WATER Quality

K-STATE Research and Extension

Wastewater Pond Operation, Maintenance and Repair

Wastewater ponds, or lagoons, are used to treat and disperse wastewater from individual homes, churches, businesses and institutions. The desirability of a new lagoon depnds largely on its design and construction. However, the desirability of an established lagoon (more than three years old) depends more on the operation maintenance and repair it receives.

A desirable lagoon looks like it has received good care, which includes:

- a secure and tight fence and gate that keeps children and animals out,
- a 3-foot-deep water level,
- no plants floating on the water or tall plants at the water's edge or that droop into the water,
- a vigorous and dense perennial grass cover on the embankment (berm),
- no trees or woody plants that shade the lagoon or whose roots would get into the berm,
- grass is no taller than 8 inches on the inside berm surfaces,
- the berm top around the lagoon is level and is at least 4 feet wide, and
- the berm slopes have no eroded or damaged spots.

The owner or user is responsible for operation, maintenance and repair of the lagoon. This publication gives an overview and provides guidance for these tasks.

Figure 1 shows a lagoon with features that indicate a good condition and Figure 2 depicts a neglected lagoon that will not give desirable results. This publication gives an overview and provides guidance for operation, maintenance, and repair.

Operation Assessment

All lagoons should be desirable wastewater treatment systems. The assessment involves evaluating the lagoon condition to maintain a standard of good care. This includes oversight, identifying maintenance and repair needs, and management decisions regarding the lagoon. The assessment needs to be done regularly, usually monthly, but does not necessarily require a lot of time. The required tasks are discussed here and the actions are covered in later sections.

Check vegetation in and near water. Watch for new plants, such as cattails, at the water's edge and for floating plants, like duckweed, that need to be controlled. Note tall plants that could droop onto the

Table 1. Color an Indicator of Lagoon Condition

COLOR	CONDITIONS	CAUSE OR SYMPTOM
Dark sparkling green	Good; best condition	Dissolved oxygen (DO) and pH high.
Dull green to yellow	Not so good	DO and pH are less than optimum. Blue-green algae may be becoming predominant.
Gray to black	Very bad	Anaerobic or septic conditions prevail; odors likely. Too much sludge is possible.
Tan to brown	Bad in Kansas where this algae is not found	Usually means erosion or inflow of surface water. Okay if brown algae.

Source: EPA, Operations Manual: Stabilization Ponds, MO-15, 430/9-77-012, August 1997

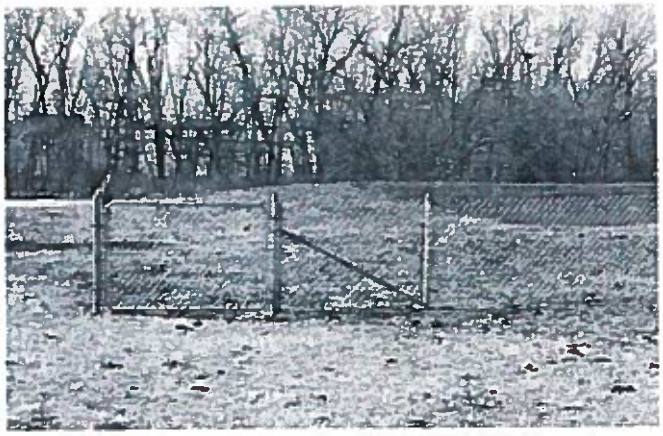

Figure 1. A lagoon with a good fence and gate outside the toe of the embankment.

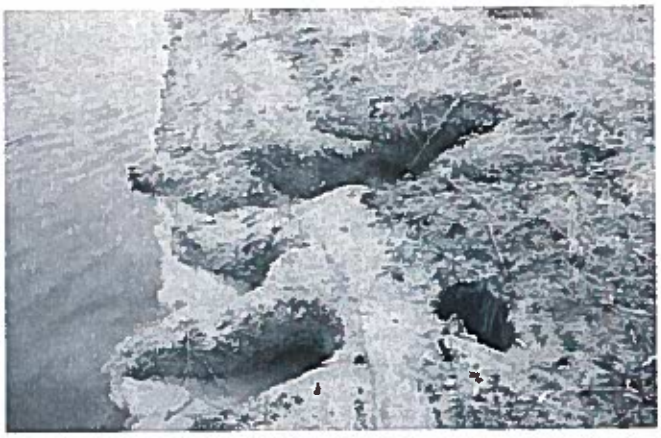

Figure 2. This neglected lagoon shows animal damage and poor grass care.

water and the health of perennial grass on the lagoon embankment (berm). Is more frequent mowing needed to keep the grass no taller than 6 or 8 inches on the inside slope?

Observe and record water color. The lagoon water's color indicates its condition. Green is the goal as it indicates balanced pH and a good oxygen level. Table 1 shows the color, the interpretation, and what causes the color. A decline to a less-desirable color has a cause and may require a correction. Observe and chart a record of the water's color, date and water depth.

Measure and record water level. Recording lagoon water level is a good operation practice. Depth can be obtained from a post with depth marks, installed in the center of an empty lagoon, or by measuring from a permanent reference on the berm. Keep a record of water levels and dates for at least five years and use this to identify problems and make operating decisions.

Look for indicators and needed repair. Evidence of possible problems include: odor, high or low water levels, profuse algae bloom, and rooted plants in the water. These indicators may result from too much sludge or other causes. The operator must also look for erosion, damage to fence, and other problems that require immediate repair.

Maintenance

Maintenance includes tasks done on a routine schedule: monthly, seasonally, or annually.

Caution: Take precautions to minimize exposure to wastewater by wearing protective clothing and waterproof gloves. After working with wastewater, thoroughly wash hands or shower and disinfect any breaks in the skin.

Control rooted plants in water. Rooted plants in the water promote mosquito breeding, encourage aquatic animals, and add to sludge. The desired 3-feet minimum water depth helps control rooted plants. Plants at the waters edge can be controlled either by physical removal or herbicide treatment. Pull or dig them when plants first appear and before the root system is established.

When plants are well established, control is quite difficult and may not be successful. Dead plants are organic debris that may cause odor, and add to the sludge. To control, use herbicides that protect algae and are labeled for the target plants. Apply it directly using an applicator. Use broadcast spraying sparingly because it requires more chemical and may get into the water.

Control vegetation on berm. To keep the grass on the inside slope no taller than 6 to 8 inches, mow often enough that no more than half of the growth is removed each time. Mow cool-season grasses such as fescue every week or two in cool months and monthly when it is hot. Discharge clippings away from the water or collect and remove them.

Mow the top and outside of the berm to stimulate a dense, healthy grass cover. Cut cool-season grasses in early May and mid-June. Cut warm-season (native) species in early July and mid-August. Burn areas as needed to control woody plants, residue, and unwanted species. The ideal time to burn is in the spring when new growth is just beginning. Try every three to five years for warm-season grasses and every five to seven years for cool-season

grasses. Always follow fire safety precautions and check with local authority before burning.

Control floating plants. Remember, green color is good. Bacteria are essential for good treatment in lagoons and they require oxygen. This is best supplied by dispersed, single-cell algae, which are green. Sunlight must penetrate the water and reach the algae to produce the oxygen. Floating plants like water lilies, duck weed, or filamentous algae (moss) intercept the light. This causes the oxygen level to drop and when that happens the lagoon color will not be as green. As discussed for rooted plants, control floating plants when they first appear either by removal or with herbicides.

Adjust supplemental water. Because of low inflow or seepage losses many lagoons need supplemental water to maintain the 3-foot depth needed to control rooted plants. Supplemental water may be added from downspouts or hose, but it must be easily controllable. A 2-foot vertical distance, or freeboard, above the water level to the top of the berm is essential to prevent overflow from an extreme rainfall. When the depth approaches the freeboard reserve, shut off or divert supplemental water.

Check and adjust fence and gate. Check the fence and gate at least twice a year to be sure it is in good condition. The gap between the gate and post or space at the bottom of the fence to the ground should not be wider than 2 inches. Holes in the fencing should not be larger than two by four inches. Check for loose or damaged posts, loose anchors to posts, sags in wire or gate, and any damage. Add or remove treated boards on the posts or gate for adjustment to keep the gap no more than 2 inches and to allow the gate to move freely. The fence must keep animals, especially pets, and children away from the lagoon.

Remove trees and woody plants. Remove trees within 50 feet and shrubs within 20 feet of the berm to reduce shading and the risk of roots in the berm and lagoon. This also helps keep leaves out of the lagoon and avoids their addition to sludge. Remove or trim trees that shade the lagoon on the east, south, and west sides. Sunlight must reach the surface year around and air must freely move across it. Oxygen enters the water through exchange at the water surface and photosynthesis by algae.

Check sludge. For best lagoon performance, maintain at least 18 inches of water above the sludge. Measure the depth to sludge in the same area, preferably near the center after 10 years and again every three to five years. Measuring the depth to sludge is not easy. It is not safe to walk into a lagoon with waders, so do not try that. A good option is to use a small pump with an intake suspended from a float at an adjustable depth. Move the intake deeper until solids are first noticed; the depth of the intake below the surface is the depth to sludge. Keep a record of depths to sludge and the years it was measured.

Repairs

Repairs are unscheduled work needed to prevent further malfunction, damage, or possible failure of the lagoon.

Repair fence and gate. The fence should be tight and securely attached to sturdy posts. A good fence has a barbed wire not more than an inch from the ground. When large animals are near, two tight barbed wire strands should top the fence to discourage them from reaching over it. Holes in the fence or gate larger than two by four inches must be repaired so animals and children cannot get through. The gap between the gate and posts should be no more than 2 inches. Attach a board to the post to fill a wider gap. Be sure the gate is securely hung and opens and closes easily. Keep it locked to prevent unauthorized entry.

Repair leakage. There should never be evidence of leakage around a lagoon. Leakage must be corrected by repairing the berm and sealing the inside surface to meet the KDHE guideline of less than a ¼ inch per day loss. Leakage is best controlled by thorough compaction of thin layers of wet soil during the construction process, creating a compacted lining at least 18 inches thick. If a leak can be found in an existing lagoon, adding bentonite clay or soil amendments may fix it. Prevent surface inflow to the lagoon with good drainage and keeping the top of the berm at least a foot above the adjacent surface or highest flood level.

Fill eroded places and reseed. The berm must be maintained at the original elevation and surface shape. Any time there is erosion or damage to the berm, the affected area must be filled, compacted, smoothed, and reseeded to the desired perennial grass. Mulching helps control erosion until vegetation is established. Watering can help establish the grass without repeated seeding.

Emergency dewatering. Under normal conditions, the lagoon water depth should be at least 2 feet below the top of the berm. Occasionally short-term conditions, such as a long wet spell or extra water use, may result in high water. If the freeboard reserve is less than 2 feet, excess water (with no solids) should be pumped to a vegetated area through a sprinkler so runoff does not occur. This dewatering must be approved by the local health department. People and animals must be kept out of the application area for at least 30 days. Wait at least 30 days to harvest hay or graze animals in the area. If dewatering is required more than once in several years, find the cause and if necessary enlarge, reconstruct, or add a second cell. Overflow or discharge lines are absolutely forbidden by KDHE for small lagoons.

Remove sludge. Sludge accumulates in lagoons and in time it must be removed or a new lagoon built. Experts do not agree about the best time or method to remove sludge. If livestock waste-handling equipment is available, a few loads of sludge could be pumped from the bottom every few years. A septage hauler can do the same but this will be more expensive. Removal would slow sludge accumulation and delay cleaning or rebuilding the lagoon. Regulations for sludge disposal are found in the EPA's 40 CFR Part 503, which covers allowed techniques and required record keeping. Check requirements of the county permitting agency.

When sludge accumulation fills a lagoon, removal is expensive. If it must be hauled away from the area, the cost could be thousands of dollars. If suitable space is available, it will be much cheaper to build a new lagoon and fill the old one rather than remove and haul the sludge away. When closing a lagoon, pump the liquid from the surface to reduce drying time, following the local code and guidelines above. If the dry sludge is more than 18 inches thick it should be removed and disposed following local code and CFR 503 regulations and then the lagoon filled.

Other Sources of Information

Lagoon design and construction details are in K-State Research and Extension publication *Wastewater Pond Design and Construction*, MF-1044, and *Minimum Standards for Design and Construction of Onsite Wastewater Systems*, MF-2214 (KDHE Bulletin 4-2). Guidelines for selection of herbicides are available in *Aquatic Plants and Their Control*, C-667. Other publications that address fences, grass management, and onsite wastewater options are available from the local extension office, health office, or K-State Research and Extension website, *www.ksre.ksu.edu/library/*.

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