K-STATE Kansas State University

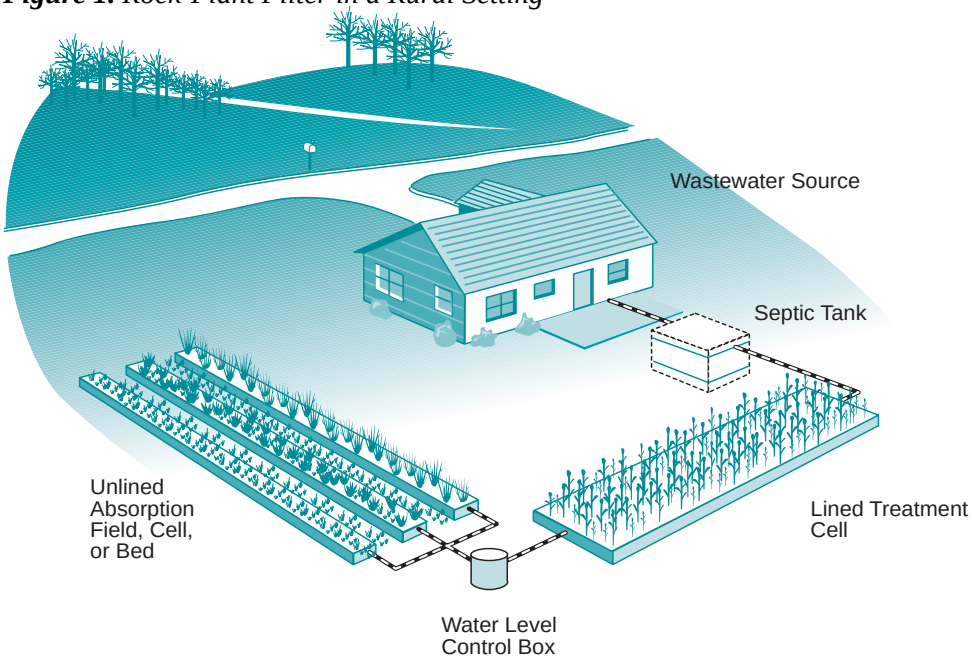
WATER QUALITY SERIES

Rock-Plant Filter Operation, Maintenance, and Repair

A rock-plant filter, also known as a constructed wetland, is a shallow bed (cell) of small rock or gravel with wetland plants. It is just one part of a system that may be used to treat wastewater from individual homes. Wastewater from bathrooms, kitchen, and laundry flows to a septic tank, then through the rock-plant filter for additional treatment before finally being absorbed into the soil (Figure 1). Plants in the treatment and absorption cells are important to wastewater treatment and operation of the system.

There has not been much experience with this treatment method in Kansas, and few details are available from other areas. The following are the best suggestions about care for a rock-plant filter available at this time. The homeowner, occupant, or other service provider must care for the system to assure good operation and long life just as for any onsite sewage system. However, the successful functioning of a rock-plant filter will probably require more care and effort from the person operating it than any of the other alternative systems. Information on designing and building a rock-plant filter is presented in a companion bulletin, *Rock-Plant Filter Design and Construction*, MF-2340.

Figure 1. *Rock-Plant Filter in a Rural Setting*



Operation of Rock-Plant Filter Systems

Using a rock-plant filter requires the homeowner to routinely check several items to ensure everything is working as planned, designed, and constructed. The checks include inspection to determine:

(1) water entering the filter is relatively clear,
(2) water in the cells is at the correct level,
(3) the wetland plants are healthy, and
(4) no signs of malfunction exist.

Check for clear inflow. Effluent leaving the septic tank and entering the lined treatment cell should be clear or nearly clear (no suspended solids). Septic tank effluent, although clear, is still sewage because it contains a high organic load and much bacteria.

Figure 2. *Water Level Control Box*

Remove the inspection cap at the inlet distribution pipe to check for solids. Make sure the water is nearly clear with no or very few suspended solids. If solids are observed, check the septic tank and effluent filter for malfunction or problems and take corrective action. These solids can easily overload the treatment cell and cause failure. Note that some black solids attached to the inside of the pipe are common and may be knocked loose as the inspection cap is removed.

Check water level in lined treatment cell. The water level in the lined treatment cell should be about 2 to 3 inches below the rock surface throughout the bed. Rock can be moved around on the cell or added to even or raise the surface in a low spot. The standpipe that controls water level should be adjusted to the desired position.

If water level is below the lip of the overflow in the morning before wastewater leaves the house under normal use, look for possible leaks in the septic tank, piping or filter lining, or other contributing cause, and correct the problem. Figure 2 shows a water level adjustment standpipe in a control box.

When water is used for washing or toilet flushing, flow from the septic tank should begin within a few minutes. Unless the treatment cell is an unusually long distance from the house, overflow at the control structure should begin within 30 minutes. If outflow does not occur, there may be blockage or leaking between the house and the overflow structure that must be repaired.

Add water as needed. Wetland plants must have water, especially in locations where there is little or no organic matter and no soil, as in the lined treatment cell. During periods of high evapotranspiration, low rainfall, and low wastewater flow, it may be necessary to add water to maintain an adequate level for plant survival. This can be done by slightly opening an indoor faucet or watering the wetland directly with a garden hose. Check water level at least weekly during hot and windy weather and add water as needed.

The operator should make provisions for adequate flow to the lined cell during low and nonuse periods, such as vacations, especially during warm or hot weather. Arrange for someone to check water level in the rock-plant filter at least every other day and add water as needed. High evapotranspiration periods can easily drop the water level in the rock or sand media by 1 to 1½ inches each day. Only 10 days of hot weather may be enough to empty the entire wetland of water when no water is being used. Plants will start to die back before the cell is empty. Frequently allowing water levels to drop too low will stress the plants and reduce the treatment effectiveness of the rock-plant filter. The unlined absorption cell can handle dry weather better because some roots will extend into soil that has water-holding capacity.

Check water in absorption field. Water in the unlined absorption cell or field should be at least 2 to 3 inches below the surface of sand or rock. The sand surface should be about level so water will not stand above the surface at any spot in the cell. If a water level control structure is used for the unlined cell, use it to adjust the water level as needed.

Because flow through the absorption field is much slower than the rock cell, it may easily take more than an hour to reach the outlet of the field. Because the field functions for absorption and treatment, it should seldom be full of water, especially in the summer when evapotranspiration is high. An exception is following a heavy rain.

Observe wetland plant condition. Wetland plants in both cells should appear healthy with no discolorations or evidence of disease, insect damage, or nutrient deficiency. First, evaluate water flow and look for leaks; next, diagnose the plant problem. County K-State Research and Extension office personnel or a nursery should be able to help.

Household wastewater should provide adequate nutrients and good conditions to grow healthy wetland plants. Although leaf and stem growth provides no direct benefit for wastewater treatment, it is essential to provide energy for root systems necessary for the filter performance. Insect or disease damage should be investigated and may require corrective action. Plants in rock-plant filters will mature and die back as if they were in natural conditions, so late-season browning may be normal.

Select plants suitable for the site. Finding the right combination of plants that will work well in a particular rock-plant filter may take experimentation. A list of plant candidates is included in *Rock-Plant Filter Design and Construction.* Some plants can tolerate more variation in water level than others. Some are more tolerant of shade. Figures 3 and 4 show the variety of plants that can be used in rock-plant filters.

If some of the plants are not thriving, consider other species. Invasive species may crowd out other plants in time. If more desirable plants are taken over by invaders, substitute less invasive plants. If, however, the plants are not growing well and other problems have been ruled out, using the invasive species may produce more vigorous plants.

Avoid surfacing and overflows from cells. Water that passes through the rock-plant filter cells still contains contaminants that are harmful to humans, pets, or wildlife. Wastewater should not pond on the soil or cell surfaces. If a rainfall event overfills the wetland, be sure to check that (1) the overflow level is set properly, (2) the system is not clogged somewhere, and (3) the sides of the cell are at least 6 inches higher than the surrounding area to keep runoff out. A heavy rain can easily overload the system, which will take a few days to recover.

If problems are apparent, a contractor should be called to help troubleshoot and take steps to avoid recurrence. In some soil conditions, an overflow basin (assuming space permits) may be needed to receive and store excess flows so runoff from the site does not occur. If the system includes an overflow basin, methods to keep people and animals away from the area during overflow periods should be prepared. Permanent or temporary fencing are options and vegetation surrounding the cell may be helpful.

Figure 3. *Lined Treatment Cell with Sweet Flag and Iris*

Figure 4. *Lined Treatment Cell with Ornamental Plants*

Maintenance and Repair of Rock-Plant Filters

Quality materials and care during construction help minimize the need for repairs. Regular maintenance also helps ensure fewer repairs are needed.

Most wetland maintenance tasks can be done by the homeowner with normal lawn and garden tools. Tasks are usually seasonal and relate to controlling the vegetation outside the wetland cells, cutting back top growth, and removing undesirable plants.

Septic tank and effluent filter. Because a properly functioning septic tank and filter are essential for a wetland, the tank must be pumped to remove accumulated solids. Pumping assures adequate detention time of liquids in the septic tank, good solids separation, and clear water entering the wetland. Pumping the tank when needed and annually cleaning the effluent filter will minimize the risk of backup into the house and helps assure good system performance. See *Septic Tank Maintenance*, MF-947, for more information.

Maintain direct sun on cells. The rock-plant filter cells should receive full direct sunlight. Trees on the east, south, and west sides of the cell should be far enough away that wetland vegetation will receive direct sunlight at least half of the day. Remove or trim existing trees to ensure adequate light. Invading roots from nearby trees may lead to liner leaks. Remove trees within 30 feet to help protect the cell lining. Keep grass outside the cells shorter than 6 inches. Do not remove more than half of the top growth with each mowing to maintain healthy grass.

Trim cell plants. After the first frost that kills top growth, cut wetland plants back to about 1½ feet tall. Standing residue collects snow and keeps it from melting. Plant residue and snow cover insulate the cells to keep water warmer during winter.

Remove plant residue in spring. At the end of winter, before spring growth, remove all top growth of wetland plants. Remove as much of the residue as is easily accessible. During the growing season, remove trees and any other unwanted plants from the wetland cells. Carefully remove the complete root systems so they do not regrow.

Ensure healthy plants. Healthy roots are needed to help transmit oxygen into the root environment. Bacteria essential to treat wastewater in a rock-plant filter must have oxygen to do their job. Healthy wetland-plant roots help supply oxygen and are essential to a properly functioning rock-plant filter. Healthy roots depend on healthy plants so the cause for problems must be discovered and corrected. Some wetland-plant species may be better suited to local conditions than others, so if problems persist, alternative plants may help. Local K-State Research and Extension personnel may be able to help. Remember plants yielding produce or other food should never be used in wetlands.

Control surface drainage. Check drainage around the cells to make certain surfaces slope away so no runoff enters the cells. The sides of the cell should be 6 inches or more above the surrounding surface level. The ground surface should drop 6 inches in 6 to 10 feet when moving away from the cell in all directions. This slope, together with good surface drainage, keeps surface water from flowing into the cells. Small drainage problems can usually be fixed with garden tools, but larger problems may require a contractor.

Control wildlife damage. Rodents, such as muskrats, like wetland plants and may dig into the sides of rock-plant filter cells. Leaky cells cannot do their job, so repairs should be made as soon as damage is noticed. Steps should be taken to prevent further damage by relocating or eliminating the animal or placing a restrictive barrier, such as a barbed-wire fence, around the site. Make repairs to any damaged components as required. Get help from a contractor, if needed, to repair damage to the lining or other components.

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