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Agenda Item #9
REPORT #RWSC 2008-04

REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY, 16 JANUARY 2008

SUBJECT WATER QUALITY TRENDS IN SOOKE RESERVOIR IN NOVEMBER AND DECEMBER 2007

SUMMARY

The water quality tests conducted for Sooke Reservoir during November continued to show good quality water. However, in early December, a major 'rain-on-snow' event occurred which caused 'off-the-chart' flows and high turbidity in Rithet Creek, the main tributary to Sooke Reservoir. This in turn caused the north basin of Sooke Reservoir to turn a slightly brownish colour and the turbidity to increase to above 2 NTU. Unusually high concentrations of *E. coli* bacteria were observed in the source water entering the Japan Gulch Plant during the event. Nevertheless, the disinfection process at the Plant provided satisfactory protection and there were no lapses in the safety of the drinking water. A technical report on the impact of this event is in preparation.

PURPOSE

This report provides information on the water quality conditions observed in Sooke Reservoir during the months of November and December 2007 and compares these data with those from previous years and long-term averages.

REPORT

Physical Parameters

*Water Levels***.** During the month of November, the water level continued to decline reaching a low for the year of 182.06 m on November 11th (**Figure 1)**. The total drawdown of the water level from the full pool level of 186.75 m was only 4.69 m and was one of the smallest drawdowns in the last 20 years (except for 2001 when mandatory water restrictions were in place). During the remainder of November, the water level slowly started to rise increasing a total of 0.33 m by the end of the month. However, on December 2nd and 3rd a 'pineapple express' roared through the watershed and caused the water level in Sooke Reservoir to rise by almost 2 metres within a 48 hr period (shown by the almost vertical rise in the 2007 red line in **Figure 1**). By the end of December, the water level had risen 3.88 m and was only about one quarter of metre (186.53 m) below full pool.

Water Temperature. During November and December, the weekly average temperature of the water entering the Japan Gulch Treatment Plant returned to levels similar to the pre-inundation average (**Figure 2**). By the end of December, the weekly average water temperature of the water entering the Japan Gulch Plant was 4ºC.

Water Clarity

Turbidity. During November, the turbidity (cloudiness) of the surface water in Sooke Reservoir returned to levels near the long term average in both the south and north basins (**Figure 3)** of the reservoir. However, the 'pineapple express' in early December changed that and caused a substantial increase in the turbidity of the water in Sooke Reservoir. Warm, heavy rains (185 mm – more than 7 inches in 24 hrs – was recorded at a high elevation station on December 3) melted 50 cm (about 2 feet) of snow in the watershed. This 'rain-on-snow event' caused high flows in Rithet Creek that exceeded all previous records. Turbidity in Rithet Creek also exceeded previous records, rising to about 400 NTU at peak flows. In turn, these high, turbid flows caused the turbidity of the water in the north basin of Sooke Reservoir to immediately increase to slightly above 2 NTU (**Figure 3)** with lower, delayed increases in the south basin and at the intake tower.

In relative terms, the increase in turbidity in Sooke Reservoir was very small in relation to turbidity increases in the water sources for other water utilities and demonstrated the inherent stability of Sooke Reservoir to provide high quality drinking water.

Nevertheless, with the exception of a few small spikes, the turbidity of the water entering the Japan Gulch Treatment Plant continued to be below the turbidity limit listed for drinking water in the *Guidelines for Canadian Drinking Water Quality*.

Water Transparency. In November, the transparency of the water at the intake tower (as measured by observing a black and white disk under the water) was similar or better than the long term average (**Figure 4**). However, in December, the transparency of the water in the north basin was some of the poorest observed in a number of years while the transparency of the water at the intake tower (**Figure 4**) was the poorest of the year.

Bacteria

Total Coliform Bacteria. The total coliform bacteria concentration in the water entering the Japan Gulch Treatment Plant from Sooke Reservoir was similar to levels observed in past years and similar to winter conditions of low coliform counts. By the end of December, the total coliform level was about 15 colony forming units per 100 mL.

E. coli Bacteria. In early December, as a result of the rain-on-snow event, the level of *E. coli* in the water entering Japan Gulch Treatment Plant from Sooke Reservoir increased to 165 colony forming units per 100 mL. While this was the highest *E. coli* level ever observed in the raw water originating from Sooke Reservoir, no total coliform bacteria or *E.coli* were able to break through the disinfection process at the Japan Gulch Plant. The high concentration of *E. coli* in the source water is believed to have been caused by overland flows of water on the forest floor which allowed wild animal feces to enter the reservoir.

The concentration of *E. coli* in the raw water returned to typical levels by mid-December. No parasites were found in the water at the Plant during the period of higher turbidities.

Nutrients

Phosphorus. During November, the total phosphorus concentrations averaged about 75% higher than the long-term, pre-inundation average in the south basin (**Figure 5**) north basin (**Figure 6**). (**Note**: In the charts, the bars on each data point indicate the range of data observed from triplicate samples.) In December the total phosphorus concentrations rose in both basins reaching levels of about 100% higher than the pre-inundation average in both basins. This was similar to past years during big storms.

Nitrogen. The total nitrogen levels in November and December hovered around the long-term pre-inundation average in the south basin (**Figure 7**) and north basins (**Figure 8**) of Sooke Reservoir for the majority of the period.

Chlorophyll-a

In November and December, chlorophyll-a concentrations (a general measure of algal populations) declined steadily throughout the reservoir (**Figure 9, intake tower**) (**Figure 10, north basin**). This drop in chlorophyll-a concentration reflected the decline in the diatom bloom of *Asterionella* in the reservoir.

Algae

Algal concentrations and activity in Sooke Reservoir in November and December 2007 were low. The minor diatom bloom that occurred at the end of October declined through November and by the end of December Sooke Reservoir reached quiescent winter concentrations of algae.

Zooplankton concentrations, present throughout the reservoir, remained low to average and did not present a filter clogging problem.

Inundation Scientific Advisory Working Group

The Sooke Reservoir Inundation Scientific Advisory Working Group met on December 6, 2007. There were no issues arising from the meeting. A number of *E. coli* isolates were provided to Dr. Mazumder's laboratory for source tracking analysis. These results are pending.

RECOMMENDATION

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

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Figure 1. Water Level Elevation in Sooke Reservoir, 2003-2007

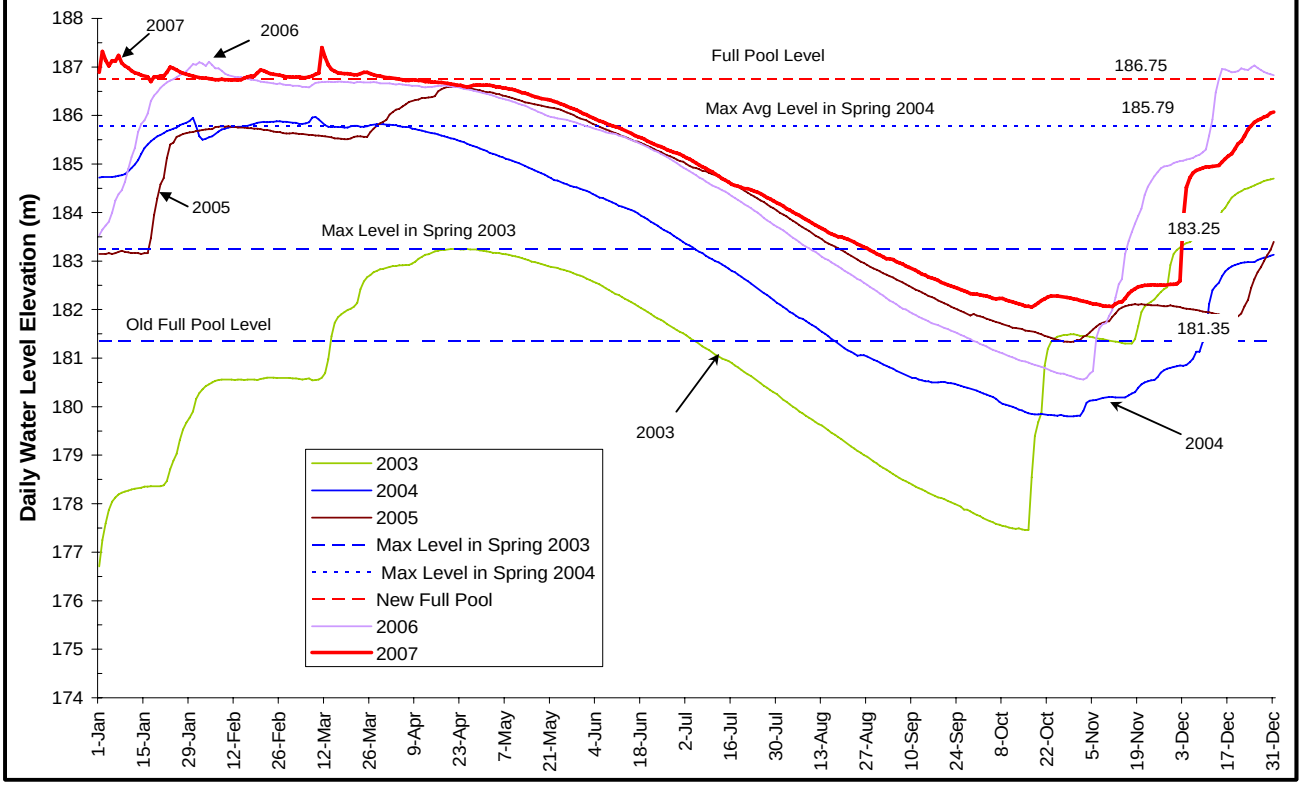

Figure 2. 2007 Temperature of Raw Water entering Japan Gulch Plant (Weekly Average)

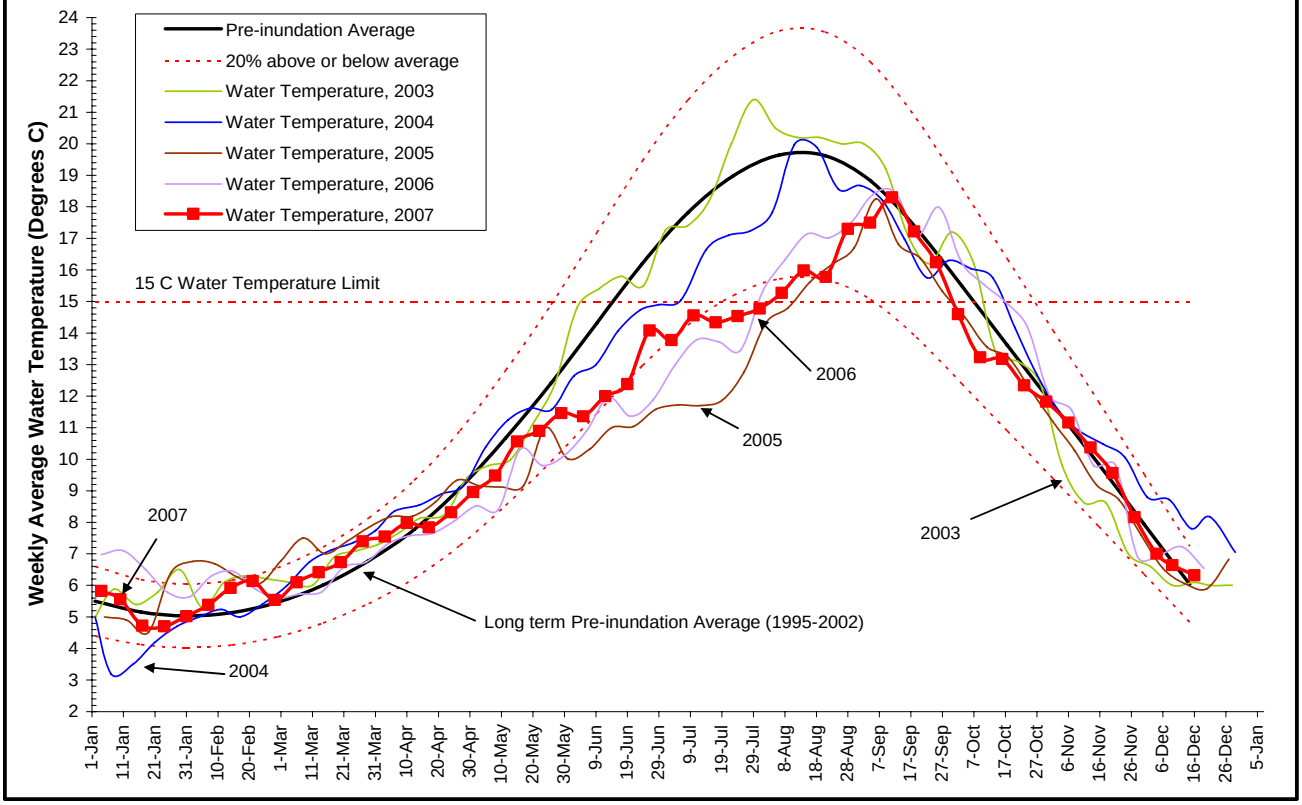

Figure 3. 2007 Turbidity in Sooke Reservoir
North Basin, 1m depth (SOL-04-01)

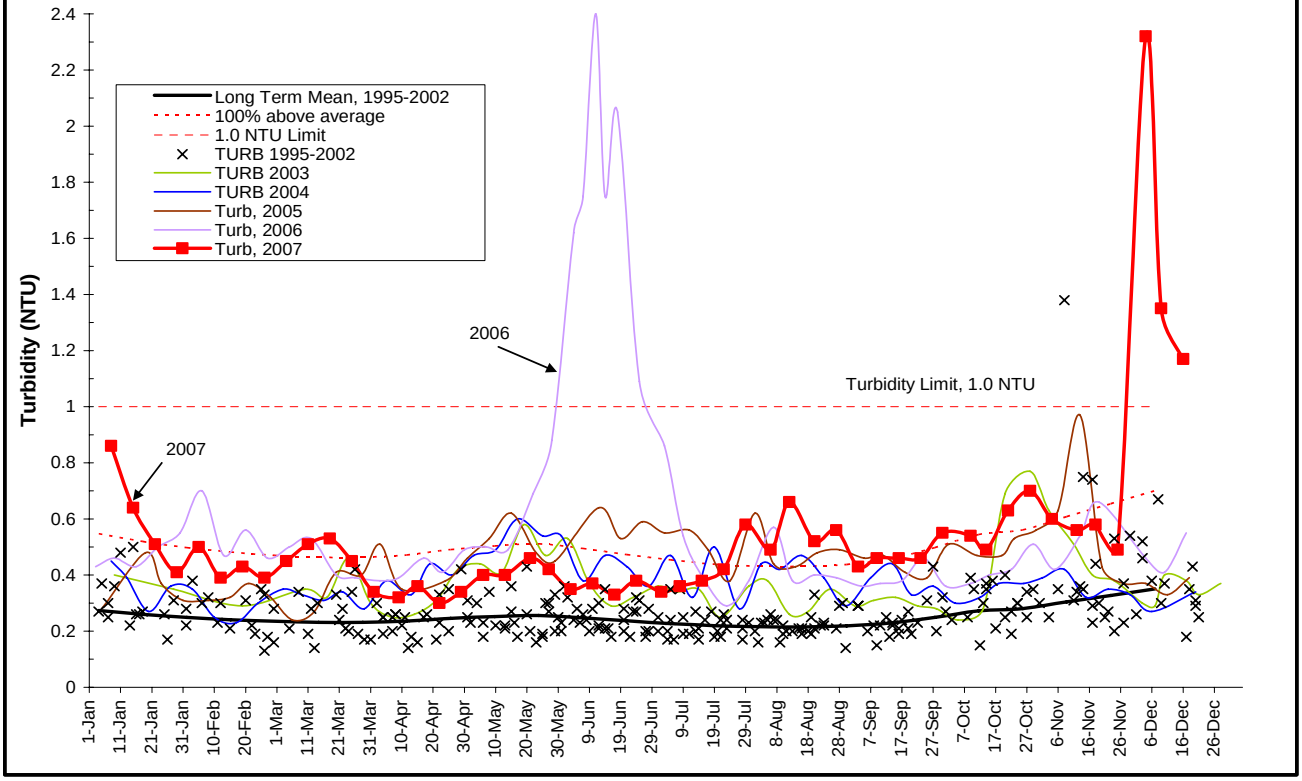

Figure 4. 2007 Water Transparency in Sooke Reservoir
Intake tower, (SOL-00-01)

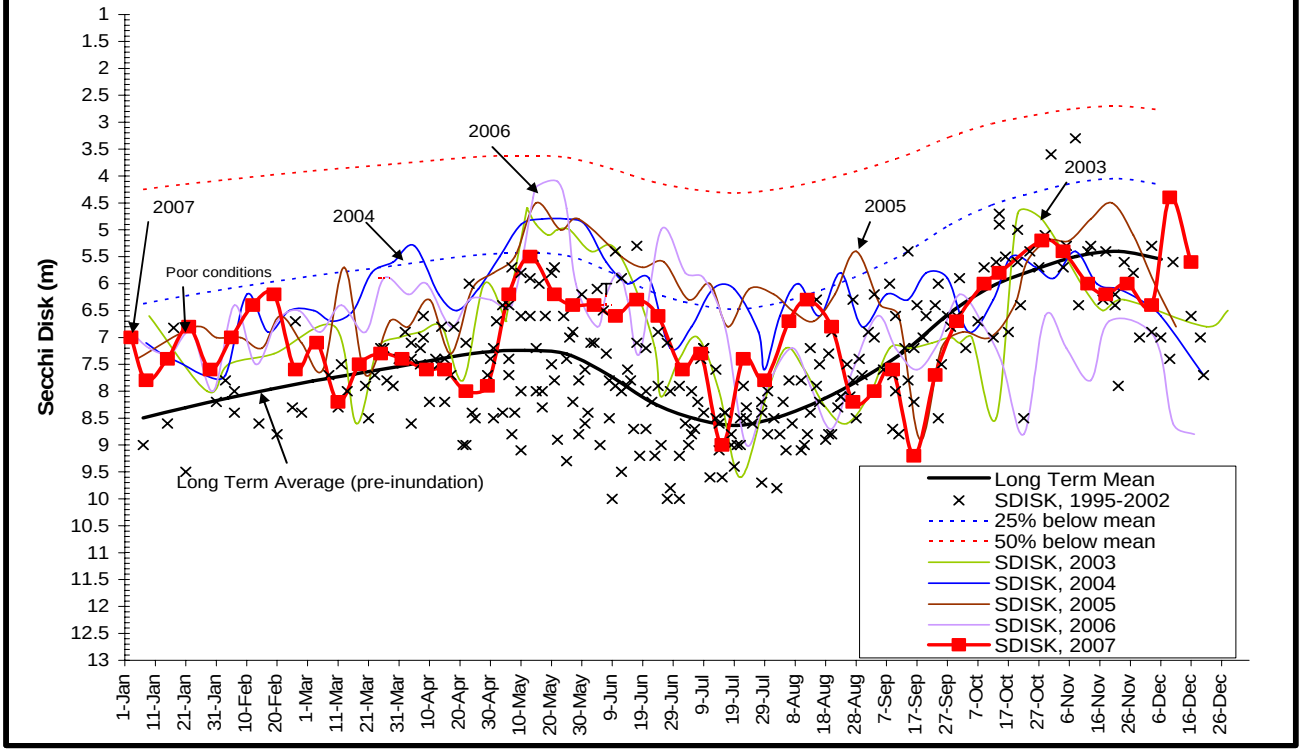

Figure 5. 2007 Total Phosphorus for Sooke Reservoir
South basin, 1 m depth (SOL-01-01)

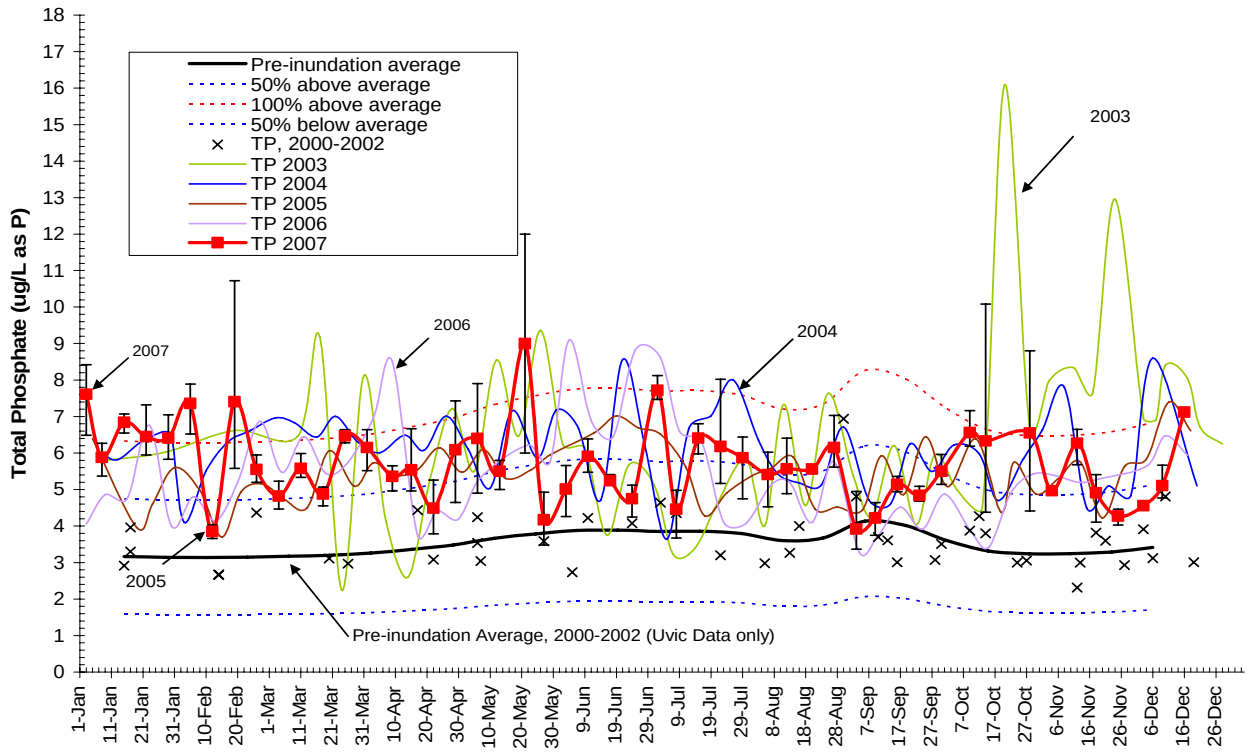

Figure 6. 2007 Total Phosphorus for Sooke Reservoir
North basin, 1m depth (SOL-04-01)

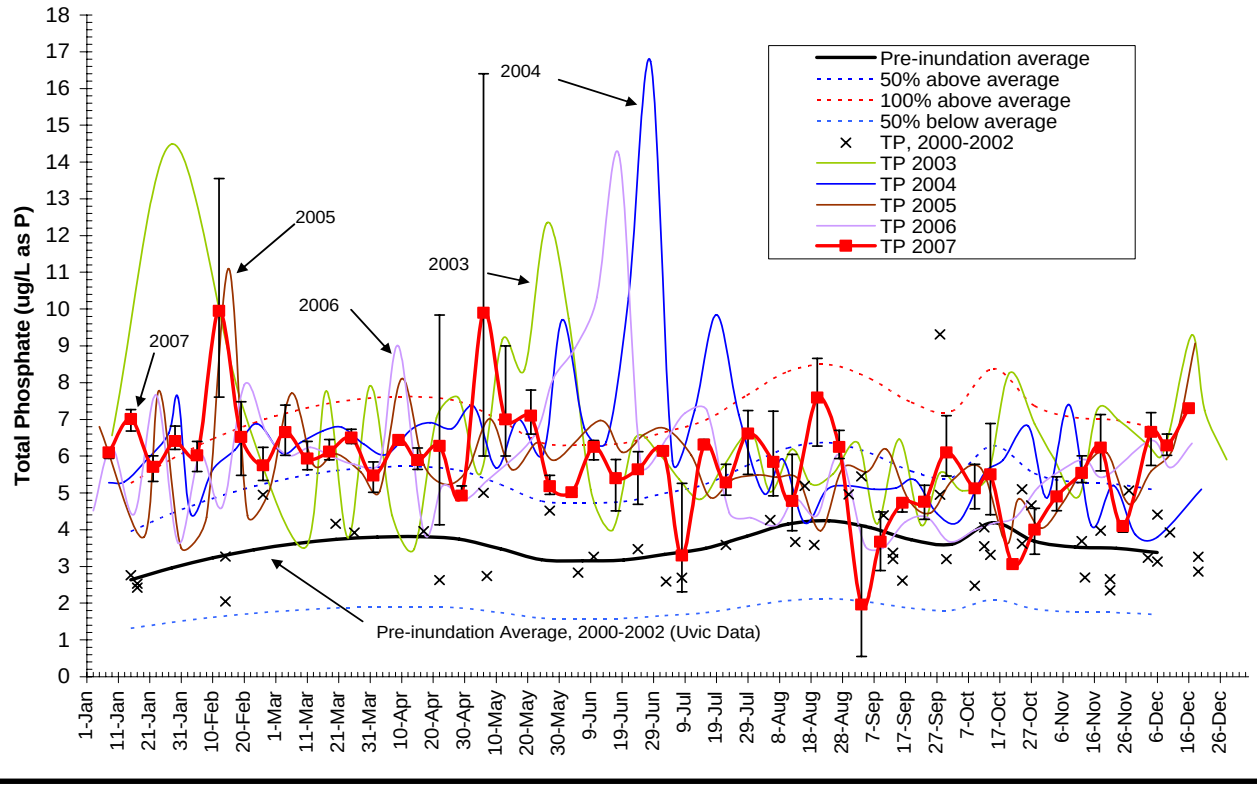

Figure 7. 2007 Total Nitrogen in Sooke Reservoir south basin, 1m depth (SOL-01-01)

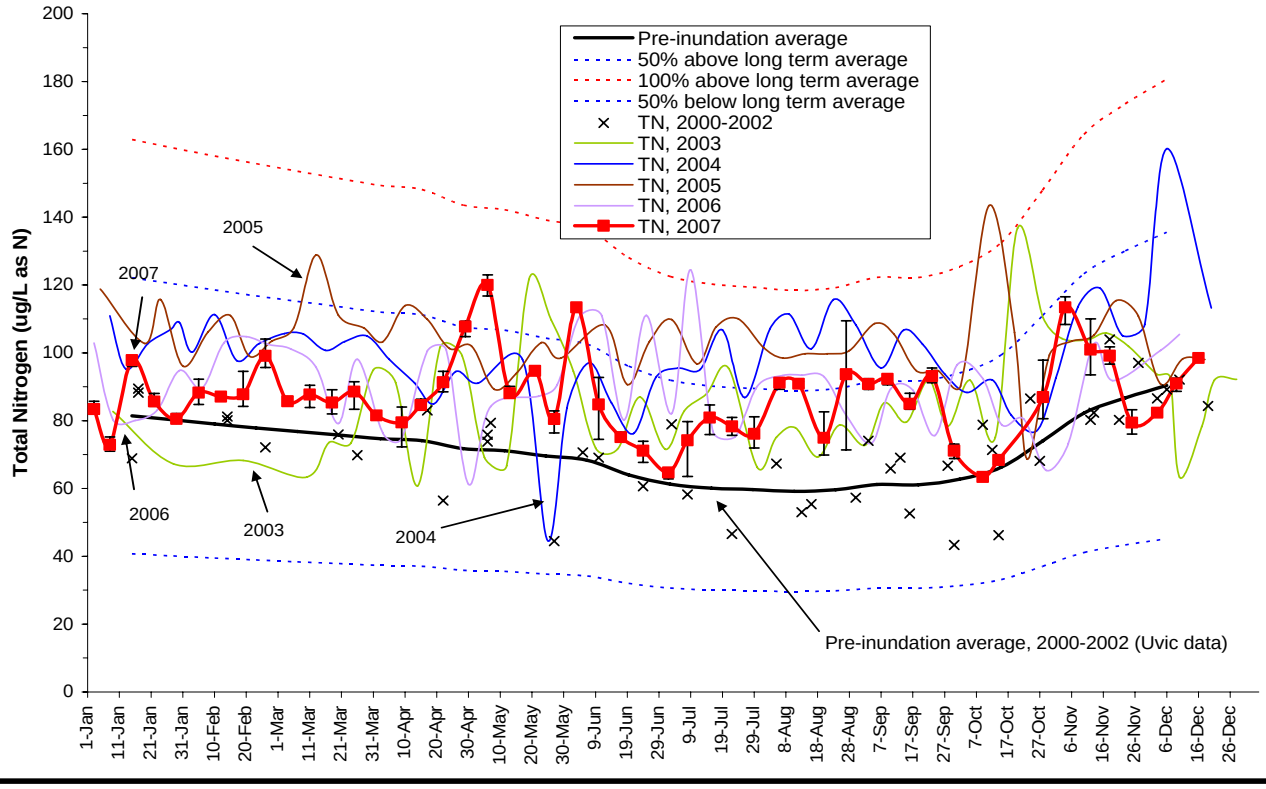

Figure 8. 2007 Total Nitrogen in Sooke Reservoir North basin, 1m depth (SOL-04-01)

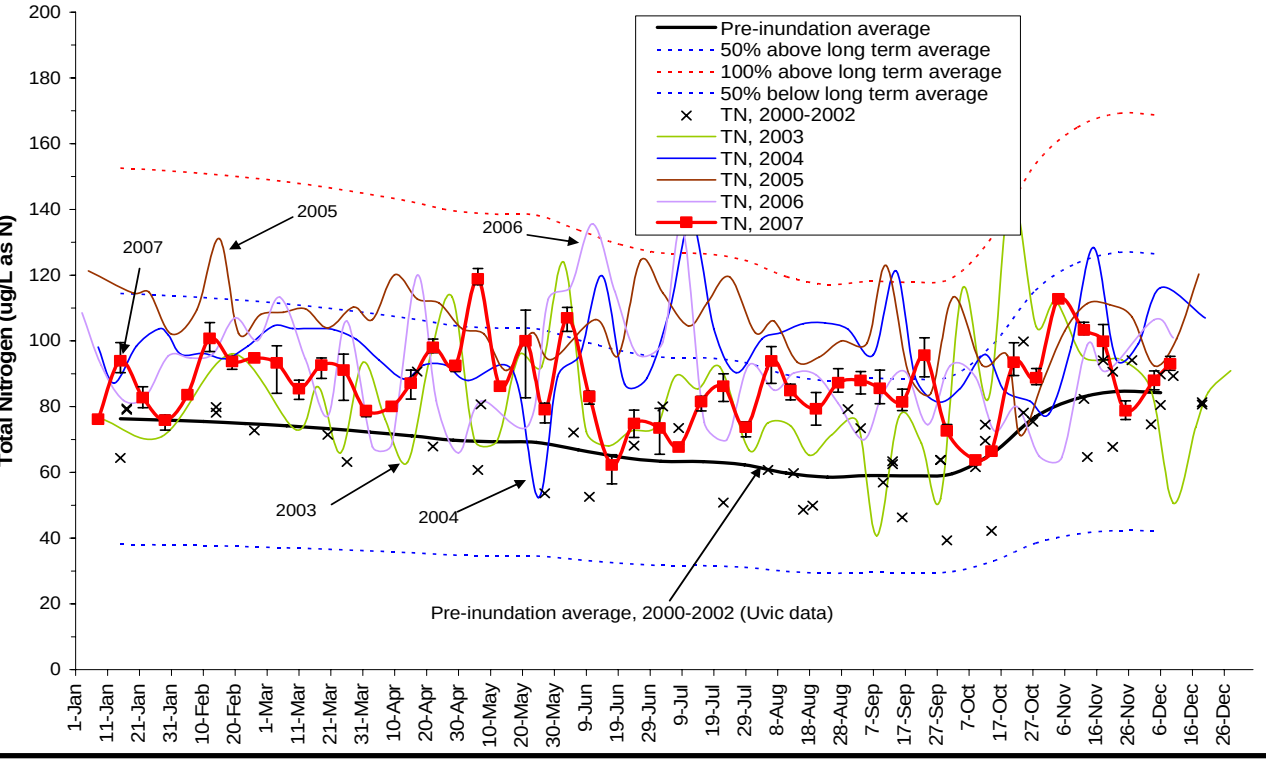

Figure 9. 2007 Chlorophyll-a in Sooke Reservoir
Intake Tower, 1 m depth (SOL-00-01)

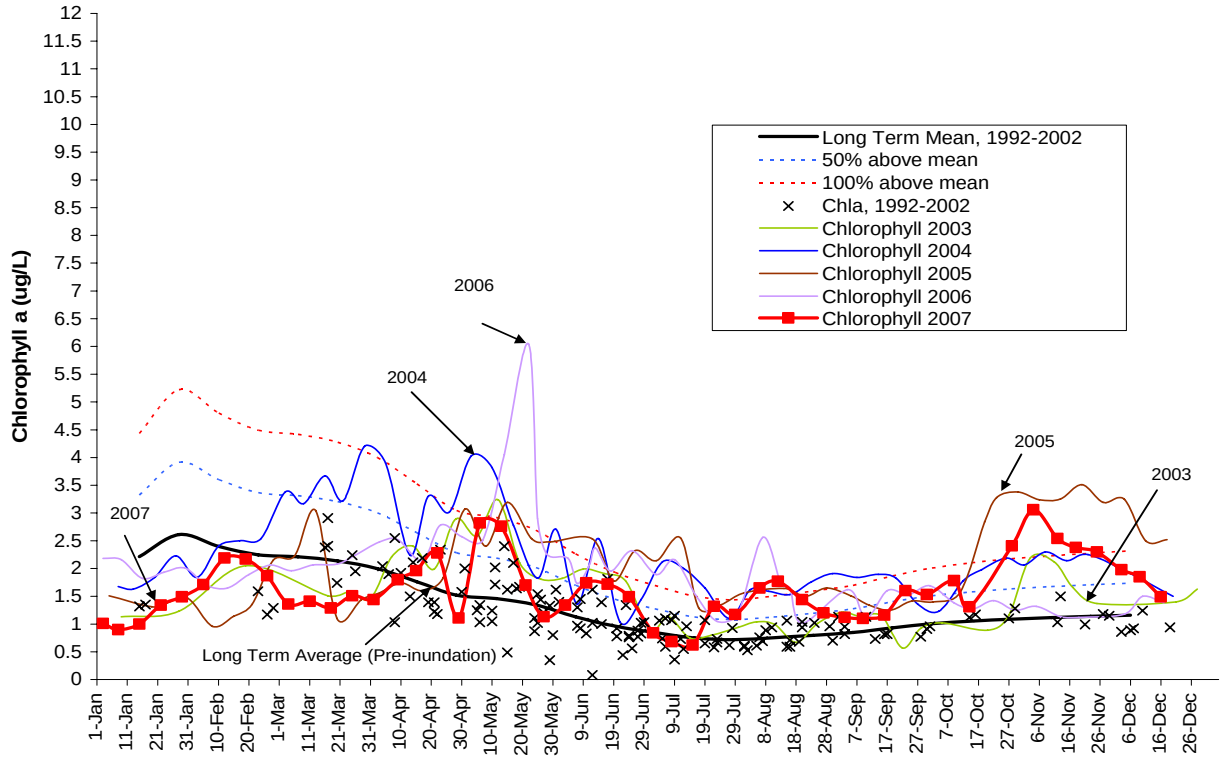

Figure 10. 2007 Chlorophyll-a in Sooke Reservoir
North Basin, 1 m depth (SOL-04-01)