

## ***Columbia / Boone County Health Department***

1005 W. Worley Street, Columbia, MO 65201

573-874-7346

---

### **Alternative System Requirements**

- < An engineer's design is required for any system that is not a lagoon or a standard septic system.
- < The design should be drawn up by a licensed engineer that is experienced with on-site wastewater.
- < The soils report and the engineer's design must be submitted to the Health Department for approval before the site evaluation is conducted.
- < Any on-site sewage system for an establishment that is not a single family dwelling must be designed by an engineer.
- < Alternative designs are generally used for sites that have poor soil or limiting conditions. They generally contain a higher degree of pretreatment than standard type septic systems.
- < A permit is required for the installation of any alternative system.
- < Permits for new home alternative system construction must be taken out at County Planning and Building Inspection, County Government Center. The cost is \$200.00. The permit may be taken out by the homeowner or contractor.
- < Permits for existing home alternative system construction, without any work being done to the home, may be taken out at the Health Department, 1005 W. Worley Street. The cost is \$125.00. If any remodeling or addition work is being done to the home, the permits should be taken out at County Planning and Building Inspection.

## **Site Evaluation**

All proposed sites for on-site sewage treatment and disposal systems shall be evaluated for the following:

- < soil conditions, properties and permeability as determined by a soil morphology examination
- < slope, the existence of lowlands, local surface depressions, rock outcrops and sinkholes
- < setback distances as required
- < surface water flooding probability and depth to water table
- < location of easements and underground utilities
- < amount of available area for the installation of the system and an area for replacement
- < location of home site or dwelling as well as management of surface runoff water from those buildings
- < any other cultural feature, such as roads, streets and the like in surrounding areas which influences surface and subsurface flow of water on or near the proposed site
- < any significant groundwater contamination potential

**A soils morphology conducted by a certified soil scientist is required.**

## **Alternative Systems**

The intent of this section is to provide minimum standards for the design, location, installation, use and maintenance of alternative sewage disposal systems in areas of limiting soil characteristics, where a standard system cannot be installed or a standard system is not the most suitable treatment. Where these systems are employed, they shall comply with all local codes and ordinances and should be subject to timely inspections to assure adherence to specifications.

## **Drip Absorption**

Wastewater going to a drip absorption system must have a high degree of pretreatment prior to entering the drip field. Drip lines shall be placed two feet (2') apart in a parallel arrangement. Emitters shall be placed in the drip lines every two feet (2') so there will be a two-foot by two-foot (2'x 2') grid pattern. Other configurations and spacing of the

drip line and emitters may be used; however, each emitter will be considered to cover four square feet (4 sq. ft.) of absorption area.

Drip soil absorption systems may be allowed at sites where the soil is classified as being in group IVb. A minimum separation distance of twelve inches (12") shall be maintained between the drip lines and emitters and a high ground water table or other limiting condition. The maximum application rate for IVb soils shall be from five-hundredths to one-tenth gallons per day per square foot (0.05-0.10 gpd/sq. ft.) of absorption field.

### **Constructed Wetlands**

Constructed wetlands provide secondary levels of treatment, which means that some form of pretreatment (septic tank, aeration tank, lagoon, etc.) must be used prior to the wetland, as wetlands cannot withstand large influxes of suspended solids. The pretreatment used must be capable of removing a large portion of these solids. Effluent from wetlands must be contained on the owner=s property with the same set-back distances as required for lagoons.

Submerged flow wetlands have channels that are filled with shallow depths of rock, gravel or sand. The depth of the porous media is usually less than eighteen inches (18"). The porous media supports the root systems of the emergent aquatic vegetation. The water level is to be maintained below the top of the porous media so that there is no open water surface.

The configuration of a wetland for an individual home can be a one (1) cell or two (2) cells in series, depending upon the soil properties at the site. Larger systems may consist of multiple cells in parallel or series in order to provide more management options.

Rock with rounded edges, such as creek gravel, shall be used. Rock must be thoroughly washed to remove fines which may cause plugging. Rock substrate size should be one inch (1") diameter, while rock to be used around inlet and outlet pipes may be two to four inches (2-4") diameter to reduce potential clogging. A three to four inch (3-4") layer of washed pea gravel may be used on top of the one inch (1") substrate for decorative purposes.

All piping shall be SDR35 sewer pipe, Schedule 40 polyvinyl chloride (PVC) DWV pipe, or material of equivalent or stronger construction. Piping shall be a four inch (4") diameter.

If effluent from the septic tank flows to the wetland by gravity and there are parallel cells in the wetland, a distribution box shall be placed ahead of the wetland so that flow can be controlled to individual cells. If effluent is pumped, the pumping rate shall not exceed twenty-five gallons per minute (25 gpm) and no more than one-third (1/3)

of the daily flow shall be pumped at one (1) time.

Water level in a wetland shall be controllable. The range of control shall be from two inches (2") above the surface of the rock to complete draining of the wetland.

Maximum water level in the wetland shall be a minimum of twelve inches (12") below the outlet of the septic tank so that water does not back up into the septic tank.

To conveniently check the water level relative to the gravel surface, a four inch (4") diameter perforated pipe may be placed in the bottom of the wetland, through the channel embankment, and then elbowed up to the elevation of the top of the channel

Water level control may be obtained by use of swivel standpipes or collapsible tubing.

Surface water shall be kept out of the wetland. This may be accomplished by diverting runoff away from the wetland or constructing an earthen berm around the wetland.

Berms shall be a minimum of six inches (6") above the surface of the porous media.

**Table 11 - Plant Growth Data after one growing season**

<b>Plant Species</b>	<b>Wet Weight</b>	<b>Dry Weight</b>	<b>Top Dry</b>	<b>Root Dry</b>	<b>Top/Root</b>	<b>Root Depth</b>
Softstem Bulrush ( <i>Scirpus validus</i> )	(lbs./sq. ft.) 9.74	(lbs./sq. ft.) 4.20	3.20	1.00	3.20	(inches) 7.0
Horsetail ( <i>Equisetum hyemale</i> )	1.90	0.55	0.20	0.35	0.57	11.0
Water Iris ( <i>Iris pseudacorus</i> )	3.28	0.66	0.31	0.35	0.90	8.0
Pickerel Rush ( <i>Pontederia cordata</i> )	6.24	1.30	0.50	0.80	0.63	15.0
Arrowhead ( <i>Sagittaria latifolia</i> )	2.25	0.35	0.17	0.18	0.94	10.0
Cattails ( <i>Typha latifolia</i> )	7.89	3.00	1.90	1.10	1.73	8.0
Soft Rush ( <i>Juncus effusus</i> )	3.00	1.05	0.65	0.40	1.62	18.0
Flowering Rush ( <i>Butomus umbellatus</i> )	0.30	0.07	0.01	0.06	0.18	12.0

**Table 12 - Characteristics of Emergent Aquatic Plants**

<b>Plant Species</b>	<b>Bloom Date</b>	<b>Type of Bloom</b>	<b>Bloom Color</b>	<b>Plant Height</b>	<b>Growth Pattern</b>	<b>Initial Spacing</b>
Softstem Bulrush ( <i>Scirpus validus</i> )	June–July	Oblong Spikelets	Gray	(inches) 40–60	Spreading	(feet) 3
Horsetail ( <i>Equisetum hyemale</i> )	July–Aug.	Oblong Spikelets	Brown	30–40	Spreading	3
Water Iris ( <i>Iris pseudacorus</i> )	May–Aug.	Flower	White-Lt. Blue	10–18	Bunches	2–3
Pickereel Rush ( <i>Pontederia cordata</i> )	July–Sept.	Flower	Purple	10–18	Bunches	2
Arrowhead ( <i>Sagittaria latifolia</i> )	June–July	Hanging Bulbs	Green-White	6–10	Spreading	2–3
Cattails ( <i>Typha latifolia</i> )	May–June	Oblong Spike	Brown	48–72	Spreading	3
Soft Rush ( <i>Juncus effusus</i> )	June–July	Flower	Brown	18–30	Bunches	2

### **Sand Filters**

Conventional pressure dosed sand filters use an intermittent filter with two (2') or more of medium sand designed to filter and biologically treat sewage tank effluent from a pressure distribution system at an application rate not to exceed one and twenty-five hundredths gallon per square foot (1.25 gals./sq.ft) sand surface area per day, applied at a dose not to exceed one-half gallon (2 gal.) per orifice per dose. These sand filters may be buried or open.

Recirculating pressure dosed sand filters use a recirculating filter with two feet (2') or more of medium filter media designed to filter and biologically treat sewage tank effluent from a pressure distribution system at an application rate not to exceed five gallons per square foot (5 gals./sq.ft) filter surface per day, applied at a dose not to exceed two gallons (2 gals.) per orifice per dose. These sand filters shall be uncovered and open to the surface.

Operation controls should be on a timer dose that distributes the average daily flow over an eighteen (18)-hour period. Recirculating filters will be set to recirculate five (5) times the average daily flow over a twenty-four (24)-hour period. Systems should be designed with a high water alarm and light signal. Control panels should be located on

an exterior location. Control operations should be located in an area available for maintenance.

Intermittent filter media shall be a mixture of sand or durable inert particles with one hundred percent (100%) passing the three-eighths inch (3/8") sieve; ninety to one hundred percent (90-100%) passing the No. 4 sieve; sixty-two to one hundred percent (62-100%) passing the No. 10 sieve; twenty-five to fifty-five percent (25-55%) passing the No. 30 sieve; ten percent (10%) or less passing the No. 60 sieve, four percent (4%) or less passing the No. 100 sieve; or sand meeting the ASTM-C 33 concrete sand specification minus four percent (4%) or less passing the No. 100 sieve. All drainage rock should be a river washed hardened and weathered rock. The treatment media will be two inches (2") deep and of a coarse media with an effective size of one and one-half to three millimeters (1 2-3 mm) and a uniformity coefficient of less than two (2). Limestone or dolomite is not acceptable for drainage rock;

Recirculating filter media shall be a mixture of sand or durable inert particles with one hundred percent (100) passing the three-eighths inch (3/8") sieve; seventy-nine to one hundred percent (70-100%) passing the No. 4 sieve; eight to ninety-two percent (8-92%) passing the No. 8 sieve; zero to fifteen percent (0-15%) passing the No. 30 sieve; zero to one percent (0-1%) passing the No. 50 sieve. All drainage rock should be a river washed, hardened and weathered rock. The treatment media will be two inches (2:) deep and of a coarse media with an effective size of one and one-half to three millimeters (1 2-3 mm) and a uniformity coefficient of less than two (2). Limestone or dolomite is not acceptable for drainage rock; and

A minimum of twenty-four inches (24") of approved filter media shall be installed over the underdrain media. The media shall be damp at the time of installation to insure compaction of the media. The top surface of the media shall be level.

Distribution laterals shall be evenly spaced on minimum, thirty inch (30") centers. Orifices shall be places such that there is one (1) orifice or more on average per six square feet (6 sq.ft.) of sand surface. Orifice holes shall be one-eighth inch (1/8") in diameter. The diameter of the piping manifold and lateral shall be no less than one-half inch (2"). The ends of the distribution laterals should be constructed with a means to perform flushing of the piping, collectively or individually, through the operation of a flushing valve. The flushed effluent may be discharged to the sand filter.

The top of the intermittent media in which the pressure distribution system is installed shall be covered with a breathable nylon or polypropylene spun filter fabric rated at eighty-five hundredths ounce per square yard (0.85 oz./sq.yd) to eliminate soil intrusion into the filter media. Recirculating filters shall be opened-topped.

The top of the intermittent sand filter area shall be backfilled with a soil cover, free of rocks, vegetation, wood waste, etc. The soil cover shall have a textural class of loamy sand. The soil cover shall have a minimum depth of six inches (6") and a maximum depth of twelve inches (12"). Intermittent sand filters designs may delete soil cover and incorporate three to six inches (3-6") of a quality cypress or cedar mulch over the entire filter area;

Other sand filters which vary in design from those described in this rule may be authorized by the administrative authority if they can be demonstrated to produce a comparable effluent quality.

If effluent can not meet the minimum separation distances, then the effluent must be disposed of into a soil absorption system. The required footage of the soil absorption system may be reduced by up to one-third (1/3) of that required for a conventional soil absorption system. Shallow bury designs should be utilized whenever possible to achieve the best absorption rates.

### **Other Systems**

Where unusual conditions exist, special systems of treatment and disposal, other than those specifically mentioned in this rule, may be employed. These systems may include at-grade systems or mound systems. These special systems may be used provided:

- < reasonable assurance of performance of the system is presented to the administrative authority;
- < the engineering design of the system is first approved by the administrative authority;
- < adequate substantiating data indicate that the effluent will not contaminate any drinking water supply, groundwater used for drinking water or any surface water;
- < treatment and disposal of the wastes will not deteriorate the public health and general welfare;
- < discharge of effluent, if any, shall be within set-back distances as described in Table 1.
- < these systems comply with local codes and ordinances, and all applicable requirements of sections 701.025-701.055 and Chapter 644, RSMo.

## **Pumps**

Two types of pumps are usually used in the forced distribution of sewage into an alternative system: effluent and turbine pumps. Effluent pumps can handle very small amounts of solids and give a high volume at a low head. They are good pumps to pump to gravity distribution. Turbine pumps are made to start and stop many times per day as is required for the artificial media and other secondary treatment methods. They emit low volumes at a high head and must receive filtered effluent. This pump is made of stainless steel.

Pumps are sized based on the desired operating pressure, the estimated friction losses and the elevation differences. These will vary from site and to site and application. The certified engineer will calculate these losses and determine the total dynamic head. Pump manufacturers supply pump curves for the various pumps that they make. The engineer will calculate a system curve for the system, and ensure that it is at least slightly above the pump curve for the chosen pump.

## **Pump Vaults**

Pump vaults may be used in a standard, properly sized septic tank to pump out of. The vault should be made of proper strength and corrosion resistant materials. The vault filter will need to be cleaned. The vault should be able to be easily removed from the tank for cleaning and repair. The pump can be starved and burned out if the filters are not cleaned regularly.

## **Float Switches**

Float switches work in pump tanks to let the pump know when to kick on. The switches work by opening and closing a wire circuit. In one position, the switch is off, the circuit is not complete. In the other position, the switch is on and current can flow through the circuit to the control panel or pump. The activation can be by means of mercury or mechanical means.

Switches are manufactured as *anormally open* (N/O) or *anormally closed* (N/C). The switch is in the normal position when it is hanging down from the horizontal. Most onsite systems use a N/O type of switch which would be open (or off) when hanging down, and activate (or close the circuit) when the level of the liquid rises enough to raise the float above the horizontal. This would be the same type of switch that is used for the high water alarm. The low water alarm is normally a N/C switch, as it does not close the circuit unless it goes down, telling the homeowner that the tank is leaking by setting off an alarm and/or shutting off the pump.

Switches will be rated as signal or motor. This will designate if the switch is used to

directly start the pump or activate the control panel to start the pump. If the switch is used to directly start the pump, it must be able to handle the same amount of current that will pass through the pump. It will be motor rated. A switch that is signal rated will signal the control panel to activate with a much smaller current flowing through them. This makes them last longer than the motor rated switches.

Float switches should be assembled on a float tree, which is a piece of PVC pipe to which the floats can be tethered to. They should not be attached to the discharge pipe as it can vibrate and dislocate the floats. The float tree can be easily removed for inspection or float replacement. The drawdown amount will be determined by the amount of time that the pump operates. This will be controlled by the length of the tether on the on/off float. The float manufacturers have charts that give the tether lengths and drawdown inches.

### **Splice Boxes**

An electrical splice box is used to house spliced wire connections in the riser between equipment such as pumps, float switches and the control panel. The splice box enables all electrical equipment to be easily removed. The splice box, cord grips and other components must be non-corrosive and rated as water resistant. All splices must be waterproof. If these components are allowed to take on water, it can cause the alarm to go off and the pumps to fail.

Adequate size wire must be used to ensure no voltage drop which will degrade pump performance. The longer distance that is traveled to the power supply, the higher the gauge of wire that must be used.

### **Control Panels**

Control panels act as the brains of many complicated systems. Components of a standard control panel consist of a programmable timer, motor starter contactor, toggle switch, current limiting circuit breakers, fuse disconnect, audio alarm, visual alarm, redundant off/low level alarm relay, terminal blocks, panel enclosure, and latch.