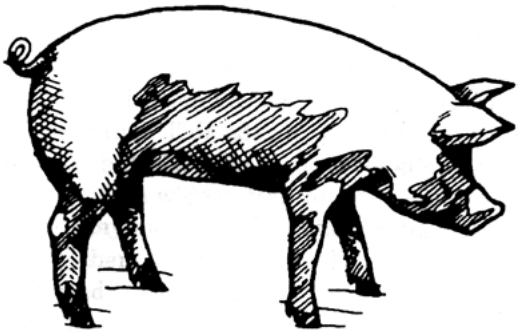

# Flat Bottom Gravity Drain Gutters for Swine Manure

Three ways to avoid long-term storage of manure in swine buildings are (1) mechanical scrapers, (2) flushing with fresh or lagoon waters, and (3) gravity drain (also known as pull-plug) gutters. These methods remove manure to outside storage. This publication deals with gravity drain gutters, specifically flat bottom gutters.

Gravity drain gutters used in the past have been deep narrow gutters, Y gutters, V gutters, and rectangular gutters. Most have a drain at one end with a slight slope toward that end (1 inch in 40 feet).

## Rectangular Gutters

One newer variation of the rectangular gutter uses a drain plug at each end of the gutter. The concept addresses the problem of many gravity drain gutters: removing the solids that remain and build up in the gutter at the opposite end from the drain plug. A rectangular gutter also is easier to construct than some of the previously used shapes, such as a round bottom, Y, or V bottom. One version, called the hairpin gutter because of its shape, has been used in Canada since 1984.

## Gutter Options

The simplest flat bottom gutter to construct would be similar to figure 1. There is no slope from side to side or from end to end. A plug on one end is pulled to drain the gutter. The next time the gutter is drained, the plug on the opposite end is pulled and this alternating process is continued.

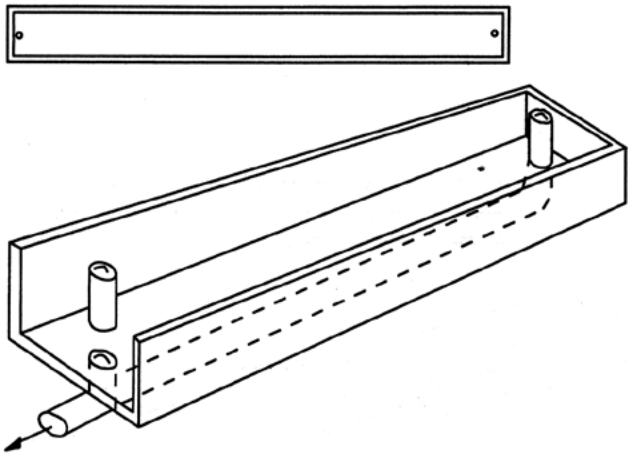

**Figure 1. Rectangular gutter with a drain on each end.**

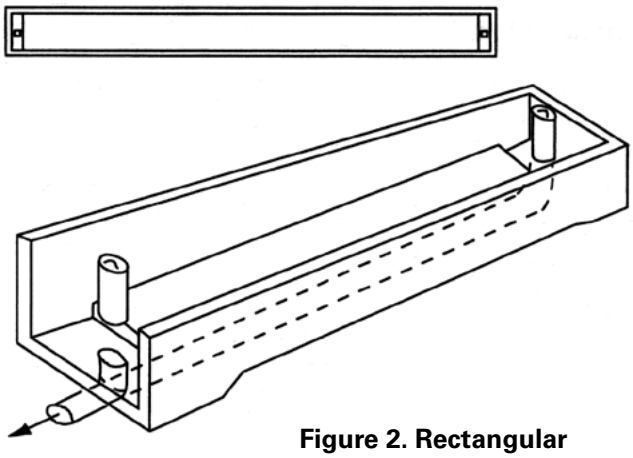

**Figure 2. Rectangular gutter with a step down.**

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An adaptation that removes more manure each time the plug is pulled is shown in figure 2 with a 3- to 5-inch step-down at each end forming a shallow sump. This adds more to the construction cost, but also aids in more complete gutter cleanout. In a wide gutter (one over 4 feet), the liquids may move around solids instead of moving them along. The problem is greatest when feed is spilled through the slats, which is another reason to watch the adjustment on your feeders. A divider can split the gutter into two narrower runs (figure 3) to improve the cleaning action.

The divider should be higher than you expect the manure to reach before you pull the plug. Plan for a divider that is 8 to 12 inches high. The divider should be made of a durable material such as concrete or a rigid plastic sheet.

The hairpin gutter is shown in figure 4. A center divider extends from the drain end to within 2 to 4 feet from the other end. The optimum spacing for this has not been determined, but experience indicates it should be less than the gutter width. In a gutter with two 4-foot wide halves, a 11/2-foot spacing may be sufficient. Each of the drain ends has a drain plug. When one plug is pulled, the manure flows toward the drain from that half and around the center divider from the other half. Some solids will remain on the floor of the gutter at the opposite end from the drain plug that is pulled. The next time the plug in the other half is pulled, the manure flows around the hairpin shape in the other direction. This method prevents a continuous build-up of solids at one end because half of the gutter is partly cleaned at every other draining.

With the hairpin gutter, the drain pipes leading from gutters to storage can be shorter than those used with gutter systems, such as those used in figures 1, 2, and 3, because the drains are located closer together. The gutter does not drain quite as well as these in figures 1-3 because of the slowdown at the turn and the extra length the manure must travel.

## When to pull the plug

The longer you wait to pull the plug, the greater the chance for increased anaerobic odors. But the gutter drains better when you allow the depth to increase to at least 6 inches. A 2- to 3-week interval appears to work well as a compromise. With partial slats, the gutter may be drained every 7 to 14 days.

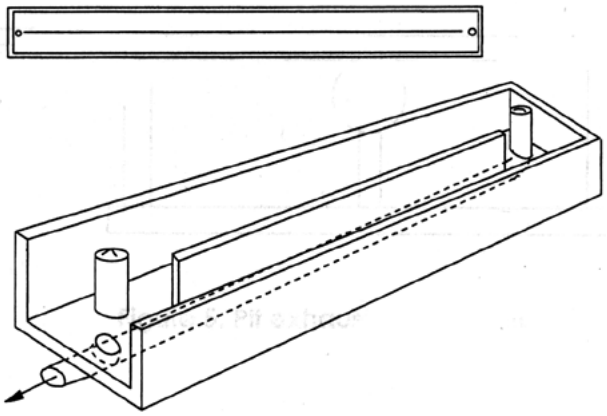

**Figure 3. Rectangular gutter with a center divider.**

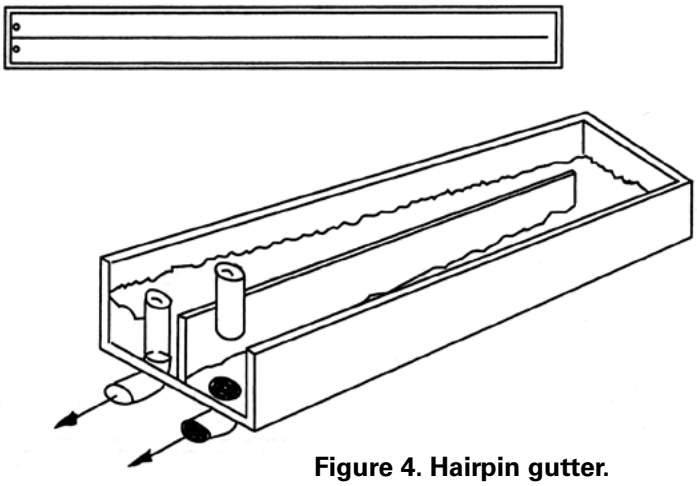

**Figure 4. Hairpin gutter.**

For a growing-finishing floor, make the gutter 24 to 36 inches deep and up to 100 feet long. In farrowing and nursery units, the gutter can be 18- to 24-inches deep and up to 50-60 feet long. Deeper gutters have been used, but may not be necessary.

Some producers have installed a pit exhaust tube to control odors. Locate this tube on the center divider as shown in figure 5. Use the minimum winter ventilation rate for the pit tube fan. See PM861, *Rigid Plastic Tubes for Pit Ventilatio*n, for details of tube design.

Figure 6 shows a sample design for a raised deck nursery pen. If decks are raised sufficiently above the floor, a pressure cleaning wand can be used to loosen and remove solids more thoroughly from the gutter floor whenever the entire room is cleaned.

Most manure in a farrowing stall is deposited at the rear of the stall. Because of this the design of the hairpin gutter can be changed to accommodate the difference.

Limited experience indicates that a gutter design similar to figure 7 works better than a gutter with a center divider. The plug on the side containing the 30-inch gutter should be pulled each time the gutter needs to be drained instead of alternating plugs. Pull the other plug after washing the room down to help remove the solids that remain on that part of the gutter floor. Raising the crates above the floor leaves space for using a pressure washer to thoroughly clean the floor periodically.

When a wet-dry feeder is used in a growing-finishing building, the manure that falls through the slats contains so little moisture that it does not flow well. Adding water after the gutter has been emptied will help reduce odors and also provide a more fluid manure. A water line controlled with an automatically timed shutoff device can be used to add the necessary amount of water. Add only enough water to make the manure flow well.

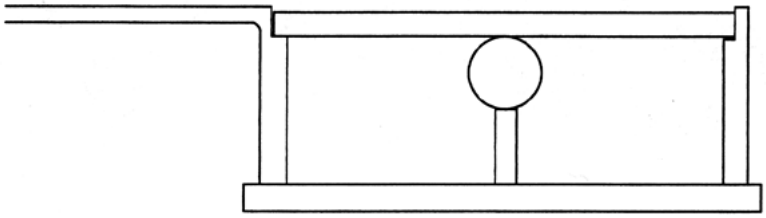

**Figure 5. Pit exhuast tube location.**

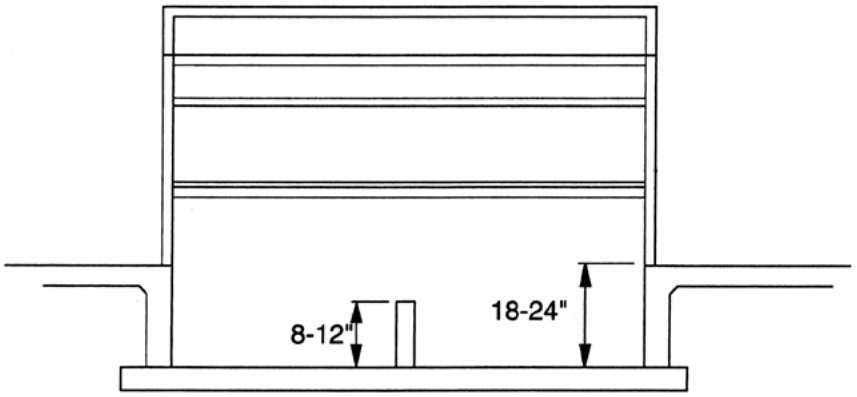


**Figure 6. Gutter under raised decks.**

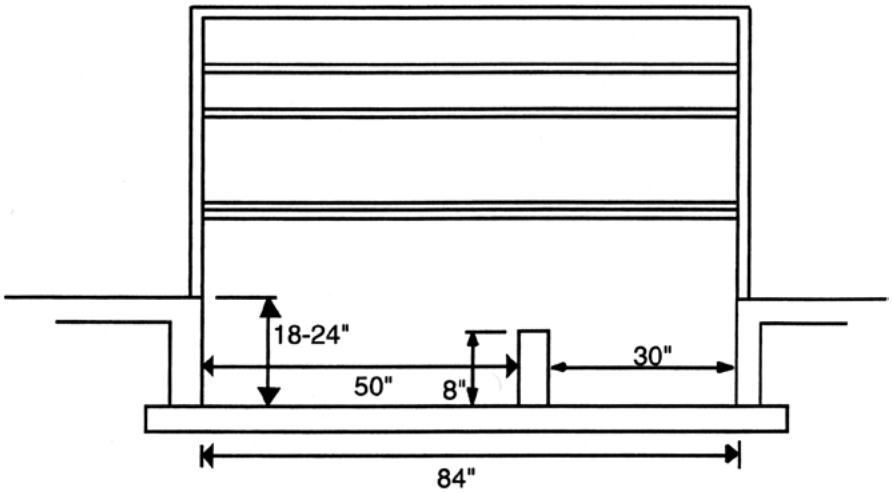


**Figure 7. Gutter under raised crates.**

## Plugs for the Gutter

The plug used must seal the outlet so no leakage occurs. If liquids seep away, the thicker remaining manure would not drain well. Also, in winter, a slowly leaking drain pipe may gradually freeze and in time plug the pipe.

Plugs must seal the drain pipe when in place so that no gases from the pit are pulled into the room. A PVC pipe such as the one in figure 8b must have the upper part of the pipe capped or sealed with a plastic plate.

## From Gutter to Storage

Use gravity flow from the gutter drain directly to the storage unit if at all possible. A sump and manure lift pump can be used if the manure is stored in an above-ground tank or if there is not enough fall to properly drain to in-ground storage.

Use a minimum size drain pipe of 8 inches to prevent plugging; 6-inch diameter might be adequate for short gutters (those less than 30 feet long). Use 10-inch pipe for any gutters longer than 80 feet or wider than 10 feet. Slope 6-inch diameter pipes at 1 percent; 8-inch and 10-inch at 1/2 percent.

If multiple rooms use a common drain pipe to storage, allow each gutter to drain before pulling another plug. A gutter will drain best if the manure can move out quickly to storage. Any slowdown results in less complete cleanout. Use a wye fitting when dropping to the common drain instead of a T fitting.

Expect some pit gas odor in the vicinity of the drain when the plug is pulled.

For information on manure storage and drain pipe system design, obtain MWPS-18, *Livestock Waste Facilities*, from your county Extension office.

Prepared by Vernon M. Meyer, former extension agricultural and biosystems engineer. Reviewed by Jay Harmon, agricultural and biosystems engineering department.

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**Figure 8. Examples of plugs that can be used.**

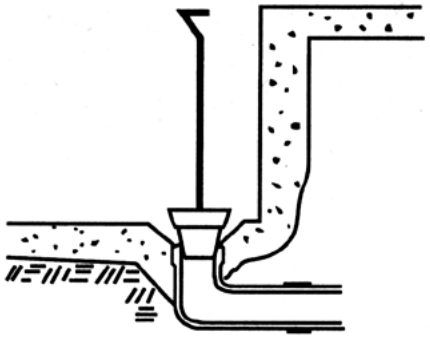

Figure 8a. Clay flower pot filled with concrete, rerod for handle.

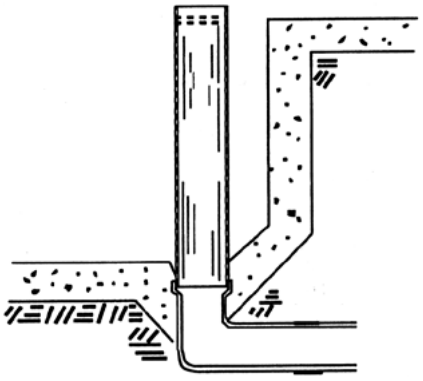

Figure 8b. PVC pipe for plug.

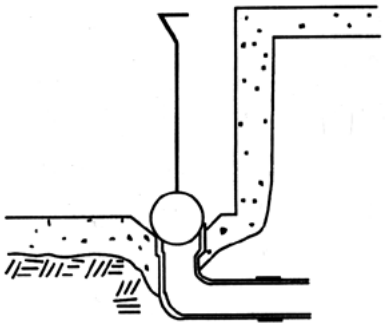

Figure 8c. Bowling ball for plug.

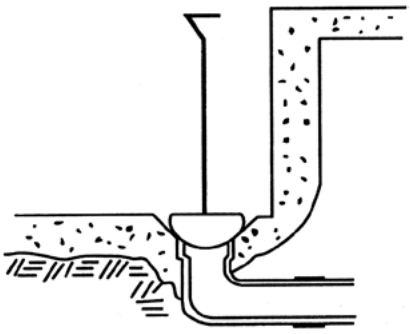

Figure 8d. Concrete plug form in steel mixing bowl.