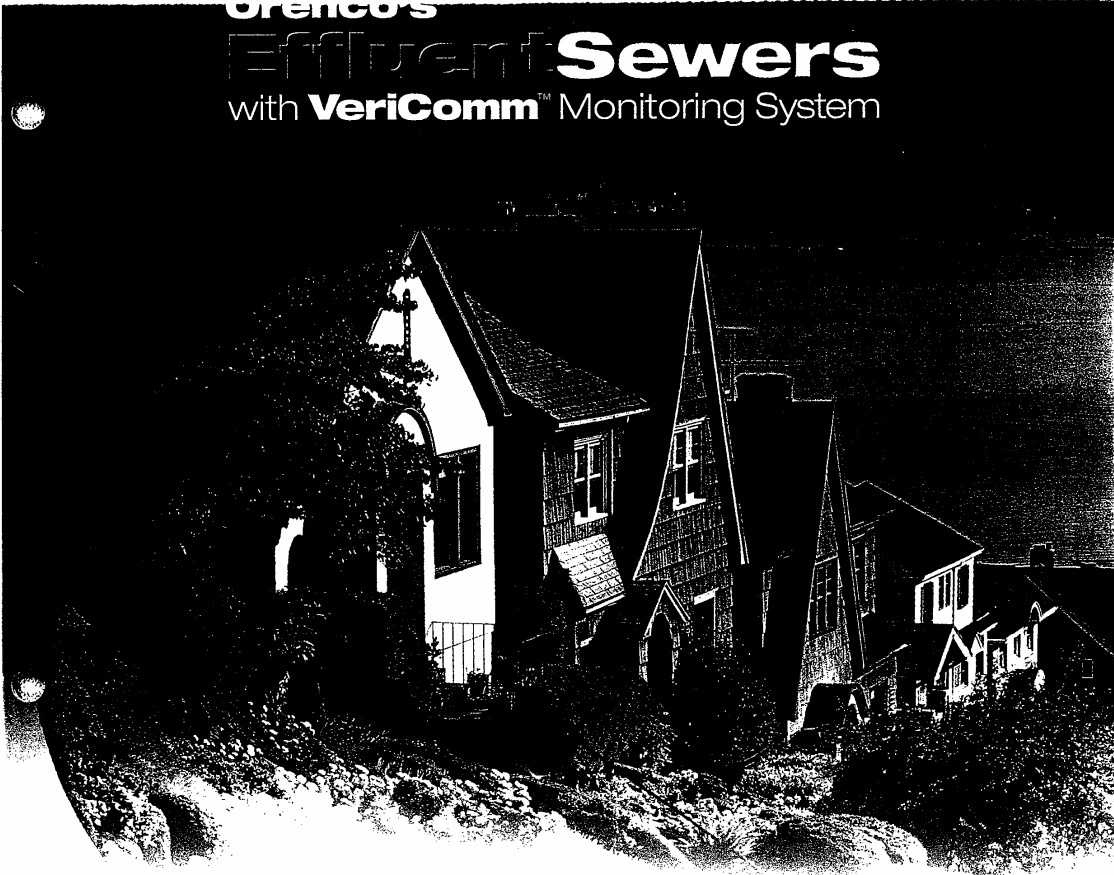


Orenco's
Effluent **Sewers**
with **VeriComm**™ Monitoring System



Cost-Effective
Environmentally Sound
Wastewater Collection System

IDEAL FOR:

- Small & mid-sized communities • Rural communities
- Neighborhood clusters • New residential subdivisions
- Commercial properties • Replacement of failing systems
- Sewer expansions • Ecologically sensitive areas (waterways, wetlands)
- Any site conditions (flat, hilly, shallow bedrock, high groundwater)



Orenco Systems
Incorporated

800-348-9843
orencocom
vericomm.net

About Orenco

Orenco Systems®, Inc. was founded in 1981 by President Hal Ball and Executive Vice President Terry Bounds to respond to widespread failures in Oregon's onsite wastewater systems.

Over the past 24 years, the company has grown to become an industry leader, with about 240 employees and more than 100 distributors and dealers, who represent most of the United States, Canada, New Zealand, and parts of Europe and South America. Research, Product Development, Engineering and Technical Services, Manufacturing, and Sales Support are handled out of our 23-acre facility in Sutherlin, Oregon.

Orenco designs and manufactures advanced onsite and decentralized wastewater technologies for individual properties, commercial facilities, and small communities – properties that are not connected to centralized sewers or whose sewers are failing or at capacity.



Orenco Systems®
Incorporated

*Changing the Way the
World Does Wastewater®*

Our wastewater solutions involve watertight fiberglass tanks, in-tank filtration systems (Biotube® effluent filters and pump vaults), secondary treatment systems (AdvanTex® textile filters, intermittent sand filters, and recirculating sand filters), effluent sewer collection systems, ProSTEP® pumping packages, accessory items, and advanced electrical controls (see back).

Our products and systems allow treated effluent to be returned harmlessly to the environment via drainfield, subsurface irrigation, or surface discharge. We have a maintenance division and an

environmental lab, and we invest time and money in a continuing research program, often in cooperation with colleges and universities.

Our research and technologies appear in numerous publications, including Metcalf & Eddy's *Wastewater Engineering: Treatment, Disposal, Reuse* and Crites & Tchobanoglous' *Small and Decentralized Wastewater Treatment Systems*. Our engineers are regularly asked to give workshops, and our systems have been installed all over the world.

800-348-9843 • www.orenco.com • www.vericomm.net

AHO-GEN-2
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Orenco Systems®, Inc.

Orenco's Effluent Sewers

Rely on Orenco for System Support

Orenco's innovative solutions to wastewater problems have become state-of-the-art. Our designs appear regularly in engineering textbooks and professional journals, and our engineers are invited to speak around the world. We routinely offer our expertise in the following ways:

Presentations

Orenco representatives are often available to make presentations to city councils, agencies, and community groups.

Engineering and Design

We can provide referrals to engineers who have successfully designed effluent sewers. And we offer a wide range of engineering and technical support services, from plan reviews, hydraulic analysis, and CD-ROMs to complete plan preparation,

bid documents, material specifications, O&M support, and tech support for advanced controls, including telemetry.

Training

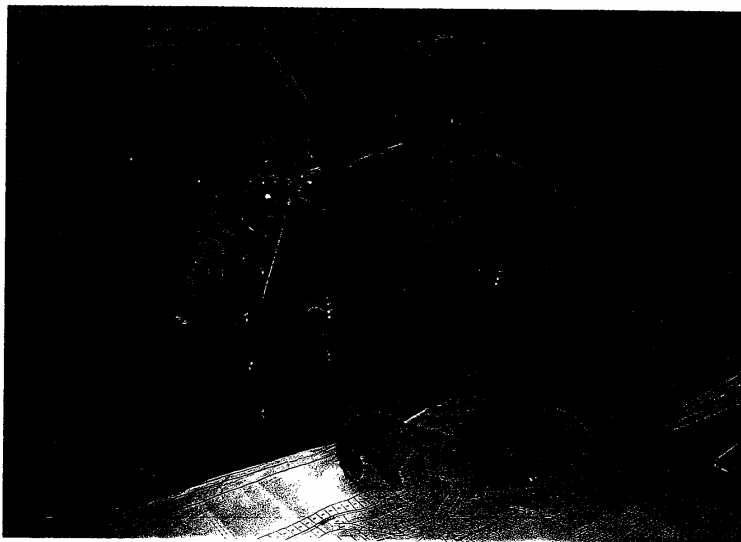
We offer installation and operation trainings and sponsor forums that give operators the chance to share tips and information.

Because our team of civil, environmental, mechanical, and electrical engineers work exclusively in the onsite and effluent sewer industries, we're able to offer unmatched

technical assistance. When you choose an Orenco system, you'll have the industry leader behind you.



We provide training at our headquarters and around the country.



Orenco maintains an environmental lab and invests heavily in research.

Our engineers offer unmatched technical assistance. They're specialists in the onsite and effluent sewer industries.

Orenco's Effluent Sewers

Frequently Asked Questions

Effluent Sewer Systems have been in use for several decades. During that time, the technology has improved so dramatically that effluent sewers are highly recommended by the U.S. Environmental Protection Agency, as well as by engineers, academics, and public agencies.



Who takes care of the system?

The community or a utility will own the system and provide centralized maintenance. Orenco's VeriComm® Monitoring System can provide automated, round-the-clock, computerized supervision. Orenco provides training for system operators and engineers.

Will there be lots of service personnel on people's property?

No. Service time per home averages less than 1 hour every 5 years. Utility meter readers come by far more frequently.

Do pumps have to be repaired or replaced frequently?

No. With normal maintenance and cleaning, our pumps last more than 25 years. Plus the electricity to run them averages less than \$1 per month.

Will the system smell?

No. Not if properly designed and installed. Any wastewater collection system will smell if not properly designed and installed.

I've heard stories about these systems failing. Are they true?

Orenco's Effluent Sewers work well. Solid engineering, proper equipment, and attention to detail ensure that. With any type of sewer system, poor engineering, substandard equipment, or sloppy installation can cause problems. Orenco's Effluent Sewers have a well-documented track record of success.

Is the underground tank hard to take care of?

No. We require watertight tanks, and most need pumping only once every 10-12

years. Otherwise, they're underground, out of sight and out of mind.

What happens to the solids that accumulate in the tank?

Accumulation of solids occurs slowly because of the digestion process that takes place in a watertight tank. In fact, the tank digests more than 80% of the biosolids. Remaining solids are easily managed through planned pumping schedules.

What if something goes wrong with my tank?

Each property has a control panel with an alarm function. VeriComm® Control Panels automatically notify your system's operator of alarms and have advanced logic to keep the system running. And the 24-hour reserve space in your tank gives the operator time to have a problem checked.

If I have more questions, whom can I call?

Call Orenco, toll-free, at 800-348-9843.

Orenco's Effluent Sewers

Community Case Studies

Hundreds of communities throughout North America are successfully collecting and treating their wastewater with Orenco's Effluent Sewer Systems. For more detailed case studies, as well as a reference list of communities and contact names, go to www.orenco.com and click on "Community Collection Systems."

Diamond Lake, Washington

In 1986-87, an Orenco Effluent Sewer system serving 500 homes was installed in this Washington lakeside community. Half the properties are seasonally occupied, with sudden start-ups and prolonged shut-downs. And the winters are very cold. Even so, operator Larry Garwood said, "The systems are simple, dependable, and easy to maintain."

New Minden, Illinois

The small farming community of New Minden, Illinois (pop. 228) is attracting nationwide attention for its Orenco Effluent Sewer and recirculating gravel filter. Built for little more than \$1 million — half the cost of the gravity sewer bid — the system produces such clean effluent (BOD and TSS below 3.0 mg/L) that it discharges to a stream. Cost per dwelling? Less than \$8,000 for collection and treatment.

Elkton, Oregon

In 1989, an Orenco Effluent Sewer system was installed to serve more than 100 homes and businesses in Elkton, Oregon, at an average cost of less than \$7,000 per home for both collection and treatment. Ten years after installation, maintenance on the entire collection system averaged less than one hour per month, and not a single residential septic tank needed pumping.

Steamboat, Oregon

In 1999, an Orenco Effluent Sewer, followed by an innovative textile filter treatment system, was installed in Steamboat, Oregon, to replace a leaking gravity system along a wild and scenic river. Annual operating costs have been reduced by a factor of 12!

Glenwood, Alabama

This 130-home community in southeast Alabama installed an Orenco Effluent Sewer system in 1995, at an average cost of \$5,000 per home. Because each home has its own 1/2-horsepower pump, the effluent can be



pumped more than seven miles to a nearby community for treatment, and no lift stations are required along the way.

SW Barry County, Michigan

To preserve water quality, this Michigan lake county has had an effluent sewer system since 1993. The system includes more than 1200 Orenco units. Orenco's units have worked so dependably that hundreds more have since been ordered.

"Progressive AE has been designing and observing the installation of STEP systems for small Michigan communities for over 15 years. And we've used the Orenco Systems STEP unit exclusively for more than 10 years."

William J. Parker, P.E.
Progressive AE

Orenco's Effluent Sewers

A Fraction of the Cost of Conventional Sewers

Orenco's Effluent Sewers dramatically reduce short-term and long-term wastewater treatment costs for communities and developers. In fact, effluent sewers are often one-half the cost of conventional gravity sewers or less. Here are the many ways you save:

Save On Equipment And Labor

- Collection lines are shallowly buried, just below the frost line, reducing excavation costs.
- Inexpensive, small-diameter collection lines are used.
- Expensive manholes and lift stations are eliminated.
- Installation time is reduced by one-half or more, compared to conventional sewers.

- Ease of installation causes less disruption to communities, allowing businesses to operate normally during construction.
- Ease of installation makes system well-suited for community "self-help" programs.
- Most equipment isn't purchased until lots are developed, deferring costs.

Save On Operation And Maintenance

- Low maintenance has been documented with Orenco Effluent Sewers.
- 24-hour back-up storage in on-lot tanks reduces emergency calls and overtime costs.
- Homeowners pay less than \$1/mo. in energy costs for pumps.
- Residential tanks typically need pumping just once every 10-12 years.

Save On Treatment Costs

- Because of high effluent quality, low-cost treatment systems, such as packed bed filters and sub-surface disposal, are ideal.
- Less costly permitting and testing are required when not discharging into waterways.
- Treatment facilities can be sized economically, since the whole system is watertight. There's no need to allow for the infiltration and inflow from high stormwater flows or groundwater.



"In general, alternative collection systems should be considered for smaller rural communities with low population density and site specific environmental conditions . . . Shallow bedrock, high groundwater conditions, extremely flat or very hilly terrain and limited room for construction make alternative collection systems more cost-effective than conventional systems."

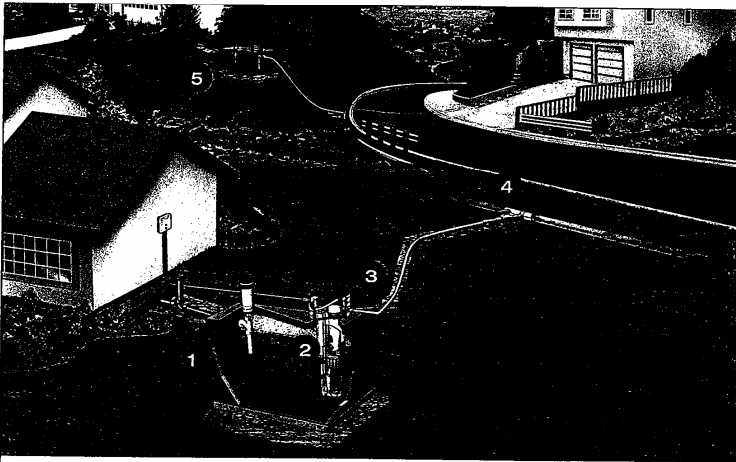
Illinois Community Action Association
Alternative Wastewater Systems in Illinois

Orenco's Effluent Sewer Systems are ideal for new subdivisions, whether on flat ground or on the most difficult terrain.

Orenco's Effluent Sewers

How an Orenco Effluent Sewer Works

With an Orenco Effluent Sewer, raw sewage flows from the house or business to a watertight underground tank, where it is pretreated. Only the filtered liquid is discharged (by either pump or gravity) through the service lines, to shallow, small-diameter collection lines that follow the contour of the land. Solids remain in the underground tank, for passive, natural treatment. Tanks typically need pumping only once every 10–12 years.



1

Watertight tanks provide primary treatment, so only liquids are conveyed to the treatment plant.

2

Our patented Biotube® Pump Vault filters out solids, and our lightweight, non-corroding pumps last more than 25 years.

3

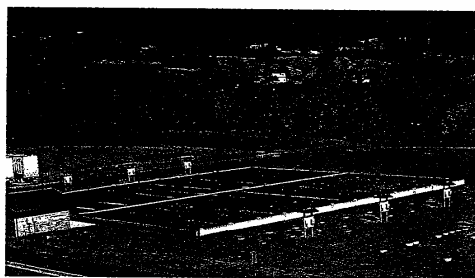
One-inch (25-mm) diameter service lines can be easily installed with a trencher.

4

Small-diameter main lines follow the contour of the ground, saving excavation costs. No expensive manholes or lift stations are required.

5

Filtered effluent is conveyed by gravity from homes at higher elevations, so no pump is typically required.



The high-quality, filtered effluent from an effluent sewer is ideal for use with a low-cost, low-maintenance treatment system, such as a recirculating sand filter or Orenco's AdvanTex® textile filter. From there, it can be reused for irrigation or to recharge groundwater. With no infiltration or solids to contend with, the treatment plant can be sized up to 90% smaller than with other collection technologies.

Orenco's Effluent Sewers are designed as a totally integrated package, and system components are compatible and pre-assembled. Each item is fully warranted, and components are corrosion-resistant, durable, and lightweight.

Orenco's Effluent Sewers

Choose the Superior Wastewater Solution:

Orenco's Effluent Sewers

Communities and developers throughout the world are struggling with wastewater collection and treatment issues. For many areas, conventional gravity sewer systems are too costly. Moreover, conventional sewers are not watertight, so their overflows contaminate our rivers, bays, and oceans.

"Given the diversity of the new technology that is now being developed, it is reasonable to speculate that, in the future, the continued use of conventional gravity flow systems will be a thing of the past."

Dr. George Tchobanoglous, UC Davis, Author of *Wastewater Engineering: Treatment, Disposal, Reuse and Small and Decentralized Wastewater Management Systems*

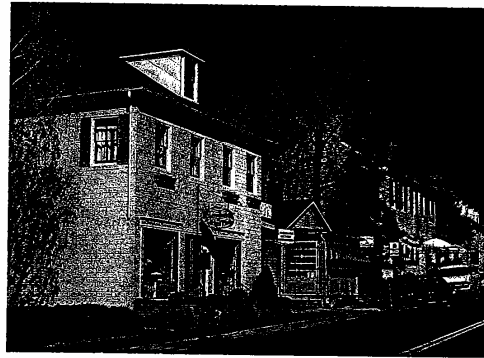
"Managed decentralized wastewater systems . . . merit serious consideration in any evaluation of wastewater management options for small and mid-sized communities and new development."

EPA, *Response to Congress on Use of Decentralized Wastewater Systems*, April 1997

Watertight effluent sewer systems are becoming recognized as one of the best solutions for collecting waste and transporting it to a treatment facility.

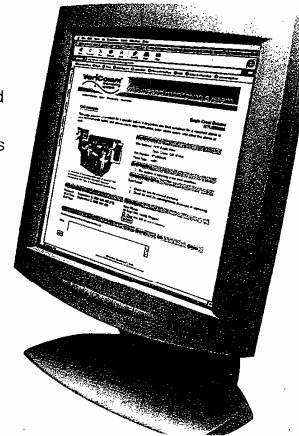
Orenco has helped hundreds of small communities throughout the world to design, build, and maintain low-cost, watertight, reliable effluent sewers. Depending on terrain, effluent sewers are often half the cost of conventional sewers, or less.


And Orenco Effluent Sewers come with VeriComm® Control Panels and their Web-based Monitoring System. So operators can monitor and maintain the system remotely, from the office or home. For residents, that means continuous supervision and 24/7 peace of mind.



There are other alternatives to conventional sewers – grinder systems, for example. However, because the effluent from an Orenco Effluent Sewer is relatively free of grease, oil, and solids, the pumps and collection lines require less maintenance. And the high-quality filtered effluent from an Orenco Effluent Sewer requires less costly treatment.

For all these reasons, communities that purchase our effluent sewers enjoy system-wide, long-term savings.

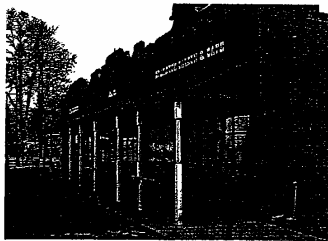




O R E N C O
C A S E S T U D Y

Starbuck, Washington:

Community Builds Own Effluent Sewer System, Cuts Cost in Half



The small Eastern Washington town of Starbuck (pop. 165) installed a low cost, reliable effluent sewer system to serve the community, followed by an AdvanTex™ Textile Treatment System.



"I've been in construction all my life and didn't know wastewater, but this is the simplest system to run. So user-friendly — better than Windows 98! And the people at Orenco couldn't have been more helpful. You guys do a great job."

Floyd Wildman
Operator
Starbuck, Washington



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When the failing septic systems in Starbuck, Washington (pop. 165) threatened to pollute the groundwater and nearby Tucannon River, residents discovered they wouldn't be allowed to rehabilitate or replace them. Their lots didn't meet the State's current minimum size for onsite wastewater systems. But residents figured they couldn't afford a community wastewater system, especially when initial estimates came in at \$1.8 million to construct and a monthly fee of \$55-\$65 per household.

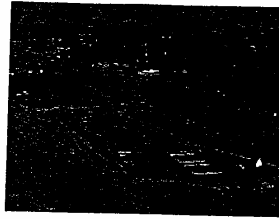
Enter the Washington Department of Ecology's "self-help" program. If Starbuck could eliminate debt from the equation by supplementing grant money with citizen contributions of labor, the town could cut the monthly fee to less than \$20. Residents embraced the concept, as well as one of its chief proponents, an engineering firm experienced in self-help projects for small communities. Loomis Austin Inc. had specified Orenco Systems' equipment in Texas and knew that effluent sewers were relatively easy to install. Armed with plans for an affordable system from Loomis Austin and grant funding from the State and the US Forest Service, the townspeople took on the challenge of doing the installation themselves.

Loomis Austin recommended an Orenco Effluent Sewer and Orenco AdvanTex™ Treatment System. On each property, a 1,500-gallon watertight tank with Biotube® effluent filter was installed, where solids are retained and treated. The filtered effluent from the tanks flows by gravity through small diameter collection lines (mostly 2" and 3") to a 8,000 gallon STEP pumping station, equipped with telemetry controls. The pumping station pumps to a 20,000 gpd AdvanTex™ Treatment System (16 RX40 textile filters). After treatment, the effluent is so clean it's used to irrigate grazing lands via a drip irrigation system.

Carol Wildman, Starbuck's former clerk/treasurer, oversaw the self-help project. "People here can be stubborn," she said, "so we made hook-ups voluntary." Each household wanting a connection to the effluent sewer was expected to donate 80 hours of labor.

(Continued on back)

Some people laid pipe; others fed the work crews or babysat for crew members. Still others ran errands or did paperwork. Retirees found a new reason to get up in the morning. In the end, virtually everyone in town opted to hook up. After nine months, installation was complete and Starbuck had accomplished what amounted to a modern-day barn-raising on an amazing scale.



Aerial view of Starbuck, Washington and its AdvanTex™ Wastewater Treatment System.

The collection system—2.5 miles of pipe and 90 hook-ups, including a school and a restaurant—cost \$325,000. Treatment facilities added \$414,000 and professional fees another \$124,000. Grant funds covered that \$863,000 total. But grant administration, housing and meals for engineers, meals for volunteers, and approximately 7,500 hours of volunteer labor were contributed by the community! Residents pay a base monthly fee of \$16, plus one dollar per thousand gallons of water used (averaged from winter monthly consumption).

The system has been performing beautifully since the January 2000 startup: lab sampling shows average BOD and TSS under 2 mg/L and total nitrogen of 13.3 mg/L. The system operator — Wildman's husband, Floyd — spends about 10 hours a month on O&M, excluding the drip irrigation equipment.

"When you design a self-help project, the goal is constructability," says engineer Andy Hollon of Loomis Austin. So forget the big pipes, deep trenches, mammoth construction equipment, and special expertise! For the town of Starbuck, Washington, Orenco's effluent sewer and AdvanTex™ Treatment System fit the bill.

"A self-help project is no picnic," says Carol Wildman. "It requires hard work and sacrifice. But look at what we accomplished. Our wastewater system is completely debt-free. It was definitely worth it!"

SUMMARY OF SPECIFICATIONS

Starbuck, Washington Effluent Sewer and AdvanTex™ Treatment System with Nitrifying Upflow Filters Using Orenco Systems' Equipment, plus Dispersal by Drip Irrigation

INSTALLATION DATE
1999. Completed in 9 months

START-UP DATE
January 2000

SYSTEM ENGINEER
Loomis Austin Inc., Austin, Texas

PROJECT COST EXCLUDING DONATED LABOR
\$863,000

DONATED LABOR
7,500 hours

FEES
\$16 per month base charge plus \$1/1,000 gal winter avg. water use

ONSITE FACILITIES

90 connections, all STEG Residential tanks by Willamette Graystone, Portland, OR: 1,500-gal* 1-piece concrete construction, single compartment, fitted with Orenco Biotube® Effluent Filters

COLLECTION SYSTEM

2.5 miles of PVC pipe, mostly 2" and 3", some 4".

One 8,000 gal STEP pumping station with two 3/4 hp pumps and VeriComm™ telemetry controls

TREATMENT SYSTEM

16 AdvanTex™-RX40 Textile Filters
2 denitrifying upflow filters—1 day HRT (peak flow)
2 flow-splitter basins set for 50/50 filtrate split

Design flow = 20,000 gpd
Average actual flow = 7,330 gpd

Recirculation rate: startup—5:1, after one year—4:1

*Although 1,000-gal tanks would have been adequate, 1,500-gal tanks were selected for reduced septage pumping frequency, from every 8 - 12 years (for a 1,000-gal tank) to every 12 - 20 years.

TANKS

20,000-gal-blend tank; (2) 10,000-gal recirculation tanks

PUMPS

Four 3/4 hp pumps in each recirc tank

DISPERSAL

20,000 gal surge/dose tank
50,000 lineal feet of drip irrigation line (4 acres)

OPERATION/MAINTENANCE

Maintenance of tanks, collection system, AdvanTex™ Treatment System, and upflow filters — Avg. 10 hrs/mo

PERFORMANCE

TEST	INFLUENT (mg/L)	EFFLUENT (mg/L)
BOD ₅	130	<1
TSS	34	1.8
TN	46	13.3

COST COMPARISON

→ Gravity Sewer Cost
→ Effluent Sewer Cost
→ "Self-Help" Effluent Sewer Cost



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ACS-SL-7

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O R E N C O
C A S E S T U D Y

Steamboat, Oregon:

AdvanTex™ Treatment System Preserves Protected Waters



The wild and scenic waters around Steamboat, Oregon have become a hot spot for fly-fishermen from around the country. An Orenco AdvanTex™ textile filter system helps to ensure that the waters remain clean and clear for years to come.

The U.S. Forest Service and the Oregon Department of Transportation (ODOT) had a costly wastewater problem. Sewer lines in their 25-year-old treatment plant for the Steamboat Ranger Station were being infiltrated by groundwater, causing daily flows to exceed 18,000 gpd. In addition, the outmoded plant was discharging directly into the wild and scenic waters of the North Umpqua River - which was unacceptable under the state's new, tougher discharge standards. And to make matters worse, the system cost \$25,000 per year to operate!

Hoping to expand his capacity for housing visiting fly-fishermen during the busy summer months, Jim Van Loan, owner of the nearby Steamboat Inn, began discussions with the agencies about sub-leasing several houses on the Ranger Station's site. Both agencies were interested, but the cost of operating the wastewater treatment plant made it difficult to justify the arrangement.

With ten years of good experience with an Orenco-designed wastewater treatment system at the Inn, Van Loan suggested bringing in Orenco Systems®, to discuss the merits of a small effluent sewer for the Ranger Station: using a new, AdvanTex™ textile filter system for treatment. After several years of planning, "We have a system in place that cost the state about \$7,000 in operating expenses the first year, versus \$25,000," explains Van Loan. And with such outstanding effluent quality (monthly BOD₅ and TSS tests have averaged 1.8 mg/L and 1.4 mg/L respectively), the DEQ has approved a semi-annual, instead of a monthly, testing procedure. "Next year we hope costs will be as low as \$1,800," states Van Loan. "The capital costs of \$135,000 will be paid for in five years."

Once the final contractor was selected, all the construction was completed in only seven weeks. Very little disruption to the ground was required, as the small diameter main lines followed the paths of the existing sewer lines. And because of the extremely

(Continued on back)



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high quality of effluent being discharged, the DEQ allowed a 50% reduction in the disposal area.

Since the system has been up and running, there have been no problems. Regular monitoring and maintenance have shown outstanding effluent quality, and an advanced remote telemetry control system hasn't recorded a single alarm.

Back in the thirties, Zane Grey walked the slippery slopes of the North Umpqua River, in search of that perfect steelhead. Today, people come from all over during the summer months to tackle the 31 miles of "fly-fishing only" water. And thanks to the advanced treatment provided by the AdvanTex™ textile filter system, and foresight of ODOT, the waters continue to remain clean and clear, for generations of steelhead to come.

SUMMARY OF SPECIFICATIONS

Steamboat, Oregon Effluent Sewer and AdvanTex™ Textile Filter System Using Orenco Systems' Equipment

INSTALLATION DATE
June 1999

SYSTEM ENGINEER
Terry Bounds, P.E., Orenco Systems, Inc.

CONTRACTOR
Greensun's Inc., Springfield, Oregon

TOTAL PROJECT COST
\$150,000 (collection and treatment)

ONSITE FACILITIES
16 EDU's, mostly residential

COLLECTION SYSTEM
Each lot has 1" service lines
2" main lines

TANKS
1,500 gal concrete meander tanks with Biotube® pump vaults

Tanks were tested extensively for watertightness and structural integrity

PUMPS
1/2 hp, 10 gpm turbine effluent pumps

TREATMENT SYSTEM
Four AdvanTex-RX40 Textile Filters
Design Flows: 4,800 gpd
Average Flows: 2,400 gpd

TANKS
Two 1,500 gal concrete meander recirc. tanks

Tanks were tested extensively for watertightness and structural integrity

PUMPS
Two 3/4 hp, 50 gpm turbine effluent pumps

DISPOSAL
960' of 18" x 36" pressurized drainfield with 60' of shallow gravelless drainfield

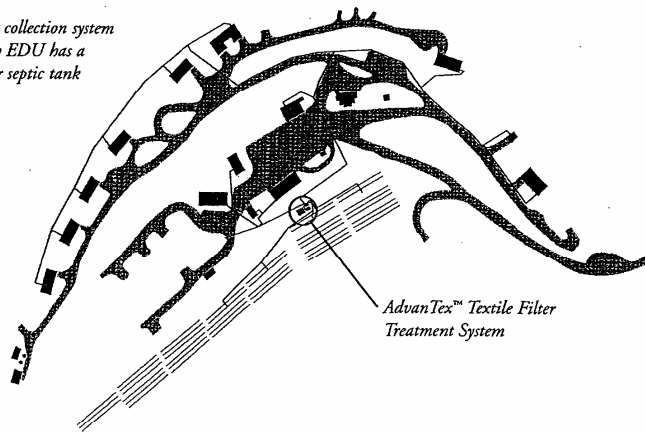
Two 3/4 hp, 50 gpm turbine effluent pumps

OPERATION/MAINTENANCE
Onsite Facilities
1 part-time operator
No alarm calls to date

Per DEQ: first year testing performed quarterly. Subsequent years performed semi-annually.

PERFORMANCE		
TEST	INFLUENT (mg/L)	EFFLUENT (mg/L)
BOD5	150	1.9
TSS	17	1.4

This map shows the effluent collection system at Steamboat, Oregon. Each EDU has a 1,500 gal. concrete meander septic tank with a 1/2 hp pump.



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O R E N C O

C A S E S T U D Y

Warren, Vermont:

Award-Winning AdvanTex® System Provides Superior Treatment in a Small Footprint



The Warren Elementary School playground sits less than ten feet from a row of AdvanTex® AX10 pods. Orenco's highly efficient AdvanTex Treatment System allows children at the school to play without fear of health or safety hazards.



"We live in a cold environment, but I've had no wintertime problems with this system. Just really good smokin' numbers. AdvanTex gets BOD and TSS down to five [mg/L]. You can't beat that!"

Mike Mayo
Sewage Officer
Town of Warren



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In the fall of 1999, the town of Warren, Vermont discovered problems in the elementary school's water supply. The culprit was the school's failing leach field, which was ponding and causing a public health hazard.

Clearly, the septic system had to be replaced. However, there was not enough land — far enough away from the well — for a conventional leach field. The town's consulting engineers recognized that they needed a compact but high-performing wastewater treatment and dispersal system . . . at a price the town could afford. After an intensive lifecycle cost analysis of several systems, they chose Orenco's AdvanTex® Treatment System with a pressurized, shallow, narrow drainfield.

Fitting into less than half the area of conventional systems, the AdvanTex system became fully operational by the end of the school's winter break. Within two days of installation (supervised by Orenco distributor Dave Cotton of WTI), effluent testing showed considerable reduction in biochemical oxygen demand. Warmer weather brought increased biological activity in the system and BOD/TSS reductions of up to 90%, with BOD₅ at 7.5 mg/L and TSS at 5.9 mg/L.

Recognizing the system's superior design and performance, the American Consulting Engineers Council awarded its Vermont Engineering Grand Award for Water Resource Projects to the system's design engineers, the town's environmental consulting firm, and the regional planning commission.

Since the system has been operational, there have been no problems. An advanced remote telemetry control system sends information on treatment system functions via modem to a computer in the town offices. If a problem occurs, the control panel pages the town's sewage officer. School staff no longer need to worry about another septic system failure.

Warren Elementary School is an EPA National Demonstration System — a model approach to solving onsite wastewater treatment and dispersal problems faced across the country.

(Continued on back)

SUMMARY OF SPECIFICATIONS

*Warren, Vermont Commercial AdvanTex® Treatment System
Using Orenco Systems Equipment*

INSTALLATION DATE
January 2001

PROJECT COSTS
TREATMENT SYSTEM
\$60,000

TOTAL PROJECT
\$150,000 (includes all engineering costs; removal of old system; and installation of new force main, new drainfield, new tanks, and new treatment system)

ENVIRONMENTAL CONSULTANT
Stone Environmental, Inc.

SYSTEM ENGINEER
Forcier Aldrich & Associates

CONTRACTOR
New England Water Systems

DISTRIBUTOR
Wastewater Technologies, Inc.

DESIGN FLOW
4,600 gpd

COLLECTION SYSTEM
Existing 4,000-gallon septic tank
New 3,000-gallon dosing pump station

TREATMENT SYSTEM
New 3,000-gallon septic tank with effluent filter
New 5,000-gallon recirc./blend tank with pumps
12 AdvanTex-AX10 textile filters
Remote telemetry control panel

EFFLUENT QUALITY
Effluent BOD averages are 7.5 mg/L;
TSS averages are 5.9 mg/L.

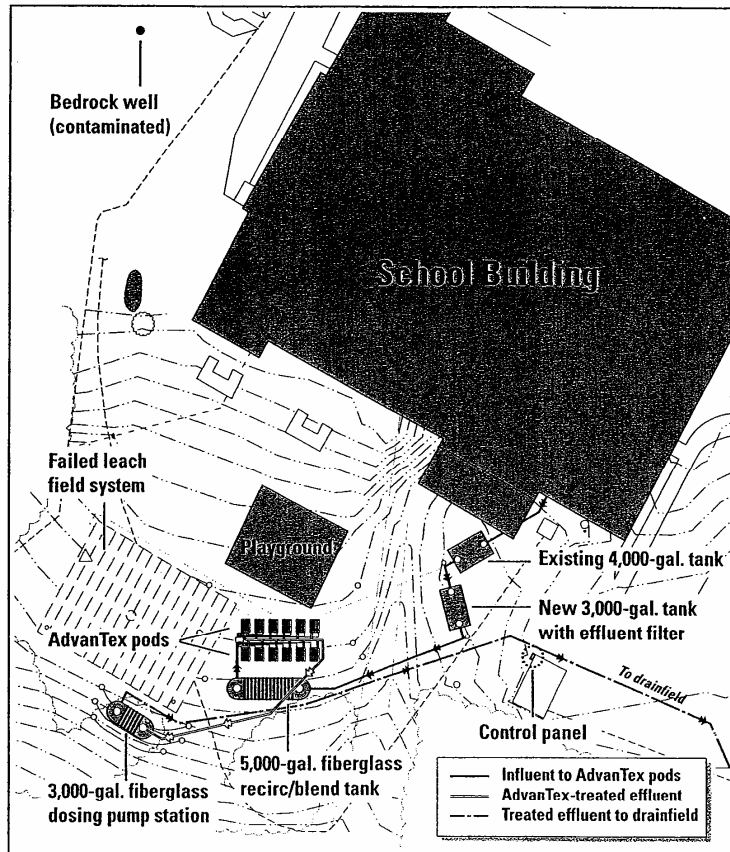
DISPERSAL
Pressurized, shallow, narrow drainfield

OPERATION/MAINTENANCE COSTS (ANNUAL)

ONSITE FACILITIES

Electrical	\$80
Engineering inspection	\$250
Operator labor	\$1,000
Telemetry/paging (telephone charges)	\$650
Annual cost	\$1,980

Per EPA/DEC, quarterly influent/effluent quality testing was required for the first two years of operation.



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O R E N C O
C A S E S T U D Y

Diamond Lake, Washington:
15-Year-Old Effluent Sewer Requires Little Maintenance



The community of Diamond Lake, in northeast Washington state, saved its beautiful 800-acre lake by replacing all its old, leaking septic tanks and inadequate disposal systems with watertight tanks and an Orenco effluent sewer system. Diamond Lake's wastewater system serves more than 500 homes, as well as one of the largest Boy Scout camps in the country.

In the early 1970s, residents of Diamond Lake, Washington (533 households) knew that something had to be done about their wastewater. According to Bob McGowan, long-time member of the Diamond Lake Water & Sewer Commission, "Our lake was being destroyed by leaking septic tanks and failing drainfields."

The community needed federal funding assistance. Even so, "A gravity system was way out of reason," recalls Larry Garwood, system operator. After nearly 15 years of research and planning, the Commission decided on an effluent sewer and purchased ProSTEP™ pumping systems from Orenco.

Construction began in 1987. Installation went well but was not easy, since the soil was heavy clay, with high groundwater. In addition, about 25% of the excavation had to be blasted for the tanks and minimum 42"-deep collection lines. "If the engineers had known about the rock, the cost estimates for the gravity sewer would have been even higher," says Garwood.

Everyone is pleased with the system, according to Garwood and McGowan. All wastewater and water system maintenance is handled by just two operators for most of the year, with a third operator added during the summer. "The system is easy to learn and maintain," says Garwood. "We don't have many alarm calls. Pump motors never give us a problem, and the lines are performing well." (See "Operation/Maintenance" summary on back.)

Equally as important, wastewater services are cost-effective, for the district and its citizens. Customers pay \$15/month for residential properties and \$25/month for commercial properties.

Best of all, there's the lake. Within three years after Orenco's effluent sewer was installed, it was clear and clean again. "It recovered very early on," says Commissioner McGowan. "Diamond Lake is now a showcase."

(Continued on back)

≈
"We're operating this system – water and sewer – with just two guys for most of the year. More than 500 sewer customers and 600 water customers. It's easy to maintain."

Larry Garwood
Diamond Lake
Water & Sewer District


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SUMMARY OF SPECIFICATIONS

*Diamond Lake, Washington Effluent Sewer
Using Orenco Systems Equipment*

INSTALLATION DATE
1987

TOTAL PROJECT COST
\$2,951,280 (excluding lagoon)
\$5,540 per home

ONSITE FACILITIES
533 EDUs, mostly residential
529 STEP units, 4 STEG units

TANKS

RESIDENTIAL

1,000-gallon single-compartment concrete tank with effluent filters or screened pump vaults.

Tanks were tested extensively for watertightness and structural integrity.

COMMERCIAL

Multiple 1,000-gallon or 2,000-gallon tanks.

PUMPS

1/2 hp (8 gpm typical) Orenco ProSTEP™ effluent pumps.

COLLECTION SYSTEM

Each lot has 1.5" - 2" service lines.
6.5+ miles of 3" - 8" main lines.

Effluent quality of collection system (measured at inlet of first lagoon):
BOD = 170± mg/L (89°-91)
TSS = 40± mg/L (89°-91)

TREATMENT SYSTEM

3-CELL AERATED LAGOON

One cell is 3/4 acre x 10.5' deep (on average).
Two cells are 3.75 acre x 16' deep.
180,000 gpd design

Q (summer average) = 68,000 gpd
Q (winter average) = 45,000 gpd
37.9 million gallons winter storage capacity (on average)

DISPOSAL

410,000 gpd irrigation to 38-acre alfalfa field (winter hold; summer irrigate)

OPERATION/MAINTENANCE

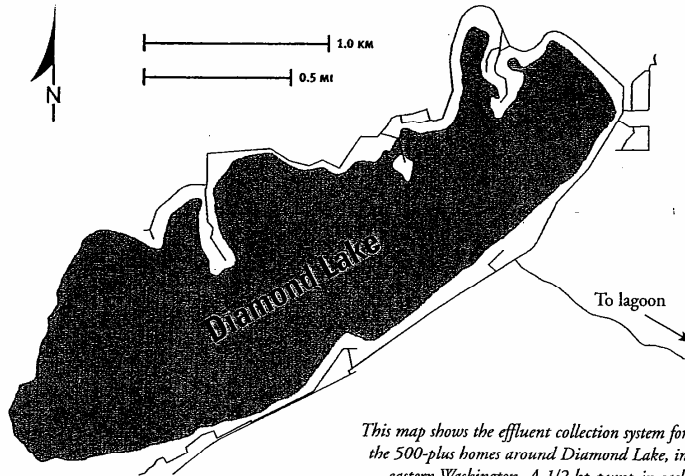
Entire system (wastewater and water) maintained by two full-time operators for most of the year, by three during the summer.

About 3.5 alarm calls per week (often for customer power failure).

Average time spent at site for an alarm: 20 min.

FEES

\$15/month residential
\$25/month commercial



This map shows the effluent collection system for the 500-plus homes around Diamond Lake, in eastern Washington. A 1/2 hp pump in each septic tank transports wastewater to an aerated lagoon, six miles distant, with no lift stations required.



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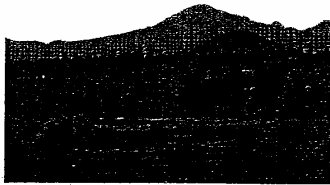
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O R E N C O
C A S E S T U D Y

La Pine, Oregon:

Textile Filter Technology Showcased in National EPA Study



In La Pine, Oregon, an EPA wastewater demonstration project includes two of Orenco's new AdvanTex™-RX Treatment Systems.

"The textile filter has the advantages of being much smaller than a sand filter, and of being pre-fabricated. We don't have the variability in performance depending on how clean and how well graded the sand is. It's also more convenient to install."

Bijan Pour, Ph.D.
Soil Scientist
Oregon Department of
Environmental Quality

Bend, Oregon, on the edge of a fragile high desert ecosystem, has experienced booming development, resulting in a number of problems, including nitrate pollution. Nitrate "hot spots" in the aquifer were traced to high-density septic systems. With the county's population projected to double over the next 20 years, groundwater modeling suggests that nitrate levels will increase further.

To complicate matters, nearly 1,800 lots near Bend have a shallow water table of two feet or less. Highly permeable pumice-derived soils give little protection to the underlying aquifer – the main drinking water source – or to the nearby Deschutes River, an internationally famous trout stream. Environmental regulations now prohibit some septic systems on lots with high water tables, and development is too dispersed for a centralized sewage system. Extreme temperatures in the cold, high-altitude desert pose additional challenges for wastewater treatment.

In the community of La Pine, Orenco Systems Inc. is actively participating with the county and with state agencies to demonstrate a new technology for onsite wastewater treatment with advanced denitrification capabilities. Orenco provided design engineering and system components for two innovative AdvanTex™-RX Treatment Systems, which use a highly absorbent textile treatment media.

One of the systems – installed in less than 12 hours at the first of two Habitat for Humanity houses, on Swan Road – began operation in February 1999. Filtrate from the 4'x8'x2.5' pre-fabricated module recirculates through the processing tank, then to a pump basin for pressure discharge. Closely monitored by the state DEQ, this installation, along with an installation at a second Habitat house next door, now receives additional third party testing.



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These two sites are part of a National Community Decentralized Wastewater Demonstration Project, funded through EPA.

The EPA study, an effort to jumpstart technology transfer of innovative decentralized wastewater treatment, has devoted considerable funds to various demonstration projects in various states, including the one in La Pine. Rigorous monitoring and data sampling will be used in the design and installation of additional denitrification systems in the area – and eventually nationally.

According to Bijan Pour, Ph.D., a soil scientist with Oregon's DEQ, "The textile filter has the advantage of being much smaller than a sand filter.



"More important, this textile filter comes pre-fabricated, and we don't have the variability in performance depending on how clean and how well graded the sand is. To me as a regulator, this is very advantageous.

"It's also more convenient to install," continued Pour. "A sand filter takes skilled labor to build onsite. This is a modular, pre-fabricated system.

"We plan to test for three years before we make any recommendations," said Pour. "Early indications are that the system is performing within our goals for most parameters. From what I see so far, I like it."

SUMMARY OF SPECIFICATIONS

*Residential Onsite Wastewater Treatment Installation
Using Orenco's AdvanTex™-RX Treatment System
55700 Swan Road, La Pine, Oregon*

INSTALLATION DATE
November 1998

START-UP DATE
February 1999

SYSTEM ENGINEER
Terry Bounds, P.E., Orenco Systems, Inc.

CONTRACTOR/SERVICE PROVIDER
Habitat for Humanity, with Orenco assistance

TANKS
1,500-gallon, two-compartment, with Orenco Biotube® Pumping Package

TREATMENT SYSTEM
Orenco AdvanTex™-RX30 textile filter
Recirculation ratio: 1 min. on, 19 min. off
Design flows: 450 gpd
Actual flows: 330 gpd

DISPOSAL
Three shallow pressure lines (105 LF total)

AVERAGE FILTRATE EFFLUENT QUALITY
DEQ Sampling
6/1/99 - 1/5/00

BOD = 7.4 mg/L
TSS = 3.6 mg/L
TKN = 2.2 mg/L
NH₃ = .5
NO₃ = 3.6 mg/L
TN = 5.8 mg/L



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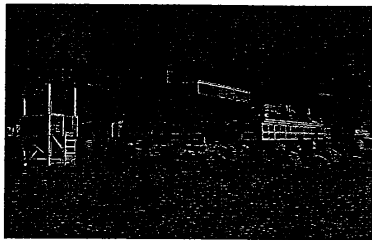


O R E N C O

C A S E S T U D Y

AdvanTex® AX100 Installations:

Commercial-Sized, Recirculating Textile Filter Solves Difficult Wastewater Problems



Paradise Cove in Malibu, a popular tourist destination, is upgrading its wastewater treatment system with 30 AX100s.



"Next spring, we're installing another 20-pod AdvanTex system, capable of treating up to 60,000 gpd peak flows, at the mobile home park next door."

Steve Braband
BioSolutions, Inc.



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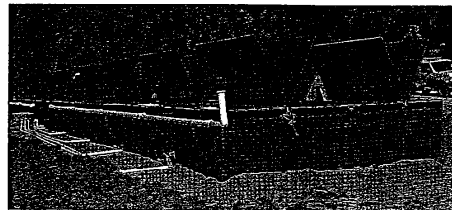
Paradise Cove Beach Café, California

Malibu's Paradise Cove — the setting for "Gidget," "Beach Blanket Bingo," "Rockford Files," and numerous commercials — is highly picturesque. But its wastewater problems are not. Realizing they needed to upgrade wastewater treatment for their large beachfront restaurant and adjacent mobile home park, Paradise Cove's property owners hired Steve Braband, a local wastewater consultant.

Braband and Engineer John Yaroslaski (john@ensitu.com) began by crafting a solution for the restaurant: the 300-seat Paradise Cove Beach Café. The design challenges were daunting: high-strength, variable waste flows along with extreme space constraints. In addition, the Café was a well-known tourist spot, so the site required a visually elegant solution with no odors.

Braband and Yaroslaski narrowed their choices down to two technologies but chose AdvanTex for its treatment performance and low power costs. Yaroslaski designed a system in which the effluent was pumped 100 feet upwards to the bluff above the restaurant, where ten AX100 textile filter pods provide secondary treatment before dispersal. Additional tankage was specified to trap grease, and an Orenco remote telemetry monitoring and control system was installed for round-the-clock supervision.

"The system started up smoothly and was trouble-free within the first week," says Braband. "Next spring, we're installing another 20-pod AdvanTex system, capable of treating up to 60,000 gpd peak flows, at the mobile home park next door."



Hinged lids with gas springs, isolation valves, and flushing valves make it easy to access and service the AX100's textile filter pods.

(Continued on back)

Hebo, Oregon

The small, coastal community of Hebo, Oregon had a big wastewater problem. Its collection system had tremendous infiltration and inflow during winter storm events, resulting in peak daily flows that were triple the dry weather design flow. This additional flow overloaded and eventually caused failure of the existing treatment facility. As a result, Oregon's DEQ placed a moratorium on all new construction, putting a number of important projects — including a community hall, fire station, child care center, and ballpark — on hold.

In 1999, the Hebo Joint Water and Sanitary Authority contracted with Westech Engineering to analyze the problem and recommend solutions. Engineer John Yarnall recommended Orenco's AdvanTex Treatment System. Said Yarnall, "We wanted a technology capable of producing high quality effluent that was modular in nature, to accommodate future growth. AdvanTex also has a small footprint, and the treatment media is covered, so rainfall doesn't cause an increase in flows. Also, since it works like a recirculating gravel filter, the operator was already familiar with the technology."



Three Rivers flows past the Hebo Wastewater Facility, thirty feet from the new septic tanks and fifty feet from the rows of AdvanTex® AX100 filter pods.

Westech designed a system with average annual design flows of 17,000 gpd and with a peak daily design flow of 80,000 gpd, to account for I&I contributions into the collection system. Twelve AX100 textile filter pods and a new, 35,000-gallon recirc tank were installed in winter, 2002 to provide secondary treatment for the community's 73 connected properties. A UV disinfection unit and an

Orenco remote telemetry monitoring system were an important part of the package, because Hebo's system discharges directly into the Three Rivers waterway.

After two months of effluent testing, five-day BOD and TSS were averaging 3.1 and 5.8 mg/L, respectively. According to operator Gerald Poulsen, the AdvanTex effluent looks like drinking water, and test results from a recent sampling showed nondetectable levels of E. coli,

BOD₅, and TSS. "That's a pristine river it discharges into, a salmon spawning river," says Poulsen, "and what we're putting in is cleaner than the river itself."

"That's a pristine river it discharges into, a salmon spawning river, and what we're putting in is cleaner than the river itself."

Gerald Poulsen, Manager
Hebo Joint Water and Sanitary Authority

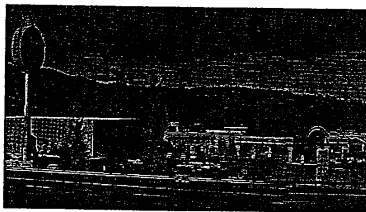
Seven Feathers Hotel & Casino Resort, Oregon

The Canyonville, Oregon resort owned by the Cow Creek Band of the Umpqua Tribe of Indians is a luxurious, full-service destination attraction with three restaurants, a 145-room hotel, full casino, 450-seat bingo hall, 22,000-square-foot convention center, and 32-space RV park. The Resort's large, four-quadrant recirculating gravel filter (RGF) was designed to handle flows of 86,000 gpd, but a big holiday or a special event could drive flows up to 150,000 gpd, overloading the treatment system.

The Cow Creek Band asked Orenco for a solution to handle overload events and preserve the life of the RGF. "We showed them our AX100 prototype,"

said Systems Engineering Manager Grant Denn, "and they said, 'How soon can we get it?' So we sold them the prototype and five more."

The six AX100s were set on grade and plumbed right into the RGF, without requiring additional pumps, controls, or tanks. This fast "plug and play" custom retrofit is providing the Resort with an additional 30,000 gpd of treatment capacity for high periodic flows, while allowing the Resort's operator to rest the RGF's zones, if necessary. Ten months of sampling after the June 2002 installation showed outstanding treatment performance: cBOD₅ and TSS were averaging 4.9 and 4.4 mg/L, respectively.



Seven Feathers Hotel & Casino added 30,000 gpd of treatment capacity to its recirculating gravel filter by plumbing six AX100 filters into the existing system.