

## National Audubon Society's Corkscrew Swamp Eco-Machine®



*Treatment wetlands are planted with species native to the swamp*

"We feel this attractive yet functional waste water treatment plant is the ideal setting to teach water chemistry, purification, and recycling lessons."

-Ed Carlson, Sanctuary and South Florida Audubon manager

### Background & Design

The National Audubon Corkscrew Swamp Sanctuary, located in Naples, Florida, is a 13,000 acre wildlife preserve and is home to North America's largest remaining stand of old growth bald cypress trees. Nearly two and a half miles of boardwalk trails allow viewers to wander through this primordial landscape and view abundant wildlife among the cathedral-like cypress trees and epiphytic plants including wood storks, migratory birds and alligators.

When the sanctuary was established in 1954, Corkscrew Swamp was a remote wilderness attracting fewer than 10,000 visitors annually in its early years. By 1994, attendance was surpassing 100,000 visitors a year. The increase in visitors overwhelmed the sanctuary facilities and the inability to handle wastewater from the public restrooms was an immediate, intolerable and costly problem. Conventional options included two small "package" plants working in tandem during the peak season with a single plant working during the winter.

<b>Waste Stream</b>	Domestic Wastewater
<b>Treated Flow</b>	6,000 GPD
<b>HRT (hours)</b>	48
<b>Treatment Level</b>	Tertiary
<b>Year Built</b>	2015



*Open aerobic tanks convert nutrients to biomass*

Dr. Todd proposed an Eco-Machine for Corkscrew Swamp that would occupy an area of only 70x70 feet, purify waste without additives, and recycle purified water back into the restrooms for reuse in the toilets. This innovative system also cost substantially less than conventional technologies.

Since its construction in 1994 this system has been providing robust and reliable treatment with a minimum of required maintenance and service. The Eco-Machine not only naturally purifies wastewater, it also helps the sanctuary to reduce potable water demand and serves as a public education facility showcasing native wetland plants and, for a time, housed a butterfly aviary.

## Treatment Process

The Corkscrew Swamp Eco-Machine uses a combination of aerobic hydroponic treatment and constructed wetlands to treat waste suitable to a level safe for reuse in toilets. Waste leaving the toilets is first pumped to two below-ground 10,000-gallon fiberglass tanks for initial anaerobic digestion, then on to a series of 2,500-gallon tanks, each of which is aerated and home to bacteria and green plants ranging from algae to trees. Macro-invertebrates such as snails, shrimp, insects, and fish are also found in the system. In the aerobic tanks nutrients and organic matter within the septic effluent are converted into living biomass and ammonia and organic nitrogen are converted to nitrates. Water then flows into a 6th tank. Any remaining sediment is pumped back to the anaerobic tanks.

The constructed wetlands consist of two 30'x30' plastic-lined, artificial marshes filled with crushed limestone. The wetlands are planted with typical wetland species from the surrounding swamp ecosystem. Here, nitrate generated through aerobic treatment is available for use by the marsh plants. Bacteria living in the anoxic root zone also consume nitrate converting it to harmless nitrogen gas as they decompose dead root growth. When the effluent exits these wetlands, it is clean. But to satisfy state regulators, it is disinfected with chlorine, pumped to a holding tank and then pumped to a chamber to de-chlorinate the water with sodium sulfite. The water is then recycled into the restrooms for toilet flushing.

The Corkscrew Swamp Eco-Machine is one of Dr. Todd's longest running systems and is an example of the longevity and robustness of ecologically-designed wastewater treatment systems.



*The facility has a long center walkway for public access*