

APPENDIX F

WASTEWATER FEASIBILITY ANALYSIS AND CONCEPTUAL SEPTIC PLANS

BioSolutions, Inc.

Environmental Engineering Consultants

1950 Olivera Drive
Agoura, California 91301
Phone: (818) 991-9997
Fax: (818) 991-9998
E-mail: biosolutions@earthlink.net

RECEIVED

FEB 17 2000

PLANNING DEPT.

**WASTEWATER FEASIBILITY ANALYSIS
FOR ASSESSOR PARCEL NUMBER 4458-022-12
CIVIC CENTER WAY
MALIBU, CALIFORNIA**

PREPARED FOR

Schmitz & Associates
29295 Agoura Road
Suite 205
Agoura Hills, California

RECEIVED

MAR 04 2003

PLANNING DEPT.

BioSolutions, Inc.

Environmental Engineering Consultants

1950 Olivera Drive
Agoura, California 91301
Phone: (818) 991-9997
Fax: (818) 991-9998
E-mail: biosolutions@earthlink.net

INTRODUCTION

The following report is a preliminary analysis of the wastewater and stormwater issues pertaining to the property known as Assessor Parcel Number 4458-022-12.

The scope of work includes a review of the documents provided by Schmitz & Associates, Leighton and Associates, Inc. Geotechnical studies of the Civic Center, the Development Feasibility Analysis of Vacant Parcels on Civic Center Way, and additional proposed site plans. Also reviewed were the recommendations of the Malibu Creek Watershed Facilitation Committee, the recommendations of the Malibu Wastewater Study Committee, extensive interactions with the Los Angeles Regional Water Quality Control Board, and the existing and projected requirements of water quality standards as issued by the City of Malibu.

SITE DESCRIPTION

The subject property consists of undeveloped flat lots totaling 14.63 acres. The property is located north of Civic Center Way, located within the Malibu Civic Center. The site is bordered by a private development, vacant commercial land, equestrian areas to the east, residential property to the north, and the existing government center to the west. The property slopes gently toward the drainage to the east. Dirt roads and a plant nursery also exist on the property. Native vegetation on the site consists of heavily disturbed native grasses and non-native grasses.

HISTORICAL WASTEWATER CONCERNS IN THE CIVIC CENTER AREA

A large portion of the Malibu Civic Center is located within the ecologically sensitive Malibu Creek flood plain. On-site septic systems, coupled with the shallow groundwater table in this area, have historically proven to be a big concern as potential contributors to water pollution in Malibu Lagoon and Surfrider Beach. Environmental Groups including Heal the Bay, the BayKeeper, and Surfrider, have frequently applied pressure on local governmental agencies. Such pressure includes a recent lawsuit settled with the USEPA, demanding improved water quality standards and regulations pertaining to wastewater disposal, as well as stormwater discharges.

Local residents have always attributed water pollution as coming from Las Virgenes Wastewater Treatment Plant's surface water discharges, located three miles upstream from Malibu. This discharge is permitted by the Los Angeles Regional Water Quality Control Board (the "Board"), however, the Board has responded by pressuring the Las Virgenes Plant, and the City of Malibu, to limit or refrain from discharging wastewater to Malibu Creek.

Fines were recently levied against the Las Virgenes Wastewater Treatment Plant for violating its wastewater discharge permit. The City of Malibu also was recently fined for failure to submit a proposal for a technical study on the effect of on-site wastewater systems in the Civic Center Area.

Two recent EPA funded studies, one by the City of Malibu with Woodward-Clyde and Associates, and the second by UCLA, will be released in the next four weeks. Both these studies address possible hydraulic connections of commercial septic systems in the Civic Center area, and investigate possible transportation of pathogens within the soil and water table.

March 3, 1999

With respect to Geotechnical issues, the Civic Center has had a reputation of being an area susceptible to liquefaction during an earthquake. As you are aware, Leighton and Associates, Inc. was hired by the Malibu Village Civic Association to study this area for potential problems.

WATER QUALITY CONSIDERATIONS

Regional Water Quality Control Board

The Los Angeles Regional Water Quality Control Board (the "Board") oversees and permits water quality issues in both Los Angeles and Ventura counties. Under the Porter Cologne Water Quality Act, the Board has been given the authority to enforce provisions of the US Clean Water Act and its resultant regulations as outlined in 40 CFR.

Historical coastal pollution has prompted the Board to investigate potential pollution from septic systems, as well as other non-point source discharges (stormwater run-off). The Regional Board has instructed the City of Malibu to submit a proposal for a technical study concerning possible pollution of Malibu Creek, Malibu Lagoon, and the receiving coastal waters. In addition, Malibu Lagoon has been designated as a protected estuary under the Clean Water Act, allowing for increased water quality monitoring concerns.

The City of Malibu

The City of Malibu incorporated because they felt that they were not being properly represented by the Los Angeles County Board of Supervisors. One of the major issues concerned the installation of a Centralized Sewer System. Local residents feared possible pollution to the coastal waters as a result of potential major spills that sometimes occur with such a centralized collection system. Other issues involved the increased traffic on Pacific Coast Highway due to accelerating development.

The City incorporated with a wastewater disposal mandate to hold each property owner responsible for all discharges of wastewater produced on-site. Thus, in addition to reinforcing the desire not to sewer the newly formed city, the wastewater disposal policy was also responsible for ultimately controlling potential development.

As part of the agreement, new technologies were examined in order to improve the quality of water being introduced into the soils and groundwater. To date, the City of Malibu Wastewater Study Committee has been formulating recommendations to the City Council requiring EPA Class 1 Secondary Treated Water for all commercial and multifamily construction and wastewater system repairs, throughout the City of Malibu. In certain cases, the City has begun enacting these standards. For example, actions have already begun with both the Malibu Villas Owners Association and the Trancas Plaza shopping area among others. The City of Malibu along with the California Coastal Commission has been requiring this same secondary treatment requirement on numerous beachfront single family homes. The Board has indicated to the City of Malibu that all property within the Malibu Civic Center area will be required to achieve secondary treatment in the future.

Environmental Organizations

Heal the Bay, BayKeeper, and Natural Resources Defense Council (NRDC) filed a lawsuit against the USEPA and recently came to a settlement requiring the establishment of Total Maximum Daily Loadings (TMDLs) on all impaired water bodies within Los Angeles and Ventura counties. New standards for nutrients and fecal bacteria will be set and enforced in the Malibu Watershed within the next three years. These increased water quality standards encompass both water quantity and water quality issues, and will certainly affect development Los Angeles and Ventura County.

Water Table

The water table for the majority of the flat area is at eleven (11) feet according to investigations by Leighton and Associates, Inc. identified as LB-1 and LB-2 (see Attachment 1). A ten (10) foot separation is necessary for a conventional septic system to be approved. This is an important factor in examining options for wastewater disposal, as will be discussed below.

Because of the historical use of the land being agriculture and equestrian, concerns of background nitrate-nitrogen could become an issue in the future. Baseline testing for nitrate-nitrogen would be recommended to show existing conditions before construction to indicate no significant increase over existing conditions.

Soils

Soil samples examined in Leighton and Associates, Inc. study, show preliminary existing soil conditions on certain portions of the site. LB-1 indicates silty-sand in the upper 4 feet to clayey-silt conditions to 10 feet. LB-2 indicates silty clay in the upper five feet to sand and silty sand from 6 to 11 feet. As previously noted, the water table is at approximately 11 feet throughout most of the site. As a potential soil liquefaction problem exists around 10 to 11 feet, the soil quality is a poor nature and any ground water infiltration must be kept at an absolute minimum.

Storm Water Pollution Prevention

The Los Angeles countywide NPDES permit for municipal storm water discharges (the "Storm Water Permit") establishes certain design requirements for the reduction of storm water run-off for all new development. The Storm Water Permit requires the implementation of a Standard Urban Storm Water Mitigation Plan (SUSMP). The SUSMP specifies that a reduction in storm water related site run-off be accomplished in one of two ways; a reduction in the total amount of impervious surfaces, or redirecting storm water away from impervious areas and the storm drain system.

By utilizing the "water feature", as illustrated in the architect's preliminary draft design, an over-all reduction in the amount of storm water run-off could easily be realized. Any resultant storm water run-off might be redirected to the water feature, preventing the water from either percolating into the ground, or directly discharging to the storm drain without being detained for treatment. However, if the run-off is redirected to the water feature, it is important to provide a means for the flow equalization of discharge from the spillway to the storm drain system. This is required in order to protect the downstream waterway from suffering erosion due to hydraulic overloading, such as occurring during a 10 or 50 year storm event.

WASTEWATER TREATMENT OPTIONS

Wastewater quality influent in Malibu is generally broken up into three categories:

- Residential Waste 250 – 400 Mg/L BOD₅ Single and Multifamily Residences
- Commercial Waste 600 – 800 Mg/L BOD₅ Office buildings and shopping Centers
- High Strength Waste 1000 – 2500 Mg/L BOD₅ Restaurants, Deli's in Grocery Stores

These categories are important, as each category may require different amounts of treatment in order to meet USEPA Class 1 standards of BOD₅ of 30 Mg/L. In order for USEPA Class 1 standards to be met, the following three aspects of wastewater treatment need to be considered:

Pretreatment of High Strength Waste

Pretreatment of high strength and commercial waste is a cost-effective method to ensure a smooth running wastewater treatment system. Whether discharging into an individual treatment system, or a large single package plant, it is a requirement for any restaurant or food facility, and is recommended for all commercial facilities.

One recommended system for pretreatment reduces high strength waste to the levels of residential strength waste. Such a system can be installed beneath the facility parking lot, thus allowing for the maximization of space for purposes other than wastewater treatment.

Wastewater Treatment

A ten foot separation soil surface to groundwater is the minimum acceptable distance for a conventional septic system at this site. Although a case might be made for treating all wastewater with conventional septic systems, it is not recommended. The Board, and the City of Malibu, are moving toward requiring that all wastewater discharges either connect into a centralized sewer system, or discharge to an individual treatment unit which is designed to provide USEPA Class 1 Secondary treated wastewater. Fortunately, both high strength waste and commercial waste, if pretreated, can utilize the same technology as used in residential systems. Several technologies exist that can be designed underground or as a landscape feature.

An additional concern is that of future nitrogen contribution to the water table. New TMDLs for the Los Angeles Basin are required to be in place by 2001. These new standards are to be instituted with nitrate-nitrogen levels set at 8 mg/L (or lower) in the LA Basin. As a result of its new limit, the Malibu Creek Watershed will have to meet much stricter requirements on ammonia discharges. These requirements will be set primarily for surface discharges, but the Regional Board also plans on using these standards for all discharges to ground water. Conventional septic systems will not meet this new standard, as they produce a nitrate-nitrogen level of 30 mg/l. As previously stated, background nitrate-nitrogen, if not previously documented, could give false readings of the wastewater performance.

Water Disposal Methods

As previously noted, considerations for wastewater disposal include soil categories and the depth of the underlying water table. Additional concerns also include increased susceptibility to liquefaction due to additional water added to the soil. In order to alleviate these problems, neighboring commercial properties (in the developmental stages) are utilizing evapo-transpiration (ET) systems as the primary method of reducing the impact of wastewater on the water table. These sites plan to dispose of wastewater by using the effluent to irrigate the landscape through a sub-surface drip irrigation system. In this way, these sites should realize an overall reduction in landscaping maintenance costs.

FEASIBILITY ANALYSIS

10C -Malibu General Plan: Preliminary Design

With a water table at averaging 12.5 ft, conventional systems are neither feasible nor wanted for long term planning. A modular system of pretreatment and decentralized wastewater treatment systems on the property allows ample room for Class 1 Secondary Quality Water. Wastewater disposal becomes the main issue. Calculations were made based on information supplied by Edward A D'Andrea, Architect and Associates. Information from two other proposed commercial developments in the Civic Center Area are included for comparison. This information is as follows:

Total Acreage	14.63
Buildings Space	95,396 Square Feet
FAR	1.5
Water Feature	1.6 Acres
Total Landscaping	318,641 Square Feet

Historical Evapotransporation (Southern Region)

Minimum:	.0416 gallons/square ft/day
Maximum	.104 gallons/square ft/day

Percolation Rate/Subsurface Drip System

Clay Soils	.1 gallons/square ft/day
------------	--------------------------

Projected Waste Flow	28,900 Gallons per day
Minimum Evapotransporation	13,256 gallons per day
Maximum Evapotransporation	33,139 gallons per day
Percolation/Clay Category	31,864 gallons per day

Wastewater Disposal could be accomplished by Percolation Rates alone. With additional evapotransporation, a buffer is added plus increases denitrification and decreases impact on the existing water table. Parking lots could use gravel parking or interlocking paver (Examples enclosed) as a semi-permeable surface.

8A -Low Density: Preliminary Design

With a water table at averaging 12.5 ft, conventional systems are neither feasible nor wanted for long term planning. Calculations were made based on information supplied by Edward A D'Andrea, Architect and Associates. The latest plan call for 16 Estate homes ranging from 6000-7000 square feet each on a ¼ acre lot. The following calculations on based on a seven bedroom house. A modular system of a decentralized wastewater treatment system on each property allows ample room. Wastewater disposal becomes the main issue.

16 ¼ acre Estate Single Family Residences

Total Acreage:	.75	
Buildings Space	7000 Square Feet	
Maximum Landscaping	25,000 Square Feet	
Percolation Rate/Subsurface Drip System		
Clay Soils	.1 gallons/square ft/day	
Historical Evapotransporation (Southern Region)		
Minimum:	.0416 gallons/square ft/day	
Maximum	.104 gallons/square ft/day	
Projected Waste Flow		1200 Gallons per Day
Area Needed for Subsurface Disposal		12,000 Square Feet
Clay Soils .1 gallon/square ft/day		
Available Landscaping (with setbacks)		20,000 Square Feet

2.63 Acre Commercial Center

Wastewater Disposal could be accomplished by Percolation Rates alone. With additional evapo-transporation, a buffer is added plus increases denitrification and decreases impact on the existing water table.

Total Acreage:	2.63	
Buildings Space	17,250 Square Feet	
FAR	1.5	
Water Feature (approx.)	1.6 Acres	
Total Landscaping	57,281 Square Feet	
Historical Evapotransporation (Southern Region)		
Minimum:	.0416 gallons/square ft/day	
Maximum	.104 gallons/square ft/day	

Percolation Rate/Subsurface Drip System

Clay Soils .1 gallons/square ft/day

Projected Waste Flow **5250 Gallons per day**

Minimum Evapotranspiration **2383 gallons per day**

Maximum Evapotranspiration **5957 gallons per day**

Percolation/Clay Category **5728 gallons per day**

Wastewater Disposal could be accomplished by Percolation Rates alone. With additional Evapotranspiration, a buffer is added plus increases denitrification and decreases impact on the existing water table. Parking lots could use gravel parking or interlocking paver (Examples enclosed) as a semi-permeable surface.

March 3, 1999

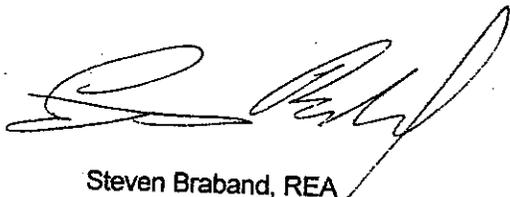
CONCLUSION

Based on a careful review of the regulatory and environmental constraints, it appears that all wastewater issues can be successfully addressed on this property. The technologies enclosed are examples of systems that could be used to accomplish both present and projected future regulations that are foreseen at this time.

If you have any questions, please feel free to contact us at any time.

Thank you.

Sincerely,



Steven Braband, REA
President



Paul Tantet, M.S., REHS, REA
Environmental Health Specialist



GEOTECHNICAL BORING LOG LB-1

Date 9-21-92

Project Kosmont/Malibu

Drilling Co. A & R Drilling, Inc.

Hole Diameter 8" Drive Weight _____

Elevation Top of Hole +/- Location _____

Sheet 1 of 2

Project No. 2920647-01

Type of Rig CME 75

Drop _____

Elevation Feet	Depth Feet	Graphic Log	Relative Compaction	Tube Sample No.	Blows Per Foot	Dry Density Pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
									Logged By <u>DB/CY</u> Sampled By <u>CY</u>
0									0'-2': SILTY SAND, very fine grained, light brown, slightly moist, loose medium dense. 2'-4': SANDY SILT, very fine grained sand, non-plastic, dark brown, slightly moist, medium dense
5		1					20.9	CL	4'-6.5': SILTY CLAY, slightly plastic, dark brown, slightly moist, medium firm
10		2					27.7	CL	6.5'-10': CLAYEY SAND, fine grained, slightly plastic, brown, moist, medium dense 10'-11': SANDY SILT, fine grained, non-plastic, brown, very moist, firm 11'-14': SILTY CLAY, some caliche, medium plastic, dark brown, very moist, firm
15		3						SC	14'-17': CLAYEY SAND, with gravel, gravel sizes to 1-1/2 inch, fine to medium grained, brown, very moist, medium dense
20		4						ML	17'-19': SILTY CLAY, medium plastic, gray, very moist, very firm 19'-20': SANDY SILT, fine grained, slightly plastic, gray, very moist, stiff 20'-23': SILTY SAND TO SAND, fine to coarse grained, gray, wet, medium dense to dense
25		5					33.6	ML	23'-25': SANDY SILT, slightly plastic, gray, very wet, stiff
30		6					29.3	SM	25'-26': SAND, fine to coarse grained, gray and brown, wet, medium dense 26'-27': SANDY SILT, fine grained, non-plastic, gray, wet, stiff 27'-30': SILTY SAND, fine grained, slightly micaceous, gray, wet, dense

GEOTECHNICAL BORING LOG LB-2

Date 9-21-92

Sheet 1 of 2

Project Kosmont/Malibu

Project No. 2920647-01

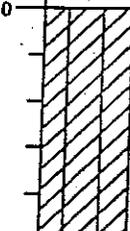
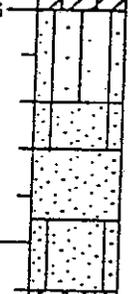
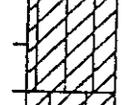
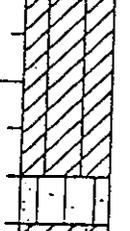
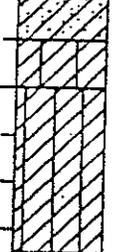
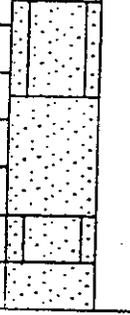
Drilling Co. A & R Drilling, Inc.

Type of Rig CME 75

Hole Diameter 8" Drive Weight _____

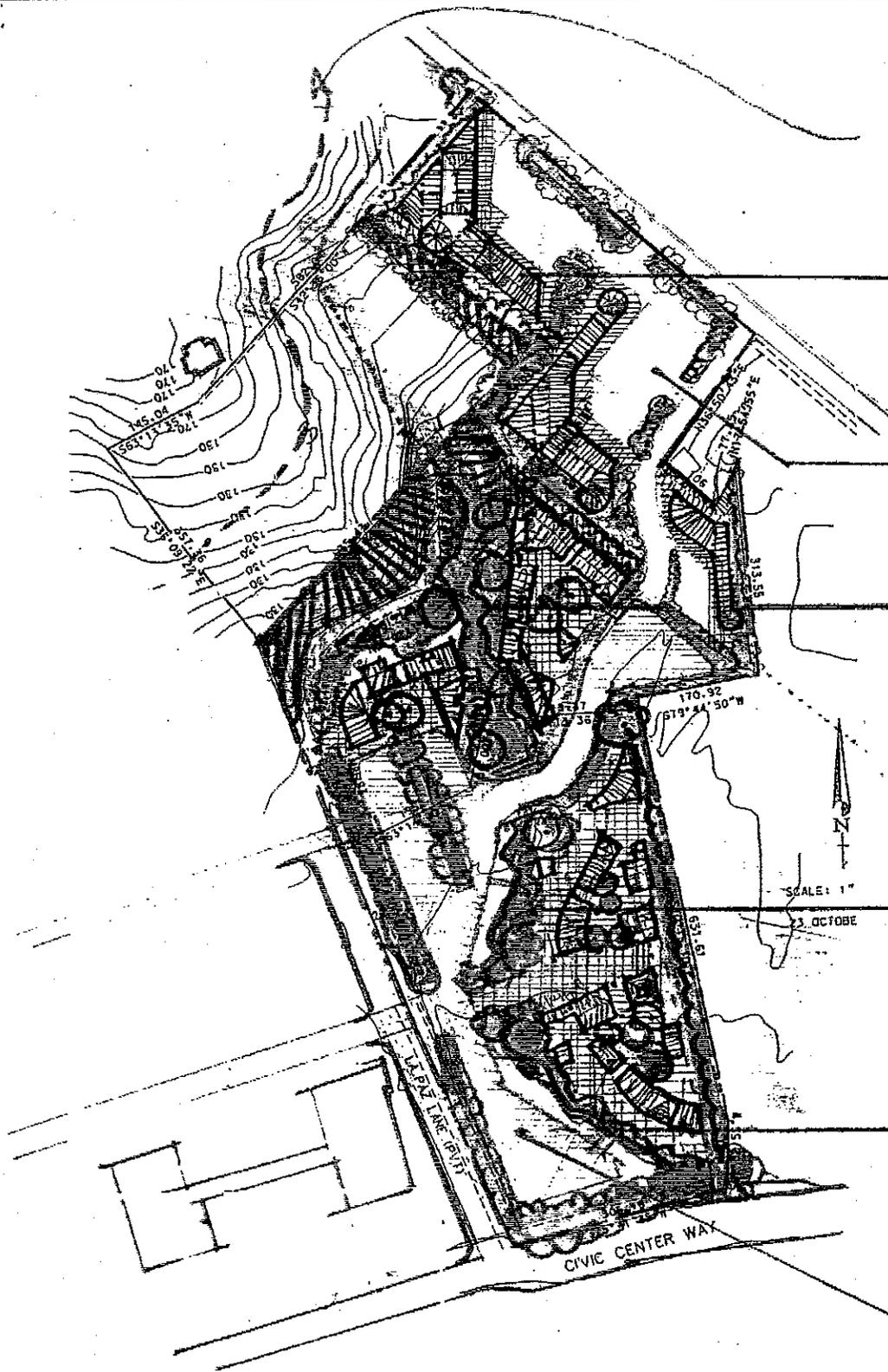
Elevation Top of Hole +/- Location _____

Drop _____

Elevation Feet	Depth Feet	Graphic Log	Relative Compaction	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
									Logged By _____ CY Sampled By _____ CY
0				BAG-1				CL	0'-5': SILTY CLAY, slightly plastic, dark brown, slightly moist, moderately firm
5				1				CL	5'-7': SANDY SILT, fine grained, slightly plastic, dark brown, slightly moist, moderately firm.
10				2				SP/SM	7'-8': SILTY SAND, fine grained, dark brown, slightly moist, medium dense 8'-9.5': SAND, cemented, fine to medium grained, yellow brown to brown, moist, medium dense
15				3			26.8	CL	9.5'-11': SILTY SAND, fine grained, trace of gravel, brown, moist, medium dense. 11'-13': CLAYEY SILT, slightly plastic, medium brown, moist, firm
20				4				CL	13'-17': SILTY CLAY, medium plastic, dark brown, moist, firm 17'-18': SANDY SILT, fine grained, slightly plastic, gray, moist, very firm
25				5			22.8	SM	18'-19': CLAYEY SAND, fine grained, slightly plastic, gray, moist, medium dense 19'-20': SILTY CLAY, medium plastic, gray, wet, firm. 20'-23.5': CLAYEY SILT, slightly micaceous, medium plastic, gray, wet, stiff
30				6			24.3	SM	23.5'-24.5': SILTY SAND, fine grained, gray, wet, medium dense 24.5'-28': SAND, fine to medium grained, brown, wet, dense 28'-29': SILTY SAND, fine grained, grayish brown, wet, dense 29'-30': SAND, fine to med. grained, brown, wet, dense

505A(11/77)

LEIGHTON & ASSOCIATES



TRAIL

COMMUNITY COMMERCIAL:

TOTAL FAR= 95 396 SQ FT

PARKING

WATER FEATURE
GREENBELT

COMMUNITY COMMERCIAL
Pedestrian Plaza

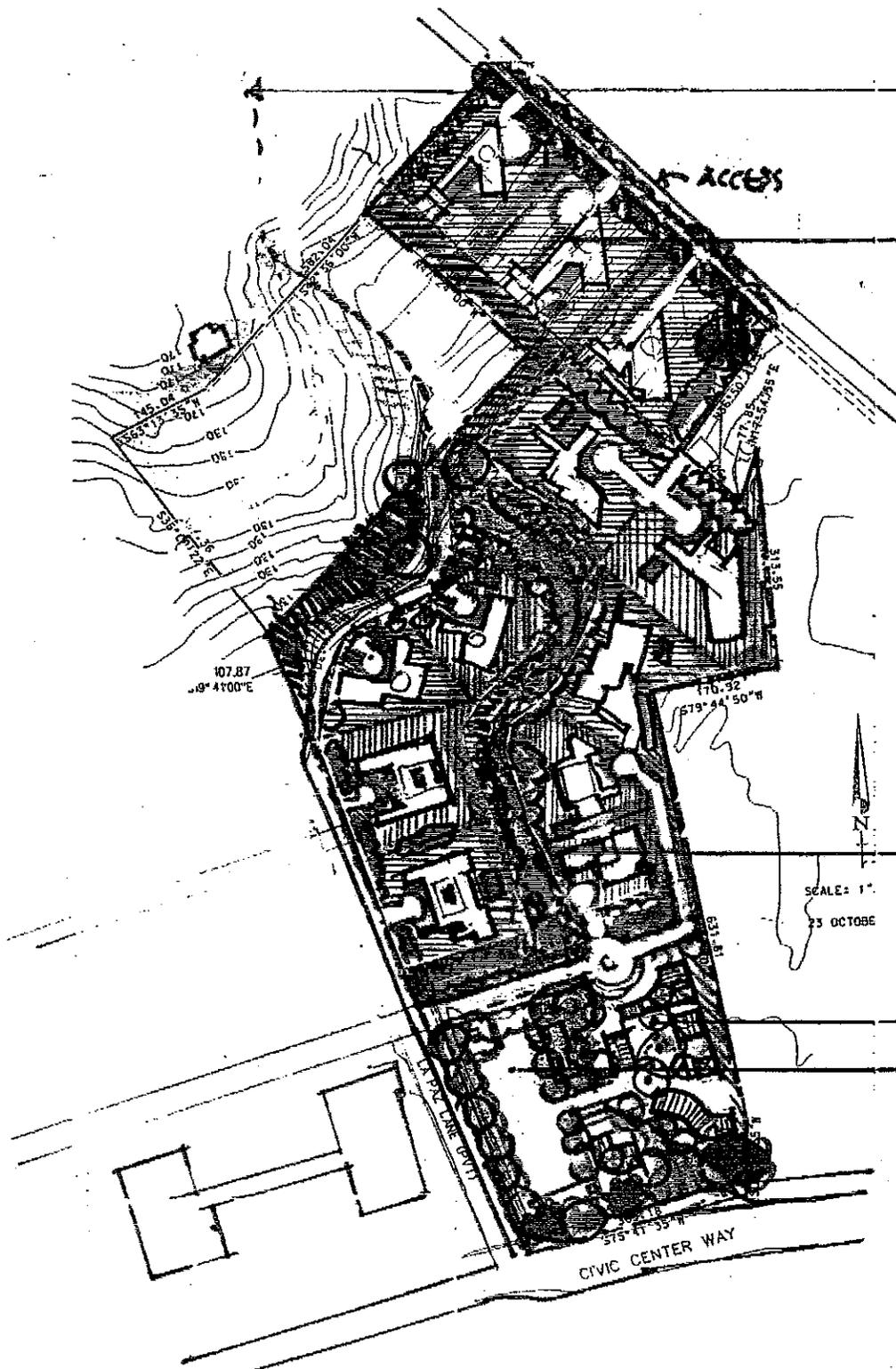
PARKING



malibu general plan:
preliminary design

Edward A. D'Andrea > architect & associates
architecture land planning interiors environmental research

10c



TRAIL

SINGLE FAMILY DWELLING

12 units @ 1acre
7000 FT

WATER FEATURE
trail access

COMMERCIAL
FAR= 17 250 SQ FT

PARKING

low density: preliminary



Edward A. D'Andrea > architect & associates
architecture land planning interiors environmental research

8a

TRAIL

16 units @ 3/4 acres

~~5444 PT~~

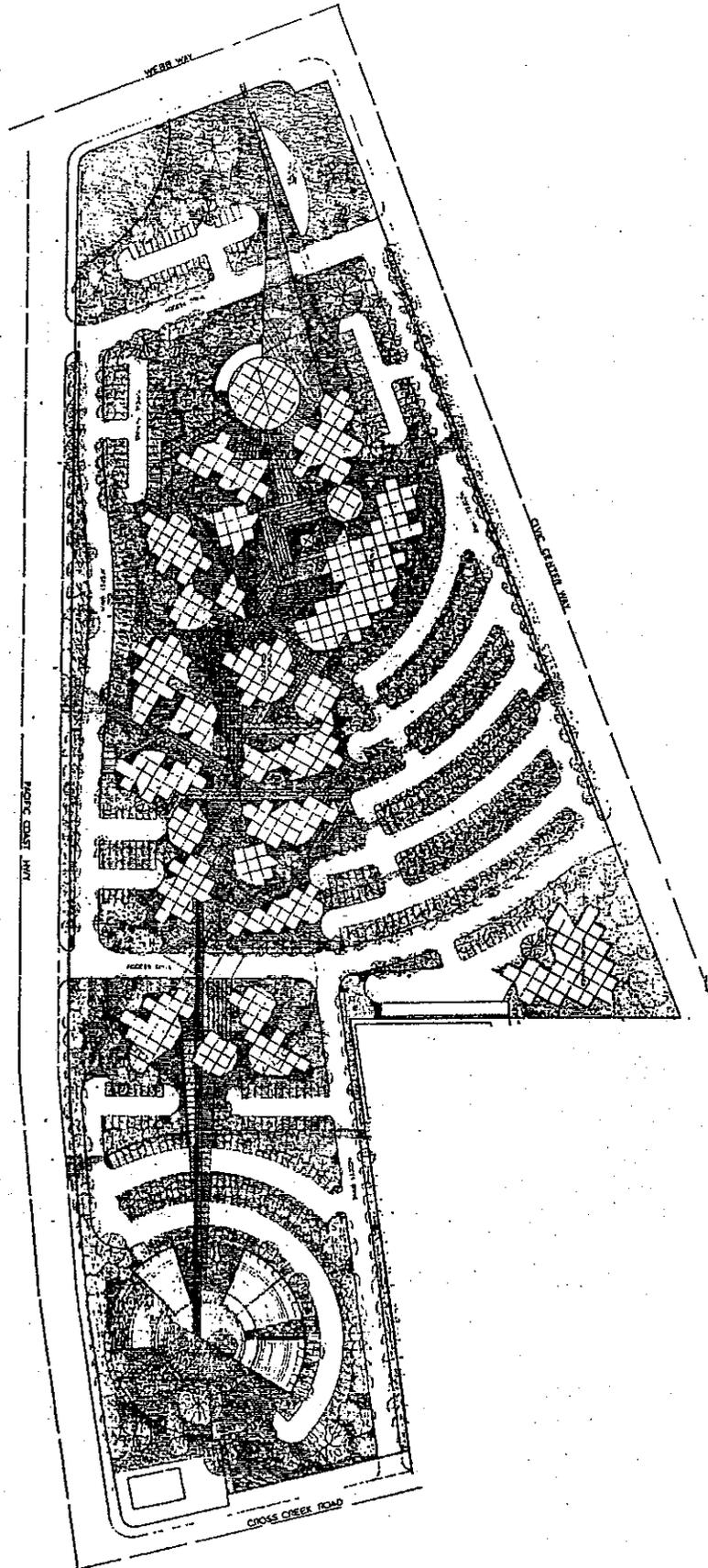
WATER FEATURE
trail access

COMMERCIAL
FAR= 17 250 SQ F
2.63 acres

PARKING



Malibu Village



For more information please call
Malibu Bay Company (310)-456-6555

Malibu Village Fact Sheet

Malibu Village has been planned by The Malibu Bay Company. The company is a partnership of the Konheim and Perenchio families. Both families have been active in the Malibu community for many years and have supported a wide range of youth and civic activities in the City.

- **The Architect**

Ed Niles, a Malibu resident and nationally acclaimed award-winning architect, was chosen to design Malibu Village. Niles has designed some of Malibu's most popular homes and commercial buildings and he has served on both the General Plan and Specific Plan Task Forces.

- **Project Location**

Malibu Village will be located on the "Chili Cook Off" site, on Pacific Coast Highway between Webb Way and Cross Creek Road.

- **The Project**

The project consists of small clusters of residentially scaled buildings in rustic ranch styles linked by active and passive open space, pedestrian pathways and tot lots. There will be an increase of 140,646 square feet of commercial space in addition to the existing 29,354 square feet of commercial space. The result is 170,000 square feet of commercial space. Included are an open-air market, a village cinema, Malibu Lumber, a gourmet specialty market and other community-serving businesses.

In addition there will be a center devoted to understanding Malibu's special nature. We look forward to soliciting community suggestions as to how this facility will be used.

- **Scale**

Malibu Village consists of residentially scaled buildings the same height as is allowed for single-family homes in Malibu. These designs are consistent with the General Plan, with the exception of a cinema building that will be 4 feet taller.

- **Density**

The floor area ratio (FAR) is .19, less dense than the City's General Plan which allows a FAR of .20 - .25. The General Plan encourages the creation of community amenities with higher FARs that could increase commercial square footage by 25%.

This project provides many of these amenities without taking advantage of the additional commercial square footage. We provide playgrounds and a civic arts plaza. We plan to build the previously mentioned center for exhibits or information. The landscaped parking lots can be transformed into spaces for community events, exhibits and festivals.

Malibu Village FARs are much less dense than surrounding developments.

	FAR	% greater density than Malibu Village
Malibu Country Mart	.25	32%
Malibu Country Shops	.38	100%
Malibu Country Stores	.37	95%
Malibu Creek Plaza	.28	37%
Malibu Professional Arts Center	1.10	479%

The average current FAR in the Civic Center is approximately .32, 60% more dense than Malibu Village.

- **Landscaping & Open Space**

Fifty-five percent of Malibu Village is open space, landscaping and turf parking areas. This amount exceeds the landscaping and open space amenities provided by any existing development in the city. The buildings will be set back from PCH and will be sheltered from view by native plants, trees and shrubbery.

- **Environmental Impacts**

The City will conduct an Environmental Impact Report (EIR), outlining significant environmental issues. The EIR process will include opportunities for all Malibu residents to make their comments.

- **Public Amenities**

The amenities complement our town's active outdoor lifestyle and unique setting. Malibu Village will create a natural gathering place in the community for people of all ages. The naturally landscaped parking areas can be closed off for citywide events.

Perhaps the most exciting public amenity featured is a center which is designed to be flexible to accommodate a changing menu of exhibits and displays about Malibu's culture. A landscaped pond adjacent to the building provides a feeling of tranquility.

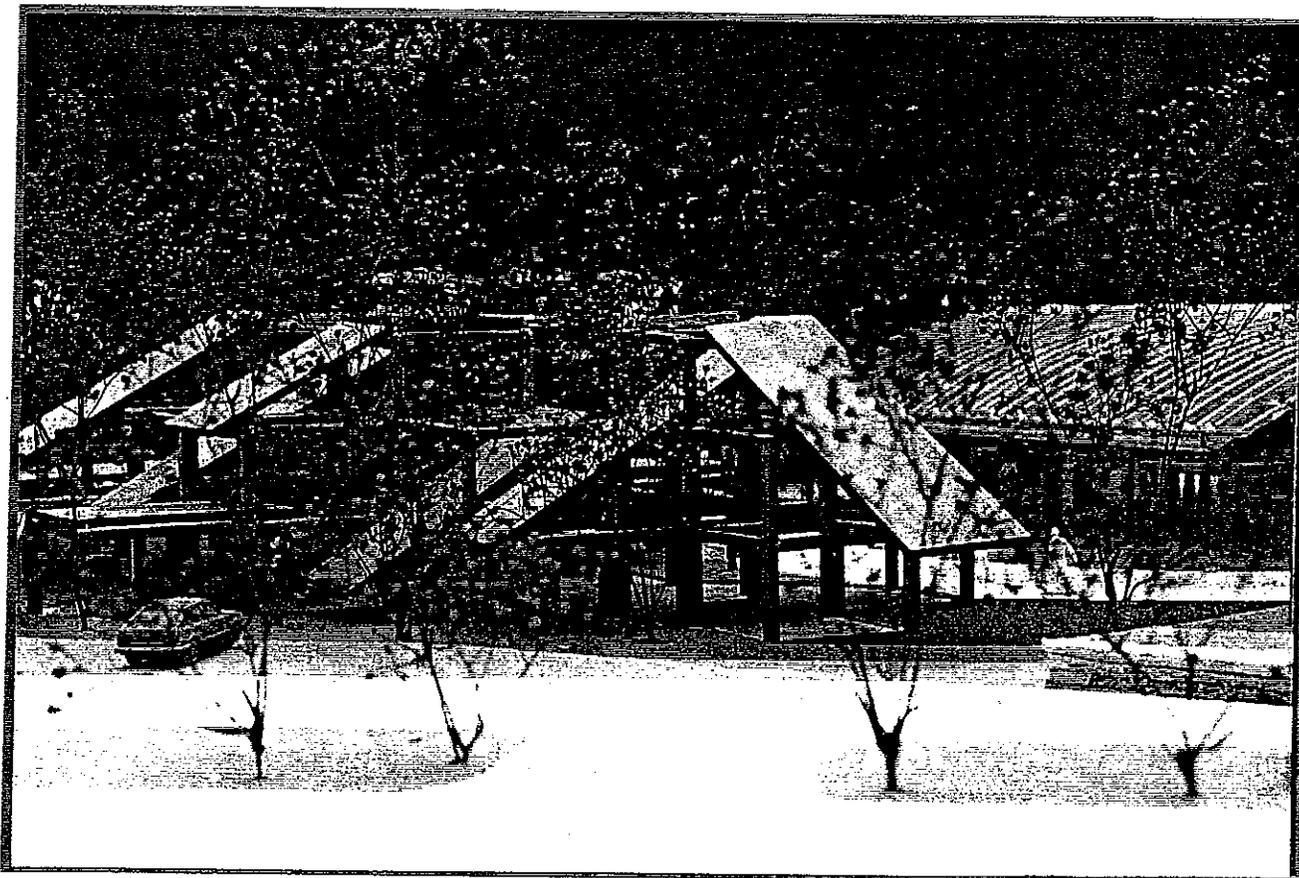
The Civic Arts Plaza contains an amphitheater where school groups, creative workshops and others can perform plays or give recitals.

- **Parking**

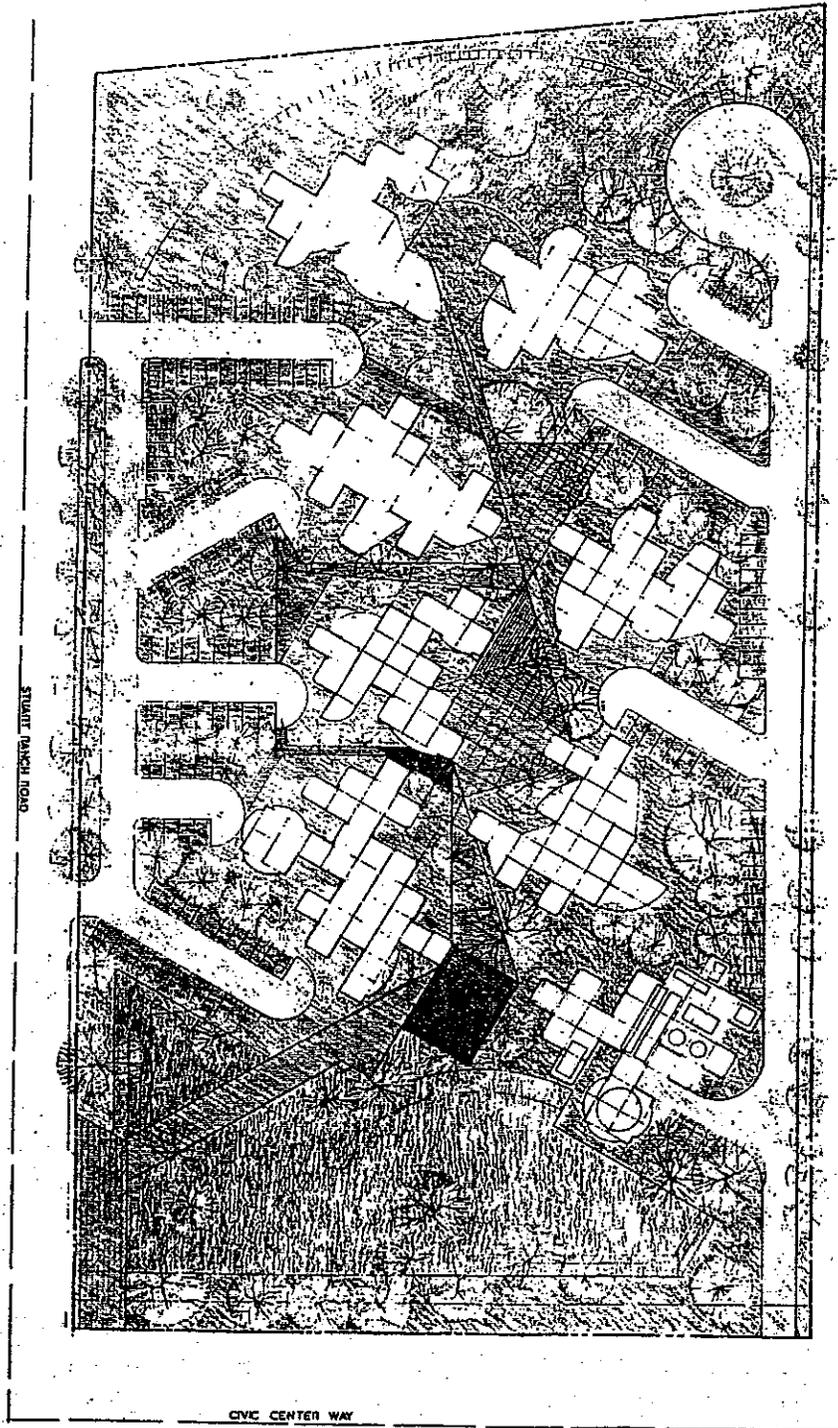
The turf parking areas interspersed throughout the project are engineered to eliminate hydrocarbon runoff and to allow the natural absorption of rainwater. Non-asphalt drives connect islands of turf parking divided by rows of shade trees. Seven hundred and seventy five parking spots are proposed for this site.

- **Wastewater**

There will be no wastewater discharge from the project into Malibu Creek or Lagoon. The tertiary water treatment plant will be located on the site of Malibu Country Park across Civic Center Way. The system will yield clean water that will be used for groundwater infiltration into Winter Canyon, irrigating landscaping and other non-potable water uses.



Malibu Country Park



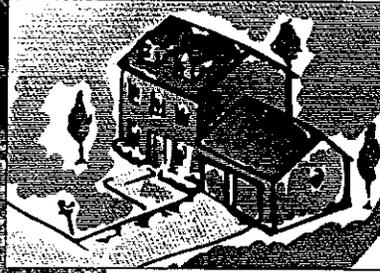
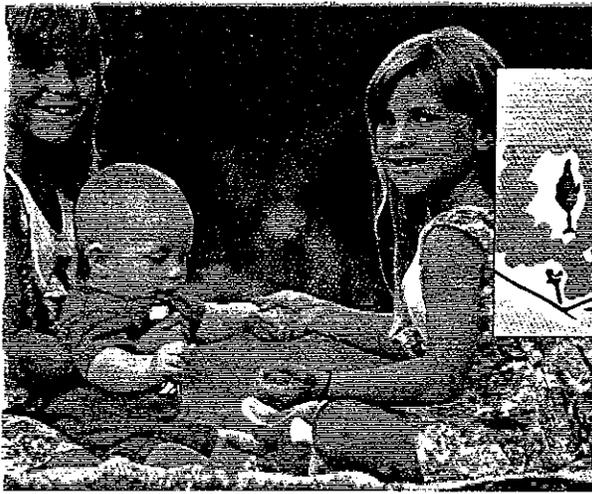
For more information please call
Malibu Bay Company (310)-456-6555

Malibu Country Park Fact Sheet

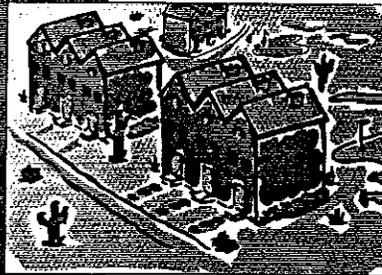
Malibu Country Park has been planned by The Malibu Bay Company. The company is a partnership of the Konheim and Perenchio families. Both families have been active in the Malibu community for many years and have supported a wide range of youth and civic activities in the City.

- **The Architect** Ed Niles, a Malibu resident and nationally acclaimed award-winning architect, was chosen to design Malibu Country Park.
- **Project Location** Malibu Country Park is planned for the northeast corner of Civic Center Way and Stuart Ranch Road, adjacent to City Hall.
- **The Project** A small cluster of seven residentially scaled garden offices, shops and food establishments, limited to a cumulative 60,000 square feet, is proposed for the 9.28 acres parcel. They are designed in a rustic ranch style.
- **Scale** The primarily one-story structures are consistent with the General Plan, built to the same height as is allowed for single-family homes in Malibu.
- **Density** Malibu Country Park has a floor area ratio (FAR) of .149, less dense than allowable FAR under the City's General Plan (.15 to .20).
- **Landscaping & Open Space** Sixty percent of Malibu Country Park will be open space, turf parking lots and landscaping in natural plants, trees and shrubbery.
- **Environmental Impact:** The City will conduct an Environmental Impact Report (EIR) outlining significant environmental issues. The EIR process will include opportunities for all Malibu residents to make their comments.
- **Public Amenities** A pond contributes to the relaxed atmosphere of Malibu Country Park, providing a peaceful setting for lunches and reflection.
- **Parking** Turf parking areas interspersed throughout the project are engineered to eliminate hydrocarbon runoff and to allow the natural absorption of rainwater. Non-asphalt drives connect islands of turf parking divided by rows of shade trees. Two hundred sixty five parking spots are proposed for this site.
- **Wastewater** There will be absolutely no wastewater discharge from the project into Malibu Creek or Lagoon. The tertiary water treatment plant will yield clean water that will be used for groundwater infiltration into Winter Canyon, irrigating landscaping and other non-potable water uses.

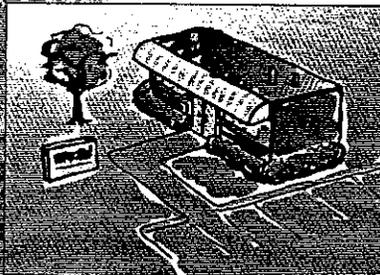
FAST wastewater
treatment
systems



Single Family Dwellings



Clustered Subdivisions



High Strength Commercial



Failed System Renovation

Dependable, Affordable FAST®

FAST® is simply great technology. Ideally suited for use in single family dwellings, clustered residential developments and subdivisions, restaurants or other high strength commercial applications, a versatile FAST system is ready to serve your needs. FAST can even be used to retrofit a failed conventional septic system, giving homeowners and small communities the innovative solutions they seek. Dependable, affordable...FAST.

Nothing to disturb your view.

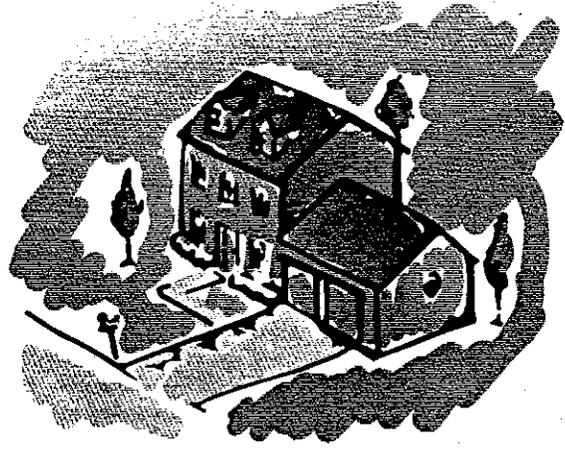
You'll like the view your FAST wastewater treatment system affords—because you can't see it. Everything is tucked neatly underground, except for an unobtrusive blower housing that can be located up to 100 feet away. For years to come you won't notice a thing about your FAST system except how well it's working. And the beautiful view.

FAST wastewater
treatment
systems



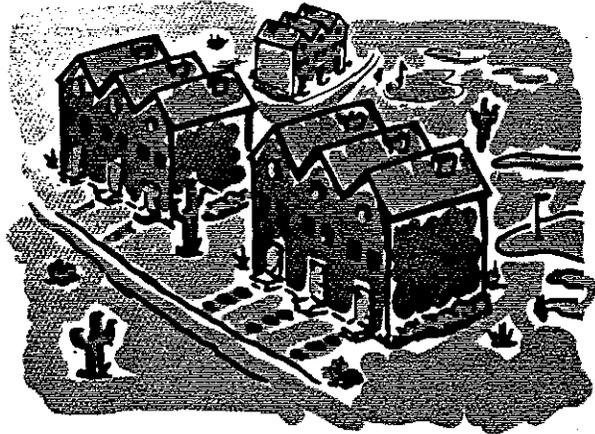
Single Family Dwellings

- Environmentally safe treatment allows full use of property by homeowners, children and pets
- Proven high performance levels could mean reductions in lot size, separation distances and other limiting factors
- Possible innovative re-use of precious water resources for irrigation
- Advanced wastewater treatment system ready for next generation requirements



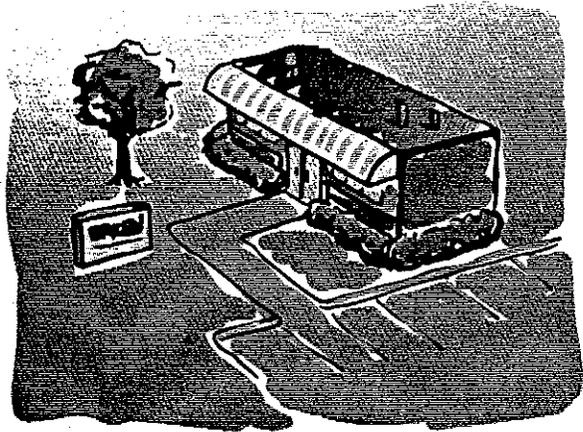
Clustered Subdivisions

- FAST may make previously unbuildable land useful and profitable
- Modular design of FAST system allows project planners maximum flexibility
- Builders and developers are able to purchase and install only when and where needed, saving large capital expenditures of a costly centralized system



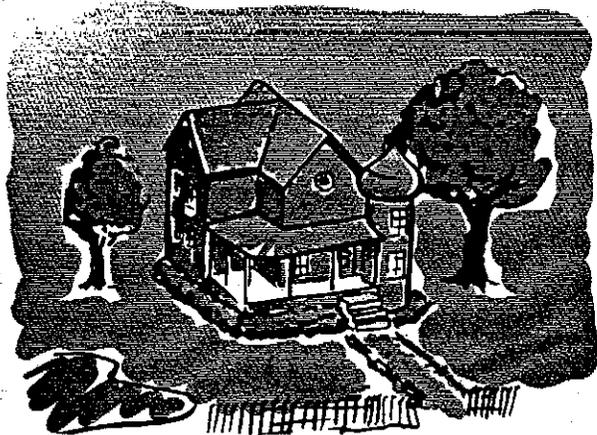
High Strength Commercial

- Restaurants and other difficult high strength waste applications are effortlessly treated with FAST's robust aerobic process
- Clubhouses, schools, trailer parks, office buildings and other commercial properties are natural fits for a FAST wastewater treatment system
- With FAST's reliable process engineering design, operation is simple and virtually maintenance free

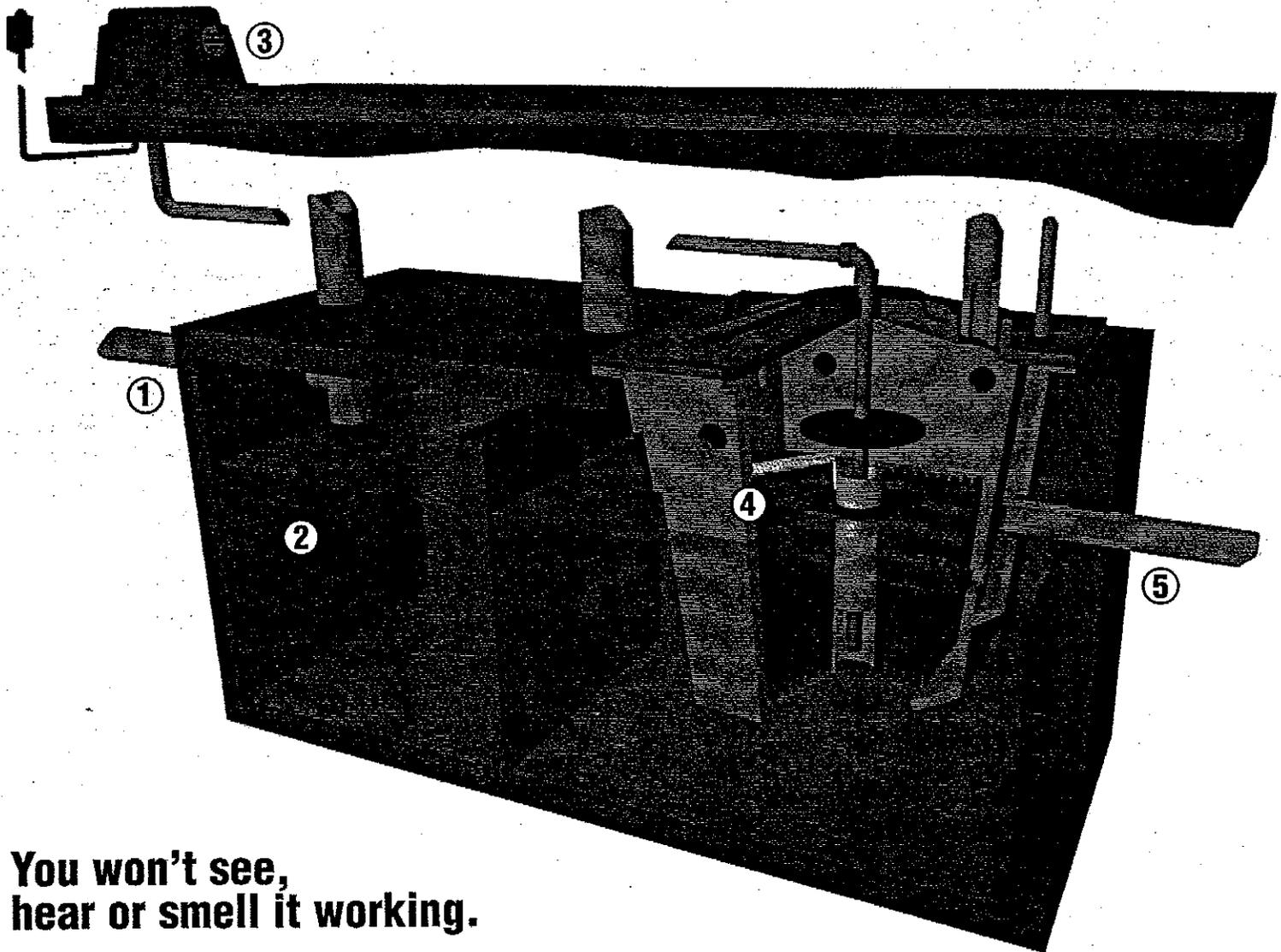


Failed System Renovation

- Failing septic systems can easily be retrofitted and upgraded with the simple, affordable design of FAST
- Small communities now have a practical, proven alternative to cost prohibitive centralized sewer systems
- Modernizing the wastewater treatment system with FAST increases value and usefulness of the property



Introducing **FAST** Wastewater Treatment Systems



**You won't see,
hear or smell it working.**

- ① FAST® wastewater treatment systems process all the wastewater from single family homes, clusters of homes, small communities or even the high strength wastes from restaurants or commercial facilities.
- ② Natural separation and settling processes occur in the first compartment of the underground tank.
- ③ Remote blower (the system's only moving part) delivers large volumes of air into the heart of the system, creating vigorous water movement. FAST is oxygen-rich and self-cleaning.
- ④ Proven, reliable FAST treatment module provides the perfect environment for "friendly bacteria" to grow and multiply. FAST consistently processes and removes more than 95% of common impurities. Special patented technology allows exceptional Total Nitrogen reductions (including nitrates) of more than 70%.
- ⑤ Clear, odorless treated water is ready for standard or innovative dispersal.

The real beauty of this remarkable system is how well it works.

The science behind a FAST® wastewater treatment system is environmentally sound and simple. FAST is an acronym for Fixed Activated Sludge Treatment. Here's why this technology is so effective:

A FAST wastewater treatment system is a pre-engineered modular apparatus designed to treat wastewater from residential, commercial, high strength and small community applications.

FAST is a fixed film, aerated system utilizing a combination of attached and suspended growth, capable of nitrification/denitrification in a single tank. This innovative combination includes the stability of fixed film media and the effectiveness of proven activated sludge treatment, making FAST technologically advanced and extraordinarily reliable.

A FAST system provides an ideal home for large volumes of friendly organisms in the inner aerated media chamber to digest the wastewater and turn it into a clear, odorless, high-quality effluent. The attached growth system assures that more organisms remain inside the system instead of being flushed out, even during times of peak hydraulic flows (for example, during large social gatherings or on multiple-washload laundry days). During times of low usage, the large volumes of

thriving organisms prevent a dying-off of the system, making FAST equally well suited to intermittent use applications.

Sufficient conditions are present which allows nitrification and denitrification to occur in the same tank—without any system modifications. Special patented technology allows FAST to consistently reduce nitrogen levels—including nitrates and all other nitrogen species—by over 70%.

Installation of the lightweight and durable FAST system is easy. It simply mounts into a septic tank. FAST is designed to be efficient, dependable, user-friendly and very easy to install.

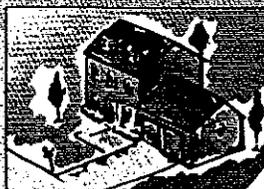
Once installed, the FAST system is virtually maintenance free. Tastefully located below ground level, the clean, odorless system blends beautifully into any landscaping design. The only moving part is the quiet aerating blower, placed above ground level in the most convenient location. FAST needs no other filters or pumps.

FAST is ideally suited for residential development, high-strength waste, light commercial applications and renovation of failing systems on marginal or severely limited sites.

FAST wastewater treatment systems share many advantages:

Single Family Dwellings

- Hidden, installs underground
- Quiet, automatic operation
- Garbage disposal and dishwasher compatible
- Affordable options



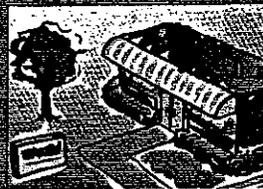
Clustered Subdivisions

- Makes marginal sites buildable
- Flexible development and landscape planning
- Saves money versus centralized system



High Strength Commercial

- Robust process handles even the toughest applications
- Virtually maintenance free—less mess
- Pre-treatment or complete treatment



Failed System Renovation

- Simple, dependable retro
- Minimal disruption
- Low cost, long-lasting solution
- Renovates soil and leach fields



Proven, safe, reliable.

The advanced technology behind FAST® was originally developed by Smith & Loveless, Inc., a worldwide leader in the design and manufacture of wastewater treatment equipment since 1946. FAST has been used successfully for many years in municipal, industrial, marine, commercial and residential applications.

Known globally for superior engineering and manufacturing, the Smith & Loveless companies are one of the most recognized water and wastewater transfer and treatment groups in the world. This innovative group of companies is known for high standards, proven technology, engineering expertise and manufacturing quality.

Environmental Protection

FAST systems greatly reduce groundwater contamination and help protect the delicate ecosystem.

Potentially harmful nitrates and all other forms of nitrogen are removed at unparalleled rates (more than 70%) through the patented FAST process. FAST is made with post-consumer recycled materials. Use of this remarkable system allows for responsible new development and the renovation of failed conventional systems.

FAST Certifications

U. S. Coast Guard

Canadian Great Lakes

UK Department of Trade

NSF Standard 40, Class I

International Maritime Organization (IMO)



NSF's Certification Program is accredited by the American National Standards Institute

NSF's Certification Program is accredited by the Dutch Council for Certification

Technical Specifications

Power required: Normal household current (120v, 60Hz). Other options (220v and international requirements) are available.

Materials of construction: Made with 100% corrosion resistant materials and contains post-consumer recycled materials.

Underground housing: FAST systems can be housed in concrete, fiberglass, steel or plastic tanks. Always check local regulations before installing or altering a wastewater system. Contact Bio-Microbics or a dealer near you for more information on the availability of proper tankage in your area.

Dispersal Options: Check your local regulations. The extraordinarily high treatment levels may allow reductions in drain field areas, use of treated water for irrigation or other innovative discharge methods.

Capacity: Available in several convenient, affordable sizes and configurations. Please contact Bio-Microbics or a dealer near you for more information on the FAST system that's right for your application.

Bio-Microbics, Inc.
8271 Melrose Drive
Lenexa, KS 66214

913-492-0707

1-800-753-FAST

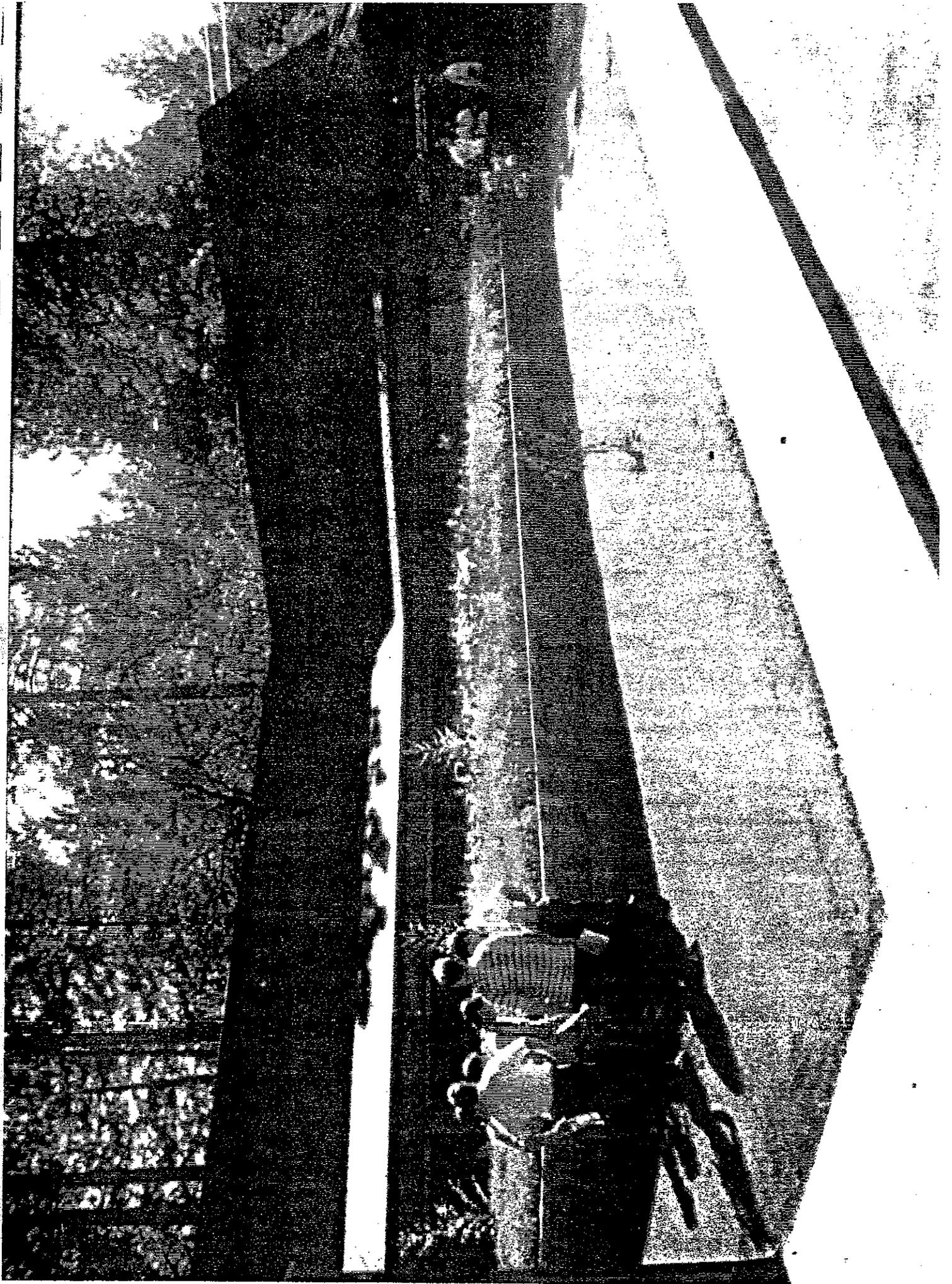
Fax: 913-492-0808

E-mail: onsite@biomicrobics.com

Web site: www.biomicrobics.com

BIO-MICROBICS[®]
INCORPORATED

© 1998 Bio-Microbics, Inc.

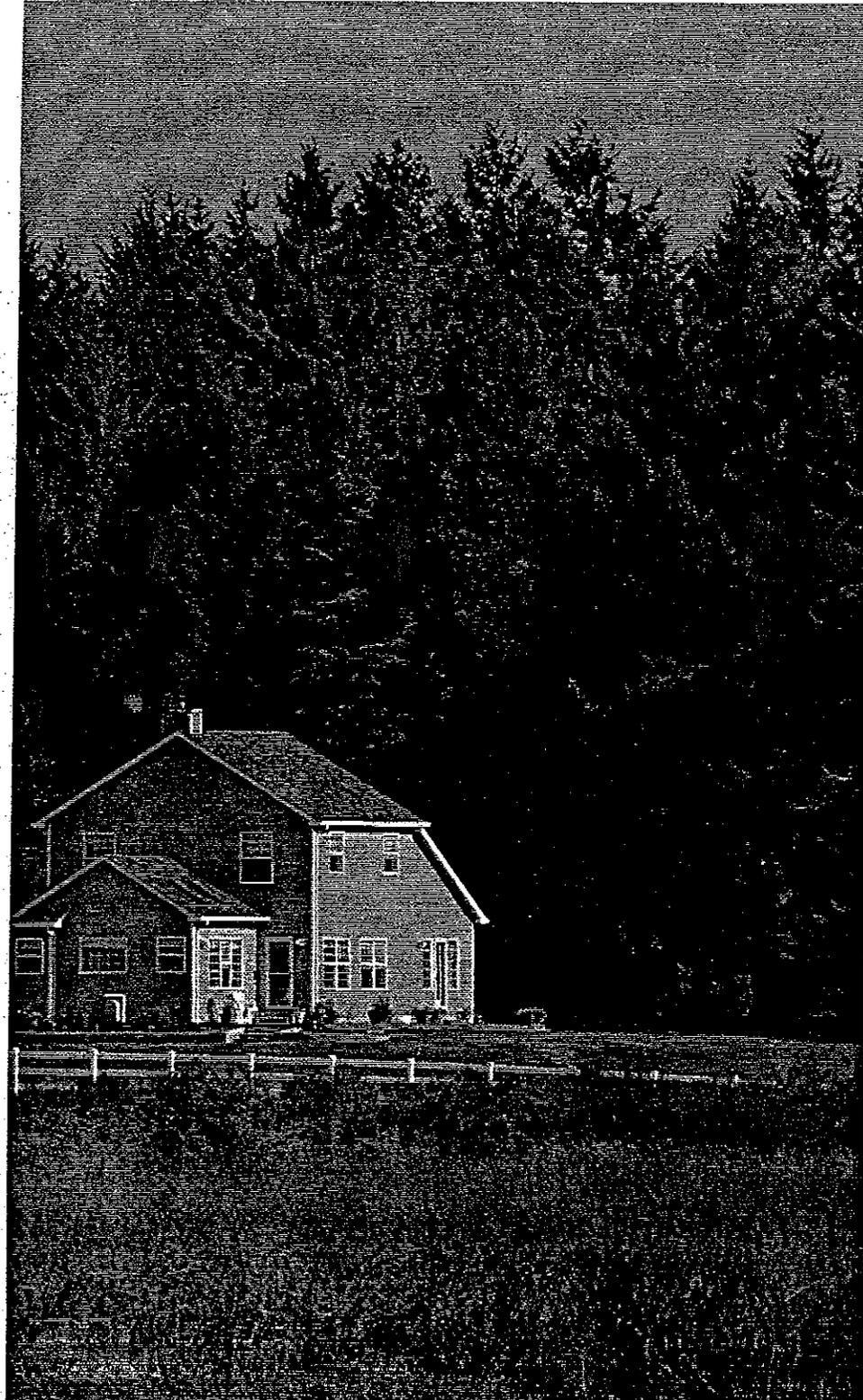


Placer County Community Center Intermittent Sand Filter/Landscape Feature



Orenco Systems[®]
Incorporated

Intermittent Sand Filters



**Setting the Standard
for Onsite Wastewater
Treatment**

The OSI Intermittent Sand Filter System

*Dependable advanced wastewater treatment
in a convenient pre-engineered kit*

Control Panel

Effluent Pumping System Using the
Biotube® Pump Vault

Why an Intermittent Sand Filter?

Where high groundwater, poor soils, or other site constraints rule out a conventional septic system, Intermittent Sand Filters (ISFs) are the ideal solution. With a long history of superior treatment, ISFs from OSI outperform aerobic treatment plants. Tucked neatly underground, modern ISFs can be planted over with lawn or flowers to blend into the landscaping. Now you can safeguard your family and enjoy your yard too!

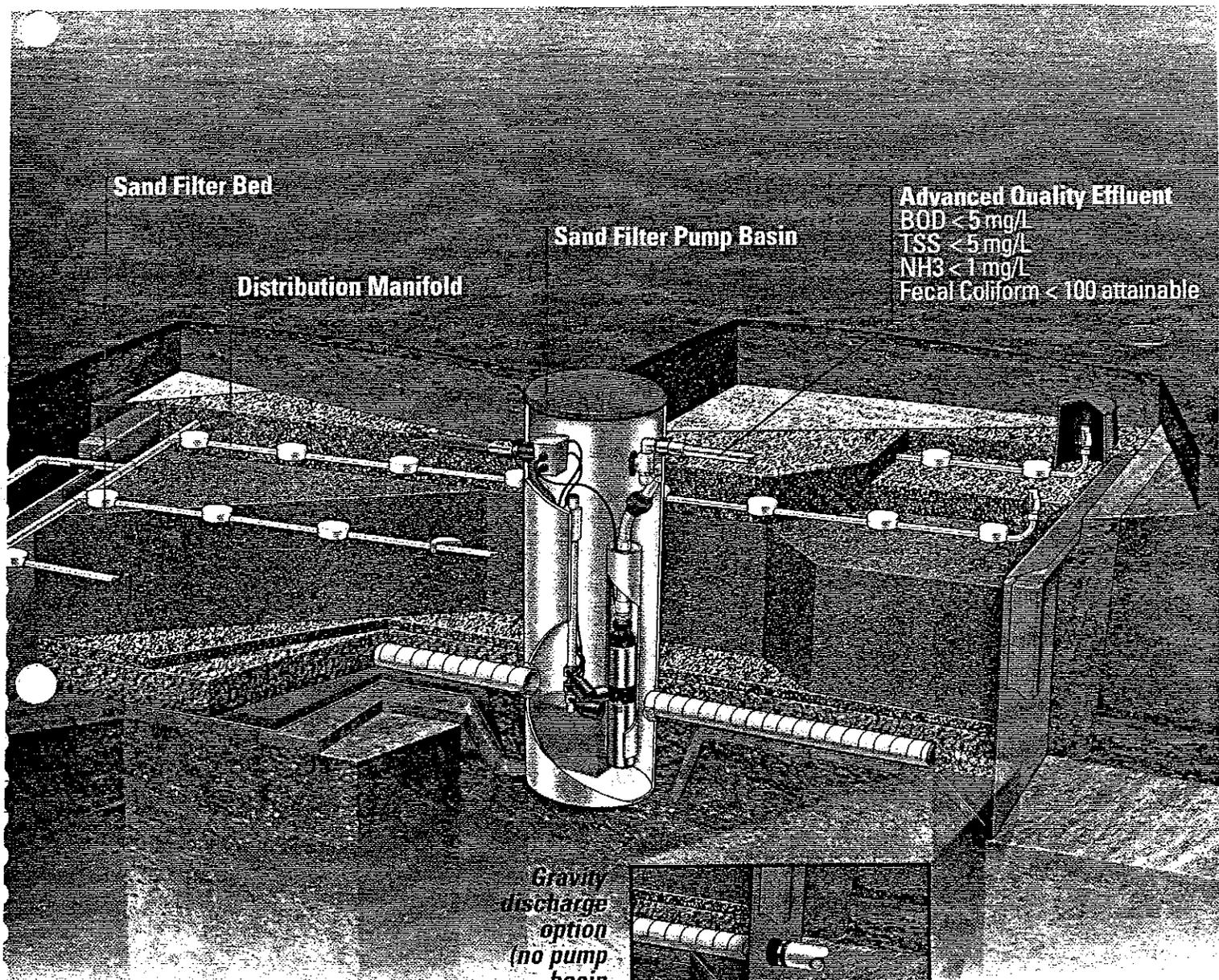
OSI Makes Sand Filters Easy

- Standard ISF designs fit nearly any site.
- Complete ISF kits*: OSI's expertise delivered to your door.
- Easy-to-follow installation instructions.
- Comprehensive owner's manuals.
- Cold weather options available.

*Covered by one or more of the following patents:
4,439,323, 5,360,556, 5,492,635.

With Reliability You Can Trust

- Nothing beats ISFs for consistent effluent quality even when faced with system fluctuations and stresses.
- Every OSI kit is engineered for long life. OSI quality pumps are designed for long life duty.
- Simple maintenance requires an average of only 30 minutes a year. No routine raking, tilling, or replacement of the sand.



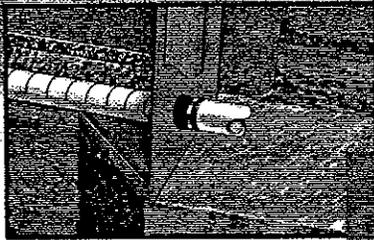
Sand Filter Bed

Sand Filter Pump Basin

Distribution Manifold

Advanced Quality Effluent
 BOD < 5 mg/L
 TSS < 5 mg/L
 NH3 < 1 mg/L
 Fecal Coliform < 100 attainable

Gravity discharge option (no pump basin required)



How an ISF Works

Following primary treatment in a septic tank, wastewater from a home is filtered by OSI's patented* Biotube® Pump Vault technology to keep solids in the tank and out of the sand filter.

The clarified wastewater is then pumped to pressurize the distribution manifold on top of the sand filter bed.

Evenly spread over the surface of the bed, the wastewater percolates through the sand, where naturally occurring microorganisms clinging to the particles organically break down contaminants. In the bottom of the sand filter, treated

effluent—now clear and odorless—is collected and conveyed by pump or gravity to landscaping for subsurface irrigation or to a reduced-size drainfield.**

*Covered by the following patents: 4,439,323 and 5,492,635.

**observe local regulations

Let OSI Help

More than 25 years of experience and continuing innovation have made OSI the world leader in sand filter technology. You can depend on OSI for—

- Design assistance
- Standard drawings
- Plans review

with every state-of-the-art ISF equipment kit.

OSI engineers are eager to share their expertise. Attend in-house training at our facilities, or ask about workshops and conferences in your area.

OSI Kits Make Intermittent Sand Filters Easy

Pre-Engineered Kit

A world leader in alternative wastewater treatment systems, OSI offers the only complete, pre-engineered kits for sand filters on the market today. Designed for easy installation, OSI's patented* sand filter kits are made of high-quality, reliable components, selected for efficiency and long-term performance.

One Stop Shopping

An OSI sand filter kit simplifies an installer's life—no shopping around for parts. It's also the best way to guarantee that installations are of consistent quality. Inspectors like OSI's sand filter kits because they know what to expect and feel comfortable with their proven record. The homeowner wins too with a sand filter system that's engineered to be not only dependable but easy to monitor and maintain.

OSI Kit Components

Effluent Pumping System

- Access Riser & Lid
- Splice Box
- Biotube® Pump Vault
- Float Switch Assembly
- Discharge Assembly
- High Head Effluent Pump
- Electrical Control Panel

Sand Filter

- 30 mil Liner
- Pre-assembled Manifold
- Slotted Underdrain
- Filter Fabric

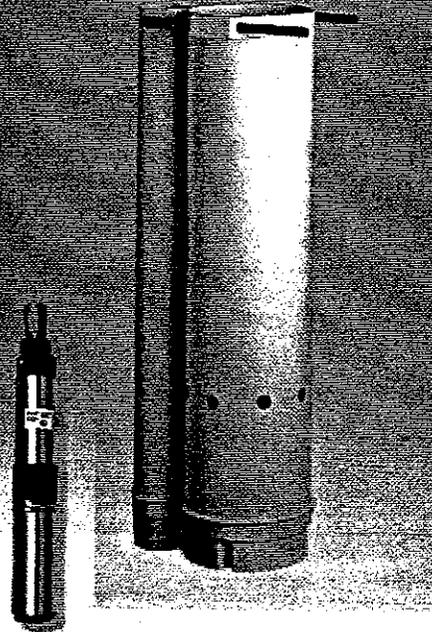
Pump Basin Assembly (optional)

- Sand Filter Pump Basin
- Splice Box
- Float Switch Assembly
- Discharge Assembly
- Effluent Pump

OSI can also provide you with ISF designs on diskette.

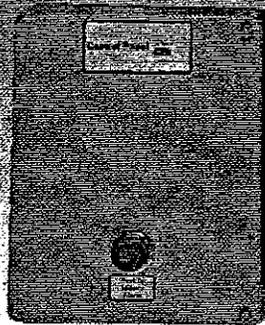
*Covered by one or more of the following patents:
4,439,323; 5,360,556; 5,492,635

Biotube® Pump Vault



- OSI's patented* Biotube® Pump Vault helps ensure an ISF system's long life and minimizes maintenance by filtering out gross solids to maximize the treatment capacity of the sand.
- Every component is corrosion-resistant and easy to install and maintain.
- Light-weight, high-head, corrosion-resistant pumps provide high pressure for continuous orifice clearing. OSI's high-head pumps possess a high cycling capability, allowing multiple small doses for optimal treatment and years of trouble-free operation.

"Smart" Control Panels



- High quality, heavy duty, UL listed components provide long lasting reliability and ease of operation, monitoring, and maintenance.
- The programmable timer promotes unsaturated flow through the sand by limiting effluent discharge from the dosing septic tank to small, discrete doses that are distributed evenly over the course of the day.

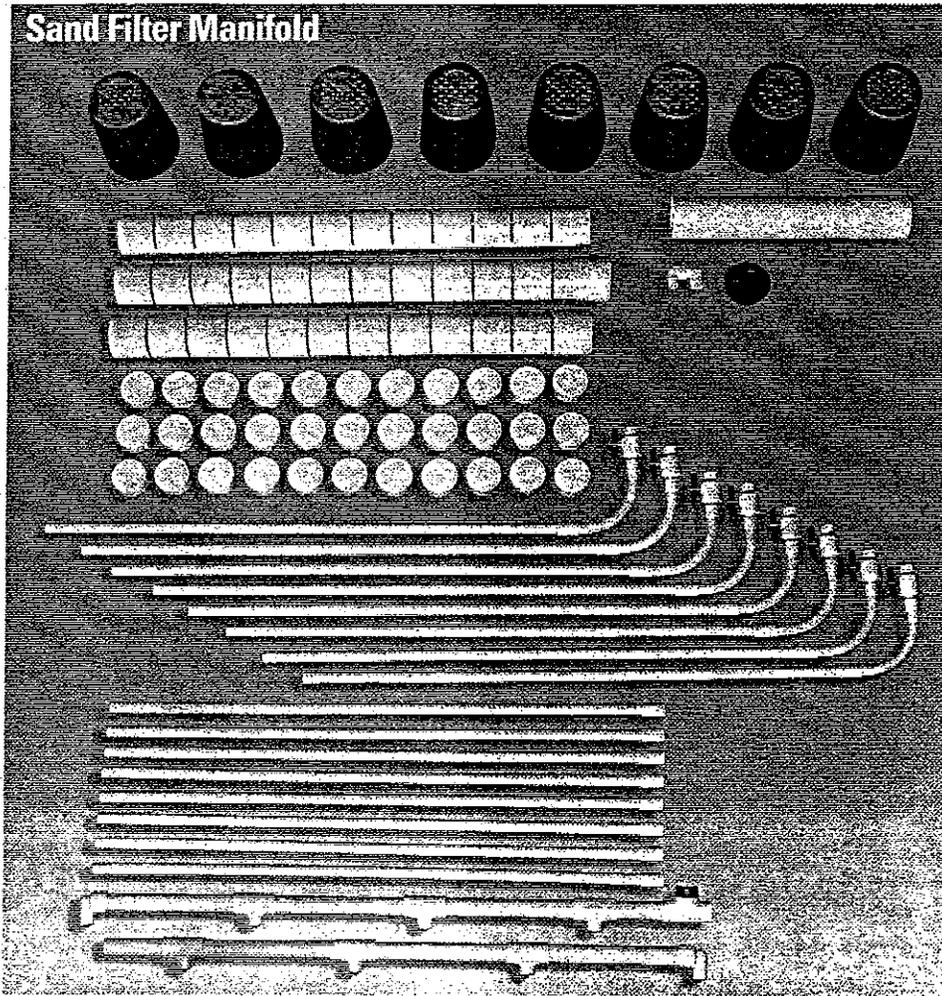
- The timer also allows for automatic monitoring of water usage, notifying the owner if flow into the septic tank exceeds the maximum expected volume.

Riser, Lid and Accessories



- Allows easy access into tank.
- Attractive, non-skid lids.
- Strong and lightweight.
- Tamper-resistant.

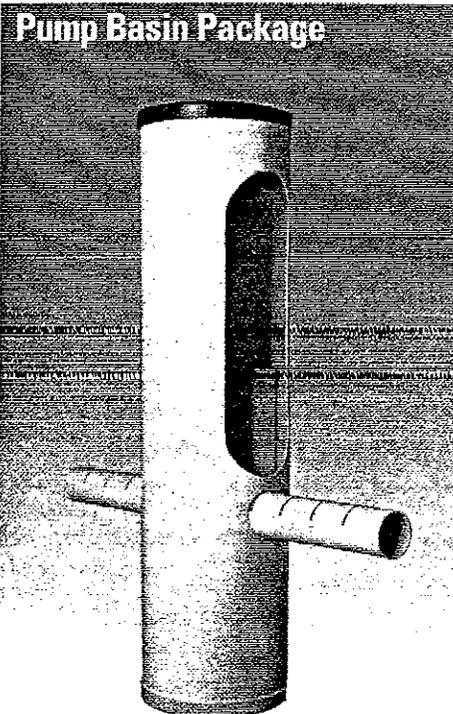
Sand Filter Manifold



Factory assembly of OSI manifolds eliminates difficult field fabrication.

- Manifold sections are labeled for ease of installation.
- Orifices are sized accurately using OSI's custom-built drilling system.
- Small diameter laterals ensure high scouring velocity for reduced maintenance.
- Flushing valve cleanout and enclosure allows easy access for maintenance and monitoring.
- Slotted underdrain collects treated effluent for transport to the pump basin or disposal area.

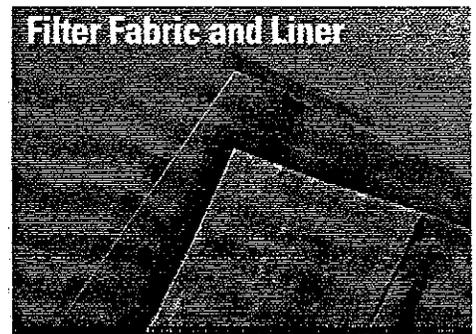
Pump Basin Package



Small diameter pump basin houses pump and associated equipment within the sand filter bed.

- Lightweight. Easily carried by hand.
- Corrosion-proof composite construction.
- Access secured by stainless steel bolts for safety and convenience.

Filter Fabric and Liner



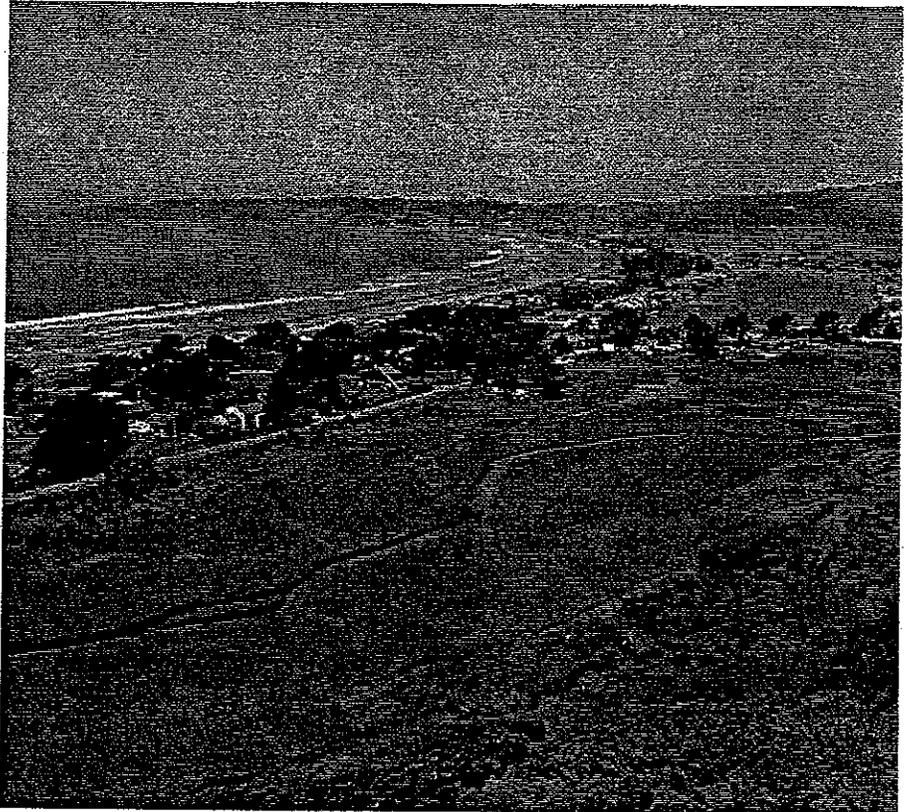
- Breathable fabric protects top of sand filter from fine soil yet allows air and water to pass through.
- Watertight PVC liner provides a barrier between the sand filter and the ground water.
- Liner is 30 mil for enhanced durability.
- Boots glue to liner to provide a watertight seal for transport pipes.

Proven Technology

OSI's Intermittent Sand Filters Perform!

- *Clear, odorless effluent averages BOD<5, TSS<5, NH₃<1, F C<100 attainable*
- *Long track record documented worldwide*
- *Complete pre-engineered kits, compatibility ensured*
- *Drainfields as small as 40 square feet*
- *Blends with the surrounding landscape*
- *Maintenance averages only 30 minutes a year*
- *Power cost 3¢-6¢ a day, vs. \$0.30-\$1.50 a day for aerobic plants*
- *More resistant to biological upset than other technologies*
- *The reassurance of OSI's years of sand filter experience.*

Solving wastewater challenges is OSI's only business. Call one of our experienced engineers for information or free technical assistance at 800-348-9843.



Stinson Beach—One Community's Story

On the Northern California coast overlooking scenic Bolinas Bay and Lagoon lies Stinson Beach, a small community where wastewater has traditionally been treated in onsite septic systems. But in the early 1970s high coliform counts in surface waters prompted the state to issue an ultimatum—clean up the pollution—and folks in Stinson Beach started looking for alternatives.

Engineering studies ensued—nine in all. A central treatment system and every other alternative proposed were out of the question—just too costly for the small population. Finally, working with renowned wastewater expert Dr. George Tchobanoglous, residents established a wastewater management district to bring the community's onsite systems into compliance.

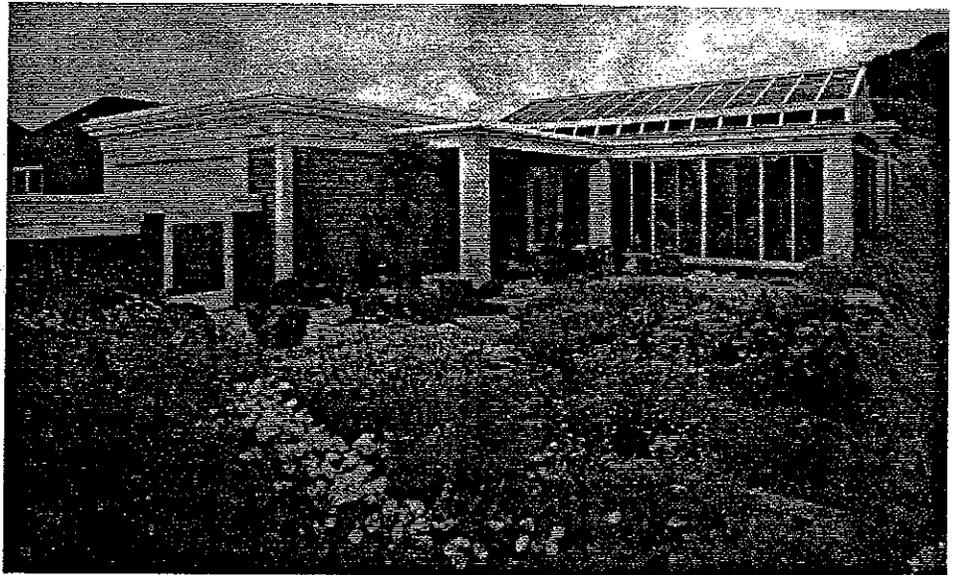
The solution to their trickiest problems? Intermittent Sand Filters from OSI. Tiny lots, coarse soils, proximity to recreational waters—ISFs could handle it all. Longtime residents who had been threatened with eviction were able to keep their homes, and previously unbuildable waterfront lots could be developed.

Today more than 100 of OSI's Intermittent Sand Filters safeguard the community's health and the sensitive ecosystem of Stinson Beach and its sheltering bay.

Adapting to the Site

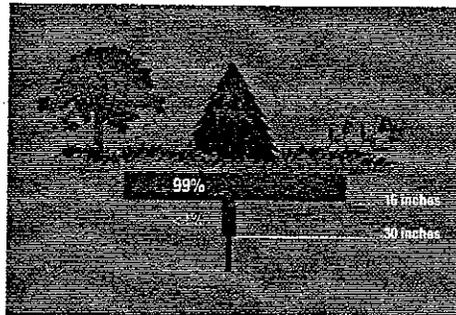
This 2,000 square foot waterfront cottage in Stinson Beach, California, occupies a lot that's only 60 by 125 feet with 6-foot side setbacks and 25-foot setbacks front and back.

Even with these challenging constraints, the site easily accommodates the OSI sand filter system. The filter bed sits under the sandy terrace (upper right), and raised flower beds (foreground) sit atop the drainfield.

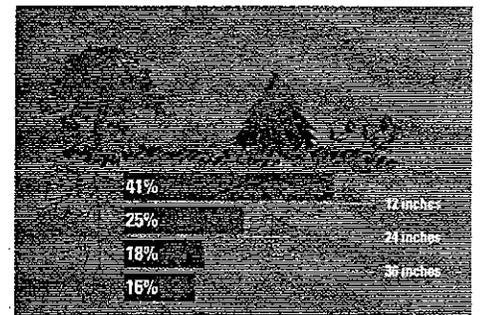


Shallow Is Better

Subsurface disposal of sand filter effluent works best in the top soil stratum where roots and soil biota are concentrated. Nitrates and other contaminants are removed by microbial activity and plant uptake.



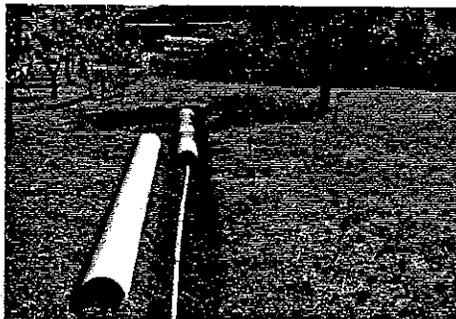
Biota



Water use

Drainfields Can Be Smaller

The Oregon-approved shallow gravel-less drainfield trench can be loaded with ISF effluent at a rate of more than 4 gpd/ft². Soil structure improves and permeability actually increases over time. Raised beds can be useful to enhance separation to groundwater in most soils.



Shallow gravel-less drainfield



Raised beds

Water Reuse Is an Option

Subsurface drip and spot irrigation are among the water reuse techniques compatible with ISF systems.



Drip irrigation



Spot irrigation

The OSI Story

In response to widespread onsite wastewater system failures during the 1970s, Oregon's Department of Environmental Quality denied many new septic tank installations (up to 50% in some areas) until hazards could be corrected and further failures prevented. Douglas County, Oregon, invested in an ambitious program to clean up local problems and to ensure the success of new systems. A dedicated group of engineers, soil scientists, and sanitarians sought out appropriate wastewater technologies, designed and monitored demonstration projects, and then helped write new onsite wastewater rules for the state.

During this process they discovered that much of the equipment required to implement their innovative designs was not commercially available. In 1981, several of these engineers founded OSI to manufacture the specialized hardware they needed.

Today OSI is a rapidly growing firm dedicated to the creation of cost-effective, technically elegant solutions to a wide variety of residential and commercial wastewater han-

dling problems. To complement its design and manufacturing functions, OSI invests time and money in a continuing research program, often cooperating in projects with colleges and universities.

Because OSI's team of civil, environmental, mechanical, and electrical engineers works exclusively in the onsite and effluent sewer industries, it is able to offer unmatched technical and design assistance. In today's world, the rules are constantly changing. At OSI the goal is to help clients make efficient use of technology to achieve a sensible, environmentally responsible solution for every individual project.



Oreco Systems[®]
Incorporated

814 AIRWAY AVENUE
SUTHERLIN, OREGON
97479-9012

Phone
(541) 459-4449

Toll Free
(800) 348-9843

Fax
(541) 459-2884

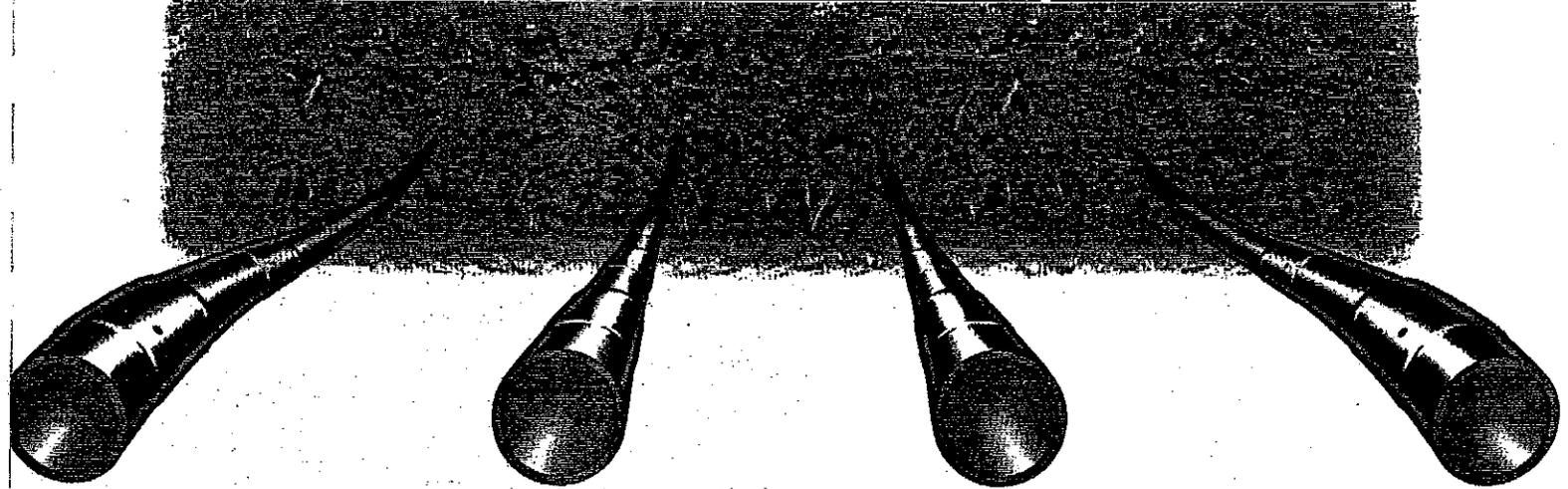
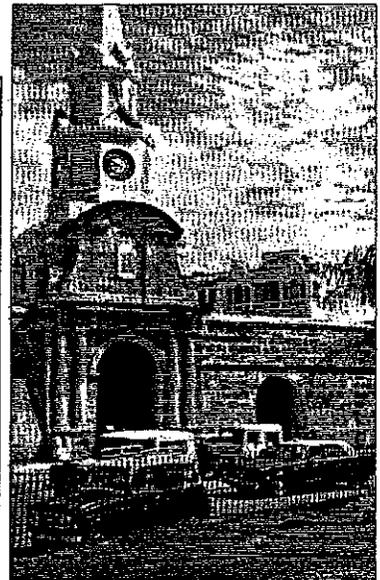
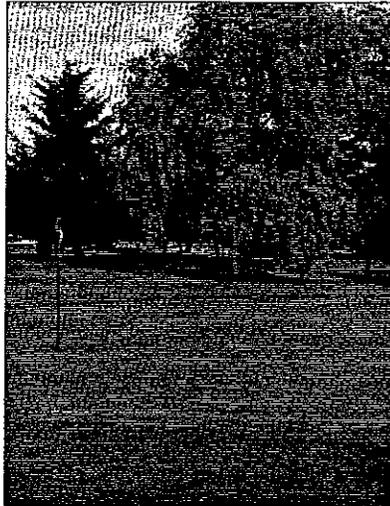
<http://www.oreco.com/~osi/>

© 1998 Oreco Systems, Inc.

Distributed by:

WASTEFLOW™

DRIPLINE FOR SUBSURFACE WASTEWATER DISPOSAL



GEOFLOW, Inc.

WASTEFLOW™

- Flexible emitterline for subsurface treated wastewater disposal.
- Guaranteed root intrusion protection plus bactericide.

CHARACTERISTICS

Reliable and economic.

The low cost of the system and low cost of installation make it possible to cover large areas or have backup fields without incurring high costs.

No ponding, surfacing or deep percolation.

Effluent is uniformly distributed over the entire area using low flow rate, uniformly spaced emitters. Water is slowly applied at each individual point, enabling the water to move laterally through capillary action, reducing percolation.

Flexible and easy to install.

A small vibratory plow or trencher is all that is required to install several thousand feet of tubing.

Easy to design.

The flow characteristics of the emitters and the uniform water distribution make it very easy to design a safe and reliable system.

Resistant to plugging.

Wasteflow has the largest flow orifices on the market. The turbulent flow design keeps fine particles in suspension, and the raised entry ports into the emitter reduce the risk of solids plugging the emitter flow path.

Can be used for irrigation.

The uniform rate of application and its reliability make the system ideal for reuse in landscaping or irrigating agricultural crops.

Solves limited area and soil problems.

Can be used in smaller areas than conventional systems, or where soil type or steep slopes preclude conventional systems.

ROOTGUARD protected.

Incorporation of Treflan guarantees protection from root intrusion and assures the system a long trouble free life.

Bactericide protected.

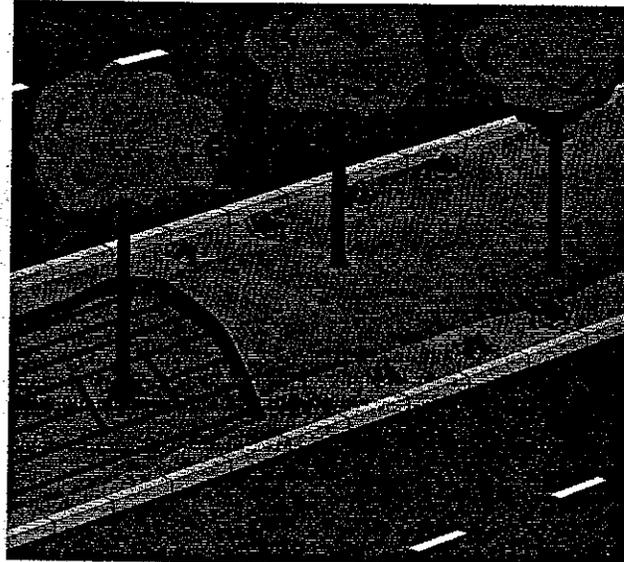
Incorporation of 10,10' oxybisphenoxarsine into the tube inhibits slime formation on the walls of the tube. This does not replace effluent pre-treatment.

Purple stripes.

3 stripes identify the Wasteflow product.

Freezing conditions.

Operating aerobic systems have shown resistance to freezing through a Wisconsin winter. In the event a system is left idle through freezing conditions Wasteflow will not crack or break.



800-828-3388

FLOW

TM

DESCRIPTION

The flexible polyethylene dripline has large turbulent flow emitters regularly spaced along the line. With the dripline hidden about six inches below ground, effluent is distributed slowly and uniformly, reducing ponding, even in difficult soils and hilly terrain.

Wasteflow is built to last. The emitters are protected against root intrusion by the ROOTGUARD® patented process, and the dripline wall is protected from organic growth with a bactericide lining.

Wasteflow is easily adaptable for projects ranging in size from single family homes to large multi-million gallon per day projects.

WASTEFLOW PC & WASTEFLOW CLASSIC

Wasteflow is now available with either classic turbulent flow emitters (Wasteflow Classic) or with pressure compensating emitters (Wasteflow PC).

Wasteflow dripline has precision molded, large flow path emitters inserted into 1/2" tubing every 2ft. The standard nominal flow rate per emitter is 1GPH. The standard spacing for effluent disposal is 24 X 24 inches. Different flow rates, tube diameters and spacings are available against special order. The 1/2" tubing presents a smooth exterior for easy insertion into the ground. Use CA600 compression adapters to connect the dripline to PVC pipe.

Wasteflow Classic				
Pressure	WF16-4-12 12" emitter spacing		WF16-4-24 24" emitter spacing	
	Max. Length of Run vs. Pressure	Flow Rate vs Pressure	Max. Length of Run vs. Pressure	Flow Rate vs. Pressure
10 psi	130ft.	0.93 gph	210 ft.	0.93 gph
15 psi	130 ft.	1.13 gph	210 ft.	1.13 gph
25 psi	130 ft.	1.49 gph	210 ft.	1.49 gph
30 psi	130 ft.	1.64 gph	210 ft.	1.64 gph
Wasteflow PC				
Pressure	WFPC16-2-12 12" emitter spacing		WFPC16-4-24 24" emitter spacing	
	Max. Length of Run vs. Pressure	Flow Rate vs Pressure	Max. Length of Run vs. Pressure	Flow Rate vs. Pressure
15 psi	174 ft.	0.53 gph	211 ft.	1.02 gph
25 psi	260 ft.	0.53 gph	315 ft.	1.02 gph
35 psi	313 ft.	0.53 gph	379 ft.	1.02 gph
45 psi	354 ft.	0.53 gph	429 ft.	1.02 gph

Wasteflow is manufactured 100% in the U.S.A.

When to use Wasteflow PC vs. Wasteflow Classic

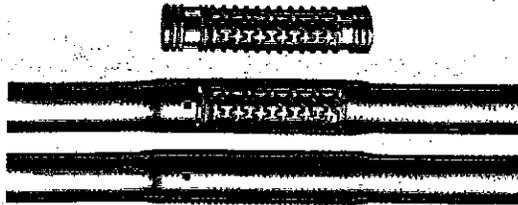
Advantages of Wasteflow PC

- Very long lateral runs are possible.
- Steep slopes require fewer pressure regulators.
- Rolling terrain. If the difference of height from trough to peak is greater than 6 foot, then Wasteflow PC is justified. Vacuum relief valves must be placed at the top of each rise.

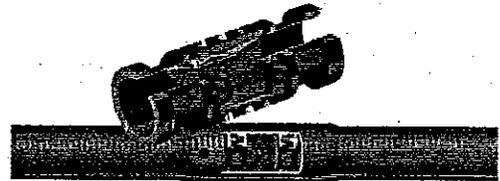
Disadvantages of Wasteflow PC

- More expensive.
- Contains a silicon rubber diaphragm which may not last as long as the plastic components.
- Systems with large elevation changes that are not designed very carefully are prone to the creation of vacuum upon shut down, causing soil ingestion. The dirt may lodge permanently under the diaphragm.

Geoflow, Inc. recommends that Wasteflow PC only be used when the advantages are of substantial economic value.



Wasteflow Classic



Wasteflow PC

THE ROOTGUARD® ADVANTAGE

ROOTGUARD® is the key to Wasteflow's success below ground. ROOTGUARD technology combines Treflan® in the drip emitter to inhibit root growth. The herbicide is released at a uniform rate, maintaining sufficient concentration in the soil immediately surrounding the drip outlet to prevent longitudinal root growth into the emitter. ROOTGUARD life is a function of the mean soil temperature. The system is guaranteed not to fail due to root intrusion for 10 years, with an expected life of 20 years. Please read the limited warranty in our design and installation manual.

- For more detailed information on this application, phone: 1-800-828-3388 and request Geoflow's Design and Installation Manual for Onsite Wastewater Disposal or check your website at www.rootguard-geoflow.com.
- Wasteflow is only guaranteed when used with NSF Class I aeration treatment plants as tested by ANSI certified laboratory, or sand filters designed to meet EPA criteria, or treatment plants designed by a professional engineer.

Wasteflow is manufactured under U.S. patents 5,332,160, 5,116,414 & foreign equivalents

ROOTGUARD® is a registered trademark of A.I. Innovations

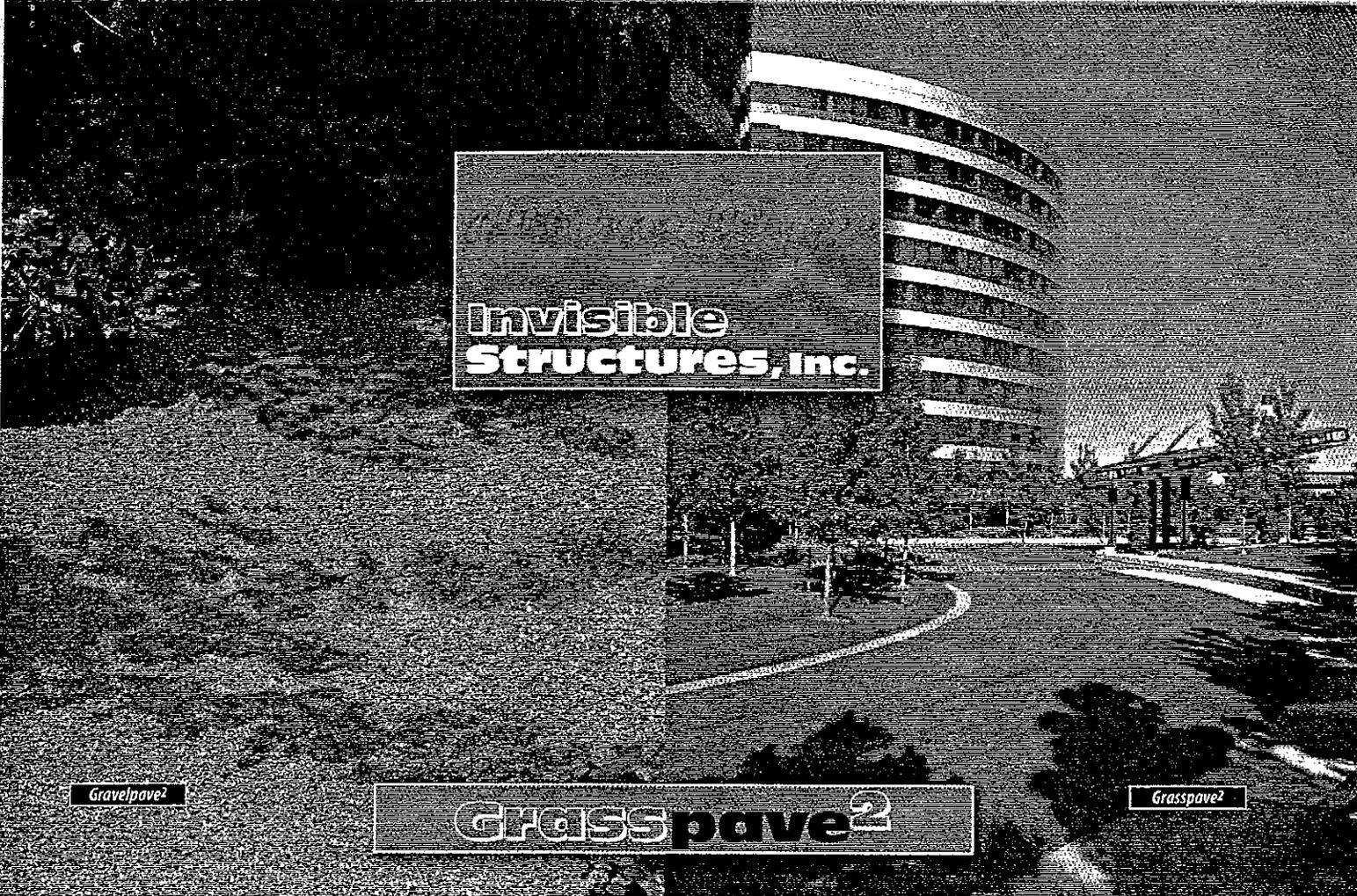
Treflan® is a registered trade-mark of DowElanco.

GEOFLOW, INC.

307-O West Tremont Avenue

Charlotte, NC 28203

800-828-3388 / 704-347-3476



**Invisible
Structures, Inc.**

Gravelpave²

Grasspave²

Grasspave²

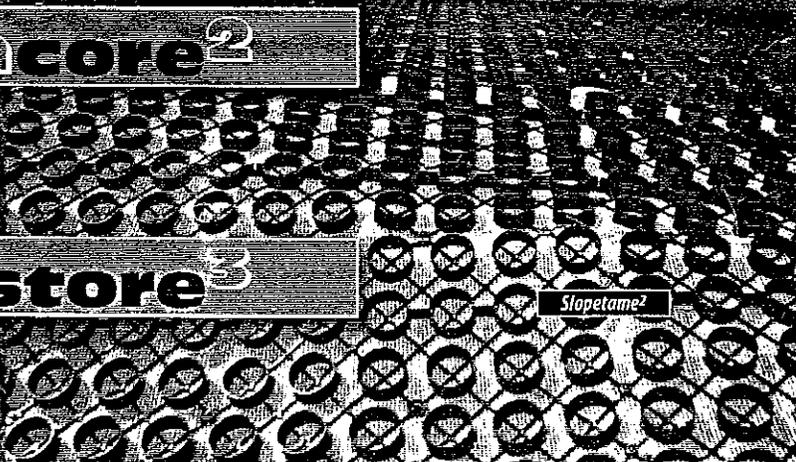


Gravelpave²

Slopetame²

Draincore²

Grasspave²



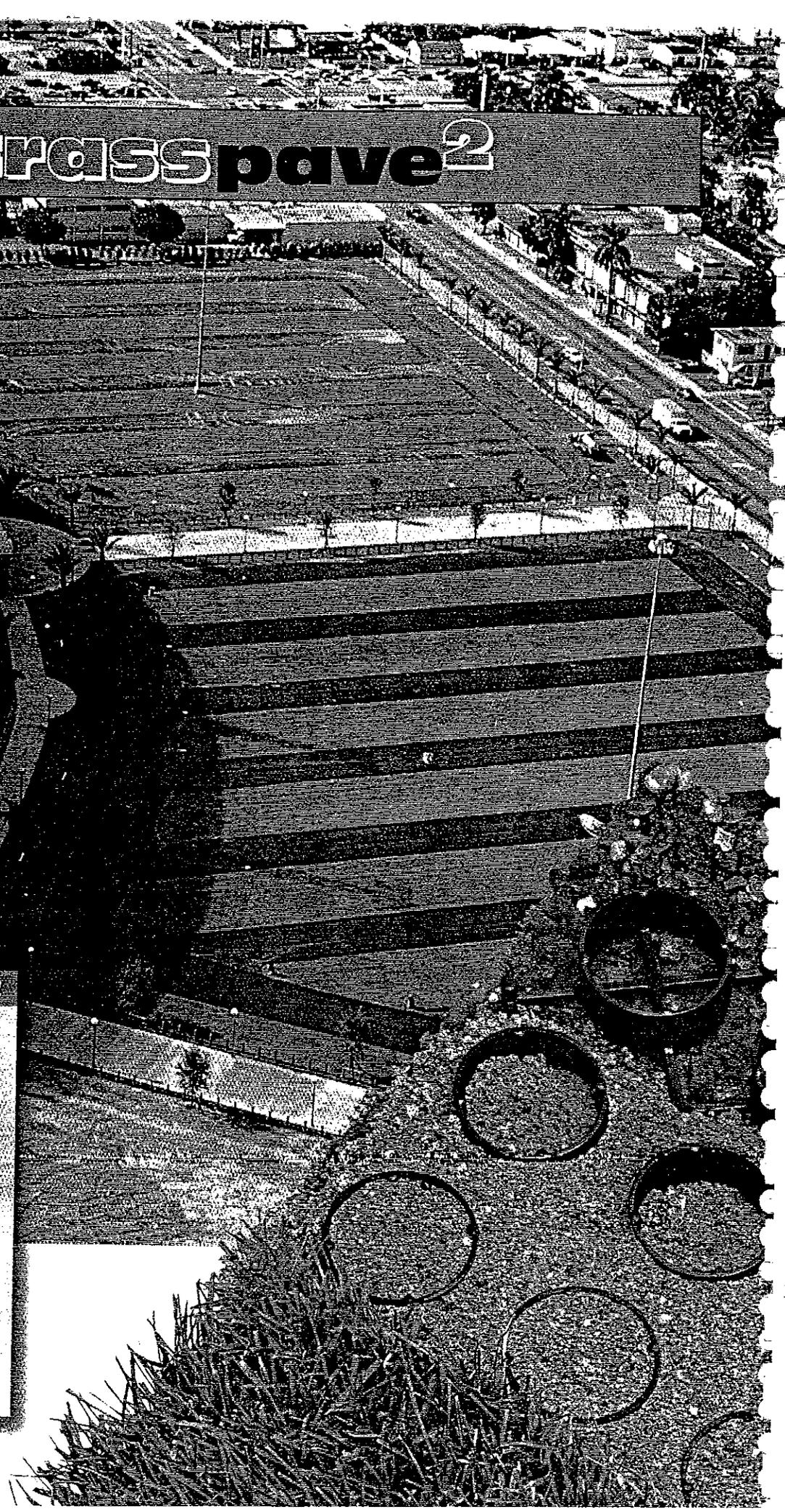
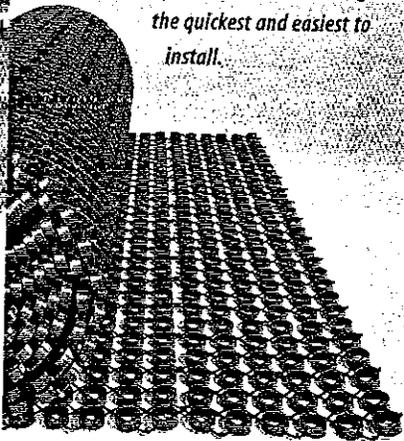
Rainstore³

Slopetame²

Grasspave²

Roll Out Your Grass Paving!

Grasspave² porous pavement is the only turf reinforcement product of its kind to be offered in a roll format, making it the quickest and easiest to install.



Grasspave²

Driving on grass has become more popular as concerns about water runoff, maintaining beautiful sites, and environmental issues have increased. By applying our large rolls of Grasspave² over a sandy gravel road base, drivable lawns are created. Our installation times have improved since 1982 with the introduction of rolls which cut construction costs. The city of Miami was one of our first clients to utilize rolls for Orange Bowl parking.

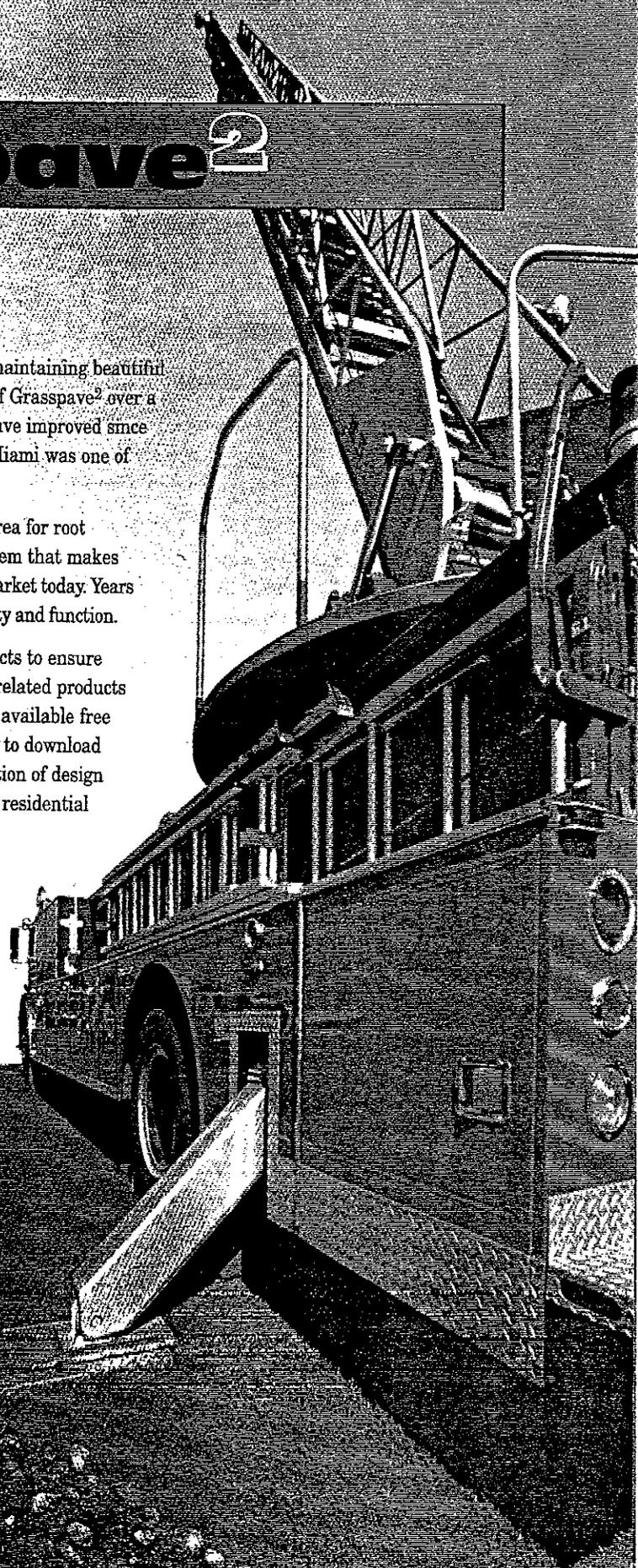
Grasspave² prices have dropped! What remains the same are the 92% void area for root development and the extremely strong design found in the ring-and-grid system that makes Grasspave² the best grass paver, both structurally and horticulturally, on the market today. Years from now with normal maintenance your installations will have kept their beauty and function.

We continue to provide professional technical assistance by landscape architects to ensure quality information and support for you. Ask them questions about industry-related products and your specific design needs. CAD disks with details and specifications are available free by calling 800-233-1510. Visit our web site — www.invisiblestructures.com — to download complete specifications, installation steps, photos to show clients, and a selection of design details — saving trees, church parking, fire lanes and how to delineate them, residential parking, RV access, and many more.

U.S. Patent No. 5,250,340



Fire lanes are safe with the proper depth sandy gravel road base, Grasspave², and recommended installation. This 100-foot ladder truck was lifted off the grass paving by rear outriggers, and no ruts were caused by either outriggers or tires. The ladder was extended, rotated, and loaded with no depressions in the road surface. All fire fighting vehicles can safely navigate even wet grass.

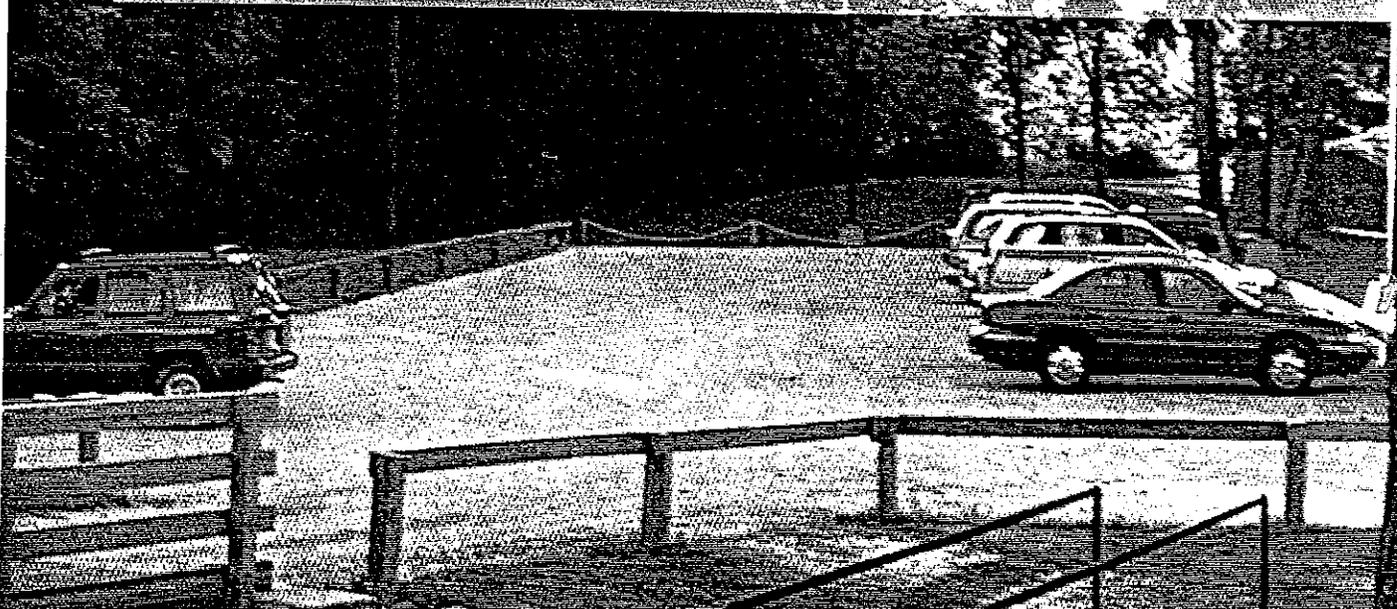


Gravelpave²

Gravelpave² has been used for high traffic porous parking areas since 1993 — banks, fast food restaurants, colleges, and residential driveways. 100% recycled plastic rings are molded onto non-woven geotextile filter fabric. The rings become invisible or camouflaged by the decorative gravel which is "contained" for a smooth, well-dressed finish. Large rolls of Gravelpave² make installation of trails or parking lots quick and easy.

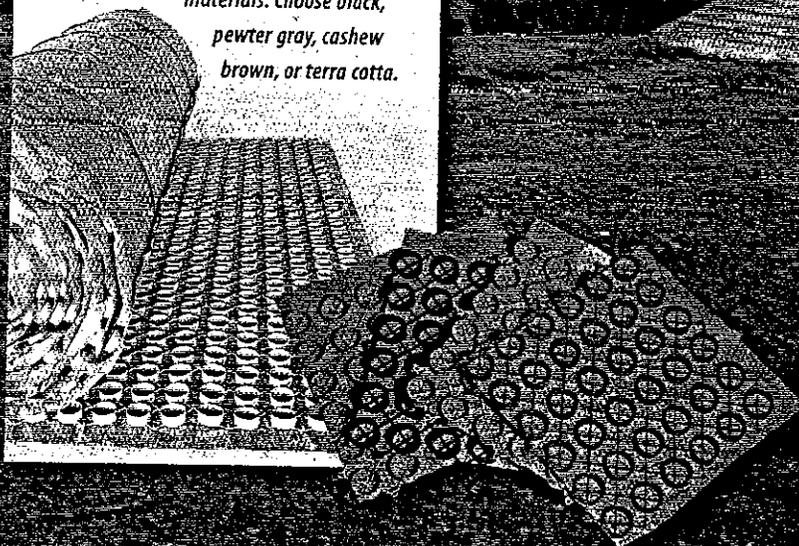
Gravel base course, depth specified by a soils engineer, is laid underneath to bear vehicle loading. Gravelpave² is unrolled and fastened together with washers included, then filled with decorative gravel of minus 5mm (1/16") using a front end loader and rakes. Settling of fill gravel can be done by either compacting with a roller or irrigating with water.

US Patent No. 5,124,724



Porous Paving for High-Use Areas

Colorful Gravelpave² selections blend well with a variety of stones and other granular materials. Choose black, pewter gray, cashew brown, or terra cotta.



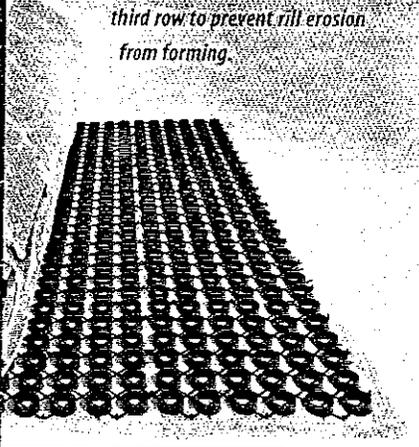
Gravelpave² parking lot used daily at Frostburg State College in Maryland. This 15,000-square-foot parking lot is permeable to water, thus allowing all the water that falls on site to percolate back into the soil. Water tables are naturally replenished and age-old trees are preserved while the function of parking is served.

Slopetame²

Working on a Slope Made Simple

Quick, complete coverage on any slope is easy with large rolls in standard or custom sizes.

Notice the walls between rings every third row to prevent rill erosion from forming.



Slopetame² covering 23,000 square feet of weak, eroding soils on a 1.5:1 slope for a retail store site in North Carolina. Trees were planted by cutting out sections in the Slopetame² rolls.

Slopetame² is a three-dimensional erosion control blanket that covers steep slopes of weak and/or eroding soils by easily unrolling high-weight large rolls downhill. The 100% recycled plastic rings and grid are molded into an open-weave fabric that also serves to cover soils and provide a support structure for vegetation.

Rolls are easily secured at the top of the slope by anchoring rebar between the rings. Custom roll sizes are available and washers are included to fasten pegs and holes together with adjoining rolls.

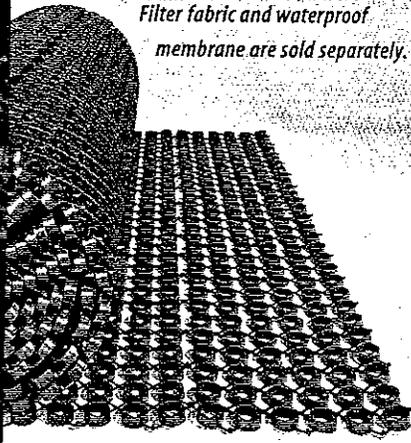
Trees and shrubs can be easily planted in cutout sections by clipping the grid with pruning shears and then digging holes. Fill the blanks with soil and hydroseed or plant ground covers on the slope for a quick finished appearance that is structurally sound.

Draincore²

Drain Areas Fast and Improve Turf Quality

Draincore² was placed under 900 square feet of tee box area at a golf course in thirty minutes.

Filter fabric and waterproof membrane are sold separately.

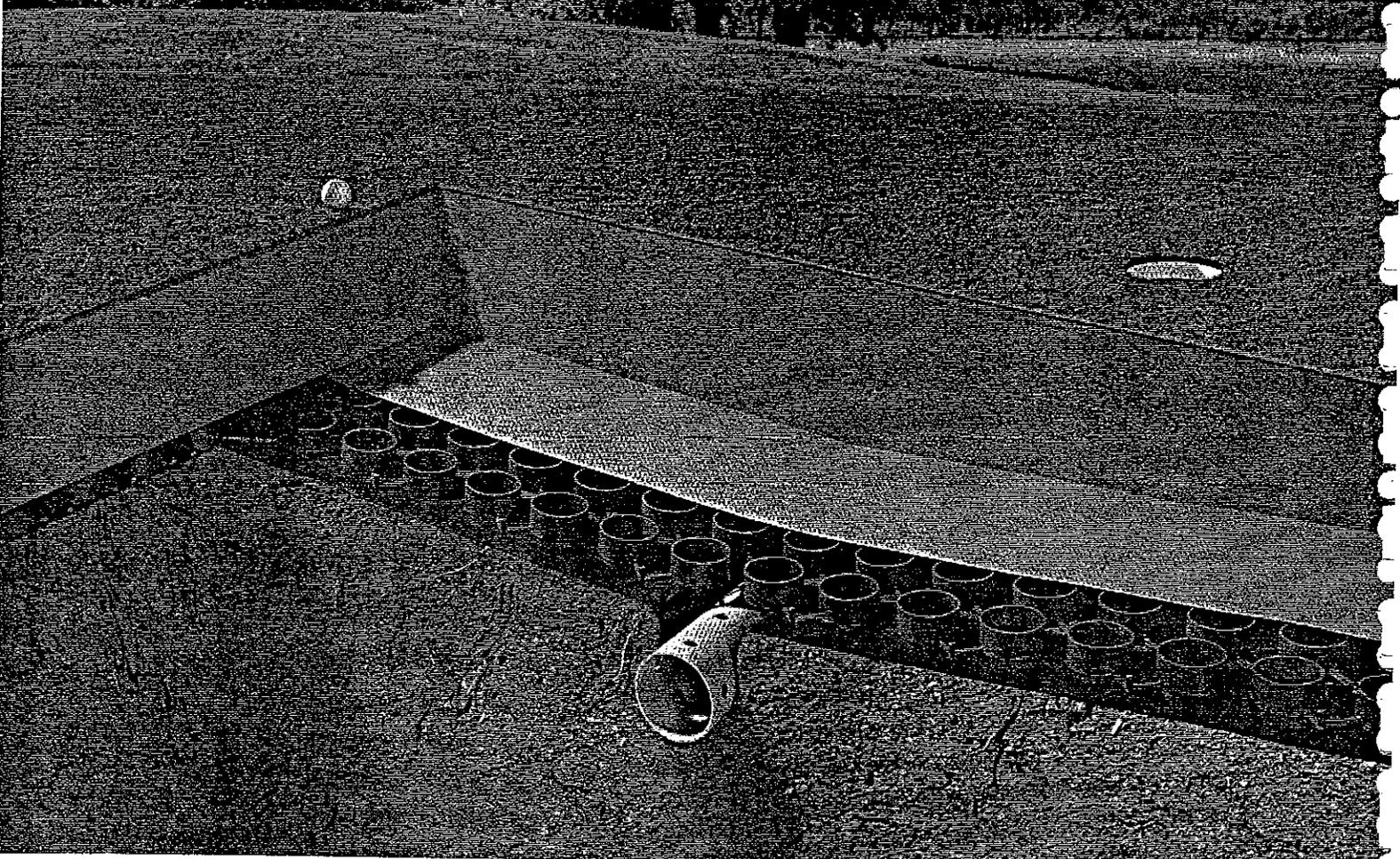


Draincore² will achieve large area subsurface drainage efficiently by gravity movement of water to a collection point. The 2.5cm (1") depth of ring moves large volumes of water quickly and easily over an impervious membrane. Colorado State University hydraulic testing data appears on our web site.

Collect water under parking lots, drainage areas, or athletic fields of all types. Draincore² can be used with your drainage soil mix or with our custom invisible turf system, which has a specific drainage composition for maximum porosity and highest quality growing medium. Subsurface aeration is also available. Call for further details.

© 2003 Draincore

This illustration shows Draincore² being used underneath a putting green for maximum drainage. The patented ring and grid system beneath a layer of greens mix and filter fabric is designed especially for rapid lateral movement of water. This means less down time for golf courses during and after heavy rains.



Rainstore³

Pavement Surface

Drainage Inlet with Optional Filtering Device

Base Course As Determined by a Soils Engineer

Ring and Grid Core in One or More Layers

Filter Fabric and Plastic Liner

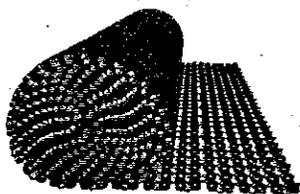
Overflow Outlet

This illustration shows the Rainstore³ system underneath a parking lot to collect runoff. Water runs to the drainage inlet and into the Rainstore³ storage chamber where sediment settles and water is cleaned and filtered before being put into urban creeks and streams.

The newest in detention basin technology is Rainstore³, which allows you to park and drive cars directly over the water storage system! Stacks of ring and grid form a structure of 92% void core with strength provided for the heaviest of loading applications. The skin is a geomembrane, varying with different applications, to provide a chamber below grade.

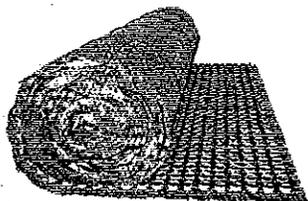
Custom sizes and depths are constructed on site to fit project specific needs. Designers at Invisible Structures, in conjunction with a licensed contractor, are available to assist with the design/build process for finished results.

Patents Pending



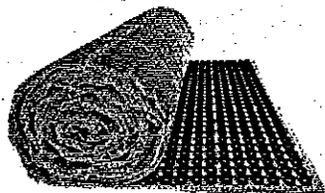
Grasspave²

9 roll sizes
Color: black, 100% recycled HDPE plastic, peg and hole connectors
Weight: 2.0 kg/m² (.42 lbs/sf)
Strength: 400 kg/cm² (5,720 psi) when filled with sand



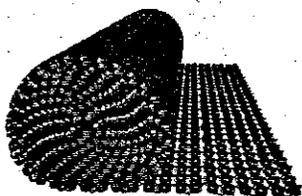
Gravelpave²

9 roll sizes
Color: black, pewter gray, cashew brown, terra cotta, 100% recycled HDPE plastic, peg and hole connectors
Weight: 2.15 kg/m² (.47 lbs/sf) with polyester non-woven filter fabric
Strength: 400 kg/cm² (5,720 psi) when filled



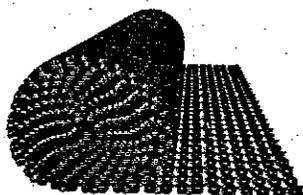
Slopetame²

9 roll sizes
Color: black, 100% recycled HDPE plastic, peg and hole connectors, crossbars every third row of connecting rings
Weight: 2.15 kg/m² (.47 lbs/sf), with open weave polypropylene netting



Draincore²

9 roll sizes
Color: black, 100% recycled HDPE plastic, peg and hole connectors
Weight: 2.0 kg/m² (.42 lbs/sf), laid over 30 mil PVC impervious liner, covered by polyester non-woven filter fabric, both sold separately



Rainstore²

Sizes built to project requirements
Color: black, 100% recycled HDPE plastic, peg and hole connectors
Weight: 2.0 kg/m² (.42 lbs/sf), encased in a bladder of 30 mil PVC (or other type) impervious liner. Built on site by a licensed contractor/distributor.

CAD disks with details and specifications are available free on all our products by calling 800-233-1510. Visit our web site — www.invisiblestructures.com — to download complete specifications, installation steps, photos to show clients, and a selection of design details.

Invisible Structures — Standard Product Roll Sizes

Model	Width		Length		Diameter		Area		Weight	
	m	ft	m	ft	m	ft	m ²	ft ²	kg	lbs
1010	1	3.3	10	32.8	0.5	1.7	10	108	19	41
1020	1	3.3	20	65.6	0.8	2.7	20	215	37	82
1050	1	3.3	50	164	1.2	4	50	538	93	205
1520	1.5	4.9	20	65.6	0.8	2.7	30	323	56	123
1550*	1.5	4.9	50	164	1.2	4	75	807	139	308
2020	2	6.6	20	65.6	0.8	2.7	40	430	75	164
2050*	2	6.6	50	164	1.2	4	100	1,076	186	410
2520	2.5	8.2	20	65.6	0.8	2.7	50	538	93	205
2550*	2.5	8.2	50	164	1.2	4	125	1,346	233	513

*Roll sizes marked with asterisks should be installed by lifting machines only. All other rolls can be installed manually (2 people advised). Rolls apply to Grasspave², Gravelpave², Draincore², and Slopetame². Custom roll sizes available by request.

100% Recycled

Recycling is at the core of our manufacturing process. We collect plastic in the form of 55-gallon drums, bread trays, shopping carts, milk jugs, road construction markers, and many other items. Our 14-foot-high granulator turns these plastic items into the little colorful pieces you see. Then our injection molding machines heat and form the pieces into our products. We reuse our manufacturing waste as well.

This year we have begun capturing film-grade plastics through the process of pelletizing to make more pieces for molding product. Instead of putting more plastic into landfills, we're encouraging more recycled products be used for improving the environment with porous paving, erosion control, and water collection.



Invisible Structures, Inc.

20100 E. 35th Drive, Aurora, CO 80011-8160
 Toll Free USA and Canada: 800-233-1510
 Fax: 800-233-1522

Overseas and Locally: Country Code + 303-373-1234
 Fax: 303-373-1223

<http://www.invisiblestructures.com>

© Copyright 1997

