

**FARMSTEAD PLANNING**  
**Brian J. Holmes**  
**Professor and Extension Specialist**  
**Biological Systems Engineering Department**  
**University of Wisconsin-Madison**  
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**What is a Farmstead Plan?**

A farmstead plan is a plan view scale drawing(s) of existing and future farmstead facilities as planned by the owner(s) of the business. The drawings can be accompanied by a supporting document which explains assumptions, calculations and time sequencing used in developing the drawings. The farmstead plan allocates space for future structures and allows a person to view flow patterns for current and future materials into, out of, and within the farmstead. Total future space needs are apparent from the farmstead plan.

**Why Should Someone Spend the Time and/or Money to Develop a Farmstead Plan?**

A well-developed farmstead plan can be a very effective communication tool. The plan can be a component of a business plan which can be used in the process of securing loans. It can communicate to the lender that there is a long-term facilities plan, and the lender can make a judgment of how feasible the plan appears.

The farmstead plan can be used to develop cost estimates for each of the components. Building contractors, equipment suppliers and excavators can use the plan to give preliminary and final cost estimates. These cost estimates can be used in the budget portion of the business plan. A complete farmstead plan with reasonable cost estimates can go a long way toward substantiating the facilities budgets in your business plan.

During the process of obtaining permits, a farmstead plan can communicate to regulators how facilities will be arranged to minimize the impacts on milk quality, groundwater and surface water quality, air quality, highway and property line setbacks, your well water quality, and other nuisances which your operation may pose to neighbors.

Current and/or future partners in the business can use the farmstead plan to understand how the facilities are expected to change over time.

Facilities designers can use the farmstead plan to better understand space needs and relative distances between structures. Having a predetermined plan precludes placing a new structure at or too close to where a future structure should be placed. Most people are reluctant to remove a functional structure to build a new structure in the best location. With inadequate planning, many new structures get built at sites which are less desirable because of the presence of an existing structure.

Utility companies (electricity, gas pipelines, water, telephone, etc.) can use a farmstead plan to properly size and locate their lines and equipment. For example, an electric utility may want to install larger wiring, transformers and auxiliary generator cut out switches if they think the facilities may support a 1000-cow dairy in 10 years vs. one that may only grow to 200 cows in that time.

If the farmstead is sold, the plan can be used by the realtor to explain current facilities and how they fit into your future plans. This could be an invaluable sales tool.

## What are Some of the Important Factors which must be Considered when Selecting a Farmstead Site?

The current farmstead is the place most producers consider first when they ponder adding new facilities to the operation. Current facilities are considered valuable and should be used to limit expenditures. This may be true in the early phases of growth, but many existing structures become extremely inadequate in a large expansion. In addition to being inadequate, they may be located on the landscape so as to limit the expansion of an operation because of space or environmental limitations. Farmsteads which were developed before rural electrification were frequently located near streams to allow convenient watering of animals. These low areas pose surface water quality concerns and limited space for structures. In fact, if you are operating a farmstead on such a site, you may have already grown to or surpassed the limits of the site. Sometimes an existing manure storage is considered a valuable resource which can be incorporated into a larger operation. Table 1 shows the amount of time an existing manure storage will hold manure, considering what it will do starting with a 50-cow herd. The table assumes the same amount of manure and milking center wastewater per cow over the expansion.

**TABLE 1.** Storage period for existing manure storage as herd size increases.

<b>Number of Cows</b>	<b>Storage Period (days)</b>	<b>Storage Period (days)</b>
50	180	360
100	90	180
200	45	90
400	22.5	45
800	11.3	22.5
1600	5.7	11.5

The existing manure storage can tend to anchor an expansion to the vicinity of the current farmstead. Table 1 shows the manure storage to be an insignificant part of the total manure storage needs once herd size exceeds about 300 cows.

Consider the current farmstead in an expanded farmstead plan but give due consideration to other potential sites. These other potential sites may be on your farm or an adjacent farm. They may even be in another county or state.

A source of quality water of sufficient quantity (delivery rate) is essential for a dairy. Water is needed to wash and sanitize milking equipment. Water is needed to wash the milking parlor and cows, water the animals, precool milk, wash clothes and towels, flush toilets, wash hands, etc. On some dairies, water may be needed to flush manure from the holding area and barn floors, mix pesticides, wash equipment, and shower workers. Where housing is provided at the farmstead, a water supply must be provided at the house(s). A 500-cow dairy may require 2000 gal/day for the parlor, 400 gal/day at one house, 20,000 gal/day to water the cows, and 4500 gal/day to water heifers, resulting in a total water use of 26,900 gal/day or an average well pumping rate of 19 gal/min. This example presumes high-producing cows, recycled precool water, and no manure flushing (except recycle water flush in holding area). Peak pumping rate demands may actually be two to three times higher than the average pumping rate. One or more

reservoirs within the system may be needed to reduce the peak pumping rate to meet well capacity.

As important as water supply is to the dairy, so is the ability to drain away excess water. Select an elevated site when locating a farmstead. This will allow an outlet for rain that falls on roofs, roads and the rest of the farmstead area, as well as snow melt. An ideal slope of 2 to 6% will provide good drainage without causing erosion problems. Elevated sites should be out of the flood plain for rivers and streams to prevent inundation during flood conditions. Elevated sites usually are above high groundwater, but borings should be made to establish the groundwater table. Manure handling is less energy intensive if manure is moved from cows down slope to a storage. In some elevated sites, gravity flow of manure can eliminate pumps to move manure to storage. An elevated site can take better advantage of natural ventilation than a lowland site.

A fully developed farmstead plan which considers how large the dairy will be in 10 to 20 years will indicate how much space will be needed to construct all of the facilities. A farmstead plan for a 1000-cow dairy with adequate support facilities for feed storage, manure storage, heifers and dry cows may require as much as 30 to 40 acres.

Good local municipal roads will be needed to transport feed, manure, milk and animals safely to and from the farmstead. These roads should be wide enough to handle farm vehicles as well as local traffic. Generally, low levels of local traffic will be safer and require less waiting time for farm equipment to enter and exit the road. Roads and their setback requirements form boundaries to farmsteads. Care must be taken to locate the center of the farmstead a sufficient distance from municipal roads so as to allow enough space for expansion. Be sure to keep the farmstead center well away from highway intersections as two roads are doubly confining.

The farmstead should be located north to east of neighbors, population centers, churches, schools, etc., when the prevailing summer winds come from the south to west. This will help to limit complaints caused by odors. Large separation distances from neighbors help minimize odor complaints. However, it is difficult to predict optimum separation distances.

Feed and manure transport time can be minimized when the farmstead is located in the center of the land area producing feed and receiving manure.

When locating a farmstead, consider the concentration of livestock in the neighborhood. Animal producers in the neighborhood will be competing with you for locally produced feed or land upon which the feed is grown and upon which manure is spread. High concentrations of livestock requires feed to be obtained at greater distances from the farmstead. This increases the cost of feed. The cost of moving manure nutrients farther from the farmstead is also greater. Mandated manure nutrient management plans will require manure to be exported from areas of high animal concentration.

The community in which you plan to locate your farmstead is an important consideration. A community which is accepting of a larger livestock operation will make fewer complaints about your activities. They will raise fewer objections during a permitting process which will allow regulators more leeway when issuing permits. The community will provide labor for your operation. Consider the supply and cost of local labor. What other businesses are competing for this labor pool? What wage rate must you pay to compete with these other businesses?

Consider the infrastructure available to support your business. How quickly can local suppliers respond to your needs? Are there sufficient competing firms to help keep service costs reasonable? Consider also the markets for your milk and cull cows. Is there sufficient competition to keep pay prices high for the long term?

## Once a Site has been Selected, What must be Considered within the Farmstead?

A topographic drawing (shows elevation lines) of the entire site is a very good starting point for a farmstead drawing. Contact a surveyor, local Land Conservation Department or Natural Resource Conservation Service to arrange for a topographic drawing. This drawing will show the location and size of high and low areas as well as drainage ways. Existing structures and other formations can be drawn onto a copy of the topographic drawing to give a complete view of the existing site. Any underground features can also be noted.

Arrange livestock housing to maximize cross flow of natural ventilation air in summer. Orient the length of the buildings perpendicular to the prevailing summer breezes. Avoid obstructions which may block the prevailing wind from the naturally ventilated building. Obstructions could include tall buildings and silos (including bunker silos and silo bags), trees and woodlots, tall crops and landforms such as bluffs and hills.. Table 2 (Holmes et al., 1989) suggested separation distances for upwind obstructions. Minimum separation from trees and structures for uninterrupted airflow is 50 feet. Recommended separation between buildings for fire protection is 75 feet or more.

**TABLE 2.** Minimum natural ventilation separation distances.

Height (ft)	Length of Windward Building or Obstruction (ft)					
	50	75	100	150	200	250
	- - - - - ft of separation - - - - -					
8	50	50	50	50	50	51
10	50	50	50	50	57	63
12	50	50	50	59	68	76
14	50	50	56	69	79	89
16	50	55	64	78	91	101
18	51	62	72	88	102	114
20	57	69	80	98	113	126
22	62	76	88	108	124	139
24	68	83	96	118	136	152
26	74	90	104	127	147	164
28	79	97	112	137	158	177
30	85	104	120	147	170	190

Locate manure storages downwind from the livestock housing units and the milking parlor so odors will be delivered away from the animals, milkers and milk. If a house(s) is on the farmstead, try to locate it upwind of the animal housing and manure storage for the same reason.

When arranging structures on the farmstead plan, consider traffic patters and material flows. A dairy can be viewed as a manufacturing operation in which materials and labor must flow to the right places at the right times. Efficiencies are obtained when these materials move quickly without obstructing other flows. Facilities should be arranged to accomplish these objectives. Security and biosecurity can be enhanced by arranging the traffic patterns of the farm

entrance. One farm entrance is easier to monitor and may limit escape routes for those who might be undesirable on the farmstead. Provide an internal traffic circle(s) to allow equipment to change direction without having to back up. Arrange farmstead drives so vehicles can be driven straight through buildings or around them so backing is avoided. Structures must be located sufficiently far apart to allow good natural ventilation (50 ft minimum) and fire control (75 ft minimum) yet close enough to have convenient materials flows (feed, animals, manure, etc.). For example, consider a 40 ft × 100 ft machine shed with 14 ft sidewall height and roof slope of 3:12. The peak height is 24 ft. From Table 2, the minimum separation distance to a naturally ventilated freestall barn located north of the machine shed is 96 ft. If a larger separation distance can be provided, an improved ventilation system can be expected.

Surface water and groundwater quality protection will be an ever more important consideration than it has been in the past. One adage of water quality protection is "to keep the clean water clean and clean up the dirty water". Generally, it is less expensive to keep the clean water clean than it is to clean up dirty water. Consequently, the farmstead plan should give serious consideration to keeping precipitation and runoff water away from manure, feed and other contaminants. Make sure roof runoff and snow slide are handled in clean drainage ways which will not be easily eroded. Roofs over feed mangers protect the feed from precipitation and avoid contaminating runoff. Roofs over yards and alleys divert precipitation from manure. Roofs may be sloped in one direction only to avoid roof runoff into yards. These roofs may be less expensive to construct than systems designed to capture contaminated water and move it to field application. Snow will accumulate in areas of low wind velocity and where it slides from roofs. Drainage systems should be designed to handle these large volumes of snow as they melt. Locate snow storages for plowed, drifted snow in drives. Covering bunker silos and diverting runoff water away from the exposed feedout face will preserve feed quality and protect runoff water from leached nutrients.

Farmstead roads will maintain their strength longer under heavy loads in wet seasons when proper drainage is provided for the road bed. Plan roads so precipitation drains from the road surface (no puddling) and moves away from the road through road ditches. Coarse aggregate road beds help to drain water from under the road to the road ditch if the bottom of the ditch is 18 inches below the base of the road. Provide adequate space along roads and parking areas for plowed snow storage.

The water supply well(s) should be located where there is a high likelihood of high water delivery rate of good quality water. The well must be located on the farmstead at a site where it is least likely to become contaminated or damaged by equipment. In Wisconsin, a "well code" specifies how far the well must be located from various sources of contamination such as manure storages and manure conveyances. These separation distances are minimums and are based on risk of contamination likelihood. Separation distances from sources of contamination should be maximized for maximum well protection. The well should be located uphill from potential contaminated runoff sources such as pesticide mixing/loading areas, cattle yards, feed storages, flood plains, and fuel storages. If possible, identify the direction of groundwater flow and locate the well(s) "up-gradient" from potential sources of groundwater contamination.

Once a farmstead plan draft has been developed, stake out the site to indicate locations of buildings, drives, well, etc. Then drive your semitrailer and/or combine throughout the staked out farmstead to make sure you have enough room to go where you need to.

## REFERENCES

Holmes, B.J. et al. 1989. *Natural Ventilating Systems for Livestock Housing* (MWPS-33).  
MidWest Plan Service, Ames, IA.

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