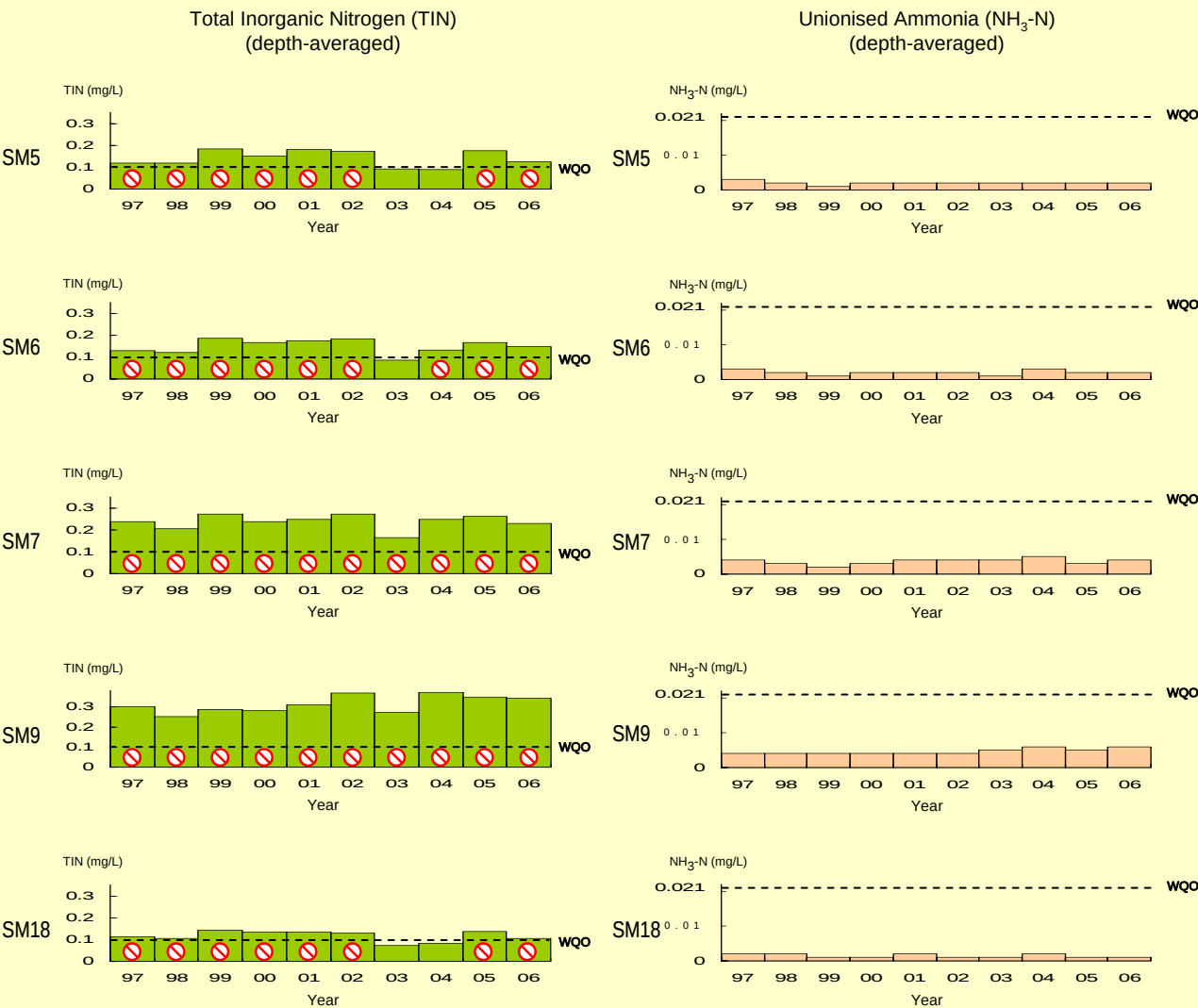
Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)



Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)



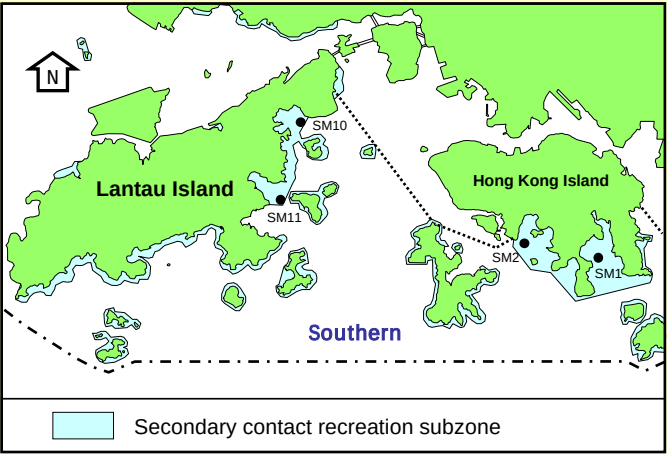
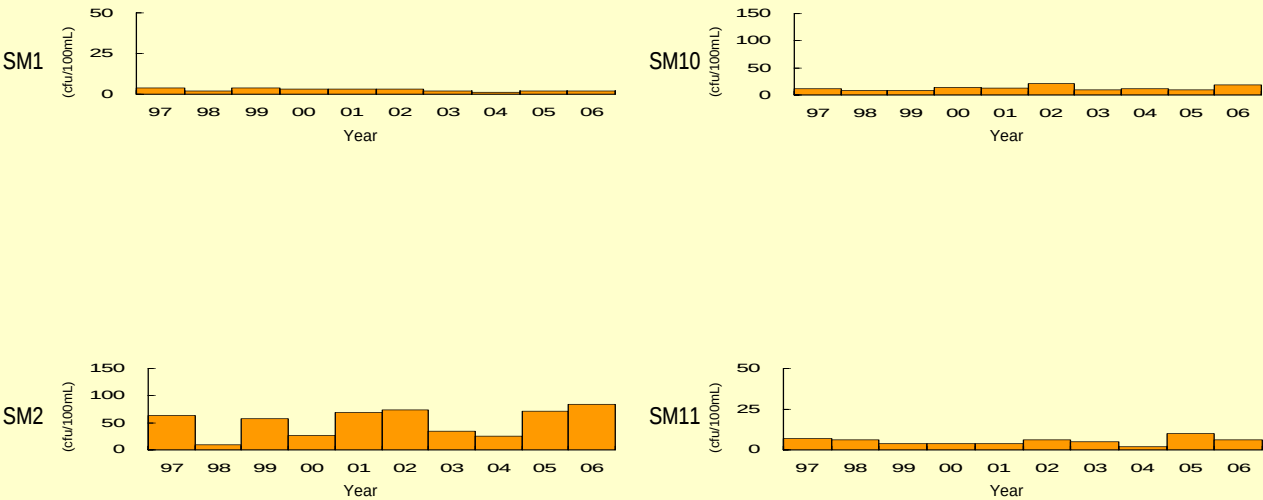
Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)





Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)

*E. coli*  
(annual geometric mean)



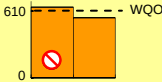
*E. coli*

WQO : annual geometric mean for depth averaged  
*E. coli*  $\leq 610$  cfu/100mL

annual geometric mean for depth averaged  
*E. coli* (cfu/100mL)



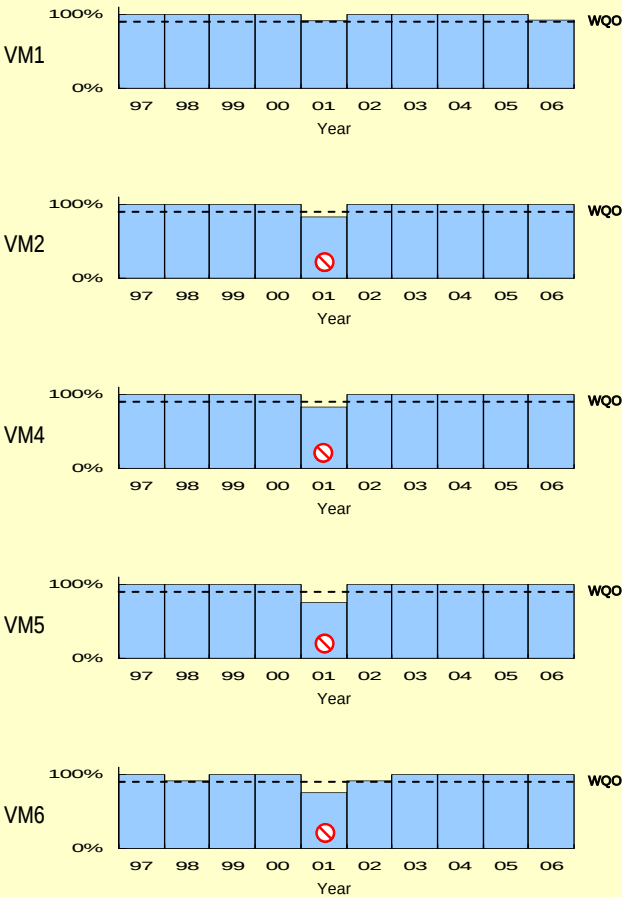
Non-compliance



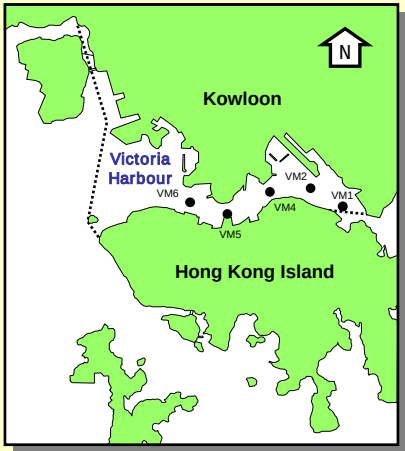
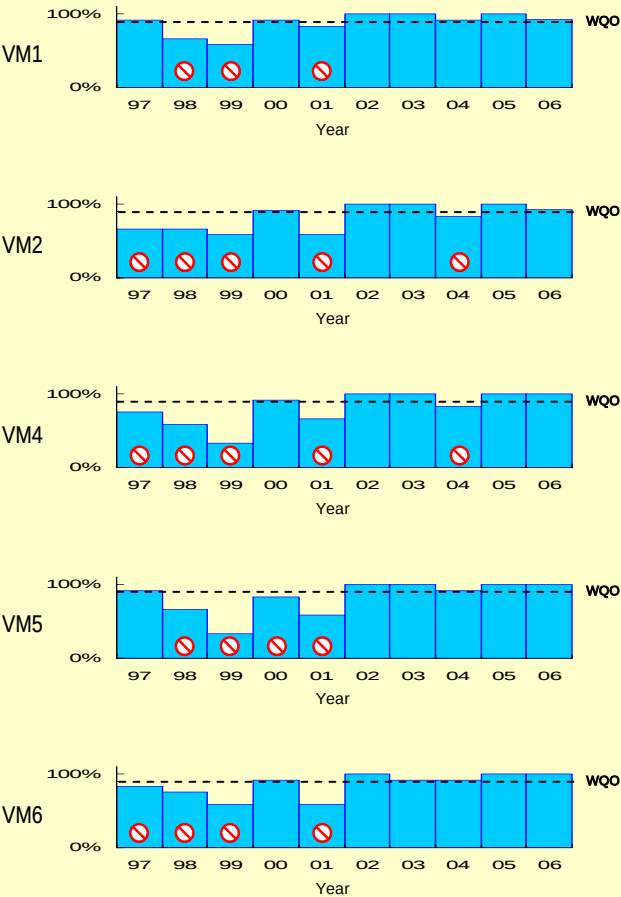


Levels of compliance with key Water Quality Objectives in the Victoria Harbour WCZ

Dissolved Oxygen (DO)  
(bottom)



Dissolved Oxygen (DO)  
(depth-averaged)

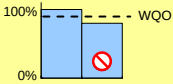


Dissolved Oxygen (DO)

1. Bottom

WQO : 90% sample with bottom DO  $\geq 2$  mg/L

■ % sample with bottom DO  $\geq 2$  mg/L



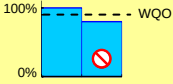
2. Depth-averaged

WQO : 90% sample with depth-averaged DO  $\geq 4$  mg/L

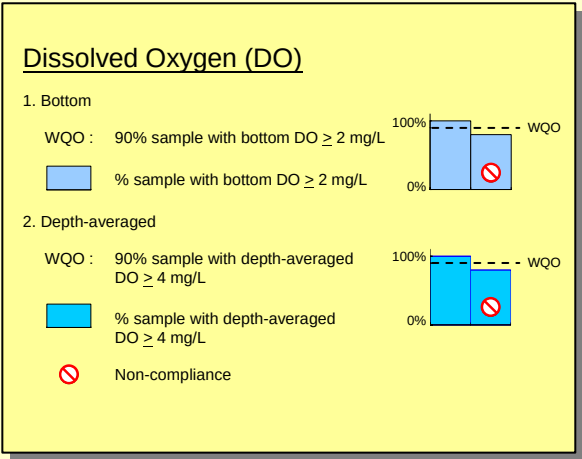
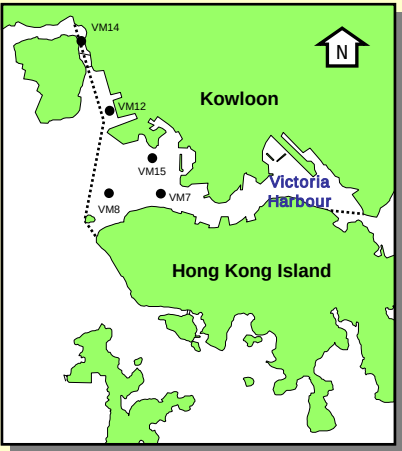
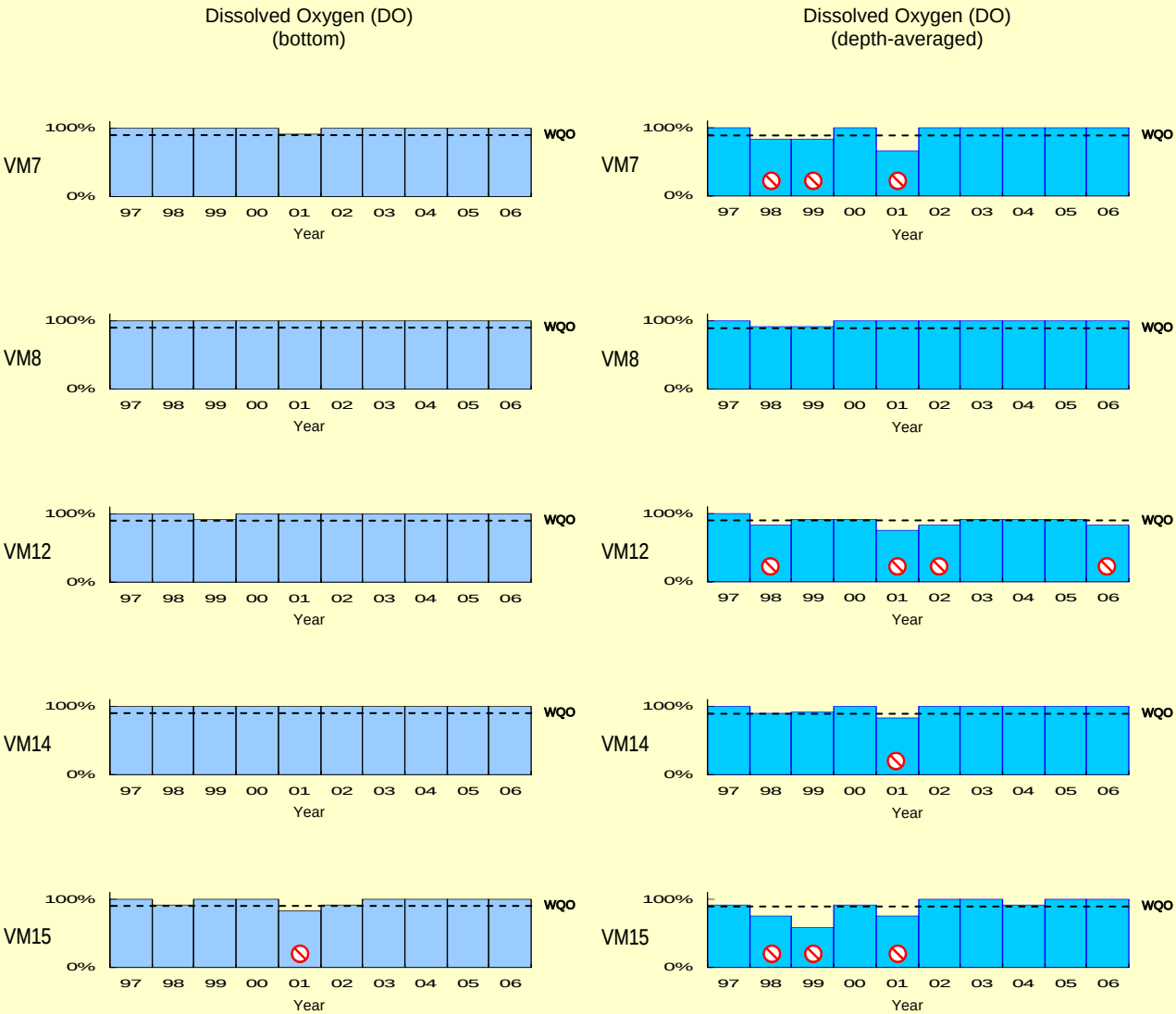
■ % sample with depth-averaged DO  $\geq 4$  mg/L



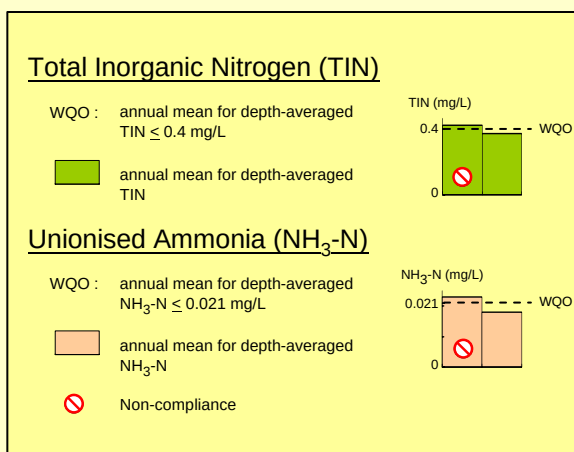
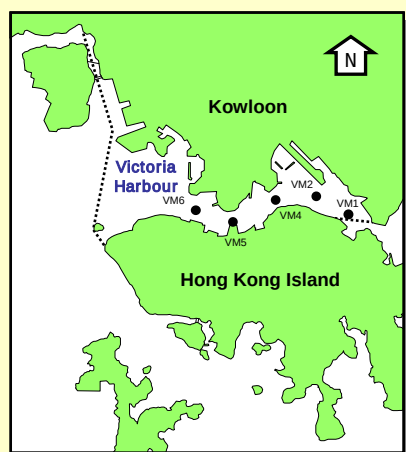
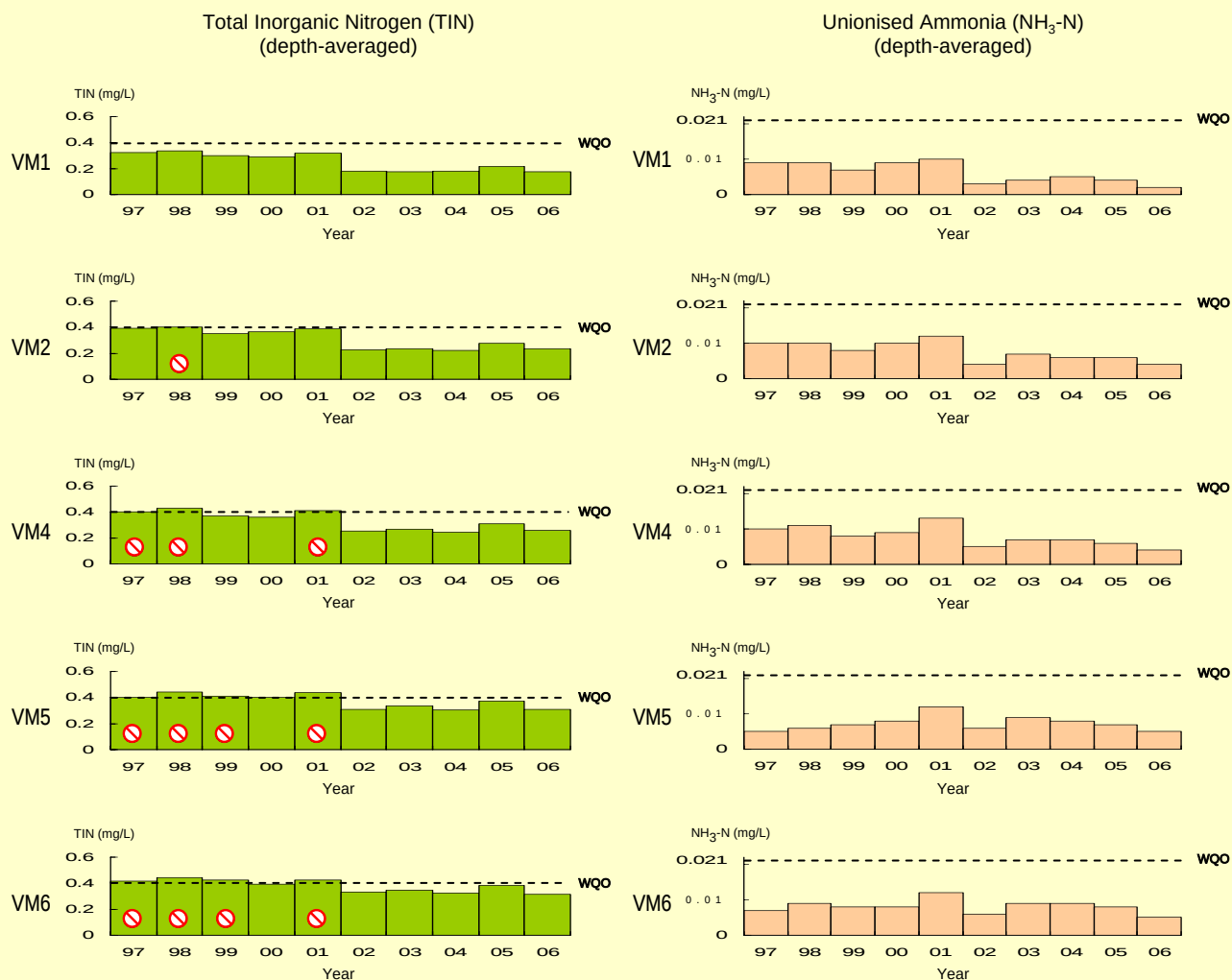
Non-compliance

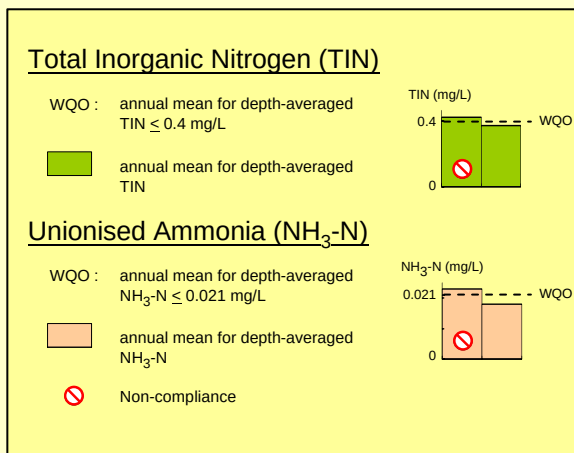
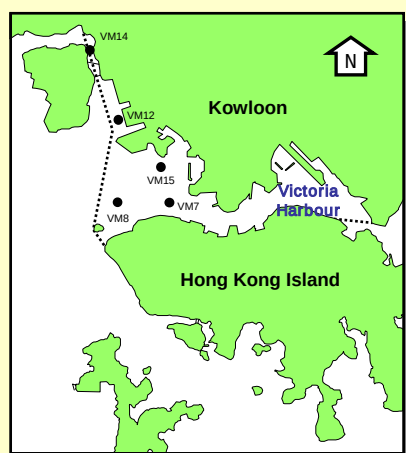


Levels of compliance with key Water Quality Objectives in the Victoria Harbour WCZ (continued)

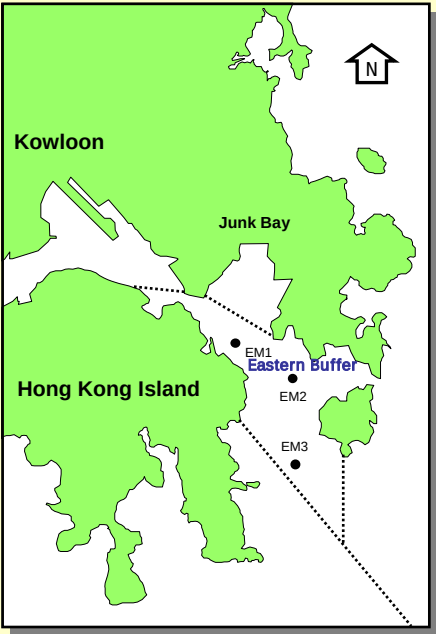
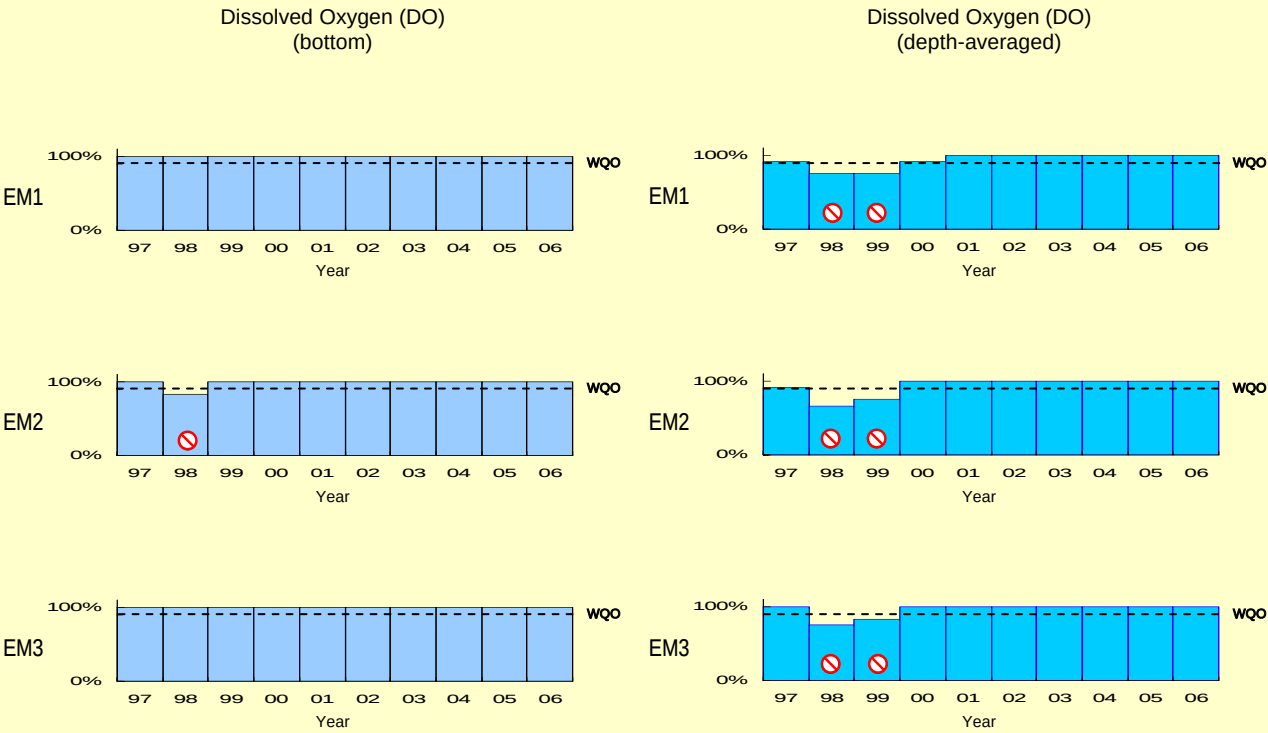


Levels of compliance with key Water Quality Objectives in the Victoria Harbour WCZ (continued)





Levels of compliance with key Water Quality Objectives in the Eastern Buffer WCZ

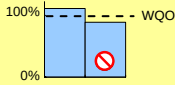


Dissolved Oxygen (DO)

1. Bottom

WQO : 90% sample with bottom DO  $\geq$  2 mg/L

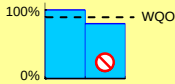
% sample with bottom DO  $\geq$  2 mg/L



2. Depth-averaged

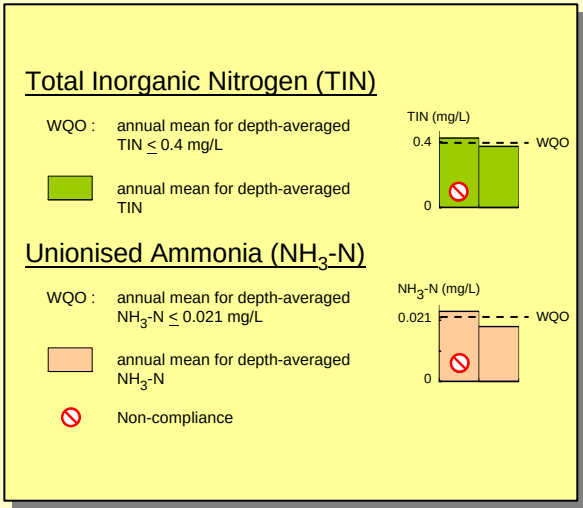
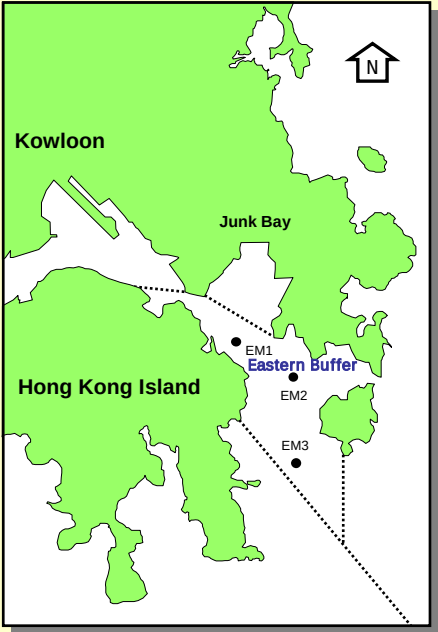
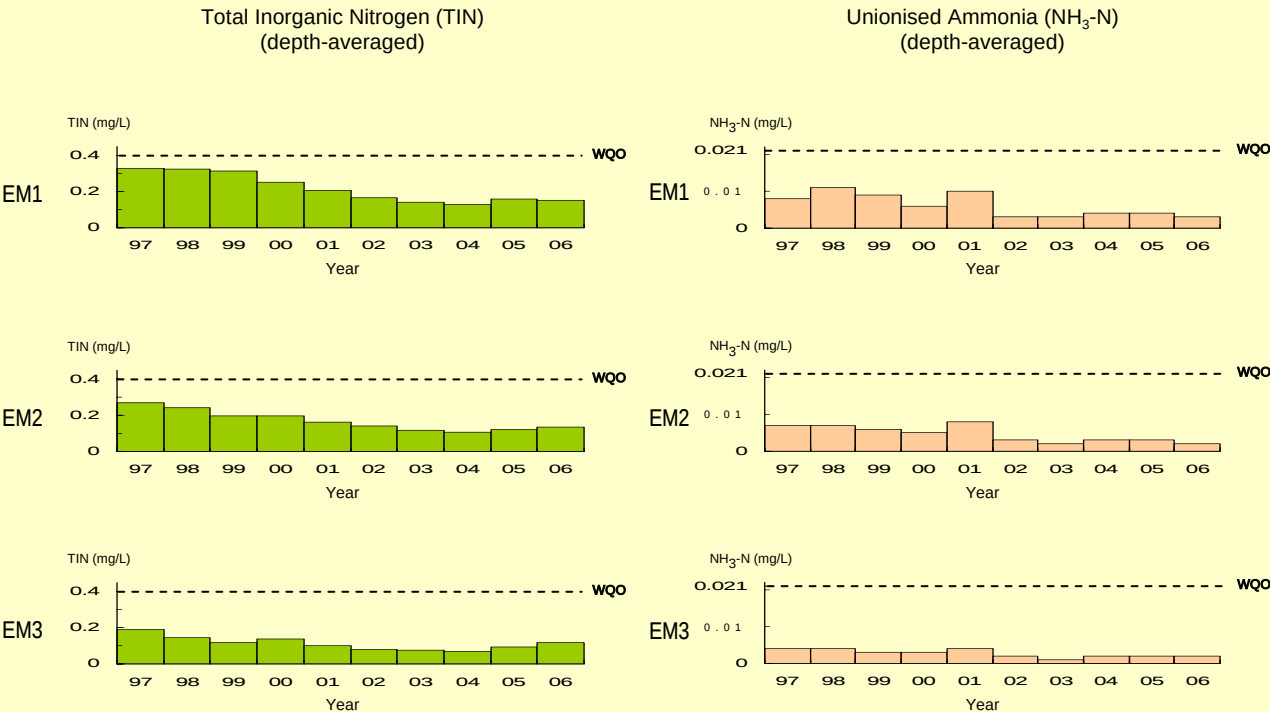
WQO : 90% sample with depth-averaged DO  $\geq$  4 mg/L

% sample with depth-averaged DO  $\geq$  4 mg/L

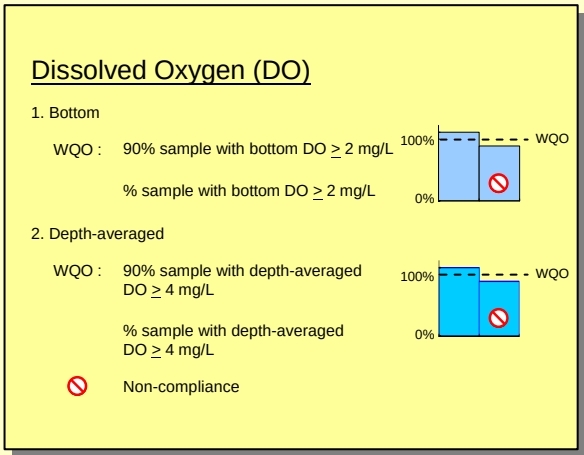
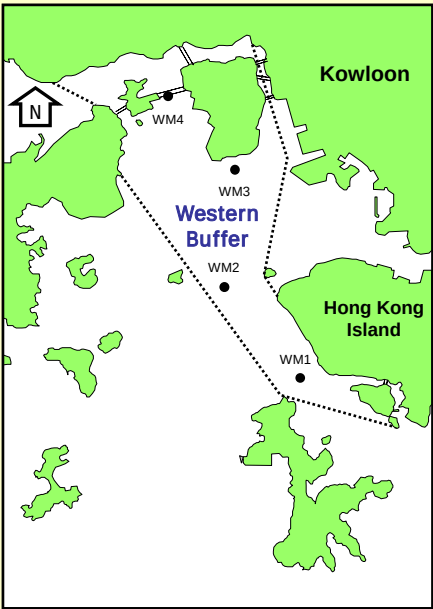
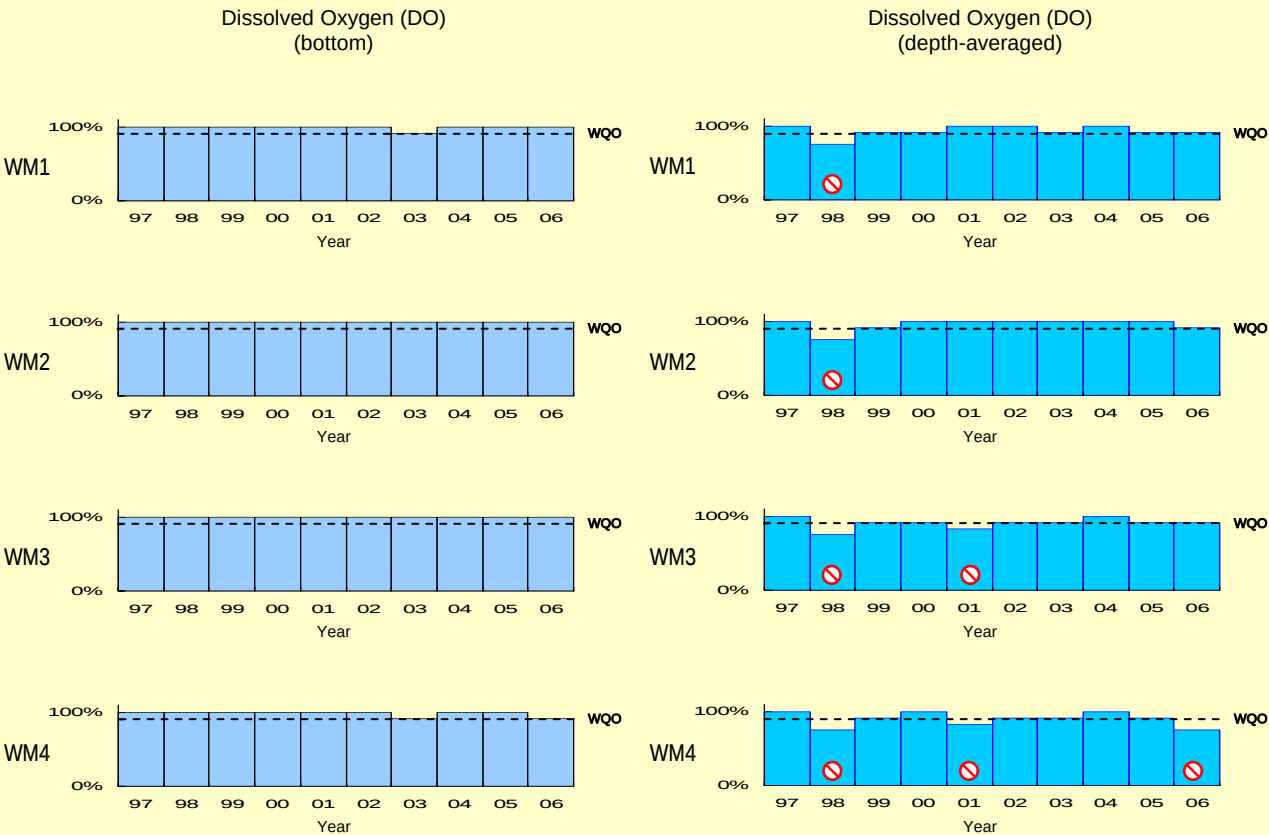


Non-compliance

Levels of compliance with key Water Quality Objectives in the Eastern Buffer WCZ (continued)

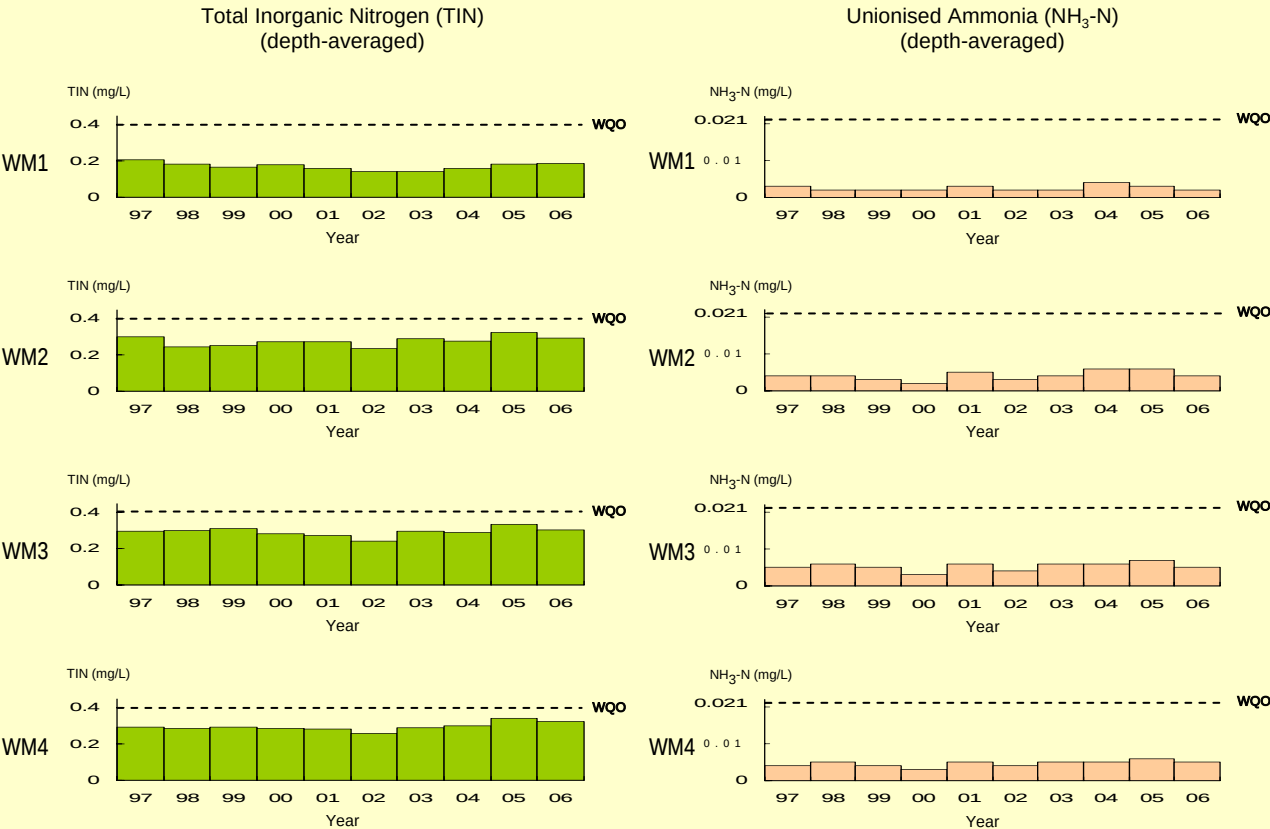


Levels of compliance with key Water Quality Objectives in the Western Buffer WCZ

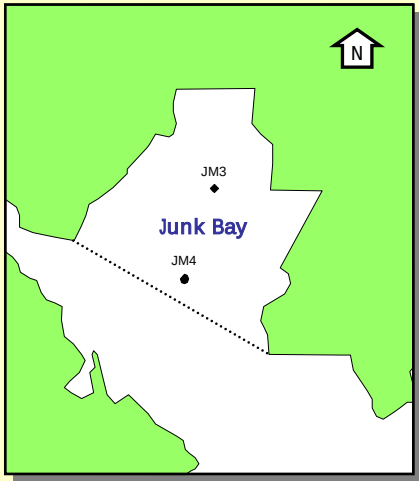
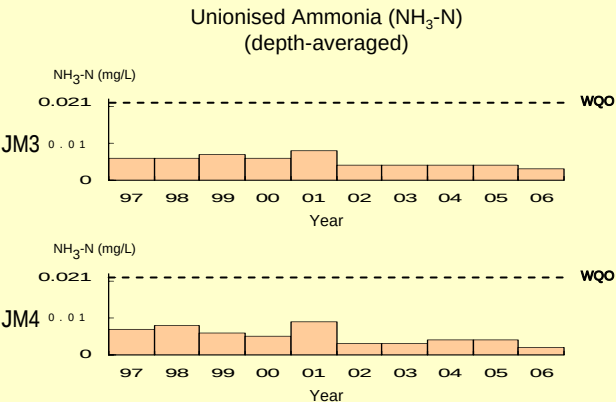
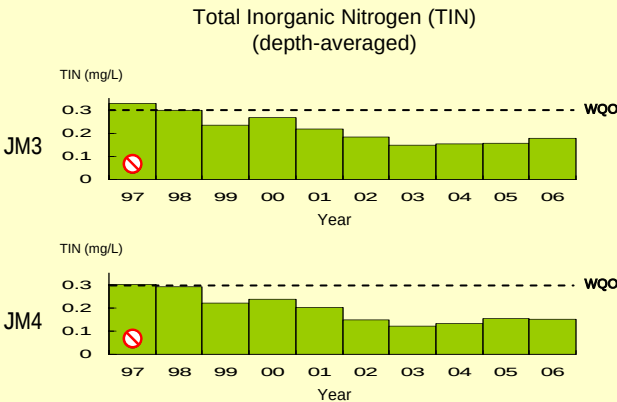
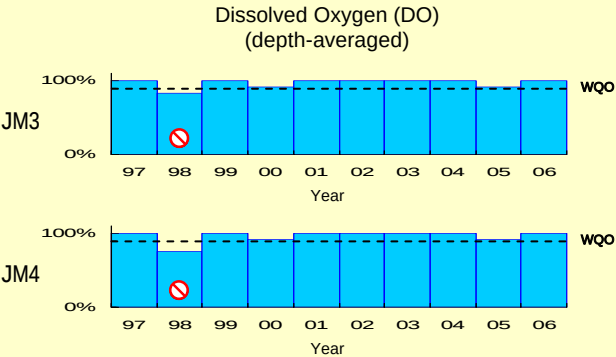
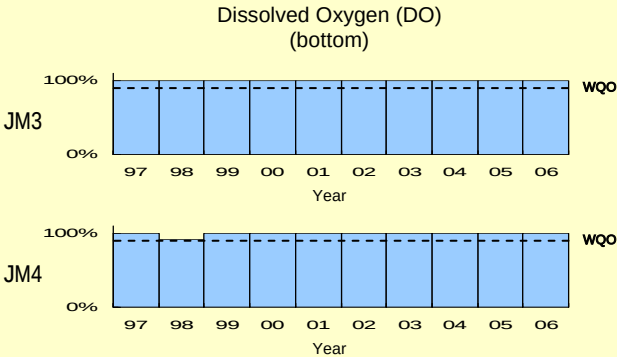




Levels of compliance with key Water Quality Objectives in the Western Buffer WCZ (continued)



Levels of compliance with key Water Quality Objectives in the Junk Bay WCZ

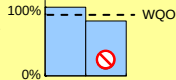


Dissolved Oxygen (DO)

1. Bottom

WQO : 90% sample with bottom DO  $\geq$  2 mg/L

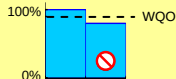
% sample with bottom DO  $\geq$  2 mg/L



2. Depth-averaged

WQO : 90% sample with depth-averaged DO  $\geq$  4 mg/L

% sample with depth-averaged DO  $\geq$  4 mg/L



Total Inorganic Nitrogen (TIN)

WQO : annual mean for depth-averaged TIN  $\leq$  0.3 mg/L

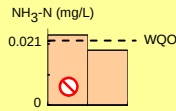
annual mean for depth-averaged TIN



Unionised Ammonia (NH<sub>3</sub>-N)

WQO : annual mean for depth-averaged NH<sub>3</sub>-N  $\leq$  0.021 mg/L

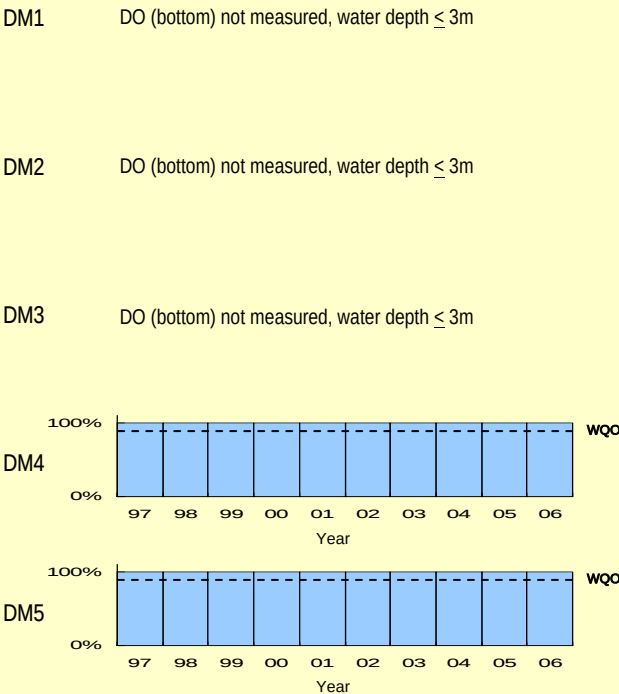
annual mean for depth-averaged NH<sub>3</sub>-N



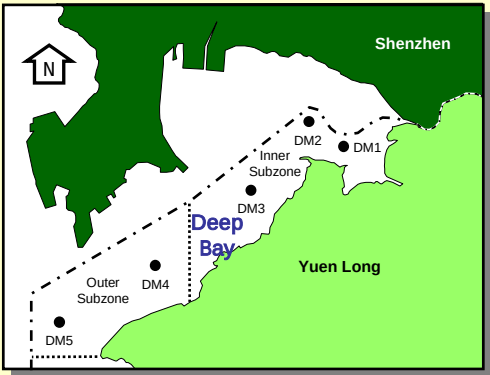
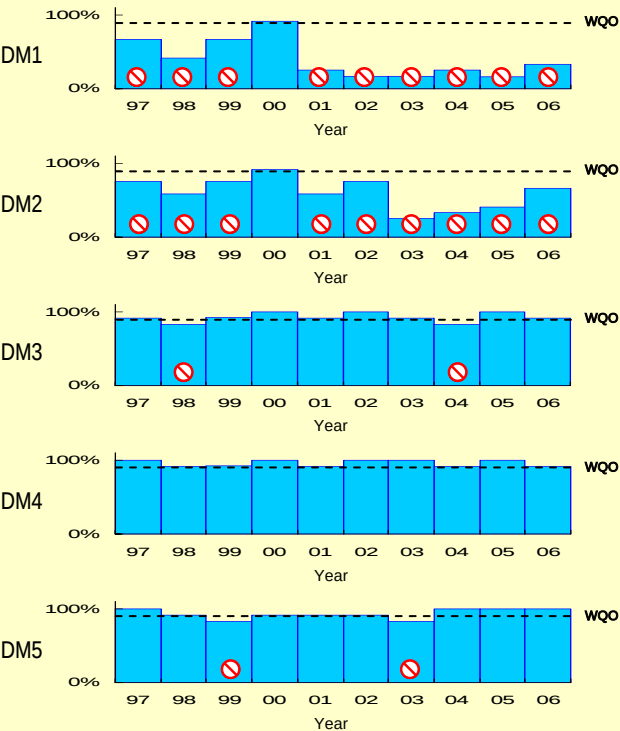
Non-compliance

Levels of compliance with key Water Quality Objectives in the Deep Bay WCZ

Dissolved Oxygen (DO)  
(bottom)



Dissolved Oxygen (DO)  
(depth-averaged)

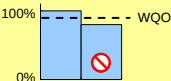


Dissolved Oxygen (DO)

1. Bottom

WQO : 90% sample with bottom DO  $\geq 2\text{ mg/L}$

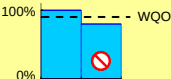
% sample with bottom DO  $\geq 2\text{ mg/L}$



2. Depth-averaged

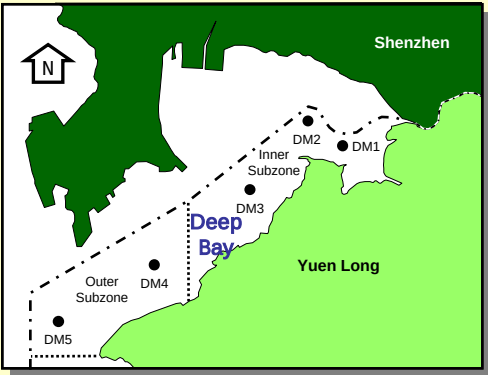
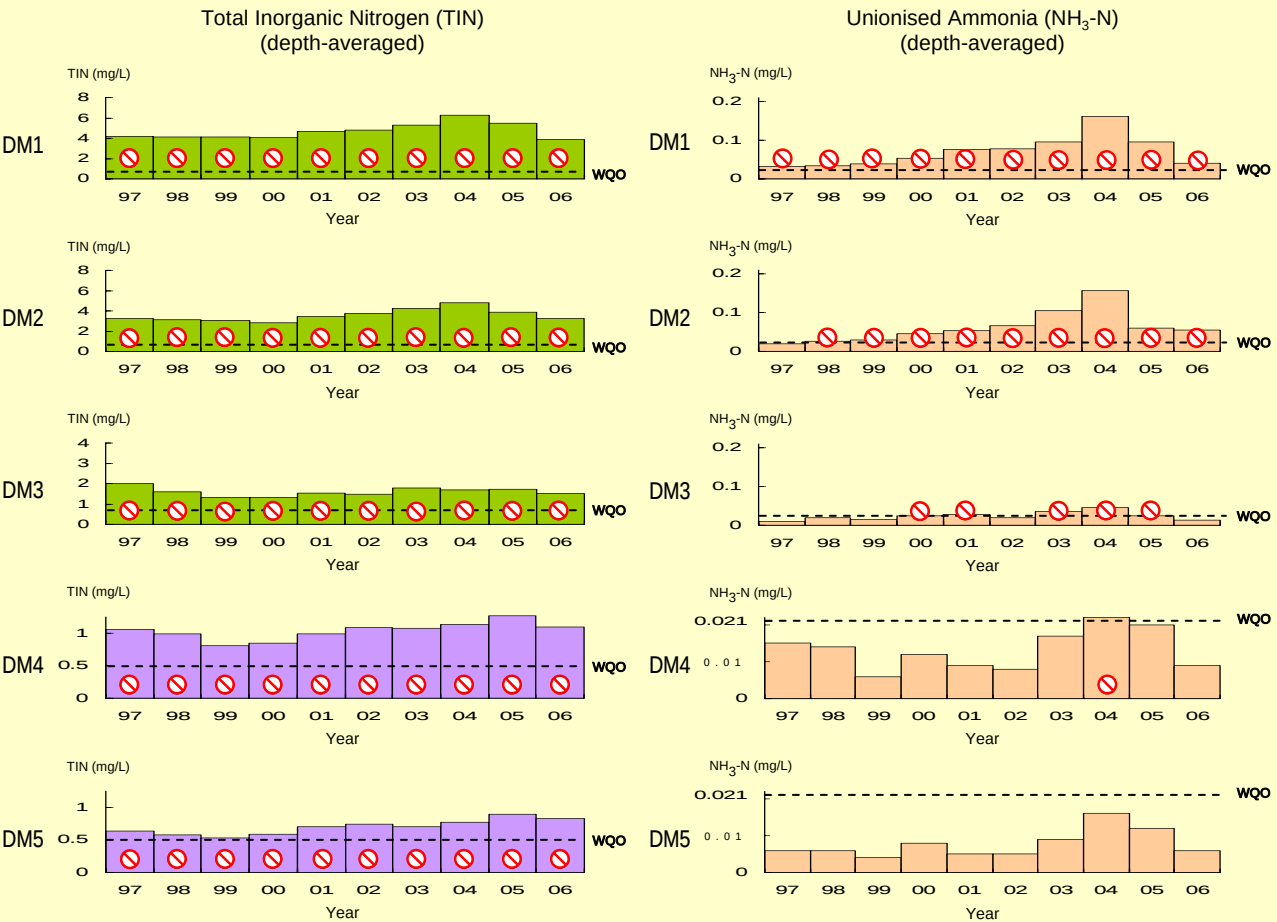
WQO : 90% sample with depth-averaged DO  $\geq 4\text{ mg/L}$

% sample with depth-averaged DO  $\geq 4\text{ mg/L}$



Non-compliance

Levels of compliance with key Water Quality Objectives in the Deep Bay WCZ (continued)

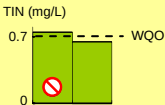


Total Inorganic Nitrogen (TIN)

Inner Subzone (DM1 - DM3)

WQO : annual mean for depth-averaged TIN  $\leq 0.7$  mg/L

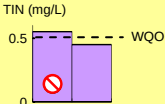
annual mean for depth-averaged TIN



Outer Subzone (DM4 - DM5)

WQO : annual mean for depth-averaged TIN  $\leq 0.5$  mg/L

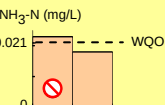
annual mean for depth-averaged TIN



Unionised Ammonia (NH<sub>3</sub>-N)

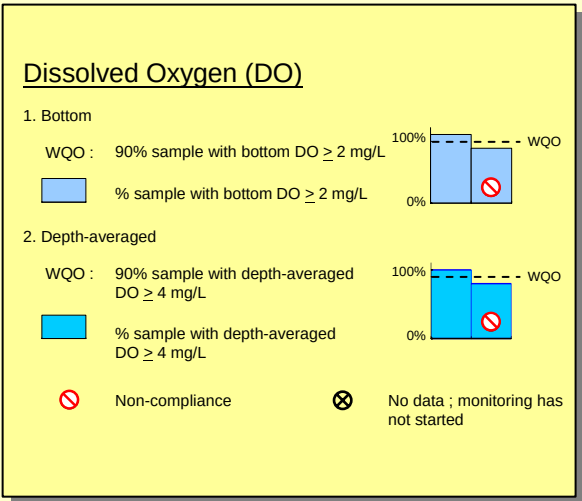
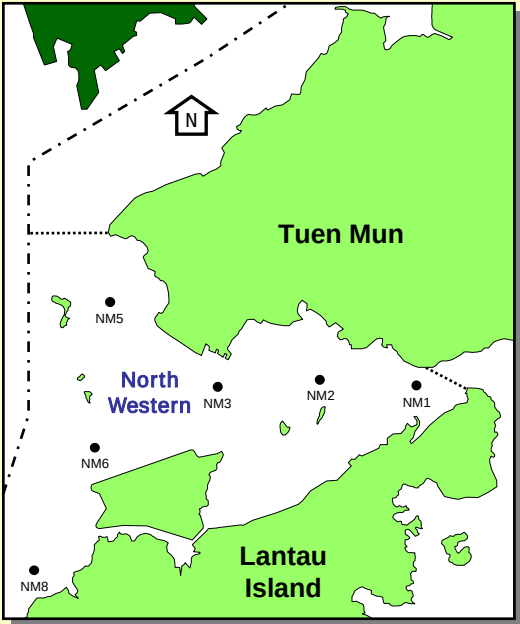
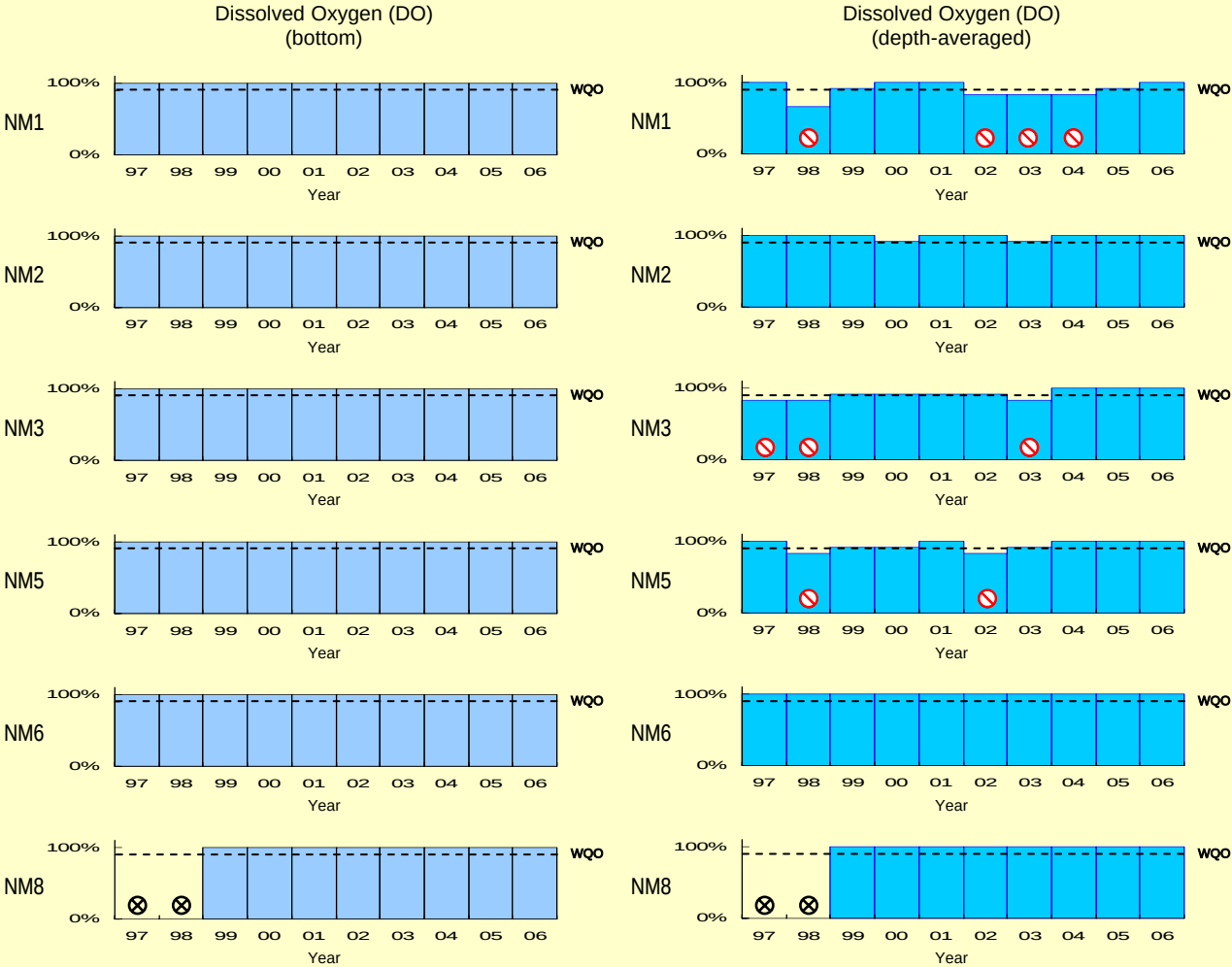
WQO : annual mean for depth-averaged NH<sub>3</sub>-N  $\leq 0.021$  mg/L

annual mean for depth-averaged NH<sub>3</sub>-N

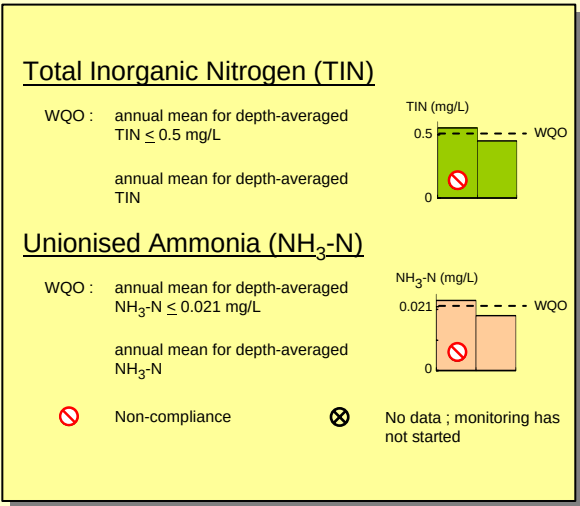
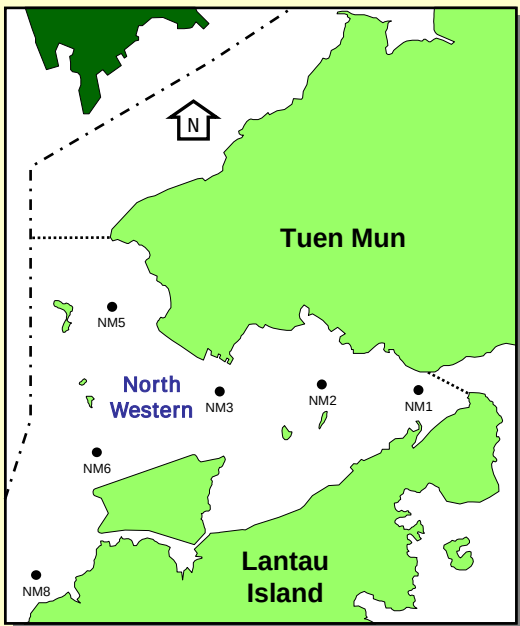
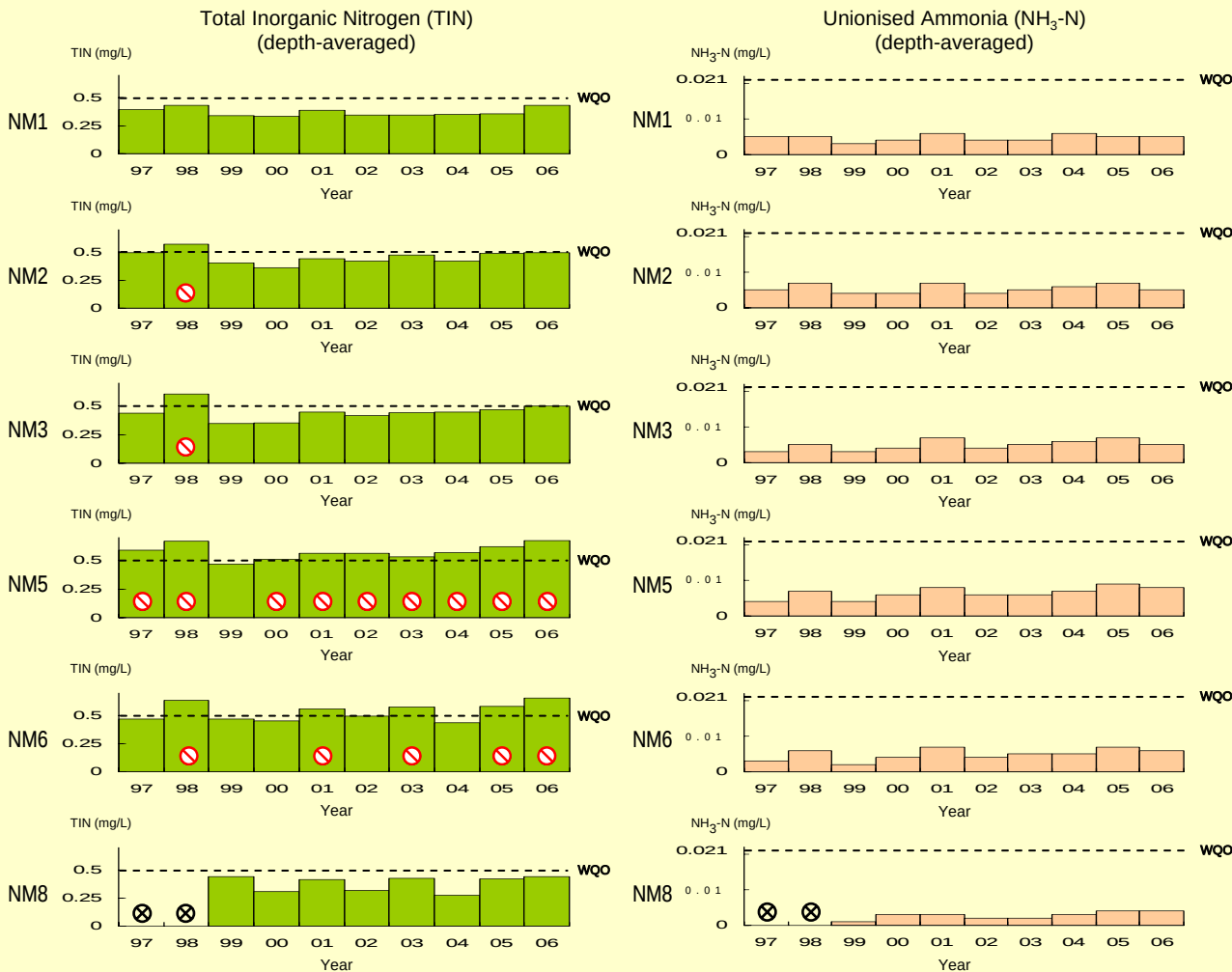


Non-compliance

Levels of compliance with key Water Quality Objectives in the North Western WCZ



Levels of compliance with key Water Quality Objectives in the North Western WCZ (continued)



Results of the Seasonal Kendall Test for water quality trends in the Mirs Bay WCZ, 1991 - 2006

| Monitoring Station                     |             | MM1               | MM2               | MM3               | MM4               | MM5               | MM6               | MM7               |
|----------------------------------------|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Monitoring Period                      |             | 1991<br>I<br>2006 | 1991<br>I<br>2006 | 1991<br>I<br>2006 | 1991<br>I<br>2006 | 1991<br>I<br>2006 | 1991<br>I<br>2006 | 1991<br>I<br>2006 |
| Parameter                              | Water Depth |                   |                   |                   |                   |                   |                   |                   |
| Temperature (°C)                       | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Salinity                               | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (mg/L)                | Surface     | -                 | -                 | -                 | -                 | 4                 | 4                 | 4                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (%)                   | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| pH                                     | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Secchi disc depth (m)                  |             | -                 | 4                 | -                 | -                 | -                 | -                 | 4                 |
| Turbidity (NTU)                        | Surface     | 3                 | 3                 | 3                 | 3                 | 3                 | 3                 | 3                 |
|                                        | Middle      | 3                 | 3                 | 3                 | 3                 | 3                 | 3                 | 3                 |
|                                        | Bottom      | 3                 | 3                 | 3                 | 3                 | 3                 | 3                 | 3                 |
|                                        | Average     | 3                 | 3                 | 3                 | 3                 | 3                 | 3                 | 3                 |
| Suspended Solids (mg/L)                | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | 3                 |
|                                        | Middle      | -                 | 3                 | 3                 | -                 | -                 | -                 | 3                 |
|                                        | Bottom      | 3                 | 3                 | 3                 | -                 | -                 | -                 | 3                 |
|                                        | Average     | -                 | 3                 | 3                 | -                 | -                 | -                 | 3                 |
| Total volatile solids (mg/L)           | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | 3                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | 3                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | 3                 |
| 5-day Biochemical Oxygen Demand (mg/L) | Surface     | -                 | -                 | -                 | -                 | -                 | 4                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Ammonia nitrogen (mg/L)                | Surface     | -                 | -                 | -                 | -                 | -                 | 4                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | 4                 | -                 | 4                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | 4                 | -                 |
| Nitrite nitrogen (mg/L)                | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Nitrate nitrogen (mg/L)                | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | 3                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Total inorganic nitrogen (mg/L)        | Surface     | -                 | -                 | 4                 | -                 | -                 | 4                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | 4                 | 4                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | 4                 | -                 | 4                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | 4                 | -                 |
| Total Kjeldahl nitrogen (mg/L)         | Surface     | 4                 | 4                 | 4                 | -                 | 4                 | 4                 | -                 |
|                                        | Middle      | 4                 | 4                 | 4                 | -                 | 4                 | 4                 | 4                 |
|                                        | Bottom      | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | -                 |
|                                        | Average     | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | -                 |
| Total nitrogen (mg/L)                  | Surface     | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |
|                                        | Middle      | -                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |
|                                        | Bottom      | -                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |
|                                        | Average     | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | -                 |
| Orthophosphate phosphorus (mg/L)       | Surface     | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |
|                                        | Middle      | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |
|                                        | Bottom      | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |
|                                        | Average     | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |
| Total phosphorus (mg/L)                | Surface     | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |
|                                        | Middle      | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |
|                                        | Bottom      | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |
|                                        | Average     | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |
| Silica (mg/L)                          | Surface     | 4                 | 4                 | 4                 | 4                 | -                 | -                 | 4                 |
|                                        | Middle      | 4                 | 4                 | 4                 | 4                 | 4                 | -                 | 4                 |
|                                        | Bottom      | -                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |
|                                        | Average     | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |
| Chlorophyll- <i>a</i> (µg/L)           | Surface     | -                 | 3                 | 3                 | -                 | -                 | -                 | 3                 |
|                                        | Middle      | 3                 | 3                 | 3                 | -                 | -                 | -                 | 3                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | 3                 | 3                 | 3                 | -                 | -                 | -                 | 3                 |
| <i>E. coli</i> (cfu/100mL)             | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Faecal coliforms (cfu/100mL)           | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |

Note: 1. Results of the Seasonal Kendall Test statistically significant at  $p < 0.05$   
2. - indicates no significant trend  
3. 3 significant increase  
4. 4 significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Mirs Bay WCZ, 1986 - 2006  
(continued)

| Monitoring Station                     |             | MM8               | MM13              | MM14              | MM15              | MM16              | MM17              |
|----------------------------------------|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Monitoring Period                      |             | 1991<br> <br>2006 | 1991<br> <br>2006 | 1994<br> <br>2006 | 1994<br> <br>2006 | 1994<br> <br>2006 | 1986<br> <br>2006 |
| Parameter                              | Water Depth |                   |                   |                   |                   |                   |                   |
| Temperature (°C)                       | Surface     | ↗                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | ↗                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | ↗                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | ↗                 |
| Salinity                               | Surface     | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (mg/L)                | Surface     | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | ↗                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (%)                   | Surface     | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | ↗                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 |
| pH                                     | Surface     | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 |
| Secchi disc depth (m)                  |             | -                 | -                 | -                 | ↘                 | -                 | ↗                 |
| Turbidity (NTU)                        | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Suspended Solids (mg/L)                | Surface     | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | ↘                 |
| Total volatile solids (mg/L)           | Surface     | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | ↗                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | ↗                 | -                 | -                 | ↘                 |
| 5-day Biochemical Oxygen Demand (mg/L) | Surface     | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 |
| Ammonia nitrogen (mg/L)                | Surface     | ↘                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | ↘                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | -                 | -                 | -                 | -                 |
|                                        | Average     | ↘                 | ↘                 | -                 | -                 | -                 | -                 |
| Nitrite nitrogen (mg/L)                | Surface     | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 |
| Nitrate nitrogen (mg/L)                | Surface     | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 |
| Total inorganic nitrogen (mg/L)        | Surface     | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 |
| Total Kjeldahl nitrogen (mg/L)         | Surface     | ↘                 | ↘                 | -                 | -                 | -                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | -                 | -                 | -                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | -                 | -                 | -                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | -                 | -                 | -                 | ↘                 |
| Total nitrogen (mg/L)                  | Surface     | ↘                 | ↘                 | -                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | -                 | -                 | -                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | -                 | -                 | -                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | -                 | -                 | ↘                 | ↘                 |
| Orthophosphate phosphorus (mg/L)       | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 |
| Total phosphorus (mg/L)                | Surface     | ↘                 | ↘                 | -                 | -                 | -                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Silica (mg/L)                          | Surface     | -                 | -                 | -                 | ↘                 | -                 | ↘                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | ↘                 |
| Chlorophyll- <i>a</i> (µg/L)           | Surface     | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 |
| <i>E. coli</i> (cfu/100mL)             | Surface     | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 |
| Faecal coliforms (cfu/100mL)           | Surface     | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 |

Note: 1. Results of the Seasonal Kendall Test statistically significant at  $p < 0.05$   
2. - indicates no significant trend  
3. MM19 has six years' data only, which are insufficient to perform Seasonal Kendall Test  
4. ↗ significant increase  
5. ↘ significant decrease



Results of the Seasonal Kendall Test for water quality trends in the Port Shelter WCZ, 1986 - 2006

| Monitoring Station                     |             | PM1               | PM2               | PM3               | PM4               | PM6               | PM7               | PM8               | PM9               | PM11              |
|----------------------------------------|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Monitoring Period                      |             | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 |
| Parameter                              | Water Depth |                   |                   |                   |                   |                   |                   |                   |                   |                   |
| Temperature (°C)                       | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
| Salinity                               | Surface     | -                 | -                 | -                 | -                 | ↗                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | ↗                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (mg/L)                | Surface     | -                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | -                 | ↗                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (%)                   | Surface     | -                 | ↘                 | -                 | ↘                 | -                 | ↘                 | ↘                 | ↘                 | -                 |
|                                        | Middle      | -                 | -                 | ↗                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| pH                                     | Surface     | ↘                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 | -                 |
|                                        | Middle      | ↘                 | -                 | -                 | ↘                 | ↘                 | ↘                 | -                 | ↘                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 | -                 |
|                                        | Average     | ↘                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 |
| Secchi disc depth (m)                  |             | ↘                 | ↗                 | -                 | -                 | ↗                 | -                 | ↘                 | -                 | -                 |
| Turbidity (NTU)                        | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Suspended Solids (mg/L)                | Surface     | -                 | -                 | ↘                 | -                 | ↘                 | ↘                 | ↘                 | -                 | -                 |
|                                        | Middle      | ↘                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | ↗                 | ↗                 | -                 |
|                                        | Average     | ↘                 | -                 | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 |
| Total volatile solids (mg/L)           | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | ↘                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| 5-day Biochemical Oxygen Demand (mg/L) | Surface     | -                 | ↘                 | -                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | ↘                 | -                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
| Ammonia nitrogen (mg/L)                | Surface     | -                 | -                 | -                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Nitrite nitrogen (mg/L)                | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Nitrate nitrogen (mg/L)                | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Total inorganic nitrogen (mg/L)        | Surface     | -                 | -                 | -                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
| Total Kjeldahl nitrogen (mg/L)         | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Total nitrogen (mg/L)                  | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Orthophosphate phosphorus (mg/L)       | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | -                 | -                 | -                 | -                 | -                 | -                 | ↘                 |
| Total phosphorus (mg/L)                | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Silica (mg/L)                          | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | ↘                 | ↘                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | -                 |
|                                        | Bottom      | ↘                 | -                 | -                 | ↘                 | -                 | -                 | ↘                 | ↘                 | -                 |
|                                        | Average     | ↘                 | ↘                 | -                 | ↘                 | -                 | -                 | -                 | -                 | -                 |
| Chlorophyll- <i>a</i> (µg/L)           | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| <i>E. coli</i> (cfu/100mL)             | Surface     | -                 | ↘                 | -                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | ↘                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | ↘                 | -                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
| Faecal coliforms (cfu/100mL)           | Surface     | -                 | -                 | ↗                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | ↘                 | -                 | -                 | -                 | -                 |

Note: 1. Results of the Seasonal Kendall Test statistically significant at  $p < 0.05$   
2. - indicates no significant trend  
3. ↗ significant increase  
4. ↘ significant decrease

| Results of the Seasonal Kendall Test for water quality trends in the Tolo Harbour and Channel WCZ, 1986 - 2006 |             |                   |                   |                   |                   |                   |                   |                   |
|----------------------------------------------------------------------------------------------------------------|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Monitoring Station                                                                                             |             | TM2               | TM3               | TM4               | TM5               | TM6               | TM7               | TM8               |
| Monitoring Period                                                                                              |             | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 |
| Parameter                                                                                                      | Water Depth |                   |                   |                   |                   |                   |                   |                   |
| Temperature (°C)                                                                                               | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                                                                                                | Middle      | NA                | ↗                 | ↗                 | NA                | ↗                 | ↗                 | ↗                 |
|                                                                                                                | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                                                                                                | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Salinity                                                                                                       | Surface     | ↗                 | -                 | ↗                 | -                 | -                 | -                 | -                 |
|                                                                                                                | Middle      | NA                | -                 | -                 | NA                | -                 | -                 | -                 |
|                                                                                                                | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | ↗                 |
|                                                                                                                | Average     | ↗                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (mg/L)                                                                                        | Surface     | -                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Middle      | NA                | -                 | -                 | NA                | ↗                 | -                 | ↗                 |
|                                                                                                                | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                                                                                                | Average     | -                 | ↗                 | -                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (%)                                                                                           | Surface     | -                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Middle      | NA                | ↗                 | ↗                 | NA                | ↗                 | ↗                 | ↗                 |
|                                                                                                                | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                                                                                                | Average     | ↗                 | ↗                 | -                 | -                 | ↗                 | ↗                 | -                 |
| pH                                                                                                             | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | -                 | ↘                 | ↘                 |
|                                                                                                                | Middle      | NA                | -                 | ↘                 | NA                | -                 | ↘                 | -                 |
|                                                                                                                | Bottom      | -                 | -                 | -                 | ↘                 | -                 | -                 | -                 |
|                                                                                                                | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Secchi disc depth (m)                                                                                          |             | ↗                 | -                 | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
| Turbidity (NTU)                                                                                                | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                                                                                                | Middle      | NA                | ↗                 | ↗                 | NA                | ↗                 | ↗                 | ↗                 |
|                                                                                                                | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                                                                                                | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Suspended Solids (mg/L)                                                                                        | Surface     | ↘                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
|                                                                                                                | Middle      | NA                | -                 | -                 | NA                | -                 | -                 | ↘                 |
|                                                                                                                | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                                                                                                | Average     | ↘                 | -                 | ↘                 | -                 | ↘                 | ↘                 | -                 |
| Total volatile solids (mg/L)                                                                                   | Surface     | ↘                 | -                 | ↘                 | -                 | -                 | ↘                 | ↘                 |
|                                                                                                                | Middle      | NA                | -                 | -                 | NA                | -                 | -                 | ↘                 |
|                                                                                                                | Bottom      | ↘                 | -                 | ↘                 | -                 | ↘                 | -                 | ↘                 |
|                                                                                                                | Average     | ↘                 | -                 | ↘                 | -                 | ↘                 | ↘                 | ↘                 |
| 5- day Biochemical Oxygen Demand (mg/L)                                                                        | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Middle      | NA                | ↘                 | ↘                 | NA                | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Bottom      | ↘                 | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                                                                                                | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Ammonia nitrogen (mg/L)                                                                                        | Surface     | ↘                 | ↘                 | ↘                 | -                 | ↘                 | -                 | ↘                 |
|                                                                                                                | Middle      | NA                | ↘                 | ↘                 | NA                | ↘                 | ↘                 | -                 |
|                                                                                                                | Bottom      | ↘                 | ↘                 | ↘                 | -                 | ↘                 | -                 | -                 |
|                                                                                                                | Average     | ↘                 | ↘                 | ↘                 | -                 | ↘                 | ↘                 | -                 |
| Nitrite nitrogen (mg/L)                                                                                        | Surface     | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 |
|                                                                                                                | Middle      | NA                | ↘                 | ↘                 | NA                | ↘                 | ↘                 | -                 |
|                                                                                                                | Bottom      | ↘                 | ↘                 | ↘                 | -                 | ↘                 | ↘                 | -                 |
|                                                                                                                | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 |
| Nitrate nitrogen (mg/L)                                                                                        | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Middle      | NA                | ↘                 | ↘                 | NA                | ↘                 | ↘                 | -                 |
|                                                                                                                | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 |
|                                                                                                                | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 |
| Total inorganic nitrogen (mg/L)                                                                                | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Middle      | NA                | ↘                 | ↘                 | NA                | ↘                 | ↘                 | -                 |
|                                                                                                                | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 |
|                                                                                                                | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 |
| Total Kjeldahl nitrogen (mg/L)                                                                                 | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Middle      | NA                | ↘                 | ↘                 | NA                | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Total nitrogen (mg/L)                                                                                          | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Middle      | NA                | ↘                 | ↘                 | NA                | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Orthophosphate phosphorus (mg/L)                                                                               | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Middle      | NA                | ↘                 | ↘                 | NA                | ↘                 | ↘                 | -                 |
|                                                                                                                | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 |
|                                                                                                                | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 |
| Total phosphorus (mg/L)                                                                                        | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Middle      | NA                | ↘                 | ↘                 | NA                | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                                                                                                | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Silica (mg/L)                                                                                                  | Surface     | -                 | -                 | -                 | -                 | ↗                 | -                 | -                 |
|                                                                                                                | Middle      | NA                | -                 | -                 | NA                | -                 | -                 | -                 |
|                                                                                                                | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                                                                                                | Average     | -                 | -                 | -                 | ↗                 | -                 | -                 | -                 |
| Chlorophyll- <i>a</i> (µg/L)                                                                                   | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                                                                                                | Middle      | NA                | -                 | -                 | NA                | -                 | -                 | -                 |
|                                                                                                                | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                                                                                                | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| <i>E. coli</i> (cfu/100mL)                                                                                     | Surface     | ↘                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
|                                                                                                                | Middle      | NA                | -                 | ↘                 | NA                | -                 | -                 | -                 |
|                                                                                                                | Bottom      | ↘                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
|                                                                                                                | Average     | ↘                 | ↘                 | ↘                 | -                 | ↘                 | -                 | -                 |
| Faecal coliforms (cfu/100mL)                                                                                   | Surface     | -                 | -                 | -                 | ↗                 | -                 | -                 | -                 |
|                                                                                                                | Middle      | NA                | -                 | -                 | NA                | -                 | -                 | -                 |
|                                                                                                                | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                                                                                                | Average     | -                 | -                 | -                 | ↗                 | -                 | -                 | -                 |

Note: 1. Results of the Seasonal Kendall Test statistically significant at  $p < 0.05$   
2. - indicates no significant trend  
3. NA (Not Applicable) indicates the measurement was not made due to shallow water  
4. ↗ significant increase  
5. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Southern WCZ, 1986 - 2006

| Monitoring Station                     |             | SM1               | SM2               | SM3               | SM4               | SM5               | SM6               | SM7               | SM9               |
|----------------------------------------|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Monitoring Period                      |             | 1986<br>I<br>2006 | 1986<br>I<br>2006 | 1986<br>I<br>2006 | 1986<br>I<br>2006 | 1986<br>I<br>2006 | 1986<br>I<br>2006 | 1986<br>I<br>2006 | 1988<br>I<br>2006 |
| Parameter                              | Water Depth |                   |                   |                   |                   |                   |                   |                   |                   |
| Temperature (°C)                       | Surface     | -                 | -                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Salinity                               | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (mg/L)                | Surface     | ↘                 | -                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (%)                   | Surface     | -                 | -                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | ↗                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | ↗                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| pH                                     | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Secchi disc depth (m)                  |             | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Turbidity (NTU)                        | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Suspended Solids (mg/L)                | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | ↗                 | ↗                 | -                 | -                 | ↗                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Total volatile solids (mg/L)           | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| 5-day Biochemical Oxygen Demand (mg/L) | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Ammonia nitrogen (mg/L)                | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | ↗                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | ↗                 | ↗                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | ↗                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | ↗                 |
| Nitrite nitrogen (mg/L)                | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | -                 | ↗                 | -                 | -                 | -                 | ↗                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | ↗                 | -                 | ↗                 | -                 | -                 | ↗                 | ↗                 |
| Nitrate nitrogen (mg/L)                | Surface     | -                 | ↗                 | -                 | ↗                 | -                 | -                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | -                 | ↗                 | -                 | -                 | -                 | ↗                 |
|                                        | Bottom      | -                 | -                 | -                 | ↗                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | ↗                 | -                 | ↗                 | -                 | -                 | -                 | ↗                 |
| Total inorganic nitrogen (mg/L)        | Surface     | -                 | ↗                 | -                 | ↗                 | -                 | -                 | ↗                 | ↗                 |
|                                        | Middle      | -                 | -                 | -                 | ↗                 | -                 | -                 | ↗                 | ↗                 |
|                                        | Bottom      | -                 | -                 | -                 | ↗                 | -                 | -                 | ↗                 | ↗                 |
|                                        | Average     | -                 | -                 | -                 | ↗                 | -                 | -                 | ↗                 | ↗                 |
| Total Kjeldahl nitrogen (mg/L)         | Surface     | ↘                 | ↘                 | -                 | -                 | -                 | -                 | ↘                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | -                 | -                 | ↘                 | -                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | -                 | -                 | -                 | ↘                 | -                 | -                 |
| Total nitrogen (mg/L)                  | Surface     | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | -                 | -                 | ↘                 | -                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | -                 | ↘                 | ↘                 | -                 | -                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | -                 | -                 | ↘                 | -                 | -                 |
| Orthophosphate phosphorus (mg/L)       | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Total phosphorus (mg/L)                | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Silica (mg/L)                          | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | ↘                 |
| Chlorophyll- <i>a</i> (µg/L)           | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| <i>E. coli</i> (cfu/100mL)             | Surface     | -                 | ↗                 | -                 | ↗                 | -                 | -                 | ↗                 | ↗                 |
|                                        | Middle      | -                 | ↗                 | ↗                 | ↗                 | -                 | -                 | ↗                 | ↗                 |
|                                        | Bottom      | -                 | -                 | -                 | ↗                 | -                 | -                 | ↗                 | ↗                 |
|                                        | Average     | -                 | -                 | -                 | ↗                 | -                 | -                 | ↗                 | ↗                 |
| Faecal coliforms (cfu/100mL)           | Surface     | -                 | ↗                 | ↗                 | ↗                 | -                 | -                 | ↗                 | ↗                 |
|                                        | Middle      | -                 | ↗                 | ↗                 | ↗                 | -                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | -                 | -                 | -                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | -                 | ↗                 | ↗                 | ↗                 | -                 | -                 | ↗                 | ↗                 |

Note: 1. Results of the Seasonal Kendall Test statistically significant at  $p < 0.05$

- 2. - indicates no significant trend
- 3. ↗ significant increase
- 4. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Southern WCZ, 1986 - 2006  
(continued)

| Monitoring Station                      |             | SM10              | SM11              | SM12              | SM13              | SM17              | SM18              | SM19              |
|-----------------------------------------|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Monitoring Period                       |             | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1989<br> <br>2006 | 1989<br> <br>2006 | 1989<br> <br>2006 |
| Parameter                               | Water Depth |                   |                   |                   |                   |                   |                   |                   |
| Temperature (°C)                        | Surface     | ↗                 | ↗                 | ↗                 | -                 | ↗                 | ↗                 | -                 |
|                                         | Middle      | NA                | ↗                 | ↗                 | ↗                 | -                 | ↗                 | ↗                 |
|                                         | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                         | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Salinity                                | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (mg/L)                 | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (%)                    | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Bottom      | ↗                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| pH                                      | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | -                 | ↘                 | ↘                 | -                 | -                 | -                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Average     | -                 | -                 | ↘                 | ↘                 | -                 | -                 | -                 |
| Secchi disc depth (m)                   |             | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Turbidity (NTU)                         | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                         | Middle      | NA                | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                         | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                         | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Suspended Solids (mg/L)                 | Surface     | -                 | -                 | -                 | ↗                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | -                 | -                 | ↗                 | -                 | -                 | -                 |
|                                         | Bottom      | -                 | -                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                         | Average     | -                 | -                 | -                 | ↗                 | ↗                 | -                 | ↗                 |
| Total volatile solids (mg/L)            | Surface     | ↗                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | ↗                 |
|                                         | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| 5- day Biochemical Oxygen Demand (mg/L) | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | -                 | ↘                 | -                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Ammonia nitrogen (mg/L)                 | Surface     | ↗                 | ↗                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | ↗                 | -                 | ↗                 | -                 | -                 | -                 |
|                                         | Bottom      | ↗                 | ↗                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Average     | ↗                 | ↗                 | -                 | -                 | -                 | -                 | -                 |
| Nitrite nitrogen (mg/L)                 | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | -                 | -                 |
|                                         | Middle      | NA                | ↗                 | ↗                 | ↗                 | -                 | -                 | -                 |
|                                         | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | -                 | -                 | -                 |
|                                         | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 | -                 | -                 |
| Nitrate nitrogen (mg/L)                 | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | ↗                 | ↗                 | ↗                 | -                 | -                 | -                 |
|                                         | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | -                 | -                 | -                 |
|                                         | Average     | ↗                 | ↗                 | ↗                 | ↗                 | -                 | -                 | -                 |
| Total inorganic nitrogen (mg/L)         | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | ↗                 | ↗                 | ↗                 | -                 | ↘                 | -                 |
|                                         | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | -                 | ↘                 | -                 |
|                                         | Average     | ↗                 | ↗                 | ↗                 | ↗                 | -                 | ↘                 | -                 |
| Total Kjeldahl nitrogen (mg/L)          | Surface     | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                         | Middle      | NA                | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                         | Average     | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
| Total nitrogen (mg/L)                   | Surface     | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                         | Average     | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
| Orthophosphate phosphorus (mg/L)        | Surface     | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                         | Average     | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
| Total phosphorus (mg/L)                 | Surface     | ↘                 | ↘                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                         | Middle      | NA                | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                         | Bottom      | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                         | Average     | ↘                 | ↘                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Silica (mg/L)                           | Surface     | -                 | -                 | -                 | -                 | -                 | ↘                 | -                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | -                 | ↘                 | -                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | -                 | ↘                 | -                 |
|                                         | Average     | -                 | -                 | -                 | -                 | -                 | ↘                 | -                 |
| Chlorophyll- <i>a</i> (µg/L)            | Surface     | ↗                 | -                 | ↗                 | ↗                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | -                 | ↗                 | ↗                 | -                 | -                 | -                 |
|                                         | Bottom      | ↗                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Average     | ↗                 | -                 | -                 | -                 | -                 | -                 | -                 |
| <i>E. coli</i> (cfu/100mL)              | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | -                 | -                 | ↗                 | -                 | -                 | -                 |
|                                         | Bottom      | -                 | -                 | -                 | ↗                 | -                 | -                 | -                 |
|                                         | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Faecal coliforms (cfu/100mL)            | Surface     | -                 | -                 | -                 | ↗                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | ↗                 | ↗                 | ↗                 | -                 | -                 | -                 |
|                                         | Bottom      | -                 | -                 | ↗                 | ↗                 | -                 | -                 | -                 |
|                                         | Average     | -                 | -                 | -                 | ↗                 | -                 | -                 | -                 |

Note: 1. Results of the Seasonal Kendall Test statistically significant at  $p < 0.05$   
2. - indicates no significant trend  
3. NA (Not Applicable) indicates the measurement was not made due to shallow water  
4. SM20 has eight years' data only, which are insufficient to perform Seasonal Kendall Test  
5. ↗ significant increase  
6. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Victoria Harbour WCZ, 1986 – 2006

| Monitoring Station                     |             | VM1               | VM2               | VM4               | VM5               | VM6               |
|----------------------------------------|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Monitoring Period                      |             | 1988<br>I<br>2006 | 1988<br>I<br>2006 | 1988<br>I<br>2006 | 1986<br>I<br>2006 | 1988<br>I<br>2006 |
| Parameter                              | Water Depth |                   |                   |                   |                   |                   |
| Temperature (°C)                       | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Salinity                               | Surface     | ↗                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | ↗                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | -                 | -                 |
|                                        | Average     | ↗                 | -                 | ↗                 | -                 | -                 |
| Dissolved Oxygen (mg/L)                | Surface     | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Dissolved Oxygen (%)                   | Surface     | ↗                 | ↗                 | -                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| pH                                     | Surface     | ↘                 | -                 | ↘                 | -                 | ↘                 |
|                                        | Middle      | -                 | ↘                 | -                 | -                 | ↘                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | ↘                 |
| Secchi disc depth (m)                  |             | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Turbidity (NTU)                        | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Suspended Solids (mg/L)                | Surface     | ↘                 | ↘                 | ↘                 | -                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | -                 | ↘                 | ↘                 | -                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Total volatile solids (mg/L)           | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| 5-day Biochemical Oxygen Demand (mg/L) | Surface     | ↘                 | ↘                 | -                 | -                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | ↘                 | -                 | -                 | -                 |
|                                        | Average     | ↘                 | ↘                 | -                 | -                 | -                 |
| Ammonia nitrogen (mg/L)                | Surface     | ↘                 | ↘                 | ↘                 | -                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | -                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | -                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | -                 | ↘                 |
| Nitrite nitrogen (mg/L)                | Surface     | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↘                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 |
| Nitrate nitrogen (mg/L)                | Surface     | -                 | -                 | -                 | ↗                 | ↗                 |
|                                        | Middle      | -                 | -                 | -                 | ↗                 | ↗                 |
|                                        | Bottom      | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Average     | -                 | -                 | -                 | ↗                 | ↗                 |
| Total inorganic nitrogen (mg/L)        | Surface     | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | -                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | -                 | -                 |
|                                        | Average     | ↘                 | -                 | -                 | -                 | -                 |
| Total Kjeldahl nitrogen (mg/L)         | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Total nitrogen (mg/L)                  | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Orthophosphate phosphorus (mg/L)       | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Total phosphorus (mg/L)                | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Silica (mg/L)                          | Surface     | ↘                 | -                 | ↘                 | -                 | ↘                 |
|                                        | Middle      | ↘                 | -                 | ↘                 | -                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | -                 | -                 | -                 |
|                                        | Average     | ↘                 | -                 | ↘                 | -                 | -                 |
| Chlorophyll- <i>a</i> (µg/L)           | Surface     | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 |
| <i>E. coli</i> (cfu/100mL)             | Surface     | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Average     | -                 | -                 | -                 | ↗                 | -                 |
| Faecal coliforms (cfu/100mL)           | Surface     | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | ↗                 | ↗                 |
|                                        | Bottom      | -                 | -                 | -                 | ↗                 | ↗                 |
|                                        | Average     | -                 | -                 | -                 | ↗                 | ↗                 |

Note: 1. Results of the Seasonal Kendall Test statistically significant at  $p < 0.05$

- 2. - indicates no significant trend
- 3. ↗ significant increase
- 4. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Victoria Harbour WCZ, 1986 - 2006 (continued)

| Monitoring Station                     |             | VM7               | VM8               | VM12              | VM14              | VM15              |
|----------------------------------------|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Monitoring Period                      |             | 1986<br>I<br>2006 | 1986<br>I<br>2006 | 1986<br>I<br>2006 | 1986<br>I<br>2006 | 1993<br>I<br>2006 |
| Parameter                              | Water Depth |                   |                   |                   |                   |                   |
| Temperature (°C)                       | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
| Salinity                               | Surface     | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (mg/L)                | Surface     | ↗                 | -                 | ↗                 | ↗                 | -                 |
|                                        | Middle      | ↗                 | -                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | -                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | -                 | ↗                 | ↗                 | ↗                 |
| Dissolved Oxygen (%)                   | Surface     | ↗                 | -                 | ↗                 | ↗                 | -                 |
|                                        | Middle      | ↗                 | -                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | -                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | -                 | ↗                 | ↗                 | ↗                 |
| pH                                     | Surface     | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | ↘                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | ↘                 | -                 | -                 | -                 |
|                                        | Average     | -                 | ↘                 | -                 | ↘                 | -                 |
| Secchi disc depth (m)                  |             | ↗                 | ↗                 | -                 | ↗                 | ↗                 |
| Turbidity (NTU)                        | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Suspended Solids (mg/L)                | Surface     | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | -                 | -                 | ↘                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Average     | ↘                 | -                 | -                 | -                 | ↘                 |
| Total volatile solids (mg/L)           | Surface     | -                 | ↘                 | -                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | -                 | ↘                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | -                 | ↘                 | -                 |
|                                        | Average     | ↘                 | ↘                 | -                 | ↘                 | -                 |
| 5-day Biochemical Oxygen Demand (mg/L) | Surface     | -                 | -                 | -                 | ↘                 | -                 |
|                                        | Middle      | -                 | -                 | ↘                 | ↘                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | ↘                 | -                 |
|                                        | Average     | -                 | -                 | ↘                 | ↘                 | -                 |
| Ammonia nitrogen (mg/L)                | Surface     | -                 | ↗                 | ↘                 | -                 | ↘                 |
|                                        | Middle      | -                 | ↗                 | ↘                 | -                 | ↘                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Average     | -                 | ↗                 | ↘                 | -                 | ↘                 |
| Nitrite nitrogen (mg/L)                | Surface     | ↗                 | ↗                 | ↗                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 |
| Nitrate nitrogen (mg/L)                | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
| Total inorganic nitrogen (mg/L)        | Surface     | -                 | ↗                 | -                 | -                 | ↘                 |
|                                        | Middle      | -                 | -                 | -                 | ↗                 | ↘                 |
|                                        | Bottom      | -                 | -                 | -                 | ↗                 | ↘                 |
|                                        | Average     | -                 | ↗                 | -                 | -                 | ↘                 |
| Total Kjeldahl nitrogen (mg/L)         | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Total nitrogen (mg/L)                  | Surface     | ↘                 | -                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | -                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | -                 | ↘                 | ↘                 | ↘                 |
| Orthophosphate phosphorus (mg/L)       | Surface     | ↘                 | -                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | -                 | -                 | ↘                 | ↘                 | ↘                 |
| Total phosphorus (mg/L)                | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Silica (mg/L)                          | Surface     | -                 | -                 | -                 | ↘                 | ↘                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Average     | -                 | -                 | -                 | -                 | ↘                 |
| Chlorophyll- <i>a</i> (µg/L)           | Surface     | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 |
| <i>E. coli</i> (cfu/100mL)             | Surface     | ↗                 | ↗                 | ↗                 | -                 | -                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | -                 | -                 |
| Faecal coliforms (cfu/100mL)           | Surface     | ↗                 | ↗                 | ↗                 | -                 | -                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | -                 |

Note: 1. Results of the Seasonal Kendall Test statistically significant at  $p < 0.05$   
2. - indicates no significant trend  
3. ↗ significant increase  
4. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Eastern Buffer WCZ, 1986 - 2006

| Monitoring Station                     |             | EM1               | EM2               | EM3               |
|----------------------------------------|-------------|-------------------|-------------------|-------------------|
| Monitoring Period                      |             | 1986<br>I<br>2006 | 1986<br>I<br>2006 | 1986<br>I<br>2006 |
| Parameter                              | Water Depth |                   |                   |                   |
| Temperature (°C)                       | Surface     | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 |
| Salinity                               | Surface     | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | ↗                 |
|                                        | Bottom      | -                 | -                 | ↗                 |
|                                        | Average     | -                 | -                 | -                 |
| Dissolved Oxygen (mg/L)                | Surface     | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 |
| Dissolved Oxygen (%)                   | Surface     | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 |
| pH                                     | Surface     | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 |
| Secchi disc depth (m)                  |             | -                 | -                 | -                 |
| Turbidity (NTU)                        | Surface     | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 |
| Suspended Solids (mg/L)                | Surface     | ↘                 | -                 | -                 |
|                                        | Middle      | ↘                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 |
|                                        | Average     | ↘                 | -                 | -                 |
| Total volatile solids (mg/L)           | Surface     | ↘                 | ↘                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | -                 |
|                                        | Average     | ↘                 | ↘                 | -                 |
| 5-day Biochemical Oxygen Demand (mg/L) | Surface     | -                 | ↘                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | -                 |
|                                        | Bottom      | ↘                 | -                 | -                 |
|                                        | Average     | ↘                 | -                 | -                 |
| Ammonia nitrogen (mg/L)                | Surface     | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | -                 |
|                                        | Average     | ↘                 | ↘                 | -                 |
| Nitrite nitrogen (mg/L)                | Surface     | -                 | ↘                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | -                 |
|                                        | Average     | -                 | ↘                 | -                 |
| Nitrate nitrogen (mg/L)                | Surface     | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 |
| Total inorganic nitrogen (mg/L)        | Surface     | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 |
|                                        | Average     | -                 | -                 | -                 |
| Total Kjeldahl nitrogen (mg/L)         | Surface     | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 |
| Total nitrogen (mg/L)                  | Surface     | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 |
| Orthophosphate phosphorus (mg/L)       | Surface     | -                 | -                 | -                 |
|                                        | Middle      | -                 | ↘                 | -                 |
|                                        | Bottom      | -                 | ↘                 | -                 |
|                                        | Average     | -                 | ↘                 | ↘                 |
| Total phosphorus (mg/L)                | Surface     | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 |
| Silica (mg/L)                          | Surface     | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 |
| Chlorophyll- <i>a</i> (µg/L)           | Surface     | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 |
| <i>E. coli</i> (cfu/100mL)             | Surface     | -                 | ↘                 | -                 |
|                                        | Middle      | -                 | -                 | -                 |
|                                        | Bottom      | -                 | ↘                 | ↘                 |
|                                        | Average     | -                 | ↘                 | ↘                 |
| Faecal coliforms (cfu/100mL)           | Surface     | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 |
|                                        | Bottom      | -                 | ↘                 | ↘                 |
|                                        | Average     | -                 | -                 | -                 |

Note: 1. Results of the Seasonal Kendall Test statistically significant at  $p < 0.05$   
2. - indicates no significant trend  
3. ↗ significant increase  
4. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Western Buffer WCZ, 1986 - 2006

| Monitoring Station                     |             | WM1               | WM2               | WM3               | WM4               |
|----------------------------------------|-------------|-------------------|-------------------|-------------------|-------------------|
| Monitoring Period                      |             | 1988<br>I<br>2006 | 1988<br>I<br>2006 | 1986<br>I<br>2006 | 1986<br>I<br>2006 |
| Parameter                              | Water Depth |                   |                   |                   |                   |
| Temperature (°C)                       | Surface     | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 |
| Salinity                               | Surface     | ↗                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↗                 | -                 | -                 | ↗                 |
|                                        | Average     | ↗                 | -                 | -                 | -                 |
| Dissolved Oxygen (mg/L)                | Surface     | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (%)                   | Surface     | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | ↗                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 |
| pH                                     | Surface     | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | ↘                 | -                 | -                 |
|                                        | Bottom      | -                 | ↘                 | -                 | -                 |
|                                        | Average     | -                 | ↘                 | -                 | -                 |
| Secchi disc depth (m)                  |             | -                 | -                 | -                 | -                 |
| Turbidity (NTU)                        | Surface     | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 |
| Suspended Solids (mg/L)                | Surface     | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↗                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 |
| Total volatile solids (mg/L)           | Surface     | -                 | -                 | ↘                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 |
| 5-day Biochemical Oxygen Demand (mg/L) | Surface     | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 |
| Ammonia nitrogen (mg/L)                | Surface     | -                 | ↗                 | -                 | ↗                 |
|                                        | Middle      | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↗                 | -                 | -                 | ↗                 |
|                                        | Average     | -                 | -                 | -                 | ↗                 |
| Nitrite nitrogen (mg/L)                | Surface     | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | -                 | ↗                 | -                 | -                 |
|                                        | Bottom      | ↘                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | ↗                 |
| Nitrate nitrogen (mg/L)                | Surface     | -                 | -                 | ↗                 | ↗                 |
|                                        | Middle      | -                 | -                 | ↗                 | ↗                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | ↗                 | ↗                 |
| Total inorganic nitrogen (mg/L)        | Surface     | -                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | -                 | ↗                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | ↗                 | ↗                 | ↗                 |
| Total Kjeldahl nitrogen (mg/L)         | Surface     | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 |
| Total nitrogen (mg/L)                  | Surface     | ↘                 | -                 | ↘                 | -                 |
|                                        | Middle      | ↘                 | -                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 |
| Orthophosphate phosphorus (mg/L)       | Surface     | ↘                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 |
|                                        | Average     | ↘                 | -                 | -                 | -                 |
| Total phosphorus (mg/L)                | Surface     | ↘                 | ↘                 | ↘                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 |
| Silica (mg/L)                          | Surface     | ↘                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | ↘                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | ↘                 | -                 | -                 |
| Chlorophyll- <i>a</i> (µg/L)           | Surface     | ↗                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 |
| <i>E. coli</i> (cfu/100mL)             | Surface     | -                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | -                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | -                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | -                 | ↗                 | ↗                 | ↗                 |
| Faecal coliforms (cfu/100mL)           | Surface     | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | -                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | -                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | -                 | ↗                 | ↗                 | ↗                 |

Note: 1. Results of the Seasonal Kendall Test statistically significant at  $p < 0.05$   
2. - indicates no significant trend  
3. ↗ significant increase  
4. ↘ significant decrease



Results of the Seasonal Kendall Test for water quality trends in the Junk Bay WCZ, 1986 - 2006

| Monitoring Station                     |             | JM3               | JM4               |
|----------------------------------------|-------------|-------------------|-------------------|
| Monitoring Period                      |             | 1986<br>I<br>2006 | 1986<br>I<br>2006 |
| Parameter                              | Water Depth |                   |                   |
| Temperature (°C)                       | Surface     | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 |
| Salinity                               | Surface     | -                 | -                 |
|                                        | Middle      | -                 | -                 |
|                                        | Bottom      | -                 | -                 |
|                                        | Average     | -                 | -                 |
| Dissolved Oxygen (mg/L)                | Surface     | -                 | -                 |
|                                        | Middle      | -                 | -                 |
|                                        | Bottom      | -                 | -                 |
|                                        | Average     | -                 | -                 |
| Dissolved Oxygen (%)                   | Surface     | -                 | -                 |
|                                        | Middle      | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 |
|                                        | Average     | -                 | -                 |
| pH                                     | Surface     | -                 | -                 |
|                                        | Middle      | -                 | -                 |
|                                        | Bottom      | -                 | -                 |
|                                        | Average     | -                 | -                 |
| Secchi disc depth (m)                  |             | -                 | -                 |
| Turbidity (NTU)                        | Surface     | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 |
| Suspended Solids (mg/L)                | Surface     | -                 | ↘                 |
|                                        | Middle      | -                 | -                 |
|                                        | Bottom      | -                 | -                 |
|                                        | Average     | -                 | -                 |
| Total volatile solids (mg/L)           | Surface     | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 |
|                                        | Average     | ↘                 | -                 |
| 5-day Biochemical Oxygen Demand (mg/L) | Surface     | -                 | -                 |
|                                        | Middle      | -                 | -                 |
|                                        | Bottom      | -                 | -                 |
|                                        | Average     | -                 | -                 |
| Ammonia nitrogen (mg/L)                | Surface     | ↘                 | -                 |
|                                        | Middle      | -                 | -                 |
|                                        | Bottom      | ↘                 | -                 |
|                                        | Average     | ↘                 | -                 |
| Nitrite nitrogen (mg/L)                | Surface     | -                 | -                 |
|                                        | Middle      | -                 | -                 |
|                                        | Bottom      | -                 | ↘                 |
|                                        | Average     | -                 | -                 |
| Nitrate nitrogen (mg/L)                | Surface     | -                 | -                 |
|                                        | Middle      | -                 | -                 |
|                                        | Bottom      | -                 | -                 |
|                                        | Average     | -                 | -                 |
| Total inorganic nitrogen (mg/L)        | Surface     | ↘                 | -                 |
|                                        | Middle      | -                 | -                 |
|                                        | Bottom      | ↘                 | -                 |
|                                        | Average     | ↘                 | -                 |
| Total Kjeldahl nitrogen (mg/L)         | Surface     | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 |
| Total nitrogen (mg/L)                  | Surface     | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 |
| Orthophosphate phosphorus (mg/L)       | Surface     | -                 | -                 |
|                                        | Middle      | -                 | -                 |
|                                        | Bottom      | -                 | -                 |
|                                        | Average     | -                 | -                 |
| Total phosphorus (mg/L)                | Surface     | ↘                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 |
| Silica (mg/L)                          | Surface     | -                 | -                 |
|                                        | Middle      | -                 | -                 |
|                                        | Bottom      | -                 | -                 |
|                                        | Average     | -                 | -                 |
| Chlorophyll- <i>a</i> (µg/L)           | Surface     | -                 | -                 |
|                                        | Middle      | -                 | -                 |
|                                        | Bottom      | -                 | -                 |
|                                        | Average     | -                 | -                 |
| <i>E. coli</i> (cfu/100mL)             | Surface     | -                 | -                 |
|                                        | Middle      | -                 | -                 |
|                                        | Bottom      | -                 | -                 |
|                                        | Average     | -                 | -                 |
| Faecal coliforms (cfu/100mL)           | Surface     | -                 | -                 |
|                                        | Middle      | -                 | -                 |
|                                        | Bottom      | -                 | -                 |
|                                        | Average     | -                 | -                 |

Note: 1. Results of the Seasonal Kendall Test statistically significant at  $p < 0.05$   
2. - indicates no significant trend  
3. ↗ significant increase  
4. ↘ significant decrease

## Results of the Seasonal Kendall Test for water quality trends in the Deep Bay WCZ, 1986 - 2006

| Monitoring Station                     |             | DM1               | DM2               | DM3               | DM4               | DM5               |
|----------------------------------------|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Monitoring Period                      |             | 1986<br>I<br>2006 | 1986<br>I<br>2006 | 1986<br>I<br>2006 | 1986<br>I<br>2006 | 1991<br>I<br>2006 |
| Parameter                              | Water Depth |                   |                   |                   |                   |                   |
| Temperature (°C)                       | Surface     | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | ↗                 |
|                                        | Bottom      | NA                | NA                | NA                | ↗                 | ↗                 |
|                                        | Average     | -                 | -                 | -                 | ↗                 | ↗                 |
| Salinity                               | Surface     | ↘                 | ↘                 | -                 | -                 | -                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | -                 |
|                                        | Bottom      | NA                | NA                | NA                | -                 | -                 |
|                                        | Average     | ↘                 | ↘                 | -                 | -                 | -                 |
| Dissolved Oxygen (mg/L)                | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | ↘                 |
|                                        | Bottom      | NA                | NA                | NA                | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Dissolved Oxygen (%)                   | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | ↘                 |
|                                        | Bottom      | NA                | NA                | NA                | ↘                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 |
| pH                                     | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | -                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | -                 |
|                                        | Bottom      | NA                | NA                | NA                | ↘                 | -                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | -                 |
| Secchi disc depth (m)                  |             | -                 | -                 | -                 | -                 | -                 |
| Turbidity (NTU)                        | Surface     | -                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | ↗                 |
|                                        | Bottom      | NA                | NA                | NA                | ↗                 | -                 |
|                                        | Average     | -                 | ↗                 | ↗                 | ↗                 | -                 |
| Suspended Solids (mg/L)                | Surface     | -                 | ↗                 | ↗                 | -                 | -                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | -                 |
|                                        | Bottom      | NA                | NA                | NA                | -                 | -                 |
|                                        | Average     | -                 | ↗                 | -                 | -                 | -                 |
| Total volatile solids (mg/L)           | Surface     | -                 | ↗                 | -                 | -                 | -                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | -                 |
|                                        | Bottom      | NA                | NA                | NA                | -                 | -                 |
|                                        | Average     | -                 | ↗                 | -                 | -                 | -                 |
| 5-day Biochemical Oxygen Demand (mg/L) | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | -                 |
|                                        | Bottom      | NA                | NA                | NA                | ↗                 | -                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
| Ammonia nitrogen (mg/L)                | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | ↗                 |
|                                        | Bottom      | NA                | NA                | NA                | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Nitrite nitrogen (mg/L)                | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | ↗                 |
|                                        | Bottom      | NA                | NA                | NA                | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Nitrate nitrogen (mg/L)                | Surface     | -                 | -                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | ↗                 |
|                                        | Bottom      | NA                | NA                | NA                | ↗                 | -                 |
|                                        | Average     | -                 | -                 | ↗                 | ↗                 | ↗                 |
| Total inorganic nitrogen (mg/L)        | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | ↗                 |
|                                        | Bottom      | NA                | NA                | NA                | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Total Kjeldahl nitrogen (mg/L)         | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | -                 |
|                                        | Bottom      | NA                | NA                | NA                | -                 | -                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | -                 | -                 |
| Total nitrogen (mg/L)                  | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | -                 |
|                                        | Bottom      | NA                | NA                | NA                | ↗                 | -                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
| Orthophosphate phosphorus (mg/L)       | Surface     | -                 | -                 | -                 | ↗                 | ↗                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | -                 |
|                                        | Bottom      | NA                | NA                | NA                | ↗                 | -                 |
|                                        | Average     | -                 | -                 | -                 | ↗                 | ↗                 |
| Total phosphorus (mg/L)                | Surface     | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | ↘                 |
|                                        | Bottom      | NA                | NA                | NA                | -                 | ↘                 |
|                                        | Average     | -                 | -                 | -                 | -                 | ↘                 |
| Silica (mg/L)                          | Surface     | -                 | ↗                 | -                 | -                 | -                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | -                 |
|                                        | Bottom      | NA                | NA                | NA                | -                 | -                 |
|                                        | Average     | -                 | ↗                 | -                 | -                 | -                 |
| Chlorophyll- <i>a</i> (µg/L)           | Surface     | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | -                 |
|                                        | Bottom      | NA                | NA                | NA                | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 |
| <i>E. coli</i> (cfu/100mL)             | Surface     | -                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | ↗                 |
|                                        | Bottom      | NA                | NA                | NA                | ↗                 | ↗                 |
|                                        | Average     | -                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Faecal coliforms (cfu/100mL)           | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | NA                | NA                | NA                | NA                | ↗                 |
|                                        | Bottom      | NA                | NA                | NA                | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |

Note: 1. Results of the Seasonal Kendall Test statistically significant at  $p < 0.05$

2. - indicates no significant trend

3. NA (Not Applicable) indicates the measurement was not made due to the shallow water

4. ↗ significant increase

5. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the North Western WCZ, 1986 - 2006

| Monitoring Station                     |             | NM1               | NM2               | NM3               | NM5               | NM6               |
|----------------------------------------|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Monitoring Period                      |             | 1988<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1988<br> <br>2006 | 1991<br> <br>2006 |
| Parameter                              | Water Depth |                   |                   |                   |                   |                   |
| Temperature (°C)                       | Surface     | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | ↗                 | -                 |
| Salinity                               | Surface     | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | ↗                 | ↗                 | -                 | -                 | -                 |
|                                        | Bottom      | ↗                 | ↗                 | -                 | ↗                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (mg/L)                | Surface     | -                 | -                 | -                 | ↘                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (%)                   | Surface     | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 |
| pH                                     | Surface     | ↘                 | -                 | -                 | ↘                 | -                 |
|                                        | Middle      | ↘                 | -                 | -                 | ↘                 | -                 |
|                                        | Bottom      | ↘                 | -                 | -                 | ↘                 | -                 |
|                                        | Average     | ↘                 | ↘                 | -                 | ↘                 | -                 |
| Secchi disc depth (m)                  |             | -                 | ↗                 | ↗                 | -                 | -                 |
| Turbidity (NTU)                        | Surface     | -                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | -                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | -                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Suspended Solids (mg/L)                | Surface     | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 |
| Total volatile solids (mg/L)           | Surface     | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 |
| 5-day Biochemical Oxygen Demand (mg/L) | Surface     | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 |
| Ammonia nitrogen (mg/L)                | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
| Nitrite nitrogen (mg/L)                | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | -                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Bottom      | -                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| Nitrate nitrogen (mg/L)                | Surface     | -                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Middle      | -                 | -                 | ↗                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | ↗                 | -                 | -                 |
|                                        | Average     | -                 | -                 | ↗                 | -                 | -                 |
| Total inorganic nitrogen (mg/L)        | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Middle      | -                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Bottom      | -                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Average     | -                 | ↗                 | ↗                 | ↗                 | -                 |
| Total Kjeldahl nitrogen (mg/L)         | Surface     | ↘                 | ↘                 | -                 | -                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | -                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | -                 | -                 | -                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | -                 | -                 |
| Total nitrogen (mg/L)                  | Surface     | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | ↘                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 |
| Orthophosphate phosphorus (mg/L)       | Surface     | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Average     | -                 | -                 | -                 | -                 | ↘                 |
| Total phosphorus (mg/L)                | Surface     | ↘                 | -                 | -                 | -                 | ↘                 |
|                                        | Middle      | ↘                 | -                 | -                 | ↘                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | -                 | -                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | -                 | ↘                 |
| Silica (mg/L)                          | Surface     | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 |
| Chlorophyll- <i>a</i> (µg/L)           | Surface     | -                 | -                 | -                 | -                 | ↗                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | ↗                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | ↗                 |
| <i>E. coli</i> (cfu/100mL)             | Surface     | ↗                 | -                 | -                 | ↗                 | -                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Bottom      | ↗                 | -                 | -                 | ↗                 | -                 |
|                                        | Average     | ↗                 | ↗                 | -                 | ↗                 | -                 |
| Faecal coliforms (cfu/100mL)           | Surface     | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | ↗                 | -                 |

Note: 1. Results of the Seasonal Kendall Test statistically significant at  $p < 0.05$   
2. - indicates no significant trend  
3. NM8 has eight years' data only, which are insufficient to perform Seasonal Kendall Test  
4. ↗ significant increase  
5. ↘ significant decrease

# Summary statistics for bottom sediment quality in the Tolo Harbour and Channel and Southern WCZs, 2002 - 2006

| Parameter                                                                                   | Tolo Harbour and Channel |                          |                          |                          | Hong Kong Island         |                          | West Lamma               |                          |
|---------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                                                                                             | Harbour                  | Subzone                  | Subzone                  | Channel                  | (South)                  |                          | Channel                  |                          |
|                                                                                             | TS2                      | TS3                      | TS4                      | TS5                      | SS1                      | SS2                      | SS3                      | SS4                      |
| Number of samples                                                                           | 10                       | 10                       | 10                       | 10                       | 10                       | 10                       | 10                       | 10                       |
| Particle Size Fractionation <63µm (%w/w)                                                    | 71<br>(14 - 88)          | 75<br>(43 - 90)          | 67<br>(34 - 80)          | 89<br>(80 - 94)          | 65<br>(57 - 84)          | 85<br>(74 - 97)          | 74<br>(52 - 92)          | 74<br>(49 - 96)          |
| Electrochemical Potential (mV)                                                              | -333<br>((-376)-(-288))  | -334<br>((-364)-(-297))  | -349<br>((-390)-(-314))  | -338<br>((-360)-(-307))  | -151<br>((-205)-(-91))   | -181<br>((-338)-(-129))  | -164<br>((-215)-(-91))   | -163<br>((-197)-(-95))   |
| Total Solids (%w/w)                                                                         | 35<br>(32 - 40)          | 31<br>(25 - 35)          | 39<br>(26 - 54)          | 31<br>(28 - 35)          | 57<br>(48 - 61)          | 46<br>(43 - 51)          | 51<br>(41 - 59)          | 46<br>(42 - 52)          |
| Total Volatile Solids (%w/w)                                                                | 10.0<br>(8.6 - 11.0)     | 10.7<br>(9.4 - 12.0)     | 9.8<br>(5.0 - 12.0)      | 11.2<br>(8.4 - 13.0)     | 6.6<br>(5.5 - 9.6)       | 8.3<br>(7.3 - 14.0)      | 7.2<br>(6.0 - 8.7)       | 8.3<br>(6.1 - 16.0)      |
| Chemical Oxygen Demand (mg/kg)                                                              | 25000<br>(22000 - 28000) | 24000<br>(21000 - 25000) | 22000<br>(17000 - 23000) | 21000<br>(19000 - 24000) | 11000<br>(10000 - 13000) | 14000<br>(13000 - 16000) | 18000<br>(15000 - 25000) | 17000<br>(14000 - 23000) |
| Total Carbon (%w/w)                                                                         | 0.8<br>(0.7 - 0.9)       | 0.7<br>(0.6 - 0.8)       | 0.9<br>(0.8 - 1.2)       | 0.8<br>(0.8 - 0.9)       | 0.9<br>(0.7 - 1.0)       | 0.7<br>(0.6 - 0.7)       | 0.9<br>(0.6 - 1.0)       | 0.8<br>(0.6 - 1.0)       |
| Ammonical Nitrogen (mg/kg)                                                                  | 9.3<br>(0.1 - 32.0)      | 5.5<br>(0.1 - 14.0)      | 10.7<br>(2.1 - 24.0)     | 14.3<br>(6.0 - 22.0)     | 6.3<br>(2.3 - 11.0)      | 10.3<br>(2.6 - 37.0)     | 6.5<br>(1.7 - 13.0)      | 4.2<br>(1.3 - 7.6)       |
| Total Kjeldahl Nitrogen (mg/kg)                                                             | 581<br>(470 - 700)       | 522<br>(350 - 630)       | 625<br>(460 - 750)       | 728<br>(620 - 830)       | 374<br>(260 - 490)       | 407<br>(230 - 510)       | 380<br>(240 - 470)       | 388<br>(240 - 500)       |
| Total Phosphorus (mg/kg)                                                                    | 179<br>(160 - 220)       | 159<br>(140 - 200)       | 182<br>(140 - 210)       | 207<br>(180 - 230)       | 211<br>(160 - 240)       | 198<br>(150 - 230)       | 224<br>(200 - 270)       | 201<br>(160 - 250)       |
| Total Sulphide (mg/kg)                                                                      | 208<br>(84 - 400)        | 170<br>(30 - 320)        | 196<br>(100 - 330)       | 199<br>(77 - 430)        | 34<br>(15 - 70)          | 56<br>(31 - 100)         | 36<br>(12 - 72)          | 50<br>(8 - 140)          |
| Total Cyanide (mg/kg)                                                                       | 0.2<br>(<0.1 - 0.3)      | 0.1<br>(<0.1 - 0.2)      | 0.2<br>(<0.1 - 0.3)      | 0.2<br>(<0.1 - 0.2)      | 0.1<br>(<0.1 - 0.1)      | 0.1<br>(<0.1 - 0.2)      | <0.1<br>(<0.1 - <0.1)    | 0.1<br>(<0.1 - 0.1)      |
| Arsenic (mg/kg)                                                                             | 8.5<br>(6.6 - 11.0)      | 9.0<br>(5.9 - 13.0)      | 8.0<br>(6.6 - 9.4)       | 6.3<br>(5.5 - 7.3)       | 6.4<br>(4.6 - 7.5)       | 8.8<br>(7.8 - 12.0)      | 7.1<br>(6.0 - 7.9)       | 7.6<br>(6.1 - 9.2)       |
| Cadmium (mg/kg)                                                                             | 0.5<br>(0.3 - 0.8)       | 0.6<br>(0.4 - 0.7)       | 0.4<br>(0.2 - 0.6)       | 0.3<br>(0.2 - 0.3)       | 0.1<br>(<0.1 - 0.1)      | <0.1<br>(<0.1 - <0.1)    | <0.1<br>(<0.1 - <0.1)    | <0.1<br>(<0.1 - <0.1)    |
| Chromium (mg/kg)                                                                            | 27<br>(21 - 31)          | 24<br>(14 - 35)          | 25<br>(19 - 33)          | 35<br>(30 - 38)          | 24<br>(17 - 36)          | 34<br>(28 - 38)          | 32<br>(25 - 38)          | 34<br>(26 - 41)          |
| Copper (mg/kg)                                                                              | 44<br>(26 - 54)          | 43<br>(25 - 60)          | 27<br>(18 - 39)          | 23<br>(19 - 26)          | 11<br>(7 - 18)           | 22<br>(19 - 25)          | 19<br>(15 - 23)          | 28<br>(18 - 37)          |
| Lead (mg/kg)                                                                                | 86<br>(71 - 100)         | 102<br>(75 - 130)        | 69<br>(56 - 82)          | 53<br>(44 - 60)          | 27<br>(21 - 35)          | 36<br>(28 - 39)          | 34<br>(23 - 41)          | 38<br>(25 - 49)          |
| Mercury (mg/kg)                                                                             | 0.09<br>(0.05 - 0.13)    | 0.07<br>(<0.05 - 0.11)   | 0.06<br>(<0.05 - 0.10)   | 0.06<br>(<0.05 - 0.09)   | 0.06<br>(<0.05 - 0.08)   | 0.09<br>(0.07 - 0.11)    | 0.09<br>(0.07 - 0.10)    | 0.11<br>(0.08 - 0.14)    |
| Nickel (mg/kg)                                                                              | 17.6<br>(12 - 22)        | 15<br>(8 - 22)           | 17<br>(13 - 20)          | 26<br>(22 - 29)          | 17<br>(12 - 23)          | 23<br>(20 - 26)          | 23<br>(17 - 25)          | 22<br>(16 - 26)          |
| Silver (mg/kg)                                                                              | 0.6<br>(0.3 - 1.0)       | 0.6<br>(0.4 - 1.0)       | 0.4<br>(<0.2 - 1.0)      | 0.4<br>(0.2 - 1.0)       | 0.4<br>(<0.2 - 1.0)      | 0.4<br>(0.3 - 1.0)       | 0.4<br>(<0.2 - 1.0)      | 0.5<br>(<0.2 - 1.0)      |
| Zinc (mg/kg)                                                                                | 206<br>(140 - 320)       | 242<br>(170 - 380)       | 155<br>(75 - 220)        | 130<br>(110 - 150)       | 72<br>(56 - 110)         | 103<br>(93 - 120)        | 91<br>(75 - 110)         | 102<br>(75 - 120)        |
| Total Polychlorinated Biphenyls (PCBs)<br>(µg/kg) <sup>(3)</sup>                            | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          |
| Low Molecular Weight Polycyclic Aromatic<br>Hydrocarbons (PAHs) (µg/kg) <sup>(4) (6)</sup>  | 91<br>(90 - 98)          | 90<br>(90 - 94)          | 90<br>(90 - 90)          | 90<br>(90 - 93)          | 92<br>(90 - 110)         | 91<br>(90 - 94)          | 91<br>(90 - 95)          | 92<br>(90 - 100)         |
| High Molecular Weight Polycyclic Aromatic<br>Hydrocarbons (PAHs) (µg/kg) <sup>(5) (6)</sup> | 53<br>(31 - 120)         | 47<br>(21 - 100)         | 49<br>(23 - 87)          | 49<br>(16 - 72)          | 55<br>(26 - 190)         | 62<br>(30 - 130)         | 59<br>(23 - 110)         | 84<br>(40 - 130)         |

**Note:**

- 1 Data presented are arithmetic means ; data in brackets indicate ranges.
- 2 All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.
- 3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.
- 4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.
- 5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.
- 6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

## Summary statistics for bottom sediment quality in the Southern, Junk Bay and Deep Bay W CZs, 2002 - 2006

| Parameter                                                                                   | Lantau Island            |                         | Junk Bay                 | Inner Deep Bay           |                          | Outer Deep Bay           |                          |
|---------------------------------------------------------------------------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                                                                                             | (East)<br>SS5            | (South)<br>SS6          | JS2                      | DS1                      | DS2                      | DS3                      | DS4                      |
| Number of samples                                                                           | 10                       | 10                      | 10                       | 10                       | 10                       | 10                       | 10                       |
| Particle Size Fractionation <63µm (%w/w)                                                    | 93<br>(79 - 99)          | 67<br>(44 - 100)        | 88<br>(77 - 96)          | 65<br>(8 - 92)           | 79<br>(65 - 90)          | 83<br>(44 - 96)          | 58<br>(37 - 88)          |
| Electrochemical Potential (mV)                                                              | -197<br>(-299)-(-92))    | -148<br>(-207)-(-62))   | -230<br>(-323)-(-98))    | -263<br>(-366)-(-143))   | -179<br>(-272)-(-34))    | -169<br>(-237)-(-88))    | -151<br>(-210)-(-29))    |
| Total Solids (%w/w)                                                                         | 38<br>(35 - 41)          | 62<br>(55 - 66)         | 43<br>(40 - 48)          | 49<br>(43 - 58)          | 47<br>(43 - 52)          | 48<br>(45 - 54)          | 55<br>(46 - 67)          |
| Total Volatile Solids (%w/w)                                                                | 8.6<br>(7.5 - 9.9)       | 4.4<br>(3.6 - 5.2)      | 7.7<br>(6.0 - 9.5)       | 6.3<br>(4.3 - 7.8)       | 6.8<br>(5.0 - 8.3)       | 7.1<br>(5.8 - 9.8)       | 6.1<br>(4.0 - 8.1)       |
| Chemical Oxygen Demand (mg/kg)                                                              | 15000<br>(14000 - 17000) | 10000<br>(8800 - 12000) | 18000<br>(15000 - 19000) | 21000<br>(15000 - 25000) | 18000<br>(12000 - 22000) | 17000<br>(12000 - 18000) | 16000<br>(13000 - 19000) |
| Total Carbon (%w/w)                                                                         | 0.6<br>(0.5 - 0.6)       | 0.5<br>(0.5 - 0.6)      | 0.7<br>(0.6 - 0.8)       | 0.6<br>(0.4 - 0.7)       | 0.6<br>(0.5 - 0.7)       | 0.6<br>(0.5 - 0.7)       | 0.6<br>(0.5 - 0.8)       |
| Ammonical Nitrogen (mg/kg)                                                                  | 10.2<br>(0.2 - 21.0)     | 7.7<br>(0.3 - 21.0)     | 6.5<br>(0.8 - 12.0)      | 54.6<br>(2.5 - 230.0)    | 12.7<br>(0.1 - 53.0)     | 2.5<br>(0.1 - 7.9)       | 4.7<br>(0.1 - 15.0)      |
| Total Kjeldahl Nitrogen (mg/kg)                                                             | 500<br>(350 - 870)       | 275<br>(190 - 350)      | 449<br>(340 - 500)       | 376<br>(210 - 750)       | 404<br>(160 - 700)       | 323<br>(160 - 470)       | 249<br>(110 - 410)       |
| Total Phosphorus (mg/kg)                                                                    | 200<br>(150 - 340)       | 170<br>(130 - 210)      | 200<br>(170 - 230)       | 250<br>(110 - 580)       | 280<br>(140 - 380)       | 220<br>(120 - 320)       | 160<br>(77 - 240)        |
| Total Sulphide (mg/kg)                                                                      | 82<br>(36 - 150)         | 23<br>(2 - 59)          | 120<br>(19 - 210)        | 390<br>(22 - 1200)       | 140<br>(29 - 570)        | 62<br>(2 - 160)          | 13<br>(1 - 68)           |
| Total Cyanide (mg/kg)                                                                       | 0.1<br>(0.1 - 0.2)       | 0.1<br>(0.1 - 0.1)      | 0.1<br>(0.1 - 0.2)       | 0.2<br>(0.1 - 0.3)       | 0.2<br>(0.1 - 0.6)       | 0.1<br>(0.1 - 0.3)       | 0.1<br>(0.1 - 0.2)       |
| Arsenic (mg/kg)                                                                             | 8.3<br>(7.5 - 9.4)       | 5.8<br>(5.2 - 7.5)      | 7.7<br>(6.8 - 8.9)       | 11.0<br>(8.5 - 14.0)     | 12.0<br>(9.9 - 16.0)     | 13.0<br>(7.7 - 16.0)     | 12.0<br>(7.6 - 18.0)     |
| Cadmium (mg/kg)                                                                             | 0.1<br>(0.1 - 0.1)       | 0.1<br>(0.1 - 0.1)      | 0.2<br>(0.1 - 0.3)       | 0.3<br>(0.1 - 0.6)       | 0.3<br>(0.1 - 0.4)       | 0.3<br>(0.1 - 0.4)       | 0.1<br>(0.1 - 0.2)       |
| Chromium (mg/kg)                                                                            | 42<br>(34 - 46)          | 24<br>(20 - 32)         | 52<br>(47 - 65)          | 40<br>(28 - 56)          | 41<br>(22 - 50)          | 44<br>(24 - 53)          | 33<br>(16 - 47)          |
| Copper (mg/kg)                                                                              | 38<br>(30 - 41)          | 12<br>(8 - 15)          | 123<br>(95 - 150)        | 55<br>(16 - 100)         | 58<br>(26 - 91)          | 56<br>(12 - 77)          | 22<br>(9 - 64)           |
| Lead (mg/kg)                                                                                | 50<br>(41 - 57)          | 25<br>(22 - 32)         | 56<br>(42 - 110)         | 57<br>(39 - 86)          | 54<br>(30 - 60)          | 53<br>(32 - 69)          | 40<br>(29 - 58)          |
| Mercury (mg/kg)                                                                             | 0.10<br>(0.10 - 0.20)    | 0.06<br>(0.05 - 0.08)   | 0.30<br>(0.20 - 0.40)    | 0.10<br>(0.05 - 0.30)    | 0.10<br>(0.06 - 0.20)    | 0.10<br>(0.05 - 0.20)    | 0.06<br>(0.05 - 0.10)    |
| Nickel (mg/kg)                                                                              | 27.3<br>(22 - 32)        | 15.6<br>(13 - 22)       | 24.5<br>(20 - 28)        | 25.9<br>(18 - 33)        | 26.3<br>(14 - 37)        | 29.9<br>(16 - 37)        | 19.4<br>(15 - 31)        |
| Silver (mg/kg)                                                                              | 0.7<br>(0.5 - 1.0)       | 0.4<br>(0.2 - 1.0)      | 2.0<br>(2.0 - 3.0)       | 0.7<br>(0.2 - 2.0)       | 0.7<br>(0.2 - 1.0)       | 0.7<br>(0.2 - 1.0)       | 0.4<br>(0.2 - 1.0)       |
| Zinc (mg/kg)                                                                                | 139<br>(110 - 160)       | 67<br>(56 - 78)         | 153<br>(120 - 200)       | 184<br>(100 - 380)       | 174<br>(91 - 230)        | 158<br>(81 - 230)        | 86<br>(60 - 140)         |
| Total Polychlorinated Biphenyls (PCBs)<br>(µg/kg) <sup>(3)</sup>                            | 18<br>(18 - 18)          | 18<br>(18 - 18)         | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          |
| Low Molecular Weight Polycyclic Aromatic<br>Hydrocarbons (PAHs) (µg/kg) <sup>(4) (6)</sup>  | 90<br>(90 - 90)          | 90<br>(90 - 90)         | 96<br>(90 - 110)         | 92<br>(90 - 100)         | 92<br>(90 - 96)          | 93<br>(90 - 98)          | 91<br>(90 - 95)          |
| High Molecular Weight Polycyclic Aromatic<br>Hydrocarbons (PAHs) (µg/kg) <sup>(5) (6)</sup> | 63<br>(44 - 91)          | 23<br>(19 - 33)         | 220<br>(130 - 400)       | 99<br>(18 - 350)         | 94<br>(54 - 150)         | 90<br>(29 - 150)         | 41<br>(16 - 82)          |

Note: 1 Data presented are arithmetic means ; data in brackets indicate ranges.

2 All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.

3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.

5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

## Summary statistics for bottom sediment quality in the Port Shelter and Mirs Bay WCZs, 2002 - 2006

|                                                                                             | Inner Port<br>Shelter    | Outer<br>Port Shelter    | Starling<br>Inlet        | Crooked Island           | Port Island              | Mirs Bay<br>(North)      |                          |                          |
|---------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Parameter                                                                                   | PS3                      | PS5                      | PS6                      | MS1                      | MS2                      | MS7                      | MS17                     | MS3                      |
| Number of samples                                                                           | 10                       | 10                       | 10                       | 10                       | 10                       | 10                       | 10                       | 10                       |
| Particle Size Fractionation <63µm (%w/w)                                                    | 90<br>(82 - 96)          | 46<br>(8 - 77)           | 80<br>(73 - 85)          | 86<br>(78 - 95)          | 84<br>(21 - 99)          | 92<br>(85 - 99)          | 90<br>(84 - 98)          | 89<br>(73 - 96)          |
| Electrochemical Potential (mV)                                                              | -263<br>((-324)-(-170))  | -163<br>((-249)-(-92))   | -202<br>((-281)-(-73))   | -331<br>((-376)-(-263))  | -359<br>((-373)-(-341))  | -357<br>((-382)-(-319))  | -225<br>((-284)-(-152))  | -242<br>((-327)-(-181))  |
| Total Solids (%w/w)                                                                         | 36<br>(33 - 41)          | 55<br>(44 - 63)          | 48<br>(43 - 51)          | 41<br>(35 - 46)          | 32<br>(31 - 35)          | 30<br>(27 - 34)          | 37<br>(34 - 42)          | 39<br>(31 - 43)          |
| Total Volatile Solids (%w/w)                                                                | 13<br>(11.0 - 14.0)      | 8.2<br>(6.5 - 9.9)       | 9.4<br>(8.2 - 11.0)      | 8.3<br>(7.4 - 11.0)      | 10.5<br>(8.6 - 15.0)     | 11.3<br>(9.5 - 15.0)     | 10<br>(7.6 - 15.0)       | 9.8<br>(8.3 - 12.0)      |
| Chemical Oxygen Demand (mg/kg)                                                              | 19000<br>(15000 - 22000) | 13000<br>(10000 - 17000) | 15000<br>(14000 - 19000) | 21000<br>(19000 - 23000) | 19000<br>(17000 - 20000) | 19000<br>(17000 - 21000) | 19000<br>(16000 - 20000) | 18000<br>(16000 - 20000) |
| Total Carbon (%w/w)                                                                         | 1.1<br>(0.9 - 1.0)       | 1.8<br>(1.0 - 2.2)       | 1.2<br>(0.8 - 1.3)       | 0.7<br>(0.6 - 0.8)       | 0.7<br>(0.6 - 0.9)       | 0.7<br>(0.7 - 0.9)       | 0.8<br>(0.7 - 1.2)       | 0.8<br>(0.7 - 0.9)       |
| Ammonical Nitrogen (mg/kg)                                                                  | 8.4<br>(3.7 - 15.0)      | 7.3<br>(2.5 - 15.0)      | 7.0<br>(2.4 - 14.0)      | 14.6<br>(0.2 - 26.0)     | 15.5<br>(5.0 - 25.0)     | 12.0<br>(6.1 - 18.0)     | 7.8<br>(0.2 - 16.0)      | 4.5<br>(<0.1 - 11.0)     |
| Total Kjeldahl Nitrogen (mg/kg)                                                             | 588<br>(280 - 700)       | 379<br>(270 - 510)       | 426<br>(270 - 540)       | 503<br>(270 - 630)       | 640<br>(510 - 720)       | 685<br>(630 - 780)       | 639<br>(420 - 770)       | 546<br>(350 - 700)       |
| Total Phosphorus (mg/kg)                                                                    | 189<br>(87 - 230)        | 165<br>(120 - 210)       | 180<br>(110 - 240)       | 178<br>(120 - 250)       | 193<br>(170 - 240)       | 195<br>(170 - 240)       | 215<br>(190 - 270)       | 189<br>(120 - 230)       |
| Total Sulphide (mg/kg)                                                                      | 77<br>(16 - 270)         | 12<br>(3 - 36)           | 30<br>(6 - 57)           | 163<br>(31 - 350)        | 170<br>(81 - 340)        | 79<br>(29 - 190)         | 65<br>(20 - 180)         | 21<br>(5 - 55)           |
| Total Cyanide (mg/kg)                                                                       | 0.1<br>(<0.1 - 0.1)      | <0.1<br>(<0.1 - <0.1)    | 0.1<br>(<0.1 - 0.1)      | 0.2<br>(<0.1 - 0.2)      | 0.2<br>(<0.1 - 0.2)      | 0.1<br>(<0.1 - 0.2)      | 0.1<br>(<0.1 - 0.2)      | 0.1<br>(<0.1 - 0.1)      |
| Arsenic (mg/kg)                                                                             | 5.7<br>(4.7 - 6.5)       | 3.9<br>(2.3 - 5.3)       | 5.7<br>(5.1 - 6.6)       | 8.8<br>(7.5 - 10.0)      | 6.9<br>(5.8 - 9.0)       | 6.4<br>(5.7 - 8.3)       | 6.3<br>(4.4 - 7.5)       | 6.5<br>(5.1 - 8.6)       |
| Cadmium (mg/kg)                                                                             | <0.1<br>(<0.1 - <0.1)    | <0.1<br>(<0.1 - <0.1)    | <0.1<br>(<0.1 - <0.1)    | 0.3<br>(0.2 - 0.5)       | 0.3<br>(0.2 - 0.3)       | 0.2<br>(0.2 - 0.3)       | 0.1<br>(<0.1 - 0.2)      | 0.1<br>(<0.1 - 0.2)      |
| Chromium (mg/kg)                                                                            | 28<br>(25 - 31)          | 22<br>(15 - 30)          | 27<br>(23 - 30)          | 31<br>(26 - 35)          | 35<br>(28 - 40)          | 34<br>(32 - 38)          | 35<br>(25 - 41)          | 32<br>(27 - 37)          |
| Copper (mg/kg)                                                                              | 23<br>(18 - 29)          | 10<br>(7 - 17)           | 12<br>(11 - 14)          | 38<br>(32 - 42)          | 22<br>(19 - 26)          | 20<br>(18 - 22)          | 16<br>(12 - 20)          | 13<br>(11 - 16)          |
| Lead (mg/kg)                                                                                | 38<br>(32 - 43)          | 25<br>(20 - 37)          | 33<br>(31 - 35)          | 50<br>(38 - 55)          | 47<br>(39 - 51)          | 43<br>(36 - 51)          | 42<br>(28 - 53)          | 37<br>(32 - 42)          |
| Mercury (mg/kg)                                                                             | 0.10<br>(0.08 - 0.12)    | 0.05<br>(<0.05 - 0.07)   | 0.05<br>(<0.05 - 0.05)   | 0.09<br>(0.07 - 0.15)    | 0.06<br>(0.05 - 0.08)    | 0.07<br>(0.06 - 0.10)    | 0.06<br>(<0.05 - 0.06)   | 0.06<br>(<0.05 - 0.08)   |
| Nickel (mg/kg)                                                                              | 19<br>(16 - 23)          | 16<br>(11 - 24)          | 21<br>(17 - 24)          | 19<br>(15 - 24)          | 24<br>(20 - 27)          | 24<br>(22 - 27)          | 27<br>(18 - 31)          | 23<br>(19 - 28)          |
| Silver (mg/kg)                                                                              | 0.4<br>(<0.2 - 1.0)      | 0.4<br>(<0.2 - 1.0)      | 0.4<br>(<0.2 - 1.0)      | 1.1<br>(0.8 - 1.0)       | 0.4<br>(<0.2 - 1.0)      | 0.4<br>(<0.2 - 1.0)      | 0.4<br>(<0.2 - 1.0)      | 0.4<br>(<0.2 - 1.0)      |
| Zinc (mg/kg)                                                                                | 103<br>(85 - 120)        | 67<br>(43 - 98)          | 80<br>(67 - 90)          | 114<br>(80 - 140)        | 108<br>(77 - 120)        | 99<br>(78 - 110)         | 99<br>(66 - 120)         | 90<br>(60 - 160)         |
| Total Polychlorinated Biphenyls (PCBs)<br>(µg/kg) <sup>(3)</sup>                            | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          |
| Low Molecular Weight Polycyclic Aromatic<br>Hydrocarbons (PAHs) (µg/kg) <sup>(4) (6)</sup>  | 90<br>(90 - 90)          | 90<br>(90 - 90)          | 90<br>(90 - 90)          | 90<br>(90 - 90)          | 90<br>(90 - 95)          | 90<br>(90 - 94)          | 90<br>(90 - 90)          | 90<br>(90 - 90)          |
| High Molecular Weight Polycyclic Aromatic<br>Hydrocarbons (PAHs) (µg/kg) <sup>(5) (6)</sup> | 51<br>(24 - 60)          | 26<br>(17 - 37)          | 30<br>(20 - 46)          | 40<br>(29 - 58)          | 44<br>(24 - 73)          | 63<br>(28 - 200)         | 40<br>(29 - 54)          | 32<br>(20 - 49)          |

Note: 1 Data presented are arithmetic means ; data in brackets indicate ranges.

2 All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.

3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.

5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

# Summary statistics for bottom sediment quality in the Mirs Bay WCZ, 2002 - 2006

|                                                                                             | Mirs Bay<br>(North)      |                          | Long<br>Harbour          | Waglan<br>Island         | Mirs Bay<br>(South)     | Mirs Bay (Central)       |                          |                          |
|---------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|
| Parameter                                                                                   | MS4                      | MS5                      | MS6                      | MS8                      | MS13                    | MS14                     | MS15                     | MS16                     |
| Number of samples                                                                           | 10                       | 10                       | 10                       | 10                       | 10                      | 10                       | 10                       | 10                       |
| Particle Size Fractionation <63µm (%w/w)                                                    | 93<br>(85 - 96)          | 88<br>(78 - 95)          | 93<br>(85 - 97)          | 94<br>(83 - 98)          | 91<br>(83 - 96)         | 89<br>(77 - 94)          | 87<br>(81 - 92)          | 81<br>(71 - 85)          |
| Electrochemical Potential (mV)                                                              | -199<br>((-282)-(-109))  | -198<br>((-255)-(-95))   | -210<br>((-308)-(-104))  | -180<br>((-237)-(-146))  | -153<br>((-195)-(-104)) | -151<br>((-202)-(-77))   | -145<br>((-209)-(-78))   | -132<br>((-191)-(-39))   |
| Total Solids (%w/w)                                                                         | 36<br>(33 - 39)          | 41<br>(36 - 44)          | 34<br>(31 - 37)          | 47<br>(45 - 49)          | 49<br>(42 - 54)         | 50<br>(46 - 54)          | 51<br>(43 - 55)          | 55<br>(49 - 58)          |
| Total Volatile Solids (%w/w)                                                                | 9.6<br>(8.3 - 13.0)      | 8.6<br>(7.1 - 12.0)      | 11.6<br>(10.0 - 16.0)    | 7.3<br>(6.0 - 8.9)       | 6.7<br>(5.5 - 8.4)      | 6.8<br>(5.7 - 8.7)       | 6.5<br>(5.3 - 8.8)       | 6.5<br>(5.8 - 8.0)       |
| Chemical Oxygen Demand (mg/kg)                                                              | 16000<br>(15000 - 18000) | 16000<br>(15000 - 17000) | 19000<br>(17000 - 21000) | 12000<br>(10000 - 14000) | 11000<br>(9700 - 12000) | 11000<br>(9900 - 12000)  | 11000<br>(10000 - 13000) | 12000<br>(10000 - 14000) |
| Total Carbon (%w/w)                                                                         | 0.7<br>(0.6 - 0.7)       | 0.7<br>(0.6 - 0.9)       | 0.9<br>(0.8 - 1.0)       | 0.6<br>(0.5 - 0.6)       | 0.6<br>(0.5 - 0.6)      | 0.6<br>(0.5 - 0.6)       | 0.6<br>(0.5 - 0.6)       | 0.7<br>(0.5 - 0.7)       |
| Ammonical Nitrogen (mg/kg)                                                                  | 10.9<br>(0.1 - 20.0)     | 11.3<br>(0.1 - 23.0)     | 10.2<br>(0.4 - 21.0)     | 3.4<br>(0.3 - 9.3)       | 5.3<br>(0.8 - 21.0)     | 3.5<br>(0.1 - 9.1)       | 3.5<br>(0.2 - 9.5)       | 7.4<br>(0.9 - 37.0)      |
| Total Kjeldahl Nitrogen (mg/kg)                                                             | 620<br>(440 - 670)       | 583<br>(360 - 670)       | 752<br>(680 - 840)       | 435<br>(320 - 520)       | 435<br>(350 - 540)      | 418<br>(280 - 520)       | 412<br>(270 - 540)       | 414<br>(260 - 490)       |
| Total Phosphorus (mg/kg)                                                                    | 203<br>(140 - 230)       | 210<br>(140 - 240)       | 241<br>(220 - 290)       | 215<br>(190 - 240)       | 235<br>(210 - 260)      | 222<br>(190 - 260)       | 224<br>(180 - 260)       | 227<br>(170 - 260)       |
| Total Sulphide (mg/kg)                                                                      | 46<br>(8 - 86)           | 31<br>(5 - 97)           | 75<br>(22 - 210)         | 46<br>(2 - 180)          | 19<br>(1 - 70)          | 11<br>(2 - 20)           | 17<br>(7 - 27)           | 36<br>(6 - 210)          |
| Total Cyanide (mg/kg)                                                                       | 0.1<br>(<0.1 - 0.2)      | 0.1<br>(<0.1 - 0.1)      | 0.1<br>(<0.1 - 0.2)      | 0.1<br>(<0.1 - 0.2)      | <0.1<br>(<0.1 - <0.1)   | 0.1<br>(<0.1 - 0.1)      | 0.1<br>(<0.1 - 0.1)      | 0.09<br>(<0.1 - 0.1)     |
| Arsenic (mg/kg)                                                                             | 6.4<br>(4.9 - 7.9)       | 6.5<br>(5.4 - 7.8)       | 5.9<br>(5.0 - 7.5)       | 7.1<br>(6.6 - 9.0)       | 8.0<br>(6.4 - 15.0)     | 7.4<br>(6.5 - 8.3)       | 6.4<br>(5.6 - 7.1)       | 6.3<br>(4.9 - 7.0)       |
| Cadmium (mg/kg)                                                                             | 0.1<br>(<0.1 - 0.2)      | 0.1<br>(<0.1 - 0.2)      | 0.1<br>(<0.1 - 0.2)      | <0.1<br>(<0.1 - <0.1)    | <0.1<br>(<0.1 - <0.1)   | <0.1<br>(<0.1 - <0.1)    | <0.1<br>(<0.1 - <0.1)    | <0.1<br>(<0.1 - <0.1)    |
| Chromium (mg/kg)                                                                            | 36<br>(30 - 41)          | 32<br>(26 - 35)          | 32<br>(27 - 35)          | 33<br>(26 - 39)          | 34<br>(29 - 60)         | 31<br>(28 - 34)          | 30<br>(25 - 35)          | 27<br>(24 - 29)          |
| Copper (mg/kg)                                                                              | 16<br>(13 - 18)          | 14<br>(11 - 15)          | 17<br>(15 - 20)          | 14<br>(11 - 20)          | 13<br>(10 - 22)         | 12<br>(10 - 16)          | 11<br>(9 - 13)           | 9<br>(7 - 13)            |
| Lead (mg/kg)                                                                                | 41<br>(33 - 45)          | 42<br>(33 - 47)          | 43<br>(36 - 49)          | 33<br>(27 - 38)          | 32<br>(26 - 53)         | 31<br>(26 - 35)          | 31<br>(25 - 39)          | 29<br>(26 - 36)          |
| Mercury (mg/kg)                                                                             | 0.06<br>(<0.05 - 0.07)   | 0.05<br>(<0.05 - 0.06)   | 0.07<br>(0.06 - 0.10)    | 0.05<br>(<0.05 - 0.06)   | 0.05<br>(<0.05 - 0.08)  | <0.05<br>(<0.05 - <0.05) | 0.05<br>(<0.05 - 0.09)   | 0.05<br>(<0.05 - 0.05)   |
| Nickel (mg/kg)                                                                              | 27<br>(23 - 32)          | 25<br>(20 - 27)          | 25<br>(21 - 28)          | 26<br>(20 - 31)          | 27<br>(21 - 45)         | 24<br>(21 - 27)          | 23<br>(18 - 28)          | 21<br>(19 - 24)          |
| Silver (mg/kg)                                                                              | 0.4<br>(<0.2 - 1.0)      | 0.4<br>(<0.2 - 1.0)      | 0.4<br>(<0.2 - 1.0)      | 0.4<br>(<0.2 - 1.0)      | 0.4<br>(<0.2 - 1.0)     | 0.4<br>(<0.2 - 1.0)      | 0.4<br>(<0.2 - 1.0)      | 0.4<br>(<0.2 - 1.0)      |
| Zinc (mg/kg)                                                                                | 95<br>(66 - 110)         | 91<br>(62 - 100)         | 104<br>(78 - 120)        | 86<br>(59 - 100)         | 87<br>(56 - 160)        | 81<br>(58 - 92)          | 77<br>(53 - 95)          | 70<br>(54 - 82)          |
| Total Polychlorinated Biphenyls (PCBs)<br>(µg/kg) <sup>(3)</sup>                            | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)         | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          |
| Low Molecular Weight Polycyclic Aromatic<br>Hydrocarbons (PAHs) (µg/kg) <sup>(4) (6)</sup>  | 90<br>(90 - 90)          | 90<br>(90 - 90)          | 90<br>(90 - 90)          | 90<br>(90 - 90)          | 90<br>(90 - 90)         | 90<br>(90 - 90)          | 90<br>(90 - 90)          | 90<br>(90 - 90)          |
| High Molecular Weight Polycyclic Aromatic<br>Hydrocarbons (PAHs) (µg/kg) <sup>(5) (6)</sup> | 37<br>(28 - 50)          | 34<br>(22 - 44)          | 53<br>(35 - 69)          | 45<br>(22 - 120)         | 30<br>(21 - 47)         | 27<br>(18 - 40)          | 24<br>(19 - 36)          | 23<br>(19 - 29)          |

- Note:
- 1 Data presented are arithmetic means ; data in brackets indicate ranges.
  - 2 All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.
  - 3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.
  - 4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.
  - 5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.
  - 6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

## Summary statistics for bottom sediment quality in the North Western and Western Buffer WCZs, 2002 - 2006

|                                                                                          | Pearl Island             | Pillar Point             | Urmston Road             | Chek Lap Kok (North)    | Tsing Yi (South)         | Hong Kong Island (West)  |
|------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|-------------------------|--------------------------|--------------------------|
| Parameter                                                                                | NS2                      | NS3                      | NS4                      | NS6                     | WS1                      | WS2                      |
| Number of samples                                                                        | 10                       | 10                       | 10                       | 10                      | 9                        | 10                       |
| Particle Size Fractionation <63µm (%w/w)                                                 | 59<br>(35 - 77)          | 61<br>(23 - 87)          | 35<br>(12 - 61)          | 41<br>(10 - 81)         | 66<br>(27 - 93)          | 81<br>(66 - 93)          |
| Electrochemical Potential (mV)                                                           | -155<br>((-230)-(-101))  | -170<br>((-236)-(-86))   | -197<br>((-242)-(-161))  | -162<br>((-214)-(-58))  | -200<br>((-289)-(-108))  | -164<br>((-216)-(-93))   |
| Total Solids (%w/w)                                                                      | 55<br>(51 - 64)          | 58<br>(49 - 68)          | 62<br>(59 - 66)          | 64<br>(51 - 76)         | 50<br>(42 - 65)          | 47<br>(45 - 54)          |
| Total Volatile Solids (%w/w)                                                             | 6.4<br>(5.4 - 7.5)       | 5.8<br>(4.3 - 7.5)       | 5.2<br>(4.6 - 5.9)       | 4.6<br>(2.2 - 7.6)      | 6.5<br>(4.0 - 7.7)       | 7.0<br>(5.6 - 8.4)       |
| Chemical Oxygen Demand (mg/kg)                                                           | 15000<br>(13000 - 17000) | 16000<br>(13000 - 23000) | 15000<br>(12000 - 19000) | 12000<br>(7500 - 17000) | 17000<br>(11000 - 20000) | 15000<br>(11000 - 17000) |
| Total Carbon (%w/w)                                                                      | 0.8<br>(0.5 - 1.0)       | 0.7<br>(0.5 - 1.0)       | 0.7<br>(0.5 - 0.8)       | 0.5<br>(0.4 - 0.8)      | 0.7<br>(0.5 - 1.1)       | 0.6<br>(0.5 - 0.7)       |
| Ammonical Nitrogen (mg/kg)                                                               | 3.3<br>(0.1 - 8.2)       | 5.4<br>(0.1 - 16.0)      | 15.9<br>(0.2 - 30.0)     | 4.8<br>(0.1 - 13.0)     | 11.4<br>(4.8 - 23.0)     | 7.2<br>(0.9 - 30.0)      |
| Total Kjeldahl Nitrogen (mg/kg)                                                          | 303<br>(120 - 520)       | 305<br>(120 - 440)       | 269<br>(160 - 350)       | 254<br>(140 - 400)      | 367<br>(200 - 480)       | 374<br>(260 - 540)       |
| Total Phosphorus (mg/kg)                                                                 | 187<br>(84 - 290)        | 189<br>(86 - 250)        | 162<br>(92 - 210)        | 165<br>(100 - 260)      | 170<br>(110 - 230)       | 182<br>(140 - 210)       |
| Total Sulphide (mg/kg)                                                                   | 19<br>(1 - 64)           | 22<br>(5 - 65)           | 33<br>(3 - 77)           | 11<br>(2 - 38)          | 112<br>(13 - 210)        | 73<br>(5 - 200)          |
| Total Cyanide (mg/kg)                                                                    | 0.1<br>(<0.1 - 0.1)      | 0.2<br>(0.1 - 0.5)       | 0.1<br>(<0.1 - 0.1)      | 0.1<br>(<0.1 - 0.1)     | 0.1<br>(<0.1 - 0.3)      | 0.1<br>(<0.1 - 0.2)      |
| Arsenic (mg/kg)                                                                          | 9.4<br>(7.5 - 14.0)      | 11.1<br>(9.1 - 14.0)     | 10.2<br>(9.1 - 11.0)     | 9.9<br>(6.1 - 16.0)     | 8.2<br>(4.7 - 12.0)      | 10.5<br>(7.1 - 16.0)     |
| Cadmium (mg/kg)                                                                          | 0.1<br>(<0.1 - 0.1)      | 0.1<br>(<0.1 - 0.1)      | 0.1<br>(<0.1 - 0.1)      | 0.1<br>(<0.1 - 0.1)     | 0.1<br>(<0.1 - 0.2)      | 0.1<br>(<0.1 - 0.1)      |
| Chromium (mg/kg)                                                                         | 32<br>(24 - 43)          | 32<br>(20 - 42)          | 29<br>(23 - 36)          | 26<br>(15 - 37)         | 33<br>(13 - 41)          | 36<br>(32 - 40)          |
| Copper (mg/kg)                                                                           | 32<br>(27 - 43)          | 30<br>(18 - 48)          | 26<br>(18 - 42)          | 16<br>(8 - 27)          | 41<br>(9 - 58)           | 25<br>(20 - 29)          |
| Lead (mg/kg)                                                                             | 37<br>(32 - 50)          | 39<br>(27 - 45)          | 36<br>(29 - 46)          | 28<br>(17 - 46)         | 39<br>(15 - 53)          | 38<br>(34 - 43)          |
| Mercury (mg/kg)                                                                          | 0.09<br>(0.07 - 0.13)    | 0.13<br>(0.06 - 0.19)    | 0.09<br>(0.06 - 0.23)    | 0.06<br>(<0.05 - 0.10)  | 0.12<br>(<0.05 - 0.16)   | 0.07<br>(<0.05 - 0.09)   |
| Nickel (mg/kg)                                                                           | 20<br>(15 - 27)          | 20<br>(11 - 25)          | 18<br>(14 - 22)          | 17<br>(9 - 24)          | 20<br>(8 - 27)           | 23<br>(21 - 26)          |
| Silver (mg/kg)                                                                           | 0.5<br>(0.3 - 1.0)       | 0.4<br>(<0.2 - 1.0)      | 0.4<br>(<0.2 - 1.0)      | 0.4<br>(0.2 - 1.0)      | 1.0<br>(0.5 - 1.4)       | 0.5<br>(0.2 - 1.0)       |
| Zinc (mg/kg)                                                                             | 93<br>(73 - 130)         | 93<br>(61 - 120)         | 98<br>(67 - 110)         | 70<br>(34 - 100)        | 101<br>(31 - 130)        | 101<br>(82 - 120)        |
| Total Polychlorinated Biphenyls (PCBs) (µg/kg) <sup>(3)</sup>                            | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)          | 18<br>(18 - 18)         | 18<br>(18 - 18)          | 18<br>(18 - 18)          |
| Low Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg) <sup>(4) (5)</sup>  | 91<br>(90 - 95)          | 91<br>(90 - 95)          | 92<br>(90 - 99)          | 90<br>(90 - 94)         | 93<br>(90 - 100)         | 90<br>(90 - 93)          |
| High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg) <sup>(5) (6)</sup> | 58<br>(27 - 120)         | 65<br>(38 - 110)         | 63<br>(32 - 120)         | 26<br>(16 - 49)         | 140<br>(22 - 420)        | 55<br>(22-120)           |

Note: 1 Data presented are arithmetic means ; data in brackets indicate ranges.

2 All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.

3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.

5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.



## Summary statistics for bottom sediment quality in the Eastern Buffer and Victoria Harbour WCZs, 2002 - 2006

| Parameter                                                                                   | Eastern Buffer          |                         |                          | Victoria Harbour         |                          |                          | Rambler Channel          |                          |
|---------------------------------------------------------------------------------------------|-------------------------|-------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                                                                                             | Chai Wan<br>ES1         | Tathong Channel<br>ES2  | ES4                      | (East)<br>VS3            | (Central)<br>VS5         | (West)<br>VS6            | VS9                      | VS10                     |
| Number of samples                                                                           | 10                      | 10                      | 10                       | 10                       | 10                       | 9                        | 10                       | 10                       |
| Particle Size Fractionation <63µm (%w/w)                                                    | 46<br>(26 - 94)         | 69<br>(15 - 98)         | 54<br>(27 - 87)          | 65<br>(10 - 91)          | 87<br>(76 - 95)          | 56<br>(43 - 78)          | 79<br>(57 - 88)          | 80<br>(18 - 97)          |
| Electrochemical Potential (mV)                                                              | -190<br>((-272)-(-65))  | -175<br>((-286)-(-123)) | -249<br>((-349)-(-166))  | -306<br>((-390)-(-183))  | -369<br>((-409)-(-244))  | -331<br>((-384)-(-218))  | -221<br>((-323)-(-80))   | -250<br>((-365)-(-121))  |
| Total Solids (%w/w)                                                                         | 67<br>(51 - 71)         | 56<br>(38 - 66)         | 57<br>(47 - 70)          | 44<br>(35 - 73)          | 37<br>(31 - 40)          | 51<br>(37 - 70)          | 49<br>(40 - 53)          | 43<br>(34 - 66)          |
| Total Volatile Solids (%w/w)                                                                | 4.4<br>(3.7 - 6.6)      | 5.8<br>(4.3 - 7.9)      | 6.0<br>(4.5 - 7.3)       | 7.2<br>(3.2 - 9.6)       | 9.1<br>(6.8 - 10.0)      | 7.2<br>(5.0 - 8.8)       | 6.8<br>(5.5 - 8.4)       | 7.4<br>(4.1 - 9.0)       |
| Chemical Oxygen Demand (mg/kg)                                                              | 12000<br>(8700 - 27000) | 13000<br>(8000 - 21000) | 15000<br>(11000 - 21000) | 22000<br>(13000 - 26000) | 29000<br>(26000 - 32000) | 26000<br>(21000 - 32000) | 18000<br>(12000 - 23000) | 21000<br>(15000 - 27000) |
| Total Carbon (%w/w)                                                                         | 1.3<br>(0.8 - 2.0)      | 0.8<br>(0.7 - 0.9)      | 0.9<br>(0.6 - 1.1)       | 0.7<br>(0.5 - 0.9)       | 0.9<br>(0.7 - 1.0)       | 1.0<br>(0.7 - 2.0)       | 0.7<br>(0.6 - 1.1)       | 0.7<br>(0.6 - 0.9)       |
| Ammonical Nitrogen (mg/kg)                                                                  | 8.5<br>(1.5 - 22.0)     | 12.5<br>(2.3 - 67.0)    | 5.3<br>(2.5 - 9.0)       | 9.4<br>(0.4 - 20.0)      | 40<br>(9.6 - 86.0)       | 15.8<br>(4.8 - 42.0)     | 10.1<br>(0.1 - 49.0)     | 11.3<br>(3.3 - 32.0)     |
| Total Kjeldahl Nitrogen (mg/kg)                                                             | 267<br>(190 - 430)      | 384<br>(210 - 590)      | 379<br>(200 - 480)       | 546<br>(220 - 1200)      | 639<br>(500 - 710)       | 398<br>(170 - 540)       | 302<br>(130 - 440)       | 421<br>(300 - 530)       |
| Total Phosphorus (mg/kg)                                                                    | 134<br>(99 - 170)       | 186<br>(140 - 230)      | 164<br>(88 - 240)        | 203<br>(130 - 430)       | 212<br>(180 - 240)       | 212<br>(110 - 280)       | 153<br>(65 - 200)        | 203<br>(150 - 260)       |
| Total Sulphide (mg/kg)                                                                      | 43<br>(3 - 140)         | 49<br>(7 - 180)         | 125<br>(8 - 310)         | 285<br>(77 - 590)        | 756<br>(41 - 1700)       | 228<br>(100 - 490)       | 59<br>(3 - 460)          | 306<br>(19 - 1100)       |
| Total Cyanide (mg/kg)                                                                       | 0.1<br>(<0.1 - 0.1)     | 0.1<br>(<0.1 - 0.1)     | 0.1<br>(<0.1 - 0.2)      | 0.1<br>(<0.1 - 0.3)      | 0.3<br>(0.1 - 0.8)       | 0.2<br>(<0.1 - 0.3)      | 0.1<br>(<0.1 - 0.2)      | 0.3<br>(<0.1 - 0.5)      |
| Arsenic (mg/kg)                                                                             | 4.4<br>(3.5 - 5.6)      | 6.2<br>(4.9 - 7.1)      | 5.2<br>(3.5 - 7.6)       | 6.5<br>(0.9 - 9.0)       | 8.3<br>(7.6 - 10.0)      | 8.4<br>(6.6 - 11.0)      | 5.7<br>(3.8 - 8.5)       | 9.1<br>(4.9 - 11.0)      |
| Cadmium (mg/kg)                                                                             | 0.1<br>(<0.1 - 0.2)     | 0.1<br>(<0.1 - 0.1)     | 0.1<br>(<0.1 - 0.3)      | 0.4<br>(<0.1 - 0.6)      | 0.8<br>(0.6 - 1.0)       | 0.4<br>(0.2 - 0.5)       | 0.3<br>(<0.1 - 1.0)      | 0.7<br>(0.1 - 2.0)       |
| Chromium (mg/kg)                                                                            | 21<br>(13 - 36)         | 29<br>(20 - 41)         | 30<br>(22 - 45)          | 41<br>(12 - 59)          | 63<br>(54 - 70)          | 40<br>(30 - 52)          | 45<br>(27 - 76)          | 87<br>(27 - 190)         |
| Copper (mg/kg)                                                                              | 34<br>(17 - 87)         | 26<br>(16 - 42)         | 67<br>(49 - 110)         | 123<br>(27 - 190)        | 207<br>(180 - 250)       | 116<br>(76 - 210)        | 108<br>(11 - 280)        | 238<br>(65 - 760)        |
| Lead (mg/kg)                                                                                | 26<br>(18 - 48)         | 32<br>(21 - 50)         | 31<br>(23 - 40)          | 47<br>(24 - 65)          | 66<br>(53 - 84)          | 84<br>(50 - 130)         | 39<br>(21 - 81)          | 57<br>(42 - 76)          |
| Mercury (mg/kg)                                                                             | 0.19<br>(0.06 - 1.00)   | 0.08<br>(<0.05 - 0.10)  | 0.17<br>(0.10 - 0.30)    | 0.37<br>(0.05 - 0.72)    | 0.47<br>(0.40 - 0.57)    | 1.49<br>(0.29 - 8.00)    | 0.15<br>(<0.05 - 0.39)   | 0.21<br>(0.14 - 0.30)    |
| Nickel (mg/kg)                                                                              | 13<br>(9 - 18)          | 20<br>(14 - 27)         | 16<br>(12 - 21)          | 19<br>(6 - 27)           | 28<br>(23 - 31)          | 19<br>(14 - 28)          | 27<br>(19 - 43)          | 41<br>(12 - 110)         |
| Silver (mg/kg)                                                                              | 0.8<br>(0.2 - 2.0)      | 0.6<br>(0.2 - 1.0)      | 1.7<br>(1.0 - 3.0)       | 3.9<br>(<1.0 - 6.0)      | 8.8<br>(7.0 - 11.0)      | 3.4<br>(1.6 - 4.5)       | 1.9<br>(0.2 - 6.3)       | 5.6<br>(1.3 - 11.0)      |
| Zinc (mg/kg)                                                                                | 62<br>(42 - 100)        | 81<br>(54 - 120)        | 91<br>(72 - 140)         | 155<br>(17 - 250)        | 277<br>(230 - 340)       | 188<br>(120 - 240)       | 114<br>(62 - 210)        | 187<br>(90 - 260)        |
| Total Polychlorinated Biphenyls (PCBs)<br>(µg/kg) <sup>(3)</sup>                            | 18<br>(18 - 18)         | 18<br>(18 - 18)         | 18<br>(18 - 18)          | 19<br>(18 - 22)          | 20<br>(18 - 23)          | 28<br>(18 - 48)          | 19<br>(18 - 23)          | 21<br>(18 - 30)          |
| Low Molecular Weight Polycyclic Aromatic<br>Hydrocarbons (PAHs) (µg/kg) <sup>(4) (6)</sup>  | 94<br>(90 - 130)        | 93<br>(90 - 110)        | 95<br>(90 - 120)         | 110<br>(90 - 140)        | 120<br>(90 - 180)        | 170<br>(110 - 410)       | 90<br>(90 - 90)          | 91<br>(90 - 99)          |
| High Molecular Weight Polycyclic Aromatic<br>Hydrocarbons (PAHs) (µg/kg) <sup>(5) (6)</sup> | 100<br>(21 - 390)       | 79<br>(24 - 190)        | 185<br>(62 - 400)        | 380<br>(66 - 670)        | 570<br>(340 - 990)       | 1500<br>(360 - 5800)     | 73<br>(16 - 180)         | 170<br>(71 - 340)        |

Note: 1 Data presented are arithmetic means ; data in brackets indicate ranges.

2 All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.

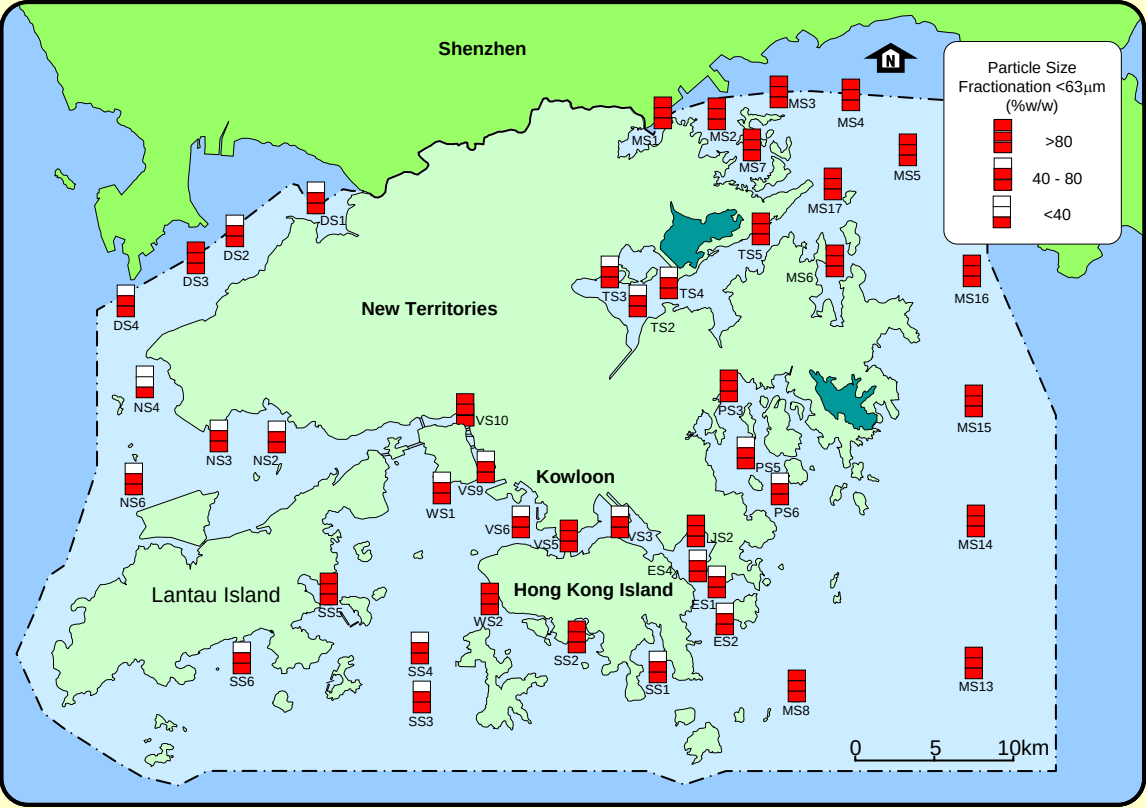
3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.

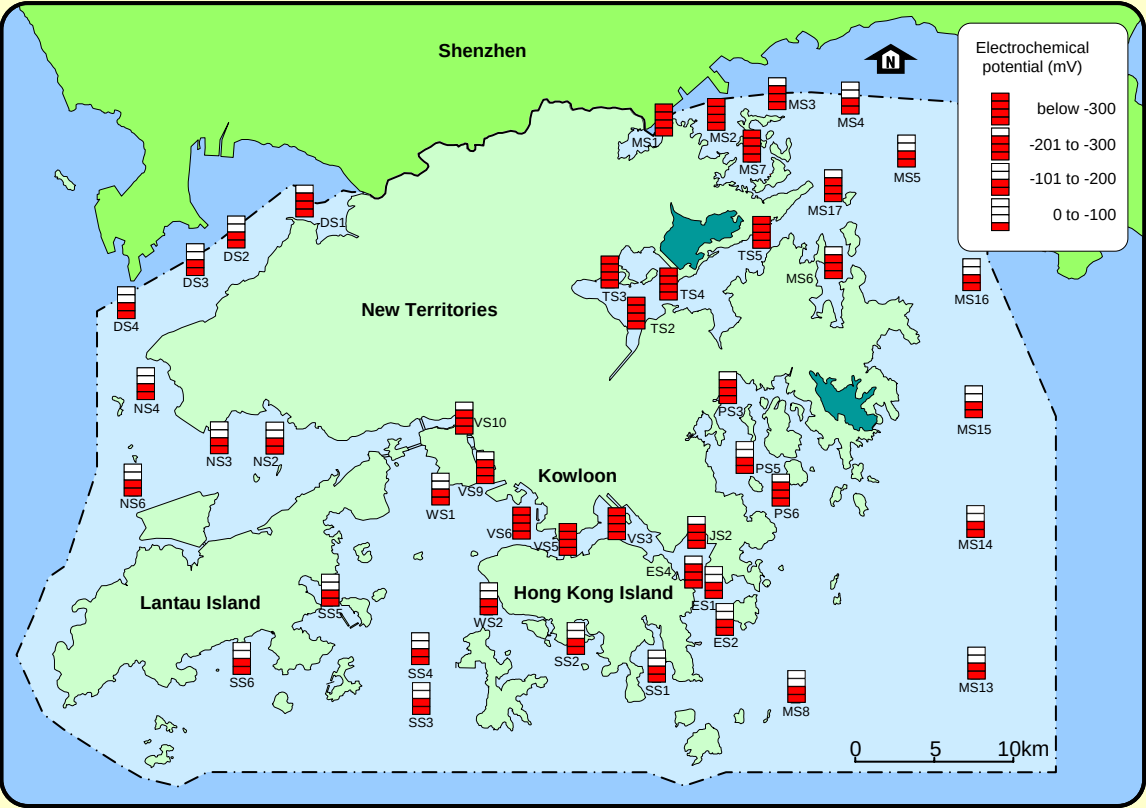
5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

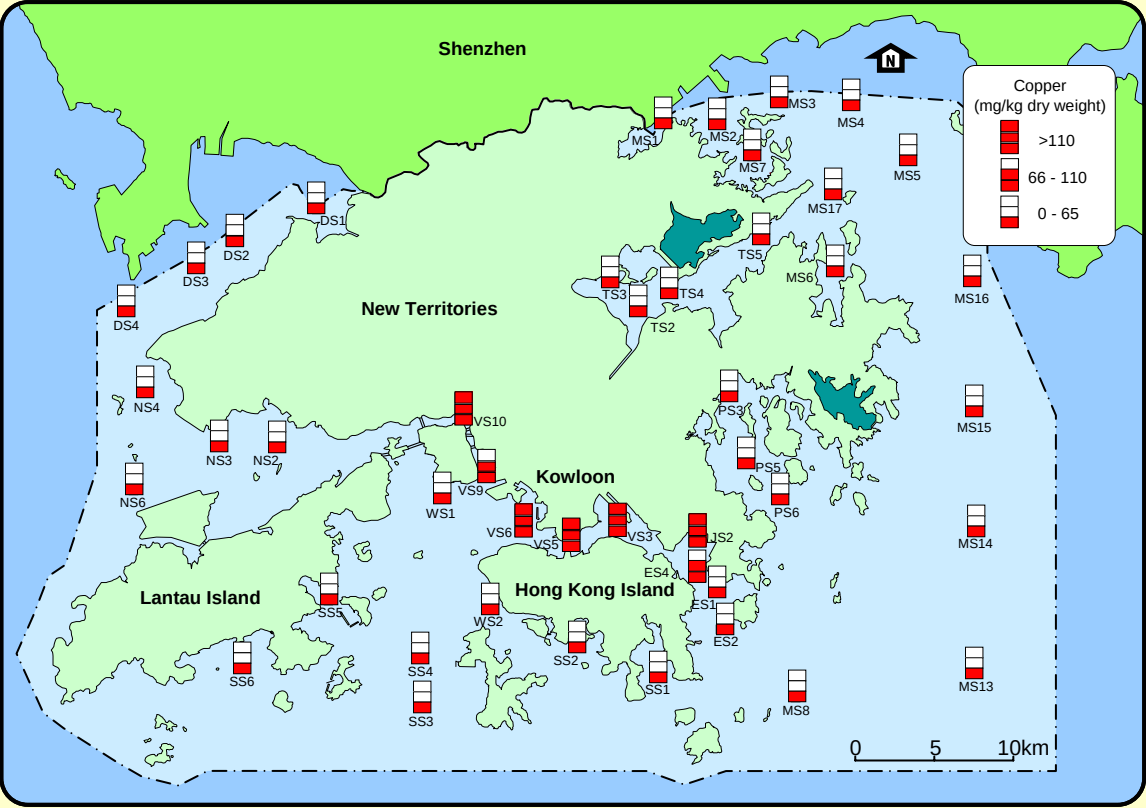
Particle Size Fractionation <63  $\mu\text{m}$  in marine sediments in Hong Kong, 2002 – 2006



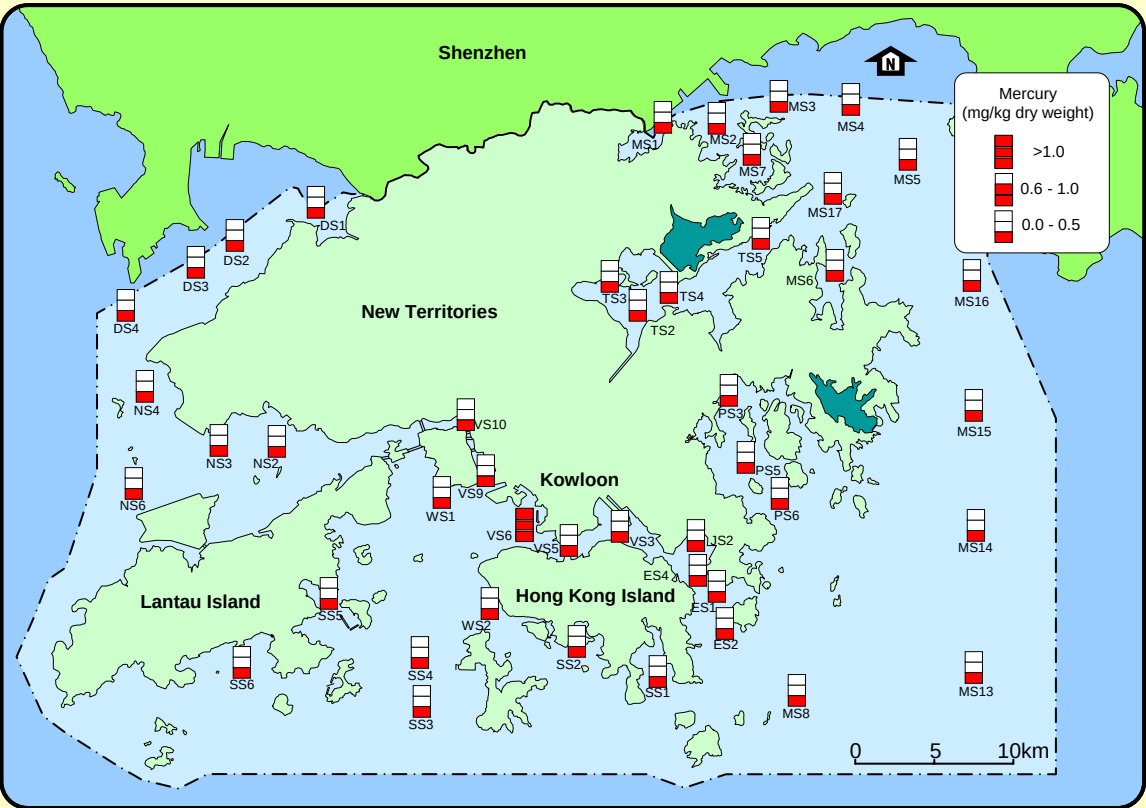
Electrochemical potential in marine sediments in Hong Kong, 2002 - 2006



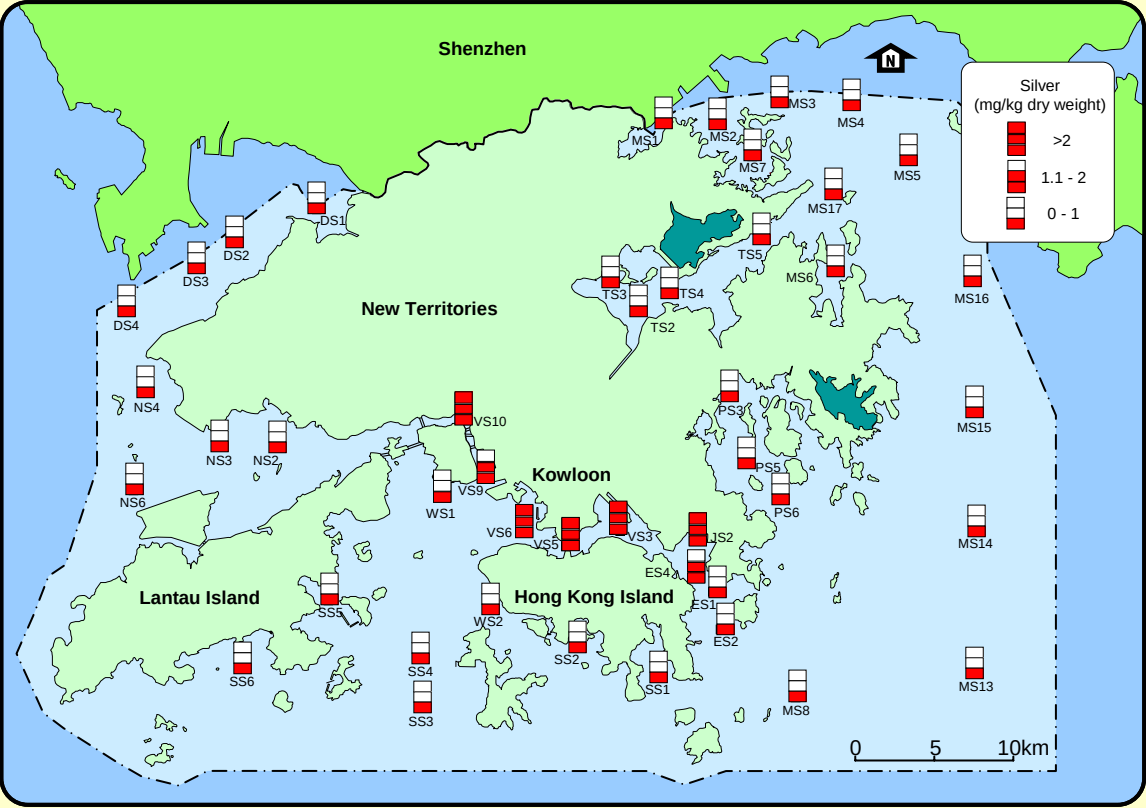
Copper in marine sediments in Hong Kong, 2002 - 2006



Mercury in marine sediments in Hong Kong, 2002 - 2006



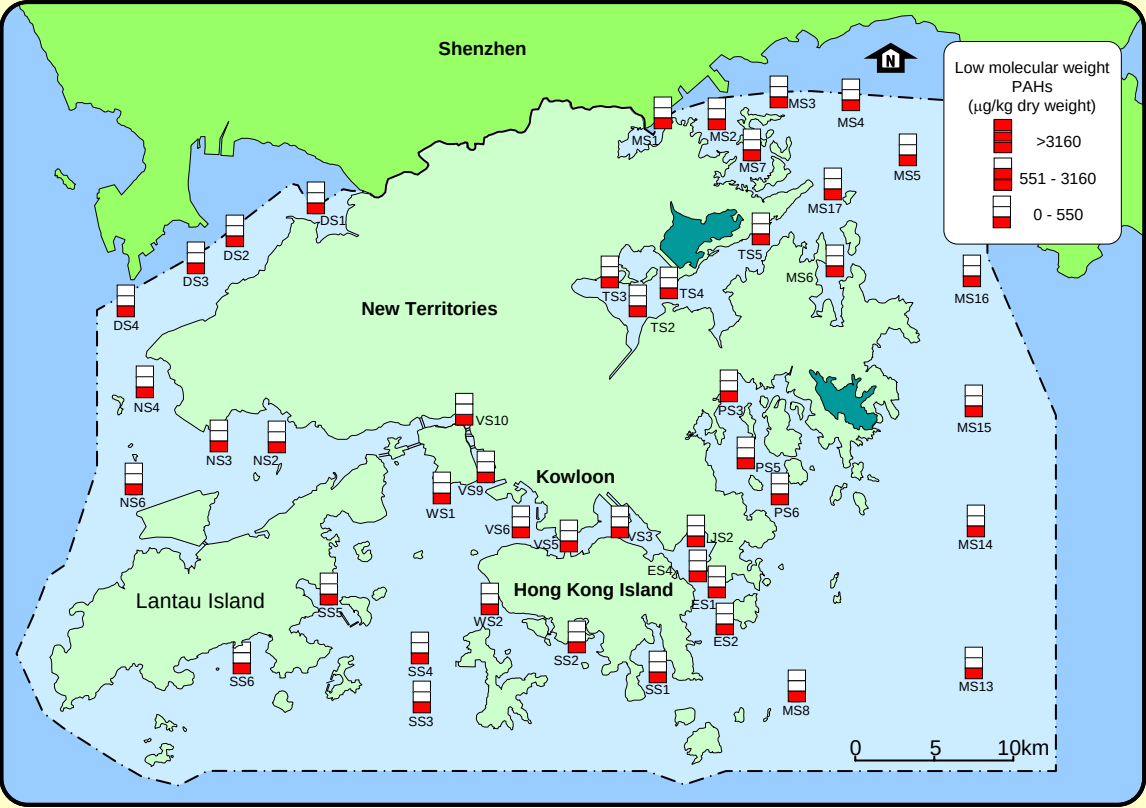
Silver in marine sediments in Hong Kong, 2002 - 2006



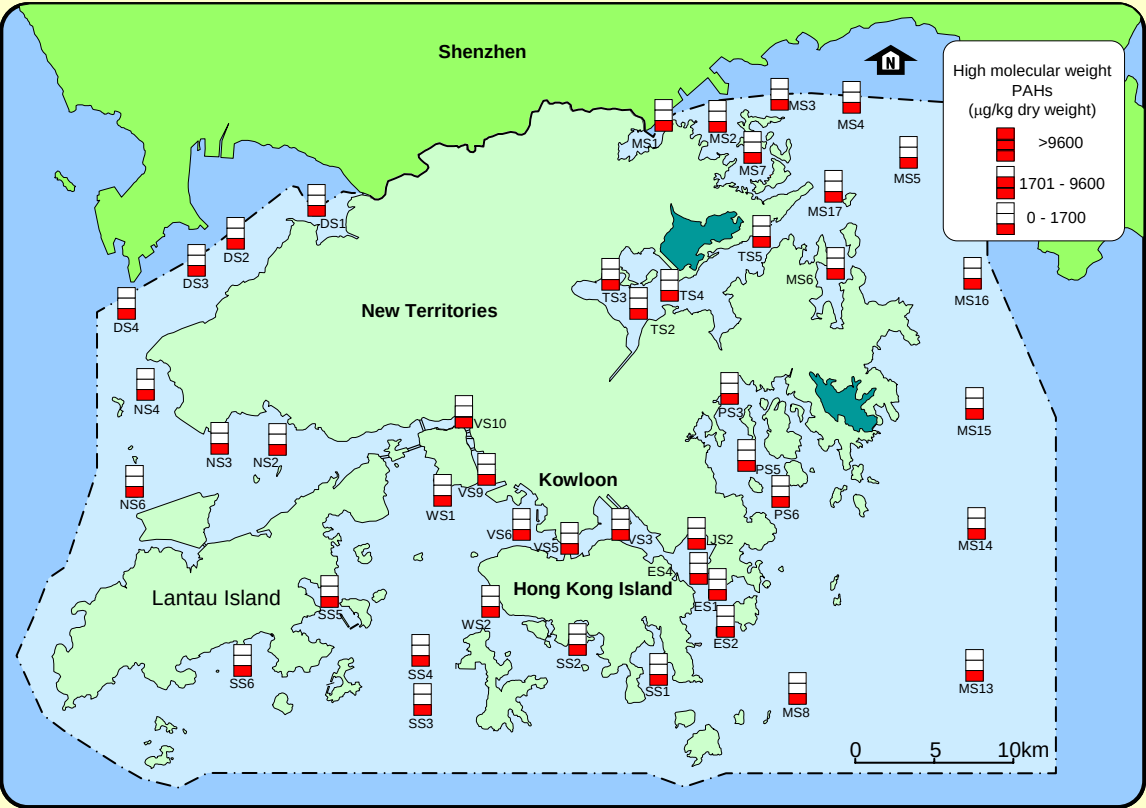
Total polychlorinated biphenyls (PCBs) in marine sediments in Hong Kong, 2002 - 2006



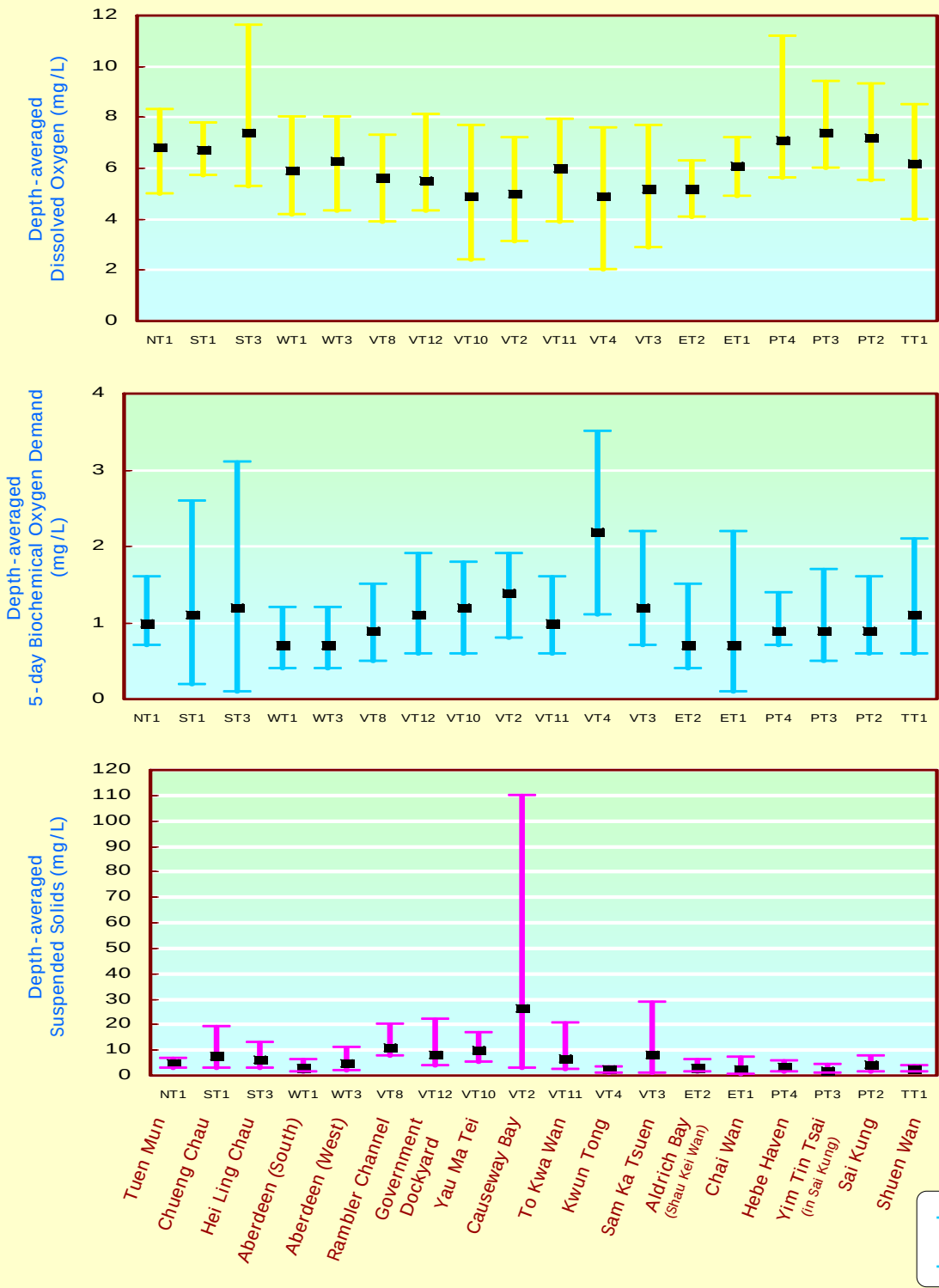
Low molecular weight polycyclic aromatic hydrocarbons (PAHs) in marine sediments in Hong Kong, 2002 - 2006



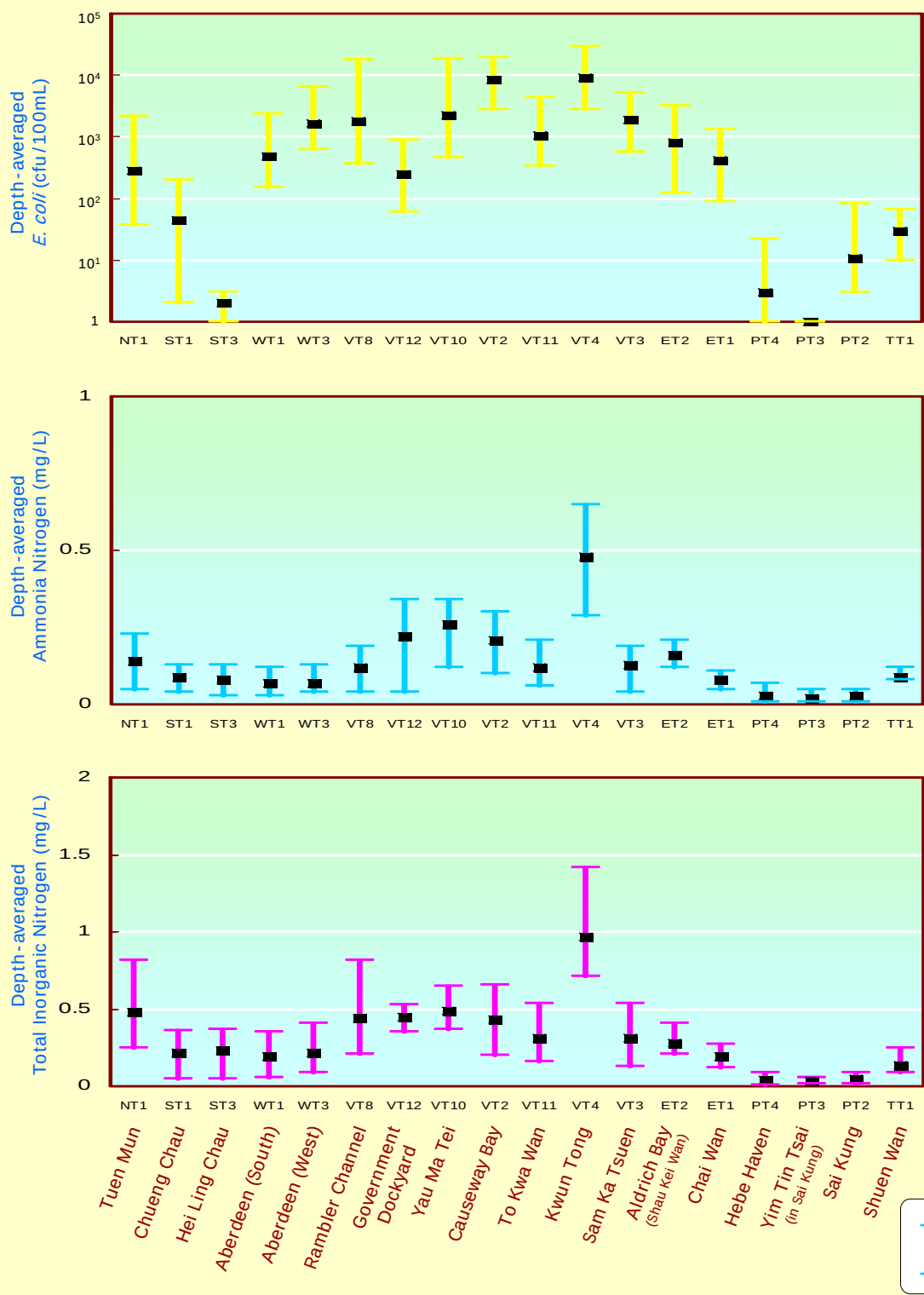
High molecular weight polycyclic aromatic hydrocarbons (PAHs) in marine sediments in Hong Kong, 2002 - 2006



Water quality of typhoon shelters in Hong Kong in 2006



Water quality of typhoon shelters in Hong Kong in 2006 (continued)



Results of the Seasonal Kendall Test for water quality trends in typhoon shelters, 1986 - 2006

| Monitoring Station                      |             | NT1               | ST1               | WT3               | WT1               | VT8               | VT10              | VT2               | VT11              |
|-----------------------------------------|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Monitoring Period                       |             | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1993<br> <br>2006 | 1986<br> <br>2006 | 1994<br> <br>2006 |
| Parameter                               | Water Depth |                   |                   |                   |                   |                   |                   |                   |                   |
| Temperature (°C)                        | Surface     | -                 | ↗                 | -                 | ↗                 | -                 | -                 | ↗                 | -                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | ↗                 | ↗                 | -                 | -                 |
|                                         | Bottom      | -                 | ↗                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Average     | -                 | ↗                 | -                 | -                 | ↗                 | -                 | ↗                 | -                 |
| Salinity                                | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (mg/L)                 | Surface     | ↗                 | -                 | -                 | -                 | ↗                 | -                 | ↗                 | ↗                 |
|                                         | Middle      | NA                | -                 | -                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                         | Bottom      | ↗                 | -                 | -                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                         | Average     | ↗                 | -                 | -                 | -                 | ↗                 | -                 | ↗                 | ↗                 |
| Dissolved Oxygen (%)                    | Surface     | ↗                 | -                 | -                 | -                 | ↗                 | -                 | ↗                 | ↗                 |
|                                         | Middle      | NA                | -                 | -                 | ↗                 | ↗                 | ↗                 | -                 | ↗                 |
|                                         | Bottom      | ↗                 | ↗                 | -                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                         | Average     | ↗                 | -                 | -                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
| pH                                      | Surface     | -                 | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | -                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 |
|                                         | Bottom      | -                 | -                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 |
|                                         | Average     | -                 | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 |
| Secchi disc depth (m)                   |             | ↗                 | -                 | ↗                 | ↗                 | -                 | ↗                 | ↗                 | -                 |
| Turbidity (NTU)                         | Surface     | ↗                 | -                 | -                 | -                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | ↗                 | -                 | ↗                 | ↗                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | ↗                 | -                 | ↗                 | ↗                 |
|                                         | Average     | -                 | -                 | -                 | -                 | ↗                 | -                 | ↗                 | ↗                 |
| Suspended Solids (mg/L)                 | Surface     | -                 | -                 | -                 | -                 | -                 | ↘                 | ↘                 | -                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Total volatile solids (mg/L)            | Surface     | -                 | -                 | ↘                 | ↘                 | -                 | -                 | ↘                 | -                 |
|                                         | Middle      | NA                | -                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 |
|                                         | Bottom      | -                 | -                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 |
|                                         | Average     | -                 | -                 | ↘                 | ↘                 | -                 | -                 | ↘                 | -                 |
| 5- day Biochemical Oxygen Demand (mg/L) | Surface     | -                 | ↘                 | -                 | -                 | ↘                 | -                 | ↘                 | -                 |
|                                         | Middle      | NA                | ↘                 | -                 | -                 | ↘                 | -                 | ↘                 | -                 |
|                                         | Bottom      | -                 | ↘                 | -                 | -                 | ↘                 | -                 | ↘                 | -                 |
|                                         | Average     | -                 | ↘                 | -                 | -                 | ↘                 | -                 | ↘                 | -                 |
| Ammonia nitrogen (mg/L)                 | Surface     | ↘                 | -                 | -                 | -                 | ↘                 | -                 | ↘                 | ↘                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                         | Average     | ↘                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Nitrite nitrogen (mg/L)                 | Surface     | ↗                 | -                 | -                 | -                 | ↗                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | ↗                 | -                 | -                 | -                 |
|                                         | Average     | ↗                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Nitrate nitrogen (mg/L)                 | Surface     | ↗                 | ↗                 | -                 | -                 | ↗                 | -                 | ↗                 | -                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | ↗                 | ↗                 | ↗                 | -                 |
|                                         | Bottom      | ↗                 | -                 | -                 | -                 | ↗                 | -                 | ↗                 | -                 |
|                                         | Average     | ↗                 | -                 | -                 | -                 | ↗                 | -                 | ↗                 | -                 |
| Total inorganic nitrogen (mg/L)         | Surface     | -                 | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                         | Bottom      | ↗                 | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                         | Average     | -                 | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
| Total Kjeldahl nitrogen (mg/L)          | Surface     | ↘                 | -                 | -                 | -                 | ↘                 | -                 | ↘                 | ↘                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | ↘                 | -                 | ↘                 | ↘                 |
|                                         | Average     | ↘                 | -                 | -                 | -                 | ↘                 | -                 | ↘                 | ↘                 |
| Total nitrogen (mg/L)                   | Surface     | ↘                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                         | Average     | ↘                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Orthophosphate phosphorus (mg/L)        | Surface     | ↘                 | -                 | -                 | -                 | ↘                 | -                 | ↘                 | ↘                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                         | Average     | ↘                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Total phosphorus (mg/L)                 | Surface     | ↘                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
|                                         | Average     | ↘                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 | ↘                 |
| Silica (mg/L)                           | Surface     | -                 | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
|                                         | Average     | -                 | -                 | -                 | -                 | -                 | ↘                 | ↘                 | ↘                 |
| Chlorophyll- <i>a</i> (µg/L)            | Surface     | ↗                 | -                 | -                 | ↗                 | -                 | ↗                 | -                 | -                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | ↗                 | ↗                 | -                 | -                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Average     | ↗                 | -                 | -                 | -                 | -                 | ↗                 | -                 | -                 |
| <i>E. coli</i> (cfu/100mL)              | Surface     | ↘                 | -                 | -                 | ↘                 | -                 | -                 | ↘                 | -                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | -                 | -                 | ↘                 | -                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | -                 | -                 | ↘                 | ↘                 |
|                                         | Average     | ↘                 | -                 | -                 | ↘                 | ↗                 | -                 | ↘                 | -                 |
| Faecal coliforms (cfu/100mL)            | Surface     | -                 | -                 | -                 | -                 | ↗                 | -                 | -                 | -                 |
|                                         | Middle      | NA                | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                         | Bottom      | -                 | -                 | -                 | -                 | ↗                 | -                 | -                 | -                 |
|                                         | Average     | -                 | -                 | -                 | -                 | ↗                 | -                 | -                 | -                 |

Note: 1. Results of the Seasonal Kendall Test statistically significant at  $p < 0.05$   
2. - indicates no significant trend  
3. NA (Not Applicable) indicates the measurements was not made due to shallow water  
4. VT12 has seven years of data only, which are insufficient to perform Seasonal Kendall Test  
5. ↗ significant increase  
6. ↘ significant decrease



Results of the Seasonal Kendall Test for water quality trends in typhoon shelters, 1986 - 2006  
(continued)

| Monitoring Station                     |             | VT4               | VT3               | ET2               | ET1               | PT4               | PT2               | PT3               | TT1               |
|----------------------------------------|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Monitoring Period                      |             | 1987<br> <br>2006 | 1986<br> <br>2006 | 1993<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 | 1986<br> <br>2006 |
| Parameter                              | Water Depth |                   |                   |                   |                   |                   |                   |                   |                   |
| Temperature (°C)                       | Surface     | -                 | ↗                 | -                 | ↗                 | ↗                 | ↗                 | ↗                 | ↗                 |
|                                        | Middle      | -                 | -                 | -                 | ↗                 | -                 | -                 | ↗                 | -                 |
|                                        | Bottom      | -                 | ↗                 | -                 | ↗                 | ↗                 | -                 | ↗                 | -                 |
|                                        | Average     | -                 | ↗                 | -                 | ↗                 | ↗                 | ↗                 | ↗                 | -                 |
| Salinity                               | Surface     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | -                 | -                 | ↗                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | -                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
| Dissolved Oxygen (mg/L)                | Surface     | ↗                 | ↗                 | ↗                 | -                 | ↘                 | ↗                 | -                 | ↘                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | -                 | -                 | ↗                 | -                 | -                 |
| Dissolved Oxygen (%)                   | Surface     | ↗                 | ↗                 | ↗                 | -                 | ↘                 | ↗                 | -                 | ↘                 |
|                                        | Middle      | ↗                 | ↗                 | ↗                 | ↗                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | ↗                 | -                 | -                 | -                 | -                 |
|                                        | Average     | ↗                 | ↗                 | ↗                 | -                 | -                 | ↗                 | -                 | -                 |
| pH                                     | Surface     | -                 | -                 | -                 | -                 | ↘                 | -                 | ↘                 | ↘                 |
|                                        | Middle      | ↗                 | -                 | -                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Bottom      | -                 | -                 | -                 | -                 | ↘                 | -                 | -                 | ↘                 |
|                                        | Average     | ↗                 | -                 | -                 | -                 | ↘                 | -                 | -                 | ↘                 |
| Secchi disc depth (m)                  |             | ↗                 | -                 | ↗                 | -                 | ↗                 | ↗                 | -                 | ↗                 |
| Turbidity (NTU)                        | Surface     | -                 | ↗                 | ↗                 | -                 | ↗                 | -                 | -                 | ↗                 |
|                                        | Middle      | -                 | ↗                 | ↗                 | -                 | -                 | -                 | ↗                 | ↗                 |
|                                        | Bottom      | ↗                 | ↗                 | ↗                 | -                 | ↗                 | -                 | ↗                 | ↗                 |
|                                        | Average     | -                 | ↗                 | ↗                 | -                 | ↗                 | -                 | -                 | ↗                 |
| Suspended Solids (mg/L)                | Surface     | ↘                 | ↘                 | ↘                 | -                 | ↘                 | -                 | -                 | ↘                 |
|                                        | Middle      | ↘                 | -                 | ↘                 | -                 | -                 | -                 | ↗                 | ↘                 |
|                                        | Bottom      | ↘                 | -                 | ↘                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 | -                 |
| Total volatile solids (mg/L)           | Surface     | ↘                 | ↘                 | -                 | ↘                 | ↘                 | -                 | -                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | -                 | ↘                 | -                 | -                 | -                 | -                 |
|                                        | Average     | ↘                 | ↘                 | -                 | ↘                 | ↘                 | -                 | -                 | -                 |
| 5-day Biochemical Oxygen Demand (mg/L) | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | -                 | ↘                 | -                 | -                 | -                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | -                 | -                 | ↘                 | -                 | -                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | -                 | ↘                 | ↘                 | -                 | ↘                 |
| Ammonia nitrogen (mg/L)                | Surface     | ↘                 | ↘                 | ↘                 | -                 | -                 | ↘                 | ↗                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | -                 | ↘                 | ↘                 | ↗                 | -                 |
| Nitrite nitrogen (mg/L)                | Surface     | ↗                 | -                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | ↗                 | -                 | ↘                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↗                 | -                 | ↘                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | ↗                 | -                 | ↘                 | -                 | -                 | -                 | -                 | -                 |
| Nitrate nitrogen (mg/L)                | Surface     | ↗                 | ↗                 | -                 | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Middle      | ↗                 | -                 | -                 | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Bottom      | ↗                 | -                 | ↘                 | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Average     | ↗                 | -                 | -                 | -                 | -                 | ↘                 | ↗                 | -                 |
| Total inorganic nitrogen (mg/L)        | Surface     | ↘                 | ↘                 | ↘                 | -                 | -                 | ↘                 | ↗                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | -                 | ↘                 | ↘                 | ↗                 | -                 |
| Total Kjeldahl nitrogen (mg/L)         | Surface     | ↘                 | ↘                 | ↘                 | -                 | ↘                 | -                 | ↗                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | ↗                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | -                 | ↘                 | -                 | ↗                 | -                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | ↗                 | -                 |
| Total nitrogen (mg/L)                  | Surface     | ↘                 | ↘                 | ↘                 | -                 | ↘                 | -                 | -                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | -                 | ↘                 | -                 | -                 | -                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | -                 | ↘                 | -                 | -                 | -                 |
| Orthophosphate phosphorus (mg/L)       | Surface     | ↗                 | ↘                 | ↘                 | -                 | -                 | ↘                 | -                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 | ↘                 |
|                                        | Average     | -                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 | ↘                 |
| Total phosphorus (mg/L)                | Surface     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 | ↘                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | ↘                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | -                 | ↘                 | -                 | -                 | ↘                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | ↘                 | ↘                 | -                 | -                 | ↘                 |
| Silica (mg/L)                          | Surface     | ↘                 | ↘                 | ↘                 | ↗                 | -                 | -                 | -                 | ↗                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | ↗                 | -                 | -                 | -                 | ↗                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 | ↗                 |
| Chlorophyll- <i>a</i> (µg/L)           | Surface     | ↗                 | ↗                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Middle      | ↗                 | ↗                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↗                 | ↗                 | -                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | ↗                 | ↗                 | -                 | -                 | -                 | -                 | -                 | -                 |
| <i>E. coli</i> (cfu/100mL)             | Surface     | ↘                 | ↘                 | ↘                 | -                 | ↘                 | ↘                 | -                 | -                 |
|                                        | Middle      | ↘                 | ↘                 | ↘                 | -                 | -                 | ↘                 | -                 | -                 |
|                                        | Bottom      | ↘                 | ↘                 | ↘                 | -                 | -                 | -                 | -                 | -                 |
|                                        | Average     | ↘                 | ↘                 | ↘                 | -                 | ↘                 | ↘                 | -                 | -                 |
| Faecal coliforms (cfu/100mL)           | Surface     | ↘                 | -                 | -                 | -                 | ↘                 | ↘                 | -                 | -                 |
|                                        | Middle      | ↘                 | -                 | -                 | ↗                 | -                 | -                 | -                 | -                 |
|                                        | Bottom      | ↘                 | -                 | ↘                 | -                 | ↘                 | -                 | -                 | -                 |
|                                        | Average     | ↘                 | -                 | ↘                 | -                 | ↘                 | ↘                 | -                 | -                 |

Note: 1. Results of the Seasonal Kendall Test statistically significant at  $p < 0.05$   
2. - indicates no significant trend  
3. ST3 has seven years of data only, which are insufficient to perform Seasonal Kendall Test  
4. ↗ significant increase  
5. ↘ significant decrease

## Summary of water quality statistics for typhoon shelters in 2006

| Parameter                              | Tuen Mun<br>NT1          | Cheung<br>Chau<br>ST1    | Hei Ling<br>Chau<br>ST3  | Aberdeen<br>(South)<br>WT1 | Aberdeen<br>(West)<br>WT3 | Rambler<br>Channel<br>VT8 |
|----------------------------------------|--------------------------|--------------------------|--------------------------|----------------------------|---------------------------|---------------------------|
| Number of samples                      | 6                        | 6                        | 6                        | 6                          | 6                         | 6                         |
| Temperature (°C)                       | 23.7<br>(18.1 - 29.1)    | 24.1<br>(18.4 - 27.7)    | 24.1<br>(18.4 - 27.8)    | 23.8<br>(16.8 - 27.6)      | 23.9<br>(16.8 - 28.8)     | 23.9<br>(17.5 - 29.0)     |
| Salinity                               | 27.7<br>(14.1 - 32.0)    | 31.8<br>(29.1 - 32.9)    | 31.5<br>(28.4 - 32.9)    | 31.4<br>(26.8 - 33.4)      | 30.7<br>(23.1 - 33.3)     | 28.5<br>(15.9 - 32.8)     |
| Dissolved Oxygen (mg/L)                | 6.8<br>(5.0 - 8.3)       | 6.7<br>(5.7 - 7.8)       | 7.4<br>(5.3 - 11.6)      | 5.9<br>(4.2 - 8.0)         | 6.3<br>(4.3 - 8.0)        | 5.6<br>(3.9 - 7.3)        |
| Bottom                                 | N.M.                     | 6.9<br>(5.7 - 8.2)       | 7.5<br>(5.2 - 11.2)      | 5.7<br>(3.9 - 7.9)         | 6.2<br>(3.7 - 7.7)        | 5.7<br>(3.6 - 7.5)        |
| Dissolved Oxygen (% Saturation)        | 95<br>(71 - 123)         | 96<br>(84 - 109)         | 106<br>(75 - 174)        | 82<br>(63 - 100)           | 89<br>(64 - 117)          | 78<br>(57 - 104)          |
| Bottom                                 | N.M.                     | 99<br>(84 - 122)         | 107<br>(75 - 167)        | 80<br>(57 - 99)            | 88<br>(55 - 114)          | 80<br>(53 - 107)          |
| pH                                     | 8.0<br>(7.7 - 8.1)       | 8.1<br>(8.0 - 8.3)       | 8.1<br>(8.0 - 8.3)       | 8.0<br>(7.8 - 8.2)         | 7.9<br>(7.8 - 8.1)        | 8.0<br>(7.8 - 8.4)        |
| Secchi Disc Depth (m)                  | 1.4<br>(1.2 - 1.7)       | 1.6<br>(1.4 - 1.8)       | 1.5<br>(1.2 - 2.1)       | 2.6<br>(1.2 - 4.0)         | 2.5<br>(1.5 - 3.4)        | 1.3<br>(0.6 - 1.7)        |
| Turbidity (NTU)                        | 20.4<br>(8.3 - 58.4)     | 14.3<br>(5.0 - 25.2)     | 13.3<br>(4.4 - 23.6)     | 9.6<br>(5.5 - 16.1)        | 10.1<br>(5.4 - 16.3)      | 20.0<br>(6.2 - 37.1)      |
| Suspended Solids (mg/L)                | 4.8<br>(3.0 - 6.6)       | 7.7<br>(2.8 - 19.1)      | 6.3<br>(3.1 - 13.0)      | 3.1<br>(1.4 - 6.1)         | 5.0<br>(1.7 - 11.1)       | 11.1<br>(7.5 - 20.3)      |
| 5-day Biochemical Oxygen Demand (mg/L) | 1.0<br>(0.7 - 1.6)       | 1.1<br>(0.2 - 2.6)       | 1.2<br>(0.1 - 3.1)       | 0.7<br>(0.4 - 1.2)         | 0.7<br>(0.4 - 1.2)        | 0.9<br>(0.5 - 1.5)        |
| Ammonia Nitrogen (mg/L)                | 0.14<br>(0.05 - 0.23)    | 0.09<br>(0.04 - 0.13)    | 0.08<br>(0.03 - 0.13)    | 0.07<br>(0.03 - 0.12)      | 0.07<br>(0.04 - 0.13)     | 0.12<br>(0.04 - 0.19)     |
| Unionised Ammonia (mg/L)               | 0.005<br>(0.002 - 0.013) | 0.005<br>(0.002 - 0.008) | 0.004<br>(0.001 - 0.008) | 0.003<br>(0.001 - 0.007)   | 0.003<br>(0.001 - 0.007)  | 0.004<br>(0.003 - 0.006)  |
| Nitrite Nitrogen (mg/L)                | 0.053<br>(0.019 - 0.100) | 0.025<br>(0.002 - 0.072) | 0.031<br>(0.003 - 0.091) | 0.018<br>(0.002 - 0.031)   | 0.023<br>(0.003 - 0.045)  | 0.047<br>(0.009 - 0.093)  |
| Nitrate Nitrogen (mg/L)                | 0.29<br>(0.14 - 0.70)    | 0.10<br>(0.01 - 0.20)    | 0.11<br>(0.01 - 0.21)    | 0.11<br>(0.02 - 0.25)      | 0.13<br>(0.03 - 0.33)     | 0.28<br>(0.08 - 0.69)     |
| Total Inorganic Nitrogen (mg/L)        | 0.48<br>(0.25 - 0.82)    | 0.22<br>(0.05 - 0.36)    | 0.23<br>(0.05 - 0.37)    | 0.19<br>(0.06 - 0.35)      | 0.22<br>(0.09 - 0.41)     | 0.44<br>(0.21 - 0.82)     |
| Total Kjeldahl Nitrogen (mg/L)         | 0.35<br>(0.24 - 0.45)    | 0.25<br>(0.21 - 0.28)    | 0.26<br>(0.18 - 0.33)    | 0.21<br>(0.15 - 0.27)      | 0.22<br>(0.17 - 0.26)     | 0.31<br>(0.26 - 0.34)     |
| Total Nitrogen (mg/L)                  | 0.69<br>(0.45 - 1.23)    | 0.38<br>(0.21 - 0.51)    | 0.40<br>(0.23 - 0.51)    | 0.33<br>(0.17 - 0.53)      | 0.37<br>(0.21 - 0.63)     | 0.63<br>(0.40 - 1.12)     |
| Orthophosphate Phosphorus (mg/L)       | 0.024<br>(0.006 - 0.035) | 0.016<br>(0.003 - 0.026) | 0.016<br>(0.002 - 0.026) | 0.013<br>(0.009 - 0.020)   | 0.013<br>(0.006 - 0.021)  | 0.024<br>(0.011 - 0.036)  |
| Total Phosphorus (mg/L)                | 0.04<br>(0.04 - 0.05)    | 0.04<br>(0.03 - 0.04)    | 0.03<br>(0.03 - 0.04)    | 0.03<br>(0.02 - 0.04)      | 0.03<br>(0.02 - 0.04)     | 0.04<br>(0.04 - 0.06)     |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 1.5<br>(0.1 - 2.9)       | 0.8<br>(0.1 - 1.3)       | 0.7<br>(0.1 - 1.2)       | 0.8<br>(0.4 - 1.5)         | 0.8<br>(0.5 - 1.4)        | 1.4<br>(0.4 - 2.6)        |
| Chlorophyll-a (µg/L)                   | 9.8<br>(1.6 - 40.0)      | 6.7<br>(1.5 - 22.7)      | 8.4<br>(1.6 - 33.0)      | 2.3<br>(0.8 - 4.0)         | 3.3<br>(1.2 - 7.1)        | 6.8<br>(1.1 - 25.3)       |
| <i>E. coli</i> (cfu/100mL)             | 280<br>(38 - 2200)       | 45<br>(2 - 200)          | 1<br>(1 - 3)             | 470<br>(160 - 2300)        | 1600<br>(630 - 6400)      | 1800<br>(370 - 18000)     |
| Faecal Coliforms (cfu/100mL)           | 2100<br>(130 - 13000)    | 150<br>(5 - 1000)        | 4<br>(2 - 7)             | 1500<br>(590 - 5000)       | 3100<br>(1300 - 8600)     | 4700<br>(850 - 49000)     |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

4. N.M. - not measured

## Summary of water quality statistics for typhoon shelters in 2006

| Parameter                              | Government<br>Dockyard<br>VT12 | Yau Ma<br>Tei<br>VT10    | Causeway<br>Bay<br>VT2   | To Kwa<br>Wan<br>VT11    | Kwun<br>Tong<br>VT4      | Sam Ka<br>Tsuen<br>VT3   |
|----------------------------------------|--------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Number of samples                      | 6                              | 6                        | 6                        | 6                        | 6                        | 6                        |
| Temperature (°C)                       | 24.3<br>(18.0 - 29.2)          | 24.0<br>(17.6 - 28.8)    | 23.7<br>(17.5 - 28.7)    | 23.5<br>(17.2 - 28.6)    | 23.9<br>(17.5 - 28.8)    | 23.5<br>(17.4 - 28.8)    |
| Salinity                               | 29.2<br>(20.8 - 32.2)          | 29.4<br>(20.3 - 32.3)    | 29.7<br>(20.1 - 32.4)    | 30.5<br>(21.8 - 32.7)    | 29.3<br>(23.2 - 31.4)    | 30.5<br>(21.8 - 32.6)    |
| Dissolved Oxygen (mg/L)                | 5.5<br>(4.3 - 8.1)             | 4.9<br>(2.4 - 7.7)       | 5.0<br>(3.1 - 6.5)       | 6.0<br>(3.9 - 7.9)       | 4.9<br>(2.0 - 7.6)       | 5.2<br>(2.9 - 7.7)       |
| Bottom                                 | 5.7<br>(4.5 - 8.4)             | 4.9<br>(2.3 - 7.7)       | 4.6<br>(3.0 - 6.5)       | 6.0<br>(3.7 - 8.0)       | 4.7<br>(1.8 - 7.4)       | 4.5<br>(2.9 - 5.4)       |
| Dissolved Oxygen (% Saturation)        | 77<br>(59 - 118)               | 68<br>(35 - 112)         | 70<br>(45 - 105)         | 83<br>(56 - 115)         | 68<br>(29 - 112)         | 73<br>(42 - 112)         |
| Bottom                                 | 81<br>(62 - 123)               | 69<br>(34 - 113)         | 63<br>(44 - 82)          | 84<br>(54 - 117)         | 66<br>(26 - 110)         | 64<br>(42 - 80)          |
| pH                                     | 7.9<br>(7.7 - 8.4)             | 7.9<br>(7.6 - 8.3)       | 7.9<br>(7.6 - 8.3)       | 8.0<br>(7.7 - 8.3)       | 7.7<br>(7.4 - 8.1)       | 7.9<br>(7.7 - 8.2)       |
| Secchi Disc Depth (m)                  | 1.6<br>(1.1 - 2.0)             | 1.4<br>(1.1 - 1.7)       | 1.3<br>(0.4 - 1.9)       | 1.7<br>(0.9 - 2.5)       | 1.4<br>(1.0 - 2.0)       | 1.7<br>(0.9 - 2.7)       |
| Turbidity (NTU)                        | 15.7<br>(5.5 - 29.9)           | 17.6<br>(12.6 - 28.9)    | 25.5<br>(5.1 - 98.4)     | 14.8<br>(9.0 - 22.1)     | 12.7<br>(4.1 - 30.1)     | 16.6<br>(6.5 - 33.9)     |
| Suspended Solids (mg/L)                | 8.0<br>(3.8 - 22.0)            | 10.3<br>(5.4 - 16.9)     | 26.3<br>(2.9 - 110.0)    | 6.7<br>(2.4 - 20.6)      | 2.6<br>(1.2 - 3.5)       | 8.0<br>(1.2 - 28.7)      |
| 5-day Biochemical Oxygen Demand (mg/L) | 1.1<br>(0.6 - 1.9)             | 1.2<br>(0.6 - 1.8)       | 1.4<br>(0.8 - 1.9)       | 1.0<br>(0.6 - 1.6)       | 2.2<br>(1.1 - 3.5)       | 1.2<br>(0.7 - 2.2)       |
| Ammonia Nitrogen (mg/L)                | 0.22<br>(0.04 - 0.34)          | 0.26<br>(0.12 - 0.34)    | 0.21<br>(0.10 - 0.30)    | 0.12<br>(0.06 - 0.21)    | 0.48<br>(0.29 - 0.65)    | 0.13<br>(0.04 - 0.19)    |
| Unionised Ammonia (mg/L)               | 0.007<br>(0.005 - 0.011)       | 0.008<br>(0.004 - 0.014) | 0.007<br>(0.003 - 0.011) | 0.004<br>(0.002 - 0.006) | 0.011<br>(0.005 - 0.016) | 0.004<br>(0.002 - 0.008) |
| Nitrite Nitrogen (mg/L)                | 0.034<br>(0.019 - 0.060)       | 0.037<br>(0.018 - 0.063) | 0.035<br>(0.014 - 0.074) | 0.029<br>(0.012 - 0.059) | 0.157<br>(0.082 - 0.227) | 0.030<br>(0.009 - 0.058) |
| Nitrate Nitrogen (mg/L)                | 0.20<br>(0.11 - 0.43)          | 0.20<br>(0.10 - 0.47)    | 0.19<br>(0.08 - 0.49)    | 0.16<br>(0.05 - 0.42)    | 0.34<br>(0.22 - 0.64)    | 0.16<br>(0.07 - 0.39)    |
| Total Inorganic Nitrogen (mg/L)        | 0.45<br>(0.35 - 0.53)          | 0.49<br>(0.37 - 0.65)    | 0.43<br>(0.20 - 0.66)    | 0.31<br>(0.13 - 0.54)    | 0.97<br>(0.71 - 1.42)    | 0.31<br>(0.13 - 0.54)    |
| Total Kjeldahl Nitrogen (mg/L)         | 0.45<br>(0.29 - 0.53)          | 0.52<br>(0.34 - 0.64)    | 0.53<br>(0.47 - 0.56)    | 0.34<br>(0.28 - 0.41)    | 0.83<br>(0.66 - 1.01)    | 0.35<br>(0.27 - 0.41)    |
| Total Nitrogen (mg/L)                  | 0.69<br>(0.60 - 0.78)          | 0.75<br>(0.66 - 0.89)    | 0.74<br>(0.57 - 1.03)    | 0.53<br>(0.39 - 0.80)    | 1.33<br>(1.02 - 1.82)    | 0.53<br>(0.35 - 0.82)    |
| Orthophosphate Phosphorus (mg/L)       | 0.039<br>(0.008 - 0.057)       | 0.040<br>(0.010 - 0.056) | 0.040<br>(0.008 - 0.055) | 0.028<br>(0.007 - 0.050) | 0.214<br>(0.153 - 0.295) | 0.028<br>(0.003 - 0.046) |
| Total Phosphorus (mg/L)                | 0.07<br>(0.05 - 0.09)          | 0.07<br>(0.04 - 0.10)    | 0.08<br>(0.07 - 0.13)    | 0.05<br>(0.04 - 0.06)    | 0.26<br>(0.20 - 0.36)    | 0.05<br>(0.02 - 0.07)    |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 0.8<br>(0.3 - 1.6)             | 0.9<br>(0.3 - 2.1)       | 1.0<br>(0.3 - 2.1)       | 0.7<br>(0.2 - 1.6)       | 1.0<br>(0.4 - 1.8)       | 0.7<br>(0.2 - 1.7)       |
| Chlorophyll-a (µg/L)                   | 8.3<br>(1.0 - 16.0)            | 6.5<br>(1.1 - 14.0)      | 6.9<br>(1.0 - 245.0)     | 7.9<br>(1.0 - 20.5)      | 18.2<br>(1.0 - 35.0)     | 5.5<br>(0.9 - 17.0)      |
| <i>E. coli</i> (cfu/100mL)             | 240<br>(60 - 890)              | 2200<br>(460 - 19000)    | 8300<br>(2800 - 19000)   | 1100<br>(340 - 4400)     | 9200<br>(2800 - 29000)   | 1900<br>(570 - 5200)     |
| Faecal Coliforms (cfu/100mL)           | 1000<br>(180 - 3900)           | 7100<br>(1300 - 72000)   | 24000<br>(6900 - 73000)  | 2600<br>(860 - 8300)     | 22000<br>(4400 - 78000)  | 4900<br>(900 - 21000)    |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

## Summary of water quality statistics for typhoon shelters in 2006

| Parameter                              | Aldrich Bay<br>(Shau Kei Wan)<br>ET2 | Chai Wan<br>ET1          | Hebe Haven<br>PT4         | Yim Tin Tsai<br>PT3      | Sai Kung<br>PT2          | Shuen Wan<br>TT1         |
|----------------------------------------|--------------------------------------|--------------------------|---------------------------|--------------------------|--------------------------|--------------------------|
| Number of samples                      | 6                                    | 6                        | 6                         | 6                        | 6                        | 6                        |
| Temperature (°C)                       | 23.6<br>(18.0 - 27.3)                | 24.1<br>(18.1 - 28.5)    | 23.1<br>(15.7 - 29.2)     | 22.8<br>(16.0 - 27.4)    | 23.2<br>(16.2 - 28.0)    | 22.9<br>(18.3 - 26.2)    |
| Salinity                               | 31.6<br>(28.7 - 32.8)                | 31.2<br>(27.6 - 32.7)    | 31.9<br>(28.4 - 32.9)     | 32.5<br>(31.9 - 33.0)    | 32.2<br>(30.3 - 33.0)    | 31.3<br>(28.5 - 32.6)    |
| Dissolved Oxygen (mg/L)                | 5.2<br>(4.1 - 6.3)                   | 6.1<br>(4.9 - 7.2)       | 7.1<br>(5.6 - 11.2)       | 7.4<br>(6.0 - 9.4)       | 7.2<br>(5.5 - 9.3)       | 6.2<br>(4.0 - 8.5)       |
| Bottom                                 | 4.6<br>(2.4 - 6.6)                   | 6.3<br>(5 - 7.3)         | 6.4<br>(5.6 - 7.3)        | 7.4<br>(5.9 - 9.6)       | 7.3<br>(5.5 - 9.2)       | 5.4<br>(3.9 - 6.5)       |
| Dissolved Oxygen (% Saturation)        | 73<br>(61 - 81)                      | 87<br>(72 - 102)         | 102<br>(72 - 171)         | 103<br>(88 - 117)        | 101<br>(80 - 142)        | 86.2<br>(57 - 124)       |
| Bottom                                 | 64<br>(34 - 84)                      | 90<br>(73 - 102)         | 87<br>(74 - 101)          | 102<br>(86 - 119)        | 102<br>(81 - 139)        | 76<br>(56 - 90)          |
| pH                                     | 7.7<br>(7.4 - 7.9)                   | 8.0<br>(7.9 - 8.1)       | 8.0<br>(7.8 - 8.0)        | 8.1<br>(7.9 - 8.3)       | 8.1<br>(7.9 - 8.3)       | 8.0<br>(7.8 - 8.3)       |
| Secchi Disc Depth (m)                  | 2.4<br>(1.6 - 3.1)                   | 2.2<br>(1.5 - 3.2)       | 2.3<br>(1.8 - 3.0)        | 2.8<br>(1.4 - 4.6)       | 2.3<br>(1.3 - 4.2)       | 2.1<br>(1.4 - 3.4)       |
| Turbidity (NTU)                        | 9.3<br>(5.3 - 11.8)                  | 8.9<br>(6.3 - 11.1)      | 13.0<br>(6.4 - 32.1)      | 9.6<br>(4.6 - 16.9)      | 11.0<br>(5.8 - 16.5)     | 9.6<br>(3.9 - 16.4)      |
| Suspended Solids (mg/L)                | 2.7<br>(1.5 - 6.1)                   | 2.6<br>(0.7 - 7.2)       | 3.3<br>(1.6 - 6.0)        | 2.1<br>(1.0 - 4.1)       | 4.2<br>(1.3 - 7.5)       | 2.4<br>(1.3 - 4.0)       |
| 5-day Biochemical Oxygen Demand (mg/L) | 0.7<br>(0.4 - 1.5)                   | 0.7<br>(0.1 - 2.2)       | 1.0<br>(0.7 - 1.4)        | 0.9<br>(0.5 - 1.7)       | 0.9<br>(0.6 - 1.6)       | 1.1<br>(0.6 - 2.1)       |
| Ammonia Nitrogen (mg/L)                | 0.16<br>(0.12 - 0.21)                | 0.08<br>(0.05 - 0.11)    | 0.03<br>(0.01 - 0.07)     | 0.02<br>(0.01 - 0.05)    | 0.03<br>(0.01 - 0.05)    | 0.09<br>(0.08 - 0.12)    |
| Unionised Ammonia (mg/L)               | 0.003<br>(0.002 - 0.005)             | 0.004<br>(0.003 - 0.006) | 0.001<br>(<0.001 - 0.002) | 0.001<br>(0.001 - 0.002) | 0.002<br>(0.001 - 0.003) | 0.004<br>(0.002 - 0.007) |
| Nitrite Nitrogen (mg/L)                | 0.017<br>(0.005 - 0.025)             | 0.015<br>(0.005 - 0.020) | 0.004<br>(0.002 - 0.008)  | 0.002<br>(0.002 - 0.003) | 0.005<br>(0.002 - 0.009) | 0.009<br>(0.002 - 0.020) |
| Nitrate Nitrogen (mg/L)                | 0.11<br>(0.04 - 0.19)                | 0.10<br>(0.04 - 0.17)    | 0.013<br>(0.002 - 0.042)  | 0.01<br>(0.002 - 0.018)  | 0.018<br>(0.004 - 0.051) | 0.04<br>(0.01 - 0.15)    |
| Total Inorganic Nitrogen (mg/L)        | 0.28<br>(0.21 - 0.41)                | 0.19<br>(0.12 - 0.27)    | 0.04<br>(0.01 - 0.09)     | 0.03<br>(0.02 - 0.06)    | 0.05<br>(0.02 - 0.09)    | 0.14<br>(0.09 - 0.25)    |
| Total Kjeldahl Nitrogen (mg/L)         | 0.32<br>(0.25 - 0.40)                | 0.26<br>(0.19 - 0.34)    | 0.19<br>(0.17 - 0.20)     | 0.15<br>(0.12 - 0.20)    | 0.16<br>(0.13 - 0.22)    | 0.27<br>(0.22 - 0.36)    |
| Total Nitrogen (mg/L)                  | 0.44<br>(0.34 - 0.61)                | 0.37<br>(0.28 - 0.51)    | 0.20<br>(0.19 - 0.22)     | 0.16<br>(0.13 - 0.22)    | 0.18<br>(0.15 - 0.23)    | 0.32<br>(0.27 - 0.38)    |
| Orthophosphate Phosphorus (mg/L)       | 0.033<br>(0.030 - 0.037)             | 0.017<br>(0.008 - 0.025) | 0.004<br>(0.003 - 0.006)  | 0.004<br>(0.003 - 0.005) | 0.004<br>(0.003 - 0.006) | 0.013<br>(0.002 - 0.036) |
| Total Phosphorus (mg/L)                | 0.05<br>(0.04 - 0.06)                | 0.03<br>(0.03 - 0.04)    | 0.02<br>(0.02 - 0.03)     | 0.02<br>(0.02 - 0.03)    | 0.02<br>(0.02 - 0.03)    | 0.03<br>(0.02 - 0.05)    |
| Silica (as SiO <sub>2</sub> ) (mg/L)   | 0.8<br>(0.4 - 1.0)                   | 0.5<br>(0.2 - 0.9)       | 0.7<br>(0.1 - 1.4)        | 0.5<br>(0.2 - 0.7)       | 0.6<br>(0.2 - 0.8)       | 1.4<br>(0.9 - 2.0)       |
| Chlorophyll-a (µg/L)                   | 4.0<br>(0.9 - 13.5)                  | 7.6<br>(1.3 - 19.7)      | 4.0<br>(2.5 - 5.8)        | 2.6<br>(1.5 - 4.2)       | 2.7<br>(1.8 - 6.3)       | 5.7<br>(1.3 - 12.6)      |
| <i>E. coli</i> (cfu/100mL)             | 830<br>(130 - 3200)                  | 410<br>(89 - 1400)       | 3<br>(1 - 22)             | 1<br>(1 - 1)             | 11<br>(3 - 81)           | 30<br>(10 - 67)          |
| Faecal Coliforms (cfu/100mL)           | 2100<br>(350 - 6900)                 | 1300<br>(400 - 6700)     | 17<br>(5 - 92)            | 2<br>(1 - 8)             | 72<br>(11 - 260)         | 120<br>(34 - 320)        |

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

## Summary statistics of bottom sediment quality of typhoon shelters, 2002- 2006

| Parameter                                                                                   | Tuen<br>Mun<br>NS5       | Cheung<br>Chau<br>SS7    | Hei Ling<br>Chau<br>SS8 <sup>10</sup> | Rambler<br>Channel<br>VS17 | Government<br>Dockyard<br>VS21 <sup>10</sup> | Yau Ma<br>Tei<br>VS19    | Causeway<br>Bay<br>VS12  |
|---------------------------------------------------------------------------------------------|--------------------------|--------------------------|---------------------------------------|----------------------------|----------------------------------------------|--------------------------|--------------------------|
| Number of samples                                                                           | 10                       | 10                       | 6                                     | 10                         | 6                                            | 10                       | 10                       |
| Particle Size Fractionation <63µm (%w/w)                                                    | 64<br>(39 - 94)          | 76<br>(7 - 97)           | 94<br>(87 - 99)                       | 68<br>(42 - 84)            | 95<br>(85 - 99)                              | 77<br>(59 - 95)          | 77<br>(27 - 95)          |
| Electrochemical Potential (mV)                                                              | -219<br>((-353)-(-169))  | -245<br>((-310)-(-150))  | -214<br>((-278)-(-81))                | -292<br>((-371)-(-184))    | -332<br>((-388)-(-246))                      | -359<br>((-403)-(-278))  | -343<br>((-407)-(-251))  |
| Total Solids (%w/w)                                                                         | 46<br>(36 - 58)          | 41<br>(34 - 51)          | 37<br>(30 - 45)                       | 46<br>(40 - 53)            | 37<br>(33 - 46)                              | 48<br>(41 - 55)          | 41<br>(34 - 68)          |
| Total Volatile Solids (%w/w)                                                                | 7.2<br>(5.8 - 9.2)       | 7.6<br>(5.4 - 8.8)       | 8.3<br>(7.4 - 11.0)                   | 7.6<br>(6.5 - 8.9)         | 8.1<br>(6.0 - 9.6)                           | 7.2<br>(5.6 - 8.6)       | 8.6<br>(3.9 - 11.0)      |
| Chemical Oxygen Demand (mg/kg)                                                              | 20000<br>(15000 - 25000) | 20000<br>(17000 - 27000) | 15000<br>(14000 - 16000)              | 30000<br>(20000 - 41000)   | 18000<br>(11000 - 21000)                     | 21000<br>(15000 - 26000) | 31000<br>(27000 - 36000) |
| Total Carbon (%w/w)                                                                         | 0.8<br>(0.5 - 1.0)       | 0.7<br>(0.5 - 0.9)       | 0.5<br>(0.5 - 0.6)                    | 0.9<br>(0.7 - 1.3)         | 0.5<br>(0.5 - 0.6)                           | 0.8<br>(0.7 - 1.0)       | 0.9<br>(0.7 - 1.0)       |
| Ammonical Nitrogen (mg/kg)                                                                  | 6.7<br>(0.1 - 14.0)      | 11.0<br>(1.9 - 21.0)     | 11.8<br>(1.9 - 22.0)                  | 11.4<br>(0.1 - 32.0)       | 8.4<br>(1.8 - 22.0)                          | 29.7<br>(13.0 - 45.0)    | 32.5<br>(3.7 - 65.0)     |
| Total Kjeldahl Nitrogen (mg/kg)                                                             | 356<br>(260 - 520)       | 474<br>(390 - 550)       | 432<br>(290 - 560)                    | 441<br>(320 - 540)         | 351<br>(290 - 410)                           | 454<br>(320 - 570)       | 614<br>(290 - 820)       |
| Total Phosphorus (mg/kg)                                                                    | 208<br>(150 - 300)       | 281<br>(210 - 510)       | 175<br>(140 - 210)                    | 210<br>(150 - 300)         | 193<br>(150 - 220)                           | 220<br>(190 - 240)       | 215<br>(150 - 260)       |
| Total Sulphide (mg/kg)                                                                      | 170<br>(5 - 750)         | 184<br>(40 - 280)        | 110<br>(33 - 200)                     | 768<br>(53 - 2500)         | 206<br>(3 - 630)                             | 360<br>(88 - 960)        | 397<br>(170 - 960)       |
| Total Cyanide (mg/kg)                                                                       | 0.1<br>(<0.1 - 0.2)      | 0.2<br>(0.1 - 0.3)       | 0.1<br>(<0.1 - 0.2)                   | 0.3<br>(<0.1 - 0.6)        | 0.1<br>(<0.1 - 0.3)                          | 0.1<br>(<0.1 - 0.2)      | 0.2<br>(<0.1 - 0.3)      |
| Arsenic (mg/kg)                                                                             | 8.1<br>(5.8 - 11.0)      | 7.9<br>(6.2 - 9.4)       | 7.6<br>(6.8 - 8.7)                    | 8.0<br>(5.2 - 9.7)         | 8.4<br>(7.3 - 9.2)                           | 6.0<br>(4.0 - 8.8)       | 8.0<br>(2.9 - 9.7)       |
| Cadmium (mg/kg)                                                                             | 0.3<br>(<0.1 - 0.7)      | 0.2<br>(<0.1 - 0.3)      | 0.1<br>(<0.1 - 0.1)                   | 0.9<br>(0.5 - 1.4)         | 0.3<br>(0.1 - 0.5)                           | 0.4<br>(0.2 - 0.9)       | 0.9<br>(0.2 - 1.0)       |
| Chromium (mg/kg)                                                                            | 33<br>(22 - 39)          | 57<br>(45 - 68)          | 41<br>(34 - 47)                       | 171<br>(85 - 310)          | 52<br>(47 - 56)                              | 39<br>(26 - 54)          | 65<br>(15 - 83)          |
| Copper (mg/kg)                                                                              | 43.8<br>(13 - 72)        | 130<br>(65 - 250)        | 37.2<br>(33 - 42)                     | 291<br>(130 - 490)         | 143<br>(24 - 180)                            | 92.9<br>(38 - 160)       | 241<br>(48 - 310)        |
| Lead (mg/kg)                                                                                | 52<br>(32 - 80)          | 52<br>(35 - 73)          | 49<br>(41 - 56)                       | 79<br>(65 - 110)           | 53<br>(28 - 65)                              | 46<br>(24 - 79)          | 76<br>(24 - 110)         |
| Mercury (mg/kg)                                                                             | 0.08<br>(<0.05 - 0.12)   | 0.26<br>(0.12 - 0.60)    | 0.14<br>(0.12 - 0.18)                 | 0.28<br>(0.14 - 0.49)      | 0.17<br>(<0.05 - 0.20)                       | 0.27<br>(0.09 - 0.44)    | 0.69<br>(0.18 - 0.91)    |
| Nickel (mg/kg)                                                                              | 19<br>(14 - 22)          | 20<br>(16 - 23)          | 27<br>(22 - 32)                       | 71<br>(37 - 150)           | 31<br>(28 - 36)                              | 24<br>(18 - 32)          | 26<br>(7 - 34)           |
| Silver (mg/kg)                                                                              | 2.0<br>(<0.2 - 11.0)     | 0.5<br>(0.2 - 1.0)       | 0.7<br>(0.5 - 1.0)                    | 6.3<br>(3.3 - 11.0)        | 1.9<br>(0.3 - 2.4)                           | 2.0<br>(0.8 - 4.0)       | 7.2<br>(0.8 - 10.0)      |
| Zinc (mg/kg)                                                                                | 156<br>(87 - 300)        | 160<br>(110 - 210)       | 140<br>(120 - 150)                    | 281<br>(170 - 350)         | 229<br>(110 - 270)                           | 196<br>(110 - 340)       | 296<br>(66 - 380)        |
| Total Polychlorinated Biphenyls (PCBs)<br>(µg/kg) <sup>(3)</sup>                            | 18<br>(18 - 18)          | 18<br>(18 - 19)          | 18<br>(18 - 18)                       | 42<br>(18 - 92)            | 20<br>(18 - 25)                              | 22<br>(18 - 30)          | 40<br>(18 - 82)          |
| Low Molecular Weight Polycyclic Aromatic<br>Hydrocarbons (PAHs) (µg/kg) <sup>(4) (6)</sup>  | 94<br>(90 - 110)         | 97<br>(90 - 120)         | 90<br>(90 - 90)                       | 120<br>(96 - 240)          | 94<br>(90 - 120)                             | 110<br>(90 - 130)        | 120<br>(90 - 150)        |
| High Molecular Weight Polycyclic Aromatic<br>Hydrocarbons (PAHs) (µg/kg) <sup>(5) (6)</sup> | 220<br>(63 - 440)        | 380<br>(62 - 1400)       | 66<br>(38 - 86)                       | 900<br>(360 - 1800)        | 180<br>(21 - 280)                            | 500<br>(190 - 1400)      | 660<br>(170 - 1000)      |

Note: 1 Data presented are arithmetic means ; data in brackets indicate ranges.

2 All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.

3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

4 Low molecular weight polycyclic aromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.

5 High molecular weight polycyclic aromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

# Summary statistics of bottom sediment quality of typhoon shelters, 2002- 2006 (continued)

| Parameter                                                                                   | To Kwa<br>Wan<br>VS20      | Kwun<br>Tong<br>VS14     | Sam Ka<br>Tsuen<br>VS13  | Aldrich Bay<br>(Shau Kei Wan)<br>ES5 <sup>10</sup> | Chai<br>Wan<br>ES3       | Hebe<br>Haven<br>PS4     | Yim Tin<br>Tsai<br>PS2   | Shuen<br>Wan<br>TS7      |
|---------------------------------------------------------------------------------------------|----------------------------|--------------------------|--------------------------|----------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Number of samples                                                                           | 10                         | 10                       | 10                       | 10                                                 | 10                       | 10                       | 9                        | 10                       |
| Particle Size Fractionation <63µm (%w/w)                                                    | 70<br>(45 - 87)            | 64<br>(36 - 81)          | 86<br>(70 - 92)          | 82<br>(8 - 98)                                     | 81<br>(25 - 96)          | 92<br>(85 - 97)          | 83<br>(25 - 98)          | 63<br>(45 - 81)          |
| Electrochemical Potential (mV)                                                              | -362<br>((-403)-(-173))    | -396<br>((-437)-(-373))  | -275<br>((-408)-(-56))   | -400<br>((-413)-(-352))                            | -326<br>((-380)-(-247))  | -276<br>((-317)-(-207))  | -229<br>((-326)-(-177))  | -356<br>((-388)-(-289))  |
| Total Solids (%w/w)                                                                         | 47<br>(37 - 51)            | 40<br>(33 - 45)          | 41<br>(39 - 43)          | 33<br>(31 - 35)                                    | 42<br>(39 - 45)          | 36<br>(34 - 39)          | 46<br>(34 - 65)          | 39<br>(29 - 51)          |
| Total Volatile Solids (%w/w)                                                                | 8.3<br>(6.2 - 13.0)        | 9.4<br>(7.0 - 11.0)      | 9.8<br>(8.7 - 12.0)      | 10.3<br>(9.0 - 11.0)                               | 8.3<br>(7.5 - 8.8)       | 10.2<br>(9.3 - 13.0)     | 10.8<br>(6.6 - 15.0)     | 8.9<br>(6.8 - 12.0)      |
| Chemical Oxygen Demand (mg/kg)                                                              | 37000<br>(30000 - 47000)   | 40000<br>(33000 - 45000) | 28000<br>(24000 - 32000) | 29000<br>(22000 - 33000)                           | 27000<br>(19000 - 32000) | 23000<br>(18000 - 26000) | 20000<br>(13000 - 30000) | 29000<br>(27000 - 32000) |
| Total Carbon (%w/w)                                                                         | 1.2<br>(0.8 - 1.7)         | 1.0<br>(1.0 - 1.5)       | 0.8<br>(0.7 - 1.0)       | 0.8<br>(0.7 - 0.9)                                 | 0.8<br>(0.8 - 0.9)       | 0.8<br>(0.7 - 0.9)       | 1.8<br>(0.9 - 4.4)       | 0.8<br>(0.7 - 1.2)       |
| Ammonical Nitrogen (mg/kg)                                                                  | 20.0<br>(8.0 - 31.0)       | 31.7<br>(11.0 - 51.0)    | 14.2<br>(4.0 - 28.0)     | 37.5<br>(26.0 - 61.0)                              | 7.3<br>(2.2 - 15.0)      | 6.2<br>(1.5 - 14.0)      | 11.2<br>(1.7 - 28.0)     | 10.4<br>(3.9 - 25.0)     |
| Total Kjeldahl Nitrogen (mg/kg)                                                             | 537<br>(420 - 630)         | 758<br>(610 - 890)       | 532<br>(380 - 700)       | 564<br>(470 - 640)                                 | 490<br>(400 - 560)       | 535<br>(450 - 610)       | 476<br>(180 - 850)       | 597<br>(310 - 740)       |
| Total Phosphorus (mg/kg)                                                                    | 224<br>(170 - 260)         | 276<br>(190 - 360)       | 250<br>(200 - 370)       | 204<br>(150 - 270)                                 | 236<br>(180 - 270)       | 182<br>(160 - 220)       | 145<br>(48 - 200)        | 220<br>(160 - 430)       |
| Total Sulphide (mg/kg)                                                                      | 304<br>(160 - 730)         | 1175<br>(180 - 2500)     | 743<br>(8 - 2300)        | 1073<br>(330 - 1600)                               | 250<br>(18 - 680)        | 89<br>(10 - 150)         | 62<br>(24 - 110)         | 338<br>(70 - 1300)       |
| Total Cyanide (mg/kg)                                                                       | 0.2<br>(0.1 - 0.2)         | 0.4<br>(0.1 - 0.5)       | 0.3<br>(0.2 - 0.6)       | 0.2<br>(<0.1 - 0.2)                                | 0.2<br>(<0.1 - 0.3)      | 0.2<br>(0.1 - 0.2)       | 0.1<br>(<0.1 - 0.1)      | 0.2<br>(<0.1 - 0.4)      |
| Arsenic (mg/kg)                                                                             | 7.4<br>(6.0 - 8.5)         | 7.2<br>(5.5 - 8.6)       | 7.4<br>(6.4 - 8.5)       | 8.2<br>(6.9 - 10.0)                                | 9.8<br>(8.4 - 12.0)      | 9.1<br>(7.9 - 12.0)      | 4.2<br>(0.6 - 6.4)       | 9.3<br>(7.0 - 13.0)      |
| Cadmium (mg/kg)                                                                             | 1.1<br>(0.8 - 2.0)         | 3.6<br>(2.4 - 5.2)       | 0.8<br>(0.7 - 0.9)       | 0.7<br>(0.5 - 0.9)                                 | 0.6<br>(0.4 - 0.9)       | 0.2<br>(0.1 - 0.2)       | <0.1<br>(<0.1 - <0.1)    | 0.5<br>(0.2 - 0.7)       |
| Chromium (mg/kg)                                                                            | 94<br>(69 - 140)           | 319<br>(250 - 490)       | 61<br>(44 - 90)          | 73<br>(58 - 89)                                    | 114<br>(79 - 180)        | 29<br>(24 - 34)          | 19<br>(9 - 23)           | 23<br>(15 - 33)          |
| Copper (mg/kg)                                                                              | 743<br>(530 - 1300)        | 2050<br>(1700 - 2500)    | 191<br>(150 - 280)       | 340<br>(290 - 430)                                 | 330<br>(250 - 540)       | 51<br>(31 - 61)          | 16<br>(8 - 20)           | 131<br>(52 - 240)        |
| Lead (mg/kg)                                                                                | 108<br>(77 - 190)          | 119<br>(75 - 140)        | 104<br>(84 - 120)        | 85<br>(67 - 130)                                   | 90<br>(63 - 140)         | 41<br>(37 - 46)          | 33<br>(16 - 39)          | 103<br>(77 - 140)        |
| Mercury (mg/kg)                                                                             | 1.18<br>(0.85 - 1.60)      | 0.87<br>(0.58 - 1.20)    | 0.62<br>(0.34 - 0.84)    | 0.38<br>(0.27 - 0.69)                              | 0.48<br>(0.42 - 0.63)    | 0.14<br>(0.12 - 0.16)    | 0.07<br>(0.05 - 0.15)    | 0.14<br>(0.07 - 0.21)    |
| Nickel (mg/kg)                                                                              | 38<br>(29 - 57)            | 84<br>(68 - 110)         | 20<br>(16 - 26)          | 30<br>(26 - 36)                                    | 33<br>(22 - 55)          | 9<br>(7 - 12)            | 13<br>(7 - 18)           | 12<br>(8 - 20)           |
| Silver (mg/kg)                                                                              | 5.0<br>(4.0 - 7.0)         | 10.2<br>(7.7 - 12.0)     | 3.2<br>(2.2 - 4.0)       | 6.7<br>(4.2 - 9.0)                                 | 16.6<br>(8.9 - 32.0)     | 0.5<br>(0.3 - 1.0)       | 0.4<br>(<0.2 - 1.0)      | 0.5<br>(0.2 - 1.0)       |
| Zinc (mg/kg)                                                                                | 264<br>(200 - 390)         | 465<br>(370 - 550)       | 311<br>(280 - 360)       | 361<br>(310 - 440)                                 | 315<br>(220 - 500)       | 154<br>(120 - 170)       | 85<br>(38 - 140)         | 297<br>(170 - 440)       |
| Total Polychlorinated Biphenyls (PCBs)<br>(µg/kg) <sup>(3)</sup>                            | 100<br>(18 - 140)          | 200<br>(35 - 290)        | 46<br>(21 - 110)         | 19<br>(18 - 22)                                    | 44<br>(34 - 56)          | 18<br>(18 - 20)          | 18<br>(18 - 18)          | 18<br>(18 - 19)          |
| Low Molecular Weight Polycyclic Aromatic<br>Hydrocarbons (PAHs) (µg/kg) <sup>(4) (6)</sup>  | 14000<br>(1800 - 42000)    | 140<br>(110 - 190)       | 100<br>(93 - 180)        | 100<br>(90 - 120)                                  | 120<br>(100 - 170)       | 90<br>(90 - 93)          | 90<br>(90 - 90)          | 91<br>(90 - 98)          |
| High Molecular Weight Polycyclic Aromatic<br>Hydrocarbons (PAHs) (µg/kg) <sup>(5) (6)</sup> | 100000<br>(21000 - 290000) | 1300<br>(900 - 2000)     | 590<br>(400 - 1500)      | 780<br>(520 - 1200)                                | 610<br>(400 - 920)       | 73<br>(37 - 100)         | 47<br>(21 - 120)         | 110<br>(46 - 190)        |

Note: 1 Data presented are arithmetic means ; data in brackets indicate ranges.

2 All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.

3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

4 Low molecular weight polycyclic aromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.

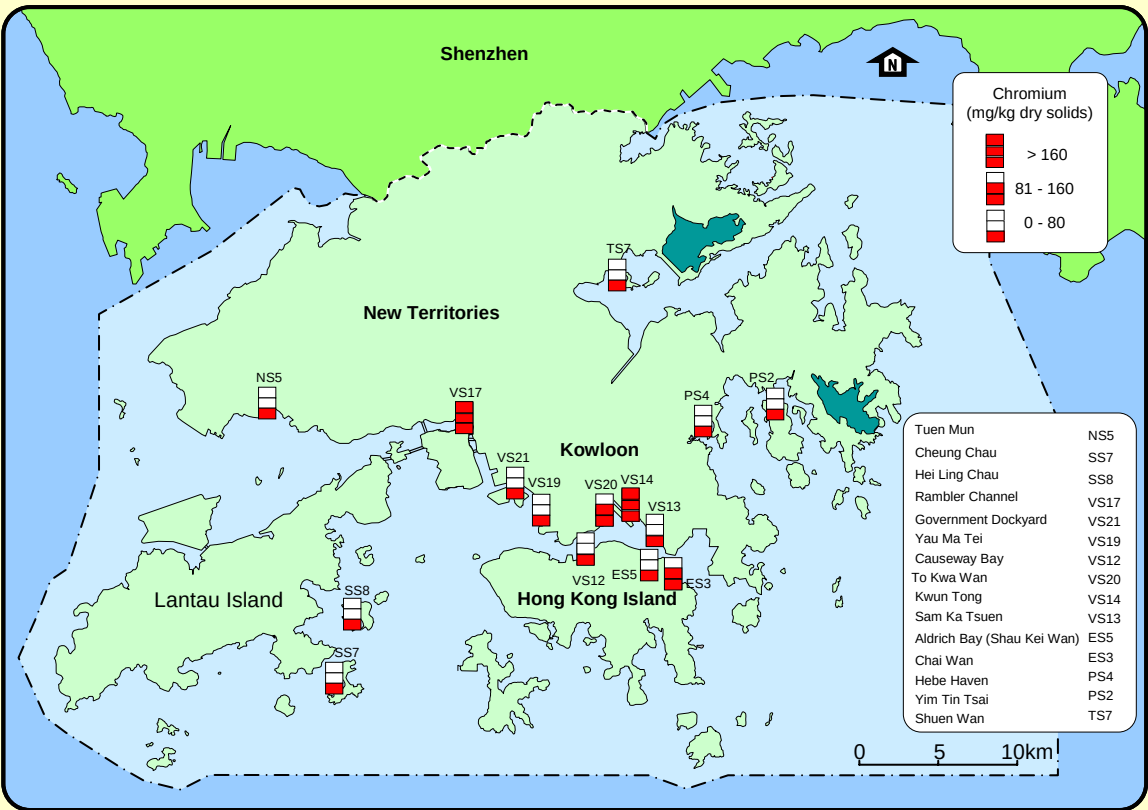
5 High molecular weight polycyclic aromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

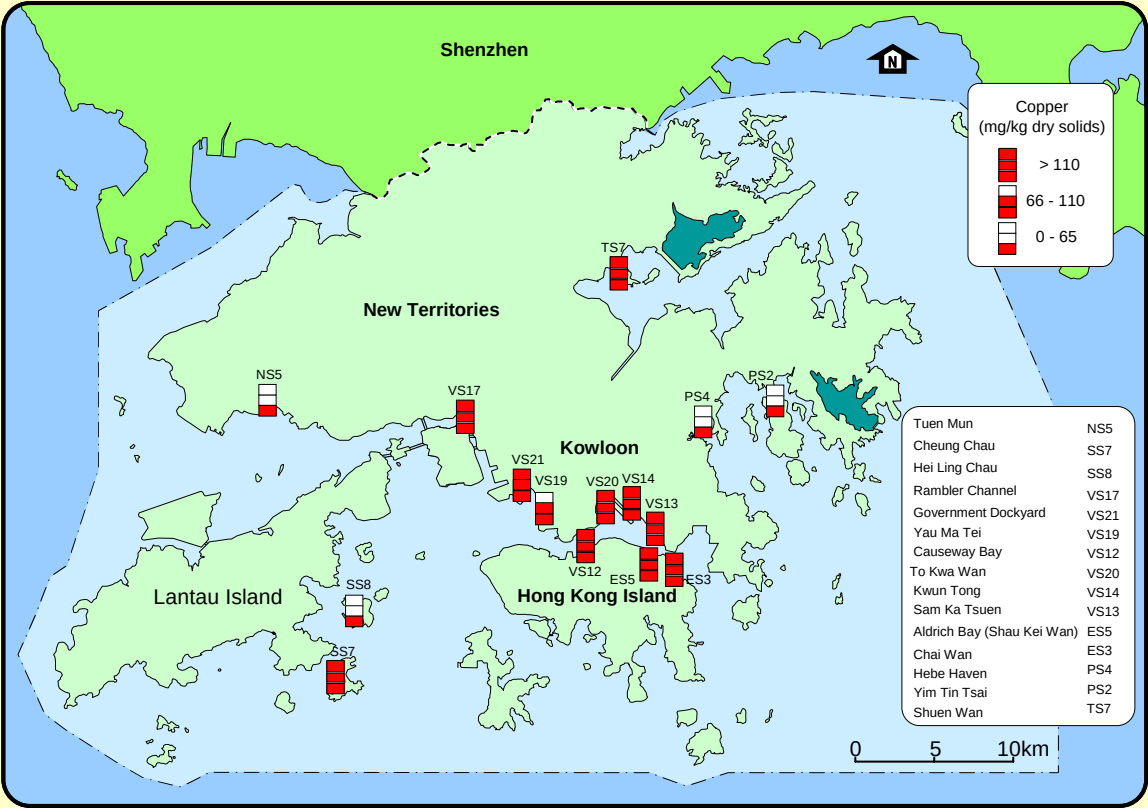
Cadmium in typhoon shelter sediments in Hong Kong, 2002 - 2006



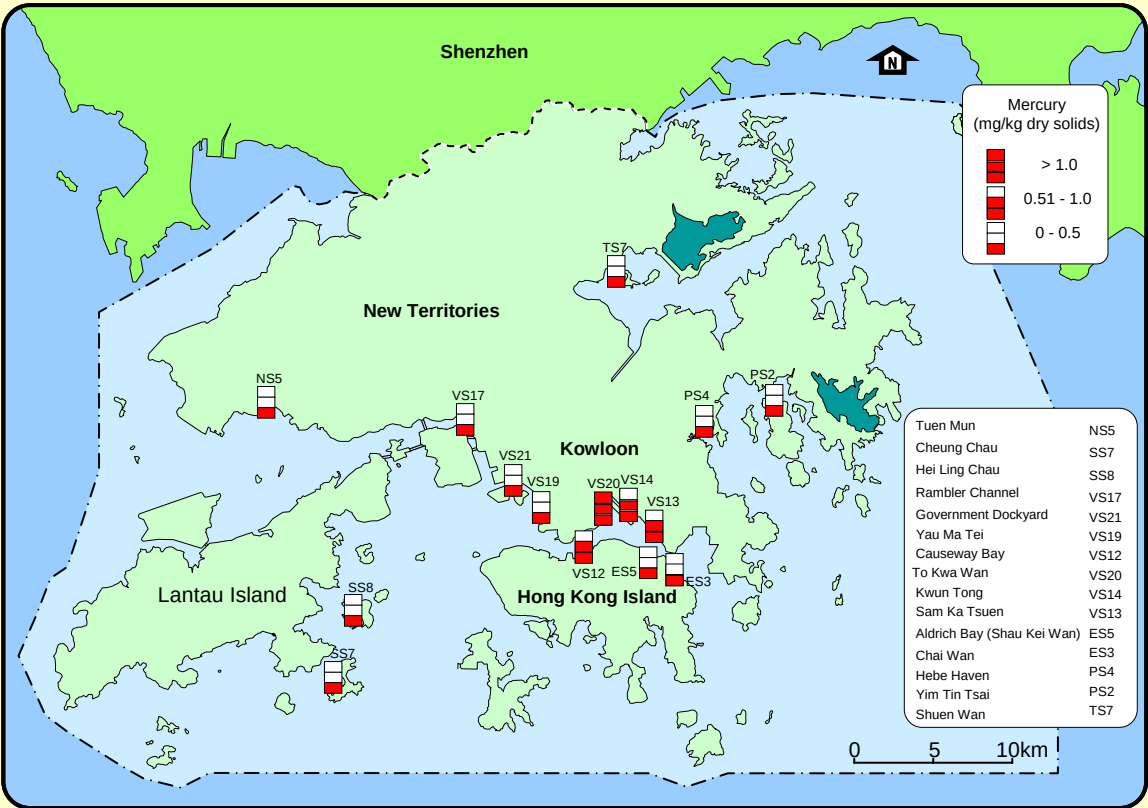
Chromium in typhoon shelter sediments in Hong Kong, 2002 - 2006



Copper in typhoon shelter sediments in Hong Kong, 2002 - 2006

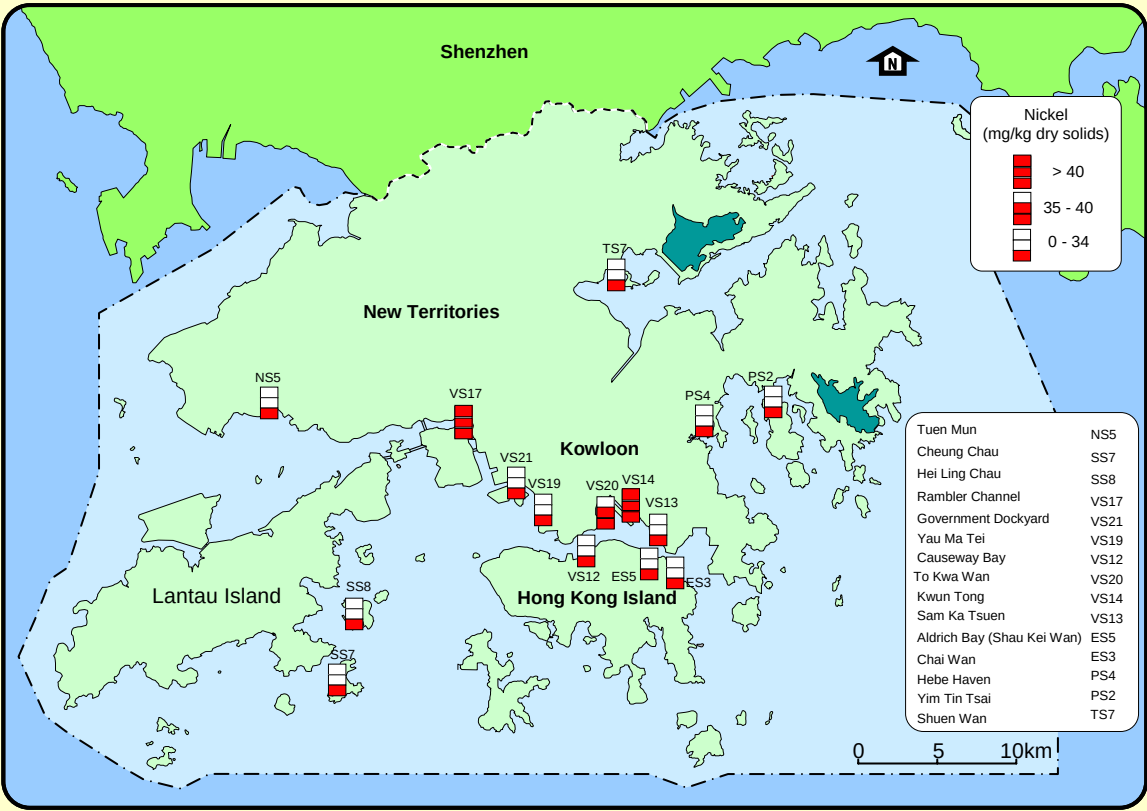


Mercury in typhoon shelter sediments in Hong Kong, 2002 - 2006

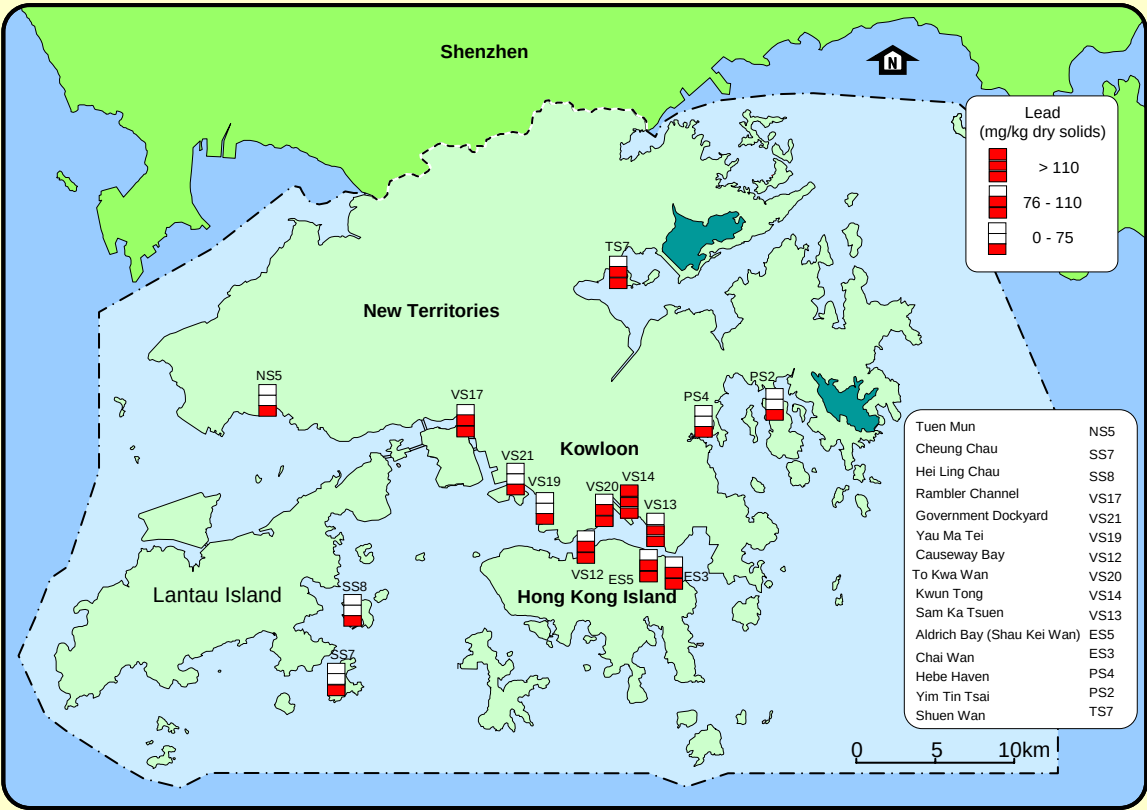




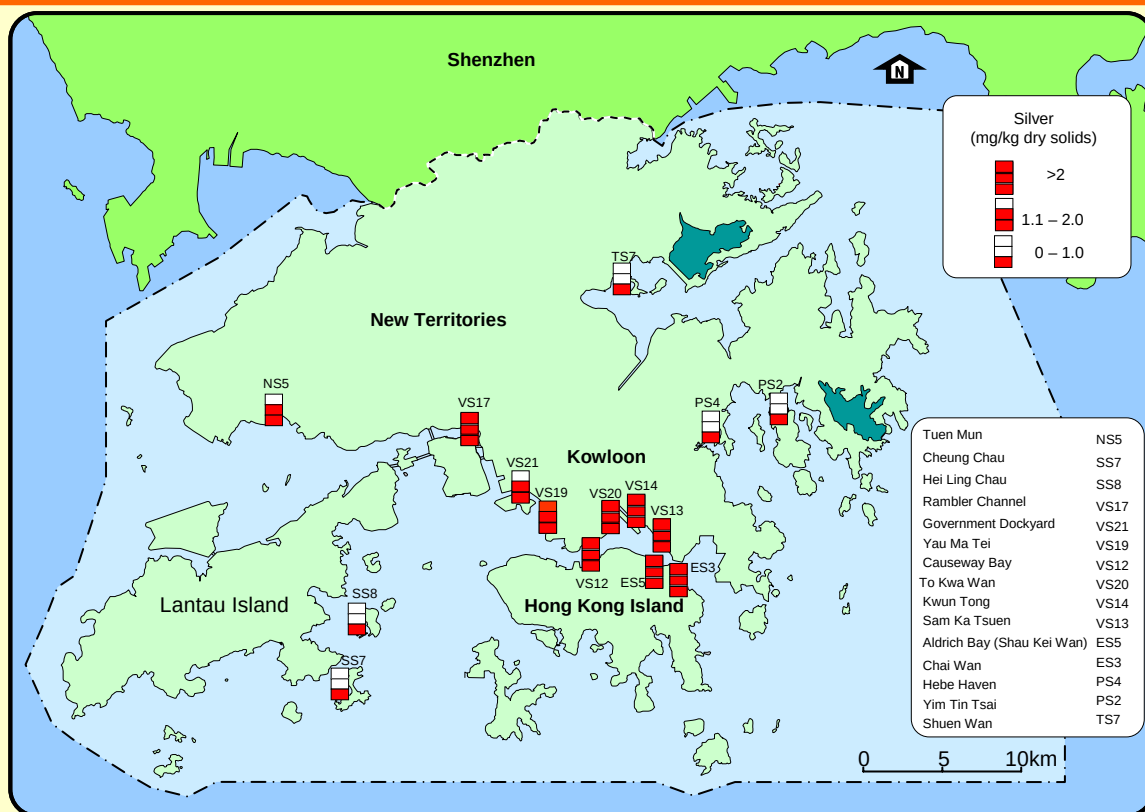
Nickel in typhoon shelter sediments in Hong Kong, 2002 - 2006



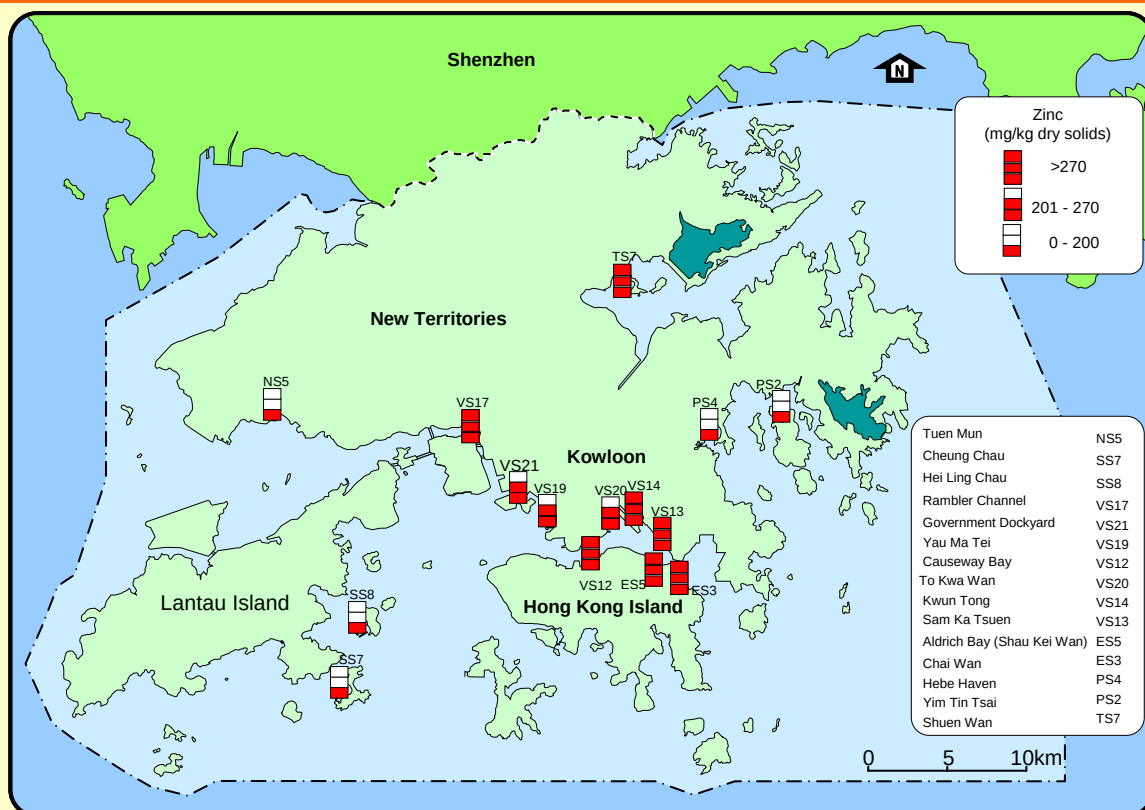
Lead in typhoon shelter sediments in Hong Kong, 2002 - 2006



## Silver in typhoon shelter sediments in Hong Kong, 2002 - 2006



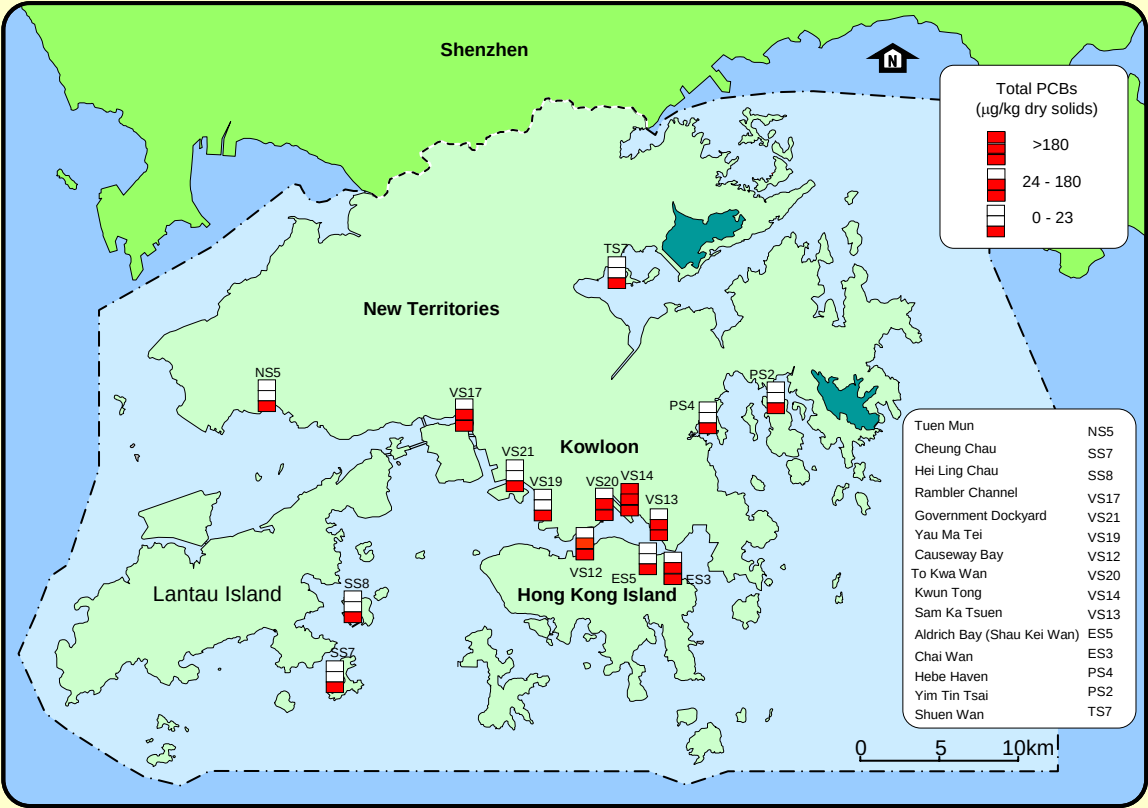
## Zinc in typhoon shelter sediments in Hong Kong, 2002 - 2006



Arsenic in typhoon shelter sediments in Hong Kong, 2002 - 2006



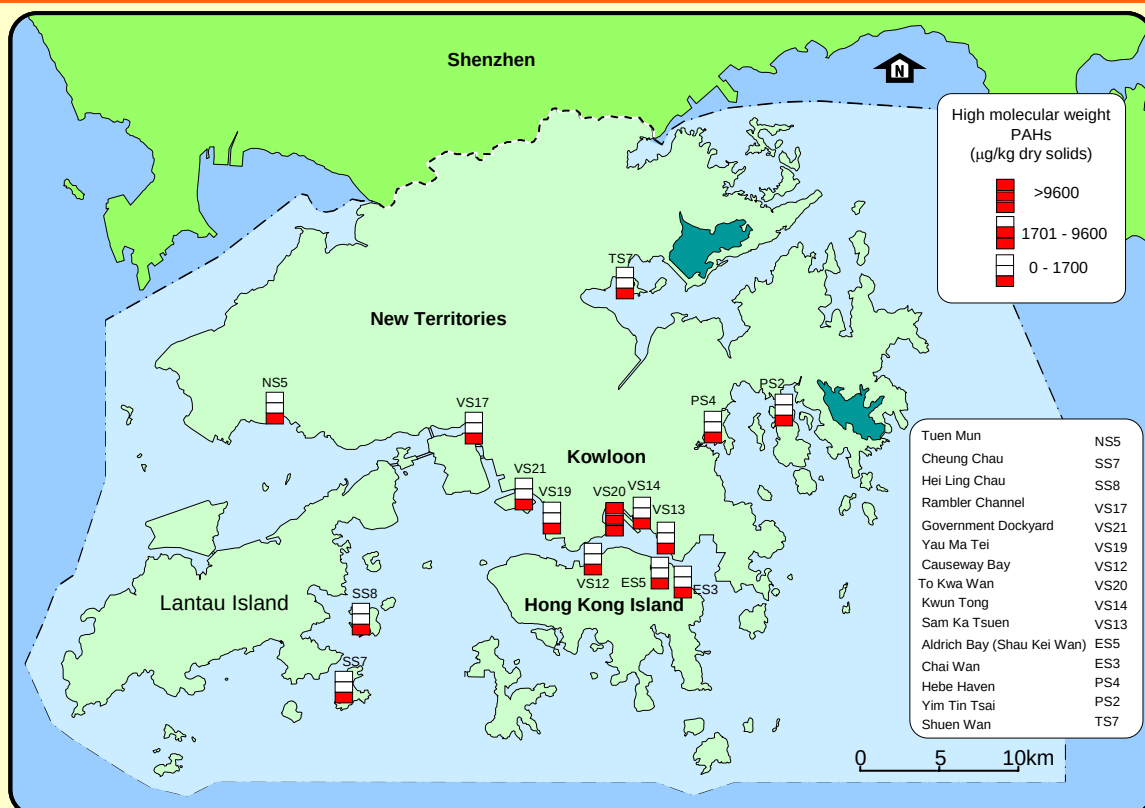
Total polychlorinated biphenyls (PCBs) in typhoon shelter sediments in Hong Kong, 2002 - 2006



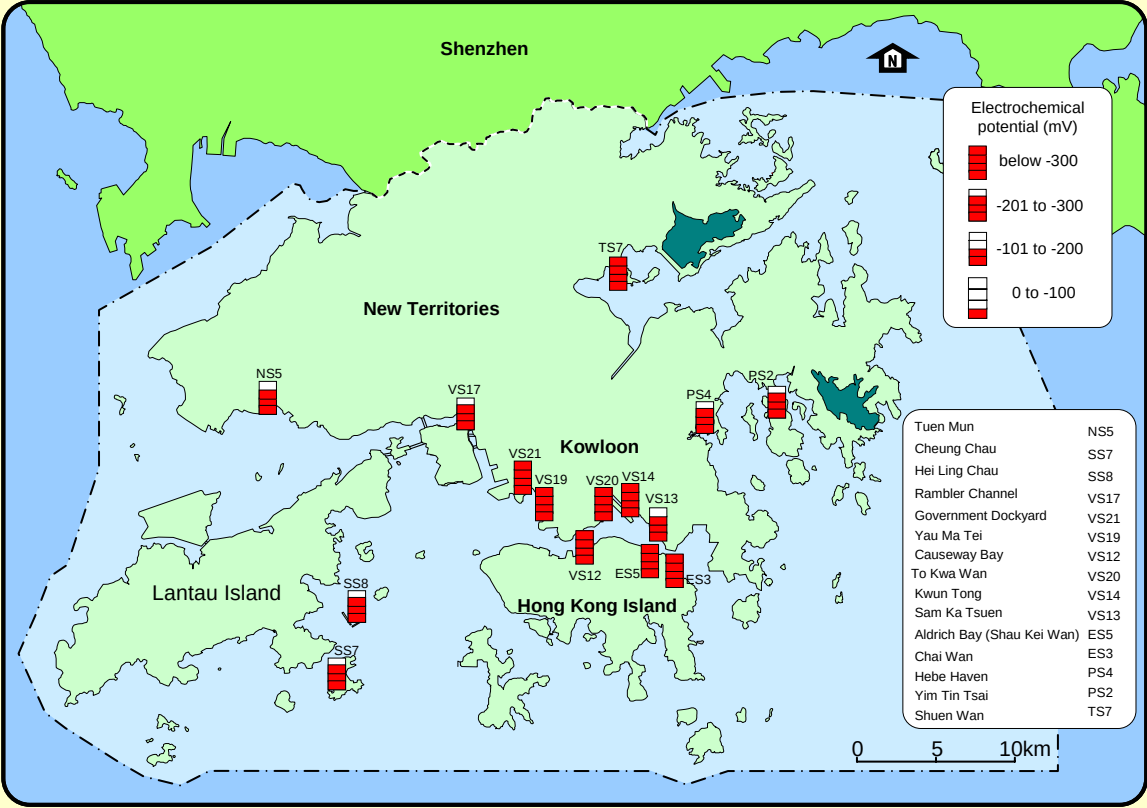
## Low molecular weight polycyclic aromatic hydrocarbons (PAHs) in typhoon shelter sediments in Hong Kong, 2002 - 2006



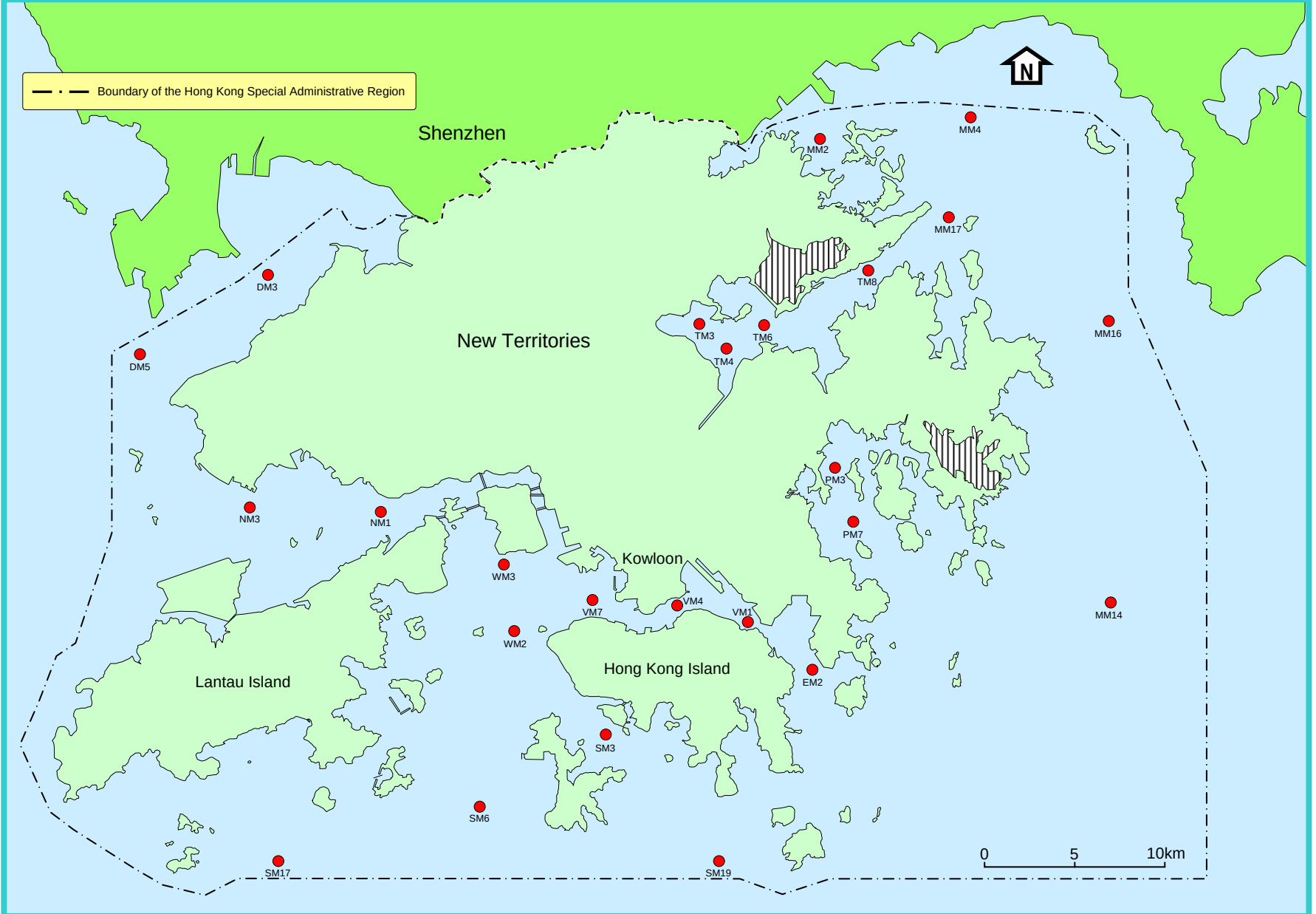
## High molecular weight polycyclic aromatic hydrocarbons (PAHs) in typhoon shelter sediments in Hong Kong, 2002 - 2006



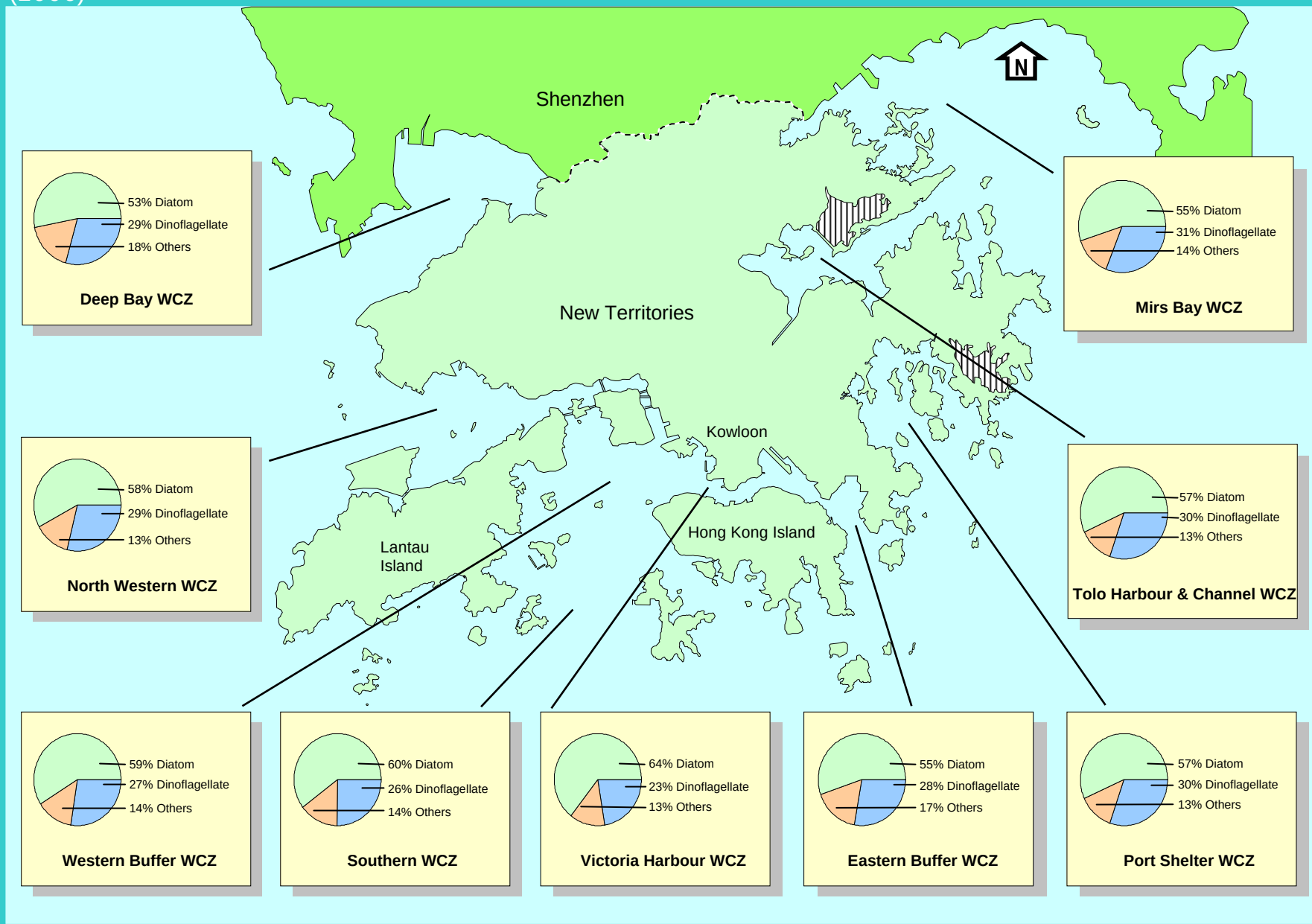
Electrochemical potential in typhoon shelter sediments in Hong Kong, 2002- 2006



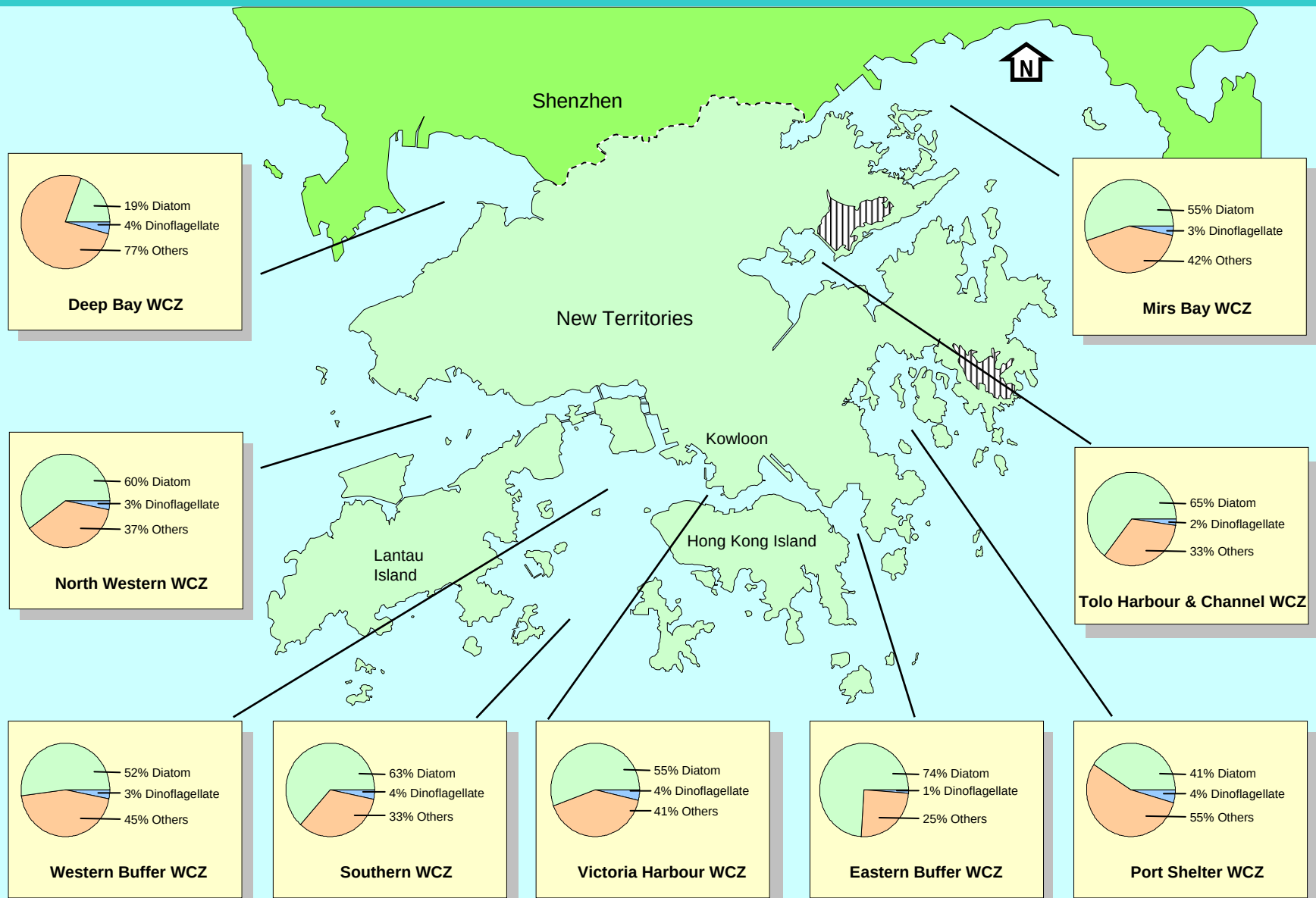
# Phytoplankton monitoring stations in Hong Kong waters in 2006



Percentage contribution of phytoplankton groups to the total number of species in the nine Water Control Zones (2006)



## Percentage contribution of phytoplankton groups to the total density in the nine Water Control Zones (2006)

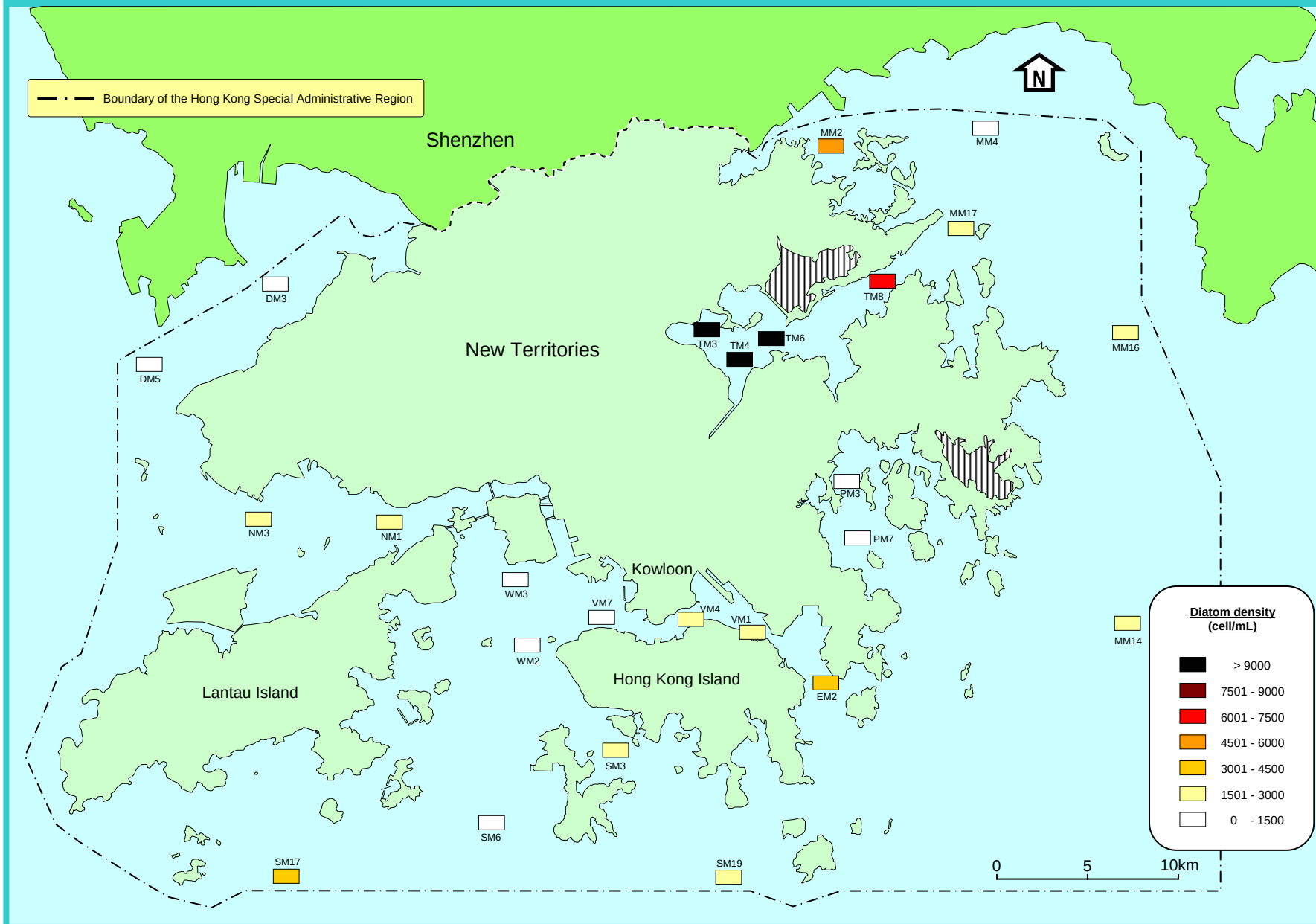




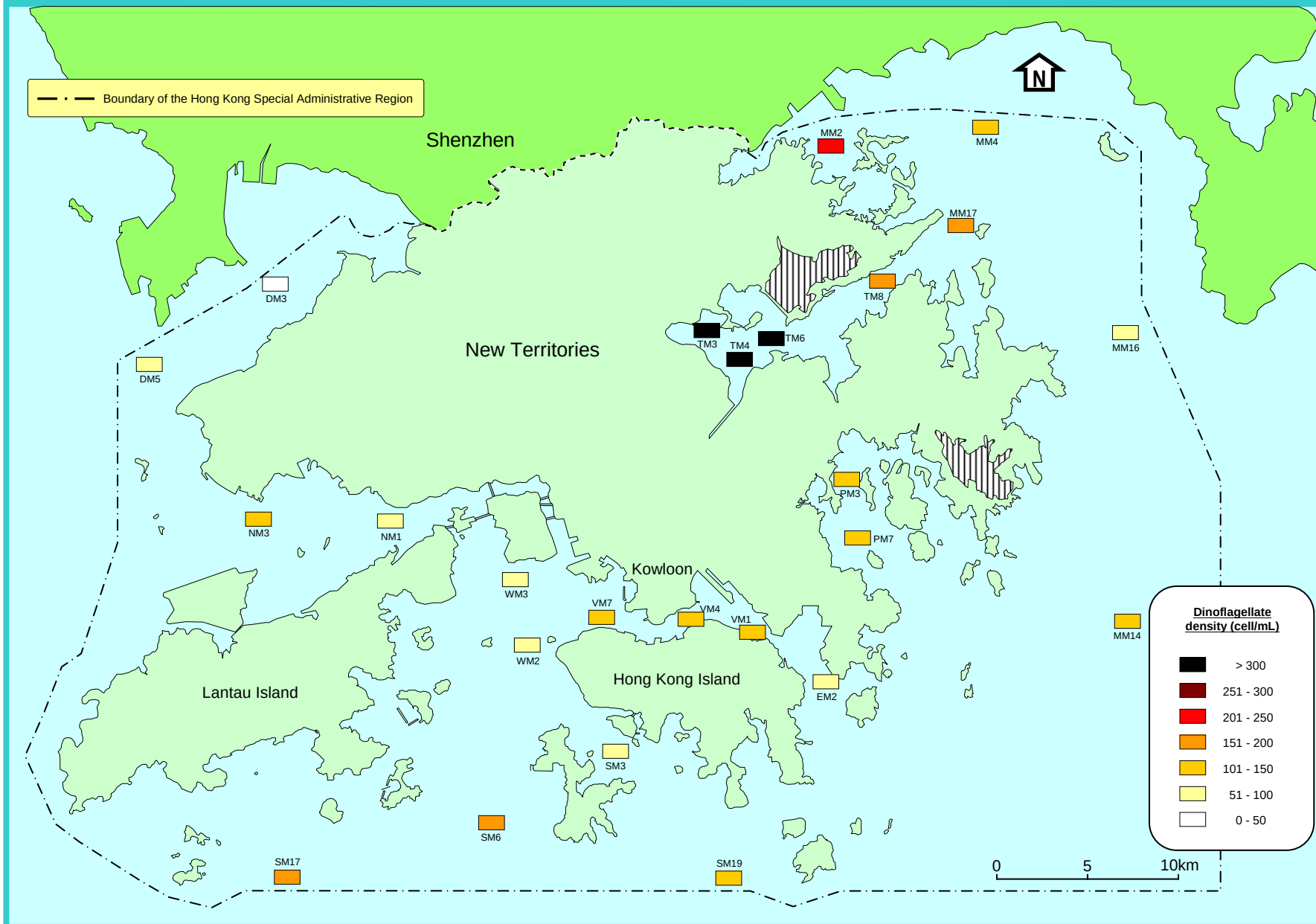
## Annual mean densities (cell/mL) of total phytoplankton at 25 monitoring stations in Hong Kong waters in 2006



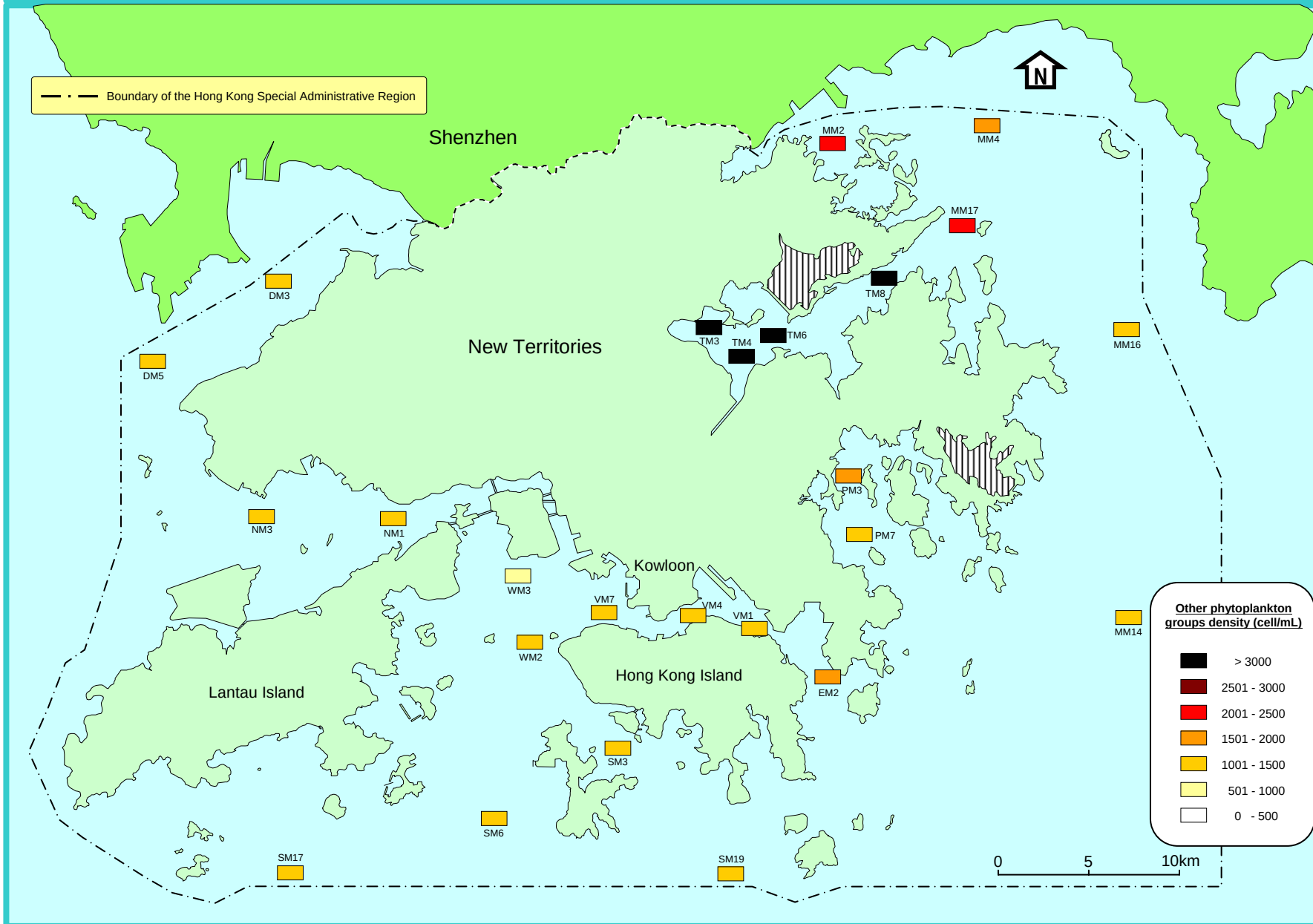
## Annual mean densities (cell/mL) of diatoms at 25 monitoring stations in Hong Kong waters in 2006



## Annual mean densities (cell/mL) of dinoflagellates at 25 monitoring stations in Hong Kong waters

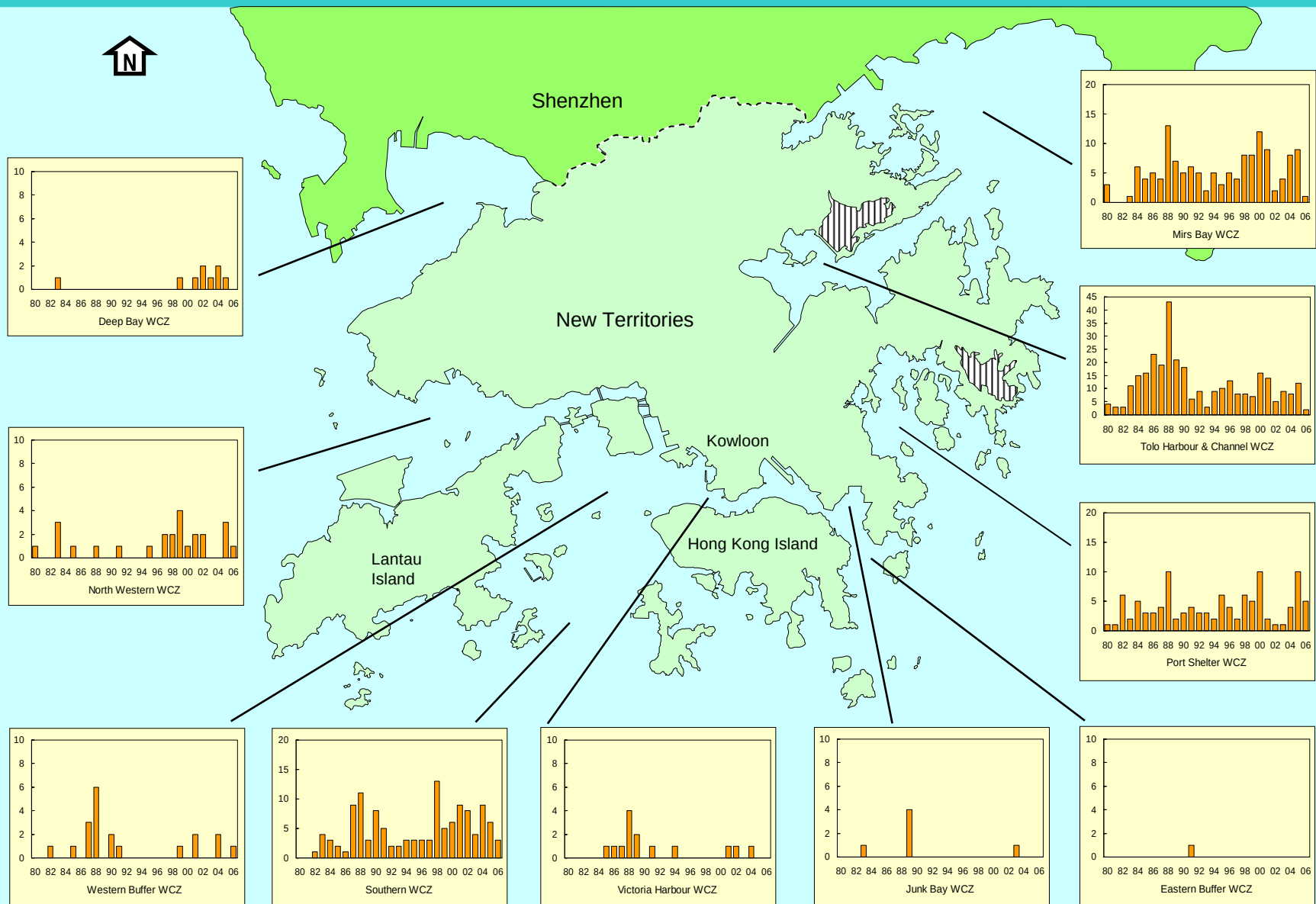


## Annual mean densities (cell/mL) of other phytoplankton groups at 25 monitoring stations in Hong Kong waters in 2006



# Frequency of red tides in 10 Water Control Zones in Hong Kong, 1980 - 2006

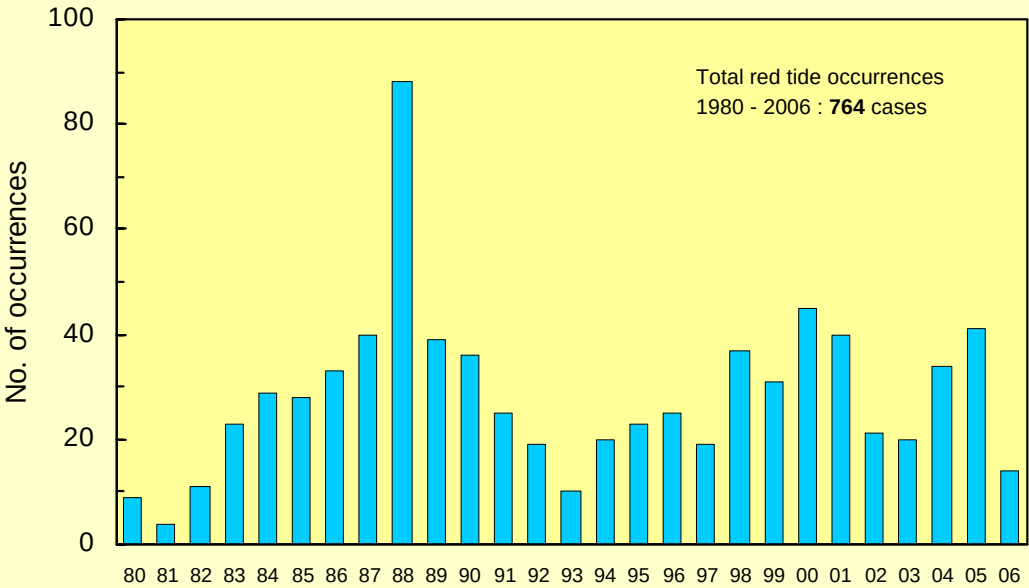
Source: Agriculture, Fisheries and Conservation Department and Environmental Protection Department



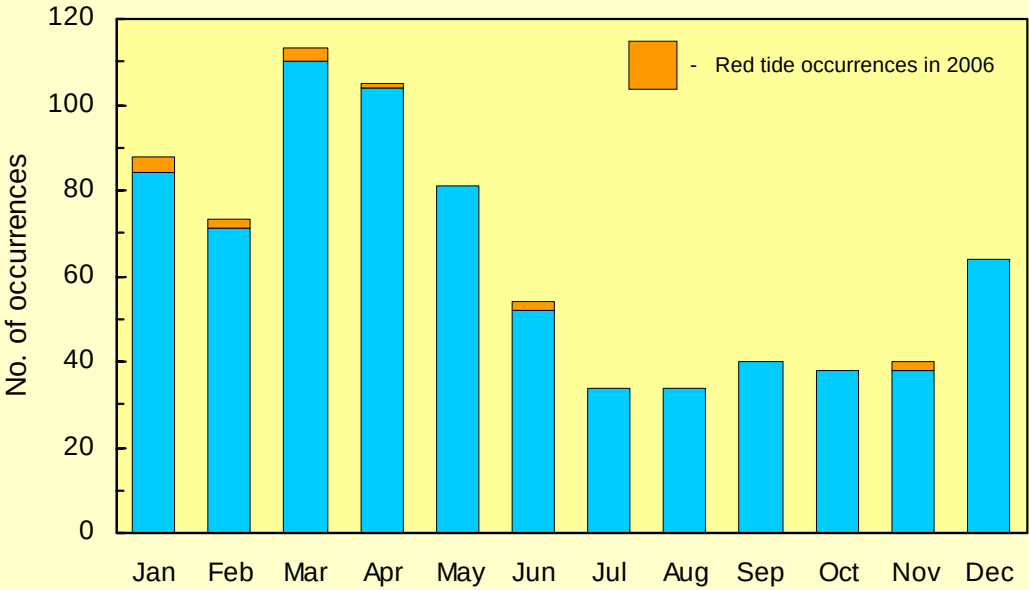
Occurrence of red tides in Hong Kong waters, 1980 – 2006

(Sources: Agriculture, Fisheries and Conservation Department and Environmental Protection Department)

Yearly Distribution

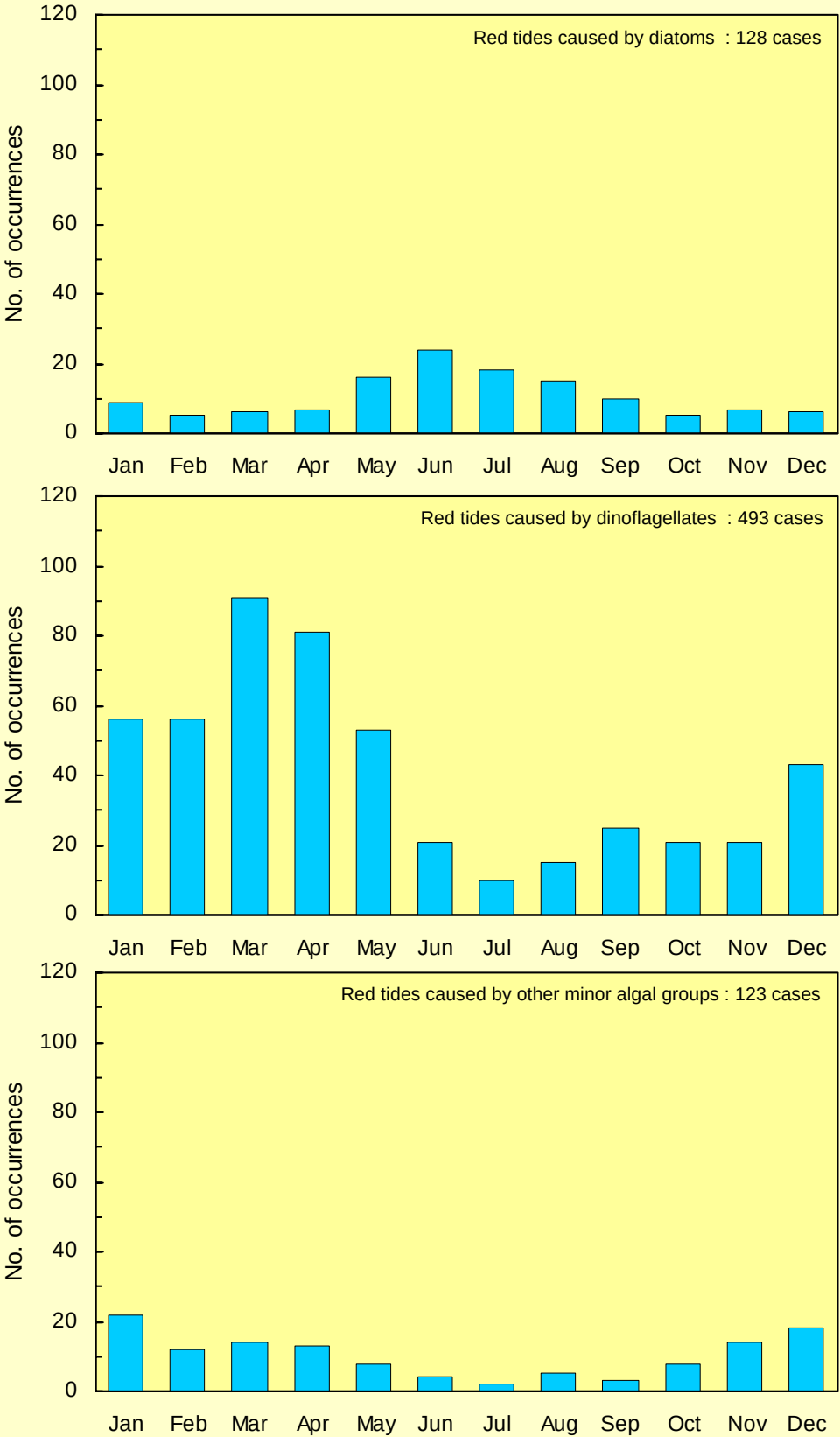


Monthly Distribution



Seasonal occurrence of red tides caused by different phytoplankton groups in Hong Kong, 1980 – 2006

(Sources: Agriculture, Fisheries and Conservation Department and Environmental Protection Department)



## Abundance and frequency of the dominant phytoplankton species in different Water Control Zones (WCZs) in 2006

| Species                               | % Abundance <sup>1</sup> | Frequency <sup>2</sup> | Species                               | % Abundance <sup>1</sup> | Frequency <sup>2</sup> | Species                           | % Abundance <sup>1</sup> | Frequency <sup>2</sup> |
|---------------------------------------|--------------------------|------------------------|---------------------------------------|--------------------------|------------------------|-----------------------------------|--------------------------|------------------------|
| <b>Tolo Harbour &amp; Channel</b>     |                          |                        | <b>Port Shelter</b>                   |                          |                        | <b>North Western</b>              |                          |                        |
| Diatoms                               |                          |                        | Diatoms                               |                          |                        | Diatoms                           |                          |                        |
| <i>Thalassiosira</i> spp.             | 37.8                     | 12                     | <i>Pseudo-nitzschia delicatissima</i> | 26.4                     | 9                      | <i>Skeletonema costatum</i>       | 83.5                     | 11                     |
| <i>Chaetoceros</i> spp.               | 24.2                     | 12                     | <i>Pseudo-nitzschia pungens</i>       | 24.9                     | 8                      | <i>Chaetoceros</i> spp.           | 6.4                      | 11                     |
| <i>Leptocylindrus danicus</i>         | 11.1                     | 9                      | <i>Thalassiosira</i> spp.             | 11.6                     | 11                     | <i>Thalassiosira</i> spp.         | 4.1                      | 12                     |
| Dinoflagellates                       |                          |                        | Dinoflagellates                       |                          |                        | Dinoflagellates                   |                          |                        |
| <i>Ceratium furca</i>                 | 32.3                     | 9                      | <i>Scrippsiella</i> spp.              | 40.8                     | 12                     | <i>Gymnodinium vestifici</i>      | 38.5                     | 12                     |
| <i>Scrippsiella</i> spp.              | 23.4                     | 11                     | <i>Gymnodinium vestifici</i>          | 20.9                     | 11                     | <i>Scrippsiella</i> spp.          | 28.8                     | 10                     |
| <i>Gymnodinium</i> spp.               | 13.6                     | 10                     | <i>Gymnodinium</i> spp.               | 18.1                     | 10                     | <i>Gymnodinium</i> spp.           | 14.0                     | 7                      |
| Others                                |                          |                        | Others                                |                          |                        | Others                            |                          |                        |
| small flagellates                     | 82.8                     | 12                     | small flagellates                     | 85.3                     | 12                     | small flagellates                 | 75.3                     | 12                     |
| <i>Plagioselmis prolunga</i>          | 15.2                     | 12                     | <i>Plagioselmis prolunga</i>          | 11.9                     | 12                     | <i>Plagioselmis prolunga</i>      | 19.6                     | 12                     |
| <i>Teleaulax acuta</i>                | 1.4                      | 12                     | <i>Teleaulax acuta</i>                | 2.1                      | 12                     | <i>Teleaulax acuta</i>            | 4.4                      | 11                     |
| <b>Mirs Bay</b>                       |                          |                        | <b>Victoria Harbour</b>               |                          |                        | <b>Western Buffer</b>             |                          |                        |
| Diatoms                               |                          |                        | Diatoms                               |                          |                        | Diatoms                           |                          |                        |
| <i>Chaetoceros</i> spp.               | 19.5                     | 12                     | <i>Skeletonema costatum</i>           | 33.2                     | 12                     | <i>Skeletonema costatum</i>       | 71.7                     | 11                     |
| <i>Pseudo-nitzschia pungens</i>       | 19.4                     | 9                      | <i>Chaetoceros</i> spp.               | 16.7                     | 11                     | <i>Chaetoceros</i> spp.           | 6.9                      | 10                     |
| <i>Pseudo-nitzschia delicatissima</i> | 14.5                     | 10                     | <i>Pseudo-nitzschia pungens</i>       | 13.6                     | 8                      | <i>Asterionellopsis glacialis</i> | 5.7                      | 3                      |
| Dinoflagellates                       |                          |                        | Dinoflagellates                       |                          |                        | Dinoflagellates                   |                          |                        |
| <i>Scrippsiella</i> spp.              | 27.4                     | 12                     | <i>Scrippsiella</i> spp.              | 26.9                     | 12                     | <i>Scrippsiella</i> spp.          | 33.3                     | 10                     |
| <i>Gymnodinium vestifici</i>          | 23.8                     | 12                     | <i>Gymnodinium vestifici</i>          | 22.9                     | 12                     | <i>Gymnodinium vestifici</i>      | 30.5                     | 11                     |
| <i>Gymnodinium</i> spp.               | 19.7                     | 12                     | <i>Gymnodinium</i> spp.               | 19.0                     | 10                     | <i>Gymnodinium</i> spp.           | 16.0                     | 10                     |
| Others                                |                          |                        | Others                                |                          |                        | Others                            |                          |                        |
| small flagellates                     | 86.7                     | 12                     | small flagellates                     | 75.9                     | 12                     | small flagellates                 | 77.8                     | 12                     |
| <i>Plagioselmis prolunga</i>          | 10.6                     | 12                     | <i>Plagioselmis prolunga</i>          | 19.4                     | 12                     | <i>Plagioselmis prolunga</i>      | 17.9                     | 12                     |
| <i>Teleaulax acuta</i>                | 1.5                      | 12                     | <i>Teleaulax acuta</i>                | 4.4                      | 12                     | <i>Teleaulax acuta</i>            | 3.5                      | 11                     |
| <b>Eastern Buffer</b>                 |                          |                        | <b>Southern</b>                       |                          |                        | <b>Deep Bay</b>                   |                          |                        |
| Diatoms                               |                          |                        | Diatoms                               |                          |                        | Diatoms                           |                          |                        |
| <i>Skeletonema costatum</i>           | 33.6                     | 9                      | <i>Skeletonema costatum</i>           | 56.2                     | 12                     | <i>Skeletonema costatum</i>       | 38.5                     | 9                      |
| <i>Pseudo-nitzschia pungens</i>       | 26.2                     | 6                      | <i>Chaetoceros</i> spp.               | 21.5                     | 12                     | <i>Thalassiosira</i> spp.         | 34.4                     | 12                     |
| <i>Chaetoceros</i> spp.               | 21.6                     | 10                     | <i>Pseudo-nitzschia pungens</i>       | 8.2                      | 8                      | <i>Nitzschia</i> spp.             | 5.2                      | 2                      |
| Dinoflagellates                       |                          |                        | Dinoflagellates                       |                          |                        | Dinoflagellates                   |                          |                        |
| <i>Scrippsiella</i> spp.              | 25.5                     | 7                      | <i>Gymnodinium vestifici</i>          | 33.7                     | 12                     | <i>Scrippsiella</i> spp.          | 70.7                     | 11                     |
| <i>Gymnodinium vestifici</i>          | 19.9                     | 8                      | <i>Scrippsiella</i> spp.              | 28.4                     | 12                     | <i>Gymnodinium</i> spp.           | 9.7                      | 9                      |
| <i>Gymnodinium</i> spp.               | 17.2                     | 8                      | <i>Gymnodinium</i> spp.               | 14.9                     | 11                     | <i>Gymnodinium vestifici</i>      | 8.8                      | 6                      |
| Others                                |                          |                        | Others                                |                          |                        | Others                            |                          |                        |
| small flagellates                     | 83.7                     | 12                     | small flagellates                     | 81.9                     | 12                     | small flagellates                 | 69.8                     | 12                     |
| <i>Plagioselmis prolunga</i>          | 11.3                     | 11                     | <i>Plagioselmis prolunga</i>          | 14.8                     | 12                     | <i>Plagioselmis prolunga</i>      | 21.6                     | 12                     |
| <i>Teleaulax acuta</i>                | 4.6                      | 8                      | <i>Teleaulax acuta</i>                | 3.0                      | 12                     | <i>Teleaulax acuta</i>            | 8.3                      | 12                     |

<sup>1</sup> % of species/group in diatoms, dinoflagellates and other phytoplankton<sup>2</sup> Number of occurrences out of 12 sampling occasions.



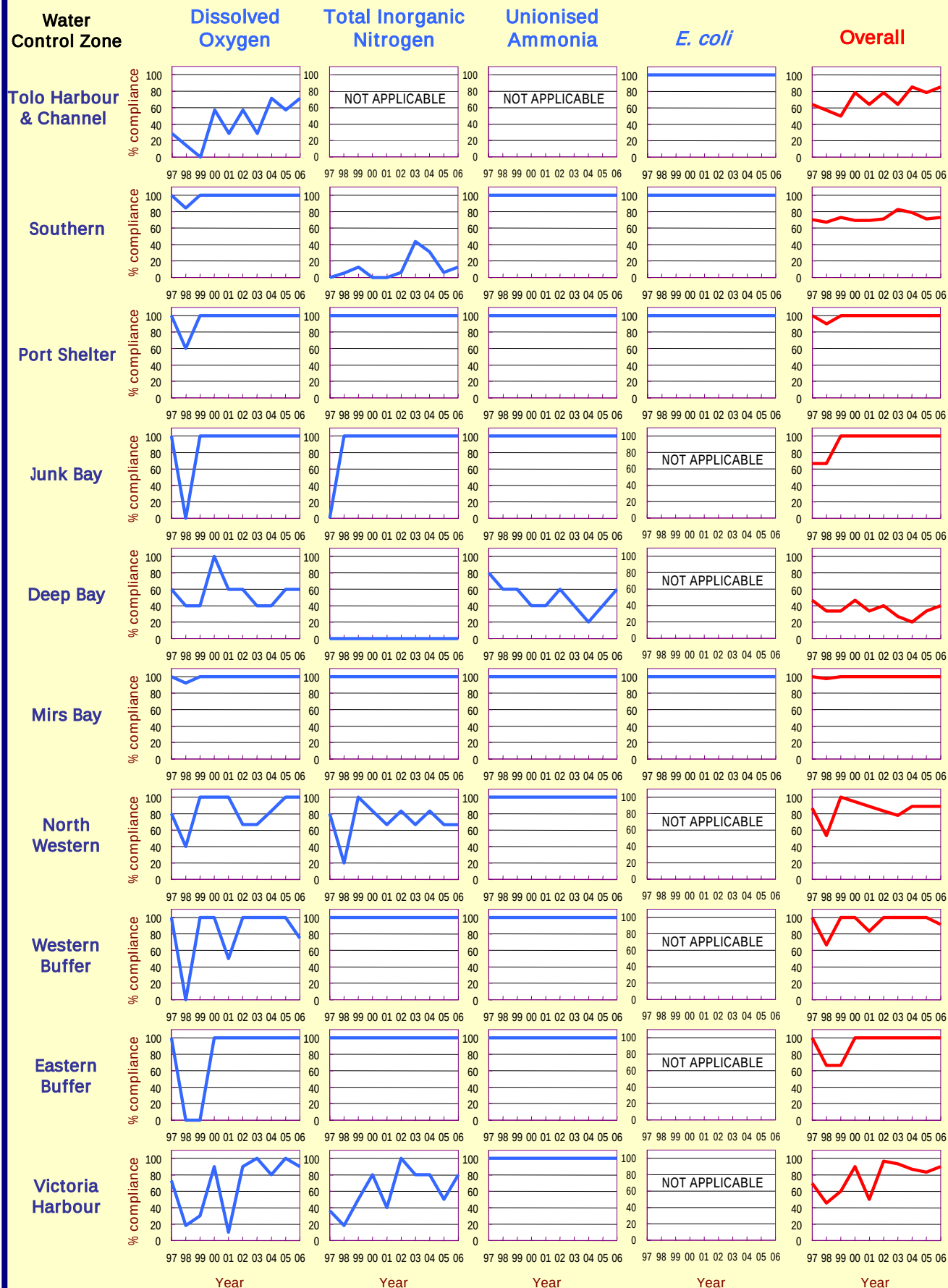
## Occurrence and distribution of red tide species in different Water Control Zones (WCZs), 1980 -2006

| Species                                     | Number of occurrences         |                    |                          |                        |                    |                         |                        |                         |                       |                    | Total      |
|---------------------------------------------|-------------------------------|--------------------|--------------------------|------------------------|--------------------|-------------------------|------------------------|-------------------------|-----------------------|--------------------|------------|
|                                             | Tolo Harbour<br>& Channel WCZ | Mirs<br>Bay<br>WCZ | Eastern<br>Buffer<br>WCZ | Port<br>Shelter<br>WCZ | Junk<br>Bay<br>WCZ | Victoria<br>Harbour WCZ | Southern<br>Waters WCZ | North<br>Western<br>WCZ | Western<br>Buffer WCZ | Deep<br>Bay<br>WCZ |            |
| <i>Noctiluca scintillans</i>                | 58                            | 65                 |                          | 51                     |                    |                         | 53                     | 5                       | 6                     |                    | 238        |
| <i>Skeletonema costatum</i>                 | 23                            | 3                  |                          | 1                      | 3                  | 8                       | 10                     | 3                       | 9                     | 1                  | 61         |
| <i>Gonyaulax polygramma</i>                 | 21                            | 8                  |                          | 12                     |                    |                         | 6                      | 1                       |                       |                    | 48         |
| <i>Mesodinium rubrum</i>                    | 8                             | 8                  |                          | 7                      | 1                  |                         | 15                     | 6                       |                       | 2                  | 47         |
| <i>Prorocentrum minimum</i>                 | 44                            | 1                  |                          |                        |                    |                         |                        |                         |                       |                    | 45         |
| <i>Ceratium furca</i>                       | 15                            | 7                  |                          | 13                     |                    |                         |                        |                         |                       |                    | 35         |
| <i>Prorocentrum triestinum</i>              | 33                            |                    |                          |                        |                    |                         |                        |                         |                       |                    | 33         |
| <i>Scrippsiella trochoidea</i>              | 14                            | 4                  |                          | 2                      |                    |                         | 1                      |                         |                       |                    | 21         |
| <i>Heterosigma akashiwo</i>                 | 14                            | 2                  |                          |                        |                    |                         |                        | 3                       |                       |                    | 19         |
| <i>Heterocapsa circularisquama</i>          | 13                            | 3                  |                          |                        |                    |                         |                        |                         |                       |                    | 16         |
| <i>Prorocentrum sigmoides</i>               | 14                            | 1                  |                          | 1                      |                    |                         |                        |                         |                       |                    | 16         |
| <i>Prorocentrum dentatum</i>                | 8                             | 3                  |                          | 1                      |                    |                         | 1                      |                         |                       |                    | 13         |
| <i>Thalassiosira nordenskiöldii</i>         | 2                             | 3                  |                          |                        |                    | 1                       | 4                      |                         | 2                     |                    | 12         |
| <i>Prorocentrum micans</i>                  | 4                             | 4                  |                          | 1                      |                    | 1                       | 1                      |                         |                       |                    | 11         |
| <i>Trichodesmium erythraeum</i>             |                               | 5                  |                          | 3                      |                    |                         | 3                      |                         |                       |                    | 11         |
| <i>Karenia mikimotoi</i>                    | 6                             | 1                  |                          | 3                      |                    |                         |                        |                         |                       |                    | 10         |
| <i>Leptocylindrus minimus</i>               | 10                            |                    |                          |                        |                    |                         |                        |                         |                       |                    | 10         |
| <i>Cryptomonas</i> sp.                      | 8                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 8          |
| <i>Dactyliosolen fragilissimus</i>          | 6                             | 1                  |                          | 1                      |                    |                         |                        |                         |                       |                    | 8          |
| <i>Thalassiosira mala</i>                   | 6                             |                    |                          |                        |                    |                         | 2                      |                         |                       |                    | 8          |
| <i>Chaetoceros</i> spp.                     | 6                             |                    |                          | 1                      |                    |                         |                        |                         |                       |                    | 7          |
| <i>Karenia digitata</i>                     | 1                             | 3                  |                          | 2                      |                    |                         | 1                      |                         |                       |                    | 7          |
| <i>Thalassiosira proschkiniae</i>           | 6                             | 1                  |                          |                        |                    |                         |                        |                         |                       |                    | 7          |
| <i>Plagioselmis prolunga</i>                | 6                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 6          |
| <i>Akashiwo sanguinea</i>                   | 2                             | 2                  |                          |                        |                    |                         |                        | 1                       |                       | 1                  | 6          |
| <i>Gyrodinium instriatum</i>                |                               |                    |                          |                        |                    | 1                       | 1                      | 2                       | 1                     | 1                  | 6          |
| <i>Phaeocystis globosa</i>                  |                               | 1                  |                          |                        |                    |                         | 4                      |                         |                       | 1                  | 6          |
| <i>Thalassiosira</i> spp.                   | 2                             |                    |                          |                        | 1                  |                         | 2                      |                         |                       |                    | 5          |
| <i>Dictyocha speculum</i>                   |                               | 2                  |                          | 2                      |                    |                         | 1                      |                         |                       |                    | 5          |
| <i>Cochlodinium</i> sp.                     | 2                             |                    |                          |                        |                    |                         |                        | 2                       |                       |                    | 4          |
| <i>Eutreptiella</i> spp.                    | 4                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 4          |
| <i>Haematococcus pluvialis</i>              | 4                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 4          |
| <i>Leptocylindrus danicus</i>               | 3                             | 1                  |                          |                        |                    |                         |                        |                         |                       |                    | 4          |
| <i>Pseudo-nitzschia pseudodelicatissima</i> | 1                             |                    |                          |                        |                    |                         | 2                      |                         | 1                     |                    | 4          |
| <i>Chaetoceros curvisetus</i>               |                               |                    | 1                        |                        | 1                  |                         | 1                      |                         |                       |                    | 3          |
| <i>Chattonella ovata</i>                    |                               | 2                  |                          | 1                      |                    |                         |                        |                         |                       |                    | 3          |
| <i>Chattonella marina</i>                   | 2                             | 1                  |                          |                        |                    |                         |                        |                         |                       |                    | 3          |
| <i>Gymnodinium simplex</i>                  | 3                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 3          |
| <i>Karenia longicanalis</i>                 | 1                             | 1                  |                          |                        |                    |                         | 1                      |                         |                       |                    | 3          |
| <i>Pseudo-nitzschia seriata</i>             | 1                             |                    |                          |                        |                    | 2                       |                        |                         |                       |                    | 3          |
| <i>Prorocentrum balticum</i>                | 1                             | 1                  |                          | 1                      |                    |                         |                        |                         |                       |                    | 3          |
| <i>Teleaulax acuta</i>                      | 3                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 3          |
| <i>Trichodesmium</i> sp.                    |                               | 1                  |                          | 1                      |                    |                         | 1                      |                         |                       |                    | 3          |
| <i>Alexandrium tamarense</i>                |                               |                    |                          | 2                      |                    |                         |                        |                         |                       |                    | 2          |
| <i>Cerataulina pelagica</i>                 | 2                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 2          |
| <i>Chaetoceros socialis</i>                 |                               |                    |                          |                        |                    |                         | 2                      |                         |                       |                    | 2          |
| <i>Chattonella</i> sp.                      | 1                             |                    |                          |                        |                    |                         | 1                      |                         |                       |                    | 2          |
| <i>Cochlodinium polykrikoides</i>           |                               |                    |                          |                        |                    |                         | 2                      |                         |                       |                    | 2          |
| <i>Eucampia zodiacus</i>                    |                               |                    |                          |                        |                    |                         | 1                      | 1                       |                       |                    | 2          |
| <i>Gymnodinium</i> sp. X                    |                               |                    |                          | 2                      |                    |                         |                        |                         |                       |                    | 2          |
| <i>Heterocapsa rotundata</i>                | 2                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 2          |
| <i>Nitzschia longissima</i>                 | 1                             |                    |                          |                        |                    |                         | 1                      |                         |                       |                    | 2          |
| <i>Prorocentrum</i> spp.                    | 1                             | 1                  |                          |                        |                    |                         |                        |                         |                       |                    | 2          |
| <i>Thalassiosira weissflogii</i>            |                               |                    |                          |                        |                    |                         |                        |                         |                       | 2                  | 2          |
| <i>Alexandrium catenella</i>                |                               |                    |                          |                        | 1                  |                         |                        |                         |                       |                    | 1          |
| <i>Chaetoceros pseudocrinitus</i>           | 1                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Chaetoceros pseudocurvisetus</i>         |                               |                    |                          |                        |                    |                         | 1                      |                         |                       |                    | 1          |
| <i>Chaetoceros</i> sp.0105                  | 1                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Chaetoceros tenuissimus</i>              |                               | 1                  |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Chlamydomonas</i> sp.                    | 1                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Chlamydomonas uva-maris</i>              | 1                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Cyclotella caspia</i>                    | 1                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Cyclotella</i> spp.                      | 1                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Cyttarocyllis</i> sp.                    |                               |                    |                          | 1                      |                    |                         |                        |                         |                       |                    | 1          |
| <i>Cylindrotheca closterium</i>             | 1                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Guinardia delicatula</i>                 | 1                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Guinardia striata</i>                    | 1                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Gymnodinium</i> sp.                      |                               | 1                  |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Gyrodinium spirale</i>                   |                               |                    |                          |                        |                    |                         | 1                      |                         |                       |                    | 1          |
| <i>Hermesinium adriaticum</i>               |                               | 1                  |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Karlodinium micrum</i>                   |                               | 1                  |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Katodinium rotundatum</i>                |                               |                    |                          |                        |                    |                         |                        | 1                       |                       |                    | 1          |
| <i>Leptocylindrus</i> spp.                  |                               |                    |                          |                        |                    |                         | 1                      |                         |                       |                    | 1          |
| <i>Navicula</i> sp.                         |                               |                    |                          |                        |                    |                         |                        |                         |                       | 1                  | 1          |
| <i>Odontella mobiliensis</i>                | 1                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Odontella sinensis</i>                   | 1                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Pedinomonadaceae</i> species             | 1                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Protoperidinium quinquecorne</i>         | 1                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Pseudo-nitzschia</i> spp.                |                               |                    |                          |                        |                    |                         | 1                      |                         |                       |                    | 1          |
| <i>Thalassomonas</i> sp.                    | 1                             |                    |                          |                        |                    |                         |                        |                         |                       |                    | 1          |
| <i>Trichodesmium thiebautii</i>             |                               |                    |                          |                        |                    |                         | 1                      |                         |                       |                    | 1          |
| <b>Total : 81 species</b>                   | <b>376</b>                    | <b>140</b>         | <b>1</b>                 | <b>109</b>             | <b>7</b>           | <b>13</b>               | <b>122</b>             | <b>25</b>               | <b>19</b>             | <b>9</b>           | <b>821</b> |

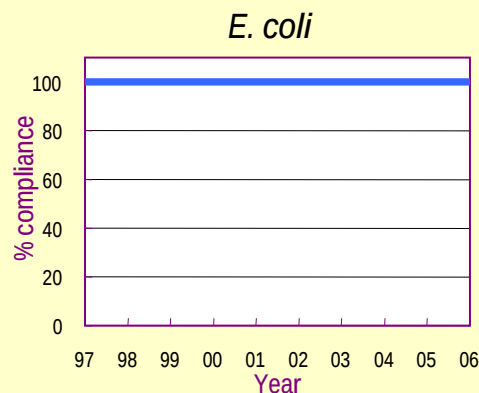
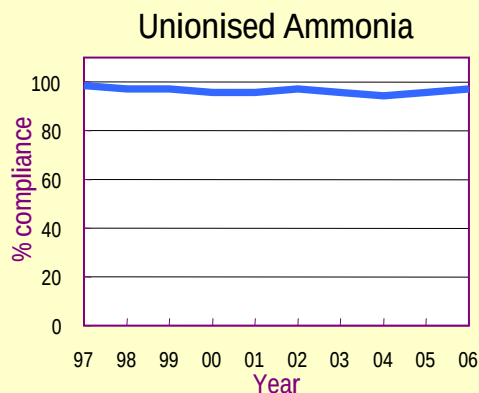
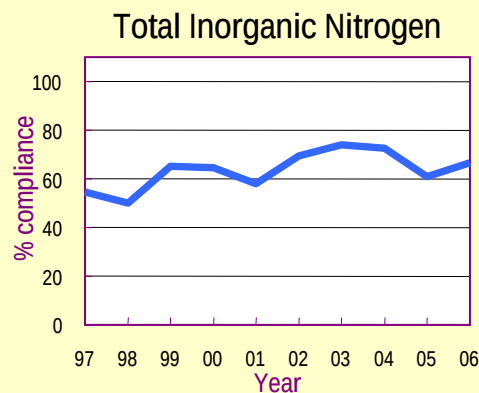
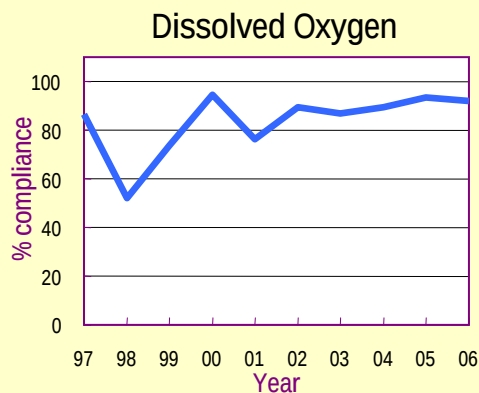
Note: a red tide incident may involve more than one causative species.

Source: Agriculture, Fisheries and Conservation Department and Environmental Protection Department

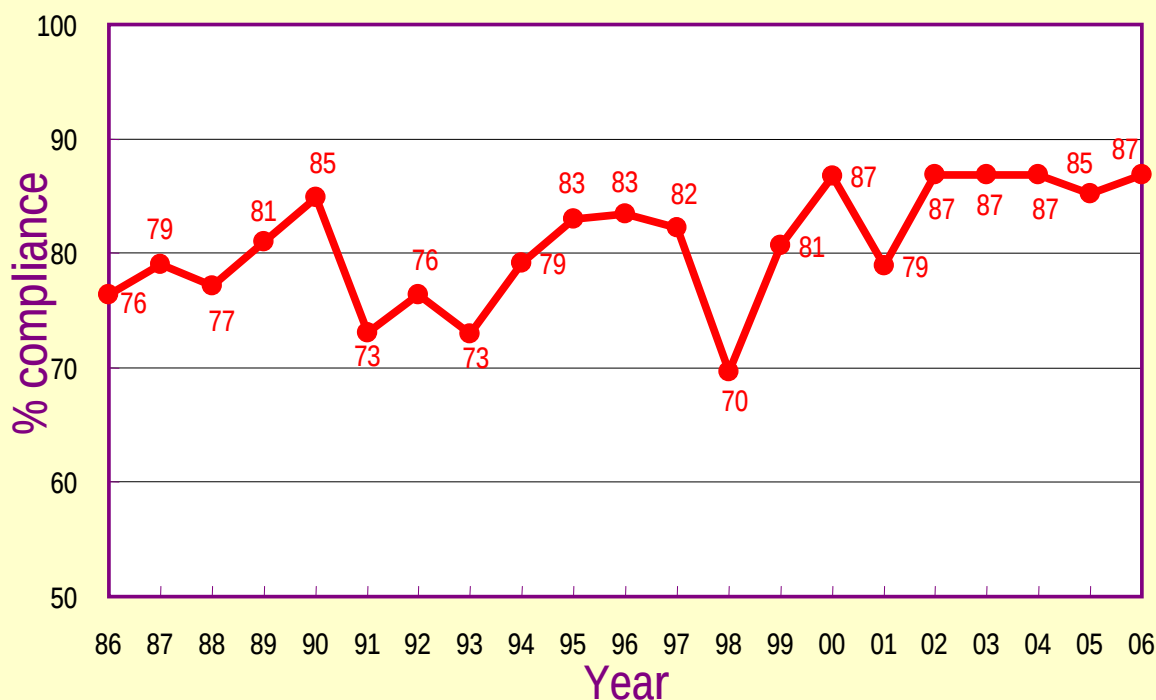
# Level of compliance with key marine Water Quality Objectives for 10 Water Control Zones in Hong Kong, 1997 - 2006



Level of compliance with key marine Water Quality Objectives  
in Hong Kong, 1997 - 2006



Overall level of compliance with key marine Water Quality Objectives  
in Hong Kong, 1986 - 2006

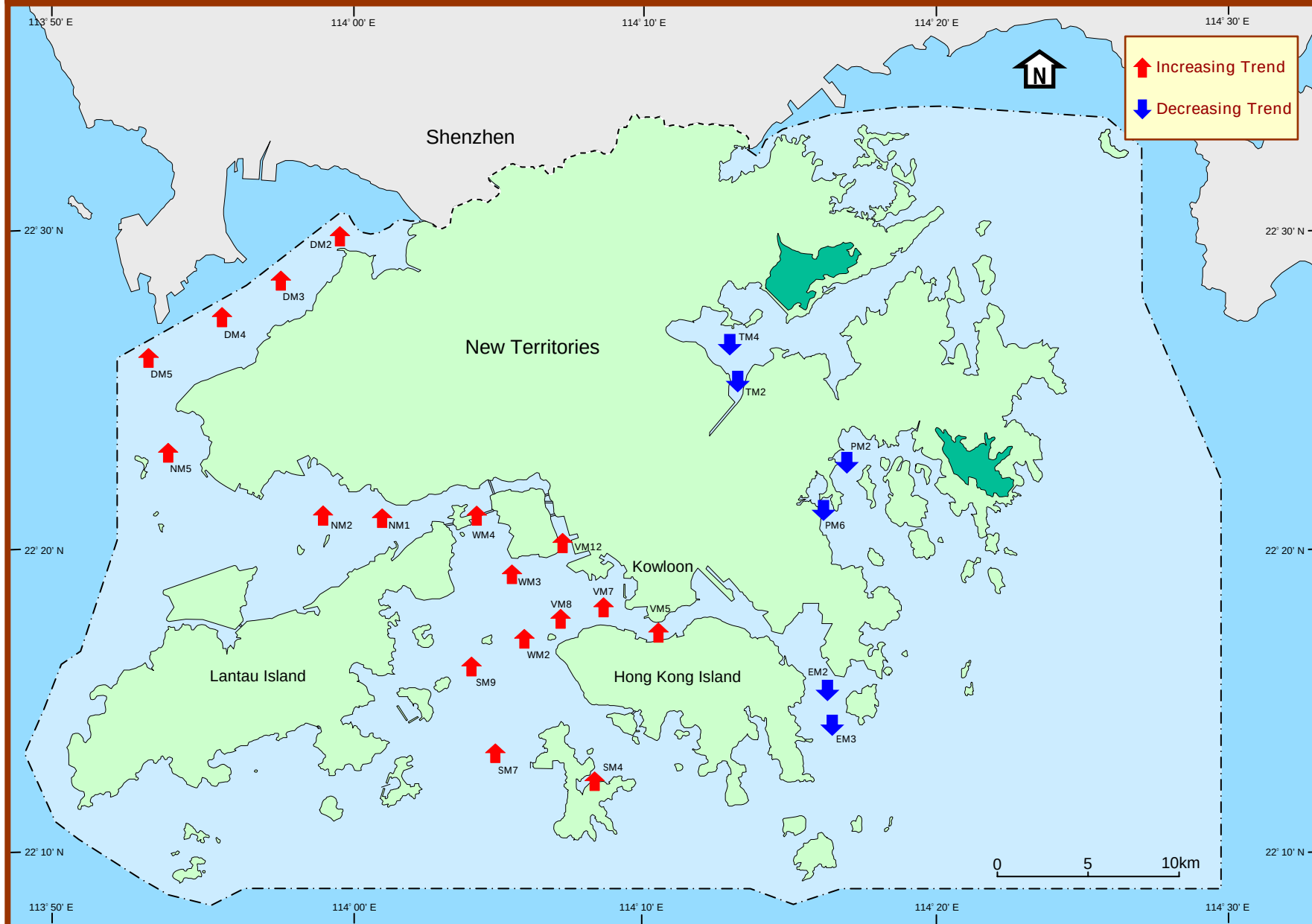


## Long-term changes in dissolved oxygen in marine waters of Hong Kong, 1986 - 2006



## Long-term changes in 5-day Biochemical Oxygen Demand in marine waters of Hong Kong, 1986 - 2006

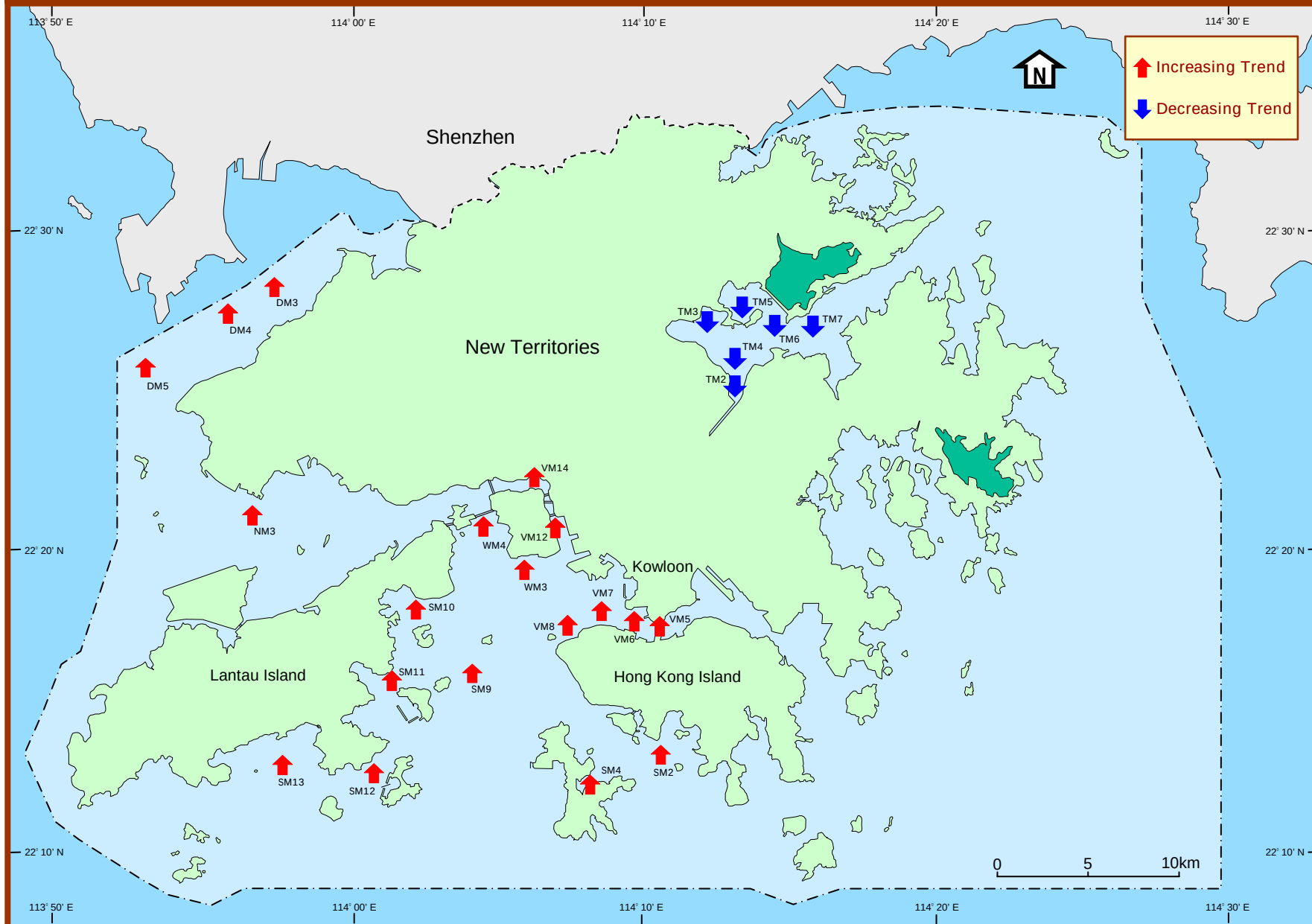


Long-term changes in *E. coli* in marine waters of Hong Kong, 1986 - 2006

## Long-term changes in ammonia nitrogen in marine waters of Hong Kong, 1986 - 2006

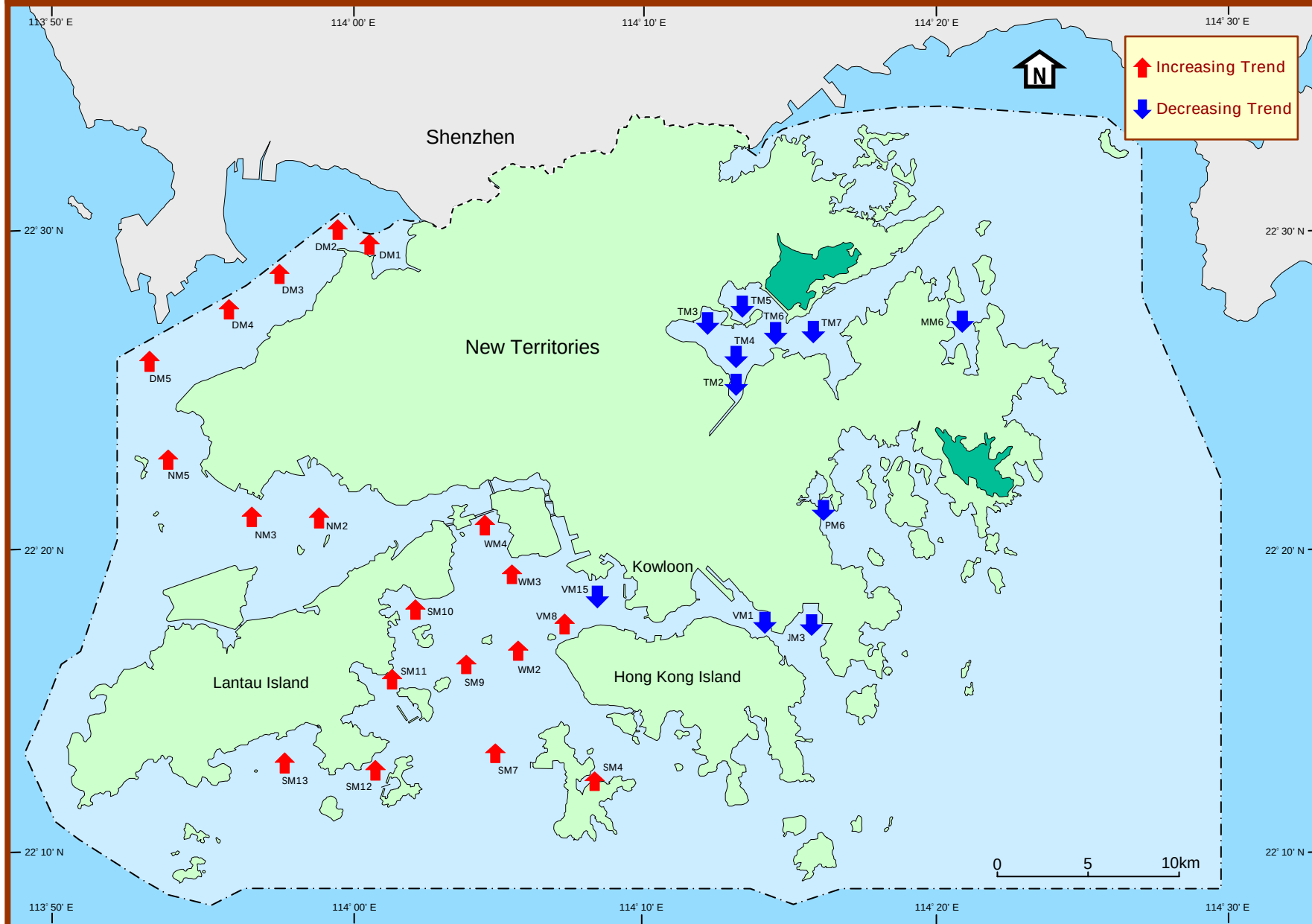


## Long-term changes in nitrate nitrogen in marine waters of Hong Kong, 1986 - 2006

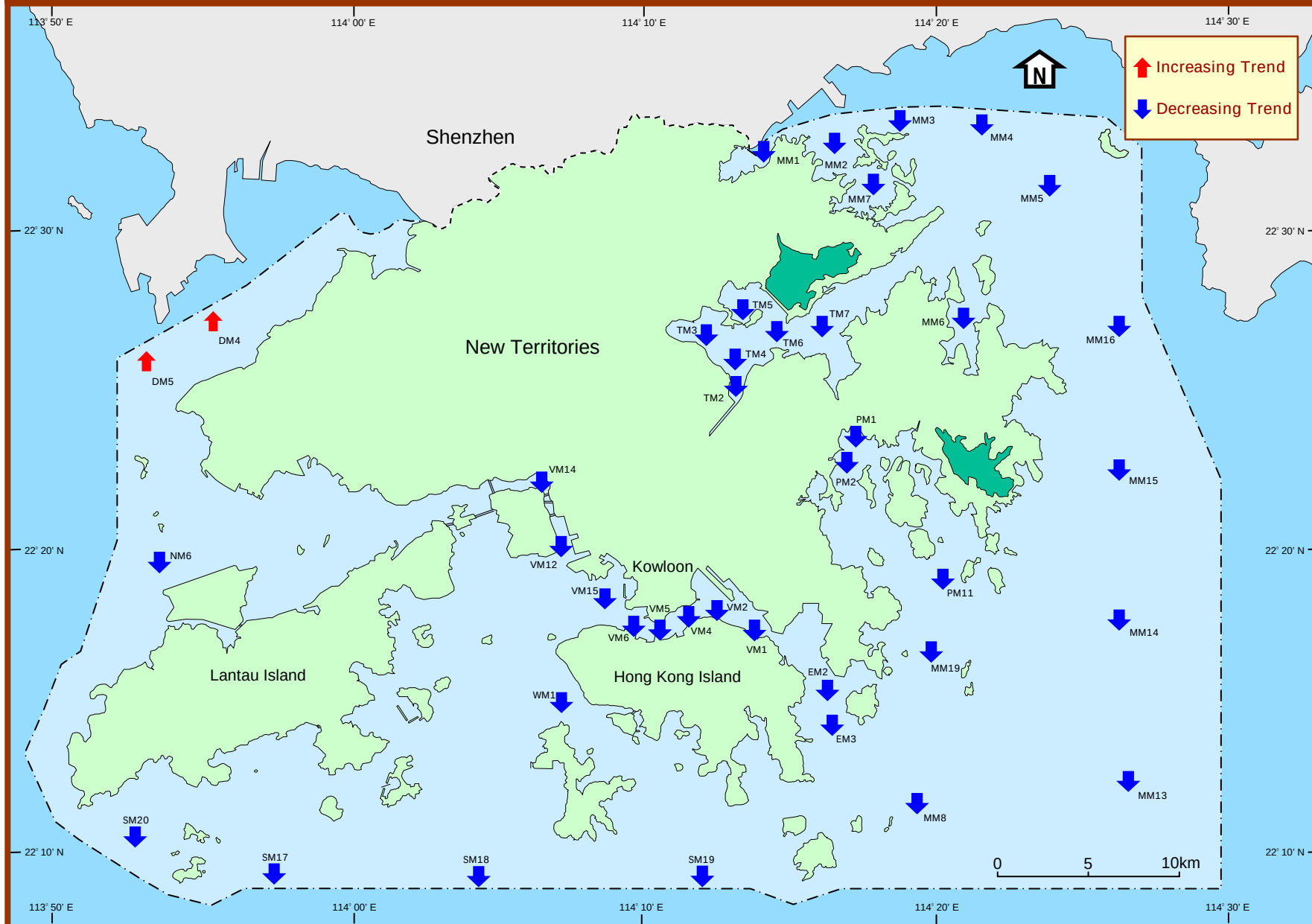




## Long-term changes in total inorganic nitrogen in marine waters of Hong Kong, 1986 - 2006



## Long-term changes in orthophosphate phosphorus in marine waters of Hong Kong, 1986 - 2006



Long-term changes in chlorophyll-*a* in marine waters of Hong Kong, 1986 - 2006

