

## Facility Facts

Total Cost: \$18 Million

## Membrane Filtration



Capacity ..... 30 ML/d (Stage 1)

### Membrane Cassettes

Number .....16  
Submerged in 4 concrete tanks

### System Type

Vacuum, Outside in

### System Control

Fully automatic

### Membrane Cleaning System

Clean-in-Place (CIP) using either sodium hypochlorite (bleach) or citric acid.

## Slow Sand Filtration



Capacity ..... 90 ML/d

### Filtration Cells

Number ..... 4  
Total Sand Area ..... 10,000 m<sup>2</sup>  
Sand and Gravel Depth ... 1.5 m

### Clearwell

Number .....1  
Capacity .....2,300,000 litres  
..... 22 m diameter  
..... 5 m high

### Disinfection

Gas Chlorination .....Contact in clearwell and transmission main

### Standby Generator

Number .....1  
Capacity ..... 200 kW  
Fuel ..... Diesel



## Operation:

The plant is operated by trained EOCP certified City staff who devote their skills and efforts to ensure a safe and dependable water supply.



Clean-in-Place Pumps Construction



Lamella Clarifier



Plant Piping



Control Valves

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\*As of 15 Nov 2010 Dayton & Knight Ltd. became Opus DaytonKnight Consultants Ltd.

# Norrish Creek Water Treatment Plant



# Norrish Creek Integrated Water Treatment Plant

## The Abbotsford/Mission Water Supply System

The service area is an area about 60 km east of Vancouver. Here, around 70,000 people in Abbotsford and 30,000 in Mission are supplied with water drawn from Norrish Creek.

Although the water quality is generally excellent, during periods of high runoff raw water turbidity and colour are often unacceptable. Until a few years ago, such excursions would force the former Central Fraser Valley Water Commission to discontinue the use of this source. However, that is no longer the case.

By 2035, the population served by the Abbotsford/Mission Water Commission is expected to reach 275,000.

The plan developed by the Commission to meet the drinking water needs of the population is staged and includes the following:

- Construction of the sand filtration plant with a capacity of 90 ML/d (million litres per day), completed in 2002.
- Construction of a membrane treatment plant. The membrane plant has been designed to be expanded in three stages, and will have an ultimate capacity of 108 ML/d. Stage 1, with a capacity of 30 ML/d, was completed in August 2004.
- PH correction to reduce corrosivity of the water.

## The Slow Sand Filtration Process

The plant's slow sand filtration process consists of four concrete lined basins each containing a 0.95 m deep sand bed laid over a gravel bed and underdrain system. The total surface area of the sand is 9,400 m<sup>2</sup>. Automatically operated weir gates on the filter outlet maintain a 4 m water depth above the sand surface.

The unique feature of slow sand filters is the schmutzdecke, a biofilm formed at the sand-water interface. Biological action takes place on the sand surface and at deeper levels within the bed. Research carried out during the last thirty years has provided a good understanding of the process.

Most of the solid particles are removed in the top 0.5 -2 cm of the sand although biological activity, carried about by algae, bacteria, protozoa and small invertebrates takes place within the top 0.4 m of the sand bed. The microbial population continuously grows and dies off. The water carries the waste organic material to organisms at lower levels and they carry out the next stage of treatment.

As the filter cycle progresses, the headloss across the bed increases. When it eventually becomes excessive, the raw water inlet is shut down and the water is drained down below the top of the sand bed. A thin layer of sand is then mechanically scraped off the surface using a tracked scraper specifically designed for this task.

The Norrish Creek Water Treatment Plant combines slow sand filtration with membrane micro-filtration, two quite different treatment technologies.

Slow sand filtration technology, first used in Europe in the early 1800's, treats water by allowing it to slowly filter through a sand bed.

In contrast to slow sand filtration, membrane filtration is truly a product of the latter half of the 20th century. A semi-permeable membrane is a thin layer of material capable of separating materials when a driving force is applied across the membrane. Synthetic membranes were developed in 1960 and since then interest in membrane processes for water treatment has grown steadily.

## The Slow Sand and Membrane Filtration Processes Operate in Parallel

The slow sand and membrane filtration processes operate in parallel. Raw water is piped to the Control Valve Building. Here, the pipeline divides into two lines. The flow to each process is measured by a flowmeter and controlled automatically.

The treated water from each process is combined, chlorinated and stored in a clearwell before flowing back to the gravity supply main.

The integrated plant is fully automated and is normally manned by a single operator. A SCADA (Supervisory Control And Data Acquisition) system allows the plant to be remotely monitored and controlled.



## The Membrane Filtration Process

The plant's membrane filtration process consists of four concrete tanks in which cassettes of membranes are suspended. Raw water is drawn through the hollow membranes using centrifugal pumps. The treated water is collected in a header pipe from where it gravitates to the clearwell.

Membranes are essentially filters that permit the passage of water, but hold back anything larger than 0.1 micron. (A human hair has a thickness of between 40 and 120 microns). Zenon Environmental Inc., a Canadian company, supplied the membrane system.

Measures taken to prevent membrane fouling include cyclic agitation using compressed air and backflushing with treated water about four times each hour.

Reject water continuously flows at a controlled rate from each membrane tank and is collected in the reject sump. From here it is pumped to a lamella clarifier, a tank designed to separate suspended solids from the water. Clarified water gravitates to the slow sand filters. Settled solids flow to an infiltration lagoon. Here the water seeps into the ground leaving the solids behind. Very little solids accumulation is expected.

Over time, the transmembrane pressure required to produce the design flow across the membranes will exceed a pre-selected value. At this point, the membranes are cleaned using a Clean-in-Place, or CIP, system. The membranes are backflushed using either citric acid or sodium chlorite and left to soak in the chemical solution. The solution is then circulated and neutralized before being slowly metered back to the head of the plant.

The operation of the membrane filtration plant is fully automated. The operator has access to the process using a keyboard and a monitor screen referred to as the human machine interface, or HMI.

The treatment plant is economical to operate. The high elevation means that overall pumping costs are minimized.

## Process Schematic

