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Agenda Item 8
REPORT #RWSC 2012 - 03

REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY, APRIL 4, 2012

SUBJECT **2011 ANNUAL OVERVIEW OF GREATER VICTORIA'S DRINKING WATER QUALITY**

ISSUE

To provide information on the quality of drinking water in the Greater Victoria Drinking Water System in 2011.

BACKGROUND

Each year, as part of the legislated reporting requirements for all water suppliers, Capital Regional District (CRD) Water Quality Division staff prepare summaries of water quality data collected in 2011 from Greater Victoria's Drinking Water System. These reports are provided to 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

The executive summary and selected charts from the *2011 Annual Overview of Greater Victoria's Drinking Water Quality* are attached.

RECOMMENDATION

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

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2011 Annual Overview of Greater Victoria's Drinking Water Quality

(Executive Summary and Selected Charts Only)

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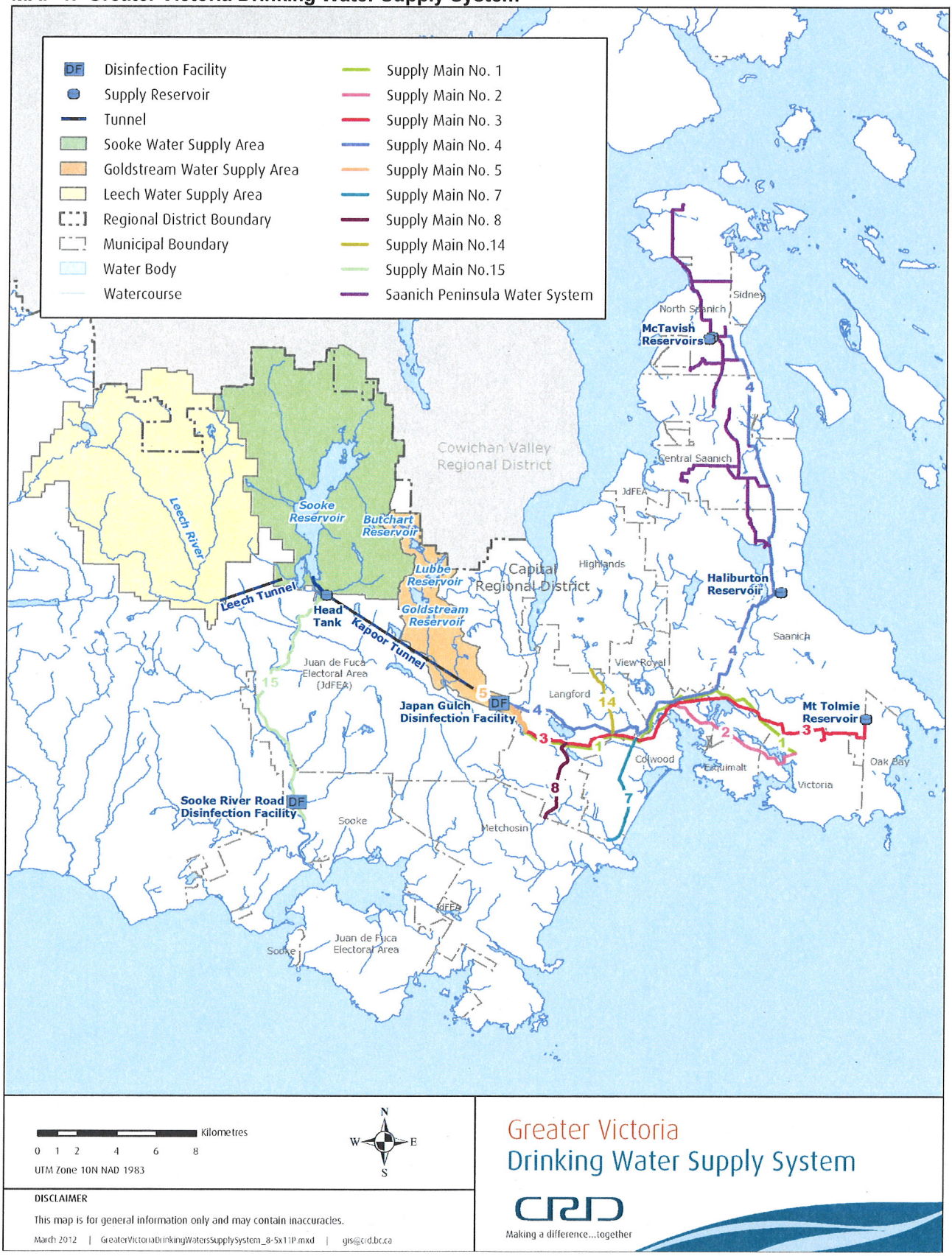
March 15, 2012

ENVIRONMENTAL SUSTAINABILITY
CAPITAL REGIONAL DISTRICT
479 Island Highway
Victoria, BC

SP ID # 968471 2011AnnualWqOverviewExecSummaryReport

MAP 1. Greater Victoria Drinking Water Supply System



Executive Summary

This report is the annual overview of water quality testing that was conducted in 2011 for the Greater Victoria Drinking Water System (**Map 1**). 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 2011, the Water Quality Division collected 6,066 samples from the Greater Victoria Drinking Water System and analyzed those samples for 37,536 individual tests. Approximately 300 different types of analyses were conducted on these samples. The data collected in 2011 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

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). In 2011, the water temperature was above the 15°C limit for a period of about 3 months from late-July to mid-October (**Figure 3**). This is similar to the previous 5 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.

Bacteria in Source Water. In 2011, 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 late August (**Figure 3**). An increase in total coliform counts was also observed during the time that the Goldstream Supply System was used to supply water to the system (December 5-12, 2011) when the Kapoor tunnel was being inspected. Nevertheless, the quality of the raw water entering the treatment plant continued to easily meet the *E. coli* limit of 20 colony forming units (CFU) 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 2011, all of the *E. coli* positive samples contained concentrations below 20 CFU/100 mL.

Treatment. The treatment process used to disinfect the raw source water entering the distribution system continued to be ultraviolet (UV) disinfection followed by the addition of free chlorine and then ammonia (to produce chloramines). The chlorine dosage level was increased twice during the year to keep the chlorine residual in the distribution system relatively constant. These changes resulted in monthly median total chlorine residuals ranging from 1.20 to 1.65 mg/L at the entry point to the distribution system (**Figure 4**).

Bacteria at First Customer. While five total coliform positive samples were found in samples taken at the first customer sampling location below the Japan Gulch Disinfection Plant during 2011, the 10% monthly limit was never exceeded (**Figure 4**). The annual total coliform positive sample rate of 2.0% was similar to the previous 8 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 that Greater Victoria's primary disinfection process is working in a satisfactory manner.

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 2011 and was therefore in compliance with the BC *Drinking Water Protection Regulation.* Over the last 20 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. The relatively low level of total coliform positive

samples (1.5%) reflects the balance maintained between reasonable concentrations of chlorine in the distribution system and acceptable levels of positive bacterial samples.

Parasites. In 2011, no *Giardia* cysts were detected in the raw source water entering Japan Gulch Disinfection Plant **(Figure 6)**. In addition, none of the 2011 samples contained *Cryptosporidium* oocysts (**Figure 7**). The 10-year average total *Giardia* cyst and total *Cryptosporidium* oocyst concentrations were only 0.02 cysts and 0.04 oocysts per 100 L, respectively (**Figures 6 and 7**). While these are extremely low values for a surface water supply, the addition of UV disinfection provides assurance that no infective parasites can enter the Greater Victoria Drinking Water System.

Inorganic and Organic Chemicals. All inorganic chemicals including metals and non-metals were within Guideline values at the entry point to the distribution system. All organic chemicals except two (a polycyclic aromatic hydrocarbon called benzo(g,h,I,)perylene and phenol) were undetectable in the raw water entering the treatment plant. The hit for benzoperylene may have resulted from an improved laboratory detection limit. It remains to be seen whether or not this represents an actual change in water chemistry or is simply a result of improved lab technology (i.e. the ability of laboratories to detect smaller and smaller quantities). However, the hit for phenols appears real – although there is no good explanation of why it was found in the source water. Regardless, neither of these organic chemicals have health related limits in the Canadian Guidelines.

Disinfection By-Products. Total trihalomethanes (TTHMs), a by-product of the disinfection process with chlorine, were well below (range of 13.1 to 22.3 μg/L) the Canadian Guideline limit of 100 μg/L in the chloraminated distribution system (**Figure 8**). The TTHMs were slightly higher in a small section of the distribution system in North Saanich that is subject to periodic rechlorination (Upper Dean Park Reservoir) but were still below Guideline values, ranging from 14.1 to 36.5 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 5 HAAs) were low in the chloraminated distribution system, ranging from 5.42 to 29.8 μg/L, and lower than in 2010 (**Figure 9**). The 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. Since 2007, the concentration appears to have reached steady state with some variation (**Figure 10**). In 2011, the chlorophyll-a concentration peaked in the spring for both the south and north basins (see **insert Figure 10**).

Phosphorus. The primary contributor to the higher levels of chlorophyll-a observed in Sooke Reservoir in 2003 through 2011 was higher levels of total phosphorus, a nutrient that is needed for the algae to grow. The median concentration of total phosphorus between 2003 and 2007 was approximately 70% higher than in the years before 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 through 2011 was only 14% higher than in the years before 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 2011, the phosphorus levels were similar, albeit slightly lower, than 2010 and substantially lower than during the inundation.

Algae. In 2011, two distinct, but not particularly significant algal blooms occurred in Sooke Reservoir. The diatom, *Asterionella formosa* (**Figure 12**) was the main contributor to the higher levels of chlorophyll-a in May (**Figure 10**). *Tabellaria fenestrata* (a diatom) also contributed to the overall increase in algal abundance (**Figure 13**). *Uroglena* spp. a golden-brown alga was the primary contributor to increased levels of chlorophyll-a in August.

Water Quality Complaints. In 2011, the number of water quality complaints received by CRD Water Quality Division staff was the second lowest (106) in the last 20 years (**Figure 14**).

Figure 1. Water Level Elevation in Sooke Reservoir, 2008-2011

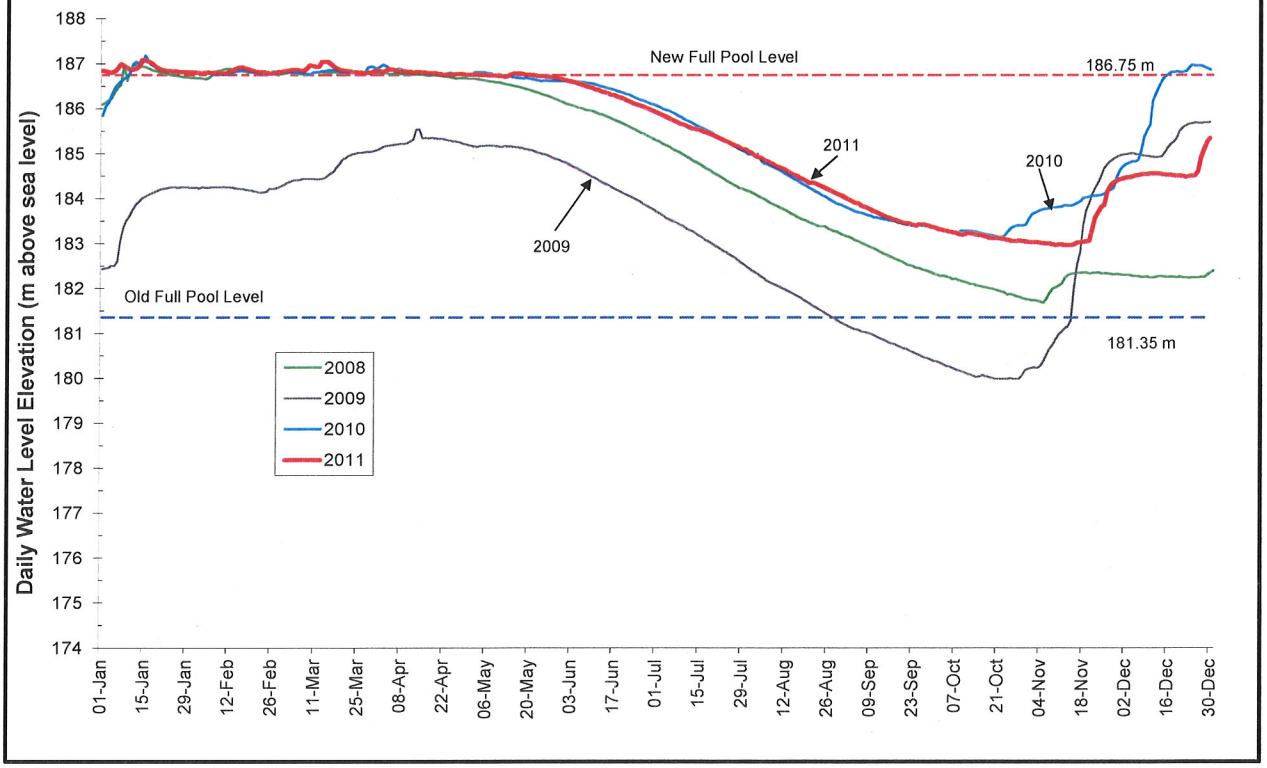


Figure 2. 2011 Temperature of Raw Water entering Japan Gulch Plant (Weekly Average)

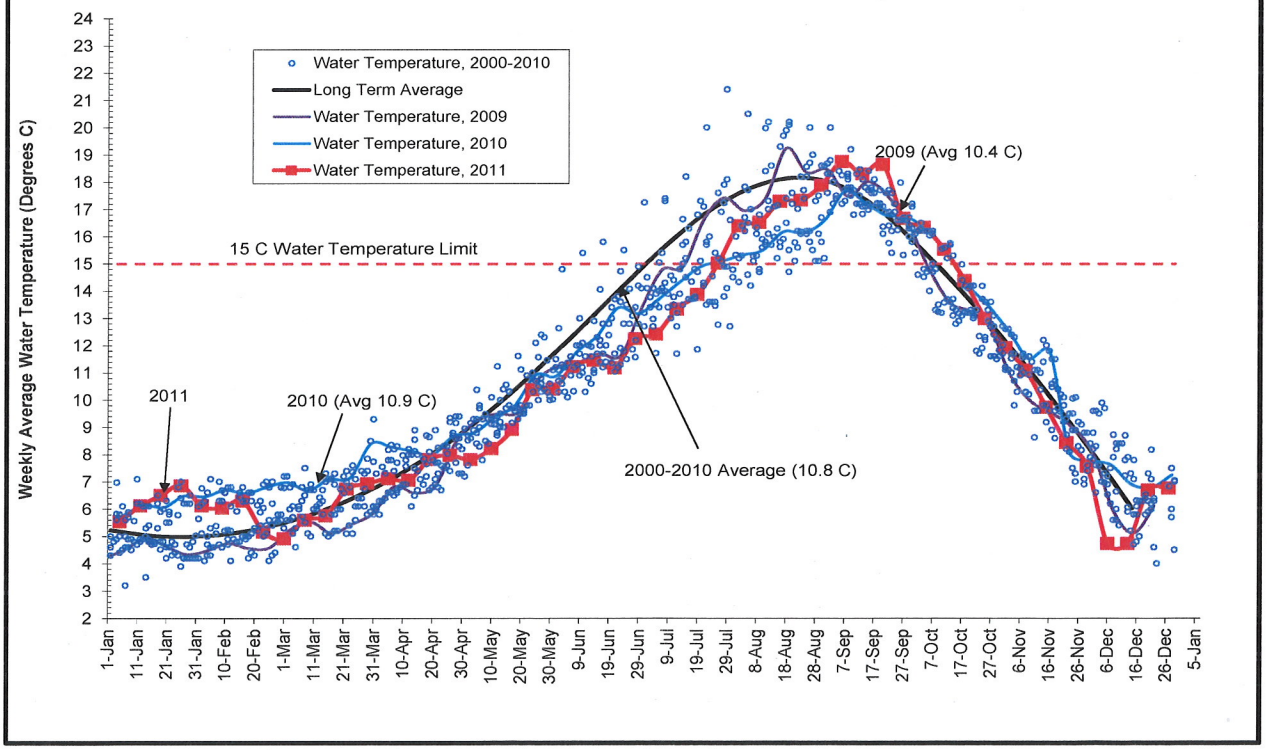


Figure 3. Raw Water Entering Japan Gulch Plant
Total Coliforms and Water Temperature in 2011

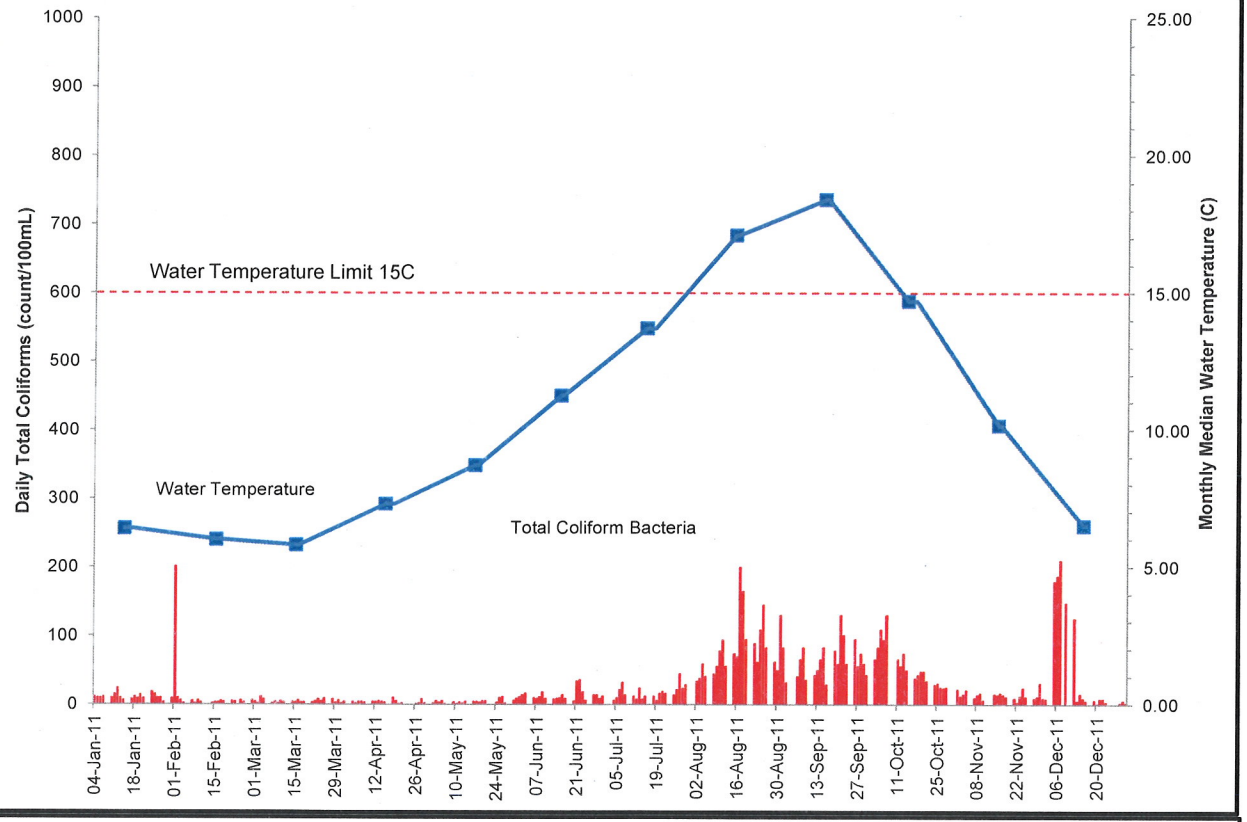


Figure 3A. *E. coli* in Raw Water Entering Japan Gulch Plant in 2011

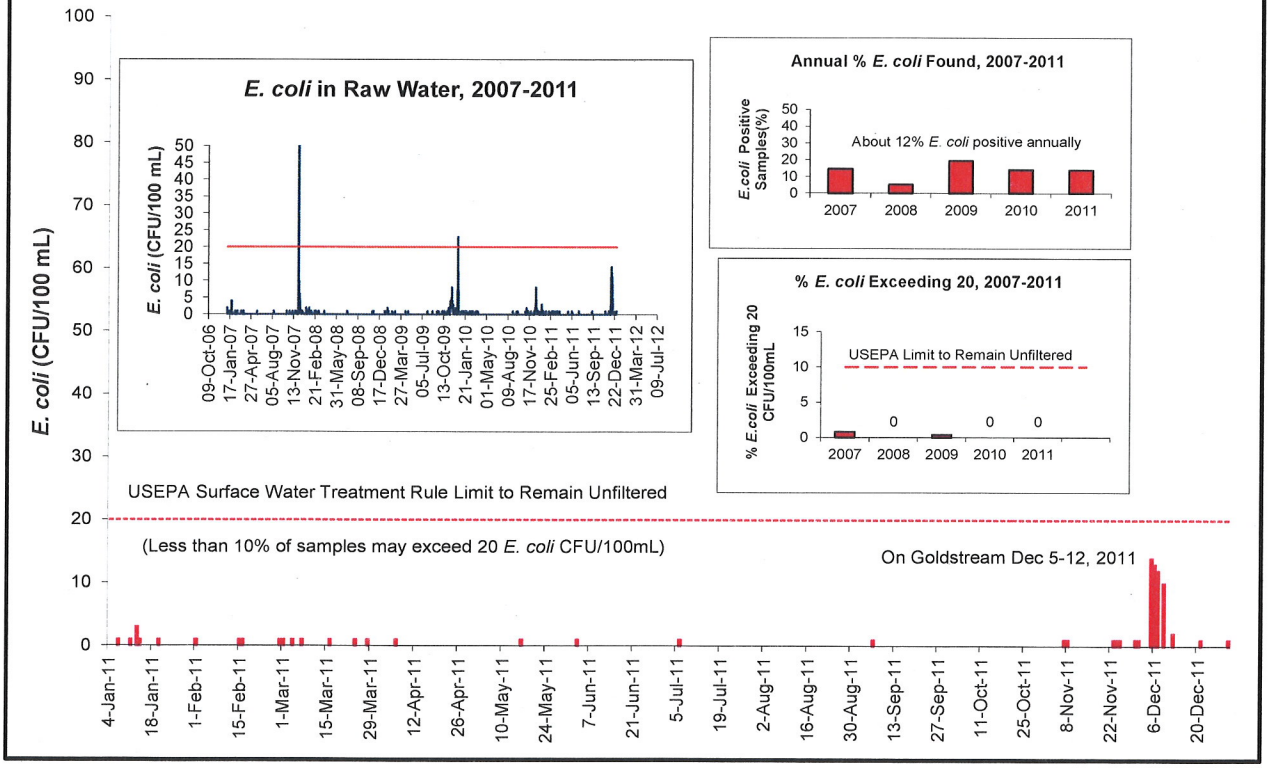


Figure 4. Treated Water at First Customer Below Japan Gulch Plant
Monthly Total Coliforms and Chlorine Residual in 2011

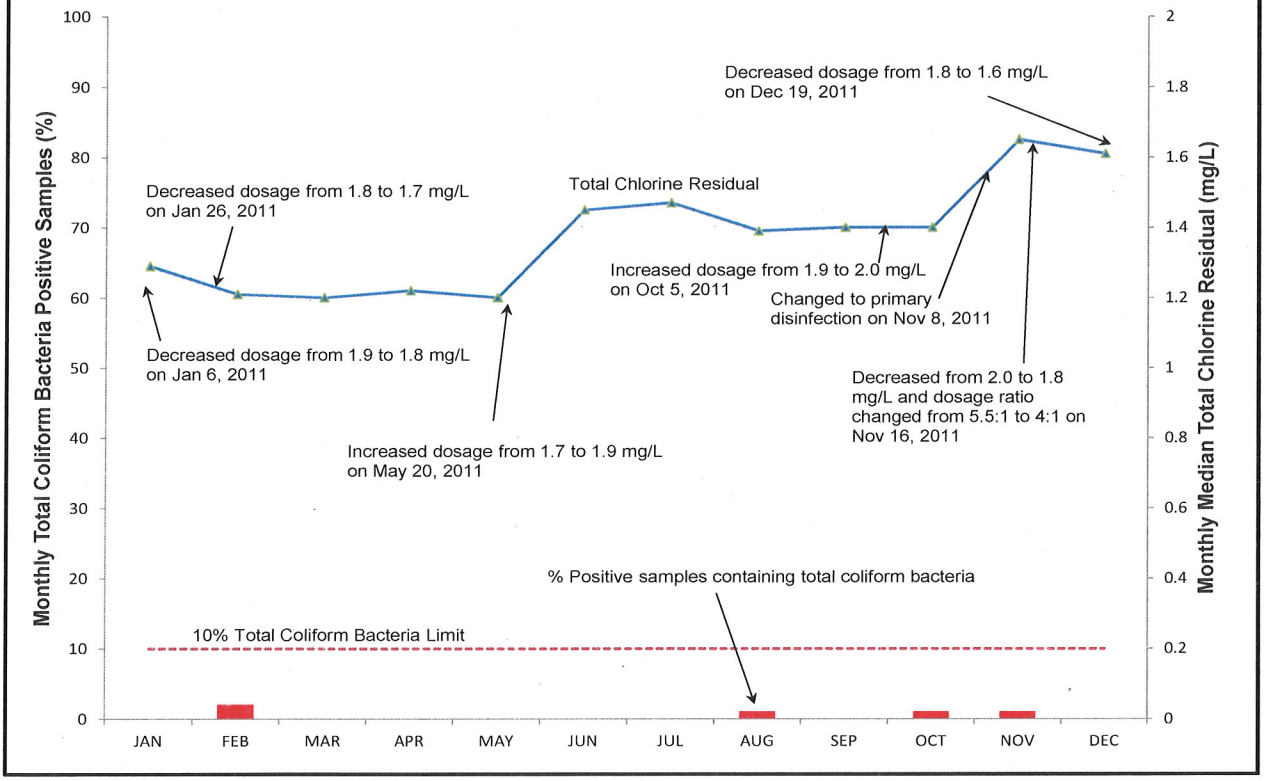


Figure 5. Greater Victoria Distribution System Combined
Annual % Samples with Total Coliforms Present, 1992-2011

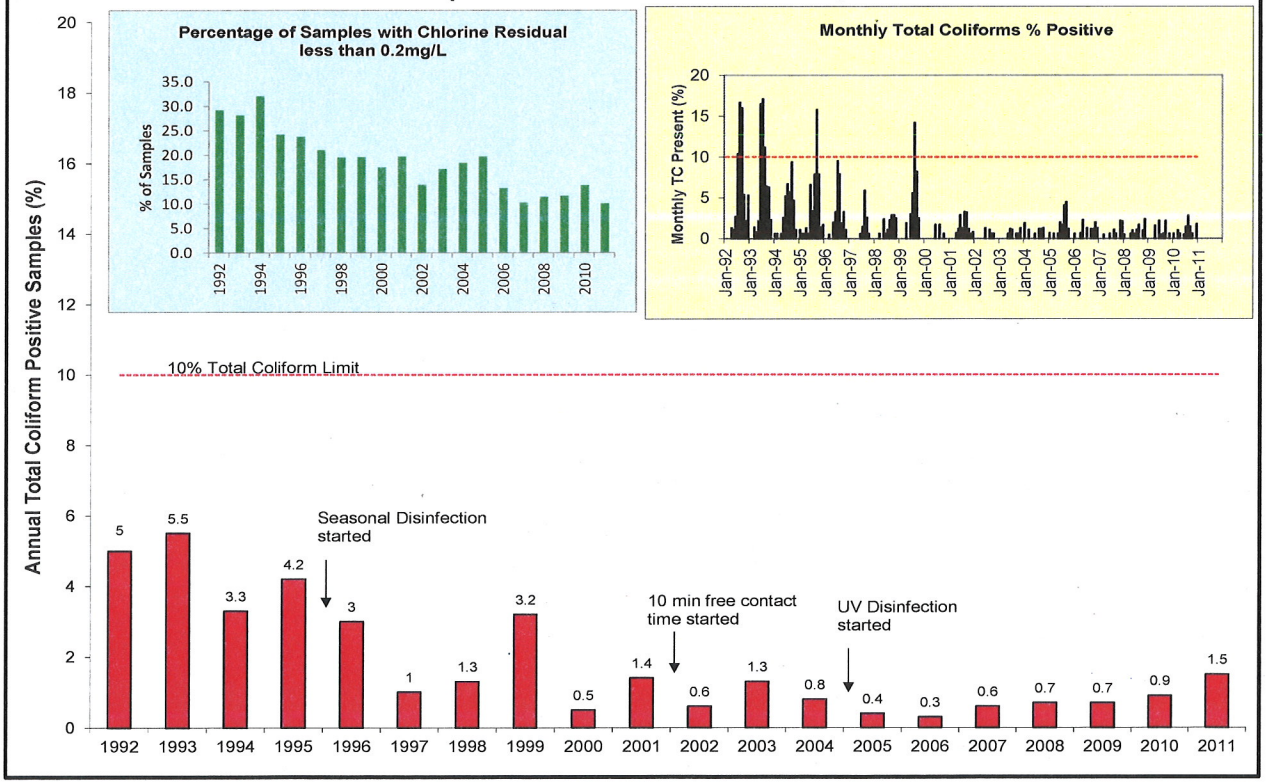


Figure 6. Annual Average Viable and Total *Giardia* Cysts Levels in Raw Water Entering Japan Gulch Plant, 2002-2011

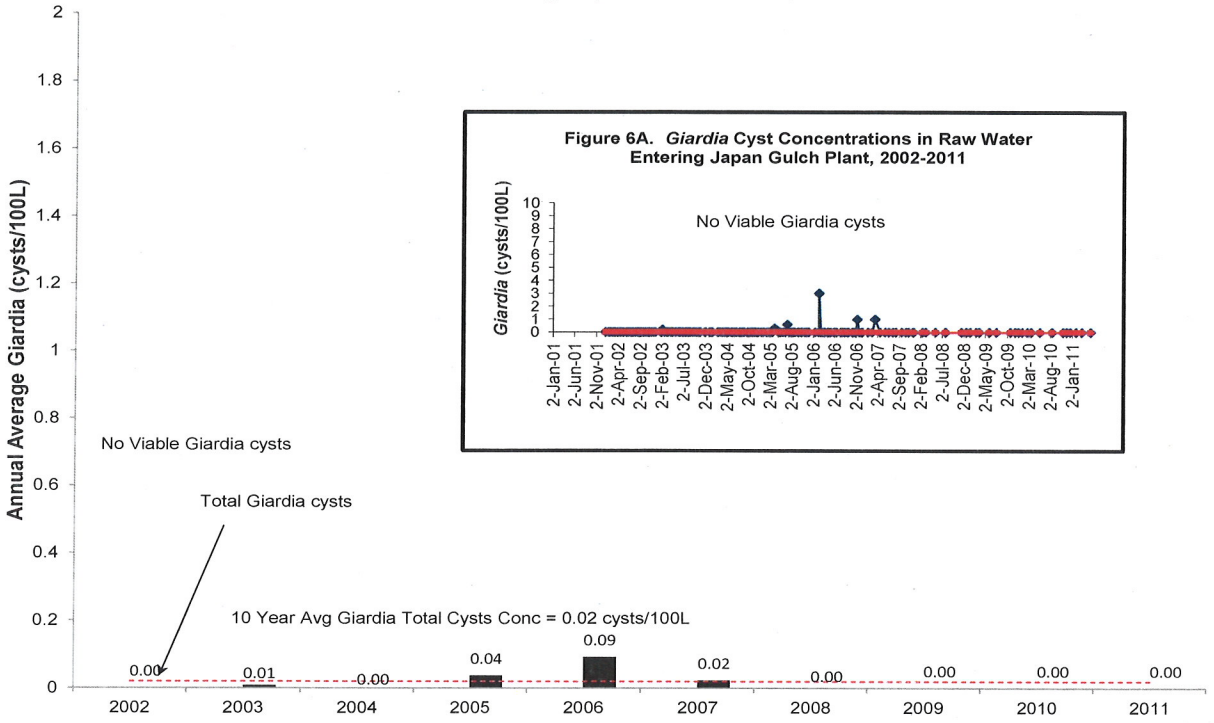


Figure 7. Annual Average Total *Cryptosporidium* Oocysts Levels in Raw Water Entering Japan Gulch Plant, 2002-2011

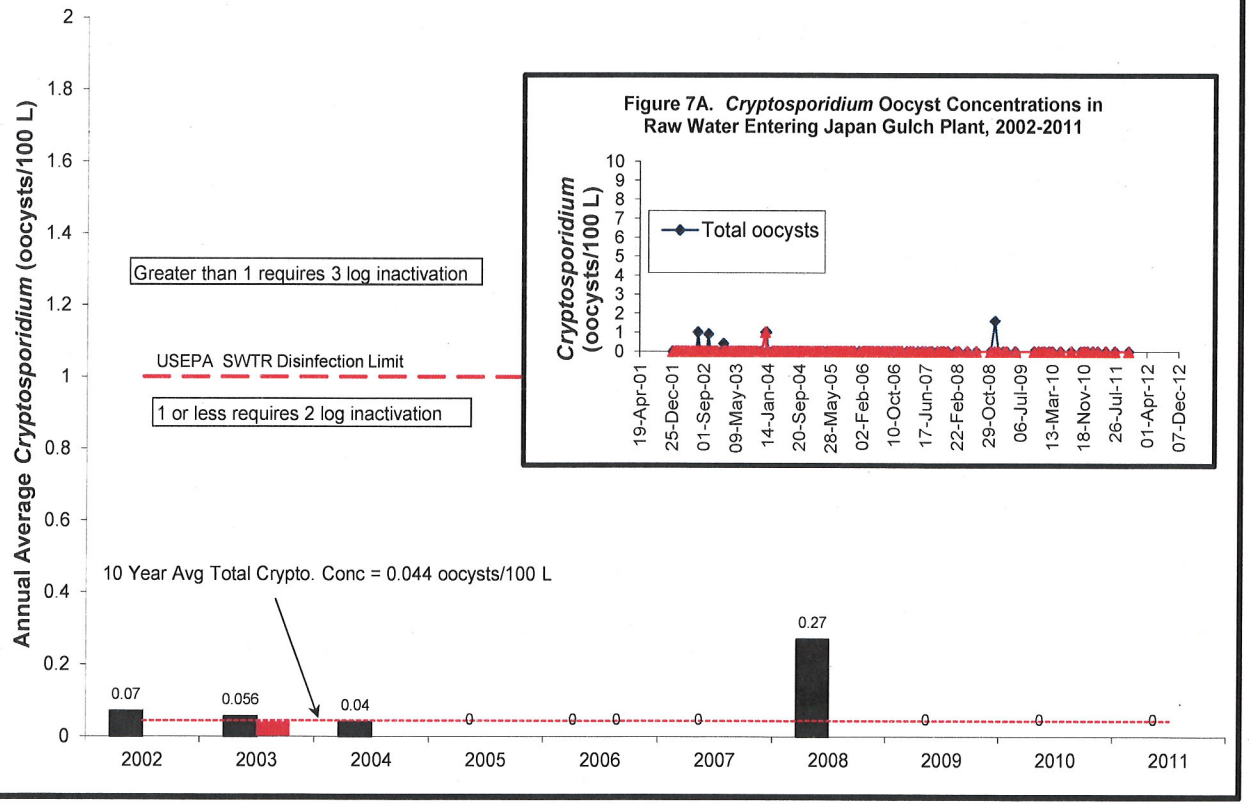


Figure 8. 2011 Trihalomethanes in Greater Victoria Distribution System

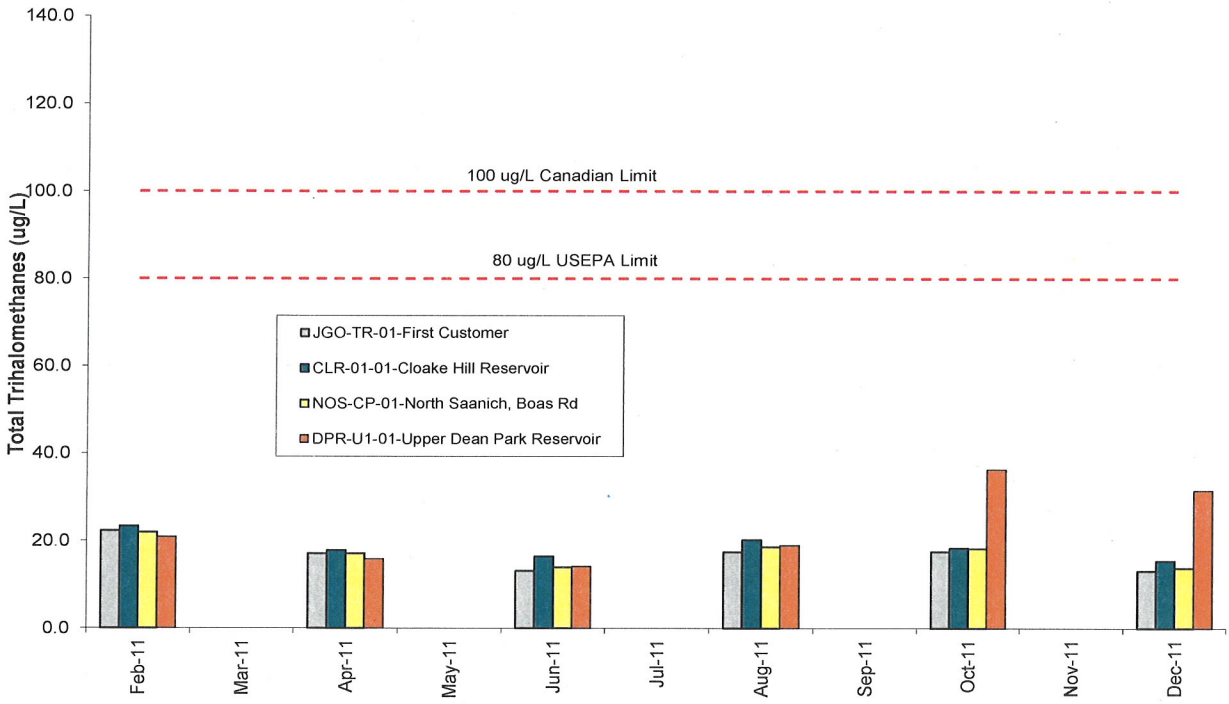


Figure 9. 2011 Haloacetic Acids in Greater Victoria Distribution System

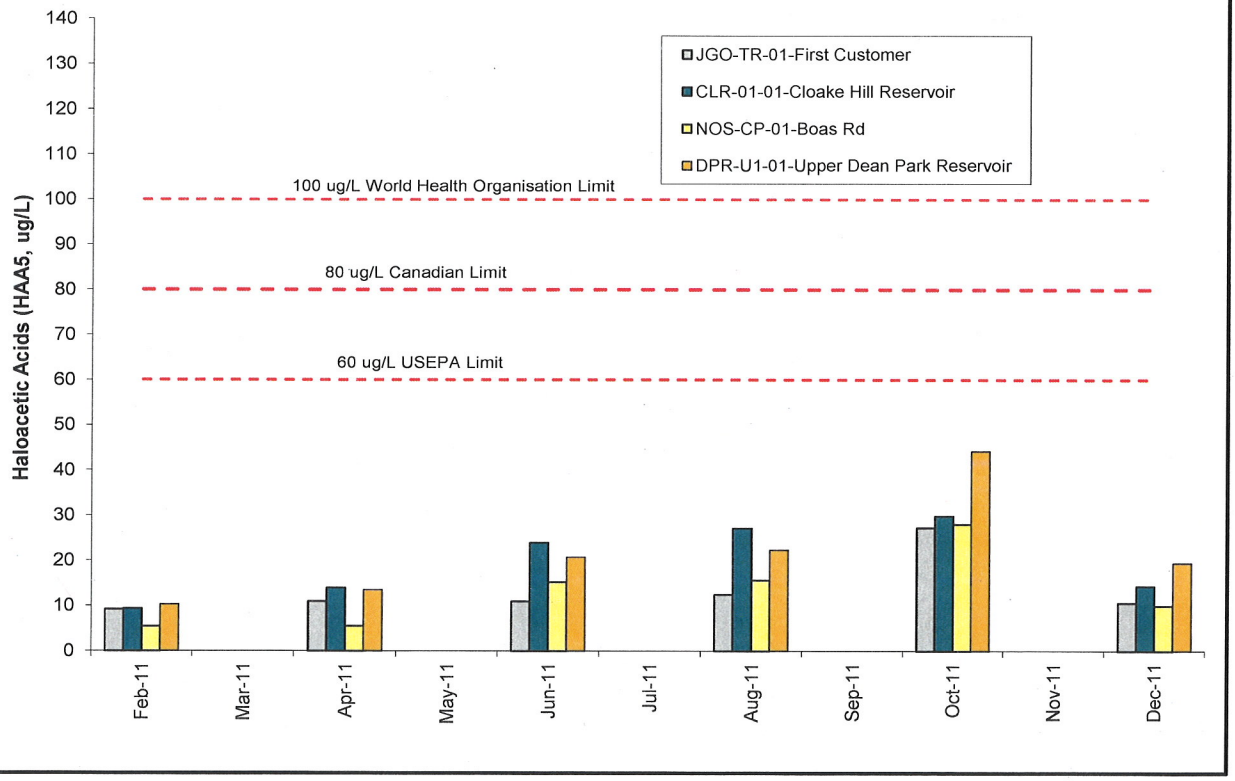


Figure 10. Chlorophyll-a Concentrations in Sooke Reservoir before and after inundation (1995-2011)

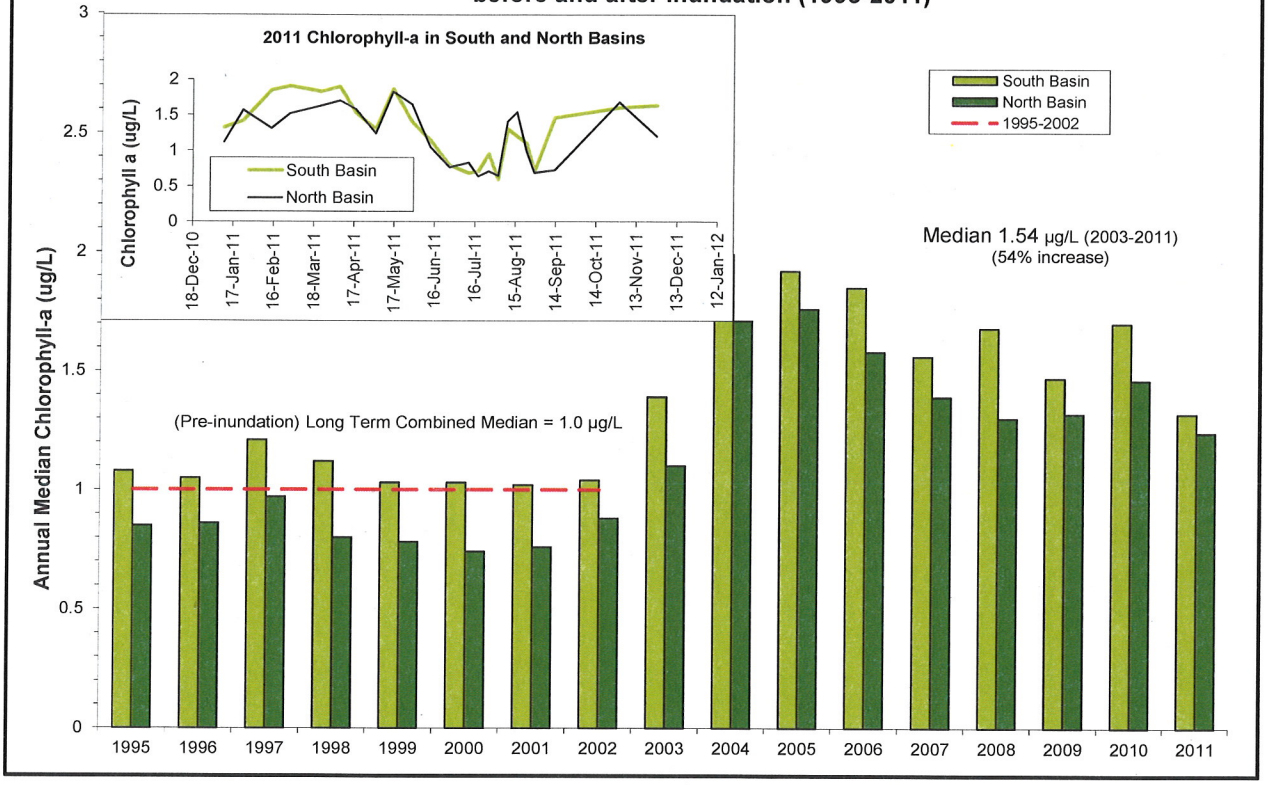


Figure 11. Total Phosphorus Concentrations in Sooke Reservoir before and after inundation (1992-2011)

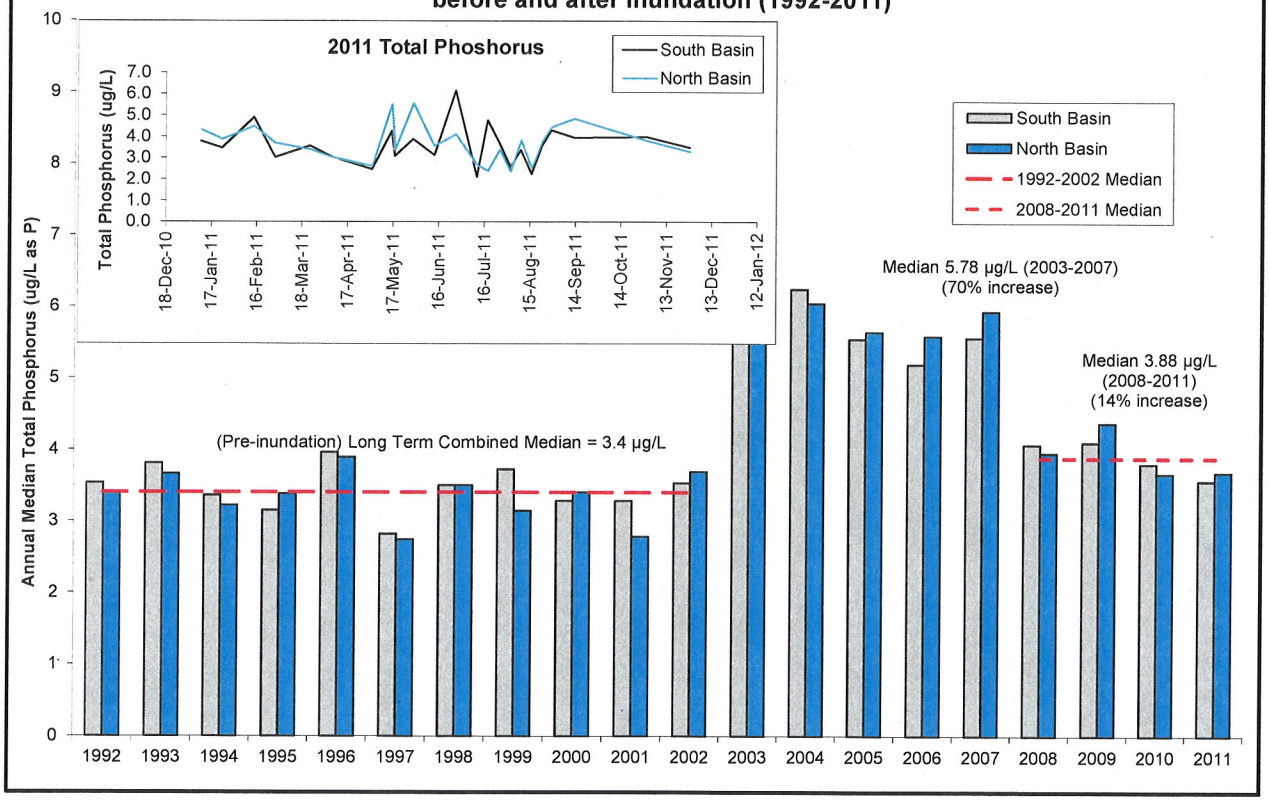


Figure 12. *Asterionella spp.* in Sooke Reservoir, South basin, 1m depth (SOL-01-01)

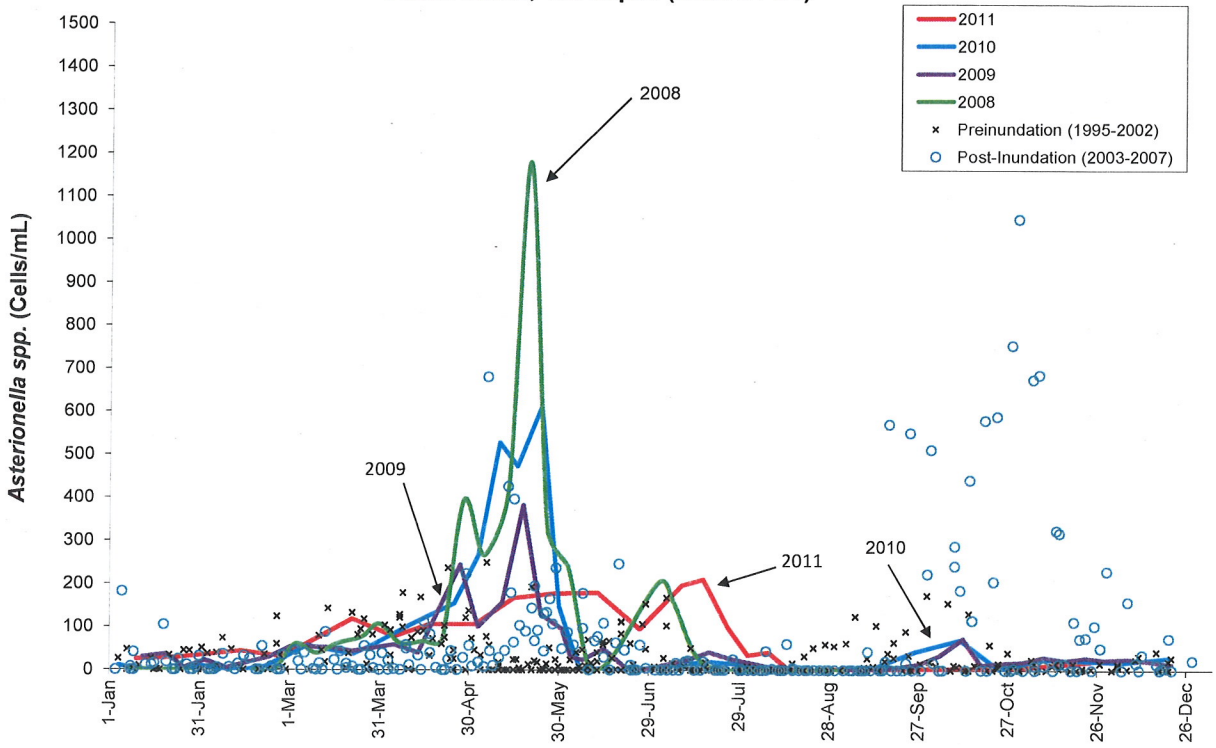


Figure 13. *Tabellaria spp.* in Sooke Reservoir, South basin, 1m depth (SOL-01-01)

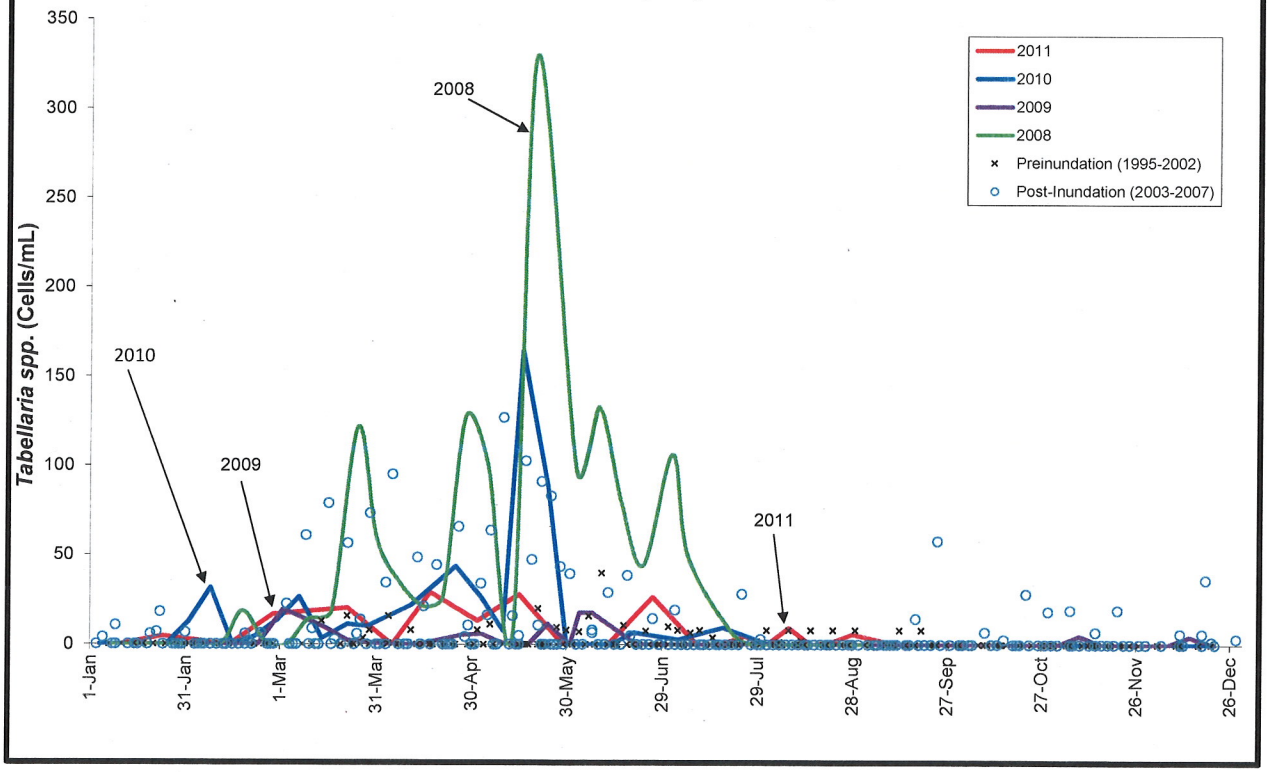
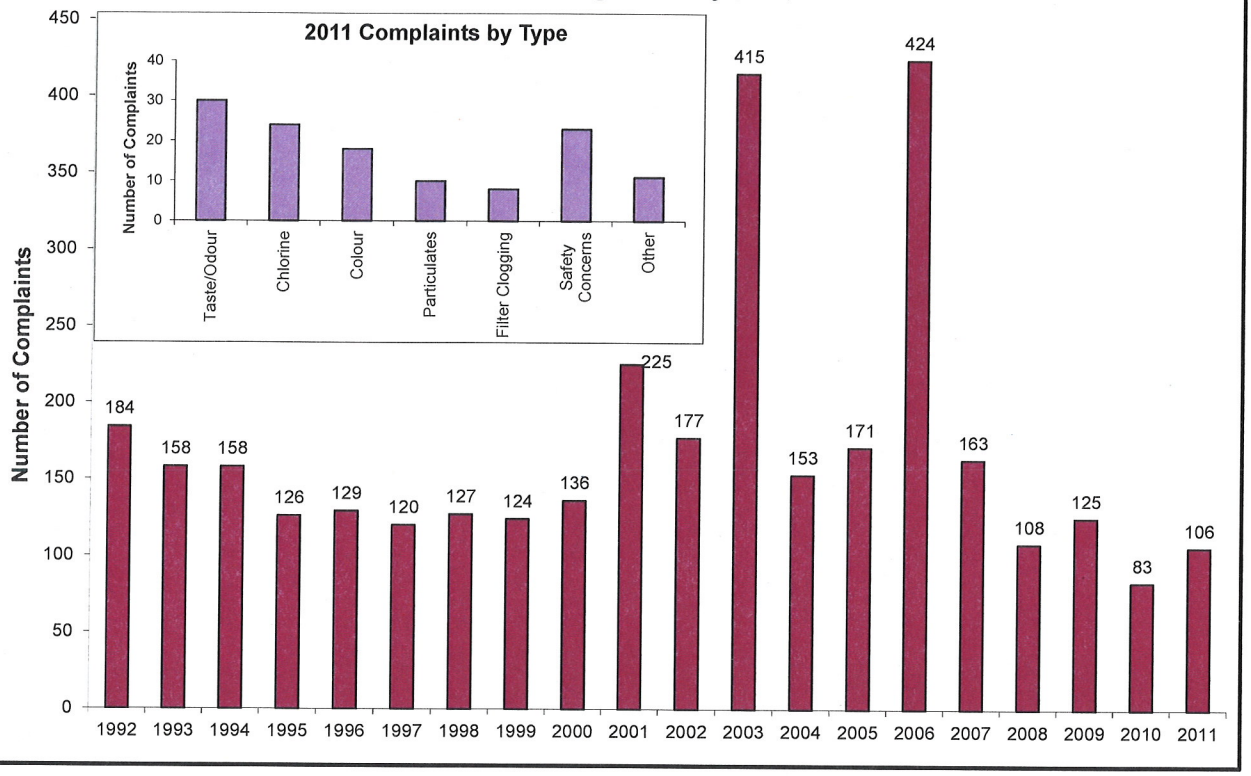


Figure 14. Annual Water Quality Complaints from the Greater Victoria Drinking Water System, 1992-2011



Information on the types of water quality complaints received each month during 2011 is provided in **Table 4** below.

Table 4. Water Quality Complaints Received by the Water Quality Division in 2011.

Month	Total Complaints[1]	Taste and/or Odour	Chlorine[2]	Colour	Particulates	Safety Concerns	Filter Clogging	Customer's Plumbing	Sensitivity	Other
January	9	4	4	0	1	2	0	0	1	0
February	11	2	3	5	0	1	0	0	0	0
March	7	1	1	1	2	1	0	0	1	0
April	15	2	4	2	4	1	0	0	0	3
May	7	2	1	0	0	0	1	0	0	3
June	12	4	1	0	2	7	1	0	1	1
July	11	5	1	3	0	3	3	0	0	0
August	11	5	0	2	0	3	3	0	0	0
September	5	2	0	4	0	0	0	0	0	0
October	6	2	2	0	1	2	0	0	0	0
November	10	1	7	0	0	1	0	0	1	0
December	2	0	0	1	0	2	0	0	0	0
Total	**106**	**30**	**24**	**18**	**10**	**23**	**8**	**0**	**4**	**7**

[1]Totals don't always reflect the numbers to the right, as some complaints fall into more than one category.
[2]Chlorine taste and odour are listed separately from other taste and odour complaints.