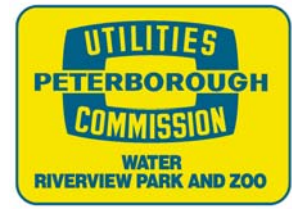


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Peterborough  
Utilities  
Commission

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**2006 WATER QUALITY REPORT**

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**On the Cover**

Water Street Pumphouse & Zone One Pipe

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## **INTRODUCTION**

With minimal disruptions to the plant process for construction or maintenance, the Peterborough Water Treatment Plant continued to produce an excellent quality of drinking water for the consumers in Peterborough during 2006. According to NASA, 2006 was the 5<sup>th</sup> warmest year worldwide since the 1890's. In Peterborough temperatures during June, July and August were very warm, averaging 4.7°C higher than normal. Rainfall in June was relatively normal but July and August's precipitation was very low. The highest pumpage day was on August 18, 2006 (70,649 m<sup>3</sup>). This was 22.4% less than last year's historical high of 91,008 m<sup>3</sup>. The Otonabee River water temperatures varied over the year from 0.0 °C to 27.7 °C.

The drier weather during the summer months gave us lower Otonabee River flows, which seemed to help with raw water turbidity. It appears that the many dams on the river act like multiple settling basins, which help lower overall raw water turbidity. Higher water temperatures, however, have contributed to an increase in the amount of blue-green algae, which were observed in the Kawartha Lakes (the head waters for the Otonabee River). This is further described in the blue-green algae section.

The following are items of interest from 2006.

In April 2006, the Trent Conservation Coalition (a partnership of 5 Conservation Authorities) began the process of conducting a surface water vulnerability analysis for each of 10 municipal drinking water intakes located within the Trent River watershed – with Peterborough Treatment Plant one of those studied. On July 6<sup>th</sup>, 2006 the Otonabee River near the Peterborough intake was studied with a river flow of 37 m<sup>3</sup>/s. At that time the preliminary study shows that a dye (fluorescent Rhodamine WT) injected into the river upstream took approximately 1 hour and 54 minutes to travel 900 metres (a flow rate of 0.13m/second). A final report on this work is due out in 2007 by XCG Consultants Ltd.; Study of Source Water; 'Surface Water Intake Studies in the Trent Watershed. Otonabee River flow and Dispersion Study'.

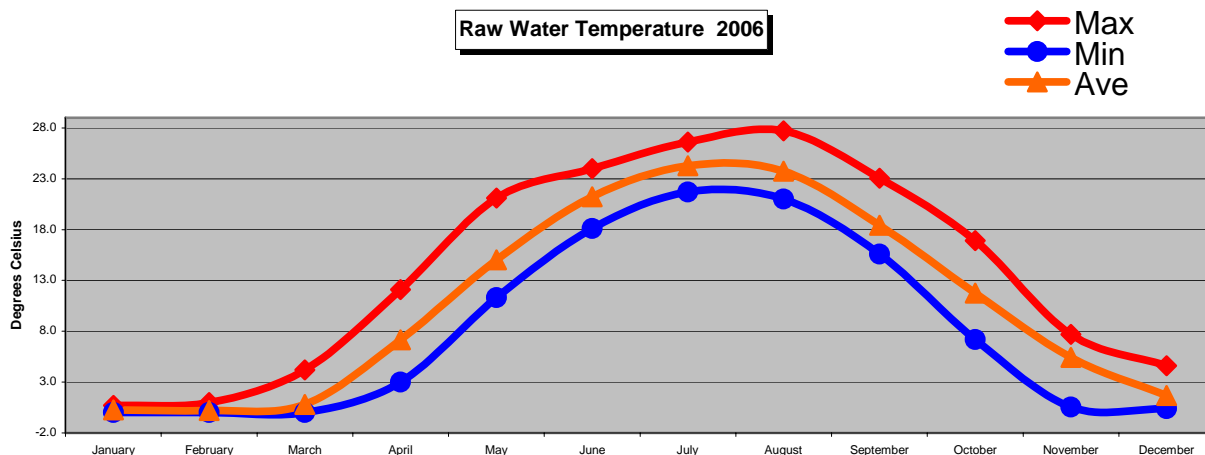
As of June 2006, amendments were made to O. Reg. 170/03. Most notable was the removal of prescribed corrective actions for adverse fecal coliforms, background colony counts, and heterotrophic plate counts (HPC) results. Another notable amendment to 170/03 was a new filtered water guideline for turbidity. The new maximum acceptable concentration (MAC) for filtered water is now 0.30 NTU (Nephelometric Turbidity Unit) for 95% of the time. This value was previously set at 1.0 NTU. The average filtered water level in the Peterborough's drinking water was 0.03 NTU for 2006.

## **TEMPERATURE**

As with most eco-systems, many measured parameters (including the weather) all affect each other, and how the water is treated. For example, higher raw water temperatures affect how much chlorine is used and the speed at which chemical reactions take place (more chlorine is used in higher temperatures to achieve the same disinfection results).

Higher water temperatures also contribute to a higher population of algae in the Otonabee River, which in turn can contribute to an elevated level of taste and odour causing compounds (geosmin and 2MIB). A higher population of algae can contribute to a higher population of zebra mussels, which can further increase the taste and odour problem. During 2006, raw water temperature varied from 0.0 °C to 27.7 °C.

Figure 1



## **BLUE-GREEN ALGAE**

Blue-green algae is technically known as cyanobacteria, a microscopic organism that is naturally present in lakes and streams. Usually present in low numbers, however blue-green algae can become very abundant in warm, shallow, undisturbed surface water that receives a lot of sunlight. These conditions existed in the Kawartha Lakes region during June and July with hot dry air, low river and lake flows (undisturbed water), warmer weather (with higher than normal raw water temperatures) these are ideal conditions for blue-green algae to proliferate.

When this occurs, they can form blooms that discolour the water or produce floating rafts or scum on the surface of the water. Blue-green algae can also produce toxins of concern when present in large enough numbers.

The high numbers of blue-green algae is probably the largest contributor to the drinking water taste and odour levels. 2-methylisoborneol (2MIB) and geosmin, are by-products of blue-green algae degradation, and are found in the water when we experience taste and odour complaints.

**ZEBRA MUSSELS**

During 2006, zebra mussel populations appeared to be stable, with a slight increase in raw water turbidities. Since the introduction of zebra mussels (an invasive species) into Ontario in and later into the Otonabee River system in 1997, the effects continue to cause noticeable changes in raw water turbidity. The Ontario Federation of Anglers and Hunters had their first confirmed sighting of zebra mussels in this area at Lock 19 in 1997. According to the literature, one zebra mussel can clear 1 litre of water per day. Large numbers of zebra mussels can actually clear a water body. Sunlight is then able to penetrate further down into the water column allowing other species of algae (possibly taste and odour algae) to flourish.

As with many unbalances in a river eco-system, there appears to be a cyclic change in zebra mussel population and raw water turbidity. When zebra mussel populations flourish the average level of turbidity decreases. [\(Figure 2\)](#)

**TURBIDITY**

Even though the 2006 average raw water turbidity increased slightly from 2005 (from 0.51 to 0.59 NTU), sunlight is still able to penetrate further into the water column thus allowing certain species of algae to proliferate. Over the last 10 years it appears that the water is clearer due to zebra mussels. This may be a contributing factor to an increase in cyanobacteria and other taste and odour producing algae. A 20-year trend of Otonabee River (raw water), and finished treated water (plant effluent) turbidity is shown in [Figure 2](#) while [Figure 3](#) illustrates the 2006 turbidity average. The annual turbidity peak occurred in June (average monthly turbidity 0.87 NTU) with higher than normal water temperatures (average June temperature at 21.2 °C.) and lower than usual river flows - perfect conditions for algae growth. The yearly average plant effluent turbidity was 0.08 NTU (for 2005 the values were: raw water at 0.51 NTU, and plant effluent was 0.07 NTU). A new filtered water guideline for turbidity was initiated in June 2006, from the Ministry of the Environment. The new Maximum Acceptable Concentration for filtered water is now 0.3 NTU for 95% of the time this is lower than the previous limit of 1.0 NTU.

Figure 2

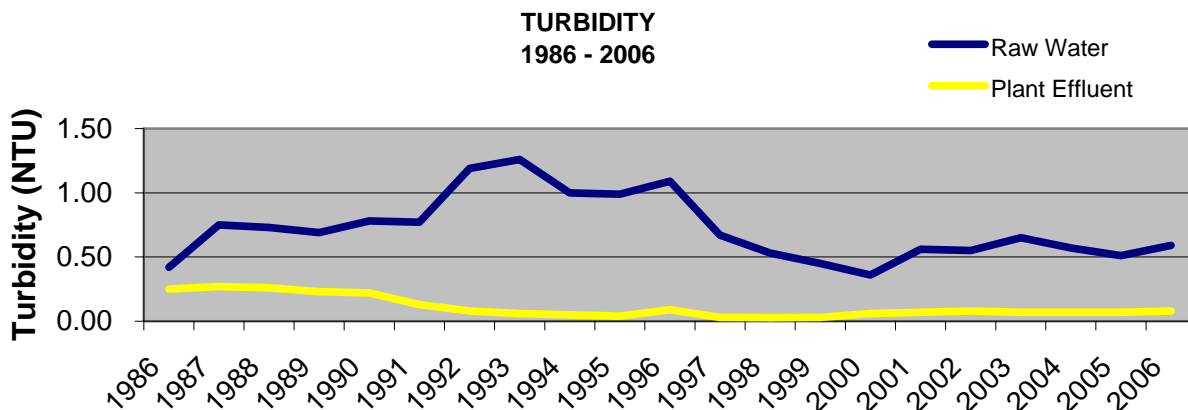
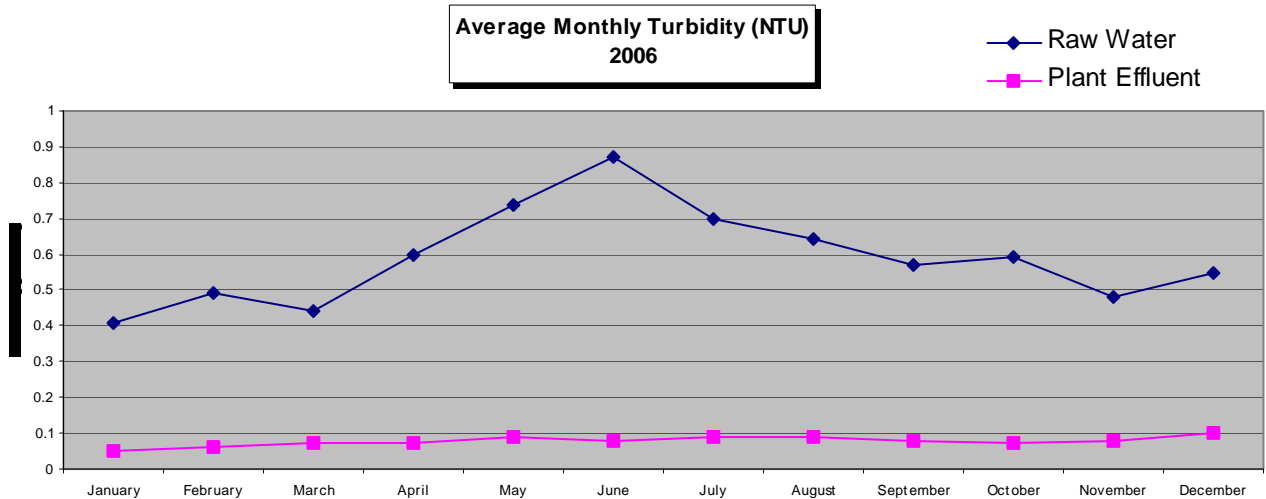


Figure 3



## **TASTE AND ODOUR**

During 2006, one of the main sources of taste and odour in our raw water are the naturally occurring compounds geosmin and 2-methylisoborneol (2MIB). These compounds can be detected by humans at very low levels (less than 10 ng/L). A ng/L is equal to one billionth of a gram per litre. Geosmin and 2MIB can be produced by the bacteria actinomycetes, zebra mussels, and some species of blue-green algae, though the exact organisms are not known. Both geosmin and 2MIB were undetectable during the cold water months (January to April) showing values less than the laboratory detectable limits of 3 ng/L.

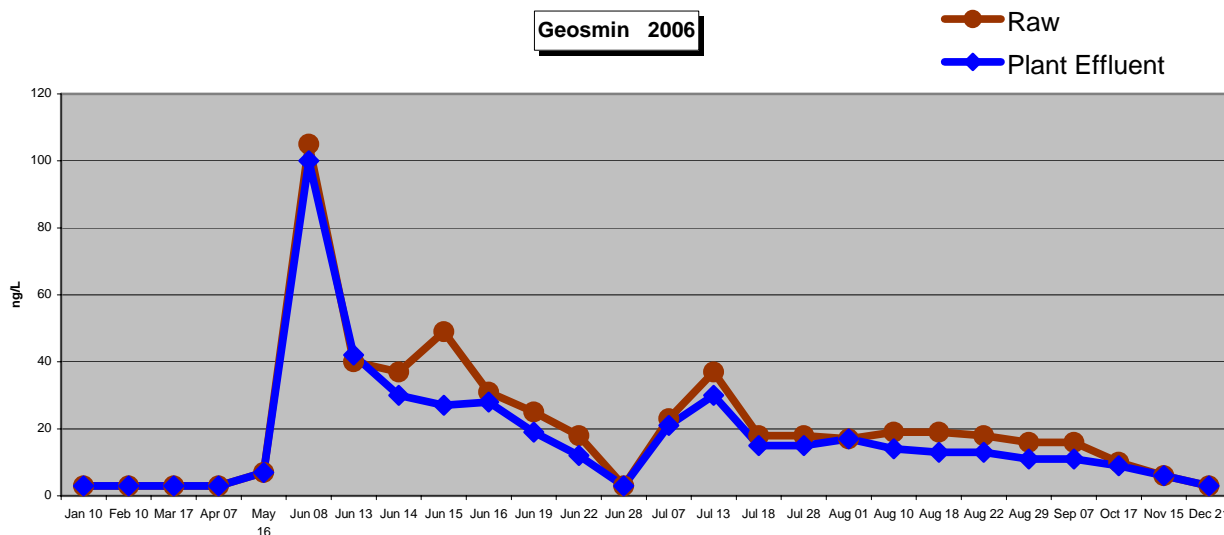
Previous years data indicated that geosmin and 2MIB would hit peaks at the same time during the summer months – usually a large peak near the end of the summer when the water temperature is the highest. During 2006, geosmin peaked early in the year while 2MIB peaked near the end of the summer. Taste and odour during 2006 lasted for most of the summer with the worst being the period when geosmin was peaking (early June). Slow moving river with high water temperatures and abundant nutrients contributed to higher than usual taste and odours in our finished water.

Many species of algae grow rapidly when there is little or no movement of water with abundant sunlight and nutrients. Perfect conditions to grow algae, a major source of taste and odour compounds (geosmin and 2MIB). These compounds can be detected by most people when the values are greater than 10 µg/L.

### Geosmin

Geosmin is thought to originate in the higher water column and produce an earthy odour – the average raw water value during 2006 was 21 ng/L and the average plant effluent was 17.6 ng/L [Figure 4](#) (both higher than 2005, which were 16.3 and 15.8 ng/L respectively). The 2006 peak occurred on June 8<sup>th</sup> at a value of 105 ng/L. During 2006, the reduction of geosmin due to water treatment processes (coagulation, sedimentation, filtration and chlorination) was only 16 %. This is not a significant reduction in taste and odour caused by geosmin.

Figure 4

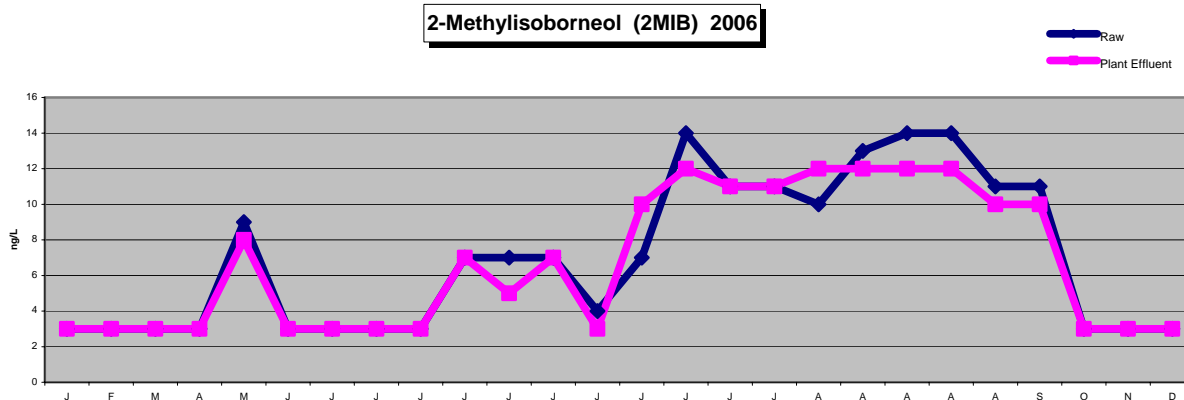


### 2-Methylisoborneol

2-Methylisoborneol (2MIB) is produced in the sediment or benthic layer and gives off a musty odour. 2MIB can reproduce well when sunlight can penetrate down to the bottom of lakes and streams. Zebra mussels may be clearing the water to allow sunlight to penetrate further down to these benthic layers.

The average raw water value during 2006 was 7.0 ng/L, the average plant effluent was 6.7 ng/L, annual average for 2005 were 8.5 and 7.9 ng/L respectively ([Figure 5](#)). Peaks for 2MIB lasted for a two-month period during July to September. During 2006, there was a 4.4% reduction of 2MIB this was due to the water treatment processes. This is not a significant reduction in taste and odour caused by 2MIB.

Figure 5



Both geosmin and 2MIB compounds resist oxidation (disinfection) and are difficult to remove by standard treatment in water filtration plants. If we continue to experience elevated summer temperatures (with warm waters), low flows, and abundant sunlight then taste and odours will continue to be a problem. Typically, elevated levels of these compounds are present when algae is found in abundance, and are frequently associated with high nutrient levels in warm and calm water.

## **COAGULANT AIDS**

### **SODIUM SILICATE (Activated Silica)**

Two forms of sodium silicate are applied at the water treatment plant. Activated silica is applied as a coagulant aid and BW46M is added for pH correction and corrosion control.

Depending upon the raw water flows, turbidity, settled water turbidity, and water temperature the activated silica system was used dosages of 0.5 mg/L to 1.5 mg/L (CO<sub>2</sub> activated sodium silicate, N-silicate). N-Silicate was only used for 5 days during 2006.

Activated silica aided the settling of alum (aluminum sulphate) formed floc, and helped to produce slightly lower settled and plant effluent turbidities. Activated silica can be used during the colder months since alum does not form the heavy floc needed to remove turbidity properly in cold water. Activated silica may also help with settling of floc when we experience higher than normal water treatment plant flows.

Experimentation with jar tests are employed to help determine the most efficient dosages and rations of alum and activated silica. These tests are conducted throughout the year since water quality and water temperatures change seasonally.

### **SODIUM SILICATE (BW46M)**

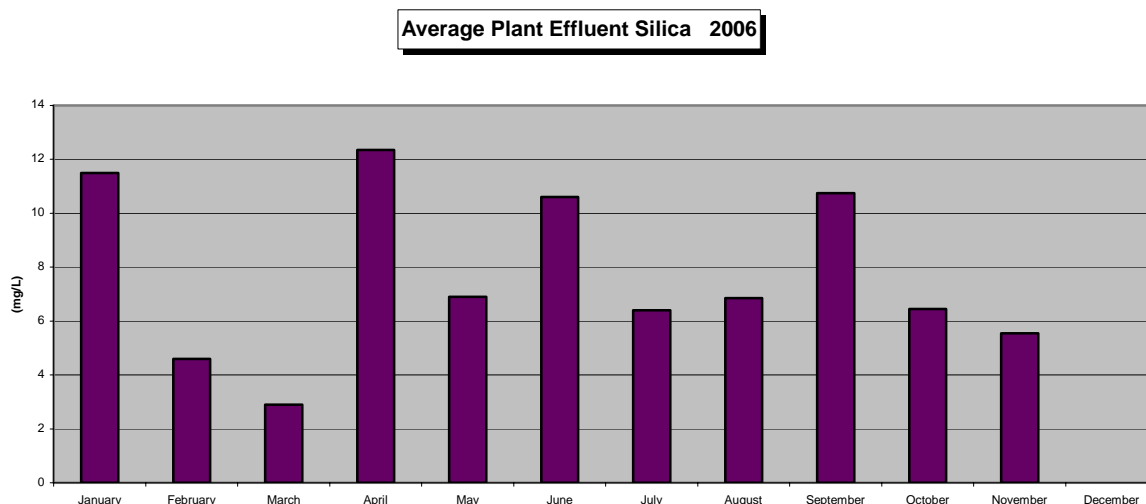
Sodium silicate (BW46M) is added to the plant effluent for corrosion control within the distribution system as well as plant effluent pH adjustment. The average sodium silicate

dosage for 2006 was 8.3 mg/L compared to 9.7 mg/L in 2005. The use of chlorine and alum during the water treatment process lowers the pH level causing the water to be slightly acidic/corrosive. Before the addition of sodium silicate the average pH level was 6.93. The addition of BW46M increases the pH to a more acceptable value of 7.1.

**Silica**

Both N-Silicate (for activated silica) and BW46 (sodium silicate for corrosion control) contribute to a total silica level found in the water. Silica levels throughout the distribution system generally ranged between 3.3 mg/L and 12.5 mg/L with an annual average of 7.6 mg/L. The annual average silica level found leaving the Water Treatment Plant was 7.7 mg/L (Figure 6). The 2006 silica values are lower than 2005 since activated silica was only used for 5 days.

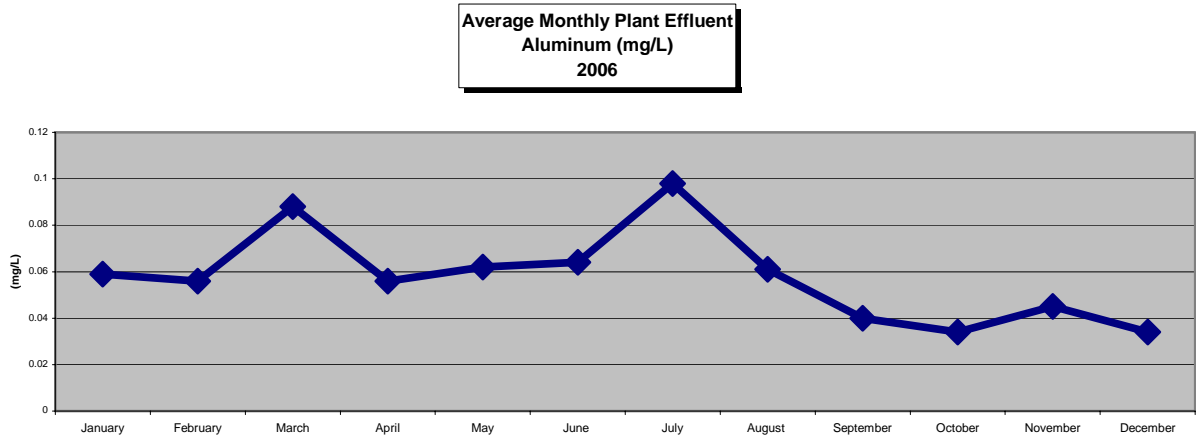
Figure 6



**ALUMINUM**

Aluminium residual found in the plant effluent can be a by-product of the addition of alum. Alum is used as our primary coagulant causing particles (silt, sand, algae, bacteria, etc.) to coagulate or ‘clump’ to form a floc, which can settle in the settled basins. The water is further clarified by filtration. A properly balanced/optimized treatment with coagulation (using activated silica), sedimentation, and filtration resulted in reduced aluminium residuals in the plant effluent sample at a 2006 average of 58 µg/L, Figure 7 (2005 average was 57 µg/L). Aluminium values seem to fluctuate with seasonal changes of raw water temperature, pH, turbidity and alkalinity.

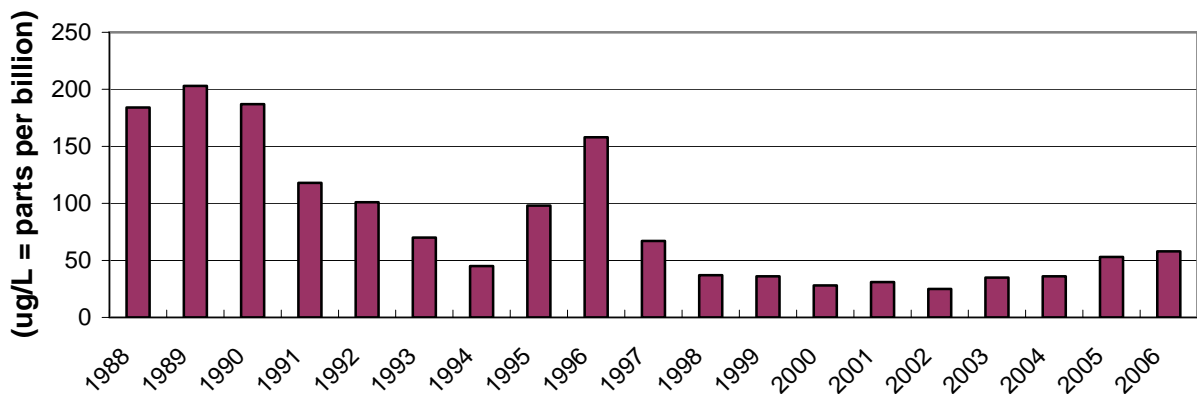
Figure 7



Aluminium residuals over the last 10 years have shown a slight increase (Figure 8). This may be due to the slight changes in raw water turbidity, alkalinity, and summer time algae populations. Slight variations in the environment over the last decade – with rising annual temperatures being a driving force have forced changes in the amount of chemicals used to obtain the best treated water possible. Chlorine usage has increased since the Walkerton tragedy in 2000. A higher amount of chlorine usage can cause a slightly lower pH, which in turn can cause an increase in metal solubility.

Figure 8

Yearly Average Plant Effluent Aluminum  
1988- 2006



**TRIHALOMETHANES**

Trihalomethanes (THM) are formed as a by-product when chlorine or bromine used to disinfect water for drinking. They result from the reaction of chlorine and/or bromine with organic matter in the water being treated. The THMs produced may have adverse health

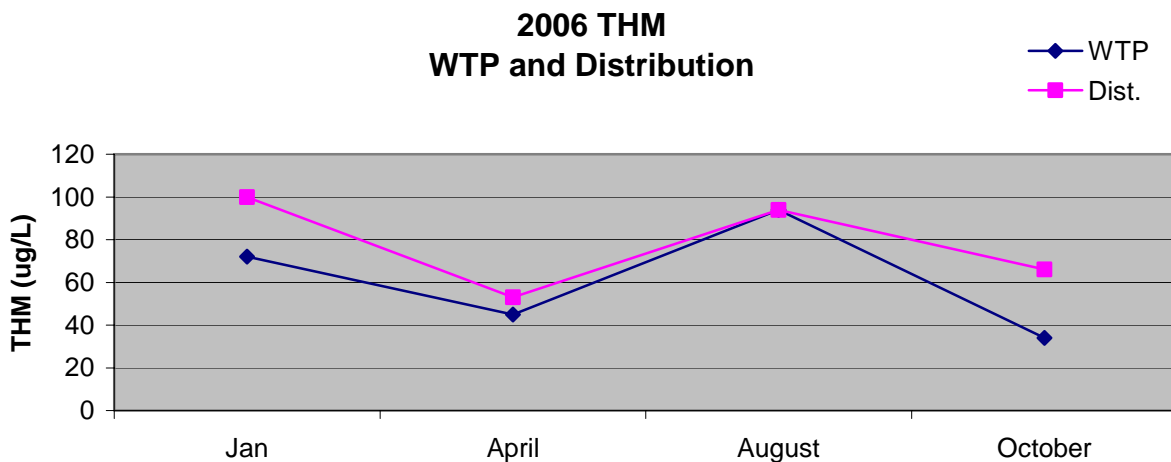
effects at high concentrations, and many governments set limits on the amount permissible in drinking water. In Ontario, the Ministry of the Environment’s MAC for total THM’s (total concentration of chloroform, bromoform, bromodichloromethane, and dibromochloromethane) are set to 100 µg/L (sliding yearly average) for the distribution system (Figure 9). According to Reg. 170/03, THM samples must be collected and analyzed at least quarterly.

There are many factors which contribute to the formation of THM’s, with the more notable being water temperature, amount of organic material present, chlorine residual present, and time at which these chemicals are in contact with each other.

With the continued removal of the majority of THM organic precursors through optimized coagulation, flocculation and sedimentation processes, 2006 levels were very consistent with the previous year’s data. The average plant effluent THM level for 2006 was 61.3 µg/L. The value in 2005 was 54.5 µg/L.

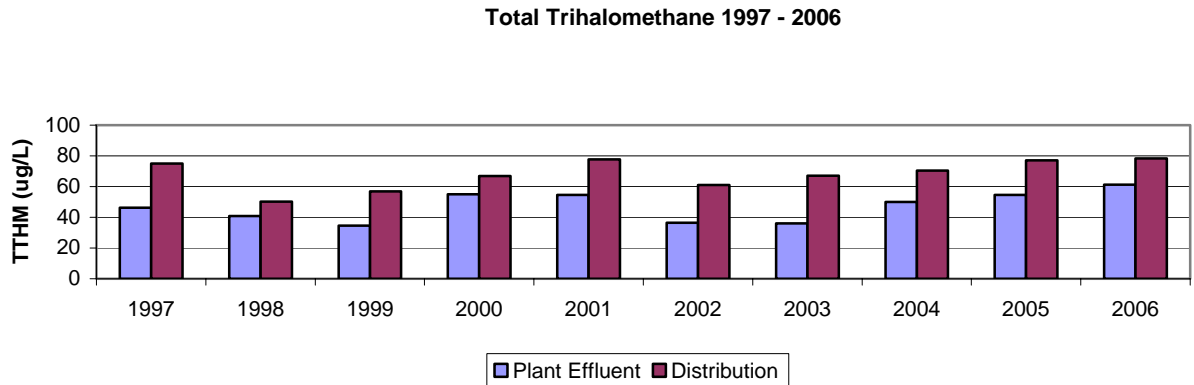
Distribution levels are always found to be higher than those leaving the Water Treatment Plant since THM’s continue to form as the water travels through the system. Approximately 60% of the total THM formation takes place at the Water Treatment Plant and the remaining 40% is formed in the distribution system. The average 2006 THM level in the distribution system was 78.25 µg/L. The value in 2005 was 77 µg/L.

Figure 9



Since there are many factors that affect the formation of THM’s in the distribution system, it will be difficult to explain why THM’s appear to be increasing in the last 5 years (Figure 10). A few explanations can be that the summers since 2002 have been warmer and the amount of chlorine used for primary disinfection (and free chlorine residuals leaving the WTP) have been higher since Walkerton (2000). Both warmer temperatures causing higher raw water organics and higher amounts of chlorine used are two primary ingredients for the formation of THM’s.

Figure 10



## **CHLORINE**

The primary disinfection dosage of chlorine for 2006 ranged between 2.2 mg/L and 3.5 mg/L. During the summer months the primary chlorine dosage could be as high as 3.5 mg/L due to warm water temperatures and also to maintain the chlorine residual throughout the distribution system to comply with the Ontario Drinking Water Standards.

Zebra mussel control for the Water Treatment Plant included adding approximately 0.6 mg/L of chlorine into the Water Treatment Plant intakes for the whole year. Normally, the addition of zebra mussel chlorine was dosed only during the months when we experienced warmer water temperatures (usually when water temperature is above 12 °C). The continual addition of zebra mussel chlorine throughout the year assisted in optimizing coagulation, flocculation and filtration in the plant process by slightly lowering the raw water pH.

## **ULTRAVIOLET ABSORPTION**



A new Ultraviolet Absorption or UV test was introduced in 2005. This test was carried out daily on Raw, Filter #1, and Plant Effluent samples to determine how well UV (at a wavelength of 253.7 nm) can penetrate our coloured waters, especially our filtered water). UV was studied since it may be a viable disinfection complement with chlorine. Using less chlorine could lower the amount of THM's and other disinfection by-products produced.

At a wavelength of 253.7 nm UV can be absorbed by a micro-organism and disrupt it's DNA thereby preventing them to reproduce. UV can be effective on bacteria, viruses, and parasites such as Giardia and Cryptosporidium. One main drawback to using chlorine as a disinfectant is that it produces THM's. Using UV as a disinfectant with chlorine provides better disinfection protection and may allow us to use less chlorine, and therefore produce

less THM's.

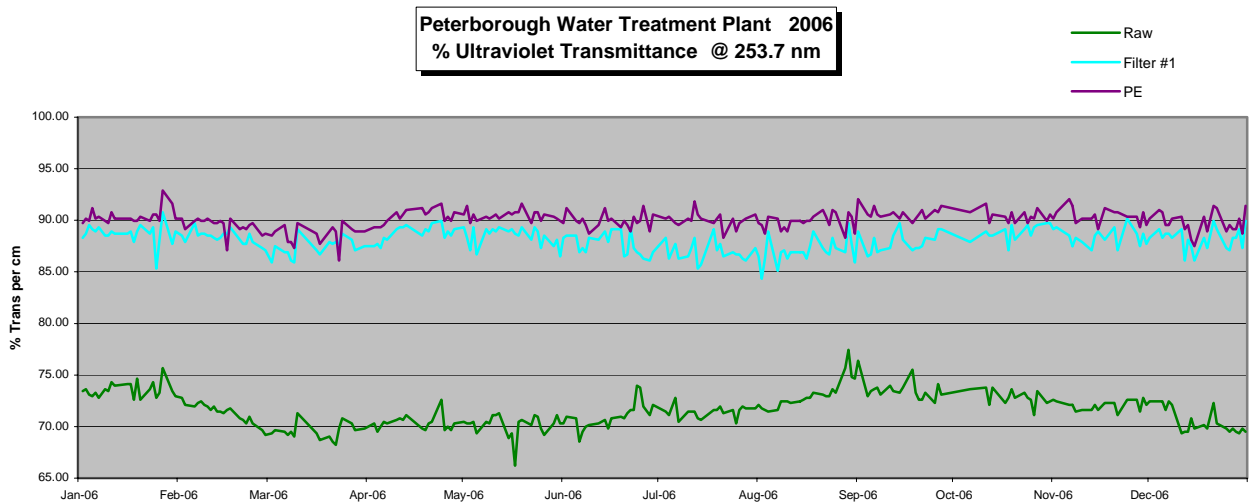
The 2006 average UV absorption for raw water was 0.145 UV Abs/cm, the average UV absorption for Filter number 1 was 0.055 UV Abs/cm, and the average UV absorption for plant effluent was 0.046 UV Abs/cm.

The inability for UV to penetrate the water sample would indicate the presence of organic material. The higher amount of organic material present the lower level of UV radiation would be transmitted through the sample.

The raw water samples have the lowest UV transmittance level in 2006, with an average of 71.6%, filtered water average was 88%, and the plant effluent average was 90% (Figure 12). This would indicate that the WTP process of flocculation, coagulation, sedimentation, and filtration removes enough organic material to possibly utilize UV as an alternative disinfectant, provided that this technology is used after filtration.

A high UV transmittance in our filtered and finished waters shows great promise to this technology as an alternative disinfectant.

Figure 12



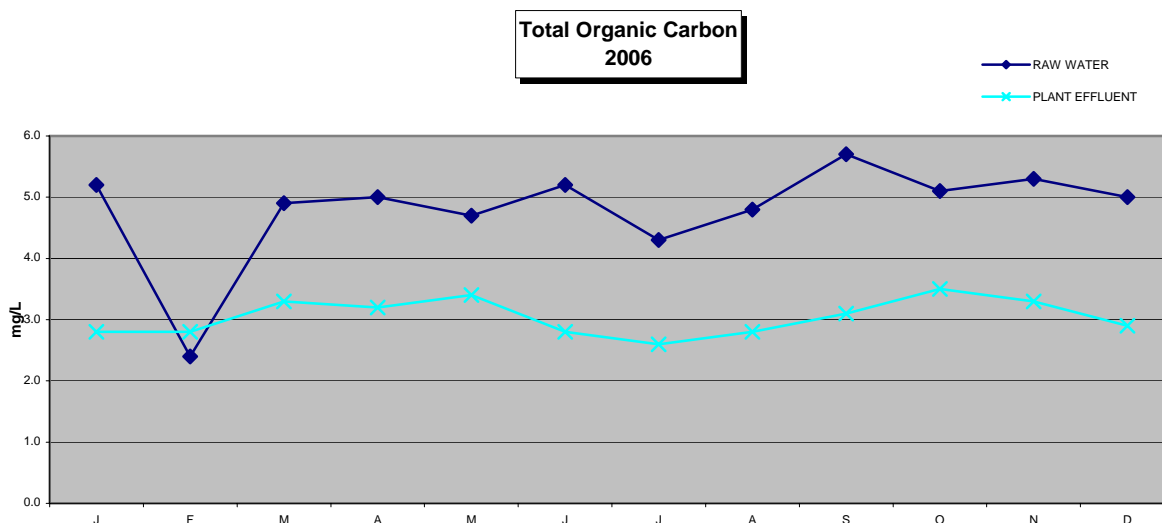
**TOTAL ORGANIC CARBON**

Another test that indicates the amount of organic matter in the raw and treated water is Total Organic Carbon (TOC). The overall health of the natural river environment can be determined by TOC since these compounds can consume more oxygen. Sources for TOC are organic contaminants (natural organic substances, insecticides, herbicides, and other agricultural chemicals) that enter waterways in a rainfall runoff. Domestic and industrial wastewaters also contribute organic contaminants in various amounts. Some of the contaminants may not be completely removed by treatment processes; therefore, they could become a problem for drinking water sources. Higher amounts of TOC in the treated

water can contribute to the formation of THM's in the distribution system.

The difference between TOC raw water and TOC treated water, [Figure 13](#) would indicate the amount of organic matter that has been removed through the water treatment process. The Water Treatment Plant removed 34.9 % of TOC from the raw water.

Figure 13



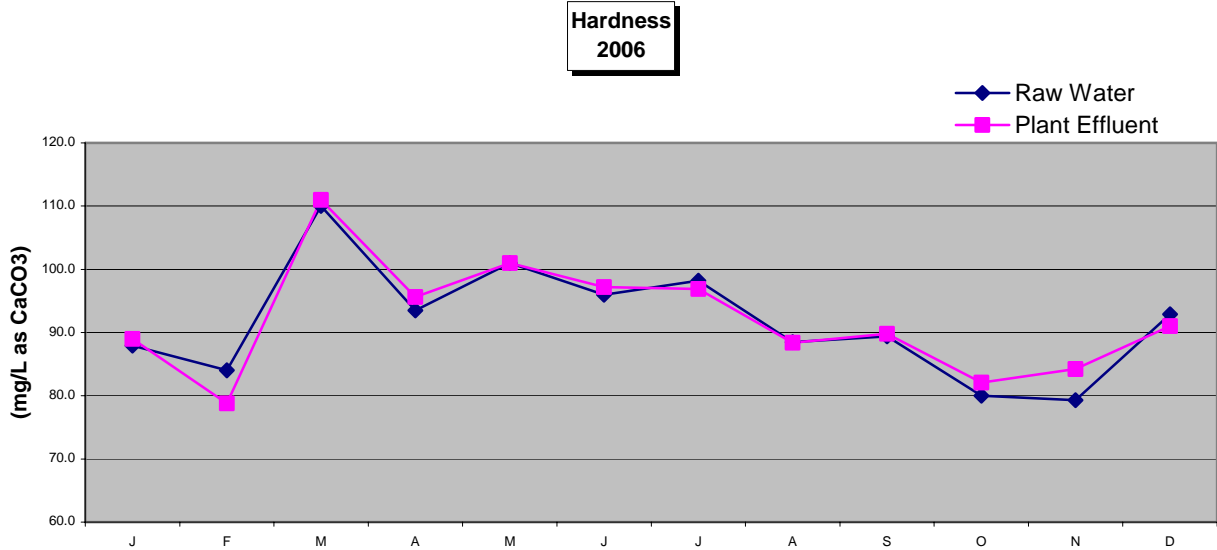
**HARDNESS**

Average hardness values for raw water in 2006, was found to be 91.7 mg/L as CaCO<sub>3</sub> and 92.1 mg/L in the treated water ([Figure 14](#)). Hardness at this level is considered to be moderately hard. The values for 2005 were: raw water 99.3 mg/L and plant effluent 97.5 mg/L. Hardness is caused by the presence of certain dissolved chemical compounds, with calcium and magnesium being the primary culprits. The amount of hardness varies significantly depending on the source. Source water in areas where there are higher amounts of limestone and dolomite will have higher amounts of hardness. Calcium is dissolved as water passes over limestone deposits. Magnesium is dissolved as water passes over dolomite and other magnesium bearing minerals.

According to the Ontario Ministry of Environment, the recommended operational guideline for hardness is 80 to 100 mg/L expressed as calcium carbonate. Levels between 80 and 100 mg/L as CaCO<sub>3</sub> are considered to provide an acceptable balance between corrosion and incrustation.

Groundwater usually has higher amounts of hardness due to the fact that groundwater will be in contact with these geologic formations for a longer period of time than surface waters.

Figure 14



## ALKALINITY

Alkalinity is a measure of the capacity of water to neutralize acids and is also known as the buffering capacity. It is due primarily to the presence of naturally available bicarbonate, carbonate, and hydroxide ions.

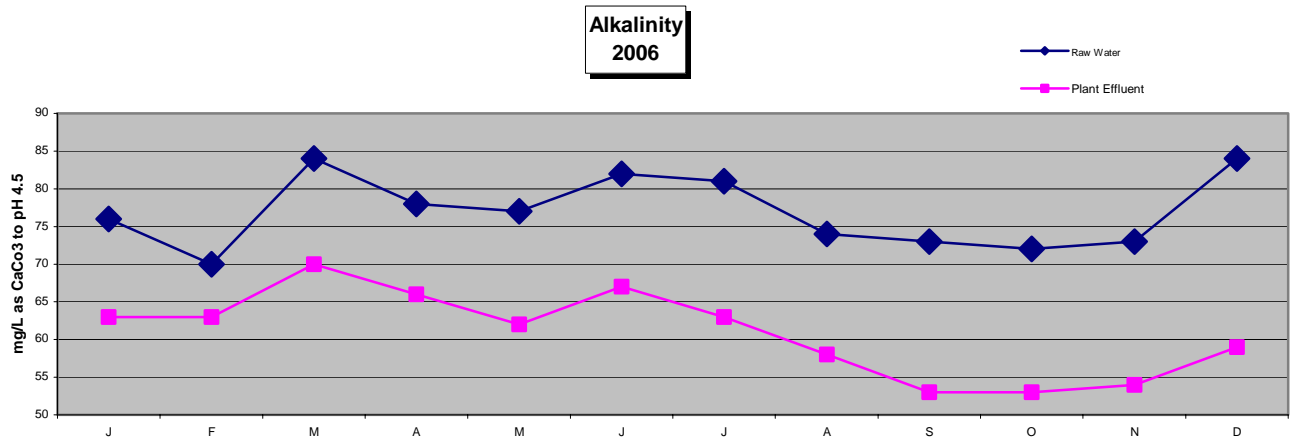
Average alkalinity values in 2006 for the raw water were 77.0 mg/L and 60.9 mg/L in the plant effluent ([Figure 15](#)). 2005 values for raw water were 85.3 mg/L and plant effluent 72.45 mg/L.

Because alkalinity varies greatly due to differences in geology, there are not general standards for alkalinity. Levels of 20-200 mg/L are typical for fresh water.

According to the Ontario Ministry of Environment, the recommended operational range for alkalinity in coagulant-treated drinking water is 30 to 500 mg/L as CaCO<sub>3</sub>. Alkalinity over 30 mg/L assists floc formation during the coagulation process (using alum).

A total alkalinity level of 100-200 mg/L will stabilize the pH level in a stream. Levels below 10 mg/L indicate that the system is poorly buffered, and is very susceptible to changes in pH from natural and human-caused sources.

Figure 15



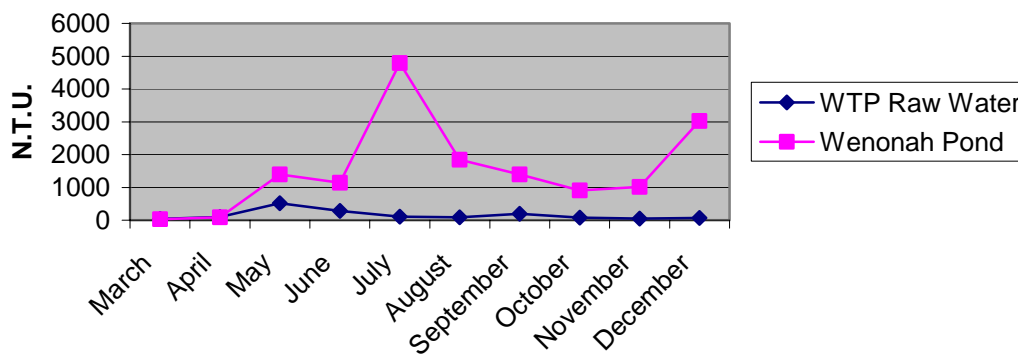
**WENONAH STORMWATER RETENTION POND**

The Wenonah Stormwater Retention Pond, found north of the Zoo property (upstream of the Water Treatment Plant) was tested during the summer months for bacteria and turbidity to determine if there was any contamination that may impact on the water treatment plant operation. This area was found to contain high bacterial counts and high turbidity values (Figure 16) especially after a rainfall. The retention pond may be a contributing factor for elevated coliform bacteria concentrations found in the raw water at the water treatment plant. The following chart displays the 2006 average test results between the Wenonah Pond and the Water Treatment Plant. This area will be further studied to determine if it has an impact on water treatment.

	Wenonah Pond	Water Treatment Plant
Turbidity	18.6 NTU	0.68 NTU
Coliform bacterial	1729 CFU/100ml	172 CFU/100ml
E. coli	224 CFU/100ml	19 CFU/100ml
Fecal streptococcus	741 CFU/100ml	31 CFU/100ml
Heterotrophic Plate Count	2311 CFU/100ml	202 CFU/100ml

Figure 16

### Coliform Bacteria Wenonah Pond vs WTP Raw Water



### HYDROFLUOSILICIC ACID

Hydrofluosilicic acid (for fluoride) was added to the treated water to attain an average concentration of 0.65 mg/L. The fluoride feed system was off for a total of 61 days during 2006 due to preventative maintenance of the fluoridation feed and test equipment.

The Ministry of the Environment recommends that the fluoride residual be between 0.5 mg/L and 0.8 mg/L with a Maximum Acceptable Concentration of 1.5 mg/L. Approximately 1,500 samples taken at the Water Treatment Plant, raw water, and the distribution system were tested for fluoride concentration during 2006.

### IRON

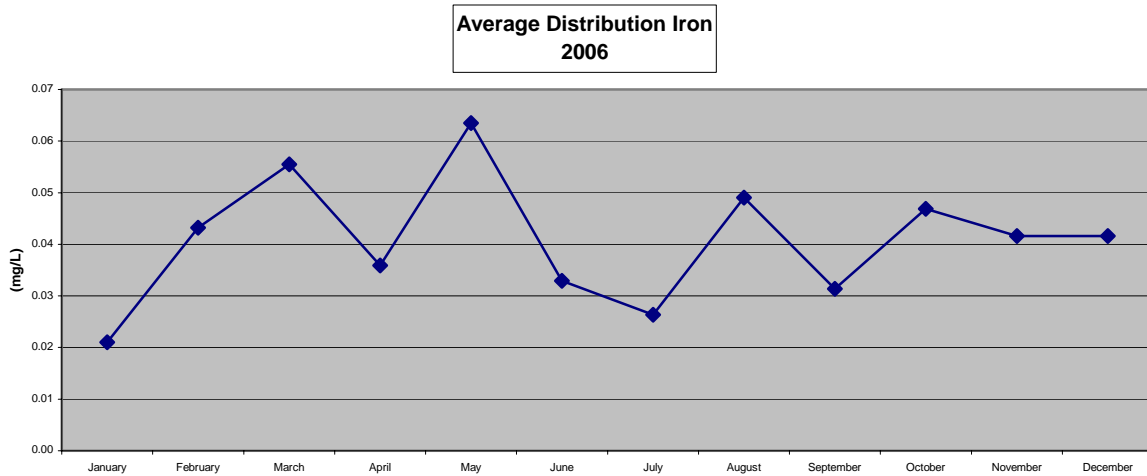
During 2006, approximately 31 distribution locations per month were sampled and tested for iron. The 2006 average distribution iron levels were 0.041 mg/L ([Figure 17](#)). The average iron residual in 2005 was found to be 0.040 mg/L. The MOE aesthetic objective (for appearance effects only) is 0.300 mg/L.

Excessive levels of iron in drinking water supplies may impart a brownish colour to laundered goods, plumbing fixtures and the water itself; it may produce a bitter, astringent taste in water and beverages; and the precipitation of iron can also promote the growth of bacteria in water mains and pipes.

Sodium silicate (BW46) is added to the plant effluent in order to coat the distribution pipes and reduce any rusting or corrosion and provide sequestration of iron. Another benefit of adding BW46 to the plant effluent water is to adjust the pH and alkalinity to decrease the corrosiveness of the water.

The iron residual leaving the Water Treatment Plant during 2006 was found to be 0.011 mg/L. In 2005 the iron residuals leaving the WTP were 0.010 mg/L.

Figure 17

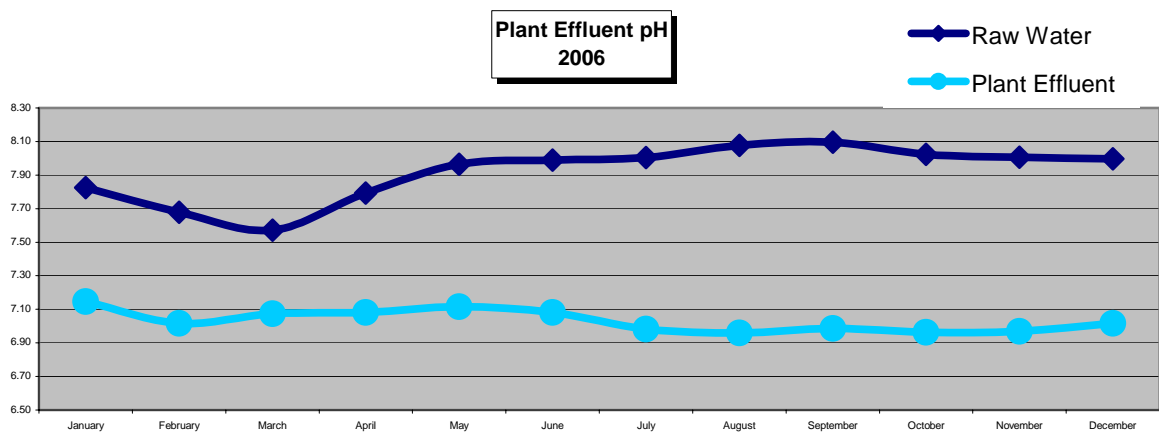


**pH**

In 2006, the average raw water pH was 7.92, [figure 20](#). With the addition of alum the pH is lowered to 7.05 (in the settled basins). With the addition of chlorine, pH is lowered further to 6.87 (in the chlorine contact tank). A pH of 6.87 is considered slightly corrosive. Therefore sodium silicate (BW46M) is added to the plant effluent in order to raise the pH to an annual average of 7.03 and to deposit a thin silicate coating to the distribution piping for corrosion protection. In 2005, the average raw water pH was 7.93, and the average plant effluent was 7.13.

The Ontario Ministry of Environment operational guideline recommended in drinking water is to maintain a pH between 6.5 and 8.5. The principal objective in controlling pH is to produce a water that is neither corrosive nor produces incrustations.

Figure 20



**BACTERIA**

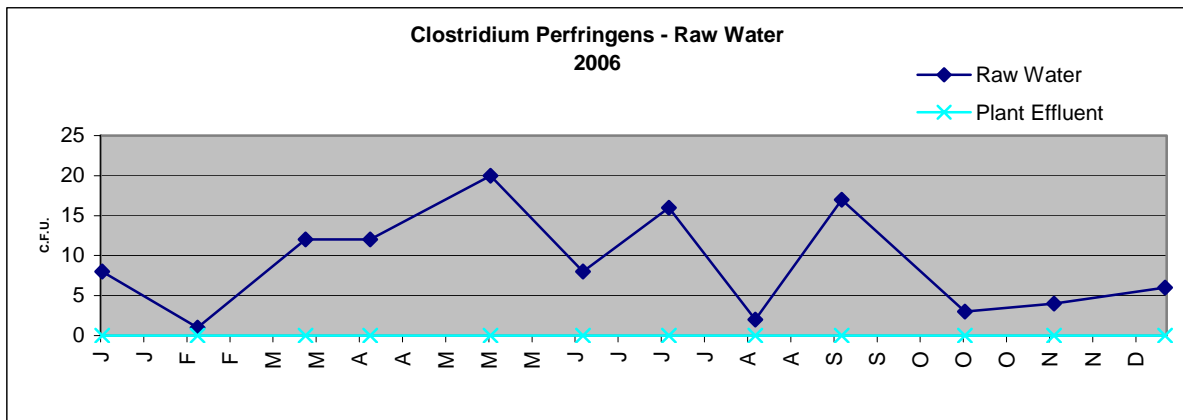
**Clostridium Perfringens**

The bacteria Clostridium perfringens is analyzed as an indicator to the possible presence of the parasitic protozoans Giardia and Cryptosporidium. Clostridium perfringens frequent the intestines of humans and many domestic and feral animals. Spores of the organism persist in soil, sediments, and areas subject to human or animal fecal pollution. Since this organism is spore forming, it can be used to mimic other organisms that can be found in an oocyst stage such as Giardia and Cryptosporidium. Giardia and Cryptosporidium are resistant to disinfection treatment and only through optimum coagulation, flocculation, sedimentation and filtration can these organisms be removed. If Clostridium perfringens can be effectively removed from the water treatment strain then there is a very low probability that Giardia and Cryptosporidium are present in the plant effluent. The relative sizes are as follows: Clostridium perfringens 1 – 2 µm, Cryptosporidium 4 – 5 µm, and Giardia 8 – 14 µm.

The theory is if you can remove Clostridium perfringens, then you most certainly will remove Cryptosporidium and Giardia. The MOE guidelines for Clostridium perfringens is to have all samples collected from the plant effluent to be zero CFU. All samples taken in 2006 from the plant effluent were zero CFU ([figure 21](#)).

The raw water, settled water and plant effluent were all monitored for Clostridium perfringens during 2006. The raw water contained on average 9.1 CFU/L of Clostridium perfringens while the plant effluent did not contain any in 2006.

Figure 21

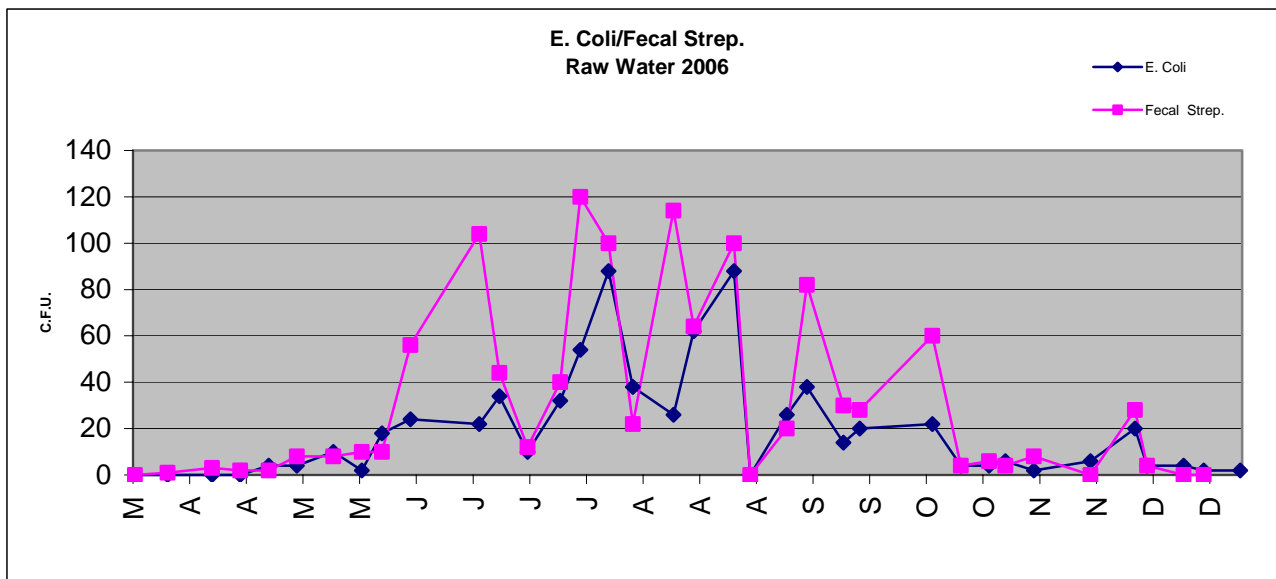


**Fecal Streptococci & E. Coli Ratios**

During 2006, a total of 36 fecal streptococci samples were analyzed from the Otonabee River (at the WTP intake) to assist in determining the source of fecal contamination within our source water ([Figure 22](#)). Fecal streptococci is another species of bacteria (similar to E. coli) that can be found from warm blooded animals.

A ratio between fecal streptococci and E. coli can assist in determining the species source of contamination. The ratio between 2006 average E. coli to fecal strep. Populations in the WTP raw water were found to be 0.61CFU. This would indicate that the majority of fecal contamination in the Otonabee River found at the WTP was from ducks or geese.

Figure 22



**TESTING**

The Peterborough Water Treatment Plant fully complied with the quarterly and annual testing and reports required under the Ministry of the Environment’s Drinking Water Systems Regulations 170/03 made under the Safe Drinking Water Act, 2002. [Table A](#) lists the annual parameters required under the Drinking Water Standards, Regulations 170/03.

In total there were 12 adverse water quality reports during 2006 (11 in the distribution system and 1 at the water treatment plant). In the distribution system there were 2 total coliform count (higher than 0), 1 background coliform counts (higher than 200 colonies per 100 mL), and 8 low free chlorine values (free chlorine lower than 0.05 mg/L). At the plant effluent there was 1 total coliform count (higher than 0). All of these sampling points were re-sampled, resulting in the resample test results were in compliance to the MOE standards.

**TOURS**

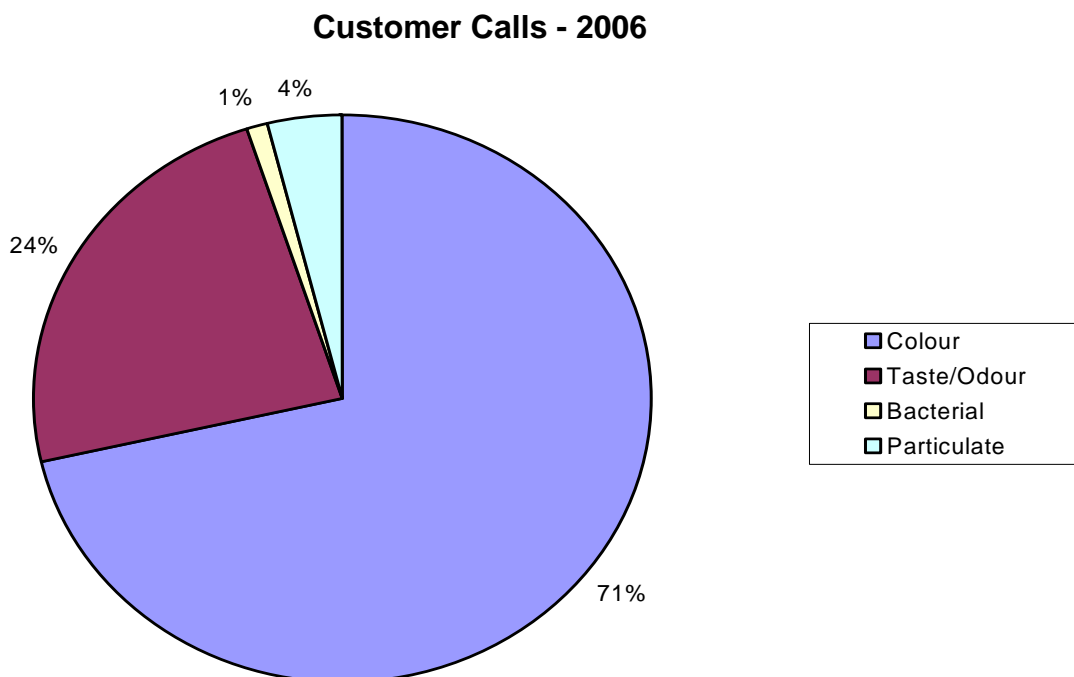
Tours have been an important part of public education at the Peterborough Water Treatment Plant. Over 150 people have had a tour of the water plant process during 2006. WTP staff have educated over 100 students at various schools on the topic of water conservation.

## **CUSTOMER CALLS**

A new customer concern computer program was initiated during 2006 to track all questions and concerns relating to water. Some questions and concerns that were asked from our WTP staff were; taste and odour questions, colour, hardness, general water quality, information on water treatment, sampling, operations, questions on ground water systems, and questions to assist with school projects on water treatment.

In 2006 the staff at the Water Treatment Plant responded to a total of 108 inquiries ([Figure 23](#)). There were also 11 requests for information, such as hardness results, water quality reports, and how the water treatment plant operates. 24% of customer calls were related to taste and odours (earthy/musty or chlorine). This may be due to the warmer summer where taste and odours are more noticeable and more prevalent. Another 71% of customer calls were relating to colour concerns (usually rusty coloured water). Some of these concerns were mainly due to water main construction or rehabilitation and routine water main maintenance.

Figure 23



During 2006, there were over 20,000 individual water quality tests performed on samples taken from the Peterborough Water Treatment Plant and the distribution system. Approximately 13,000 tests were performed at the Peterborough Water Treatment Plant laboratory. SGS Lakefield Research Analytical Laboratory performed approximately 6,000 microbiological and chemical tests. The Ministry of the Environment laboratories performed approximately 1,000 tests including inorganic and organic parameters taken as part of the Drinking Water Surveillance Program.

The Peterborough Water Treatment Plant effluent and distribution sample test results for inorganic and organic parameters in 2006 met present health-related Ministry of the Environment Drinking Water Standards; [Schedule 23](#) and [Schedule 24](#) as per the MOE Reg. 170/03.

Please note that the majority of results indicated '< MDL' meaning that the results were below the Method Detection Limit (i.e. test could not detect any concentration). All tested parameters were found to be below the Ontario Drinking Water Standards, MAC.

Lead is not part of Schedule 23 or schedule 24 but is required to be sampled and tested annually. This sample must be taken from a location in the city's distribution system that may have the oldest water mains. Sherbrooke Street was selected as this location since it was indicated that the water mains in this area are as old as 100 years.

Sodium is not part of schedule 23 or 24 but is required to be tested at least once every 5 years. It was sampled January 2006 and was found to be below the ODWS (Ontario Drinking Water Standards), aesthetic objective of 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L, so that this information may be passed on to local physicians.

Records of individual test results are kept on file at the Peterborough Water Treatment Plant laboratory. An updated copy of the Peterborough Water Treatment Plant annual report can be found on the Peterborough Utilities web site at [www.puc.org](http://www.puc.org).

In conclusion, the Peterborough Water Treatment Plant continued to produce an excellent quality of water for its consumers and once again exceeded the quality required in the Drinking Water Standards. This is largely due to the optimization of the facilities and the continuing expertise and dedication of the staff to produce and maintain an excellent quality product.

## **Table A - SUMMARY OF ANNUAL ANALYTICAL TEST REQUIRED UNDER REGULATIONS 170/03**

### **Schedule 23 – Inorganic Parameters**

Antimony	Chromium
Arsenic	Mercury
Barium	Selenium
Boron	Uranium
Cadmium	

Note: Copper, Iron, and Manganese are not required with the new regulations (after June, 2003). Lead must be sampled in the distribution system (reg. 170/03).

### **Schedule 24 – Organic Parameters**

Alachlor	DDT	Paraquat
Aldicarb	1,2 – dichloroethane	Parathion
Aldrin+Dieldrin	1,1 – Dichloroethylene	Pentachlorophenol
Atrazine	Dichloromethane	Phorate
Azinphos-methyl	2,4 – Dichlorophenol	Picloram
Bendiocarb	2,4 – Dichlorophenoxy acetic acid	PCB
Benzene	Diclofop-methyl	Prometryne
Benzopyrene	Dimethoate	Simazine
Bromoxynil	Dinoseb	Temephos
Carbaryl	Diquat	Terbufos
Carbofuran	Diuron	Tetrachloroethylene
Carbon Tetrachloride	Glyphosate	2,3,4,6-Tetrachlorophenol
Chlordane	Heptachlor+heptachlor epoxide	Triallate
Chlorpyrifos	Lindane (Total)	Trichloroethylene
Cyanazine	Malathion	2,4,6-Trichlorophenol
Diazinon	Methoxychlor	2,4,5 – Trichlorophenoxy acetic acid (2,4,5 –T)
Dicamba	Metolachlor	Trifluralin
1,2 - Dichlorobenzene	Metribuzin	Vinyl Chloride
1,4 - Dichlorobenzene	Monochlorobenzene	

Note: If any parameter from Schedules 23 and 24 were found to exceed half of the prescribed standard for the parameter, the frequency of sampling and testing for that parameter shall be increased so that at least one water sample is taken and tested every three months.

## **PLANT EFFLUENT 2006 - TREATED WATER ANALYSIS**

Annual Analysis beginning June 2003 as per Regulations 170/03 and PUC Certificate of Approval (7-0073-95-006)

Note: all units are µg/L unless otherwise stated

Note: <MDL = Less Than SGS Lakefield Laboratory Method Detection Limits

MAC = Maximum Acceptable Concentration (SDWA)

ODWS = Ontario Drinking Water Standard

### **Ontario Drinking Water Standards - Schedule 23 – Inorganic Parameters**

Parameter	Date:	ODWS	
	Jan 6, 2006	MAC	
Antimony	0.6	6	<MDL
Arsenic	2	25	<MDL
Barium	26	1000	
Boron	10	5000	
Cadmium	0.1	5	<MDL
Chromium	3	50	<MDL
Mercury	0.02	1	<MDL
Selenium	3	10	<MDL
Uranium	0.05	20	<MDL

\*Lead is not part of Schedule 23, but is required annually.

\*\*Sodium is not part of Schedule 23, but it is required every 5 years.

Sampled at Water Treatment Plant, treated water.

Sodium is measured in mg/L, with an objective of 20 mg/L.

Lead* (sampled at WTP)	0.1	10	<MDL
Lead* (sampled at Sherbrooke Firehall)	0.2	10	<MDL
Sodium**	7.22	20	

### **Ontario Drinking Water Standards - Schedule 24 – Organic Parameters**

Parameter	Jan. 6, 2006	MAC/IMAC	
Alachlor	0.11	5	<MDL
Aldicarb	0.30	9	<MDL
Aldrin + Dieldrin	0.067	0.7	<MDL
Aldrin	0.060		<MDL
Atrazine + N-dealkylated metabolites	0.12	5	<MDL
Atrazine	0.11		<MDL
De-ethylated atrazine	0.12		<MDL
Azinphos-methyl	0.21	20	<MDL
Bendiocarb	0.13	40	<MDL
Benzene	0.36	5	<MDL
Benzo(a)pyrene	0.004	0.01	<MDL

Bromoxynil	0.094	5	<MDL
Carbaryl	0.16	90	<MDL
Carbofuran	0.37	90	<MDL
Carbon Tetrachloride	0.34	5	<MDL
Chlordane (total)	0.11	7	<MDL
a-chlordane	0.069		<MDL
g-chlordane	0.063		
Chlorpyrifos	0.18	90	<MDL
Cyanazine	0.18	10	<MDL
Diazinon	0.081	20	<MDL
Dicamba	0.17	120	<MDL
1,2-Dichlorobenzene	0.56	200	<MDL
1,4-Dichlorobenzene	0.25	5	<MDL
Dichlorodiphenyltrichloroethane (DDT) & Metabolites	0.14	30	<MDL
op-DDT	0.095		<MDL
pp-DDD	0.098		<MDL
pp-DDE	0.075		<MDL
pp-DDT	0.14		<MDL
1,2-dichloroethane	0.32	5	<MDL
1,1-Dichloroethylene (vinylidene chloride)	0.52	14	<MDL
Dichloromethane	1.17	50	<MDL
2-4-Dichlorophenol	0.15	900	<MDL
2,4-Dichlorophenoxy acetic acid ( 2,4-D)	0.11	100	<MDL
Diclofop-methyl	0.13	9	<MDL
Dimethoate	0.12	20	<MDL
Dinoseb	0.084	10	<MDL
Diquat	1	70	<MDL
Diuron	0.087	150	<MDL
Glyphosate	6	280	<MDL
Heptachlor + Heptachlor Epoxide	0.11	3	<MDL
Heptachlor	0.061		<MDL
Heptachlor epoxide	0.11		<MDL
Lindane (total)	0.056	4	<MDL
Malathion	0.091	190	<MDL
Methoxychlor	0.14	900	
Metolachlor	0.092	50	<MDL
Metribuzin	0.12	80	<MDL
Monochlorobenzene	0.46	80	<MDL
Oxychlordane	0.11		<MDL
Paraquat	1	10	<MDL
Parathion	0.18	50	<MDL
Pentachlorophenol	0.15	60	<MDL
Phorate	0.11	2	<MDL
Picloram	0.20	190	<MDL
Polychlorinated Biphenyls (PCB)	0.04	3	<MDL
Prometryne	0.23	1	<MDL
Simazine	0.15	10	<MDL
Temephos	0.31	280	<MDL

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Terbufos	0.12	1	<MDL
Tetrachloroethylene (perchloroethylene)	0.48	30	<MDL
2,3,4,6 - Tetrachlorophenol	0.14	100	<MDL
Triallate	0.10	230	<MDL
Trichloroethylene	0.54	50	<MDL
2,4,6 - Trichlorophenol	0.25	5	<MDL
2,4,5 - Trichlorophenoxy acetic acid (2,4,5-T)	0.14	280	<MDL
Trifluralin	0.12	45	<MDL
Vinyl Chloride	0.08	2	<MDL

**Abbreviations**

2MIB	2-Methylisoborneol
HPC	Heterotrophic Plate Count
MAC	Maximum Acceptable Concentration
<MDL	Less than Method Detection Limit
MOE	Ministry of Environment
ng/L	nano gram (one billionth) per liter
NTU	Nephelometric Turbidity Units
ODWS	Ontario Drinking Water Standards
THM	Trihalomethanes
µg/L	Micro gram per liter
TOC	Total Organic Carbon
WTP	Water Treatment Plant