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Agenda Item #6
REPORT #RWSC 2010 - 06

REPORT TO THE REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY, 17 MARCH 2010

SUBJECT 2009 ANNUAL OVERVIEW OF GREATER VICTORIA'S DRINKING WATER QUALITY

PURPOSE

To provide information on the quality of drinking water in the Greater Victoria Drinking Water System in 2009.

BACKGROUND

Each year, as part of the legislated reporting requirements for all Water Suppliers, CRD Water Quality Division staff prepare summaries of water quality data collected in 2009 from Greater Victoria's Drinking Water System. These reports are provided for use by individual Water Suppliers, the Chief Medical Health Officer and the public.

Water Quality Division staff post the annual reports and water quality data tables at the following CRD website locations:

- http://www.crd.bc.ca/water/waterquality/annualreports.htm
- http://www.crd.bc.ca/water/waterquality/datatables.htm

Please find the executive summary and selected charts from the *2009 Annual Overview of Greater Victoria's Drinking Water Quality* attached.

RECOMMENDATION

That the Regional Water Supply Commission receive the staff report for information.

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2009 Annual Overview of Greater Victoria's Drinking Water Quality

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March 1, 2010

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CAPITAL REGIONAL DISTRICT
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HDM-#335188-v1-2009_Annual_WQ_Overview_Exec_Summary.DOC

Executive Summary

This report is the annual overview of water quality testing that was conducted in 2009 for 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.* This report is posted at http://www.crd.bc.ca/water/waterquality/annualreports.htm on the Capital Regional District (CRD) website.

Samples and Tests. In 2009, the Water Quality Division collected 7,606 samples from the Greater Victoria Drinking Water System and analyzed those samples for 48,683 individual tests. Approximately 300 different types of analyses were conducted on these samples. The data collected in 2009 are reported in the water quality data tables (**Tables 1, 2 and 3**) that are posted in the Water Quality section of the CRD website at http://www.crd.bc.ca/water/waterquality/datatables.htm

Bacteria in Source Water. In 2009, as in the past few years, the level of total coliform bacteria in the raw (untreated) source water entering the Japan Gulch Disinfection Plant continued to be higher during the late summer and peaked in mid August (**Figure 3**). Nevertheless, the quality of the raw water entering the treatment plant continued to easily meet the fecal coliform bacteria (*E. coli*) limit of 20 colony forming units per 100 mL at least 90% of the time as stipulated in the USEPA Surface Water Treatment Rule and therefore continued to qualify to remain an unfiltered surface water supply under this portion of the USEPA regulations (**Figure 3A**). In 2009, all of the *E. coli* positive samples contained *E. coli* concentrations below 20 CFU/100mL with the exception of three samples in December originating from the Goldstream watershed (while Kapoor tunnel was being inspected).

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 1.6 mg/L for most of the year and increased to 1.8 mg/L on September 17, 2009. This dosage level resulted in a monthly median total chlorine residual ranging from 1.09 to 1.37 mg/L at the entry point to the distribution system (**Figure 4**).

Bacteria at First Customer. Only two total coliform positive samples were found from the samples taken at the first customer sampling location below the Japan Gulch Disinfection Plant during 2009 and the 10% monthly limit was never exceeded (**Figure 4**). The annual total coliform positive sample rate of 1.6% was similar to the previous seven years and much better than earlier years before the use of UV and free chlorine as primary disinfectants. No *E. coli* bacteria were found in any of the samples collected at the entry point to the distribution system. This provides 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 (**Figure 5**), the percentage of total coliform positive samples in the Greater Victoria distribution system did not exceed the 10% Guideline limit during any month in 2009 and was therefore in compliance with the BC *Drinking Water Protection Regulation*. Over the last 18 years, a broad reduction in total coliform bacteria detection (see inset in **Figure 5**) has been observed and hence, an overall improvement in the bacteriological quality of the water.

Parasites. In 2009, no viable (living) or non-viable (dead) *Giardia* cysts were detected in the raw source water entering Japan Gulch Treatment Plant **(Figure 6)**. In addition, none of the 2009 samples contained viable or non-viable *Cryptosporidium* oocysts (**Figure 7**). The 10-year average total *Cryptosporidium* oocyst concentration was only 0.02 oocysts per 100 L (**Figure 7**). While this is an extremely low value for a surface water supply, the addition of UV disinfection provides assurance that no infective *Cryptosporidium* oocysts (or other parasites) can enter Greater Victoria's drinking water system.

Physical-Chemical-Radiological. All the physical, chemical and radiological parameters were well within the Canadian Guideline limits except for summer water temperatures (aesthetic limit of 15ºC) and a turbidity spike in mid January. In 2009, the water temperature was above the 15°C limit for a period of two and a half months from mid July to early October (**Figure 3**). This is similar to the previous four years and an improvement from earlier years when the water temperature was above the 15°C limit for about 4 months of the year (**Figure 2**). This cooler water is one of the benefits of raising the water level in Sooke Reservoir and the ability to draw from deeper and cooler strata.

Inorganic and Organic Chemicals. All inorganic chemicals including metals and non-metals were within Guideline values at the entry point to the distribution system. No synthetic organic chemicals including pesticides and herbicides were detected in the raw water entering the treatment plant with the exception of one sample collected in early December which shows the presence of bis-2-ethylhexyl phthalate. A subsequent resample collected from the same sampling location showed no detection of this chemical. There is no Canadian Guideline limit for this organic compound and the amount detected was well below the USEPA limit of 6 μg/L.

Disinfection By-Products. Disinfection by-products such as total trihalomethanes (TTHMs) were well below (range of 9.8-25.8 μg/L) the Canadian Guideline limit of 100 μg/L in the chloraminated distribution system (**Figure 8**). The TTHMs were higher in a small section of the distribution system in North Saanich that is subject to rechlorination (Upper Dean Park Reservoir) but was still below Guideline values, ranging from 11.5 to 72 μg/L. Similarly, 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 very low in the chloraminated distribution system, ranging from 3.14-17.3 μg/L (**Figure 9**). However, in Upper Dean Park Reservoir, one sample collected in early January exceeded the Guideline limits (**Figure 9**). A new Canadian Guideline limit for HAAs of 80 μg/L was introduced in 2008.

Sooke Reservoir Biological Activity. The overall level of algal activity in Sooke Reservoir is measured using chlorophyll-a, a component of all algal cells. In 2009, the concentration of chlorophyll-a in the south and north basins continued to be elevated (as was observed in past years) following the raising of the water level in Sooke Reservoir (**Figure 10**). The median increase in chlorophyll-a for the 7 years following the initial raising of the water level in Sooke Reservoir was 55% **(Figure 10)** but is showing a declining trend.

The primary contributor to the higher levels of chlorophyll-a observed in Sooke Reservoir in 2003 through 2009 was higher levels of total phosphorus, a nutrient that is needed for the algae to grow. The median concentration of total phosphorus was approximately 58% higher than in the years prior to inundation in both the north and south basins of Sooke Reservoir (**Figure 11**). However, the levels of total phosphorus are declining as the median concentration in 2008 and 2009 was only 21% higher than in the years prior to inundation. The highest phosphorus levels coincided with flooding of the newly cleared lands around the margin of Sooke Reservoir when the reservoir was expanded. In 2009, the phosphorus levels were similar to 2008 and substantially lower than past few years.

In 2009, one distinct, but not particularly significant spring algal bloom occurred in Sooke Reservoir. The diatoms, *Asterionella formosa v. formosa* and *Tabellaria fenestrata* are commonly present in Sooke Reservoir but have only been reaching spring bloom conditions since the water level raise in 2003. In 2009 *Asterionella formosa v. formosa* was responsible for the bloom (**Figure 12**) and was the main contributor to the higher levels of chlorophyll-a (**Figure 10**). Unlike previous years *Tabellaria fenestrata* abundance remained fairly low throughout the year (**Figure 13**).

Water Quality Complaints. In 2009, the number of water quality complaints received by CRD Water Services was relatively low (fourth lowest in eighteen years) (**Figure 14**).

Figure 1. Water Level Elevation in Sooke Reservoir, 2006-2009

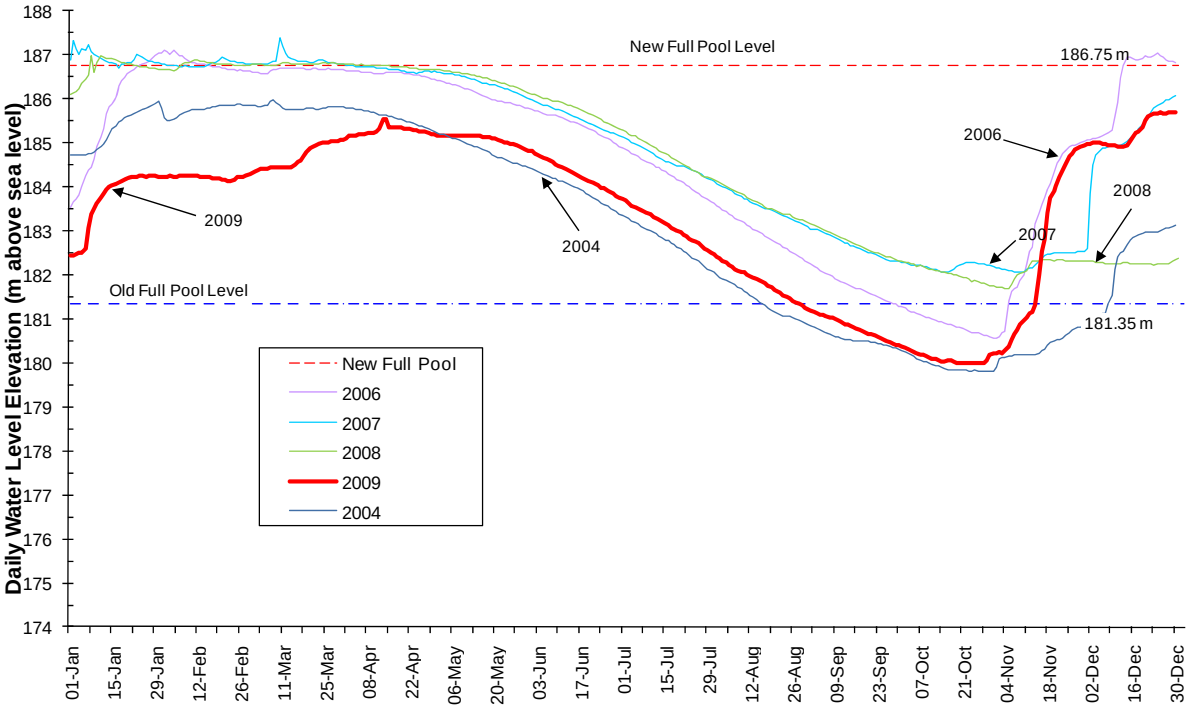
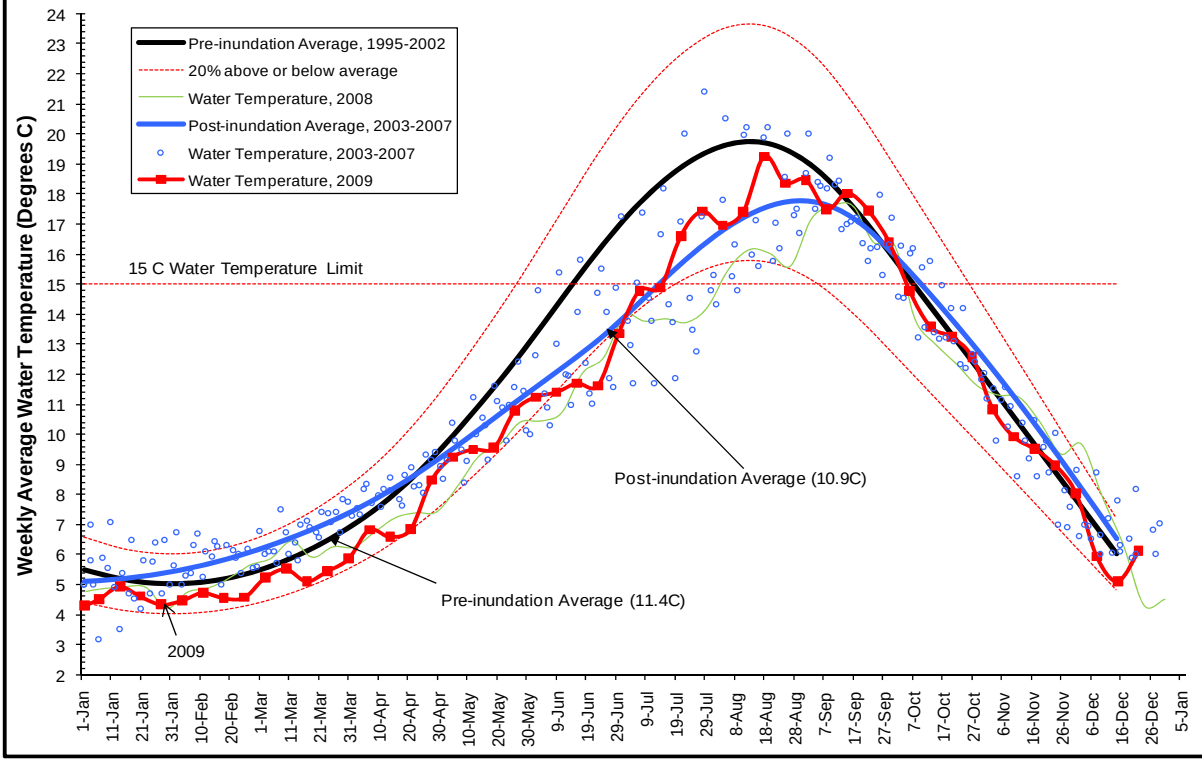


Figure 2. 2009 Temperature of Raw Water entering Japan Gulch Plant (Weekly Average)



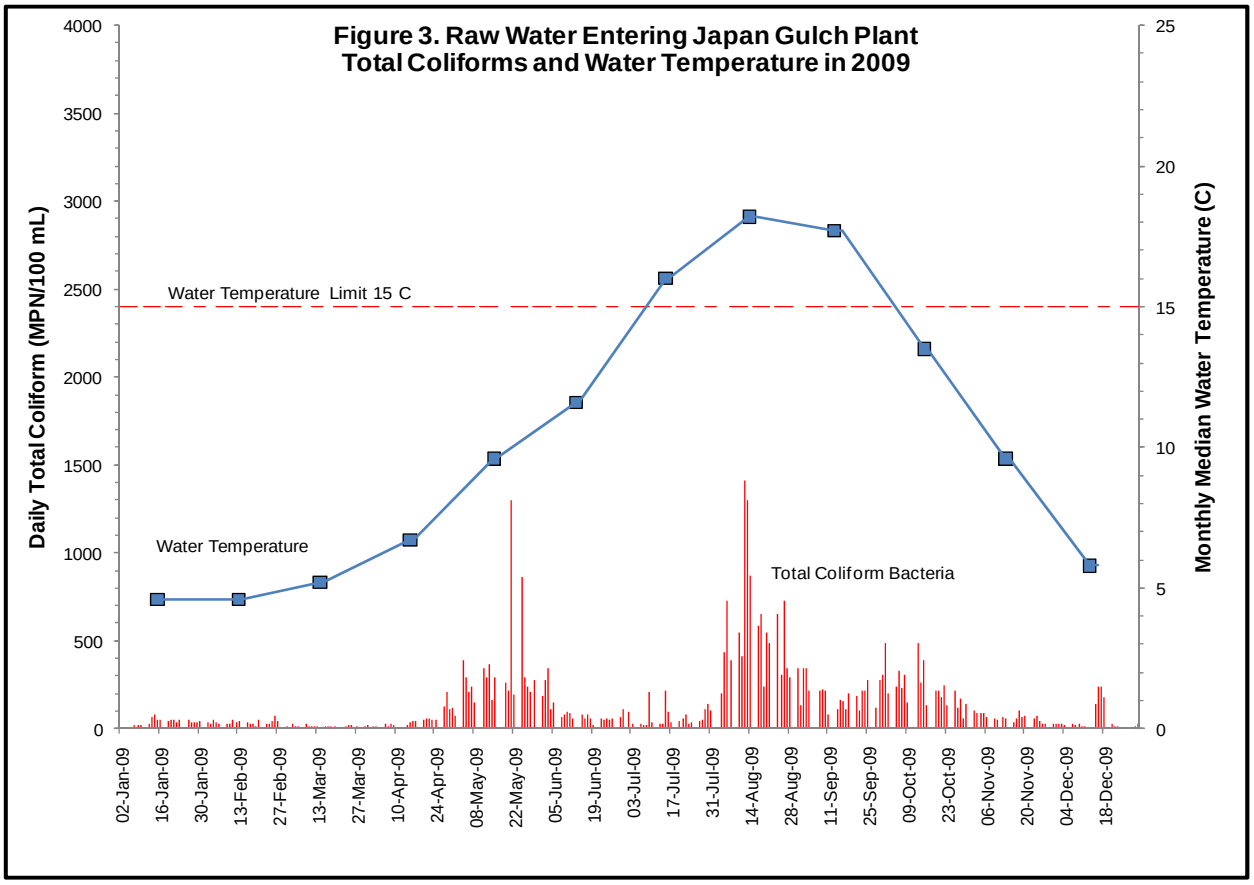


Figure 3. Raw Water Entering Japan Gulch Plant
Total Coliforms and Water Temperature in 2009
Daily Total Coliform (MPN/100 mL)
Monthly Median Water Temperature (C)
Water Temperature Limit 15 C
Water Temperature
Total Coliform Bacteria
4000
3500
3000
2500
2000
1500
1000
500
0
25
20
15
10
5
0
02-Jan-09
16-Jan-09
30-Jan-09
13-Feb-09
27-Feb-09
13-Mar-09
27-Mar-09
10-Apr-09
24-Apr-09
08-May-09
22-May-09
05-Jun-09
19-Jun-09
03-Jul-09
17-Jul-09
31-Jul-09
14-Aug-09
28-Aug-09
11-Sep-09
25-Sep-09
09-Oct-09
23-Oct-09
06-Nov-09
20-Nov-09
04-Dec-09
18-Dec-09

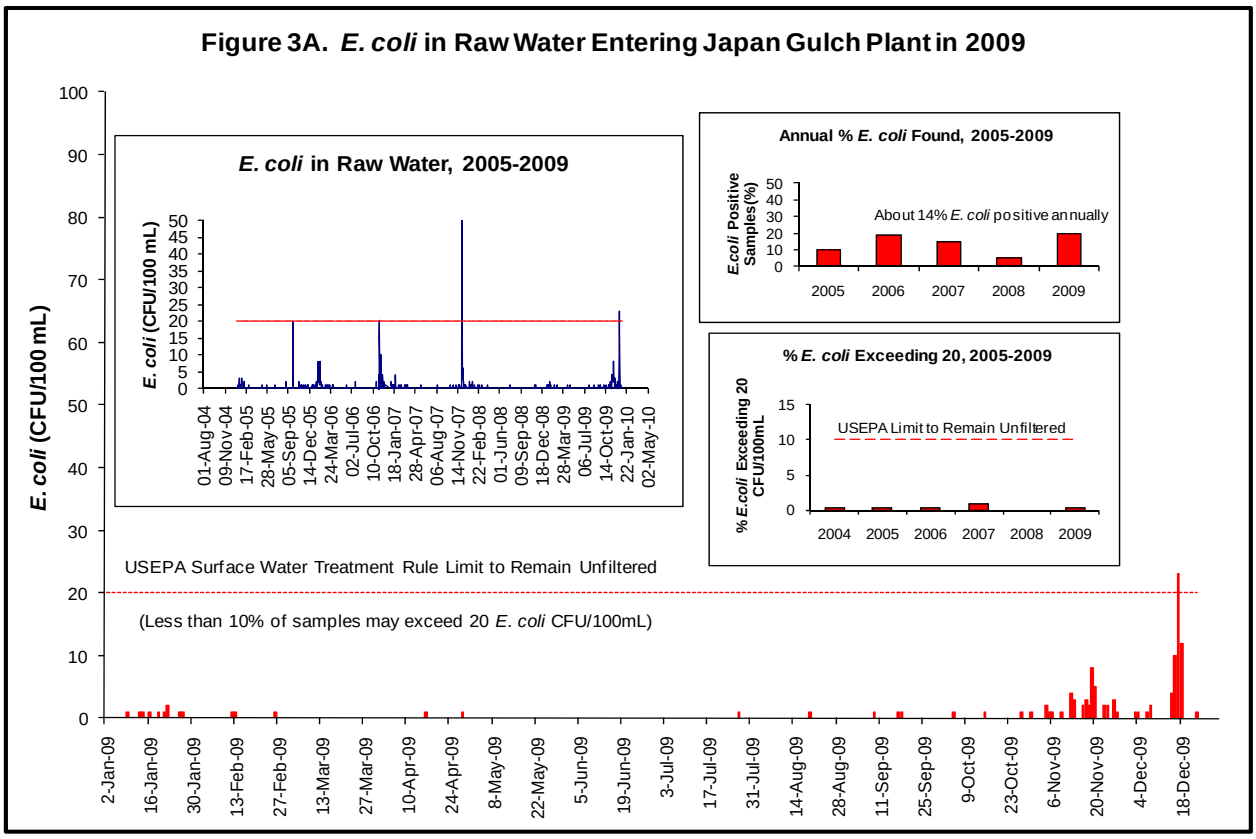


Figure 3A. *E. coli* in Raw Water Entering Japan Gulch Plant in 2009
E. coli (CFU/100 mL)
E. coli in Raw Water, 2005-2009
E. coli (CFU/100 mL)
01-Aug-04
09-Nov-04
17-Feb-05
28-May-05
05-Sep-05
14-Dec-05
24-Mar-06
02-Jul-06
10-Oct-06
18-Jan-07
28-Apr-07
06-Aug-07
14-Nov-07
22-Feb-08
01-Jun-08
09-Sep-08
18-Dec-08
28-Mar-09
06-Jul-09
14-Oct-09
22-Jan-10
02-May-10
Annual % *E. coli* Found, 2005-2009
E.coli Positive Samples(%)
About 14% *E. coli* positive annually
2005
2006
2007
2008
2009
% *E. coli* Exceeding 20, 2005-2009
% *E.coli* Exceeding 20 CFU/100mL
USEPA Limit to Remain Unfiltered
2004
2005
2006
2007
2008
2009
USEPA Surface Water Treatment Rule Limit to Remain Unfiltered
(Less than 10% of samples may exceed 20 *E. coli* CFU/100mL)
100
90
80
70
60
50
40
30
20
10
0
2-Jan-09
16-Jan-09
30-Jan-09
13-Feb-09
27-Feb-09
13-Mar-09
27-Mar-09
10-Apr-09
24-Apr-09
8-May-09
22-May-09
5-Jun-09
19-Jun-09
3-Jul-09
17-Jul-09
31-Jul-09
14-Aug-09
28-Aug-09
11-Sep-09
25-Sep-09
9-Oct-09
23-Oct-09
6-Nov-09
20-Nov-09
4-Dec-09
18-Dec-09

**Figure 4. Treated Water at First Customer Below Japan Gulch Plant
Monthly Total Coliforms and Chlorine Residual in 2009**

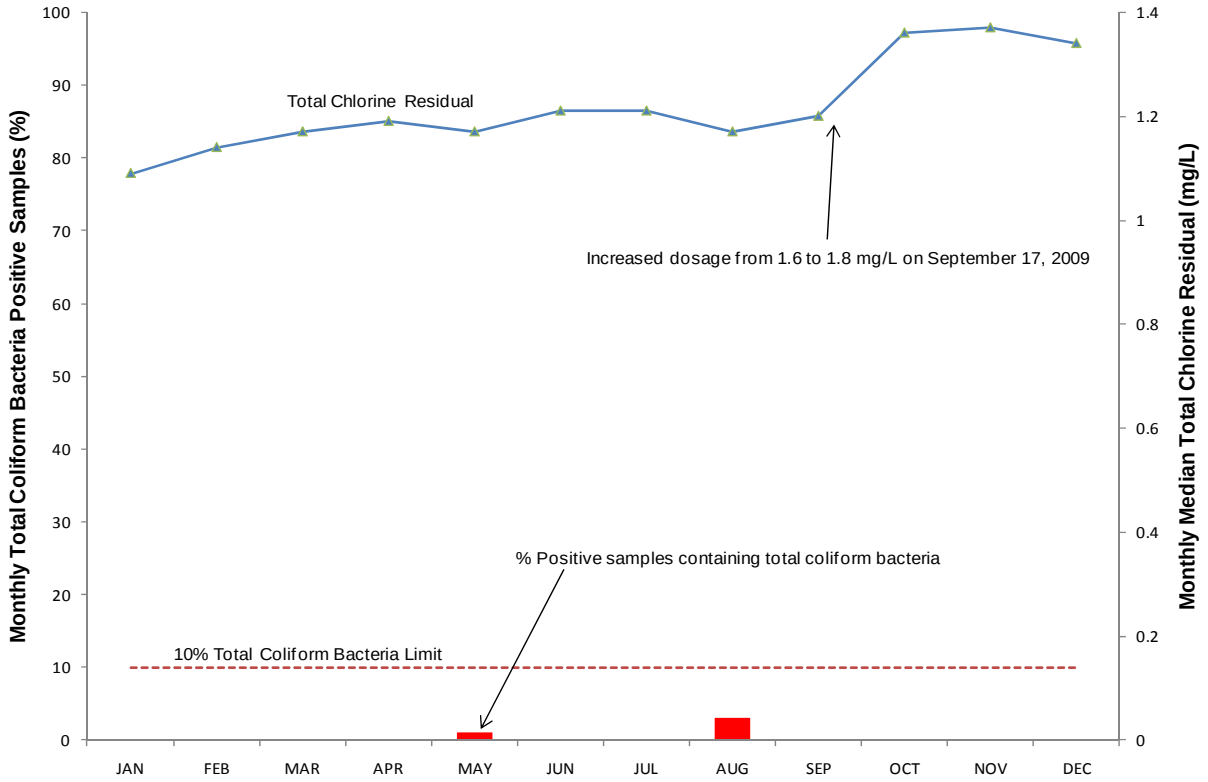


**Figure 5. Greater Victoria Distribution System Combined
Annual % Samples with Total Coliforms Present, 1992-2009**

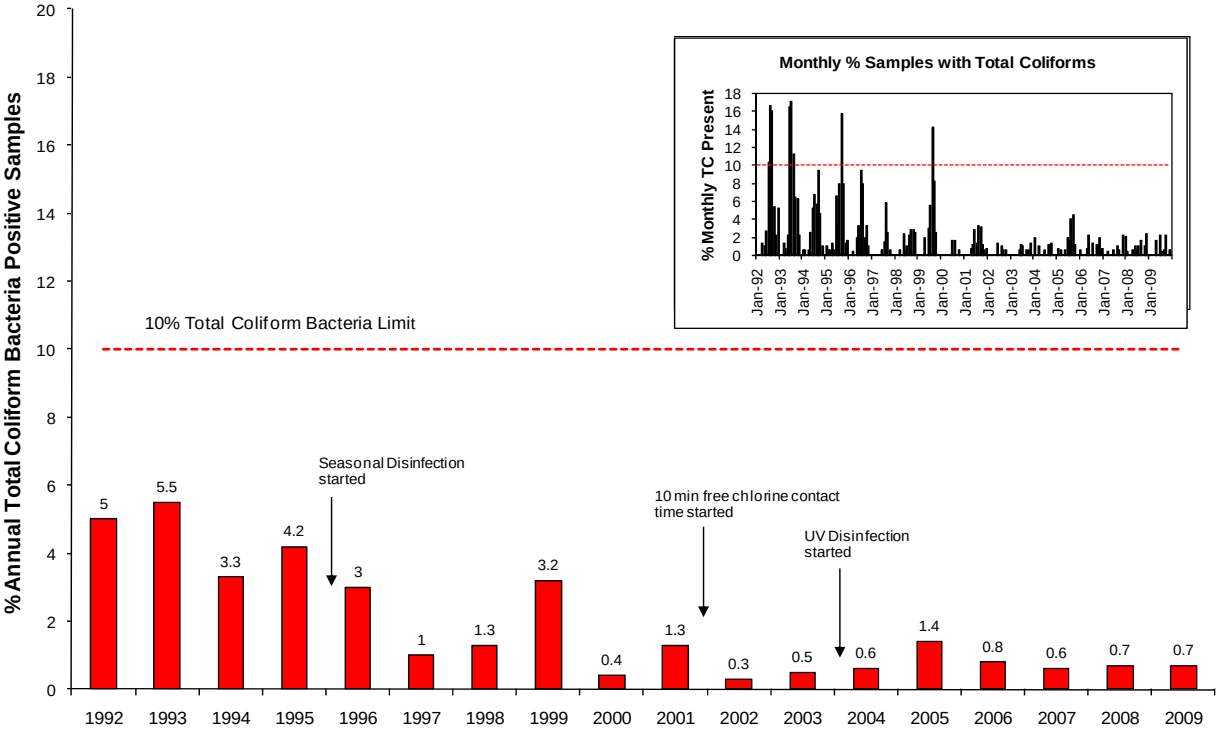


Figure 6. Annual Average Viable and Total *Giardia* Cysts Levels in Raw Water Entering Japan Gulch Plant, 2000-2009

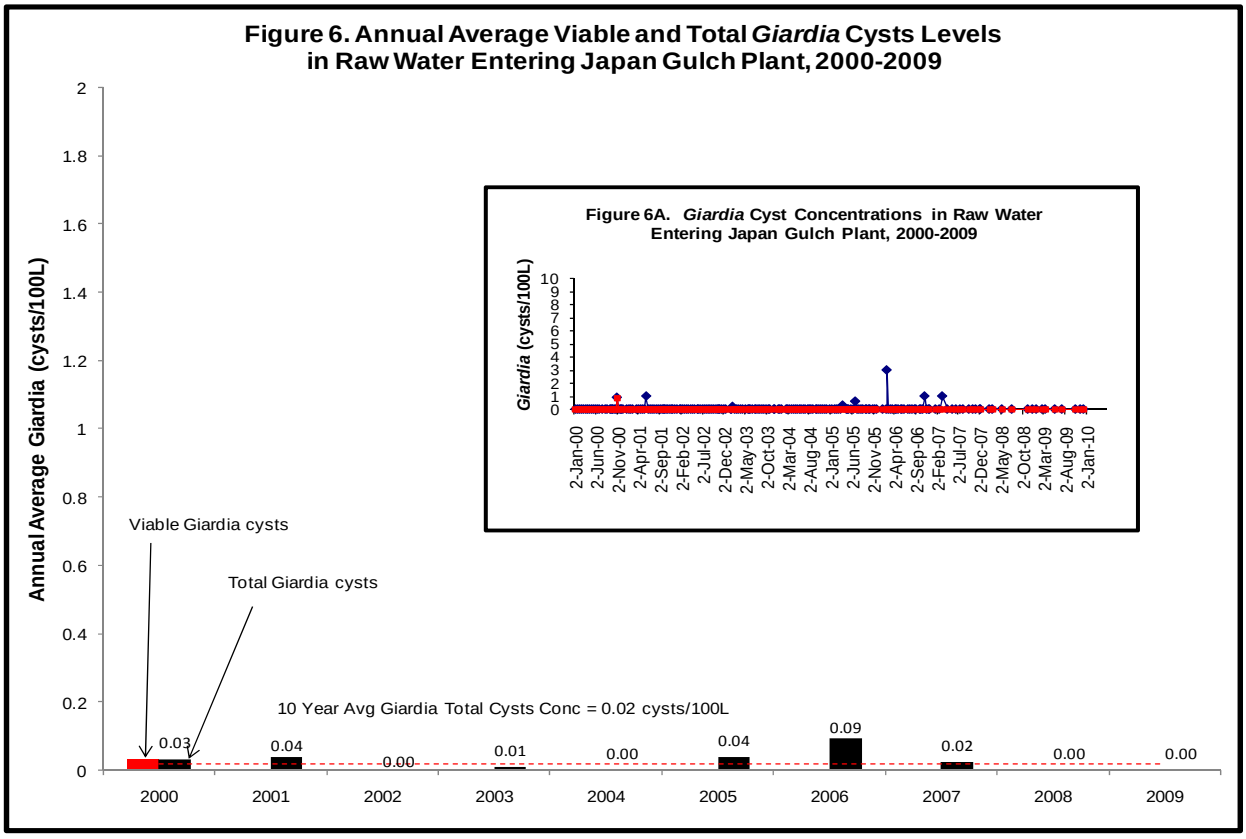


Figure 7. Annual Average Total *Cryptosporidium* Oocysts Levels in Raw Water Entering Japan Gulch Plant, 2000-2009

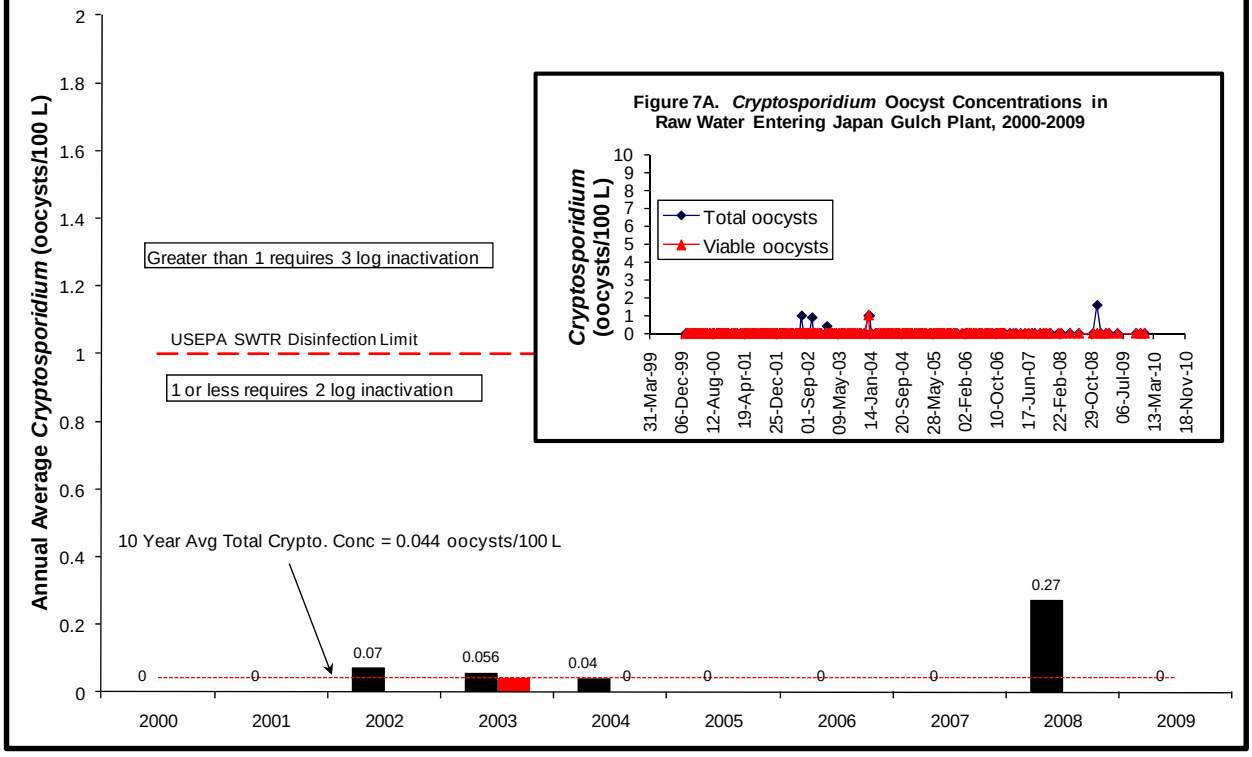


Figure 8. 2009 Trihalomethanes in Greater Victoria Distribution System

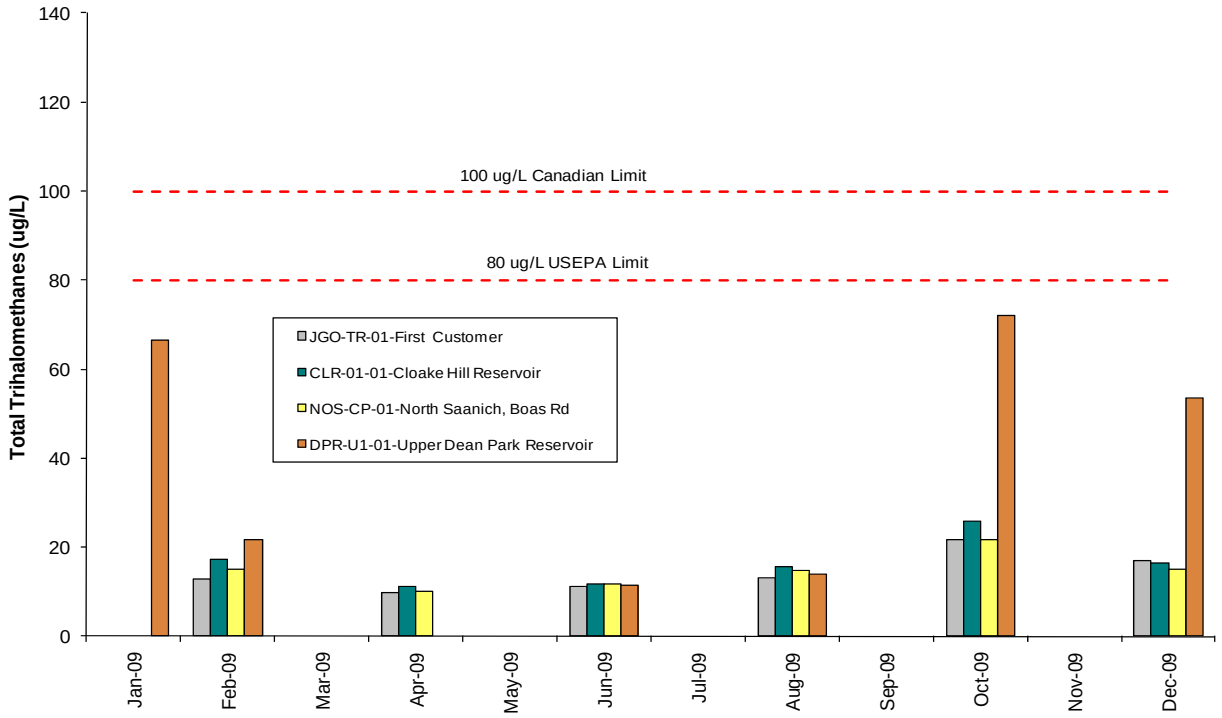


Figure 9. 2009 Haloacetic Acids in Greater Victoria Distribution System

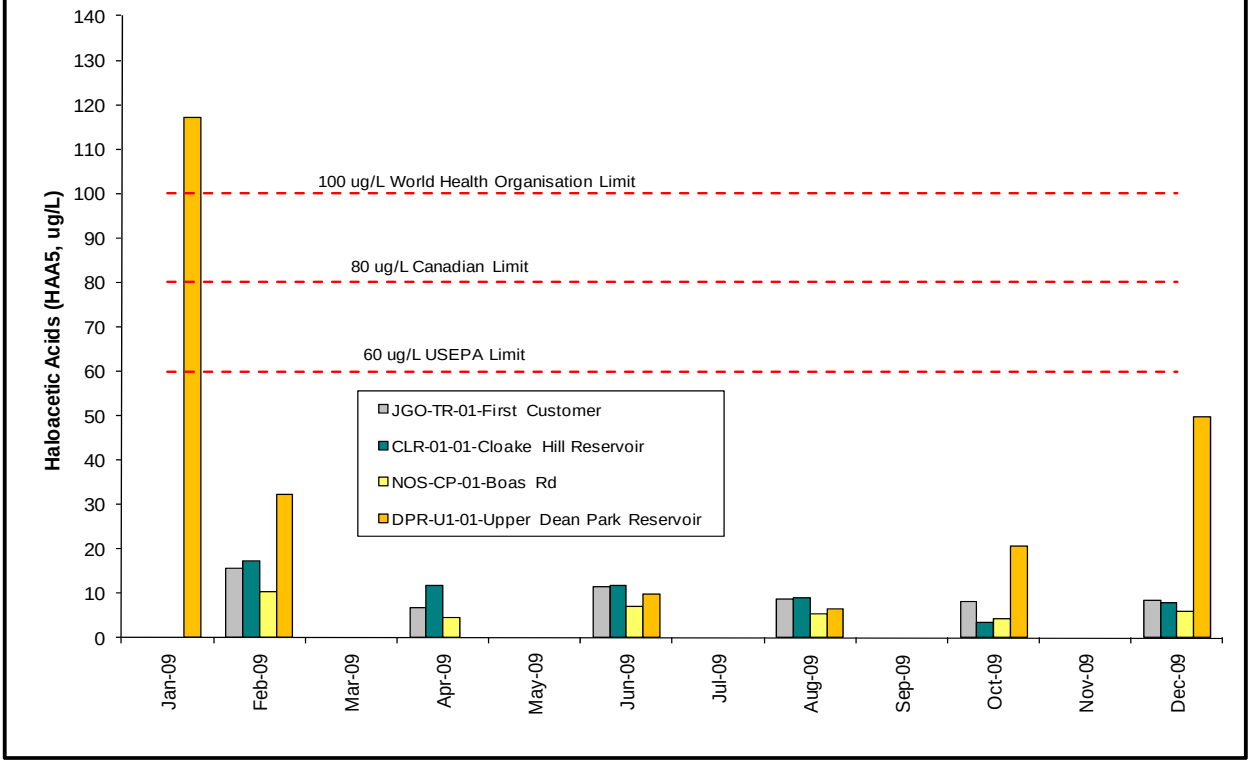


Figure 10. Chlorophyll-a Concentrations in Sooke Reservoir before and after inundation (1995-2009)

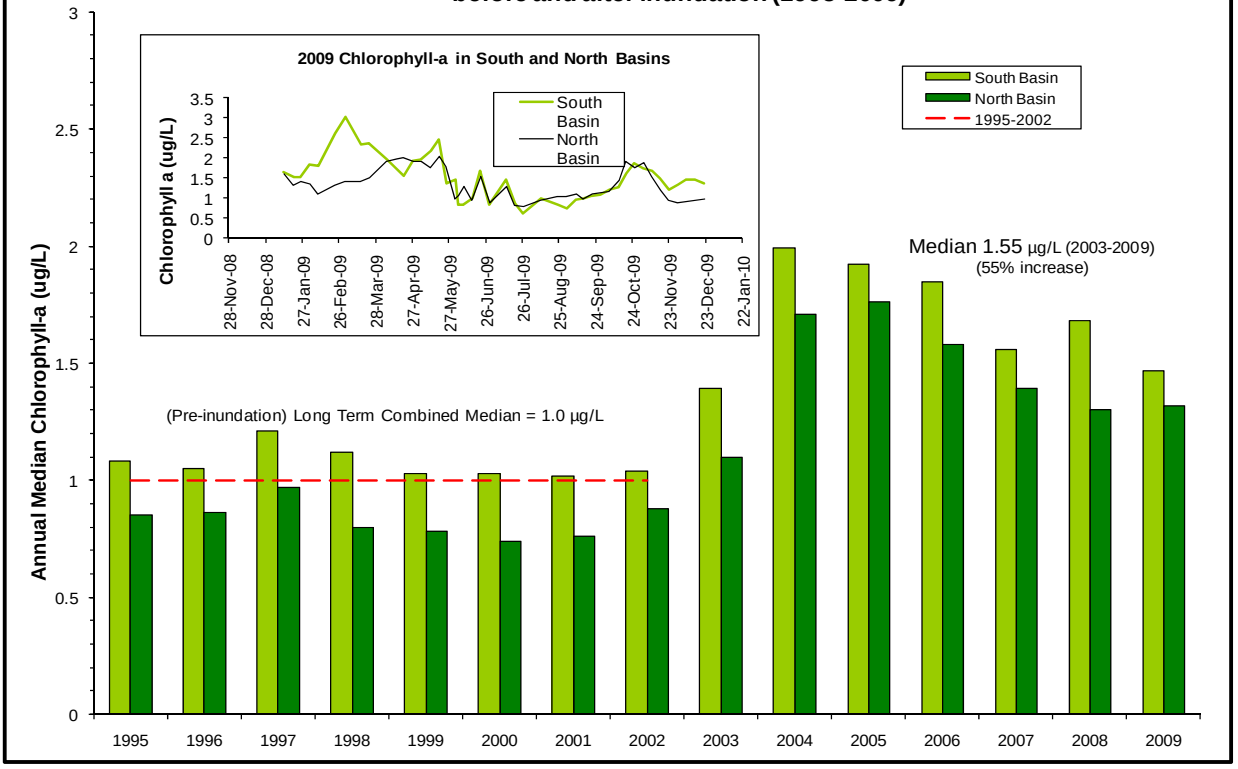


Figure 11. Total Phosphorus Concentrations in Sooke Reservoir before and after inundation (1992-2009)

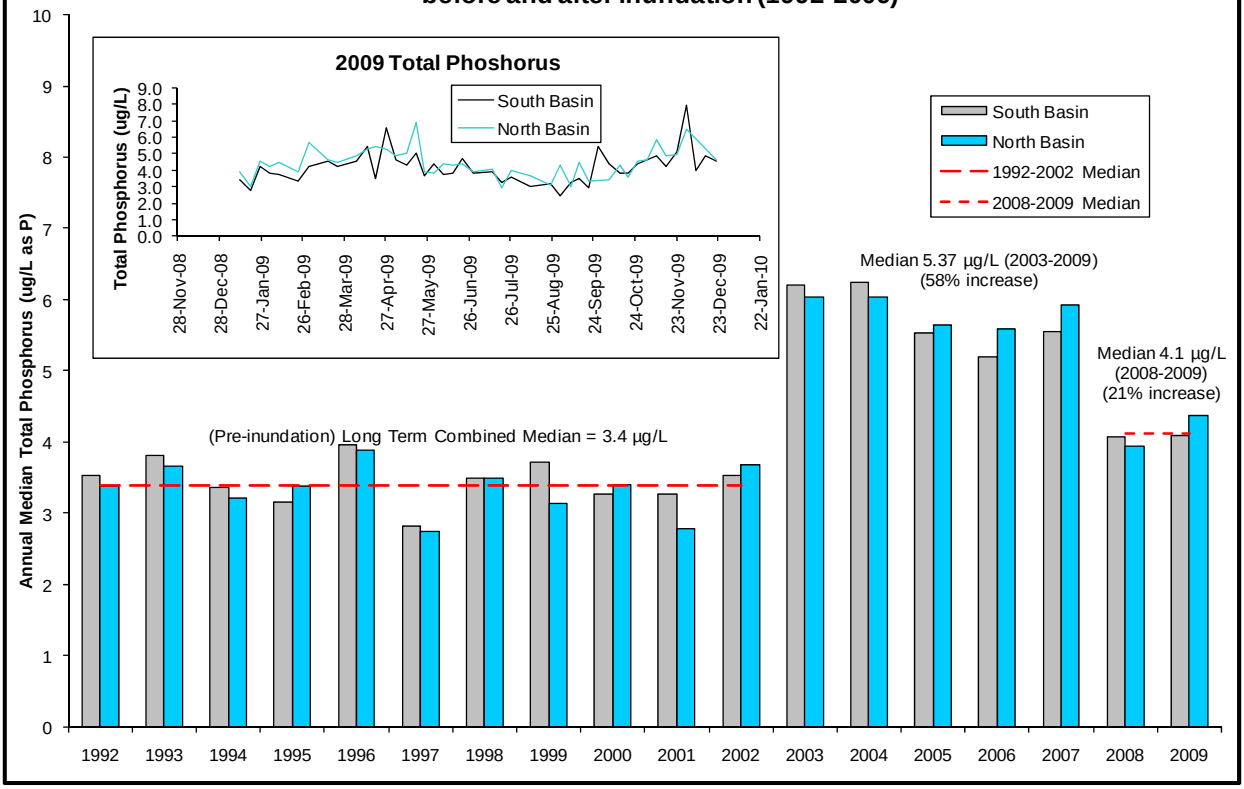


Figure 12. *Asterionella spp.* in Sooke Reservoir, South basin, 1m depth (SOL-01-01)

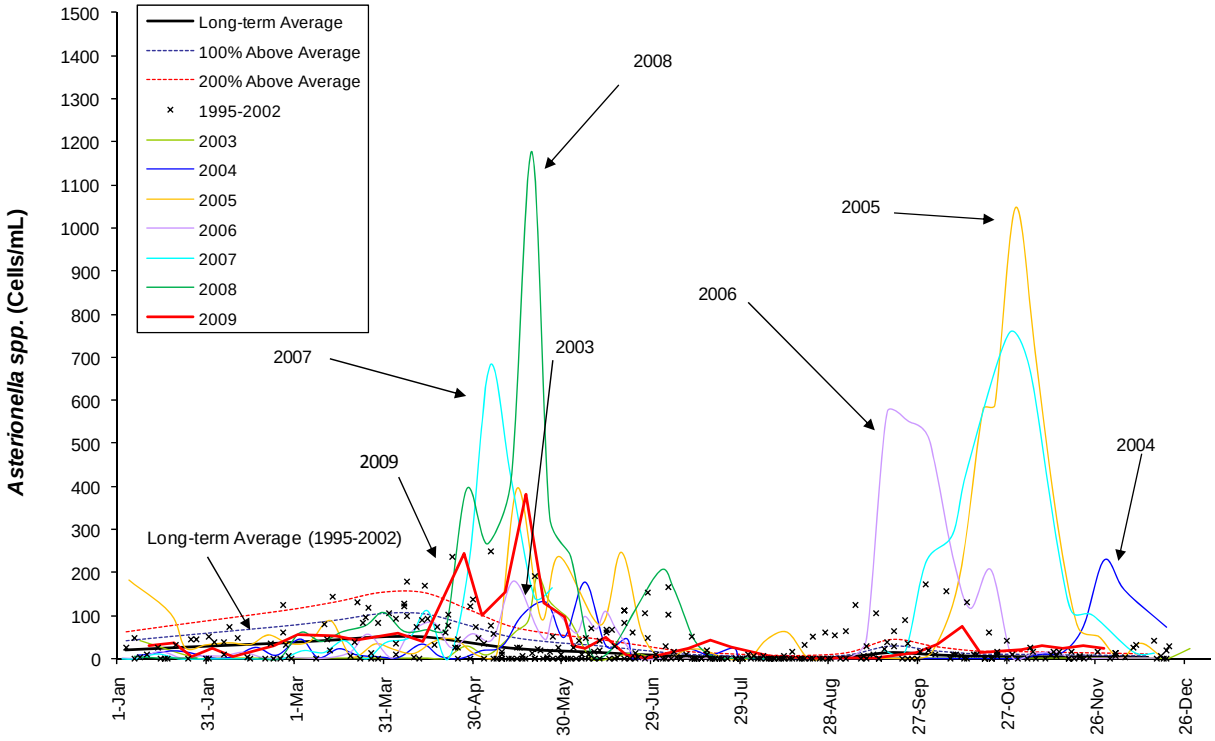


Figure 13. *Tabellaria spp.* in Sooke Reservoir, South basin, 1m depth (SOL-01-01)

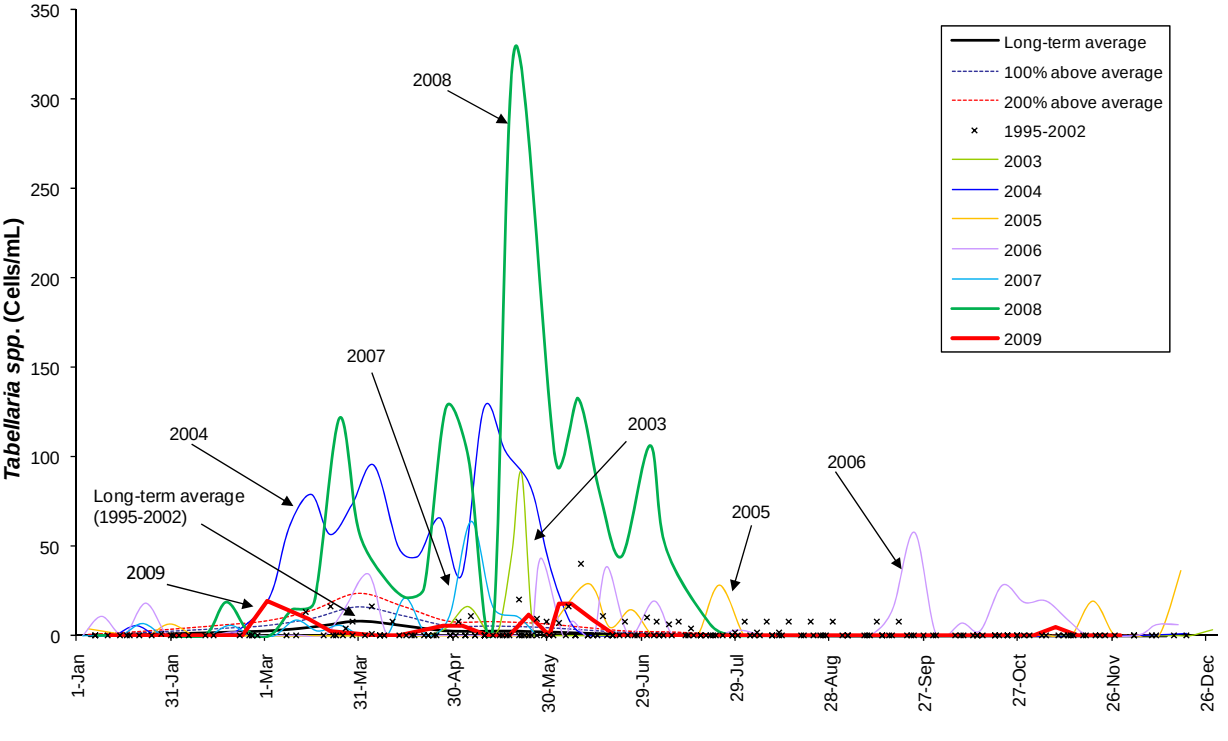


Figure 14. Annual Water Quality Complaints from the Greater Victoria Drinking Water System, 1992-2009