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New aeration technology rehabilitates Aylmer's old lagoon system

Similar to much of Canada's wastewater treatment infrastructure, the majority of the Town of Aylmer, Ontario's wastewater lagoons were significantly expanded in the 1980s. Now, more than 30 years later, they have begun to show their age.

Despite the fact that Aylmer (Pop. 7,300) has one of the largest wastewater lagoon systems in Ontario, they were still relying on a severely outdated aeration system. One hundred and ninety two coarse bubble static tube aerators and their air laterals were beginning to fail. Air from the blower system gushed out of breakages in the aeration lines. As a result, ammonia and BOD levels suffered greatly, and the facility risked falling out of compliance with Ontario Ministry of the Environment.

Rod Tapp, Director of Operations for the Town turned to Peter Penner from Cyril J. Demeyere (CJDL) Consulting Engineers to help rectify this problem.

Evaluation criteria

The largest hurdle for Aylmer to overcome in this project was funding. They needed a system that could be installed on a limited budget, as well as maintained and operated without increased costs. Also, as the lagoon cells work in series to provide sufficient storage and treatment time, they could not afford to incur a long period of system downtime. Lastly, they wanted to maintain the turbulent and effective water mixing in the 5.2m deep Cell #1 that they received from their existing coarse bubble system. This was needed in order to ensure only limited sludge accumulation over time.

Mechanical treatment plant

In recent years effluent release limits have become increasingly stricter. These regulations, combined with ever-growing populations, can be difficult to manage for small municipalities like Aylmer that have limited financial and human resources.

In an effort to meet new standards,



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many small municipalities have either replaced their lagoon systems with a mechanical plant, or have opted to pump their wastewater to a nearby municipality for treatment. Initially, a mechanical plant appeared to be a very desirable option for Aylmer. Higher quality effluent can be achieved in a smaller footprint, which allows more land for other development and improvements.

Unfortunately, a deeper analysis revealed that the cost of designing and building a new mechanical plant was going to far exceed the available budget. The only feasible alternative left was to upgrade their existing infrastructure. Furthermore, they needed a wastewater treatment system that would not increase ongoing operational and maintenance costs. A mechanical plant, with many more moving parts, would not be likely to accomplish that.

Mechanical surface aerators

Surface aerators are commonly utilized in wastewater lagoons, similar to Aylmer's. There are some benefits that met Aylmer's evaluation criteria. For example, they are portable, and can be quickly installed without incurring downtime. However, maintenance and operation costs would increase from their current system, as surface aerators can malfunction, especially in colder climates.

Furthermore, surface aerators have relatively low energy efficiency (SAE 1.5 to 2.25 lb O₂/hp-hr) as compared to diffused technologies. This level of energy efficiency was bound to increase the operation costs of the Aylmer lagoon aeration system.

Tapp was also concerned about the limited zones of mixing influence. Surface aerators with the most advanced

mixing capabilities max out around 2.5 to 3.0m. Since Cell#1 at the Aylmer lagoons is 5.2m in depth, the lower half of the water column would remain untouched. This would result in decreased aerobic activity and increased sludge accumulation.

According to Penner, “the longer that the solids remain in suspension, with optimum oxygen levels, the greater the microorganisms’ ability to complete the natural treatment process to remove nutrients and minimize sludge accumulation.”

Fine bubble aeration

As a means of counteracting the low energy efficiency of the surface aeration system, CJDL also considered fine bubble aeration technology. SAEs of 4-7 lb O₂/hp-hr translates into much lower operating costs, and a much more sustainable system option. Furthermore, a fine bubble system could potentially utilize the existing blowers. This type of arrangement would result in fewer on-shore motors to maintain, as compared to surface aeration.

However, research performed by Penner revealed that fine bubble diffusers were prone to clogging. The tiny holes in the diffuser material are susceptible to being blocked by solids or natural fouling buildup. This would likely increase maintenance costs as they would have to be cleaned and replaced regularly.

With a fine bubble system such as this, a floating lateral design is necessary. Tapp expressed serious reserva-

tions about this type of design, saying: “Cell#1 in the lagoons has 7.8 hectares of surface area and is wide open to the prevailing winds. Once the ice starts to melt around the edges, the whole sheet of ice will move and shift with the wind, causing a lot of stress on a floating aeration system. If we lose one of the floating laterals, the whole string of individual aerators gets shut down and taken out of service until spring when repairs can be completed.”

MARS Aeration System

As a result of research on the internet, CJDL discovered the MARS Aeration System and, through detailed consultation with Triplepoint Water Technologies, were able to design a system that met all of Aylmer’s criteria.

The MARS Aeration System is a hybrid that combines the efficiency of fine bubble systems with the mixing capabilities of coarse bubble static tube technology in one portable unit. As a result, it can be easily lowered from a small boat into a lagoon from the surface of the water, eliminating the need for dewatering of the lagoon and limiting system downtime.

Each unit’s air supply can be isolated via its own individual airline and on-shore valve. Similarly, a stainless steel tether allows each unit to be pulled to the surface individually, in the event that maintenance is necessary.

The unique design incorporates EPDM fine bubble diffusers to avoid clogging problems.

Triplepoint’s staff worked closely with CJDL and the Town of Aylmer to customize the system layout to suit the high organic loading at the lagoon’s Cell#1 inlet location and to avoid the defunct aeration system that was partially abandoned in place. Triplepoint also addressed the Town’s concerns with coupling successive lengths of weighted tubing by using stainless steel fittings to provide strength and corrosion resistance.

Following the first two years of operation, there has been no maintenance required or deficiencies to address. The quality of the treated lagoon effluent has improved and has easily met the strict quality objectives set out in the Ministry of Environment’s Certificate of Approval.

The Ontario Clean Water Agency (OCWA) operates the lagoon system under contract with the Town. According to Dale Le Britton, Operations Manager at OCWA, “the new aeration system has definitely made an improvement in the quality of our final effluent for release. We have experienced higher dissolved oxygen levels with less run time on the blowers and we have been able to reduce the discharge phosphorus using less chemical addition. The operators are pleased with how easy it is to control air flow and have not experienced any maintenance issues.”

*For more information,
E-mail: matthewn@metconeng.com*



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