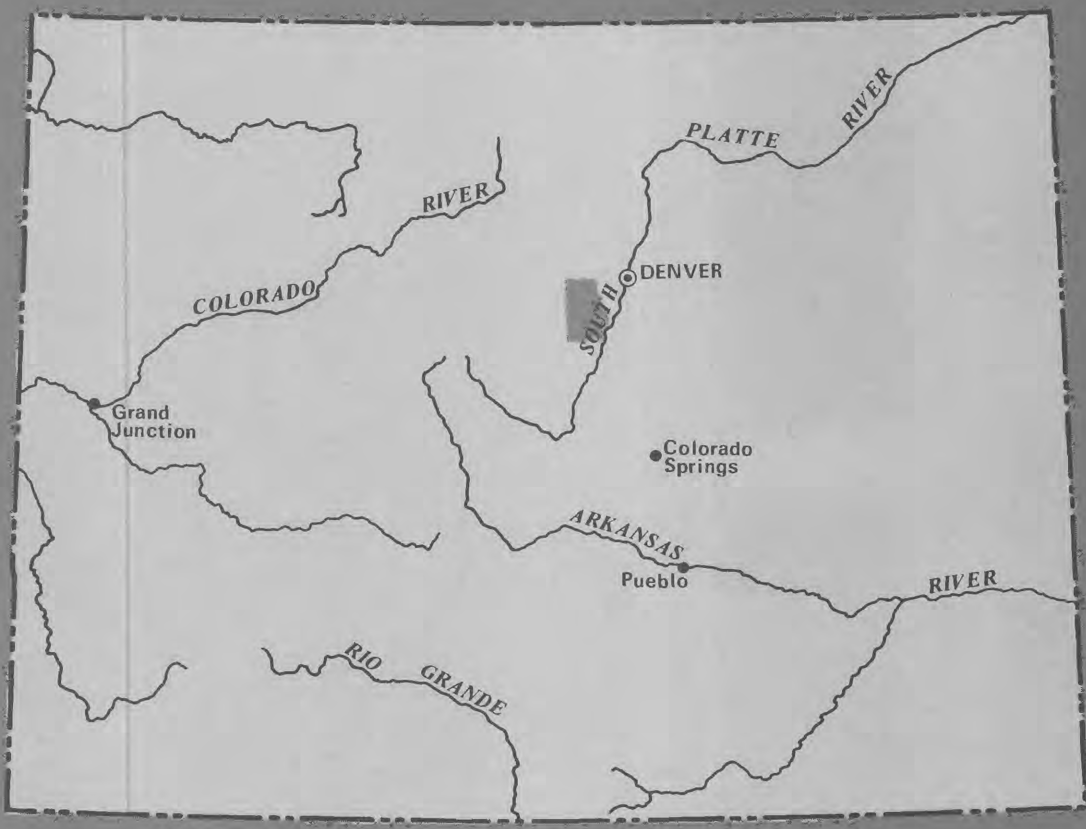
EFFECTS OF RESIDENTIAL WASTEWATER-TREATMENT SYSTEMS ON GROUND-WATER QUALITY IN WEST-CENTRAL JEFFERSON COUNTY, COLORADO

U.S. GEOLOGICAL SURVEY



Water-Resources Investigations
Open-File Report 81-73

Prepared in Cooperation with the
Jefferson County Health Department

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By Dennis C. Hall and Donald E. Hillier,

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Lakewood, Colorado
1981

UNITED STATES DEPARTMENT OF THE INTERIOR

JAMES G. WATT, Secretary

GEOLOGICAL SURVEY

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Lakewood, CO 80225

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METRIC CONVERSIONS

Inch-pound units used in this report may be converted to metric units by use of the following conversion factors:

Multiply	*By*	*To obtain*
inch (in.)	25.40	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
square foot	0.0929	square meter
acre	0.4047	hectare
square mile (mi^2)	2.590	square kilometer
gallon	3.785	liter
gallon per minute	0.06309	liter per second

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Edward Nickum and William G. Dorrance, Jefferson County Health Department

ABSTRACT

The use of residential wastewater-treatment systems in Evergreen Meadows, Marshdale, and Herzman Mesa has degraded ground-water quality to some extent in each community. Age of community; average lot size; slope of land surface; composition, permeability, and thickness of surficial material; density, size, and orientation of bedrock fractures; maintenance of wastewater-treatment systems; and presence of animals are factors possibly contributing to the degradation of ground-water quality.

Ground water in Evergreen Meadows, the youngest community and the community with the largest average lot size, is the least degraded and most suitable for use as a drinking-water supply. Ground water in Marshdale, the oldest community and the community with the smallest average lot size, is degraded to the degree that disinfection of the water to avoid bacterial contamination may be warranted in parts of the community. Ground water in Herzman Mesa is the most degraded and least suitable for use as a drinking-water supply. Bacterial contamination and excessive concentrations of dissolved nitrite plus nitrate are the major water-quality problems. Disinfection of the water to eliminate bacteria may be warranted in the community.

When compared with effluent from aeration-treatment tanks, effluent from septic-treatment tanks is characterized by greater biochemical oxygen demand and greater concentrations of detergents. When compared with effluent from septic-treatment tanks, effluent from aeration-treatment tanks is characterized by greater concentrations of dissolved oxygen, nitrite, nitrate, sulfate, and dissolved solids.

Changes in the effluent in the aerobic soil-absorption fields associated with the two systems were: Biochemical oxygen demand and concentrations of detergents and sulfate decreased in both systems; concentrations of dissolved oxygen and nitrite increased in septic systems and decreased in aeration systems; concentrations of nitrate increased in both systems; and concentrations of dissolved solids remained about the same in septic systems and increased in aeration systems.

INTRODUCTION

Increasing residential development and the resulting increase in the number of wells drilled for domestic water supplies and in the number of residential waste-treatment systems installed to dispose of domestic wastes are causing significant changes in the hydrology of the fractured crystalline-rock aquifer in west-central Jefferson County (fig. 1). In 1971, the U.S. Geological Survey began a 6-year, two-phase investigation of west-central Jefferson County to determine the effects of the increased development on the quality and quantity of water in the fractured crystalline-rock aquifer.

The first phase of the investigation, done in cooperation with the Jefferson County Planning Commission and the Colorado Geological Survey, was conducted to determine water availability, general water quality, and factors controlling water quality. Results of the first phase of the investigation (Hofstra and Hall, 1975a and 1975b) showed that the disposal of domestic wastes is causing degradation of ground-water quality and that radiochemicals in the water may pose a health risk.

In 1975, the U.S. Geological Survey, in cooperation with the Jefferson County Health Department, began the second phase of the investigation. One of the objectives of the second phase was to determine the effects of residential wastewater-treatment systems on ground-water quality by: (1) Comparing the ground-water quality in three communities that use residential wastewater-treatment systems, and (2) comparing the quality of wastewater effluent from septic-treatment and aeration-treatment systems. This report presents the results of this aspect of the second phase of the investigation.

The results of other aspects of the second phase of the investigation are presented in a report by Hall and Johnson (1979). Topics discussed in their report include: (1) The chemical and bacterial quality of water in the fractured crystalline-rock aquifer, (2) concentrations of trace elements and radiochemicals in ground water, (3) seasonal variations in ground-water quality, (4) the presence or absence of degradation in chemical quality during a 2-year period in extensively developed areas, and (5) the pattern and extent of fluctuation in water levels.

Approach

The effects on water quality of residential wastewater-treatment systems were determined by comparing ground-water quality in representative areas (about 0.25 mi^2) of three communities: Marshdale, Herzman Mesa, and Evergreen Meadows (fig. 1). These communities have similar geohydrologic settings and types of wastewater-treatment systems. Major differences between the representative areas were average lot size (1.2 acres in Marshdale, 1.9 acres in Herzman Mesa, and 3.5 acres in Evergreen Meadows) and age of the communities (Marshdale was subdivided in 1923, Herzman Mesa in 1946, and Evergreen Meadows in 1969).

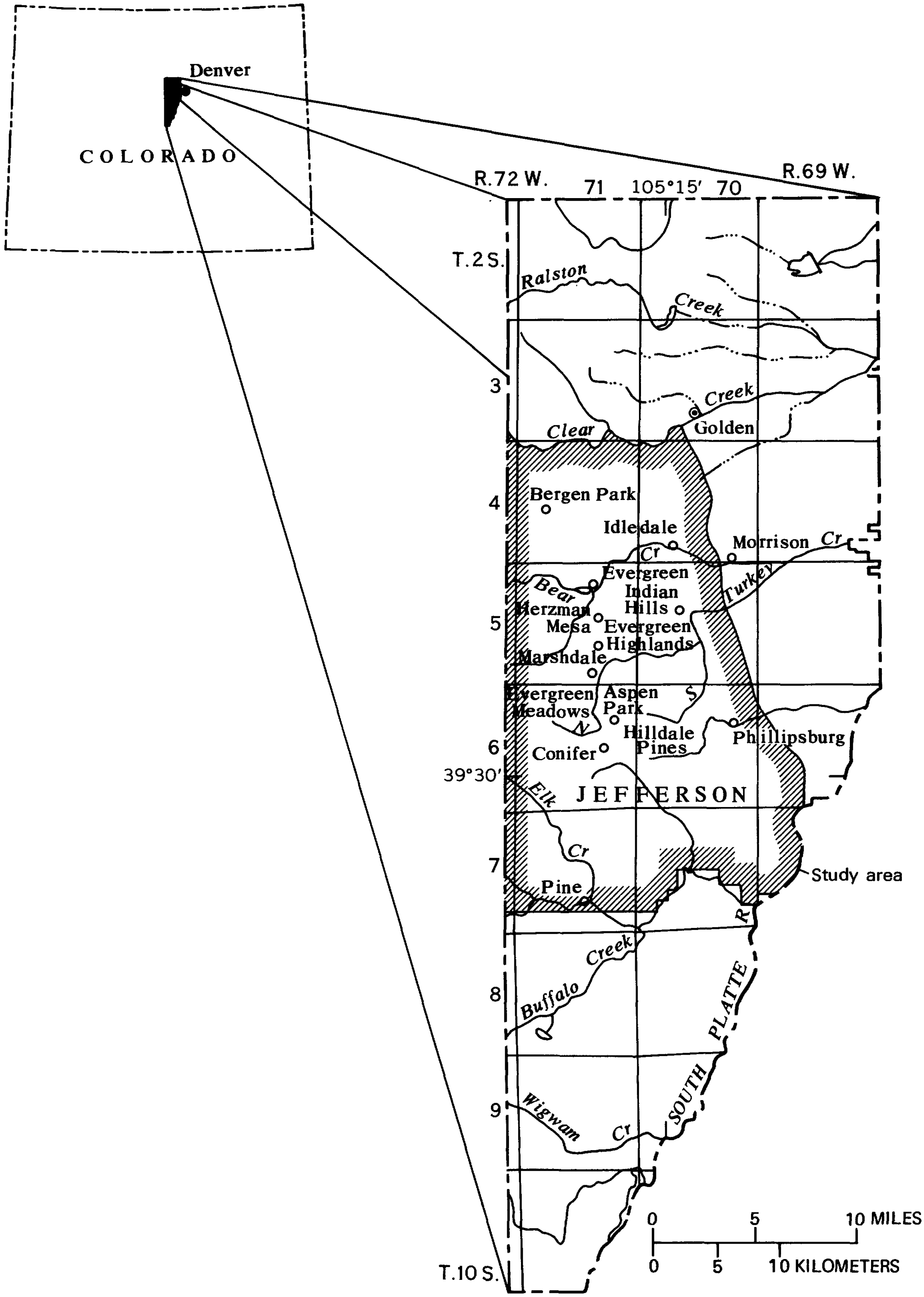

Figure 1.--Location of study area.

Samples for water-quality analyses were collected from about 30 wells in each of the three communities. The samples were analyzed for: Dissolved chloride, dissolved nitrite, dissolved nitrate, detergents, coliform bacteria, and fecal-coliform bacteria. For some samples, dissolved nitrite plus nitrate was determined rather than the individual constituents. In addition, the specific conductance of the water was measured at the time the water samples were collected.

Comparisons between residential wastewater-treatment systems were made using eight septic-treatment systems, two or three in each community, and seven aeration-treatment systems. Because few aeration systems had been installed in the three communities (only one, in Evergreen Meadows, was sampled in the three communities), aeration systems in other parts of west-central Jefferson County were used--Bergen Park (one system), Evergreen Highlands (one system), and Hilldale Pines (four systems) (fig. 1). At the site of each system, a test well was installed in the soil-absorption field and samples for water-quality analyses were collected from the test well, treatment tank, and the water-supply well. Most samples were analyzed for specific conductance and major chemical constituents. Selected samples were analyzed for bacteria, biochemical and chemical oxygen demand, detergents, dissolved oxygen, oil and grease, and turbidity.

Well-water samples were obtained from inside or outside faucets and placed in sterile containers, after water was discharged for a few minutes. Treatment-tank samples were dipped from the tank at the exit pipe and placed in sterile containers. Test-well samples were dipped from the wells in soil-absorption fields and placed in clean sample bottles.

Acknowledgments

Appreciation is extended to the landowners who permitted water samples to be collected and who allowed the installation of test wells on their property. Carl J. Johnson, Dan W. Tipton, and Richard A. Bell of the Jefferson County Health Department assisted in the planning and data-collection phases of the investigation. Well records were obtained from the files of the Colorado Department of Natural Resources, Division of Water Resources, Office of the State Engineer.

GEOHYDROLOGIC SETTING

Marshdale, Herzman Mesa, and Evergreen Meadows are located within a mountainous, 8-mi^2 area between Evergreen and Conifer in west-central Jefferson County (fig. 1) about 15 mi southwest of Denver, Colo. The average altitude of the area is about 7,800 ft. The bedrock underlying the communities is migmatite that includes mostly gneiss and schist (Bryant, 1974) (pl. 1). Soil and weathered rock overlie the bedrock in most areas; however, alluvial deposits occur in stream valleys.

Most homeowners, who are permanent residents, obtain their water supplies from wells completed in the bedrock where it is fractured. A few domestic wells are completed in the alluvial deposits. Household wastes are usually treated in septic tanks and disposed of through leach fields installed in the soil and weathered bedrock or in the alluvial deposits.

Unconsolidated surficial material is usually less than 10 ft thick, and soil is poorly developed. Alluvial deposits found along stream valleys also are usually less than 10 ft thick. Bedrock consists of nonporous granitic and metamorphic rocks. Water is present in and moves through fractures in the bedrock. The frequency of occurrence and width of the fractures decreases with depth. Recharge to the aquifer is from precipitation. The hydrologic surface generally follows the topographic surface. This generalization has been verified by preliminary potentiometric-surface maps constructed from well-drillers' records.

The altitude of Marshdale ranges from about 7,800 to 8,000 ft and the average slope of the land surface is 17 percent, the greatest for the three communities. The distribution of soil, bedrock, and alluvium is shown on plate 1. About 60 percent of the community is underlain by soil with subordinate rock (SR on pl. 1), about 35 percent by mostly rock (MR on pl. 1), and about 5 percent by alluvial soil (AL on pl. 1).

Drillers' records are available for 27 wells in Marshdale; the records are summarized in table 1. Well depth and depth to water generally are greatest while well yield and thickness of surficial material (depth to bedrock) generally are least when compared with the other communities.

The altitude of Herzman Mesa ranges from about 7,600 to 7,800 ft and the average slope of the land surface is 12 percent, which is less than that of Marshdale but greater than that of Evergreen Meadows. The distribution of soil, bedrock, and alluvium is shown on plate 1. About 75 percent of the community is underlain by mostly soil (MS on pl. 1) and about 25 percent by soil with subordinate rock (SR on pl. 1).

Drillers' records are available for 23 wells in Herzman Mesa and are summarized in table 1. Thickness of surficial material generally is greatest while well depth generally is least when compared with the other communities. Well yield generally is greater than in Marshdale but less than in Evergreen Meadows. Depth to water generally is greater than in Evergreen Meadows but less than in Marshdale.

The altitude of Evergreen Meadows ranges from about 7,800 to 8,000 ft and the average slope of the land surface is 10 percent, the least for the three communities. The distribution of soil, bedrock, and alluvium is shown on plate 1. About 85 percent of the community is underlain by mostly soil (MS on pl. 1) and about 15 percent by alluvial soil (AL on pl. 1).

Drillers' records are available for 18 wells in Evergreen Meadows and are summarized in table 1. Well yield generally is greatest while depth to water generally is least when compared with the other communities. Well depth generally is greater than in Herzman Mesa but less than in Marshdale. Thickness of surficial material generally is greater than in Marshdale but less than in Herzman Mesa.

Table 1.--*Summary of well data, Marshdale, Herzman Mesa, and Evergreen Meadows*

	Marshdale (27 wells)			Herzman Mesa (23 wells)			Evergreen Meadows (18 wells)		
	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum
Well depth, in feet below land surface--	84	202	400	60	173	340	100	178	340
Well yield, in gallons per minute-------	.3	1.6	7	.1	2.8	12	1.5	5.8	15
Depth to water, in feet below land surface----------------------------------	22	90	250	7	51	160	10	41	120
Depth to bedrock, in feet below land surface-------------------------------	0	11	42	0	17	60	0	14	34
Year of installation-------------------	1957	1966	1972	1956	1963	1971	1971	1972	1972

INDICATORS OF GROUND-WATER QUALITY

The presence in ground water of chemical and bacterial constituents that are major components of effluent from residential wastewater-treatment systems is an indication of the relative efficiency of the systems. Concentrations of dissolved solids (calculated from specific conductance), dissolved chloride, dissolved nitrite, dissolved nitrate, detergents, and coliform and fecal-coliform bacteria were the indicators used in this study.

Dissolved Solids

Degradation of water by effluent from residential wastewater-treatment systems commonly is indicated by increased concentrations of dissolved solids in the water. Results of studies in areas with geohydrologic settings similar to west-central Jefferson County (Klein, Goddard, and Livingston, 1978--Park and Teller Counties; Hall and others, 1979--Boulder County) and results of a previous study in Jefferson County (Hofstra and Hall, 1975a) indicate that ground water rarely will contain more than several hundred milligrams per liter of dissolved solids unless the water has been degraded by effluent from wastewater-treatment systems. Hofstra and Hall (1975a) determined that the dissolved-solids concentration in ground water in the study area may be estimated by multiplying specific conductance by 0.7. Using this relationship, water with a specific conductance greater than 715 micromhos per centimeter at 25° Celsius will probably contain more than 500 mg/L (milligrams per liter) of dissolved solids, which is the recommended standard for drinking water established by the U.S. Environmental Protection Agency (1977). Dissolved-solids concentrations greater than 500 mg/L may impart an unpleasant taste to the water but will ordinarily have no serious physiological effect on humans (McKee and Wolf, 1971).

Chloride, Nitrite, and Nitrate

Chloride, nitrite, and nitrate occur naturally in ground water in the area; however, natural concentrations of these constituents in ground water are relatively small. Large concentrations of these constituents in ground water indicate possible contamination of water supplies by human or animal wastes.

Chloride is chemically stable and generally remains in a soluble form both in effluent from wastewater-treatment systems and in ground water. In addition to being an indicator of contamination, concentrations of dissolved chloride exceeding the recommended standard of 250 mg/L for drinking water (U.S. Environmental Protection Agency, 1977) may impart a salty taste to the water (McKee and Wolf, 1971).

The contribution of nitrite and nitrate to ground water from aquifer materials is limited, except possibly from organic-rich shales (Goldberg, 1971), which are not found in the study area (Bryant, 1974). The contribution of nitrite and nitrate to ground water from commercial fertilizers probably is insignificant in the study area because there are few lawns and no large agricultural areas.

Infiltrating wastewater is considered a major source of nitrite and nitrate in ground-water supplies (Goldberg, 1971). The nitrogen in the wastes is converted to nitrite and nitrate in the presence of oxygen and certain bacteria. Nitrite generally does not occur in large concentrations because it is oxidized to form nitrate. Concentrations of dissolved nitrate exceeding the mandatory standard of 10 mg/L for drinking water (Colorado Department of Health, 1977) may cause methemoglobinemia (blue-baby disease) in newborn infants who drink the water or who are breast fed by mothers who drink the water (McKee and Wolf, 1971). Although the mandatory standard of 10 mg/L is for dissolved nitrate only, concentrations of both dissolved nitrite and nitrate were determined because both can cause the same health problems.

Detergents

The presence of detergents (methylene blue active substances or MBAS) in ground water is a positive indication of contamination by domestic wastes because detergents do not occur naturally in water. Excessive concentrations of detergents may cause water to foam and may impart an unpleasant taste to the water (McKee and Wolf, 1971). The recommended standard for detergents in drinking water is 0.5 mg/L (U.S. Environmental Protection Agency, 1977).

Bacteria

The presence of coliform bacteria in ground water may indicate either fecal or nonfecal contamination of the water. Fecal-coliform bacteria, which occur most commonly in the intestines of humans and animals or in soils contaminated by human and animal wastes, in ground water indicate recent contamination by human or animal wastes. Drinking water containing fecal-coliform bacteria is considered a health hazard because pathogenic bacteria and viruses may be associated with these bacteria (McKee and Wolf, 1971).

Drinking-water standards for bacteria (Colorado Department of Health, 1977; U.S. Environmental Protection Agency, 1976b) are based on multiple tests of municipal supplies, but the Jefferson County Health Department routinely advises that samples containing more than 1 coliform bacterium per 100 milliliters may be unsafe, and that the presence of any fecal-coliform bacterium is unacceptable. When bacteria are present in a water supply, disinfection using chlorine usually is recommended or required by public-health officials. A single disinfection of the well may eliminate the bacteria, but in wells where continual contamination is occurring, installation of a chlorinator or some other type of disinfection system may be needed. In addition, inspection of the well is appropriate to verify that proper grouting and a sanitary seal are preventing contamination by surface runoff at the well site.

GROUND-WATER QUALITY

Ground-Water Quality in the Three Communities

Marshdale

On the basis of specific-conductance values and chemical-constituent concentrations in water from 29 wells in the 0.25-mi^2 area of Marshdale, chemical concentrations increased downgradient to the southwest (pl. 2). The most degraded ground water occurs along State Highway 73. The pattern of increasing chemical concentrations generally reflects the movement of water in the aquifer, concentrations being least at the higher altitudes and greatest at the lower altitudes.

Although ground water in the area contains increased concentrations of bacterial and chemical indicators, the summary of water-quality data (table 2) indicates that there are few water-quality problems severe enough to affect the suitability of the water for use as a drinking-water supply. The maximum dissolved-solids concentration, based on specific conductance, was about 300 mg/L. Concentrations of dissolved chloride, dissolved nitrite plus nitrate, and detergents were all less than drinking-water standards. Bacterial contamination is the most serious problem in the area. Coliform bacteria were present in water from wells 202 and 235 (see pl. 2 for well locations), and both coliform and fecal-coliform bacteria were present in water from well 225. Because these wells are located more than 1,000 ft from each other interspersed with many wells without coliform bacteria, it is evident that the bacterial contamination is a localized rather than a widespread problem. Only well 225 is located in the area where water-quality degradation is greatest. Disinfection of the water should eliminate the bacterial-contamination problems.

Herzman Mesa

On the basis of specific-conductance values and chemical-constituent concentrations in water from 30 wells in the 0.25-mi^2 area of Herzman Mesa, water is least suitable for drinking in the north-central and northwestern parts of the area (pl. 3). The pattern of constituent-concentration increases is more random than in Marshdale. Altitude and direction of water movement in the aquifers do not appear to be as important in affecting the values or concentrations and distribution of constituents as they were in Marshdale.

In Herzman Mesa the maximum dissolved-solids concentration, based on specific conductance, was about 375 mg/L (table 2). Although concentrations of dissolved chloride did not exceed the drinking-water standard, concentrations of dissolved nitrite plus nitrate exceeded the Colorado drinking-water standard in water from wells 114, 120, and 124 (see pl. 3 for well locations), which are located in the north-central or northwestern parts of the area, and detergents exceeded the drinking-water standard in water from well 109. Coliform bacteria were present in water from wells 109 and 140. Again disinfection of the water should eliminate the bacterial-contamination problems.

Table 2.--*Summary of water-quality indicators in well water, Marshdale, Herzman Mesa, and Evergreen Meadows*

[micromho=micromho per centimeter at 25° Celsius; mg/L=milligram per liter; number/100 mL=number per 100 milliliters]

Indicator	Marshdale				Herzman Mesa				Evergreen Meadows			
	Number of samples	Value or concentration			Number of samples	Value or concentration			Number of samples	Value or concentration		
		Minimum	Median	Maximum		Minimum	Median	Maximum		Minimum	Median	Maximum
Specific conductance (micromhos)	29	140	250	425	30	250	380	540	34	175	235	320
Dissolved chloride (mg/L)	29	.8	2.6	30	30	2.8	19	30	34	.7	2.2	5.8
Dissolved nitrite plus nitrate as nitrogen (mg/L)	29	.14	0.51	7.9	30	.13	3.61	16	34	.00	.16	1.2
Detergents[1] (mg/L)	29	.00	([2])	.06	29	.00	([3])	.65	33	.00	.00	.0
Coliform bacteria (number/100 mL)	29	0	([4])	5	30	0	([5])	15	34	0	0	0
Fecal-coliform bacteria (number/100 mL)	29	0	([6])	1	30	0	0	0	34	0	0	0

[1]Methylene blue active substances or MBAS.
[2]Detected only in a sample from well 225.
[3]Detected only in samples from two wells: well 109 (0.65 mg/L) and well 139 (0.03 mg/L).
[4]Present only in samples from three wells: well 202 (2 coliform bacteria), well 225 (2 coliform bacteria), and well 235 (5 coliform bacteria).
[5]Present only in samples from two wells: well 109 (15 coliform bacteria) and well 140 (8 coliform bacteria).
[6]Present only in a sample from well 225.

Evergreen Meadows

On the basis of specific-conductance values and chemical-constituent concentrations in water from 34 wells in the 0.25-mi^2 area of Evergreen Meadows, water is least suitable for drinking in the central part of the area (pl. 4). The pattern of chemical-constituent increases generally parallels the eastward-trending valley that bisects the area and reflects movement of water in the aquifer, chemical concentrations being least at the higher altitudes and greatest at the lower altitudes. The greater amount of chemical concentrations on the north slope of the valley is due to the greater housing density on this slope.

In Evergreen Meadows the maximum dissolved-solids concentration, on the basis of specific conductance, was about 225 mg/L (table 2). The concentrations of all chemical constituents were less than Colorado or U.S. Environmental Protection Agency drinking-water standards. No bacteria were present in water from any well.

Comparison of Ground-Water Quality in the Three Communities

The differences in ground-water quality in the 0.25-mi^2 areas of the three communities are shown graphically using specific-conductance values (fig. 2), concentrations of dissolved chloride (fig. 3), and concentrations of dissolved nitrite plus nitrate (fig. 4). Based on these data as well as bacterial data in table 2, ground water in Evergreen Meadows has the best quality and is the most suitable for use as a source of drinking-water supplies. Disinfection of the water before use probably is not warranted at this time (1979). Ground water in Marshdale may require disinfection before use as a drinking-water supply, particularly in the area immediately northeast of State Highway 73. Ground water in Herzman Mesa is the least suitable for use as a drinking-water supply, especially in the north-central and northwestern parts of the area because concentrations of dissolved nitrite plus nitrate exceeded 10 mg/L as nitrogen and fecal-coliform bacteria were present in the water. Ground water throughout Herzman Mesa may require disinfection before use as drinking water. Concentrations of dissolved nitrite plus nitrate exceeding 10 mg/L as nitrogen in the ground water could be a health hazard to infants (McKee and Wolf, 1971), and are an indication that inspection and cleaning of wastewater-treatment systems may be warranted. Proper regular maintenance of the entire treatment system--tank and leach field--will aid in maintaining or improving ground-water quality in all the communities.

Estimating Chemical Quality of Ground Water in the Three Communities

The specific-conductance values and chemical- and bacterial-constituent concentrations in the 0.25-mi^2 parts of the communities may be indicative of water-quality conditions throughout the three communities. The chemical ground-water quality in parts of the communities that were not included in this investigation may be determined using relationships between dissolved nitrite plus nitrate and dissolved chloride (fig. 5), between dissolved nitrite plus nitrate and specific conductance (fig. 6), and between dissolved chloride and specific conductance (fig. 7). The relationships were developed using a linear least-squares method to determine the line of best fit on the basis of the data obtained during this investigation.

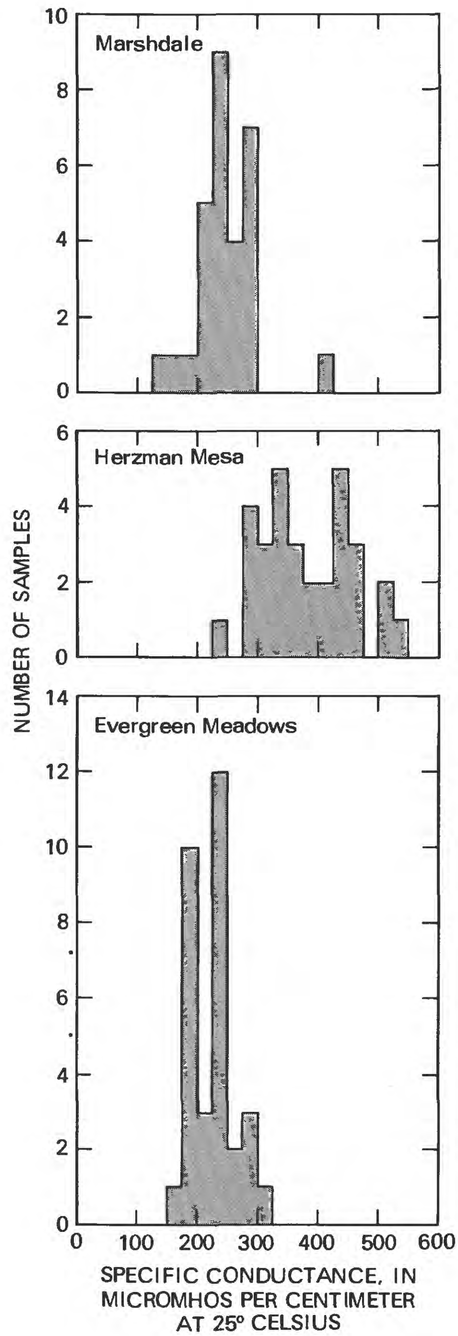

Figure 2.--Values of specific conductance in well water in Marshdale, Herzman Mesa, and Evergreen Meadows.

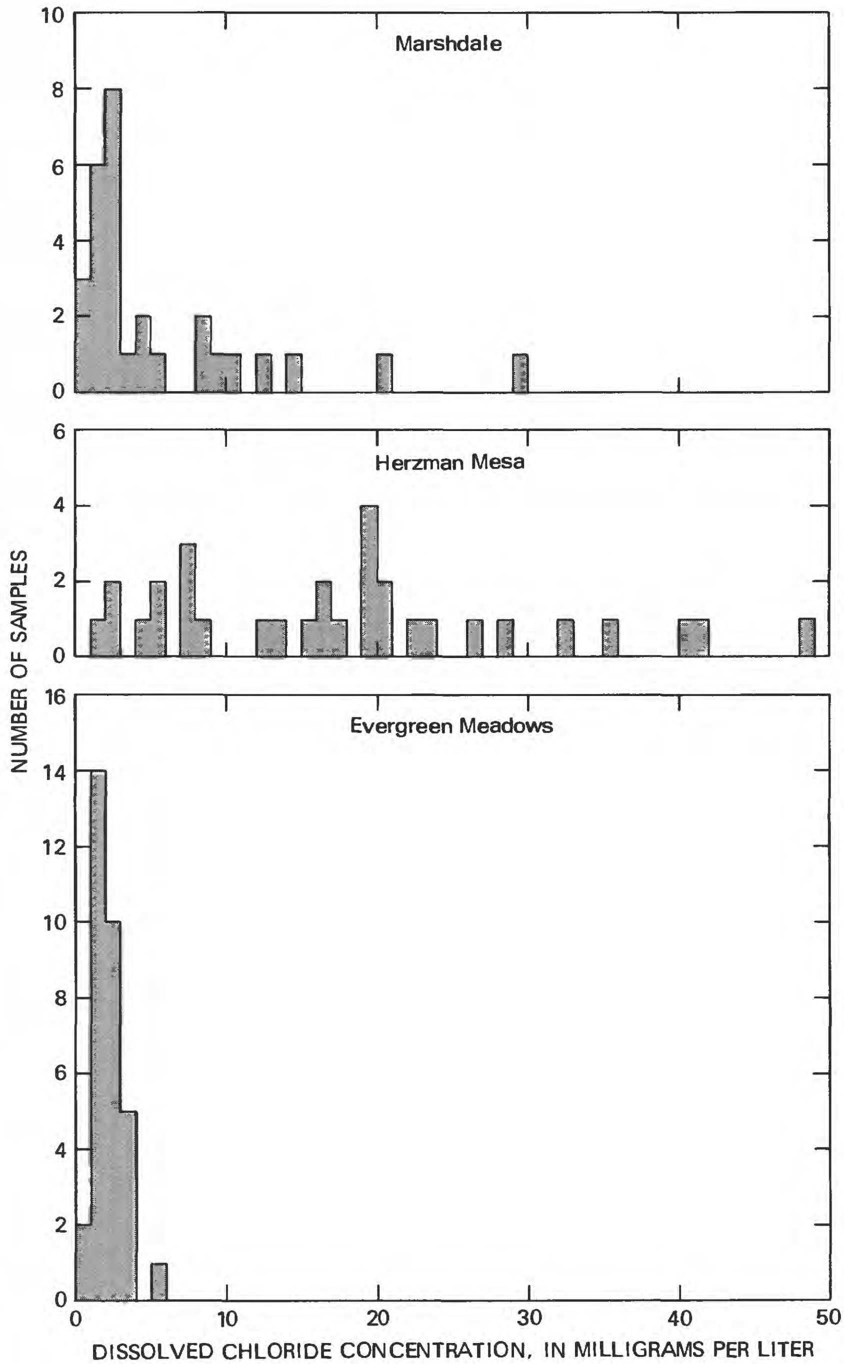

Figure 3.--Concentrations of dissolved chloride in well water in Marshdale, Herzman Mesa, and Evergreen Meadows.

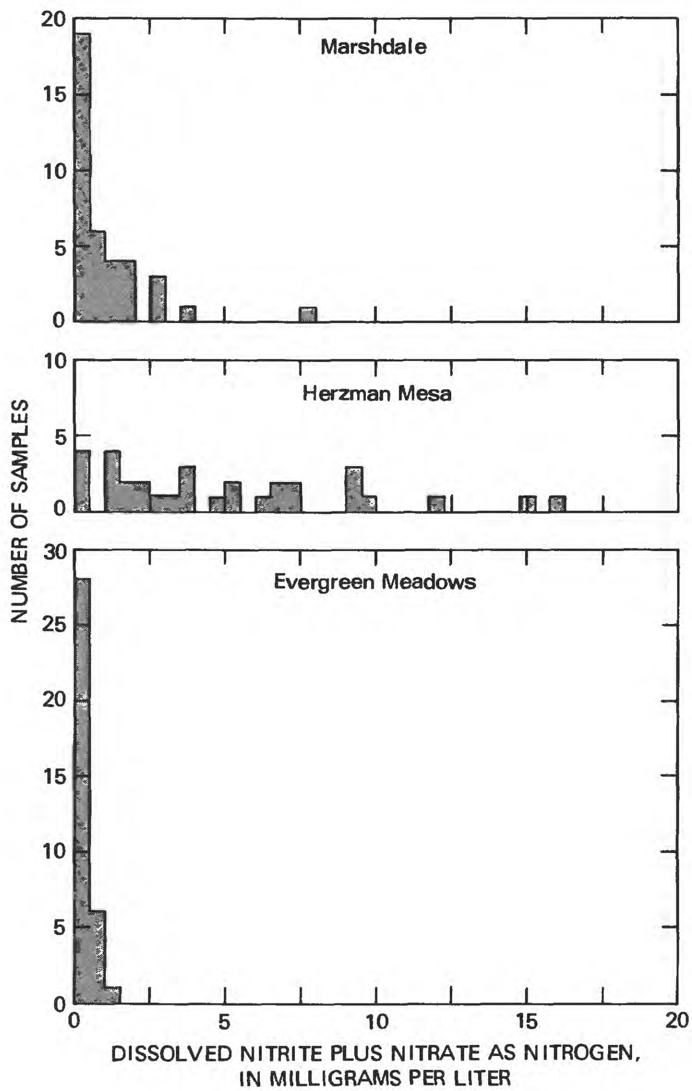

Figure 4..- Concentrations of dissolved nitrite plus nitrate in well water in Marshdale, Herzman Mesa, and Evergreen Meadows.

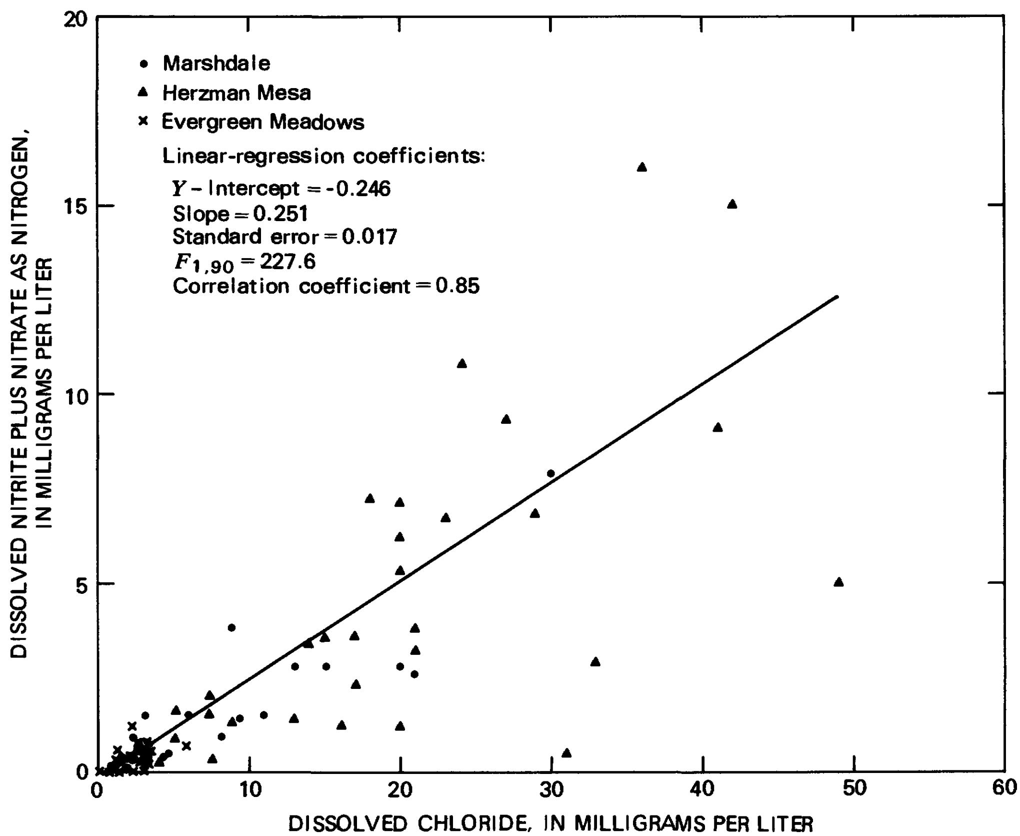

Figure 5.--Relationship between concentrations of dissolved nitrite plus nitrate and dissolved chloride in well water from Marshdale, Herzman Mesa, and Evergreen Meadows.

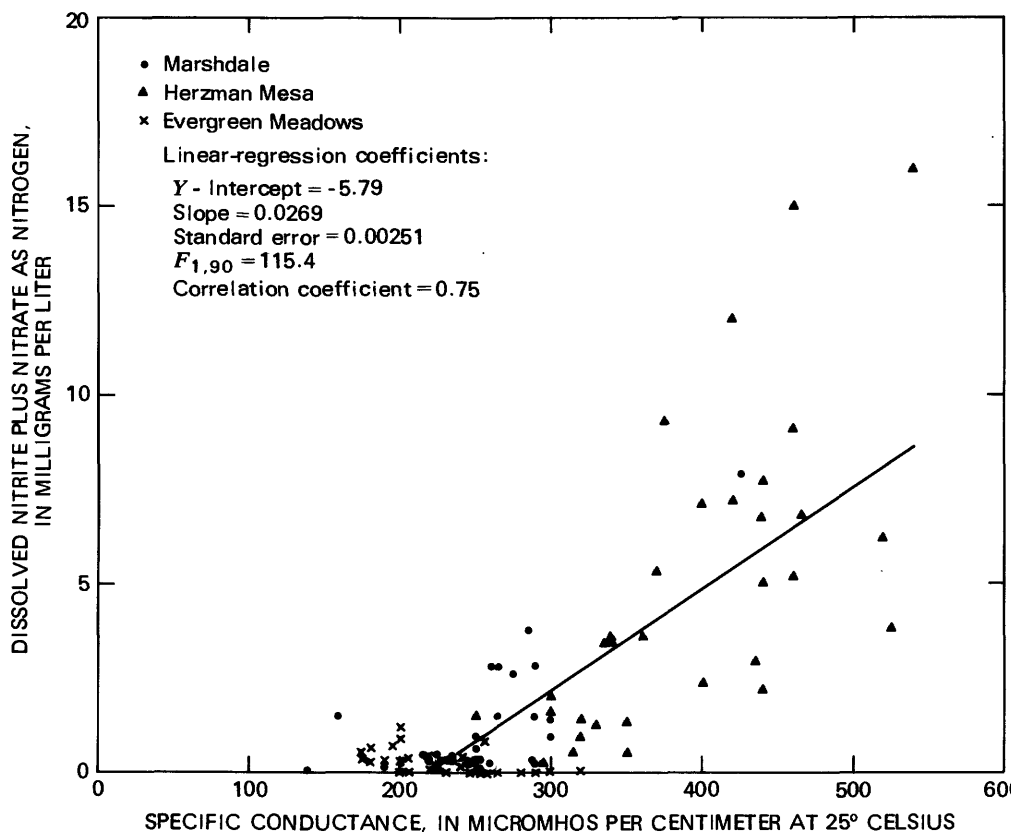

Figure 6.--Relationship between concentration of dissolved nitrite plus nitrate and specific conductance in well water from Marshdale, Herzman Mesa, and Evergreen Meadows.

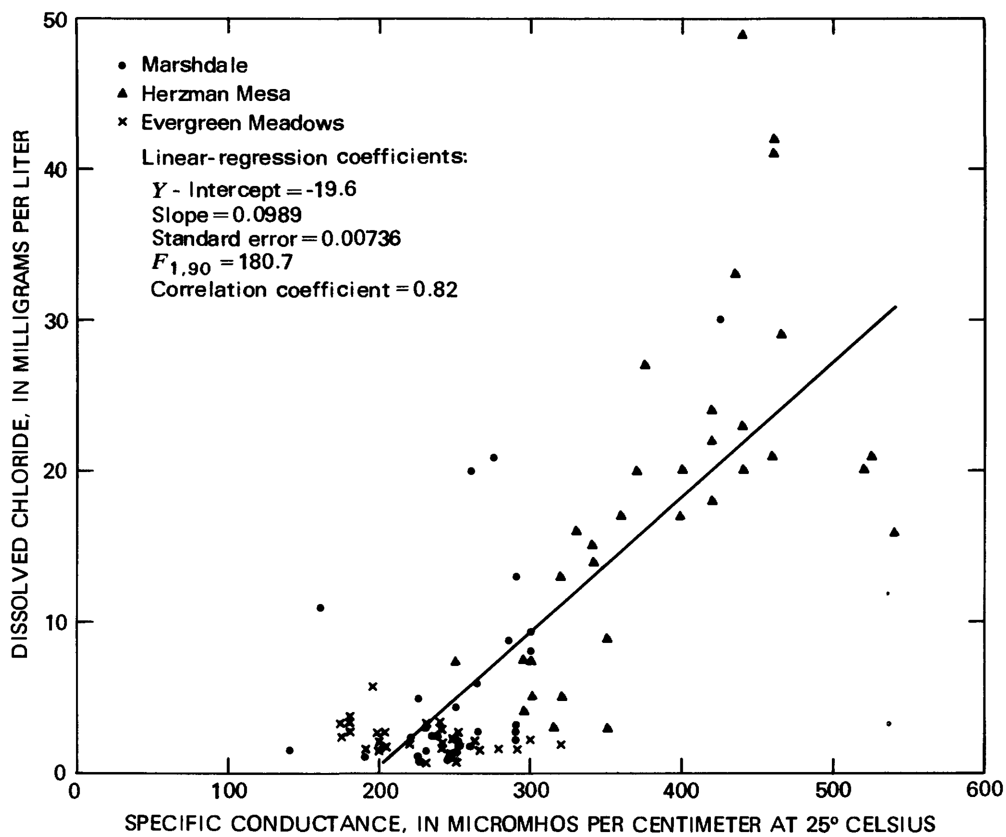

Figure 7.--Relationship between concentration of dissolved chloride and specific conductance in well water from Marshdale, Herzman Mesa, and Evergreen Meadows.

If the concentration of dissolved chloride is known in water from a well, then, using the relationship in figure 5, an estimate of the dissolved nitrite plus nitrate in the water can be made. On the basis of the relationship in figure 5, the concentration of dissolved nitrite plus nitrate as nitrogen probably will be greater than the Colorado drinking-water standard of 10 mg/L when the concentration of dissolved chloride is greater than 32 mg/L.

If the specific conductance of well water is known, then the relationships in figures 6 and 7 may be used to estimate the concentration of dissolved nitrite plus nitrate or dissolved chloride in the water. Based on the relationship in figure 6, the concentration of dissolved nitrite plus nitrate as nitrogen will probably be greater than 10 mg/L when specific conductance is greater than 455 micromhos.

FACTORS AFFECTING GROUND-WATER QUALITY

Factors that can affect ground-water quality in the three communities include: Age of community; average lot size; slope of land surface; fracture density, size, and orientation in the bedrock aquifer; composition, permeability, and thickness of surficial material; types and maintenance of residential wastewater-treatment systems; use of fertilizers; and the presence of animals such as horses and other livestock. Few data are available to evaluate the factors with respect to existing (1975) ground-water quality in the three communities. Therefore the discussions of the factors generally are limited to descriptions of how the factors may affect ground-water quality in the three communities.

Age of Community

Because increasing chemical concentrations in ground water resulting from residential wastewater-treatment systems are cummulative, the age of a community generally can be correlated to water quality. Ground water in older communities, such as Marshdale (subdivided during 1923) and Herzman Mesa (subdivided during 1946), generally contains greater chemical concentrations than in younger communities, such as Evergreen Meadows (subdivided during 1964). At some time after development has stabilized, chemical concentrations and specific conductance in ground water also should tend to stabilize. The time required to reach this level would be related to the rate of addition of contaminants and to the rates of natural and artificial recharge and discharge.

Additionally, homes in older communities tend to be smaller, have fewer bathrooms, and have fewer water-using appliances, such as automatic dishwashers and garbage disposals. The use of these appliances adds a significant load to wastewater-treatment systems (Bennett and Linstedt, 1975). Also, the size of families tends to be smaller in older communities. The combination of more waste-producing facilities and appliances and larger families generally results in larger volumes of wastes being discharged into the ground-water system in younger communities.

Average Lot Size

Average lot size is directly related to the density of homes (population) and residential wastewater-treatment systems. Generally, the greater the density of treatment systems, the greater the volume of effluent being discharged into the ground-water system. The average lot size in the three communities is 1.2 acres in Marshdale, 1.9 acres in Herzman Mesa, and 3.5 acres in Evergreen Meadows.

Slope of Land Surface

Movement of water through the fractured bedrock aquifer is related to the slope of the land surface. Assuming that the aquifer characteristics are similar throughout an area, the greater the slope, the faster the movement of water through the aquifer. If the fracture density, size, and orientation vary within an area, both slope and fracture characteristics would affect the rate of movement. Generally, the rate of movement would be faster through a densely fractured aquifer on steep slopes and slower through a sparsely fractured aquifer on gentle slopes. The concentrations of chemical constituents should be greatest where ground water moves the slowest. The average slopes in the three communities are 17 percent in Marshdale, 12 percent in Herzman Mesa, and 10 percent in Evergreen Meadows.

Fracture Density, Size, and Orientation in the Bedrock Aquifer

Fracture density, size, and orientation affect the amount of water in storage in the bedrock aquifer and local patterns of water movement through the aquifer. Studies of individual home sites in Jefferson, Boulder, and Larimer Counties by Waltz (1972a) indicate the importance of fracture orientation in pollution of well water by effluent from adjacent residential wastewater-treatment systems. Detailed mapping of fractures in the three communities is not available. However, no large fracture zones occur in the three communities (pl. 1).

Composition, Permeability, and Thickness of Surficial Material

The surficial materials are a natural filter, interact chemically with effluent from wastewater-treatment systems, and affect the environment needed for bacterial growth. Thick, less permeable material increases the traveltime required for effluent from waste-disposal fields to reach bedrock or the water table. Longer traveltimes allow more time for occurrence of chemical reactions, such as decomposition of organic compounds or nitrate formation. On the other hand, slow movement of ground water also permits greater buildup of pollutants, such as nitrate or chloride, by concentration due to evapotransporation or by enrichment during reuse and redisposal of water in the area.

Less permeable or fine-grained material also increases the removal by filtration of suspended material, including bacteria. Concentrations of coliform bacteria tend to increase in the upper few millimeters in fine-grained material because the bacteria attach themselves to soil particles and reproduce or survive longer. However, fecal-coliform bacteria, which die off rapidly outside their human or animal hosts, do not usually live more than 1 or 2 weeks (Geldreich, 1972; Gordon, 1972).

Generally, water will move into and through coarse-grained materials more rapidly than into and through fine-grained materials. According to Schmidt (1976), the coarsest surficial materials occur in Marshdale (60 percent soil with subordinate rock, 35 percent mostly rock, and 5 percent alluvial soil), the finest in Evergreen Meadows (85 percent mostly soil and 15 percent alluvial soil), and a mixture in Herzman Mesa (75 percent mostly soil and 25 percent soil with subordinate rock).

Thickness of surficial material affects the amount of filtration that occurs, as water, including effluent from wastewater-treatment systems, percolates through the unsaturated zone. The greater the thickness of surficial material overlying the fractured bedrock aquifer, the greater the possibility for more complete filtration. On the basis of drillers' records, the greatest mean thickness of surficial material occurs in Herzman Mesa (17 ft), the least in Marshdale (11 ft), and intermediate in Evergreen Meadows (14 ft).

Types and Maintenance of Residential Wastewater-Treatment Systems

All three communities have similar types of residential wastewater-treatment systems--septic tanks with soil-absorption fields or leaching wells; therefore the type of system is not a factor affecting differences in ground-water quality between the communities. However, maintenance of the systems probably is a factor, based on the conditions of several septic tanks that were observed during the investigation. While obtaining data for the purpose of comparing septic-tank and aeration-tank systems, several sludge-filled septic tanks were observed. Wastes in these systems were moving directly from the homes, through the tanks, and into the soil-absorption fields with little or no treatment. Lack of proper maintenance of the tanks and soil-absorption fields can significantly affect ground-water quality. The "backing up" of wastes into homes or the ponding of effluent in the vicinity of the soil-absorption fields are indications of lack of maintenance. Periodic cleaning of tanks is needed to keep the systems functioning properly and to lessen the adverse effects on ground-water quality.

Use of Fertilizers

Farming is not important in the study area because tillable land is scarce and the growing season is short. Grass meadows are present along stream valleys and are used predominantly as horse pasture and occasionally for cattle. Commercial fertilizers are not commonly used in the study area. Consequently, contamination of ground water by nutrients from fertilizers is an uncommon occurrence.

Animals

Livestock, particularly horses, and other animals are often kept near dwellings in the study area. When these animals are confined near a well site, as is often the case, the possibility exists for contamination by coliform bacteria, fecal-coliform bacteria, and nutrients. Just as soil-absorption fields should be located some distance from a well, animals and their wastes should also be kept away from the area near the well site.

COMPARISON BETWEEN SEPTIC AND AERATION SYSTEMS

Aerobic waste-treatment systems have been installed infrequently in Jefferson County, and performances of these units have been inadequately studied under the conditions prevalent in the area. In order for regulating agencies to better judge if aerobic systems are appropriate as waste-treatment systems in the mountains, more data pertaining to waste-degradation efficiencies are required. Septic systems predominate in the area and for this reason were used for comparison.

Septic systems function in the absence of oxygen (anaerobically). In contrast, aeration systems function with a continual supply of oxygen (aerobically) obtained from the air. Digestion of wastes by bacteria under aerobic conditions is more complete than digestion under anaerobic conditions. The end products of digestion under aerobic conditions generally are simple chemical constituents such as carbon dioxide and water, which are not toxic to bacteria. The end products of digestion under anaerobic conditions generally are complex chemical constituents, such as acids, which may limit further bacterial growth if they accumulate.

Data Obtained for Comparison

Data were obtained from eight septic systems and seven aeration systems. All the septic systems were located in Marshdale, Herzman Mesa, or Evergreen Meadows (fig. 8). Because of the lack of aeration systems in the three communities, data were obtained from one aeration system in Evergreen Meadows, one system in Bergen Park, one system in Evergreen Highlands, and four systems in Hilldale Pines (fig. 8).

Observation wells, drilled with a power auger, were installed in the soil-absorption fields or sand filters at each site. In all instances, bedrock was reached at depths of less than 10 ft. Four-inch plastic casings with slots in the lower 18 to 24 in. were placed in the holes. Where possible, the top of the slotted part of the casing was placed 4 ft below the distribution pipes in the soil-absorption fields. A gravel pack was installed outside of the slotted part of the casing and a bentonite seal installed above the gravel pack. The remaining annular space was then filled with dirt.

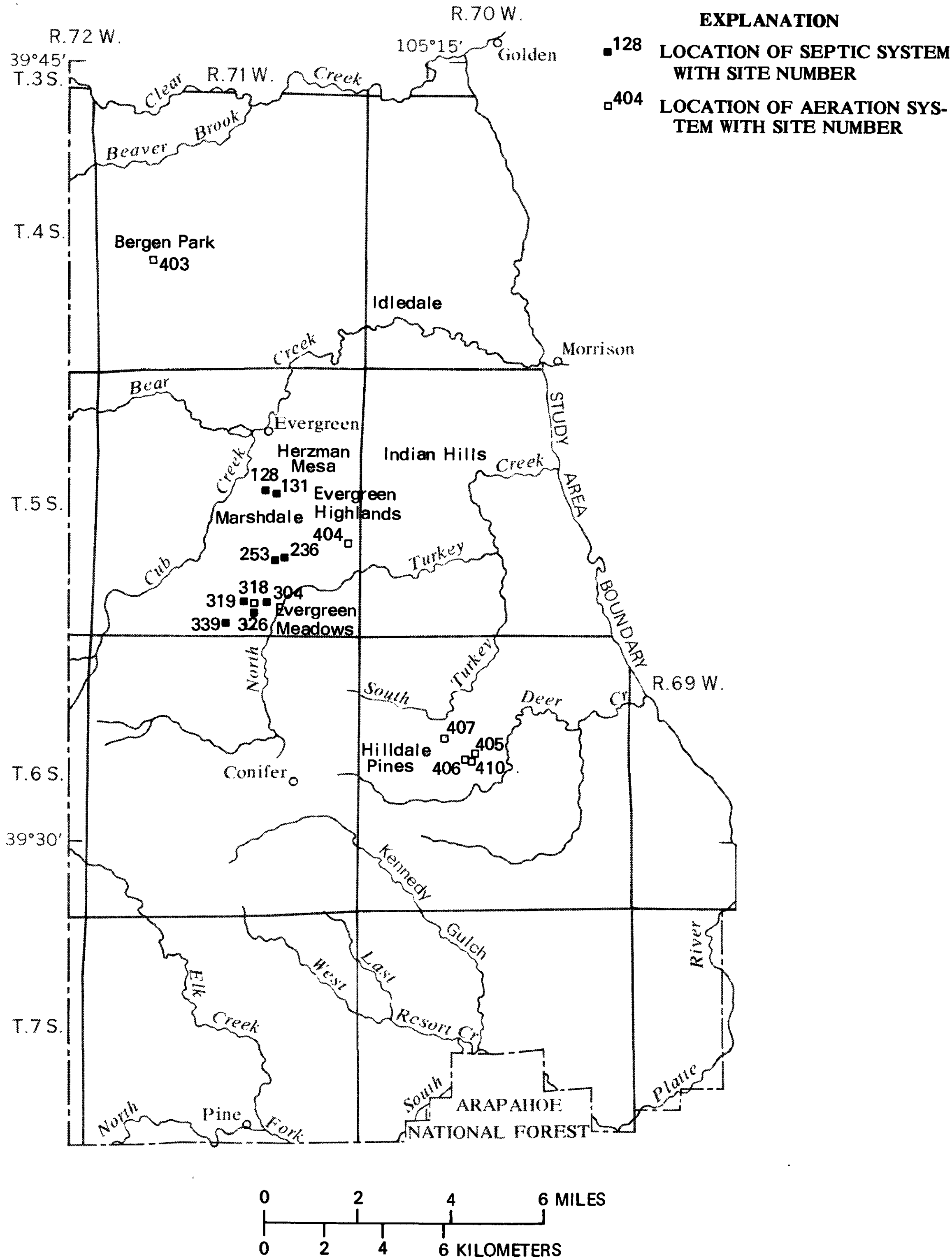

Figure 8.--Location of septic and aeration systems where data were collected for use in comparing the two systems.

Samples of water from the water-supply wells and samples of effluent from the treatment tanks and observation wells were collected for analysis. These samples were taken after the observation well had been in place for several weeks. Samples were obtained from five observation wells associated with septic systems and from two observation wells associated with aeration systems. Analytical results used in the comparison of the two systems are summarized in table 3. Complete analytical results are presented in tables 8 and 9 at the end of the report.

Results of the Comparison

Chemical constituents in effluent from septic and aeration tanks (table 3) were compared by first determining how much each constituent was increased or decreased in the different treatment tanks with respect to the concentration of the constituent in water from the water-supply well. The resulting values were compared to determine how much greater the average concentration in one system would be than the average concentration in the other system. A step-by-step explanation of the method used is presented below using dissolved sulfate as an example:

Step 1: Determine the increase or decrease in average sulfate concentration in a typical septic tank: (a) Average sulfate concentration in well water=8.9 mg/L; (b) average sulfate concentration in septic-tank effluent=24.9 mg/L; and (c) increase in average sulfate concentration in septic-tank effluent is 16.0 mg/L (24.9-8.9).

Step 2: Determine the increase or decrease in average sulfate concentration in a typical aeration tank: (a) Average sulfate concentration in well water=10.2 mg/L; (b) average sulfate concentration in aeration-tank effluent=61.9 mg/L; and (c) increase in average sulfate concentration in aeration-tank effluent is 51.7 mg/L (61.9-10.2).

Step 3: Compare increases in average sulfate concentrations in the two systems: Increase in average sulfate concentration was about 3.2 times (51.7÷16.0) greater in aeration-tank effluent than in septic-tank effluent.

EXAMPLE: If the dissolved-sulfate concentration in well water were 5 mg/L and the water, after use, were disposed of using a septic system, the dissolved-sulfate concentration would be about 21 mg/L (5+16) in the septic-tank effluent. If the same well water, after use, were disposed of using an aeration system, the dissolved-sulfate concentration would be about 57 mg/L (5+51.7) in the aeration-tank effluent.

Results of the comparisons for effluent from treatment tanks are presented in table 4. The results are consistent with the methods by which the two systems function. Anaerobic treatment of wastes in septic tanks is characterized by greater biochemical oxygen demand and greater concentrations of detergents resulting from incomplete biological digestion of wastes. Aerobic treatment of wastes in aeration tanks is characterized by greater concentrations of dissolved oxygen, greater concentrations of oxidized products (nitrite, nitrate, and sulfate) that are produced during the biological digestion of wastes, and greater concentrations of dissolved solids resulting from evaporation and more complete oxidation to end products.

Table 3.--*Summary of chemical data used in the comparison of septic and aeration systems*

[Mg/L=milligram per liter]

Chemical or bacterial constituent	Household water-supply well				Treatment tank				Soil-absorption field[1]			
	Number of samples	Concentration			Number of samples	Concentration			Number of samples	Concentration		
		Minimum	Average	Maximum		Minimum	Average	Maximum		Minimum	Average	Maximum
SEPTIC SYSTEMS												
Biochemical oxygen demand (mg/L)------	2	0.6	0.7	0.8	8	158	609.1	1,960	5	4	32.0	92
Detergents[2] (mg/L)---	8	.00	.00	.00	8	.00	2.23	7.00	3	.00	.073	.2
Dissolved oxygen (mg/L)------------	6	1.7	4.25	6.8	1	--------	.00	--------	4	.2	2.02	5.4
Nitrite, dissolved as nitrogen (mg/L)----	8	.00	.002	.01	6	.00	.007	.01	5	.01	.034	.0
Nitrate, dissolved as nitrogen (mg/L)----	8	.01	1.77	7.9	6	.00	.037	.11	5	.00	7.9	36
Sulfate, dissolved (mg/L)------------	8	2.3	8.9	14	6	2.9	24.9	90	5	1.2	14.9	38
Dissolved solids, calculated sum (mg/L)------------	8	124	178.5	286	6	185	387.8	563	5	237	437.2	600
AERATION SYSTEMS												
Biochemical oxygen demand (mg/L)------	0	------	-------	------	7	38	344	1,630	2	8	19.5	31
Detergents[2] (mg/L)---	7	0.00	0.00	0.00	7	.00	.267	.96	2	.00	.035	.7
Dissolved oxygen (mg/L)------------	5	.6	2.64	3.9	4	.0	2.45	7.5	1	1.5	-------	1.5
Nitrite, dissolved as nitrogen (mg/L)----	7	.00	.070	.49	7	.01	.861	3.4	2	.11	.115	.12
Nitrate, dissolved as nitrogen (mg/L)----	7	.01	.79	3.9	7	.04	3.39	6.3	2	.48	90.2	180
Sulfate, dissolved (mg/L)------------	7	3.7	10.2	30	7	12	61.9	140	2	12	35.5	59
Dissolved solids, calculated sum (mg/L)------------	7	114	158.9	201	7	285	436.6	581	2	287	803.5	1,320

[1]First analysis used in calculations when more than one sample was collected.
[2]Methylene blue active substances or MBAS.

Table 4.--*Comparison between average concentrations of selected constituents in effluent from treatment tanks*

Constituent	Change in average concentration in effluent with respect to average concentration in well water		Comparison of increase or decrease of average concentrations in effluent
	Septic tank	Aeration tank	
Biochemical oxygen demand-------------	Increase	Increase	Increase was about 1.8 times greater in septic-tank effluent.
Detergents-----------	Increase	Increase	Increase was about 8.4 times greater in septic-tank effluent.
Dissolved oxygen------	Decrease	Decrease	Decrease was about 47 times greater in septic-tank effluent.
Nitrite, dissolved----	Increase	Increase	Increase was about 160 times greater in aeration-tank effluent.
Nitrate, dissolved----	Decrease[1]	Increase[2]	-----------
Sulfate, dissolved----	Increase	Increase	Increase was about 3.2 times greater in aeration-tank effluent.
Dissolved solids------	Increase	Increase	Increase was about 1.3 times greater in aeration-tank effluent.

[1]Average concentration in effluent will decrease about 58 times.
[2]Average concentration in effluent will increase about 4.3 times.

The effluent from soil-absorption fields associated with the two systems also was compared. Ideally, because the soil-absorption fields function as aerobic systems, the following changes in the characteristics of the effluent from the two systems should occur:

1. Biochemical oxygen demand should decrease in both systems because of the additional oxygen available for use by bacteria. The decrease should be greater in septic systems because of the change from anaerobic conditions in treatment tanks to aerobic conditions in soil-absorption fields. However, the biochemical oxygen demand should still be greater in septic systems because of the larger concentration of undigested wastes entering soil-absorption fields.

2. Detergent concentrations should decrease in both systems as bacterial digestion continues and filtration occurs. The decrease should be greatest in septic systems because of the change from anaerobic conditions in treatment tanks to aerobic conditions in soil-absorption fields. However, detergent concentrations should still be greater in septic systems because of the larger concentration of undigested detergents entering soil-absorption fields.

3. Dissolved-oxygen concentrations should increase in septic systems as the effluent absorbs oxygen from the air. Dissolved-oxygen concentrations should decrease in aeration systems because the effluent is not being mechanically aerated in soil-absorption fields. However, dissolved-oxygen concentrations should still be greater in aeration systems because of the lack of dissolved oxygen in the effluent entering soil-absorption fields from septic tanks and because biochemical oxygen demand is greater in septic systems.

4. Dissolved-nitrite concentrations should increase in septic systems because additional oxygen is available for bacterial digestion of wastes containing nitrogen compounds. Nitrite concentrations should decrease in aeration systems as bacterial digestion of wastes continues or is completed.

5. Dissolved-nitrate concentrations should increase in both systems as bacterial digestion of wastes continues. Nitrate concentrations should still be the same or greater in aeration systems depending on how much nitrate is formed in the septic system soil-absorption field; if wastewater residence times are short in the field, nitrate formation may be limited. Because nitrate does not readily combine with other constituents to form compounds that may precipitate or be filtered out of the effluent (Polkowski and Boyle, 1970; Elliot and McCalla, 1973), nitrate concentration, if not used by plants growing over the field, generally does not decrease as the effluent moves thorugh soil-absorption fields.

6. Dissolved-sulfate concentrations initially should increase in both systems. As bacterial digestion of wastes continues, small sulfur-containing molecules are released. Concentrations should then decrease as compounds either are incorporated in biological organisms or are filtered out of the effluent as it moves through soil-absorption fields. Dissolved-sulfate concentrations should still be equal or greater in aeration systems because of the larger concentrations entering soil-absorption fields, and the possibility of short wastewater residence times.

7. Dissolved solids in both systems generally are increased by solubilization, oxidation, and hydrolysis, or by evaporation, although dissolved-solids concentrations may be decreased by filtration, consumption in biological metabolism, or by incorporation into biological organisms. Dissolved-solids concentrations should still be greater in aeration systems because of the larger concentrations entering soil-absorption fields.

Results of the comparisons for effluent from the soil-absorption fields are presented in table 5. The results, with the exception of the average concentration of dissolved oxygen in effluent from aeration systems, are consistent with the expected functioning of the soil-absorption fields. Insufficient data were available on dissolved-oxygen concentrations in effluent from aeration systems, so conclusions cannot be made with any certainty.

SUMMARY

The effects on ground-water quality of residential wastewater-treatment systems were determined in representative parts (0.25-mi^2 areas) of Evergreen Meadows, Marshdale, and Herzman Mesa. Ground-water quality is degraded to some extent in all the communities. Age of community; average lot size; slope of land surface; composition, permeability, and thickness of surficial material; density, size, and orientation of bedrock fractures; maintenance of wastewater-treatment systems; and presence of animals are factors possibly contributing to the degradation of ground-water quality.

Ground water in Evergreen Meadows, the youngest community (subdivided in 1969) and the community with the largest average lot size (3.5 acres), contains the smallest chemical and bacterial concentrations and is most suitable for use as a source of drinking water. Disinfection of the water to avoid bacterial contamination probably is not warranted at this time (1979). However, the potential for increases in chemical and bacterial concentrations in the ground water is indicated on the basis of the small average slope of the land surface and the composition, permeability, and thickness of surficial material.

On the basis of the chemical and bacterial quality of the ground water in Marshdale, the oldest community (subdivided in 1923) and the community with the smallest average lot size (1.2 acres), disinfection of the water to avoid bacterial contamination may be warranted, particularly in the area immediately northeast of State Highway 73. Bacterial contamination was the only major water-quality problem identified in Marshdale during the study.

On the basis of chemical and bacterial quality, the ground water in Herzman Mesa, the community of intermediate age (subdivided in 1946) and intermediate average lot size (1.9 acres), is the least suitable for use as drinking water, especially in the north-central and northwestern parts of the area. Because bacteria were found in the ground water in several parts of the area, disinfection of the water to avoid bacterial contamination may be warranted throughout the area. Concentrations of dissolved nitrite plus nitrate exceeded the Colorado mandatory drinking-water standard of 10 mg/L as nitrogen in water from three wells located in the north-central and northwestern parts of the area.

Table 5.--*Comparison between average concentrations of selected constituents in effluent from soil-absorption fields*

Constituent	Change in average concentration in effluent from soil-absorption fields with respect to average concentration in treatment-tank effluent		Comparison of increase or decrease of average concentrations in effluent
	Septic-system field	Aeration-system field	
Biochemical oxygen demand------------	Decrease	Decrease	Decrease was about 1.8 times greater in septic-system effluent. Average concentration greater in septic-system effluent.
Detergents----------	Decrease	Decrease	Decrease was about 9.3 times greater in septic-system effluent. Average concentration greater in septic-system effluent.
Dissolved oxygen----	Increase[1]	(2)	Insufficient data.
Nitrite, dissolved--	Increase[3]	Decrease[4]	Average concentration still greater in aeration-system effluent.
Nitrate, dissolved--	Increase	Increase	Increase was about 11 times greater in aeration-system effluent. Average concentration still greater in aeration-system effluent.
Sulfate, dissolved--	Decrease	Decrease	Decrease was about 2.6 times greater in aeration-system effluent. Average concentration still greater in aeration-system effluent.
Dissolved solids----	Increase	Increase	Increase was about 7.4 times greater in aeration-system effluent. Average concentration still greater in aeration-system effluent.

[1]Average concentration increased about 2.0 times.
[2]Insufficient data.
[3]Average concentration increased about 4.9 times.
[4]Average concentration decreased about 7.5 times.

Concentrations of selected chemical constituents in effluent from treatment tanks and from soil-absorption fields were used to compare septic and aeration systems, the two principal types of residential wastewater-treatment systems in the study area. Results of the comparison for effluent from treatment tanks were consistent with expected results, based on the processes by which the two systems function. Anaerobic treatment of wastes in septic tanks is characterized by greater biochemical oxygen demand and greater concentrations of detergents resulting from incomplete biological digestion of wastes. Aerobic treatment of wastes in aeration tanks is characterized by greater concentrations of dissolved oxygen, nitrite, nitrate, and sulfate that are produced during the biological digestion of wastes.

Results of the comparisons for effluent from the soil-absorption fields were consistent with the expected functioning of the aerobic soil-absorption fields. Biochemical oxygen demand, concentrations of detergents, and sulfate decreased in both systems. Concentrations of dissolved oxygen and nitrite increased in septic systems and decreased in aeration systems. Concentrations of nitrate increased in both systems. Concentrations of dissolved solids remained about the same in septic systems and increased in aeration systems.

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SUPPLEMENTAL DATA

Table 6.--*Analyses of selected constituents in well water*

EXPLANATION OF DATA

AQUIFER:

Holocene and Pleistocene
- ALFP (111ALFP)--Alluvium, flood plain
- VLFL (111VLFL)--Valley-fill deposits

Precambrian
- PCMBC (400 PCMBC)--Precambrian crystalline rock

IMMEDIATE AND FECAL COLIFORMS:
- BXXX--The number XXX was based on a non-ideal colony count

UNITS:
- Y-M-D--year-month-day
- MG/L--milligram per liter
- MICROMHOS--micromhos per centimeter at 25° Celsius
- COL. PER 100 ML--colonies per 100 milliliters

Table 6.--*Analyses of selected constituents in well water*--Continued

SITE NUMBER ON MAPS	LOCAL WELL NUMBER	SITE IDENTIFICATION NUMBER	AQUIFER	DATE OF SAMPLE (Y-M-D)	DIS-SOLVED CHLO-RIDE (CL) (MG/L)	DIS-SOLVED NITRATE (N) (MG/L)	DIS-SOLVED NITRITE (N) (MG/L)	DIS-SOLVED NITRATE PLUS NITRITE (N) (MG/L)	SPECIFIC CON-DUCT-ANCE (MICRO-MHOS)	IMMEDIATE COLI-FORM (COL. PER 100 ML)	FECAL COLI-FORM (COL. PER 100 ML)	METHYL-ENE BLUE ACTIVE SUB-STANCE (MG/L)
103	SC00507114CABC1	393655105183800	PCMBC	75-07-29	14	3.4	0.02	3.4	340	<1	<1	0.00
104	SC00507114CABC2	393656105183600	PCMBC	75-08-11	20	7.1	.01	7.1	400	<1	<1	.00
106	SC00507114CACA1	393651105183200	PCMBC	75-08-18	18	7.2	.01	7.2	420	<1	<1	.00
107	SC00507114CACA2	393651105183300	PCMBC	75-08-18	13	1.3	.05	1.4	320	<1	<1	.00
108	SC00507114CACA3	393651105182900	PCMBC	75-08-18	17	3.6	.02	3.6	360	<1	<1	.00
109	SC00507114CADC	393649105182800	PCMBC	75-08-11	23	6.7	.02	6.7	440	B15	<1	.65
114	SC00507114CBAA1	393658105183900	PCMBC	75-07-29	36	16	.01	16	540	<1	<1	.00
115	SC00507114CBAA2	393658105184100	PCMBC	75-07-23	27	9.3	.01	9.3	354	<1	<1	.00
118	SC00507114CBAC	393654105184200	PCMBC	75-07-25	21	4.1	.05	4.2	460	<1	<1	.00
119	SC00507114CBAD1	393656105183900	PCMBC	73-02-13	47	—	—	16	564	<1	<1	—
				75-07-23	41	9.1	.01	9.1	436	<1	<1	.00
120	SC00507114CBAD2	393656105183700	PCMBC	75-07-24	24	12	.01	12	420	<1	<1	.00
122	SC00507114CBBC	393656105185000	PCMBC	75-07-22	20	5.3	.01	5.3	344	<1	<1	.00
124	SC00507114CBBD	393655105184800	PCMBC	75-07-24	42	15	.14	15	460	<1	<1	.00
126	SC00507114CBCA	393653105184700	PCMBC	75-07-22	5.1	.95	.01	.96	320	<1	<1	.00
128	SC00507114CBCB	393653105185100	PCMBC	75-10-08	2.8	.48	.00	.48	350	[1] <1	[1] <1	.00
				76-09-27	—	—	—	—	340	—	—	—
129	SC00507114CBCD	393649105184900	PCMBC	75-07-22	7.4	1.5	.01	1.5	250	<1	<1	.00
130	SC00507114CBDA	393653105183900	PCMBC	75-08-04	49	5.0	.01	5.0	440	<1	<1	.00
131	SC00507114CBDB	393652105184000	PCMBC	75-10-29	21	3.8	.01	3.8	525	[1] <1	[1] <1	.00

Table 6.--*Analyses of selected constituents in well water*--Continued

SITE NUMBER ON MAPS	LOCAL WELL NUMBER	SITE IDENTIFICATION NUMBER	AQUIFER	DATE OF SAMPLE (Y-M-D)	DIS-SOLVED CHLORIDE (CL) (MG/L)	DIS-SOLVED NITRATE (N) (MG/L)	DIS-SOLVED NITRITE (N) (MG/L)	DIS-SOLVED NITRATE PLUS NITRITE (N) (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	IMMEDIATE COLIFORM (COL. PER 100 ML)	FECAL COLIFORM (COL. PER 100 ML)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
				76-09-28	–	–	–	–	500	–	–	–
133	SC00507114CBDC	393648105184200	PCMBC	75-07-28	5.1	1.6	0.00	1.6	300	<1	<1	0.00
135	SC00507114CCAB	393645105184500	PCMBC	75-07-23	20	6.2	.01	6.2	494	<1	<1	.00
136	SC00507114CCAD	393643105183700	PCMBC	75-12-01	33	2.7	.15	2.9	434	<1	<1	.00
137	SC00507114CCDA	393638105183900	PCMBC	75-12-01	7.5	.29	.00	.29	295	<1	<1	.00
138	SC00507114CCDB	393638105184300	PCMBC	73-02-06	4.1	–	–	.13	279	<1	<1	–
139	SC00507114CCDD	393637105183700	PCMBC	75-12-01	29	5.2	1.6	6.8	465	<1	<1	.03
140	SC00507114CDAA	393645105182000	PCMBC	75-08-13	15	3.6	.00	3.6	340	B8	<1	.00
141	SC00507114CDAB	393645105182600	PCMBC	75-08-12	8.9	1.3	.00	1.3	350	<1	<1	.00
143	SC00507114CDAD	393644105182100	PCMBC	73-02-06	5.7	–	–	1.7	284	<1	<1	.00
				75-08-13	7.4	2.0	.00	2.0	300	<1	<1	–
147	SC00507114CDCA	393639105183000	PCMBC	75-11-28	20	1.2	.01	1.2	440	<1	<1	.00
149	SC00507114CDCC1	393637105183300	PCMBC	75-11-28	17	2.3	.02	2.3	400	<1	<1	.00
150	SC00507114CDCC2	393635105183200	PCMBC	75-11-28	3.0	.48	.01	.49	315	<1	<1	.00
[2] 151	SC00507114DBBC	393656105181600	ALFP	73-02-06	21	–	–	.01	222	50	<1	–
[2] 152	SC00507114DBCC	393650105182600	PCMBC	75-08-14	16	1.2	.00	1.2	330	<1	<1	.00
201	SC00507123CCCC	393545105184800	PCMBC	75-11-25	8.2	.91	.00	.91	300	<1	<1	.00
202	SC00507123CCDD1	393544105183800	PCMBC	73-02-13	3.5	–	–	.39	241	<1	<1	–
				75-11-14	4.7	.63	.01	.64	225	B2	<1	.00
203	SC00507123CCDD2	393441105183700	PCMBC	75-11-25	.8	.21	.00	.21	245	<1	<1	.00

Table 6.--*Analyses of selected constituents in well water*--Continued

SITE NUMBER ON MAPS	LOCAL WELL NUMBER	SITE IDENTIFICATION NUMBER	AQUIFER	DATE OF SAMPLE (Y-M-D)	DISSOLVED CHLORIDE (CL) (MG/L)	DISSOLVED NITRATE (N) (MG/L)	DISSOLVED NITRITE (N) (MG/L)	DISSOLVED NITRATE PLUS NITRITE (N) (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	IMMEDIATE COLIFORM (COL. PER 100 ML)	FECAL COLIFORM (COL. PER 100 ML)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
204	SC00507123CDCB1	393545105183300	PCMBC	75-10-20	1.7	0.38	0.02	0.40	250	<1	<1	0.00
205	SC00507123CDCB2	393547105183500	PCMBC	75-11-14	2.7	.29	.00	.29	290	<1	<1	.00
206	SC00507126BAAA	393541105182100	PCMBC	73-03-07	2.1	–	–	.18	189	<1	<1	–
				75-11-25	1.6	.21	.00	.21	140	<1	<1	.00
207	SC00507126BAAB	393540105182700	PCMBC	75-08-07	1.5	.50	.01	.51	250	<1	<1	.00
211	SC00507126BAAD	393537105181900	PCMBC	75-12-07	1.1	.16	.01	.17	190	<1	<1	.00
213	SC00507126BABB	393540105183200	PCMBC	75-08-13	2.4	.33	.00	.33	220	<1	<1	.00
214	SC00507126BABC1	393537105183500	PCMBC	75-08-07	2.5	.34	.01	.35	235	<1	<1	.00
215	SC00507126BABC2	393536105183600	PCMBC	75-08-13	3.0	.38	.01	.39	230	<1	<1	.00
218	SC00507126BABD	393537105183100	PCMBC	75-08-06	2.6	.55	.01	.56	235	<1	<1	.00
220	SC00507126BACA	393535105183100	PCMBC	75-08-05	9.3	1.5	.00	1.5	300	<1	<1	.00
225	SC00507126BACC	393532105183500	PCMBC	75-08-06	11	1.4	.08	1.5	160	2	1	.06
227	SC00507126BACD	393532105183200	PCMBC	75-08-05	1.9	.35	.00	.35	260	<1	<1	.00
234	SC00507126BADA	393533105182200	PCMBC	75-11-27	1.0	.19	.00	.19	225	<1	<1	.00
235	SC00507126BADB1	393534105182500	PCMBC	75-10-30	.8	.13	.01	.14	225	5	<1	.00
236	SC00507126BADB2	393535105182500	PCMBC	75-11-06	–	.61	.00	.61	215	<1	<1	.00
				76-07-14	2.3	.62	.00	.62	220	[1,3] <1	[1,3] <1	.00
237	SC00507126BADC	393532105182600	PCMBC	75-08-11	2.3	.32	.01	.33	290	<1	<1	.00
238	SC00507126BADD	393532105181900	PCMBC	75-12-07	1.4	.39	.01	.40	230	<1	<1	.00
241	SC00507126BBAC	393532105184000	PCMBC	75-11-06	3.2	1.5	.00	1.5	290	<1	<1	.00

Table 6.--*Analyses of selected constituents in well water*--Continued

SITE NUMBER ON MAPS	LOCAL WELL NUMBER	SITE IDENTIFICATION NUMBER	AQUIFER	DATE OF SAMPLE (Y-M-D)	DISSOLVED CHLORIDE (CL) (MG/L)	DISSOLVED NITRATE (N) (MG/L)	DISSOLVED NITRITE (N) (MG/L)	DISSOLVED NITRATE PLUS NITRITE (N) (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	IMMEDIATE COLIFORM (COL. PER 100 ML)	FECAL COLIFORM (COL. PER 100 ML)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
[2] 243	SC00507126BBBC	393536105183400	VLFL	75-08-06	20	2.8	0.00	2.8	260	<1	<1	0.00
253	SC00507126BBDA	393532105183700	PCMBC	75-11-11	30	7.9	.01	7.9	425	[1] <1	[1] <1	.00
259	SC00507126BBDD1	393530105183600	PCMBC	75-08-06	13	2.8	.00	2.8	290	<1	<1	.00
260	SC00507126BBDD2	393529105183700	PCMBC	75-12-07	15	2.8	.01	2.8	265	<1	<1	.00
264	SC00507126BCAA	393528105183600	PCMBC	73-03-07	20	-	-	2.4	272	<1	<1	-
				75-07-24	21	2.6	.01	2.6	275	<1	<1	.00
265	SC00507126BDBA	393527105182800	PCMBC	75-11-03	4.4	.40	.00	.40	250	<1	<1	.00
266	SC00507126BDBB1	393528105183300	PCMBC	75-08-05	2.4	.88	.01	.89	250	<1	<1	.00
267	SC00507126BDBB2	393528105183500	PCMBC	75-08-06	6.0	1.5	.00	1.5	265	<1	<1	.00
270	SC00507126BDBD	393525105183200	PCMBC	75-12-07	8.8	3.8	.01	3.8	285	<1	<1	.00
[2] 271	SC00507127AAAA	393539105185500	ALFP	73-03-07	8.1	-	-	.34	235	<1	<1	-
301	SC00507134AAAB	393446105185600	PCMBC	75-07-29	2.2	.03	.01	.04	250	<1	<1	.00
303	SC00507134AAAD1	393445105185200	PCMBC	75-08-14	3.4	.34	.00	.34	180	<1	<1	.00
304	SC00507134AAAD2	393443105185400	PCMBC	75-10-22	2.3	.08	.00	.08	200	[1] <1	[1] <1	.00
				76-09-27	-	-	-	-	180	-	-	-
305	SC00507134AABC	393446105190600	PCMBC	75-08-04	1.6	.01	.00	.01	280	<1	<1	.00
306	SC00507134AABD	393446105190300	PCMBC	75-07-29	1.8	.07	.01	.08	250	<1	<1	.00
307	SC00507134AACA	393443105190200	PCMBC	73-03-08	2.1	-	-	.28	190	<1	<1	-
				75-08-14	2.7	.43	.00	.43	180	<1	<1	.00
308	SC00507134AACC	393438105190600	PCMBC	75-08-04	1.5	.10	.01	.11	250	<1	<1	.00

Table 6.--*Analyses of selected constituents in well water*--Continued

SITE NUMBER ON MAPS	LOCAL WELL NUMBER	SITE IDENTIFICATION NUMBER	AQUIFER	DATE OF SAMPLE (Y-M-D)	DIS-SOLVED CHLO-RIDE (CL) (MG/L)	DIS-SOLVED NITRATE (N) (MG/L)	DIS-SOLVED NITRITE (N) (MG/L)	DIS-SOLVED NITRATE PLUS NITRITE (N) (MG/L)	SPECI-FIC CON-DUCT-ANCE (MICRO-MHOS)	IMMEDI-ATE COLI-FORM (COL. PER 100 ML)	FECAL COLI-FORM (COL. PER 100 ML)	METHYL-ENE BLUE ACTIVE SUB-STANCE (MG/L)
310	SC00507134AACD	393438105190300	PCMBC	75-07-30	3.0	0.22	0.01	0.23	240	<1	<1	0.00
312	SC00507134AADB	393440105185700	PCMBC	75-07-30	3.2	.51	.02	.53	175	<1	<1	.00
313	SC00507134AADC	393437105190000	PCMBC	75-07-28	2.2	1.2	.01	1.2	200	<1	<1	.00
315	SC00507134ABAA	393445105191000	PCMBC	75-07-28	1.5	.00	.00	.00	290	<1	<1	.00
316	SC00507134ABAB	393447105191400	PCMBC	75-07-30	2.2	.15	.00	.15	240	<1	<1	.00
317	SC00507134ABAC	393446105191300	PCMBC	75-07-28	1.1	.01	.01	.02	250	<1	<1	.00
318	SC00507134ABAD	393442105191200	PCMBC	75-11-05	2.0	.01	.00	.01	260	[1] <1	[1] <1	.00
319	SC00507134ABBC	393444105192400	PCMBC	75-10-21	1.3	.01	.00	.01	260	[1] <1	[1] <1	.00
				76-09-27	—	—	—	—	250	—	—	—
320	SC00507134ABBD	393443105191900	PCMBC	75-08-05	.7	.02	.00	.02	230	<1	<1	.00
321	SC00507134ABCC	393436105192200	PCMBC	75-08-05	3.2	.82	.01	.83	230	<1	<1	.00
322	SC00507134ABDC	393438105191600	PCMBC	75-07-25	1.5	.08	.01	.09	200	<1	<1	.00
323	SC00507134ABDD	393438105192200	PCMBC	75-08-04	.9	.02	.00	.02	250	<1	<1	.00
324	SC00507134ACAA	393436105190800	PCMBC	75-07-25	3.6	.67	.01	.68	180	<1	<1	.00
325	SC00507134ACAB1	393436105191600	PCMBC	75-07-28	1.8	.37	.01	.38	205	<1	<1	.00
326	SC00507134ACAB2	393435105191200	PCMBC	75-10-14	5.8	.67	.00	.67	195	[1] <1	[1] <1	.00
				76-09-27	—	—	—	—	220	—	—	—
327	SC00507134ACBB	393435105192400	PCMBC	75-08-13	1.6	.14	.00	.14	240	<1	<1	.00
328	SC00507134ACBC	393433105192400	PCMBC	75-08-13	1.8	.25	.00	.25	200	<1	<1	.00
329	SC00507134ADCA	393429105190900	PCMBC	75-08-11	2.3	.04	.01	.05	300	<1	<1	.00

Table 6.--*Analyses of selected constituents in well water*--Continued

SITE NUMBER ON MAPS	LOCAL WELL NUMBER	SITE IDENTIFICATION NUMBER	AQUIFER	DATE OF SAMPLE (Y-M-D)	DIS-SOLVED CHLORIDE (CL) (MG/L)	DIS-SOLVED NITRATE (N) (MG/L)	DIS-SOLVED NITRITE (N) (MG/L)	DIS-SOLVED NITRATE PLUS NITRITE (N) (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	IMMEDIATE COLIFORM (COL. PER 100 ML)	FECAL COLIFORM (COL. PER 100 ML)	METHYLENE BLUE ACTIVE SUBSTANCE (MG/L)
330	SC00507134ACDB	393428105191500	PCMBC	73-03-08	3.6	—	—	0.46	178	<1	<1	—
				75-08-12	3.3	0.34	0.00	.34	240	<1	<1	0.00
332	SC00507134ADAA1	393437105185600	PCMBC	75-07-29	2.6	.84	.01	.85	200	<1	<1	.00
333	SC00507134ADAA2	393433105185400	PCMBC	75-08-18	2.6	.16	.01	.17	250	<1	<1	.00
334	SC00507134ADAC	393431105185800	PCMBC	75-07-25	1.9	.11	.01	.12	220	<1	<1	.00
336	SC00507134ADCB	393429105190700	PCMBC	75-08-07	2.2	.34	.01	.35	220	<1	<1	.00
337	SC00507134BDAA	393436105192600	PCMBC	75-08-06	1.4	.26	.00	.26	190	<1	<1	.00
338	SC00507134BDAD	393434105192700	PCMBC	75-08-12	1.9	.07	.00	.07	320	<1	<1	.00
339	SC00507134CBBD	393419105195100	PCMBC	73-03-09	2.0	-	-	.46	194	<1	<1	-
				75-11-12	2.3	.59	.00	.59	175	[1] 1	[1] <1	.00
				76-09-27	—	—	—	—	200	—	—	—
340	SC00507134DBDB	393415105191400	PCMBC	73-03-18	2.6	—	—	.22	219	<1	<1	—
[3] 341	SC00507135BCBD	393431105184700	PCMBC	73-03-08	2.3	—	—	.08	245	<1	<1	—
[2] 342	SC00507135CBBA	393420105184600	ALFP	73-03-09	8.1	—	—	1.7	185	B16	<1	—

[1] Laboratory determination by the Jefferson County Health Department.

[2] Data from this well not included in calculations of constituent ranges and mean for the three communities.

[3] Water samples for the bacterial analyses for well 236 were collected several days after July 14, 1976. The records were lost.

Table 7.--*Supplemental data for sites listed in table 6*

EXPLANATION OF DATA

DISTANCE WELL TO WASTE DISPOSAL SYSTEM--VERTICAL:
- xxu--Disposal system site is xx feet higher than the well site
- xxL--Disposal system site is xx feet lower than the well site

WASTE DISPOSAL TREATMENT SYSTEM--TYPE:
- AT--Aeration tank
- LF--Soil absorption field
- LW--Leaching well
- OH--Outhouse
- SF--Sand filter
- ST--Septic tank

ADDITIONAL COMMENTS:
- A--Animals about well site
- B--Gray water bypasses septic tank
- C--Well water is chlorinated
- E--These wells are located outside of the area of intensive study
- F--Well water is filtered
- G--Gray water is treated separately
- N--Well water not used for drinking or cooking
- $P\chi$--Water from χ number of wells is pooled
- $S\chi$--Well supplies water to χ number of dwellings
- T--Two waste treatment systems or absorption fields are in use
- W--Well water is softened

Table 7.--*Supplemental data for sites listed in table 6*--Continued

SITE NUMBER ON MAPS	WELL						DISTANCE WELL TO WASTE DISPOSAL SYSTEM		WASTE TREATMENT SYSTEM				ADDITIONAL COMMENTS
	PERMIT NUMBER	DEPTH (FEET)	DEPTH TO ROCK (FEET)	REPORTED DEPTH TO WATER (FEET)	YIELD (GALLONS PER MINUTE)	YEAR IN-STALLED	HORIZONTAL (FEET)	VERTICAL (FEET)	TYPE	TREATMENT TANK SIZE (GALLONS)	EST. SIZE OF FIELD (SQUARE FEET)	YEAR IN-STALLED	
103	–	250	70	–	2.5	74	96	5.2 D	OH	–	–	–	
104	–	–	–	–	–	–	50	9.7 D	ST-LF	–	600	–	
106	9172	180	5	41	.1	61	45	9.1 D	ST-LW	1000	–	–	
107	46891	130	2	42	3	71	135	13.9 D	ST-LW	1000	–	–	N
108	–	50	–	–	7	50	123	7.0 D	ST-LW	–	–	–	A
109	–	180	–	–	–	58	60	6.7 D	ST-LF	–	600	–	
114	50163	175	3	55	.7	71	60	4.5 D	ST-LF	–	600	70	
115	–	–	–	–	–	55	38	2.5 D	ST-LF	–	–	55	
118	46924	225	40	50	.4	71	57	9.5 D	ST-LF	600	970	60	P2, G
	–	90	–	–	.3	60	45	8.4 D	–	–	–		P2, G
119	–	127	–	–	1	53	115	8.0 D	ST-LF	1000	360	62	G, S2
120	–	109	–	–	6	55	64	4.8 D	ST-LF	–	–	55	
122	21067	275	28	102	.2	64	55	4.7 D	ST-LF	–	575	–	G
124	–	86	6	–	.5	56	79	9.8 D	ST-LF	900	500	60	
126	189	237	22	144	1.5	57	84	.2	ST-LF	500	1600	–	A
128	33694	240	0	70	.5	68	75	11.3 D	ST-LF	900	800	68	
129	–	–	–	–	2	73	166	16.9 D	ST-LF	–	1224	73	
130	–	–	–	–	–	–	40	3.5 D	ST-LF	–	–	–	
131	12303	178	24	–	.5	62	50	3.3 D	ST-LF	800	720	63	
133	31638	340	60	160	.5	67	93	3.9 D	ST-LF	750	675	60	A

Table 7.--*Supplemental data for sites listed in table 6*--Continued

SITE NUMBER ON MAPS	WELL						DISTANCE WELL TO WASTE DISPOSAL SYSTEM		WASTE TREATMENT SYSTEM				ADDITIONAL COMMENTS
	PERMIT NUMBER	DEPTH (FEET)	DEPTH TO ROCK (FEET)	REPORTED DEPTH TO WATER (FEET)	YIELD (GALLONS PER MINUTE)	YEAR IN-STALLED	HORIZONTAL (FEET)	VERTICAL (FEET)	TYPE	TREATMENT TANK SIZE (GALLONS)	EST. SIZE OF FIELD (SQUARE FEET)	YEAR IN-STALLED	
135	–	260	10	–	25	74	36	9.6 D	ST-LF	1300	–	52	A
136	–	90	–	–	–	52	135	9.5 D	ST-LF	–	1500	52	
137	14254	166	26	21	1	63	177	8.0 D	ST-LF	–	1500	56	
138	14202	113.5	3	44	1.5	63	45	–	ST-LF	–	–	63	
139	–	105	–	–	1	55	28	1.7 D	–	–	–	–	
140	17861	258	8	55	.7	63	66	11.5 D	ST-LF	1000	600	62	
141	2125	179	8	40	83	58	–	–	ST-LF	–	–	–	S5
143	–	100	–	–	–	60	90	1.7 D	ST-LF	1000	675	60	
147	–	100	–	–	–	–	110	12.4 D	ST-LF	500	1500	–	
149	–	131	–	–	.2	52	128	13.8 D	ST-LF	–	1100	–	
150	13001	232	0	–	3	62	118	16.2 D	ST-LF	–	1000	60	
151	–	20	–	–	–	–	200	U	ST-LF	–	–	63	
152	–	150	–	–	6	57	253	40.0 U	ST-LF	–	500	49	G, C
201	–	240	–	–	5	60	55	10.7 D	ST-LF	–	550	–	W
202	–	–	–	–	–	67	90	2.6 D	ST-LF	–	468	67	
203	–	475	–	–	3	73	136	9.0 D	ST-LF	–	950	45	
204	–	523	–	–	40	75	71	17.6 D	ST-LF	500	1500	75	G
205	50329	250	0	142	.5	71	112	8.8 D	ST-LF	–	1000	71	
206	574	118	3	82	1	57	150	35.4 D	ST-LW	–	–	57	
207	–	–	–	–	–	–	–	–	ST-LF	–	–	–	

Table 7.--*Supplemental data for sites listed in table 6*--Continued

SITE NUMBER ON MAPS	WELL						DISTANCE WELL TO WASTE DISPOSAL SYSTEM		WASTE TREATMENT SYSTEM				ADDITIONAL COMMENTS
	PERMIT NUMBER	DEPTH (FEET)	DEPTH TO ROCK (FEET)	REPORTED DEPTH TO WATER (FEET)	YIELD (GALLONS PER MINUTE)	YEAR IN-STALLED	HORIZONTAL (FEET)	VERTICAL (FEET)	TYPE	TREATMENT TANK SIZE (GALLONS)	EST. SIZE OF FIELD (SQUARE FEET)	YEAR IN-STALLED	
211	-	-	-	-	10	-	72	6.6 D	ST-LF	1000	1040	68	F
213	-	260	-	-	-	55	90	.3 U	ST-LF	1500	-	68	A
214	-	300	-	-	.5	-	70	9.5 D	ST-LF	-	480	72	A, G
215	42345	200	0	132	.6	70	75	7.7 D	ST-LF	500	400	70	
218	-	360	-	-	-	-	190	17.3 D	ST-LF	1250	470	75	
220	-	585	-	-	15	73	125	2.9 D	ST-LF	1000	500	68	
225	-	128	-	-	-	49	35	4.8 D	OH, ST-LF	-	-	-	C, S2
227	-	201	-	-	5	74	180	4.4 D	ST-LF	-	1500	65	A
234	-	-	-	-	-	74	121	16.0 D	ST-LF	-	715	-	
235	-	350	-	-	1	74	108	21.0 D	ST-SF	1000	3600	74	
236	-	325	-	-	-	63	299	20.2 D	ST-LF	1250	1320	74	T2, S3
237	-	383	-	-	1.2	75	60	2.5 D	ST-LF	-	-	63	
238	-	-	-	-	-	63	79	1.4 D	ST-LF	-	888	68	
241	-	-	-	-	-	74	75	.3 U	AT-LF	1200	3000	-	
243	41404	75	15	7	7	70	-	-	-	-	-	-	E, P3, C, T6, S6
	-	68	-	-	3	52	-	-	-	-	-	-	E, P3, C, T6, S6
	-	68	-	-	4	22	-	-	-	-	-	-	E, P3, C, T6, S6
253	41561	152	0	102	1.3	70	64	14.3 D	ST-LF	-	-	65	S2, G
259	-	105	-	-	7.5	54	20	.0	ST-LF-LW	2400	200	54	
260	-	200	-	-	1.5	60	118	19.7 D	ST-LF	-	1300	65	

Table 7.--*Supplemental data for sites listed in table 6*--Continued

SITE NUMBER ON MAPS	WELL						DISTANCE WELL TO WASTE DISPOSAL SYSTEM		WASTE TREATMENT SYSTEM				ADDITIONAL COMMENTS
	PERMIT NUMBER	DEPTH (FEET)	DEPTH TO ROCK (FEET)	REPORTED DEPTH TO WATER (FEET)	YIELD (GALLONS PER MINUTE)	YEAR IN-STALLED	HORIZONTAL (FEET)	VERTICAL (FEET)	TYPE	TREATMENT TANK SIZE (GALLONS)	EST. SIZE OF FIELD (SQUARE FEET)	YEAR IN-STALLED	
264	-	115	-	-	1	51	115	10.3 D	ST-LF	300	100	50	
265	-	253	-	-	1.5	66	103	21.0 D	ST-LF	1000	-	66	G
266	-	115	-	-	-	-	54	10.3 D	ST-LF	-	420	71	
267	63144	161	7	48	5	72	40	3.0 D	ST-LF	-	400	-	A, G, S2
270	-	350	-	-	2	72	96	3.4 D	ST-LF	1000	1180	62	
271	-	43	-	-	8	56	300	U	ST-LF	-	-	-	
301	-	-	-	-	-	73	-	-	ST-LF	-	-	73	
303	52942	160	20	60	3	72	166	.2 D	ST-LF	-	1680	72	
304	-	-	-	-	-	72	197	6.3 D	ST-LF	-	1000	72	F
305	62628	200	3	20	15	72	120	7.6 D	ST-LF	-	1600	72	
306	54874	320	8	18	4	72	182	10.3 D	ST-LF	1000	1650	73	
307	55248	116	8	30	4.5	72	133	8.2 D	ST-LF	-	1125	72	
308	54982	250	15	61	15	72	169	13.3 D	ST-LF	1000	1200	72	
310	53792	120	18	28	4	72	170	7.4 D	ST-LF	1000	750	72	
312	50533	100	1	10	6	71	165	8.7 D	ST-LF	-	1080	72	
313	-	130	-	-	6	73	97	11.1 D	ST-LF	1500	1490	74	
315	50863	140	3	5	15	72	140	12.5 D	ST-LF	500	1600	73	
316	49838	113	34	17	4	71	108	8.5 D	ST-LF	500	1200	71	
317	-	180	6	-	2.5	74	119	11.1 D	ST-LF	-	840	74	
318	-	-	-	-	7	72	230	7.8 D	AT-LF-SF	1000	1370	75	T2

Table 7.--*Supplemental data for sites listed in table 6*--Continued

SITE NUMBER ON MAPS	WELL						DISTANCE WELL TO WASTE DISPOSAL SYSTEM		WASTE TREATMENT SYSTEM				ADDITIONAL COMMENTS
	PERMIT NUMBER	DEPTH (FEET)	DEPTH TO ROCK (FEET)	REPORTED DEPTH TO WATER (FEET)	YIELD (GALLONS PER MINUTE)	YEAR IN-STALLED	HORIZONTAL (FEET)	VERTICAL (FEET)	TYPE	TREATMENT TANK SIZE (GALLONS)	EST. SIZE OF FIELD (SQUARE FEET)	YEAR IN-STALLED	
319	-	-	-	-	-	72	149	10.7 D	ST-SF	-	1000	73	
320	-	420	-	-	1	72	209	27.0 D	ST-LF	-	1500	73	
321	-	100	-	-	2.5	71	104	11.4 D	ST-LF	1000	1600	71	
322	-	160	-	-	6	74	104	16.6 D	ST-LF	1000	825	74	
323	-	210	-	-	3	74	135	10.6 D	ST-LF	1800	1800	74	
324	-	100	-	-	3	72	105	8.6 U	ST-LF	1500	1200	72	
325	-	100	-	-	8	72	115	9.3 D	ST-LF	-	750	72	
326	53790	180	15	39	3	72	120	7.1 D	ST-LF	900	800	73	
327	-	260	-	-	1.8	72	69	8.9 D	ST-LF	1000	-	72	
328	-	120	-	-	2.5	72	100	9.6 D	ST-LF	-	-	72	
329	-	221	-	-	3	73	175	12.4 D	ST-LF	1000	1080	73	
330	51800	100	0	28	4	72	225	14.3 D	ST-LF	1000	-	72	
332	-	80	10	-	6	72	120	9.0 D	ST-LF	-	950	72	
333	53791	160	10	20	3	72	120	1.8 D	ST-LF	-	840	72	
334	55323	120	15	20	15	72	195	12.1 D	ST-LF	800	720	73	
336	61283	120	5	50	3.5	72	150	9.6 D	ST-LF	1500	1200	73	
337	-	180	-	-	5.5	73	114	11.8 D	ST-LF	1000	480	73	
338	-	250	-	-	3	73	123	20.4 D	ST-LF	-	750	73	
339	44638	280	0	90	1	71	99	15.6 D	ST-LF	-	60	71	
340	-	140	-	-	2.5	71	110	-	ST-LF	-	-	72	

Table 7.--*Supplemental data for sites listed in table 6*--Continued

SITE NUMBER ON MAPS	WELL						DISTANCE WELL TO WASTE DISPOSAL SYSTEM		WASTE TREATMENT SYSTEM				ADDITIONAL COMMENTS
	PERMIT NUMBER	DEPTH (FEET)	DEPTH TO ROCK (FEET)	REPORTED DEPTH TO WATER (FEET)	YIELD (GALLONS PER MINUTE)	YEAR IN-STALLED	HORIZONTAL (FEET)	VERTICAL (FEET)	TYPE	TREATMENT TANK SIZE (GALLONS)	EST. SIZE OF FIELD (SQUARE FEET)	YEAR IN-STALLED	
341	—	110	—	—	2	68	50	0.0	AT-LF	—	—	72	
342	—	90	—	—	3	40	150	D	ST-LF	—	—	40	

Table 8.--*Analyses of water from wells and effluent from treatment tanks and soil-absorption fields*

EXPLANATION OF DATA

SITE NUMBERS ON MAPS AND LOCAL IDENTIFIER:
- A--Aeration tank
- L--Absorption field
- S--Septic tank

GEOLOGIC UNIT (Aquifer):
- 400 PCMBC--Precambrian crystalline rock

UNITS:
- MG/L--milligram per liter
- UG/L--microgram per liter
- MICROMHO--Micromho per centimeter at 25° Celsius
- DEG C--Degree Celsius
- COL. PER 100 ML--Colonies per 100 milliliters

Table 8.--*Analyses of water from wells and effluent from treatment tanks and soil-absorption fields*--Continued

SITE NO. ON MAPS	LOCAL IDENTIFIER	LAT-I-TUDE	LONGI-TUDE	SEQ. NO.	GEO-LOGIC UNIT	DATE OF SAMPLE	TIME	DIS-SOLVED SILICA (SIO2) (MG/L)	DIS-SOLVED IRON (FE) (UG/L)	DIS-SOLVED MAN-GANESE (MN) (UG/L)	DIS-SOLVED CAL-CIUM (CA) (MG/L)
401	SC00407120ABCB	39 41 32	105 21 30	00	400PCMBC	75-12-08	1530	--	--	--	--
402	SC00407120ACAD	39 41 24	105 21 18	00	400PCMBC	76-02-17	0930	--	--	--	--
403	SC00407120ACBB	39 41 27	105 21 29	00	400PCMBC	75-11-18	0930	21	0	0	39
	SC00407120ACBB-A	39 41 27	105 21 29	02	--	75-11-18	0930	26	260	60	39
128	SC00507114CBCB	39 36 53	105 18 51	00	400PCMBC	75-10-08	1030	14	80	10	44
					400PCMBC	76-09-27	0900	--	--	--	--
	SC00507114CBCB-L	39 36 53	105 18 51	01	--	75-10-08	1100	21	6900	3300	70
					--	75-10-29	1200	19	6900	4000	66
					--	76-07-20	0800	20	2800	750	52
	SC00507114CBCB-S	39 36 53	105 18 51	02	--	75-10-08	1100	16	290	60	54
131	SC00507114CBDB	39 36 52	105 18 40	00	400PCMBC	75-10-29	0900	12	70	10	69
					400PCMBC	76-09-28	0815	--	--	--	--
	SC00507114CBDB-S	39 36 52	105 18 40	02	--	75-11-04	1200	14	150	50	68
404	SC00507124DDBA	39 35 54	105 16 49	00	--	76-07-14	1020	22	120	--	30
	SC00507124DDBA-A	39 35 45	105 17 15	02	--	76-07-14	1020	28	160	60	36
236	SC00507126BADB2-S	39 35 35	105 18 25	02	--	76-07-14	0900	35	510	190	37
	SC00507126BADB2	39 35 35	105 18 25	00	400PCMBC	75-11-06	1015	--	--	--	--
					400PCMBC	76-07-14	0900	27	90	10	27
253	SC00507126BBDA	39 35 32	105 18 37	00	400PCMBC	75-11-11	0930	23	2500	20	50
	SC00507126BBDA-L	39 35 32	105 18 37	01	--	76-07-28	1030	19	4000	2000	34
304	SC00507134AAAD2	39 34 43	105 18 54	00	400PCMBC	75-10-22	1000	18	370	210	21
					400PCMBC	76-09-27	0945	--	--	--	--
	SC00507134AAAD2-L	39 34 43	105 18 54	01	--	75-10-30	1300	34	8800	5900	75
					--	76-07-20	0930	46	10000	2600	42
	SC00507134AAAD2-S	39 34 43	105 18 54	02	--	75-10-22	1000	34	480	210	12
318	SC00507134ABAD	39 34 42	105 19 12	00	400PCMBC	75-11-05	0930	14	30	30	32
	SC00507134ABAD-A	39 34 42	105 19 12	02	--	75-11-05	0930	21	100	10	33
319	SC00507134ABBC	39 34 44	105 19 24	00	400PCMBC	75-10-21	1030	17	10	10	35
					400PCMBC	76-09-27	1615	--	--	--	--
	SC00507134ABBC-L	39 34 44	105 19 24	01	--	75-10-21	1030	31	780	80	110
					--	76-07-20	1000	33	130	250	130
326	SC00507134ACAB2	39 34 35	105 19 12	00	400PCMBC	75-10-14	1050	21	40	10	22
					400PCMBC	76-09-27	1015	--	--	--	--
	SC00507134ACAB2-S	39 34 35	105 19 12	02	--	75-10-14	1050	24	150	20	45
339	SC00507134CBBD	39 34 19	105 19 51	00	400PCMBC	73-03-09	1300	--	--	--	--
					400PCMBC	75-11-12	1000	26	40	10	24
					400PCMBC	76-09-27	1030	--	--	--	--
	SC00507134CBBD-S	39 34 19	105 19 51	02	--	75-11-12	1000	27	110	50	23
	SC00507134CBBD-L	39 34 19	105 19 51	01	--	75-11-12	1000	32	90	880	37
					--	76-07-20	1100	40	670	1800	67

Table 8.--*Analyses of water from wells and effluent from treatment tanks and soil-absorption fields*--Continued

SITE NO. ON MAPS	LOCAL IDENTIFIER	LAT-I-TUDE	LONGI-TUDE	SEQ. NO.	GEO-LOGIC UNIT	DATE OF SAMPLE	TIME	DIS-SOLVED SILICA (SIO2) (MG/L)	DIS-SOLVED IRON (FE) (UG/L)	DIS-SOLVED MAN-GANESE (MN) (UG/L)	DIS-SOLVED CAL-CIUM (CA) (MG/L)
405	SC00607016ADCA	39 31 50	105 13 33	00	400PCMBC	76-07-13	1025	30	120	0	18
	SC00607016ADCA-A	39 31 50	105 13 33	02	--	76-07-13	1025	34	300	170	23
	SC00607016ADCA-L	39 31 50	105 13 33	01	--	76-07-13	1025	40	590	1600	32
406	SC00607016ADCC	39 31 44	105 13 40	00	400PCMBC	76-08-10	0900	19	40	120	31
	SC00607016ADCC-A	39 31 44	105 13 40	02	--	76-08-10	1000	24	770	220	47
	SC00607016ADCC-L	39 31 44	105 13 40	01	--	76-08-10	0940	91	120	3600	150
407	SC00607016BBAA	39 32 07	105 14 17	00	400PCMBC	75-11-05	1200	24	20	20	18
	SC00607016BBAA-A	39 32 07	105 14 17	02	--	75-11-11	1130	20	730	90	22
408	SC00607016BBAB	39 32 09	105 14 20	00	400PCMBC	75-12-08	1415	--	--	--	--
409	SC00607016BBAD	39 32 04	105 14 19	00	400PCMBC	75-12-08	1330	--	--	--	--
410	SC00607016DABB	39 31 43	105 13 37	00	400PCMBC	76-08-10	1040	21	30	60	42
	SC00607016DABB-A	39 31 43	105 13 37	02	--	76-08-10	1110	26	100	90	48

Table 8.--*Analyses of water from wells and effluent from treatment tanks and soil-absorption fields*--Continued

SITE NO. ON MAPS	LOCAL IDENTIFIER	DATE OF SAMPLE	DIS-SOLVED MAG-NE-SIUM (MG) (MG/L)	DIS-SOLVED SODIUM (NA) (MG/L)	DIS-SOLVED PO-TAS-SIUM (K) (MG/L)	BICAR-BONATE (HCO3) (MG/L)	CAR-BONATE (CO3) (MG/L)	ALKA-LINITY AS CACO3 (MG/L)	DIS-SOLVED SULFATE (SO4) (MG/L)	DIS-SOLVED CHLO-RIDE (CL) (MG/L)	DIS-SOLVED FLUO-RIDE (F) (MG/L)
401	SC00407120ABCB	75-12-08	--	--	--	--	--	--	--	50	--
402	SC00407120ACAD	76-02-17	--	--	--	--	--	--	--	2.4	--
403	SC00407120ACBB	75-11-18	6.3	9.2	3.9	152	--	125	15	2.8	.3
	SC00407120ACBB-A	75-11-18	7.1	91	20	370	--	303	140	31	.3
128	SC00507114CBCB	75-10-08	7.6	15	1.4	203	--	167	11	2.8	.2
		76-09-27	--	--	1.1	--	--	--	--	--	--
	SC00507114CBCB-L	75-10-08	15	72	20	562	--	461	4.4	58	.4
		75-10-29	16	72	23	362	--	297	18	61	.5
		76-07-20	12	87	25	623	--	511	4.8	97	.3
	SC00507114CBCB-S	75-10-08	13	60	25	602	--	494	8.2	55	.2
131	SC00507114CBDB	75-10-29	12	17	1.9	243	--	199	13	21	1.0
		76-09-28	--	--	1.9	--	--	--	--	--	--
	SC00507114CBDB-S	75-11-04	13	40	11	403	--	331	2.9	39	.8
404	SC00507124DDBA	76-07-14	6.9	13	--	154	--	126	6.9	5.7	.3
	SC00507124DDBA-A	76-07-14	8.2	51	12	222	--	182	40	18	.3
236	SC00507126BADB2-S	76-07-14	7.4	40	15	295	--	242	7.4	18	.3
	SC00507126BADB2	75-11-06	--	--	--	--	--	--	--	--	--
		76-07-14	5.0	8.7	1.3	128	--	105	5.2	2.3	.3
253	SC00507126BBDA	75-11-11	9.3	13	1.0	142	--	116	13	30	.3
	SC00507126BBDA-L	76-07-28	8.7	29	5.6	144	--	118	16	33	.6
304	SC00507134AAAD2	75-10-22	5.4	10	1.0	114	--	94	7.0	2.3	.4
		76-09-27	--	--	1.0	--	--	--	--	--	--
	SC00507134AAAD2-L	75-10-30	19	92	7.0	518	--	425	1.2	26	.5
		76-07-20	11	110	5.4	429	--	352	2.2	31	.6
	SC00507134AAAD2-S	75-10-22	5.5	120	8.0	256	--	210	90	21	.4
318	SC00507134ABAD	75-11-05	6.9	17	1.1	160	--	131	4.7	2.0	1.7
	SC00507134ABAD-A	75-11-05	7.9	110	14	137	--	112	68	37	1.7
319	SC00507134ABBC	75-10-21	7.8	12	1.0	169	--	139	2.3	1.3	.7
		76-09-27	--	--	1.0	--	--	--	--	--	--
	SC00507134ABBC-L	75-10-21	9.2	54	5.9	266	--	218	38	26	.3
		76-07-20	14	54	11	464	--	381	18	26	.3
326	SC00507134ACAB2	75-10-14	5.0	10	.8	92	--	75	14	5.8	.5
		76-09-27	--	--	.8	--	--	--	--	--	--
	SC00507134ACAB2-S	75-10-14	6.4	53	9.0	249	--	204	22	28	.5
339	SC00507134CBBD	73-03-09	--	--	.9	--	--	--	--	2.0	--
		75-11-12	4.5	10	.8	108	--	89	5.5	2.3	.3
		76-09-27	--	--	.8	--	--	--	--	--	--
	SC00507134CBBD-S	75-11-12	5.3	27	6.1	99	--	81	19	16	.3
	SC00507134CBBD-L	75-11-12	8.2	37	.9	205	--	168	15	20	.2
		76-07-20	18	65	1.3	407	--	334	4.4	45	.2

Table 8.--*Analyses of water from wells and effluent from treatment tanks and soil-absorption fields*--Continued

SITE NO. ON MAPS	LOCAL IDENTIFIER	DATE OF SAMPLE	DIS-SOLVED MAG-NE-SIUM (MG) (MG/L)	DIS-SOLVED SODIUM (NA) (MG/L)	DIS-SOLVED PO-TAS-SIUM (K) (MG/L)	BICAR-BONATE (HCO3) (MG/L)	CAR-BONATE (CO3) (MG/L)	ALKA-LINITY AS CACO3 (MG/L)	DIS-SOLVED SULFATE (SO4) (MG/L)	DIS-SOLVED CHLO-RIDE (CL) (MG/L)	DIS-SOLVED FLUO-RIDE (F) (MG/L)
405	SC00607016ADCA	76-07-13	2.6	12	.8	100	--	82	3.7	.8	.2
	SC00607016ADCA-A	76-07-13	3.4	30	8.2	270	--	221	12	18	.3
	SC00607016ADCA-L	76-07-13	7.0	40	31	227	--	186	19	24	.4
406	SC00607016ADCC	76-08-10	4.3	12	1.9	120	0	98	30	4.6	.3
	SC00607016ADCC-A	76-08-10	8.2	98	24	394	0	323	81	50	.2
	SC00607016ADCC-L	76-08-10	28	110	27	10	0	8	59	43	.1
407	SC00607016BBAA	75-11-05	4.0	12	.7	94	--	77	4.3	1.7	.7
	SC00607016BBAA-A	75-11-11	6.0	51	25	106	--	87	28	54	.8
408	SC00607016BBAB	75-12-08	--	--	--	--	--	--	--	.8	--
409	SC00607016BBAD	75-12-08	--	--	--	--	--	--	--	6.5	--
410	SC00607016DABB	76-08-10	4.0	9.8	1.4	158	0	130	6.9	1.6	.5
	SC00607016DABB-A	76-08-10	5.2	77	13	212	0	174	64	24	.5

Table 8.--*Analyses of water from wells and effluent from treatment tanks and soil-absorption fields*--Continued

SITE NO. ON MAPS	LOCAL IDENTIFIER	DATE OF SAMPLE	DIS-SOLVED NITRITE (N) (MG/L)	DIS-SOLVED NITRITE PLUS NITRATE (N) (MG/L)	DIS-SOLVED ORTHO. PHOS-PHORUS (P) (MG/L)	DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) (MG/L)	HARD-NESS (CA,MG) (MG/L)	NON-CAR-BONATE HARD-NESS (MG/L)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)
401	SC00407120ABCB	75-12-08	.10	1.2	--	--	--	--	600	--	--
402	SC00407120ACAD	76-02-17	.00	1.2	--	--	--	--	245	--	--
403	SC00407120ACBB	75-11-18	.00	.83	.01	177	120	0	260	--	--
	SC00407120ACBB-A	75-11-18	.01	.07	10	568	130	0	978	--	13.0
128	SC00507114CBCB	75-10-08	.00	.48	.03	201	140	0	350	--	--
		76-09-27	--	--	--	--	--	--	340	--	--
	SC00507114CBCB-L	75-10-08	.01	.02	1.2	552	240	0	950	--	9.0
		75-10-29	.01	.03	.40	466	230	0	950	--	9.0
		76-07-20	.01	.35	5.5	627	180	0	1310	--	12.0
	SC00507114CBCB-S	75-10-08	.01	.01	11	563	190	0	1145	--	--
131	SC00507114CBDB	75-10-29	.01	3.8	.00	286	220	23	525	--	--
		76-09-28	--	--	--	--	--	--	500	--	--
	SC00507114CBDB-S	75-11-04	.01	.05	2.9	399	220	0	780	--	12.5
404	SC00507124DDBA	76-07-14	.00	.56	.04	167	100	0	260	--	--
	SC00507124DDBA-A	76-07-14	2.1	3.7	12	357	120	0	510	--	25.0
236	SC00507126BADB2-S	76-07-14	.01	.12	8.8	334	120	0	626	--	18.0
	SC00507126BADB2	75-11-06	.00	.61	--	--	--	--	215	--	--
		76-07-14	.00	.62	.05	144	88	0	220	--	--
253	SC00507126BBDA	75-11-11	.01	7.9	.04	250	160	47	425	--	--
	SC00507126BBDA-L	76-07-28	.06	3.1	.04	237	120	3	381	--	14.5
304	SC00507134AAAD2	75-10-22	.00	.08	.00	124	75	0	200	--	--
		76-09-27	--	--	--	--	--	--	180	--	--
	SC00507134AAAD2-L	75-10-30	.01	.01	.21	525	270	0	840	--	--
		76-07-20	.00	.07	3.6	484	150	0	765	--	10.0
	SC00507134AAAD2-S	75-10-22	.01	.02	25	495	53	0	725	--	--
318	SC00507134ABAD	75-11-05	.00	.01	.00	159	110	0	260	--	--
	SC00507134ABAD-A	75-11-05	.34	15	34	527	120	3	700	--	17.0
319	SC00507134ABBC	75-10-21	.00	.01	.00	161	120	0	260	--	--
		76-09-27	--	--	--	--	--	--	250	--	--
	SC00507134ABBC-L	75-10-21	.05	36	11	600	310	94	880	--	12.0
		76-07-20	.59	20	11	638	380	2	950	--	13.0
326	SC00507134ACAB2	75-10-14	.00	.67	.18	131	76	0	195	--	--
		76-09-27	--	--	--	--	--	--	220	--	--
	SC00507134ACAB2-S	75-10-14	.00	.06	13	351	140	0	580	--	21.0
339	SC00507134CBBD	73-03-09	--	.46	--	--	--	--	194	--	--
		75-11-12	.00	.59	.06	131	78	0	175	--	--
		76-09-27	--	--	--	--	--	--	200	--	--
	SC00507134CBBD-S	75-11-12	.00	.00	4.0	185	79	0	310	--	17.0
	SC00507134CBBD-L	75-11-12	.04	.69	.74	272	130	0	385	--	7.0
		76-07-20	.01	.25	.48	447	240	0	740	--	11.0

Table 8.--*Analyses of water from wells and effluent from treatment tanks and soil-absorption fields*--Continued

SITE NO. ON MAPS	LOCAL IDENTIFIER	DATE OF SAMPLE	DIS-SOLVED NITRITE (N) (MG/L)	DIS-SOLVED NITRITE PLUS NITRATE (N) (MG/L)	DIS-SOLVED ORTHO. PHOS-PHORUS (P) (MG/L)	DIS-SOLVED SOLIDS (SUM OF CONSTI-TUENTS) (MG/L)	HARD-NESS (CA,MG) (MG/L)	NON-CAR-BONATE HARD-NESS (MG/L)	SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS)	PH (UNITS)	TEMPER-ATURE (DEG C)
405	SC00607016ADCA	76-07-13	.00	.20	.04	124	56	0	160	--	--
	SC00607016ADCA-A	76-07-13	.12	.60	7.3	287	71	0	542	--	23.0
	SC00607016ADCA-L	76-07-13	1.5	26	12	460	110	0	685	--	17.0
406	SC00607016ADCC	76-08-10	.49	3.9	.09	201	95	0	285	6.2	--
	SC00607016ADCC-A	76-08-10	.05	.30	17	581	150	0	950	7.2	16.0
	SC00607016ADCC-L	76-08-10	.11	180	.88	1320	490	480	1700	6.8	12.0
407	SC00607016BBAA	75-11-05	.00	.05	.01	114	62	0	155	--	--
	SC00607016BBAA-A	75-11-11	.01	.05	8.1	285	80	0	800	--	8.8
408	SC00607016BBAB	75-12-08	.00	.14	--	--	--	--	140	--	--
409	SC00607016BBAD	75-12-08	.00	3.4	--	--	--	--	315	--	--
410	SC00607016DABB	76-08-10	.00	.45	.04	170	120	0	256	7.2	--
	SC00607016DABB-A	76-08-10	3.4	9.7	15	451	140	0	600	7.5	21.0

Table 8.--*Analyses of water from wells and effluent from treatment tanks and soil-absorption fields*--Continued

SITE NO. ON MAPS	LOCAL IDENTIFIER	DATE OF SAMPLE	IMME-DIATE COLI-FORM (COL. PER 100 ML)	FECAL COLI-FORM (COL. PER 100 ML)
401	SC00407120ABCB	75-12-08	<1	<1
402	SC00407120ACAD	76-02-17	<1	<1
403	SC00407120ACBB	75-11-18	--	--
	SC00407120ACBB-A	75-11-18	--	--
128	SC00507114CBCB	75-10-08	--	--
		76-09-27	--	--
	SC00507114CBCB-L	75-10-08	--	--
		75-10-29	--	--
		76-07-20	--	--
	SC00507114CBCB-S	75-10-08	--	--
131	SC00507114CBDB	75-10-29	--	--
		76-09-28	--	--
	SC00507114CBDB-S	75-11-04	--	--
404	SC00507124DDBA	76-07-14	--	--
	SC00507124DDBA-A	76-07-14	--	--
236	SC00507126BADB2-S	76-07-14	--	--
	SC00507126BADB2	75-11-06	<1	<1
		76-07-14	--	--
253	SC00507126BBDA	75-11-11	--	--
	SC00507126BBDA-L	76-07-28	--	--
304	SC00507134AAAD2	75-10-22	--	--
		76-09-27	--	--
	SC00507134AAAD2-L	75-10-30	--	--
		76-07-20	--	--
	SC00507134AAAD2-S	75-10-22	--	--
318	SC00507134ABAD	75-11-05	--	--
	SC00507134ABAD-A	75-11-05	--	--
319	SC00507134ABBC	75-10-21	--	--
		76-09-27	--	--
	SC00507134ABBC-L	75-10-21	--	--
		76-07-20	--	--
326	SC00507134ACAB2	75-10-14	--	--
		76-09-27	--	--
	SC00507134ACAB2-S	75-10-14	--	--
339	SC00507134CBBD	73-03-09	<1	<1
		75-11-12	--	--
		76-09-27	--	--
	SC00507134CBBD-S	75-11-12	--	--
	SC00507134CBBD-L	75-11-12	--	--
		76-07-20	--	--

Table 8.--*Analyses of water from wells and effluent from treatment tanks and soil-absorption fields*--Continued

SITE NO. ON MAPS	LOCAL IDENTIFIER	DATE OF SAMPLE	IMMEDIATE COLIFORM (COL. PER 100 ML) (31501)	FECAL COLIFORM (COL. PER 100 ML) (31616)
405	SC00607016ADCA	76-07-13	--	--
	SC00607016ADCA-A	76-07-13	--	--
	SC00607016ADCA-L	76-07-13	--	--
406	SC00607016ADCC	76-08-10	--	--
	SC00607016ADCC-A	76-08-10	--	--
	SC00607016ADCC-L	76-08-10	--	--
407	SC00607016BBAA	75-11-05	--	--
	SC00607016BBAA-A	75-11-11	--	--
408	SC00607016BBAB	75-12-08	<1	<1
409	SC00607016BBAD	75-12-08	<1	<1
410	SC00607016DABB	76-08-10	--	--
	SC00607016DABB-A	76-08-10	--	--

Table 9.--*Analyses by the Jefferson County Department of Health of water from wells and effluent from treatment tanks and soil-absorption fields*

EXPLANATION OF DATA

SITE NUMBER ON MAPS:
- A--Aeration tank effluent
- L--Soil absorption field leachate
- S--Septic tank effluent
- SF--Sand filter leachate
- T--Soil absorption trench leachate
- W--Domestic well water

DETERGENT:
- MBAS--Methylene blue active substance

UNITS:
- °C--degree Celsius
- Y-M-D--year-month-day
- MG/L--milligram per liter
- FTU--formazin turbidity units
- COL. PER 100 ML--colonies per 100 milliliters

Table 9.--*Analyses by the Jefferson County Department of Health of water from wells and effluent from treatment tanks and soil-absorption fields*--Continued

SITE NUMBER ON MAPS	DATE OF SAMPLE (Y-M-D)	DISSOLVED CHLORIDE (CL) (MG/L)	DISSOLVED NITRATE (N) (MG/L)	DISSOLVED NITRITE (N) (MG/L)	TOTAL SOLIDS, RESIDUE AT 103°C (MG/L)	SUSPENDED SOLIDS, RESIDUE AT 20°C (MG/L)	SETTLEABLE SOLIDS (MG/L)	TURBIDITY (FTU)	DISSOLVED OXYGEN (DO) (MG/L)	CHEMICAL OXYGEN DEMAND (COD) 0.025 *N* K_2CrO_7 (MG/L)	BIOCHEMICAL OXYGEN DEMAND (BOD), 5-DAY, 20°C (MG/L)	IMMEDIATE COLIFORM (COL. PER 100 ML)	COLIFORM, MPN, CONFIRMED (COL. PER 100 ML)	FECAL COLIFORM (COL. PER 100 ML)	FECAL COLIFORM, MPN (COL. PER 100 ML)	DETERGENT (MBAS) (MG/L)	OIL AND GREASE, TOTAL (MG/L)
128-W	75-10-08	–	0.00	–	219	3	<0.1	1.0	–	< 35	0.6	< 1	–	< 1	–	0.00	–
S	75-10-08	–	.09	–	1490	790	24	100	–	1390	884	970,000	460,000	190,000	460,000	3.40	63.3
L	75-10-08	–	.04	–	550	88	.3	35	–	117	28	–	43		9	.20	11.9
L	75-10-28	–	.00	–	423	120	.5	85	–	148	44	–	4300		1500	.80	3.1
L	76-07-20	88.7	.10	0.01	5250	3490	30	–	0.2	1550	150	–	7500		1500	.00	–
131-W	75-10-29	–	3.67	–	388	20	< .1	2.5	5.1	–	–	–	–	–	–	.00	–
W	75-11-13	–	–	–	–	–	–	–	–	–	–	< 1	–	< 1	–	–	–
S	75-11-04	–	.00	–	599	124	.6	9.5	–	388	158	450,000	9000	3000	9000	1.76	15.2
L	Dry hole																
236-W	76-07-14	2.1	.6	.00	143	2	< .1	–	4.1	–	–	–	–	–	–	.00	–
W	[1] 76-07-21	–	–	–	–	–	–	–	–	–	–	< 1	–	< 1	–	–	–
S	76-07-14	13.3	.12	.00	502	92	.3	–	.0	541	250	1,500,000	–	430,000	–	.00	–
L	Dry hole																
253-W	75-11-11	–	6.89	–	273	18	< .1	.6	–	–	–	< 1	–	< 1	–	.00	–
S	75-11-11	–	.00	–	952	528	10	140	–	2460	386	17,500,000	15,000,000	1,070,000	15,000,000	3.28	72.1
L	76-08-10	–	5.17	.19	–	7580	–	–	2.3	411	24	–	2300	–	430	–	–
304-W	75-10-22	–	.00	–	49	9	< .1	1.0	2.3	–	–	< 1	–	< 1	–	.00	–
S	75-10-22	–	.00	–	12,000	7770	46	350	–	5960	1960	1,500,000	930,000	760,000	230,000	7.00	5196
L	75-10-28	–	.02	–	16,100	7570	44	62	.2	325	92	–	9300	–	< 3	2.56	14.7
L	76-07-20	23.3	.10	.01	5240	3490	30	–	.2	1550	150	–	< 3000	–	< 3000	.22	–

Table 9.--*Analyses by the Jefferson County Department of Health of water from wells and effluent from treatment tanks and soil-absorption fields*--Continued

SITE NUMBER ON MAPS	DATE OF SAMPLE (Y-M-D)	DISSOLVED CHLORIDE (CL) (MG/L)	DISSOLVED NITRATE (N) (MG/L)	DISSOLVED NITRITE (N) (MG/L)	TOTAL SOLIDS, RESIDUE AT 103°C (MG/L)	SUSPENDED SOLIDS, RESIDUE AT 20°C (MG/L)	SETTLEABLE SOLIDS (MG/L)	TURBIDITY (FTU)	DISSOLVED OXYGEN (DO) (MG/L)	CHEMICAL OXYGEN DEMAND (COD) 0.025 N K_2CrO_7 (MG/L)	BIOCHEMICAL OXYGEN DEMAND (BOD), 5-DAY, 20°C (MG/L)	IMMEDIATE COLIFORM (COL. PER 100 ML)	COLIFORM, MPN, CONFIRMED (COL. PER 100 ML)	FECAL COLIFORM (COL. PER 100 ML)	FECAL COLIFORM, MPN (COL. PER 100 ML)	DETERGENT (MBAS) (MG/L)	OIL AND GREASE, TOTAL (MG/L)
318-W	75-11-05	–	0.00	–	76	4.0	< .1	1.5	3.3	–	–	< 1	–	< 1	–	0.00	–
A	75-11-05	–	7.11	–	1750	1380	78	200	–	3400	1630	30,000	2,400,000	2300	< 3000	.00	–
L	Dry hole																
319-W	75-10-21	–	.00	–	140	9	< .1	1.0	1.7	–	–	< 1	–	< 1	–	.00	–
S	75-10-21	–	.00	–	1760	1180	39	100	–	2160	578	3,410,000	4,300,000	1,010,000	2,300,000	2.00	73.9
SF	75-10-21	–	.00	–	2590	960	14	240	5.4	1230	12	8400	110,000	100	< 3	.00	4.1
SF	76-07-20	–	26.5	0.52	7150	6790	16	–	1.4	247	16	–	2300	–	39	.00	–
326-W	75-10-14	–	.80	–	136	3	<.1	1.5	5.5	–	.8	< 1	–	< 1	–	.00	–
S	75-10-14	–	.00	–	762	380	5.0	120	–	640	498	460,000	240,000	147,000	240,000	.15	83.2
L	Dry hole																
339-W	75-11-12	–	.67	–	134	17	< .1	1.5	6.8	–	–	1	–	< 1	–	.00	–
S	75-11-12	–	.11	–	1220	1170	11.5	52	–	196	159	70,000	93,000	9000	43,000	.24	26.7
T	75-11-12	–	3.67	–	528	312	.2	145	–	44	4	< 200	2300	< 200	900	.02	12.1
T	76-07-20	41.8	.15	.02	8628	6050	28	–	1.7	258	9	–	93	–	43	.00	–
403-W	75-11-18	–	.83	–	202	6	< .1	1.9	–	–	–	< 1	–	< 1	–	.00	–
A	75-11-18	–	.00	–	757	128	.2	89	7.5	409	76	>800,000	4,600,000	4900	930,000	.96	11.5
SF	Dry hole																
404-W	76-07-14	.2	.50	.00	156	3	< .1	–	3.7	–	–	2	–	< 1	–	.00	–
A	76-07-14	17.1	2.00	2.68	481	188	7.5	–	2.3	310	87	–	240,000	–	24,000	.00	–
SF	Dry hole																

Table 9.--*Analyses by the Jefferson County Department of Health of water from wells and effluent from treatment tanks and soil-absorption fields*--Continued

SITE NUMBER ON MAPS	DATE OF SAMPLE (Y-M-D)	DISSOLVED CHLORIDE (CL) (MG/L)	DISSOLVED NITRATE (N) (MG/L)	DISSOLVED NITRITE (N) (MG/L)	TOTAL SOLIDS, RESIDUE AT 103°C (MG/L)	SUSPENDED SOLIDS, RESIDUE AT 20°C (MG/L)	SETTLEABLE SOLIDS (MG/L)	TURBIDITY (FTU)	DISSOLVED OXYGEN (DO) (MG/L)	CHEMICAL OXYGEN DEMAND (COD) 0.025 *N* $K_2Cr_2O_7$ (MG/L)	BIOCHEMICAL OXYGEN DEMAND (BOD), 5-DAY, 20°C (MG/L)	IMMEDIATE COLIFORM (COL. PER 100 ML)	COLIFORM, MPN, CONFIRMED (COL. PER 100 ML)	FECAL COLIFORM (COL. PER 100 ML)	FECAL COLIFORM, MPN (COL. PER 100 ML)	DETERGENT (MBAS) (MG/L)	OIL AND GREASE, TOTAL (MG/L)
405-W	76-07-13	0.3	0.01	0.00	124	3	< 0.1	-	-	-	-	< 1	-	< 1	-	0.00	-
A	76-07-13	17.3	.02	.08	412	120	.5	-	-	203	38	-	43,000	-	< 3000	.56	-
SF	76-07-13	7.1	22.9	1.76	1620	616	1.5	-	-	174	31	-	24,000	-	90	.07	-
406-W	76-08-10	2.4	1.20	.71	215	6	< .1	-	0.6	-	-	< 1	-	< 1	-	.00	-
A	76-08-10	56.1	.25	.02	2020	1920	56	-	.0	2320	338	-	430,000	-	230,000	.25	-
SF	76-08-10	44.8	177	3.83	3340	868	3.0	-	1.5	126	8	-	930	-	230	.00	-
407-W	75-11-05	-	.00	-	104	13	< .1	3	3.9	-	-	< 1	-	< 1	-	.00	-
A	75-11-11	-	.00	-	463	240	4.5	74	-	2100	198	150,000	240,000	15,000	24,000	.05	25.6
L	Dry hole																
410-W	76-08-10	.7	.11	.00	175	23	< .1	-	1.7	-	-	< 1	-	< 1	-	.00	-
A	76-08-10	24	17.2	4.88	516	64	1.5	-	.0	168	43	-	240,000	-	93,000	.05	-
SF	Dry hole																

[1]This date is approximate.

Table 10.--*Supplemental data for sites where observation wells were installed in soil-absorption fields*

EXPLANATION OF DATA

COMMUNITY:
- BP--Bergen Park
- EH--Evergreen Highlands
- EM--Evergreen Meadows
- HM--Herzman Mesa
- HP--Hilldale Pines
- MP--Marshdale Park

TYPE OF WASTEWATER TREATMENT SYSTEM:
- AT--Aeration tank
- MST--Modified septic tank
- ST--Septic tank
- LF--Soil absorption field
- 2LF--two soil absorption fields
- LT--Soil absorption trench
- SF--Sand filter

LOCATION OF OBSERVATION WELL IN ABSORPTION FIELD:
- Center-1/χ--Located in the center of the first 1/χth part of the field
- Downslope-1/χ--Located on the downslope side of the field, 1/χth of the distance from the beginning of the field
- II-Center--Center of second field

UNITS:
- GAL PER MIN--Gallon per minute
- GAL--Gallon
- MIN PER INCH--Minute per inch
- Y-M-D--Year-month-day

Table 10.--*Supplemental data for sites where observation wells were installed in soil-absorption fields*--Continued

SITE NUMBER ON MAPS	OWNER	COMMUNITY	WELL PERMIT NUMBER	YEAR OF WELL INSTALLATION	DEPTH OF WELL (FEET)	DEPTH TO BEDROCK (FEET)	DEPTH TO STATIC WATER LEVEL	WELL YIELD (GAL PER MIN.)	TYPE OF WASTE-WATER TREATMENT SYSTEM	SIZE OF TREATMENT TANK (GAL.)	SIZE OF ABSORPTION FIELD (SQ. FEET)	INFILTRATION RATE (MIN PER INCH)	YEAR OF ABSORPTION FIELD (INSTALLATION)	DEPTH OF OBSERVATION WELL (FEET)	DEPTH TO TOP OF ABSORPTION FIELD (FEET)	DEPTH TO TOP OF OPEN CASING IN OBSERVATION WELL (FEET)	DEPTH TO UNWEATHERED BEDROCK (FEET)	LOCATION OF OBSERVATION WELL IN ABSORPTION FIELD	DATE OF OBSERVATION WELL INSTALLATION (Y-M-D)	DISTANCE FROM WELL TO ABSORPTION FIELD (FEET)
403	Bergen Park LTD	BP	4645	59	203	8	-	2.5	AT-SF	-	1200	24	74	8.6	2.8	7.3	8.6	Center-1/3	75-10-16	300
128	F.J. Waggoner	HM	33694	68	240	0	70	.5	ST-LF	900	800	70	68	8.0	3.0	7.0	7.0	center	75-07-14	75
131	R. Bisgaard	HM	12303	62	178	24	-	.5	ST-LF	800	720	-	63	9.5	3.5	7.5	9.5	-	75-07-14	50
236	M. Lilywhite	MP	-	63	325	-	-	-	ST-LF	1250	1320	21	74	9.0	3.0	7.0	9.5	Center-1/4	76-06-29	300
253	T. Lams	MP	41561	70	152	0	102	1.2	ST-LF	-	-	-	-	9.8	2.0	8.2	7.0	-	75-07-14	65
404	V.O.C. Wilson	EH	-	75	360	-	-	2.5	AT-SF	-	711	-	74	8.5	3.0	6.5	8.5	Center(?)	76-06-29	104
304	J. Dunn	EM	-	72	-	-	-	-	ST-LF	1000	910	20	72	8.0	3.0	6.5	7.5	Center	75-07-14	197
318	J. Harrow	EM	-	72	-	-	-	7	AT-2LF	1000	650, 720	40	72, 75	8.5	4.0	6.5	8.5	II-Center	75-07-14	160, 230
319	W. K. Walker	EM	-	72	-	-	-	-	MST-SF	1000	640	-	73	6.5	2.0	5.0	6.0	Center-1/3	75-07-14	150
326	B.F. Sheehan	EM	53790	72	180	15	39	3	ST-LF	900	780	20	72	6.5	3.0	5.0	6.5	Center	75-07-14	120
339	D. Carson	EM	44638	71	280	0	90	1	MST-LT	-	60	-	71	10.0	.5	9.5	10.0	1 foot downslope-1/4	75-10-16	101
405	R.J. Burns	HP	-	73	440	-	-	2.2	AT-SF	900	475	15	73	3.5	2.5	1.8	3.5	Center-1/3	76-06-29	104
406	J. Dietrich	HP	-	73	480	-	-	1.2	AT-SF	-	180	-	73	5.0	2.0	3.2	5.0	Center	76-06-29	120
407	L. Romero	HP	42390	70	153	0	-	2	AT-LF	1200	720	-	70	7.5	2.5	6.0	7.5	Center	75-10-16	110
410	H.J.H.M. Hilgers	HP	-	73	420	-	-	2	AT-SF	-	760	50	74	6.0	3.0	4.2	6.0	Center-1/2	76-06-29	130

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