NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

LIVESTOCK SHELTER STRUCTURE

(No.)

CODE 576

DEFINITION

A permanent or portable structure with less than four walls and/or a roof to provide for improved utilization of pastureland and rangeland and to shelter livestock from negative environmental factors. This structure is not to be construed to be a building.

PURPOSE

- To provide protection for livestock from excessive heat, wind, cold, or snow.
- Protect surface waters from nutrient and pathogen loading.
- Protect wooded areas from accelerated erosion and excessive nutrient deposition by providing alternative livestock shelter/shade location.
- Improve the distribution of grazing livestock to enhance wildlife habitat, reduce over-used areas, or correct other resource concerns resulting from improper livestock distribution.

CONDITIONS WHERE PRACTICE APPLIES

This practice is applied to provide protection to sensitive areas by providing a source of shade or shelter that is located away from the existing shade or shelter in wooded areas and on stream banks or depressions. This practice must be used in conjunction with exclusion of animals from the sensitive area. Use a livestock exclusion practice NRCS Conservation Practice (CPS) Fence - (382).

This practice is applicable where animal productivity and well-being are adversely affected by negative environmental conditions such as direct and unimpeded sunshine, wind, or snow.

This practice can facilitate livestock management under prescribed grazing to protect water quality and soil health.

This practice can be used to provide protection on range or pasture; cropland or hayland used for grazing; winter feeding areas; or in a livestock heavy use area.

CRITERIA

General Criteria Applicable to All Purposes and Structure Types

Transport of Portable Structure. Equip the portable structure with runners or wheels or other means to facilitate transport. Provide lateral support to vertical and horizontal structural members to prevent twisting and/or buckling.

Location. Locate the structure to avoid adverse effects to cultural resources and endangered, threatened, and candidate species and their habitat. Select upland locations that are away from riparian areas and concentrated flow areas to avoid impairment of water quality. Locate structures a minimum of 100 feet from any surface water bodies, 150 feet from an up-gradient well and 300 feet from a down-gradient well. Select location(s) that will not have surface water flow through the structure.

Erosion Protection. Provide erosion protection from roof runoff.

Materials. Construct the structure of durable materials that are commensurate with a minimum structure life of 10 years. Fabric or other non-structural material may need to be replaced in accordance with its anticipated lifespan (typically no more than 5 years). Dispose of or recycle worn out fabric or other non-structural material as appropriate.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service State Office or visit the Field Office Technical Guide.

Waste Management. Design the structure to facilitate the distribution of manure across grazing lands in accordance with a nutrient management plan.

Prescribed Grazing. When the livestock protection structure is installed to improve livestock distribution to address resource concerns, then Prescribed Grazing - (528) must also be included in the resource management plan.

Additional Criteria Applicable to Shade Structures

Figure 1 – Typical Shade Structure

Orientation. Orient the longest axis in a north to south direction to maximize the amount of shade and to allow sunlight to dry the area under the structure.

Shade cover. Design the top of the structure to be relatively flat so that wind will have minimum load on the structural supports. Provide a minimum1:25 pitch for the structure roof to allow runoff. Anchor the four corners of the shade structure with tie-downs of adequate size and strength to meet the local wind conditions during season of use.

Size. The minimum size requirements for a shade structure are shown in Table 1. Limit the maximum size of individual shade structure units to 25 feet wide by 50 feet in length (1250 sq ft). Portable structures may be smaller to facilitate movement. Multiple structures may be needed depending on the number of animals to be sheltered.

In prescribed grazing systems for high-producing livestock, provide shade for at least 75% of the herd, particularly for dairy or beef cows.

Table 1 – Minimum Shade Requirements

Animal Type	Minimum Shade Requirements	
	Area (ft^2/head)	Height (ft)
Dairy, beef, or horse	35-50	10 – 12
Swine, sheep, or goats	10-15	7
Poultry	3 - 7	7

Location. Locate the structure a minimum of 50 feet from any existing structure that could obstruct the circulation of air. Use the location of the structure to create the desired livestock travel patterns. Move portable structures as needed to maintain healthy vegetation in the immediate area.

Additional Criteria Applicable to Wind Shelter Structures

Location. Locate the wind shelter structure in an area where livestock shelter from prevailing winds is desired. See Figure 2. The site must be accessible by vehicle or equipment.

Figure 2 – Typical Wind Shelter Structure

Locate the shelter on level, uninterrupted terrain, if possible. If the shelter must be located downwind of a hill, place the shelter as far downwind as possible. A shelter upwind of a hill shall be placed a minimum of 75 times the shelter height upwind of the base of the hill.

Locate wind shelters perpendicular to the prevailing winter winds, where possible. Be careful that wind shelters do not block summer breezes, increasing heat stress.

Shape and Size. Wind shelters shall be a 90º "V" shaped, semi-circular shaped, or straight line structures.

For optimum protection from wind and drifting snow, a "V" shaped or semicircular structure is recommended. The shelter opening width (perpendicular to the wind direction) should be no wider than 15 times the shelter height.

"V" Shelters. Construct "V" shaped shelters with a solid face to divert drifting snow around ends of the barrier. Wind speed reduction of 60-80 percent is possible in the protected area extending 5H downwind of the barrier (Figure 3). The V, or closed end, should point in the direction of the winter and early spring prevailing winds. The shelters cause the snow to be diverted around the shelter and deposited in drifts extending five times the shelter width (D) downwind.

Compute the shelter zone area as shown in Figure 3. Table 2 shows the shelter zone. The shelter structure shall provide a shelter zone area based on the values in Table 2.

Design the shelter dimensions following guidance provided in Tables 2 and 3.

Figure 3 -- Snowdrift Protection from "V" Shaped Structures

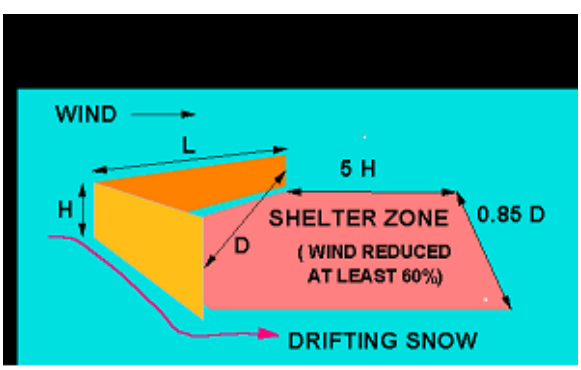

Table 2 – Minimum Wind Shelter Requirements

Animal Type	Minimum Shelter Zone Requirement Area (ft^2/head)
Dairy, beef, or horse	35-50
Swine, sheep, or goat	10-15
Poultry	3 - 7

Table 3 - Protected Area at Maximum Wing Length (See Figure 3)

Barrier height, ft.	Wing L, ft.	Wing D, ft.	Protected area, ft^2.
6	60	84.8	3,964
8	80	113.1	7,047
10	105	148.5	11,823
12	125	176.8	16,828
14	145	205.1	22,714

Semi-circular Shelters. Semi-circular shaped shelters can be built with approximately the same quantity of materials as the "V" design. The ratio of protected area to shelter length is about 27 percent higher than in the "V" shape. Base the dimensions for the semi-circular shaped barrier on a radius equal to one-half D for the "V" shaped barriers as shown in Table 3. Semi-circular shelters are generally the most economical (material cost per square foot); however, the type of material used for board or panels can be a limiting factor due to the shape. The semi-circular shape also tends to be self-bracing.

Straight line shelters. Straight line windbreaks are not as effective as the "V" shaped design since less protection is provided if wind direction varies from anything perpendicular to the fence. They will however provide effective wind protection for up to 15 to 20 times the height of the structure for solid and porous walls. Snow is

forced over the fence and deposited downwind of the structure rather than diverted around it.

General Structural Criteria. Post spacing and depth will require site specific designs based on sustained wind speed and direction.

Lumber installed within eight inches of the ground must be pressure treated in accordance with ASTM D1760 Standard Specification for Pressure Treatment of Timber products. For facilities that are organic producers or that sell compost to organic producers, ensure that the treated lumber used in the shelter meets the requirements for organic production. It may be best to have the producer consult with the organic certifier as to the use and acceptability of treated lumber.

CONSIDERATIONS

Permanent structures should be centrally located in the grazing system to promote equidistant travel to all grazing areas.

The livestock shelter structure may require pollution and erosion prevention measures in the design.

Consider the economics, the overall waste management system plan, and safety and health factors.

If the structure is permanent, consider applying Heavy Use Area Protection - (561) where vegetation cannot be maintained underneath or within the structure.

When applicable, consider the use of Animal Trails and Walkways - (575) when frequent travel to headquarters, grazing areas or watering facilities is required.

With portable shade structures, consider removing and storing the structure or fabric during winter months to extend the life of the shade cloth.

Consider removing and storing mobile shade structures during stormy weather events.

Consider soil types and seasonal water table zones when planning the location of the livestock shelter structure.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for a livestock shelter structure according to this standard.

Describe the requirements for applying the practice to achieve its intended purposes.

Include construction plans, drawings, job sheets or other similar documents. Specify in these documents the requirements for installing the practice.

As a minimum, include:

- The type, location (if permanent structure), and orientation of the shelter structure.
- Wind calculations, as needed to set minimum thicknesses, strengths, etc., for the structures based on a standard design wind speed. Include the seasonal wind directions needed to determine the orientation of the structure.
- Develop a plan for movement of the structure, if portable.
- Job sheets or construction drawings.
- Construction specifications including dimensions of the structure, and configuration.
- Materials, including the dimensions, amount, any coatings, and quality to be used.

The following list of Construction Specifications is intended as a guide to selecting the appropriate specifications for a specific project. The list includes most but may not contain all of the specifications needed for a specific project.

IA-1 Site Preparation
IA-3 Structural Removal
IA-31 Concrete
IA-32 Concrete for Nonstructural Slabs
IA-81 Metal Fabrication and Installation
IA-83 Timber Fabrication and Installation
IA-92 Fences

OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan for the operator. The minimum requirements to be addressed in the O&M plan are:

- Inspect the structure annually and after major storm events.
- Maintain the structural and fabric components through the practice lifespan.

- Replace and/or repair maintenance coatings on structural steel components as necessary.
- Periodically tighten the shade cloth to minimize wind damage.
- Replace the fabric cover when it has deteriorated due to environmental conditions.
- Move portable structures periodically to prevent destruction of vegetation in the immediate area.
- If shelters are not moved frequently, collect and remove accumulated animal waste on a regular basis or specified time interval and utilize in accordance with Waste Recycling - (633) or Nutrient Management - (590), as appropriate.

REFERENCES

ASTM D A-36, A-120, D-751, D-1494, D-1682, D-1760, D1910.;

Federal Specification TT-P-641;

Federal Test Method Standard No. 191, Method 5804;

"Warm Cows & Cool Breezes", Montana State University Extension Service; http://www.msuextension.org/counties/Stillwater/articles/Ag%20Articles/Windbreaks.pdf ;

"Taming Blizzards for Animal Protection, Drift Control and Stock Water", R. L. Jairell and R.A. Schmidt, USDA Forest Service;

"Portable Animal Protection Shelter and Wind Screen", R. L. Jairell and R.A. Schmidt, USDA Forest Service;

"Effect of a Solid Windbreak in a Cattle Feeding Area", Earl M. Bates, Oregon State University and Ralph L. Phillips, Eastern Oregon Agricultural Research Center.