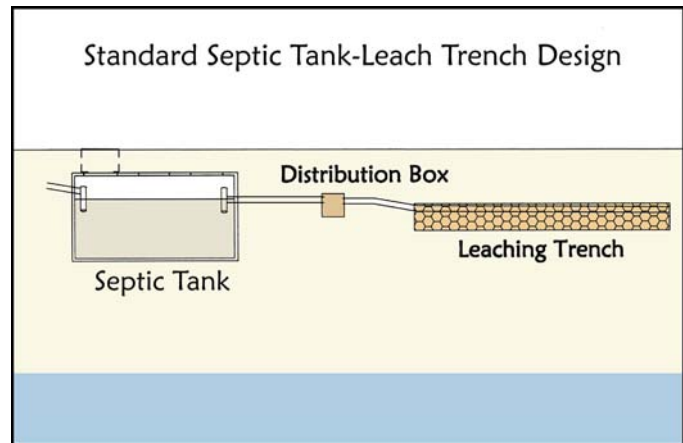


Massachusetts Alternative Septic System Test Center Technology Fact Sheet - *Interim Findings*

Conventional Title 5 System D-box and leaching trench design

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:	Massachusetts Title 5 Onsite Disposal System, D-box and leach trench SAS
Technology Type:	Conventional: 1500 gallon septic tank with leaching trench SAS
Manufacturer:	Non-proprietary, many manufacturers
Contact:	Massachusetts DEP
Company Website:	Not applicable.
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:	Evaluate pollutant removal for technology comparisons, pathogen removals at different depths in SAS, performance under stress conditions, and maintenance frequency recommendations.
Testing Period:	Testing began 5/99 and is ongoing, results shown for 7/99 to 7/00.
Test Loadings:	System loading was 330 gpd, (in 15 doses AM/PM), SAS was 0.74 gallons per sq. ft per day.



Conventional Title 5 system with leaching trench SAS.

Siting Considerations and Installation Notes

A conventional septic tank-consists of a septic tank and a soil absorption system (SAS) of various configurations. The design may include a pump chamber where required by land elevations. The SAS can consist of perforated pipe laid in stone aggregate (such as the unit tested and reported on here), or consist of concrete and plastic chambers of various designs. A separation between the bottom of the soil absorption system and high groundwater elevation of five or four feet is normally required; the separation distance is dependent on the soil type.

Actual and Estimated Costs (3-bedroom home) and Labor System Parts: \$2,000.

With Installation: \$3,500 best case for new construction, up to \$60,000 for lots with low permeable soils, high groundwater elevations, or other features requiring SAS mounding, replacement of soils, use of pumps, etc. However, most typical range of cost is \$8,000 to \$16,000.

Electrical: \$0 per year typical, but pumps sometimes used if tank is downslope of SAS.

O&M: \$60 per year average cost for inspection and pumping, assuming inspection/pumping every three years.

Inspections: DEP recommends that the tank be inspected once every three years and pumped if necessary.

Replacements: SAS expected to last typically 30 years.

Theory of Operation

This traditional and simple system has been the most common onsite wastewater disposal system used in the United States during the past several decades. The system uses a septic tank to clarify sewage and an SAS to dispose of the clarified effluent. Treatment in the septic tank consists of settling of solids, conversion of organic nitrogen to ammonium, and anaerobic digestion of settled solids. Treatment in the SAS includes: filtration and removal of remaining suspended solids, microbial utilization and reduction of organic contaminants; microbial oxidation of ammonium to nitrate (nitrification); removal of pathogens by the combined processes of mechanical filtration, oxidation, and biological grazing. Biological activity and filtration by soils reduce the discharge of pathogen organisms to groundwater. The Title 5 system is not specifically designed to remove either nitrogen or phosphorus. However, a small amount of nitrogen entering Title 5 systems is removed by settling in the tank, or possibly via



Septic tanks during installation.



SAS trench with sampling wells at construction.

denitrification in the tank and SAS. Some phosphorus may chemically bind to soils in the SAS.

Permitting and Use in Massachusetts (as of June 2001)

The preferred onsite wastewater disposal method per 310 CMR 15.000 (Title 5).

Conventional MA Title 5 System

Operation and Maintenance Issues

[This information will be included in the final report findings.]

Explanation of the Graphs

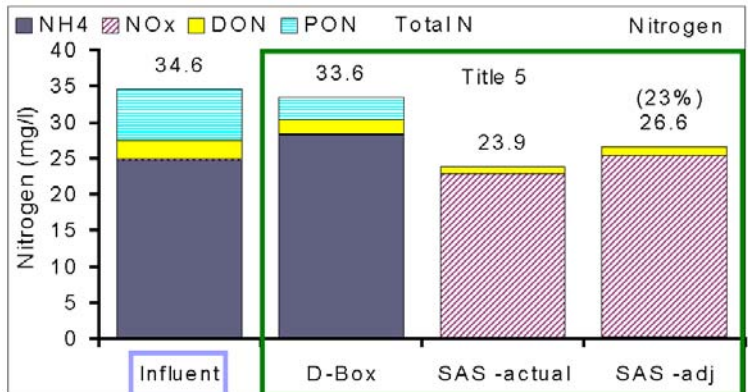
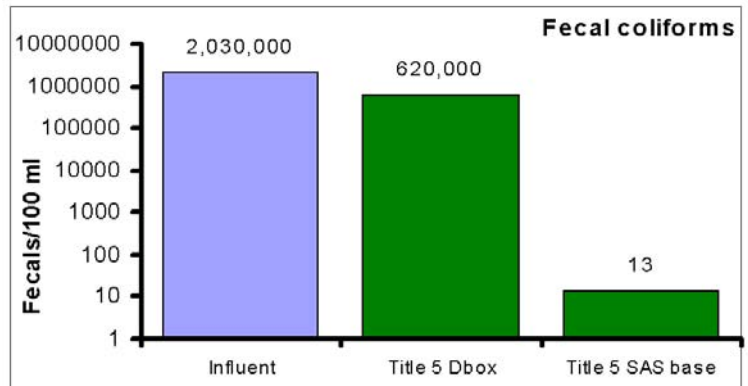
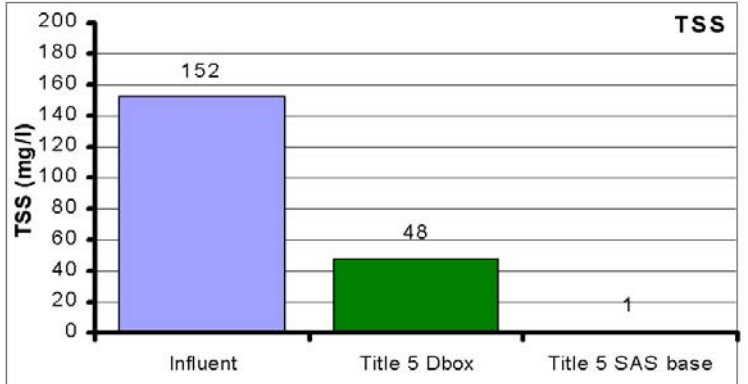
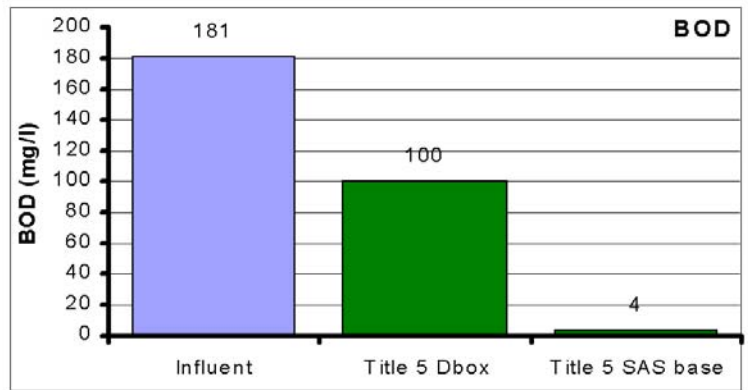
The graphs to the right show the mean of three replicates for each parameter over the testing period, compared to Title 5 performance and influent measured in parallel samples during the same period. Fecal coliform results are expressed as geometric means. In the nitrogen graph, NH₄ represents ammonia, NO_x 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 and 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

The Septic System Test Center affirmed that conventional Massachusetts Title 5 systems remove BOD, TSS and fecal coliform bacteria to a sufficient degree necessary to protect public health. Although Title 5 systems are not designed to remove nitrogen, as a result of biological and chemical processes in the SAS, they were found to reduce nitrogen in the influent wastewater by approximately 19 to 22 percent depending upon the test period. The performance of the Title 5 systems in removing pollutants was used as the baseline to compare the performance of alternative technologies evaluated at the Septic System Test Center.

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 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.



Funding for the Massachusetts Septic System Test Center was provided by the US EPA, through Cooperative Agreements x991657 and x981007, the Massachusetts Department of Environmental Protection (319-99-01, 319-00-02), Massachusetts Office of Coastal Zone Management, Massachusetts Environmental Trust, Barnstable County Department of Health and Environment, UMass Dartmouth SMAST, and other organizations. Other information on this initiative can be found at www.buzzardsbay.org. These fact sheets were reviewed by a multi-agency work group. The views or opinions expressed are not necessarily those of the Commonwealth of Massachusetts, the US EPA, or any of the funding organizations and agencies. The information presented here represents the technical findings of the Massachusetts Septic System Test Center after at least one year of system testing. Manufacturer claims of cost and longevity, warranties, or stated costs have not been verified. Modifications to system designs from those tested, or installation under other soil or climate conditions may result in different system performance. This fact sheet was prepared and printed by the Buzzards Bay Project.



Commonwealth of Massachusetts
 Jane Swift, Governor
Executive Office of Environmental Affairs
 Bob Durand, Secretary
Buzzards Bay Project
 Dr. Joe Costa, Executive Director
 2870 Cranberry Highway East Wareham, MA 02538
 508.291.3625

