CAPITAL REGIONAL DISTRICT
Water Services

2005 Annual Overview of Greater Victoria's Drinking Water Quality

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WATER SERVICES
CAPITAL REGIONAL DISTRICT
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Executive Summary

This report is the annual overview of water quality testing that was conducted in 2005 in the Greater Victoria Drinking Water System. The test results show that Greater Victoria's drinking water continues to be good quality and is safe to drink. With a few minor exceptions, all the results were within the limits of both the *Guidelines for Canadian Drinking Water Quality* and the BC *Drinking Water Protection Regulation.* The full report is posted at http://www.crd.bc.ca/water/waterquality/annualreports.htm on the Capital Regional District (CRD) website.

Samples and Tests. In 2005, the Water Quality Division collected 7,990 samples from the Greater Victoria Drinking Water System and analyzed those samples for 36,834 individual tests. Approximately 300 different types of tests were conducted on these samples.

Bacteria in Source Water. In 2005, as in the past few years, the level of total coliform bacteria in the raw source water entering the treatment plants continued to be elevated during the summer although the peak was reached in mid-September 2005 rather than in early August as in past years (**Figure 1**). Overall the bacterial levels were lower than in the past few years. The quality of the raw water entering the plant continued to easily meet the fecal coliform (*E. coli*) limit of 20 colony forming units per 100 mL in the USEPA Surface Water Treatment Rule and therefore continued to qualify to remain an unfiltered surface water supply under this portion of their regulations (**Figure 1B**). The level of 20 per 100 mL was only reached once the entire year. Both the median value of 0 per 100 mL and the maximum value of 20 per 100 mL indicate a good quality source that is not subject to contamination.

Treatment. The treatment process used to disinfect the raw source water entering the distribution system continued to be ultraviolet (UV) disinfection followed by free chlorine and then ammonia (to produce chloramines. The chlorine dosage level was maintained at 1.5 mg/L for the majority of the year. This dosage level resulted in a monthly average total chlorine residual ranging from 1.13 to 1.47 mg/L at the entry point to the distribution system (**Figure 2**).

Bacteria at First Customer. No total coliform bacteria were observed at the first customer sampling location below the Japan Gulch Treatment Plant during 2005 (**Figure 2**). The annual total coliform positive sample rate of 0% was one of the lowest ever observed and was due to the use of the combination of UV and free chlorine as primary disinfectants. No fecal coliform (*E. coli*) bacteria were found in any of the samples collected at this point. This provides further assurance of the bacterial safety of Greater Victoria's drinking water.

Bacteria in Distribution System. When all of the results from the various municipal distribution systems are grouped together, the percentage of total coliform positive samples in the distribution system did not exceed the 10% Guideline limit during any month in 2005 and was therefore in compliance with the BC *Drinking Water Protection Regulation*. Over a 14 year period of time, a reduction in total coliform detection and hence, an improvement in the bacteriological water quality (**Figure 2A**) was observed.

Parasites. In 2005, the average annual percentage of samples containing *Giardia* cysts was 8.3% (median 0/100 mL) (**Figure 3**). One *Giardia* cyst was detected in each of two samples. However, both cysts were reported as being non-viable and therefore incapable of causing disease. None of the samples contained *Cryptosporidium* oocysts (**Figure 5**). The long term average (1992-2005) *Cryptosporidium* oocyst concentration was 0.08 oocysts per 100 L. While this is an extremely low value for a surface water supply, the addition of UV disinfection provides assurance that no infective *Cryptosporidium* oocysts can enter Greater Victoria's drinking water.

Physical-Chemical-Radiological. All the physical, chemical and radiological parameters were well within the Canadian Guideline limits except for water temperature (aesthetic limit of 15ºC). In 2005, the water temperature entering the plant was cooler than in previous years because it was being drawn from a deeper strata in the reservoir. All inorganic chemicals including metals and non-metals were within Guideline values. No synthetic organic chemicals including pesticides and herbicides were detected in the raw water entering the treatment plants.

Disinfection By-Products. Disinfection by-products such as total trihalomethanes (TTHMs) were well below (range of 3.5–15.4 μg/L) the Canadian Guideline value of 100 μg/L in the chloraminated portion of the distribution system but were higher in the portion of the distribution system in North Saanich where periodically additional free chlorine is being added to the water to prevent the regrowth of bacteria. In that section of the distribution system, during the period when the additional chlorine is being added, the total trihalomethane concentration ranged from 28 to 56 μg/L. Similarly, in that same portion of the distribution system, a second group of disinfection by-products, haloacetic acids (referred to as HAA5 because the limit is based on the concentration of a group of five HAAs) were also elevated and ranged from 36-86 μg/L. No Canadian limit exists for this parameter.

Sooke Reservoir Biological Activity. The overall level of algal activity in Sooke Reservoir can be measured using chlorophyll-a, a component of all algal cells. In 2005, the concentrations of chlorophyll were substantially higher (93% and 77%) than the pre-inundation concentrations but were similar to those observed in 2004 **(Figure 9).** The primary contributor to the higher levels of chlorophyll-a observed in Sooke Reservoir in 2003 through 2005 was the higher levels of total phosphorus, a nutrient that is needed for the algae to grow. As can be seen in **Figure 10**, while the median concentration of total phosphorus was approximately 78% higher than in previous years in both the north and south basins of Sooke Reservoir, the 2005 levels were slightly lower than in 2003 and 2004. The higher levels coincided with flooding of the newly cleared lands around the margin of Sooke Reservoir when the reservoir was expanded. In 2005, the two primary algal contributors to the high levels of chlorophyll-a were two diatoms: *Asterionella* and *Cyclotella bodanica* (**Figures 11 and 12**). Both organisms occur commonly within Sooke Reservoir but the fall bloom of *Asterionella* and the first-ever observed bloom of *Cyclotella bodanica* were unusual.

Water Quality Complaints. In 2005, the number of water quality complaints received by the Water Services Department was similar to 2002 and 2004 and much less than the record number received in 2003 (**Figure 13**). A number of calls were received from people experiencing skin sensitivities or allergies prompting the Division to add a new category of complaint called 'Sensitivity'. At present, there is no definitive relationship between the observed skin sensitivities and Greater Victoria's drinking water.

RECOMMENDATIONS

In conjunction with the Saanich Peninsula Water Commission and the CRD Environmental Services Department, it is recommended that the chlorination process at the Deep Cove Pumphouse on the Saanich Peninsula be changed to a chloramination process to reduce the levels of disinfection by-products in that portion of the North Saanich distribution system served from the Deep Cove Pumphouse. This work was planned to be completed in 2005. However, the cost of making these treatment changes was substantively higher than budgeted and was subsequently postponed.

Figure 1. Total Coliforms and Water Temperature of Raw Water Entering Japan Gulch Plant in 2005

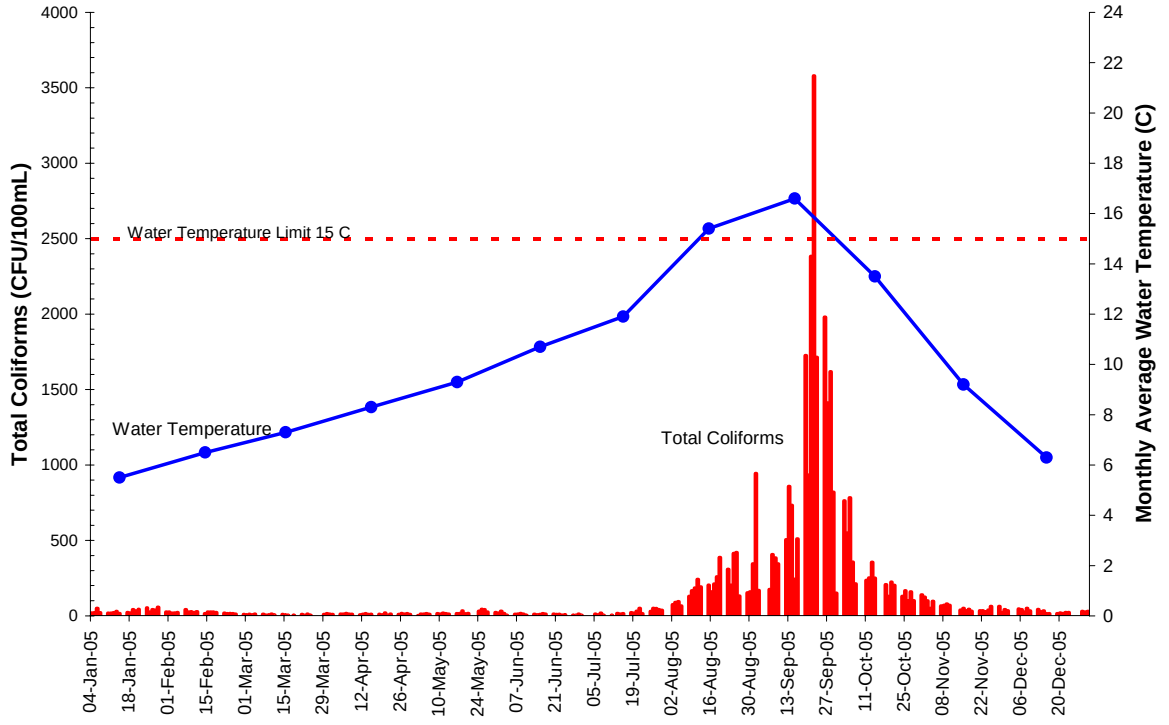


Figure 1B. *E. coli* in Raw Water Entering Japan Gulch Plant in 2005

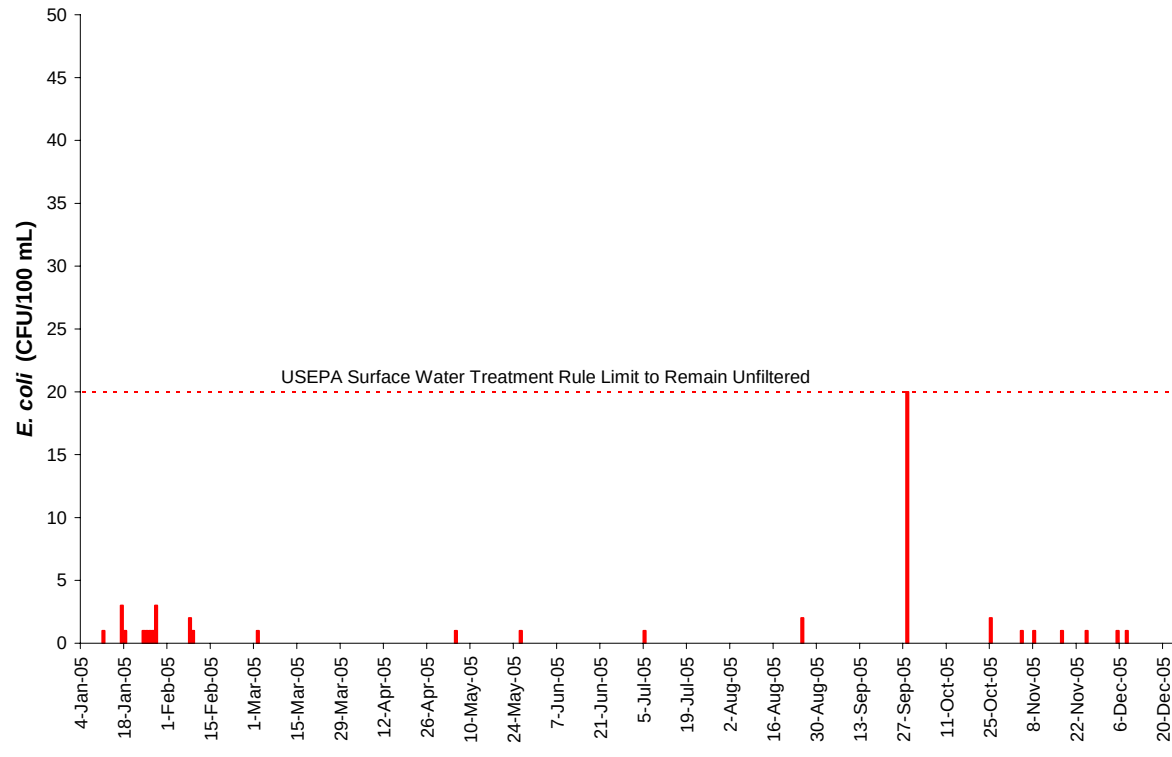


Figure 2. Treated Water at First Customer Below Japan Gulch Plant
Monthly Total Coliforms and Chlorine Residual in 2005

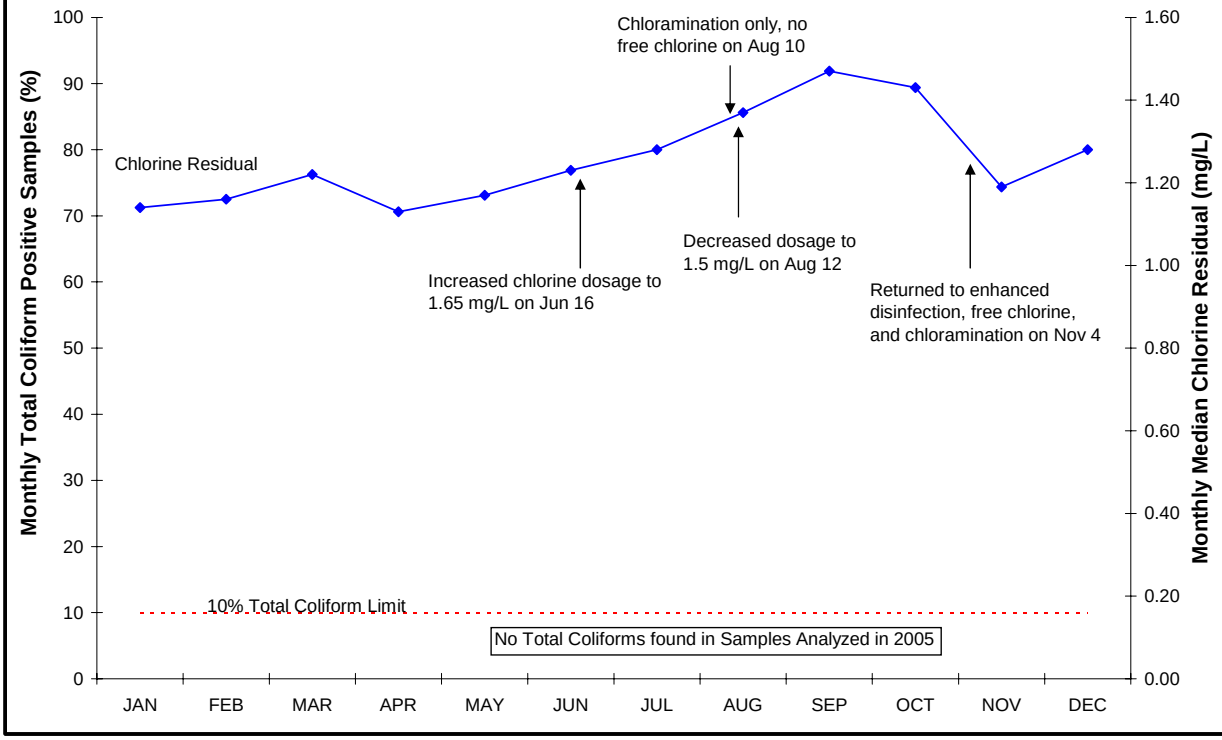


Figure 2a. Greater Victoria Distribution System Combined
Annual % Samples with Total Coliforms Present, 1992-2005

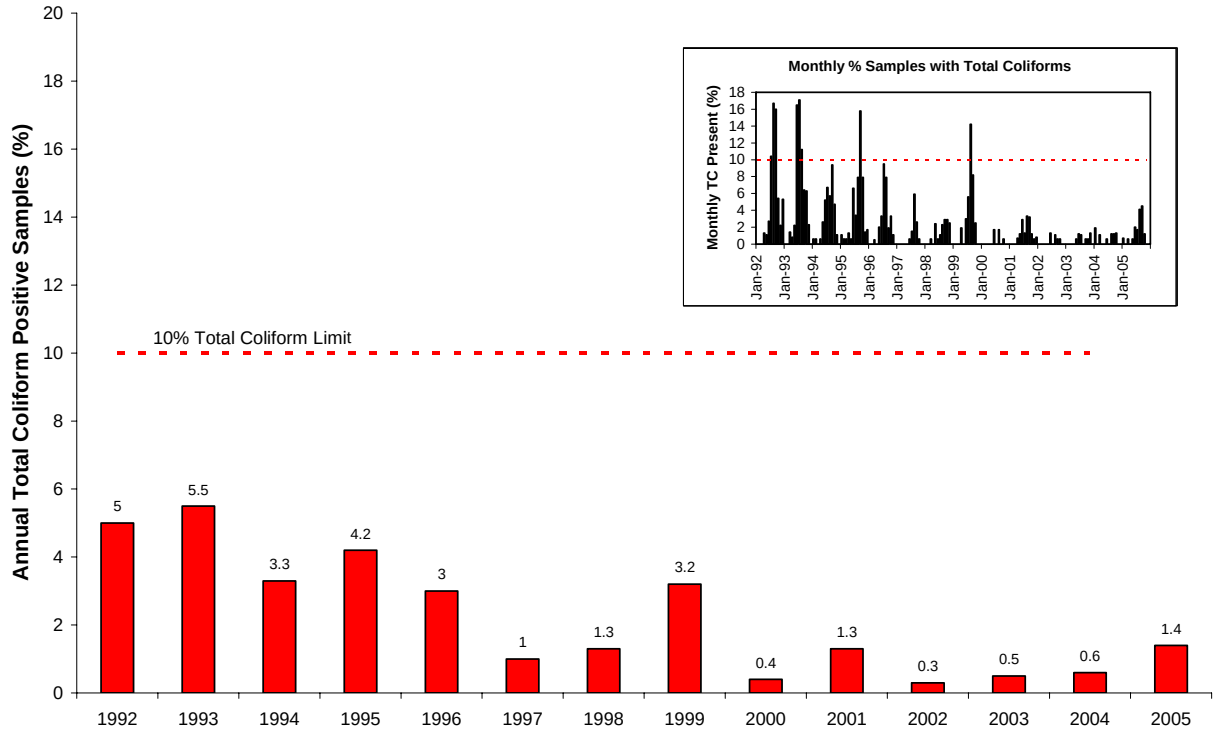
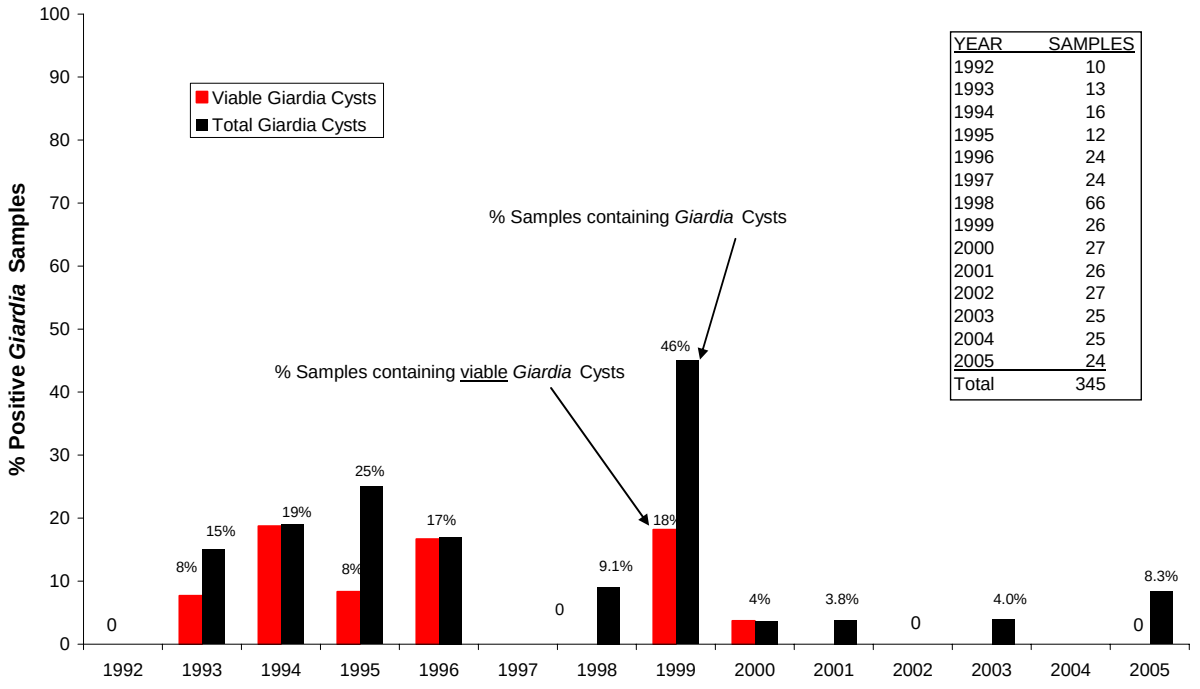
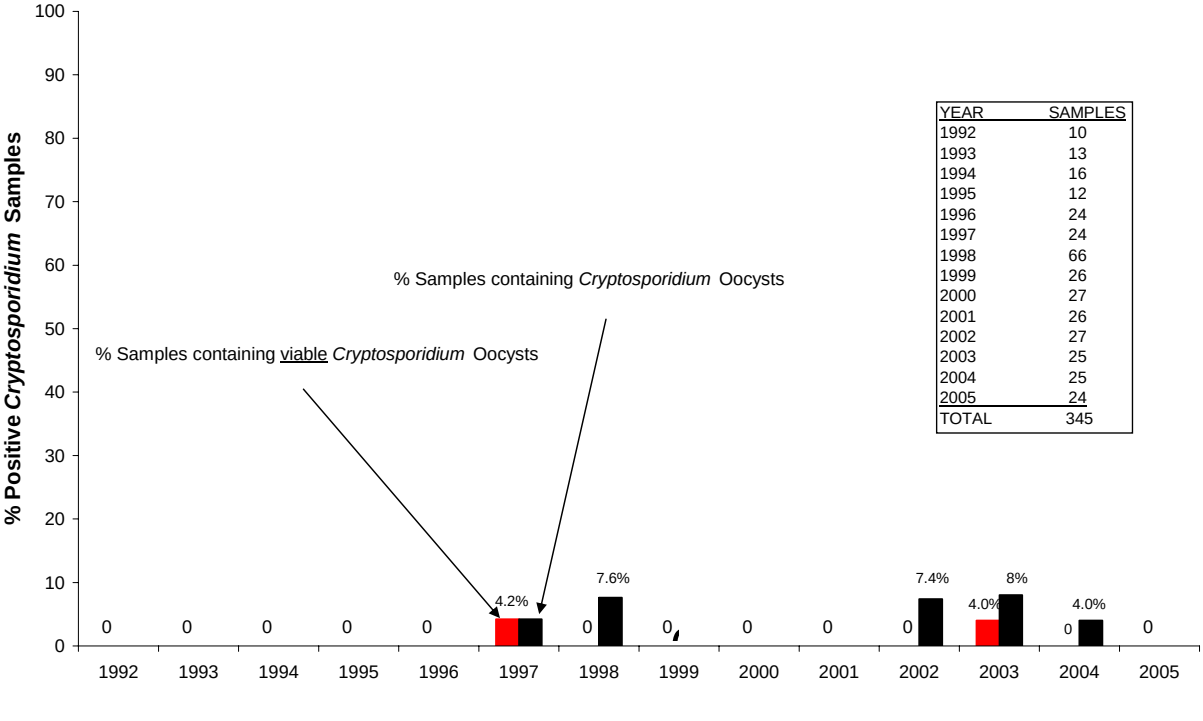


Figure 3. Percentage of Samples Containing *Giardia* Cysts in Raw Water Entering Japan Gulch Plant, 1992- 2005



YEAR	SAMPLES
1992	10
1993	13
1994	16
1995	12
1996	24
1997	24
1998	66
1999	26
2000	27
2001	26
2002	27
2003	25
2004	25
2005	24
Total	345

Figure 5. Percentage of Samples Containing *Cryptosporidium* Oocysts in Raw Water Entering Japan Gulch Plant, 1992- 2005



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TOTAL	345

Figure 9. Chlorophyll-a Concentrations in Sooke Reservoir, 1995-2005

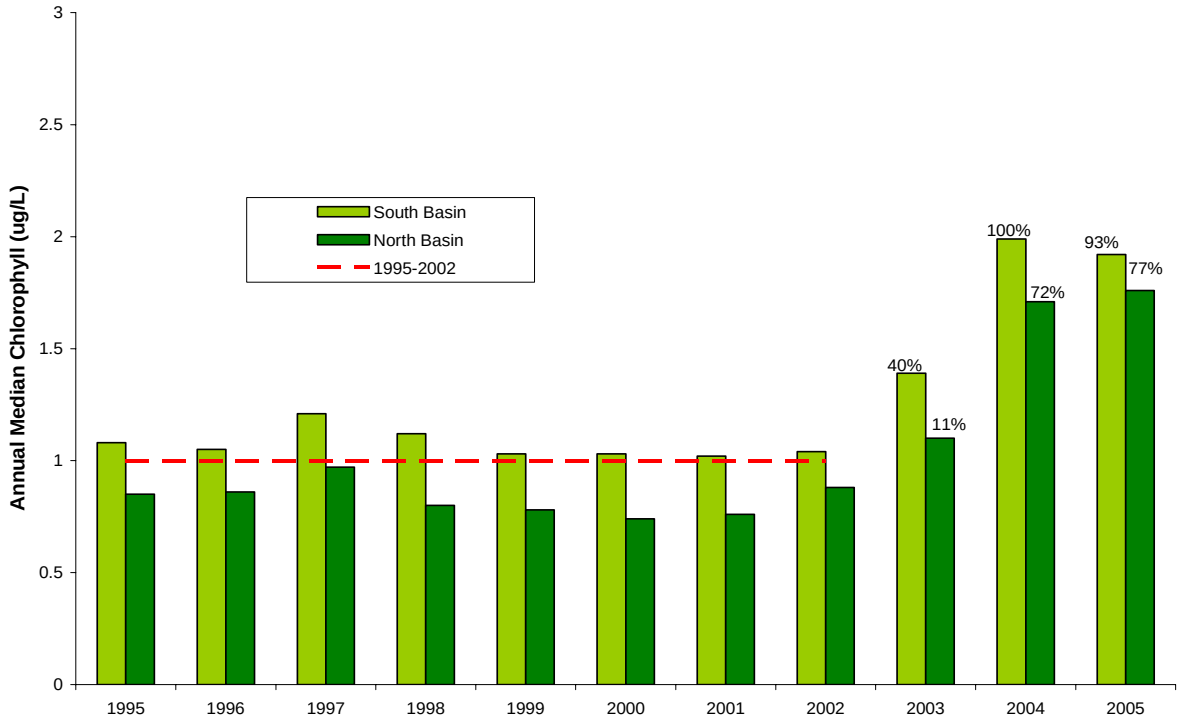

Figure 10. Total Phosphorus Concentrations in Sooke Reservoir 1992-2005

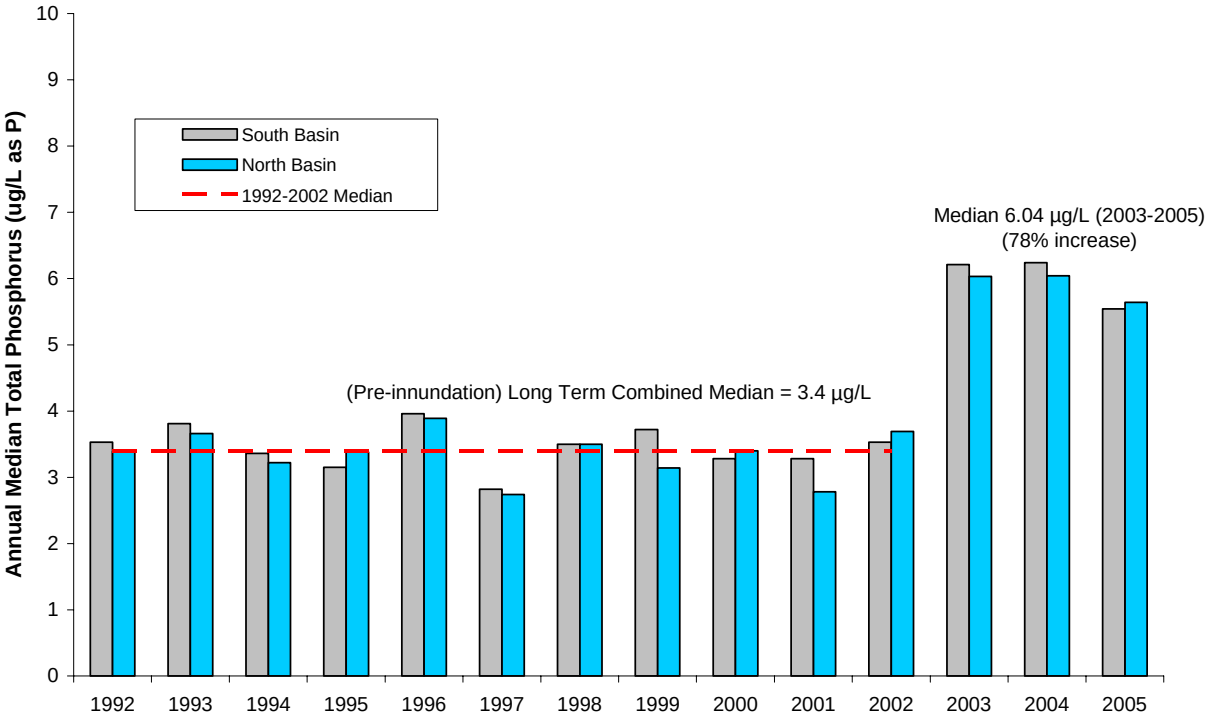

Figure 11. *Asterionella spp*. in Sooke Reservoir, Intake Forebay, 1m depth (SOL-00-01)

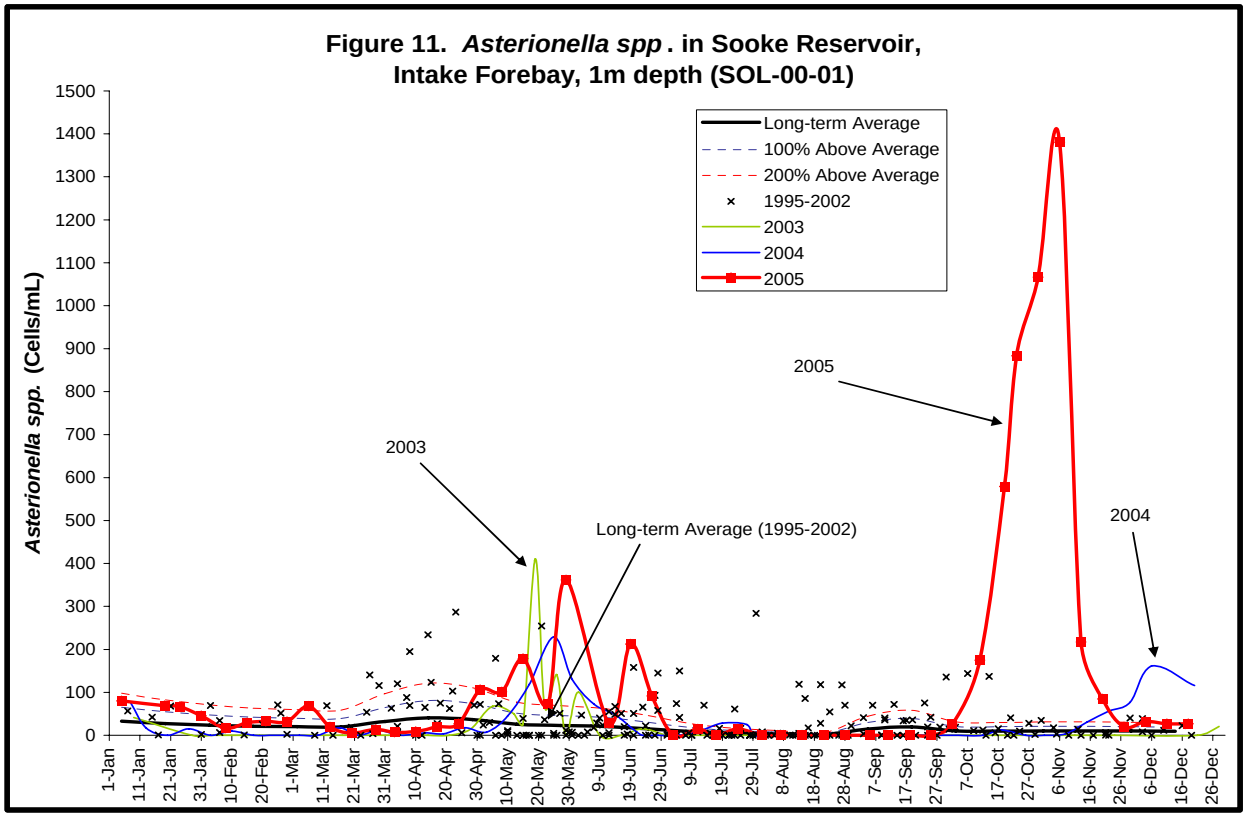

Figure 12. *Cyclotella bodanica* in Sooke Reservoir, Intake Forebay, SOL-00-01 (1m depth)

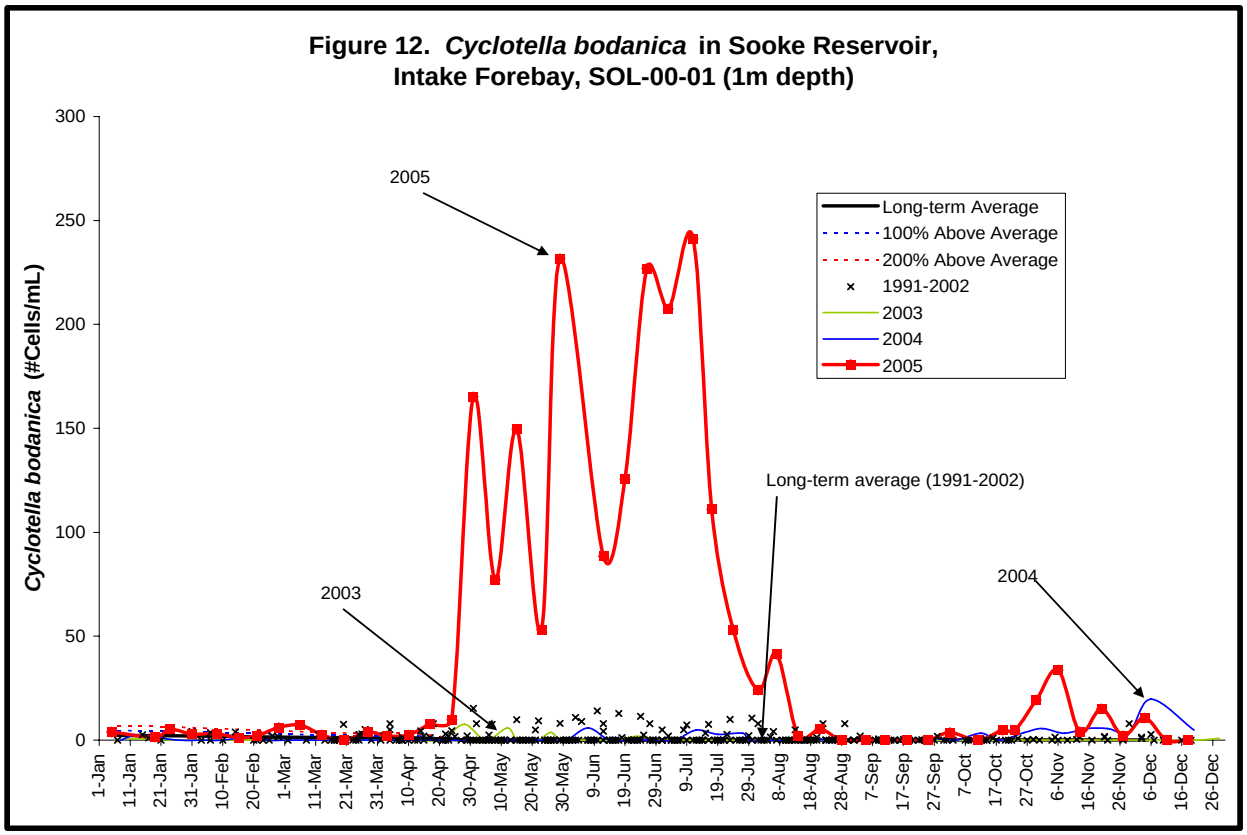

Figure 13. Annual Water Quality Complaints from the Greater Victoria Drinking Water System, 1992-2005