

## Darrow School's Samson Environmental Center Eco-Machine®



*Solar aquatic tanks treat effluent from Darrow's campus inside the greenhouse*

"Bringing balance to our campus is an ultimate goal of the Darrow School's interest in ecological sustainability and we try to imbue each of our students with this sense of one's personal responsibility to their environment."

-The Darrow School

### Background & Design

The Darrow School, located in New Lebanon, New York, is a boarding and day school for grades 9-12 offering a comprehensive, hands-on, college preparatory curriculum. The school occupies original buildings from the Mount Lebanon Shaker Village and carries the Shaker traditions of sustainability into its core mission and activities.

In the mid 1990's Darrow School administrators were seeking a cost-effective, environmentally-friendly solution to their failing septic system. Rather than installing traditional septic tanks and leach fields, they decided to invest in an Eco-Machine to meet their wastewater needs. The Eco-Machine was designed into the heart of the Samson Environmental Center, which officially opened in 1998, as the most visible embodiment of the school's commitment to sustainability.

<b>Waste Stream</b>	Domestic Wastewater
<b>Treated Flow</b>	8,500 GPD
<b>HRT (hours)</b>	3.7 days
<b>Treatment Level</b>	Tertiary
<b>Foot Print</b>	1500 sq ft
<b>Year Built</b>	1998



*Exterior of the Samson Environmental Center*

Using the energy cycling of an aquatic ecosystem as a model, the Eco-Machine treats wastewater from school dorms and other campus buildings before returning the water to the Hudson River watershed. In this alternative system, nature's "processors"—a diversity of microorganisms, snails, oxygen, fish, and higher plants—are used to break down and digest organic pollutants. For a portion of its energy requirements the Eco-Machine utilizes photovoltaic panels and gravity as renewable sources.

In addition to processing the school's wastewater, the Eco-Machine provides a setting for a wide variety of educational activities. Students routinely monitor levels of bacteria,

phosphorous, nitrogen, and other biological and chemical levels. They observe and maintain plant life which grows in the aquatic treatment tanks throughout the facility. By intimately participating with the treatment system, concepts such as nutrient cycling, wetland ecology and the human impact on water quality are effectively conveyed. Since its opening the Samson Environmental Center has been visited by more than 500 guests a year. Educational, corporate and environmental groups have toured the center to learn about environmentally responsible solutions for wastewater treatment. During the winter calla lilies flowering in the Eco-Machine are harvested by a local florist.

## Treatment Process

The Samson Environmental Center Eco-Machine is a greenhouse-based, hydroponic treatment process. Wastewater flows at a rate of 8,500 GPD into a 12,000 gallon tank which initially holds and distributes the wastewater into the first component of the treatment system; a single aerobic digester. This closed tank contains a diverse microbial community that begins the process of breaking down the organic waste. Aeration and mixing is provided by air diffusers at the bottom of the tank. There is approximately 1.4 days of retention in this aerobic tank. This component and the following aquatic cells are all housed in a 1,500 sq ft greenhouse. The effluent from the closed aerobic tank then flows, via gravity, to the first in a series of five open aerobic tanks.



*Students learn about the Eco-Machine*

These open aerobic cells are covered with surface plant racks whose prime function is to provide ideal habitat for a wide range of organisms that function to further breakdown the waste. The robust and increasingly diverse sequence of ecologies within the cells provides highly stable, resilient treatment that minimizes the production of bio-solids. Any remaining solids are then settled out by a clarifier. Following the open aerobic tanks, the waste flow enters the first in a series of two ecological fluidized beds (EFBs). These serve as a final polishing step in the treatment process. An outer ring of open water surrounds a central media-filled core. The flow first enters the outer zone and is circulated down through the media in the center zone. Residual organic matter is removed within this component. Polished effluent from the Eco-Machine is then safely discharged into the Hudson River watershed.