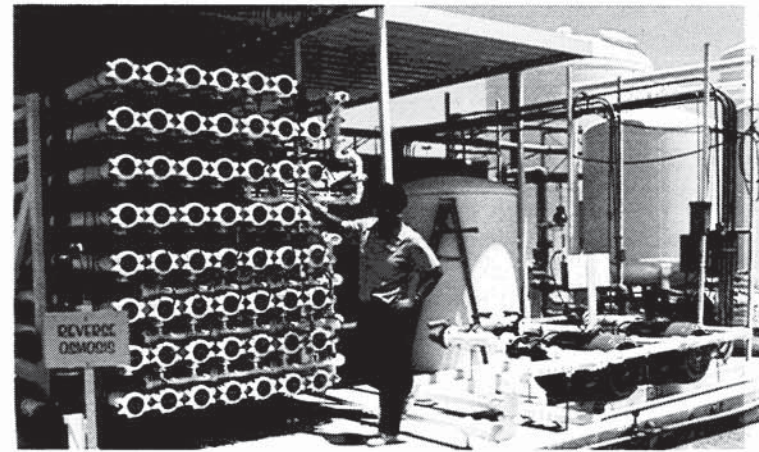


## Sewage Treatment

For more than a decade, NASA's National Space Technology Laboratories (NSTL), Bay St. Louis, Mississippi, has been conducting research on the use of aquatic plants—principally water hyacinths—for treatment and recycling of wastewater. Already serving a number of small towns, the "aquaculture" technique has advanced significantly with its adoption by a major U.S. city. The Water Utilities Department (WUD) of San Diego, California is using water hyacinth filtration as part of a multi-step reclamation process designed to recover potable water from sewage.

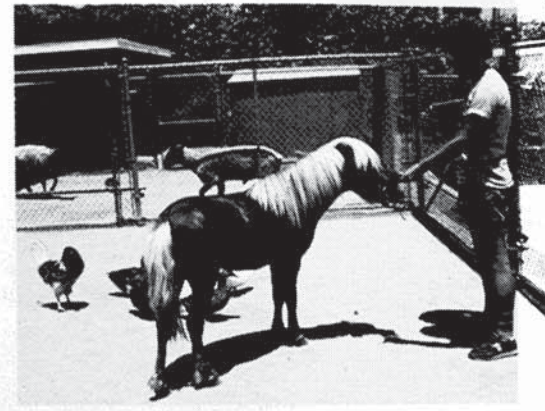
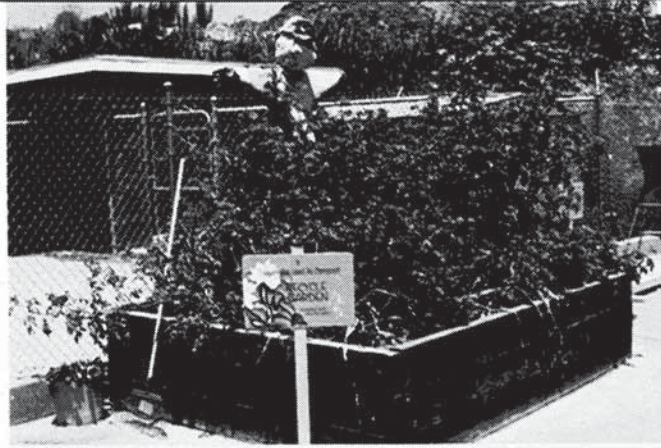
In the early 1970s, NSTL discovered that the glossy green water hyacinths literally thrive on sewage; they absorb and digest nutrients and minerals from wastewater, converting sewage effluents to clean water. Thus, they offer a means of purifying water at a fraction of the cost of a conventional sewage treatment facility. Additionally, they provide bonus value in byproducts. The protein-rich hyacinths must be harvested at intervals; the harvested plants can be used as fertilizer, as high protein animal feed, or as a source of energy.

NSTL first tested the practical application of aquaculture in 1975, when hyacinths were planted in a 40-acre sewage lagoon at Bay St. Louis; the once-noxious lagoon soon became a clean water garden.



NSTL published a study report that attracted considerable attention and followed up by providing technical guidance to communities interested in applying the technology. Several southern towns, with populations ranging from 2,000 to 15,000, use water hyacinths as their year-round primary method of treating wastewater. Other towns employ aquaculture as a part-time or supplementary process in sewage treatment operations. In its Experimental Prototype Community of Tomorrow, Walt Disney World, Buena Vista, Florida operates a water hyacinth facility to explore advanced applications. Wastewater treatment capacity of these installations ranges from 50,000 to 350,000 gallons a day.

San Diego has been involved in experimental water reclamation projects since the 1950s because the city does not have enough potable water to meet the needs of its population; it must import water from the Colorado River and from northern California.



In the late 1970s, WUD developed a two-phase reclamation system involving a process called “reverse osmosis,” which removes most of the salt and viruses from the sewage, and a carbon absorption technique that further purifies the wastewater. Early tests found the system efficient and cost-effective, but there was need for a means of removing other pollutants, such as metals and suspended solids. After consultation with NSTL, the city added a water hyacinth treatment facility and the combined processes began operation as an experimental system in 1981, treating 25,000 gallons of sewage daily. Additional testing demonstrated the system’s capability for producing reclaimed water of extremely high quality; the tests also showed that toxic waste buildup, a normal result of other methods of treatment, does not occur in the aquaculture facility because the hyacinths reproduce rapidly and must be harvested frequently, thus toxin accumulation is limited. The prototype facility operated so successfully over a two-year span that San Diego built a one million gallon per day plant for service in 1984. The new facility has an aquaculture component that employs—in addition to water hyacinths—a reed-rock filter unit, the latest wastewater treatment developed at NSTL. The hybrid aquatic plant/microbial filter combination, unlike the water hyacinth system, will operate in cold as well as warm climates.

The accompanying photos illustrate the sewage treatment process in the initial San Diego facility. At upper left on the opposite page is the first step, in which the sewage passes through a screening device for removal of large solids. The raw sewage is pumped into greenhouse-like aquaculture tanks, such as the one shown below the screening device. After aquaculture cleansing, the water is further treated by an “ultrafilter,” then it passes into the reverse osmosis facility (left center) where it is demineralized. A final cleanup is provided in a carbon absorption tank. San Diego’s WUD projects that, within the next decade, the system will be able to treat 40 percent of the city’s sewage, substantially reducing water and sewage bills and providing drinking water of much better quality than could be obtained by other reclamation methods.

WUD is also investigating the byproduct bonus potential of harvested water hyacinths. The photo at lower left shows hyacinths being harvested. The left-hand photo above pictures an experimental garden in which hyacinths are used as compost. Animals are fed chopped harvested hyacinths (top right) and they also drink the processed water. Other harvested plants are ground up and pumped into a bacterial digester (right center) that produces methane gas (right) for use in generating electricity.

