

Regulatory Framework for Water Reuse

1.1 BC MUNICIPAL SEWAGE REGULATION

The use of reclaimed water in British Columbia is governed by the Municipal Sewage Regulation issued under the Waste Management Act. This document regulates the treatment standards and the allowable uses for reclaimed water. In addition, the Province has developed a *Code of Practice for the Use of Reclaimed Water*. These two documents are titled:

Municipal Sewage Regulation under the Waste Management Act; BC Regulation 129/99.

Code of Practice for the Use of Reclaimed Water – A Companion Document to the Municipal Sewage Regulation; Issued May 2001; BC Ministry of the Environment

Schedule 2 of the Municipal Sewage Regulation prescribes treatment standards and requirements for two types of uses for reclaimed water:

Category 1 - Unrestricted public access. In this category, water is of high enough standard that it can be used in areas with public access.

Category 2 - Restricted public access. Category 2 reclaimed water is at a level more stringent than discharge to water and marine environment, though the resulting water quality still requires that the public be restricted from contact with it.

In an urban environment, the higher Category 1 treatment standard that is applicable for unrestricted public access should be provided. The permitted uses for areas with unrestricted public access include:

Parks	Playgrounds
Cemeteries	Golf courses
Road rights-of-way	School grounds
Residential lawns	Greenbelts
Vehicle and driveway washing	Landscaping around buildings
Toilet flushing	Outside landscape fountains
Outside fire protection	Street cleaning

The treatment and effluent quality requirements for Category 1 effluent for unrestricted public access, as indicated in the Municipal Sewage Regulation, are as follows:

- Secondary treatment followed by chemical addition and filtration:
 - BOD \leq 10 mg/L
 - Turbidity \leq 2 NTU

- TSS \leq 5 mg/L
- pH = 6 - 9
- Disinfection
 - Fecal coliform \leq 2.2/100 mL
 - Minimum total residual chlorine of 0.5 mg/L at point of use
- Storage requirements
 - 20 days minimum storage
 - can be reduced to 2 days if treatment plant has multiple units

The monitoring requirements are as follows:

- | | |
|--------------|------------|
| • BOD and pH | Weekly |
| • Coliform | Daily |
| • Turbidity | Continuous |

Other requirements of the Municipal Sewage Regulation include:

- An environmental impact study (EIS) must be carried out by a qualified professional. At a minimum, the EIS must consider the other uses of the groundwater, determine maximum application rates to ensure there is no surface runoff generated by irrigation and establish a monitoring program with locations, sampling frequencies and parameters, and
- Approval is required from the Ministry of the Environment and the Vancouver Health Authority.

1.2 CALIFORNIA REGULATIONS RELATED TO RECYCLED WATER

The California Department of Public Health issued regulations related to recycled water in January 2009. These regulations define the following types of reclaimed water:

- *Disinfected secondary-2.2 recycled water* – recycled water that has been oxidized and disinfected such that the concentration of total coliform does not exceed 2.2/100 ml;
- *Disinfected secondary-23 recycled water*– recycled water that has been oxidized and disinfected such that the concentration of total coliform does not exceed 23/100 ml;
- *Disinfected tertiary recycled water* – a chlorine disinfection process that provides a CT value of not less than 450 milligram-minutes with a minimum contact time of 90 minutes based on peak dry weather flow. As an alternative to coagulation and filtration, filtered wastewater can be water that has passed through microfiltration, ultrafiltration, nanofiltration or reverse osmosis membrane such that the turbidity does not exceed 0.2 NTU more than 5% of the time and never exceeds 0.5 NTU. The median concentration of total coliform bacteria measured in the disinfected effluent shall not exceed 2.2/100 ml.

Disinfected tertiary recycled water can be used for irrigation of the following areas:

- Food crop;
- Parks and playgrounds;
- School yards;
- Residential landscaping; and
- Unrestricted public access golf courses.

Any use of recycled water shall comply with the following:

- No irrigation within 50 metres of a domestic water supply;
- Irrigation runoff shall be confined to the recycled water use areas;
- Spray, mist, or runoff shall not enter dwellings, designated outdoor eating areas, or food handling facilities;
- Drinking water fountains shall be protected against contact with recycled water spray,
- All use areas where recycled water is used shall be posted with signs.

1.3 PROPOSED SEWAGE TREATMENT PLANT

It is proposed to construct a membrane bioreactor (MBR) plant to service the East Saanich North Oak Bay area. This type of treatment plant uses ultrafiltration which is a pressure driven membrane with pore sizes of 0.02 micron. This provides a barrier to suspended solids, bacteria and many viruses to produce effluent water with very high purity and low silt content. These types of plant typically will achieve the following effluent water quality before disinfection:

Table 3.1 – Effluent Quality of MBR Plant

BOD	≤ 2 mg/L
TSS	≤ 2 mg/L
Turbidity	≤ 0.2 NTU
Fecal Coliform	≤ 10 CFU/ 100 mL

The proposed MBR plant meet the stringent requirements to produce disinfected tertiary recycled water as per the California regulations, which require a concentration of total suspended solids less than 2 mg/L and a turbidity less than 0.2 NTU.

It also meets the BC MSR requirements for reclaimed water unrestricted public access which require a BOD of less than 10 mg/L a turbidity of less than 2 NTU.

In order to meet the fecal coliform requirements of 2.2/100 mL for both regulations, disinfection using chlorine is required.

The main difference between MBR plants and conventional processes is that the low level of turbidity is obtained without the use of chemical coagulation.

With conventional sewage treatment processes such as activated sludge, biological treatment must be followed by coagulation and filtration in order to achieve turbidity lower and 2 NTU as required for high quality reclaimed water suitable for unrestricted public access in the BC MSR. This is typically done with sand filtration preceded by chemical addition for coagulation. Because of the small pore size, the ultrafiltration membrane process (MBR) on its own will achieve equivalent or better water quality and will produce a water with turbidity of less than 0.2 NTU. Furthermore, the membrane filtration process does not require chemical addition. An ultra filtration plant, in conjunction with chlorine disinfection followed by adequate contact time of 90 minutes or more, would meet the requirement of the California regulations for *disinfected tertiary recycled water*.

Section 10 (9) of the MSR states: "Methods of treatment for reclaimed water other than those included in this regulation and their reliability features, may be accepted by the Director if the discharger demonstrates to the satisfaction of the Director that the method of treatment and their reliability features will assure an equal degree of treatment, public health protection and treatment reliability."

In order to eliminate the chemical addition component of the treatment train, a submission to the Minister must present evidence that the membrane bioreactor without chemical addition will meet this test. Evidence to this effect could be obtained from the Dockside Green development in Victoria. This mixed residential and commercial development has a membrane bioreactor (MBR) treatment plant and is using reclaimed water for various uses such as toilet flushing, and decorative ponds and streams. The CRD also has a membrane bioreactor plant at the Ganges sewage treatment facility and effluent water quality data could be obtained from this plant as well.

1.4 STORAGE

BC Municipal Sewage Regulation

The Municipal Sewage Regulation indicates that a minimum of 20 days of emergency storage must be provided at the sewage treatment facility to allow the effluent flow to be diverted to storage in case the water does not meet the standards required - see Clause 10 (1) (c). However, if the treatment plant is built with multiple units capable of meeting the reclaimed water standard with one unit out of operation, emergency storage may be reduced to a minimum of 2 days.

The Code of Practice indicates that storage of reclaimed water is required for:

- Irrigation purpose – for times when the method of application is not continuous; storage is required for the non-growing season;
- Normal balancing (seasonal) storage;
- Emergency storage – for times when reclaimed water usage is unexpectedly interrupted, or the reclaimed water does not meet the quality standards;
- Storage for treatment (in lieu of providing filtration)

The Code of Practice further indicates that if emergency disposal is not available, emergency storage must be available to retain 75% of the normal reclaimed water production for a period of at least 20 days.

California Public Health Regulation

The California regulation for disinfected tertiary recycled water requires storage to provide sufficient contact time after the addition of chlorine. The minimum size of the tank is to provide 90 minutes of contact time.

Analysis

At the Saanich East / North Oak Bay sewage treatment plant, an ocean outfall will be provided for the discharge of the water that is not reclaimed for other uses. The ocean outfall will be sized for the entire peak flow into the plant. Based on the analysis of potential use of reclaimed water in the area, as discussed later in this report, the maximum potential irrigation demand is approximately 50% of the current plant flow and 30% of the plant design flow for the year 2030. There will always be a significant portion of the plant effluent that will be discharged to the ocean. During the winter months when there is no irrigation demand, it is anticipated that most if not all of the plant effluent will be discharged to the outfall. Since the plant will have a properly sized ocean outfall, it is proposed not to provide storage at the plant except for process requirements and equalization.

It is our understanding that the storage requirements of the MSR are under currently review and that the storage requirements may be amended. However, at this time a minimum of 2 days emergency storage is required. Until the MSR are amended, it may be possible to remove the storage requirements by making a submission to the Minister that the plant would be designed with multiple units capable of meeting the reclaimed water standard with one unit not in operation and that controls will be in place to provide immediate discharge to the outfall if the reclaimed water standard is not met.

At the design average day flow of 16.6 ML/day, the storage requirements indicated in the MSR would be as follows:

	2-day Storage	20-day Storage
Volume	33.2 ML	332 ML
Storage Dimensions	80 m x 60 m concrete tanks based on 6 m depth	300 m x 300 m earth lagoon 5 metre deep

The cost of providing a 33.2 ML concrete storage tank is estimated at \$15 million plus rock excavation. The area required for the storage tank would measure 80 m by 70 m which would add significantly to the site of the proposed sewage treatment. The need to provide storage for two days or more is a major expenditure and would likely result in effluent irrigation not being feasible.

As an alternative of providing two days of storage at the plant, it is proposed to use the approach indicated in the California regulation by including chlorination followed by an adequately sized contact tank and to provide multiple barrier by providing UV disinfection prior to chlorination as follows:

- Ultraviolet disinfection sized on the peak demand for reclaimed water;
- Chlorination using sodium hypochlorite is then applied in order to prevent re-growth and to ensure the minimum chlorine residual of 0.5 mg/L is maintained at the point of use;
- Chlorine contact tank sized based on peak irrigation demand rate and a minimum contact time of 90 minutes, and
- On-going monitoring of turbidity.
- Automated valves to divert effluent to the outfall when the turbidity in the effluent exceeds 0.2 NTU.

1.5 HEALTH AND SAFETY CRITERIA FOR THE USE OF RECLAIMED WATER

The Municipal Sewage Regulation (Appendix 3 to Schedule 7) and the Code of Practice specifies the following construction and operating requirements:

Construction Requirements:

- All piping, valves, meters and irrigation equipment must be marked to differentiate reclaimed water from domestic water (purple pipe);
- Hose and hose bibs on reclaimed water irrigation system are not permitted;

- There must be 3 metre horizontal and 0.3 m vertical separation between reclaimed water pipes and other water pipes;
- No irrigation with reclaimed water within 30 m of any water well;
- Any water impoundment with reclaimed water must have warning signs, and
- At all areas irrigated with reclaimed water, warning signs must be posted in sufficient numbers to advise the public that reclaimed water is being used and is not safe for drinking.

Operating Criteria:

- In parks, playgrounds and school grounds, there shall be no contact between the reclaimed water and any person while irrigation is occurring;
- Golf score cards and signage must be posted to indicate that reclaimed water is used;
- Irrigation with reclaimed water must not occur within 60 m of areas where food is handled or consumed;
- Precaution must be taken that reclaimed water will not drift outside of property or on passing vehicles, buildings, water facilities and food handling facilities;
- Irrigation must be controlled to prevent ponding and run-off from reclaimed water;
- Irrigation systems using reclaimed water in a residential area can operate only between 10:00 PM and 6:00 AM, and
- Use only pop-up heads or drip irrigation systems.

Preliminary discussions were held with the Health Authority regarding irrigation with reclaimed water in urban areas. Their main concern is to ensure there is no risk to public health. Measures to protect public health include signage to advise the public where spray irrigation with reclaimed water will be practiced, wind drifting of reclaimed water on adjacent properties, continuous monitoring of reclaimed water quality, and labeling of all pipes and irrigation equipment.

Golf courses are closed to the public during the evening and at night, and they usually irrigate between 10 pm and 6 am. The health and safety criteria can be met for irrigation using reclaimed water. A more detailed discussion on how these criteria will affect the use of reclaimed water on the campus of the University of Victoria is included in Section 4.