**PDHonline Course C533 (4 PDH)**

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# Repairing Failing Onsite Wastewater Systems

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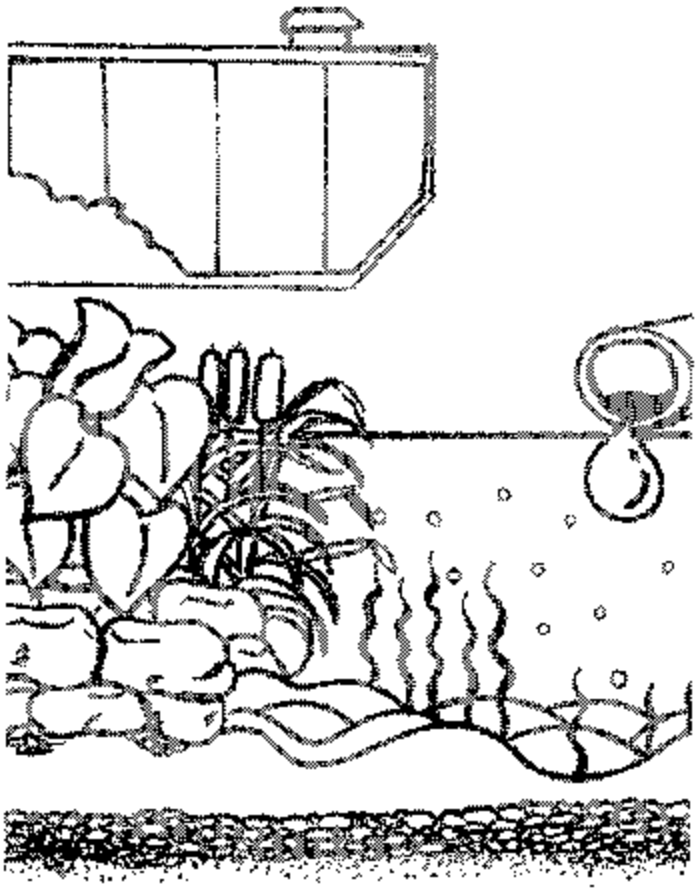
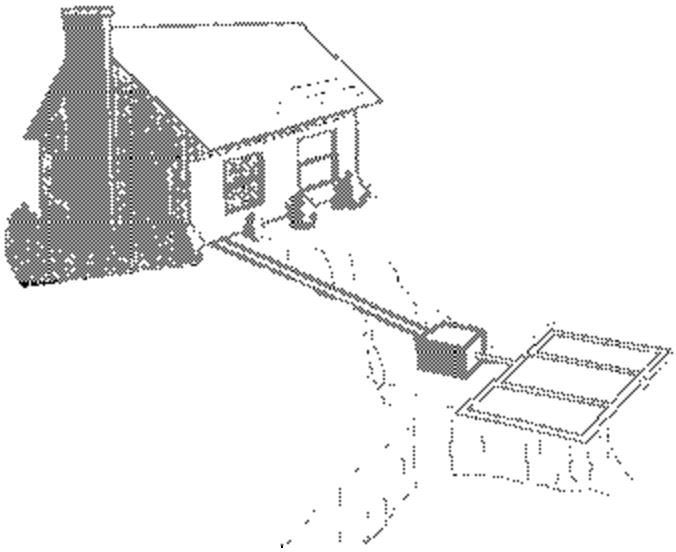
# Repair of Failing Onsite Wastewater Systems

**Mississippi State Department of Health**
**Bureau of General Environmental Services**
**Division of Onsite Wastewater**





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# Wastewater System Repairs

## Introduction

In recent years, the potential for groundwater and surface water pollution from individual onsite wastewater disposal systems (IOWDS) has emerged as a serious concern in the United States. Domestic wastewater (sewage) is known to contain many bacteria and viruses that are capable of causing illness and even death in man, through either direct or indirect contact. Nitrate, a product of aerobic degradation of wastewater, is a highly soluble compound that can move readily to groundwater from onsite disposal systems. Phosphate and organic substances also cause pollution, including the excessive nutrient enrichment of lake water. This renders it unable to support oxygen-dependent life, leaving it useless for recreational purposes as well.

According to the 1990 Census, 42% of individual residences in Mississippi have no access to public sewage disposal systems and rely on individual onsite disposal systems, of which approximately 85% are the conventional septic tank and soil absorption field type. This system is very effective in treating and disposing of domestic sewage, but certain site and soil conditions can be problematic. Factors at a particular site such as high seasonal water table in the soil, flood hazard, presence of any impermeable subsurface layer, and low soil permeability can cause this system type to fail. Failed sewage effluent drain field systems become a health hazard when the effluent breaks through the surface of the ground, or contaminates groundwater or surface waters. It is important to note that about 12% of housing units in Mississippi (in 1990) relied on private wells for drinking water. Because of their proximity to onsite disposal systems, these wells are more likely to be exposed to contamination than are community water systems. Many disease outbreaks in the United States traced to drinking untreated groundwater are caused by intrusion of sewage from IOWDS.

Failed IOWDS contribute to non-point source pollution. Surface waters statewide are affected, but particularly the coastal waters of Mississippi. Non-point source pollution adversely affects water quality and, potentially, human health. Commercial shellfish harvesting waters are subject to closure

when fecal coliform organisms reach certain levels. Runoff from malfunctioning, or improperly placed, IOWDS is a major contributor to contamination of these waters.

Proper repair of malfunctioning sewage systems is essential to help reduce pollution. Should an onsite disposal system malfunction, it is not required that the Mississippi State Department of Health (MSDH) be involved in repairs. Therefore, many homeowners do not contact their county health department, but rather may enlist the services of anyone the homeowner perceives as capable of alleviating their problem. Often, inappropriate repairs are made that do nothing to correct the failure, and in some cases even further damage both water quality and human health. For this reason it is important for homeowners, installers, and environmental regulatory staff to realize the dangers that improperly installed, serviced, and repaired IOWDS impose.

This Resource Manual for Repairs of IOWDS is intended to illustrate best management practices in the repair of individual onsite wastewater disposal systems. It describes problems and specific malfunctions of selected existing systems, and shows the selection of certain repair options chosen to overcome the soil and site conditions present on the property. The law and regulations on repairs are applied to these circumstances. Technical designs, equipment specifications, and installation schematics as utilized in the repairs installed under a grant from the Mississippi Department of Environmental Quality (DEQ) are included to illustrate the possibilities for overcoming malfunctions as well as site limitations.

This manual is a reference guide only. The Mississippi Individual Onsite Wastewater Law and the MSDH Regulation Governing Individual Onsite Wastewater Disposal are the regulatory authority for design and installation of any IOWDS.

# Requirements for Wastewater Repairs in Law and Regulation

1. All individual onsite wastewater disposal system (IOWDS) installations, including both new systems and repairs to existing systems, must be consistent with the federal Clean Water Act, consistent with

maintaining the wastes on the property of the generator, and consistent with the protection of the public health. (See Section 41-67-3, MS Code of 1972, Annotated; MSDH Wastewater Regulation 2.4 (1.)

2. All repairs must be installed by a certified installer or professional engineer, or by the homeowner on their own property. (See Section 41-67-25, MS Code of 1972, Annotated; MSDH Wastewater Regulation 2.18)

3. All pumping and disposing of the sludge and liquid waste (septage) from septic tanks or aerobic treatment units must be done by a licensed Sewage Pumper. (See MSDH Wastewater Regulation 2.19)

4. Repairs are not required to be approved, but the MSDH may approve repairs upon request, provided the repairs fully comply with requirements in law and regulation. (See Section 41-67-6 (1), MS Code of 1972, Annotated; MSDH Wastewater Regulation 2.12 (1) and (2).

5. Failing existing systems should be repaired or replaced, where possible, with a fully functioning system meeting all requirements. In cases where this is not possible (e.g., no available space, limitations of topography, soil restrictions), the existing system shall be repaired by a method that includes **all** of the following three parameters: adequately treat the effluent, reduce the volume of effluent, and to the greatest extent possible confine any discharge to the property of the generator. (See Section 41-67-9 (2), MS Code of 1972, Annotated; MSDH Wastewater Regulation 2.12 (2).

Adequate treatment of the effluent may include use of an aerobic treatment unit (ATU), sand filter, or plant-rock filter. The filters should be constructed as near to the required size and configuration as possible for the particular site.

Reducing the volume of effluent may include any or all of the following: plant-rock filter, low-flow fixtures and/or faucets, and water conservation measures. Separate “gray water” and “black water” treatment/disposal systems may be used in concert with the effluent reduction methods listed above.

Confining the effluent to the property of the generator must be attempted through any available means. Under no circumstances may there be a direct discharge. On lots too small for normal overland flow, methods such as multiple discharge points combined with planted rock beds or groupings of water-loving plants must be used to confine any discharge to the greatest extent possible.

6. If an existing approval is requested for a repaired system that is less than fully approvable (as in #5 above), "Approval of Repaired System" shall be checked on MSDH approval form #910 and a letter shall be provided for documentation (See Appendix F of the MSDH Wastewater Policy for Form Letter).

7. Property owners can be required to repair malfunctioning systems; property owners must take action to correct an immediate health hazard; property owners may be assessed penalties or fines for unrepaired systems. (See Section 41-67-21, MS Code of 1972).

8. Violation of the MSDH Wastewater Regulation (including, but not limited to, discharging raw sewage on the surface of the ground, discharging any wastewater off the property of the generator, and failure to repair a malfunctioning IOWDS ) is a misdemeanor and subject to the penalties for such as stated in law. (See Section 41-3-59, MS Code of 1972)

# Best Management Practices

## 1. Perform regular inspections of IOWDS.

Homeowners often overlook the fact that a septic tank system should have a regular check-up to prevent problems. The septic tank traps the solids in the wastewater and should be checked to determine whether or not it is time for it to be pumped. To avoid problems, homeowners should establish and maintain a pump-out schedule for their tank. The inspection port should be opened and the baffles or tees checked to ensure that they have not been damaged since the last inspection. The absorption field should be checked for sogginess or flooding, which indicates improper drainage, a clogged system, or excessive water use. The entire area containing the system should be checked for

damp or soggy areas or odors, indicating a leak in the system.

Special dyes are available that may help to find the problems that otherwise are difficult to notice. This method can help verify the other symptoms listed above.

The motors on aerobic treatment plants should be checked regularly to determine if they are functioning properly. All treatment plants have a warning device to indicate when there is a malfunction of the system. If a homeowner is not certain that the motor is operating, he/she should contact a certified installer who is an authorized representative for the ATU manufacturer. Other system components such as spray heads must be inspected to ensure they are not stopped up and that the spray pattern is evenly distributed.

Public Health Environmentalists at each county health department can aid in identifying failing systems. Homeowners can serve as monitors if they are educated on how to inspect their own systems. Brochures can be made available to instruct individuals on how to inspect their systems and the steps they need to take if they determine that their IOWDS is not functioning properly.

## 2. Perform regular maintenance of IOWDS.

IOWDS are not maintenance-free systems. The length of life and dependability of a wastewater system depends on how the homeowner maintains the system. One of the worst mistakes that a homeowner can make regarding an IOWDS is to forget that it's there. It is estimated that half of IOWDS failures are due to abuse of the system and lack of regular maintenance. The schedule for pumping tanks will be determined by how much organic material is loaded into the system. A widely accepted general rule is to have the tank pumped every three to five years. The cost of this service is reasonable, and there are many licensed pumpers available to check the solids level in a tank to determine if it needs to be pumped. The homeowner or installer can also make a determination of when it is time to pump the tank by occasionally checking the depth of solids and the level of scum buildup on top of the water in the tank.

Failure of the system will not occur immediately if a septic system is not pumped regularly; however,

continued neglect will cause the system to fail because the soil absorption system is no longer protected from solids and may need to be replaced.

Homeowners should repair leaky faucets and toilet tanks to help reduce hydraulic overload. They should also replenish chlorine tablets in the chlorine contact chamber if their system has a surface discharge of aerobically treated wastewater. Only chlorine tablets labeled for use in wastewater systems should be used.

## 3. Retrofit or upgrade improperly functioning systems.

Improperly functioning systems are usually the result of failure of the soil absorption field. The most common reason for failure is hydraulic overload. In that event, the existing system may be salvaged by avoiding making excessive demands on the system's capacity. The homeowner should avoid several loads of laundry in one day, extremely long showers, and filling large whirlpool tubs to capacity. They may wish to consider conserving water by installing low-flow shower heads and low-flow faucet aerators on sink faucets. Ultra low-flush toilets may provide up to a 30 percent water savings, but something as simple as placing a brick or two in the toilet tank is a no-cost method of reducing water use.

It is important to keep roof drains, basement sump pump drains, and other rain water or surface water drainage systems away from the absorption field. Flooding of the absorption field with excessive water will keep the soil from naturally cleansing the wastewater and lead to groundwater pollution. In certain situations, there has been good success in retrofitting failing systems by combining the construction of backup soil absorption fields with water conservation measures. Alternating absorption fields will allow one set of field lines to "rest" while the wastewater is diverted to the other field, and then alternated back and forth on a periodic basis.

In many cases, either because of improper siting (e.g., inadequate separation distance, proximity to surface water, poor soil conditions, or lack of land available for a backup absorption system) or the inadequacy of conventional IOWDS to remove pollutants of concern, the above retrofit practice may not be feasible. In these cases, alternative IOWDS using plant rock filters, or aerobic treatment units (ATU's) followed by spray irrigation, subsurface drip disposal, multiple discharge points or other approved systems may be necessary to adequately protect surface waters or ground water.

In cases where the repair or replacement of the existing system to full compliance with law and regulation is not possible, the existing system should be repaired to adequately treat the effluent, reduce the volume of effluent, and to the greatest extent possible confine the discharge to the property of the

generator. Repairs such as described will be a vast improvement in protecting both the environment and the public health when compared with the untreated raw sewage that emits from most malfunctioning septic systems.

## 4. Use denitrification systems where conditions indicate that nitrogen-limited surface waters may be adversely impacted by excessive nitrogen loading.

Even properly functioning conventional IOWDS, such as a septic tank and underground absorption trench or bed, are not effective at removing nitrogen. In areas where nitrogen is a problem pollutant, existing conventional systems should be retrofitted to provide adequate nitrogen removal. Several systems such as sand filters and constructed wetlands have been shown to remove over 50% of the total nitrogen from septic tank effluent.

A subsurface-flow constructed wetland design is known as a plant-rock filter in Mississippi's wastewater regulations. A plant-rock filter uses common wetland plants, including flowers, to treat wastewater. The plants grow in a trench filled with rock through which the effluent from the septic tank or treatment plant passes. This system operates on the premise that plant roots and the associated microorganisms living on the plant roots and gravel degrade and remove pathogens and nutrients from the wastewater. Products of this microbial degradation are absorbed and used as a food source by the plants, along with nitrogen, phosphorus, potassium, and other minerals. Plant-rock filters are an effective method of providing treatment to wastewater, and are especially useful in the repair of an existing wastewater system that is malfunctioning.

Groupings of water-loving plants can be used in soggy areas around an absorption field to help prevent runoff and thereby help mitigate nitrogen loading in adjacent surface waters.

## 5. Discourage the use of phosphate in detergents.

Conventional IOWDS are usually effective at removing phosphorus. However, certain soil conditions,

combined with close proximity to sensitive surface waters, can result in phosphorus pollution problems from IOWDS. Eliminating phosphates from detergent can reduce phosphorus loads to IOWDS significantly. Homeowners should read the labels on washing detergents and select detergents with no phosphorus.

## 6. Eliminate the use of garbage disposals.

The use of a garbage disposal will increase the amount of solids in the tank by as much as 50 percent. Eliminating the use of garbage disposals can significantly reduce the loading of suspended solids and biochemical oxygen demand (BOD) in an IOWDS. Eliminating garbage disposals can reduce the buildup of solids in the septic tank and reduce the frequency of pumping required. Reduction of the solids also provides added protection against clogging of the soil absorption system.

If a homeowner does use a garbage disposal, the size of the septic tank should be increased and the tank should be inspected on an annual basis for solids buildup. Pumping of the tank will need to be done more frequently in order to protect the absorption field from being clogged by overflowing solids.

## 7. Discourage or ban the use of acid and organic chemical solvent septic system additives.

Homeowners may wonder about the need for septic tank additives. The best advice is to avoid biological additives. None of these products have been found to have any significant value in improving performance or preventing failures. Additives are no substitute for proper inspection and maintenance.

Organic solvents used as septic system cleaners are frequently linked to pollution from septic systems. There is little evidence indicating these cleaners perform any of the advertised functions. In fact, their use may actually hinder effective septic system operation by destroying useful bacteria that aid in the degradation of waste, resulting in disrupted treatment activity and the discharge of contaminants. Toxic and hazardous chemicals should be kept out of the IOWDS. Even small amounts can destroy the biological digestion taking place within the system.

## 8. Promote proper operation and maintenance of IOWDS through public education and outreach programs.

Public education programs can help homeowners to prepare, operate, and maintain an IOWDS and thus help to ensure the continued pollutant removal effectiveness of the IOWDS. A variety of brochures and other educational materials regarding IOWDS have been developed. Homeowners may contact the MSDH Onsite Wastewater Division, or their county health department or county extension service. A video titled *Preventing Pollution -- Your Responsibility* (produced by the MSDH under a DEQ grant) shows how malfunctioning IOWDS contribute to non-point source pollution, and how proper repairs can reduce pollution. The DEQ conducts educational programs on preventing non-point source pollution.

Educational and outreach programs target builders, developers, realtors, certified installers, and regulatory inspectors, in addition to prospective home buyers and current homeowners.

**Adapted from EPA's *Guidance Specifying Management for Sources of Nonpoint*

# Warning Signs of a Failing Sewage System

Be alert to these warning signs of a failing system:

* Sewage odors
* Slow-draining toilets or drains
* Plumbing backups in the house
* Gurgling sounds in plumbing
* More lush, green growth over the drain field than elsewhere in the yard
* Excessive weed or algae growth in adjacent water bodies
* Ground surface damp or soggy underfoot
* Sewage surfacing over the drain field or running out at the end

If one or more or these warning signs are noted, the system may need to be repaired or replaced. Repairs or replacement for an individual onsite wastewater disposal system must be done by a licensed, certified installer.

# Estimated Septic Tank Pumping Frequencies in Years

| Tank Size (gals) | Household Size (Number of People) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 750 | 9.1 | 4.2 | 2.6 | 1.8 | 1.3 | 1.0 |
| 900 | 11.0 | 5.2 | 3.3 | 2.3 | 1.7 | 1.3 |
| 1000 | 12.4 | 5.9 | 3.7 | 2.6 | 2.0 | 1.5 |
| 1250 | 15.6 | 7.5 | 4.8 | 3.4 | 2.6 | 2.0 |
| 1500 | 18.9 | 9.1 | 5.9 | 4.2 | 3.3 | 2.6 |
| 1750 | 22.1 | 10.7 | 6.9 | 5.0 | 3.9 | 3.1 |
| 2000 | 25.4 | 12.4 | 8.0 | 5.9 | 4.5 | 3.7 |

The table above shows how often a septic tank should be pumped out on average, given the size of the tank and the number of persons living in the household. These figures assume there is no garbage disposal unit in use. The use of a garbage disposal will increase the amount of solids in the holding tank by as much as 50 percent.

You can make a specific determination of when it's time to pump out the solids by occasionally checking the depths of solids and the level of scum buildup on top of the water in the tank. You should have your septic tank inspected regularly (every two to three years) by a professional and pump out the sludge when necessary.

Remember, commercial septic tank additives will not eliminate the need for periodic cleaning and may be harmful to the absorption field. Be sure the septic tank is completely emptied. It is not necessary to retain any of the solids to restart the digestive process. You do not need biological or chemical additives for successful restart or continuous operation of your septic tank system. Nor should you wash or disinfect the tank after having it pumped.

(Adapted from National Small Flows Clearinghouse)

# Do's And Don'ts
## For Homeowners

**DO** know the location and components of your Individual Onsite Wastewater Disposal System.

**DO** regularly inspect, pump, and maintain your septic tank or aerobic treatment system.

**DO** conserve water in your home.

**DO** balance water use throughout the week to avoid overloading the system at any one time.

**DO** keep surface water runoff out of the septic tank, treatment plant or absorption area.

**DO** plant a greenbelt between the absorption field and a shoreline of any adjacent waterway.

**DO** keep all trees and other woody vegetation away from the absorption field where roots may clog the drainfield.

**DO** plant grass as a cover over the absorption field to prevent erosion and help remove excess water.

**DO** clean your toilets, sinks, showers, and tubs with mild detergents or baking soda rather than the stronger commercial cleaners.

**********

**DON'T** use your wastewater system as a trash can – never put items down the drain such as grease, coffee grounds, paper towels, plastics, disposable diapers, sanitary napkins, cat box litter.

**DON'T** pour toxic substances down the drain, such as solvents, acids, oils, paints, or pesticides.

**DON'T** use caustic drain openers for a clogged drain; instead use boiling water or a drain snake.

**DON'T** drive vehicles or heavy equipment over the absorption field.

**DON'T** plant trees or shrubbery in the absorption field area; roots will plug up the lines.

**DON'T** use chemical or biological septic tank additives.

**DON'T** cover the absorption field with a hard surface such as concrete or asphalt.

# Cost of Repairs

Mississippi law provides that the MSDH "---- to the extent practicable, shall encourage the use of economically feasible systems, including alternative techniques and technologies for individual onsite wastewater disposal".

While some repair methods are very low cost (aquatic plants to absorb wastewater) or no cost (reducing water usage), most repairs do involve a cost to the homeowner. In some cases, the cost can be significant. The ten repairs installed during the demonstration grant project ranged from a low cost of $2,400.00 to a high cost of $11,051.00.

# System Types Used for Repairs

Many types of systems can be used for repairs, depending on the nature of the malfunction and the soil and site conditions of the property.

These four system types were utilized for repairs in this grant project to prevent non-point source pollution:

1. Subsurface Disposal
2. Plant-Rock Filter
3. Spray Irrigation
4. Overland Discharge (Multiple-point)

The brief narratives that follow describe how these systems were used, and in some cases modified, for these particular repairs. For full descriptions of these system requirements, see Design Standards II, III, VI, VII, X, and XI. The use of septic tanks and aerobic treatment units is found in Design Standard I.

## Subsurface Disposal

Septic tanks and field lines or absorption beds are one of the 'passive' onsite wastewater disposal systems in use today. This particular onsite wastewater disposal system can be installed if the following guidelines are met:

## Design Standard II Gravel Disposal Systems

## IV. Location of Onsite Wastewater Disposal Systems

1. All components of the onsite wastewater disposal system shall be located a minimum of:
   a. five feet from any dwelling.
   b. ten feet from any property line.

2. Any vessel holding wastewater shall be located a minimum of 50 feet from any public, private or individual potable water source.

3. The effluent disposal field shall be located at a lower elevation and a minimum of 100 feet from any public, private or individual potable water source.

4. Potable water lines shall not pass under or through any part of the sewage disposal system. Where a water supply line must cross a sewer line, the bottom of the water service within ten feet of the point of crossing, shall be at least 12 inches above the top of the sewer line. The sewer line shall be of Schedule 40 pipe with cemented joints at least ten feet on either side of the crossing. Water and sewer lines shall not be laid in the same trench. The water and sewer lines, when laid on the same elevation , shall maintain a minimum separation distance of 10 feet.

5. The surface of or the surface above the disposal field shall not be used for vehicular traffic or vehicular parking.

6. No portion of an onsite wastewater disposal system shall be located under dwellings or other permanent structures.

7. Effluent disposal systems shall not be located in depressed areas where surface water will accumulate. Provision shall be made to minimize the flow of surface water over the effluent disposal field.

8. Subsurface wastewater disposal fields located on slopes of less than eight percent shall have a minimum setback from recreational waters, shellfish waters or other sensitive areas **[See Table I]**.

9. Subsurface wastewater disposal fields located on slopes of greater than eight percent shall be located a minimum of 100 feet from recreational waters, shellfish waters and other sensitive areas.

10. Slopes of greater than 30% shall not be considered for subsurface disposal installation.

11. Where all or part of the onsite wastewater disposal system is proposed to be installed on property other than the owner's, an easement in perpetuity shall be legally recorded in the proper county. The easement shall be of sufficient area to permit access, construction and maintenance of the onsite sewage disposal system.

12. No site for an effluent disposal field or expansion area shall be approved which is located wholly within an area which is frequently flooded, swamp, marsh, or wetland. Except that if permits have been issued by the proper regulatory agency authorizing the use of wetlands for building sites, the property shall be evaluated using standard soil and site criteria for IOWDS.

13. When a proposed lot is located partially within a frequently flooded area, that portion of said lot not within the flood prone area may be considered for approval for the effluent disposal field.

14. There shall be maintained a minimum of 12 inches of unsaturated soil between the bottom of the subsurface disposal system and a perched or seasonal water table in soils that contain a restrictive horizon (fragipan, chalk, bedrock, clay or silty clay) within five feet of the surface.

15. There shall be maintained a minimum of 24 inches of unsaturated soil between the bottom of the subsurface disposal system and any perched or seasonal water table in soils that do not contain a restrictive horizon (fragipan, chalk, bedrock, clay or silty clay) within five feet of the surface.

16. Easements or right-of-way areas for utilities, surface or subsurface drainage, roads, streets, ponds or lakes shall not be used as available space for location of individual onsite sewage disposal systems.

**TABLE I SETBACK REQUIREMENTS FOR SENSITIVE WATERS**

Setback Requirements from Sensitive Waters For all Subsurface Absorption Field Areas on Slopes of 8 Percent or Less:

| *Soil Textural Class | Minimum Distance From Water Edge |
|---|---|
| Gravel (Skeletal) | Not Applicable |
| Coarse to medium sand, fine sand, loamy sand, sandy loam, silty clay, clay | 100 Ft. |
| Loam, silt, silt loam, sandy clay loam, Silty clay loam, clay loam, | 50 Ft. |

*The texture of the subsoil material having the greatest permeability rates within the absorption area, inclusive of material to a depth of two feet below the absorption trenches or beds.

## TABLE II RESULTS OF SOIL EVALUATION

The following rates should be used to size conventional subsurface disposal systems: (See also Section 2.8)

| Soil Textural Class | Ribbon Length (inches) | EPA Manual Appl. rate gpd/ft$^2$ | [A]Absorption Area in sq. ft./bedroom | Additional absorption area in ft.$^2$/person over 2 persons/bedroom |
|---|---|---|---|---|
| Gravel and Coarse Sand | Not Suitable[B] | | | |
| Coarse to Medium Sand | - | 1.2 | 125 | 60 |
| Fine Sand, Loamy Sand | - | 0.8 | 190 | 95 |
| Sandy Loam | <.5 | 0.6 | 250 | 125 |
| Loam | <.5 | 0.6 | 250 | 125 |
| | .5-1 | 0.45 | 335 | 165 |
| Silt Loam | <1 | 0.45 | 335 | 165 |
| Sandy Clay Loam | 1-2 | 0.45 | 335 | 165 |
| *Silty Clay Loam or, | 1-1.5 | 0.30 | 500 | 250 |
| *Clay Loam | 1.5-2.0 | 0.20 | 750 | 375 |
| Sandy Clay, Silty Clay, Clay | >2.0 | Not Suitable | | |

A. Length of field line = $\frac{\text{Total sq.ft. of Absorption Area}}{\text{Width of Trench (ft.)}}$

B. See Section **2.15**

*Construction should proceed when the soil is sufficiently dry to resist compaction and smearing during excavation. This point is reached when soil material crumbles when trying to roll a sample into a wire between the palms of the hands.

Underground absorption may be useful in a repair if the soil and site are suitable, but the existing system is clogged due to age and/or lack of proper maintenance, or if it is damaged.

The installation process for this particular system starts with the plumbing within the dwelling. This plumbing should include water saving devices so as to ensure the design flow of 150 gallons per day per bedroom is not exceeded. Once the wastewater leaves the dwelling, a primary treatment unit must be installed. This could be either a septic tank or an aerobic treatment unit.

This primary treatment unit is designed to retain the waste for a 24 hour period. Once this time frame is reached, the treated effluent can be discharged to the surface from an aerobic treatment unit, but must be treated further if the effluent is from a septic tank.

One of the further treatment methods for septic tank effluent is underground absorption. Underground absorption systems must be placed in aerated soil. This soil will then allow for the removal of bacteria through filtration. The underground disposal system must be installed no deeper than 36".

The underground disposal system can be installed following either a septic tank or aerobic treatment unit. The underground disposal system must be installed in a two to three foot wide trench which is excavated to the recommended depth with a bottom slope of no more than two inches per 100 feet. Once the trench is completed either a gravel or gravel replacement system can be installed. For a gravel type absorption field, six inches of gravel is placed in the trench which is then smoothed or leveled for the perforated pipe placement. The perforated pipe is glued or connected with the appropriate fitting. Once the perforated pipe is installed an additional six inches of gravel is placed around the pipe so the gravel media within the disposal system is 12" deep.

Once the completed gravel system is installed, a minimum of 12" of cover must be placed over the trench with some mounding over the trench. This mounding will prevent the intrusion of surface water, thus insuring that only wastewater will be entering the field lines or field bed.

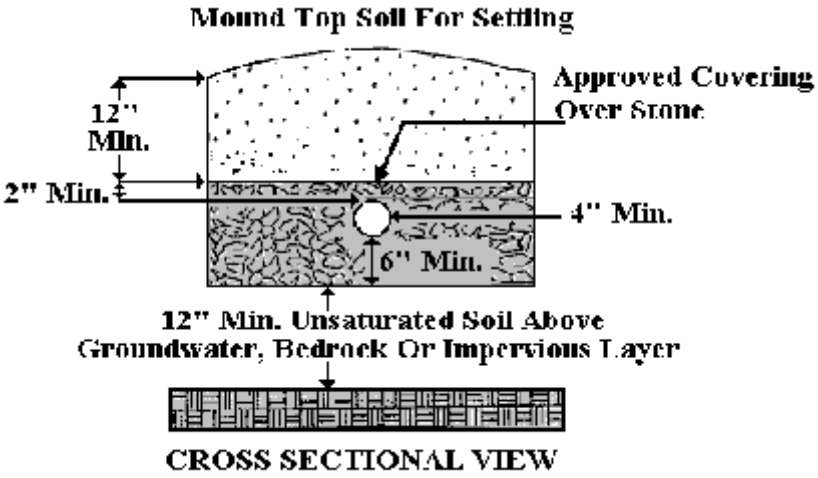
**Design Standard II**

**Gravel Disposal Systems**

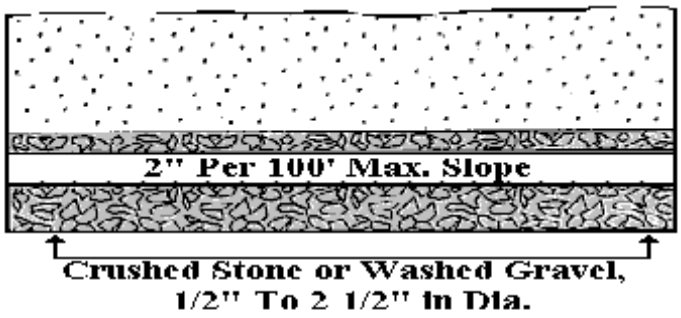
## Figure 1

## Conventional Subsurface Absorption

## Trench Cross Section



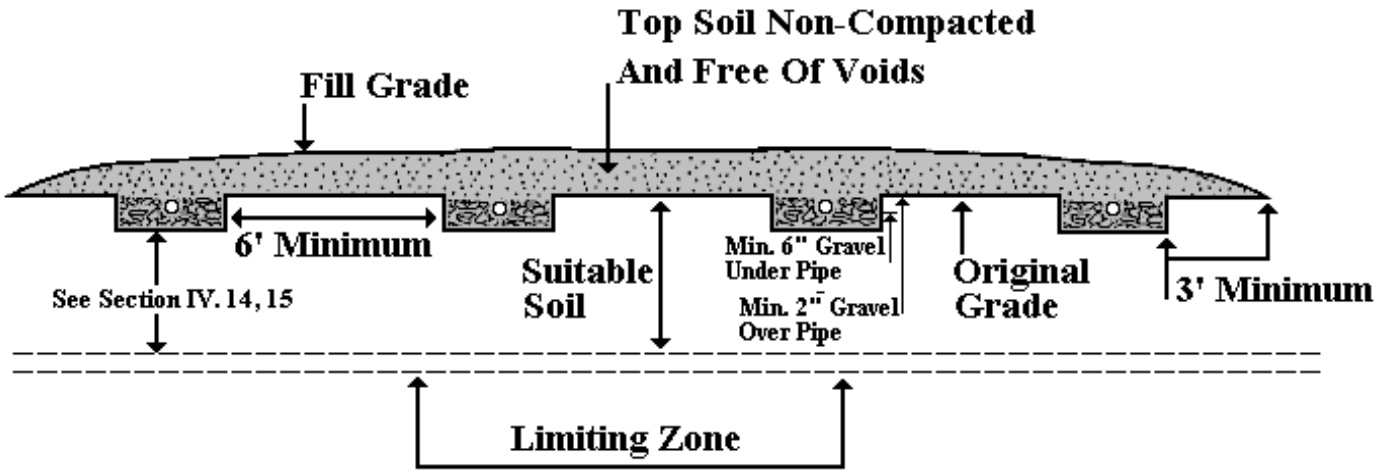

CROSS SECTIONAL VIEW




LONGITUDINAL VIEW

## Figure 2

## Ultra Shallow Absorption Field



Even though this is a 'passive' system, it must be maintained by the property owner or user. The property owner or user should inspect his/her individual onsite wastewater disposal system on at least a monthly interval. This inspection can be from simple to complex. The simple inspection is to notice wet areas in the area during mowing. The complex is keeping a detailed record starting from the date of installation through the life of the system. This record should include pumping cycle, any maintenance on the system and if underground absorption is replaced, a comment indicating the amount of the absorption area installed, installer name and date of installation.

An approval may be granted for a "repaired system", even if all design criteria are not met. While circumstances may dictate a slight reduction in the square footage of disposal field, for example, there should NOT be a deviation from critical public health parameters. These public health parameters may include, but are not limited to, setbacks from potable water wells and sensitive waters and depth to the seasonal water table.

## **Plant Rock Filter** (Constructed Wetlands)

The constructed wetland is one of the most useful individual onsite wastewater disposal systems. This system complies with the three parts of the legislation that governs onsite wastewater disposal repairs. It reduces the volume of wastewater during parts of the year, it treats the wastewater to an acceptable level, and when the outfall line is placed appropriately, maintains the discharge on the property of the generator. This disposal system consists of a gravel media bed with ornamental flowers planted that introduce oxygen into the wastewater. This oxygenated effluent is then chlorinated and discharged.

The specific site criteria for constructed wetlands should meet the location criteria for overland discharge systems as follows:

## **Design Standard X Overland Discharge**

## **IV. Location of Overland Discharge Systems**

1. Any vessel holding wastewater shall be located a minimum of 50 feet from any public, private or individual potable water source.

2. The effluent disposal field shall be located at a lower elevation and a minimum of 100 feet from any public, private or individual potable water source.

3. Potable water lines shall not pass under or through any part of the sewage disposal system. Where a water supply line must cross a sewer line, the bottom of the water service within ten feet of the point of crossing, shall be at least 12 inches above the top of the sewer line. The sewer line shall be of Schedule 40 pipe with cemented joints at least ten feet on either side of the crossing. Water and sewer lines shall not be laid in the same trench. The water and sewer lines shall maintain a minimum horizontal separation distance of 10 feet.

4. The area of the effluent disposal field shall not be used for vehicular traffic or vehicular parking.

5. Septic tanks, treatment plants, disinfection units and/or pump chambers shall not be located under dwellings or other permanent structures.

6. Effluent disposal systems shall not be located in depressed areas where surface water will accumulate. Provision shall be made to minimize the flow of surface water over the effluent disposal field.

7. Surface wastewater disposal fields located on slopes of less than eight percent shall have a minimum setback from the outermost edge of the effluent and recreational waters, shellfish waters or other sensitive areas as prescribed in **TABLE I**.

8. Surface wastewater disposal fields located on slopes of greater than eight percent shall be located a minimum of 100 feet from recreational waters, shellfish waters and other sensitive areas.

9. Slopes of greater than 30% shall not be considered for surface disposal field installation.

10. Where all or part of the onsite wastewater disposal system is proposed to be installed on property other than the owner's, an easement in perpetuity shall be legally recorded in the proper county. The easement shall be of sufficient size to permit access, construction and maintenance of the onsite sewage disposal system.

11. No site for a surface disposal field shall be approved which is located wholly within an area which is frequently flooded, swamp, marsh, or wetland.

12. When a proposed lot is located partially within a frequently flooded area, that portion of said lot not within the flood prone area may be considered for approval for the effluent disposal field.

13. Easements or right-of-way areas for utilities, surface or subsurface drainage, roads, streets, ponds or lakes shall not be used as available space for location of individual surface disposal fields.

**TABLE I**

Setback Requirements from Sensitive Waters For all Surface Disposal Field Areas on Slopes of 8 Percent or Less:

| *Soil Textural Class | Minimum Distance From Water Edge |
|---|---|
| Gravel (Skeletal), Coarse sand | Not Applicable |
| Medium sand, fine sand, loamy sand, sandy loam, silty clay, clay | 75 Ft. |
| Loam, silt, silt loam, sandy clay loam, Silty clay loam, clay loam, | 50 Ft. |

*The texture of the subsoil material having the greatest permeability rates within two feet below the surface receiving effluent shall be used to determine setback.

This system may used with either a septic tank or an aerobic treatment unit as the primary treatment. This system will perform extremely well if the water saving fixtures are placed in the dwelling. The installation criteria of a fully approvable system is as follows:
See Design Standard VII, Plant Rock Filter System (TVA Constructed Wetlands Guidelines)

The version of the constructed wetland that may be approved as a "repaired system"differs somewhat from the above design. These criteria for constructed wetlands for repairs may be used when needed to treat raw sewage and also reduce the flow as much as possible:
The primary treatment unit must be either a septic tank or an aerobic treatment unit. The effluent from the primary treatment unit is then piped into the bottom of the plant rock filter bed.

The plant rock filter bed is constructed based on the number of bedrooms or occupants. The usual size of the system is 300 square feet. A 300 square foot area is excavated with the length being at least twice the width. The bottom of the trench should be sloped slightly from inlet to outlet, but this slope should not exceed two inches per 100 feet.

Once the area is excavated a 30 - 40 mil EPDM liner is placed over the entire area including sidewalls of the trench or bed. Then a minimum of six inches of gravel media is placed on the liner for a distance of 15 feet. The inlet pipe is then installed and placed over and around the inlet pipe. The remainder of the trench or bed is then filled with 12 inches of gravel media.

The outlet pipe is then installed and placed on the gravel media. The remaining six inches of gravel media is added to the plant rock filter for a total of 18 inches of gravel media. Then aquatic or semi-aquatic plants are placed on one foot centers throughout the plant rock filter.

The outfall line must be placed in an area that is suitable to maintain the effluent or in the case of a repair 'to the greatest extent possible on the property of the generator'.

PLANT/ROCK FILTER

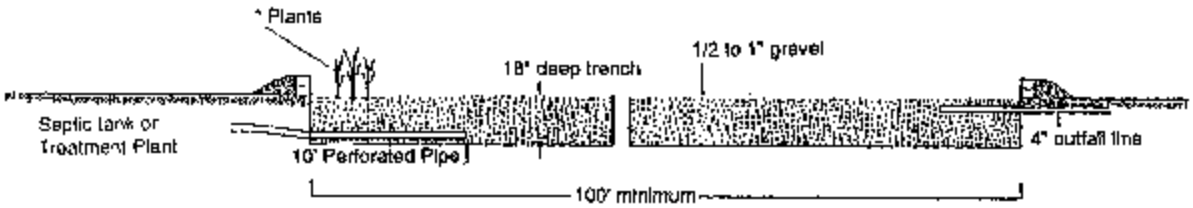



FIGURE I

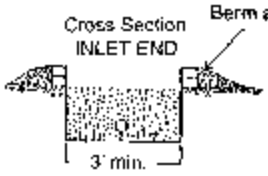



FIGURE II

*Ginger Lilies
Elephant Ears
Calla Lilies
Canna
Water Iris
(Plant 1 to 1.5 ft. apart)
Harvest Plant Tops After Frost

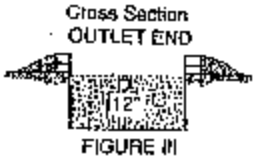



FIGURE III


FIGURE IV
Cross Section
Inlet manifold used for bed design

During the growing season, with conservative water use, a “trickle”of treated effluent should replace the larger volume of untreated effluent that may be emitted from a failing disposal system.

These (or other) aquatic or semi-aquatic plants may be suitable for use in a plant-rock filter:

| | | | |
|---|---|---|---|
| Louisiana iris | Elephant ear | Arrowhead | Cattail |
| Pickeral rush | Ginger lily | Arrow arum | Softstem bullrush |
| Yellow canna lily | Calla lily | Sweet flag | Water iris |

## Spray Irrigation

This disposal system distributes the treated effluent over a large area through wastewater or reclaimed-water spray heads. These spray heads are spaced so that the effluent will not be placed on the surface of the ground in an overlapping pattern.

This individual onsite wastewater disposal system makes use of an aerobic treatment unit as a primary treatment unit. Thus, if a septic tank is existing it must be replaced with an aerobic treatment unit.

This disposal system must meet the following requirements: Design Standard VI

Location of spray irrigation disposal fields must meet the following site criteria and setbacks:

## Design Standard VI

## Spray Irrigation Disposal

## IV. Location of Spray Irrigation Disposal Systems

1. All components of the spray irrigation disposal system shall be located a minimum of:
    a. five feet from any dwelling or permanent structure.
    b. ten feet from any property line.

2. The aerobic treatment plant and pump chamber shall be located a minimum of 50 feet from any public, private or individual potable water source.

3. Potable water lines and wastewater lines shall not be laid in the same trench. The potable water lines and wastewater lines shall maintain a minimum horizontal separation of 10 feet. Where a potable water line must cross a wastewater line, the potable water line within 10 feet of the point of crossing shall be at least 12 inches above the wastewater line.

4. The area of the disposal spray field shall not be used for vehicular traffic or parking.

5. Spray Irrigation Disposal systems shall not be located in depressed areas where surface water will accumulate. Provisions shall be made to minimize the flow of surface water over the effluent disposal field.

6. There shall be maintained, from the outer edge of the spray pattern, the following distances:

   a. 100 feet from any public, private or individual potable water source and be located at a lower elevation.

   b. 50 feet from recreational waters, shellfish waters or other sensitive areas for spray fields located on slopes of less than eight percent.

   c. 75 feet from recreational waters, shellfish waters or other sensitive areas for spray fields located on slopes of greater than eight percent.

   d. 50 feet from dwellings, swimming pools, businesses or other inhabited structures.

   e. 25 feet from lot lines, porches, patios and decks.

   f. 15 feet from outbuildings.

   g. 10 feet from walkways, private roads, driveways and parking areas.

7. Where all or part of the Spray Irrigation Disposal system is proposed to be installed on property other than the owner's, an easement in perpetuity shall be legally recorded in the proper county and a copy furnished to the local county Health Department prior to listing Spray Irrigation Disposal as an option. The easement shall be of sufficient area to permit access, construction and maintenance of the system.

8. It is the intent of these regulations that a minimum separation of 50 feet between independent spray disposal fields be maintained. Over lapping of the required setback from property lines cannot be negated by the granting of easements.

9. No site for a Spray Irrigation Disposal system shall be approved which is located wholly within an area which is frequently flooded, swamp, marsh or wetland. Except that if permits have been issued and provided to the local health department by the proper regulatory agency authorizing the use of such areas for building sites and the installation of individual onsite wastewater disposal systems, the permitted property shall be evaluated using standard soil and site criteria for an IOWDS.

10. When a proposed lot is located partially within an area which is frequently flooded, swamp, marsh or wetland, that area not within the frequently flooded, swamp, marsh or wetland area may be evaluated using standard soil and site criteria for an IOWDS.

11. In soils that contain a restrictive horizon (fragipan, chalk, bedrock, clay or silty clay), within two feet of the surface, there shall be maintained a minimum of 6 inches of unsaturated soil between the surface and the perched or seasonal water table.

12. In soils that do not contain a restrictive horizon (fragipan, chalk, bedrock, clay or silty clay), within two feet of the surface, there shall be maintained a minimum of 12 inches of unsaturated soil between the surface and the perched or seasonal water table.

13. Easements or right-of-way area for utilities, surface or subsurface drainage, roads, streets, ponds or lakes shall not be used as available space for the location of spray fields.

The installation of this system requires the sewage from the dwelling to enter the aerobic treatment unit. The aerobic treatment unit processes the sewage into a clear odorless effluent. The treated effluent is then discharged through a chlorinator into a pump chamber. Chlorine tablets must be maintained in the

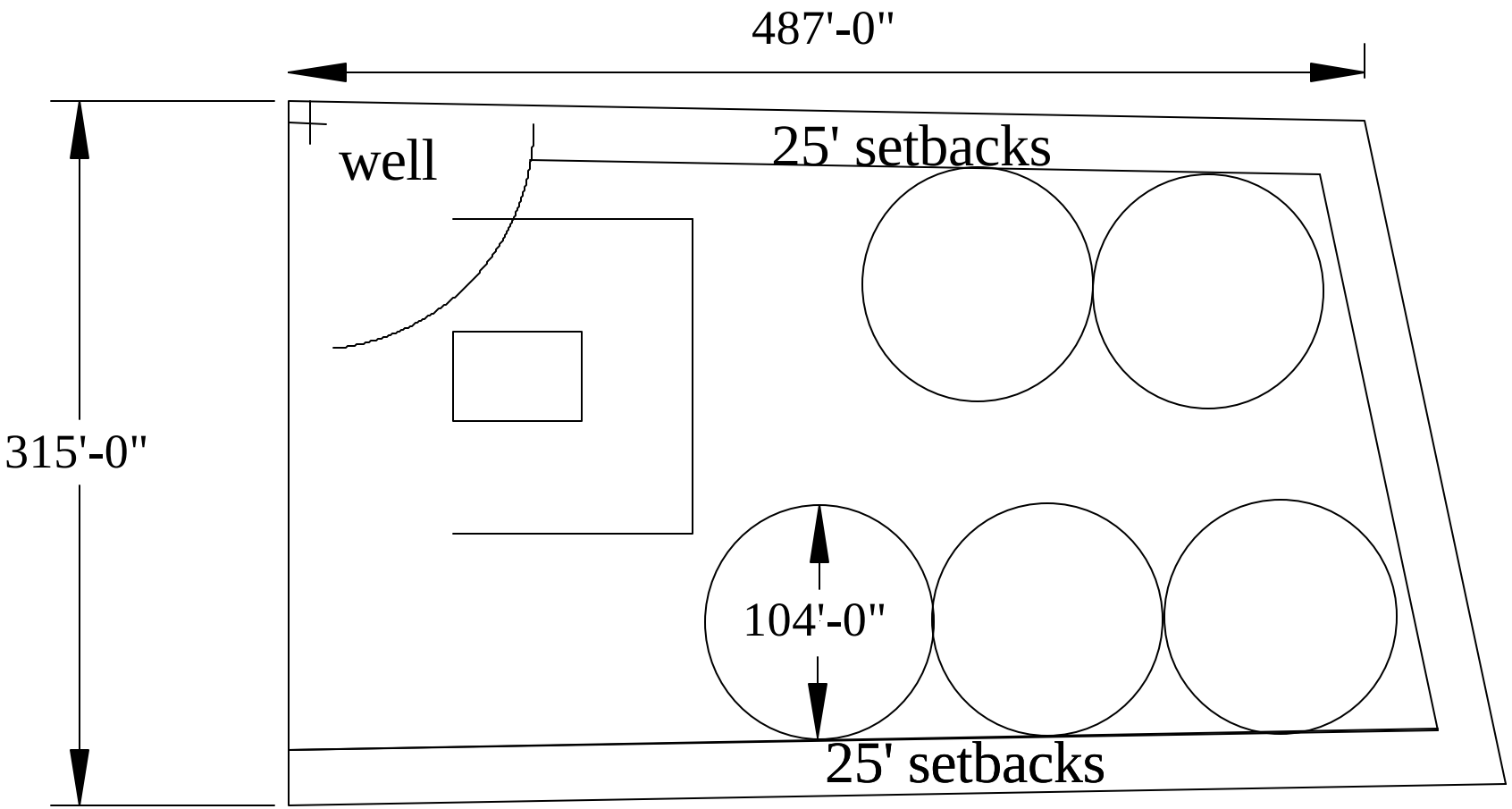
chlorinator so the effluent will be properly disinfected, See Design Standard XI, Disinfection.

The pump chamber holds the treated effluent until a switch is activated on the pump. The pump then pressurizes the manifold and spray heads. The spray heads then disburse the chlorinated effluent onto the surface of the ground.

If a timer is used with this system, the soil receiving the treated effluent has a 'resting' cycle between spray applications. The use of this disposal system as a repair is not recommended for some areas due to setbacks and lack of available space.

The system should only be used if at least 70% of the area required for a new spray irrigation system is available on the repair site. A spray system may be useful in repairs where the soil and site cannot adequately support subsurface disposal, if there is sufficient available space.

# Example of Spray Layout



## Multiple Point Discharge

The criteria for a fully approvable overland discharge system can be found in Design Standard X. The multiple point discharge disposal system can be incorporated with any of the following discharge Systems:

ATU with overland

Septic Tank & Sand filter with overland

Septic Tank & Lagoon with overland

Septic Tank & Plant Rock Filter with overland.

This can be either a gravity or pressure distributed treated effluent control device. Controlling the treated effluent is critical to maintaining the effluent on the property of the generator.

The land area receiving the discharge must be of sufficient size to maintain the outermost edge of the effluent the following prescribed distances:

a. 50 feet from property lines, down slope or same grade, and dwellings; 10 feet from property lines up slope.

b. 100 feet from any well or source of potable water and any sensitive waters, or other sensitive areas.

A gravity fed multiple point discharge system is built with splitter ‘tees’ or double 'ells’. The initial splitter tee or double ell is placed on the out-fall pipe following chlorination. The number of discharge points will determine the number of splitter tees or double ells that must be used. It is necessary to place all splitter tees or double ells on a level grade to insure equal distribution of effluent from each discharge point.

The pressure fed multiple point discharge system is much easier to install and design. The installation of this system requires a very low-pressure low-volume pump with no more than 5psc at the point of discharge.

This type of multiple point discharge system can be placed on more varying terrain than the gravity systems.

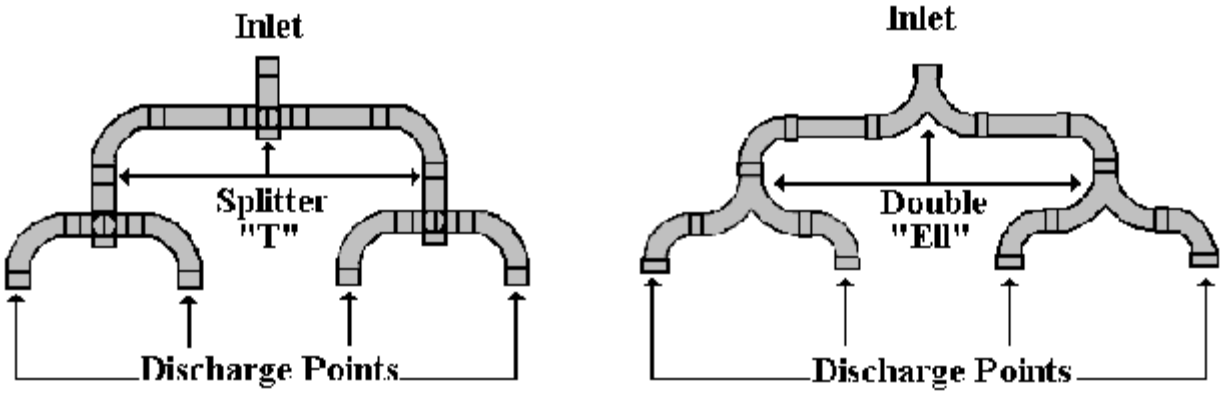
Check valves and pressure compensator valves must be used in a pressure fed system to ensure equal distribution of the discharge. As with spray irrigation, the effluent must be chlorinated as required in Design Standard XI, Disinfection.

**Design Standard X**

**Overland Discharge**

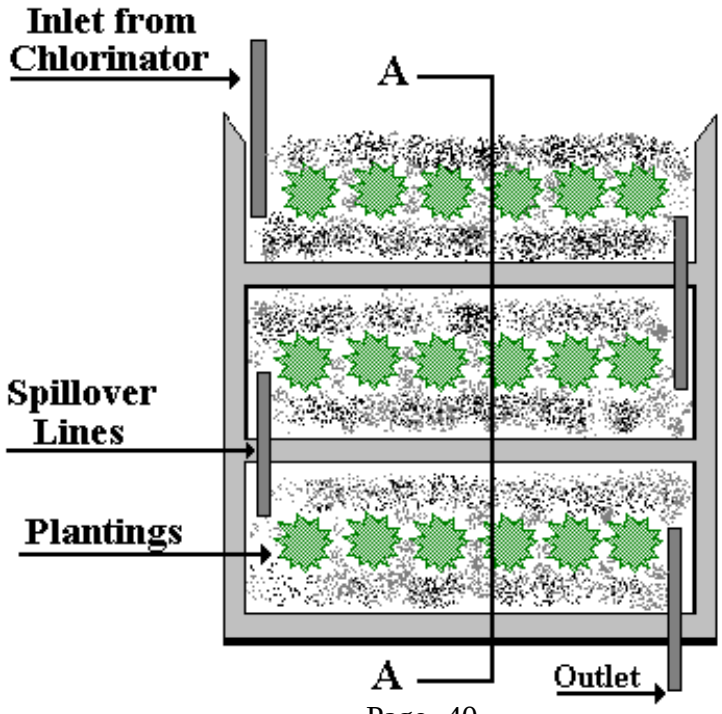
**Figure 1**

**Overland Flow Using Multiple Discharge Points**



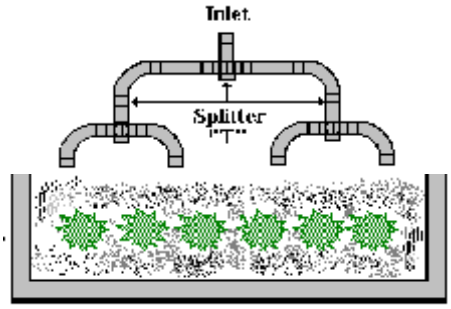

Drawing A
Discharge manifold
Using Splitter "T" Fittings

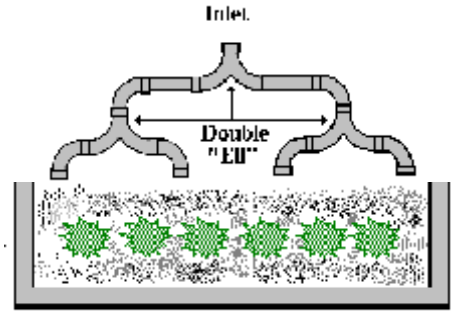
Drawing B
Discharge Manifold
Using Double "Ell" Fittings



A manifold can be constructed using splitter “T” fittings or double “Ell” fittings. This will equally divide the effluent into multiple discharge points. Care must be taken to ensure the fittings used are level or effluent will not be divided equally.

The manifold shall be designed, constructed and installed in such a manner that the effluent will be distributed equally and be self draining.

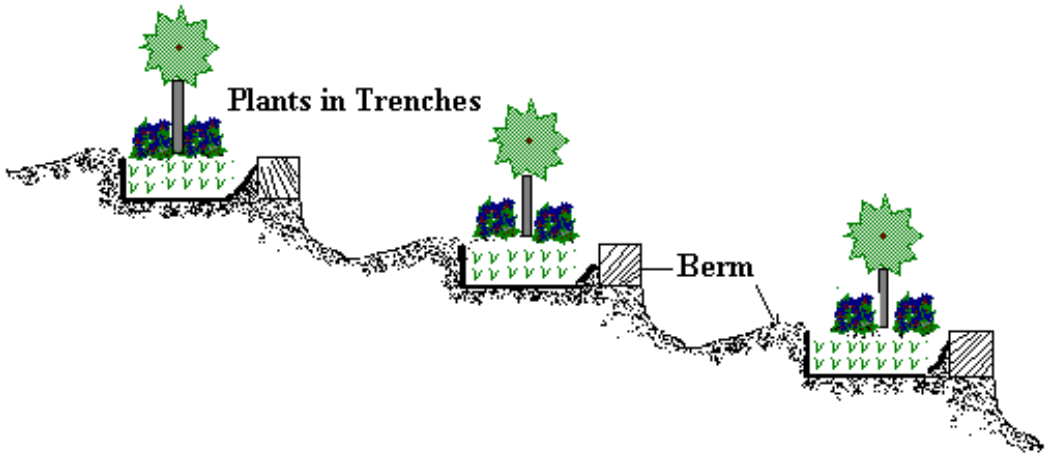


Further absorption of the effluent could be enhanced with the addition of plantings (canna, calla lilies, elephant ears, etc.) in a bed following the distribution manifold.

## Figure 1A

## Overland Flow Using Terraced Plant Beds




**DISCHARGE ROUTED THROUGH TERRACES WITH PLANTINGS.**

**SECTIONAL DRAWING [AA]**

The chlorinated discharge can be routed through terraces with plantings. The terraces shall be bermed to prevent the entrance of surface water. The final discharge point from the terraces must conform to the setbacks for overland flow discharge.

# Repair Sites

## Narrative Description

### Site 1

The first site selected for the Nonpoint Source grant program consisted of a septic tank and field line. The field line was surfacing due to a "wet weather overflow" installed to keep the surfacing sewage out of the yard. This "wet weather overflow" was flowing downhill to a pond located on the property. This individual onsite wastewater disposal system was judged to be 20+ years of age.

More problems were found to exist during the excavation of the area around the septic tank. The existing septic tank was found to have collapsed inward thus reducing the volume and treatment effectiveness.

The recommended repair for this site included a new septic tank and constructed wetland. The new septic tank was sealed with butyl rubber and fitted with an effluent filter. The filter is being used to help reduce the number of solids that may enter the constructed wetland.

The constructed wetland was designed for the biological loading instead of hydraulics. This constructed wetland is a 300 square foot system with an effective depth of 18 inches. This being a subsurface flow constructed wetland, the level of the water is 12 inches from the bottom of the system.

# Completed Filter

## Site 2

The second site selected for the Nonpoint Source grant program consisted of a septic tank and field line. This system was being utilized by a medical clinic. The flow from the medical clinic was combined with the flow from a grocery store located on the same property. This individual onsite wastewater disposal system was judged to be 20+ years of age.

During the excavation of the aerobic treatment unit, pump chamber and spray grid, the existing field line was cut several times revealing that the field line was partially filled with solids. This is shown in the 'before" photograph showing the condition of the field line.

This failing system was replaced with an aerobic treatment plant, pump chamber and spray field. The combined flowrate from the business was calculated to be 900 gallons per day. The aerobic treatment unit was sized based on a 1000 gallon per day flow. The pump chamber is 500 gallons. The spray field consists of three 3l-foot radius spray heads. The spray area is located southwest of the grocery store and west of the medical clinic.

# Adjusting the Spray Pattern

## Site 3

The third site selected for the Nonpoint Source grant program consisted of a septic tank and field line. This individual onsite wastewater disposal system was judged to be 30+ years of age. Both the field lines and washing machine were being discharged into a drainage ditch separating the property from the adjoining property.

A previous repair to the field line had been done prior to the grant project repair. The previous repair consisted a 50 foot run of gravel replacement line, leading to the adjoining property line. Because of the previous repairs, there was no available space remaining for a subsurface disposal field.

This failing system was replaced with an aerobic treatment plant, pump chamber and multi-point discharge. Three points were chosen on the property, each located near an existing shrub. Each shrub is being dosed each pump cycle with approximately 15 gallons of treated effluent.

## Site 4

The fourth site selected for the Nonpoint Source grant program consisted of a septic tank and field line. This system was approximately 15+ years of age. The leaking field line was being maintained on the property of the generator, but the surfacing effluent was beginning to become a mosquito haven.

This failing system was placed at an inappropriate depth as indicated by "grey" mottles. This system was also being filled with solids from a non-maintained septic tank.

The repair to this system consisted of having the existing septic tank pumped and new field line being installed at the appropriate depth above the seasonal water table as indicated by the "grey" mottles.

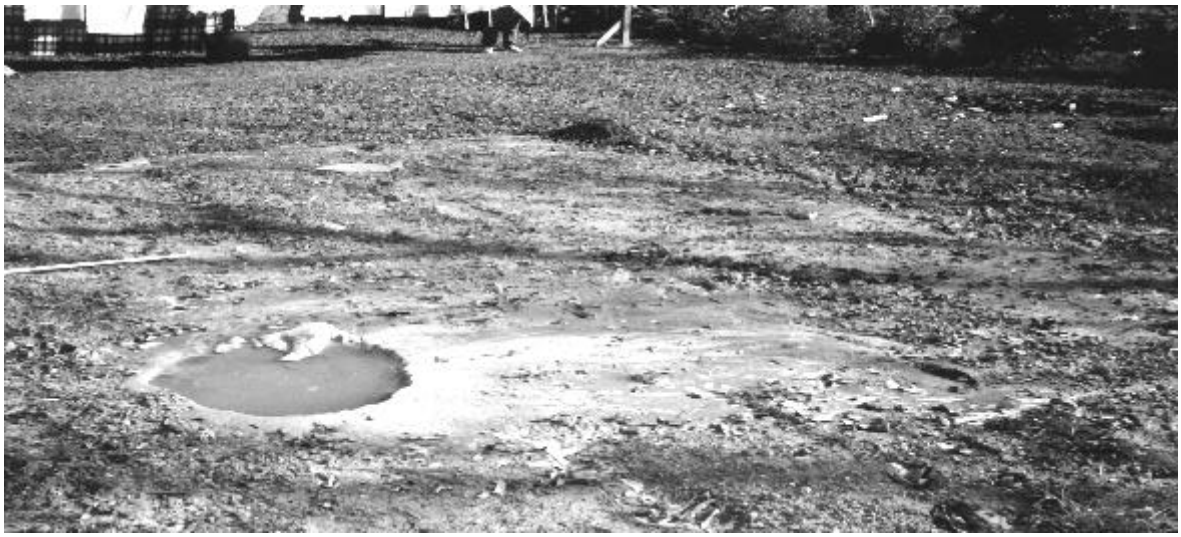
## Site 5

The fifth site selected for the Nonpoint Source grant program consisted of a septic tank and field line. This system was approximately 10+ years of age. The leaking field line was being maintained on the property of the generator, but the surface area was beginning to become a problem for children and pets in the area. This failing system was placed at an inappropriate depth as indicated by "grey" mottles. This system was also being filled with solids from a non-maintained septic tank.

The repair to this system consisted of having the existing septic tank pumped and new field line being installed at the appropriate depth above the seasonal water table as indicated by the "grey" mottles.

## Site 6

The sixth site selected for the Nonpoint Source grant program consisted of a septic tank and gravel-replacement field line which was placed in an area of marginal soil. This system was approximately 2 years or less of age. The leaking field line was being maintained on the property of the generator, but the surfacing effluent was beginning to become a problem for the neighbor.



The repair to this system consisted of having the existing septic tank pumped and new gravel field line being installed at the appropriate depth above the seasonal water table as indicated by the "grey" mottles.

**Site 7**

The seventh site selected for the Nonpoint Source grant program consisted an aerobic treatment unit and subsurface drip disposal. This "first generation" drip disposal system was troubled by filtration problems. The existing drip lines were beginning to clog with solids and the fill area for the drip disposal area had become saturated. This failing system was approximately 4+ years of age.

The correction for this failing system was to replace the drip disposal with a spray disposal and pumping of the aerobic treatment unit.

## Site 8

The eighth site selected for the Nonpoint Source grant program consisted of an aerobic treatment unit and field line with a point discharge. The soil conditions were inappropriate for any type of underground absorption. This failing system was approximately 4+ years of age.

During the excavation, the existing aerobic treatment unit was found to be leaking due to what appeared to be a fracture. This allowed untreated effluent to be discharged into the seasonal water table. The correction to this failing system was first to install a new aerobic treatment unit.

The final disposal was also replaced with a spray irrigation system utilizing the placement of five spray heads with various radii.

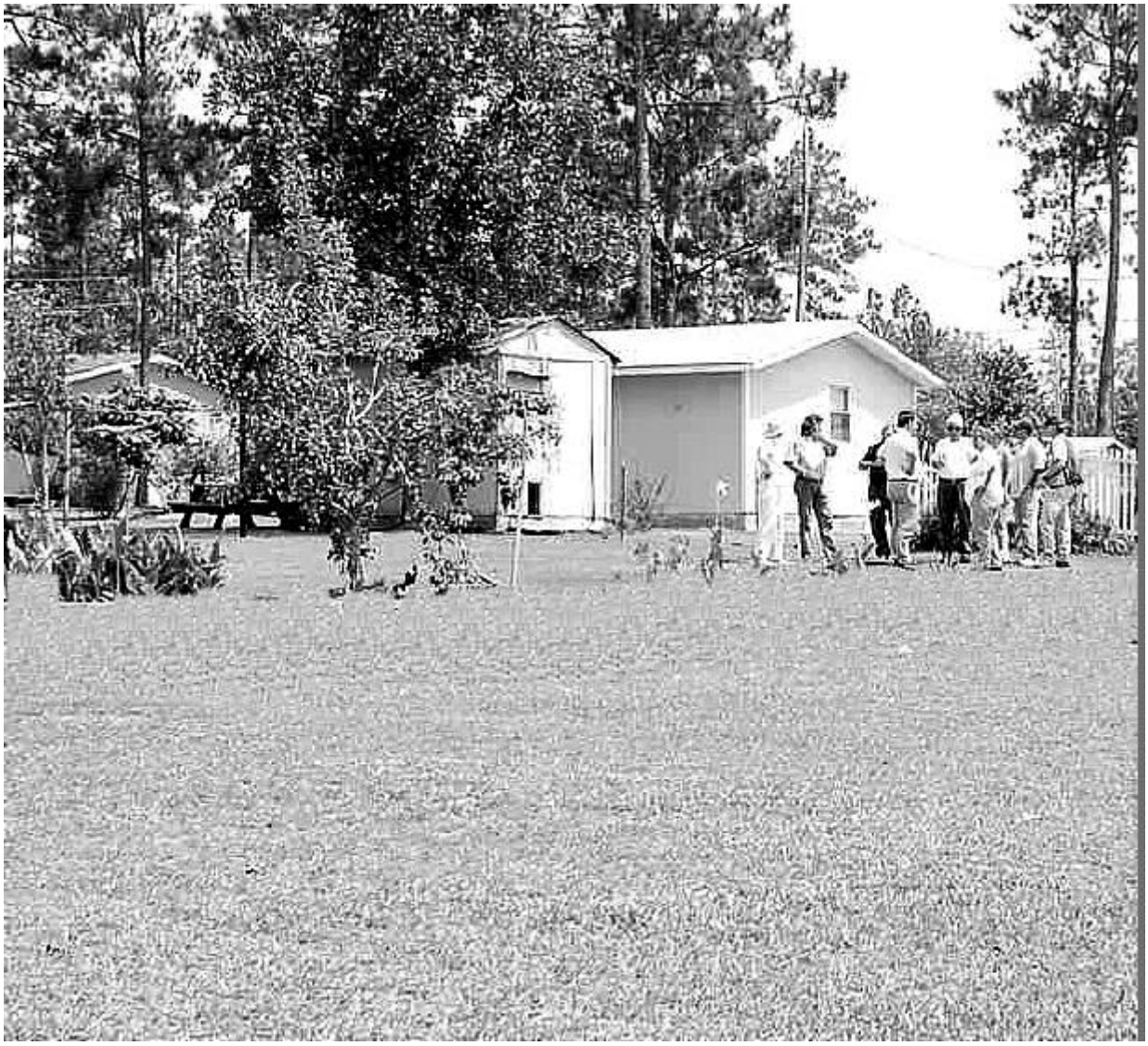
## Site 9

The ninth site selected for the Nonpoint Source grant program consisted of an aerobic treatment unit and inappropriate oxidation pond, located in an area known to have a high seasonal water table. The correction to this site consisted of first replacing the undersized aerobic treatment unit and then filling the inappropriate oxidation pond. Repair included the installation of a spray irrigation system located in front of the residence. This system has three spray heads for effluent dispersal.

## Site 10

This selected site consisted of a septic tank and malfunctioning field lines approximately 30 years old. The soil conditions for this site indicated that underground absorption was unsuitable as a method of effluent disposal.

This failing system was replaced with an aerobic treatment unit, chlorinator and overland disposal. The aerobic treatment unit was sized at 750 gallons per day due to the size of the residence. The final disposal area is a large field of sufficient size to maintain the effluent on the property of the generator.



# Conclusion

Installing the proper onsite wastewater system, on a site that will support it, and using proper construction techniques are requisites for a sewage system that will function properly and give good service to the homeowners for years to come. Regular maintenance for the particular type system by the homeowner and/or by certified/licensed professionals is critical. This will insure that a system will function properly and need few or no repairs.

When an IOWDS does need to be repaired, state law does not require approval. However, health department staff are trained and available to evaluate the site to recommend the proper repairs. The repair can range from a relatively minor correction to the complete replacement of the system.

The repair chosen, if not fully compliant with the wastewater regulations, must reduce the flow of wastewater as much as possible, properly treat the wastewater, and maintain the treated effluent on the property of the generator to the greatest extent possible. Public health parameters such as protection of potable water supplies and sensitive surface waters must be maintained.

Staff of the Onsite Wastewater Division, Mississippi State Department of Health, are available for assistance in making repairs. Three wastewater program specialists give technical assistance statewide:

Eugene Herring – North
Kevin Traylor – Central
Jim Weston – South

Ralph Turnbo is the Division Director, and Lynda Davis handles installer licensing. All of these staff may be reached at the MSDH Jackson office by calling 601-576-7695 (FAX 601-576-7632).

The program specialists can give onsite assistance in designing repairs for difficult sites and circumstances, once the county/district staff have made a site visit and provided soil and site information. Computer design aids (run-off program) are available.

Preventing non-point source pollution from individual onsite wastewater disposal systems is a responsibility shared between homeowner, installer, and regulatory agency. Working together, we can help protect the environment, the health of the community, and your family's health.