



Natural Resources Conservation Service
CONSERVATION PRACTICE STANDARD
LIVESTOCK SHELTER STRUCTURE

CODE 576

(no)

DEFINITION

A permanent or portable structure to protect animals from negative environmental factors. Structure will have fewer than four walls; this structure is not to be construed to be a building.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Provide protection for animals from excessive heat, wind, cold, or snow
- Improve the distribution of grazing animals to enhance wildlife habitat, reduce over-used areas, or correct other resource concerns resulting from improper animal 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, on stream banks, or in depressions.

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 animal management under prescribed grazing to protect water quality and soil health.

This practice can be used to provide protection on pasture, cropland, or hayland used for grazing, winter feeding areas, or in an animal heavy use area.

This practice may be used in conjunction with exclusion of animals from sensitive areas.

CRITERIA

General Criteria Applicable to All Purposes and Structure Types

Location

Locate the structure to avoid adverse effects to cultural resources and endangered, threatened, or candidate species and the habitat of each respective species. Assess soil types, flood prone areas and seasonal water table zones when planning the location of the shelter structure. 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.

Erosion Protection

Provide erosion protection as needed to protect the site.

Materials

Construct the structure of durable materials that are commensurate with a minimum structure life of 10 years.

Any wood in contact with soil or manure must be a rot-resistant wood species, or treated in accordance with ASTM D1760 "Standard Specification for Pressure Treatment of Timber Products."

For organic operations, it is the producer's responsibility to ensure that all methods and materials used are consistent with USDA National Organic Program requirements for organically produced agricultural products. It is recommended that the producer consult with their organic certifier as to the use and acceptability of treated lumber and other materials.

Transport of Portable Structures

Equip portable structures with runners, wheels, or other means to facilitate transport. Provide lateral support to vertical and horizontal structural members to prevent twisting and buckling during transport.

Additional Criteria for Shade Structures

Location

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

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.

Size

The minimum size requirements for a shade structure are shown in Table 1. 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 animals, provide shade for at least 75 percent of the herd, particularly for dairy or beef cows. Natural shade, if available, can be considered when calculating the shade area requirements for the herd(s).

Table 1. Minimum Shade Requirements

Animal Type	Area (square feet per head)	Height (feet)
Dairy	40	10
Beef - 400 lb calves	15	10
Beef - 800 lb feeders	20	10
Beef - cows	30	10
Horses	50	12
Swine, sheep, or goats	10	7
Poultry	3	7

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 minimum 1:25 pitch for the structure roof to allow runoff. Arched or gothic style structures can also be used.

Use minimum 80-percent light reduction shade cloth for protection of animals.

Anchor the four corners of the shelter with tie-downs of adequate size and strength to withstand local wind conditions during season of use. When installing a manufactured kit shelter, anchor the cover and structure in accordance with the manufacturer's recommendations.

Additional Criteria for Wind Shelter Structures

Location

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

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

Shape and Size

A wind shelter shall be 90° V-shaped structures, semicircular-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 (D) (perpendicular to the wind direction) should be no less than 10 and no more than 15 times the shelter height (H) (see Fig. 1).

"V-shaped" shelter

Construct a V-shaped shelter 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 (Fig. 1). Orient the "V", or closed end, toward the direction of the winter and early spring prevailing winds. The shelter will cause the snow to be diverted around the shelter and deposited in drifts extending five times the shelter width (D) downwind.

Use Figure 1 and Tables 2 and 3 to compute the needed shelter zone. Table 3 shows the maximum wing length (L) to achieve a shelter opening (D) of 15 times the shelter height (H). The shelter structure will provide a shelter zone area based on the values in Table 3.

Figure 1. Snowdrift Protection from "V-shaped" Structures

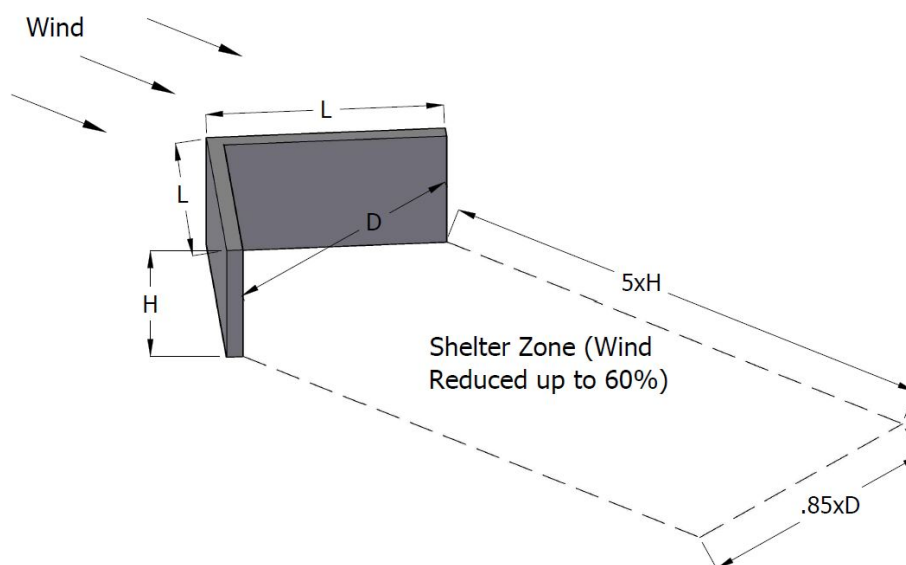


Table 2. Minimum Wind Shelter Requirements

Animal Type	Minimum Shelter Zone - Area (square feet/head)
Dairy	40
Beef - 400 lb calves	15
Beef - 800 lb feeders	20
Beef - cows	30
Horses	50
Swine, sheep, or goats	10
Poultry	3

Table 3. Shelter Zone Area at Maximum Wing Length (see Fig. 1)

Barrier height (feet)	L (feet)	D (feet)	Protected Area (square feet)
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

Semicircular shelter

A semicircular-shaped shelter will function similarly to a “V”-shaped shelter and can be built with approximately the same quantity of materials as the V-shaped structure. Multiply the protected area in Table 3 by 1.27 to determine the protected area. Base the dimensions for the semicircular-shaped barrier on a radius equal to one-half D for the “V”-shaped structures as shown in Table 3. The semicircular shape also tends to be self-bracing.

Straight-line shelter

Use a straight-line windbreak to provide effective wind protection for up to 15 to 20 times the height of the structure for solid and porous walls. Provide no more than a 1-foot gap at the base for a straight-line shelter.

General Structural Criteria

Perform stability and structural analyses on wind shelter structures. Develop wind loading for these analyses using the 3-second gust speed for a 50-year mean recurrence interval (MRI) according to American Society of Civil Engineers (ASCE) Standard 7-16, “Minimum Design Loads and Associated Criteria for Buildings and Other Structures.” Apply a 1.0 factor of safety for shelter stability. Anchor a portable shelter as necessary to meet this criterion for overturning and sliding. Design structural components of shelters according to industry standards (American Institute of Steel Construction, American Wood Council, etc) applicable to the materials of construction.

Note: Specific programs may dictate criteria in addition to, or more restrictive than, those specified in this standard.

CONSIDERATIONS

Protect surface waters from nutrient and pathogen loading.

Protect wooded or sensitive areas from accelerated erosion and excessive compaction.

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

If the structure is permanent, consider applying NRCS Conservation Practice Standard (CPS) Heavy Use Area Protection (Code 561) where vegetation cannot be maintained underneath or within the structure.

When the shelter structure is installed to improve animal distribution to address resource concerns, NRCS CPS Prescribed Grazing (Code 528) may also be included in the resource management plan.

When applicable, use NRCS CPS Trails and Walkways (Code 575) when frequent travel to headquarters, grazing areas, or watering facilities is required.

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

Remove and store mobile shade structures during stormy weather events.

For wind shelter structures, for stability analysis, apply a factor of safety greater than 1.0 to account for variable site conditions and soil properties, when needed.

During stability analysis of portable wind shelter requiring anchorage, take into account the consequences and performance of an unanchored shelter.

For portable structures, monitor pasture conditions. Moving the structures frequently is advisable to avoid local degradation of vegetation, soil, and water.

For waste management purposes, locate structures to facilitate the distribution of manure across grazing lands in accordance with a nutrient management plan.

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 purpose.

Use 576 Implementation Requirements (IR) sheets, construction plans, drawings, or other similar documents to specify the requirements for installing the practice.

As a minimum, include—

- The type, location, and orientation of the shelter structure.
- Design wind speed and seasonal wind directions needed to determine the orientation of the structure.
- IR 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.
- Describe the requirements for anchoring a portable shelter structure (as applicable).

OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan for the operator as indicated below.

General O&M Plan

- Inspect the structure annually and after major storm events.
- Replace or repair maintenance coatings on structural steel components as necessary.

Specific O&M Requirements for Shade Structures

- Maintain the structural and fabric components through the practice lifespan. Dispose of or recycle worn-out fabric or other nonstructural material as appropriate.
- Periodically tighten the shade cloth to minimize wind damage.
- Replace the fabric cover when it has deteriorated due to environmental conditions.

Specific O&M Requirements for Portable Structures

- Move portable structures periodically to prevent destruction of vegetation in the immediate area.
- Develop recommendations for movement of the structure. These recommendations may be included in the Prescribed Grazing Plan.
- Re-anchor portable structures following relocation.

SUPPORTING DATA AND DOCUMENTATION

The following is a list of the minimum data and documentation to be recorded in the case file:

- Location(s) of the practice on the conservation plan map.
- Assistance notes. The notes shall include dates of site visits, name or initials of the person who made the visit, specifics as to alternatives discussed, decisions made, and by whom.
- Prescribed Grazing Plan that integrates the shelter(s) into a grazing system to improve livestock health and protect water quality and soil health.

For Structures That Have Implementation Requirements Sheets:**Design Data**

Completed 576 Implementation Requirements (IR) sheet that specifies the type and number of livestock, type of shelter, manufacturer, materials requirements, size and quantity of structure(s), location and orientation on the landscape, and anchoring requirements, as applicable.

Construction Check Data

At a minimum, use the IR sheet to certify implementation of the practice as applied, including the location, extent, types of materials used, and date completed. “Red line” and initial acceptable substitutions or changes to the design. If the practice extent or location was changed, revise the practice geometry when certifying in Conservation Desktop. Prepare an “as-built” map, and as applicable, attach it to the IR sheet or place it in the conservation plan folder or engineering design folder.

For All Other Structures:**Field Data and Survey Notes**

Make a full investigation of the topography of the site, soil conditions, farming operations, erosion, hydrology, water quality, and degree and type of usage before a specific plan is prepared for the area.

Record field data and survey notes on appropriate MD forms and engineering paper. The following is a list of the minimum data needed:

- Location and size of the shelter structure.
- Description of the objectives of the practice, including the desired functions that the shelter is expected to provide.
- Soils investigation logs and notes, as appropriate for site conditions and the proposed design. Soil survey map with the site identified. Documentation should include soil texture, soil types, description of unsuitable materials, allowable bearing capacity of each soil layer, depth to seasonal high water table, depth to bedrock and permeability of the soil.
- Topographic survey of the site, as appropriate for site conditions and the proposed design.

Design Data

Record design data on appropriate MD forms and engineering paper. For guidance on the preparation of engineering plans, see Chapter 5 of the Engineering Field Handbook. The following is a list of the minimum required design data:

- Design summary summarizing in narrative form the objectives, data, criteria, assumptions, procedures, and decisions used in the design. The summary should provide relevant site history and background information as well as a brief description of major features, job classification, drainage area, storm frequencies, direction and velocity of prevailing winds, landscape resources, capacities, etc., as appropriate.
- For prefabricated structures, attach the appropriate exhibit(s) from the structure manufacturer.
- Show on the plans the job class, the plan view showing the extent of the structure, location map, grades, cross section of constructed components and outlets, design assumptions, utility notification and construction specifications.
- For portable structures, conduct stability analysis under variable site conditions and soil properties at sites when needed.
- Runoff treatment design.
- Grading and drainage plan for the site where appropriate.
- Vegetative plan. If the site is disturbed or unvegetated, include the seedbed preparation, seeding species and rate, lime, fertilizer, and mulching requirements according to Maryland conservation practice standard Critical Area Planting (Code 342) or other applicable practice, e.g., Pasture and Hay Planting (Code 512).
- Estimated quantities.
- Written Operation and Maintenance plan.

Construction Check Data

Record the construction check data on survey notepaper, ENG-28, or other appropriate engineering paper. Plot the survey data in red on the as-built plans. The following is a list of minimum data needed for as-built documentation.

- Document site visits on CPA-6. Include the date, name of recorder, and specifics about discussions, inspections, activities, personnel on site and decisions made and by whom.
- Installation and construction check notes are to be recorded in sufficient detail to show that the practice meets this standard and applicable specification. Minimum requirements are:
- Measurements to show length, width, and height of completed shelter marked in red on the “as-built” plans.
- Statement as to the materials installed, to be placed on the “as-built” plans.
- Statement on seeding installation, as applicable.
- If appropriate, state/local authorities approve urban erosion and sediment control plans, no additional documentation is necessary.
- Final quantities and documentation for quantity changes.
- Materials certification documentation.
- Sign and date statement on plans that “Construction meets or exceeds plans and NRCS practice standards and specifications.” Statement to be signed and dated by a person with appropriate engineering job approval authority for construction.

REFERENCES

ASTM D A36, Standard Specification for Carbon Structural Steel; A120, D751, Standard Test Methods for Coated Fabrics; D1494, Standard Test Method for Diffuse Light Transmission Factor of Reinforced Plastics Panels; D1682, D-1760, D1910.

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