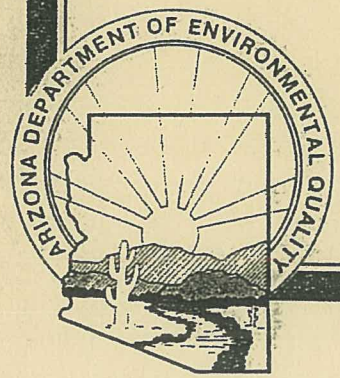
Engineering Bulletin No. 19

Guidelines for

APPROVAL OF SUBDIVISIONS

WITH INDIVIDUAL SEWAGE DISPOSAL SYSTEMS



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GUIDELINES FOR APPROVAL OF SUBDIVISIONS WITH INDIVIDUAL SEWAGE DISPOSAL SYSTEMS

ARIZONA DEPARTMENT OF HEALTH SERVICES

DIVISION OF ENVIRONMENTAL HEALTH SERVICES

BUREAU OF WATER QUALITY CONTROL

Bruce Babbitt, Governor
State of Arizona

Suzanne Dandoy, M.D., M.P.H., Director
Arizona Department of Health Services

October 1977

FOREWORD

The following guidelines are intended as an aid in the preparation of applications for subdivisions approval with individual sewage disposal systems pursuant to Rules and Regulations for Subdivisions (Part 2-10)

These guidelines are intended to enable developers and their consultants to plan their projects in conformance with the requirements of the Arizona Department of Health Services. These guidelines do not supplant or supersede any of the rules and regulations of the Arizona Department of Health Services. They are intended to bring about a better understanding of the specific data needed to permit a thorough review of all pertinent aspects of a proposal.

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PART I - GENERAL CONSIDERATIONS

A. APPLICATION

The following information shall be included with any application:

1. Two completed "Application for Approval of Sanitary Facilities for Subdivisions" forms. (See Appendix A)
2. One completed "County Approval of Individual Sewage Disposal Systems" form. (See Appendix B)
3. Plats.

   a. Subdivisions having lots over one acre submit four copies of plat as recorded, or as will be recorded.

   b. Subdivisions having lots under one acre submit two copies of plat as recorded, or as will be recorded.
4. A geological report. The report shall be made by an engineer, geologist or other qualified person. (Reg. 2-10-3.2, E., 1.) (See Part II - Geological Report for Septic Tank Installations.)
5. A master plan shall be submitted where large amounts of land will be subdivided or the subdivision will be incorporated into an existing subdivision. The plan shall include a statement of existing and proposed land use in the adjoining area of the proposed subdivision, i.e., commercial, domestic, recreational, unsubdivided (private or public ownership).
6. Water plans and data as required by Arizona Department of Health Services Rules and Regulations 2-l0-2.1.

B. PROHIBITIONS

1. Where soil conditions and terrain features or other conditions are such that individual sewage disposal systems cannot be expected to function satisfactorily or where groundwater or soil conditions are such that individual sewage disposal systems may cause pollution of groundwater, they are prohibited. (Reg. 2-10-3.2., B.)
3. The use of cesspools is prohibited. (Reg. 2-l0-3.2, D.)
4. Individual sewage disposal systems will not be approved where connection to a public sewer system is determined by the Department to be practicable.
5. Where a sewage disposal system is required and individual sewage disposal systems are prohibited, some alternate method of sewage disposal acceptable to the Department and local county health department may be provided.

C. SIZE OF LOTS

The minimum size lot approved by the Department will be governed largely by the area necessary for the safe accommodation of individual wells and/or sewage disposal systems. Where both the water supply and sewage disposal system must be developed on the same lot, the minimum size shall be at least one acre, excluding streets, alleys and other rights-of-way. Where water from a central system is provided for residental uses, the lot shall be sufficient to accommodate the sewage disposal system and provide for at least

100 percent expansion of the system based on a four-bedroom house within the bounds of the property allowing a minimum of five feet distance to the property lines. Where lots are zoned for commercial uses the lot shall be sufficient to accommodate the sewage disposal system and provide for at least 100 percent expansion of the system within the bounds of the property allowing a minimum of five feet distance to the property lines. (Reg. 2-l0-1.4)

D. DEFINITIONS

1. *Subsurface disposal system* - a rock or gravel-filled underground pit or trench into which septic tank effluent is discharged and from which the liquid seeps into the surrounding soil.
2. *Individual disposal system* - device or system for the treatment and disposal of sewage from a single housing unit.
3. *Qualified Person* - a person having experience in soils testing, geology, percolation testing, sanitation or related fields.
4. *Master Plan* - a conceptional land use plan in the general area of the subdivision discussing population projections, construction staging sanitary facilities, etc.
5. *Septic-tank system* - a method used for treatment and disposal of sewage. It usually consists of a septic tank and subsurface disposal trench or pit.
6. *Disposal trench* - a subsurface trench used for disposal of septic tank effluent, commonly called leach field, or disposal fields.
7. *Disposal pit* - a subsurface pit used for disposal of septic tank effluent, commonly called seepage pits or dry wells.
8. *Septic tank* - a watertight container which receives the raw sewage and discharges a settled, slightly treated effluent. Detention time is usually 24 hours.
9. *Effective absorption area* - the sidewall area below the top of the gravel backfill of a disposal trench or pit acceptable for effluent disposal. Areas of rock of poor permeability are not included.
10. *Standard percolation test* - the test used to determine the rate water is absorbed by the soil. From this data the suitability of a soil for subsurface disposal systems is determined.
11. *Distribution pipe* - the network of pipe used for distributing septic tank effluent to the subsurface disposal system.

PART II - GEOLOGICAL REPORT FOR SEPTIC TANK INSTALLATIONS

A. The Geological Report shall include the following items:

1. General description of the area.
2. A vicinity map having sufficient detail to enable a person unfamiliar with the area to find the site.
3. Description of methods used in making the soil profile and percolation tests. (See Sections B, C and F below)
4. Map giving location of soil profiles and percolation tests.
5. Boring log results. (See Sections B and C below)
6. Percolation test results. (See Sections B and F below)
7. Depth to groundwater. (See Section D below)
8. Description of topography. (See Section E below)
9. Detailed description of present and future land uses around the proposed subdivision.

B. NUMBER OF PERCOLATION TESTS AND BORING LOGS

1. Sufficient percolation tests and boring logs shall be made to give an accurate picture of soil conditions. Location of percolation test sites and depth of boring logs shall be determined by the local county health department.
2. There shall be a minimum of one percolation test and boring log per acre, or one percolation test and boring log per lot where lots are larger than one acre, except when it can be shown by submission of other reliable data that soil conditions are such that individual disposal systems could reasonably be expected to function properly on each lot in the proposed subdivision. (Reg. 2-l0-3.2, E., 1.)
3. History data of existing systems, in the *immediate* area is needed to justify fewer percolation and boring log tests. This history along with percolation and boring log tests could be used to demonstrate that soils in the proposed subdivision were the same in physical makeup as those at existing dwellings. Thus, proposed septic-tank practices might be expected to develop a history, at least equal to the history of existing systems.

   In areas proposed for septic tanks where there are no septic tanks in the immediate area, the slope of the terrain is 5% or less and te depth to groundwater or an impermeable strata is greater than 15 feet below the existing ground surface, fewer percolation and boring log tests than one per acre may be acceptable if the boring log test results indicate a uniform soil structure and percolation test results indicate that the percolation rate in the area is less than 10 minutes per inch.
4. The Department may require additional tests when it deems necessary. (Reg. 2-10-3.2, E., 1.)
5. Results of all tests shall be submitted to the Department and the local county health department for review and approval of the subdivision for the use of individual sewage disposal systems. (Reg. 2-10-3.2, E., 2.)

6. Such approval must be obtained in writing from the local county health department and a copy of the approval shall be submitted to the Department with the subdivision application for approval. (Reg. 2-10-3.2, E., 3.)

C. BORING LOGS

Data on the types of soil strata, rock or impervious strata, and depth to groundwater shall be obtained from boring logs to a depth of at least four feet below the bottom of the proposed subsurface disposal system, i.e., much deeper boring logs will be needed for disposal pits than disposal trenches.

1. Digging a soil profile hole.

   With a backhoe, dig a hole as deeply as possible before rocks or groundwater, if present, limit digging. Dig a ramp at one end of the hole so that a man could climb in and out.

2. Deep holes dug with power augers.

   Where deep pits are contemplated, a backhoe might not dig adequately deep for exploratory studies. Soil augers may be used. Augered holes do not provide an opportunity to view soils in profile, but samples of soils removed from the hole can be examined and logged.

3. Safety.

   Judgment and care must be exercised in managing deep holes. They are extremely dangerous to people and livestock; cattle tend to avoid them, but horses may not.

   Collapsing could be dangerous to people inspecting the hole; holes in soils of questionable coherence should be wider at the top than the bottom.

   Soil profile holes should be backfilled as soon as their usefulness ends; this is after logs have been taken, and the appropriate authorities have had an opportunity to view the soil profile.

   Inasmuch as authorities cannot view soils in profile in augered holes of customary diameters, it would be good practice to collect soil samples and log the holes and cover them as soon as possible.

   Holes dug with an auger are dangerous. Livestock break legs in these holes rather readily because they are not easily seen. People have been known to fall into and die in these holes. Augered holes approaching 1 foot or more in diameter are far more dangerous than a backhoe hole would be. If available, use of an auger no larger than 6 inches in diameter would be good practice for a boring log.

4. Use of boring logs.

   Upon inspection of the soil profile, choose soil strata considered suitable for subsurface disposal system use. A few feet away, dig a hole about 1 foot shallower than the bottom of the contemplated percolation test hole would be. This shallower hole shortens work needed to perform a percolation test, and it should be dug with the intention of facilitating a fieldman's working within it. (See Part II, F. Standard Percolation Test.)

   Except where deep pits are to be recommended, most soils can be described adequately by a single percolation test at a location. If needed, the boring log hole and its ramp provide opportunities for percolation tests in various strata.

Log the soil profile in terms of an accepted soils classificaion system; the USDA-Soil Conservation Service system is widely understood.[1] Samples can be collected and later analyzed for texture by standard hydrometer techniques[2], if need be.

Determine the depth to groundwaters, if present. If soils are mottled such as would indicate seasonal groundwaters, note the depth and extent of the mottling.

The presence of plant roots is generally an indication of permeable soils. Note the depth to which roots may be found.

If bedrock is found in the hole, note their kind and depth. Also note whether or not weathering or fracturing of bedrock might permit deep percolation. If on a slope, judge whether or not bedrock might be expected to conduct water to the surface of outcrops below, or out of a cut bank, if constructed later. Any open fractures, solution cavities (limestone), or other open holes could conduct untreated wastewaters to water supplies; these situations should be reported, if found.

Knowledge of clay content of a soil is useful along with observations of soil structure. Generally, clays and clay loams with good structure percolate waters readily. Nevertheless, subsurface disposal systems should not be dug when clay soils are wet because soil structure is destroyed in the process; it might be practical to recommend construction of subsurface disposal systems in subdivisions with clay soils only during drier times of the year.

5. Miscellaneous considerations.

   The soil mantle serves subsurface disposal systems in absorbing effluents and in conducting them away from the immediate area. Whereas the percolation test is used to assess ability of a soil to absorb effluent, subjective judgment is needed to assess the ability of the soil mantle to conduct effluent away from a subsurface disposal system. This latter consideration is not always given adequate thought in customary practices.

6. Soil depths.

   It is generally agreed that impervious soil strata or bedrock should be about 4 feet or more under the bottoms of proposed subsurface disposal systems, providing the bedrock is impermeable or would limit construction of subsurface disposal systems in some way. If shallower soils are to be considered, it should be demonstrated that bedrock is permeable and does not limit construction practices and it can be shown that contamination of water supplies is improbable.

D. GROUNDWATER

Groundwater, free water, can interfere with proper operation of a subsurface disposal system, if it enters the system or is within about 4 feet of the bottom of the system, several weeks at a time. Capillary action can conduct water upwards about 4 feet in many soils and the capillary fringe is best kept beyond reach of the subsurface disposal system, at least, much of the time.

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[1] *Soil Survey Manual,* USDA Handbook No. 18. Reissued October 1962 with no change in text. Washington, D.C., U.S. Government Printing Office. August 1951. pp 207-210.

[2] Day, P. R. "Report of the Committee on Physical Analyses." 1954-1955 *Soil Science Society of America. Proceedings* 20 (2): 167-169.

On slopes, subsurface drainage can sometimes exist as free water; it can be found in holes during wet seasons, and during drier times of the year, mottled soils sometimes betray such situations. Where found or expected, subsurface runoff problems can sometimes by solved by placing curtain drains uphill of subsurface disposal systems to divert subsurface drainage to appropriate drainage courses downhill.

Drainage swales on slopes should be avoided as locations for subsurface disposal systems. Mountain valleys should be suspect and thoughts given to the possibility of curtain drains for individual drainfields.

E. TOPOGRAPHY

1. Topographic map of proposed site. The contour interval shall be such as to clearly identify any wash, water course, rock, outcropping, etc. The maximum contour interval shall be:

Grade	Contour Interval (feet)
0 - 5%	2
5 - 10%	5
Greater than 10%	10

2. General.

   In flat terrain, hardpans or other impermeable strata are sometimes found. In these areas pits extending into deeper, permeable strata are satisfactory and are preferred.

   Sloping terrain provides gradients, beneficial in conducting percolating waters away from subsurface disposal systems. In a sense, soil on a slope is comparable to a deep soil in flat terrain, in which downward percolation might be at an angle, rather than straight down. Soils on slopes can be thinner and serve the same function that thicker soils serve in flatter areas. Generally, soil on slopes needs to be at least 3 feet thick, providing the soil has a percolation rate less than about 30 min./inch. Where percolation rates are greater than about 30 min./inch soils on slopes need to be at least 4 feet thick. (Here it is assumed that disruption of the soil mantle in the affected area would not occur, and that permeability of bedrock has been assessed and can absorb percolating waters, given enough distance of travel downslope. Further, it is assumed that the disposal trench is constructed on as much of an upper contour as is practical one trench right above another can interfere with the lower trench.)

   Steep slopes are difficult for contractors constructing disposal trenches. A 20% slope is almost the uppermost limit at which a backhoe can negotiate safely. Sometimes, a terrace can be cut for operations, but this requires deep soils and tends to ruin landscapes.

3. Roadcuts and other disruptions of the soil mantle on sloping terrain.

   Where the soil mantle is to be cut for a driveway or roadway, and the cut would expose soil lying over a less permeable subsoil or bedrock, a subsurface disposal system placed above the cut could yield effluent to daylight from the cut. Generally, a 50-foot setback of subsurface disposal systems above cuts solves problems, but subjective judgment of an experienced person must be applied to individual situations.

4. Demonstration trenches.

   Where it is questionable that effluent could daylight from a cut bank or outcrop of rock, it is sometimes practical to construct a trench above the questionable area and

waterfill the trench daily with volumes exceeding what a disposal trench might expect to discharge at the locality. The placement of a trench, its dimension, and the length of time it is to be daily waterfilled, require experienced judgment for a valid assessment of the potential of waters from disposal trenches finding daylight.

F. STANDARD PERCOLATION TEST

A percolation test is used to identify a suitable soil strata for septic tank practices and to estimate the size a system should be, to have a reasonably long life span. It is extremely important that only qualified personnel conduct percolation tests as the results obtained will determine not only the acceptability of the site but also the design of the subsurface disposal system.

1. Depth of percolation tests.

   Percolation tests should be performed in whatever soil horizons are believed to be useful. If, for example, the engineer plans to recommend trenches about 8 feet deep and he considers the soil permeable to that depth, plus a few feet below that, he should perform tests at about 4 feet deep, and also at perhaps 10 to 12 feet deep. (All tests at one locality constitute one test in the required density of tests.) Flexibility can be used in choosing depths of tests. The object is to describe the permeability of the soil mantle in a sampling fashion. Judgment should be exercised in the field.

2. Disposal trenches.

   a. *Digging the hole.* With a backhoe dig a hole about 1 foot shallower than the bottom on the contemplated percolation test hole.

   With handtools, dig a 12-inch square or 15-inch round hole in the bottom of the backhoe hole. If water is in short supply, or if soils tend to collapse, place a perforated pipe vertically in the hole and carefully pack gravel or some other supporting material between the pipe and the hole wall. Perform the test within the vertical pipe and adjust calculations to account for the displacement of water by the gravel used to support the sides of the hole.

   b. *Preparing the hole.* Remove any smeared soil surfaces from the sides of the hole to provide as natural a soil interface as practical, to infiltrating waters. Remove loose material from the bottom of the hole. To protect the bottom from scouring, add an inch or two of coarse sand or fine gravel.

   c. *Presoaking the hole.* Presoak the hole by filling it deeper than 8 inches with clean water. Add the water gently so the bottom and sides of the hole are not damaged.

   If it is known that the soil has a low shrink-swell potential and low clay contents (less than 15%) proceed with the test. If not, let the hole rest overnight.

   d. *Data Collection.* Use either method. Note the method used in the Geological Report.

      1) Fill the hole with clean water to exactly 6 inches above the soil bottom of the hole (do not consider the layer of protective gravel as the bottom of the hole). With a float gauge, and a timepiece, determine the time for the water to recede exactly 1 inch. Refill immediately and repeat the process until successive time intervals needed for 1 inch of fall indicate that an approximately stabilized rate has been obtained.

Report the stabilized percolation rate in minutes per inch.

2) Where soil suitability is the major concern, such as in subdivision studies, the following process would be a practical and adequate abbreviation of the design procedure.

After following procedures given in a., b. and c. above, equip the percolation test hole with a float gauge, note the time, and fill the hole exactly 6 inches above the soil bottom of the hole (do not consider the layer of protective gravel as the bottom of the hole). After a period of one hour, measure the water level. Immeditely refill the hole to the original level and repeat the process until four determinations have been made. Use the last determination to calculate the percolation rate.

If the percolation rate is less than 1 inch of water per hour, the soil is unsuitable for customary practices and alternate designs or methods of disposal must be considered.

Report the percolation rate in minutes per inch.

3. Disposal pits.

a. *Method.* Various methods of performing percolation tests for disposal pits are under consideration. The method detailed below is preferred. If another method is used, a detailed description must be included in the geological report.

b. *Digging the hole.* With an auger drill a hole 18 inches in diameter, or larger, to the depth of the contemplated disposal pits. The minimum acceptable depth is 30 feet. Add an inch or two of coarse sand or fine gravel to protect the bottom from scouring.

If results of the boring logs indicate the disposal pits will penetrate several different soil strata a percolation test will be required in each strata considered to be useful. Each auger hole should penetrate the strata being tested, but not the strata below it.

c. *Presoaking the hole.* Presoak the hole by filling it deeper than 12 inches with clean water but not above the soil strata being tested. Add the water gently so the bottom and sides of the hole are not damaged.

If it is known that the soil has a low shrink-swell potential and low clay contents (less than 15%), proceed with the test. If not, let the hole rest overnight.

d. *Data Collection.* Use either method. Note the method used in the Geological Report.

1) Fill the hole with clean water to approximately 12 inches above the soil bottom of the hole (do not consider the layer of protective gravel as the bottom of the hole). With a measuring device, and a timepiece, determine the time for the water to recede exactly 1 inch. Repeat the process until successive time intervals needed for 1 inch of fall indicate that an approximately stabilized rate has been obtained.

Report the stabilized percolation rate in minutes per inch.

2) Where soil suitability is the major concern, such as in subdivision studies, the following process would be a practical and adequate abbreviation of the design procedure.

After following the procedures given in a., b., and c. above, equip the percolation test hole with a measuring device, note the time, and fill the hole approximately 12 inches above the soil bottom of the hole (do not consider the layer of protective gravel as the bottom of the hole). After a period of one hour, measure the water level. Repeat the process until four determinations have been made. Use the last determination to calculate the percolation rate.

If the percolation rate is less than 1 inch of water per hour, the soil is unsuitable for customary practices and alternate designs or methods of disposal must be considered.

Report the percolation rate in minutes per inch.

4. Variations among percolation tests.

A testing program attempts to describe soil over an area. Sometimes soils change in kind over an area, because of geological changes and other reasons. Inspections of soil profiles and percolation rates could describe such changes. The point of a program is to see if such real differences exist and if so, what are the situations.

Within any one kind of soil there would be a variation due to test procedures themselves. Variation on one lot could be greater than variations soils actually offer from place to place on an entire subdivision. Where a percolation test program yields a rather wide range of percolation rates, it would be good practice for the engineer to pick a typical lot (if there is such a thing), and perform several tests on it. If the range is as great on that lot as on the rest of the subdivisions, he knows clearly that no practical amount of further testing over the subdivision would yield much better data. It might be well for him to look into his mode of performing tests to see if he could reduce variations arising from procedural sources, before assuming that soils are indeed so variable.

ARIZONA DEPARTMENT OF HEALTH SERVICES ⊙ Environmental Health Services ⊙ Bureau of Water Quality Control
1740 West Adams Street ⊙ Phoenix, Arizona 85007

APPLICATION FOR APPROVAL OF SANITARY FACILITIES FOR SUBDIVISIONS

SUBMIT IN DUPLICATE

GENERAL INFORMATION -

1. Name of subdivision _____

   Lot numbers* _____

   City or location _____ County _____ Sect. _____ Tp. _____ Range _____

2. Owner or subdivider _____ Phone _____

   Mailing Address _____ City _____ Zipcode _____

3. Area of subdivision _____ acres Number of lots - residential _____ commercial _____

   If more than one type of lot, plat shall clearly show zoning. industrial _____ TOTAL _____

WATER SUPPLY -

4. Name of water supply _____

5. Have plans and specifications been approved by the Arizona Department of Health Services? ☐ Yes ☐ No Date _____

6. Water distribution system will be constructed by - ☐ subdivider ☐ water company ☐ municipality

SEWAGE DISPOSAL -

7. Where existing sewerage treatment facilities are to be used:

   a. Name of existing system _____

   b. Have proposed sewer extensions been approved by the Arizona Department of Health Services? ☐ Yes ☐ No Date _____

8. Where separate system is proposed:

   a. Distance to nearest public sewer _____ Sewer size _____

   b. Description of proposed system _____

   c. Method of proposed treatment _____

   d. Method of proposed effluent disposal _____

   e. Have plans and specifications been approved by the Arizona Department of Health Services? ☐ Yes ☐ No Date _____

   f. Has application for U.S. Environmental Protection Agency NPDES permit been submitted? ☐ Yes ☐ No Date _____

9. Sewerage facilities will be constructed by - ☐ subdivider ☐ municipality ☐ sanitary district

10. Where individual systems are proposed:

    a. Distance to nearest public sewer _____

    b. Attach "County Approval of Individual Sewage Disposal Systems". (If not attached give reason) _____

_____

_____

Continue on a separate sheet of paper if space is not adequate.

REFUSE AND GARBAGE DISPOSAL -

11. Will municipal or private collection service be provided to the subdivision? ☐ Yes ☐ No

If answer is yes, give the name of the collection agency. *(Attach completed and signed garbage service agreement and garbage disposal agreement)*

_____

If no, complete the following:

a. Will purchaser or tenant be informed of his responsibility for proper storage, hauling and disposal in accordance with the plan indicated on the approved application? ☐ Yes ☐ No

b. Location of nearest approved sanitary landfill disposal area: _____

_____

Distance from subdivision: _____

Identify the party (city, county, firm or individual) responsible for operating the site: *(Attach completed and signed garbage disposal agreement)*

_____

Where the distance to the nearest disposal area is 5 miles or greater, the subdivider must arrange for a new conveniently located disposal area:

a. Submit detailed plans as to location and operation of the new disposal facility if provided by the subdivider, or

b. Identify the party (city, county, firm or individual) responsible for providing and operating new site, and attach the completed and signed Garbage Disposal Agreement.

I verify that all information given in this application is correct. I am informed that no construction of sanitary facilities shall commence unless and until a "Certificate of Approval to Construct" is issued by the Arizona Department of Health Services. I am informed further that no operation of sanitary facilities shall commence unless and until a "Certificate of Approval to Operate" is issued by the Arizona Department of Health Services.

_____

TYPE OR PRINT NAME OF SUBDIVIDER OR AGENT

_____ _____

DATE SIGNATURE OF SUBDIVIDER OR AGENT (IF AGENT, WRITTEN CONFIRMATION MUST BE SUBMITTED)

ARIZONA DEPARTMENT OF HEALTH SERVICES ⊙ Environmental Health Services ⊙ Bureau of Water Quality Control
1740 West Adams Street ⊙ Phoenix, Arizona 85007

COUNTY APPROVAL OF INDIVIDUAL SEWAGE DISPOSAL SYSTEMS

To be filled out and signed, where appropriate, and submitted with application

The location of percolation test and boring logs for the proposed:

_____
NAME OF PROJECT

have been designated and the results have been reviewed by the

_____
NAME OF COUNTY HEALTH DEPARTMENT

and the use of individual sewage disposal systems is approved, except as noted below (this is an approval of the method only and approval of plans and inspection of individual systems by the county health department will be required later). Final approval by the Arizona Department of Health Services must be obtained before construction of the project can commence.

Date _____ Name _____ _____
TYPE OR PRINT SIGNATURE

Title _____

Address _____

City _____