CHAPTER 13

SEPTIC SYSTEMS

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13.0 SEPTIC SYSTEMS

13.1 GENERAL

A) The Town of Bennett does not allow the construction and use of septic systems within its current Town limits and has identified and designated large sections within their projected Urban Growth Area as critical zones towards future surface and alluvial water resources development. Individual Septic Systems are strongly discouraged in these areas and in most cases prohibited.

B) The use of septic systems in non-sensitive areas, that are not within reasonable reach of the Town's wastewater collection system, may be allowed on an individual review basis.

C) For proposed large residential or commercial sub-division type developments, in designated sensitive areas, that are not within reasonable reach of the Town's currently existing wastewater collection system, temporary septic systems may be allowed if they are clustered and if a main-loop wastewater collection system is designed and constructed within the proposed development that would allow for future tie-in's with the Town's projected system.

13.2 PRESSURE, VACUUM AND CLUSTER SYSTEMS

Low-pressure, vacuum and cluster systems are possible alternatives to serve areas where septic-tank systems are inappropriate or failing. Unsuitable soil, high groundwater, small lots, hilly terrain, and high-density recreational areas are situations where such systems may have application.

In the pressure sewer system the septic-tank effluent from one or more dwellings flows by gravity to a pumping station from which the sewage is pumped through small diameter pipe to an existing sewer or a new central treatment

plant. The septic tanks require periodic cleaning. In some designs the individual septic tank is eliminated and a special collection tank-grinder pump and check valve assembly is used.

In the vacuum system a vacuum pump creates a vacuum in collector pipes. A valve opens when sewage from a dwelling presses against it. Sewage and a plug of air behind it enter the collection pipe. Air (vacuum) forces sewage to a collection tank. A sewage pump then pumps sewage from the tank to a treatment plant. Special vacuum valves and intermediate sumps (usually) are needed.

In the cluster system a group of dwellings is served by a common treatment and disposal system. Each dwelling makes connection to a common treatment system, or each house has its own septic tank or aerobic tank, which connects to a common absorption field or other approved system. The septic tanks require periodic cleaning.

Both the pressure system and vacuum system require regular maintenance. All of the systems need to have a sewer district or equivalent to assure continued maintenance and operation in perpetuity.

13.3 DESIGN REQUIREMENTS

Allowable uses of Septic, Pressure, Vacuum and Cluster Systems shall be designed and constructed in full compliance with the latest Standards and Regulations of the Tri-County Health Department.

A copy of these Regulations, identified as "Regulation Number I-96", is attached within the back of this Chapter and incorporated as part of this Manual. It will be the Contractor's responsibility to insure that his Design and Construction is in strict compliance with the latest issue of these Regulations and that they will meet all the Tri-county Health Department approvals and inspections in addition to the Town requirements.

13.4 INDIVIDUAL SEWAGE DISPOSAL SYSTEMS (ISDS)

A) A well-engineered and maintained septic or individual disposal system can be protective of groundwater quality criteria, while not contributing to surface water degradation. However, poorly designed or failed systems frequently contribute to nonpoint source pollution in specific watersheds.

B) From a regulatory perspective, septic and individual disposal systems less than 2,000 gallons per day flow are the responsibility of the state and/or local health departments, where they exist. These systems are to be designed, operated, inspected and maintained according to existing local health departments' Regulations and Recommendations.

C) Septic or individual disposal systems designed for flows over 2,000 gallons per day within existing service areas require approval from the appropriate management agency and or the Water Quality Control Division. Systems over 2,000 gallons per day are regulated as wastewater treatment work as defined in the state site approval process. For example, these type of systems are listed in the DRCOG regional water quality management plan (*Metro Vision 2020 Clean Water Plan*, DRCOG 1998) as permanent minor wastewater treatment facilities. Other section 208 plans developed for other portions of the state also recognize permitted ISDS systems. Generally, these facilities do not require expansion within a 20-year planning horizon. Wastewater service areas mapped for these facilities are generally very limited (less than 25 acres).

D) Generally, individual septic systems are best used on large, relatively level, well-drained lots with deep, moderately permeable soil. However, there are many types of

onsite wastewater treatment systems, which can be used for less than perfect sites and soils. Topsoil development in some portions of the region is typically thin with underlying soil material frequently coarse grained. These coarse-grained soils, except for some valley and terrace deposits, are very permeable with little filtering capacity. Lack of appropriate top soil is a critical site condition affecting system design and a common factor leading to failure.

E) Depth to bedrock is also a critical site condition affecting system design and potentially leading to groundwater contamination. Some available options for onsite wastewater treatment based on particular limitations or constraints are shown in Table 1.

13.5 SYSTEM PERFORMANCE AS A FUNCTION OF HYDRAULIC DESIGN

Wastewater flow in excess of the hydraulic design, soil clogging, impermeable soils and leachline pipe failure can cause surface malfunctions. Frequent back-ups into plumbing systems can suggest a problem with the adequacy of an on-site system. Demonstrated significant groundwater contamination from on-site facilities is often difficult to quantify. Standard soil absorption systems and most innovative alternate technologies discharge to groundwater and contribute constituents, which can lead to contamination. The significance of this contamination is dependent on the groundwater uses and concentrations at the points of use. For example, total phosphorus, nitrate and bacteria have been identified as potential contaminates of concern caused by failed or failing systems.

Table 1

General On-Site Wastewater Management Options

Limitation or Constraint	On-Site Options
Shallow Depth to Bedrock Or Highly Permeable Soil	Elevated sand mounds, Shallow placement system, Evapotranspiration system, Artificial Drainage, Buried sand filters; Pressure distribution, Oversized soil absorption system
Steep Sloped Sites	Parallel distribution; Terraced and or contoured fields; Serial distribution (parallel treatment provides better treatment)
Hydraulic, Organic or Solids Overload	Flow reduction, Waste stream segregation, increase septic tank capacity, Septic solids retainer, Septic tank baffles, Large diameter tubing in leach-line; Pretreatment
Subsurface Disposal Not Possible without Pretreatment	*Pretreatment Options* • Fixed film reactors • Recirculating sand Filters • Intermittent sand filters • Wetlands
Subsurface Disposal Not Possible	*Non-Discharge Options* • Evapotranspiration (Well permit limited) • Vaults • Lagoons • Aerobic units (package plants) • Compost and similar toilets

13.6 PHOSPHORUS

Total phosphorus concentrations in typical septic system wastewater effluent range from 4 to 90 mg/l with a mean concentration of about 15 mg/l (Environmental Protection Agency 1977). This effluent phosphorus usually does not enrich the groundwater below septic systems or reach adjacent waterways. The phosphorus is fixed in soil by sorption reactions or as phosphate precipitates of calcium, iron or aluminum. The type of soil will affect the phosphorus sorption reaction with clays and silts generally having better absorption characteristics.

Phosphorus can leak into either the underlying groundwater system or adjacent waterways, where systems have been built in areas of coarse sand, gravel and thin soils or where surface malfunctions have occurred because of heavy hydraulic loading. Total phosphorus concentrations over 5 mg/l have been measured under these circumstances (Environmental Protection Agency 1977).

13.7 RESPONSIBILITIES OF HOME OWNERS AND PUMPERS

Homeowners who use individual sewage disposal systems have a clearly defined set of responsibilities. The failure to meet some or all of these responsibilities can cause their systems to fail. Homeowners that meet the following 7 homeowner responsibilities will generally have systems that operate well over a longer time.

Seven Homeowner responsibilities

1. Do regular pumping of the septage from the septic tank.
2. Locate the tank riser (septic tank lid) and keep it marked.
3. Understand how the system operates, including knowing what the minimum maintenance requirements are for the particular design.
4. Respond to a failing system with required maintenance, particularly when surfacing of effluent occurs or odors are apparent.
5. Do not dispose of hazardous household wastes in the septic system.
6. Recognize the value to the property by having a well-maintained system.
7. Keep records of the system design, location and maintenance activities (including pumping dates).

Inspectors and commercial pumpers also have defined responsibilities that can assist the homeowner in having a well operating system. Commercial pumpers are responsible for the proper collection and disposal of septage. The disposal of septage is regulated by the State 503 Biosolids Regulations.

The 4 primary responsibilities required of all commercial pumpers are as follows:

Four responsibilities of all commercial pumpers

1. Educate homeowners on how their system operates, including listing the minimum maintenance requirements and a preferred pumping schedule.
2. Establish a marker system for tank risers.
3. Inspect the system and recommend or perform any required maintenance.
4. Keep records of pumping activities including: owner, parcel location, date, depth to tank lid, location and type of riser marker, quantity or volume of septage, condition and operation of system (e.g. dosing system functional), basic system design (e.g. number of chambers), needed maintenance and maintenance performed, surfacing or odor problems and location septage is hauled for disposal.

13.8 MAINTENANCE AND OPERATION

Homeowners generally do not take the initiative to perform routine maintenance. The homeowner not knowing where the septic tank lid is located is one of the most common excuses for not pumping the septic tank on a routine basis.

A major problem with individual systems is that homeowners generally do not take the initiative to perform routine maintenance. This problem is related to lack of understanding on how the system operates and the maintenance requirements, cost of maintenance, perceived nuisance, lost or lack of septic tank risers and fear that inspection or pumping could identify a major problem requiring a major investment. Countries have found that citizens are generally uninformed about maintenance needs of septic systems. Consequently, homeowners do not perceive the need to pump septic tanks or perform other maintenance requirements that would prolong the life of the system. The critical question is whether it is more effective to mandate and regulate or provide the necessary amount of education to solve this problem.

Maintenance and operation issues that may be required and mandated by the Town of Bennett include system cleaners, voluntary compliance and education, penalties, access to tanks, pumping records, inspection ports, requirements needed at time of sale, responsibilities, target education groups, inspection costs, standards of evaluation, things that cause systems to fail and working concepts for improving processes related to maintenance and operation.

The Town believes that some information handout material to the homeowners would be useful. Guides for citizens need to be easily read, simple and informative, while giving the homeowners a sense of value for maintenance activities. A generic document that could be easily and inexpensively customized would be ideal. This type of document should be produced in an electronic format with incorporated text graphics. A window type of environment could allow for insertion of local information without disrupting the format.

13.9 INSPECTION

A) The cost of system inspection can range from $125 to $1,000, dependent on the location, number of inspection points and the level of evaluation. A test to determine the ability of the system to absorb wastewater needs to be performed over a 24-hour period. This type of test is more costly than a simple inspection program. However, the more expensive testing may be required, if the homeowner or inspector believes the system is performing poorly. Some realty companies will check for surfacing of effluent, septic tank level and other obvious signs of failure for about $125. Generally, this level of inspection is sufficient for sale of a home. More detailed inspections are made by some engineering firms that will certify the operational quality. On cluster systems the Town of Bennett will require an annual performance inspection. Individual residential systems shall comply

with the pertaining Tri-County Regulations 13.7.

B) A single factor or combination of factors can cause an ISDS to fail. Many factors that can lead to failure are easily identified and repaired. A good inspection program, whether conducted by a county inspector or by the homeowner, should target potential causes of failure. An example of the types of inspection criteria used in some programs for homes and associated onsite systems is shown in Table 2.

Table 2
Examples Of Inspection Program Evaluation Factors

General Inspection Program Areas	Factors That Can Be Evaluated
Basement	Water pressure gauge, check for pressure losses to determine if there are leaks
	Footing drain sump pump check or other sump pumps
	Water softener backwash brine being sent to seepage field
	Self-cleaning humidifiers can add up to 125 gallons per day to system
House	Float valves in toilets checked for leaks
	Faucet leaks
Septic Tank	Locating tank or lid
	Wet weather check for infiltration and tank leakage
	Check outlet baffle for condition
	Tank lid seal and potential for seepage into tank
Seepage Field and Yard	Check drop boxes
	Roof runoff or parking area runoff should be directed away from fields
	Depth of system and trenches and potential for external infiltration
	Inspection ports
Hydraulic Capacity	Hydraulic capacity determined by water level measurements during a 24-hour absorption test
	Undersized system for current occupants
	Monitoring tubes
Maintenance	Cleaned septic tank
	Excess grease
Surface Conditions	Saturated Soils (spongy Surface)
	Soil Compaction
	Surfacing of effluent
	Lack of soil or filtration material
Groundwater quality	Monitoring well water quality
	Spring water quality (If used as a potable source or suspected as a connected source)
	Regional water quality data

13.10 SYSTEM FAILURE

Health Departments and other local agencies recognize 4 major categories of failures associated with individual disposal systems.

Four categories of failures:
Direct discharge
Surface malfunctions
Backups into structures
Groundwater contamination

Failures that are considered significant and require corrective action include: direct discharge, surfacing caused by system malfunctions, backups into residential or commercial plumbing, and either groundwater contamination at a direct or a potential point of use (e.g. well or spring).

Direct discharge of wastewater constitutes a public health risk and should not be allowed under any circumstances. Surface malfunctions of soil absorption systems are typically caused by inadequate hydraulic capacity in the leach-line system, can be attributed to engineering design failure or from lack of routine maintenance. Backups in structures generally indicate a full septic tank or failed leach field. Groundwater contamination has been the most commonly measured failure. Although, groundwater contamination tends to be more regionalized and not attributable to individual systems.

Seven things that can cause an individual system failure

1. Unsuitable soil that was not identified by soil analysis, profile logs or percolation tests or the failure to use soil analysis or percolation tests in determining the suitability of the site.
2. Geologic or hydrologic setting that was not accounted for in the design.
3. Seasonally high groundwater and hydrology of site, including the use of flood irrigation techniques on the site.
4. System design does not work for the development site or the system is not designed to fit within the designated site.
5. Peak loading to the system from intermittent use (seasonal occupation) or from heavy short-term usage (excessive peaking).
6. Improper operation and maintenance of the treatment system including failure to maintain leach field, failure to pump the septic tank (septage) on a timely basis or lack of septage pumping.
7. Age of system (biological matting in old systems).

13.11 GUIDANCE CONCEPTS

The Town identified guidance concepts, which should be considered in evaluating system performance.

1. Alternative technologies may be required in areas with identified water quality problems and where use of alternate technology could reasonably be expected to improve the water quality or other problems.
2. The Town may also require alternative technology when there is a request for a lot size variance below an established minimum lot size or if the proposed development is within an area that the Town considers critical to its future water resources development. The minimum lot size should be based on an estimated ISDS carrying capacity for a watershed or other specified area. Additional Town requirements shall

include the following design improvement features:

Nine design improvement features

1. Require new leach field designs to include a field monitoring port.
2. All tank risers to be at the surface with no burial allowed. Hidden tank risers lead to a lack of maintenance.
3. The Town does require septic tanks to be watertight. This could potentially prevent several of the water quality contamination problems associated with ISDSs.
4. Laterals should be designed for service and with distribution boxes or relays, which would improve performance, make maintenance easier, be more cost effective and increase the potential for more timely maintenance.
5. Simple effluent filters for tanks can add substantial life to a leach field, improve performance of the system and reduce the potential for failure.
6. A clean out feature allowing for cleaning on a 2 to 5 year cycle of the leach system will improve performance and increase the life of the system.
7. *Smart* control panels are a simple new technology which provide a method to monitor flow rates, regulate dosing and improve trouble shooting without adding substantial cost to the system.
8. Grease traps will be required on all commercial facility systems. The grease traps preserve the life of the leach field and enhance performance of the overall system. The design engineer needs to understand the operations of the business, peaking potential and function.
9. Septic tank sizing must match intended uses with size of residential tanks related to number of bedrooms.

3. The Town may require service permits for ongoing maintenance with specific criteria for pumping and record keeping systems.
4. Eventually a conventional system will fail, although this may take 25 or more

years. The soil can bind only so much waste before it ceases to function and water quality is degraded. The problem will not go away and a proactive program to deal with on-site systems must be incorporated in the system design. To that purpose the following map additionally be recommended or required by the Town:

Twelve simple and cost-effective performance and maintenance enhancement features

- Field monitoring ports.
- Tank risers.
- Water tight septic tanks.
- Serviceable laterals.
- Effluent filters.
- Water conservation fixtures.
- Air release assemblies.
- Automatic distribution values.
- Hydrosplitters.
- Flow splitter basins and distribution boxes.
- Dosing systems (siphons or pumps).
- Smart control panels.

5. Generally, phosphorus loading to ground waters beneath ISDSs or adjacent surface sources is not a problem. Studies from various states have shown phosphorus is bound by soil systems. However, there are geologic conditions, such as thin soil, fractured bedrock, coarse glacial tills and gravely soils, where phosphorus is not bound and is released to groundwater and surface waters. Additionally, research has shown that soil systems can experience cascade releases of nutrients and causes plug flows with high concentrations. The voluntary reduction of high phosphorus detergents by the soap industry for Colorado

should help reduce phosphorus loading.

6. The discharge and accumulation of nitrate is a big problem associated with ISDS water quality. High nitrate in groundwater is both a health and water quality issue. The high density of ISDSs in some watersheds has already greatly increased the concentration of nitrate in groundwater and surface systems. High nitrate loading from ISDS systems are identified by EPA as a national problem.

7. Citizens, public health officials and others will determine the acceptable level of degradation.

8. A fundamental concept that must be presented to homeowners is to fix problems *before* they occur.

9. All development sites require a soil suitability test (e.g., percolation test). The number of test sites within subdivisions is not uniform and often too few tests are run on large subdivision projects. The Town recommends that a uniform percentage of test sites be required for subdivisions based on number and distribution of lots.

10. The Town recommends that the issues associated with the hauling and disposal of septage should be addressed by the Developer.

13.12 PREVENTING FAILURES

Prevention programs can also reduce the potential for water quality degradation within watersheds that are dominated by on-site systems. Performance criteria or guidance should be designed to prevent failures. The general steps

to prevent failure include, but are not limited to:

1. Maintenance and operation by homeowners and pumpers or other appropriate institutional agencies or groups (e.g., homeowner association, special district, contract operator).

2. Inspection of systems by homeowners and local Health Departments or other appropriate institutional agencies or groups (e.g., homeowner association, special district, contract operator).

3. Educational programs and/or information dissemination directed at the target education groups.

4. Monitoring surface and groundwater quality in counties or watersheds dominated by on-site systems to determine if water quality trends are changing.

5. Monitor groundwater quality near on-site systems in areas with known site conditions limitations or problems (i.e., flooding or other hydrologic constraints, soil conditions, steep slopes, faults).

6. Establish performance guidance for both conventional and alternate technologies.

7. Establish permit, licensing or registration programs.

8. Use alternate technology on sites with marginal conditions or setback limitations.

9. Maintain good documentation and records regarding all on-site systems at either

a county level or by designated watersheds.

10. Allow variances based on good science and not economic gain.

The Town may require any or all of these measures to protect its interests.

13.13 WATER QUALITY MONITORING

The cost to monitor individual systems is potentially prohibitive. While on-site monitoring could be done for less than $500 annually, the cost could range as high as $8,000 per year using specialized dedicated monitoring wells. The water quality characterization of failure does not need to focus on individual systems, but rather track quality at the watershed or sub-watershed level. However, individual systems which are surfacing effluent should be considered as failed and have caused both a health risk and water quality degradation. These systems, once repaired, may require site-specific monitoring.

In general, water quality monitoring for trend characterizations is a cost-effective mechanism to help identify problems and begin corrective measures before a watershed shows extensive water quality degradation and requires expensive corrective actions. Generally, water quality monitoring programs should be established at the watershed level. Areas with lot densities of 2 dwelling units or more per acre on an ISDS system may warrant special water quality monitoring programs. Areas with lot densities of one dwelling unit per 2 acres may not be causing a water quality degradation problem and monitoring may not be appropriate.

13.14 INFORMATION AND TECHNOLOGY

1) Alternate Technology: Standard ISDS Systems are characterized as having a septic tank with a drain field system. Any other system

design has been viewed as new technology. In truth, there is very little new technology, but *alternate technology*. Many alternate technologies have been used for a number of years with proven results. Changes in design and improvement features are viewed by many agencies as alternate technologies. However, there has been reluctance by many counties and local health officials to accept alternate technologies because of the perceived potential for failure.

Alternate technology includes all technologies, which are not traditionally used as depicted in Table 3. A number of new technology improvements have been used in combination with standard system designs to allow installation of systems where site conditions or set back requirements preclude the use of standard systems. Examples of major types of alternate technology used in Colorado include aeration and sand filter systems, wetland processing systems and small mechanical systems. Sand filter systems include recirculating, intermittent and trickling with both single and multiple pass systems. These alternate technologies have been well described in a number of publications.

Table 3

Standard System Versus Alternate Technology

Standard System	Intermediate Technology	Alternate Technology
Septic tank	Dosing siphons	Mechanical systems
Drain field or	Pump system	Aeration systems
Leach field	Mound system	Sand filter systems
	Drip irrigation system	Wetlands
	Chambers	Design improvements
	Design improvements	

The Town is allowing alternate technology such as recirculating sand filters, but requires testing of the installed systems to prove effectiveness under site-specific conditions. There are new design components developed for these types of systems, which have not been tested under Colorado conditions. In order to reduce unnecessary testing of alternate technologies or improvements to design, the test results shall be made available to all interested agencies within the state. Currently, there are limited mechanisms to share this type of information.

Drivers for using alternate technologies

1. Site specific geologic features (e.g., bedrock, faults, fractures), soils, hydrologic or other conditions and topography which require alternative treatment to meet defined requirements.
2. Higher levels of treatment or standards required by counties or local health departments because of public pressure.
3. Set back requirements may be such that alternate technology must be used because of space limitations.
4. Point of compliance to meet drinking water standards requires nontraditional systems.
5. Measured water quality degradation.
6. Failure of traditional systems.
7. Public preference for an alternative system (e.g., wetland treatment).
8. Small lots and old plats.

2) Design Improvements: The performance of all ISDS systems can be easily enhanced by simple and cost-effective design improvements. Alternative treatment systems will work if they are designed correctly and maintained as designed. The traditional engineering strategy of designing systems to meet minimum requirements may no longer be enough. Additionally, local requirements are often driving the need for system enhancement features. A number of design improvement features have been developed and applied in Colorado by engineering firms that allow systems to exceed minimum requirements or meet local requirements. Design improvement features identified for possible consideration relate to leach fields, tank risers, water tight tanks, serviceable laterals, effluent filters, other clean-out features, smart control panels, grease traps and system sizing. The operation performance of several alternative technologies is shown in Table 4.

Table 4
Performance And Characteristics Of Some Alternate Technologies

System	Characteristics	Performance
Aerobic units	Air is forced or drawn into mixing Chamber; Support suspended growth Of aerobic bacteria; require Maintenance	Meet secondary standards; sensitive to shock loads; Generally little nutrient removal; Nitrogen reduction 25-35%; BOD @30mg/l;TSS @ 40mg/l
Constructed Wetlands	Generally an aerobic process; Good for treating surface runoff; Requires more land; aesthetic Benefits	Nitrogen reduction 25-50%; BOD 64-87%; Phosphorus 20-40%
Intermittent Sand Filters	Uses filter media; media supports Biological film which treats many Flexible design types; high level Of treatment; higher costs	Nitrogen reduction 50%; BOD @10mg/l; Phosphorus removal is dependent on filter type; TSS @ 10mg/l
Drip irrigation	Many flexible design types; Generally a high level of Treatment. Drip and evaporation Systems are types of dispersal Systems. Same category as beds And trenches, soil treatment Media for drip irrigation with some Root uptake.	Best available technology for phosphorus reduction
Recirculating Sand filters	Effluent passes through coarse grained filter media several times Before discharge; treatment also Occurs from biological film growth On media reduced filter areas; Many flexible design types; high level of treatment	Nitrogen reduction 50% BOD @ 10mg/l; Phosphorus removal is dependent on filter type; TSS @ 10mg/l
Septic tank Trickling filter	Effluent is cycled over filter media and back to a carbon-rich Primary chamber for De-nitrification; installs in tank; Anaerobic to aerobic system	High reduction of BOD and TSS; nutrient removal; 70-90% TN removal

13.15 POINT OF COMPLIANCE FOR STANDARDS

The point of compliance where groundwater standards should be applied has not been well characterized under some Colorado conditions. Other standards besides Drinking Water Standards that ISDS need to comply with include aquatic life, groundwater and agriculture. Monitoring information is needed to better understand the point of compliance issue with all applicable standards. Since there is no disinfection from most ISDS systems, soil systems are still needed to filter out bacteria. Therefore, the amount of filter media available needs to be part of the point of compliance definition. Until the State or County has defined the issue more clearly, the Town of Bennett will designate the point of compliance and applicable standards on an individual development review basis.

13.16 RECORD KEEPING

Consistent record keeping is an area of concern. Counties, local health departments, pumpers, engineering firms and others involved with ISDSs have a variety of record taking and keeping processes. Some records are minimal and not easily assessable, while others are more comprehensive. Generally, pumpers maintain some type of record. The Town will require submittal of these records on a designated time basis.

In the future this information should be collected in an electronic form and made available to the Town. The actual location of many systems is not well known and the Town recognizes the future potential of locating systems using global position systems (GPS) and recording this and the other system information in a geographical information system (GIS) database. This type of information would be valuable in characterizing accumulated water quality impacts at a watershed level.

Other useful information besides the pump records that should be considered for a geographical information database includes, but is not limited to, the total number of permits in place, number

of non-permitted sites, upgraded systems, geologic information on type and depth of soils, bedrock type and characteristics, percolation test results, hydrologic features, and depth to groundwater.

Types of information that should be collected by pumpers

1. Owner and mailing address.
2. Parcel location.
3. Date.
4. Reason for pumping (i.e., routine, back-up, odor, overflow).
5. Depth to tank lid.
6. Type of tank.
7. Location and type of riser marker.
8. Quantity or volume of septage.
9. Condition and operation of system (e.g. dosing system functional).
10. Basic system design (e.g. number of chambers).
11. Needed maintenance and maintenance performed.
12. Surfacing or odor problems.
13. Location septage is hauled for disposal.
14. Identify sites or locations that are not pumped.

13.17 DEVELOPMENT INFORMATION

The Town reviewed the type of information that should be supplied by Developers. The 2 basic types of development reviewed were subdivisions and individual lots. Different amounts and types of information are needed from these 2 development types. The suitability of an individual or subdivision site for ISDS utilization needs to be determined as part of the platting process. This suitability determination should help determine the appropriate lot size. Suitability factors include, but are not limited to soils, percolation test, underlying geology, hydrology, watershed water quality, slope, roads and layout, and environmentally sensitive areas (e.g. wetlands and riparian corridors). All too often this suitability information is not developed until the design phase of the project

after the lots are platted. Additional subdivision information should be supplied by a Developer, before design begins.

All development sites should require a Soil Suitability Test (e.g., Percolation Test). The number of test sites within subdivisions is not uniform and often too few tests are run on large subdivision projects. The Town recommends that a uniform percentage of test sites be required for subdivisions based on number and distribution of lots.

Subdivision Information Supplied by a Developer Before Design

- The institutional framework of the subdivision (i.e., water and or sanitation district, homeowners association, septic district, county responsibility).
- Types of systems and appropriate technology that will best suit the site (i.e., consult with a hydro-geologist or geo-engineer about systems).
- Review and resolve water quantity and quality issues.
- Incorporate site suitability information into designs.

Guidelines will be developed by the Town, which can be used in the development review process. Such Guidelines could list minimum targets for increasing the amount and type or decreasing the amount and type of information needed for a development site. For example, a subdivision development that proposes lot sizes at or below 2 acres would require the most information, while subdivision with lots greater than 5 acres would require only the minimum set of information.

13.18 HAULING AND DISPOSAL

Septage hauling and disposal is a regulated activity. Commercial pumpers are responsible for the proper disposal of septage. Most septage is hauled to wastewater treatment facilities regulated under Colorado discharge permits for

processing. The Town of Bennett does not accept disposal of septage in their treatment facilities. The Town recommends that the issues associated with the hauling and disposal of septage should be evaluated in detail prior to development approval of applicable sites.

13.19 A COPY OF THE TRI-COUNTY HEALTH DEPARTMENT REGULATION NUMBER I-96 FOLLOWS ON THE NEXT PAGE

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REGULATION NUMBER I-96

Revised 05/31/98, Pursuant to Article 10 of Title 25 Colorado
Revised Statutes, 1989 Repl. Vol. with the Relocation of Provisions.

SECTION I.—SCOPE AND APPLICABILITY

1.1 DECLARATION

In order to preserve the environment and protect the public health; to eliminate and control causes of disease, infection, and aerosol contamination; and to reduce and control the pollution of the air, land and water, it is declared to be in the public interest to establish minimum standards, rules and regulations for individual sewage disposal systems in the counties of Adams, Arapahoe, and Douglas, State of Colorado, and to provide the authority for the administration and enforcement of such minimum standards, rules and regulations.

1.2 PURPOSE

The purpose of these regulations, as authorized by Title 25, Article 10, *Colorado Revised Statutes* (C.R.S.), is to provide guidance and establish minimum standards for the location, construction, performance installation, alteration and use of individual sewage disposal systems within the counties of Adams, Arapahoe and Douglas, State of Colorado, and concerning the application for and issuance of permits, the inspection, testing, and supervision of installed systems, the maintenance and cleaning of systems and the disposal of waste material. THESE REGULATIONS SHALL APPLY TO INDIVIDUAL SEWAGE DISPOSAL SYSTEMS. (Site approval and a groundwater discharge permit from the Colorado Department of Public Health and Environment are also required for a system with design capacity greater than or equal to 3000 gallons per day.)

SECTION II.—DEFINITIONS

For the purpose of these regulations the following words and phrases shall have the following meaning ascribed to them unless the context otherwise requires:

2.1 ABSORPTION SYSTEM - a wastewater disposal field or a leaching field and adjacent soils or other system for the treatment of sewage in an individual sewage disposal system by means of absorption into the ground and may include evaporation.

2.2 ABSORPTION TRENCH - one or more trenches not over three feet in width of varying length and depth in which sewage effluent is percolated into the soil.

2.3 AEROBIC SEWAGE TREATMENT SYSTEM - an individual sewage disposal system employing biological action which is maintained by the addition of air or oxygen.

2.4 APPLICANT - any person who submits an application for a permit for an individual sewage disposal system.

2.5 BEDROCK - the MORE OR LESS SOLID UNDISTURBED ROCK in place either at the surface or beneath surficial deposits of gravel, sand, or soil or a CONSOLIDATED ROCK FORMATION OF MORE OR LESS IMPERVIOUS MATERIAL which may exhibit jointed, fractured, or weathered characteristics.

2.6 BEDROOM - any room that could be used as a bedroom now or at some future date; or any room so designated by the owner or agent, or any room which has a closet.

2.7 BOARD OF HEALTH - the Board of Health of the Tri-County Health Department.

.8 BOD_5 - a measure of the amount of molecular oxygen required by bacteria to stabilize the decomposable matter present in wastewater by aerobic biochemical action. The method for determining BOD_5 is prescribed in the most recent edition of *Standard Methods for the Examination of Water and Wastewater.*

2.9 BUILDING SEWER - that part of the piping of a drainage system which extends from the end of the building drain and which receives the discharge of the building drain and conveys it to a public sewer, private sewer, individual sewage disposal system, or other point of disposal.

2.10 CESSPOOL - a covered underground receptacle which receives untreated sewage from a building or dwelling and which permits the untreated sewage to seep into the surrounding soil.

2.11 CHERRY CREEK BASIN WATER QUALITY AUTHORITY - a quasi-municipal corporation and political subdivision of the state, created pursuant to section 25-8.5-103, C.R.S.

2.12 CHERRY CREEK BASIN - the basin consisting of the drainage basin of Cherry Creek, as defined section 25-8.5-104, C.R.S.

2.13 COMPETENT TECHNICIAN - a person designated by the Department who is able to conduct and interpret the results of percolation tests.

2.14 COMPOSTING TOILET - a unit which consists of a toilet seat and cover over a riser which connects to a compartment or vault that contains or will receive composting materials sufficient to reduce waste by aerobic decomposition.

2.15 CONSTRUCTED WETLANDS - a system which utilizes various wetland plants to provide secondary treatment of wastewater through biological, physical, and chemical processes.

2.16 DAWSON SAND - a soil which classifies (under the Unified System) as sand. The fine grained (minus 200) fraction consists of clay minerals with plastic cohesive characteristics. A moist sample of the material will typically exhibit cohesive behavior which allows the material to form into a mass, which has low to high compressive strength when dried.

2.17 DEPARTMENT - the Tri-County Health Department.

2.18 DISPERSAL SYSTEM - a system for the disposal of effluent after final treatment in an individual sewage disposal system by a method which does not depend upon or utilize the treatment capability of the soil.

2.19 DISTRIBUTION BOX - a watertight chamber which receives wastewater from a septic tank or other primary treatment unit and from which effluent is distributed evenly throughout the absorption area.

2.20 DOSING - a high rate periodic discharge to an absorption area, constructed wetlands, or sand filter.

2.21 DOSING TANK - a tank which provides for storage of wastewater from a septic tank intended to periodically be discharged at a high rate to an absorption area, constructed wetlands, or sand filter.

2.22 DRIP IRRIGATION SYSTEM - a system of small diameter perforated pipe placed in narrow, shallow, closely spaced trenches, which relies upon evapotranspiration and absorption for treatment and disposal of effluent. The effluent is dosed into the laterals in the absorption area using a pump or siphon.

2.23 DRYWELL - a type of soil absorption system dependent upon suitable soil, filled with gravel and containing a system of approved distribution which is designed on the basis of sidewall and bottom absorption area.

2.24 EFFECTIVE SIZE D_{10} (of granular media) - is that size such that no more than 10% by weight of the media is finer than the size specified.

2.25 EFFLUENT - the liquid waste discharge from an individual sewage disposal system.

2.26 ENVIRONMENTAL HEALTH SPECIALIST - a person who is trained in physical, biological, and/or sanitary science to carry out educational and inspectional duties in the field of environmental health.

2.27 EVAPOTRANSPIRATION SYSTEM - a type of dispersal system that wholly or primarily utilizes liquid evaporation or transpiration by vegetation as a means of effluent disposal.

2.28 EXPERIMENTAL SYSTEM - a particular design or type of system based upon improvements, or development in the technology of sewage disposal and not otherwise provided for in paragraphs (e) to (k), C.R.S.

2.29 FLOODPLAIN - that area of the floodplain in which the channel of the watercourse and those portions of the adjoining floodplain which must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one (1) foot at any point or as designated by the Federal Emergency Management Agency or National Flood Insurance Program. In the absence of FEMA/NFIP maps, a Colorado Registered Professional Engineer shall certify the floodway elevation and location.

2.30 FLOODWAY - that area of the floodplain in which the channel of the watercourse and those portions of the adjoining floodplain which must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one (1) foot at any point or as designated by the Federal Emergency Management Agency or National Flood Insurance Program. In the absence of FEMA/NFIP maps, a Colorado Registered Professional Engineer shall certify the floodway elevation and location.

2.31 GREYWATER SYSTEM - a system designed to accommodate only liquid wastes from sinks, lavatories, tubs, showers, and laundry or other plumbing fixtures approved by the Department.

2.32 GROUNDWATER TABLE - the upper surface of groundwater in the zone of saturation of a geologic formation.

2.33 HEALTH OFFICER - the chief administrative public health officer of the Tri-County Health Department or his authorized representative.

2.34 HOLDING TANK - a watertight receptacle for the retention of sewage either before, during or after treatment.

2.35 INDIVIDUAL SEWAGE DISPOSAL SYSTEM (ISDS) AND THE TERM "SYSTEM" (where the context so indicates) - a system or facility for treating, neutralizing, stabilizing, or disposing of sewage which is not a part of or connected to a sewage treatment works.

2.36 LINER - a watertight membrane liner of at least 0.02 inch (20 mil) thickness which is used to prevent effluent from entering the soil or groundwater table. Material shall be polyvinyl chloride or material of equal integrity.

2.37 LOW PRESSURE PIPE SYSTEM - (See 2.22 Drip Irrigation System)

2.38 MANUFACTURER - the person or firm that constructs or assembles individual sewage treatment system components.

2.39 MOUND SYSTEM - an absorption system installed where the top of the gravel, rock, or chamber is installed above the original grade of the area where the system is installed.

2.40 PERCOLATION TEST - a subsurface soil test at the depth of a proposed absorption system or similar component of an individual sewage disposal system to determine the water absorption capability of the soil, the results of which are normally expressed as the rate at which one inch of water is absorbed.

2.41 PERMEABILITY - the property of a material which permits movement of water through the material.

2.42 PERMIT - a permit authorizing the construction, alteration, repair, or use of an individual sewage disposal system.

2.43 PERSON - an individual, partnership, firm, corporation, association, or other legal entity and also the state, and political subdivision thereof, or other governmental entity.

2.44 PRETREATMENT TANK - a watertight receptacle which receives sewage from the building sewer for pretreatment before transmission to another treatment unit.

2.45 PRIVY - a structure allowing for the disposal of excreta not transported by a sewer and which provides privacy and shelter and prevents access to the excreta by flies, rodents, or other animals.

2.46 PUBLIC HEALTH SANITARIAN - (See 2.26 Environmental Health Specialist)

2.47 RECIRCULATING SAND FILTER - a subsurface system which uses effluent filtration or absorption or both, and which contains an intermediate layer of sand as filter material. Effluent is dosed from a recirculation tank which receives septic tank effluent and returned filtrate. A portion of the filtrate is diverted for further treatment or disposal during each dose or when the recirculation tank is full.

2.48 REGISTERED PROFESSIONAL ENGINEER - an engineer licensed in the State of Colorado in accordance with Section 12-25-114, C.R.S.

2.49 SAND FILTER - a subsurface system which utilizes effluent filtration or absorption or both, and which contains an intermediate layer of sand as filter material.

2.50 SEEPAGE BED OR ABSORPTION BED - a subsurface soil absorption area which is wider than three (3) feet, together with a system of perforated distribution pipes through which effluent may seep or leach into the soil.

2.51 SEEPAGE PIT - a type of soil absorption system dependent upon suitable soil containing a structural internal void and designed on the basis of sidewall area.

2.52 SEPTIC TANK - a watertight, accessible covered receptacle designed and constructed to receive sewage from a building sewer, to settle solids from the liquid, to digest organic matter, to store digested solids through a period of retention and allow the clarified liquids to discharge to other treatment units for final disposal.

2.53 SERIAL DISTRIBUTION - an arrangement of absorption trenches, seepage pits or seepage beds where effluent is retained to utilize the absorption capacity of a component before flowing into a succeeding component.

2.54 SEPTAGE - a liquid or semisolid which includes normal household wastes, human excreta, animal or vegetable matter in suspension or solution generated from a septic tank serving a dwelling, building or other establishment.

2.55 SEWAGE - a combination of liquid wastes which may include chemicals, house wastes, human excreta, animal or vegetable matter in suspension or solution, or other solids in suspension or solution and which is discharged from a dwelling, building, or other establishment.

2.56 SEWAGE TREATMENT WORKS - a system or facility for treating, neutralizing, stabilizing, or disposing of sewage, which system or facility has a designed capacity to receive more than two thousand gallons of sewage per day, unless designed as an absorption system. The term "sewage treatment works" includes appurtenances such as interceptors, collection lines, outfall and the outlet sewers, pumping stations, and related equipment.

2.57 STATE WATERS - any and all surface and subsurface waters which are contained in or flow in or through this state, except waters in sewage systems, waters in treatment works of disposal systems, waters in potable water distribution systems, and all waters withdrawn for use, until all uses and treatment have been completed.

2.58 SUITABLE SOIL - a soil which will effectively filter effluent by removal of organisms and suspended solids before the effluent reaches any seasonal or perched water tables (determined by direct observation of the water table or salts, chemically reduced iron expressed as mottling or gleying); bedrock with impermeable, slowly permeable, or fractured strata; or excessively coarse sand and/or gravels and which meets percolation test requirements and has a vertical thickness of at least four feet below the bottom of the absorption area, as installed.

2.59 SYSTEMS CLEANER - a person licensed by the Department and engaged in cleaning and pumping of sewage disposal systems and removal of the residues deposited in the operation thereof.

2.60 SYSTEMS CONTRACTOR (Installer) - a person licensed by the Department and engaged in the installation, renovation, and repair of sewage disposal systems.

2.61 UNIFORMITY COEFFICIENT (C_u) - a value which is the ratio of D_{60} to D_{10} where D_{60} is the soil diameter of which sixty (60%) percent of the soil weight is finer and D_{10} is the corresponding value at 10% finer. (A soil having a uniformity coefficient smaller than four (4) would be considered "uniform" for purposes of this regulation.)

2.62 UNIFORM DOSING - a dosing system whereby the entire distribution network is pressurized to uniformly distribute effluent over the entire surface of the treatment or absorption area.

2.63 VAULT - a watertight, covered receptacle, which is designed to receive and store excreta or wastes either from a sewer or from a privy and is accessible for the periodic removal of its contents.

2.64 WASTEWATER POND - a designed pond which receives exclusively wastewater from a second stage treatment unit and which provides an additional degree of treatment.

SECTION III.—ADMINISTRATION AND ENFORCEMENT

3.1 PERMIT APPLICATION REQUIREMENT AND PROCEDURES

3.2 No person or persons shall install, alter, or repair an individual sewage disposal system (ISDS) within the counties of Adams, Arapahoe, and Douglas, State of Colorado, unless such person holds a valid permit, issued by the Health Officer in the name of the property owner for the specific construction, remodeling, installation, or use, proposed at the location described on the permit.

A permit shall be required for the following repairs or alterations:

A. Addition or replacement of septic tank.

B. Replacement of an existing absorption system.

C. Addition of an absorption system.

D. Expansion of an existing absorption system.

E. Addition of a lift station or pump and associated piping, where a lift station, pump or piping were not a part of original ISDS.

3.3 All applications for permits shall be made in writing on the forms provided by the Department. The Health Officer shall issue the permit, upon compliance by the applicant with provisions of this regulation.

3.4 Applications for a permit to construct a new ISDS shall be accompanied by percolation test, soil profile data and maximum slope determination in the absorption area, performed by or under the supervision of a Registered Professional Engineer. A plot plan, drawn to scale, signed by the owner or applicant and showing the following information shall accompany the application and soils test data.

A. Location of property, address and lot, block, subdivision, or other legal description.

B. Accurate property boundary measurements with an indication of north direction and ground slope direction.

C. Accurate location of both existing and proposed structures, trees, walks, and driveways.

D. Accurate location of the ISDS showing soil profile and percolation test hole locations.

E. Accurate or proposed location of domestic well, neighboring wells and neighboring septic systems within one-hundred (100) feet of the subject property lines.

F. Accurate location of streams, lakes, irrigation ditches, washes or other drainage conditions within the boundaries of the parcel and within one-hundred (100) feet of the subject property lines.

G. Topographic mapping with two (2) foot contour intervals when the slopes exceed fifteen (15%) percent in the area of the proposed construction and when any lot grading is proposed which will affect the system construction.

The Department may waive the requirements of 3.4 C, E and F if the property for which the permit is being applied for exceeds five (5) acres in size and the Department determines that the information required by 3.4 C, E and F is not necessary to show conformance with this Regulation.

3.5 Any changes or relocation of proposed structures or additions to the plot plan without approval by the Health Officer may void the permit. Any other information deemed necessary by the Health Officer shall be furnished.

3.6 A non-refundable fee in the amount established by resolution of the Board of Health shall be required of applicants for accepting and processing an application for a permit to construct and install any new, or for the repair or alteration of any existing individual sewage disposal system. The fee shall be payable to the Department at the time the application is accepted. The Board of Health may waive any permit fee normally required for an individual sewage disposal system.

3.7 Permits to install and construct an individual sewage disposal system shall expire at the end of twelve (12) months from date of issue unless the permit is extended to a fixed date upon written request by the applicant and at the discretion of the Health Officer.

3.8 No change of design of an individual sewage disposal system after the permit has been issued shall be made unless authorized in writing by the Health Officer.

3.9 The systems contractor shall be responsible for proper installation of the individual sewage disposal system.

3.10 An ISDS permit may be required for expanded use of an existing system beyond the design capacity of said system.

3.11 The property owner shall be responsible for proper maintenance of the system and for abatement of any nuisance arising from its failure.

3.12 Application to repair and for emergency use of a malfunctioning individual sewage disposal system shall be made within two business days by any owner or occupant after receiving notice from the Health Officer that the system serving his property is not functioning in compliance with these regulations. The date of expiration for repair permits

shall not extend beyond four (4) weeks from the date of issuance and shall not be renewed unless such a person can show good cause in writing to the Department and can demonstrate that no hazard or nuisance exists on the property.

3.13 Denials of permits shall be made in writing by the Health Officer stating reasons for the denial and requirements for reconsideration of the application.

3.14 The Health Officer may refuse to issue a permit for the construction of an individual sewage disposal system where a sewage treatment works is available within four-hundred (400) feet of the nearest property line and connection can be made thereto. The applicant shall provide a letter from the sewer district, municipality or county having jurisdiction, stating whether it is permissible for the Department to issue a permit for installation, alteration or repair of an individual sewage disposal system.

3.15 Any applicant who is denied a construction permit, or any person who is adversely affected by the denial or issuance of a permit, within thirty (30) days following such denial, may request and receive a hearing before the Board of Health.

3.16 The State Administrative Procedure Act (Article 4 of title 24, C.R.S.) shall govern any hearings held by the Department under the "Individual Sewage Disposal Systems Act."

3.17 The issuance of a permit and specifications of terms and conditions therein shall not constitute assumption or create a presumption that the Department or its employees may be liable for the failure of any system nor act as a certification that the equipment used in the system or any component thereof used in its operation or that the system for which the permit was issued insures continuous compliance with the provision of Title 25, Article 10, C.R.S., the rules and regulations adopted thereunder or any terms and conditions of a permit.

SECTION IV.—APPLICATION REQUIREMENTS

The application shall include such information, data, plans, specifications, statements, and commitments as required by Title 25, Article 10, C.R.S. and the rules and regulations adopted thereunder.

4.1 ADDITIONAL EVALUATION - When in the opinion of the Health Officer the Department does not have sufficient information for evaluation of an application or a system he may require additional tests, including soil percolation tests. This requirement may apply to applications for new, repair or altered systems.

4.2 ADDITIONAL HYDROLOGICAL, GEOLOGICAL, ENGINEERING, OR OTHER INFORMATION - When specific evidence suggest that undesirable subsurface conditions exist, additional hydrological, geological, engineering or other information provided by a Registered Professional Engineer or Geologist may be required to be submitted by the applicant..

4.3 The Health Officer shall review each application along with test results and other required information. The Health Officer will determine if the proposed system is in compliance with Title 25, Article 10, C.R.S. and applicable rules and regulations after which a permit may be issued.

SECTION V.—INSPECTIONS

5.1 SITE INSPECTION, FOLLOWING PERMIT APPLICATION AND PRIOR TO PERMIT ISSUANCE - After receiving an application for an individual sewage disposal system permit, the application shall be reviewed by the Health Officer and an inspection of the premises (site visit), unless previously made, shall be made by the Health Officer. A determination will be made as to the suitability of the site and of the proposed design based upon observation of a test pit as required in Section 13.3 B.3, to verify depth of the ground water table, suitable soil, depth to bedrock, in addition to ground slope and pertinent physical features.

5.2 SYSTEM INSTALLATION - It is the responsibility of the systems contractor to notify the Department when construction, installation, alteration, or repair has been sufficiently completed to allow inspection before the system is

placed in use. Inspection of the system by the Department shall be made within forty-eight (48) hours, weekends and holidays excluded, after being notified that the system is ready for inspection. Final inspection and approval of all individual sewage disposal systems shall be made by the Health Officer before any top soil or fill dirt covers any part of the system. The Department will determine if work has been performed in accordance with the permit requirements and will determine if the system complies with Title 25, Article 10, C.R.S., and the rules and regulations adopted thereunder.

5.3 AUTHORIZATION TO ENTER UPON PROPERTY - For the purpose of inspection and enforcing applicable rules and regulations and the terms and conditions of any permit issued, the Health Officer is authorized to enter upon private property at reasonable times and upon reasonable notice for the purpose of determining whether or not operating individual sewage disposal facilities and systems are functioning in compliance with Title 25, Article 10, C.R.S., and applicable rules and regulations adopted pursuant thereto and the terms and conditions of any permit issued and to inspect and conduct tests in evaluating any permit application. The owner or occupant of every property having an individual sewage disposal system shall permit the Health Officer access to the property to conduct required tests, take samples, monitor compliance and make inspections.

SECTION VI.—LOAN APPROVAL INSPECTION

A Loan Approval Inspection shall be performed whenever any person, pursuant to a housing loan, requests an inspection by the Department of an existing individual sewage disposal system. Application for the Loan Approval Inspection shall be made in writing on the form provided by the Department and shall be accepted and processed upon receipt of a Loan Approval Inspection fee for the amount established by resolution of the Board of Health. Application for this inspection shall be made a minimum of ten (10) working days prior to the time the inspection is requested. The applicant shall provide the Department with a receipt from a licensed system cleaner, indicating that the tank has been pumped, tank capacity and condition of the tank, tees/or baffles, within the previous four (4) years.

SECTION VII.—IMPACT OF CHERRY CREEK BASIN CONTROL REGULATION ON INDIVIDUAL SEWAGE DISPOSAL SYSTEMS

The water quality management master plan (Master Plan), prepared for the Cherry Creek Basin by the Cherry Creek Basin Water Quality Authority, determined that phosphorus loading from septic systems should be limited to four-hundred-fifty (450) pounds per year. The Colorado Water Quality Control Commission adopted the four-hundred-fifty (450) pounds per year phosphorus limit as regulation on November 6, 1985. The Master Plan has charged Tri-County Health Department with developing regulations to require Best Management Practices (BMPs) to limit phosphorus contributions from individual sewage disposal systems within the basin, consequently, new systems permitted and installed within the Cherry Creek Basin in soils classified as gravels or sands and/or having percolation rates faster (less than) twenty (20) minutes per inch shall be subject to the following additional requirements:

A. Two alternating absorption areas shall be constructed. The absorption areas shall be sized based on the criteria given in Table #7, page 29, with no reduction in size allowed.

B. A diverter valve shall be installed to allow wastewater to be applied to one absorption area at a time for a period of one year. The diverter valve shall be changed during the summer.

C. Each field shall be dosed in accordance with section 17.27.

SECTION VIII.—PROHIBITION OF INDIVIDUAL SEWAGE DISPOSAL SYSTEMS IN UNSUITABLE AREAS

The Board of Health may conduct a public hearing, after written notice to all affected property owners as shown in the records of the county assessor and publication of notice in a newspaper of general circulation at least ten days prior to the hearing, to consider the prohibition of permits of individual sewage disposal systems in defined areas which contain or are subdivided for a density of more than two dwelling units per acre. The Board of Health may order such prohibition upon a finding that the construction and use of additional individual sewage disposal systems in the defined area will constitute a hazard to the public health. In such a hearing, the Board of Health may request affected

property owners to submit engineering and geological reports concerning the defined area and provide a study of the economic feasibility of constructing a sewage treatment works.

SECTION IX.—LICENSES OF SYSTEMS CONTRACTORS AND SYSTEMS CLEANERS

9.1 No person shall install, alter, or repair an individual sewage disposal system unless he holds a valid Systems Contractor License issued by the Health Officer. Fees shall be set by resolution of the Board of Health. Licenses shall expire on December 31st of each year and shall be renewed within thirty (30) days prior thereto. A license which lapses shall be subject to the fee established for new licenses upon reapplication.

A system contractor license is issued to the individual who takes and passes the written systems contractor examination. The license shall follow the individual if they change employment. Each systems contractor shall have a minimum of one owner or employee with a valid systems contractor license at all times.

9.2 STANDARD OF PERFORMANCE REQUIRED OF HOLDERS OF SYSTEMS CONTRACTOR LICENSE

A. Application for Systems Contractor's Licenses or renewals shall be made on forms supplied by the Department.

B. Prior to the issuance or renewal of a license, the Health Officer may require the applicant to demonstrate adequate knowledge of these regulations. This may include, but is not limited to, passing an exam prepared by the Department or attending educational conferences conducted by the Department.

C. Installation, alteration, or repair of any individual sewage system shall be in compliance with these regulations and with the conditions set out in the application and installation permit.

D. Notice of a requested inspection shall be given by the license holder not less than forty-eight (48) hours before the inspection is to be made.

E. A license holder shall have made certain that an installation permit has been obtained prior to starting construction and the installer shall install the system in compliance with all plans and specification as submitted by the applicant and approved by the Department. System contractors shall have a copy of the permit, plans, and specifications on the property at all times that construction of the system is occurring and at the time of final inspection if so requested by the Department.

F. The Systems Contractor shall provide the Department, prior to or at the time of the Department's final inspection of the system installation, a diagram accurately locating all parts of the system in relationship to the dwelling and/or property lines and give at least two measured points from a fixed location to the first compartment of the septic tank and two corners of the longest dimension of the absorption area with the measurements indicated on the drawing. (See Diagram 1, page 10) The diagram shall be drawn on forms provided by the Department. Final approval of the system installation may be withheld for failure to submit the diagram.

G. The Systems Contractor shall be required by the Department, upon completion of the system installation, to appropriately mark and flag the system so as to identify its location in order to prevent vehicles or persons building the structure from driving over any part of the system. The contractor should also notify the general contractor of the above information.

9.3 A contractor or cleaner's license may be revoked for failure to comply with these regulations. Revocation shall take place only after a hearing before the Board of Health. The license holder shall be given not less than ten (10) days notice of the hearing and may be represented at the hearing by counsel.

A. Written notice of revocation, specifying the violations, shall be served upon the holder of the License. Service of notice as required in this section shall be as provided by the Colorado Rules of Civil Procedure, or by registered or certified mail, return receipt requested, deliverable to addressee only.

Town of Bennett

355 Fourth Street
Bennett, Colorado
80102-7806
(303) 644-3249

Property Address _____
Permit # _____
Date System Completed _____
System's Contractor Name _____
System's Contractor License # _____
System's Contractor Address and Phone _____
_____

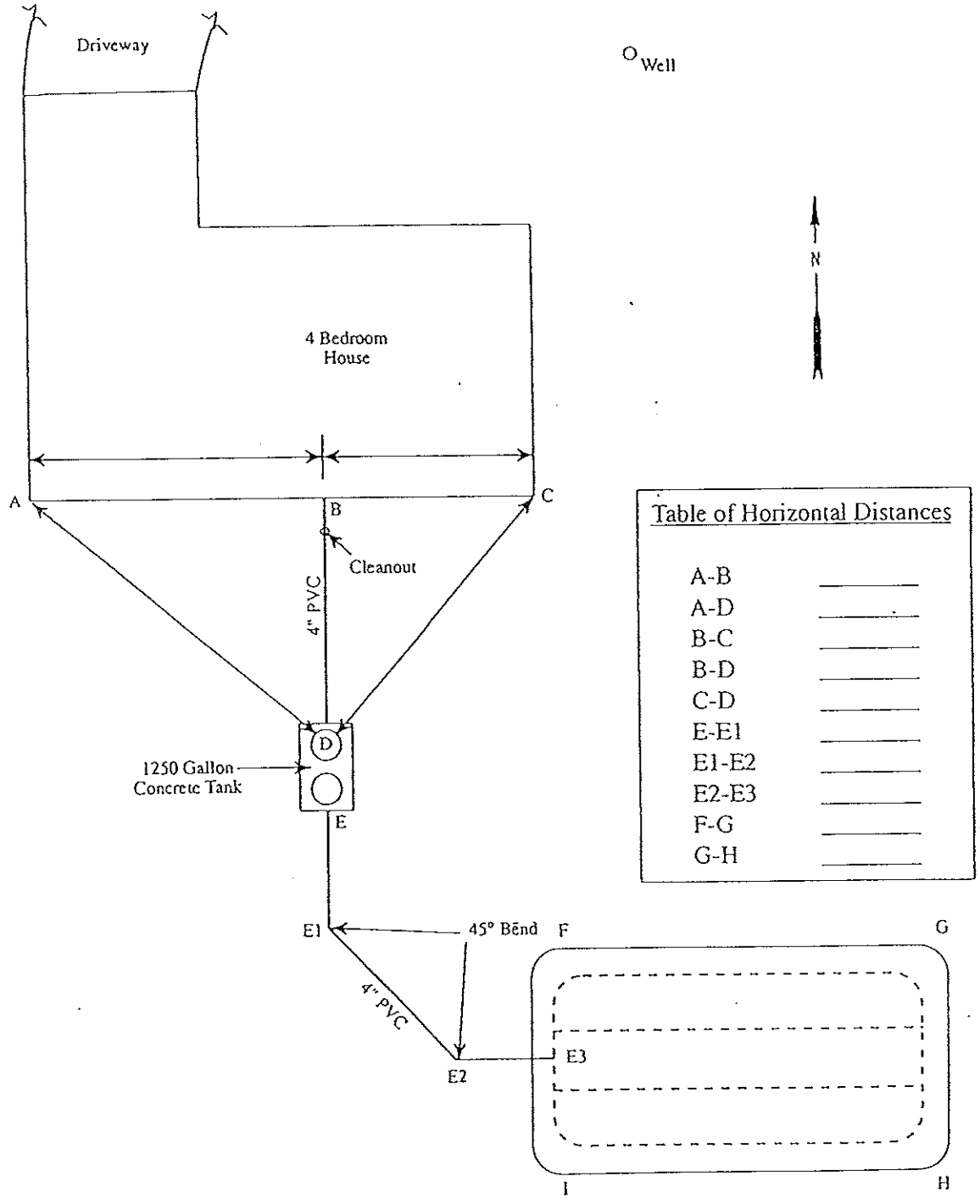


Table of Horizontal Distances

A-B	_____
A-D	_____
B-C	_____
B-D	_____
C-D	_____
E-E1	_____
E1-E2	_____
E2-E3	_____
F-G	_____
G-H	_____

Diagram 1

Onsite System As-Built Drawing

B. Licenses shall expire on December 31st of each year. A license which lapses because of failure to renew shall be subject to the fee established for a new license upon reapplication. A person who has previously had a license revoked may be denied renewal by the Board of Health.

9.4 No person shall engage in the cleaning of individual sewage disposal systems or the transportation of sewage to a disposal site unless he holds a valid Systems Cleaner License issued by the Health Officer. Employees under direct supervision of a licensed System Cleaner shall not be required to be licensed. Fees shall be set by resolution of the Board of Health.

9.5 STANDARD OF PERFORMANCE FOR SYSTEMS CLEANERS

A. Application for Systems Cleaners License or renewals shall be made upon forms supplied by the Department.

B. A license holder, when cleaning tanks or aeration plants, shall remove the liquid, sludge and scum from both compartments of divided tanks and both tanks that are in series, leaving only enough sludge to act as a seed for continuing operation. Three inches of remaining residue is recommended. Tanks should not be washed or disinfected after pumping. The outlet tees or baffles of tanks shall be checked for proper installation and/or damage provided they can be observed as part of the routine pumping process. Missing or damaged tees or baffles on the outlet side of tanks shall be reported to the owner and the Department for immediate repair.

C. A license holder shall maintain his equipment so as to insure that no spillage of sewage will occur during transportation, and that his employees are not subjected to undue health hazards.

D. A license holder shall dispose of the collected sewage only at sites approved by local county officials, or the Health Officer in a manner which does not create a hazard to the public health, a nuisance or an undue risk of pollution and which complies with state and local rules and applicable regulations.

E. For each tank pumped, a license holder shall be required to keep a record of location serviced, volume of septage pumped, site of disposal, and condition of tank tees or baffles. These records shall be kept on forms approved by the Department. When requested by the Department, the license holder shall submit records for review by the Department. No later than December 31 of each year the System Cleaner shall submit to the Department copies of contracts with facilities approved by local county officials or the Health Officer for accepting septage.

9.6 Prior to the issuance of or renewal of a license, the Health Officer may require the applicant to demonstrate adequate knowledge of these regulations.

9.7 REVOCATION OF A SYSTEMS CLEANER LICENSE - The procedure, as described in Section 9.3 shall be followed for the revocation of a license. Failure to keep records, submit records or quarterly reports upon request, or show evidence of proper disposal, shall be cause for the Department to initiate revocation of license proceedings.

9.8 The Board of Health may adopt rules and regulations for the scheduling of maintenance and cleaning of systems and practices adequate to insure proper functioning of acceptable systems, and may require proof of proper maintenance and cleaning, pursuant to any such schedules and practices, to be submitted periodically to the Department by the owner of the system.

9.9 NOTICE OF VIOLATION - Whenever the Health Officer determines that there has been a violation of any provision of these regulations or standards as herein provided, he shall give notice of such violation to the responsible person. Such notice shall be in writing and shall particularize the violation, provide a reasonable time for correction, and be addressed to the owner and/or occupant of the property concerned.

9.10 CEASE AND DESIST - The Health Officer shall issue an order to cease and desist from the use of any system found not to be functioning in compliance with these regulations and standards or otherwise to constitute a nuisance or a hazard to public health and which has not received timely repairs in accordance with the notice issued under these

regulations. Such an order will be issued only after a hearing which shall be conducted by the Health Officer not less than forty-eight (48) hours after written notice thereof is given to the owner or occupant of the property on which the system is located and at which the owner and occupant may be present, with counsel, and be heard. The order shall require that the owner or occupant bring the system into compliance or eliminate the nuisance or hazard within a reasonable period of time, not to exceed thirty (30) days, or thereafter cease and desist from the use of the system. A cease and desist order issued by the Health Officer shall be reviewable in the district court for the county wherein the system is located and upon a petition filed not later than ten (10) days after the order is issued.

SECTION X.—MAINTENANCE AND CLEANING

10.1 MAINTENANCE, CLEANING AND EFFLUENT TESTING SCHEDULES - In order to insure good working order, the following minimum schedule shall apply to all individual sewage disposal systems:

TABLE #1
SEPTIC TANK CLEANING AND EFFLUENT TESTING SCHEDULE

Type of Treatment	Inspection or Maintenance	Cleaned or Pumped	Routine Effluent Testing
Septic Tank	4 years	4 years	none
Vaults, Privies	Annually	at 75% Capacity	none
Aeration Plants	6 months	4 years	a) Not more than 2 times/year b) Weekly, if surfaced discharged.

10.2 All material pumped from an individual sewage disposal system during a cleaning procedure shall be disposed at a site approved by local county officials or Health Officer, in a manner which does not create a hazard to the public health, a nuisance or an undue risk of pollution which complies with all applicable state and local rules and regulations.

SECTION XI.—CALCULATION OF SEWAGE FLOW AND CHARACTERISTICS

11.1 Where gallons per day and pounds of five (5) day biochemical oxygen demand (BOD_5) per day can be obtained by measurement of existing conditions, such data shall be used.

11.2 For new facilities, Table #2 of quantities and BOD_5 strength of sewage may be used as a guide to represent average conditions (pages 13 - 14).

11.3 Maximum Flow shall be considered as 150 percent of average daily flow, and shall be the basis for design proposed unless otherwise established by evidence satisfactory to the Health Officer.

11.4 To calculate the sewage flow for dwellings and mobile homes, use a figure of 3.5 people per dwelling unit or at least two persons per bedroom, whichever is greater.

11.5 In no event may the system be designed for a lesser capacity than the anticipated maximum daily sewage flow or treatment requirements of the sewage or wastes in the system, except for design of evapotranspiration beds using the water balance method.

SECTION XII.—MINIMUM HORIZONTAL DISTANCES BETWEEN COMPONENTS OF A SYSTEM AND PHYSICAL FEATURES

12.1 Minimum horizontal distances from the various components of a system to pertinent terrain features, including streams, lakes, water courses, springs, wells, subsoil drains, cisterns, water lines, suction lines, gulches, dwellings, other occupied buildings and property lines, shall be in accordance with Table #3, page 15, of minimum horizontal distances.

TABLE #2
TABLE OF QUANTITIES AND BOD_5 STRENTH OF SEWAGE

TYPE OF ESTABLISHMENT	GALLONS/PERSON/DAY	LBS BOD_5 PER PERSON/DAY (Unless otherwise stated)
Residential		
Hotels & Motels without private baths	50	0.15
Hotels & Motels with private baths	75	0.15
Multiple family dwellings or apartments	75	0.20
Rooming houses	50	0.15
Single family dwellings	75	0.20
Commercial & Miscellaneous		
Airline	3 gal/meal served	0.03 lbs/meal served
Airports (not including food)	5 gal/passenger	0.02 lbs/passenger
Airports	10 gal/employee/day	0.06 lbs/employee/day
Bus service station (not including food)	5	0.02
Country clubs (not including food)	30	0.02
Day workers at offices	15	0.06
Drive-in theaters (not including food)	10 gal/space/day	0.06 lbs/space/day
Factories and plants (excl. of indust. wastes)	35	0.08
Laundries, self-service	400 gal/washer/day	2.00 lbs/washer/day
Food service estab. (toilet & kitchen wastes)	10 gal/patron/day	80.17
Food service estab.(kitchen wastes)	3 gal/meal served	0.03 lbs/meal served
Food service estab. (with paper service)	1.5 gal/meal served	0.01 lbs/meal served
Additional for bars & cocktail lounges	2	0.02
Movie theaters, churches (not including food)	5 gal/seat/day	0.03 lbs/seat/day
Stores	400 gal/public toilet	2.00 lbs/pubic toilet/day
Work or construction camps (semi-permanent) w/. flush toilets	50	0.17
Work or construction camps (semi-permanent) w/o flush toilets	35	0.02
Travel trailer parks with individual water & sewer hook-up	100 gal/unit/day	2.00 lbs/public toilet/day
Travel trailer parks without individual water & sewer hook-up	50 gal/unit/day	0.17 lbs/unit/day
Institutional		
Hospital	250 gal/bed space/day	0.20 lbs/bed space/day
Institutions other than hospitals	125 gal/bed space/day	0.17 lbs/bed space/day
Mobile home parks	75	0.20
Schools, boarding	100	0.17
Schools, day (w/o cafeterias, gym or showers)	15	0.04
Schools, day (with cafeterias, but not gym or shower)	20	0.08
Schools, day (with cafeterias, gym and showers)	25	0.10
Recreational & Seasonal		
Camps, day (no meals served	15	0.12
Camps, Luxury resort	125	0.17
Camps, resort (night & day) with limited plumbing	50	0.12
Camps, tourist, trailer or campground	100 gal/unit/day	0.50 lbs/unit/day
Cottages and small dwellings (seasonal)	50	0.17

TABLE #2 - Continued.
TABLE OF QUANTITIES AND BOD_5 STRENTH OF SEWAGE

TYPE OF ESTABLISHMENT	GALLONS/PERSON/DAY	LBS BOD_5 PER PERSON/DAY (Unless otherwise stated)
Country Club:		
Shower	500 gal/fixture/day	0.48 lbs/fixture/day
Country Club Continued	300 gal/fixture/day	0.29 lbs/fixture/day
Bath	100 gal/fixture/day	0.25 lbs/fixture/day
Lavatory	150 gal/fixture/day	0.18 lbs/fixture/day
Toilet	50 gal/fixture/day	0.51 lbs/fixture/day
Sink	36 gal/fixture/hour	0.04 lbs/fixture/hour
Public Park:		
Flush toilet	36 gal/fixture/hour	0.04 lbs/fixture/hour
Urinal	10 gal/fixture/hour	0.01 lbs/fixture/hour
Shower	100 gal/fixture/hour	0.10 lbs/fixture/hour
Faucet	15 gal/fixture/hour	0.04 lbs/fixture/hour
Swimming Pools and Bath Houses	10	0.06
Separate Flow - Residential Use		
Bath/shower	14.7	0.014
Dishwasher	1.8	0.002
Kitchen Sink	4.4	0.045
Additional for Garbage Grinder	1.4	0.052
Laundry Washer	19.5	0.037
Lavatory	8.4	0.021
Vater Closet	24.8	0.029

DIAGRAM 2: SETBACK FROM CUT BANKS

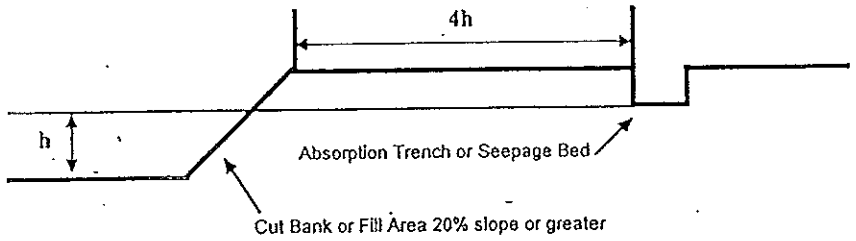


TABLE 3
MINIMUM HORIZONTAL DISTANCES IN FEET BETWEEN COMPONENTS OF A SEWAGE DISPOSAL SYSTEM INSTALLED AFTER NOVEMBER 15, 1973, AND PERTINENT PHYSICAL FEATURES

	Spring, Wells, Suction Lines	Potable Water Supply Line	Potable Water Supply Cistern	Dwelling Occupied Building	Property Lines, Piped or Lined Irrigation Ditch	Subsoil Drains, Intermittent Irrigation Lateral	Lake, Water Course, Irrigation Ditch or Stream	Dry Gulches	Septic Tanks
Dispersal System Utilizing Aerosol Methods	(3) 100	(4) (2) 10	50	125	10	0	(3) 25	(3) 10	10
Seepage Pit or Slit Trench	(3) 100	(4) (2) 50	25	20	25	10	(3) 50	(3) 25	6
Absorption Trench, Seepage Bed, Sand Filter, Sub-surface Dispersal System, or Drywell	(3) 100	(4) (2) 25	25	20	10	10	(3) 50	(3) 25	6
Unlined Sand Filter in Soil With a Percolation Rate Slower than 60 Minutes per Inch.	100	(4) (2) 25	25	15	10	10	25	15	10
Unlined or Partially Lined Evapotranspiration System, Wastewater Pond, or Surface Disposal System other than Aerosol	100	(4) (2) 25	25	15	10	10	25	15	10
Lined Sand Filter	60	(4) (2) 10	25	15	10	10	25	10	5
Lined Evapotranspiration Field or Lined Wastewater Pond	60	(4) (2) 10	25	15	10	10	25	10	5
Pit Privy or Vault Privy	50	(4) (2) 10	25	15	10	10	25	10	——
Septic Tanks, Treatment Plants, Dosing Tanks, Vaults	(2) 50	(4) (2) 10	25	(1) 5	10	10	50	10	——
Building Sewer or Effluent Lines	(2) (4) 50	(4) (2) 10	(4) 25	0	(2) (4) 10	(4) 10	(2) (4) 50	(2) (4) 10	——

Note: The minimum distance shown above shall be maintained between the system components and the physical features described. Where soil, geological or other conditions warrant, greater distances may be required by the local board of health or by the Water Quality Control Commission pursuant to C.R.S. 25-8-206 In accordance with authority prescribed by law and rules and regulations implemental of said section. Components which are not water tight should not extend into areas of the root system of nearby trees. For repair or upgrading of existing systems where the size of lot precludes adherence to these distances, repaired facility shall not be closer to water supply components than the existing facilities.

(1) Distance shown shall not apply to treatment plants or effluent lines where recycling is permitted.

(2) Crossings or encroachments may be permitted at the points as noted above provided that the water conveyance pipe is encased for a minimum distance of ten (10) feet on each side of the crossing. A length of pipe shall be used with a minimum Schedule 40 rating of sufficient diameter to easily slide over and completely encase the water conveyance. Ridged end caps of at least Schedule 40 rating must be glued or secured in a watertight fashion to the ends of the encasement pipe. A hole of sufficient size to accommodate the pipe shall be drilled in the lowermost section of the ridged cap so that the conveyance pipe rests on the bottom of the encasement pipe. The area which the pipe passes through the endcaps shall be sealed with an approved underground sealant compatible with the piping used.

(3) Add 8 feet additional distance for each 100 gallons per day of design flow over 1000 gallons per day as specified in the table, unless it can be demonstrated by a Registered Professional Engineer or Geologist that a mechanical or natural barrier will prevent contamination.

(4) Encroachments may be permitted provided the water or wastewater conveyance pipe is encased as in (2) above, specified in the table.

12.2 New wells, springs or potable water supply suction lines and all other construction units listed in Table #3 shall be installed or located in accordance with the minimum distance requirements provided by the Board of Health regulations. The minimum horizontal distance required from cut banks and fill areas to individual sewage disposal system components discharging effluent into or onto the surrounding soil shall be four (4) times the height of the bank, measured from the top edge of the bank (see Diagram 2, page 14) unless additional geotechnical information demonstrates to the satisfaction of the Department that a minimum horizontal distance less than 4th will not result in a violation of Section 25.8 of this Regulation

SECTION XIII.—STANDARDS FOR INDIVIDUAL SEWAGE DISPOSAL SYSTEMS

13.1 No person shall establish, construct, or maintain any premises having a dwelling, or other structure, which is not equipped with approved facilities for the disposal of sewage in a sanitary manner. Under no condition shall sewage or effluent from any premises having a dwelling or other structure, be deposited upon the surface of the ground, into a stream, irrigation ditch, drainage ditch or other water course, except in such manner as provided by these regulations, the *Statues of the State of Colorado,* the Standards, Rules, and Regulations adopted by the Colorado Department of Public Health and Environment and the Colorado Water Quality Control Commission.

13.2 Individual sewage disposal systems constructed in the counties of Adams, Arapahoe and Douglas, State of Colorado, shall meet the following standards, specifications, tables and criteria and shall include, as a minimum, provisions regarding the following matters:

13.3 SOIL TEST AND TEST PIT

A. Location: Soil percolation tests shall be performed in at least three (3) test holes in the area in which the absorption system is to be located, spaced uniformly over the proposed site, except there shall be no less than one (1) test hole in any twelve-hundred (1200) square foot area of the absorption system.

B. Dimensions:

1. The percolation test holes shall be from four (4) to twelve (12) inches in width or diameter, and shall be terminated a minimum of six (6) inches below the bottom of the proposed absorption system in those soils comprising the four (4) feet of soils beneath the bottom of the absorption system. If a change of soil type, color, or structure is present within those soils comprising the four (4) feet of soils beneath the absorption system, a minimum of two (2) soil percolation test holes shall be terminated in this soil and a percolation test shall be run in both test holes.

2. One soil profile test hole at least eight (8) feet deep or to bedrock, must be completed to give an indication of the soil condition in the area including that soil zone at least four (4) feet below the bottom of the proposed absorption system. To meet this requirement on sloping lots or lots where grading will occur, the soil profile hole may have to be completed to a depth greater than eight (8) feet. Soils in the soil profile hole shall be classified using the Unified System (ASTM D 2487). As a minimal requirement, one undisturbed sample shall be taken at the approximate depth of the proposed system (bottom of the rock). When drive samples are collected, blow counts associated with collecting this sample shall be reported. The undisturbed sample shall be classified by gradation and plotted on a percent passing curve. Where the minus 200 fraction is greater than fifty (50%) percent, or where Dawson Sand is encountered, Atterberg Limits (ASTM D 4318) shall be run on the sample. All test results shall be shown on a log of the hole. Moist soil color shall also be reported on the log.

3. Prior to the site visit by the Health Officer (see Section 5.1), one soil profile test pit at least four (4) feet below the bottom of the absorption area or to bedrock must be excavated to give an indication of the soil condition in the area including that soil zone at least four (4) feet below the bottom of the proposed absorption system. The pit must be at least six (6) feet long and three (3) feet wide at the bottom. The pit

must be located outside the area of the proposed absorption system. Any excavated pit which is not back-filled the same day which it is excavated shall be surrounded with barricades or fencing to prevent persons and animals from falling into the pit. The pit must be available for inspection by the Health Officer at the Site Visit (see section 5.1). If bedrock is encountered in the test, two additional test pits shall be excavated to bedrock, to determine the dip and strike of the bedrock unit, and to assist in evaluation of the lateral extent the unit. If the ground surface slopes more than two (2%) percent, the two (2) additional pits shall be excavated to bedrock down slope from the location of the proposed absorption area. The two (2) additional pits shall be a sufficient distance apart such that the dip, strike and lateral extent of the bedrock unit under the proposed absorption area and down slope of the absorption area can be evaluated. If bedrock is not encountered in the two (2) additional pits within eight (8) feet of the ground surface, the excavations may be terminated at the eight (8) foot depth.

13.4 PROCEDURE - Percolation test shall be conducted utilizing the hole preparation, soil saturation and rate measurement procedures outlined in the U.S. Department of HEW, *Public Health Service Manual of Septic Tank Practice* (Robert A. Taft Sanitary Engineering Center Procedure). These procedures are summarized below and in Diagram 3 on page 18.

A. **Preparation of Percolation Test Holes:** Carefully scratch the bottom and sides of the hole with a knife blade or sharp pointed instrument, in order to remove any smeared soil surfaces and to provide a natural soil interface into which water may percolate. Remove all loose material from the hole. Add two (2) inches of coarse sand or fine gravel to protect the bottom from scouring and sediment.

B. **Saturation and Swelling of the Soil:** It is important to distinguish between saturation and swelling. Saturation means that the void spaces between soil particles are full of water. This can be accomplished in a short period of time. Swelling is caused by intrusion of water into the individual soil particles. This is a slow process, especially in clay-type soil, and is the reason for requiring a prolonged soaking period.

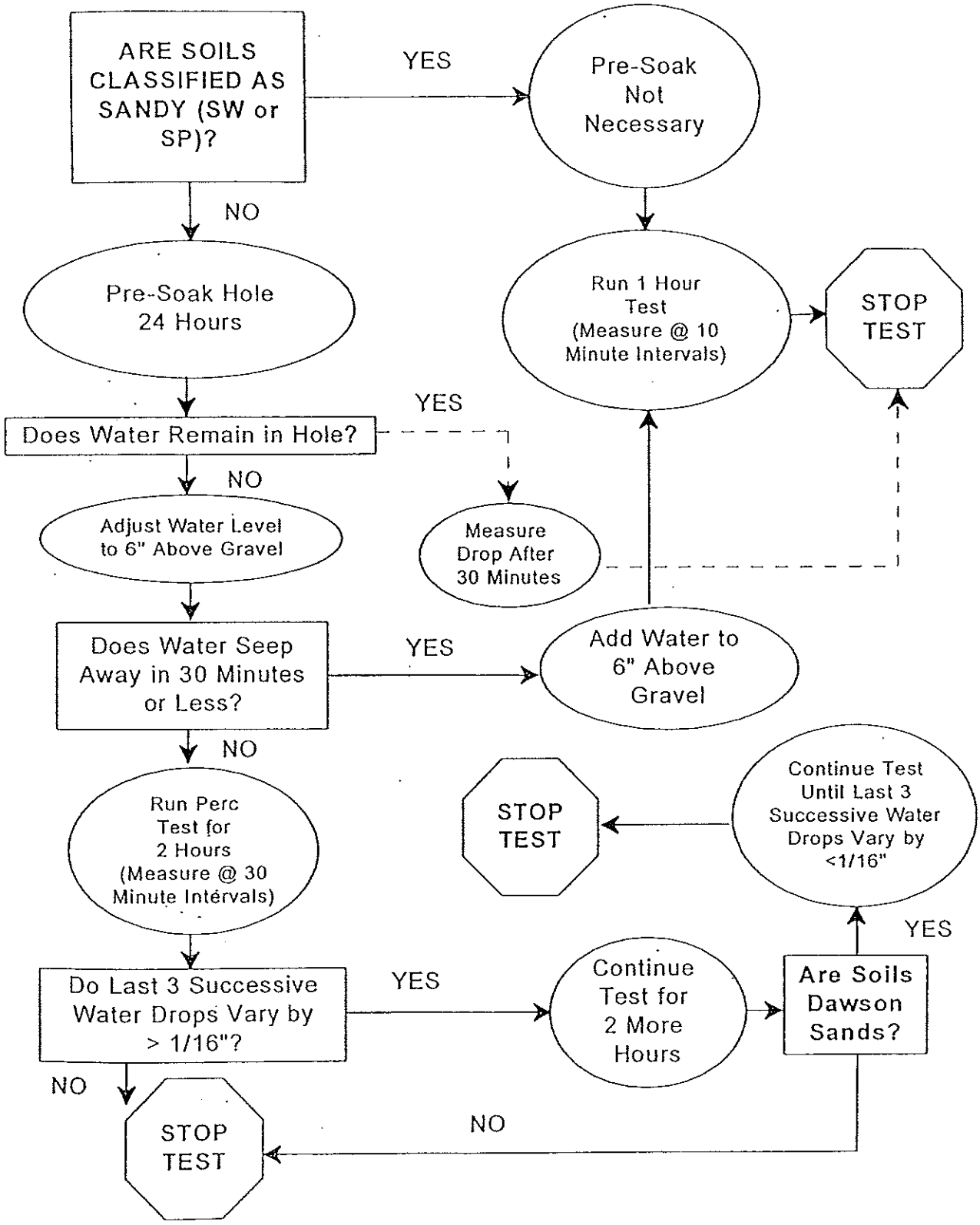
In the conduct of the test, carefully fill the hole with clear water to minimum depth of twelve (12) inches over gravel. In most soils, it is necessary to refill the hole by supplying a surplus reservoir of water, possibly by means of an automatic siphon, to keep water in the hole for at least four (4) hours and preferably overnight. Determine the percolation rate twenty-four (24) hours after water is first added to the hole. This procedure is to insure that the soil is given ample opportunity to swell and to approach the condition it will be in during the wettest season of the year. Thus, the test will give comparable results in the same soil, whether made in a dry or in a wet season. In soils classified as SW or SP (containing five [5%] percent or less minus 200 particles), the swelling procedure is not essential, and the test may be made as described under item C (3), after the water from one filling of the hole has completely seeped away.

C. **Percolation Rate Measurement:** With the exception of sandy soils (classified as SW or SP), percolation-rate measurements shall be made on the day following the procedure described under item B, above.

1. If the water remains in the test hole after the overnight swelling period, adjust the depth to approximately six (6) inches over the gravel. From a fixed reference point, measure the drop in water level over a thirty (30) minute period. This drop is used to calculate the percolation rate.

2. If no water remains in the hole after the overnight swelling period, add clear water to bring the depth of water in the hole approximately six (6) inches over gravel. From a fixed reference point, measure the drop in water level at approximately thirty (30) minute intervals for four (4) hours, refilling to six (6) inches over the gravel as necessary. The drop that occurs during the final thirty (30) minute period is used to calculate the percolation rate. The drops during prior periods provide information for possible modification of the procedure to suit local circumstances. The requirement to conduct to a four (4) hour test under this section is waived if three (3) successive water level drops do not vary by more than one-

DIAGRAM 3: PERCOLATION TEST PROCEDURE



sixteenth (1/16) inch; however, in no case shall the test under this section be less than two (2) hours in length.

3. In sandy soils classified as SW or SP, (or other soils in which the first six [6] inches of water seeps away in less than thirty [30] minutes, after the twenty-four [24] hour swelling period), the time interval between measurements shall be taken as ten (10) minutes and the test run for one (1) hour. The drop that occurs during the final ten (10) minutes is used to calculate the percolation rate.

4. In Dawson Sands, the test shall be a minimum of four (4) hours, or until the last three (3) successive drops vary by less than one-sixteenth (1/16) inch, whichever is greater.

D. The engineer conducting the percolation test shall, upon completion of the tests, flag or otherwise mark each percolation hole so that they can be easily located. Percolation and profile holes must also remain open for evaluation by the Department.

13.5 CALCULATION AND REPORTING - The field percolation rate shall be the average rate of the percolation tests in the test holes observed in the proposed absorption area. A percolation rate determined by the test shall be used in calculating the absorption area required for the proposed system. The engineer shall supply an accurate site plan drawn to scale showing the location of the soils tests tied to lot corners or other permanent markers. For all lots less than five (5) acres, the site plan shall show the entire lot. Reporting of all data generated under the requirements of Sections 13.3, 13.4 and 13.5, shall only be done on forms provided by the Department.

13.6 PERFORMANCE OF PERCOLATION TESTS AND SLOPE CALCULATION - The percolation test and slope calculation shall be performed by or under the supervision of a Registered Professional Engineer or by a competent technician of the Department. If the applicant demonstrates to the satisfaction of the Board of Health that the system is not dependent upon soil absorption, the requirement for percolation tests may be waived.

13.7 ALTERNATE PERCOLATION TEST - Alternate percolation test procedures may be approved providing the test results of alternate procedures are substantially equivalent to those determined using the test procedure detailed in this section. Prior approval from the Health Officer for use of alternate test procedures is required

13.8 WATER TABLE - LOCATION OF MAXIMUM SEASONAL GROUND WATER TABLE

The location of the maximum seasonal groundwater table shall be determined by the following methods:

A. Direct visual observation of infiltrated water at the time of year when groundwater table is highest within an excavation.

B. Observation of soil in a trench of at least ten-foot depth for evidence of crystals or salts left by the maximum seasonal groundwater table, or chemically reduced iron in the soil, reflected by a dull gray or mottled coloring.

C. Or, by other scientific methods approved by the Department.

SECTION XIV—DESIGN FEATURES (GENERAL)

14.1. RELIABILITY - Individual sewage disposal systems shall be designed and constructed such that each component shall function, when installed and operated, in a manner not adversely affected by the normal operating conditions including erosion, vibration, shock, climatic conditions, and usual household chemicals used. Each component shall be free of non-functional protrusions or sharp edges, or other hazards, which could cause injury to persons, animals, or properties. Design shall be such as to exclude flies and rodents and to prevent the creation of nuisances and public health hazards and shall provide for efficient operation and maintenance.

14.2. PLUMBING CODES - Plumbing fixtures, grease traps, building sewers, vents, sewer lines and other appurtenances shall be designed, operated and maintained so as to comply with the minimum requirements of the Uniform Plumbing Code in force of the effective date of these regulations or those revisions of said Code as are adopted.

14.3. ELECTRICAL EQUIPMENT (if used) - All electrical work, equipment, and material shall comply with the requirements of the National Electrical Code in force on the effective date of these regulations, or those revisions of said Code as are adopted by the State Electrical Board.

14.4. IDENTIFICATION AND DATA MARKING - A permanent type plate or other indelible marking on major components not constructed on the site where installed shall be provided, so inscribed as to be easily read and visible for the purpose of inspection. Said inscription shall include the following:

A. Name of manufacturer.

B. Model or serial number of designation.

C. Maximum design capacity of the unit and the unit of measurement.

14.5. STRUCTURAL INTEGRITY - Tanks shall be so constructed and installed so as to withstand earth and hydrostatic pressures when full and when empty. All metal surfaces shall be properly coated to prevent corrosion. All treatment tanks shall be installed and maintained in accordance with the tank manufacturer's installation and maintenance instructions.

14.6. WATER TIGHTNESS - Septic tanks, vaults, or other units, shall not allow infiltration of groundwater or surface water and shall not permit the release of wastewater or liquids through other than designed openings.

14.7. ACCESSIBILITY FOR INSPECTION AND MAINTENANCE - Each treatment unit shall be equipped with an access manhole located within (8) inches of the ground surface, to permit periodic physical inspection, collection and testing of samples and maintenance of all components and compartments including but not limited to submerged bearings, moving parts, tubes, intakes, slots, filters, inlet and outlet baffles, and other devices.

14.8. INDICATORS OF FAILURE FOR SYSTEMS UTILIZING MECHANICAL APPARATUS - A signal device shall be installed which will provide a recognizable indication or warning to the user that the system or component is not operating or is operating but malfunctioning. This indication or warning shall be in the form of a visual and audible signal, acceptable to the Department.

14.9. SERVICEABILITY - Components shall be so designed and constructed that when installed in accordance with manufacturer's recommendations, they shall be capable of being easily maintained, sampled, drained, pumped, inspected and cleaned.

14.10. SAMPLING ACCESS - Where a required final effluent sample cannot be easily obtained, a sampling well shall be constructed. The sampling well shall be accessible and provided with a properly secured cover.

14.11. INSTRUCTIONS - The manufacturer shall provide clear, concise instructions covering the unit which, when followed, will assure proper installation and safe and satisfactory operation.

14.12. SURFACE ACTIVITY - the surface of the ground over the individual sewage disposal system or any part thereof, must be restricted to activity or use which will permit the system to function as designed and which will not contribute to compaction of the soil nor to structural loading detrimental to the capability of the component to function as designed.

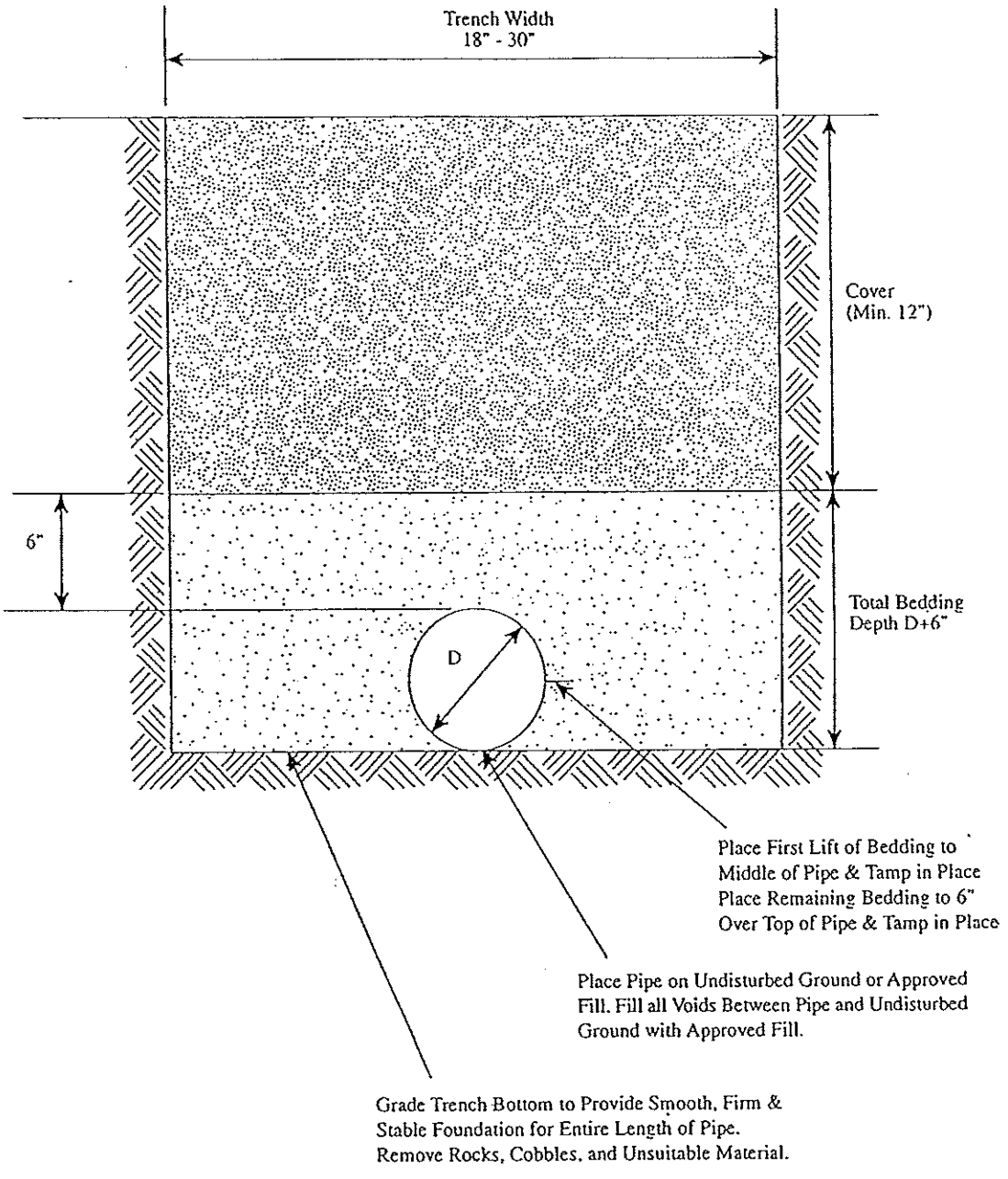


Diagram 4

Pipe Bedding Detail

14.13 BUILDING SEWERS

A. **Materials:** All piping used in individual sewage disposal systems shall be constructed of approved plastic pipe as shown in Table #4 or other durable material. All joints in the sewer shall be watertight and root proof. That portion of the sewer line within fifty (50) feet of any well or suction line from a well, or within ten (10) feet of any drinking water supply line under pressure or within five (5) feet of any basement foundation shall be durable, corrosion resistant, root proof, and so installed as to remain water tight.

B. **Excavation:** Excavations for pipelines, fittings, and appurtenances shall be open trench to the depth, grade and in the direction necessary. The trench bottom shall be graded to provide a smooth firm and stable foundation at every point throughout the length of the pipe, fitting or appurtenance. Should large gravel, cobbles, rocks, clods, or other unsuitable material be encountered at the trench bottom, they shall be removed. (See Diagram 4, page 21) Where necessary, approved fill, as specified in Section C below, shall be placed to provide

TABLE #4
LIST OF APPROVED PLASTIC PIPE FOR SEPTIC USES

TYPES OF PIPES	ASTM STANDARD	BUILDING SEWER LINES	OTHER SEWER LINES	ALL LINES IN ABSORPTION SYSTEM
PVC (Type PS-46)	F787-82	YES	YES	YES
ABS (Sewer Pipe)	D2751-80	YES (2)	YES (2)	YES (2)
ABS (DMV Schedule 40)	D2661-78	YES	YES	YES
PVC (Type PSM)	D3034-80	YES (2)	YES (2)	YES (2)
PVC (STD or Perforated)	D2729-80	NO	NO	YES
PE (Corrugated-Perforated)	F405-82(3)	NO	NO	YES

1. From building to septic/aeration tank to absorption system or trenches. Commingling of plastic materials shall not be done within this area except through the use of proper adapters. When the building sewer is of a type of material that is different from the building drain, proper transition fittings shall be used.
2. Pipe shall not have an SDR (Standard Dimension Ratio) number greater than 35.
3. Heavy duty (only)
4. Additional treatment facilities and sand filter collection lines and distribution lines. ASTM- American Society for Testing Materials.

Note: The last two numbers of the ASTM Standard indicate the date of the edition. The latest edition shall be the basis for this regulation.

uniform support between the pipe, fitting or appurtenance and undisturbed trench bottom. The area of the trench at pipe joints (bells) shall be over excavated as necessary to provide uniform bearing of the bells on undisturbed ground. Each joint shall be recessed in undisturbed soil or approved fill in such a manner as to relieve the bell of the pipe of all load and to ensure continuous bearing along the pipe barrel upon the pipe subgrade (trench bottom).

C. Approved Fill: Approved fill shall be as specified in Table #5 on page 23. All voids between the pipe and undisturbed soils shall be filled with approved fill. Approved fill shall be worked into place or tamped, as necessary, to consolidated the fill material and completely fill all void space between the pipe and undisturbed trench bottom. (See Diagram 4, page 21.) Alternate fill materials and/or methods may be allowed, upon prior approval from the Department. The Department may require that an alternate fill material or method be specified and approved by a Registered Professional Engineer.

D. Pipe Bedding: All system piping, except for distribution laterals and manifolds within the absorption area, shall be bedded with select material. Select bedding material shall consist of loose, granular material, free from stones, clods, frozen soils, and other deleterious, material. Select material may consist of job excavated or imported material, and shall be placed as shown in Diagram 4 on page 21. All piping within 10 feet of the building foundation shall be bedded with sufficiently fine grained material to minimize the transmission of water to soils adjacent to the foundation.

E. Pipe Grade: The grade of the building sewer shall be at least two (2) percent (two [2] foot-fall per hundred [100] feet or one-fourth [1/4] in per foot), except for the ten (10) feet immediately preceding the septic tank, where it shall not exceed two (2) percent. Buildings shall be planned so that a proper slope can be obtained. Where the terrain is extremely flat, the Department may allow a slope of only six (6) inches per one-hundred (100) feet, or five-tenths (0.5%) percent.

TABLE #5
APPROVED FILL SPECIFICATION

Sieve Size	Percent Passing
3/8"	100
#4	70-80
#8	10-25
#16	0-10
#200	0-2

F. Appurtenances:

Cleanouts: A cleanout shall be provided:

1. Within five (5) feet of the outside of the building.

2. Upstream at each change of direction of the building sewer greater than forty-five (45) degrees and at any combination of bends greater than forty-five (45) degrees occurring within any (10) ten foot section of building sewer.

3. Bends: Bends ahead of the septic tank should be limited to forty-five (45) degrees or less wherever possible. If ninety (90) degree bends cannot be avoided, they should be made with two (2) forty-five (45) degree ells, or a long sweep quarter curve.

SECTION XV. — DESIGN FEATURES (SEPTIC TANK)

15.1 A septic tank shall be constructed to permit detention of incoming sewage for a minimum of thirty (30) hours, based on peak flow (1.5 x average flow), or the capacity shall be based upon the number of bedrooms according to Table #6 on page 24.

TABLE #6
SEPTIC TANK SIZE BASED UPON NUMBER OF BEDROOMS

Number of Bedrooms	Minimum Effective Liquid Tank Capacity (gallons
3 or less	1000
4	1250
Each Additional	250

15.2 SEPTIC TANK DESIGN CRITERIA (See Diagram 5 on page 26.)

A. Except for gray water systems, the effective liquid capacity shall be no less than one-thousand (1000) gallons.

B. Inlet invert shall be a minimum of three (3) inches higher than the outlet invert.

C. Outlet tee or baffle shall extend above the surface of the liquid to within one (1) inch of the underside of the tank top and shall extend at least fourteen (14) inches below the outlet invert.

D. The distance from the outlet invert to the underside of the tank top shall be at least ten (10) inches.

E. Liquid depth shall be a minimum of thirty (30) inches and the maximum depth shall not exceed the tank length or sixty (60) inches, whichever is less.

F. A septic tank shall have two (2) or more compartments or more than one (1) tank may be used in series to provide the following capacity arrangement. The first compartment of a septic tank shall hold between fifty (50%) and sixty-seven (67%) percent or the required effective capacity.

G. The transfer of liquid from the first compartment to the second or successive compartment shall be made at a liquid depth of at least 14 inches below the outlet invert but not in the sludge zone.

H. At least one (1) access no less than twenty (20) inches across shall be provided in each compartment of a tank.

I. The opening cover of a septic tank manhole, inspection port, or sampling access port shall be no deeper than eight (8) inches below the finished grade. Risers, where used, shall be sealed at the manhole with mastic rope or by other means such that they are water tight.

J. Septic tanks and vaults shall be set on a firm, level, stable footing so as to avoid settling.

K. Backfilling around a septic tank shall be accomplished in a manner to prevent tank settlement and avoid undue strain on the tank and the pipes entering and leaving the tank. Tanks shall be constructed and installed to

to withstand earth and hydrostatic pressures while either full or empty. Unless otherwise approved by the Department, concrete tanks shall have a minimum thickness as follows: Outside Walls: three-and-one-half (3-1/2) inches; Lids: six (6) inches; Top of Tank: six (6) inches, Divider Walls: three (3) inches; Bottom: (4) inches.

L. PVC SDR 35 or ASTM D 3034 pipe of equal strength shall extend from the building or dwelling to the septic tank, and from the septic tank to the absorption system. The inlet and outlet tee or baffle shall be sealed with mastic rope or cement grout to prevent leakage into or out of the septic tank.

M. Septic tanks shall contain all liquids and solids within the tank, without leaking. The Department may require a water tightness test prior to approval of a system.

N. Abandoned septic tanks and vaults shall be pumped and filled with soil.

No septic tank shall be used in the Tri-County area unless it has been approved by the Department.

SECTION XVI.—DESIGN FEATURES (Aerobic Sewage Treatment System)

16.1 GENERAL DESIGN - The shape and design of an aeration compartment, its inlet and outlet arrangement, baffling and air application shall:

A. Allow for intimate mixing of applied sewage, return solids, and applied air.

B. Prevent excessive short circuiting of flow.

C. Prevent the deposition and build-up of solids in the aeration compartment.

16.2 METHOD OF AERATION - The method of aeration shall be accomplished by mechanical aeration, diffused air, or a combination of these. The method of aeration shall at all times maintain aerobic conditions at the maximum organic loading in both the aeration and settling compartments.

SECTION XVII.—DESIGN FEATURES (On Site Systems)

17.1 For a system treating and disposing of effluent through a soil absorption system, the method for calculating minimum absorption area shall be based upon the amount of suitable soil and the capacity of the soil to absorb liquids as established by the percolation test and upon the design criteria and construction standards for such type of absorption system, as set forth in this Regulation.

17.2 FLOODPLAINS - No new or expanded system shall be installed in a floodway. When a system is installed in a 100-year floodplain, then the new or repaired system shall meet or exceed the requirements of the National Flood Insurance Program. The system, as approved by the Health Officer, shall be designed to minimize or eliminate infiltration of flood waters into the system, and discharge of the system into the flood waters.

17.3 ENGINEERED SYSTEMS - One or more of the following conditions will require that the system be designed by a Registered Professional Engineer and be approved by the Department:

A. Where the soil percolation rate is slower than one (1) inch in sixty (60) minutes or faster than one (1) inch in five (5) minutes. A non-engineered system may be allowed with a percolation rate faster than one (1) inch in five (5) minutes in soils of sandy texture.

B. Where the maximum seasonal level of the groundwater table is less than four (4) feet below the bottom of the proposed absorption system,

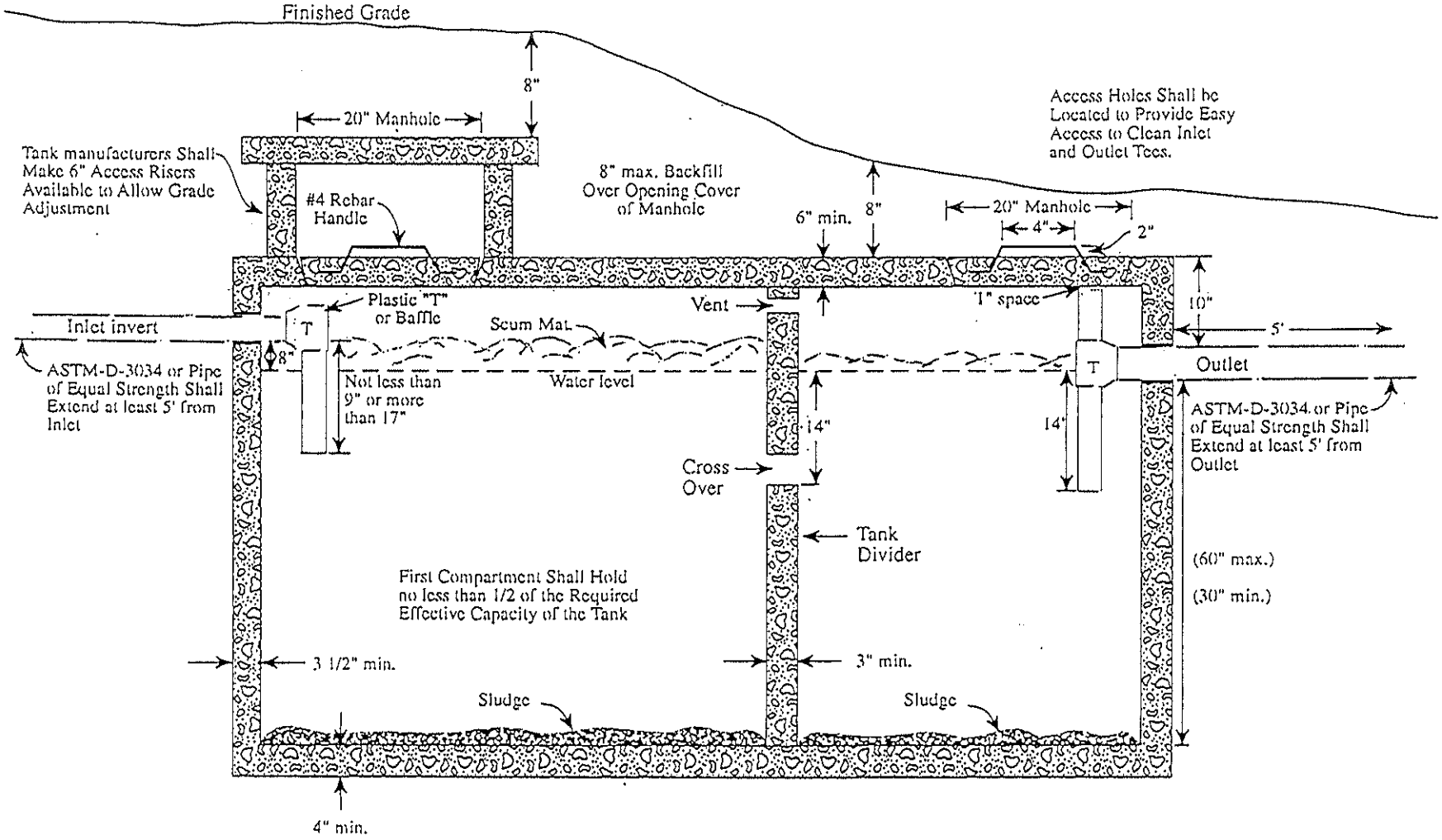


Diagram 5

Typical Concrete Septic Tank

C. Where bedrock or Dawson Sand exists less than four (4) feet below the bottom of the proposed absorption system.

D. Where the ground slope is in excess of twenty (20%) percent.

E. Where the individual sewage disposal system will service a commercial, business, institutional or industrial property or multi-family dwellings(s).

F. Where the system must be dosed due to site conditions or requirements of this regulation. In addition to the requirements of Section 3.4, plans and specifications for systems designed by a Registered Professional Engineer shall include, as a minimum, the following elements:

1. A plan view to scale of the system on the property including the building sewer.

2. All distribution piping and the septic tank.

3. A cross section through the system.

4. Pipeline slopes and materials

5. Specifications for all materials used in the system.

6. Any other information required by the Department in order to determine that the proposed system is designed in accordance with this regulation.

Plans and specifications shall be stamped and signed by the engineer responsible for the design. The design engineer shall specify in the plans what inspections will be required during construction of the engineered system. The system installer shall notify the design engineer to make all specified inspections during the course of construction. Engineered systems shall be inspected by or under the supervision of the Registered Professional Engineer responsible for the design. At the completion of the installation of an engineered system, the engineer shall submit to the Department a letter stating that the system has been installed in conformance with the plans and specifications approved by the Department. Signed copies of all field inspection reports shall accompany this letter. In conjunction with a field visit by a Department representative prior to backfill, the final determination by the Department as to whether work has been performed in accordance with permit requirements will be withheld until the letter and field inspection reports are received and approved. The inspection reports shall document that all inspections specified in the plans have been made and passed.

17.4 Soil building or replacement may be permitted to bring the soil within the requirements of suitable soil. After installation, the surface area of absorption areas have limited uses. Nothing shall be placed or constructed on the finished absorption areas that will seal the surface of the soil or cause compaction, i.e., concrete, asphalt, driveways, and corrals. Absorption areas should be seeded with a low water demand grass as recommended by the County Extension Office.

17.5 ABSORPTION AREA - The minimum absorption area in square feet for an individual sewage disposal system shall be determined as set forth in Table #7, page 29. The minimum absorption areas for absorption beds and trenches shown in Table #7, are calculated by System Sizing Formula #1, page 28.

The maximum application rates (in gallons per square foot per day) given in Table #7, for commercial, business, institutional or industrial installations, are calculated by System Sizing Formula #2 on page 29.

The minimum absorption areas for commercial, business, institutional, or industrial installations are calculated by System Sizing Formula #3 on page 30.

17.6 ADDITIONAL AREA - The absorption area so calculated shall be the minimum required area. The Department may recommend additional area if soils, percolation, flow or other data indicate that the minimum required area may be insufficient.

A. Alternating Systems: A diversion valve or other approved diversion mechanism may be installed on the septic tank effluent line allowing alternating soil absorption systems. Each soil absorption system shall be a minimum of fifty (50%) percent of the total area required in Table #7, page 29. The diversion mechanism shall be readily accessible from the finished grade and shall be switched on an annual basis in the summer. Reductions in absorption field area are not applicable to alternating systems. Where a repair is made requiring an additional absorption area, a diversion valve or other approved diversion mechanism shall be installed to allow alternating effluent flow.

B. Soils with percolation rates exceeding 60 min./in. are unsuitable for absorption systems sized by the criteria in Table #7, page 29.

C. For ten (10) inch SB-2 Pipe, 1 L.F. of pipe = three (3) sq. ft., for eight (8) inch, 1 LF = two (2) sq. ft.

SYSTEM SIZING FORMULA #1
MINIMUM BED AND TRENCH ABSORPTION AREA PER BEDROOM

$$A = 1.6 \text{ (BED) OR } 1.25 \text{ (TRENCH) } X \quad \frac{Q\sqrt{t}}{5}$$

Where:

A	=	Minimum area for absorption beds or trenches (sq.ft./bedroom)
Q	=	Total daily peak flow per bedroom (1.5 x 2 persons/bedroom x 75 gallons/person/day) = 225 gals.
t	=	Average Percolation Rate, in minutes per inch, *Rounded upward to 20, 40, or 60 mpi*
1.6	=	Bed sizing Factor for additional BOD_5 loading from garbage disposal and washing machine
1.25	=	Trench Sizing Factor for additional BOD_5 loading from garbage disposal and washing machine (includes credit for sidewall absorptive area)
NOTE:		Values appearing in Table #7 are rounded

TABLE #7
MODIFIED SYSTEM SIZING CRITERIA
(only applicable with percolation rates from 5 to 60 mpi)

Percolation Rate Range	Minimum Area for Seepage Beds*	Minimum Area for Trenches & SB-2*	Maximum Application Rate Commercial, Business, Institutional or Industrial Installations **
(min./in)	(square feet/bedroom)	(square feet/bedroom)	(gal/sq.ft./day)
5-20	325	250	1.1
21-40	450	360	0.8
41-60	560	435	0.6

* See System Sizing Formula #1, page 28.

** See System Sizing Formula #2, page 29.

SYSTEM SIZING FORMULA #2
COMMERCIAL, BUSINESS, INSTITUTIONAL, OR INDUSTRIAL SYSTEMS

$$\text{MAXIMUM APPLICATION RATE (gallons/sq.ft./day)} = \frac{5}{\sqrt{t}}$$

Where:

t = average percolation rate, *Rounded upward* to 20, 40, or 60 minutes per inch

For an individual sewage disposal system serving a commercial, business, institutional or industrial property with percolation rates between 5 and 60 minutes per inch, the absorption area shall be sized using System Sizing Formula #3 page 30.

17.7 ADJUSTMENT FOR DEEP GRAVEL - The length of an absorption trench or bed may be calculated by allowance for the sidewall area of additional depth of gravel in excess of six (6) inches below the bottom of the distribution pipe according to System Sizing Formula #4 (below).

17.8 ADJUSTMENT FOR DOSING - If dosing is used in conjunction with an absorption trench or bed system, a reduction of twenty-five (25%) percent is allowed.

17.9 The ground surface shall be graded to deflect precipitation or other outside water from the absorption area. The absorption area shall be protected against erosion .

SYSTEM SIZING FORMULA #3
COMMERCIAL, BUSINESS, INSTITUTIONAL, OR INDUSTRIAL SYSTEMS

$$A = \frac{Q}{\text{Maximum Application Rate (gal/sq.ft./day), from System Sizing Formula \#2 and Table \#7}}$$

Where:

A = Minimum area for absorption beds (percolation rate between 5 and 60 mpi)

Q = Maximum Flow (1.5 x average flow): (See Section XI, page 12.)

17.10 Trenches or beds shall not exceed one hundred (100) feet in length in any one direction from point of effluent entry and the bottom shall be excavated level. Trenches or beds shall not be excavated when the soil is wet enough to smear or compact easily. Care must be taken to prevent sealing of the soil on the bottom and sides of the rock to reduce the effects of compaction. Open excavations shall be protected from surface runoff to prevent the entrance of silt and debris.

SYSTEM SIZING FORMULA #4
ADJUSTMENT FOR DEEP GRAVEL

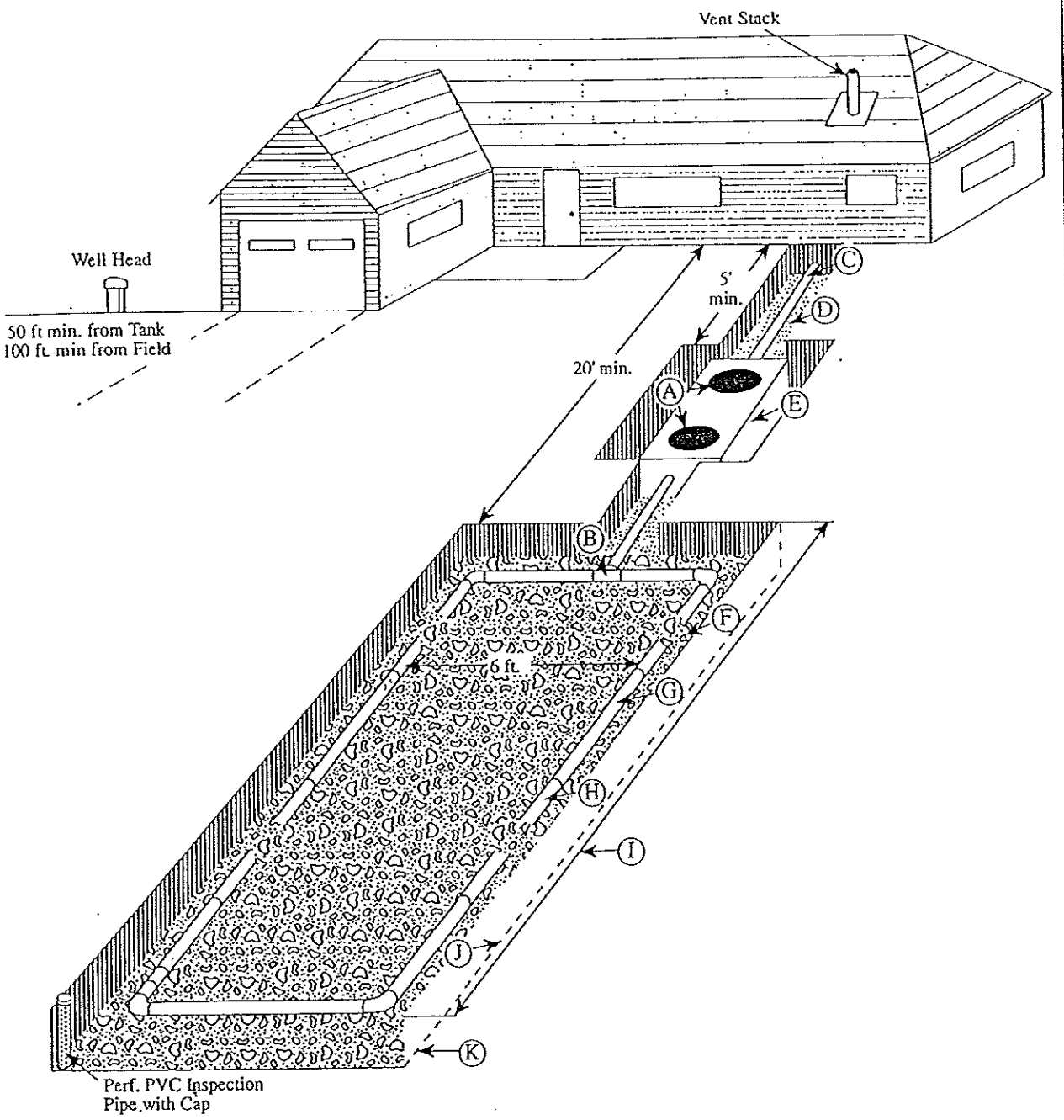
$$\text{CALCULATED LENGTH} = \text{length required prior to adjustment} \times \frac{W + 2}{W + 1 + 2d}$$

Where: W = width of field or trench (in feet)

d = depth of gravel below distribution pipe (in feet)

17.11 Clean graded gravel, rock or material of equal efficiency shall cover the entire bed or trench to an average depth of one (1) foot, as indicated in Diagram 6 on pages 31-32. Rock used in absorption beds shall be clean, graded rock, one-half (1/2)-inch to two-and-one-half (2-1/2) inch in size, with the amount of rock less than half-inch (1/2) inch not to exceed ten (10) percent by volume.

17.12 Perforated distribution pipe PVC (rigid type) not less than three (3) inches in diameter shall be required in beds and trenches. It shall be laid level and surrounded by gravel or rock. It shall be placed so that there is a minimum of at least two (2) inches of rock above the top of the pipe. The rock may be mounded over the top of the pipe provided there is no less than six (6) inches of rock in the valley between the pipes. The separating distance between parallel distribution pipe in a seepage bed shall not exceed six (6) feet. The pipe should be no more than three (3) feet from sides and end walls of the excavation. (See Diagram 6, pages 31-32.) Seepage beds with two or more distribution lines, shall be tied or looped together so that effluent can reach all parts of the system. The perforations shall be placed so that they are opposite each other at the bottom of the pipe. Most perforated PVC has a printed data line stenciled directly on the top, so that if the print is on top, the perforations will be in proper position at the bottom.



No Part of the System can be Backfilled Prior to Inspection

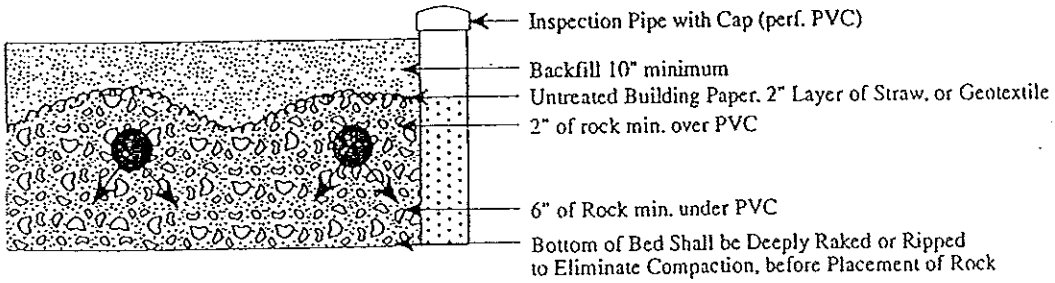


Diagram 6
(page 1 of 2)
Typical Individual Sewage Disposal System

Diagram 6
(page 2 of 2)
Typical Individual Sewage Disposal System

A Both manhole lids or concrete rings shall extend to within 8" or less, of grade (see tank diagram)

B "T" - set level, and may be attached at any point

C 5' cast iron or local plumbing code.

D at least 1/4" per foot (2%) fall. last 10' should not exceed 2% fall. Clean-out required if 100' or more. Pipe shall be bedded per Diagram 4.

E 2 compartment tank or 2 tanks in series, set level. Both inlet & outlet must have a "T" or baffle extending down 14". Outlet "T" extension shall be within 1" or roof of tank.

F 1' of clean, graded rock, 1/2" to 2 1/2" in size.

G Perforated PVC imbedded in rock at least 2 " over top and 6" below. Perforated PVC must be 3' from edge of bed and no more than 6' apart.

H Perforated PVC must be level.

I Bed should not exceed 100' in length - must be 10' from property line.

J Bed should be kept at perc. test depth, usually 3' and installed in perc. test location. If bed cannot be kept at perc test depth, contact health department.

K Bottom of bed or trench excavated level. Bed shall not be excavated when soil is wet enough to smear or compact. Perforated PVC shall be placed so that perforations are opposite each other at the bottom (see end view drawing). The ends must be joined (looped) together.

Inspection pipes shall be installed at the opposite ends of the absorption area from where the effluent enters. Inspection pipes must extend to finished grade (see Diagram 6, pages 31-32).

17.13 Before the final cover of soil, the top of the rock shall be covered with untreated building paper, a two (2) inch layer of hay, straw or similar pervious material to prevent the stone from becoming clogged by the earth backfill.

17.14 At least ten (10) inches of soil shall be placed over the paper, straw or hay to finished surface grade of the seepage bed or trench. The final cover shall be graded to deflect runoff water away from the absorption area.

17.15 Machine tamping, rolling or hydraulic compaction of final cover shall not be permitted, however, hand tamping may be allowed where necessary to stabilize the soil to prevent erosion or the intrusion of extraneous water.

17.16 ABSORPTION OR SEEPAGE PITS - Absorption or seepage pits in an area having adequate soil absorption, may be permitted as an alternative when seepage beds are impractical and where the subsurface conditions are otherwise suitable for pit installations. The capacity of a pit shall be computed on the basis of percolation tests made in each vertical stratum penetrated. The weighted average of the results shall be used to obtain a design figure. Soil strata in which the percolation is over thirty (30) minutes per inch shall not be used for absorption or seepage pits. The effective area of the pit is the vertical wall area (based on dug perimeter) of the pervious strata below the inlet. No allowance shall be made for impervious strata or bottom area. Pits shall be separated by a distance equal to three (3) times the greatest lateral dimension of the largest pit. For pits over twenty (20) feet in depth, the minimum space between pits shall be twenty (20) feet. Pits shall be provided with both vertical sidewall and top supporting structural concrete or other material of equal structural integrity. Adequate safety protection shall be provided to protect against personal injury during construction or use.

17.17 DRYWELLS - Drywells shall be filled with clean, graded rock from one-half (1/2) to two-and-one half (2-1/2) inches in diameter. The rock shall extend from the bottom of the pit to at least two (2) inches above the inlet pipe. At least one (1) four (4) inch perforated vertical standpipe will be attached to the end of the distribution line and fitted with a removable cap to be used as an inspection pipe. The absorption area of the drywell shall be computed on the basis of percolation rates. The weighted average of the results shall be used to obtain a design figure. The effective area of the pit will be calculated by adding the area of the side walls below the horizontal inlet line and the area of the bottom of the pit excluding any impermeable stratum penetrated. Drywells so sized may only be permitted in soils with a percolation rate less than sixty (60) minutes per inch. Drywells shall be separated by a distance equal to the depth of the excavation or ten (10) feet, whichever is greater.

17.18 SERIAL DISTRIBUTION SYSTEM - A serial distribution system may be used in all situations where a soil absorption system is permitted and may be used where the ground slope does not allow for suitable installation of a single-level seepage bed. The horizontal distance from the side of the absorption trench to the surface of the ground shall be adequate to prevent lateral flow and eruption of effluent above ground. When a serial distribution system is used, the following design and construction procedures shall be followed:

A. The bottom of each absorption trench and its distribution line shall be level.

B. There shall be a minimum of ten (10) inches of backfill over the gravel fill.

C. An absorption trench shall follow approximately the ground surface contours so that variation in trench depth will be minimized.

D. There shall be a minimum of six (6) feet (horizontal measurement) of undisturbed earth between adjacent absorption trenches and between the septic tank or other treatment unit and the nearest absorption field.

E. Adjacent absorption trenches shall be connected with a relief line or a drop box arrangement such that each trench fills with effluent to the top of the gravel before flowing to succeeding trenches.

F. Relief lines connecting adjacent trenches shall be constructed on undisturbed ground, to prevent "short-circuiting" of effluent to the lower trenches. An impermeable collar may be required to be constructed around the relief line at each upper trench, to prevent "short-circuiting" of effluent from a higher trench to a lower trench.

17.19 EVAPOTRANSPIRATION SYSTEM

An evapotranspiration system (ET) may be used exclusively or in combination with a soil absorption system. (See Diagram 7, page 38.)

A. An evapotranspiration system shall be designed by a Registered Professional Engineer who shall furnish design data for a complete review of the design.

B. Data to be furnished shall include, but shall not be limited to: liner material and bedding, properties of the soil in the evapotranspiration bed, and provision for vegetation cover.

C. When high groundwater table, permeable bedrock, fractured rock, or highly pervious material (percolation faster than five [5] minutes per one [1] inch) endanger the underground water, a durable and impermeable liner shall be installed in the bed to prevent the sewage effluent from entering the underlying formation or groundwater table.

D. An evapotraspiration system shall be located in an area where there is unobstructed exposure to sunshine.

E. The system bed shall be crowned and covered with a minimum of four (4) inches of selected backfill material and with a vegetation cover.

F. **Flow Rates:** Flow rates are based upon the number of bedrooms. Flow rates shown in the second column of Table #8 below, entitled "Design Residential Flow Rate (Formula Method)" are calculated as indicated for "Q" in System Sizing Formula #1, page 28, and discussed in Section XI. Flow rates shown in the third column of Table #8, entitled "Design Flow Rate (Water Balance Method)" are calculated as indicated for "Q" in System Sizing Formula #1, omitting the 1.5.

TABLE # 8
DESIGN RESIDENTIAL FLOW RATES-ET SYSTEMS

Bedrooms	Design Flow Rate (Formula Method) (Gallons Per Day)	Design Flow Rate (Water Balance Method) (Gallons Per Day)
2	450	300
3	675	450
4	900	600

G. Sizing: Evapotranspiration Systems shall be sized using one of the following methods:

1. FORMULA METHOD

If this method is selected, System Sizing Formula #5, below, shall be used for determining the area necessary for total evapotranspiration of septic tank effluent.

SYSTEM SIZING FORMULA # 5 EVAPOTRANSPIRATION SYSTEMS (FORMULA METHOD)
$\text{Area (in square feet)} = \frac{\text{Design Flow (gal/day)} \times 586}{\text{Lake Evaporation (in/year)}}$

Lake evaporation in the Tri-County area is shown on U.S. Department of Commerce Weather Bureau, Technical Paper #17 as ranging from 40 to 50 inches/year with the front range area at approximately 40 in/yr. or an application rate of approximately 0.07 gal/sq.ft/day. This translates to the minimum sizes shown in Table #9, below.

TABLE # 9 MINIMUM ET BED SIZES USING FORMULA METHOD	
2 Bedroom	6430 sq. ft
3 Bedroom	9645 sq. ft
4 Bedroom	12,860 sq. ft

2. WATER BALANCE METHOD

An evapotranspiration system may be designed on the basis of a monthly water balance for the system. Such a design shall provide for total storage of average daily flows for all periods in which evapotranspiration is not shown to occur. Table #10 (below) shall be used to determine the maximum allowable soil absorption rate, based on the maximum percolation rate from the set of percolation test holes.

TABLE #10
MAXIMUM ALLOWABLE SOIL ABSORPTION RATES
USING WATER BALANCE METHOD

MAXIMUM PERCOLATION RATE (Min./Inch)	MAXIMUM ALLOWABLE SOIL ABSORPTION RATE (gal/sq. ft./day)
61-90	0.20
91-120	0.15
121+	0.10
Fully Lined Bed	0.00

If the water balance method is selected, the following minimum information shall be provided in at table or spreadsheet format:

1. Monthly wastewater flow into system.
2. Monthly precipitation infiltrating into system.
3. Initial moisture content in bed sand and topsoil cover.
4. Monthly evapotranspiration rate.
5. Amount absorbed into soils.
6. Storage capacity of bed in gallons.
7. Monthly change in storage within the bed, in gallons.
8. Monthly precipitation, and evapotranspiration shall be from a reputable source, such as the National Oceanic and Atmospheric Administration.

H. Design: The design shall conform to Diagram 7 on page 38.

I. Topsoil: This Material should be selected or mixed to provide a cover that will promote the movement of water to the surface and provide a base for good vegetative cover.

J. Sand: Sand utilized in ET beds shall meet the gradation requirements shown in Table #11, below. Sand shall be well graded as defined by ASTM D.2487 particularly between the #40 and #200 sieve sizes. Design engineers shall approve systems contractors sand prior to delivery of material to the site and shall submit to the Department, prior to final approval, sand gradation results showing conformance with this Section.

K. Gravel: Clean one-half (1/2) inch to two-and-one-half (2-1/2) inch rock.

L. Line Separation: Line separation shall not exceed six (6) feet.

TABLE #11 ET BED SAND SPECIFICATION	
Sieve Size	Percent Passing
4	100
40	50-55
200	<15

M. **Chamber Systems Within ET Beds:** Approved chamber systems may be utilized in evapotranspiration beds. The chamber units must be spaced to provide an equal or greater amount of storage within the bed than would be provided by gravel as required Diagram #7 on page 38.

N. **Liner:** Liners are only required where there is a possibility of surface breakthrough or possible contamination of groundwater. Liners, if required, are to be a minimum of 20 mil. thickness. Surfaces on which liners are to be placed shall be thoroughly prepared to be free of protrusions and materials which could puncture or otherwise damage or weaken the liner. If it is not possible to remove protrusions which may damage the liner, the systems installer shall provide sand bedding for the liner, of adequate thickness to protect the liner.

O. **Drainage:** All surface drainage must be diverted around the field and the field must be sufficiently crowned to provide good runoff.

P. **Vegetation:** It will be necessary to contact the Soil Conservation Service or County Extension Agent to determine what grasses are best suited for each area and landscaping plan. Trees should not be planted at any location which will eventually shade the field.

Q. **Plans:** Provide a good set of plans including a topographical map and plot plan showing the location of the system and any feature on the lot that might affect the location or operation of the system. This will expedite the Department review and subsequent issuance of an installation permit.

R. The bed area shall be protected to prevent damage from vehicular, pedestrian, or equestrian travel. A diversion ditch and/or berm shall be provided on the uphill side(s) of the bed to deflect precipitation and other outside water away from the evapotranspiration system.

17.20 SYSTEMS NOT USING GRAVEL - Systems not using gravel may be allowed by the Department provided they have been approved by the Colorado Department of Public Health and Environment (CDPHE) in accordance with C.R.S., 25-10-108. Specific Department requirements for systems not using gravel which have been approved by CDPHE prior to the effective date of this regulation are presented below.

A. SB-2 Systems are acceptable as non-engineered systems in areas where trenches and seepage beds are allowed by the Department. SB-2 Systems may be allowed by the Department provided the installation meets the following requirements:

1. Four (4) feet of suitable soil shall be provided below the bottom of the SB-2 trench.

2. SB-2 trench width shall not be less than twenty-four (24) inches.

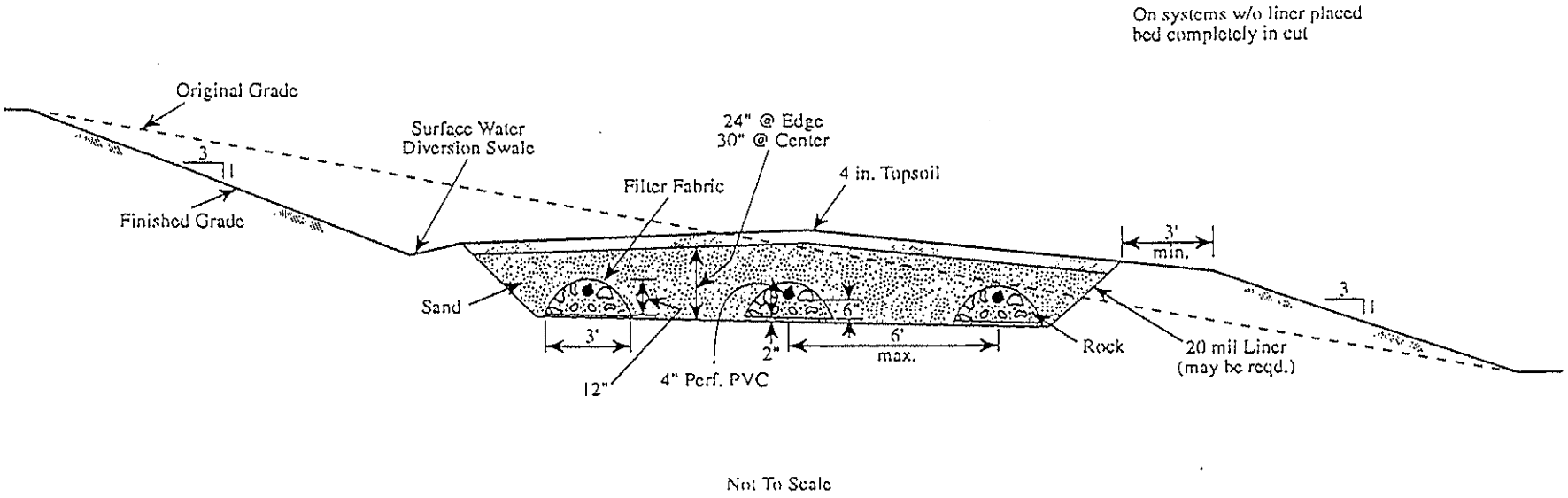


Diagram 7

Typical ET Bed Section

3. Trench depth shall not exceed thirty-six inches (36) and a minimum of six (6) inches of backfill shall be provided over the SB-2 pipe.

4. Trench length shall not exceed eighty (80) feet and trench bottom shall be level to plus or minus one (1) inch in eight (80) feet.

5. A minimum of six (6) feet of undisturbed soil shall exist between successive trenches. All trench bottoms shall be at the same elevation unless a serial distribution system is utilized. The Department may approve the use of distribution boxes and manifold lines on SB-2 systems on a case-by-case basis.

6. System sizing requirements are presented in Table #7, page 29.

7. SB-2 pipe shall be placed in the trench with the green stripe at the top. Pipe shall be joined with acceptable corrugated polyethylene couplings. Drain guard protective wrap shall be installed following manufacturer's recommendations. Inspection/cleaning ports shall be installed on each line for serially distributed systems and on a minimum of one line when all trenches are installed at the same elevation. Any line not ending with a port shall have a polyethylene (PE) cap. All PVC to PE pipe connections shall be made with approved fittings including but not limited to offset adapters and reducing tees. PE to PE connections shall use PE fittings.

8. Rock and soil clumps exceeding two (2) inches in diameter shall not be used as backfill.

9. For soils with percolation rates exceeding forty (40) min./in., or fine textured soils, a loose backfill may be required by the Department.

10. Any system installer who cannot prove to the satisfaction of the Department that he/she has previously installed a SB-2 system shall have a SB-2 authorized factory representative onsite for the installer's first SB-2 installation in Tri-County. The SB-2 factory representative shall instruct the installer in proper SB-2 installation technique and shall report to the Department in writing whether or not the system was installed in conformance with manufacturer's recommendations. As a substitute for the onsite factory representative, the Department may accept certification that the installer has attended a factory sponsored SB-2 training program.

B. Approved chamber systems are acceptable in areas where trenches and absorption beds are allowed by the Department. Chamber systems shall be installed in accordance with all manufacturers requirements. For single-family residential systems, the minimum number of chambers per bedroom are determined using System Sizing Formula #6, on page 40.

C. For business, commercial, industrial, or institutional installations utilizing chamber systems, the minimum number of chambers shall be determined using System Sizing Formula #7 on page 41.

D. Drip-Irrigation or Low Pressure Pipe systems may be allowed by the Department provided the system is designed by a Registered Professional Engineer and approved by the Department. All Drip-Irrigation or Low Pressure Pipe systems shall meet the following minimum requirements:

1. Trenching shall not occur when soils are wet.

2. Trench depth shall not exceed thirty (30) inches and trench length shall not exceed one hundred (100) feet. Trench bottom shall be level + or - 1-1/2".

3. System dosing shall comply with the requirements of Section 17.26.

4. No irrigation shall be allowed over the disposal area.

SYSTEM SIZING FORMULA #6
CHAMBER SYSTEMS FOR SINGLE FAMILY DWELLING
ABSORPTION AREAS

Number of Chambers Per Bedroom (Bed Configuration) =

$$\frac{[0.6\ (1.40 \times Q\ \sqrt{t}\ /5\ ]}{\text{Open Area (square feet) per chamber *}}$$

Number of Chamber Per Bedroom (Trench Configuration) =

$$\frac{[0.5\ (1.40 \times Q\ \sqrt{t}\ /5)\ ]}{\text{Open Area (square feet) per chamber *}}$$

Where:

Q = Total daily peak flow per bedroom (1.5 x 2 persons/bedroom x 75 gallons/person/day) = 225 gallons

t = Average Percolation Rate, in minutes per inch, *Rounded upward* to 20, 40, or 60 mpi

* OPEN AREA PER CHAMBER:

Hancor Envirochamber = 15.5 square feet

Infiltrator = 15.5 square feet

Biodiffuser = 15.5 square feet

5. The system shall only be utilized when a four-foot separation can be obtained between the bottom of the trench and fractured bedrock and /or seasonally high water table.

6. Systems shall not be located upgradient from structures unless the design engineer makes a determination and certifies in writing to the Department that it is his/her professional opinion that effluent from the system will not enter foundation drains and/or will not have any structural impact on the building.

7. In observing the construction of the system, the engineer shall inspect and survey with appropriate level, tripod and survey rod the alignment, elevation and grade of manifold and distribution lines to assure that they conform with approved plans. The engineer's written final report to the Department shall certify that this work was performed and that the construction is approved.

8. Engineers designing Drip Irrigation or Low Pressure Pipe systems shall submit design criteria for system sizing for review and approval by the Department. The effects of soil permeability (percolation rate), slope, and depth to the bedrock must be addressed by the criteria. The criteria must include soil and site conditions under which system installation is unacceptable. Design criteria shall also estimate the percent disposal by evapotranspiration and absorption.

SYSTEM SIZING FORMULA #7
CHAMBER SYSTEMS FOR COMMERCIAL, BUSINESS, INSTITUTIONAL OR INDUSTRIAL ABSORPTION AREAS

Number of Chambers (Bed Configuration) = $\frac{A \times 0.60}{\text{Open Area (square feet) per Chamber*}}$

Number of Chambers (Trench Configuration) = $\frac{A \times 0.50}{\text{Open Area (square feet) per chamber*}}$

Where the Area A is determined from System Sizing Formula #3 on page 30

*OPEN AREA PER CHAMBER:

Hancor Envirochamber = 15.5 square feet

Infiltrator = 15.5 square feet

Biodiffuser = 15.5 square feet

17.21 SAND FILTER - A sand filter shall be designed by a Registered Professional Engineer. The filtering material shall be clean, coarse sand, all passing a screen having four meshes to the inch. The sand shall have an effective size (D_{10}) between 0.24 and 1 mm. The uniformity coefficient (C_u) shall be 4.0 or less.

A. The sand shall be at least 2 feet deep. The distributors and underdrain, shall be surrounded by coarse screened gravel or crushed stone.

B. All of the gravel or stone shall pass a two and-one-half (2 1/2) inch screen and shall be retained on a three-fourths (3/4) inch screen. Fine gravel one-fourth (1/4) inch size or less may be used above and around the coarse material, both at the distributor and underdrains. The separating distance between parallel distribution lines shall not exceed six (6) feet and a underdrains shall be five-tenths (0.5%) to one (1.0%) percent. It is required that the sand be thoroughly settled by flooding or other means before the distributors are placed at the final grade. The distributor and underdrains shall be of PVC perforated pipe. The top of the sand bed shall be no less than four (4) feet above the high ground water table for installations in which effluent percolates downward through the soil.

C. The minimum area for a sand filter shall be computed as a function of the maximum daily sewage flow according to Table #12, page 42. A dosing system shall be designed to provide uniform distribution of effluent over the filter. Uniform Dosing shall comply with the provisions of section 17.27. The size of the dose shall be at least five time the volume of the distributors, plus the supply line volume.

TABLE #12
LOADING RATES FOR A SAND FILTER

TYPE OF SERVICE	APPLICATION RATE (Gallons/Sq.Ft./Day)
Without garbage grinder	1.15
With garbage grinder	0.95

17.22 RECIRCULATING SAND FILTER - A system utilizing a recirculating sand filter shall be designed by a Registered Professional Engineer and shall comply with the requirements listed below.

A. Filter Design and Dosing

1. Filter area shall be sized based on a maximum organic load. The area shall mean basal or bottom area. For residential strength septic tank effluent, the maximum hydraulic load shall be 5 gal/sq. ft./ day.

2. For BOD_5 waste strength stronger than residential septic tank effluent, but not exceeding 400 mg/l, the filter size shall be increased proportionately.

3. Higher strength wastewaters shall be pretreated or will require special consideration. The concentration of greases and oil applied shall in no case exceed 30 mg/l.

B. Filter Media

1. Filter media shall consist of a minimum of two feet of very coarse washed sand, conforming to the maximum and minimum sand gradation shown in Table #13 on page 43.

2. Design engineers shall approve filter media prior to delivery of the material and shall submit to the Department prior to final approval, media gradation results showing conformance with this Section.

3. Filter Media shall be overlain by a three (3) inch bed of one-half (1/2) inch to three-fourths (3/4) inch washed gravel. It shall be only lightly covering the distribution piping. Unless otherwise authorized, each orifice shall be covered by an orifice shield.

4. Filter dosing shall be designed to provide uniform dosing to comply with section 17.27.

5. Filter media shall be underlain by a six (6) inch bed of three-eighths (3/8) inch to three-fourths (3/4) inch washed gravel underdrain media. There shall be no filter fabric over the underdrain media.

6. Perforated collection pipes shall be bedded in the underdrain media. Pipes shall be a four (4) inch minimum diameter with no filter fabric wrap. There should be at least fifteen (15) lineal feet of collection pipe for each 225 square feet of filter basal area.

7. The filter container shall be watertight to suit the design conditions. Underflow shall be contained. A concrete container may be used. Other materials may be used where equivalent function, workmanship, water tightness and at least a twenty (20) year service life can be expected.

TABLE #13 MAXIMUM AND MINIMUM MEDIA SIZE FOR RECIRCULATING SAND FILTERS		
Sieve Size	Maximum Media Size (Percent Passing)	Minimum Media Size (Percent Passing)
3/8"	100	100
#4	60	100
#8	7	75
#16	0	5
#30	0	3
#50	0	2
Effective Size (D_{10}): 1.5 to 2.5 mm		

C. Recirculation/Dilution Tank

1. A recirculation tank receives septic tank effluent and underflow from the filter. A pumping system at this tank delivers flow to the filter dose piping network according to design. The recirculation tank volume shall be equal to the projected daily sewage flow volume.

2. The recirculation ratio at design flow shall not be less than four (4). Recirculation ratio is the daily volume of recycle divided by design daily volume of the wastewater. A fabricated "T" or "Splitter T" float valve located in the recirculation tank should be used whenever possible. Minimum recirculation tank liquid volume should be no less than eighty (80) percent of the gross tank volume when a float valve is used. Alternatively, a splitter basin using orifice or weir control may be used where required and reasonable to divide underflow twenty (20) percent to disposal and eighty (80) percent to recycle on a daily basis. Orifice control should be used wherever possible. Minimum recirculation tank liquid volume should be no less than fifty (50) percent of the gross tank volume when a splitter basin is used.

3. An evaluation and design for overflow and surge control at the recirculation tank shall be included in each design.

4. A high water alarm shall be included in the recirculation tank immediately below the overflow level.

5. Parallel pump start/stop electric controls (usually floats) should be installed to correct any unforeseen high liquid level even and keep sewage contained. This pump start function merely precludes overflow and shall operate in parallel with the start/stop function of a timer. It shall not interfere with or depend upon a timer position.

6. All areas of the filter should be dosed forty-eight (48) times a day or each thirty (30) minutes, to achieve the recirculation ratio of at least four (4).

7. Access openings to the recirculation tank shall be provided at each end. Lager tanks should have additional openings.

D. Operation and Maintenance (O & M) Manual

The design engineer shall provide an operation and maintenance manual to the property owner and the Department before the system commences operation. The manual shall incorporate "as built" details, certification that all system components have been installed in accordance with plans and specifications, and shall specify routine system inspections and frequency of those inspections.

17.23 WASTEWATER POND

A wastewater pond to provide tertiary treatment, where permitted by the Board of Health, may be used to provide an additional degree of treatment following secondary stage treatment. A wastewater pond shall be designed by a Registered Professional Engineer. The pond shall be designed for a loading not to exceed 0.46 pounds of BOD_5 per 1000 square feet of water surface area. Special design shall be required in each case in which non-domestic kinds of individual sewage disposal system wastes will be received.

A. Maximum water depth in the pond shall not exceed three (3) feet. The inside slope of the pond, dike or embankment shall not be steeper than 3:1 (3 feet measured horizontally for each foot measured vertically). A center inlet shall be provided.

B. Unless constructed in impervious soil, the pond shall be lined to prevent excess seepage of wastewater.

C. Adequate safety protection shall be provided, such as fencing, to protect against personal injury.

D. Surface runoff shall be diverted away from the pond except where controlled by design.

17.24 MOUND SYSTEMS

A mound soil absorption system shall be designed by a Registered Professional Engineer, and the design shall be site-specific and include specifications for fill material, fill area and basal area size calculations, distribution networks, cap, topsoil, final grading, and other pertinent information to the construction of the system as may be requested by the Health Officer. The design engineer shall submit a plan and cross-sectional view, with all dimensions indicated in Diagram 8 on page 45.

A. The distribution system shall be designed for uniform effluent distribution over the absorption area, in accordance with section 17.27 (Uniform Dosing) of this Regulation.

B. The effluent supply line to the distribution network within the mound shall be graded to drain back to the dosing chamber or be buried below the frost line.

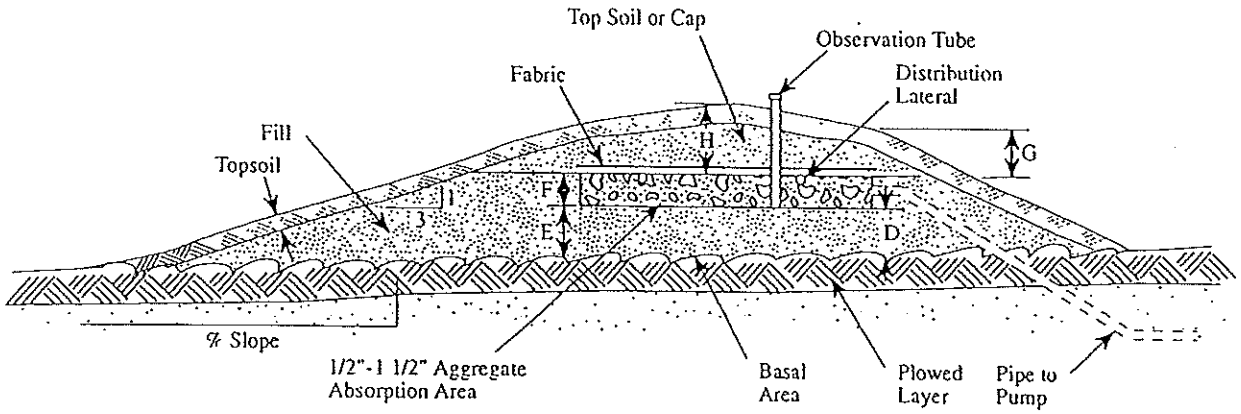
C. The final slope of the mound backfill shall be no steeper than 3 to 1 (three [3] feet horizontally to one [1] foot vertically).

D. The mound shall be planted with suitable vegetative cover. A typical mound plan and cross section is shown in Diagram 8 on page 45.

17.25 CONSTRUCTED WETLAND TREATMENT

A constructed wetland treatment system shall be designed by a Registered Professional Engineer and the design shall be site-specific and include specifications for: loading, capacity, liner material, filter media, density and species of plant material, effluent level, final discharge type, and other pertinent information as requested by the Health Officer. Constructed Wetlands shall conform to the following criteria:

A. A level control structure that allows for the altering of water level or complete drainage of water from the wetland shall be installed in each wetland treatment cell.



Section A-A

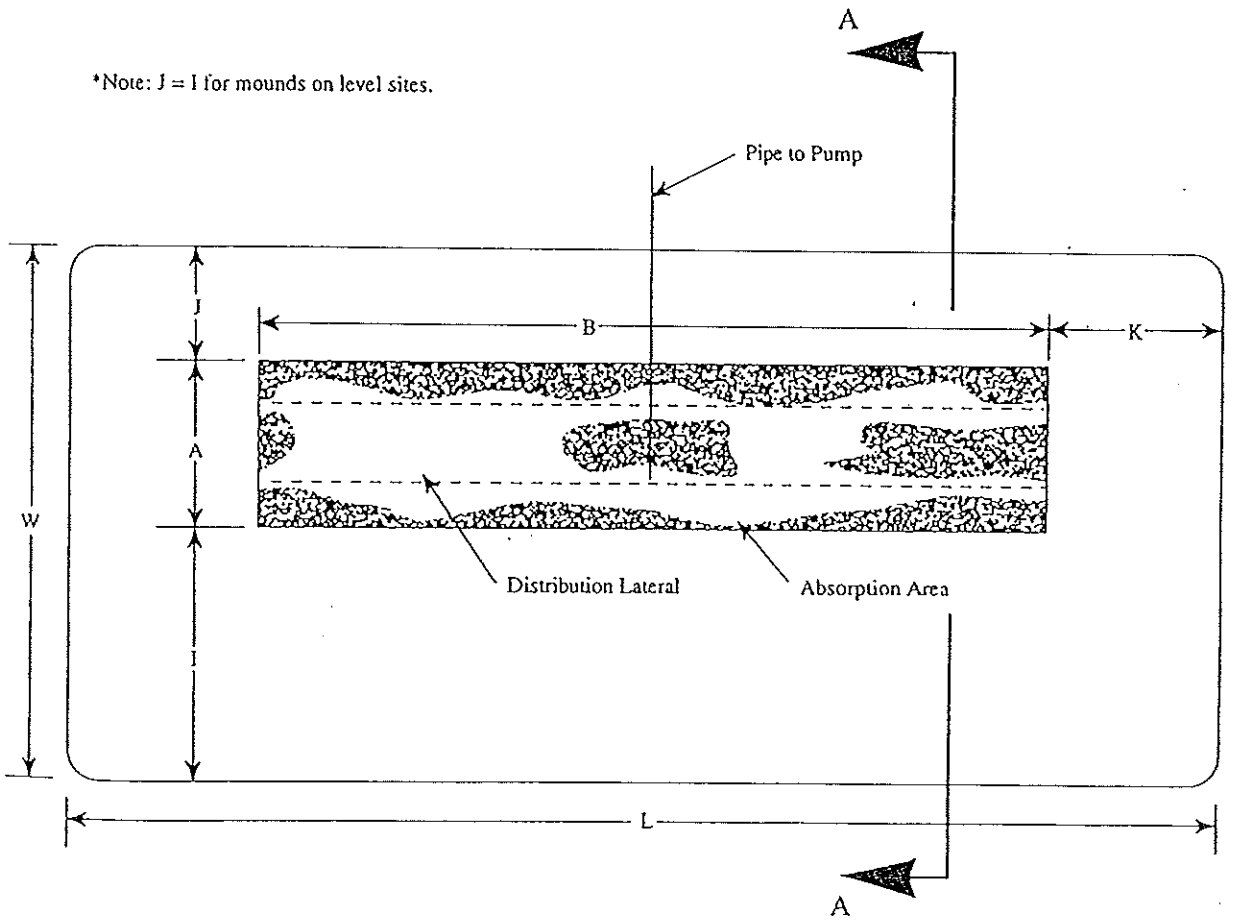


Diagram 8

Cross Section and Plan View of a Mound System on a Site

B. Neither the common reed (Phragmites communis) nor purple loosestrife (Lythrum salicaria) shall be intentionally planted within a constructed wetland.

C. All constructed wetlands shall be designed as sub-surface flow through the treatment area.

D. The minimum residence time within the constructed wetland shall not be less than four days for residential sewage flows.

E. The length to width ratio of a constructed wetland shall not exceed 5:1.

F. The design shall include estimates of effluent quality at the inlet and outlet. If discharge from the constructed wetland will be directly to the atmosphere, the ground surface, or below ground through unsuitable soil, sampling ports, or some other means of effluent sampling, to demonstrate compliance with Section XX of these Regulations, shall be required. Sampling, if required, is to be paid for by the property owner.

17.26 DOSING SYSTEMS/LIFT STATIONS

A. All dosing systems and lift stations shall be designed by a Registered Professional Engineer. The engineer shall submit design calculations and drawings for the system, to include the following minimum information:

1. Manufacturer's pump performance curve for pump selected, showing capacities, heads, and efficiencies, for the entire range of the pump.

2. If a dosing siphon is selected, provide manufacturer, model number, and all other relevant information.

3. System curve.

4. Size of dose.

5. Drawing showing the layout of supply piping and distribution network, including diameter of piping, spacing and lengths of piping, perforation (orifice) size and spacing.

B. A non-clog pump opening shall have at least 2 inch diameter solids handling capacity where raw sewage is pumped or at least one-half (1/2) inch diameter solids handling capacity if previously settled effluent is pumped.

C. Automatic liquid level controls shall be provided to start and shut off pumps at a frequency required by the design.

D. Pressure pipe shall be of sufficient strength to accommodate pump discharge pressure and the pipe shall be sized to maintain a velocity of two (2) or more feet per second.

E. Automatic air release valves shall be installed at high points in the pressure line where necessary to prevent air locking.

F. Provision shall be made to prevent siphoning of effluent within the absorption system back to the dosing tank, and to drain effluent within the supply line back to the dosing tank between doses, to prevent freezing of the effluent within the supply line.

G. A dosing tank shall be provided to allow pump cycling commensurate with pump and system design capacity and to allow a minimum of three-hundred (300) gallons for emergency storage.

H. Large Absorption Fields: Any absorption field, which exceeds two-thousand (2000) square feet in area or more than four-hundred (400) lineal feet of distribution pipe, shall be dosed. The Dosing Siphon or Pump cannot be a part of the digestive or clarification compartments of a two (2) compartment septic tank.

I. Pumps shall be installed at least four (4) inches off the floor of the tank.

J. The system must be provided with both an audible and visual alarm located inside the dwelling, garage or building to signal malfunction of the system.

K. Dosing of Chamber Systems: If a dosing system is utilized in conjunction with chambers in the absorption area, the following criteria shall apply:

1. Distribution piping shall be installed the full length of the chambers.

2. Discharge orifices shall be placed in the top of the piping, such that discharge is directed upward.

3. Provision shall be made to drain the distribution piping between doses, to prevent freezing.

17.27 UNIFORM DOSING

Engineered or other systems utilizing uniform dosing shall meet the following minimum requirements:

A. Each dose shall be at least five (5) and no more than (10) times the volume of the distribution lines within the disposal area, plus the volume of the supply line.

B. The system shall be designed such that the distribution network is pressurized sufficiently to provide a minimum of 2.5 foot of head at each discharge orifice.

C. The length of the laterals shall be such that the difference in discharge volume between the supply end orifice and the distal end orifice is no more than ten (10%) percent.

D. Designs for uniform dosing shall include all additional information required for dosing systems in Section 17.26.

SECTION XVIII—DESIGN CRITERIA: (Other Facilities)

18.1 GREYWATER SYSTEM—A greywater system shall meet at least all minimum design and construction standards for a septic tank system based on the amount and character of wastes for the fixtures and the number of persons to be served.

18.2 VAULT - A vault shall have a minimum one-thousand (1000) gallon effective capacity and may be permitted by the Health Officer under limited use occupancy for water carriage sewage systems on property which cannot accommodate a sewage treatment system. An audio and visual signal device set at seventy-five (75%) percent of tank capacity shall be installed to indicate when pumping is necessary. Vault permits are valid for six (6) months and maybe renewed depending on sewer availability.

18.3 VAULT PRIVY - A vault privy may be permitted by the Board of Health and shall be built to include: Fly-tight construction, a superstructure affording complete privacy, an earth mound around the top of the vault and below floor level, which slopes downward away from the superstructure base, a floor and riser of concrete or other impervious material, and with seats and covers of easily cleanable, impervious material, hinged, self closing and fly proof. All venting shall be fly-proofed with No. 16 or tighter mesh screening. Effective capacity of the vault shall be no less than four-hundred (400) gallons.

18.4 PIT PRIVY - A Pit Privy constructed in soil may be permitted by the Board of Health and shall be built to include: fly-tight construction; a superstructure affording complete privacy; an earth mound around the top of the compartment and below the floor level which slopes downward away from the superstructure base; a floor and riser of concrete or other impervious material; and with seats and covers of easily cleanable, impervious material, hinged, self-closing and fly-proof. All venting shall be fly-proofed with No. 16 or tighter screening. Effective capacity of the pit shall be not less than four-hundred (400) gallons. The pit shall be located in soil where the maximum seasonal level of the ground water table or fractured bedrock will be no closer than four (4) feet below the bottom of the pit.

18.5 INCINERATION AND CHEMICAL TOILETS - An incineration toilet which may be used in connection with a greywater system by permit from the Board of Health shall be designed and installed in accordance with all applicable federal, state and local air pollution requirements. A portable chemical toilet which may be used by permit from the Board of Health shall have a superstructure which meets the requirements of the paragraph titled VAULT PRIVY. Use of a portable chemical toilet in permanently occupied buildings shall be prohibited except during construction or under emergency circumstances as determined by the Department.

18.6 SLIT TRENCH - A slit trench may be permitted by the Board of Health and shall be located in suitable soil and shall be excavated approximately one (1) foot wide and two (2) feet deep for the required length. Excrement shall be covered with at least two (2) inches of soil at least once a day or more frequently if required by the Health Officer. A superstructure of a temporary nature shall be provided to afford privacy. A slit trench shall be considered a temporary convenience to be used no longer than seven (7) days and shall be backfilled with at least 1 foot of soil with additional allowance for settling to grade when use has been discontinued.

18.7 GREYWATER DISPOSAL AND REUSE - Greywater disposal shall be administered by the Department in the same manner as sewage disposal is regulated (see Section 18.1 Greywater System). Greywater reuse must comply with the applicable provisions of Section XX. In addition, surface irrigation of greywater which complies with the requirements of Section XX shall not be approved by the Department if use of the water in this manner violates a condition of approval of a well permit issued by the Colorado Department of Water Resources.

18.8 COMPOSTING TOILETS

A. Deposits of feces, urine and readily decomposable household garbage that are not diluted with water or other fluids may be retained in a compartment in which aerobic composting will occur. The compartment may be located, subject to the Broad of Health or other applicable regulations or codes, within a dwelling or building provided the unit complies with the applicable requirements of these regulations, and provided the installation will not result in conditions considered to be a health hazard as determined by the Department. The effective volume of the receptacle must be sufficient to accommodate the number of persons served.

B. Adequate additional volume shall be provided for the use of composting materials which shall not be toxic to the process or hazardous to persons and shall be used in sufficient quantity to assure proper decomposition.

C. Compartment and appurtenances related to the unit shall include fly-tight construction and exterior ventilation as required by the plumbing code.

D. When the available effective volume is filled to seventy-five (75%) percent of capacity, residue from the unit shall be properly disposed of by acceptable solid waste practices.

E. If a system will be installed where low temperature may be a factor, design shall compensate for the effects of the low temperature.

F. Manufactured composting toilets shall bear the seal of approval of the National Sanitation Foundation, or an equivalent testing program and are otherwise approved by the Department. Composting toilets shall be operated and maintained according to manufacturer's specifications.

SECTION XIX—BUSINESS, COMMERCIAL, INDUSTRIAL, INSTITUTIONAL OR MULTI-FAMILY DWELLING WASTE SYSTEMS

19.1 Performance criteria and construction standards for a system which will service commercial, business, institutional or industrial property or multi-family dwellings shall conform to these regulations.

19.2 Such systems shall be designed by a Registered Professional Engineer.

19.3 Systems which recycle treated wastewater for non-potable purposes such as flushing water closets or urinals:

A. That portion of the wastewater recycled for non-potable purposes such as flushing water closets or urinals must meet the treatment requirements of Section XX of these regulations for effluent in which the possibility exists for occasional direct human contact.

B. No cross-connection to a pipe, fixture, or supply containing potable water shall be permitted.

19.4 SYSTEMS WHICH RECYCLE TREATED WASTEWATER FOR POTABLE PURPOSES

No system shall be permitted which will recycle wastewater for potable purposes except a system which shall consistently meet all of the sanitation and maximum contaminant level requirements of rules, regulations and standards of the Colorado Department of Public Health & Environment and the Board of Health.

19.5 CESSPOOLS - No person shall install, construct or operate cesspools in said counties of Adams, Arapahoe and Douglas, State of Colorado.

SECTION XX—TREATMENT SYSTEMS OTHER THAN THOSE DISCHARGING THROUGH A SOIL ABSORPTION OR SAND FILTER SYSTEM AND NON-DISCHARGING SYSTEMS

20.1 Those systems which will discharge effluent directly to the atmosphere, the ground surface or below ground, or which employ aerobic principles of sewage treatment or a dispersal system, may be permitted only if designed by a Registered Professional Engineer. This section shall not apply to systems discharging below ground through a soil absorption system or sand filter system or to a non-discharging system.

20.2 REVIEW OF APPLICATION—The Board of Health shall review all applications for such systems which may result in discharge or drainage of effluent from the property of origin. No permit shall be issued for such a system if the Board of Health determines that a potential health hazard or private or public nuisance or undue risk of contamination exists. The Board of Health authorizes the Department to review applications and issue permits for systems which do not permit the drainage of effluent off the property of origin. For systems discharging to State Waters see Section XXIII.

20.3 The following minimum performance criteria shall be required for all systems pursuant to this Section.

A. If effluent discharge is made into the atmosphere or upon the ground surface in areas in which the possibility exists for occasional direct human contact with the effluent discharge, the effluent at the point of sampling shall consistently meet each of the following standards:

1. The fecal coliform density shall not exceed two (2) per one hundred (100) milliliters.

2. The standard five (5) day biochemical oxygen demand (BOD_5) shall not exceed twenty (20) milligrams per liter.

3. The total suspended matter shall not exceed forty (40) milligrams per liter.

B. If effluent discharge is made into the atmosphere or upon the ground surface in an area so restricted as to protect against the likelihood of direct human contact with the discharged effluent, the effluent at the point of sampling shall consistently meet each of the following standards:

1. The fecal coliform density shall not exceed five-hundred (500) per one-hundred (100) milliliters.

2. The standard five (5) day biochemical oxygen demand (BOD_5) shall not exceed twenty (20) milligrams per liter.

3. The total suspended matter shall not exceed forty (40) milligrams per liter.

C. If effluent discharge is made beneath the surface of the ground and discharge will not be made through suitable soil, either existing or constructed, or through a sand filter, the following standards shall be met:

1. There shall be at least four (4) feet of soil between the maximum seasonable high water table and the level of effluent discharge.

2. The standard five (5) day biochemical oxygen demand (BOD_5) shall not exceed sixty (60) milligrams per liter.

3. The total suspended matter shall not exceed one-hundred (100) milligrams per liter.

D. Methods of Analysis - Sampling Points

All effluent samples shall be analyzed according to methods prescribed in the most recent edition of "Standard Methods for the Examination of Water and Wastewater" (American Public Health Association). The point of sampling shall be a location that is representative of final discharge from the system. The cost of effluent sampling shall be borne by the property owner.

E. Frequency of Analysis

To determine compliance with the standards contained in the Section XX, samples shall be taken at least once per week, but no more frequently than once per day.

SECTION XXI—EXPERIMENTAL SYSTEM

Except for designs or types of systems which have been approved by the Colorado Department of Public Health and Environment, Water Quality Control Division, pursuant to Title 25-10-108-(1), C.R.S., the Board of Health may approve an application for a type system not otherwise provided for in paragraphs (e) to (k) of Title 25-10-105, C.R.S., only if the system has been designed by a Registered Professional Engineer, and only if the application provides for the timely installation of a backup system of a type described in said paragraphs in the event of a failure of the experimental system. The Board of Health shall not arbitrarily deny any person the right to consideration of an application for such a system and shall apply reasonable performance standards in determining whether to approve such an application.

SECTION XXII—MANUFACTURED UNITS UTILIZING MECHANICAL APPARATUS FOR TREATMENT OF SEWAGE AND SYSTEMS EMPLOYING NEW TECHNOLOGY

22.1 Individual sewage disposal systems utilizing mechanical apparatus and furnished for installation in Colorado shall comply with the minimum requirements of criteria and construction standards set forth in these regulations and NSF Standard No. 40.

22.2 No such unit utilizing mechanical apparatus and which is designed for discharge either upon the ground or beneath the ground surface or which maybe adversely affect State Waters shall be permitted unless (1) the system is installed within a geographic area wherein a public, quasi-public, or private entity, or political subdivision is continually

responsible for the efficient operation and maintenance of said unit, or (2) the operator of the system insures an efficient operation of all mechanical and electrical component parts provided prior to and during continuing use.

22.3 APPROVAL OF SYSTEMS EMPLOYING NEW TECHNOLOGY

A. For the purpose of this section, a system employing new technology is a system based on improvements and developments in technology or sewage disposal not otherwise provided in Section 25-10-105-(1)-(e) to (k), C.R.S.

B. Such systems may be considered by the Board of Health provided they have been certified by the Colorado Department of Public Health and Environment according to Section XI. of the *Colorado Department of Public Health and Environment Guidelines on Individual Sewage Disposal Systems*, as adopted in 1994.

SECTION XXIII—EFFLUENT DISCHARGED TO STATE WATERS

23.1 Any system which will dispose of effluent by discharging into State Waters shall be designed by a Registered Professional Engineer, and the application shall be submitted for preliminary approval to the Board of Health. Once approved, the application shall be forwarded to the Water Quality Division of Colorado Department of Public Health and Environment for issuance of a permit in compliance with all applicable regulations of the Water Quality Control Commission. Compliance with such a permit shall be deemed full compliance with all individual sewage disposal system regulations.

SECTION XIV—INSTALLATION

24.1 GENERAL - Treatment units shall be set on a firm and level base except as otherwise provided in these guidelines and shall be capable of accommodating flow with hydraulic efficiency.

24.2 MECHANICAL COMPONENTS

A. **Ventilation and Air Systems:** Mechanical components shall be installed in a properly vented location and all vents, air intakes, and air hoses shall be protected from snow, ice, or water vapor accumulations.

B. **Components installation:** Mechanical components installed in or at the unit must be protected against damage or impairment of their efficiency by flooding, foaming, or surcharging.

C. **Covers, Barriers, or Other Protection:** All systems must be installed to include protection of openings against entrance of insects and rodents. Barriers shall be provided to prevent entrance by unauthorized persons.

SECTION XXV—OPERATIONS AND MAINTENANCE

25.1 RESPONSIBILITY - The owner and the party in possession of real property upon which an individual sewage disposal system is used, shall be jointly and severally responsible for operation and maintenance of the system unless jurisdiction for responsibility has been transferred to a public, quasi-public, or political subdivision. The person denying such responsibility shall bear the burden of proof for such denial upon establishment of ownership or possessor rights in the property served by the system.

25.2 SERVICE LABEL - For treatment plants utilizing mechanical apparatus or under a service policy, a clearly visible, permanently attached label or plate giving instructions for obtaining service shall be placed at a conspicuous location.

25.3 MAINTENANCE AND CLEANING - When directed by the Department for the purpose of obtaining compliance with rules and regulations, the owner or user of a system shall provide for maintenance and cleaning of an individual sewage disposal system and shall notify the Department upon completion of any maintenance work and report to said

Department and submit such evidence of compliance with any maintenance and cleaning schedule in the form and as the Department requires.

25.4 MONITORING AND SAMPLING

Reasonable periodic collection and testing by the Department of effluent samples from individual sewage disposal systems for which monitoring of effluent is necessary in order to insure compliance with the provisions of rules and regulations may be performed not more than two times a year, except when required by the Health Officer in conjunction with an enforcement action.

25.5 Any owner or occupant of property on which an individual sewage disposal system is located may request the Department to collect and test an effluent sample from the system. The Department may perform such collection and testing services.

25.6 A fee to be fixed by the Board of Health by separate resolution shall be charged by the Department for each sample collected and tested, and payment of such charge may be stated in the permit as a condition for its continued use.

25.7 DISPOSAL OF WASTE MATERIALS

Disposal of waste materials removed from a system in the process of maintenance or cleaning shall be accomplished at an approved site or facility in a manner which does not create a hazard to the public health, a nuisance or an undue risk of pollution and which complies with state and local rules and regulations.

25.8 NO DISCHARGE IS PERMITTED WHICH DOES NOT COMPLY WITH RULES AND REGULATIONS

No sewage or effluent shall be permitted to be discharged into or upon the surface of the ground or into state waters unless the sewage system and effluent meets the minimum requirements of applicable rules and regulations.

25.9 TERMINATION (ABANDONMENT) OF USE OF SYSTEM

The contents of a septic tank, vault, seepage pit, or cesspool, the use of which has been terminated, shall be properly disposed of and the emptied tank, vault, pit or cesspool, shall be filled with soil or rock, or collapsed and buried, or crushed and removed.

SECTION XXVI—FINDINGS ON APPEAL

26.1 Upon review of denial by the Board of Health as provided by Section 25-10-106-(1)-(f), C.R.S., that an applicant for individual sewage disposal system has demonstrated that said system will be constructed and used in such a manner as to comply with the declaration and intent of these regulations and all applicable state and local rules and regulations and required terms and conditions in any permit issued pursuant thereto, a permit may be issued therefore.

26.2 For purposes of administration and enforcement of the "Individual Sewage Disposal Systems Act" (Title 25, Article 10, C.R.S.), the following provisions of said Act specifying general prohibitions and penalties are set forth:

A. No city, county, or city and county shall issue to any person a permit to construct or remodel a building or structure which is not serviced by a sewage treatment works, until a permit for an individual sewage disposal system has been issued by the Department.

B. No city, county, or city and county occupancy permit shall be issued to any person for the use of a building which is not serviced by a sewage treatment works until a final inspection of the individual sewage disposal system has been issued by the Department, as provided for in Section 25-10-106-(1)-(h), C.R.S., and the installation has received the approval of the Department.

C. No individual sewage disposal system presently in use which does not comply with the provisions of Section 25-10-105-(1)-(e), C.R.S., regarding minimum separation between the maximum seasonal level of the groundwater table and the bottom of an absorption system shall be permitted to remain in use without compliance with this article and the rules and regulations adopted under this article.

D. Construction and/or use of cesspools defined as covered underground receptacles which receive untreated sewage from a building and permit the untreated sewage to seep into surrounding soil are prohibited.

E. Not more than one dwelling, commercial, business, institutional, or industrial unit shall be connected to the same individual sewage disposal system unless such multiple connection was specified in the application submitted and in the permit issued for the system.

F. . No person shall construct or maintain any dwelling or other occupied structure which is not equipped with adequate facilities for the sanitary disposal of sewage without endangering the public health.

26.3 Any person who commits any of the following acts or violates any of the provisions of this article commits a Class 1 Petty Offense as defined in Section 18-1-107, C.R.S.

A. Constructs, alters, installs, or permits the use of any individual sewage disposal system without first having applied for and received a permit as provided for in Section 25-10-105 (1)-(g) or Section 25-10-106, C.R.S.;

B. Constructs, alters, or installs an individual sewage disposal system in a manner which involves a knowing and material variation from the terms or specifications contained in the application or permit;

C. Violates the terms of a cease-and-desist-order which has became final under the terms of Section 25-10-106-(1)-(k), C.R.S.;

D. Conducts a business as a system contractor without having obtained the license provided for in Section 25-10-109 (1), C.R.S., which the Board of Health has adopted licensing regulations pursuant to said Section;

E. Conducts a business as a systems cleaner without having obtained the license provided for in Section 25-10-109 (1) C.R.S., which the Board of Health has adopted licensing regulations pursuant to said Section;

F. Willfully fails to submit proof of proper maintenance and cleaning of a system as required by rules and regulations adopted pursuant to Section 25-10-106 (l) - (m), C.R.S.

26.4 SEVERABILITY - Should any section, paragraph, sentence, clause or phrase of these regulations and standards be declared unconstitutional or invalid for any reason, such portion shall be deemed separate and distinct and shall not effect the validity of the remaining portion of these regulations and standards.

26.5 PENALTIES - Any person failing to comply with said notice or violation any of the provisions of these regulations shall be deemed to have committed a Class 1 Petty Offense as defined in Section 18-1-107, C.R.S.

26.6 REPEAL - Regulation No. 1-73 adopted by the Board of Health of the Tri-County Health Department on September 25, 1973 and as amended July 9, 1974, Regulation No. I-80 adopted October 14, 1980, Regulation No. I-85 adopted October 8, 1985, and Regulation No. I-88 adopted December 8, 1987, are hereby repealed.

26.7 DECLARATION: The Board of Health of the Tri-County Health Department finds, determines and declares these regulations and standards to be necessary for the preservation of the public health and welfare of the inhabitants of the counties of Adams, Arapahoe, and Douglas, State of Colorado. This regulation and standard is adopted by the Board of Health of the Tri-County Health Department on the 12th day of December, 1995, and shall become effective the third day of June, 1996.

SECTION XXVII—LICENSE FEES FOR SYSTEMS INSTALLERS AND CLEANERS

WHEREAS, The General Assembly of the State of Colorado in the 1997 session did amend Article 10 of Title 25, Colorado Revised Statutes, as amended, with the relocation of provisions, to allow local boards of health to:

Set fees for permits, not to exceed actual and direct costs associated with that permit, not to exceed one thousand dollars (25-10-107); and

Set fees, not to exceed actual and direct costs for other services as required by the applicant (25-10-107); and

Set fees, not to exceed actual costs, for licensing of systems contractors and systems cleaners, and renewal of licenses (25-10-109); and

WHEREAS, the Board has determined, and has taken such action and made such investigations as are necessary, in its judgment, to support its determinations that the fees established by this resolution meet the requirements set forth above;

NOW, THEREFORE BE IT RESOLVED that the Tri-County Board of Health adopts the following revisions to Table #14 License Fees and Table #15 Permit Fees of Section XXVII of Tri-County Regulation I-96 titled Individual Sewage Disposal Systems effective September 1, 1997

TABLE #14 LICENSE FEES	
New License Fee for Systems Installers and Cleaners	$30.00
Annual Renewal Fee For Systems Installers and Cleaners (Received by 12/31	$20.00
Renewal Fee For Those Applications Received Late	$30.00

TABLE #15 PERMIT FEES	
1. New System Permit Fees	$300.00
2. Repair Permits	$250.00
3. Loan Approval Inspections	$100.00

John L. Dawson, President

Tri-County Board of Health

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