

**ON-SITE WASTEWATER MANAGEMENT
IN NEW MEXICO**

**A CASE STUDY OF
ENTRANOSA WATER AND WASTEWATER
ASSOCIATION**

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TABLE OF CONTENTS

	<u>Page</u>
EXECUTIVE SUMMARY	ii
ENVIRONMENT	1
COMMUNITY	1
ON-SITE MANAGEMENT SYSTEM: VISION.....	6
ON-SITE MANAGEMENT SYSTEM: PLAN.....	6
ON-SITE MANAGEMENT SYSTEM: IMPLEMENTATION & OPERATION.....	7
ON-SITE MANAGEMENT SYSTEMS: C2 PROCESS	7
ON-SITE MANAGEMENT SYSTEMS: REVIEW.....	7
ON-SITE MANAGEMENT SYSTEMS: RE-VISION	8
REFERENCES	9
EXHIBIT A REPORT - GROUNDWATER QUALITY DEGRADATION IN THE EAST MOUNTAIN AREA	
EXHIBIT B EWWC MEMBER SURVEY	
EXHIBIT C LEGAL OPINION - Validity of Septic System Regulations	
EXHIBIT D ENTRANOSA SEPTIC TANK PUMPING DISTRICT ASSUMPTIONS FOR COST ESTIMATE	
EXHIBIT E MANAGEMENT PLAN FOR BERNALILLO COUNTY ENVIRONMENTAL HEALTH DEPARTMENT	
EXHIBIT F ADVERTISEMENT FOR BIDS AND CONTRACT DOCUMENTS FOR SEPTIC TANK PUMPING	
EXHIBIT G AGREEMENT FOR WASTEWATER MAINTENANCE SERVICES	

EXECUTIVE SUMMARY

The Entranosa Water and Wastewater Cooperative (EWWC) was the first membership organization in New Mexico to institute a septic tank maintenance program. The program was initiated without government urging or intervention and at little cost to the cooperative association.

The EWWC provides service to an area approximately 20 miles east of the City of Albuquerque, known as the East Mountain Area (EMA). The service area extends from the Paa Ko Planned Communities (near Sandia Park) to Edgewood in the east, over 15 miles, and its area of service covers approximately 170 square miles. In 1993, the water cooperative expanded into the wastewater field with a mission to protect groundwater, and it began providing certified operators to wastewater treatment facilities being constructed for large subdivisions in the EMA. From 1993 to 1996 subdivisions were approved at an increasing rate by Bernalillo County, the governing body for the EMA. EWWC saw a 51% increase in service connections between 1993 and 1996.

Ground water is the only source of drinking water in the EMA and the soils are shallow with fractured bedrock below. Studies commissioned by Bernalillo County raised concerns about contamination of ground water by onsite wastewater systems and recommended minimum lot sizes for septic tank systems of five acres or more. The EWWC prepared its own study of the potential for ground water contamination and urged the County to adopt stricter standards for subdivisions in the EMA. The EWWC does not have the authority to regulate subdivisions, only the county can do that.

One of the recommendations of the EWWC study was to initiate a septic tank management program of its own. After several years of review and debate, the EWWC implemented a voluntary service program to provide members with discounted septic tank pumping at a three year interval. The program was presented to the membership and the bylaws were revised to make the program mandatory for all new and transfer memberships.

Initially about 70 members signed up for the voluntary program at a cost of \$5.00 per month. By the end of 2005, over 1100 households were served by the septic tank pumping program and the rate increased to \$5.50 per month.

ENVIRONMENT

The Entranosa Water and Wastewater Cooperative (EWWC) serves a portion of an unincorporated area, located approximately 20 miles east of Albuquerque, New Mexico, in Bernalillo and Santa Fe Counties. The area stretches from Sandia Park on the west to the Town of Edgewood on the east. The area has become a mountainous suburb of the City of Albuquerque and is referred to as the East Mountain Area (EMA). In the 1990's, the area included over 8,000 platted lots. The area sits in an uplifted mountainous region that contains shallow soils underlain by massive limestone deposits from an ancient seabed. Vegetation is typical of the piñon/juniper region of the high desert in New Mexico. Ground water is the sole source of drinking water and exists at depths of less than one hundred feet to over seven hundred feet. The major aquifer is located in the Estancia Basin on the east. This basin stretches from Galisteo on the north, to the playas near Willard on the south, and from Sedillo Hill on the west to Clines Corners on the east – approximately 2,450 square miles. Residential subdivisions have worked their way east from Albuquerque and the land use patterns reflect spotty development with little coordination.

COMMUNITY

The area reflects development with no consistent patterns of use and with median household incomes that vary from subdivision to subdivision. The area is almost entirely rural residential with no industry and only a few commercial service operations. Most people are employed in Albuquerque or Santa Fe and make the daily commute. This case study considers only the area served by the EWWC. The association was originally organized under New Mexico State Statutes 53-4-1 to 54-4-45 (Cooperative Association Act)¹. These associations are private, non-profit, membership based organizations with limited powers over their members. They do not have the authority to levy and collect taxes, issue bonds, condemn property, or require property owners to connect to a sewer system.

Wastewater from households in the EMA are discharged to septic tanks and cesspools and then to soil dispersal systems. Bernalillo County has demonstrated a continuing concern in contamination of groundwater from onsite wastewater systems and has initiated a number of studies over the years. A report by Alyce B. DeGravelle [2] notes concerns date back to at least 1927. Studies completed for the County document contamination (Rankin[5], USGS[7]) and recommend minimum lot sizes for onsite wastewater systems of 5 acres or larger for the EMA (CH2M Hill[1], Geohydrology[3], Molzen-Corbin[4], Summers[6])

The Board of Directors (BOD) of the EWWC shared the County's concern for the proliferation of onsite wastewater systems as they watched the requests for new water service connections increase 51% between 1993 and 1996. In 1996 the BOD created a special subcommittee on groundwater protection to outline threats to groundwater quality, document existing conditions, and make recommendations to the BOD for actions to protect the groundwater drinking supply. The report is contained in Appendix A. The findings and conclusions are reproduced below.

¹ Note: The cooperative association was reorganized as a mutual domestic association, a public entity, in 2001

FINDINGS

Water Supply

- F1 The Entranosa Water & Wastewater Cooperative is the largest supplier of domestic drinking water to the East Mountain Area and is totally dependent on groundwater for its supply.*
- F2 Private wells, which are also increasing, may be affected by new land developments supplied by Entranosa.*
- F3 Conventional septic tank and drainfield wastewater treatment systems can contaminate groundwater with high concentrations of nitrates and other pollutants.*

Groundwater Protection

- F4 Nitrate concentrations are influenced by the density of the septic tank and drainfield population.*
- F5 Nitrate concentrations are influenced by varying geological conditions which are difficult and expensive to model.*
- F6 A number of alternative wastewater treatment systems are currently available, at a reasonable cost, to remove nitrogen and prevent groundwater contamination.*

Treatment System Maintenance

- F7 Regular maintenance of existing septic tank systems can increase the useful life of the system, prevent bacterial and other chemical pollution, and reduce the incidence of catastrophic failure and expensive repair.*

Authorities Having Jurisdiction

- F8 The City of Albuquerque and the County of Bernalillo have commissioned at least four studies of the impacts of septic systems on water quality since 1989. All studies indicated that the existing liquid wastewater ordinance (88-1) does not adequately protect groundwater quality and recommended increasing the minimum lot size for septic tank and drainfield applications.*
- F9 The Director of the Bernalillo Environmental Health Department, by memorandum dated May 31, 1989, recommended that the County Board of Commissioners adopt the recommendation of the 1989 Geohydrology Associates, Inc. study for larger minimum lot sizes (two acre minimum) for septic tank and drainfield installations in the valley and change the liquid waste ordinance accordingly.*
- F10 County Environmental Health Department Geohydrologist, Jeffery Peterson, by memorandum dated March 14, 1995, recommended that the County Planning Department revise the East Mountain Performance Criteria to include the following*

provisions: All land divisions and subdivisions for which the average lot size is less than five acres shall provide sewage treatment by either connection to a regulated sewer system, centralized collection and treatment of wastewater (including nitrogen and pathogen removal), or approved alternative on-site liquid waste disposal system proven to remove nitrogen and pathogens. These recommendations are consistent with the conclusions of the 1992 CH₂M Hill study entitled Effect of Lot Sizes on Potential Ground-Water Contamination from Conventional Septic-Tank Systems: Numerical Modeling.

Implementation of Groundwater Protection Recommendations

F11 By letters dated June 2, 1995 and February 6, 1996, the Entranosa Water & Wastewater Cooperative urged County Commissioner Les Houston to support implementation of the recommendations contained in the County Environmental Health Department memorandum by Jeffery Peterson.

CONCLUSIONS

- C1 To date, November 1996, after seven years of studies and recommendations, Bernalillo County has not implemented recommendations from the studies it commissioned, nor has it implemented recommendations of its staff to protect groundwater quality in the East Mountain Area (F6,7 &8). During this time, the East Mountain Area has experienced explosive growth. Membership in the Entranosa Water & Wastewater Cooperative has grown 51% between 1993 and 1996 (F1, F2).*
- C2 The groundwater resource continues to be threatened by increasing use of septic tank systems (F3). Although discussions with Bernalillo County staff in the Environmental Health Department (Jeffery Peterson), the Planning Department (Susan Jones), and the Public Works Division (Brian Speicher) indicate they are supportive of changes to prevent groundwater contamination, no effective changes have been implemented (F11). According to Malcolm Fleming, Community Services Division Director, Bernalillo County's position toward any Entranosa groundwater policy would be neutral until such time as its latest study (see Reference 20) is completed [34].*
- C3 While Entranosa is not able to develop a model that demonstrates our concerns about the potential for high levels of nitrate concentrations in any one area of our entire serving area, we have an obligation to protect the groundwater based on reasonable assumptions that the groundwater can be threatened by the density of conventional septic tank and drainfields in our serving area (F4, F5).*
- C4 Existing septic tank systems would benefit from regular maintenance, particularly removal of accumulated solids. The addition of septic tank filters would also help reduce the incidence of system failures and improve effluent quality. Entranosa could provide such services in its capacity as a wastewater cooperative (F6).*

Entranosa's Authority to Implement a Groundwater Protection Policy

C5 Legal counsel was sought from the firm of Sheehan, Sheehan and Stelzner regarding the authority of Entranosa to condition water service on actions to protect groundwater quality. In the opinion of the firm, neither the laws of New Mexico nor the Cooperative's Articles of Incorporation and Bylaws present any impediment to implementation of a policy to protect groundwater quality (F9, F10, and F11).

The report contains the following specific recommendations for BOD action.

RECOMMENDATIONS

New Wastewater Systems

- R1 The Entranosa Water & Wastewater Cooperative should continue to work with Bernalillo and Santa Fe Counties and to encourage the Counties to adopt policies to protect the drinking water in the EMA.
- R2 Should County action not be forthcoming to protect groundwater quality within the area served by the Entranosa Water & Wastewater Cooperative, and in accordance with recommendations of the County Environmental Health Department as expressed in the March 14, 1995 Jeffery Peterson Memorandum, and the February 1992 CH₂M Hill Report, *Effect of Lot Sizes on Potential Ground-Water Contamination From Conventional Septic-Tank Systems: Numerical Modeling*, it is recommended that Entranosa no longer provide Letters of Intent or provide water service to land divisions with lots less than five (5) acres in size, which propose only the use of conventional septic tank and drainfield systems for wastewater treatment and no acceptable alternative.

For future water service (proposed after adoption of this policy), water for residential or commercial use should only be provided under any of the following conditions to prevent groundwater contamination:

- Lot size is increased to a minimum of five (5) acres (F4),
- Sewage treatment is provided by connection to a sewer system regulated by the State of New Mexico,
- Sewage treatment is provided by centralized collection and treatment of wastewater that includes nitrogen and pathogen removal (F6), or
- Sewage treatment is provided by an alternative on-site system or cluster system proven to remove nitrogen and pathogens (F6) and a maintenance agreement is put in place to ensure continued satisfactory operation of the systems (F7)

Existing Septic Tank Systems

- R3 Entranosa should aggressively pursue methods to reduce the potential of pollution from existing septic tank systems. To that end, Entranosa should provide septic tank maintenance services as determined by the membership. A questionnaire has been sent to the members asking what level of service they would support. This could range from simply sending a post card reminding them to pump their septic tank, to scheduling and pumping septic tanks and installing septic tank filters. This Committee should be expanded to include interested members of the Cooperative. The expanded Committee should explore services that could be provided and make recommendations to the full Board of Directors for implementation.

The BOD solicited comments from members through a survey in its newsletter. The results of the survey indicated its members were generally receptive and willing to endorse a pumping and maintenance program (Appendix B). From this, the BOD eventually decided to implement Recommendation R3 and establish a septic tank pumping and maintenance program for its members.

The BOD considered a legal opinion regarding its ability to implement the recommendations (Appendix C). The legal opinion concluded that cooperative associations primarily operate by contracts with its members and these contracts can only be changed by mutual agreement. Thus, the cooperative may not impose new conditions retroactively. However, the cooperative is free to change its conditions of service for new members as part of their contract of service. The BOD brought this to the membership at their 2000 annual meeting. The members voted to change the association's bylaws to require new members and membership transfers to participate in the wastewater pumping program.

A cost analysis was completed to determine what rate would need to be charged to implement the proposed program (Appendix D). The analysis concluded the program could be provided for a monthly fee of \$5.00 per household with a pumping frequency of once every three years, a common interval found in the literature. Initially over 70 members volunteered to receive the pumping service. The number has increased as new members join and as existing members sell their houses and transfer the membership to the new owners. At the end of 2005, over 1100 members were enrolled in the pumping program.

Ancillary benefits of the program include providing a management plan acceptable to Bernalillo County and starting an education program for all members of the association. Bernalillo County did revise its liquid waste ordinance with a provision that onsite wastewater treatment systems would be required to have a management plan for proper maintenance. The EWWC developed a plan for all members subscribing to the pumping service, bringing them into compliance with the new ordinance (Appendix E). Proceeds from the pumping fees provided funding for an education program. Many people moving from Albuquerque to the EMA had no experience with septic tank systems, toilets look the same in either location. Through the EWWC newsletter, all members were informed of the basic working of septic tank systems, "do's and don'ts", and of the benefits of the pumping program. That effort continues today.

ON-SITE MANAGEMENT SYSTEM: VISION

The vision for the EWWC BOD was simple, to provide protection of its groundwater source. This vision was pursued in a variety of ways – completing its own study of groundwater protection in the EMA, supporting efforts of Bernalillo County to strengthen its liquid waste ordinance, and initiating efforts within the capacity of the EWWC to protect groundwater.

ON-SITE MANAGEMENT SYSTEM: PLAN

The onsite management plan implemented by the BOD reflects the vision. The BOD supported efforts by Bernalillo County to revise and strengthen its liquid waste ordinance and this came to pass. A pumping program was initiated, improving performance of existing and future onsite

wastewater systems. An educational program was started to improve understanding of onsite wastewater systems and elicit support from the public to protect groundwater resources in the EMA.

ON-SITE MANAGEMENT SYSTEM: IMPLEMENTATION & OPERATION

To implement the pumping program, the Engineering Committee of the EWWC prepared bid documents in 1999 for solicitations of quotes to pump septic tanks, record sludge and scum levels, and install access manways and septic tank effluent filters (Appendix F). Bids were received from two pumping firms with prices of \$90 to pump a 1000 gallon tank. The going rate at the time was about \$110, an 18% savings. The guarantee of consistent work over the year and the ability to group work that resulted in full truck loads, allowed the pumpers to reduce their rates. Recordation of sludge and scum depths was part of the pumping contract to develop a database to determine if the three year pumping interval was optimal, and pumpers were required to file a copy of the delivery manifest at the disposal point in Albuquerque. Members were notified of the service and over seventy requested to be part of the initial program.

The program was implemented through an Agreement for Wastewater Maintenance Service (Appendix G), a contract within the cooperative's authority. The maintenance fee is added to monthly water service bill for ease of administration. Staff of the EWWC track the pumping cycle, notify the homeowner of the need for pumping, and make final arrangements with the pumper and homeowner for the date and time of service. Information for the EWWC education program was readily attainable from the New Mexico Environment Department and other State and EPA sources.

ON-SITE MANAGEMENT SYSTEMS: C2 PROCESS (CHECKING AND CORRECTIVE ACTION)

The EWWC has operated the pumping program for over six years and has had the opportunity to evaluate the results and economics. Increasing costs of operation (fuel) have required the monthly fees to increase and, for planning purposes, EWWC has developed projections for escalating rates over a ten year period. A continuing process to educate the membership and remind them of the purpose of the program is necessary – the program has been well received although a dozen have objected to being required to participate. The EWWC includes septic management information in at least two of their monthly bill stuffers every year, with a complete review of the program once a year. Having at least two pumpers on contract allows for the merit of the competitive process as well as flexibility in scheduling. As growth continues, land areas that are supportive of traditional septic treatments are diminishing and a plethora of advanced treatment units are appearing, using proprietary mechanisms that drive specialized maintenance contracts – however, every advanced treatment unit must have a collection chamber pumped on a routine basis, and the EWWC continues to grow its program.

ON-SITE MANAGEMENT SYSTEMS: REVIEW

Annually, the EWWC staff formally reviews the management system and adjusts its procedures accordingly. The EWWC is currently looking at the acquisition of their own septic pumping

capacity and expanding service to include maintenance of advanced treatment units, particularly as the installers abandon their service contracts.

ON-SITE MANAGEMENT SYSTEMS: RE-VISION

The EWWC vision that facilitated these actions remains the same – provide support to protect the ground water resource.

REFERENCES

- [1] CH₂M Hill. *Effect of Lot Sizes on Potential Ground-Water Contamination from Conventional Septic-Tank Systems: Numerical Modeling*, prepared for the Policy Coordinating Committee (Albuquerque Public Works Department, Albuquerque Environmental Health Department, Albuquerque Planning Department, and Bernalillo County Environmental Health Department), February 1992.

A predictive model was developed, consistent with other research and models in the discipline, to estimate the required minimum lot size to prevent ground-water contamination from conventional septic-tank systems. The model recognizes and accounts for vast differences in climate and geology within Bernalillo County. The report recommends the following minimums:

In crucial areas where ground water occurs within porous media [the Rio Grande valley] the minimum lot size is 2 acres with a maximum density of 160 systems per square mile [1 per 4 acres]. [*Note this is in agreement with the earlier work of Geohydrology and Associates, Inc.*]

In crucial areas where ground water occurs within Madera Limestone [the majority of the East Mountain Area] the minimum lot size is 5 acres with a maximum density of 64 systems per square mile [1 per 10 acres].

In crucial areas where ground water occurs within low-flow fractured rocks [the remainder of the East Mountain Area] the minimum lot size is 40 acres with a maximum density of 16 systems per square mile [1 per 40 acres].

“The calculations show that the minimum lots sizes that will allow for ample dilution of septic-tank contamination depend on how many septic-tank systems occur along a ground-water flow path. If the ground water needed to dilute septic-tank contamination has already been degraded by upgradient contamination, these minimum lot sizes will no longer provide for sufficient dilution.”

- [2] DeGravelle, Alyce B. *Sewer Expansion & Water Quality in Rose Acres Subdivision, Albuquerque South Valley*, Bernalillo County Environmental Health, November 1996.

“This kind of pollution problem in Albuquerque’s South Valley is not new. One study cites ground-water contamination as a recorded health problem as far back as 1927. In 1963, the United States Geological Survey recognized the longevity of the contamination problems that existed and reported that ‘New Mexico will have its hands full in solving its water problems and making secure the water supplies on which its future depends.’ Back then, the state and local Health Departments made recommendations for half-acre lot regulations when no city utilities were available in an effort to cut down on septic system-induced pollution. In the mid 1960’s, further concern was expressed by the Director of the Albuquerque Environmental Health Department that over-use and the continued use of private septic tanks and onsite water supplies had caused residents of

Albuquerque to face potentially serious health problems. Exposure monitoring through water sampling was being done even then and in a 1966 Albuquerque Environmental Health Department report, one-third of the wells tested in the South Valley exceeded the exposure limits of three or more standards. Only 11% of wells that were eighty feet deep or less met all standards.

All twenty-four samples showed a decrease in the level of nitrates, some drastically. Among the highest levels recorded in 1989 and 1994 were 17.5 mg/l, 12.6 mg/l, and 10.9 mg/l. These wells in 1996 read 0.5 mg/l, 0.3 mg/l, and 0.3 mg/l respectively.

This follow-up study of Rose Acres has proven that getting large numbers of septic systems off line is an extremely effective solution that should be supported in an effort to incorporate more and more communities into the program.”

- [3] Geohydrology Associates, Inc. *Lot Size Evaluation*, Prepared for Bernalillo County Health Department, New Mexico, April 1989.

“Historical data and modeling predictions indicate that high-density development in unsewered areas will result in water-quality degradation in excess of recommended limits.

Liquid Waste Ordinance 88-1 and existing waste-disposal practices are not adequate to protect against contamination in the inner valley. Sufficient technical and historical data are available to show that sites and levels of contamination can be accurately predicted.

This illustrates that contamination from liquid waste persists many years after septic tanks have been abandoned. Once an area is contaminated, natural reclamation is extremely slow.

New subdivisions in the valley should be required to have a minimum lot size of two acres when the subdivision is not served by a community sewage system.”

- [4] Molzen-Corbin & Associates and Lee Wilson & Associates. *Bernalillo County East Mountain Area Water System Feasibility Study – Final Report*, January 1991.

“... wastewater disposal in the EMA is intimately related to groundwater quality since conventional septic tanks and drainfields are by far the most common method used to manage household wastes. There is evidence of sewage pollution of the groundwater at certain sites in the area in the form of elevated levels of nitrate-nitrogen.

This approach, while extremely simplistic, indicates that development at a density of 1 household per acre would pose a substantial risk of causing groundwater pollution, if domestic sewage is discharged to the local aquifers without advanced treatment.

However, if one sets as a target that nitrate-nitrogen should be kept below 10 mg/l, then if several (5+) miles of adjacent lots dispose of sewage on-site, it would take an average lot size of 15+ acres to meet that target.

High nitrate levels in the EMA have been a concern for many years. A 1961 USGS memo reported on an infant boy from Carnue [*sic*] who was admitted

to a hospital with an illness suspected to be caused by high nitrates.

The nature of EMA aquifers is such that wastewater can move rapidly, but the exact direction of movement in any one area is difficult to predict. Thus it is almost impossible to site a well and be sure that it is not downgradient of a wastewater source.

Nitrate is a conservative pollutant – not readily removed by natural soil processes – so that nitrate can move rather easily into local wells.”

- [5] Rankin, Dale R. *Water-Quality and Ground-Water-Level Data, Bernalillo County, Central New Mexico, 1995*, U.S. Geological Survey Open-File Report 96-578, 1996.

Compilation of groundwater sampling data from 1995 sampling of 53 wells in the East Mountain Area documenting high groundwater nitrate concentrations.

- [6] Summers, W.K. *Draft – Septic Tank Systems in Bernalillo County, New Mexico, and Their Effect on Ground-Water Quality: A Status Report*, Ground Water Scientist, Public Works Department, Albuquerque, New Mexico, October 1991.

“To ground-water scientists and engineers the evidence says clearly ‘Septic-tank systems have polluted the ground-water’.

The recommended density of septic-tank systems range from one system per two acres in the South Valley (Geohydrology Associates, Inc. 1989) to one system per 15 acres in the East Mountain Area (Lee Wilson and Associates, Inc. 1991).

Developers have platted more than 8,000 lots in the East Mountain Area. In Bernalillo County where we have chemical analyses of the water from wells and where wells and septic-tank systems cluster, the indicators of pollution are evident. Concentrations of nitrates or iron and manganese, chlorides, and total dissolved solids are larger than those in nearby pristine waters. The South Valley and the Carnue [*sic*] Area stand out as classic examples of the effect of septic-tank effluent on ground water in their terrains. The limited work on the North Valley argues that conditions there match those in the South Valley. Evidence hints at a pervasive problem in the East Mountain Area where septic-tank systems cluster.”

- [7] U.S. Geological Survey. *Ground-Water Availability and Quality in Eastern Bernalillo County and Vicinity, Central New Mexico*, Water Resources Investigation Report 89-4127, 1990.

“Nitrate concentrations increased from 1.6 to 7.8 milligrams per liter between 1962 and 1984 in a well in the Sandia Park area, an area that has undergone considerable development.”

EXHIBIT A

REPORT GROUNDWATER QUALITY DEGRADATION IN THE EAST MOUNTAIN AREA

SUPPORT FOR A PREVENTION/PROTECTION POLICY

ENTRANOSA WATER & WASTEWATER COOPERATIVE

GROUNDWATER QUALITY DEGRADATION IN THE EAST MOUNTAIN AREA

SUPPORT FOR A PREVENTION/PROTECTION POLICY

ENTRANOSA WATER & WASTEWATER COOPERATIVE

Entranosa Water & Wastewater Cooperative's Directors and staff have attempted to present facts concerning groundwater pollution in this report. Our concern is that the explosive growth of the last five years cause a definite pollution threat to our precious groundwater supply. This report is an attempt to factualize this potential threat from the pollution source of septic systems. It is our concern that possibly State and County officials do not overlook the issue of pollution in a fractured limestone area.

This report benefited from the input of various articles. Entranosa Water & Wastewater Cooperative funded preparation of the report, but is in no way responsible for statements or errors made herein.

**PREPARED BY:
SPECIAL COMMITTEE
ON GROUNDWATER PROTECTION
Richard P. Rose, P.E., Chairman
F. Kip Paskewich
Hal E. Engle**

April 1997

November 21, 1996

**Gene Young, President
Board of Directors
Entranosa Water & Wastewater Cooperative**

Mr. President:

The Special Committee on Groundwater Protection that you appointed has completed its research and prepared a report on protecting groundwater quality within the Entranosa service area. We are pleased to transmit this report and its recommendations to you and the full Board for review, approval, and implementation.

Sincerely,

Richard P. Rose, P.E., Chairman

F. Kip Paskewich

Hal E. Engle

TABLE OF CONTENTS

	<u>PAGE NO.</u>
GLOSSARY OF TERMS	ii
PURPOSE	1
BACKGROUND	1
The East Mountain Area	1
Septic Tank System Problems.....	2
Past Recommendations.....	4
Alternative Systems	5
Existing Systems.....	7
FINDINGS	9
CONCLUSIONS.....	10
RECOMMENDATIONS.....	11
Authorities Having Jurisdiction	11
New Wastewater Systems.....	11
Existing Septic Tank Systems	12
REFERENCES	13

GLOSSARY OF TERMS

Aerobic	Processes that require oxygen or environment that has oxygen
Alternative Systems	Wastewater systems that provide more treatment than septic tanks
Anaerobic	Processes that do not require oxygen or oxygen lacking environment
Anoxic	A condition where oxygen is lacking
BOD	Biochemical Oxygen Demand, measure of wastewater organic material
COD	Chemical Oxygen Demand, measure of chemically degradable material
Effluent	Discharge from wastewater treatment systems
EMA	East Mountain Area of Bernalillo County
Enteric Viruses	Viruses associated with the mammalian digestive tract
Entranosa	Entranosa Water & Wastewater Cooperative
Drainfield	Liquid waste absorptive disposal area that follows septic tanks
gpd	Gallons per day
Ion Exchange	Water treatment technology using synthetic media to capture chemicals
LUST	Leaking Underground Storage Tank
Nitrate (NO₃⁻)	Compound of nitrogen and oxygen responsible for blue baby syndrome
NSF	National Sanitation Foundation, tester of wastewater systems
Ordinance 88-1	Bernalillo County Liquid Waste Ordinance 88-1
Pathogens	Disease causing organisms
Reducing Condition	A condition supporting anaerobic decomposition
Reverse Osmosis	Water treatment technology using membranes to screen out chemicals
Septic Tank Filter	Filter that attach to end of the septic tank to contain solids
Septic Tank Pumping	Pumping septic tanks to remove accumulated solids
Septic Tank Systems	Conventional septic tank and drainfield wastewater disposal systems
SS	Suspended Solids, measure of undissolved solids in wastewater
Vadose Zone	Partially saturated zone above the water table

PURPOSE

The Entranosa Water & Wastewater Cooperative (Entranosa) is the largest supplier of domestic drinking water in the East Mountain Area (EMA) of Bernalillo and Santa Fe Counties, New Mexico. Entranosa is completely dependent upon groundwater for its source of drinking water. The Cooperative wishes to take an active role in the protection of its precious groundwater resources.

The purpose of this report is to outline threats to groundwater quality as the EMA develops and recommend a course of action to protect groundwater quality within the Entranosa area of service.

BACKGROUND

The East Mountain Area

The EMA is a high desert plain on the east side of the Sandia Mountains. The majority of the area is underlaid by fractured limestone deposits and receives approximately 10" of rainfall per year. Vegetation in the area is predominantly piñon/juniper. The area is one of the fastest growing regions in Bernalillo County, as indicated by the number of building permits issued. Entranosa has experienced a 51% increase in service connections between 1993 and 1996. The vast majority of new housing disposes of wastewater via conventional septic tank and drainfield systems on lots about 2 to 5 acres in size.

Within Bernalillo County, septic tank systems that discharge less than 2,000 gallons per day (gpd) are regulated by the Bernalillo County Environment Health Department under Liquid Waste Ordinance 88-1. Larger systems are regulated by the New Mexico Environment Department. Liquid Waste Ordinance 88-1 was adopted in January, 1988 and sets limits for soil conditions suitable for septic tank drainfields, specifying the range of percolation rates, depth to groundwater or bedrock, minimum setbacks, maximum ground slope, and minimum lot sizes. The regulation is based on recommendations of the U.S Department of Health, Education, and

Welfare contained in the *Manual of Septic-Tank Practice*, first published in 1957. The regulation permits septic tank systems on lots as small as ½ acre with a community water system. The intent of the regulation is to keep septic tank effluent from surfacing and provide separation distances from homes, wells, and property lines. It does not address chemical contamination.

Septic Tank System Problems

Septic tank systems directly discharge the largest volume of wastewater to the subsurface and are the most frequently reported source of contamination according to an Office of Technology Assessment report to Congress [1,2]. The Environmental Protection Agency (EPA) considers areas with septic tank densities greater than 40 per square mile (1 system per 16 acres) as regions of potential groundwater contamination [3].

The primary pollutant of concern from septic tank systems is nitrate. Nitrate is the natural product of biodegradation of organic material under anaerobic and aerobic processes found in septic tank and drainfield systems [4]. Nitrates are a documented health hazard at concentrations greater than 10 milligrams per liter (mg/l). Serious and occasionally fatal poisonings of infants have occurred following ingestion of water high in nitrates [5]. The condition is known as methemoglobinemia (blue baby syndrome) because the chemical reacts with hemoglobin in the blood, preventing the transfer of oxygen. Nitrate is a conservative pollutant; once it reaches the groundwater it can travel great distances [6]. As such, it is a good indicator of pollution. The primary method for lowering nitrate concentration in groundwater is dilution. The arid southwest receives little rainfall and has a greater potential for nitrate contamination of groundwater due to less rainfall dilution [7,8]. A more recent concern is enteric viruses (viruses that live in the digestive tract) that have also been found to travel through septic tanks and survive for extended periods [9]. Once groundwater is contaminated by nitrate, treatment to remove it is expensive, from \$0.50 to \$1.00 per 1,000 gallons. The two primary technologies for nitrate removal are reverse osmosis and ion exchange. Each of these treatment processes produce their own waste streams that must be dealt with. In other words, nitrate is not destroyed, but taken from one media and concentrated in another.

Nitrate is only one form of nitrogen found in wastewater. Nitrogen is one of the major building blocks of organic material, along with carbon, hydrogen, and oxygen. Organic nitrogen

is reduced to ammonium ion in the anaerobic atmosphere of the septic tank. Ammonium ion is oxidized to nitrate in the aerobic environment of the drainfield. Therefore, if wastewater from the septic tank is analyzed, the nitrate concentration will be low and the ammonia concentration will be high. A better measurement is "total nitrogen" that accounts for all forms of nitrogen. This is why treatment technologies that reduce "nitrogen" are called for because total nitrogen is reduced, not just converted from one form to another. Given a typical total nitrogen concentrations of 85 mg/l in the influent, over 80% removal would be required to maintain an effluent concentration of 10 mg/l.

Studies across the country have found that septic tank systems pollute groundwater [10,11,12,and 13]. Studies within the State of New Mexico confirm the national findings. A Geological Survey study of the Albuquerque-Belen Basin found high levels of dissolved iron attributable to anoxic reducing conditions from on-site waste disposal practices [14]. Other studies conducted by the State Health and Environment Department have documented specific instances of septic tank system contamination of groundwater in the South Valley area of Albuquerque [15] and Fowler area of Hobbs [16]. An ongoing follow-up to the South Valley study found that when septic tank discharges were eliminated by connecting to sewers, groundwater nitrate concentrations returned to background levels [17]. A general State survey reports that most populated areas in New Mexico have experienced pollution from septic tank systems with a disturbing number of cases involving groundwater at depths between 200' and 600' [18]. Another State study found that although information on groundwater quality is not readily available, the lack of documentation does not mean that contamination has not occurred or that it will not occur in the future. The study also notes that pollution from septic tank systems is generally widespread and not economically or technologically practical to clean up [19].

A few studies have been conducted in the EMA to document groundwater contamination. The Bernalillo County Environmental Health Department is in the process of establishing a groundwater monitoring network in the area to conduct two years of monitoring as a continuation of the Ground-Water Protection Policy and Action Plan [20]. Pervasive problems are suspected in the EMA where septic tank systems cluster [21]. One study found there is evidence of sewage pollution of groundwater at certain sites in the EMA in the form of elevated

nitrate levels [22]. A groundwater availability study by the U.S. Geological Survey found nitrate concentrations in the Sandia Park area increased from 1.6 mg/l to 7.8 mg/l between 1962 and 1984 [23]. The most recent open file report presenting information gathered by the U.S. Geological Survey found over 25% of the 53 wells sampled in the EMA in 1995 had nitrate concentration above 5 mg/l [24].

Overwhelming evidence supports the conclusion that even properly designed, constructed, and installed septic tank and drainfield systems contribute pollutants, primarily nitrate, to the subsurface. These pollutants become a health hazard when dilution can no longer reduce concentrations below safe levels.

Past Recommendations

The City of Albuquerque and Bernalillo County have commissioned at least four reports in the past seven years to evaluate septic system problems. A 1989 report by Geohydrology Associates concluded that the County's Liquid Waste Ordinance 88-1 did not provide adequate protection of groundwater from septic system use. The report recommended that new subdivisions in the Rio Grande Valley should be required to have a minimum lot size of 2 acres to utilize septic tank systems [25]. The recommendation was based on predictive modeling of nitrate concentrations. The County Environmental Health Director at the time, recommended the Board of County Commissions amend the Liquid Waste Ordinance to reflect the findings of the report [35].

A more recent report by CH₂M Hill, a major environmental engineering firm, examined all of Bernalillo County and recommended increasing the minimum lot size for septic tank systems in accordance with area geology [26]. They used a U.S. Geological Survey two-dimensional computer model to predict the impact of lot sizes on nitrate concentrations. In the Rio Grande Valley, the minimum recommended lot size for septic tank systems was the same as the earlier Geohydrology study, 2 acres. For the majority of the EMA characterized as within the Madera limestone area, the recommended minimum lot size is 5 acres. For the portion of the EMA within the low flow fractured rock area (Tijeras Canyon and Sandia Crest areas), the minimum recommended lot size is 40 acres. Consistent with the study, the County Environmental Health Geohydrologist recommended amendment of the East Mountain

Performance Criteria to require wastewater treatment to remove nitrogen and pathogens on all newly created lots, less than 5 acres in size [36]. Entranosa has supported the recommendation and urged its adoption through written correspondence with the East Mountain Bernalillo County Commissioner, Les Houston.[37,38].

Alternative Systems

On-site wastewater treatment systems have been developed to provide a higher level of treatment than offered in conventional septic tank systems. The treatment units generally apply aerobic treatment by mixing or the addition of compressed air. Treatment units and vendor contacts that have expressed interest to the Bernalillo Health Department to provide products to the EMA are summarized in Table 1, with the addition of Orenco Systems, a provider specializing in septic tank products. Other products may be available, but the intent of the listing is only to demonstrate a variety of products are available, not to produce a complete list.

Examples of the aerobic units available in the area include the following.

- Single-Home Fixed Activated Sludge Treatment (FAST) system produced by Smith and Loveless, Inc. The unit carries the National Sanitation Foundation (NSF) certification and has demonstrated more than 80% removal of nitrogen. The unit costs approximately \$4,500 and must have a septic tank for pretreatment.
- Clearstream by Wastewater Systems, Inc. has no moving parts, utilizing an external air compressor to provide mixing and treatment of the waste. The unit is NSF certified and costs approximately \$5,000, which includes a 500 gallon septic tank for sludge removal.
- Multi-Flo by Waste Treatment Systems, Inc. is an aeration unit that utilizes a submerged pump for mixing and aeration. The unit is NSF certified and costs approximately \$6,000 and must have a septic tank for pretreatment.
- Cromaglass, marketed by RUCON Enterprises, is a sequencing batch reactor (SBR). The process is controlled by a programmable control center that can include a denitrification step. The unit costs approximately \$3,600 and requires no pretreatment.
- Whitewater Mechanical Sewage Treatment System is manufactured by Delta Fiberglass & Environmental Products, Inc. The unit is aerated and mixed by an external air compressor like the Clearstream. It is NSF certified, costs approximately \$3,000, and must have a septic tank for pretreatment.

- Jet Individual Home Wastewater Treatment Plant by Jet, Inc. is essentially a septic tank with a mixer. An external motor turns a paddle to stir and aerate the waste. The unit is NSF certified and costs approximately \$1,700.
- Septic Tank Trickling Filter by Orenco Systems, Inc. adds a recirculating trickling filter to a standard septic tank. It can be installed on a new or existing septic tank.

Bernalillo County has initiated a study to document the performance of five alternative systems marketed in the Albuquerque area compared to conventional septic tanks and constructed wetlands. The final report from the study is due in two years [20].

Other technologies have been demonstrated to provide effective treatment for nitrogen removal. Intermittent and recirculating sand filters provide high nitrogen removals and low concentrations of organic matter [27,28,and 29]. These systems are simply a sand bed through which the septic tank effluent is passed, either in a single or multiple dose. Another promising technology is reactive porous media barriers. A carbon source, such as sawdust, is placed at the bottom of the drainfield to enhance denitrification in the saturated zone. Field trials conducted by the Waterloo Centre for Groundwater Research in Ontario, Canada produced consistently high nitrate removals [30]. Thus, a variety of options are currently available to remove nitrogen and prevent contamination of groundwater.

Existing Systems

Septic tanks already installed must be maintained to function properly. Over time, sludge that settles in the tank builds up and the scum layer that floats on the surface becomes thicker. Eventually, if not pumped, these solids will wash out of the tank into the drainfield. Solids that reach the drainfield clog the pore spaces in the rock media, contribute to the biomat build up, and prevent effluent from percolating into the subsurface. When this happens, effluent surfaces and presents a direct public health threat. This is commonly the source of bacteria in drinking water wells. Once the drainfield fails, there is usually no alternative but to construct a replacement field. This is an expensive and disruptive alternative. A survey of failed systems in Stinson Beach, California found that 85% of the failures were due to clogged drainfields, poor drainfield design, or inadequate septic tank maintenance [31]. Septic tank filters are now on the market that prevent or at least reduce the amount of solids that can flow to the drainfield. These filters

connect to the outlet pipe and cost from \$40 to \$140 depending on the capacity. Manufacturers recommend the filters be cleaned when the tank is pumped.

Proper maintenance of septic tanks requires periodic removal of the accumulated sludge and scum layers. Opinions vary as to the appropriate interval for pumping. The general rule of thumb, according to the septic tank pumpers, is that septic tanks should be pumped every 3 to 5 years. This does depend upon the size of the septic tank, the number of people in the household, and the disposal practices, such as the use of garbage disposals. A study of sludge accumulation in septic tank effluent pump collection systems in Glide, Oregon and Montesano, Washington suggests that pumping is required only about once every ten years [32]. The sludge and scum layers can be measured to determine whether the tank should be pumped. This is the practice of the Sea Ranch, California On-site Wastewater Disposal Zone. At Sea Ranch, on-site inspection of septic tanks includes the condition of the tank and plumbing fittings, and condition of the drainfield. Records are kept of the results and homeowners are notified when the tank must be pumped. Thus, several approaches are available for scheduling septic tank pumping.

Regular maintenance of septic tank systems increases the useful life of the system, prevents bacterial and other chemical pollution, and reduces the incidence of catastrophic failure and expensive repair. However, regular maintenance cannot prevent the discharge of nitrates as noted earlier. Additional treatment is required to eliminate nitrates. Technology is being developed that could be added to an existing septic tank for nitrate removal. These include the septic tank trickling filter and porous media barriers discussed in the Alternative System section. Septic tank filters have also been shown to improve the quality of effluent over unfiltered waste [33]. These are devices that are added at the end of the septic tank to contain solids within the tank. They also provide a media that supports bacterial growth, providing additional treatment.

FINDINGS

The following findings are derived from the information detailed in this report.

Water Supply

- F1 The Entranosa Water & Wastewater Cooperative is the largest supplier of domestic drinking water to the East Mountain Area and is totally dependent on groundwater for its supply.

- F2 Private wells, which are also increasing, may be affected by new land developments supplied by Entranosa.
- F3 Conventional septic tank and drainfield wastewater treatment systems can contaminate groundwater with high concentrations of nitrates and other pollutants.

Groundwater Protection

- F4 Nitrate concentrations are influenced by the density of the septic tank and drainfield population.
- F5 Nitrate concentrations are influenced by varying geological conditions which are difficult and expensive to model.
- F6 A number of alternative wastewater treatment systems are currently available, at a reasonable cost, to remove nitrogen and prevent groundwater contamination.

Treatment System Maintenance

- F7 Regular maintenance of existing septic tank systems can increase the useful life of the system, prevent bacterial and other chemical pollution, and reduce the incidence of catastrophic failure and expensive repair.

Authorities Having Jurisdiction

- F8 The City of Albuquerque and the County of Bernalillo have commissioned at least four studies of the impacts of septic systems on water quality since 1989. All studies indicated that the existing liquid wastewater ordinance (88-1) does not adequately protect groundwater quality and have recommended increasing the minimum lot size for septic tank and drainfield applications.
- F9 The Director of the Bernalillo Environmental Health Department, by memorandum dated May 31, 1989, recommended that the County Board of Commissioners adopt the recommendation of the 1989 Geohydrology Associates, Inc. study for larger minimum lot sizes (two acre minimum) for septic tank and drainfield installations in the valley and change the liquid waste ordinance accordingly.
- F10 County Environmental Health Department Geohydrologist, Jeffery Peterson, by memorandum dated March 14, 1995, recommended that the County Planning Department revise the East Mountain Performance Criteria to include the following provisions: All land divisions and subdivisions for which the average lot size is less than five acres shall provide sewage treatment by either connection to a regulated sewer system, centralized collection and treatment of wastewater (including nitrogen and pathogen removal), or approved alternative on-site liquid waste disposal system proven to remove nitrogen and pathogens. These recommendations are consistent with the conclusions of the 1992

CH₂M Hill study entitled *Effect of Lot Sizes on Potential Ground-Water Contamination from Conventional Septic-Tank Systems: Numerical Modeling*.

Implementation of Groundwater Protection Recommendations

- F11 By letters dated June 2, 1995 and February 6, 1996, the Entranosa Water & Wastewater Cooperative urged County Commissioner Les Houston to support implementation of the recommendations contained in the County Environmental Health Department memorandum by Jeffery Peterson.

CONCLUSIONS

- C1 To date, November 1996, after seven years of studies and recommendations, Bernalillo County has not implemented recommendations from the studies they commissioned, nor has it implemented recommendations of their staff to protect groundwater quality in the East Mountain Area (F6,7 &8). During this time, the East Mountain Area has experienced explosive growth. Membership in the Entranosa Water & Wastewater Cooperative has grown 51% between 1993 and 1996 (F1, F2).
- C2 The groundwater resource continues to be threatened by increasing use of septic tank systems (F3). Although discussions with Bernalillo County staff in the Environmental Health Department (Jeffery Peterson), the Planning Department (Susan Jones), and the Public Works Division (Brian Speicher) indicate they are supportive of changes to prevent groundwater contamination, no effective changes have been implemented (F11). According to Malcolm Fleming, Community Services Division Director, Bernalillo County's position toward any Entranosa groundwater policy would be neutral until such time as their latest study (see Reference 20) is completed [34].
- C3 While Entranosa is not able to develop a model that demonstrates our concerns about the potential for high levels of nitrate concentrations in any one area of our entire serving area, we have an obligation to protect the groundwater based on reasonable assumptions that the groundwater can be threatened by the density of conventional septic tank and drainfields in our serving area (F4, F5).
- C4 Existing septic tank systems would benefit from regular maintenance, particularly removal of accumulated solids. The addition of septic tank filters would also help reduce the incidence of system failures and improve effluent quality. Entranosa could provide such services in its capacity as a wastewater cooperative (F6).

Entranosa's Authority to Implement a Groundwater Protection Policy

- C5 Legal counsel was sought from the firm of Sheehan, Sheehan and Stelzner regarding the authority of Entranosa to condition water service on actions to protect groundwater quality. In the opinion of the firm, neither the laws of New Mexico nor the Cooperative's

Articles of Incorporation and Bylaws present any impediment to implementation of a policy to protect groundwater quality (F9, F10, and F11).

RECOMMENDATIONS

New Wastewater Systems

- R1 The Entranosa Water & Wastewater Cooperative should continue to work with Bernalillo and Santa Fe Counties and to encourage the Counties to adopt policies to protect the drinking water in the EMA.
- R2 Should County action not be forthcoming to protect groundwater quality within the area served by the Entranosa Water & Wastewater Cooperative, and in accordance with recommendations of the County Environmental Health Department as expressed in the March 14, 1995 Jeffery Peterson Memorandum, and the February 1992 CH₂M Hill Report, *Effect of Lot Sizes on Potential Ground-Water Contamination From Conventional Septic-Tank Systems: Numerical Modeling*, it is recommended that Entranosa no longer provide Letters of Intent or provide water service to land divisions with lots less than five (5) acres in size, which propose only the use of conventional septic tank and drainfield systems for wastewater treatment and no acceptable alternative.

For future water service (proposed after adoption of this policy), water for residential or commercial use should only be provided under any of the following conditions to prevent groundwater contamination:

- Lot size is increased to a minimum of five (5) acres (F4),
- Sewage treatment is provided by connection to a sewer system regulated by the State of New Mexico,
- Sewage treatment is provided by centralized collection and treatment of wastewater that includes nitrogen and pathogen removal (F6), or
- Sewage treatment is provided by an alternative on-site system or cluster system proven to remove nitrogen and pathogens (F6) and a maintenance agreement is put in place to ensure continued satisfactory operation of the systems (F7)

Existing Septic Tank Systems

- R3 Entranosa should aggressively pursue methods to reduce the potential of pollution from existing septic tank systems. To that end, Entranosa should provide septic tank maintenance services as determined by the membership. A questionnaire has been sent to the members asking what level of service they would support. This could range from simply sending a post card reminding them to pump their septic tank, to scheduling and pumping septic tanks and installing septic tank filters. This Committee should be

expanded to include interested members of the Cooperative. The expanded Committee should explore services that could be provided and make recommendations to the full Board of Directors for implementation.

REFERENCES
FOR A POLICY FOR THE PROTECTION OF
GROUNDWATER QUALITY WITHIN THE
ENTRANOSA WATER AND WASTEWATER COOPERATIVE
AREA OF SERVICE
(AN ANNOTATED BIBLIOGRAPHY)

Documentation of Septic Tank/Drainfield Pollution

- [1] Office of Technology Assessment, *Protecting the Nations Groundwater from Contamination - Volumes I and II*, Congress of the United States, 1984.
"Of all the sources known to contribute to groundwater contamination, septic tank systems and cesspools directly discharge the largest volume of wastewater into the subsurface. They are also the most frequently reported source of contamination and they contribute to both local and regional problems.
Major factors affecting the potential of septic systems to contaminate groundwater in general are the density of systems per unit area and hydrogeological conditions. Areas with a density of more than 40 systems per square mile [1 per 16 acres] are considered regions with potential for contamination.
Infectious disease has been traced to groundwater contaminated by septic tanks. In Polk County, Arkansas, in 1971, an outbreak of viral hepatitis was traced to a well that was contaminated by seepage from a septic tank 30 meters away. In 1972, typhoid in Yakima, Washington was attributed to ... a drainfield."
- [2] Perkins, Richard J. *Septic Tanks, Lot Size and Pollution of Water Table Aquifers*, Journal of Environmental Health, Vol 46, No. 6, May/June 1984.
"The second largest source of groundwater contamination has been identified as discharge from septic tanks and cesspools. This discharge source ranks highest in total volume of waste water discharged through soil to groundwater (more than 1 trillion gallons per year) and is the most frequently reported cause of groundwater contamination."
- [3] Yates, Marylynn V. *Septic Tank Density and Ground-Water Contamination*, Ground Water, Vol 23, No. 5, September/October 1985.
"Septic tanks contribute the largest volume of wastewater, 800 billion gallons per year to the subsurface, and are the most frequently reported cause of ground-water contamination associated with disease outbreaks. The U.S. Environmental Protection Agency has designated areas with septic tank densities of greater than 40 systems per mi² (1 system per 16 acres) as regions of potential ground-water contamination.
The single most important means of limiting ground-water contamination by septic tanks is to restrict the density of these systems in an area.
According to the Farmer's Home Administration, many counties and states are increasingly providing rural zoning ordinances or laws limiting the use of septic tanks to 2 to 10 acre lots."
- [4] Wilhelm, Sheryl R.; Schiff, Sherry L.; and Cherry, John A. *Biogeochemical Evolution of Domestic Waste Water in Septic Systems: 1 Conceptual Model*, Ground Water, Vol 32, No. 6, November/December 1994.
"The nitrate formed by ammonia oxidation in this zone [aerobic area beneath the drainfield] is the primary adverse impact of septic systems at most sites and is generally an unavoidable consequence of the proper functioning of conventional septic systems. ...

properly designed and constructed septic systems frequently cause nitrate concentrations greater than 10 mg/l in underlying ground water.

In settings such as sand and gravel aquifers and fractured bedrock, low dispersion often maintains high nitrate concentrations for considerable travel distances."

- [5] U.S. Environmental Protection Agency. *Quality Criteria for Water*, Office of Water and Hazardous Materials. July 1976.
Contains water quality criteria for a long list of organic and inorganic substances based on Safe Drinking Water Act and World Health standards. The limit of nitrates in domestic drinking water is 10 mg/l based on health considerations, primarily methemoglobinemia in infants.
- [6] Robertson, W.D.; Cherry, J.A.; and Sudisky, E.A. *Ground-Water Contamination from Two Small Septic Systems on Sand Aquifers*, Ground Water, Vol 29, No. 1, January/February 1991.
"At the older site, where the septic system has been in operation since 1977 and where our field investigations began in 1987, a long narrow plume of septic system-impacted ground-water, more than 130 m in length, has been identified within a carbonate-rich sand aquifer.
Nitrate occurred at more than 50% of the source concentrations 130 m downgradient from the septic system."
- [7] Bauman B.J. and Schafer, W.M. *Estimating Ground-Water Quality Impacts from On-Site Sewage Treatment Systems*, Proceedings of the Fourth National Symposium on Individual and Small Community Sewage Systems, December 10 - 11, 1984.
"Figures 2 - 6 illustrate the relationship between predicted ground-water nitrate-N and housing density for various combinations of the above factors. In each of these figures the model predicts that at higher housing densities (approaching 1 and 2 acres/lot) this standard [10 mg/l nitrate] is likely to be exceeded.
Geographical areas with higher precipitation and infiltration will be better able to dilute septic system nitrogen. Thus, arid and semi-arid parts of the country may be at greater risk from such contamination."
- [8] Hantzsche, Norman N. and Finnemore, E. John. *Predicting Ground-Water Nitrate-Nitrogen Impacts*, Ground Water, Vol 30, No. 4, July/August 1992.
"This work found denitrification to be an insignificant nitrate removal mechanism in unsaturated sandy soils, as deep as 15 to 20 feet, due to the lack of anaerobic conditions and organic material which support denitrification bacteria. It was thus suggested that the only active mechanism of lowering the nitrate content in such situations is dilution by higher quality ground water or by recharge waters.
The greatest potential for ground water nitrate-nitrogen problems arises in areas of low rainfall recharge and high development density."
- [9] Carlile, Bob; Cogger, CG; Sobsay, Mark D.; Scandura, John; and Steinbeck, Steve J. *Movement and Fate of Septic Tank Effluent in Soils of the North Carolina Coastal Plain*, October 1981.
"This investigation has analyzed the movement and fate of enteric viruses in on-site waste water treatment systems. It has demonstrated that model enteric viruses introduced into septic tanks are capable of moving with septic waste effluents to the drainfields, entering the water table, and persisting for extended periods. The study is one of the first to establish the potential for virus contamination of ground water by on-site septic waste disposal systems, and raises questions concerning the adverse public health effects from these systems."
- [10] Alpay, S.; Robertson, W.D.; and Schiff, S.L. *Fate of Wastewater Nutrients (N and P) Beneath Septic Tile Fields in Low Permeability Sediments*, Waterloo Center for Groundwater Research, University of Waterloo, Conference Proceedings - Problem Environments for Septic Systems and Communal

Treatment Options, May 17, 1993.

"The two septic system sites exhibit vertical attenuation of nitrate and phosphate inside the wastewater plumes. PL1 [raised sand filter bed] indicates high nitrate and phosphate concentrations within the raised sand filter bed that could be transported laterally and affect lake water quality."

- [11] Tinker, John R., Jr. *An Analysis of Nitrate-Nitrogen in Ground Water Beneath Unsewered Subdivisions*, GWMR, Winter 1991.
"The results indicate that nitrogen from septic systems and lawn fertilizer cause nitrate-nitrogen to increase in the ground water beneath the downgradient side of the subdivisions.
In three of the five subdivisions, the highest nitrate-nitrogen values exceeds the drinking water standard of 10 mg/l."
- [12] Manbeck, D.M. *Presence of Nitrate Around Home Waste Disposal Fields, 1975 Annual Meeting-American Society of Agricultural Engineers - University of California at Davis, June 22 - 25, 1975.*
"Samples between 10 and 100 mg/l [nitrate-nitrogen] constituted 73.4% of the total number. ...there is a high nitrate content within 30 cm of septic tank disposal fields. ...One of five household site wells has nitrate-nitrogen content above 10 mg/l."
- [13] Porter, Keith S. *An Evaluation of Sources of Nitrogen as Causes of Ground-Water Contamination in Nassau County, Long Island, May 1981.*
"Over a 12-month period the average concentration of total nitrogen at a depth of four feet in the leaching field was 38.2 mg/l.
This result is consistent with other studies, which have shown that average levels of nitrogen in ground water directly under properly functioning on-site disposal systems, are rarely above 30 mg/l."
- [14] Anderholm, Scott K. *Reconnaissance of Hydrology, Land Use, Ground-Water Chemistry, and effects of Land Use on Ground-Water Chemistry in the Albuquerque-Belen Basin, New Mexico, U.S. Geological Survey, 1987.*
"Dissolved-iron concentrations in water in the Rio Grande valley near Albuquerque are greater than dissolved-iron concentrations in areas adjacent to the valley.
Recharge associated with residential land use (onsite waste-disposal effluent) is relatively reduced and contains organic carbon, biological oxygen demand, and chemical oxygen demand. The constituents in onsite waste-disposal effluent cause reducing conditions in the aquifer and dissolution of iron and manganese oxides."
- [15] McQuillan, Dennis M.; Jasper, Molly J.; and Swanson, Baird H. *Ground-Water Contamination by Septic-Tank Use: A Field Study in the Albuquerque South Valley-West Mesa Region, New Mexico Health and Environment Department, November 1989.*
"Clearly, residential areas platted with lot sizes of 1/10 to 1/2 acre and developed with septic systems have caused ground-water contamination in excess of drinking-water standards for total dissolved solids and nitrate. Since the actual development has been less than 100% of the lots platted, the effective lot sizes causing ground-water contamination are somewhat larger.
Damage to the ground-water resource will continue as long as septic tanks discharge waste water to the subsurface at existing or greater densities."
- [16] Earp, Douglas E. and Koschal, Gerard J. *A Field Investigation of Effects of Septic Tank Density on Ground-Water Quality in New Mexico*, New Mexico Environmental Improvement Division, September 1986.
"Results indicated significant ground-water contamination below both subdivisions. Contaminant concentrations were higher and contaminant plumes

extended farther under the subdivisions having the greater density of septic tanks.

In the Fowler study area (one-half acre lots), nitrate-nitrogen concentrations exceeded the drinking water standard [10 mg/l] under portions of the subdivision and for several hundred feet downgradient."

- [17] DeGravelle, Alyce B. *Sewer Expansion & Water Quality in Rose Acres Subdivision, Albuquerque South Valley*, Bernalillo County Environmental Health, November 1996.

"This kind of pollution problem in Albuquerque's South Valley is not new. One study cites ground-water contamination as a recorded health problem as far back as 1927. In 1963, the United States Geological Survey recognized the longevity of the contamination problems that existed and reported that 'New Mexico will have its hands full in solving its water problems and making secure the water supplies on which its future depends.' Back then, the state and local Health Departments made recommendations for half-acre lot regulations when no city utilities were available in an effort to cut down on septic system-induced pollution. In the mid 1960's, further concern was expressed by the Director of the Albuquerque Environmental Health Department that over-use and the continued use of private septic tanks and onsite water supplies had caused residents of Albuquerque to face potentially serious health problems. Exposure monitoring through water sampling was being done even then and in a 1966 Albuquerque Environmental Health Department report, one-third of the wells tested in the South Valley exceeded the exposure limits of three or more standards. Only 11% of well that were eighty feet deep or less met all standards.

All twenty-four samples showed a decrease in the level of nitrates, some drastically. Among the highest levels recorded in 1989 and 1994 were 17.5 mg/l, 12.6 mg/l, and 10.9 mg/l. These wells in 1996 read 0.5 mg/l, 0.3 mg/l, and 0.3 mg/l respectively.

This follow-up study of Rose Acres has proven that getting large numbers of septic systems off line is an extremely effective solution that should be supported in an effort to incorporate more and more communities into the program."

- [18] McQuillan, Dennis. *Ground-Water Contamination and Remediation in New Mexico: 1927 - 1992*, New Mexico Environment Department.

"Non-point sources, predominantly the estimated 170,000 household septic tanks and cesspools, are responsible for 61% of all supply well contamination incidents.

These discharges have caused widespread nitrate or anoxic pollution in Albuquerque, Belen, Bernalillo, Bosque Farms, Carlsbad, Chamita, Corrales, Espanola, Hobbs, Los Lunas, Lovington, Nara Visa, Pojoaque, Santa Fe, and Tesuque.

A disturbing number of contamination cases are being discovered in areas where the depth to groundwater is between 200 and 600 feet, suggesting that depth to water may not be as important for aquifer protection as is widely believed."

- [19] McQuillan, Dennis M. *Ground-Water Quality Impacts of Septic-Tank Use*, New Mexico Health and Environment Department, November 1989.

"There are areas within the state where mechanisms such as mechanical dispersion ... and denitrification ... apparently attenuate contaminants significantly. In other areas, however, septic-tank discharges are a common source of ground-water contamination.

'Water Fair' programs provide important ground-water quality surveillance in many rural areas in the state where data are lacking. Serious contamination problems have been discovered at several Water Fairs. Hence, the lack of documented contamination in any specific area does not necessarily mean that contamination has not occurred or will not occur in the future.

Unlike typically localized ground-water contamination caused by point sources, septic tanks typically cause widespread contamination that is economically and technologically impractical to cleanup."

Bernalillo County Studies

- [20] Waste-management Education and Research Consortium. *Development of a Study Plan for Evaluation of On-Site Wastewater Treatment and Disposal: Determination of Groundwater Contamination and Demonstration of Alternative Technologies*, 1996.

A cost proposal to establish a groundwater monitoring program as envisioned by the Ground-Water Protection Policy and Action Plan as adopted by Bernalillo County in 1993. Existing LUST monitoring wells and newly drilled monitoring wells will be used to determine the existence of groundwater contamination. Pollution transport in the vadose zone beneath drainfields will also be investigated.

A second part of the proposal is an evaluation of existing alternative wastewater treatment technologies for nitrogen removal. Five manufactured systems will be monitored over an 18 month period and compared with a conventional septic tank system and constructed wetland for nitrogen removal performance. The manufactured systems are all currently marketed in the Albuquerque area.

- [21] Summers, W.K. *Draft - Septic Tank Systems in Bernalillo County, New Mexico, and Their Effect on Ground-Water Quality: A Status Report*, Ground Water Scientist, Public Works Department, Albuquerque, New Mexico, October 1991.

"To ground-water scientists and engineers the evidence says clearly 'Septic-tank systems have polluted the ground-water'.

The recommended density of septic-tank systems range from one system per two acres in the South Valley (Geohydrology Associates, Inc. 1989) to one system per 15 acres in the East Mountain Area (Lee Wilson and Associates, Inc. 1991).

Developers have platted more than 8,000 lots in the East Mountain Area.

In Bernalillo County where we have chemical analyses of the water from wells and where wells and septic-tank systems cluster, the indicators of pollution are evident. Concentrations of nitrates or iron and manganese, chlorides, and total dissolved solids are larger than those in nearby pristine waters. The South Valley and the Carnue [*sic*] Area stand out as classic examples of the effect of septic-tank effluent on ground water in their terrains. The limited work on the North Valley argues that conditions there match those in the South Valley. Evidence hints at a pervasive problem in the East Mountain Area where septic-tank systems cluster."

- [22] Molzen-Corbin & Associates and Lee Wilson & Associates. *Bernalillo County East Mountain Area Water System Feasibility Study - Final Report*, January 1991.

"... wastewater disposal in the EMA is intimately related to groundwater quality since conventional septic tanks and drainfields are by far the most common method used to manage household wastes. There is evidence of sewage pollution of the groundwater at certain sites in the area in the form of elevated levels of nitrate-nitrogen.

This approach, while extremely simplistic, indicates that development at a density of 1 household per acre would pose a substantial risk of causing groundwater pollution, if domestic sewage is discharged to the local aquifers without advanced treatment.

However, if one sets as a target that nitrate-nitrogen should be kept below 10 mg/l, then if several (5+) miles of adjacent lots dispose of sewage on-site, it would take an average lot size of 15+ acres to meet that target.

High nitrate levels in the EMA have been a concern for many years. A 1961 USGS memo reported on an infant boy from Carnue [*sic*] who was admitted to a hospital with an illness suspected to be caused by high nitrates.

The nature of EMA aquifers is such that wastewater can move rapidly, but the exact direction of movement in any one area is difficult to predict. Thus it is almost impossible to site a well and be sure that it is not downgradient of a wastewater source.

Nitrate is a conservative pollutant - not readily removed by natural soil processes -

so that nitrate can move rather easily into local wells."

- [23] U.S. Geological Survey. *Ground-Water Availability and Quality in Eastern Bernalillo County and Vicinity, Central New Mexico*, Water Resources Investigation Report 89-4127, 1990.
"Nitrate concentrations increased from 1.6 to 7.8 milligrams per liter between 1962 and 1984 in a well in the Sandia Park area, an area that has undergone considerable development."
- [24] Rankin, Dale R. *Water-Quality and Ground-Water-Level Data, Bernalillo County, Central New Mexico, 1995*, U.S. Geological Survey Open-File Report 96-578, 1996.
Compilation of groundwater sampling data from 1995 sampling of 53 wells in the East Mountain Area documenting high groundwater nitrate concentrations.
- [25] Geohydrology Associates, Inc. *Lot Size Evaluation*, Prepared for Bernalillo County Health Department, New Mexico, April 1989.
"Historical data and modeling predictions indicate that high-density development in unsewered areas will result in water-quality degradation in excess of recommended limits. Liquid Waste Ordinance 88-1 and existing waste-disposal practices are not adequate to protect against contamination in the inner valley. Sufficient technical and historical data are available to show that sites and levels of contamination can be accurately predicted.
This illustrates that contamination from liquid waste persists many years after septic tanks have been abandoned. Once an area is contaminated, natural reclamation is extremely slow.
New subdivisions in the valley should be required to have a minimum lot size of two acres when the subdivision is not served by a community sewage system."
- [26] CH₂M Hill. *Effect of Lot Sizes on Potential Ground-Water Contamination from Conventional Septic-Tank Systems: Numerical Modeling*, Prepared for the Policy Coordinating Committee (Albuquerque Public Works Department, Albuquerque Environmental Health Department, Albuquerque Planning Department, and Bernalillo County Environmental Health Department), February 1992.
A predictive model was developed, consistent with other research and models in the discipline, to estimate the required minimum lot size to prevent ground-water contamination from conventional septic-tank systems. The model recognizes and accounts for vast differences in climate and geology within Bernalillo County. The report recommends the following minimums:

In crucial areas where ground water occurs within porous media [the Rio Grande valley] the minimum lot size is 2 acres with a maximum density of 160 systems per square mile [1 per 4 acres]. [Note this is in agreement with the earlier work of Geohydrology and Associates, Inc.]

In crucial areas where ground water occurs within Madera Limestone [the majority of the East Mountain Area] the minimum lot size is 5 acres with a maximum density of 64 systems per square mile [1 per 10 acres].

In crucial areas where ground water occurs within low-flow fractured rocks [the remainder of the East Mountain Area] the minimum lot size is 40 acres with a maximum density of 16 systems per square mile [1 per 40 acres].

"The calculations show that the minimum lots sizes that will allow for ample dilution of septic-tank contamination depend on how many septic-tank systems occur along a ground-water flow path. If the ground water needed to dilute septic-tank contamination has already been degraded by upgradient contamination, these minimum lot sizes will no longer provide for sufficient dilution."

Alternative Wastewater Treatment Systems

- [27] Sandy, Arthur Thomas, II. *Nitrogen Removal Using a Batch Recirculating Bottom Ash Filter*, 1987.
"The removal of nitrogen using a batch recirculating bottom ash filter in its second year of operation at a single family dwelling was studied. ...denitrification was primarily achieved by recycling effluent to the septic tank. Final nitrate effluent concentrations averages ranged from 2.5 to 14.56 mg/l while ammonia concentrations ranged from 1.4 to 14.8 mg/l during the entire study."
- [28] Sack, William A.; Sandy, Arthur T.; and Dix, Stephen P. *Utilization of Septic Tank Carbon to Enhance Nitrogen Removal in a Modified Recirculating Sand Filter System*, October 1988.
"Recirculating sand filters (RSF) are a popular choice for small waste generators, especially where soil conditions are not suitable for a subsurface disposal system. Most RSF systems accomplish excellent BOD-5 and suspended solids removals (over 90 percent) and often achieve a high degree of nitrification. Unfortunately, the nitrate-N produced may reach undesirable levels in surface and groundwaters and there is need for a reliable and inexpensive method for reduction of nitrogen in the RSF effluent."

"Enhanced denitrification was accomplished even at temperatures as low as 6 to 8°C by recycling filter effluent to the septic tank. During the recycle mode, the septic tank/RSF² system achieved ammonia-N removals of 87 to 96% and total-N removals of 83 to 90%. Excellent CBOD-5 removals were achieved by the system with final effluent values ranging from 2 to 4 mg/."
- [29] Darby, Jeannie; Tchobanoglous, George; Nor, M. Asr; and Maciolek, David. *Shallow Intermittent Sand Filtration: Performance Evaluation*, The Small Flows Journal, Vol.2, Issue 1, Winter 1996.
"Intermittent sand filtration is one of the oldest known methods of wastewater treatment and was common in the U.S. before 1900 for treating community sewage."

"At an HLR [hydraulic loading rate] of 0.163 m/d, with a DF [dosing frequency] of 12/d or greater, the maximum effluent values of BOD, COD, SS, and turbidity were below levels listed as typical for activated sludge followed by granular media filtration and carbon adsorption; organic N and NH₃-N were below levels listed as typical for activated sludge with separate stage nitrification/denitrification. Based on the above-listed loading and dosing rates, each 1.2-m diameter filter unit was able to treat 184 L/d of septic tank or similar quality effluent to tertiary treatment levels."
- [30] Robertson, W.D. and Cherry, J.A. *In Situ Denitrification of Septic-System Nitrate Using Reactive Porous Media Barriers: Field Trials*, Ground Water, Vol.33, No.1, January - February 1995.
"Nitrate generated by oxidation of septic-system effluent can occur in septic-system plumes at concentrations several times higher than the common drinking water limit of 10 mg/l as N."

"Two additional field trials were initiated in which silt layers similar to that at Long Point were installed in a test plot at a seasonal use family cottage located in central Ontario and at a septic system servicing a seasonal trailer camp also in central Ontario. During these trials, however, solid phase organic carbon [sawdust] was added to the silt material."

"During one year of operation both barrier configurations have been successful in substantial attenuation (60 to 100%) of input NO₃⁻ levels of up to 124 mg/l as N. The horizontal configuration can be readily installed during the construction of new infiltration beds. Advantages of the barrier system are that it is simple to construct, no surface structures or additional plumbing are necessary, and treatment is passive requiring no energy consumption and little or no maintenance. Mass balance calculations and

preliminary results suggest that conveniently sized barriers have the potential to last for decades without replenishment of the reactive material."

- [31] Batz, Michael R. *Operation and Maintenance Function of an Onsite Wastewater Management District*, Proceeding of the National Sanitation Foundation: Sixth National Conference, Pgs 283-293, 1981.

A report on the history of the formation of the Stinson Beach Onsite Wastewater Management District. The report includes events leading to the formation of the district as well as how the district functions. Elements of the operating program are outlined.

- [32] Bounds, T.R. *Septic Tank Septage Pumping Intervals*, 1993.

"In the 1970s effluent sewer systems were relatively rare, and operation and maintenance scheduling, including septic tank pumping intervals, were projected using information from U.S. Public Health Service studies published in 1955. During the 1980s, an eight-year audit of 450 watertight septic tanks in an effluent sewer system at Glide, Oregon, demonstrated respectable correlation with those Public Health Service studies, determining that 12 year pumping intervals predicted 30 years before, for an average size family with an adequately sized tank, were not unreasonably long. In 1991 Montesano, Washington, an effluent sewer community of 1,125 watertight septic tanks, found after monitoring 19 percent of their system that they too experience similar septage accumulation rates."

- [33] Treanor, Bill and Roberts, K.L. *Field Evaluation of Septic Tank Effluent Filters*, 1995.

"In-tank filters were developed recently to remove suspended solids and BOD from the effluent of the septic tank. They are relatively inexpensive and, once installed, do not increase the cost or complexity of septic systems. It is recommended only that they be cleaned when the tank is pumped (every two or three years). Although proprietary data from the companies that manufacture the filters is promising, they have not been tested in a totally non-biased environment."

"It was concluded that the in-tank effluent filters tested reduced the suspended solids and BOD from the tanks in this study by a statistically significant amount. The suspended solids removals ranged from -4 to 33% at the 3" deep level to -2 to 73% at the surface. The BOD removals ranged from 11 to 40%. There appears to be a minimum level of suspended solids (approximately 50 mg/l) that is attainable in the effluent. Because of these factors and the small sample size, no conclusions can be drawn about the differences between the different sizes and brand of filters."

- [34] Fleming, Malcolm. Bernalillo County Community Services Division Director. Personal communication via telephone to Richard Rose, November 1, 1996.

Mr. Fleming expressed his opinion that the County would take a neutral position regarding any Entramosa groundwater policy because the County has just commissioned a two year investigation of groundwater quality in the East Mountain Area as part of the recommendations of the Ground-Water Protection Policy Coordinating Committee and will wait for its results.

Reference 35

**May 31, 1989 Memorandum from
Gene Clement, Environmental Health Director to
Board of County Commissioners**

Reference 36

**March 14, 1995 Memorandum from
Jeffery L. Peterson, Environmental Health Department Geohydrologist to
City/County Planning Department**

References 37 and 38

**June 2, 1995 and February 6, 1996 Letters from
Entranosa Water and Wastewater Cooperative to
Les Houston, County Commissioner**

TABLE 1
ALTERNATIVE WASTEWATER TREATMENT SYSTEMS AND SUPPLIERS LIST

Supplier	Product	Comments
Gordon Gammill 281-7723	Whitewater Mechanical Sewage Treatment System	DF50 is 500 gpd unit with a cost of \$3000, installation, septic tank, and drainfield are additional costs. Aeration unit with external compressor, no other moving parts. Similar to Clearstream. NSF certified.
Dick Conant RUCON Enterprises 877-3707	Cromaglass	Sequencing Batch Reactor (SBR) with programmable controller. NSF certified. Complicated unit with four submersible pumps, likely to increase O&M costs. Estimate \$3600 for unit alone.
John Van Damme JC Plumbing 505-471-1831	Multi-Flo	Aeration unit with submersible pump. Requires 1000 gal septic tank preceding. Unit cost \$6000. Expect additional \$2700 for septic tank and drainfield. Uses Geoflow for distribution. NSF certified.
Mike Rudys Bioclere of New Mexico 281-0230	Clearstream	Aeration unit with external compressor, no moving parts. NSF certified. Requires 500 gal septic tank preceding. Estimate \$6500 for complete installation including drainfield.
Richard Rinehart 4Corners Pre- Cast 505-327-4874	Jet	Three compartment septic tank with external aerator paddle motor. Unit cost \$1700 plus \$4/loaded mile for delivery or about \$2540 to Albuquerque. Drainfield required. NSF certified.
York Trenching 281-5316	Own Designs	Have low profile septic tanks for \$1000. Use Infiltrators for distribution. Can do wetlands. Will provide cost estimates.
Chuck Miller Smith & Loveless 913-888-5201	Single-Home FAST Sewage System	Aerated treatment unit with external compressor and submerged media bed. Denitrification and no septic tank required. NSF certified. Estimated cost \$4500.
Orenco Systems 541-459-4449	Septic Tank Trickling Filter	Recirculating trickling filter installed on new or existing septic tanks.

APPENDIX B

EWWC MEMBER SURVEY

EWWC MEMBER SURVEY

Entranosa is progressing in its relatively new role in wastewater management. The Board of Directors has been considering ways to become more proactive in protection of our groundwater resource. This is our sole source of drinking water. Failure to protect its quality will mean increased costs for treatment for us all.

One of the ideas under consideration is improved management of septic tank systems. Septic tanks accumulate sludge over time and require pumping. Failure to pump the sludge can lead to failure of the drainfield and serious public health problems. The frequency of pumping depends on use, but once every three years is a rough average. Entranosa could offer a scheduling service to remind members of the time to pump their tanks. Entranosa could also work with septic tank pumpers in the area to obtain a discount for members if a certain amount of business could be guaranteed. Entranosa could even schedule the service and arrange for the pumping of the tank. Other products, such as septic tank filters, might be obtained for members at a discount as well and services, such as helping to locate your septic tank, could be offered.

To help the Board determine what services would be most useful to members, would you please take the time to complete the questionnaire and return it to the Co-op? Entranosa exists for its members, so your input is highly valued.

Do you presently inspect your septic tank to determine when it should be pumped?

YES _____ NO _____

Do you pump your septic tank on a regular basis?

YES _____ NO _____

When was the last time your septic tank was pumped? Month _____ Year _____ No Clue _____

Would you like Entranosa to place you on a schedule and notify you when your septic tank should be pumped?

YES _____ NO _____

Would you like Entranosa to schedule and arrange for pumping of your septic tank?

YES _____ NO _____

Would you use the scheduling service if Entranosa was able to provide a discount for members? YES _____ NO _____

Would you use the scheduling service if Entranosa was **NOT** able to provide a discount?

YES _____ NO _____

Would you have Entranosa help you locate your septic tank? YES _____ NO _____

Would you have Entranosa help you locate your septic tank if a nominal fee was charged?

YES _____ NO _____

COMMENTS:

One item for discussion at this year's annual meeting is the implementation of a septic tank pumping program. Members have shown interest in this idea and we can use your help in deciding the best way to get started. Our bylaws require separate accounting of income from water sales and income derived from wastewater activities, so the pumping program must be self-supporting. One way to start would be to charge an initial fee for the first time tank locating and pumping and then begin a regular schedule. A small monthly fee, estimated to be about \$5.00 per month, would be collected to cover the cost of future pumping and administration. With the interest shown thus far, it appears that a committee could be formed to work out the details. Please bring your thoughts and suggestions to the meeting.

For those of you that are still wondering why you should participate in a pumping program, there is one very good reason - MONEY. One of the most frequent causes of septic tank/leachfield failure is clogging due to poor maintenance of the system. Repairs after failure can cost major MONEY. In this case, an ounce of prevention is in deed worth a pound of cure. Properly maintained septic tank systems not only last longer, they are less likely to pollute the environment from these catastrophic failures. The pollution from failed systems not only creates a real health hazard but can lower property values due to odors and nuisance.

Well if pumping your septic tank is such a good idea, why have Entranosa do it? - For some of same reasons people take their cars to the quickie oil change places. The business has the tools and correct spare parts to perform the operation quickly and efficiently - and they properly dispose of the waste. By binding together, Entranosa can put this work out to bid to obtain the most competitive price for members. Entranosa will also keep track of the schedule to make sure the job gets done on a regular basis and take care of all the arrangements. So if you haven't signed up already, give Lori a call and let her know you're interested.

EWWC SURVEY RESULTS SUMMARY

ENTRANOSA WATER AND WASTEWATER CO-OP NOVEMBER 1, 1996 NEWSLETTER SEPTIC SYSTEM SURVEY SUMMARY OF RESPONSES

Total number of responses = 93 [Note not all questions were answered on each response]

- 1) *Do you know the location of the access lid for your septic tank?*
Yes = 77 (83%) No = 16 (17%)
- 2) *Do you inspect your tank to determine when it should be pumped?*
Yes = 16 (17%) No = 71 (76%)
- 3) *Would you like Entranosa to place you on a schedule and notify you when your tank should be pumped?*
Yes = 68 (73%) No = 18 (19%)
- 4) *Would you use this discounted service which provides an ongoing discount to Entranosa Members?*
Yes = 85 (91%) No = 2 (2%)
- 5) *Would you prefer that Entranosa would charge your water account \$7.50 per month to have your tank pumped?*
Yes = 41 (44%) No = 46 (49%)

Which would you prefer?

Plan #1 (You call and you pay York Trenching directly) ----- 46 (49%)

Plan #2 (We bill you monthly and call York for you) ----- 42 (45%)

A total of 72 (77%) respondents said they knew when their tank was last pumped. However, this was mainly due to the fact that the homes were constructed in the past two to five years and the tanks had not been pumped since.

A total of 14 (15%) generally positive comments were included in the response and a total of 5 (5%) generally negative comments were included. Two respondents suggested an education program be developed to inform members of the “do’s and don’ts” of septic tank management.

APPENDIX C

LEGAL OPINION

Validity of Septic System Regulations

MEMORANDUM

TO: Liz Taylor
FROM: Cyndi Mojtabai
DATE: August 20, 1996

RE: Validity of Septic system Regulations. Entranosa Water & Wastewater Cooperative File No. 381.94.209.

FACTS

Richard Rose, an Entranosa Water & Wastewater Cooperative ("Entranosa") member and director, proposes that Entranosa prospectively impose septic system requirements as a pre-condition to membership and service. These requirements are stricter than those imposed by the appropriate governing body. Mr. Rose asked us for an opinion of the validity of these requirements, and whether their imposition would require a change in the articles of incorporation or bylaws.

QUESTIONS PRESENTED

Can Entranosa impose septic system requirements, which are stricter than the appropriate governing body's requirements, as a pre-condition to membership and service? If so, must the articles of incorporation or bylaws be changed?

DISCUSSION

Entranosa is a private cooperative association, as opposed to a public utility, and as such may condition membership and service. Morningstar Water Users v. Pub. Util., 120 N.M. 579, 592, APPENDIX at II (1995). There is nothing to preclude Entranosa from prospectively limiting membership through the septic tank requirements in case law or the applicable statute. In fact, it may be prudent from a legal perspective for Entranosa to take steps to protect its water source. Finally, the possible political consequences should be considered.

I. The applicable case law does not preclude the septic system membership term.

The New Mexico Supreme Court found that an association's choice to only "serve select individuals" is a deciding factor in excluding it from the definition of a public utility and the requirement that it serve the public generally. Id. In a Montana case, a private water association's condition of service upon a limitation that water be supplied to no more than 60 mobile homes in a trailer park was enforceable because the association was not a public utility and the service was contractual. Lockwood Water Users Assoc. v. Anderson, 542 P.2d 1217, 1220-21 (Mont. 1975). In a Washington case, a city supplying water outside its city-limits did so in a proprietary capacity and therefore could validly condition service upon a covenant requiring landowners to sign and support an annexation petition. Five Mile prairie v. City of Spokane, 755 P.2d 836 (Wash.App. 1988). Although some courts require electric cooperatives or associations to extend

service to those within the area of service, even these courts require service to only those who are also willing to "comply with the ordinary conditions as to membership as set forth in the charter or reasonable bylaws of the association." 64 AM. JUR. 2D Public Utilities §17 (1972). Mr. Rose makes a persuasive case that the septic system requirements are reasonable in light of protection of Entranosa's water source. They seem to be at least more reasonable than the City of Spokane's requirement of support for an annexation petition. Therefore, as a private association, Entranosa may, if it chooses, most likely condition service upon the septic system requirements.

II. The applicable statute does not preclude the septic system membership term, but requires the articles or bylaws be amended to reflect the new terms.

The only relevant limitation upon the conditions for membership eligibility in the relevant statute is that they be stated in the articles or bylaws. NMSA 1978, § 53-4-23 (1983 Repl. Pamp.). Entranosa's articles of incorporation do not specify membership eligibility. They state: "[t]he common stock of this Association may be purchased, owned and held only by water users or landowners who patronize the Association in accordance with the uniform terms and conditions prescribed thereby...." Revised (Oct. 1983) Articles of Incorporation of Entranosa Water and Wastewater Cooperative at 4, Article IX (emphasis added). Furthermore, the articles need not contain membership eligibility requirements, although they may. NMSA 1978, § 53-4-5 (1983 Repl. Pamp. & 1996 Supp.). Therefore, it is not necessary to amend the articles of incorporation.

The bylaws of a cooperative may provide for "the method and terms of admission to membership...." NMSA 1978, § 53-4-9 (1983 Repl. Pamp.). As Entranosa's bylaws do in fact address membership, they should be changed to reflect any modification of the terms of membership, such as the septic tank requirement.

III. The prospective nature of the septic system requirements should be retained.

Mr. Rose's proposed addition to the membership eligibility requirements is prospective only, which is proper. A cooperative is limited to the terms of any existing 'contract between itself and its members. 18 AM. JUR. 2D Cooperative Associations § 31 (1985). Entranosa cannot unilaterally modify existing contracts, therefore the prospective nature of the proposed requirement should be retained.

IV. The septic system requirements may be prudent from a legal standpoint.

Taking steps to maintain the purity of Entranosa's water supply might be a sound decision from a legal perspective. A "water-supply corporation is ... bound to use reasonable care and diligence in providing pure and wholesome water." 78 AM. JUR. 2D Waterworks and Water Companies § 41 (1975) (citations omitted). Furthermore, if a corporation, in the exercise of reasonable care, discovers a "reasonable probability of infection, then it becomes its duty to adopt whatever approved precautionary measures as are, under the circumstances of the case, proper and necessary to protect the community served from the risk of infection." Id. Therefore it may be prudent, legally, for Entranosa to take some steps to protect the quality of its water source.

V. Entranosa itself must weigh the political consequences.

Finally, political consequences should be considered. Adopting the septic system requirements as terms for membership might be seen as an encroachment of the regulatory arena. This might create friction between Entranosa and those political bodies that deal with Entranosa. On the other hand, adoption of the septic system terms may relieve some pressure from public officials who really do wish to adopt similar measures but hesitate because of pro-development considerations. Similarly, the reaction from the development community could be against Entranosa. This additional requirement by Entranosa will increase the cost of development by increasing minimum lot size or requiring additional wastewater treatment. Of course, until Entranosa signs a Letter of Intent with a developer, it is free to change its requirements. The political question, as well as whether the adoption of the new membership term is prudent, is for Entranosa to decide.

I spoke with Urey Lemon at the New Mexico Environment Department, District I, and Albert Ibarra at the Public utilities commission in Santa Fe about this question. Neither saw a problem with Entranosa requiring more strict septic regulations that required by county or state regulations, since it is a private entity. Mr. Lemon was not aware of any other private water companies or utilities that have restricted service in this manner.

APPENDIX D

ENTRANOSA SEPTIC TANK PUMPING DISTRICT ASSUMPTIONS FOR COST ESTIMATE

ENTRANOSA SEPTIC TANK PUMPING DISTRICT ASSUMPTIONS FOR COST ESTIMATE

The cost of pumping was assumed to vary between \$90 to \$110 per tank and to increase by 3% per year. Pumping interval from three to five years were considered, assuming $1/x$ of the tanks would be pumped each year for $x = 3, 4, \text{ and } 5$. It was assumed that pumping would only occur during good weather, eight month per year. The sensitivity analysis demonstrates the variability of rates depending on pumping frequency and cost of pumping. Rates vary from \$3.30 per month to \$5.00 per month depending on the parameters. Our current contract with York for Paa-Ko is at a cost of \$89 per tank, plus gross receipts tax. The worse case considered is pumping every three years at a cost of \$110 per tank for 800 members. In this case, rate increases would be required about every three years to avoid a negative operation cost.

A nominal monitoring cost of \$500 per year was assumed for miscellaneous testing.

The administrative cost consists of the per member cost for billing and supplies, overhead at 10%, and one field hand's time to check for problems at approximately one-half of the pumping sites. A one time set-up cost of \$5 is included to initialize the accounts and enter the startup information into the computer. Entranosa would set up the tracking system, notify the members, arrange for pumping, and account for billing. The field hand would assist with problems encountered in the field, such as help locate the tank or assist with utility conflict problems. It is likely that field time will decrease after the first year of pumping, after tanks are located and a routine is established with the members.

The use of 800 members participating in the program comes from the newsletter survey where approximately 50% of the respondents indicated they would be willing to pay \$7.50 per month to have their septic tank pumped annually. The number of users was kept constant for the duration of the analysis.

The cross-over of the income and expense curves indicates the point at which the rates would need to be increased to avoid a deficit. The cumulative balance in the table is a straight accumulation with no interest. Saving the net excess could allow a delay in the rate increase.

One way to implement the program would be to impose the monthly fee on all members and ask that those who do not want to participate be removed from the program. Having less than 100% participation could make tracking and billing more complicated, but our new software is suppose to be able to handle such tasks. The pumping services should be obtained through an open bidding process. It would be prudent to negotiate contracts with at least two pumpers. This arrangement would limit Entranosa capital costs as well as liability. The program could be started with existing computer and staff support. A reasonable time line would be to finalize the decision by the annual meeting in October, begin collecting fees in November, advertise for bids in January, and begin pumping in April.

From the analysis, it is estimated that the pumping service could generate about \$48,000 per year of income, enough to provide significant support for two staff positions. The added income would free an equivalent amount of money from water revenues that is now spent to support these staff members, perhaps delaying or reducing a water rate increase.

To begin the process, the member's tank would be located and pumped. The member would pay the cost of this initial pumping and then pay the monthly fee and be put on a regular pumping schedule, like once every three years. The monthly fee could be based on water use to allow for more frequent pumping of high use systems.

The derivation of administration costs is as follows:

Initial set-up cost to enter data in computer and set-up accounts

\$4.25 office set-up
0.43 plus 10% overhead
\$4.68 round to \$5.00 per member as one time cost (7% extra)

Cost of monthly billing and supplies

\$1.34 per member per month
0.13 plus 10% overhead
\$1.47 per member per month

Cost of Field Technician to help locate tank and supervise field work

\$6.50 per pumping
0.65 plus 10% overhead
\$7.15 per pumping
0.36 plus 5% Administrative overhead
\$7.51

For the case of pumping once every three years and 800 members participating

$$800/3 \text{ years} \times \$7.15 = \$1907 + 5\% \text{ Administrative overhead (95)} = \$2002 \text{ per year}$$

$$\$2002/12 \text{ month} = \$166.83 \text{ per month}/800 \text{ members} = \$0.21 \text{ per member per month}$$

The total monthly cost per member for this scenario is

$$\$1.47 + 0.21 = \$1.68 \text{ per month}$$

The annual expense is $\$1.68 \times 12 \text{ month} \times 800 \text{ members} = \$16,114$

[Note: The spreadsheet makes this calculation, adjusting for the number of members and the frequency of pumping. The Administrative Cost per Year cell is calculated as follows:

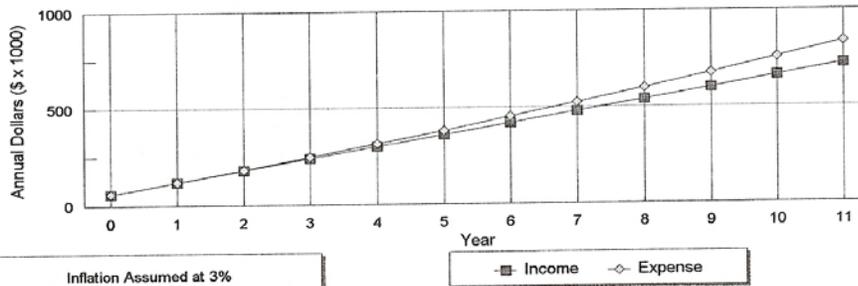
$$(\$7.51 \times \text{dwellings} / \text{pump frequency}) + \$1.47 \times 12 \times \text{dwellings}]$$

Proposal For Entranosa Septic Tank Pumping District

Initial Fee	Monthly Fee	Pumping Cost	Annual Monitor Cost	Initial Install Cost	Total Dwellings	Pump Every No. of Years	Admin Cost/yr
\$0	\$5.00	\$110.00	\$500	\$5	800	3	\$16,115

Year	Cumulative D.U. Income *	D.U. Pump Expense	D.U. Annual Monit+Admin	D.U. Cumulative Expense *	Total Expense	Total Revenue	Cumulative Balance	Required Reserve
0	\$60.00	\$36.67	\$20.77	\$59.10	\$47,281	\$48,000	\$719	\$369,408
1	120.00	37.77	21.39	119.93	95,941	96,000	\$778	
2	180.00	38.90	22.03	182.53	146,021	144,000	(\$1,243)	
3	240.00	40.07	22.69	246.95	197,563	192,000	(\$6,806)	
4	300.00	41.27	23.37	313.26	250,611	240,000	(\$17,417)	
5	360.00	42.51	24.08	381.51	305,210	288,000	(\$34,627)	
6	420.00	43.78	24.80	451.76	361,408	336,000	(\$60,035)	
7	480.00	45.10	25.54	524.06	419,252	384,000	(\$95,287)	
8	540.00	46.45	26.31	598.49	478,791	432,000	(\$142,078)	
9	600.00	47.84	27.10	675.09	540,076	480,000	(\$202,153)	
10	660.00	49.28	27.91	753.95	603,159	528,000	(\$277,312)	
11	720.00	50.76	28.75	835.12	668,095	576,000	(\$369,408)	

ENTRANOSA SEPTIC DISTRICT Cumulative Income vs Expense



Sensitivity Analysis Between Pumping Cost and Pumping Frequency

Pump Cost	Frequency (yrs)				
	2	3	4	5	
90	\$5.90	\$4.50	\$3.75	\$3.30	Required
95	\$6.15	\$4.65	\$3.85	\$3.40	Monthly
100	\$6.35	\$4.75	\$4.00	\$6.50	Fee
110	\$6.75	\$5.00	\$4.20	\$3.65	(\$/month)

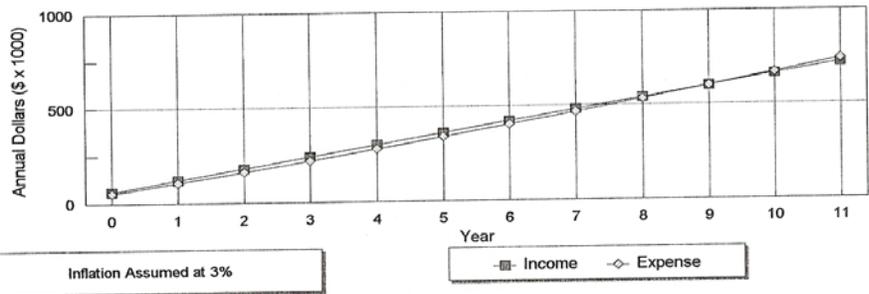
SEPTCOST.WK4 01/31/99

Proposal For Entranosa Septic Tank Pumping District

Initial Fee	Monthly Fee	Pumping Cost	Annual Monitor Cost	Initial Install Cost	Total Dwellings	Pump Every No. of Years	Admin Cost/yr
\$0	\$5.00	\$90.00	\$500	\$5	800	3	\$16,115

Year	Cumulative D.U. Income *	D.U. Pump Expense	D.U. Annual Monit+Admin	D.U. Cumulative Expense *	Total Expense	Total Revenue	Cumulative Balance	Required Reserve
0	\$60.00	\$30.00	\$20.77	\$52.44	\$41,948	\$48,000	\$6,052	\$0
1	120.00	30.90	21.39	106.39	85,114	96,000	\$16,938	
2	180.00	31.83	22.03	161.92	129,536	144,000	\$31,402	
3	240.00	32.78	22.69	219.06	175,250	192,000	\$48,152	
4	300.00	33.77	23.37	277.87	222,295	240,000	\$65,856	
5	360.00	34.78	24.08	338.39	270,712	288,000	\$83,144	
6	420.00	35.82	24.80	400.68	320,542	336,000	\$98,602	
7	480.00	36.90	25.54	464.78	371,826	384,000	\$110,776	
8	540.00	38.00	26.31	530.76	424,609	432,000	\$118,168	
9	600.00	39.14	27.10	598.67	478,935	480,000	\$119,233	
10	660.00	40.32	27.91	668.56	534,851	528,000	\$112,382	
11	720.00	41.53	28.75	740.51	592,405	576,000	\$95,977	

ENTRANOSA SEPTIC DISTRICT Cumulative Income vs Expense



Sensitivity Analysis Between Pumping Cost and Pumping Frequency

Pump Cost	Frequency (yrs)				Required Monthly Fee (\$/month)
	2	3	4	5	
90	\$5.90	\$4.50	\$3.75	\$3.30	
95	\$6.15	\$4.65	\$3.85	\$3.40	
100	\$6.35	\$4.75	\$4.00	\$6.50	
110	\$6.75	\$5.00	\$4.20	\$3.65	

SEPTCOST.WK4 02/05/99

APPENDIX E

PRIVATE ONSITE WASTEWATER TREATMENT SYSTEMS (POWTS) MANAGEMENT PLAN FOR BERNALILLO COUNTY ENVIRONMENTAL HEALTH DEPARTMENT

ENTRANOSA WATER & WASTEWATER COOPERATIVE (EWWC)
PRIVATE ONSITE WASTEWATER TREATMENT SYSTEMS (POWTS)
MANAGEMENT PLAN FOR BERNALILLO COUNTY ENVIRONMENTAL HEALTH DEPARTMENT

The following plan addresses management of septic tank/leachfield systems for compliance with the Bernalillo County Liquid Waste Ordinance. The plan is intended to cover all POWTS that subscribe to the EWWC septic tank pumping service.

1. EWWC is a water and wastewater cooperative that employs certified wastewater treatment plant operators to perform wastewater management services. Pumping services are provided by professional contractors, experienced in the pumping business.
2. EWWC provides routine maintenance of septic tank/leachfield systems by scheduling pumping of tanks once every three years. At the time of pumping, the depth of scum and sludge is measured and recorded by the pumping contractor. The contractor also notes the size and location of the tank and any deficiencies or failures observed during the site visit. The contractor is required to maintain a manifest of the waste hauled and the location of final disposal.
3. EWWC maintains a record of the pumping schedule and data gathered at the time of pumping. The homeowner is notified of any deficiencies or failures observed during the visit. All records are available for inspection by Bernalillo County Environmental Health Department staff.
4. EWWC maintains records of metered water use for each homeowner that is supplied water. These records can be used to derive waste loads to the POWTS and correlated with measured sludge depths to establish trends for future modifications to the pumping schedule.
5. EWWC provides maintenance tips and information regarding the care of septic tank systems as part of an on-going educational effort. The education effort is part of the conservation and source water protection program adopted by EWWC.

APPENDIX F

ADVERTISEMENT FOR BIDS AND CONTRACT DOCUMENTS FOR SEPTIC TANK PUMPING

ADVERTISEMENT FOR BIDS

**ENTRANOSA WATER AND WASTEWATER COOPERATIVE
P.O. BOX 2380
TIJERAS, NM 87059-2380**

Separate sealed BIDS for the pumping of septic tanks within ENTRANOSA Cooperative's service area will be received by ENTRANOSA Water and Wastewater Cooperative at the main office, 1330 Old Route 66, P.O. Box 2380, Tijeras, New Mexico. Bids will be accepted until 10:00 a.m. on **March 26, 1999**, and then publicly opened and read aloud.

The **CONTRACT DOCUMENTS** may be examined at the following location:

Entranosa Water and Wastewater Cooperative Main Office
1330 Old Route 66
Edgewood, New Mexico
505-281-8700

Copies of the **CONTRACT DOCUMENTS** may be obtained at the Main Office, located at the address given above. Mail and telephone requests should be directed to Lori Self at the address and telephone number above.

Equal opportunity in Employment: All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

Any requests for deviations from the **CONTRACT DOCUMENTS** must be submitted to Entranosa at least 10 days prior to the Bid Opening for approval and issuance of an addendum.

INFORMATION FOR BIDDERS

BIDS will be received by the ENTRANOSA Water and Wastewater Cooperative (herein called "ENTRANOSA") at 1330 Old Route 66, P.O. Box 2380, Tijeras, New Mexico, 87059-2380, until **March 26, 1999** at 10:00 a.m., and then public opened and read aloud.

Each BID must be submitted in a sealed envelope addressed to ENTRANOSA at the same address noted previously. Each sealed envelope containing a BID must be plainly marked on the outside as BID for SEPTIC TANK PUMPING, and the envelope should bear on the outside the name of the BIDDER, his address, his license number, if applicable, and the name of the project for which the BID is submitted. If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope, addressed to ENTRANOSA at the same address noted previously.

All BIDS must be made on the required BID form. All blank spaces for BID prices must be filled in, in ink or typewritten, and the BID form must be fully completed and executed when submitted. Only one copy of the BID form is required.

ENTRANOSA may waive any informalities or minor defects or reject any and all BIDS. Any BID may be withdrawn prior to the above scheduled time for the opening of BIDS or authorized postponement thereof. Any BID received after the time and date specified shall not be considered. No BIDDER may withdraw a BID within 60 days after the actual date of the opening thereof. Should there be reasons why the contract cannot be awarded within the specified period, the time may be extended by mutual agreement between ENTRANOSA and the BIDDER.

BIDDERS must satisfy themselves of the potential quantity of WORK in the Pumping Schedule/Checklist and the nature of the WORK. After BIDS have been submitted, the BIDDER shall not assert that there was a misunderstanding concerning the quantities of WORK or the nature of the WORK to be done.

The CONTRACT DOCUMENTS contain the provisions required to perform the WORK. Information obtained from an officer, agent, or employee of ENTRANOSA or any other person shall not affect the risks or obligations assumed by the BIDDER or relieve him or her from fulfilling any of the conditions of the contract.

Each BID must be accompanied by a BID bond payable to ENTRANOSA for \$ 500.00. As soon as the BID prices have been compared, ENTRANOSA will return the BONDS of all except the three lowest responsible BIDDERS. When the Agreement is executed, the bonds of the two remaining unsuccessful BIDDERS will be returned. The BID BOND of the successful BIDDER will be retained until proof of liability and workmen compensation insurance have been submitted and approved, after which it will be returned. A certified check may be used in lieu of a BID BOND.

Attorneys-in-fact who sign BID BONDS must file with each BOND a certified and effective dated copy of their power of attorney.

The party to whom the contract is awarded will be required to execute the Agreement and obtain the liability and workmen compensation insurance within ten (10) days from the date when the contract is awarded to the BIDDER. In case of failure of the BIDDER to execute the Agreement, ENTRANOSA may at its option consider the BIDDER in default, in which case the BID BOND accompanying the proposal shall become the property of ENTRANOSA as compensation for the cost of seeking a new BIDDER.

ENTRANOSA within ten (10) days of receipt of acceptable liability and workmen compensation insurance and the Agreement signed by the responsible party to whom the Agreement was awarded, shall sign the Agreement and return to such party an executed duplicate of the Agreement. Should ENTRANOSA not execute the Agreement within such period, the BIDDER may by WRITTEN NOTICE, withdraw his or her signed Agreement. Such notice

of withdrawal shall be effective upon receipt of the notice by ENTRANOSA.

The NOTICE to perform WORK will be conducted in accordance with procedures of the CONTRACT DOCUMENTS.

ENTRANOSA may make such investigations as it deems necessary to determine the ability of the BIDDER to perform the WORK and the BIDDER shall furnish ENTRANOSA all such information and data for this purpose as ENTRANOSA may request. ENTRANOSA reserves the right to reject any BID if the evidence submitted by, or investigation of, such BIDDER fails to satisfy ENTRANOSA that such BIDDER is properly qualified to carry out the obligations of the Agreement and to complete the WORK contemplated therein.

A conditional or qualified BID will not be accepted.

Award will be made to the lowest responsible BIDDER(S) such that the cost for the entire WORK shall be the least to ENTRANOSA. ENTRANOSA intends to select one or two CONTRACTORS to perform the work. The term of the CONTRACT will be for one year, with up to three one year extensions.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over the WORK shall apply to the contract throughout.

Each BIDDER is responsible for inspecting the site and for reading and being thoroughly familiar with the CONTRACT DOCUMENTS. The failure or omission of any BIDDER to do any of the foregoing shall in no way relieve any BIDDER from any obligation in respect to his or her BID.

The CONTRACT will be awarded to the lowest responsible, responsive BIDDER(S) with the understanding, however, that ENTRANOSA reserves unto itself the right to reject any or all bids or proposals and to readvertise the bids, and to waive bids or proposals and to readvertise for bids, and to waive any formality or technicality in any bid or proposal in the interest of ENTRANOSA. ENTRANOSA makes no guarantees as to the actual quantity of WORK required during the term of the Agreement.

BID

Proposal of _____ (hereinafter called "BIDDER"), organized and existing under the laws of the State of New Mexico doing business as _____ *, to the Entranosa Water and Wastewater Cooperative (hereinafter called "ENTRANOSA").

In compliance with your Advertisement for Bids, BIDDER hereby proposes to perform all work for the pumping of septic tanks in strict accordance with the CONTRACT DOCUMENTS, within the time set forth therein, and at the prices stated below.

By submission of this BID, each BIDDER certifies, and in the case of a joint BID each party thereto certifies as to his or her own organization, that the BID has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this BID with any other BIDDER or with any competitor.

BIDDER hereby agrees to commence WORK under this contract on a date to be specified by ENTRANOSA and to fully complete WORK in accordance with the schedule prescribed by ENTRANOSA. BIDDER further agrees to pay as liquidated damages, the sum of \$100.00 for each week of slippage in the schedule as provided in the General Conditions of the CONTRACT DOCUMENTS. BIDDER agrees to hold the prices presented in this bid for a period of sixty (60) days after the bid opening.

*Insert "a corporation", " a partnership", or "an individual" as applicable.

BIDDER agrees to perform all the work described in the CONTRACT DOCUMENTS for the following unit prices:

BID SCHEDULE

No.	ITEM	UNIT	ESTIMATED QUANTITY*	AMOUNT	TOTAL PRICE
1	Pump 1,000 gallon or less septic tanks as described in the CONTRACT DOCUMENTS	EACH	300		
2	Pump 1,200 gallon septic tanks as described in the CONTRACT DOCUMENTS	EACH	400		
3	Pump 1,500 gallon septic tanks as described in the CONTRACT DOCUMENTS	EACH	20		
4	Install septic tank filter as described in the CONTRACT DOCUMENTS	EACH	200		
5	Locate and excavate septic tank for up to one hour and 5' bury as described in the CONTRACT DOCUMENTS	EACH	700		
6	Install riser and manhole cover as described in the CONTRACT DOCUMENTS	FOOT	2400		
7	Additional crew work to locate tanks beyond the unit quantities in item No. 5 over 1 hour	HOURS	200		
	TOTAL OF BID ITEMS 1 THROUGH 7				

*NOTE: The quantities shown here are approximate for bid comparative purposes only. ENTRANOSA reserves the right to add or delete quantities. Applicable gross receipt taxes will be paid as required.

BID AWARD: The contract shall be awarded on the basis of the lowest responsive TOTAL BID, as shown above, received from a responsible BIDDER.

KNOWLEDGE OF LOCAL CONDITIONS AND CONTRACT DOCUMENTS: The Undersigned is skilled and experienced in the use and interpretation of the CONTRACT DOCUMENTS. He/she has carefully reviewed the CONTRACT DOCUMENTS for this project and has found them to be free of errors and ambiguities and sufficient for bid. Further he/she has carefully examined the site of the work and, from his/her own observations, has satisfied him(her)self as to the nature and location of the work, the difficulties likely to be encountered; and the other items which may affect the performance of the work. He/she has based his/her bid solely on these documents and observations and has not relied in any way on any explanation or interpretation, oral or written, from any other source.

PROPOSAL GUARANTY: The Proposal Guaranty attached, without endorsement, in the sum of not less than \$500.00, is furnished to ENTRANOSA as a guarantee that the Agreement will be executed or the Undersigned will pay to ENTRANOSA the stipulated amount for which ENTRANOSA may in good faith contract with another party to perform the work covered by this Proposal, and that such payment be limited to the amount of the Proposal

Guaranty.

EXECUTION OF AGREEMENT AND FURNISHING INSURANCE: Within 10 days after being awarded the Contract, the Undersigned agrees to execute the form of Agreement included as one of the CONTRACT DOCUMENTS, and to furnish liability insurance in the amount of \$500,000.00 and workmen's compensation insurance for all employees performing the work of the Contract.

ENTRANOSA'S RIGHTS RESERVED: The Undersigned understands that ENTRANOSA reserves the right to reject any or all Proposals or to waive any formality or technicality in any Proposal in the interest of ENTRANOSA. ENTRANOSA further makes no guarantee regarding the actual quantity of WORK to be performed nor any minimum amount of WORK during the term of the CONTRACT.

THE ABOVE PROPOSAL IS HEREBY RESPECTFULLY SUBMITTED BY:

BIDDER

ADDRESS

TELEPHONE NUMBER

New Mexico Contractor's License No. and Classification: _____
(If none, so state)

(SEAL) if bid is by a Corporation

**PRE-BID CONFERENCE
ENTRANOSA WATER AND WASTEWATER COOPERATIVE**

A Pre-Bid Conference will be held at:

Time: 3:30 p.m.

Date: March 19, 1999

Location: ENTRANOSA WATER AND WASTEWATER COOPERATIVE MAIN OFFICE
1330 Old Route 66
Edgewood, NM

Attendance at the conference is **mandatory**. Bids will only be accepted from contractors who attended and registered at the pre-bid conference.

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____
as Principal, and _____ as Surety, are hereby held and firmly bound unto
ENTRANOSA WATER AND WASTEWATER COOPERATIVE as ENTRANOSA in the penal sum of \$500
(FIVE HUNDRED DOLLARS) for the payment of which, well and truly to be made, we hereby jointly and
severally bind ourselves, successors and assigns.
Signed, this _____ day of _____ 1999.

The Condition of the above obligation is such that whereas the Principal has submitted to the
ENTRANOSA WATER AND WASTEWATER COOPERATIVE a certain BID, attached hereto and hereby made a
part hereof, to enter into a contract in writing, for providing septic tank pumping services as described in the
CONTRACT DOCUMENTS.

NOW, THEREFORE,

- (a) If said BID shall be rejected, or
- (b) If said BID shall be accepted and the Principal shall execute and deliver a contract, in the Form of
CONTRACT, attached hereto (properly completed in accordance with said BID) and shall in all
other respects perform the agreement created by the acceptance of said BID,

then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood
and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal
amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its
BOND shall be in no way impaired or affected by any extension of the time within which ENTRANOSA may
accept such BID; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such
of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by
their proper officers, the day and year first set forth above.

Principal

Surety

By: _____

IMPORTANT-*Surety companies executing BONDS must appear on the Treasury Department's most current list
(Circular 570 as amended) and be authorized to transact business in the State of New Mexico.*

AGREEMENT

THIS AGREEMENT, made this _____ day of _____ 1999 by and between the ENTRANOSA WATER AND WASTEWATER COOPERATIVE, hereinafter called "ENTRANOSA" and _____ doing business as (an individual,) or (a partnership,) or (a corporation) hereinafter called "CONTRACTOR".

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned:

1. The CONTRACTOR will commence and complete pumping of septic tanks as directed by ENTRANOSA.
2. The CONTRACTOR will furnish all of the material, supplies, tools, equipment, labor and other services necessary for the pumping of the septic tanks.
3. The CONTRACTOR will maintain pumping records as required in the CONTRACT DOCUMENTS.
4. The CONTRACTOR will commence the work required by the CONTRACT DOCUMENTS within 10 calendar days after the date of the notification of the task list by ENTRANOSA and will complete the same within one week of the scheduled time.
5. The CONTRACTOR agrees to perform all of the WORK described in the CONTRACT DOCUMENTS and comply with the terms therein as shown in the BID schedule.
6. The term "CONTRACT DOCUMENTS" means and includes the following:
 - (A) Advertisement for BIDS
 - (B) Information for BIDDERS
 - (C) BID
 - (D) BID BOND
 - (E) Agreement
 - (F) General Conditions
 - (G) NOTICE OF AWARD
 - (H) Pumping Checklist for each member
7. ENTRANOSA will pay to the CONTRACTOR in a manner and at such times as set forth in the General Conditions such amounts as required by the CONTRACT DOCUMENTS.
8. This Agreement shall be for a period of one year with an option for renewal by ENTRANOSA and CONTRACTOR for up to three additional one year terms.
9. This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns. IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, this Agreement in three copies each of which shall be deemed an original on the date first above written.

ENTRANOSA WATER AND WASTEWATER COOPERATIVE

BY: _____

Name: _____

Title: _____

(SEAL)

ATTEST: _____

Name: _____

Title: _____

CONTRACTOR: _____

BY: _____

Name: _____

Address: _____

(SEAL)

ATTEST: _____

Name: _____

NOTICE OF AWARD

To: _____

PROJECT Description: Pump septic tanks as directed by ENTRANOSA and perform
associated work, such as locate septic tank and install riser, as directed and described in
the CONTRACT DOCUMENTS.

ENTRANOSA has considered the BID submitted by you for the above described WORK in response to its Advertisement for Bids dated _____ 19__.

You are hereby notified that your BID has been accepted for items in the amount of \$ _____, or as shown in the BID schedule.

You are required by the Information for Bidders to execute the Agreement and furnish the required certificates of insurance within ten (10) calendar days from the date of this Notice to you.

If you fail to execute said Agreement and to furnish said certificate within ten (10) days from the date of this Notice, ENTRANOSA will be entitled to consider all your rights arising out of ENTRANOSA's acceptance of your BID as abandoned and as a forfeiture of your BID BOND. ENTRANOSA will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this NOTICE OF AWARD to ENTRANOSA.

Dated this _____ day of _____ 19__.

By _____

Title _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged

by _____
this the _____ day of _____ 19__.

By _____

Title _____

INDEX OF THE GENERAL CONDITIONS

	<u>PAGE</u>
1. DEFINITIONS.....	1
2. PERMITS AND LICENSES.....	2
3. PROTECTION OF WORK, PROPERTY, AND PERSONS	2
4. SUSPENSION OF WORK, TERMINATION AND DELAY.....	2
5. PAYMENTS TO CONTRACTOR.....	3
6. ACCEPTANCE OF PAYMENT AS RELEASE.....	4
7. INSURANCE	4
8. ASSIGNMENTS.....	5
9. INDEMNIFICATION.....	5
10. ARBITRATION	5
11. TAXES.....	5
12. REQUIREMENTS FOR THE WORK.....	6

GENERAL CONDITIONS

1. DEFINITIONS

1.1 Wherever used in the CONTRACT DOCUMENTS, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof:

1.2 BID -- The offer or proposal of the BIDDER submitted on the prescribed form setting forth the prices for the WORK.

1.3 BIDDER -- Any person, firm, or corporation submitting a BID for the WORK.

1.4 BONDS -- Bid instrument of security furnished by the CONTRACTOR and his surety in accordance with the CONTRACT DOCUMENTS.

1.5 CONTRACT DOCUMENTS -- The contract, including Advertisement For Bids, Information for Bidders, BID, Bid Bond, Agreement, NOTICE OF AWARD, General Conditions and Pumping Checklist.

1.6 CONTRACTOR -- The person, firm or corporation with whom ENTRANOSA has executed the Agreement.

1.7 CONTRACT TIME -- The period of time the contract is in effect including any extension thereof.

1.8 NOTICE OF AWARD -- The written notice of the acceptance of the BID from ENTRANOSA to the successful BIDDER.

1.9 ENTRANOSA -- The Cooperative association, for whom the WORK is to be performed.

1.10 WORK -- All labor, material, and equipment necessary to provide the services required by the CONTRACT DOCUMENTS.

1.11 WRITTEN NOTICE -- Any notice to any party of the Agreement relative to any party of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address, or delivered in person to said party or his authorized representative on the WORK.

2. PERMITS AND LICENSES

Permits and licenses necessary for the prosecution of the WORK shall be secured and paid for by the CONTRACTOR. The CONTRACTOR shall give all notices and comply with all laws, ordinances, rules, and regulations bearing on the conduct of the WORK.

3. PROTECTION OF WORK, PROPERTY, AND PERSONS

3.1 The CONTRACTOR will be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the WORK. He/She will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees on the WORK SITE and other persons who may be affected thereby, and other property at the site or adjacent thereto, including (but not limited to) trees, shrubs, lawns, walks, pavements, roadways, structures, and/or utilities. The CONTRACTOR will not be responsible for property placed within the easement of ENTRANOSA by the homeowner.

3.2 The CONTRACTOR will comply with all applicable laws, ordinances, rules, regulations, and orders of any public body having jurisdiction.

3.3 In emergencies affecting the safety of persons or the WORK or property at the site or adjacent thereto, the CONTRACTOR without special instruction or authorization from ENTRANOSA shall act to prevent threatened damage, injury, or loss. He/She will give ENTRANOSA prompt WRITTEN NOTICE of any significant changes in the WORK or deviations from the CONTRACT DOCUMENTS caused thereby and report all such incidents in writing to ENTRANOSA within forty-eight (48) hours of occurrence.

4. SUSPENSION OF WORK, TERMINATION AND DELAY

4.1 If the CONTRACTOR disregards laws, ordinances, rules, regulations, or orders of any public body having jurisdiction of the WORK or if he/she disregards the authority of ENTRANOSA, or if he/she otherwise violates any provisions of the CONTRACT DOCUMENTS, then ENTRANOSA may, without prejudice to any other right or remedy and after giving the CONTRACTOR a minimum of ten (10) days from delivery of a WRITTEN NOTICE, terminate the services of the CONTRACTOR, and finish the WORK by whatever method, Entranosa may deem expedient. If the unpaid balance of the CONTRACT PRICE exceeds the direct and indirect costs of completing the PROJECT, including compensation for additional professional services, such excess SHALL BE PAID TO THE CONTRACTOR. If such costs exceed such unpaid balance, the CONTRACTOR will pay the difference to ENTRANOSA.

4.2 Where the CONTRACTOR'S services have been so terminated by ENTRANOSA, said termination shall not affect any right of ENTRANOSA against the CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of monies by ENTRANOSA due the CONTRACTOR will not release the CONTRACTOR from compliance with the CONTRACT DOCUMENTS.

4.3 After ten (10) days from delivery of a WRITTEN NOTICE to the CONTRACTOR, ENTRANOSA may, without cause and without prejudice to any other right or remedy, elect to abandon the WORK and terminate the CONTRACT. In such case, the CONTRACTOR shall be paid for all WORK executed and any expense sustained plus reasonable profit, not to exceed ten (10) percent.

4.4 If through no act or fault of the CONTRACTOR, the WORK is suspended for a period of more than ninety (90) days, other than the winter months (November through April), by ENTRANOSA or under an order of court or other public authority, or ENTRANOSA fails to pay the CONTRACTOR substantially the request for payment within forty-five (45) days of its approval and presentation, then the CONTRACTOR may, after ten (10) days from delivery of a WRITTEN NOTICE to ENTRANOSA, terminate the CONTRACT and recover from ENTRANOSA payment for all work executed and all expenses sustained. In addition and in lieu of terminating the CONTRACT, if ENTRANOSA has failed to make any payment as aforesaid, the CONTRACTOR may upon ten (10) days written notice to ENTRANOSA stop the WORK until he/she has been paid all amounts then due.

4.5 If the performance of all or any portion of the WORK is suspended, delayed, or interrupted as a result of a failure of ENTRANOSA to act within the time specified in the CONTRACT DOCUMENTS, an extension of the CONTRACT TIME shall be made by ENTRANOSA.

5. PAYMENTS TO CONTRACTOR

5.1 After thirty (30) days of WORK, but not more often than once a month, the CONTRACTOR will submit to ENTRANOSA a partial payment estimate, accompanied with the pumping schedule and pumping records of the CONTRACT DOCUMENTS, filled out and signed by the CONTRACTOR covering the WORK performed during the period covered by the partial payment estimate. ENTRANOSA will, within twenty (20) days after receipt of each partial payment estimate to the CONTRACTOR, determine if the estimate is complete and accurate and indicate in writing ENTRANOSA'S approval or disapproval of the partial payment estimate. Receipt of a payment from ENTRANOSA by the CONTRACTOR within twenty (20) days of submittal of a partial payment request signifies approval of the partial payment estimate by ENTRANOSA. If ENTRANOSA disapproves the partial payment estimate, the CONTRACTOR must again submit a partial payment estimate which ENTRANOSA must

approve or disapprove within twenty (20) days. ENTRANOSA will, within forty-five (45) days of presentation to it of an approved partial payment estimate, pay the CONTRACTOR a progress payment on the basis of the approved partial payment estimate.

5.2 If ENTRANOSA fails to make payment forty-five (45) days after approval by ENTRANOSA, in addition to other remedies available to the CONTRACTOR, there shall be added to each such payment interest at the rate of one and one-half percent (1½%) per month commencing on the first day after said payment is due and continuing until the payment is received by the CONTRACTOR.

6. ACCEPTANCE OF PAYMENT AS RELEASE

The acceptance by the CONTRACTOR of payment shall be and shall operate as a release to ENTRANOSA of all claims and all liability to the CONTRACTOR. Any payment, however, final or otherwise, shall not release the CONTRACTOR or his/her sureties from any obligations under the CONTRACT DOCUMENTS.

7. INSURANCE

7.1 The CONTRACTOR shall purchase and maintain such insurance as will protect him or her from claims set forth below which may arise out of or result from the CONTRACTOR'S execution of the WORK, whether such execution be by him(her)self or by anyone directly or indirectly employed by him or her, or by anyone for whose acts any of them may be liable:

- 7.1.1 Claims under workmen's compensation, disability benefit and other similar employee benefit acts;
- 7.1.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of his/her employees;
- 7.1.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than his/her employees;
- 7.1.4 Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the CONTRACTOR, or (2) by any other person; and
- 7.1.5 Claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom.

7.2 The CONTRACTOR shall procure and maintain, at his own expense, during the CONTRACT TIME, liability insurance as hereinafter specified;

7.2.1 CONTRACTOR'S General Public Liability and Property Damage Insurance including vehicle coverage insured to the CONTRACTOR and protecting him or her from all claims for personal injury, including death, and all claims for destruction of or damage to property, arising out of or in connection with any operations under the CONTRACT DOCUMENTS, whether such operations be by him(her)self or anyone directly or indirectly employed by the CONTRACTOR. Insurance shall be written with a limit of liability of not less than \$500,000 for all damages arising out of bodily injury, including death, at any time resulting therefrom, sustained by any one person in any one accident; and a limit of liability of not less than \$1,000,000 aggregate for any such damages sustained by two or more persons in any one accident. Insurance shall be written with a limit of liability of not less than \$500,000 for all property damage sustained by any one person in any one accident; and limit of liability of not less than \$1,000,000 aggregate for any such damage sustained by two or more persons in any one accident.

7.3 The CONTRACTOR shall procure and maintain, at his own expense during the CONTRACT TIME, in accordance with the provisions of the laws of the State of New Mexico, Workmen's Compensation Insurance, including occupational disease provisions, for all of his or her employees at the site of the WORK.

7.4 Certificates of Insurance acceptable to ENTRANOSA shall be filed with ENTRANOSA within ten (10) days after the CONTRACT has been awarded to the BIDDER. These certificates shall contain a provision that

coverages afforded under the policies will not be canceled unless at least fifteen (15) days prior WRITTEN NOTICE has been given to ENTRANOSA.

8. ASSIGNMENTS

Neither the CONTRACTOR nor ENTRANOSA shall sell, transfer, assign, or otherwise dispose of the CONTRACT or any portion thereof, or of his or her right, title, or interest therein, or his or her obligations thereunder, without WRITTEN CONSENT of the other party.

9. INDEMNIFICATION

The CONTRACTOR will indemnify and hold harmless ENTRANOSA and their agents and employees from and against all claims, damages, losses, and expenses including attorney's fees arising out of or resulting from the performance of the WORK, provided that any such claims, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting therefrom; and is caused in whole or in part by any negligent or willful act or omission of the CONTRACTOR, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable.

10. ARBITRATION

10.1 All claims, disputes and other matters in question arising out of, or relating to the CONTRACT DOCUMENTS or the breach thereof, shall be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association. This agreement to arbitrate shall be specifically enforceable under the prevailing arbitration law. The award rendered by the arbitrators shall be final, and judgment may be entered upon it in any court having jurisdiction thereof. Each party shall bare its own cost for arbitration including attorney fees.

10.2 Notice of the demand for arbitration shall be filed in writing with the other party to the CONTRACT DOCUMENTS and with the American Arbitration Association. Demand for arbitration shall in no event be made on any claim, dispute or other matter in question which would be barred by the applicable statute of limitations.

11. TAXES

The CONTRACTOR will pay all sales, consumer, use and other similar taxes required by the law of the place where the WORK is performed.

12. REQUIREMENTS FOR THE WORK

12.1 SCHEDULING THE WORK - ENTRANOSA will be responsible for scheduling the WORK. ENTRANOSA will contact individual homeowners and prepare a pumping task schedule for the CONTRACTOR. The CONTRACTOR is responsible for verifying the appointment with each homeowner at least 24 hours in advance.

12.2 INITIAL PUMPING -

12.2.1 For first time pumping, the CONTRACTOR will locate and excavate the septic tank, unless the homeowner has completed this task. The CONTRACTOR will install access risers at least two (2) inches above grade, or no more than four (4) inches below grade if so directed by the homeowner. The access risers shall be *Orengo Systems Inc. Model RR24*, or approved equal. The CONTRACTOR shall backfill around the access risers in eight (8) inch lifts, compacting each lift before adding the next. Backfill will be brought up to the original grade, but positive drainage shall be provide away for the access risers.

12.2.2 The CONTRACTOR will be paid for locating and excavating the septic tank according the unit bid price for up to one hour of time and depths up to five feet. For longer times and depths in excess of five feet, the CONTRACTOR will be paid by the hour at the unit price for such additional work.

12.2.3 The CONTRACTOR will be paid for installing the access riser and manhole cover according to the unit price bid per foot of installed depth.

12.3 SEPTIC TANK PUMPING

12.3.1 The CONTRACTOR shall exercise due care and diligence to avoid any damage to the homeowner's property during the pumping operation. It is the CONTRACTOR'S responsibility to inspect the area for hazards prior to driving on the site. If needed, the CONTRACTOR shall provide an assistant to guide the driver into the area. Any damage caused during the pumping operation shall be reported immediately to ENTRANOSA to allow for ENTRANOSA'S inspection. The CONTRACTOR shall provide a WRITTEN explanation to ENTRANOSA within ten (10) days of the incident and documentation of notification of the CONTRACTOR'S insurance company. The CONTRACTOR shall notify ENTRANOSA of the status of any claims with each pay request.

12.3.2 To pump the scum and sludge from the septic tanks, the CONTRACTOR shall remove the two access covers (one on the inlet compartment and one on the outlet compartment). It is important that the scum and sludge be pumped from both chambers to prevent a stockpile of scum or sludge in either of the compartments. Before pumping the scum and sludge from the septic tank, the CONTRACTOR shall carefully break up the scum and sludge layers by using a long pole but shall not agitate the entire contents of the septic tank. All sludge and scum shall be pumped from both compartments and the liquid sewage should be left. No additives (enzymes or other enhancers) shall be added to the septic tank and no additional money will be paid for such additives.

12.3.3 For systems provided with discharge pumps, the access cover shall be removed from the pump wet well and all scum and sludge shall be pumped from the wet well. After the pumping operation is complete the CONTRACTOR shall replace the covers and return the fill dirt and any grass sod to their original state.

12.3.4 The CONTRACTOR shall maintain pumping records as follows on the pumping checklist form for each unit pumped:

- a) Sludge and scum depth (measuring device to be provided by ENTRANOSA).
- b) Was a riser installed.
- c) Size of tank pumped.
- d) Number of septic tanks pumped per day.
- e) Date of pumping of each tank.

The pumping record shall be submitted to ENTRANOSA with each request for payment.

12.3.5 The CONTRACTOR shall immediately report any spills or deficiencies observed in the septic tank system to ENTRANOSA to allow for ENTRANOSA'S inspection. Deficiencies could include broken or damaged piping, leaking septic tank, or failure of the leachfield as evidenced by odors or surfacing effluent. ENTRANOSA will contact the homeowner and may provide direction for repair after negotiating a separate price agreement for the additional WORK with the CONTRACTOR.

12.3.6 The CONTRACTOR shall restore the property to previous conditions and clean up the work area.

12.3.7 The CONTRACTOR will be paid for pumping according to the unit bid price for the size of tank pumped.

12.4 SEPTIC TANK FILTER

12.4.1 The CONTRACTOR shall install septic tank filters on the discharge pipe from the last chamber of the septic tank as directed by ENTRANOSA or homeowner. The filter shall be *Orenco Systems Inc. FT0444-36*, or approved equal. Filters shall be installed according to the manufacturer's recommendations. Workmanship shall be of good quality and in accordance with the industry standard.

12.4.2 The CONTRACTOR shall be paid for installation of septic tank filters according to the unit bid price.

12.5 SEPTAGE DISPOSAL AND MANIFEST

12.5.1 It is the CONTRACTOR'S responsibility to make certain that the scum and sludge removed from the septic tank are disposed of in a proper manner and in accordance with all state and local regulations. Disposal costs are to be included in the unit bid price for pumping. Failure to properly dispose of septage is grounds for immediate termination of the agreement.

12.5.2 The CONTRACTOR shall maintain a manifest, supplied by ENTRANOSA, that documents the date and location where the septage was obtained, the volume of septage pumped from the septic tank, intermediate storage location (if any), and final disposal location. The purpose of the manifest is to document proper handling and disposal of septage from "cradle to grave". The CONTRACTOR shall certify that the manifest is true and correct, maintain the manifest, and retain evidence of proper disposal (receipts or load slips). The CONTRACTOR shall submit copies of the manifest and evidence of proper disposal with each request for payment.

**PUMPING CHECKLIST
PER UNIT**

CUSTOMER INFORMATION:

DATE OF SERVICE: _____

NAME: _____

ADDRESS: _____

DEPTH FROM GROUND LEVEL TO LID: _____

DEPTH OF SCUM LAYER: _____

DEPTH OF SLUDGE: _____

TANK SIZE: _____ DBL OR SINGLE CELL

RISER INSTALLED: YES OR NO SIZE/FT.: _____

ADDITIONAL CHARGES: _____

NOTES: _____

Completed by: _____

Contractor _____

EWWC LOGO

ACCOUNT NUMBER: _____

APPENDIX G

Agreement for Wastewater Maintenance Services

Entranosa Water and Wastewater Cooperative

Agreement for Wastewater Maintenance Services

THIS AGREEMENT is made this _____ day of _____, 19____, between the Entranosa Water and Wastewater Cooperative (Entranosa), a New Mexico Cooperative Association, and _____ (OWNER) residing at _____ to wit:

WHEREAS the OWNER desires to make arrangements for the maintenance of their on-site wastewater treatment system and,

WHEREAS Entranosa has the facilities and capability to provide such services.

NOW, THEREFORE, for mutual consideration, the parties agree as follows:

6. The OWNER agrees to pay a startup fee. The startup fee will include the cost of establishing an account, locating the OWNER'S septic tank, measuring the accumulated sludge depths, pumping the tank, and installing an access riser to facilitate future pumping.
7. The OWNER agrees to pay a monthly fee as established by the Entranosa Board of Directors. The fee will pay for administration of the maintenance program and future pumping of the OWNER'S septic tank.
8. The OWNER grants access to Entranosa, its employees and contractors, for the purpose of maintaining the on-site wastewater system and further agrees not to place obstructions in the way of the septic tank that would prevent the septic tank pumper free access to the tank. The OWNER agrees to hold Entranosa and its employees and contractors harmless from damages resulting from the OWNER'S placement of obstructions in the way of the septic tank.
9. OWNERS must be present or make arrangements for access for the pumping of their septic tank due to locked gates, animals, or other reasons. They will be liable for all charges levied by the septic tank pumper if that OWNER is not present or access is not available for the pumping and an appointment was made between the OWNER and Entranosa or the pumper previous to the visit.
10. The OWNER agrees not to discharge hazardous materials to the wastewater system that would render the sludge in the septic tank toxic for purposes of disposal. These materials include, but are not limited to, heavy metals, flammable liquids, toxic or poisonous materials, pesticides or herbicides, and strong acids or bases.
11. The OWNER agrees that Entranosa may discontinue water service in the event the OWNER fails to make payment in accordance with this agreement and the OWNER is liable for all costs of collection, including reasonable attorney fees. Entranosa will observe the requirements for appropriate notice as contained in the Bylaws and operating procedure.
12. Entranosa agrees to maintain records of the location and size of the OWNER'S septic tank, frequency of pumping, and accumulated sludge depths. Entranosa will establish a schedule for pumping and arrange for pumping of the septic tank.
13. Entranosa, through its employees or contractors, will inspect the wastewater treatment system at the

time of pumping and report any deficiencies to the OWNER in writing. The cost of correction of such deficiencies shall be the responsibility of the OWNER and is not included in the monthly fee.

14. Entranosa agrees to develop and maintain a maintenance plan that will comply with requirements of the Bernalillo County Environment Health Department and the New Mexico Environment Department.
15. This instrument comprises the entire understanding and agreement of the parties hereto and may only be modified by a written agreement executed by both parties.

IN WITNESS whereof the parties execute this AGREEMENT effective the date herein above set forth.

Entranosa Water and Wastewater Cooperative:

OWNER:

By : _____