

Scavenger Vessel Scrubs Miami River

Low tech and high tech combine to treat the Miami River.

With Miami's emergence as an urban center during the boom of the 1920s, the area's population exploded, resulting in stormwater and untreated sewage flowing unchecked into the Miami River and Biscayne Bay. During World War II, the river became a manufacturing center for PT boats for the U.S. Navy with industrial waste adding to the river's pollution. In the second half of this century, saltwater intrusion, disposal of trash and unwanted items into the river, chemical and oil seepage from the airport and hospitals, along with oil spills have further damaged this once pristine waterway.

Public attention turned to the River's environmental health in the 1970s. In 1984, the Miami River Coordinating Committee came into being as a clearinghouse for information and issues relating to the river. However, cleansing

actions taken in the 1980s did not reverse the river's neglect quickly enough. In 1991, a grand jury report called the river a "cesspool" and attacked the civic and political community's neglect of the river. A second report in 1998 was also sharply critical.

In January 1998, the Miami River Study Commission issued a "call to action" urging a community-wide effort to clean up the river and bring it back to a cleaner state. The Miami River Commission (MRC) soon started to fulfill its mission, by uniting disparate interest groups along the river to act with common cause to restore the river, revive it as a public destination and attraction, and promote its role as a principal focus of trade and commerce. In one of its earliest attempts to improve the condition of the river, the MRC entered into an agreement in 2000 with Water Management

Technologies II for a demonstration project featuring the company's innovative new water decontamination vessel—the Scavenger (www.scavenger2000.com).

Ramifications of the Problems

Miami needed to comply with the Federal Clean Water Act's standards for total maximum daily load (TMDL), which is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. The river suffered from poor water quality as a result of stormwater runoff and a large amount of surface debris. The poor water quality was prohibiting recreational use of the river and negatively impacting the city financially by hurting commercial development in the area. Prior to engaging the Scavenger, the city had used debris collection vessels, but these only removed trash from the water, not harmful contaminants.

Following the success of the Scavenger Pilot project, the city entered into a new service contract with Water Management Technologies in 2001 to use its Scavenger decontamination vessel to continue cleaning the Miami River.

According to analysis by Nova Southeastern University's Oceanographic Center, the Scavenger can significantly improve water quality. A single pass through the vessel's systems can reduce bacteria and coliform in water up to 98 percent, and algae counts by more than half. Today, the boat continues



Scavenger has a narrow beam—only eight feet—but opens its split bow from the center, mimicking the claw of a lobster, to dramatically widen its sweep through the Miami River.

to patrol and clean the Miami River. In its five years on the river, more than 40,000 cu ft of trash has been removed, 20 billion gallons of water decontaminated, and 1.5 billion liters of oxygen introduced into area waters

The key to the vessel is an advanced water decontamination system that treats and revitalizes waterways by directly aerating the water with a combination of ozone and oxygenation. In one swift sucking motion, the boat scoops up floating debris, destroys bacteria, oxidizes oil sheen, and then pumps cleansing, life-supporting oxygen into the water. This process raises the overall dissolved oxygen levels in the water. The moving boat can pump about 130,000 liters of oxygen per hour into the water up to a depth of 30 ft and treat 10,000 gal of water per minute.

When oxygen is pumped into infected water, the enrichment contributes directly to reducing suspended toxins. With the addition of ozone to the aeration process a powerful yet environmentally safe disinfection occurs in the body of water being treated. Ozone has been applied with great success in municipal sewer treatment processes worldwide because of its ability to disinfect water without leaving the harmful by-products left by chlorine. In fact, ozone has been found through laboratory examination to be more than 100 times as powerful as chlorine in destroying *E. coli* bacteria.

Ozone alters the surface charge, allowing suspended particles to coagulate and be easily removed. In addition to reducing odor and algae and improving water clarity, ozone effectively filters most pesticides and other polluting chemicals.

A colorless gas, ozone, is so extremely unstable that it must be manufactured on board the boat. Production of ozone normally is accomplished by passing oxygen through an electrical field such as might be created by two electrodes. Scavenger's water cleansing system uses an onboard system to create ozone, which is fed into the 10,000 gal of river water that passes under the boat every minute. In this application, the ozone neutralizes germs and viruses, destroys and removes algae, and removes color,

taste, and odor from the water it touches. Then the ozone decays rapidly, providing a generous supply of oxygen to the water it has just disinfected.

In operation, a single worker drives the boat, steering it into the most needy areas and operating the system that collects debris as well as the water cleaning and aeration systems. Occasionally this person also controls the water cannon that can spray the shoreline to clear debris and also further aerate the river water.

Scavenger operates in a surprisingly low-tech manner in one aspect of its work and is rather high-tech in the other. In collecting surface debris, the narrow boat—with only an eight-ft beam—opens its split bow from the center much like the claw of a giant lobster, dramatically widening its sweep through the water.

In the process, debris on the surface gathers at the base of the claw and is periodically lifted out of the water by a wire basket and deposited into the boat's trash bin. The debris varies in size, from soda bottles, plastic sheets, and foam cups to 55-gal drums. Glass bottles and spray cans are common.

"Natural" trash items such as coconuts, tree limbs, and sea grass abound. Dog, cat, chicken, and small fish carcasses make up about two percent of the haul.

Boat Specifications

The 38-ft Scavenger is constructed from Cor-Ten steel and built in accordance to internationally recognized marine vessel design standards. It stands ten ft tall from the water line, has an eight-ft beam, and weighs 10.5 metric tons. It is equipped with an opening bow and ballasting system and can be operated by one crewmember

An important part of the boat's design is a transfer hopper basket for scooping debris out of the water. The bucket can hold up to one quarter of a cubic meter and is emptied into a large containment bin that can hold six or more cubic meters.

The boat is also equipped with a water cannon capable of shooting 1,000 gal of water a minute at 100 psi to douse fires and reach hard to clean shorelines.

In the water, the specially designed deflector enables the vessel to do 360-degree turns in place—essential for operating in narrow and hard to reach places. The vessel never stops the decontamination process—even while it is moving. The boat was designed for rapid deployment with an easy to remove cabin and can be easily transported by road, rail, ship, or plane.

As a side benefit, operators of the boat have found and notified officials about more than 250 hazards to navigation that were spotted on or just under the surface of the water. Some have been well over 20 ft length long and have included shopping carts, a bookcase, and a tent.

Yearly maintenance includes painting the hull and greasing all mechanical parts. In addition, every three months the boat receives an engine oil change and all fluids are replaced. If the boat is leased from the manufacturer, the company supplies the maintenance, the captain, fuel, other trained personnel, insurance, and garbage removal. Related costs include fuel, garbage removal, insurance, captain fees, water quality analysis sampling, monthly system performance test, mortgage on boat, and yearly registration fee for boat.

Compared to surface debris removal only, the Scavenger costs about \$50 more an hour. However, the benefits are well worth it. Unlike traditional trash removal boats, the boat removes debris while cleaning and re-oxygenating the water. It actually improves the quality of the water it patrols.

The vessel is a proven and effective water treatment solution for any body of water (salt and fresh water) that is not too far from shore. In other words, it works best in water with waves smaller than four ft. It is effective in polluted lakes, rivers, ports, bays, and industrial wastewater. Contamination of water by chemical waste, floating debris, and stormwater runoff is creating a growing concern for the world's waterways. The vessel deals effectively with issues related to low levels of dissolved oxygen. It improves water quality by reducing and eliminating bacteria and viruses, controlling algae growth, improving water clarity, and eliminating odors. 