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This installation used an aerobic treatment unit to provide effluent from the household. The site is on fractured granite, so the ATU was bermed into a hillside. The former septic tank was used as a pump tank (1). The geology of the site also required above ground storage tanks, again bermed into a slope (2). The effluent is pumped from an above ground pump house (3). The pump house is insulated and has a thermostat and 2—100 watt light bulbs for winter operation. A drip irrigation system supplies an extensive landscape (4). The water budget indicated that a surplus of effluent would exist during the winter. A timing circuit and solenoid valves allow this surplus to be dosed to pumice wicks in the apple orchard that is down gradient from the bases of the tanks (5).

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Effluent Recycling with an Aerobic Treatment Unit and Above Ground Tanks

Eldorado, New Mexico

EARTHWRIGHTS DESIGNS

Technology and Nature

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The Pirana-Sludgehammer Aerobic Bacteria Generator is the first device of its kind. This system can be dropped into virtually any septic tank to improve effluent quality and to provide a source of irrigation water. The Sludgehammer achieves the objectives of sustainable design:

1. **Mechanically simple.** It has only one moving part, the diaphragm in the air pump (#2). The element that is inserted into the septic tank (#1), is all inert plastic, and has no moving parts.
2. **Biologically Complex**. The "moving parts" of the system are facultative bacillus bacteria. These bugs can survive with or without oxygen. The bacillus culture was obtained from a naturally occurring ecological niche in forest leaf litter, so these bugs are already a natural part of ecosystems. The environment created by the Sludgehammer system is so rich in oxygen that earthworms are found in septic tanks where they would normally drown (#4). The resulting effluent is clear with little odor. The Sludgehammer can discharge the nitrogen as a bioavailable fertilizer thus turning the system from a "wasterwater disposal" system into a moisture and nutrient distribution system.
3. **Low Energy Use.** In a home sized system, the energy load is about 25 watts.
4. **Low operation and maintenance costs.** The Sludgehammer has an annual fee for operation and maintenance that ensures that the system always operates at peak performance. At the same time, the need to pump the septic tank is greatly reduced. This is due to the fact that the Sludgehammer "bugs" consume the sludge and scum that normally form in septic tanks.

Connecting a Sludgehammer system to landscape irrigation can dramatically improve a household water budget and elimi-


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Effluent Recycling with a "Sludgehammer" Aerobic Bacteria Generator

Sonoma, California & Santa Fe, New Mexico

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A Sludgehammer Aerobic Bacteria Generator was used at a single family residence to provide a high quality effluent for irrigation. Surrounding soils are clay with very slow percolation rates. The home is surrounded by a Piñon and Juniper woodland which is typical of many areas of the Southwest. The trees had begun showing signs of drought stress with the beginnings of bark beetle infestation and mortality. A water budget was created based on the design flows of the residence. A local tree expert, Frank Walker, walked the site. Key trees and groves were marked and coded. The effluent was allocated to the chosen trees and a supply driven system was designed and built. The plan is that the variances in household use can be dosed to trees in the woodland in such a way that the trees will receive adequate moisture in drought for their survival. In wetter times the effluent will be a valuable supplement of moisture and nutrients. The supply driven system doses when a fixed amount of effluent is produced. A sequencer doses each zone in turn. Sensors prevent dosing in weather that is too cold or too wet. At these times an additional dose is stored in the tank and then two doses are released sequentially when conditions improve. If there is still a surplus of effluent, it is sent to a traditional leach field. The final result of the system is that effluent is treated as a resource instead of a disposal problem. By using the effluent in this way, the leach field sizing was reduced by 75%. The financial savings from the leach field reduction meant that the entire system cost only $3,000 more than a traditional disposal system. 1. Installation of head works and valve boxes. 2. Layout of zone laterals. 3. Frank Walker, tree expert. 4. Custom sequencer. 5. Irrigated trees

Constructed Ecosystem with a "Pirana" Aerobic Bacteria Generator

Tijeras, New Mexico

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Treated effluent is a valuable resource for landscape irrigation. In some communities it is reasonable to replace all potable water demands for landscape irrigation, simply by reusing water that is already on the site. In addition, these systems convert what would be pollutants of groundwater into nutrients for plants. Almost all landscape or orchards can benefit from the application of effluent as the primary source of moisture.

Septic tank effluent that has been treated to at least secondary level (30 mg/ltr for both TSS and BOD) can be used with subsurface irrigation. (Figs 1-3). The quality of effluent varies from one secondary treatment system to another, so it is best to choose the treatment system carefully. It is reasonable to figure the irrigation system as the major part of leach field requirement which makes drip irrigation relatively simple to retrofit into existing landscapes. A smaller backup leachfield is still used for system service times or in the few days when it is too cold or too wet to use effluent. These conditions are automatically sensed (Fig 6) and the effluent diverted to the leachfield. Additional controls can use potable water for such uses as vegetable gardens from a common irrigation clock. (Fig 5). Electrical systems can be interconnected, but effluent and potable water line cannot. When effluent is used above the surface, disinfection with UV or ozone is recommended. In such cases, a locked, purple hydrant makes accidents much less likely. (Fig. 4) When the effluent system is the sole source of moisture, a makeup line from drinking water can add water when needed, (such as vacations). Note that two valves are plumbed in series to act like master and zone valves so that the failure of one valve will not allow a constant flow of effluent to the pump tank and then to the leachfield. (Fig 7).

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Landscape Irrigation With Treated Effluent

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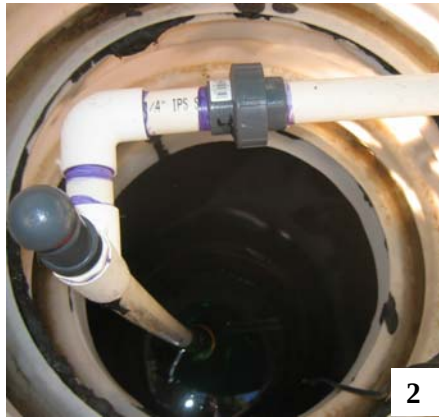

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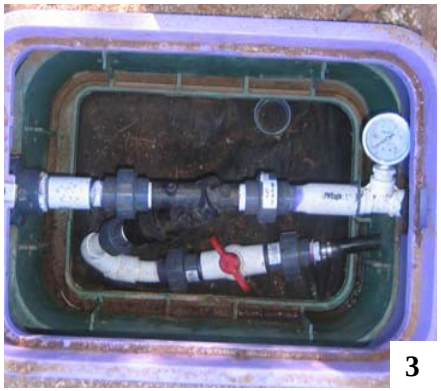

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This project uses treated residential effluent. The treatment unit is a Pirana-Sludgehammer P 46 which creates a secondary quality effluent (TSS and BOD each less than 30 ppm). Treated effluent is a valuable resource for irrigation. Besides the moisture value, the effluent has nutrients required for plant growth. Most effluent is treated as a disposal "problem". The objective of this project is to use these resources to create an oasis in a semi arid area. This oasis produces shade, food, habitat, transpiration and a modest amount of carbon sequestration. The objective is to offset the CO_2 that is used in the treatment and distribution of the effluent to create a miniature carbon neutral system.

The distribution system is a series of level trenches filled with pumice and wrapped with a Geotextile weed barrier (#4). The fabric prevents root intrusion. The pumice is laid in a 1 square foot cross section. At the top of the pumice is a distribution pipe with 1/8 inch holes, 3 feet apart, and pointed down into the pumice. This creates a moist "sponge" that absorbs doses of effluent and releases it slowly to the surrounding soil and future root zones.

The system is intended to run all year which means that it must be designed to prevent freezing. At the pump tank a vacuum breaker (#2) is installed at the high point and, a 1/8" hole is drilled in the pump line immediately above the pump. This insures that the line drains between doses. The headworks box drains via the filter flush back to the treatment tank (#3). The individual lines have drains in the valve box (#1).

The system can demand driven with an irrigation clock where an effluent design flow is known and the pump tank has adequate reserves for flow variations. This system uses standard irrigation valves (#1). The system can also be supply driven with electric or mechanical sequencers to alternate the flows as they are created.

The trees chosen are heritage trees (#5) that are appropriate to the area. They are also selected for bloom times, pollenizing, and timing of harvest to coincide with the local seasons. Fruits include plums, peaches, apples, pears, and apricots.

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Low Pressure Dosed Manifold For Treated Effluent to an Orchard

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