

## The Tema Living Machine®

The Living Machine demonstration system is located in the port city of Tema between a residential community and an important wetland called the Sakumono Lagoon. The lagoon receives water from the heavily polluted Sakumono River. The Living Machine is located a few kilometers from the mouth of the lagoon where it empties into the Gulf of Guinea and Atlantic Ocean.



*Sakumono Lagoon*

In the past, sewage from the adjacent community entered a primary treatment tank and was released directly into the Sakumono Lagoon. Now the wastewater from the primary tank enters the Living Machine and the treated water emerging from the system is being used to irrigate a food crop and to sustain the surrounding wetland.



*Tema Living Machine newly planted wetland cell*

The demonstration system has an 8,000 gallon per day (30 m<sup>3</sup>) wastewater capacity. Living Machines can be designed to treat much larger flows (>200,000 gallons per day -- >750 m<sup>3</sup>).

## Visit the Demonstration Site

Visitors are welcome at the Living Machine® demonstration site. An observation deck and interpretative signs are in place for educational purposes.

### Directions

To reach the site, take the Accra-Tema Highway to Hospital Road. Go towards Tema 3 km to SOS (Hermann Gmeiner) Road. Take a right on SOS Road, go 2 km, and turn left on Cocoa Avenue. Go to the end of Cocoa Avenue and turn right on Tangerine Street. The Living Machine is located at the end of Tangerine Street in Tema Community 10.



*Tema Community 10*

Worrell Water Technologies is working to help Africa meet its water supply and water quality needs. The company is exploring ways for the Ghana project to help advance activities throughout the continent. Our hope is to build capacity within Africa to design, construct, and operate Living Machine systems to help ensure the availability of clean water for the benefit of all people and the environment.



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## Natural Wastewater Treatment System



## Technology Demonstration

**Tema, Ghana**



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## Water: A Valuable Resource

Water is a vital resource, particularly in many areas of Africa where demand greatly exceeds availability. A reliable supply of clean water is essential for human health and economic growth. Efficient, low-cost, and widely available wastewater treatment and reuse is critical to meeting Africa's water demands.



Tema Living Machine horizontal flow wetland at start up

## The Need for Clean Water

As in other areas of Africa, many waterways in populated areas of Ghana are heavily polluted, creating public health and economic problems. Fisheries along the coast have been adversely affected by sewage and industrial pollution, diminishing this important food source. Major improvements in wastewater treatment capacity are needed to protect public health, ensure an adequate supply of clean water for agriculture, sustain fisheries, and allow for economic growth.

Smaller, less expensive, decentralized systems are more practical in countries seeking to rapidly advance their water quality programs. Large conventional wastewater treatment systems are beyond the reach of most communities. Multiple decentralized systems can also be coordinated as part of a regional or national water management strategy and integrated with economic development and job creation programs.

## What is a Living Machine®?

The Living Machine is a small-scale, energy efficient wastewater treatment system ideally suited for application in Africa. It operates by simulating and speeding up natural wetland processes to treat wastewater. This innovative technology has been built in numerous locations over the past ten years in the United States and other countries.

Living Machine systems are a product of Worrell Water Technologies, LLC a company established to help make clean water available to all people worldwide. Worrell Water Technologies is working to advance small scale, low cost technologies to address this urgent global challenge.

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*“Clean and safe water is the foundation of healthy and productive lives, and our technologies and solutions will further water availability throughout the world.”*

*— Thomas E. Worrell, Jr.  
Founder, Worrell Water Technologies*

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Economic growth requires clean water, human health, and environmental health. The Living Machine is not just a technology; it is a system that helps fulfill these requirements and provide a basic human need: clean water and sanitation for a healthy, prosperous life.

## The Living Machine Technology

Living Machines are a family of natural wastewater treatment technologies designed to treat a wide variety of wastewater for reuse using no harmful chemicals, only a small amount of supplemental energy, and no free water surfaces.

The **Hybrid Wetland Living Machine** installed at Tema is the most energy efficient design currently in use. This system is a hybrid of two wetland subsystems:

- In the **Horizontal Flow Wetland** subsystem, wastewater moves laterally through a gravel

medium, where bacteria and microorganisms remove pollutants.

- The **Tidal Flow Wetland** subsystem accelerates the productive ecological processes of natural tidal marshes, alternately draining and filling a bed of crushed brick to maximize effectiveness.

The Living Machine process facilitates the removal of harmful nitrogen-containing compounds. When these compounds contaminate ground water they adversely affect human health, and can also cause ecological collapse of aquatic habitat, impacting the local economy.

Water treated by the Living Machine system is ideal for agricultural irrigation, landscaping, or certain industrial processes. If the desired product is drinking water, the effluent from the Living Machine can be treated further with other purification technologies.



Living Machine wetland

## Living Machines in Africa

To demonstrate the value of this technology in Africa, Worrell Water Technologies has donated a Hybrid Wetland Living Machine to the city of Tema, which participated in the construction of the system and has taken over operation and maintenance of it.

The Tema system showcases the key features of this technology including low cost, ease of maintenance, water reuse, and aesthetic attractiveness. It also demonstrates the opportunity to reuse the effluent for agricultural irrigation. Water reuse is becoming increasingly important throughout the world as the availability of freshwater declines.