COBOURG	**THE CORPORATION OF THE TOWN OF COBOURG**
	STAFF REPORT
TO:	Mayor and Council
FROM: TITLE:	Laurie Wills, Director of Public Works Bill Peeples, Manager of Environmental Services
DATE OF MEETING:	December 15, 2020
TITLE / SUBJECT:	Sequence Batch Reactor Expansion
REPORT DATE:	December 11, 2020

1.0 STRATEGIC PLAN

Invest in programs, services and infrastructure to make Cobourg more accessible.

2.0 PUBLIC ENGAGEMENT

N/A

3.0 RECOMMENDATION

THAT Council approve a total project budget of $6,300,000 and proceed with Option 1 for a new receiving station and sequence batch reactor at Water Pollution Control Plant #2.

4.0 ORIGIN

2018 Environmental Services Capital Budget $100,000 (Design of SBR)
2019 Environmental Services Capital Budget $100,000 (Design of SBR)
2020 Environmental Services Capital Budget $3,000,000 (Construction of SBR)

5.0 BACKGROUND

The Sequence Batch Reactor (SBR) at Water Pollution Control Plant #2 is an advanced pre-treatment system, specifically designed to biodegrade high strength liquid waste so it can be safely decanted into the headworks of Plant #2 at concentrations compliant with the Town's Sewer Use By-Law (22-2008). Its intended purpose was to pre-treat leachate from the Town-owned landfill site on Eagleson Road (i.e. Taken over by Northumberland County in Q1/14) and was never designed to accept septic waste. Nonetheless, the SBR has become an essential service for haulers of both septic waste and leachate.

The liquid waste processing business is a highly specialized, microbiological process that must be administered by licensed Operators. The necessary tanks and equipment represent a substantial capital investment. These two requirements make entry into the liquid waste processing business extremely difficult. While any municipal Wastewater Treatment Plant can process liquid waste, the high strength nature of leachate limits the volumes they can accept. Introducing large volumes of raw leachate would ultimately cause the Plant to exceed its effluent limits prescribed by its Environmental Compliance Approval (ECA).

Cobourg's SBR is the only known unit operating in this region of the province. This attracts haulers of leachate and high strength industrial waste from a very large catchment area (i.e. Toronto, Peterborough, Belleville). This has led to the SBR becoming a victim of its own success. Its current processing capabilities can no longer keep up with the demand from haulers and the continual use make it nearly impossible to shut the unit down for routine maintenance.

The SBR has been in use for 26 years. The only upgrade in that time was a "temporary" Septic Receiving Station to screen out solids and meter volumes for billing purposes. This temporary equipment has now been in use for 14 years. The Septic Receiving Station and the existing SBR both require upgrades and the SBR expanded in order for the Town to meet the needs of its customers.

Upon approval from Council in 2018 to begin the design process for a new SBR, Stantec Consulting was retained to first prepare a needs assessment for the implementation of a second SBR. A high level cost estimate was provided in 2019 and approved in the 2020 budget deliberations in the amount of $3.2M including design and construction for the second SBR. Staff received a commitment from the County to continue to bring leachate to Plant 2 to ensure a timely payback period. A survey of the SBR user group (i.e. Customers/haulers, Operational Staff) was conducted and the main recommendations to come out of the survey and needs assessment were as follows:

(a) Increase Processing Capacity

The SBR is currently processing ~40,000 m3 per year. In the Spring, when leachate volumes are high and landfill wells are close to overflowing, Cobourg is unable to accommodate the extra leachate from Northumberland County. This has forced the County to find alternate Wastewater Treatment Plants who are willing to accept full strength leachate. Failure by the County to remove the leachate before the wells overflow could result in fines by the Ministry of the Environment, Conservation and Parks (MECP). Increasing the processing capacity of the SBR would help resolve this issue.

(b) Screening & Grit Removal

The SBR was originally designed to process leachate from the Town-owned (Eagleson) landfill site. A small Septic Receiving Station with a 6 mm perforated screen was installed in 2006. While succeeding in removing solids, it also significantly increases the time required for trucks to off-load and for staff to have to manually clean the screen of rags.

The screen, scroll and pump should last in excess of 10 years. However, without the ability to remove sand/grit, these components wear out prematurely (i.e. 1-2 yrs) and are costly to replace. The scroll brush require changing annually and the rock trap must be cleaned manually 3 times per week.

(c) Shorter Off-Loading Time

Time is money to haulers. The more loads they can make each day, the better it is for their business. Shortening discharge times is a main concern for our customers. To optimize off-loading efficiency, several enhancements were recommended:

- Ease of Entry – The current system only allows a single truck to connect and, once connected, requires 20-45 minutes to offload (depending on the size and characteristics of the truck). Other tanker trucks wanting to unload, must wait in line and back into position, only after the previous tanker has left. The recommended corrective action is build the new Septic Receiving Station off to the side of the driveway and extend the driveway to a second gate at the south end of the facility. This will allow tanker trucks to drive in one gate, connect, unload and continue straight out through to the second gate without ever having to back up.

- Increased Hours of Operation – The two entry gates and Septic Receiving Station would be separated from the main Plant by a security fence and monitored by CCTV cameras. This will allow haulers 24/7 access to services without the need to have a Plant Operator present.

- Faster Discharge Times – Installing a higher capacity screening/grit removal system will reduce the amount of time required for each tanker to off-load. Faster off-loading will allow haulers to deliver more loads per day to the SBR.

(d) Preventative Maintenance

The SBR is currently in use 365 days per year. The constant delivery schedule never provides an opportunity for Plant staff to carry out routine maintenance on the tanks and equipment (e.g. Sediment removal, pumps/valves/diffuser replacement). The SBR has been in use for 26 years and only taken out of service when inert debris (i.e. sand, rags) reaches levels that begin to impede proper operation of the Aeration Cell. The longer the interval between takedowns, the more debris that must be removed. The last such tank takedown occurred in 2019 and cost $150,000 to remove sand and debris from the aeration cell. Additionally, the cleanout required the SBR to be out of service for several weeks equaling a loss of revenue in excess of ~$15,000/week.

(e) Decreased Downtime Post-Maintenance

The SBR is a biological system. Digestion of the liquid waste is carried out by a specialized population of microorganisms that are capable of catabolizing liquid waste containing high organic loads and heavy concentrations of ammonia. When taken out of service for maintenance, the tank must be drained and the microbes are lost. Once maintenance is complete, it will take an additional 2-4 weeks to re-grow the lost microbes and get the SBR back to 100% efficiency. A second SBR would permit one SBR to remain in use while maintenance is performed on the other. Once maintenance is complete, the aeration cell can be re-seeded using microbes from the adjacent tank.

(f) Volume and Nutrient Management

Volume fluctuations and nutrient deficiency are two common problems in the SBR. Installing connecting pipes from the main Plant to the SBR Holding Tank will permit Operators to pump raw sewage from the clarifiers to add nutrients, if required. Similarly, if leachate ammonia is too high (i.e. toxic), effluent from the main Plant could be used to dilute the leachate down to an ammonia concentration that will not kill the SBR microbes.

6.0 ANALYSIS

In 2020, a Request for Tender (RFT) was prepared incorporating the identified needs of the 2019 study. The main components of the RFT were as follows:

1. Process Improvements:

    a) Site Modifications – Required to provide ease of entry/exit, off-hours deliveries and rapid off-loading by gravity.

    b) Card Reader System – Magnetic swipe cards to identify the truck that is discharging, activate the Septic Receiving equipment and track volumes discharged by each truck/company.

    c) Add CCTV Cameras – Security cameras installed to monitor trucks as they unload and to ensure security of the area during off-hours.

    d) Optimize Off-Loading – Provide a more rapid means of off-loading trucks. Improve throughput of rock trap, sediment trap and screening systems.

    e) Heated Building for Receipt of Septic Waste – Construct an engineered building specifically designed for the screening/grit removal and is properly heated and ventilated. It should also have a separate electrical room (Electrical Code requirement), large double doors to move screenings bin/equipment in/out, heat traced water lines (prevent freezing), 40 mm fire hose (cleaning), safety shower/eye wash (safety code) and a utility sink. The present shelter is not well insulated and is therefore expensive to heat in the winter. It has inadequate ventilation and electrical components corrode prematurely from the damp, corrosive environment.

    f) New Holding Tank – To permit the storage of an additional 227 m3 of septic waste/leachate. The new tank will be connected to the existing holding tank and separated by gates. The two tanks can

be operated separately or joined, in order to balance or dilute nutrients as needed to protect the viability of the resident microbial population. A holding tank is required for each SBR. Even without a second SBR, a second holding tank would allow Operators more space to dilute over-strength waste or supplement nutrient deficient waste.

g) New Sequence Batch Reactor (SBR) – Add a second SBR to double capacity, add redundancy and permit maintenance without having to shut down the process. The two tanks will operate asynchronously, so that a single blower can be used to aerate both systems. The SBR will be covered to control odour and include probes to control the dissolved oxygen levels (i.e. conserve electricity) and monitor ammonia conversion to nitrates. The system will be monitored, controlled and alarmed using the Plant SCADA system.

h) Improve and optimize the SBR wasting system – The current system employs two wells (i.e. upper and lower). The lower well continually floods. This will be corrected to waste directly to the Primary Clarifiers and/or Digesters.

i) Add piping to permit addition of primary effluent to holding tanks - Primary Effluent will be used as food source during periods of low deliveries to ensure microbial population will not die off. It can also be used to supplement nutrient to leachate if there is insufficient septic waste being delivered.

j) Provide amended Environmental Compliance Approval (ECA) and other required permits – The facility ECA will need to be amended to include all the applicable changes relating to the new SBR system. Building Permit, GRCA permit, etc. as required.

k) Maintenance access lane – Cleaning of the SBR currently requires the use of a specialized vacuum truck due to a lack of proximity access to the tanks. Regular vacuum trucks cannot achieve adequate suction given the distance from the tank. The high vacuum trucks are much more costly to rent, thereby increasing the overall cleanout cost.

2. SBR Process Specifications

a) Hauled Waste Receiving Station – Capable of handling a maximum flow rate of 136 m3/hr with a screening capacity of 2.55 m3/hr.

b) Leachate Holding Tank – One (1) concrete tank measuring 18.8 x 9.2 x 2.0 m with a capacity of 208.5m3. The Holding Tank will be located upstream of the Aeration Cell.

c) New SBR Aeration Cell – Same tank measurements as existing. Internal workings will include fine bubble diffusers, decant mechanism, sludge wasting system, ultrasonic level sensors, a high efficiency variable speed blower and SCADA connectivity to monitor, control and record the processing system. SCADA will also have the ability to alter cycle times (i.e. 8, 12, 24 hour cycle times) to match process time with the strength of the waste being treated.

Priorities Realized

Through consultation with staff and clients as well as with the consultant during the preparation of the RFT, the importance of the septic receiving station became the higher priority of the process above the second SBR. The existing SBR process is suffering already without an adequate receiving station. The temporary setup/building has far exceeded its purpose and needs to be replaced with a permanent building that has the proper capabilities of a receiving station. Although the additional SBR may increase revenue, without an adequate way to efficiently receive and screen the waste, the Plant will continue to operate in an underutilized capacity. The failing capabilities and protracted off-loading times of the current system has already resulted in Northumberland County having to divert more than half of its leachate elsewhere. This volume lost equates to nearly a quarter of a million dollars in lost revenue annually.

Tender Results

During the summer of 2020, the RFT was let as a design/build project whereby a general contractor teams up with engineering consultants to essentially provide a high level preliminary design at the time of submitting bids. The Town received three (3) bids, all of which were over the 2020 budget which is entirely attributed to the significant increase in scope of work that included a new septic receiving station, an additional holding tank, and the site/driveway improvements that were not accounted for in the original cost estimate from 2019.

Staff have since reduced the scope of work to exclude the second SBR and site/driveway improvements in an effort to stay within the approved 2020 budget. The reduced bids received (from only 2 of the 3 bidders) were still in excess of the 2020 budget. Although the septic receiving station has become the needed component of the project, should it be determined to proceed only with the receiving station, the cost savings of designing and building all

components at the same time will not be realized nor will the increased revenue.

7.0 FINANCIAL IMPLICATIONS/BUDGET IMPACT

(a) Competition for Service

Leachate is an extremely potent liquid waste that is toxic to normal Wastewater Treatment Plants. The extremely high biological oxygen demand (BOD) and ammonia will kill the microbes used in standard Conventional Activated Sludge Plants. A standard Wastewater Treatment Plant is simply not equipped to deal with such high-potency liquid waste. Most facility Managers will not risk putting their Plants out of compliance by accepting it. There are a few Plants (e.g. Trent Hills WPCP) that are capable of storing leachate in off-line storage tanks and feeding the leachate into the Plant slowly. However, even these Plants are limited by the capacity of the storage tank.

Cobourg is extremely fortunate to have a Sequence Batch Reactor (SBR) on site. This highly specialized liquid waste processing system provides the Town with a unique and highly sought after business opportunity. The system has a high startup cost and requires licensed Operators to run it. These features, plus a general unwillingness of other area Wastewater Treatment Plants to accept liquid waste, makes entry into the business extremely difficult. Since landfill sites must remove leachate from their site for processing, Cobourg is in a favorable position to accept it.

(b) Volume Estimates

Northumberland County has committed to sending a minimum of 154,000 m3 of leachate to Cobourg over the next 5 years. Given that the actual annual volume received from the County over the past 5 years (2015-2019) is 223,713 m3, it is estimated that the committed volume will be received well within 5 years time. A summary of historical volumes and revenues are as follows:

Year	Eagleson	Brighton	Misc Leachate	Septic Waste	Total SBR Volume	Process Rate	Leachate Revenue	Septic Revenue	Total Revenue
	m3	m3	m3	m3	m3	$/m3	$	$	$
2021 (Est)	28,000	12,000	0	18,000	58,000	$13.58	$543,200	$244,440	$787,640
2020 (Est)	28,489	11,784	0	16,761	57,034	$13.58	$546,907	$227,614	$774,522
2019	28,180	13,842	0	19,946	61,968	$13.35	$560,994	$266,279	$827,273
2018	30,373	20,576	0	17,360	68,309	$13.02	$663,356	$226,027	$889,383
2017	38,585	26,499	782	15,655	81,521	$12.85	$846,378	$201,167	$1,047,545
2016	19,322	11,523	477	15,681	47,003	$12.59	$394,344	$197,424	$591,768
2015	21,241	13,572	928	11,596	47,337	$12.48	$446,048	$144,718	$590,766
2014	23,499	17,654	928	11,914	53,995	$12.16	$511,705	$144,874	$656,579
2013	17,881	10,336	1,802	16,635	46,654	$12.00	$360,228	$199,620	$559,848
2012	15,034	7,961	1,637	12,929	37,561	$10.80	$266,026	$139,633	$405,659
Total	**250,604**	**143,909**	**7,005**	**156,477**	**559,382**	**126**	**5,139,186**	**1,991,796**	**7,130,983**
Ave.	**25,060**	**14,391**	**701**	**15,648**	**55,938**	**12.64**	**513,919**	**199,180**	**713,098**

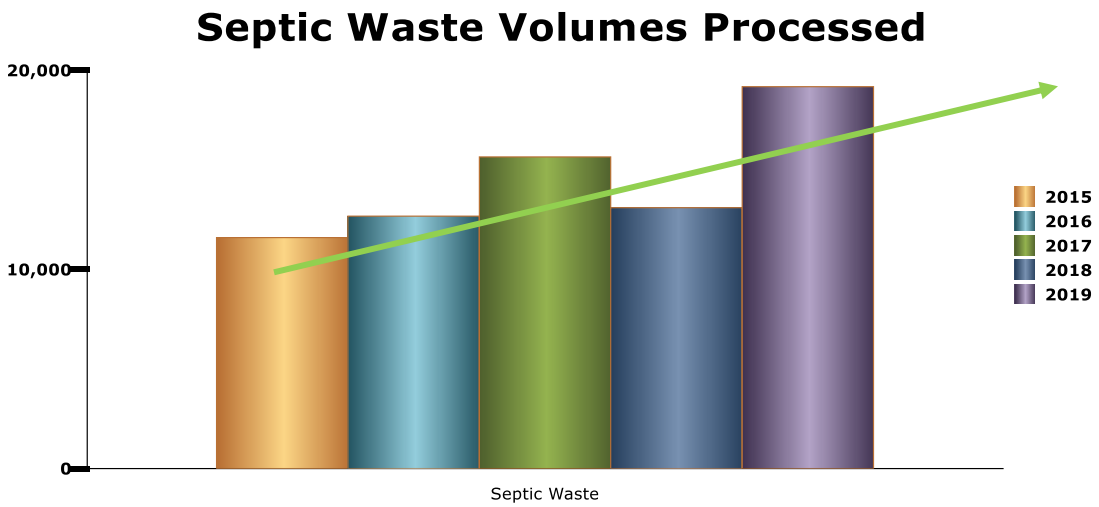
Cobourg currently receives all of the Eagleson landfill leachate, however, in recent years a lack of capacity in Cobourg has forced the County to begin hauling Brighton leachate elsewhere. Below are the actual volumes generated from the Brighton landfill versus the volumes received by Cobourg.

Year	Total Brighton Leachate	Amount Hauled to Cobourg	Cobourg Share of Leachate
	(m3)	(m3)	(%)
2019	33,322	13,842	42%
2018	38,472	20,576	53%
2017	29,511	26,499	90%
2016	10,903	10,903	100%
2015	12,354	12,354	100%

In 2019, Cobourg lost 19,480 m3 of potential leachate. This equates to $264,538 in lost revenue. There is no guarantee that increasing Cobourg's

SBR capacity will result in Cobourg regaining all of this volume. However, if the Town were to provide the County with an incentive, it may entice them to do so. For examples, a 10% discount would provide an annual net gain to Cobourg of $264,539 while concurrently saving the County $45,251.

Over the past 5 years, the SBR has processed a total of 72,219 m3 or approximately 14,000 m3 per year with an annual average increase of 25%.



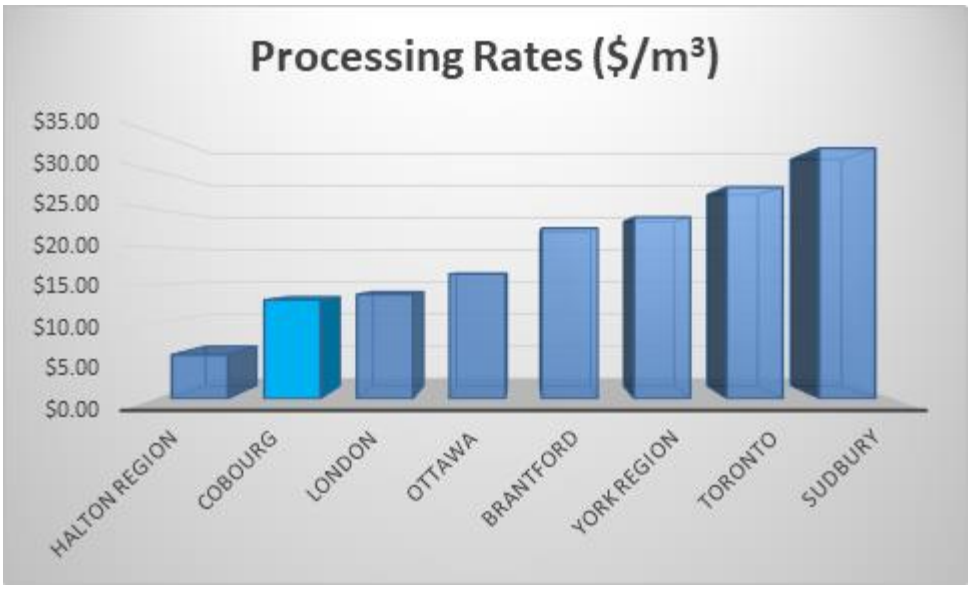
(c) Pricing

The Town of Cobourg's 2020 Processing Rates are $13.58/$m^3$. The rates are increased each year by the annual average Consumer Price Index (i.e. CPI) measured October to October. In the past 5 years, the CPI increases have been ~2% per year. However, due to the COVID-19 pandemic in 2020, it is unlikely that this rate will increase in 2021.

A recent customer survey indicated that the hauler's location of choice for discharging their waste was largely dependent on:

- ✓ Processing fees
- ✓ Discharge times
- ✓ Proximity to their customers (i.e. travel time, fuel costs)

By keeping our processing rates at the low end of the provincial range, fuel costs become less of a factor, allowing Cobourg to draw haulers from a larger geographic area.



(d) Operational Expenses

Once constructed, the overall operational cost of running an SBR is quite low. The most significant operational expense is electricity (used to run the aeration blower). The proposed upgrade would include a new, high efficiency blower that would consume approximately half the electricity of the existing Lamson blower. Additionally, the Plant #2 SCADA could be used in conjunction with a dissolved oxygen probe to reduce the blower output in the late stages of the aeration sequence, when less oxygen is required. This would allow the Plant to operate two SBR systems for the same cost as the current single unit.

(e) Estimated Payback Periods

Proposals were received from Peak Engineering, North American Contractors and HIRA Contractors.

Contractor	Bid
HIRA General Contractors	$5,964,300
North American Contractors	$5,859,000
Peak Engineering	$7,200,000

(f) Assumptions

In order to estimate the payback period for this capital investment, the following assumptions were made:

1. Annual combined processing volumes of 51,594 m^3/yr:
   - Septic Waste Volume: 14,000 m^3 (annual average since 2012)
   - Leachate Volume: 37,594 m^3 from the 2020

2. Processing Rate of $13.58/m3 (No annual rate increase)
3. a) No additional revenue gains from either septic or leachate sources
   b) 40% additional revenue gain through increased rates and volumes

(g) Options

Option 1: SBR & Receiving Station

Debt Repayment Schedule on $6.3M Debenture (10 yrs @ 2.5%)

Payback Period for $6,300,000 Loan – Assumes Static Revenue:
$7,210,000/(51,594 x $13.58) = 10.3 years

Payback Period for $6,300,000 Loan – Assumes a 40% Increase in Revenue:
$7,210,000/(51,594 x $13.58 x 1.4) = 7.4 years

Option 2: Receiving Station Only

A post-tender addendum was sent out to all bidders to have them revise their bids to just price the septic receiving station as the base scope of work:

Contractor	Bid
HIRA General Contractors	$3,574,200
North American Contractors	$3,676,000
Peak Engineering	*Elected not to re-bid on this option*

Debt Repayment Schedule on $3.7M Debenture (10 yrs @ 2.5%)

Payback Period for $3,700,000 Loan – Assumes No Increase in Revenue:
$4,190,000/(51,594 x $13.58) = 6 years

Payback Period for $3,700,000 Loan – Assumes 40% Increase in Revenue:
$4,190,000/(51,594 x $13.58 x 1.4) = 4.3 years

8.0 CONCLUSION

Option 1: SBR & Receiving Station

- Full Project Cost: $6,300,000
- Carrying Cost of Debenture: $721,000/year
- Assists County with Leachate Removal Issues: Yes
- Addresses operational inefficiencies: Yes
- Addresses maintenance constraints: Yes
- Probability of Increased Annual Revenue: Good

Option 2: Receiving Station Only

- Full Project cost: $3,700,000
- Carrying Cost of Debenture: $421,000/year
- Assists County with Leachate Removal Issues: No
- Addresses operational inefficiencies: Partially
- Addresses maintenance constraints: No
- Probability of Increased Annual Revenue: Negligible

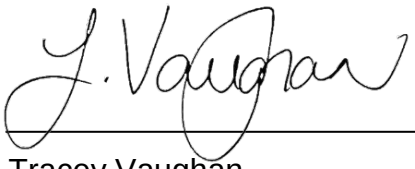
Option #1 will theoretical double the processing capacity and will provide the potential for increased revenues thereby shortening the effective payback period. This option allows for both SBR's to be maintained properly and extend their useful life to the fullest extent possible while also eliminating any opportunity of lost revenues due to long shut down periods required for maintenance/clean out operations. Option 1 will also reduce staffing time required on weekends/evenings to attend and supervise the truck offloading as well as for manual paperwork and invoicing.

Option #2 would allow the existing system to run more efficiently and reduce the cost of tank cleanouts, but would do nothing to address the capacity issues or the inability to conduct regular maintenance, nor does it increase the likelihood of more revenue generation.

Staff are recommending proceeding with Option #1 which will require a $3.1M budget approval in addition to the previously approved $3.2M for the second SBR.

12.0 AUTHORIZATION/SIGNATURES

Laurie Wills, P,Eng.
Director, Public Works



Tracey Vaughan
Chief Administrative Officer

Appendix - Definitions

Activated Sludge

The activated sludge process is a type of wastewater treatment process for treating sewage or industrial wastewaters using aeration and biological flocculation (coagulation) composed microorganisms.

The general arrangement of an activated sludge process for removing carbonaceous pollution includes the following items: An aeration tank where air (or oxygen) is injected in the mixed liquor (microbial suspension). This is followed by a settling tank (Secondary Clarification) to allow the biological floc (the sludge blanket) to settle, thus separating the biological sludge from the clear treated water.

BOD

Biochemical oxygen demand (BOD) is the amount of dissolved oxygen needed (i.e. demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period. The BOD value is most commonly expressed in milligrams of oxygen consumed per litre of sample during 5 days of incubation at 20 °C and is often used as a surrogate of the degree of organic pollution of water.

CPI

Consumer Price Index (CPI) is an indicator of changes in consumer prices experienced by Canadians. It is obtained by comparing, over time, the cost of a fixed basket of goods and services purchased by consumers. The **CPI** is widely used as an indicator of the change in the general level of consumer prices or the rate of inflation.

DO

Dissolved oxygen (DO) is a measure of how much oxygen is dissolved in the water, which is, the amount of oxygen available to living aquatic organisms.

ECA

Section 9 of the Ontario Environmental Protection states that no person shall, except under and in accordance with an environmental compliance approval (ECA) use, operate, construct, alter, extend or replace any plant, structure, equipment, apparatus, mechanism or thing that may discharge a contaminant (chemical agents and physical agents (noise and vibration) into any part of the natural environment, or alter a process or rate of production with the result that a contaminant may be discharged into any part of the natural environment. For compliant operations, an ECA is required to operate, install or modify such a facility or equipment discharging air contaminant to the outside environment.

Effluent

Effluent refers to the treated water that flows out of a Wastewater Treatment Plant, to a natural body of water.

Leachate
A leachate is the liquid that, in the course of passing through material in a landfill site, extracts soluble or suspended solids, or any other component of the material through which it has passed. Leachate is a widely used term in the environmental sciences where it has the specific meaning of a liquid that has dissolved or entrained environmentally harmful substances that may then enter the environment.

MECP
Acronym referring to the Ministry of the Environment, Conservation and Parks

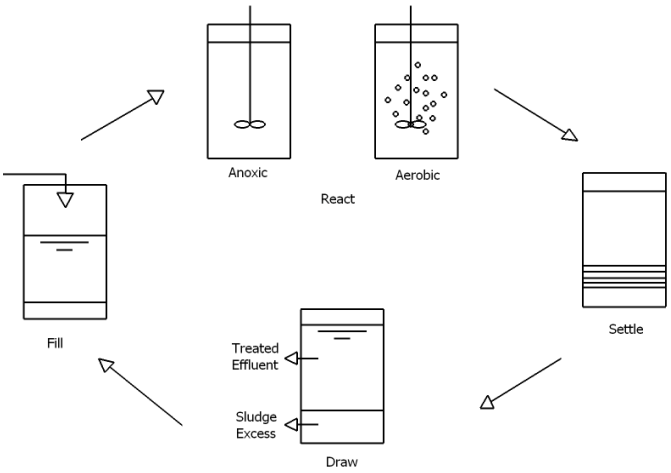
Raw Sewage
Raw sewage is untreated wastewater derived from residential properties, such as houses and apartments, as well as commercial buildings and industrial and agricultural processes.

RFT
A request for tender (RFT) is a document that solicits proposals through a bidding process, by an agency or company interested in procurement of a commodity or service to potential suppliers to submit business proposals.

Primary Effluent
Refers to the raw sewage in a Wastewater Treatment Plant, that has passed through the Primary Clarifier (i.e. Primary settling) only.

Septic Waste
Refers to any waste extracted from a septic tank, cesspool, sewage holding tank, seepage pit, interceptor or other containment for human excretion and wastes.

SBR
A Sequence Batch Reactor (SBR) is a type of activated sludge process for the treatment of wastewater such as sewage or leachate. Oxygen is bubbled through the mixture of wastewater and activated sludge to reduce the organic matter (measured as BOD) and ammonia to levels to a level compliant with the Town's Sewer Use By-Law limits.



SCADA

Supervisory Control and Data Acquisition (SCADA) is a control system used to automate the sewage treatment process. The SCADA system is comprised of computers, networked data communications and graphical user interfaces (GUI) for high-level process supervisory management, while also comprising other peripheral devices like programmable logic controllers (PLC) and discrete proportional-integral-derivative (PID) controllers to interface with process plant or machinery.

WPCP

An acronym meaning “Water Pollution Control Plant”