CLEAN

By Daniel Rome Levine

Engineering firms must design infrastructure projects that seamlessly mesh with the environment. Nature, viewed from the perspective of an engineer, can be likened to a row of dominoes: Topple one and a whole row of complications can follow. Below are five brief case studies on how ACEC-member firms are working to implement groundbreaking water infrastructure designs in an increasingly eco-sensitive world, all the while making sure the dominoes fall in the right way.

WATER & ENVIRONMENT

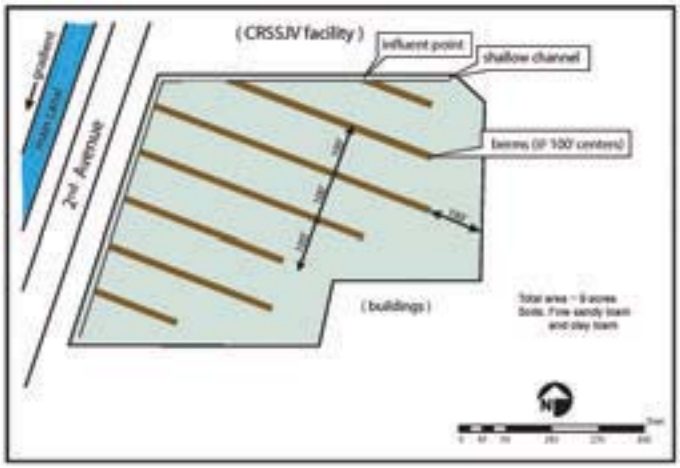
ACEC member firms apply innovative solutions to water infrastructure dilemmas

PROJECT:
Colorado River Indian Tribes Wetland Design

FIRM:
Project Resources Inc.; San Diego

Jeremiah Jackson

The nine-acre artificial marsh (opposite page) will treat pollutants and recycle water for future use.



When a consortium of seven American Indian tribes located near Parker, Ariz., considered building an artificial marsh as an alternative to discharging a million gallons of treated sewage a day into the Colorado River, it turned to Jeremiah D. Jackson at Project Resources Incorporated (PRI).

It was a good choice. For the last 25 years, Jackson, an executive vice president with the firm, has designed marshes all over the world that treat contaminated water and wastewater.

In this case, a sewage treatment plant owned by the Colorado River Indian Tribes (CRITs) already was removing about 90 percent of the pollutants. But they wanted even cleaner effluent and they wanted it to be reusable.

CRITs and Jackson came up with the idea of building a nine-acre marsh right next to the treatment plant that would not only retreat the water so that nearly all of the pollutants would be removed, but would then make it possible for the treated water to be re-injected into the aquifer so that it could be accessed later from wells as drinking water. When completed, the marsh is expected to treat one million gallons of water a day.

"It's a great way to store water without having to build water tanks," says Jackson.

Since the marsh is to be built on land that mostly is sand and, therefore, highly permeable, the challenge was coming up with a way to keep the marsh water from simply being sucked into the earth. PRI designed a network of shallow channels that will crisscross the marsh and keep the water moving across its surface.

The project will be built this spring, and Jackson says he can't wait to see the results. "Not only is the marsh a sustainable technology, but also it allows the recycling of a scarce resource, namely water," he says.

Tarpaulin-like covers control the temperature of the lagoon and help kill bacteria.

PROJECT:

Jasonville Wastewater Treatment Facility

FIRM:

Hannum, Wagle & Cline; Terra Haute, Ind.

Michael Cline

A portion of the UV Disinfection System at the Jasonville site.

About five years ago, the mayor of tiny Jasonville, Ind., had a frustrating problem. His town, about 75 miles from Terra Haute, had a lagoon wastewater treatment facility that did not comply with new environmental regulations for ammonia nitrogen bacteria. This bacteria is resistant to a lagoon's cleaning process, especially in cold weather, which is common in Jasonville for half the year.

The mayor met with Michael Cline, vice president at Hannum, Wagle & Cline (HWC), and, according to Cline, said: "Every engineer tells me I've got to put a mechanical treatment plant in and get rid of the lagoon."

Cline knew that mechanical plants were not well-suited for small towns like Jasonville because of their expense and high power consumption. He told the mayor he would try to find a way that he could keep his lagoon and still get rid of the ammonia nitrogen bacteria.

Cline's research led him to Lemna Technologies, Inc. in Minneapolis, which makes special covers for lagoon-based facilities. HWC's engineers blanketed the 10-acre lagoon with large sections of a tarpaulin-like material that were sewn together and floated on pieces of foam, similar to a massive swimming pool cover.

The purpose? The cover controls the temperature of the lagoon and makes it possible to kill the ammonia nitrogen bacteria. Also, because the temperature is controlled at a constant level, the city was able to get a 20-percent increase in rated capacity.

But the special cover did not quite reduce the ammonia nitrogen levels called for by the new regulations. To fix this, HWC engineers designed an upflow reactor to treat the effluent just before it was released into the nearby Eel River. The reactor essentially forced the treated sewage and the few remaining ammonia nitrogen bacteria into a tank filled with water and thousands of tiny filtering balls floating on top. The ammonia nitrogen was filtered out as the sewage passed through.

The $2-million system went into effect in October 2005 and cost about $700,000 less than a mechanical plant would have.

"We as engineers tend to be conservative and risk-averse," says Cline. "But here's a case where we tried something different and we were able to meet the needs of the mayor and the townspeople."

PROJECT:

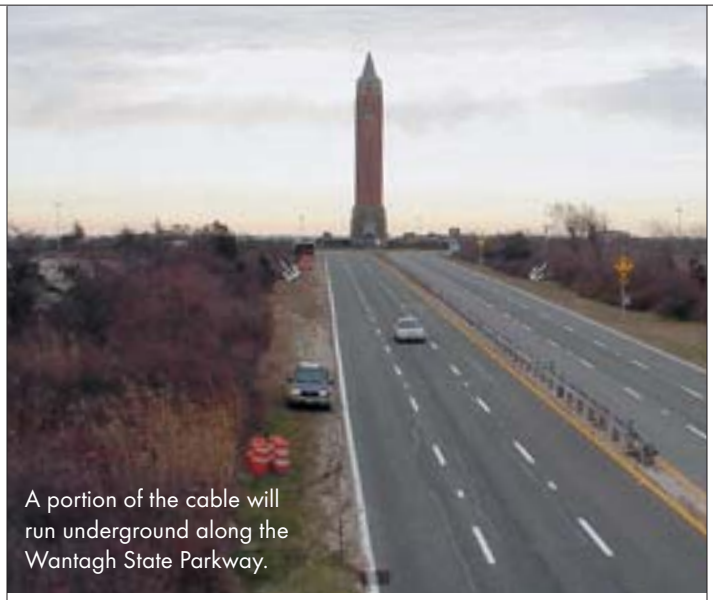
Neptune Regional Transmission System

FIRM:

P.W. Grosser Consulting Engineer & Hydrogeologist;
Bohemia, N.Y.

Paul Grosser

Lisa Santoro



A portion of the cable will run underground along the Wantagh State Parkway.

The Bohemia, N.Y.-based P.W. Grosser Consulting Engineer & Hydrogeologist is playing a pivotal role in the development of what is being described as the most important energy project ever undertaken for New York's Long Island.

The project, which started construction in October 2005, will provide 660 megawatts of power to Long Island via a 65-mile-long cable stretching 52 miles underwater from New Jersey. When completed later in 2006, it will provide 10 percent of the island's power demand.

P.W. Grosser is responsible for monitoring environmental compliance of the $600-million cable project, known as the Neptune Regional Transmission System, and providing the New York Public Service Commission with regular environmental compliance reports.

"Our role is to ensure the protection of the sensitive environmental areas through which the cable passes," says Paul W. Grosser, the company's founder. "This includes proper storm water and silt management as well as the proper placement of excavated material."

A big part of that is proactively looking for potential trouble spots.

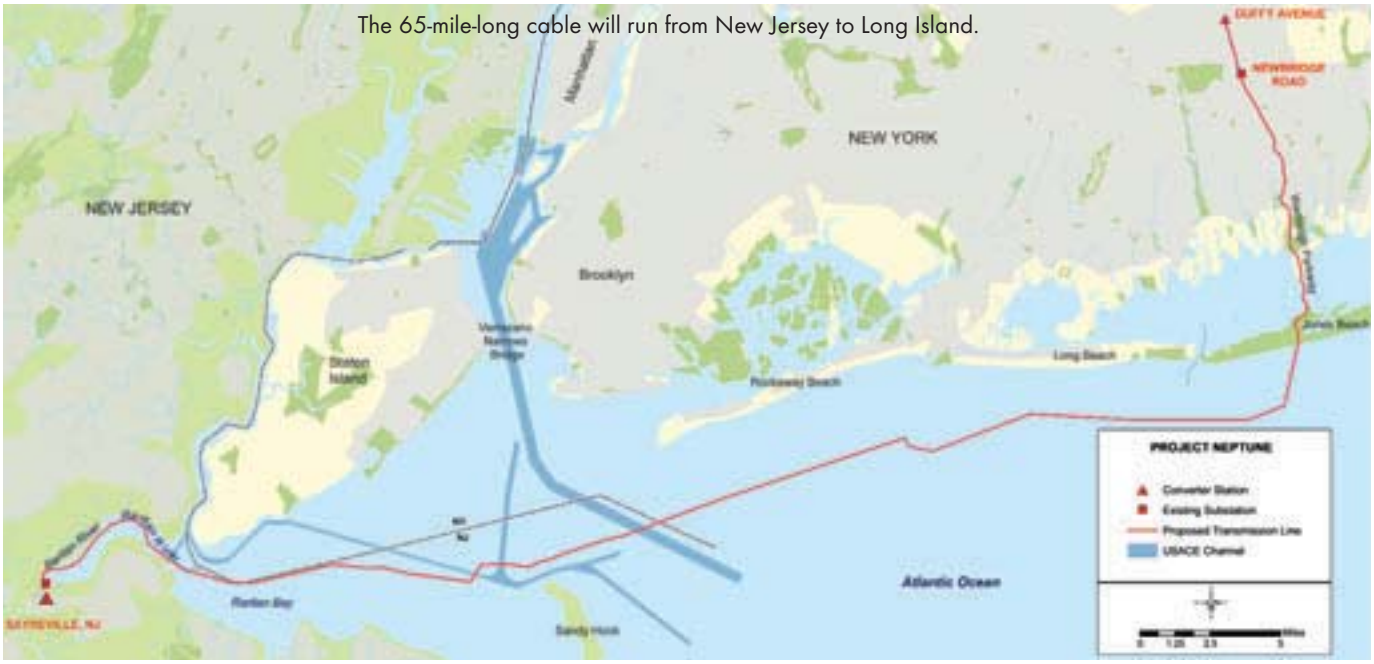
"We try to head off problems so that action can be taken before they become real problems," says Lisa Santoro, P.W. Grosser's project manager. "The hard part is getting construction workers to appreciate and understand the potential environmental impact of their activities."

In addition to running primarily underwater, a 15-mile underground section of the cable will parallel the Wantagh State Parkway and traverse several environmentally sensitive areas, including wetlands.

Anything that could harm the environment, such as horizontal directional drilling or trenching near wetlands, is reported to managers of one of the two companies running the project, Prysmian Power Cables and Systems U.S.A. and Siemens Power Transmission and Distribution.

"This project will provide power to Long Island and protect its fragile natural resources," says Grosser. "Those are two things that our organization is all about."

The 65-mile-long cable will run from New Jersey to Long Island.



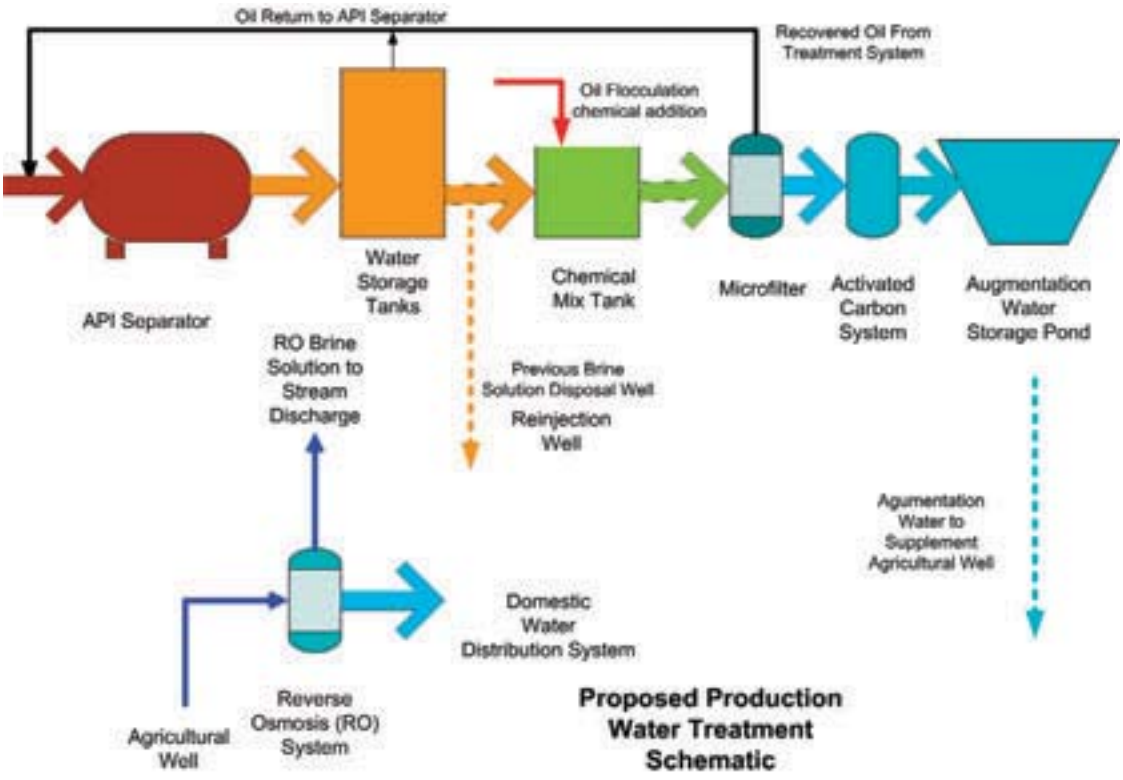
PROJECT:

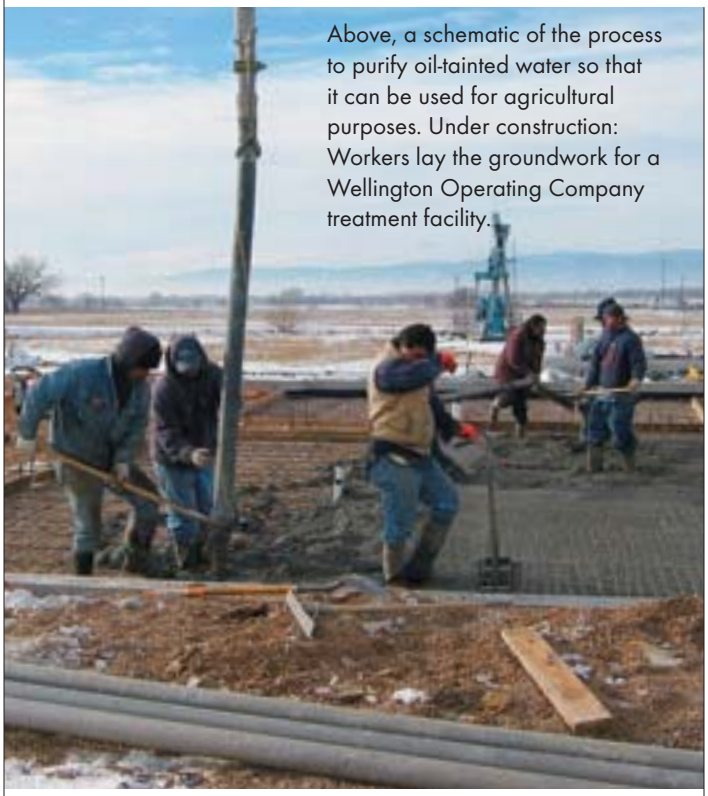
Wellington Operating Company Wastewater Treatment Facilities

FIRM:

Stewart Environmental Consultants;
Fort Collins, Colo.

David Stewart





Above, a schematic of the process to purify oil-tainted water so that it can be used for agricultural purposes. Under construction: Workers lay the groundwork for a Wellington Operating Company treatment facility.

Water is a scarce resource in the West, and Colorado is no exception. High population growth is straining a water supply still drained from a severe drought four years ago, while snow melt captured by reservoirs is no longer sufficient to meet increasing demand.

That's why engineers at Stewart Environmental Consultants are looking for water in unusual places—in oil wells.

When oil is pumped out of the ground it brings with it large quantities of water. This so-called production water is typically re-injected where it came from, about a mile beneath the earth's surface.

David R. Stewart, president and CEO of Stewart Environmental Consultants, has formed Wellington Water Works. Along with two partners, he plans to use a new process to purify this tainted water so it can be consumed and used for agricultural purposes.

Starting this summer, Stewart engineers will begin taking production water from 35 oil wells owned by Wellington Operating Company, an oil producer outside Fort Collins, and treating it at two plants, one using reverse osmosis and special ceramic membranes patented by Stewart, to remove all traces of oil and heavy metals.

"By treating this water we're taking what was considered waste product and turning it into an asset," he says.

It could be financially rewarding, as well. Because water in Colorado is considered a property right that is valued at up to $20,000 per acre-foot, this treated production water can be sold to communities or agricultural interests eager for new sources of water. Wellington Water Works is in final negotiations with the town of Wellington to purchase $2.6 million worth of this treated water.

But even after the facility that uses reverse osmosis is ready, there may still be hurdles, like securing the required state permits to begin operation.

State officials who have never seen such a treatment process for oil production water have been slow to act, says Stewart, and have dragged the approval process for three permits out over more than three years. "The biggest challenge has been the regulatory maze we've had to go through," he adds. "I was amazed."

PROJECT:

Forest Park Water Treatment Plant

FIRM:

Gannett Fleming;
Camp Hill, Pa.

Gene Koontz

In suburban Philadelphia, Gannett Fleming has designed a way for a major water treatment plant to double its capacity and produce cleaner water, all without expanding its space.

The change at the Forest Park Water Treatment Plant was brought about by new federal water quality regulations, which require higher removal of certain organisms, such as cryptosporidium, a parasite commonly found in lakes and rivers.

Gannett Fleming is installing high-tech membrane filters made of a polymer material to ensure these disease-causing bacteria don't make it into the water supply.

Because the new membrane technology is capable of catching and straining much smaller particles, it will nearly double the plant's treatment efficiency. And because the membranes are so efficient, they will allow the plant to double its capacity to 40 million gallons of water a day when the project is completed in spring 2007.

Prior to starting construction in April 2005, Gannett Fleming and Forest Park Water went through an exhaustive one-year preliminary engineering process to ensure the membranes would be effective. This included extensive pilot testing and cost evaluations. The firm and client finally settled on membranes manufactured by U.S. Filter, of Warrendale, Pa., a division of Siemens.

The membranes aren't the only upgrade at the plant. Gannett Fleming also is increasing pump capacity and installing plate settlers, which will improve the plant's ability to capture sediment in the water prior to the membranes.

All of this is being done within the plant's existing space for $33 million, "a fairly economical cost because we limited the amount of new construction," says Gene Koontz, Gannett Fleming's senior vice president and director of environmental resources.

The new membrane technology not only is making it possible to upgrade the plant within its current space, but it also means customers of Forest Park Water in the Pennsylvania counties of Montgomery and Bucks will enjoy cleaner water far into the future.

"This project meets all new environmental regulations and provides people the assurance that their water is safe to drink," says Koontz. ■

High-tech membrane filters at the facility keep disease-causing bacteria from entering the water supply.