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PROCEEDINGS:
SEVENTH WORKSHOP ON
HOME-SEWAGE DISPOSAL IN COLORADO

Edited by
Robert C. Ward

June 1989

Colorado State University

Colorado Water Resources Research Institute

Information Series No. 60

PROCEEDINGS

SEVENTH WORKSHOP ON ON-SITE WASTEWATER TREATMENT IN COLORADO

Edited by

Robert C. Ward

June 1989

COLORADO WATER RESOURCES RESEARCH INSTITUTE
Colorado State University
Fort Collins, Colorado 80523

Neil S. Grigg, Director

PROGRAM

SEVENTH WORKSHOP ON ON-SITE WASTEWATER TREATMENT IN COLORADO

March 28, 1989

Lory Student Center
Colorado State University
Fort Collins, Colorado

Sponsored by: Cooperative Extension Service and Water Resources Research Institute, Colorado State University

Colorado Environmental Health Association

8:30 am Registration: Lory Student Center, Room 228

9:15 am **WELCOME** - Neil Grigg, Director, Water Resources Research Institute, Colorado State University

SESSION I: Technology Update

9:30 am **Evolution of Septage Handling Practices in Colorado** - Brian Janonis, RBD Inc., Fort Collins, Colorado

9:55 am **Summit County's Experience with Mound Systems** - Carolyn Yeagle, Summit County Health Department, Dillon, Colorado

10:20 am Break

SESSION II: Management Update

10:45 am **Incorporating New Technologies into On-site Wastewater Treatment in Colorado** - Rick Kenshella, Tri-county Health Department, Colorado

11:10 am **EPA's Outreach Initiative** - Steve Dix, EPA Small Flows Clearinghouse, West Virginia University, Morgantown, West Virginia

11:35 am **Small Flow Management Initiatives Utilized in Other States** - Steve Dix, EPA Small flows Clearinghouse, West Virginia University, Morgantown, West Virginia

Noon Luncheon - North Ballroom, Lory Student Center

Speaker: Dave Holm, Director, Water Quality control Division, Colorado Department of Health, Denver, Colorado

SESSION III: State guidelines - A Need to Revise?

1:30 pm — Panel Discussion on the status of Colorado's Individual Sewage Disposal System (ISDS) Guidelines

Moderator: Jim Dingman, Tri-county Health Department, Commerce city, Colorado

Panel Members:

Ed Church, E.O. Church, Inc., Denver, Colorado

Wes Potter, Weld County Health Department, Greeley, Colorado

Ken Grein, Grein Construction Co., Brighton, Colorado

Jim Brooks, Region VIII, U.S. EPA, Denver, Colorado

Robert Ward, Colorado State University, Fort Collins, Colorado

3:00 pm — Adjourn

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INTRODUCTION TO PROCEEDINGS

The Seventh Workshop on On-site Wastewater Treatment in Colorado was held March 28, 1989, on the campus of Colorado State University in Fort Collins, Colorado. The Workshop was sponsored by the Cooperative Extension Service and Colorado Water Resources Research Institute and the Colorado Environmental Health Association. The support of these three organizations is greatly appreciated.

On-site wastewater treatment in Colorado has evolved over the years as the science that supports it is being better defined and understood. As more science enters what has traditionally been an empirically based means of treating wastewater, the need to update regulations, design methods, installation procedures and management practices becomes more obvious. The purpose of this Seventh Workshop is to review developments in on-site technology and management that may be precipitating changes in past practices as a result of the evolving use of more science in the field.

The first two sessions provided update on technology and management practices. David Holm, the luncheon speaker, discussed on-site wastewater treatment issues related to state-wide efforts to manage water quality. The afternoon session was devoted to a discussion of current on-site regulations and the need, if any, for change.

WELCOME

Neil S. Grigg, Director
Colorado Water Resources Research Institute
Fort Collins, Colorado 80523

I commend Robert Ward for organizing the Seventh Workshop on On-Site Wastewater Treatment in Colorado. This is an example of the kind of responsible, low-cost but effective wastewater treatment that we require to meet needs in many rural areas across the country. We are particularly aware of that here at Colorado State because of our mission to provide research and education in natural resources management, with emphasis on agricultural and rural areas. We feel proud of this mission, and are glad to serve you.

Colorado State is also a focal point for education in water resources and environmental management around the world. We have many graduate students from foreign countries who are here studying technologies and management strategies to help them solve some very severe problems. In many of these countries they lack even the rudimentary wastewater treatment facilities. Certainly they lack the finances needed to develop capital-intensive and expensive systems, and implementing cost-effective, on-site technologies is, in many cases, their only hope.

I salute you who work in this area because I know firsthand of the difficulty that you face in finding, on the one hand, effective technologies, and on the other hand controlling the high pressure of growth and development that sometimes would seek to take short cuts at the expense of public health and the environment. In some previous work in North Carolina, I witnessed firsthand the difficulty of the local

health department, for example, in trying to find a compromise between the many different competing interests.

Again, welcome, and let me conclude with just a remark or two about what we are doing at Colorado State. You know that we have traditionally placed considerable emphasis on water resources engineering and management. This continues, and we are breaking new ground with subjects that are at the forefront of today's social and environmental problems. This summer, for example, we will have a very active program of conferences and institutes covering subjects as widely diverse as monitoring of water quality systems, hydraulic structures, and systems analysis for the use of computers in complex water resources systems. I represent the Colorado Water Resources Research Institute, and we are developing a program of research and conferences to deal with unique Colorado water policy and management problems. As you know, there are many of these that need our best attention, such as how to find water supply for the state's developing areas without sacrificing agriculture. We hope you will cooperate with us in these future programs.

EVOLUTION OF SEPTAGE HANDLING PRACTICES IN COLORADO - PAST, PRESENT AND FUTURE

J.R. Burgeson, P.E.; RBD, Inc., Fort Collins
B.A. Janonis, P.E; RBD, Inc., Fort Collins

Introduction

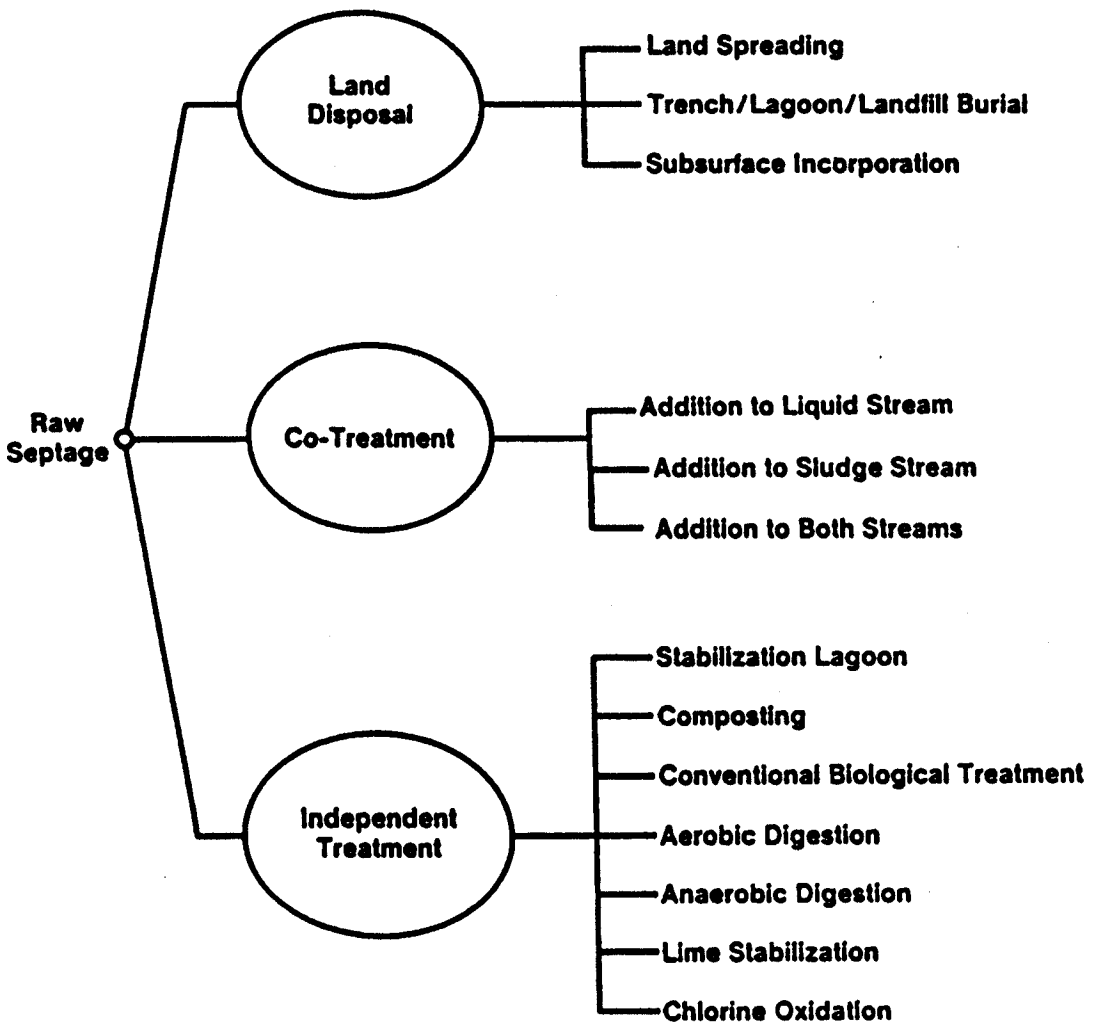
Man's use of natural resources results in residues/solids/residuals and in this case, solids in the form of SEPTAGE. The entire range of handling possibilities for such residues is "into the air, the water or the land (SINKS), as gases, liquids, or solids." In general, air and flowing water are transport systems with the land and sea the SINKS ultimately receiving transported materials. From the land, man obtains food for the sustenance of life; such is the source of his wastes as well.

The word "evolution" will herein be defined as the process of development or change. "Septage" will be defined as those residual solids removed from septic tanks, vault toilets, chemical toilets and grease/sand trap. Available SINKS for receipt of waste solids from whatever source have not, and most probably will not, change. Similarly, technological or other change has not markedly affected the handling of septage residuals. Recent EPA materials (Exhibit 1) present basic septage handling options, both past and present. The Exhibit fails to describe the SINK used for Co-Treatment and Independent Treatment. In each case, the land is typically the SINK of choice.

What has changed and what is changing are the costs associated with the use of the SINKS available (both capital and O&M) and changes in character of the SINK i.e., intensity of use. Costs are increasing significantly and a less intense use of the land is "evolving". With regard to the latter, we are changing from a point-source to a non-point

EXHIBIT 1.

BASIC SEPTAGE MANAGEMENT OPTIONS



Source: EPA Septage Handbook

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source SINK use-intensity. In the authors' judgement, both of these changes are regrettable and open to question. The changes noted are being implemented in Colorado via State and Federal Rules and Regulations that can be considered inflexible without considerable administrative latitude on the part of implementing technical personnel.

THE STATE OF COLORADO

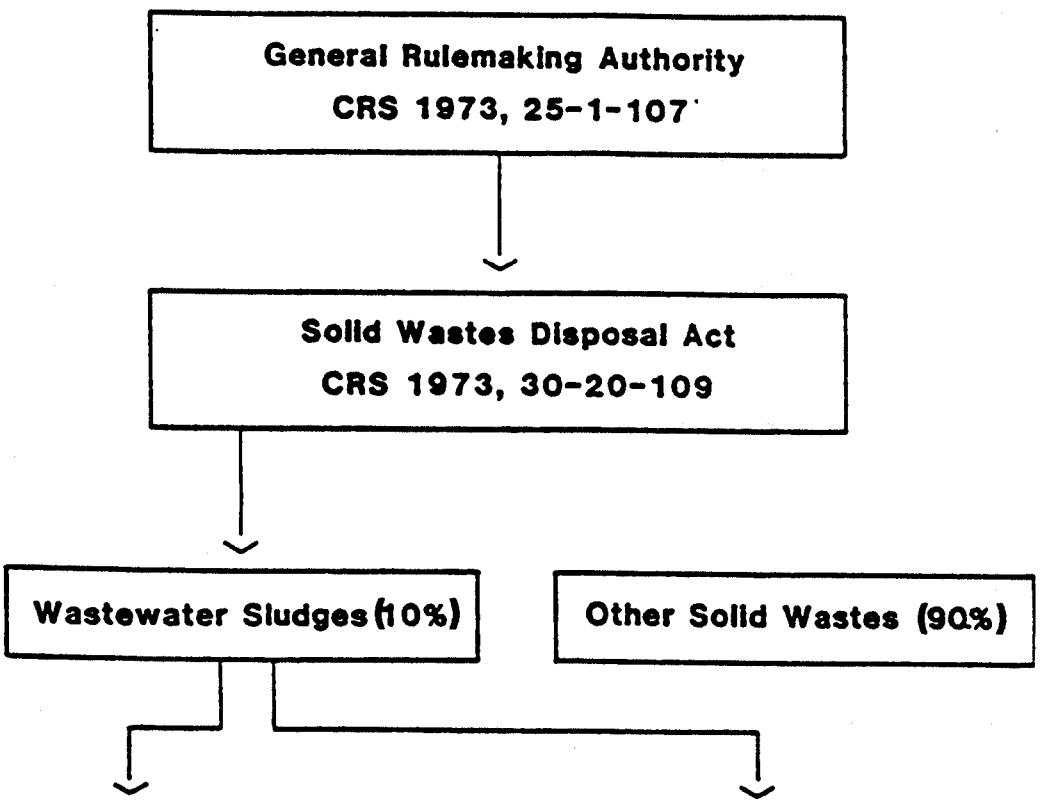
It is our intention to share with you 1), the current status of Colorado Septage Rules & Regulations, 2) recent survey results re: septage handling practices in Colorado and 3) describe recent local experience with septage handling based on facilities of Larimer county, City of Fort Collins, Upper Thompson Sanitation District, National Park Service (Rocky Mountain National Park) and Lafayette, Colorado.

The State of Colorado recently promulgated Rules and Regulations for the Beneficial Use of Septage. The regulations cover basically the incorporation of septage into soil mantle. They also direct that, within a 20 mile radius of wastewater treatment plant willing and able to accept septage, septage must be taken to such plant. The latter requirement, in the author's judgement, could constrain the implementation of more cost effective/efficient approaches to septage handling. The status of sludge solids administrative procedures in Colorado is shown on Exhibit 2.

A recent study conducted by the Fremont Sanitation District documented practices and attitudes re: septage disposal at Colorado wastewater treatment plants. One hundred seven facilities were surveyed.

The forty respondents to the survey represent the full range of Colorado treatment facilities in size, location, and treatment methods.

EXHIBIT 2.



Beneficial Use (C.D. not required)

- **Domestic Sewage Sludge Reg's.**
- **Septage Sludge Reg's. --- Treatment via WWTP or direct land application / incorporation**

Non-Beneficial Use (C.D. required)

- **Septage Pond --- Treatment via total containment / impoundment**

NOTES: **1) I.S.D.S. Rules and Regulations -- State and individual counties**
2) Colorado water rights considerations -- Augmentation plans

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Two-thirds of the facilities do not allow septage disposal. With one exception, all the plants with influent flows greater than 4 MGD do receive septage. Of those which do receive septage, most (84 percent) operate under activated sludge or advanced waste treatment modes. Among the plants which do receive septage, the predominant method of sludge treatment prior to disposal is aerobic digestion (50 percent). This is followed by anaerobic digestion (42 percent) and composting (8 percent). Of those plants which do not receive septage, 22 percent did receive septage in the past. The reasons for discontinuing the service include problems with odor, interference with the treatment process, and difficulties in managing sludge haulers. Fifteen percent of the plants which do not receive septage are now in the process of considering this service. One third of the facilities which do not receive septage report that they might consider it in the future.

Among the plants which do receive septage, 38 percent do so as the result of an inter-government agreement, usually with a county. These agreements usually involve the other agency paying for the construction of the receiving and pretreatment facility. More than a third of the facilities which receive septage simply dump it into a manhole just upstream of the plant headworks. Most have a receiving station which removes garbage and grit and then holds the septage for pumping into the plant at a convenient time. In most plants, the septage is introduced directly into the main treatment process (not the digestors). Most of the facilities which receive septage report minimal impacts on the treatment process, the sludge disposal program, and the staff and budget. Only two of the facilities pretreat the septage, one by aeration and one with chlorine. Most have a permitting system for septage haulers.

Monthly charges are made for sludge hauled to the facility; the average rate is $36.41 per 1000 gallons (Range = $3.20 - $60.00).

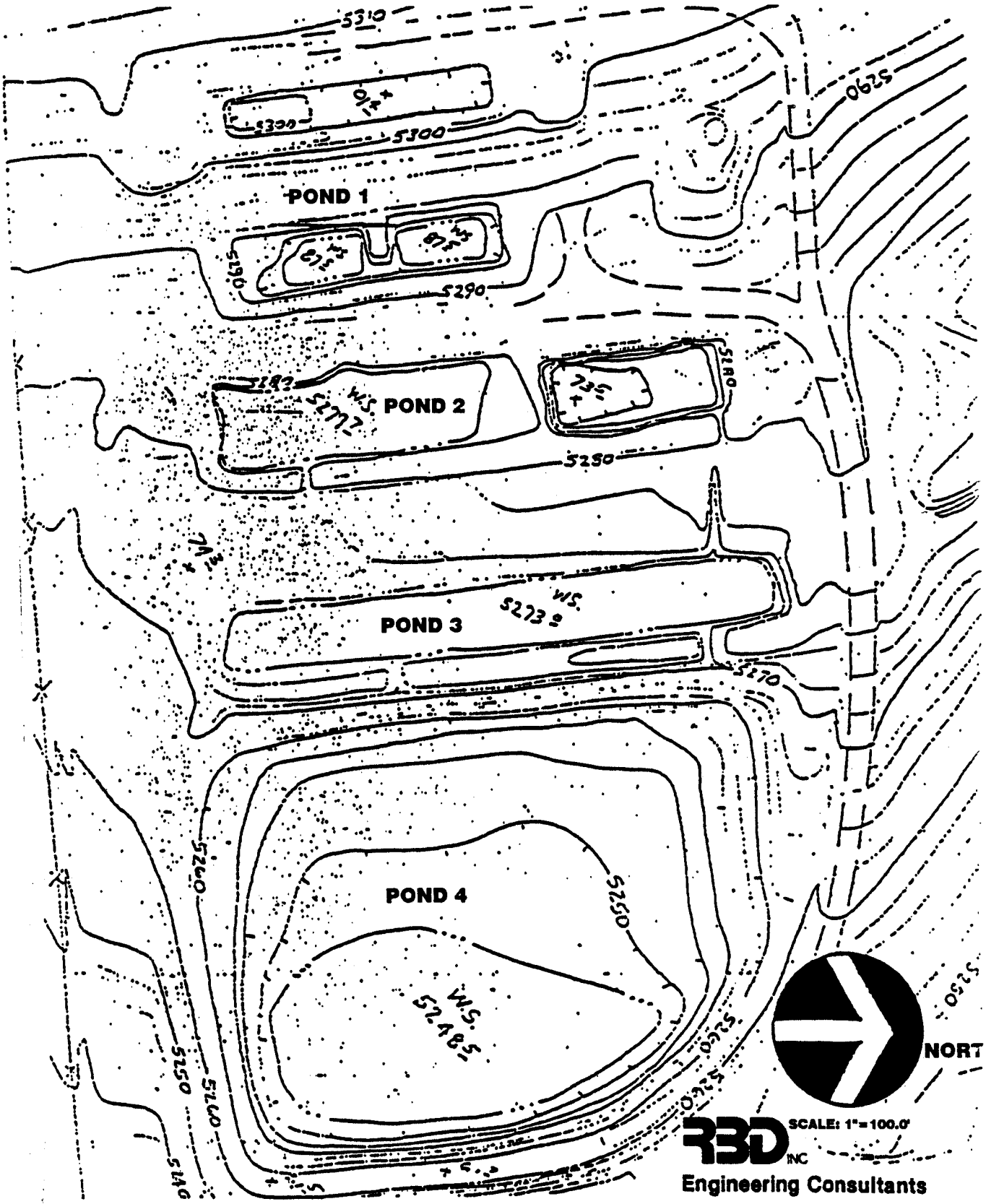
CURRENT SYSTEMS

Larimer County -- The county, by virtue of its municipal solid waste landfill operations, has accepted septage at the landfill since the early 1970's. Physical facilities include a multi-cell unaerated pond system as shown on Exhibit 3. In this case, septage materials are delivered by private septage haulers and directly off-loaded to the pond(s). Due to annual evaporation rates reaching 5 feet, the ponds represent a non-discharging land SINK system with minimal capital and O/M expense. The point source nature of this SINK is readily apparent. Most recent budgets for the facility include a charge of $15.00/1000 gallons or 1.5 cents/gallon. Concerns about the pond system leaking and saturating nearby landfill municipal solid wastes led the county to explore alternatives to the pond containment system. The county subsequently commissioned a landfill sited septage treatment facility. The system was not implemented due to joint deliberations re: septage handling by the City of Fort Collins and the County. Most recently, these two political entities concluded joint design and construction activities for a septage receiving facility at the City's Wastewater Treatment Plant No. 1.

City of Fort Collins -- City facilities, placed in operation early this month, include the following features: septage will be conveyed by an existing 42" interceptor connecting City plants No.1 and No. 2; Plant No. 2 provides conventional secondary treatment via activated sludge. Pretreatment and primary clarification precede biological treatment; waste primary solids are combined with thickened waste activated sludge

EXHIBIT 3.

SEPTIC POND LOCATION MAP



solids prior to anaerobic digestion. Following digestion, solids are conveyed in liquid (4-5%) form for direct soil injection, dewatered prior to composting, or various combinations of the preceding options. The SINK in this case is again the land, but a "dispersal" or scattering of residuals is practiced (non-point source).

The new septage facility has been sized for 3,500,000 gallons/year. At 5,000 mg/1 BOD_5, about 150,000 # of BOD_5 per year (equivalent population = 3000) will pass through the plant. Charges for use of the facilities are to be $50.00/1000 gallons or 5 cents/gal. This is nearly 4x the current Larimer County charges. For users outside Larimer county, charges are $75.00/1000 gallons (7.5. cents/gal.).

Such dump station facilities represent a situation where concentrated septage/waste sludge of 4-5% (the goal of waste water treatment) is reintroduced to a dilute water carriage system for retreatment, followed by reconcentration and restabilization prior to incorporation into some land SINK.

The wisdom of this dilution, and attendant costs for downstream separation/oxidation/clarification/stabilization and residuals handling is certainly open to debate. Assuming 5% septage solids, the $50.00/1000 gallon charge represents a charge of about $250/dry ton. The loss of treatment plant capacity, aeration energy charges and sludge stabilization costs are additional charges being paid by users of the City's wastewater system. Current State of Colorado Rules and Regulations for Septage Beneficial Reuse are a driving force for this questionable and costly practice, as noted earlier re: the required use of wastewater treatment plants within a 20-mile radius willing and able to take the septage.

Upper Thompson Sanitation District -- The District serves a large area surrounding the Town of Estes Park. Currently, septage in the area is brought to a manhole on the District's main interception sewer at the plant. Septage is introduced to the line, mixed with normal domestic sewage and pumped to a flow equalization basin. Following equalization, conventional activated sludge with downstream nitrification and mixed media filtration treatment is provided. The District has recently completed facilities that will allow introduction of septage directly to its aerobic digestors which are used for waste activated sludge solids stabilization. This represents an effort to avoid the dilution and costs of treatment referred to earlier, and to treat septage as the concentrated solids product that it is. Digested sludge of the District is currently conveyed by private hauler to the front range for land application. The non-point nature of this waste sludge residuals handling is, again, contrasted with the point source nature of Larimer County's existing pond system.

Rocky Mountain National Park (RMNP) -- The park accommodates a large seasonal tourist population in and around the Town of Estes Park. Septage is generated at a number of facilities and is subsequently picked up by park personnel for conveyance to a Park Service dump station. The dump station is located some 5 miles upstream of the Upper Thompson Sanitation District plant described earlier. A District interceptor line conveys Park Service septage to the plant much as the downstream District septage is introduced. Again, a concentrated waste is diluted, conveyed for treatment, treated, reconcentrated, stabilized and liquid hauled for land application (non-point source dispersal). The Park Service is assessed charges as a function of volume and strength by the Upper

Thompson Sanitation District for handling of septage.

City of Lafayette -- The City does not accept septage wastes. Waste sludge solids (primary and secondary sludge) at the City's treatment plant are stored prior to further treatment by Purifax chlorine oxidation. Stabilized solids are stored and then hauled for land application. The Purifax system has been used directly for septage in other locations of the U.S. and while not treating septage in Lafayette, it represents a technology that has been applied to a wide variety of sludges and is the only known chlorine oxidation system in Colorado.

FUTURE SYSTEMS

Because of the concentrated nature of septage wastes, the economics of handling the same and the continued use of the land as the ultimate SINK for solids residuals, it would be wise to step back and reconsider Exhibit 2. Most of the waste solids in a community (90%) are represented by municipal solid wastes (MSW). Only 10% are involved in waste solids generated outside MSW volumes. In Colorado, MSW is being buried at a cost of about $10.00/ton. To incur costs of $250.00 - $500.00/ton of dry solids for wastewater sludge or septage solids seems excessive. The State of Colorado allows stabilization for sludge solids (including septage) via several routes. These include anaerobic digestion, aerobic digestion, composting and others. As one potential alternative to the present handling of sludge and MSW solids, co-composting is emerging as a cost effective/efficient approach. Because raw sludge can be co-composted directly, significant capital and O/M costs can be realized with co-composting. In fact, prior stabilization via aerobic digestion creates the most difficult situation in combination with composting. The

processing of MSW i.e., size reduction followed by mixing with raw sludge and co-composting represents a significant cost reduction opportunity. Sludge storage/stabilization capital and O/M costs can be avoided with this approach and the total community solids stream addressed.

Besides cost savings in wastewater treatment, landfill life can be extended and landfill contingent liabilities can be reduced with co-composting. Landfill contingent liability costs may represent the significant future cost faced by many public entities. Products from processing and co-composting MSW represent potential revenues as well. This approach is also compatible with curbside or tipping floor recycling efforts.

The City of Longmont, Colorado has been considering such an approach for some time now. Faced with rapidly filling private landfill and landfill acquisition costs, the City is considering, among several alternatives, the processing of MSW prior to co-composting with sludge and/or sludge filtrate and septage to address its total community solids handling needs. A decision should be reached by the City about mid-1989 in this regard.

SUMMARY

As stated in the Introduction, little "evolution" has occurred in Colorado with regard to septage handling/disposal in the last 20 years. What has changed is the significant increase in costs for such handling and the land SINK use-intensity i.e., from landfill (point source containment) to land application (non-point source dispersal). Colorado Rules and Regulations reinforce the changes noted and may impede more cost effective/efficient solids handling alternatives in the future.

NEW TECHNOLOGIES IN ON-SITE WASTEWATER TREATMENT IN COLORADO

Jim Dingman - Tri-County Health Department

This presentation is intended to provide you with an introduction to the new technologies in on-site wastewater treatment in Colorado. It is not intended to approve or disapprove any of the technologies presented, nor to make recommendations as to their use.

New technologies in on-site wastewater treatment are provided for in CRS 25-10-107, and in Colorado Board of Health guidelines for ISDS (5 CCR 1003-6, Section XI).

New technologies are defined as: Any system employing improvements or developments in the technology of sewage disposal which is not already provided for in the statute; i.e., conventional absorption systems, certain engineered systems, vaults, privis, etc.

In order to obtain certification as a new technology, applications must be made to the Colorado Department of Health, Water Quality Control Division. The Water Quality Control Division will review the application and determine if certification as a new technology is appropriate. In making this determination, performance standards, design criteria, system reliability, and previous review criteria are considered.

Even though a system may be considered as a new technology by the Colorado Department of Health, the local health department may or may not adopt it as a new technology.

To date the following systems have been approved as new technologies:

Bell-Patt	June 1987
SB2	September 1987
Hancor	July 1988
Prinsco	July 1988
Infiltrator	February 1989

A brief description of these new technologies is provided below.

BELL-PATT

This system utilizes two septic tanks, with a pump located in the second compartment of the second tank. Effluent is then pumped to a valve arrangement which distributes the effluent to trenches. The trench system is a series arrangement with an equal number of lines in each trench series. The maximum depth of the trench series is two feet, with the minimum depth being one foot. Each trench series can be controlled by the valve arrangement, thus directing the effluent to various areas of the trench system. This installation requires careful and frequent surveying to insure that the system is installed at the proper depth. At the end of each distribution line, an inspection port can be installed. This port also can be used as a cleanout should the need arise.

SB2

This system replaces the usual bed or trench systems with a corrugated polyethylene tubing with a permeable wrap covering the tubing. This system utilizes a trench design, and has the flexibility to be installed to somewhat follow the contour of the site. The tubing is lightweight and can easily be carried by one person. The drain holes are situated at 60 degrees off the bottom to allow for additional storage of effluent, which in turn permits more settling of suspended solids. As the tubing is installed, it is covered with the protective wrap to prevent clogging of the drain holes. It is also desirable to cover the connections and ends of the tubing with the protective wrap.

HARCOR, PRINSCO, AND INFILTRATOR

Since these three systems are quite similar in design and operation, I will discuss the Infiltrator system.

The Infiltrator is a leaching chamber molded from high density polyethylene. It is designed after the concrete leaching chambers which have been used in the Northeastern U.S. for 20 years. Each chamber is lightweight and can easily be handled by one person. This system can be used in either a trench or bed design. It also has the flexibility to be installed to somewhat conform to the contour of the site. After the chambers are installed, they must be bedded to minimize the potential for movement, and to support the sides of the chambers. After the system is installed and properly backfilled, this system will withstand vehicular traffic.

The Bell-Patt, SB2, Harcor, Prinsco, and the Infiltrator systems are all new technologies utilizing gravel-less systems. They are intended to eliminate problems associated with conventional gravel systems, and to be flexible enough for modification with regard to the latest wastewater disposal theories.

CREATING AN ATMOSPHERE CONDUCIVE TO LOW-COST ALTERNATIVES FOR WASTEWATER TREATMENT: A CASE STUDY

by Stephen P. Dix, P.E.
Director, National Small Flows Clearinghouse

A close working relationship between the West Virginia Department of Health and the National Small Flows Clearinghouse at West Virginia University laid the foundation for a full-scale demonstration of an alternative collection and wastewater treatment system. Cooperation between the two agencies encouraged the private sector to rapidly design and construct the system using low-cost and downsized components that kept cost to a minimum.

Cooperation and trust are the key ingredients for developing an atmosphere conducive to low-cost alternatives for wastewater treatment. Regulatory agencies, research organizations, and construction firms must be willing to join together and support each other to invest in alternative technology demonstrations. Regulatory agencies, such as state health departments, must be willing to allow flexibility with existing regulations to make room for experimentation with new low-cost designs and materials. Research and technology transfer organizations can then provide research support and expertise to construction firms that are willing to design alternative systems and to states seeking more information on the performance of alternative systems. Only when all participants involves in a project work together can the necessary atmosphere for initiating low-cost technologies be created and maintained.

The following case study details one instance in which an atmosphere conducive to alternative technologies resulted in a prompt low-cost solution to one developer's wastewater treatment problem.

Fairmont, West Virginia

In the spring of 1988, the developer of a small low-income subdivision financed by the Farmers Home Administration in Fairmont, West Virginia was planning to use on-site septic tank systems to treat the subdivision's wastewater, but decided to wait until the homes were complete before installing them. Unfortunately, results of the soils evaluation precluded the use of soil absorption and the health department insisted on the use of vaults. The cost of pumping the vaults on a weekly basis motivated the developer to seek a central sewer. He soon realized, however, that installation costs for a conventional sewer system and package treatment plant were well beyond his means.

Faced with no feasible solution to his dilemma, the developer turned to the West Virginia Department of Health. The WV Department of Health called an emergency meeting consisting of representatives from a local wastewater systems construction firm, the National Small Flows Clearinghouse, and the health department to discuss possible options for the Fairmont subdivision's wastewater dilemma.

One option examined by the group was the recently completed research by the West Virginia University Department of Civil Engineering on the performance of recirculating sand filters with rock storage filters (RSF^2). After several years of field and laboratory research, the possibility of using this filter design, which uses bottom ash, was considered as attractive alternative by the group. The most recent laboratory study supported the use of unscreened bottom ash, a readily available commodity.

The results of WVU's research raised the question of whether an RSF^2 could be designed for the subdivision. The NPDES permit for discharging

into the small stream adjacent to the subdivision required a BOD_5 , SS and TKN of 5, 30, and 18 mg/l respectively. In addition, the dissolved oxygen in the effluent had to be 6 mg/l.

A five-unit module design was proposed that would take advantage of the pretreatment/storage within the filter and support the unscreened material. Given the severe economic constraint, a two-inch variable grade gravity sewer to collect septic tank effluent was also proposed.

With the support of the WV Department of Health, the project was reviewed and approved in a few weeks and construction began immediately. Less than 10 weeks after the emergency meeting, the system began operation.

The two bottom ashes used were tested before installation. The uniformity coefficient (D60/D10) for unscreened bottom ash was 7.1 with an effective size (D10) of .28 mm. Sampling ports and control of loading to individual filters were built into the system, permitting an investigation of the filters' performance. Sampling was initiated in November 1988 and will continue through the summer of 1989.

West Virginia University funded data collection for the system for one year. Performance data shown in Table 1 reveals that the system is meeting its discharge requirement even in the cold winter months. Surprisingly, oxidation of the ammonia continued while effluent temperatures dropped to 3 degrees Celsius. It is unusual for a wastewater system to reduce ammonia to less than 1 mg/l under these conditions.

The centralized system was installed for costs similar to projected costs for on-site septic tank systems. The developer participated in the construction wherever possible, installing the two-inch variable grade

Table 1 RSF2 Composite Sample Data

	BOD		CBOD		TSS		NH3		pH		Alkalinity		DO		Temp		% Removal	% Removal	% Removal
Date	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	BOD	TSS	NH3
11/8/88	112	7			16	5			7.4	6.5	195	95		6.8			93.75	68.15	
11/22/88	148	6			63	8	41	5									95.95	87.3	87.8
11/25/88	129	13			25	9	32	6							10	8	89.92	64	81.25
12/3/88							47	9											80.85
12/20/88	130	8			72	4	30	4	7.4	7.6						5	93.85	94.44	86.67
1/3/88	207	22	156	8	62	8	73	3	7.2	7.4	292	102		7.8	7	5	89.37	87.1	95.89
1/10/89	213	7	147	7	50	4								6.8	9	6	96.71	92	
1/18/89	156	5	120	4	54	6								6.6	10	6	96.79	88.89	
1/24/89	210	6	180	5	51	4	43	2	8	6.7				7.4			97.14	92.16	95.35
1/31/89	192	4	138	4	87	10	23	1						7.1	9	7	97.92	88.51	95.65
2/7/89	132		99		30														
2/14/89	162	4		4		3	53	1	7.8	7.1	266	98			7	3	98.7		99.06
2/21/89	132	2		2			32	1	7.4	7	198	110			7	6	97.58		96.88
3/2/89	132	3		3	18	2	40	1	8.6	8.2	272	108			8.2	3	97.73	88.89	97.5
3/10/89	159	3		2	26	—	31	1	7.3	7.7					7.7	5			98.39
SUM	2214	90	840	39	554	63	445	34	61	58	1223	513		43	75	54	1145	851	1015
Mis. Data	1	2	5	6	3	4	4	4	7	7	10	10		9	6	5	2	5	4
D. Points	14	13	10	9	12	11	11	11	8	8	5	5		6	9	10	12	10	11
Average	158	7	84	4	46	6	40	3	8	7	245	103		7.08	8	5	95	85	92

effluent sewers. Contracts for preparing the applications and securing all approval were included in the filter design and construction. The cost of 500 feet of two-inch effluent sewer, five on-site septic tanks, and installation has been estimated at $4,150. The engineering and RSF[2] construction bid came in at $13,800. Through its service mission, WVU helped design and provided guidance in setting up the system. The contractor also donated many hours to the project, working out construction details, finetuning the system's operation, and supporting data collection.

During the summer of 1988, two more homes were added to the system. These homes were sold in November, bringing the total to five homes connected to the 375 square-foot filter system. Operating experience as of June 1989 shows electrical cost at about $3.30 per month per home and an additional cost of $1.62 per month per home for chlorine tablets, for an average operating cost of $4.92 per month per home. The homeowners have agreed to pay the developer $20 per month to operate the facility.

Over the first year the contractor is training the developer to inspect the facility. A bimonthly inspection by a professional operator assures that pumps, controls, and disinfection are in proper working order. With this inspection/maintenance program, the total monthly cost for operating the facility is approximately $125.

All parties involved with the Fairmont project deserve to be commended: the West Virginia Department of Health for initiating the demonstration of this new technology; West Virginia University for supporting the project through guidance in design and operation in addition to providing a grant for data collection on the technology's performance; and the construction firm for willingly accepting the

research data and taking responsibility for quickly designing and building a new, unproven system.

This combination of efforts by regulatory agencies and the private sector worked well to promote application of the RSF^2 technology. The blend of state health department and university support created an environment in which both the private and financial sectors could operate, permitting the rapid design and construction of a new low-cost alternative wastewater system.

Panel Discussion Summary

Following the opening statements by the panel members, the initial discussion generated by the audience focused on the definition of operation and maintenance (O&M). Concern was expressed that if ground water quality monitoring was to be conducted at every on-site system as part of O&M, then the practicality of on-site system O&M must be questioned. The cost, especially, was questioned versus the information gained.

The increasing costs of septage disposal and the resulting increase in the costs of septic tank pumping were noted as causing some homeowners to omit O&M of their systems. Septic tank pumping costs have risen from $100 per pumping to close to $400 in some areas of the state. The apparent ad hoc closing of septage disposal sites and methods, without making sure acceptable alternatives are available, were noted as the cause of the large price increases. The overall septage handling, treatment and disposal process in Colorado is in need of more systematic planning and implementation if on-site technology is to be able to play a meaningful role in Colorado's total wastewater treatment picture.

One suggestion to help prevent some on-site system failures was to have a state law passed that required septic tanks to be pumped and the entire system inspected at the time of a home's sale. This is already occurring in many places of the state, but not in all. It was pointed out that the inspections do not catch all problems with the systems. It is very difficult to tell if an on-site system is functioning properly if you are not present at the time the septic tank is pumped or if the

system does not provide access points for O&M and, therefore, inspection (as most in Colorado do not). Pumpers, by watching backflow from the drain lines at the time of pumping and by examining the baffles on the inflow and outflow lines, are probably in the best position to comment about the overall "health" of an on-site system.

Alternating drainline systems were noted as an excellent strategy to overcome problems associated with the failure of a single drainline system. Alternating drainlines involve dividing the design leachfield into two parts. A valve permits the flow to be diverted from one drainline system to another. It is normally recommended that the flow be changed from one portion to another every six months to a year. The "resting" portion then has an opportunity to "renew" its drainage characteristics. In addition to providing for long life of an on-site system, the alternating drainlines provide a ready emergency solution to a clogged leachfield.

Several in the audience pointed out that homeowners could not be counted on the turn the valve. This prompted several stories about homeowners not assuming O&M responsibility for their systems. It was noted, also, that this is one of the main reasons that on-site technology is viewed as inadequate when compared to a central sewer system where professional O&M is built into the technology. For on-site technology to become "respectable", some formal means of providing professional O&M must be developed. The exact nature of such ongoing O&M was debated and no alternative appeared acceptable to all present. Does a county health department assume O&M responsibility? Do they just assume the responsibility for systems installed after a set date or do they take on all the old systems as well? Can county or state law require

professional O&M of on-site technology? Are there private firms that can take on the O&M responsibilities for a fee? What will homeowners, who have paid nothing for the O&M of their systems for years, think when they are suddenly assessed an O&M fee? Will this homeowner reaction doom any effort to professionally manage on-site systems in Colorado?

Over design of on-site systems was noted as one strategy to help offset the lack of continuing, professional O&M. Several in the audience expressed opposition to this approach. It is costly and places the design of on-site systems on the opinion of the county employee as to what is necessary to cover all eventualities. The design should be based on a scientific understanding of what is required to properly treat the wastewater and provide quantitative protection of public health and the environment. Such design should be able to include a minimum of continuing O&M.

One member of the audience noted that Colorado permits on-site systems to be design and installed with no access points defined on the surface of the ground. This makes routine O&M very difficult and costly. It was pointed out that O&M, at a very minimum, should be "designed" into every on-site system installed in Colorado. This would include risers above the septic tank to ground surface to permit easy location and access for routine sludge inspections and pumping. Also, risers in the leachfield permit inspection and entrance of equipment when repairs are necessary. Such access points also remind the homeowner of the type of wastewater technology being utilized at his or her home and may, therefore, increase the probability that O&M functions will be performed. The public's perception of on-site systems as "temporary" solutions to the wastewater "problem" until central sewers reach the home, was noted as being

unrealistic in the day of rapidly shrinking Federal dollars to support construction of central wastewater treatment plants and sewers. In fact, the loss of money to build central systems was noted as being a reason that on-site technology will be receiving renewed support in the future. This will require that our past status quo with long term management of on-site technology may need to be reviewed. This "new thinking" about on-site technology will require a stronger state presence than has existed in the past.

Development of a state strategy for management of on-site technology was viewed as a way to overcome some of the local problems in trying to provide county-by-county management. One member of the audience noted that, based on his experience, about 10-20 percent of the public on-site system owners want someone else to manage their system and are willing to pay for such management. Approximately 20-30 percent of the people provide the management themselves and are willing to do it. The remainder do nothing until the system fails. This last group needs prodding to provide management for their systems. Some counties provide information to homeowners about the need to provide O&M. Many in the audience felt that more information for the public is needed. The key is getting them to take an interest and initiate action.

The current design approval structure that requires the design of every system handling over 2000 gallons of wastewater per day be sent to the State Department of Health for approval was criticized for delays. It was noted that the Colorado, at the State level, only devotes one tenth of a staff person's time to on-site technology. This accounts for many of the delays. Some delays were noted as being as long as 18 months! There were two options discussed for resolving the problem: (1)

increase the limit to State approval to 10,000 gallons, or (2) increase State staff time to deal with the work load. The first option was criticized because of the hydraulic properties that the larger systems possess. It was pointed out that a technological approach that works well with 2000 gallons may not work well with 10,000 gallons per day. Several experiences were cited.

The role of pumpers and installers in the total on-site wastewater treatment picture is not well defined or organized in Colorado. It was suggested that a Colorado Association of Pumpers and Installers should be formed to bring the concerns and experience of this vital segment of the on-site system "industry" to its proper role in the total management picture. Issues such as septage disposal and differences in county regulations could be addressed. There was only one pumper and one installer present at the workshop.

The purpose of the panel discussion was to discuss the directions that should be taken with the Colorado Individual Sewage Disposal System Guidelines. In the final wrap up to the discussion, it was noted that the guidelines should be reviewed in light of some of the specific points brought out during the discussion. Also, if on-site technology is to play a larger role in Colorado's wastewater treatment future, then the technology's overall management must be addressed in the guidelines.

The exact procedures to be used to upgrade the state guidelines was debated with several alternatives suggested but no consensus reached. In general, however, there was a consensus that the guidelines need to be examined in light of the evolving nature and role of on-site technology in Colorado. The exact nature of any update will have to be discussed and debated within the overall context of on-site system

management. This may include O&M being added to the guidelines in some formal context. Such considerations may involve changes in state and county laws.

SEVENTH WORKSHOP ON ON-SITE WASTEWATER TREATMENT

March 28, 1989

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