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# Wastewater facility upgraded without abandoning existing lagoons

By Kevin Vieira, Ken Musyoka and Merle Kroeker

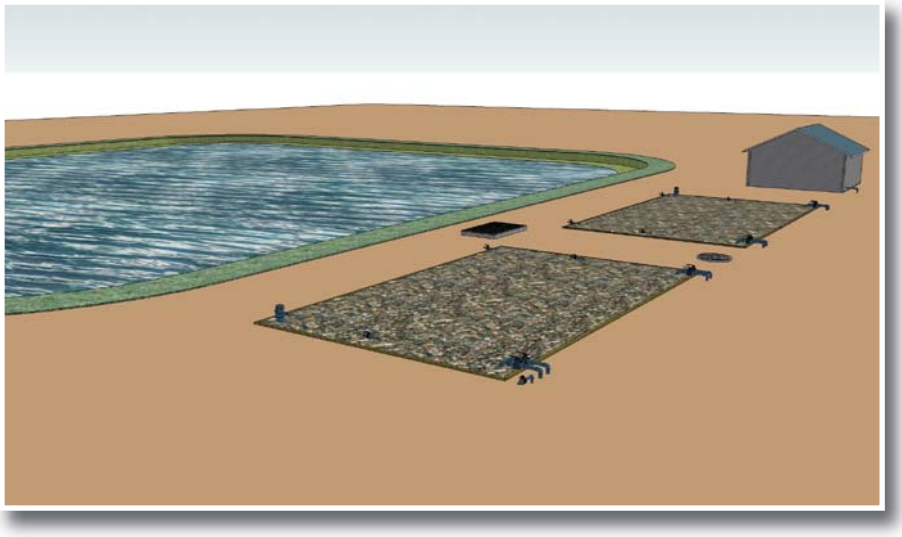
Effluent quality limits for municipalities discharging treated wastewater into watersheds have become more stringent in recent years. However, many communities struggle to find the technical and financial resources to keep up with these limits, due to restricted options for post-lagoon nutrient removal technologies.

Until recently, cost-effective tertiary treatment technologies, following cold oxidation ponds or aerated lagoons, that meet low ammonia levels have been few and far between. Communities have been left with no choice but to abandon their lagoons and construct a new mechanical treatment plant, in order to remain compliant with the regulations.

Recent advances in cold-climate nitrification have provided the Town of Mentone, in Kosciusko County, Indiana, with an innovative solution for post lagoon nutrient removal. The community added the SAGR® (Submerged Attached Growth Reactor) technology to its existing lagoon system to provide nitrification, without taking the existing lagoons off-line.

*Mentone's SAGR (Submerged Attached Growth Reactor).*

The existing wastewater treatment facility consisted of a two-cell facultative lagoon system providing secondary treatment. This facility was designed to meet effluent $BOD_5$/ TSS limits of 25/70 mg/L,



*Mentone's WWTP facility utilizes two SAGR beds for post-secondary treatment.*

but was unable to meet the required National Pollutant Discharge Elimination System (NPDES) limits for total ammonia nitrogen (TAN) of 9.6 mg/L in summer and 10.4 mg/L in winter.

Nelson Environmental Inc. collaborated with the town's engineering consultant to design an upgraded system that retained the facultative lagoons for secondary treatment, followed by a SAGR.

**SAGR process**

The SAGR is an aerated gravel bed reactor, with a horizontal-flow hydraulic profile. The module provides year-round nitrification well beyond most total ammonia permit requirements for influent water temperatures as low as 0.5°C (32.9°F), making it ideal for post-lagoon treatment in cold climates. An added benefit of the process is effluent polishing to $BOD_5$/TSS levels of less than 10/10 mg/L. Test data from a demonstration facility in Lloydminster, Saskatchewan, have also shown significant (90%+) reduction of fecal coliform to less than 200 CFU; in some cases this has eliminated the need for additional disinfection.

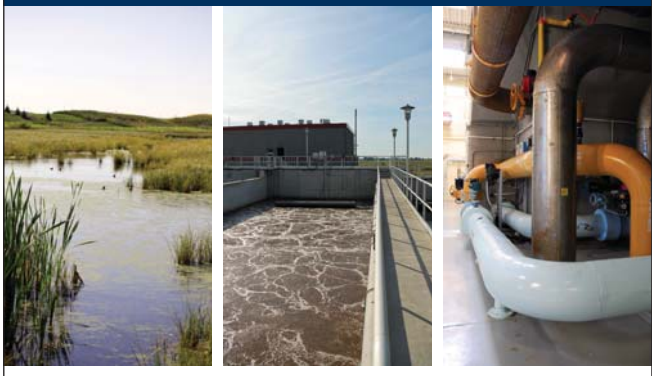
SAGR was developed primarily to provide post-lagoon ammonia removal without abandoning existing lagoon treatment infrastructure. The performance parameters and sizing for the process are based on extensive testing performed on the post-lagoon SAGR in Lloydminster and a demonstration SAGR that was located in Steinbach, Manitoba.

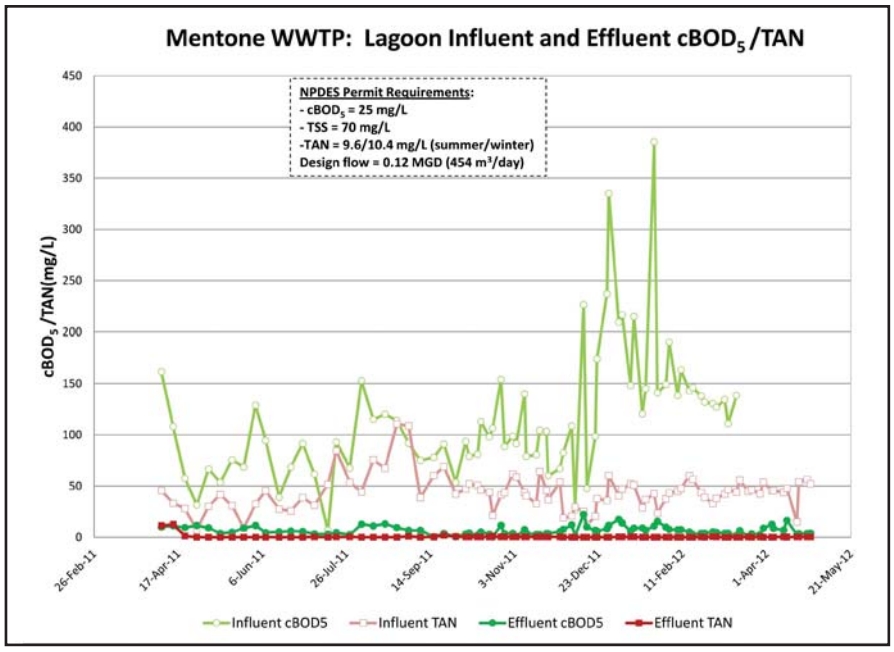
The process can be utilized for nitrification following any secondary treatment process, including either aerated or non-aerated lagoons. It is a clean gravel bed with a horizontal flow distribution chamber at the front end to distribute influent wastewater across the width of the entire cell. The aggregate is submerged,

*continued overleaf...*










*Mentone WWTP: influent and effluent $cBOD_5$ / TAN data in 2011-'12.*

providing the necessary surface area for growth and attachment of a nitrifying biomass within the bed, and is sized to optimize bacterial growth and hydraulic flow. A horizontal effluent collection chamber at the back end collects all the treated effluent and channels it to the discharge structure. Sizing of the bed is based on influent flow and loading rates, expected influent water temperature, and the required rate of nitrification.

The SAGR process is very simple to operate. There is no solids return to monitor and adjust, or sludge to waste and dispose of. The operations and maintenance aspect of the process is similar to the operation of a conventional diffused-air aerated lagoon. The only moving parts in the system are the blowers supplying oxygen to the SAGR process. A simplified control scheme manages the day-to-day operation of the blowers. Blowers for the SAGR are sized to meet the oxygen requirements for nitrification and final BOD polishing only. This translates to significant energy savings, that would otherwise be required to run blowers for a conventional aerated lagoon system.

Mentone's SAGR system consists of two beds in parallel, with each bed handling 50% of the hydraulic loading. No aeration was required in the lagoons to meet the recommended lagoon effluent $BOD_5$ feeding the process. It is estimated that over the long term, the operator of the Mentone facility will spend an average of 30 minutes per day doing a systems check (visual inspection) and maintenance.

It is estimated that 50% energy savings are realized with this design compared to other systems achieving similar effluent quality. The trade-off is the higher lagoon footprint required for the necessary residence time. Since the capacity was available at the onset of the system design, utilizing the existing infrastructure was deemed the most cost-effective approach for Mentone. Using the existing lagoons provided cost savings in both the construction and long-term operation and maintenance of the system.

**Commissioning and performance**

Nelson Environmental Inc. provided system commissioning and operational training on March 24, 2011. Following a two-week startup window, effluent quality from the Mentone facility is not only meeting NPDES permit requirements but is producing low effluent concentrations averaging 6.5 mg/l BOD, 3 mg/L /TSS and 0.3 mg/L TAN year-round. The system design flow is 0.12 MGD (454 $m^3$/day).

The upgraded system in Mentone is an example of a cost-effective and efficient solution for WWTP operators in North America, who face the same regulatory challenges and want to keep their existing lagoon system, while maintaining low operation complexity.

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## The process is similar to the operation of a conventional diffused-air aerated lagoon.