

## Siting manure storages revisited

By Karl Czymmek, Peter Wright and Curt Gooch

To properly recycle nutrients, and to reduce the potential for nutrient and pathogen losses to the environment, dairy farmers will be planning, constructing, and using more manure storage systems. Nutrients, particularly nitrogen, should be applied as close to the plant's use as practical to reduce the potential for emission, runoff, and leaching losses. To meet environmental objectives, manure spreading during winter and wet weather conditions, which present a higher risk for runoff, are increasingly scrutinized and will likely be limited further. Dairy farmers should look for ways to store manure for longer periods (perhaps eight months or more) and in locations that allow quick and efficient spreading when the time is appropriate.

Although manure storages are a best management practice and contribute to a sustainable farm operation, community concerns are vitally important to consider in planning the system. Even at the farmstead, thought needs to go into keeping the storage out of sight, with a minimal odor impact, while protecting water resources. These concerns are even more important as satellite storages are placed away from the farmstead. Experience in New York State suggests that neighbors have more concerns with satellite manure storage structures. Either way, siting a storage to avoid potential neighbor reaction

### *Placing the manure storage where the community can't see it or smell it will keep good neighbor relations.*

may offer significant advantages to the farm. Of course, the storage must be functional, sized for the operation and expected growth, and able to be loaded and unloaded easily and safely. When building a manure storage structure, farms of all sizes, whether regulated or not, should use the USDA-NRCS manure storage standard.

Select a site that is compatible with the community. Check for local setbacks from property lines. Work with your Comprehensive Nutrient Management Plan (CNMP) planner and engineer or local conservation service staff to find the best location. Keeping the storage out of sight goes a long way to reduce community objections. Use a longer access road, locate it behind a viewscreen of trees or buildings, or have the berm or wall high enough to prevent the manure from being seen from the road or houses. Consider prevailing wind direction. Locate the storage to get the greatest downwind distance from occupied structures that is practical. Adjusting the dimensions of the surface

area to move the storage away from the homestead reduces the odor potential. The surface area of the storage can be minimized by making it deeper. Air drainage needs to be considered as well. During low wind conditions, heavier-than-air odorous gases can flow much like water, down from a storage to surround a low-lying area. This can be particularly unpleasant when it permeates residences.

Safety concerns include limiting access and protection from gases. When practical, eliminate or minimize confined spaces in manure storage systems during the design stage, especially those below grade. Use fences and warning signs to prevent people, equipment and animals from accidentally entering the storage or confined spaces. Protect against vandalism by limiting access to valves and pumps. Access road entrances should have enough sight distance to allow traffic to adjust to farm equipment

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## *Siting manure storages revisited, cont'd from front*

and hardened enough to prevent mud from tracking into the roadway. Work with local authorities to take steps to protect high traffic/frequent turn areas.

The site selection decision needs to consider how the storage will be loaded and unloaded. Pumps and pipe systems add versatility to where manure storages can be located. There are powerful pump systems available that can increase the effective range in locations that manure storages can be placed on the farm. If manure is pumped, the manure and bedding consistency comes into play. Sand-laden dairy manure (SLDM) has an impact on pumped and gravity flow systems. Bedding amount and type influences how far and how high manure can be easily pumped. Route the pipe so that it can be monitored for leaks during

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Examples of different types of manure storage. Storage must be functional, sized for the operation and expected growth, and able to be loaded and unloaded easily and safely.

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pumping. Install pipe cleanouts to access the pipe should plugging occur. Locate the pump so it can be accessed if automatic safety equipment fails.

With winter spreading limitations, the need to store solid or frozen manure requires access to the storage over the top. Storage of SLDM and other settling solids in the bedding (or even a large storage that agitators can't stir completely) need access to the bottom for solids removal. Ramps that will be traveled in and out of the storage by manure hauling equipment should be at least 8:1 slope and roughened for traction. Ramps to be used occasionally to move pumps, agitators or solid handling equipment occasionally should be at least 4:1 for safety. If the pumping and agitating equipment is just lowered down the sides, the hardened area can match the sideslopes.

Historically, gravity flow to load and unload manure storages were often a major consideration for storage sites. With the improvement and prevalence of pumps (and the need to homogenize the storage to get a uniform nutrient application), the usefulness of gravity flow has declined. Gravity-out systems bring an additional safety concern as a failure of the valves have allowed the release of large flows of manure. Pumped loading to a higher storage has the same potential if the valves fail (unless there is a designed air gap in the system as it enters the storage). The stored manure can flow back down catastrophically. Locate the storage and pump-out areas to

provide room and/or facilities so that unintentional minor or major spills can be intercepted and mitigated before they enter a water course.

Access roads should be planned for heavy equipment. Reinforcing fabric under a base consisting of well-graded angular gravel will provide a longer-lasting useable surface. Plan the access roads carefully to allow for efficient traffic patterns and good drainage. A circular access road may help the spreading operation move faster. Routing the empty tankers over any steeper topography while allowing a more gradual slope for full spreaders can save operation and management costs. Keep the storage out of floodplains to avoid flow damage and limited access during flooding events.

The size of the storage should be determined with the help of your comprehensive nutrient management planner (CNMP) and/or engineer. It should be sized to meet the production of the cows and the land base on which the nutrients will be utilized. Satellite storages for more remote field complexes need to have enough storage for the manure to be spread, plus any precipitation for the storage period. If they will only be emptied once a year, the year's precipitation will need to be added. In addition to a function of normal precipitation the storage needs to be able to contain extreme storms without overtopping the freeboard. In general, a round (or square) and deep storage will have the most volume for the least construction cost. A shallow

storage will collect more precipitation and have a larger perimeter.

Test pits are needed to determine the soil characteristics and the presence of ground water or bedrock to properly design the storage. The test pits should go at least 2 feet deeper than the bottom of the storage. Bedrock should be 2 feet lower than the bottom of the storage and even deeper (or use an impermeable bottom) if the bedrock is fractured and has solution channels. Areas with carbonate bedrock near the surface need special care and outside expertise should be consulted. Groundwater control is very important. If ground water enters the storage, it will fill the storage prematurely and will add to time and cost of hauling to fields. Groundwater movement through the banks of the storage can collapse the bank and make channels for manure water to leak out. Seepage layers need to be sealed and a drainage system designed to keep the ground water out.

Soil samples should be taken to test the soil to make sure it has the capability of adequately containing the manure. If the soils on site are not appropriate, it may be possible to find suitable material nearby. If testing confirms, material from a borrow pit can be hauled to the site to construct an earthen liner. Some earth materials can be modified by adding a specific amount of bentonite to decrease the

*Continued on page 4*

## *Siting manure storages revisited, cont'd from page 3*

permeability. An impermeable high-density plastic liner can be placed at an additional cost if the existing or modified earth cannot be made impermeable enough. Plastic-lined storages will need concrete agitation areas or a concrete floor to remove solids. Concrete or metal structures can be used to limit the surface area.

Properly planned and designed manure storages will improve the efficiency of recycling the manure

back to the land for optimum nutrient benefit. Placing the manure storage where the community can't see it or smell it will keep good neighbor relations. Determining the soil conditions that don't require extra modification or structural components can keep costs lower. Finding the right site is so important that some farmers might actually buy the land with these conditions so a satellite storage can be installed to benefit the dairy enterprise. ■

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## **PLANNING A STORAGE? SOME NEW YORK FUNDING SOURCES:**

**Dairy Advancement Program** is designed to enhance profitability and environmental stewardship of New York dairy farms. Eligible environmental projects include funds for farms with fewer than 300 mature cows to engage the services of an AEM Certified Planner to develop or update a Comprehensive Nutrient Management Plan (CNMP) and for farms with fewer than 700 mature cows funds to engage an engineer to design best management practices identified in the farm CNMP. Additionally, the program provides business planning funds including funds for implementing recordkeeping systems, operational planning, financial analysis, transition analysis, as well as funds to facilitate participation in strategic focus groups with peers or advisory teams.

Visit: [prodairy.cals.cornell.edu/dairy-advancement](http://prodairy.cals.cornell.edu/dairy-advancement) or contact Caroline Potter, PRO-DAIRY, by phone at (315) 683-9268 or email at [dap@cornell.edu](mailto:dap@cornell.edu).

**NYS Agricultural Nonpoint Source Abatement & Control Grant Program** assists farmers in preventing water pollution from agricultural activities by providing technical assistance and financial incentives. County Soil & Water Conservation Districts apply for the competitive grants on behalf of farmers and coordinate funded conservation projects. Grants can cost-share up to 75 percent of project costs or more if farmers contribute in: 1) Planning—funds awarded to conduct environmental planning and 2) Implementation—funds awarded to construct or apply management practices. The NYS Soil & Water Conservation Committee and the NYS Department of Agriculture & Markets coordinate the statewide program and allocate funds provided by the NYS Environmental Protection Fund on a semi-annual basis.

Visit: [nys-soilandwater.org/aem/nonpoint.html](http://nys-soilandwater.org/aem/nonpoint.html) or contact your local SWCD.

**The Environmental Quality Incentives Program** (EQIP, available in every state) is a voluntary conservation program that helps agricultural producers in a manner that promotes agricultural production and environmental quality as compatible goals. Through EQIP, agricultural producers receive financial and technical assistance to implement structural and management conservation practices that optimize environmental benefits on working agricultural land. Incentives and priorities vary depending on location. Sign-up is ongoing.

Visit: [nrcs.usda.gov/wps/portal/nrcs/main/ny/programs/financial/eqip/](http://nrcs.usda.gov/wps/portal/nrcs/main/ny/programs/financial/eqip/) or contact your local NRCS office.