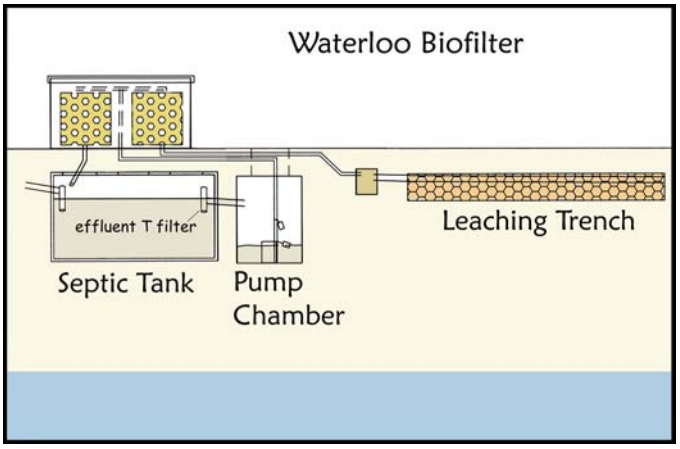
Massachusetts Alternative Septic System Test Center
Technology Fact Sheet - *Interim Findings*

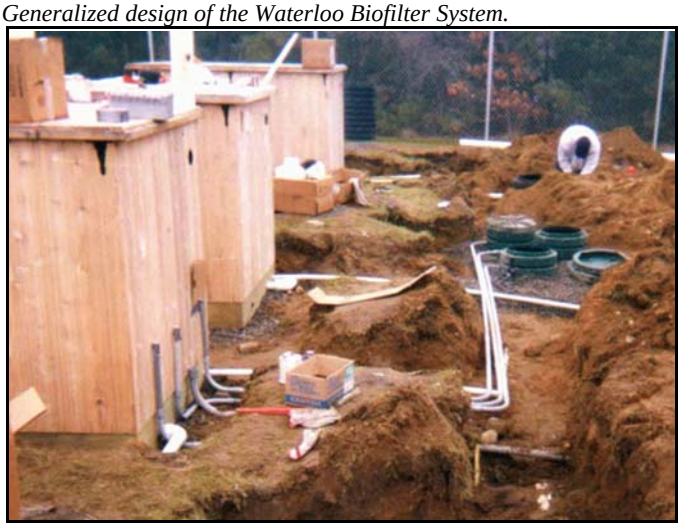
Waterloo Biofilter ®

The Massachusetts Alternative Septic System Test Center is a collaborative project of the Buzzards Bay Project National Estuary Program, Massachusetts Office of Coastal Zone Management, Massachusetts Department of Environmental Protection, Barnstable County Department of Health and the Environment, and UMass Dartmouth School for Marine Science and Technology. The Test Center was established in recognition of the need in Massachusetts for cost-effective wastewater disposal systems suitable for sites with limited space, poor soils, high groundwater elevations, or where advanced pollutant removal is required. Its mission is twofold. First, to evaluate the performance and operation costs of new and innovative wastewater disposal technologies in a carefully controlled and unbiased manner, and provide this information to regulators and consumers. Second, to assist vendors in getting their technologies more quickly approved for use in Massachusetts, and at a lesser cost.

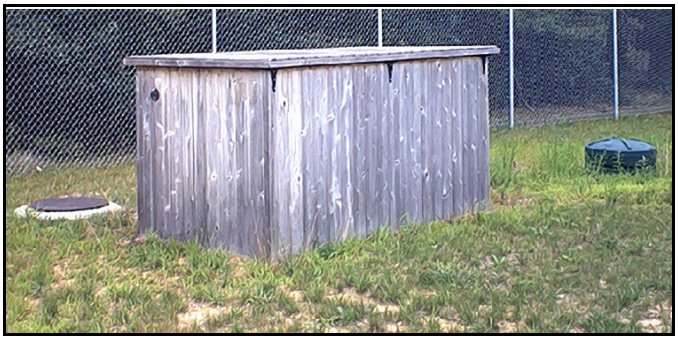
Technology Name:	Waterloo Biofilter®
Technology Type:	Trickling filter, aeration with foam media.
Manufacturer:	Waterloo Biofilter Systems, Inc. 143 Dennis Street Rockwood, ON N0B 2K0 Canada 519-856-0757
Contact:	Craig Jowett, Ph.D., P. Eng., President
Company Website:	www.waterloo-biofilter.com
Performance & Permitting info at MA DEP and BCHED Websites:	www.state.ma.us/dep/brp/wwm/t5pubs.htm#it www.barnstablecountyhealth.org/AlternativeWebpage/
Testing Objectives:	Demonstrate N removal for use in N-sensitive watersheds. Obtain approval for reductions in SAS size or high groundwater elevation separation distance.
Testing Period:	Testing began 6/99 and is ongoing, results shown for 9/99 to 9/00.
Test Loadings:	System loading was 330 gpd, (in 15 doses AM/PM), SAS was 0.74 gallons per sq. ft per day.



Generalized design of the Waterloo Biofilter System.



Waterloo Biofilter during installation (3 side by side installations)



One unit, after installation.

Siting Considerations and Installation Notes

System can be variously configured, but all installations include a septic tank, pump chamber and filter. The trickling filter may be installed flush to grade where gravity flow from the bottom of the filter can be directed back to the septic tank. Below ground installations may use concrete tanks with a proper access opening (5' x 4'). The pressure manifold atop filter media must be self-draining to prevent freezing. Above ground wooden enclosure installations (8' x 4' x 5') should consider treatment for carpenter ants and burrowing insects. An approved effluent tee filter should be installed in the septic tank. Above ground components include varying heights of the filter itself (dependent on topography) and an electrical control panel with a visual and audible alarm. Consult with the vendor for approved system configurations. Dosing to the filter can be controlled by demand (Test Center configuration) or alternately by timer.

Actual and Manufacturer's Estimated Costs (3-bedroom home) and Labor

Non-Title 5 Components: $7,000 (manufacturer's claim).
Components + Installation: $7,350 more than conventional (claim).
Electrical: $50 per year actual (local rates, annual KWh= 451).
O&M: Quarterly inspection of motors, air flow, effluent and filter media. A service contract is required in Massachusetts (Approximately $400 per year minimum, but varies). Septic tank pumping averages $60 per year.
Other Costs: Quarterly effluent quality monitoring is required for some permits ($300 or more annually). Design, permitting costs vary with site.
Replacement: Pumps ($300) have one-year manufacturers warranty, media claimed to last 30 years, but may require cleaning every 7-10 years. ($100-$300 to top-off the media compartment).

Theory of Operation

The Waterloo Biofilter is a trickling filter that uses an open-cell foam to achieve the nitrification (conversion of ammonium to nitrate) of septic tank effluent, and the anoxic environment of the septic tank to complete the denitrification (conversion of nitrate to nitrogen gas). Clarified septic tank effluent is first sprayed over a bed of foam. At the bottom of the filter housing, the filtered nitrified wastewater is split to return approximately one-half back to the anoxic septic tank for denitrification, with the remaining portion discharged to the soil absorption system (SAS).

Permitting and Use in Massachusetts (***as of June 2001)***

Certification for General Use: No approval in this category. Provisional Use Approval: No approval in this category. Remedial Use Approval: Waterloo has approval in remedial situations where a system is failed, failing or nonconforming where relief is sought to construct an SAS within two feet (or three feet for percolation rates exceeding two minutes per inch) of the high groundwater elevation, or to construct an SAS reduced in size by up to 50 percent or in areas where at least 2 feet of suitable material is available beneath the SAS. Piloting Approval: Waterloo is attempting to demonstrate the System can be designed and operated at increased loading rates to the SAS and with a reduction in distance from the bottom of the SAS to the high groundwater elevation.

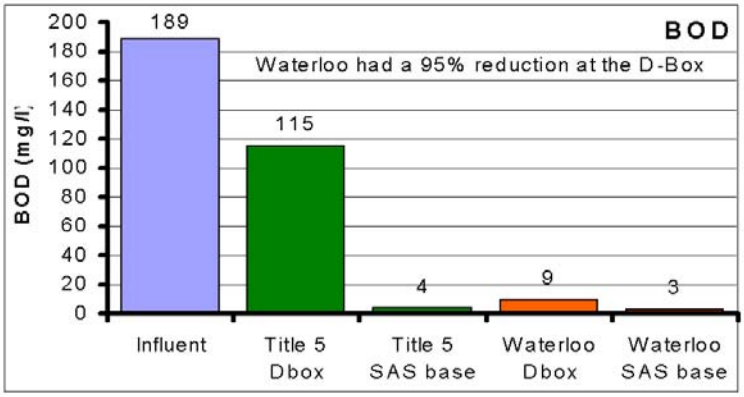
Operation and Maintenance Issues
[This information will be included in the final report findings.]

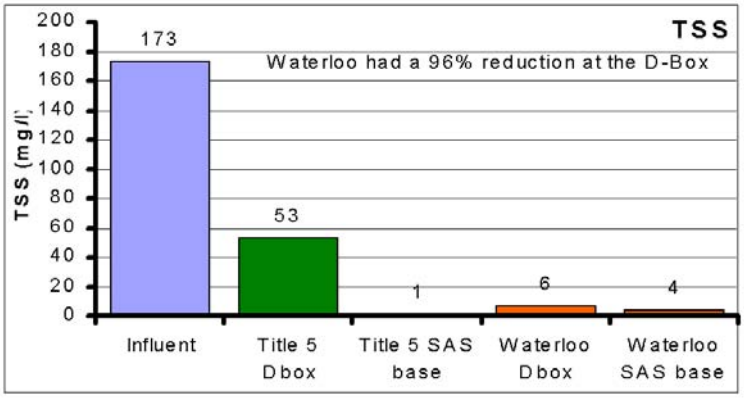
Explanation of the Graphs
The graphs to the right show the mean of three replicates for each parameter over the testing period, compared to Title 5 performance and influent measured in parallel samples during the same period. Fecal coliform results are expressed as geometric means. In the nitrogen graph, NH4 represents ammonia, NOx represents nitrate + nitrite, DON is dissolved organic nitrogen, and PON is particulate organic nitrogen. Total nitrogen is the sum of these four parameters.

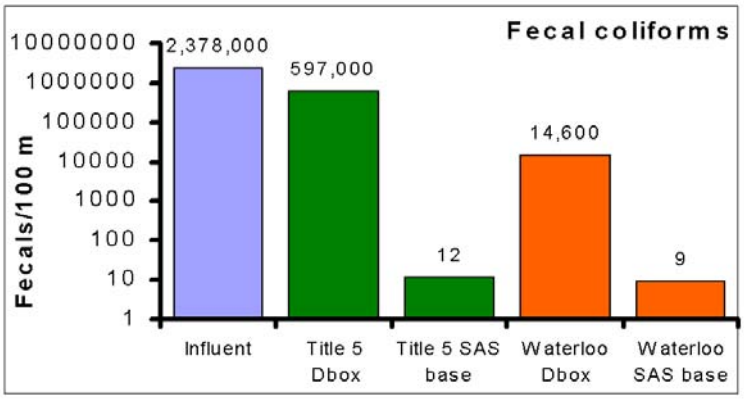
Soil absorption system samples include wastewater disposal system effluent and precipitation. The recharge of precipitation to groundwater is estimated to be between 8 percent-16 percent of effluent discharge based on local rainfall, estimated groundwater recharge rates, SAS size and dosage rates. For all technologies, an interim dilution rate of 10 percent was employed based on precipitation and theoretical and measured dosage rates at the Test Center. The results for nitrogen removal include this estimated dilution factor (note bars labeled "SAS adj.") Results shown for biological oxygen demand (BOD), total suspended solids (TSS), and fecal coliforms were not adjusted for dilution by precipitation, because the adjustment was negligible in evaluating overall performance. This interim approach, is being compared to specific conductivity, chlorides, and bromide tracer to better refine this estimate, and develop system specific dilution factors. **Thus, the "SAS adjusted" values reported here for nitrogen discharge to groundwater should be considered preliminary.**

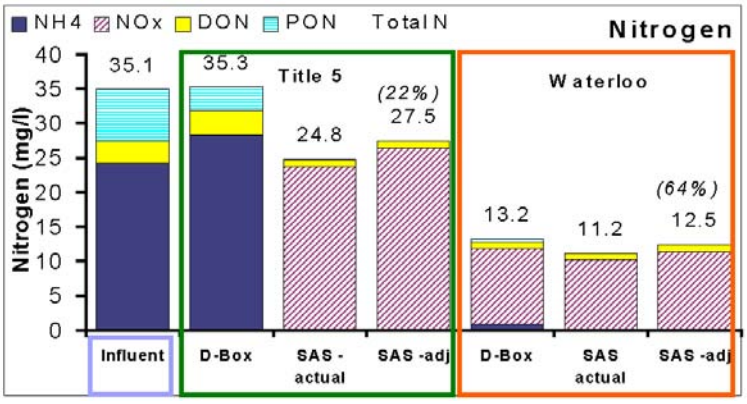
Summary of Interim Findings
This technology exceeds secondary treatment (*i.e.*, TSS and BOD less than or equal to 30 mg per liter) to allow for the reduced separation to groundwater, or reduced soil absorption system size. BOD and TSS concentrations at the base of the SAS for this technology and the Title 5 system are similar. This technology discharged below the regulatory standard of 19 mg/l TN to allow for use in nitrogen sensitive areas. At the SAS base, this system was estimated to remove 64 percent of nitrogen inputs compared to 20 percent for a Title 5 system during the same period. This system was not tested at the Test Center for seasonal or intermittent use or for high hydraulic loading conditions.

The Technical Review Committee does not recommend adoption of nitrogen loading ratings for this technology until the two-year testing period is complete. Differences in nitrogen removal among innovative technologies tested are not necessarily significant. Nitrogen removal performance may vary with soil types and other site differences. The Buzzards Bay Project will recommend nitrogen loading rates for this technology for planning purposes and watershed loading evaluations at a later date.









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