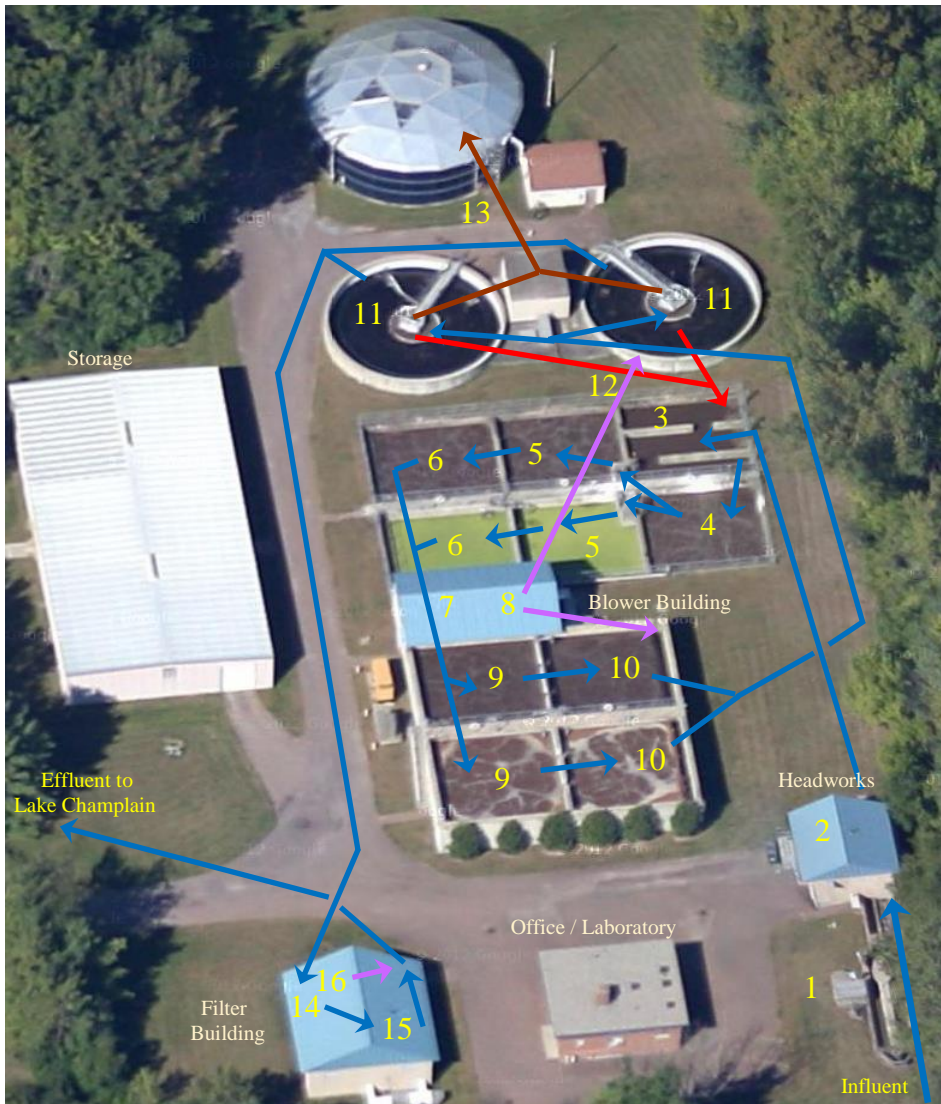


# SOUTH BURLINGTON BARTLETT BAY WATER QUALITY FACILITY



**1. Grit Chamber:** Flow enters facility through 18" gravity line. Sand and Rocks are settled out by a reduction in the Influent velocity, dewatered, pumped into a bin and sent to the landfill

**2. Lakeside Screen/Wash Press:** Paper/plastic/rags are screened, washed, compressed and sent to the landfill

**3. Anaerobic Tanks:** Influent then flows to anaerobic tanks to assist in Biological Nutrient Removal

**4. Aeration Tanks:** BOD/TSS are further reduced by bacteria/single cell organisms in the mixed liquor (aerated at >2.0 mg/L O<sub>2</sub>)

**5. Aeration Tanks:** Flow is split into two trains and is aerated in second stage tanks

**6. Aeration Tanks:** Aerated in third stage tanks

**7. Intermediate Pumps:** Lift flow to fourth stage tanks to continue through rest of facility by gravity

**8. Chemical Addition:** Polyaluminum Chloride is added to precipitate out Phosphorus

**9. Aeration Tanks:** Aerated in fourth stage tanks

**10. Aeration Tanks:** Aerated in fifth stage tanks

**11. Secondary Clarifiers:** Secondary Solids are settled out in the Clarifiers

**12. Return Activated Sludge (RAS):** Secondary Solids flow by gravity from the bottom by the Secondary Clarifiers and are returned to the Anaerobic Tank

**13. Waste Activated Sludge (WAS):** WAS is pumped to the 280,000 gallon holding tank

**14. Filters:** Secondary Effluent passes through 10 micron filters

**15. Ultraviolet Disinfection (UV)** The Secondary Effluent passes through 254 nanometer wavelength UV causing DNA thymine dimers, disrupting reproduction

**16. Chemical Addition:** Sodium Hydroxide is added for pH adjustment

## HISTORY

**1970** Primary facility constructed.

**1987** Sludge holding tank added.

**1999** Upgraded to Kruger A/O (Anaerobic/Oxic) Extended Air System with UV disinfection and 10 micron filtration. A/O utilizes an anaerobic selector for release of soluble phosphorus and uptake of BOD by phosphorus accumulating organisms (PAOs). Upon entering the oxic stage, the PAOs uptake soluble phosphorus, the remaining BOD is consumed, and nitrifying bacteria oxidize the ammonia to nitrate. Most of the settled sludge from the final clarifier is returned to the anaerobic selector and a fraction of the phosphorus rich sludge is removed with the wasted sludge. Dissolved oxygen (D.O.) control in the oxic stage maximizes denitrification, which in addition to saving energy, reduces the amount of nitrate returned to the anaerobic selector. Bartlett Bay replacement cost is estimated at \$35-\$40 million.

	DESIGN	EFFLUENT 2015	
Average Daily Flow	1,250,000 gallons	610,000 gallons	
Peak Hourly Flow	3,750,000 gallons	<b>Limit 2015</b>	
Organic Loading	BOD: 310 mg/L	BOD:	30 mg/L 1 mg/L
	TSS: 180 mg/L	TSS:	30 mg/L 1 mg/L
	NH3-N: 20 mg/L		
	TP: 10 mg/L	TP:	0.8 mg/L 0.4 mg/L
		E. coli:	77/100 ml 3/100 ml

# GLOSSARY OF TERMS

**BOD (Biochemical Oxygen Demand):** Test for the “strength” of wastewater where 300 mL of sample water is stored in a dark chamber, sealed, at 20° C for 5 days and the amount of oxygen used by the organisms is then analyzed.

**TSS (Total Suspended Solids):** Test for the amount of suspended solids in a sample of water. A set quantity of sample water is filtered through a glass fiber filter paper. The paper is weighed before the sample is filtered through it and after drying at 104° C, for one hour, giving weight of solids left on filter.

**pH:** Test for the amount of hydrogen atoms in a water sample (1-6 acid, 7 neutral, 8-14 alkaline) by a probe connected to the meter with a temperature compensation probe also inserted into the sample.

**E. Coli:** Test for the amount of e. coli in a water sample where a set quantity of sample water added to sealed media tray and kept at 35° C for 24 hours. E. coli colonies are then counted under a florescent light.

**Settleable Solids:** Test where 1000 mL of Influent and 1000 mL of Effluent are settled in separate Imhoff cones for 60 minutes (stirred at 45 minutes).

**Volatile Solids:** Test where organic solids are burned off at 550° C for 1 hour leaving inorganic solids. Original weight – residue weight = volatile solids.

**Influent:** Untreated water that enters the facility.

**Effluent:** Treated water that leaves the facility.

**MGD:** Millions of Gallons per Day.

**Weight of water:** 8.34 pounds per gallon.

**Gallons of water per cubic foot:** 7.48 gallons.

**Anaerobic:** without oxygen

**Anoxic:** less than 0.5 mg/L O<sub>2</sub>

**Aerobic:** over 2.0 mg/L O<sub>2</sub>

**Mixed liquor:** Industry term for bacteria under aeration

**Cake:** Industry term for processed Biosolids

**Nitrification:** Process in aeration tanks where ammonia is converted by Nitrosomonas bacteria to nitrite and nitrite is then converted by Nitrobacter bacteria to nitrate under temperatures above 10° C and O<sub>2</sub> levels >2 mg/L. Ammonia to Nitrite:  $\text{NH}_4^+ + 1.5 \text{O}_2 \rightarrow \text{NO}_2^- + 2 \text{H}^+ + \text{H}_2\text{O}$  Nitrite to Nitrate:  $\text{NO}_2^- + 0.5 \text{O}_2 \rightarrow \text{NO}_3^-$

**Denitrification:** Process where nitrate converted to nitrogen gas by heterotrophic bacteria in anoxic conditions. Nitrate to Nitrogen gas:  $2 \text{NO}_3^- + 10 \text{e}^- + 12 \text{H}^+ \rightarrow \text{N}_2 + 6 \text{H}_2\text{O}$

**BNR (Biological Nutrient Removal):** Process that facilitates the removal of nitrogen and phosphorus. The first tank in series is anaerobic where influent is mixed with recycled mixed liquor that has been through an anoxic zone to remove nitrates. The lack of oxygen and nitrates forces the bacteria to utilize stored energy in their cells in the form of phosphorus when taking in the influent BOD (food) to reproduce and grow.

**F/M (Food to Mass):** = (Influent BOD into tank \* Influent flow into tank \* 8.34) / (Size of tank \* 8.34 \* Tank Suspended Solids \* Total Volatile Solids). Optimum ratio for South Burlington is approximately 0.30.

**MCRT (Mean Cell Residence Time):** = Pounds of solids in the aeration tanks + Pounds of solids in secondary clarifiers / Pounds of solids wasted to the digesters (in days). Optimum for South Burlington varies by season but approximately 10 days is average.

**Detention Time:** Gallons into facility for plant detention time or into digesters for digester detention time / capacity of facility or digesters in gallons = detention time in days.

