576-Livestock Shelter Structure

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576-Livestock Shelter Structure

DEFINITION

A permanent or portable structure with less than four walls and a roof, if needed, 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.

USDA United States Department of Agriculture

576-CPS-1

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

LIVESTOCK SHELTER STRUCTURE

CODE 576

(no)

DEFINITION

A permanent or portable structure with less than four walls and a roof, if needed, 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

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

- 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 Standard (CPS) Fence (Code 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 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

NRCS, MN
January 2020

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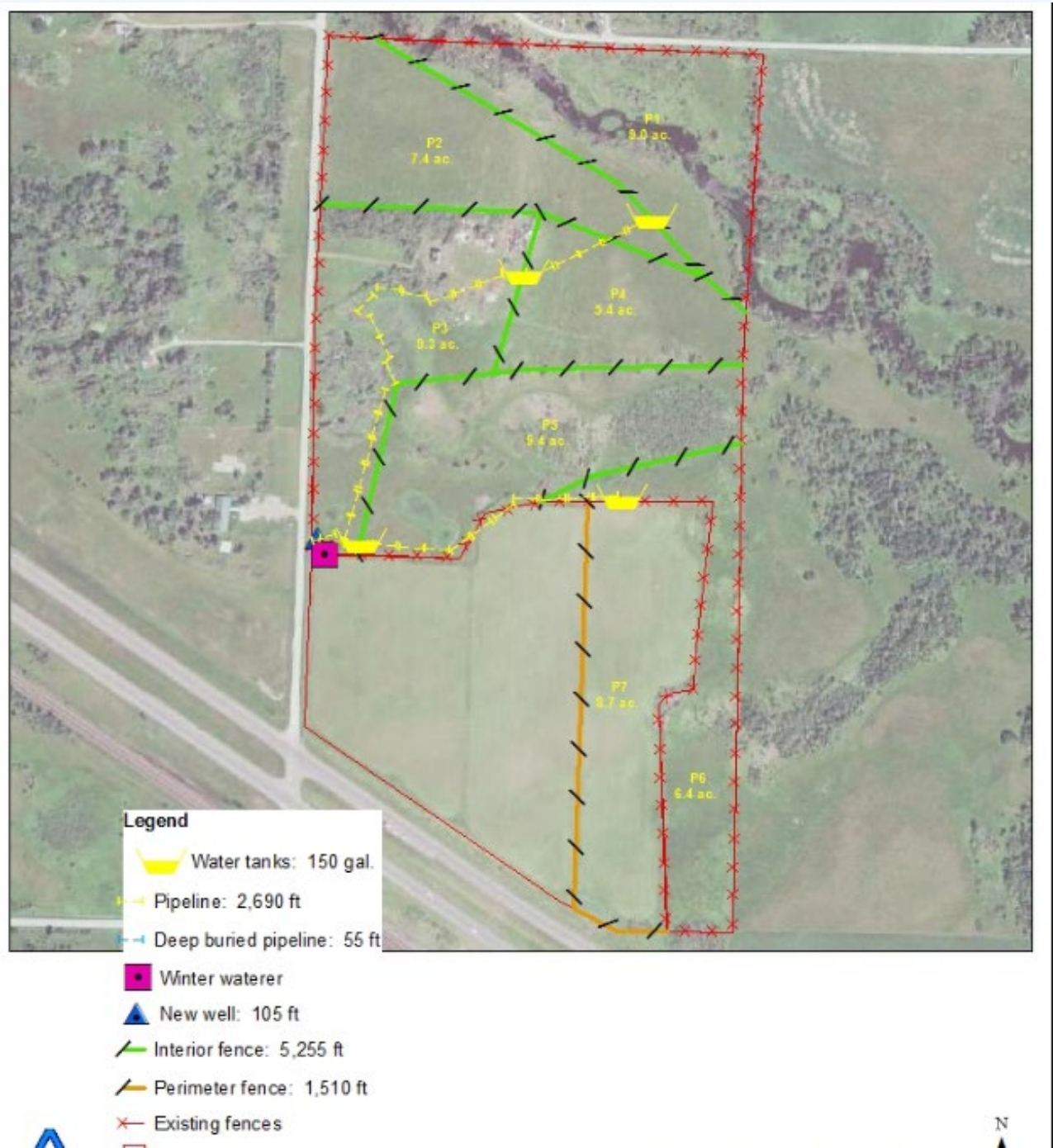
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P5
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P7
8.7 ac.
P6
6.4 ac.
Legend
Water tanks: 150 gal.
Pipeline: 2,690 ft
Deep buried pipeline: 55 ft
Winter waterer
New well: 105 ft
Interior fence: 5,255 ft
Perimeter fence: 1,510 ft
Existing fences
N

CONDITION WHERE PRACTICE APPLIES

- 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.

CONDITION WHERE PRACTICE APPLIES

- This practice can facilitate livestock management under prescribed grazing to protect water quality and soil health.
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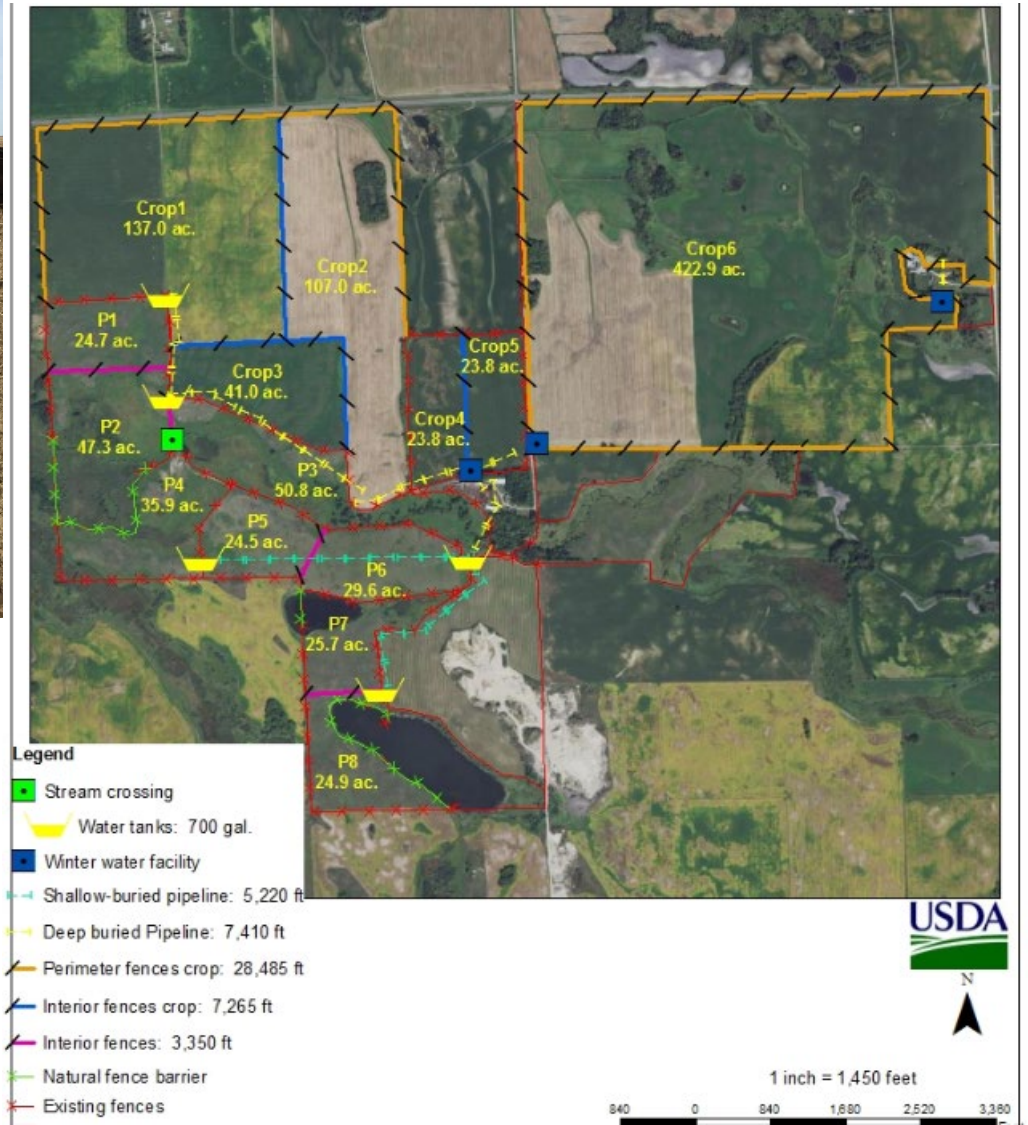
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Crop3
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Crop5
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P2
47.3 ac.
Crop4
23.8 ac.
P3
50.8 ac.
P4
35.9 ac.
P5
24.5 ac.
P6
29.6 ac.
P7
25.7 ac.
P8
24.9 ac.
Legend
Stream crossing
Water tanks: 700 gal.
Winter water facility
Shallow-buried pipeline: 5,220 ft
Deep buried Pipeline: 7,410 ft
Perimeter fences crop: 28,485 ft
Interior fences crop: 7,265 ft
Interior fences: 3,350 ft
Natural fence barrier
Existing fences
USDA
N
1 inch = 1,450 feet
840 0 840 1,680 2,520 3,360

CRITERIA

- **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 locations that will not have surface water flow through the structure.

CRITERIA

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

CRITERIA

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

Plans and Specifications

- 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.
- 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.

Operation and Maintenance

- Inspect the structure annually and after major storm events.
- Maintain the structural and fabric components through the practice lifespan.
- Replace 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 NRCS CPSs Waste Recycling (Code 633) or Nutrient Management (Code 590),as appropriate.

United States Department of Agriculture

576 – Livestock Shelter Structure Implementation Requirements

Producer: _____ **Contract #:** _____

Location: _____ **County:** _____

Farm Name: _____ **Tract Number:** _____

☐ Permanent Shelter Structure

☐ Permanent Shade Structure

☐ Portable Wind Shelter Structure

This practice is applied to provide protection to sensitive areas by providing a source of shade or shelter that is located away from existing shade or shelter in wooded areas, 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 Standard (CPS) 382 Fence.

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.

Gopher State One Call Utility Service 651-454-0002 or 800-252-1166

Practice Purpose (check all that apply)

- ☐ Provide protection for livestock from excessive heat, wind, 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.

Producer Goals and Objectives

Design - Standard for Construction Details

Describe current and planned condition:

- ☐ Practice 576 drawing used (or equivalent has been completed).
- ☐ All identified supporting practices within the Prescribed Grazing Plan have implementation Requirements and Engineering Designs completed and attached.
- ☐ Permanent Livestock Shelter Structure is placed – Nutrient Management 590 Plan is required and provided.

Required Permits (To be obtained by the client)

	Permit Type	Entity to Contact
1.		
2.		
3.		

Operation and Maintenance

- ☐ Inspect the structure annually and after major storm events.
- ☐ Maintain the structural and fabric components through the practice lifespan.
- ☐ Replace 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 NRCS CPSs Waste Recycling (Code 633) or Nutrient Management (Code 590), as appropriate.
- ☐ Immediately repair any damage due to vandalism, vehicles, or livestock.
- ☐ List other items.

☐ All facilitating conservation practices that are needed to implement a Livestock Shelter Structure are maintained in good working order (check all that apply).

☐ 314 – Herbaceous Weed Control	☐ 512 – Forage and Biomass Planting	☐ 590 – Nutrient Management
☐ 315 – Brush Management	☐ 516 – Pipeline	☐ 595 – Pest Management
☐ 382 – Fence	☐ 533 – Pumping Plant	☐ 614 – Watering Facility
☐ 472 – Access Control	☐ 561 – Heavy Use Protection	☐ 642 – Water Well
☐ 528 – Prescribed Grazing	☐ Other:	☐ Other:

Notes:

Practice Specifications Approval and Completion Certification

Provided Practice Cost information

☐ Site specific cost estimate or specifications for the producer to develop a cost estimate or obtain the bid for himself or herself.

Design Installation and Layout Approval

Designed by:	Date:	Job Approval Authority:
Approved by:	Date:	Job Approval Authority:

Record of Completion and Check Out Certification

Feet Completed	Date Completed by Client	Date Certified	Approver's Initials

☐ Additional documentation to support practice certification is located in the case file.

Certification Statement

I certify that implementation of this conservation practice is complete, meets criteria for the stated purpose(s), and meets the NRCS conservation practice standard and specifications.

Name (Please print): _____ Date: _____

Title: _____ Job Approval Authority: _____

Signature: _____

Notes:

STATEMENT OF WORK
Livestock Shelter Structure (576)
Minnesota

These deliverables apply to this individual practice. For deliverables for other planned practices, refer to those specific Statements of Work.

DESIGN

Deliverables

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
   - Practice purpose(s) as identified in the conservation plan
   - Compliance with NRCS national and State utility safety policy (National Engineering Manual (NEM), Part 503, Subpart A, Engineering Activities Affecting Utilities, Sections 503.00 through 503.06).
   - Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
     - Location/Alignment
     - Height
     - Size
     - Spacing
     - Type of material
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits.
   - Location map with legal description and north arrow
   - Plan view of structure installation showing type of structure, location (if permanent), and orientation of the shelter structure
   - Structural details
   - Materials, including the dimensions, amount, any coatings, and quality to be used
3. Identify fields where practice to be applied on a conservation plan map.
4. Operation and maintenance plan
5. Certification that the design meets practice standard criteria and comply with applicable laws and regulations (NEM, Part 505, Subpart B, Sections 505.10 through 505.12).
6. Documentation of design modifications during installation as required.

INSTALLATION

Deliverables

Deliverables

1. Documentation of a pre -installation conference held between client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Installation inspection (according to inspection plan as appropriate)
   - Actual materials used (NEM, Part 512, Subpart D, Quality Assurance Activities, Section 512.33)
   - Inspection records
5. Facilitate and implement required design modifications with client and original designer
6. Advise client/NRCS on compliance issues with all Federal, State, Tribal, and local laws, regulations and NRCS policies during installation
7. Certification that the installation process and materials meets design and permit requirements.

CHECK OUT

Deliverables

1. As-Built documentation.
   - Extent of practice units applied
   - Drawings
   - Final quantities
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM-505-B, Sections 505.10 through 505.12)
3. Progress reporting.

REFERENCES

- NRCS Field Office Technical Guide (FOTG), Section IV, Conservation Practice Standard – Livestock Shelter Structure, 576
- USDA NRCS. National Engineering Manual (Title 210). Washington, D.C. https://directives.sc.egov.usda.gov/
- USDA NRCS. National Environmental Compliance Handbook (Title 190). Washington, D.C.
- USDA NRCS. National Cultural Resources Procedures Handbook (Title 190). Washington, D.C.

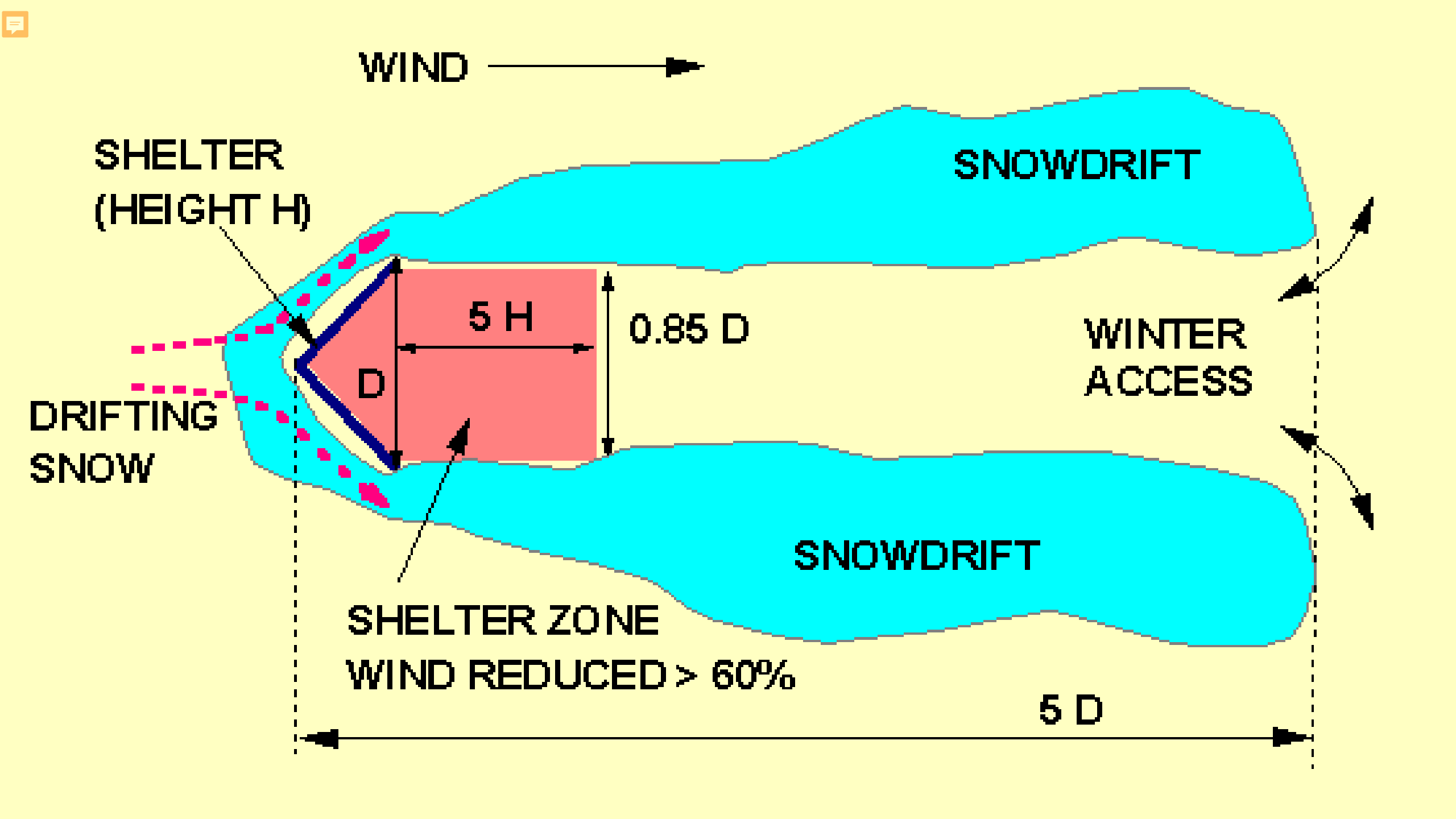
How much interest will you have with 576-Livestock Shelters in your work area?

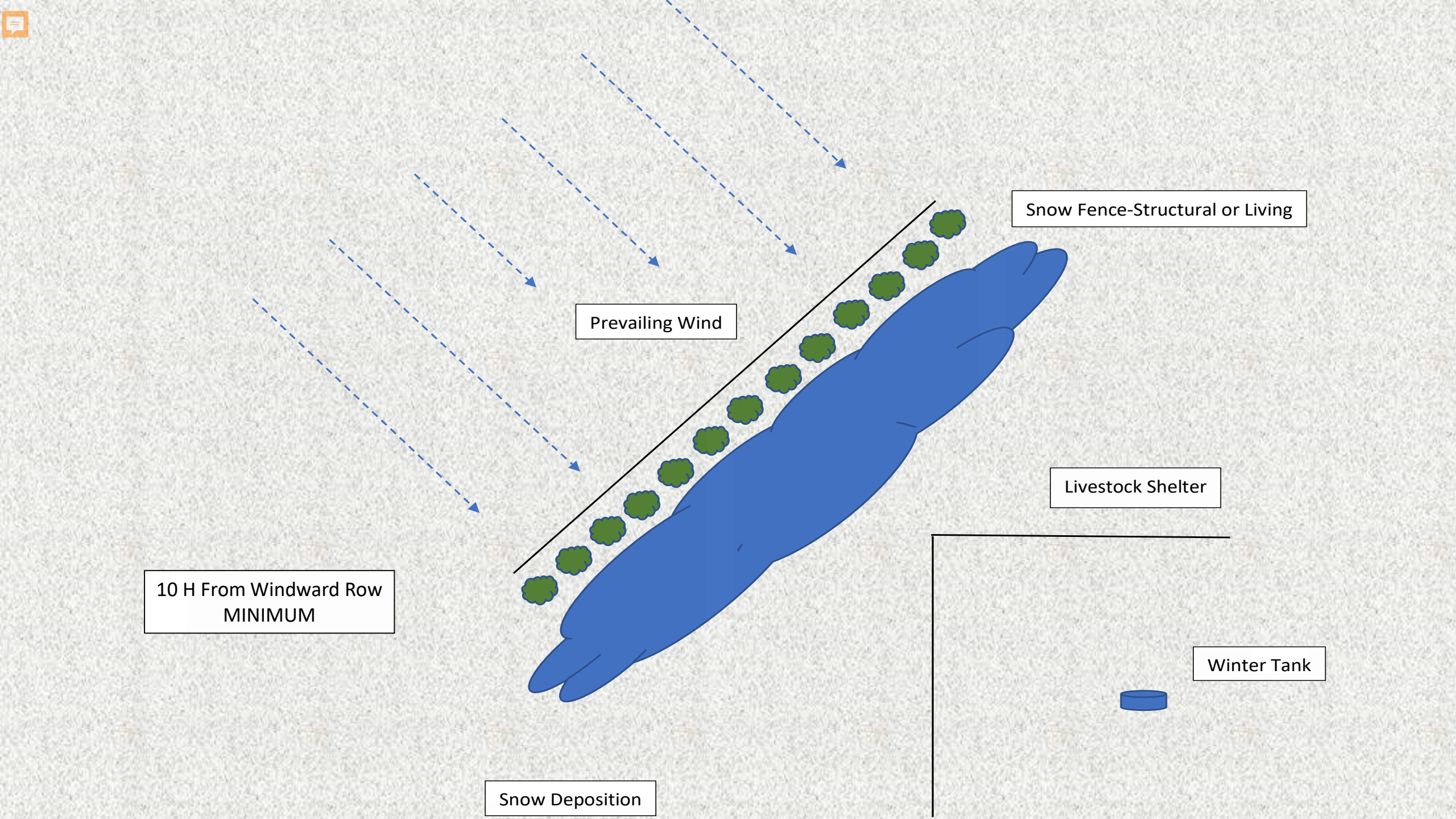
A. A lot of Interest
B. Some Interest
C. A little Interest
D. No Interest

What should I do with my hair?

A. Mohawk
B. Shaved Head with full beard
C. Dye it to match the Vikings: Purple and Gold!
D. Just let it go man

Planning Considerations


WIND
SHELTER
(HEIGHT H)
SNOWDRIFT
5 H
0.85 D
D
WINTER
ACCESS
DRIFTING
SNOW
SNOWDRIFT
SHELTER ZONE
WIND REDUCED > 60%
5 D


Snow Fence-Structural or Living
Prevailing Wind
Livestock Shelter
10 H From Windward Row
MINIMUM
Winter Tank
Snow Deposition

PLANNING CONSIDERATIONS

- Whole Farm or Ranch Plan
- 365 Days – Spring, Summer, Fall & Winter
  - Shade or Wind or Both
- Systems Approach
- Existing Protection
  - Change Management
- New Management
  - 528 – Prescribed Grazing Plan
  - 590 – Nutrient Management Plan

PLANNING CONSIDERATIONS

- Placement on Landscape
  - Feasibility
- Prevailing Wind Direction
  - More Than 1 During a Storm?
- Heat Stress Forecast Maps-NOAA & NWS
  - Temperature
  - Humidity
  - wind speed
  - cloud cover

PLANNING CONSIDERATIONS

- Permanent vs Portable
  - Management Flexibility
  - Cost
  - Strength
  - Labor
- Sizing - Engineering

PLANNING CONSIDERATIONS

PERMANENT

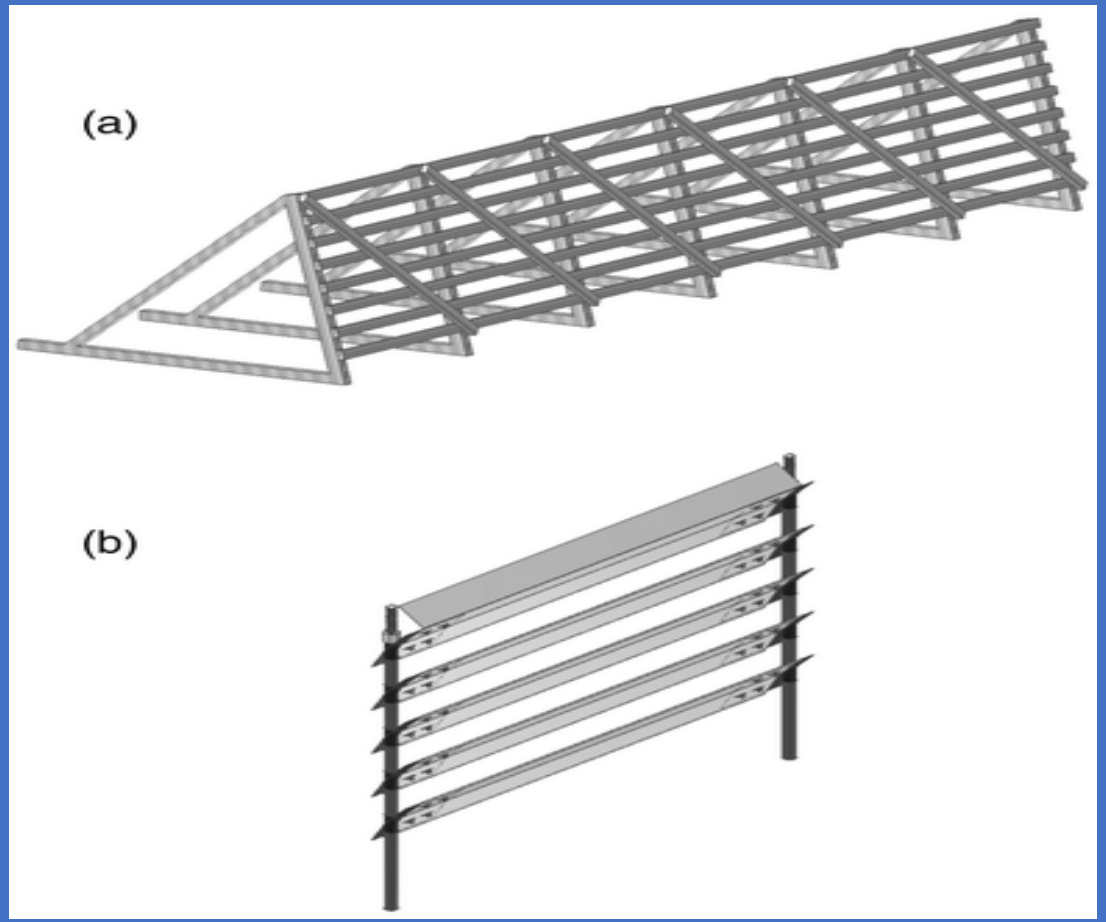
PORTABLE

GOOD WINDBREAK DESIGNS

- V or C Shape with point to prevailing wind
- Solid (Non Porous)
- No gap at bottom
- Straight (vs Slanted)
- Provide Protection From Wind *AND* Snow
- Sheeting on windward side (rub rail on leeward side)
- This design diverts wind and snow creating a protected area.

POOR WINDBREAK DESIGNS

- Straight
- Perpendicular to prevailing wind
- Porous
- Gap at bottom
- Slanted
- Sheeting on leeward side
- This is a snow fence design. Deposits snow within the protection zone.



SHADE STRUCTURES

QUESTION

Which of the following 4 Pictures of Livestock Shelter Structures for Wind Protection most closely meets the criteria we have discussed?

A B C D

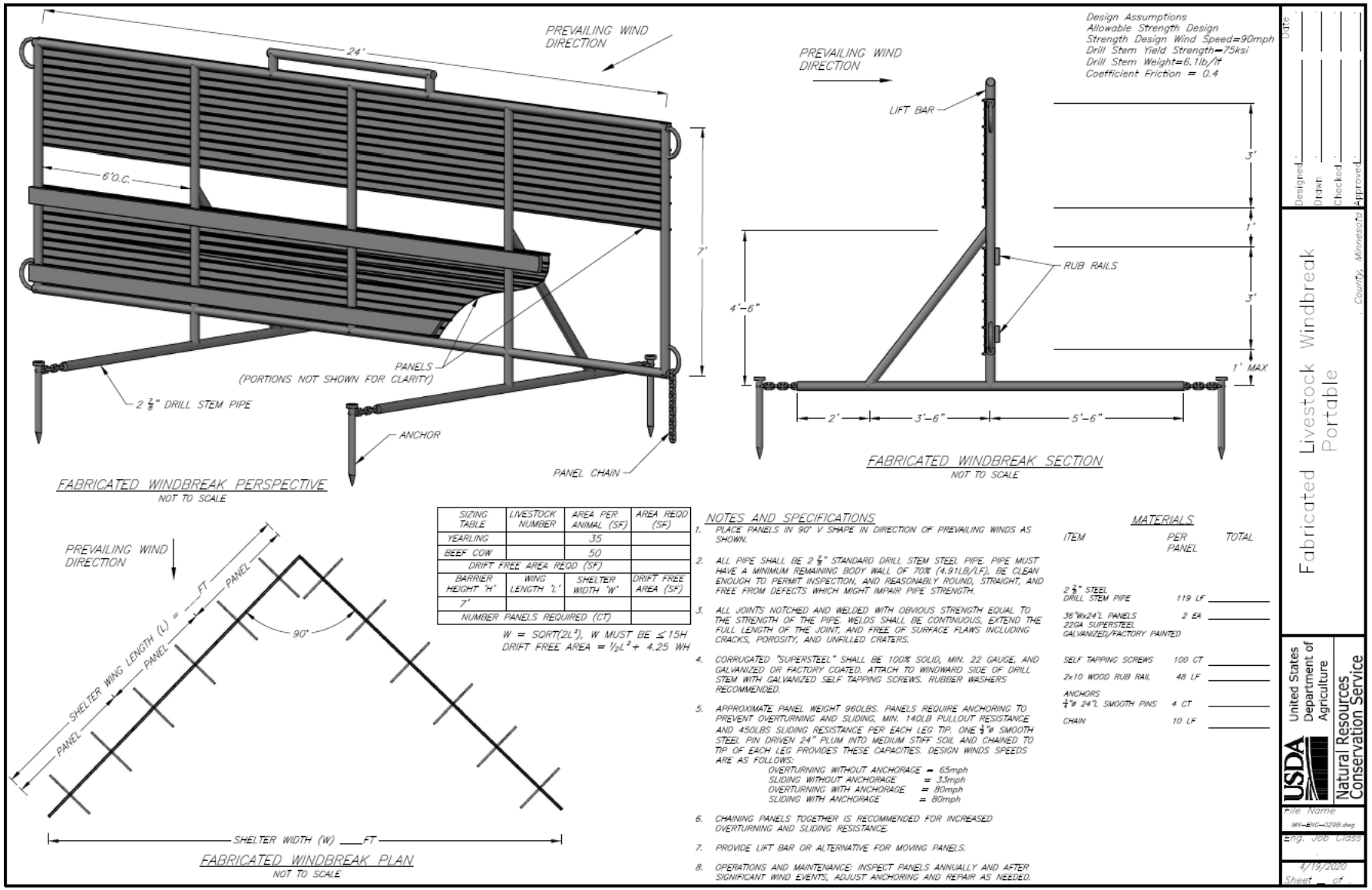

A


B


C


D


JCB



SIZING TABLE	LIVESTOCK NUMBER	AREA PER ANIMAL (SF)	AREA REQD (SF)
YEARLING		35	
BEEF COW		50	
DRIFT FREE AREA REQD (SF)			
BARRIER HEIGHT 'H'	WING LENGTH 'L'	SHELTER WIDTH 'W'	DRIFT FREE AREA (SF)
7'			
NUMBER PANELS REQUIRED (CT)			

$W = SQRT(2L^2)$, W MUST BE $\leq 15H$
DRIFT FREE AREA = $\frac{1}{2}L^2 + 4.25\ WH$

NOTES AND SPECIFICATIONS

1. PLACE PANELS IN 90° V SHAPE IN DIRECTION OF PREVAILING WINDS AS SHOWN.
2. ALL PIPE SHALL BE 2 7/8" STANDARD DRILL STEM STEEL PIPE. PIPE MUST HAVE A MINIMUM REMAINING BODY WALL OF 70% (4.91LB/LF), BE CLEAN ENOUGH TO PERMIT INSPECTION, AND REASONABLY ROUND, STRAIGHT, AND FREE FROM DEFECTS WHICH MIGHT IMPAIR PIPE STRENGTH.
3. ALL JOINTS NOTCHED AND WELDED WITH OBVIOUS STRENGTH EQUAL TO THE STRENGTH OF THE PIPE. WELDS SHALL BE CONTINUOUS, EXTEND THE FULL LENGTH OF THE JOINT, AND FREE OF SURFACE FLAWS INCLUDING CRACKS, POROSITY, AND UNFILLED CRATERS.
4. CORRUGATED "SUPERSTEEL" SHALL BE 100% SOLID, MIN. 22 GAUGE, AND GALVANIZED OR FACTORY COATED. ATTACH TO WINDWARD SIDE OF DRILL STEM WITH GALVANIZED SELF TAPPING SCREWS. RUBBER WASHERS RECOMMENDED.
5. APPROXIMATE PANEL WEIGHT 960LBS. PANELS REQUIRE ANCHORING TO PREVENT OVERTURNING AND SLIDING. MIN. 140LB PULLOUT RESISTANCE AND 450LBS SLIDING RESISTANCE PER EACH LEG TIP. ONE 3/4"ø SMOOTH STEEL PIN DRIVEN 24" PLUM INTO MEDIUM STIFF SOIL AND CHAINED TO TIP OF EACH LEG PROVIDES THESE CAPACITIES. DESIGN WINDS SPEEDS ARE AS FOLLOWS:
   OVERTURNING WITHOUT ANCHORAGE = 65mph
   SLIDING WITHOUT ANCHORAGE = 33mph
   OVERTURNING WITH ANCHORAGE = 80mph
   SLIDING WITH ANCHORAGE = 80mph
6. CHAINING PANELS TOGETHER IS RECOMMENDED FOR INCREASED OVERTURNING AND SLIDING RESISTANCE.
7. PROVIDE LIFT BAR OR ALTERNATIVE FOR MOVING PANELS.
8. OPERATIONS AND MAINTENANCE: INSPECT PANELS ANNUALLY AND AFTER SIGNIFICANT WIND EVENTS, ADJUST ANCHORING AND REPAIR AS NEEDED.

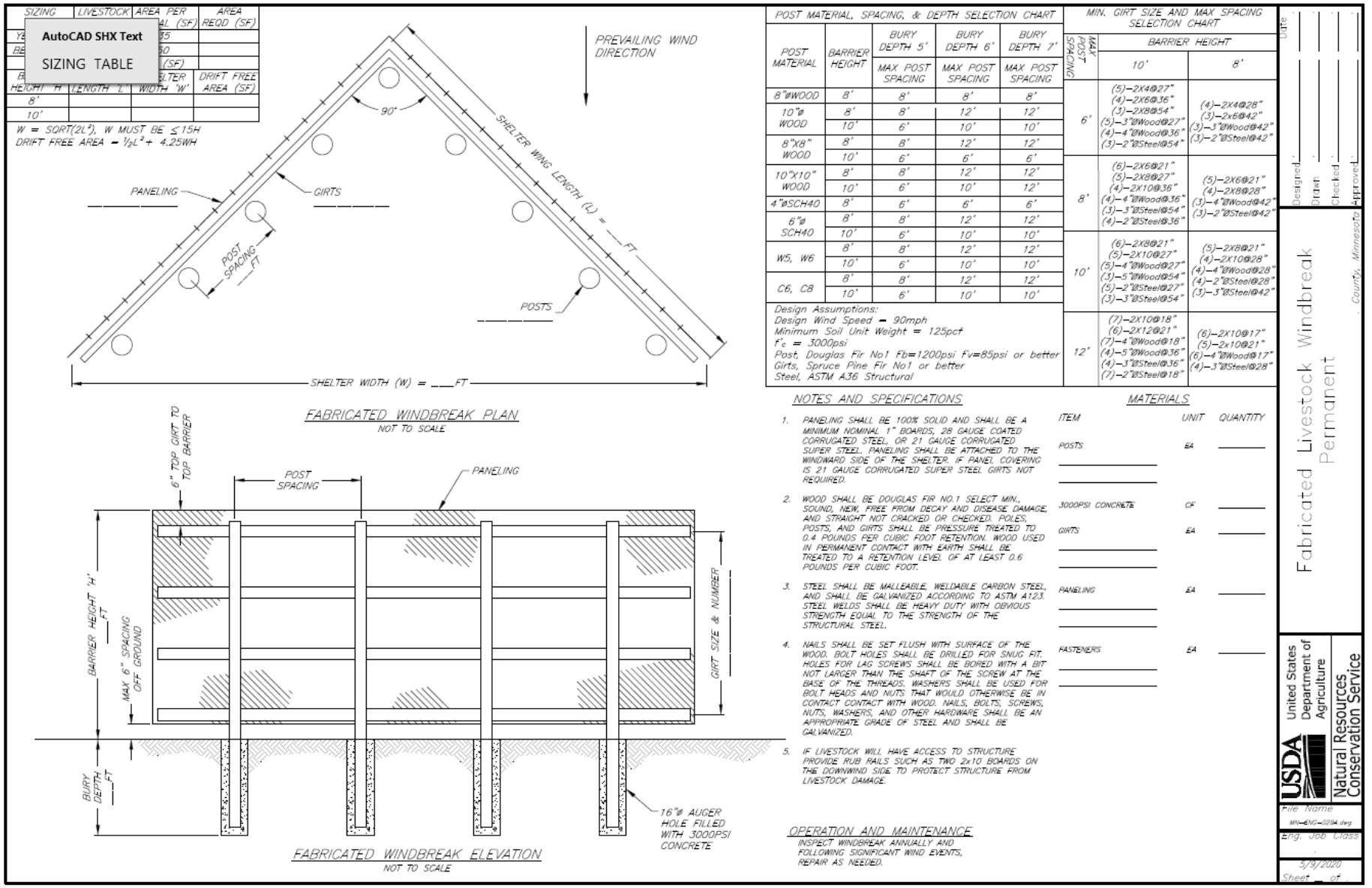
MATERIALS

ITEM	PER PANEL	TOTAL
2 7/8" STEEL DRILL STEM PIPE	119 LF	
36"Wx24'L PANELS 22GA SUPERSTEEL GALVANIZED/FACTORY PAINTED	2 EA	
SELF TAPPING SCREWS	100 CT	
2x10 WOOD RUB RAIL	48 LF	
ANCHORS 3/4"ø 24'L SMOOTH PINS	4 CT	
CHAIN	10 LF	

Date
Designed:
Drawn:
Checked:
Approved:
County, Minnesota
Fabricated Livestock Windbreak Portable
United States Department of Agriculture
USDA
Natural Resources Conservation Service
File Name
MN-ENG-0298.dwg
Eng. Job Class
4/19/2020
Sheet ___ of ___

Steps to implement

1. Animal numbers to protect
2. Determine size
3. Determine site
4. Assemble design
5. Preconstruction
6. Check/Asbuilt



POST MATERIAL, SPACING, & DEPTH SELECTION CHART

POST MATERIAL	BARRIER HEIGHT	BURY DEPTH 5' MAX POST SPACING	BURY DEPTH 6' MAX POST SPACING	BURY DEPTH 7' MAX POST SPACING
8"øWOOD	8'	8'	8'	8'
10"ø WOOD	8'	8'	12'	12'
	10'	6'	10'	10'
8"X8" WOOD	8'	8'	12'	12'
	10'	6'	6'	6'
10"X10" WOOD	8'	8'	12'	12'
	10'	6'	10'	12'
4"øSCH40	8'	6'	6'	6'
6"ø SCH40	8'	8'	12'	12'
	10'	6'	10'	10'
W5, W6	8'	8'	12'	12'
	10'	6'	10'	10'
C6, C8	8'	8'	12'	12'
	10'	6'	10'	10'

Design Assumptions:
Design Wind Speed = 90mph
Minimum Soil Unit Weight = 125pcf
f'c = 3000psi
Post, Douglas Fir No1 Fb=1200psi Fv=85psi or better
Girts, Spruce Pine Fir No1 or better
Steel, ASTM A36 Structural

MIN. GIRT SIZE AND MAX SPACING SELECTION CHART

MAX POST SPACING	BARRIER HEIGHT 10'	BARRIER HEIGHT 8'
6'	(5)–2X4@27" (4)–2X6@36" (3)–2X8@54" (5)–3"ø Wood@27" (4)–4"ø Wood@36" (3)–2"ø Steel@54"	(4)–2X4@28" (3)–2x6@42" (3)–3"ø Wood@42" (3)–2"ø Steel@42"
8'	(6)–2X6@21" (5)–2X8@27" (4)–2X10@36" (4)–4"ø Wood@36" (3)–3"ø Steel@54" (4)–2"ø Steel@36"	(5)–2X6@21" (4)–2X8@28" (3)–4"ø Wood@42" (3)–2"ø Steel@42"
10'	(6)–2X8@21" (5)–2X10@27" (5)–4"ø Wood@27" (3)–5"ø Wood@54" (5)–2"ø Steel@27" (3)–3"ø Steel@54"	(5)–2X8@21" (4)–2X10@28" (4)–4"ø Wood@28" (4)–2"ø Steel@28" (3)–3"ø Steel@42"
12'	(7)–2X10@18" (6)–2X12@21" (7)–4"ø Wood@18" (4)–5"ø Wood@36" (4)–3"ø Steel@36" (7)–2"ø Steel@18"	(6)–2X10@17" (5)–2x10@21" (6)–4"ø Wood@17" (4)–3"ø Steel@28"

NOTES AND SPECIFICATIONS

1. PANELING SHALL BE 100% SOLID AND SHALL BE A MINIMUM NOMINAL 1" BOARDS, 28 GAUGE COATED CORRUGATED STEEL, OR 21 GAUGE CORRUGATED SUPER STEEL. PANELING SHALL BE ATTACHED TO THE WINDWARD SIDE OF THE SHELTER. IF PANEL COVERING IS 21 GAUGE CORRUGATED SUPER STEEL GIRTS NOT REQUIRED.
2. WOOD SHALL BE DOUGLAS FIR NO.1 SELECT MIN., SOUND, NEW, FREE FROM DECAY AND DISEASE DAMAGE, AND STRAIGHT NOT CRACKED OR CHECKED. POLES, POSTS, AND GIRTS SHALL BE PRESSURE TREATED TO 0.4 POUNDS PER CUBIC FOOT RETENTION. WOOD USED IN PERMANENT CONTACT WITH EARTH SHALL BE TREATED TO A RETENTION LEVEL OF AT LEAST 0.6 POUNDS PER CUBIC FOOT.
3. STEEL SHALL BE MALLEABLE, WELDABLE CARBON STEEL, AND SHALL BE GALVANIZED ACCORDING TO ASTM A123. STEEL WELDS SHALL BE HEAVY DUTY WITH OBVIOUS STRENGTH EQUAL TO THE STRENGTH OF THE STRUCTURAL STEEL.
4. NAILS SHALL BE SET FLUSH WITH SURFACE OF THE WOOD. BOLT HOLES SHALL BE DRILLED FOR SNUG FIT. HOLES FOR LAG SCREWS SHALL BE BORED WITH A BIT NOT LARGER THAN THE SHAFT OF THE SCREW AT THE BASE OF THE THREADS. WASHERS SHALL BE USED FOR BOLT HEADS AND NUTS THAT WOULD OTHERWISE BE IN CONTACT CONTACT WITH WOOD. NAILS, BOLTS, SCREWS, NUTS, WASHERS, AND OTHER HARDWARE SHALL BE AN APPROPRIATE GRADE OF STEEL AND SHALL BE GALVANIZED.
5. IF LIVESTOCK WILL HAVE ACCESS TO STRUCTURE PROVIDE RUB RAILS SUCH AS TWO 2x10 BOARDS ON THE DOWNWIND SIDE TO PROTECT STRUCTURE FROM LIVESTOCK DAMAGE.

MATERIALS

ITEM	UNIT	QUANTITY
POSTS	EA	
3000PSI CONCRETE	CF	
GIRTS	EA	
PANELING	EA	
FASTENERS	EA	

OPERATION AND MAINTENANCE

INSPECT WINDBREAK ANNUALLY AND FOLLOWING SIGNIFICANT WIND EVENTS, REPAIR AS NEEDED.

Date:
Designed:
Drawn:
Checked:
Approved:

Fabricated Livestock Windbreak
Permanent

County, Minnesota

USDA United States Department of Agriculture
Natural Resources Conservation Service

File Name
MN-ENG-0204.dwg
Eng. Job Class
5/9/2020
Sheet __ of __

Steps to implement

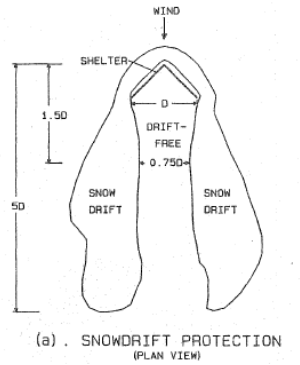
1. Animal numbers to protect
2. Determine size
3. Determine site
4. Determine exact configuration
5. Assemble design
6. Preconstruction
7. Check/Asbuilt

Protected Area

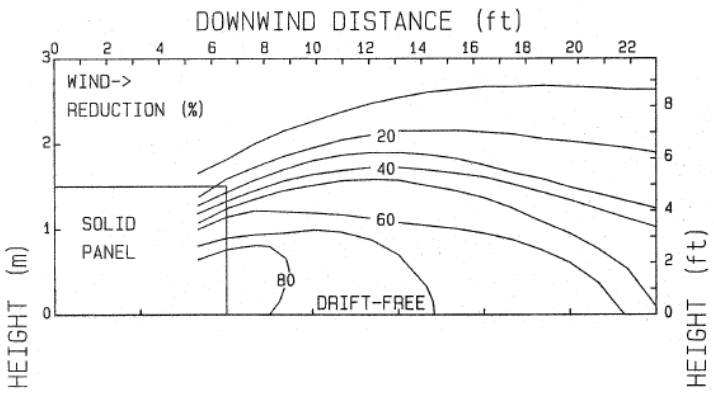
Wind speed is reduced over an area downwind.

Must provide sufficient area for livestock.

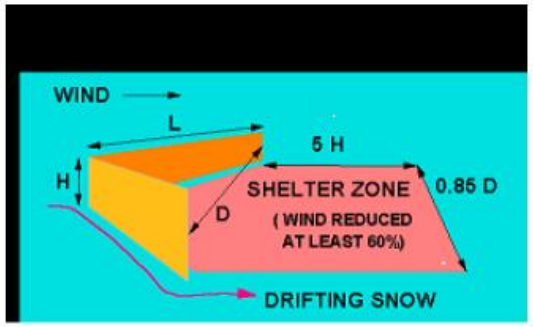
Standard drawing gives the equation shown in standard.



(a). SNOWDRIFT PROTECTION
(PLAN VIEW)



Portable Animal Protection Shelter and Wind Screen, Forest Service Jairell 1988



CPS 579

Area of Protection = Triangle Area + Square Area

Triangle Area = (L x L)/2 =$1/2L^2$

D = SQRT($2L^2$)

Square Area = (5H) x (0.85D) = 4.25HD

Adding together = $1/2L^2$ + 4.25HD. This is the equation in the standard drawings and the basis for chart in CPS 579.

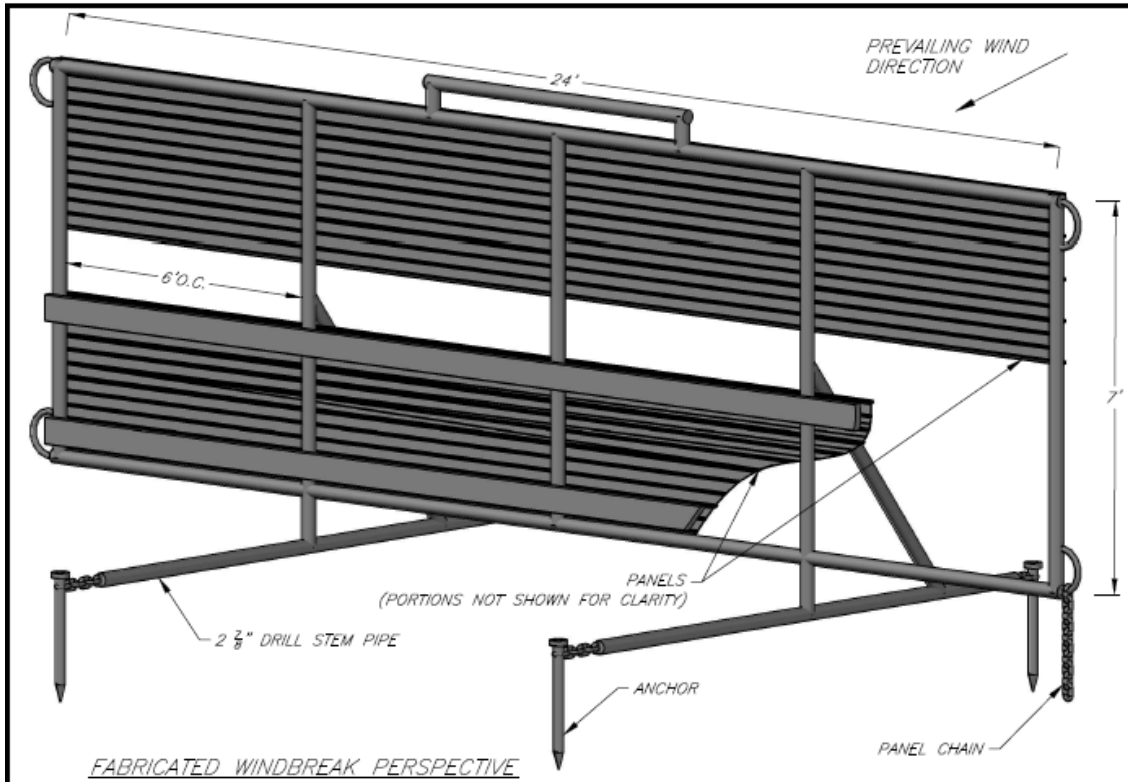
Table 3. Protected Area at Maximum Wing Length (See figure 3)

Barrier height, feet	Wing 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

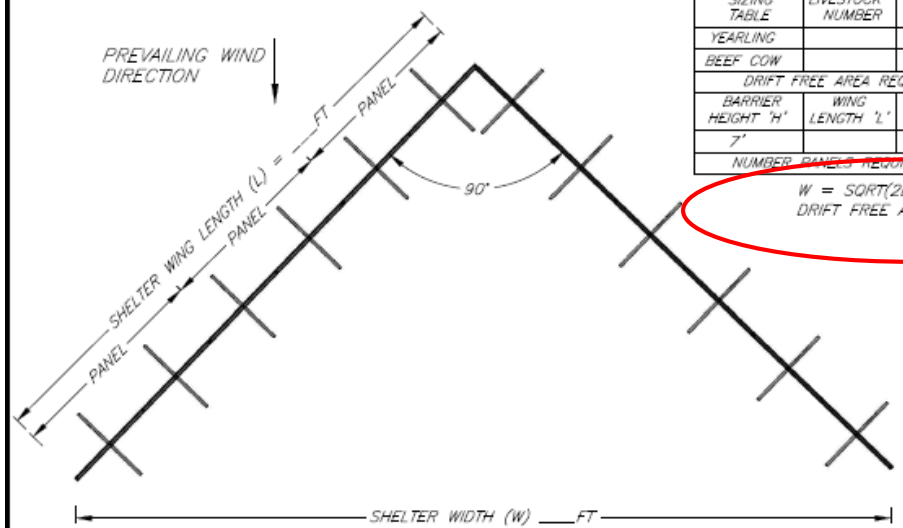
Maximum length of the wings for a V-shaped shelter structure

CPS 579

A minimum width (10H) is needed to protect from eddy currents (whirlwinds) at shelter ends. Conversely, if the shelter is too wide (15H), drifting snow is forced up, over the shelter into the protected area



FABRICATED WINDBREAK PERSPECTIVE
NOT TO SCALE

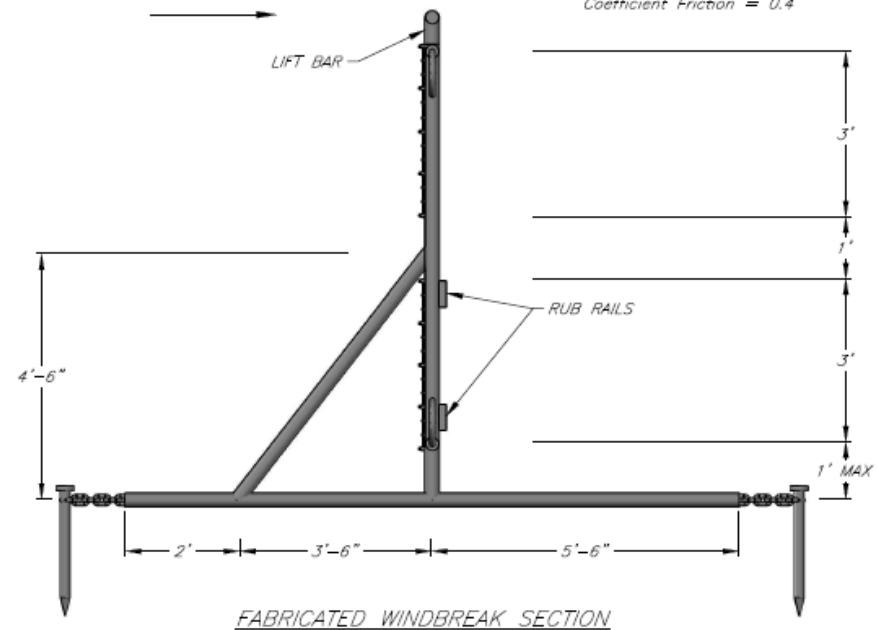


FABRICATED WINDBREAK PLAN
NOT TO SCALE

SIZING TABLE	LIVESTOCK NUMBER	AREA PER ANIMAL (SF)	AREA REQD (SF)
YEARLING		35	
BEEF COW		50	
DRIFT FREE AREA REQD (SF)			
BARRIER HEIGHT 'H'	WING LENGTH 'L'	SHELTER WIDTH 'W'	DRIFT FREE AREA (SF)
7'			
NUMBER PANELS REQUIRED (EA)			

$W = SQRT(2L^2)$, W MUST BE $\leq 15H$
DRIFT FREE AREA $= 1/2L^2 + 4.25\ WH$

PREVAILING WIND DIRECTION



FABRICATED WINDBREAK SECTION
NOT TO SCALE

Design Assumptions
Allowable Strength Design
Strength Design Wind Speed=90mph
Drill Stem Yield Strength=75ksi
Drill Stem Weight=6.1lb/lf
Coefficient Friction = 0.4

NOTES AND SPECIFICATIONS

1. PLACE PANELS IN 90° V SHAPE IN DIRECTION OF PREVAILING WINDS AS SHOWN.
2. ALL PIPE SHALL BE 2 7/8" STANDARD DRILL STEM STEEL PIPE. PIPE MUST HAVE A MINIMUM REMAINING BODY WALL OF 70% (4.91LB/LF), BE CLEAN ENOUGH TO PERMIT INSPECTION, AND REASONABLY ROUND, STRAIGHT, AND FREE FROM DEFECTS WHICH MIGHT IMPAIR PIPE STRENGTH.
3. ALL JOINTS NOTCHED AND WELDED WITH OBVIOUS STRENGTH EQUAL TO THE STRENGTH OF THE PIPE. WELDS SHALL BE CONTINUOUS, EXTEND THE FULL LENGTH OF THE JOINT, AND FREE OF SURFACE FLAWS INCLUDING CRACKS, POROSITY, AND UNFILLED CRATERS.
4. CORRUGATED "SUPERSTEEL" SHALL BE 100% SOLID, MIN. 22 GAUGE, AND GALVANIZED OR FACTORY COATED. ATTACH TO WINDWARD SIDE OF DRILL STEM WITH GALVANIZED SELF TAPPING SCREWS. RUBBER WASHERS RECOMMENDED.
5. APPROXIMATE PANEL WEIGHT 960LBS. PANELS REQUIRE ANCHORING TO PREVENT OVERTURNING AND SLIDING. MIN. 140LB PULLOUT RESISTANCE AND 450LBS SLIDING RESISTANCE PER EACH LEG TIP. ONE 3/4"ø SMOOTH STEEL PIN DRIVEN 24" PLUM INTO MEDIUM STIFF SOIL AND CHAINED TO TIP OF EACH LEG PROVIDES THESE CAPACITIES. DESIGN WINDS SPEEDS ARE AS FOLLOWS:
   - OVERTURNING WITHOUT ANCHORAGE = 65mph
   - SLIDING WITHOUT ANCHORAGE = 35mph
   - OVERTURNING WITH ANCHORAGE = 80mph
   - SLIDING WITH ANCHORAGE = 80mph
6. CHAINING PANELS TOGETHER IS RECOMMENDED FOR INCREASED OVERTURNING AND SLIDING RESISTANCE.
7. PROVIDE LIFT BAR OR ALTERNATIVE FOR MOVING PANELS.
8. OPERATIONS AND MAINTENANCE: INSPECT PANELS ANNUALLY AND AFTER SIGNIFICANT WIND EVENTS, ADJUST ANCHORING AND REPAIR AS NEEDED.

MATERIALS

ITEM	PER PANEL	TOTAL
2 7/8" STEEL DRILL STEM PIPE	119 LF	
36"Wx24'L PANELS 22GA SUPERSTEEL GALVANIZED/FACTORY PAINTED	2 EA	
SELF TAPPING SCREWS	100 CT	
2x10 WOOD RUB RAIL	48 LF	
ANCHORS 3/4"ø 24"L SMOOTH PINS	4 CT	
CHAIN	10 LF	

Date:
Designed:
Drawn
Checked:
Approved:
County, Minnesota

Fabricated Livestock Windbreak Portable

United States Department of Agriculture
Natural Resources Conservation Service

File Name
MN-ENG-029B.dwg
Eng. Job Class
4/19/2020
Sheet __ of __

Orientation

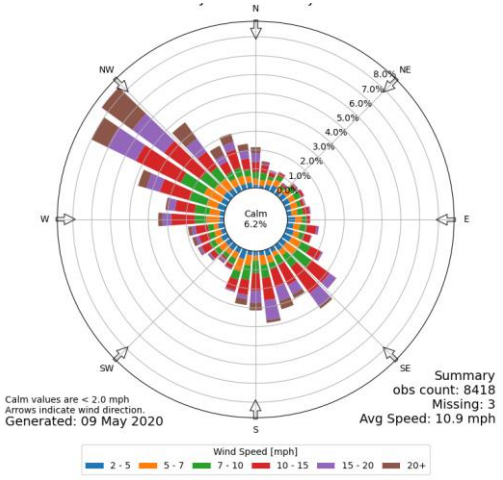
Use V shaped for sizing, siting, and layout

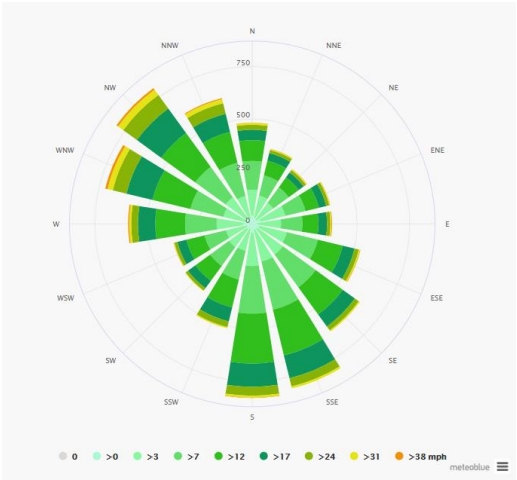
Point of V facing into the prevailing wind direction.

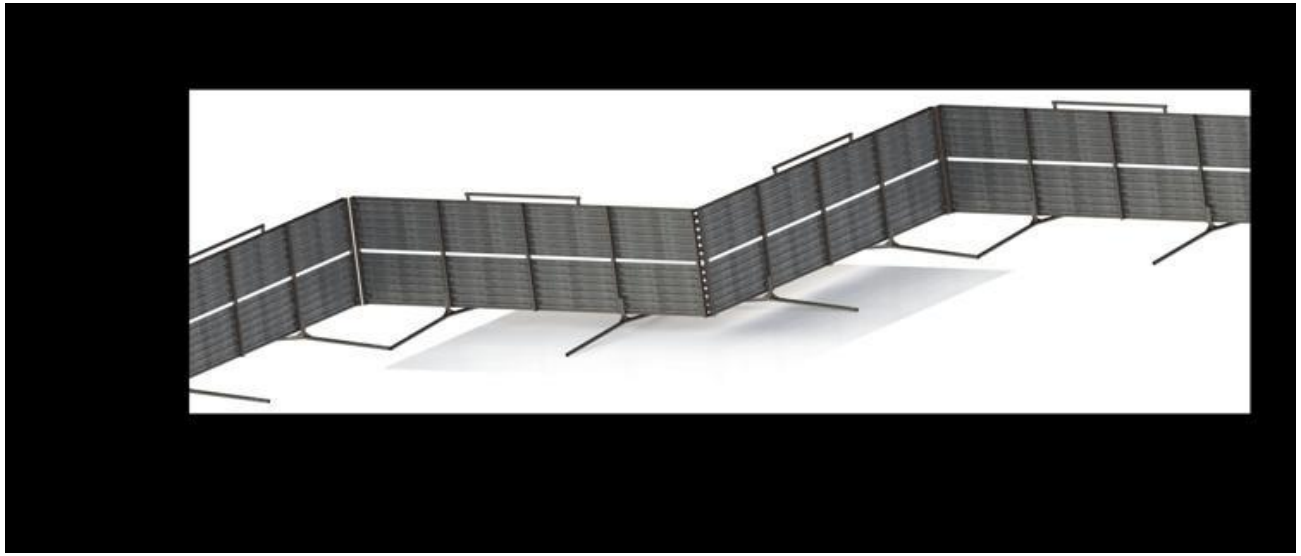
Straight-line, V shaped, or semi circular. Each orientation will protect a different size area downwind.

V is generally thought to be optimum due to balance of wind direction variability, self supporting, and area protected.

C&W Welding Dimock, SD







https://mesonet.agron.iastate.edu/sites/windrose.phtml?station=FFM&network=MN_ASOS <--------- custom wind roses!

https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/minneapolis_united-states-of-america_5037649

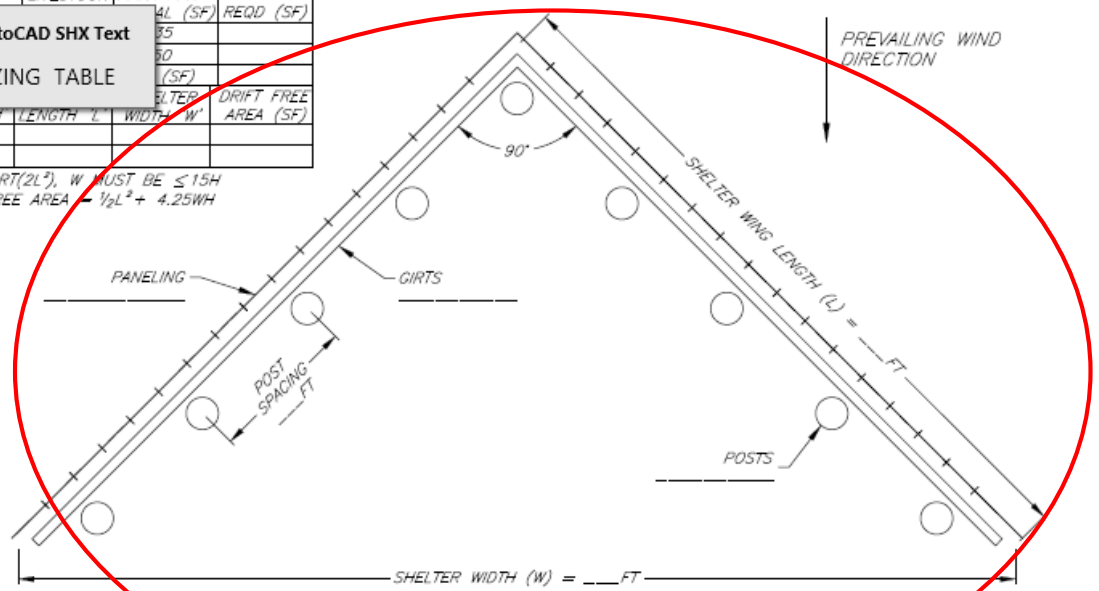
SIZING	LIVESTOCK	AREA PER	AREA
		AL (SF)	REQD (SF)
YE		35	
BE		50	
		(SF)	
B		ELTER	DRIFT FREE
HEIGHT 'H'	LENGTH 'L'	WIDTH 'W'	AREA (SF)
8'			
10'			

AutoCAD SHX Text

SIZING TABLE

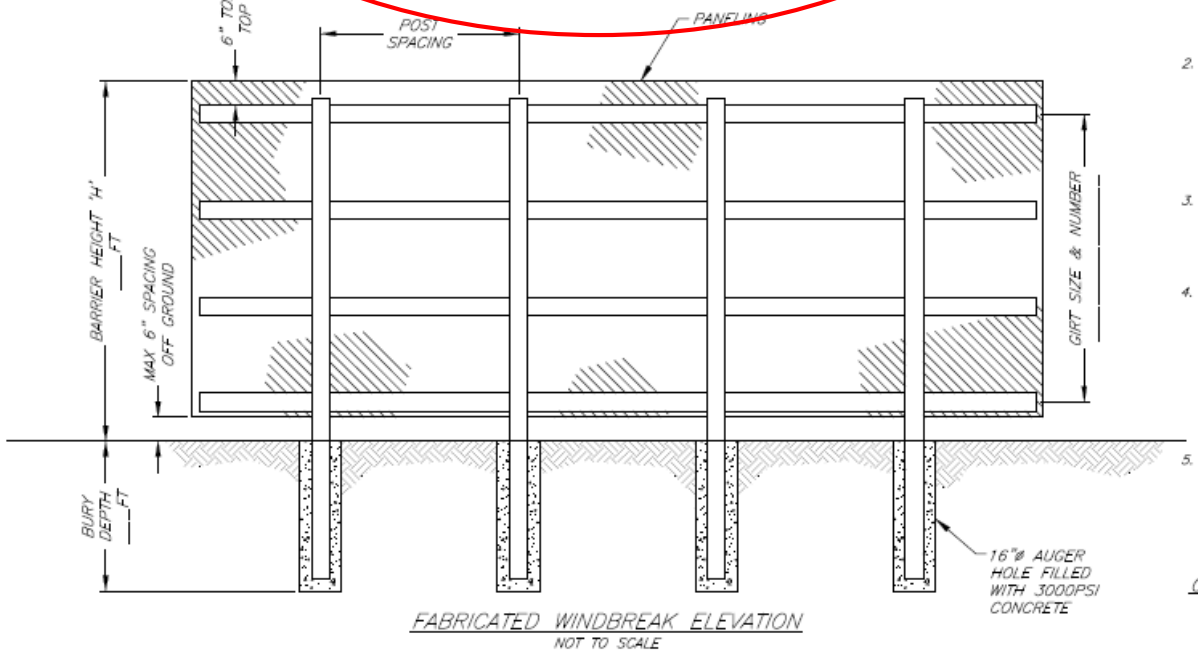
W = SQRT(2L²), W MUST BE ≤ 15H

DRIFT FREE AREA = ½L² + 4.25WH



FABRICATED WINDBREAK PLAN

NOT TO SCALE



FABRICATED WINDBREAK ELEVATION

NOT TO SCALE

POST MATERIAL, SPACING, & DEPTH SELECTION CHART

POST MATERIAL	BARRIER HEIGHT	BURY DEPTH 5' MAX POST SPACING	BURY DEPTH 6' MAX POST SPACING	BURY DEPTH 7' MAX POST SPACING
8"øWOOD	8'	8'	8'	8'
10"ø WOOD	8'	8'	12'	12'
	10'	6'	10'	10'
8"X8" WOOD	8'	8'	12'	12'
	10'	6'	6'	6'
10"X10" WOOD	8'	8'	12'	12'
	10'	6'	10'	12'
4"øSCH40	8'	6'	6'	6'
6"ø SCH40	8'	8'	12'	12'
	10'	6'	10'	10'
W5, W6	8'	8'	12'	12'
	10'	6'	10'	10'
C6, C8	8'	8'	12'	12'
	10'	6'	10'	10'

Design Assumptions:
Design Wind Speed = 90mph
Minimum Soil Unit Weight = 125pcf
f'c = 3000psi
Post, Douglas Fir No1 Fb=1200psi Fv=85psi or better
Girts, Spruce Pine Fir No1 or better
Steel, ASTM A36 Structural

MIN. GIRT SIZE AND MAX SPACING SELECTION CHART

MAX POST SPACING	BARRIER HEIGHT 10'	BARRIER HEIGHT 8'
6'	(5)–2X4@27" (4)–2X6@36" (3)–2X8@54" (5)–3"ØWood@27" (4)–4"ØWood@36" (3)–2"ØSteel@54"	(4)–2X4@28" (3)–2x6@42" (3)–3"ØWood@42" (3)–2"ØSteel@42"
8'	(6)–2X6@21" (5)–2X8@27" (4)–2X10@36" (4)–4"ØWood@36" (3)–3"ØSteel@54" (4)–2"ØSteel@36"	(5)–2X6@21" (4)–2X8@28" (3)–4"ØWood@42" (3)–2"ØSteel@42"
10'	(6)–2X8@21" (5)–2X10@27" (5)–4"ØWood@27" (3)–5"ØWood@54" (5)–2"ØSteel@27" (3)–3"ØSteel@54"	(5)–2X8@21" (4)–2X10@28" (4)–4"ØWood@28" (4)–2"ØSteel@28" (3)–3"ØSteel@42"
12'	(7)–2X10@18" (6)–2X12@21" (7)–4"ØWood@18" (4)–5"ØWood@36" (4)–3"ØSteel@36" (7)–2"ØSteel@18"	(6)–2X10@17" (5)–2x10@21" (6)–4"ØWood@17" (4)–3"ØSteel@28"

NOTES AND SPECIFICATIONS

1. PANELING SHALL BE 100% SOLID AND SHALL BE A MINIMUM NOMINAL 1" BOARDS, 28 GAUGE COATED CORRUGATED STEEL, OR 21 GAUGE CORRUGATED SUPER STEEL. PANELING SHALL BE ATTACHED TO THE WINDWARD SIDE OF THE SHELTER. IF PANEL COVERING IS 21 GAUGE CORRUGATED SUPER STEEL GIRTS NOT REQUIRED.
2. WOOD SHALL BE DOUGLAS FIR NO.1 SELECT MIN., SOUND, NEW, FREE FROM DECAY AND DISEASE DAMAGE, AND STRAIGHT NOT CRACKED OR CHECKED. POLES, POSTS, AND GIRTS SHALL BE PRESSURE TREATED TO 0.4 POUNDS PER CUBIC FOOT RETENTION. WOOD USED IN PERMANENT CONTACT WITH EARTH SHALL BE TREATED TO A RETENTION LEVEL OF AT LEAST 0.6 POUNDS PER CUBIC FOOT.
3. STEEL SHALL BE MALLEABLE, WELDABLE CARBON STEEL, AND SHALL BE GALVANIZED ACCORDING TO ASTM A123. STEEL WELDS SHALL BE HEAVY DUTY WITH OBVIOUS STRENGTH EQUAL TO THE STRENGTH OF THE STRUCTURAL STEEL.
4. NAILS SHALL BE SET FLUSH WITH SURFACE OF THE WOOD. BOLT HOLES SHALL BE DRILLED FOR SNUG FIT. HOLES FOR LAG SCREWS SHALL BE BORED WITH A BIT NOT LARGER THAN THE SHAFT OF THE SCREW AT THE BASE OF THE THREADS. WASHERS SHALL BE USED FOR BOLT HEADS AND NUTS THAT WOULD OTHERWISE BE IN CONTACT CONTACT WITH WOOD. NAILS, BOLTS, SCREWS, NUTS, WASHERS, AND OTHER HARDWARE SHALL BE AN APPROPRIATE GRADE OF STEEL AND SHALL BE GALVANIZED.
5. IF LIVESTOCK WILL HAVE ACCESS TO STRUCTURE PROVIDE RUB RAILS SUCH AS TWO 2x10 BOARDS ON THE DOWNWIND SIDE TO PROTECT STRUCTURE FROM LIVESTOCK DAMAGE.

MATERIALS

ITEM	UNIT	QUANTITY
POSTS	EA	
3000PSI CONCRETE	CF	
GIRTS	EA	
PANELING	EA	
FASTENERS	EA	

OPERATION AND MAINTENANCE

INSPECT WINDBREAK ANNUALLY AND FOLLOWING SIGNIFICANT WIND EVENTS, REPAIR AS NEEDED.

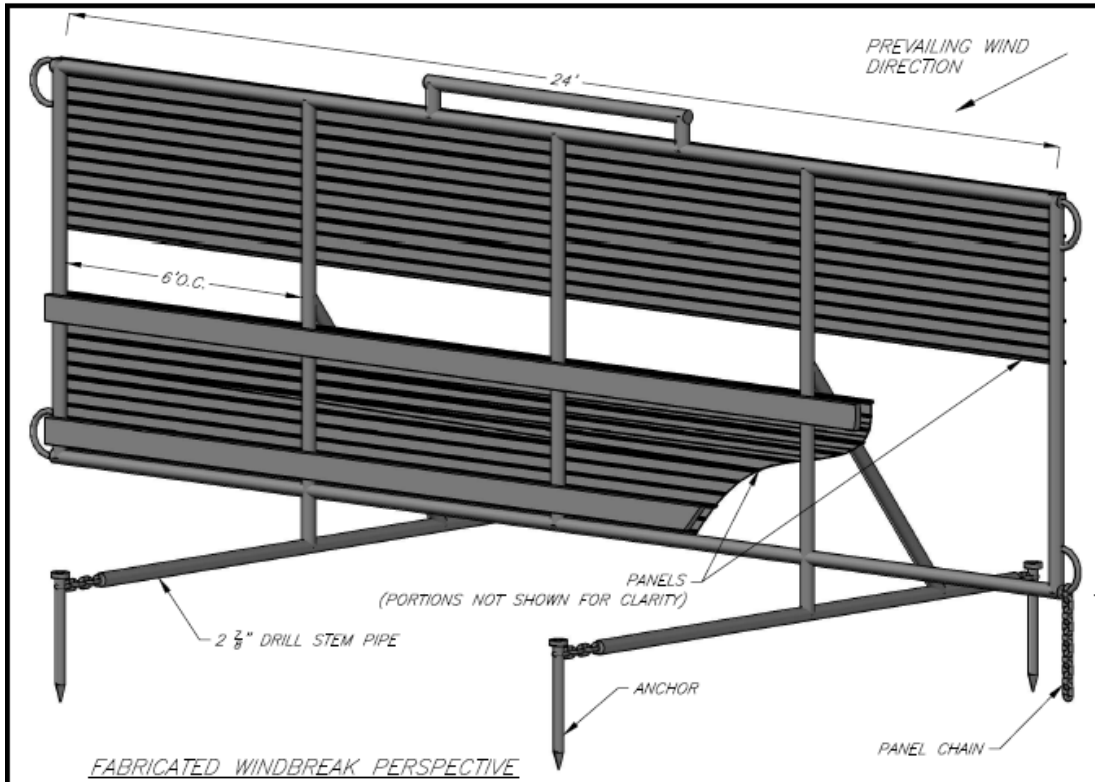
Date:
Designed:
Drawn:
Checked:
Approved:
County, Minnesota

Fabricated Livestock Windbreak

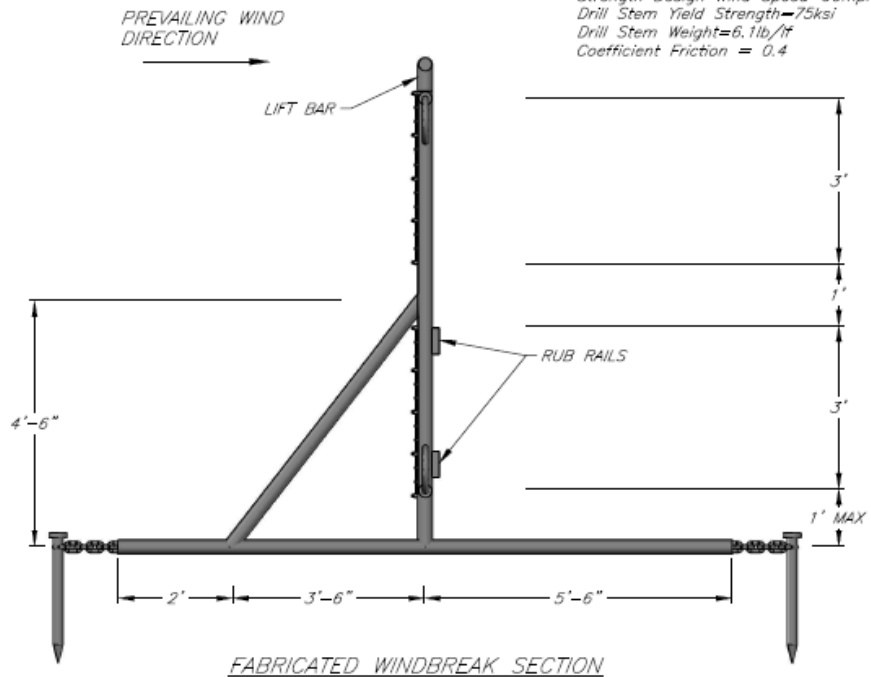
Permanent

United States Department of Agriculture
Natural Resources Conservation Service

File Name
MN–ENG–0204.dwg
Eng. Job Class
5/9/2020
Sheet ___ of ___

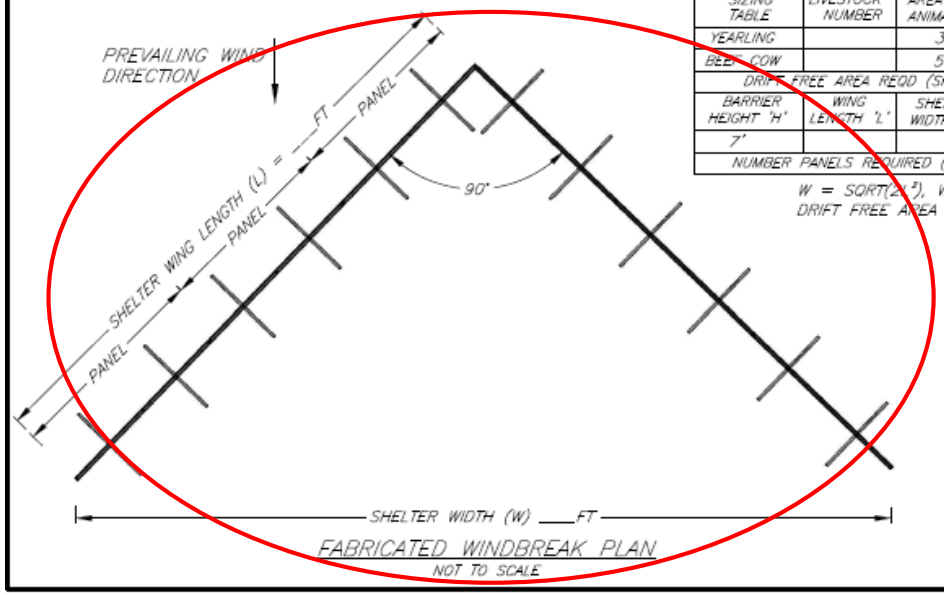


FABRICATED WINDBREAK PERSPECTIVE
NOT TO SCALE



FABRICATED WINDBREAK SECTION
NOT TO SCALE

Design Assumptions
Allowable Strength Design
Strength Design Wind Speed=90mph
Drill Stem Yield Strength=75ksi
Drill Stem Weight=6.1lb/lf
Coefficient Friction = 0.4



FABRICATED WINDBREAK PLAN
NOT TO SCALE

SIZING TABLE	LIVESTOCK NUMBER	AREA PER ANIMAL (SF)	AREA REQD (SF)
YEARLING		35	
BEEF COW		50	
DRIFT FREE AREA REQD (SF)			
BARRIER HEIGHT 'H'	WING LENGTH 'L'	SHELTER WIDTH 'W'	DRIFT FREE AREA (SF)
7'			
NUMBER PANELS REQUIRED (CT)			

$W = SQRT(2L^2)$, W MUST BE $\leq 15H$
DRIFT FREE AREA = $\frac{1}{2}L^2 + 4.25\ WH$

NOTES AND SPECIFICATIONS

1. PLACE PANELS IN 90° V SHAPE IN DIRECTION OF PREVAILING WINDS AS SHOWN.
2. ALL PIPE SHALL BE 2 ⅞" STANDARD DRILL STEM STEEL PIPE. PIPE MUST HAVE A MINIMUM REMAINING BODY WALL OF 70% (4.91LB/LF), BE CLEAN ENOUGH TO PERMIT INSPECTION, AND REASONABLY ROUND, STRAIGHT, AND FREE FROM DEFECTS WHICH MIGHT IMPAIR PIPE STRENGTH.
3. ALL JOINTS NOTCHED AND WELDED WITH OBVIOUS STRENGTH EQUAL TO THE STRENGTH OF THE PIPE. WELDS SHALL BE CONTINUOUS, EXTEND THE FULL LENGTH OF THE JOINT, AND FREE OF SURFACE FLAWS INCLUDING CRACKS, POROSITY, AND UNFILLED CRATERS.
4. CORRUGATED "SUPERSTEEL" SHALL BE 100% SOLID, MIN. 22 GAUGE, AND GALVANIZED OR FACTORY COATED. ATTACH TO WINDWARD SIDE OF DRILL STEM WITH GALVANIZED SELF TAPPING SCREWS. RUBBER WASHERS RECOMMENDED.
5. APPROXIMATE PANEL WEIGHT 960LBS. PANELS REQUIRE ANCHORING TO PREVENT OVERTURNING AND SLIDING, MIN. 140LB PULLOUT RESISTANCE AND 450LBS SLIDING RESISTANCE PER EACH LEG TIP. ONE ¾"ø SMOOTH STEEL PIN DRIVEN 24" PLUM INTO MEDIUM STIFF SOIL AND CHAINED TO TIP OF EACH LEG PROVIDES THESE CAPACITIES. DESIGN WINDS SPEEDS ARE AS FOLLOWS:
   - OVERTURNING WITHOUT ANCHORAGE = 65mph
   - SLIDING WITHOUT ANCHORAGE = 35mph
   - OVERTURNING WITH ANCHORAGE = 80mph
   - SLIDING WITH ANCHORAGE = 80mph
6. CHAINING PANELS TOGETHER IS RECOMMENDED FOR INCREASED OVERTURNING AND SLIDING RESISTANCE.
7. PROVIDE LIFT BAR OR ALTERNATIVE FOR MOVING PANELS.
8. OPERATIONS AND MAINTENANCE: INSPECT PANELS ANNUALLY AND AFTER SIGNIFICANT WIND EVENTS; ADJUST ANCHORING AND REPAIR AS NEEDED.

MATERIALS

ITEM	PER PANEL	TOTAL
2 ⅞" STEEL DRILL STEM PIPE	119 LF	
36"Wx24'L PANELS 22GA SUPERSTEEL GALVANIZED/FACTORY PAINTED	2 EA	
SELF TAPPING SCREWS	100 CT	
2x10 WOOD RUB RAIL	48 LF	
ANCHORS ¾"ø 24"L SMOOTH PINS	4 CT	
CHAIN	10 LF	

Date
Designed:
Drawn:
Checked:
Approved:

Fabricated Livestock Windbreak
Portable

County, Minnesota

United States Department of Agriculture
USDA
Natural Resources Conservation Service

File Name
MN-ENG-0298.dwg
Eng. Job Class
4/19/2020
Sheet ___ of ___

Porosity

Ratio of open panel space to total panel space. If porosity is too high drifting can occur where livestock are located. Portable has 14% porosity, Permanent has none. Recommended no more than 20% porosity.

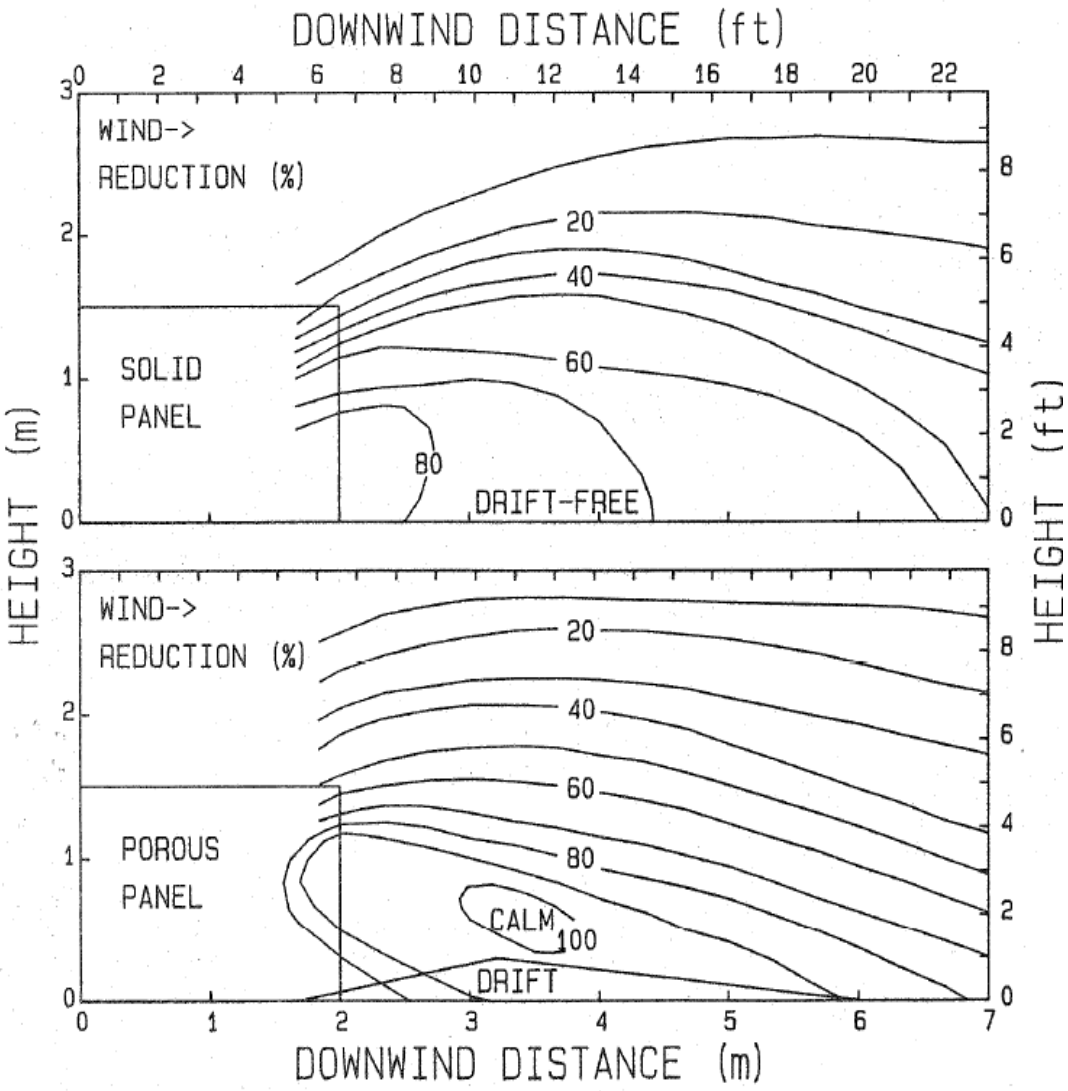


Figure 4. Reduction in mean wind speed is greatest behind the porous covering, but a small snowdrift developed in the protection area.

Portable Animal Protection Shelter and Wind Screen, Forest Service Jairell 1988


Pursuit
8372

SIZING	LIVESTOCK	AREA PER ANIMAL (SF)	AREA REQD (SF)
YEARLING		35	
BEEF		50	
		(SF)	

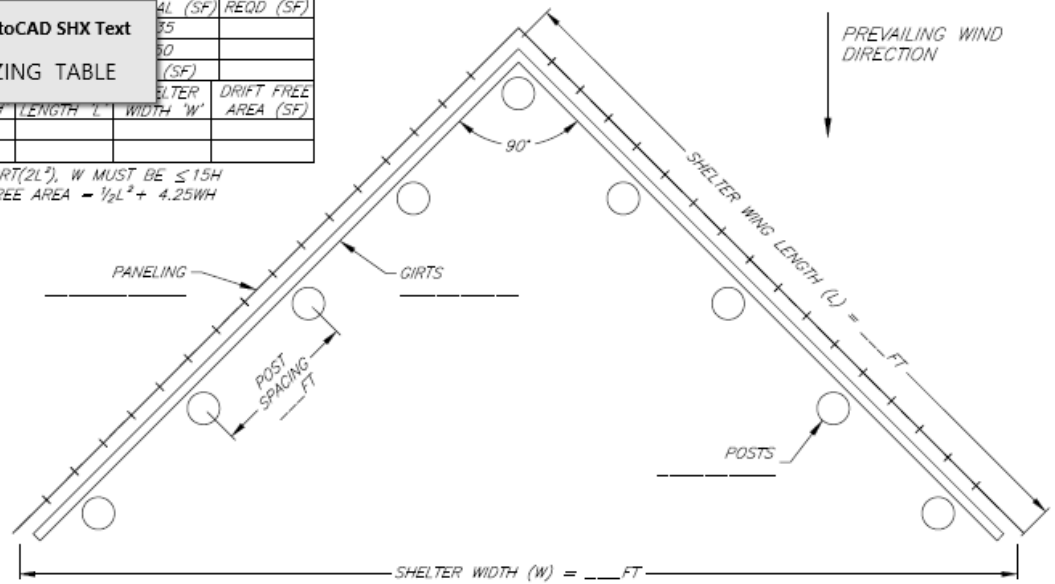
BARRIER HEIGHT 'H'	SHELTER LENGTH 'L'	SHELTER WIDTH 'W'	DRIFT FREE AREA (SF)
8'			
10'			

W = SQRT(2L²), W MUST BE ≤ 15H

DRIFT FREE AREA = $\frac{1}{2}L^2 + 4.25WH$

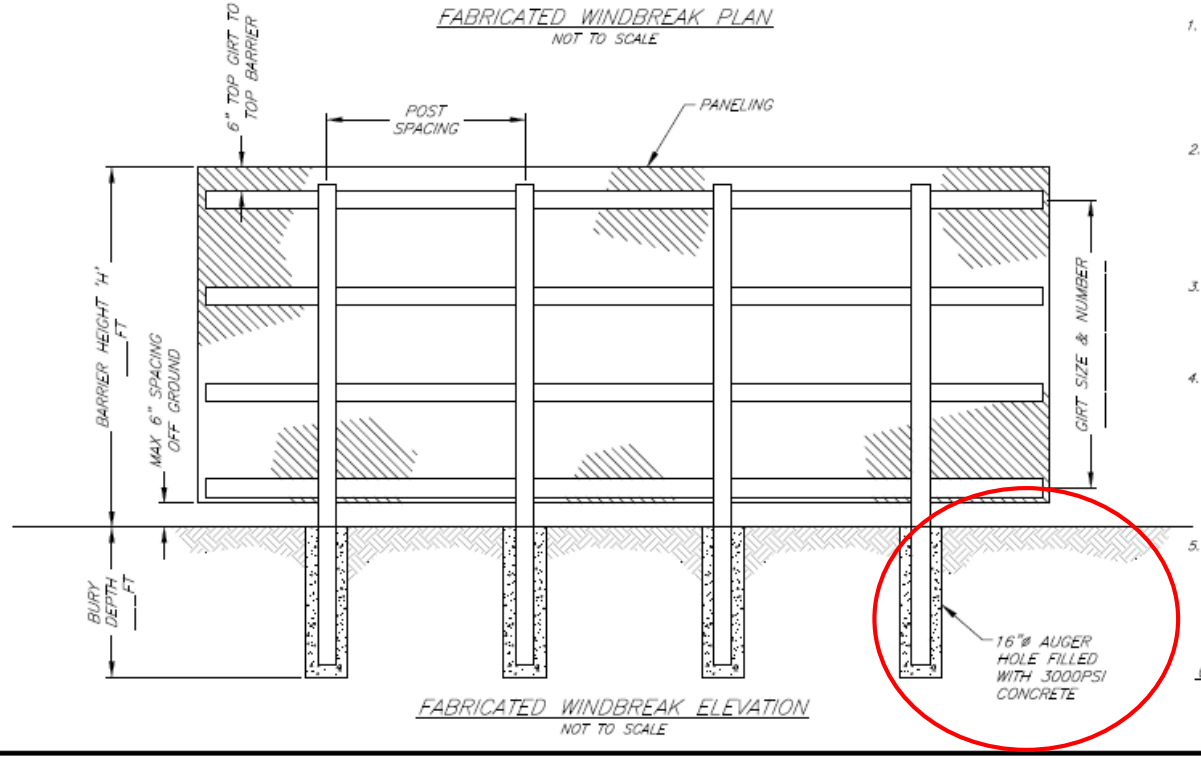
AutoCAD SHX Text

SIZING TABLE



FABRICATED WINDBREAK PLAN

NOT TO SCALE



FABRICATED WINDBREAK ELEVATION

NOT TO SCALE

POST MATERIAL, SPACING, & DEPTH SELECTION CHART

POST MATERIAL	BARRIER HEIGHT	BURY DEPTH 5' MAX POST SPACING	BURY DEPTH 6' MAX POST SPACING	BURY DEPTH 7' MAX POST SPACING
8"øWOOD	8'	8'	8'	8'
10"ø WOOD	8'	8'	12'	12'
	10'	6'	10'	10'
8"X8" WOOD	8'	8'	12'	12'
	10'	6'	6'	6'
10"X10" WOOD	8'	8'	12'	12'
	10'	6'	10'	12'
4"øSCH40	8'	6'	6'	6'
6"ø SCH40	8'	8'	12'	12'
	10'	6'	10'	10'
W5, W6	8'	8'	12'	12'
	10'	6'	10'	10'
C6, C8	8'	8'	12'	12'
	10'	6'	10'	10'

Design Assumptions:
Design Wind Speed = 90mph
Minimum Soil Unit Weight = 125pcf
f'c = 3000psi
Post, Douglas Fir No1 Fb=1200psi Fv=85psi or better
Girts, Spruce Pine Fir No1 or better
Steel, ASTM A36 Structural

MIN. GIRT SIZE AND MAX SPACING SELECTION CHART

MAX POST SPACING	BARRIER HEIGHT 10'	BARRIER HEIGHT 8'
6'	(5)–2X4@27" (4)–2X6@36" (3)–2X8@54" (5)–3"ØWood@27" (4)–4"ØWood@36" (3)–2"ØSteel@54"	(4)–2X4@28" (3)–2x6@42" (3)–3"ØWood@42" (3)–2"ØSteel@42"
8'	(6)–2X6@21" (5)–2X8@27" (4)–2X10@36" (4)–4"ØWood@36" (3)–3"ØSteel@54" (4)–2"ØSteel@36"	(5)–2X6@21" (4)–2X8@28" (3)–4"ØWood@42" (3)–2"ØSteel@42"
10'	(6)–2X8@21" (5)–2X10@27" (5)–4"ØWood@27" (3)–5"ØWood@54" (5)–2"ØSteel@27" (3)–3"ØSteel@54"	(5)–2X8@21" (4)–2X10@28" (4)–4"ØWood@28" (4)–2"ØSteel@28" (3)–3"ØSteel@42"
12'	(7)–2X10@18" (6)–2X12@21" (7)–4"ØWood@18" (4)–5"ØWood@36" (4)–3"ØSteel@36" (7)–2"ØSteel@18"	(6)–2X10@17" (5)–2x10@21" (6)–4"ØWood@17" (4)–3"ØSteel@28"

NOTES AND SPECIFICATIONS

1. PANELING SHALL BE 100% SOLID AND SHALL BE A MINIMUM NOMINAL 1" BOARDS, 28 GAUGE COATED CORRUGATED STEEL, OR 21 GAUGE CORRUGATED SUPER STEEL. PANELING SHALL BE ATTACHED TO THE WINDWARD SIDE OF THE SHELTER. IF PANEL COVERING IS 21 GAUGE CORRUGATED SUPER STEEL GIRTS NOT REQUIRED.
2. WOOD SHALL BE DOUGLAS FIR NO.1 SELECT MIN., SOUND, NEW, FREE FROM DECAY AND DISEASE DAMAGE, AND STRAIGHT NOT CRACKED OR CHECKED. POLES, POSTS, AND GIRTS SHALL BE PRESSURE TREATED TO 0.4 POUNDS PER CUBIC FOOT RETENTION. WOOD USED IN PERMANENT CONTACT WITH EARTH SHALL BE TREATED TO A RETENTION LEVEL OF AT LEAST 0.6 POUNDS PER CUBIC FOOT.
3. STEEL SHALL BE MALLEABLE, WELDABLE CARBON STEEL, AND SHALL BE GALVANIZED ACCORDING TO ASTM A123. STEEL WELDS SHALL BE HEAVY DUTY WITH OBVIOUS STRENGTH EQUAL TO THE STRENGTH OF THE STRUCTURAL STEEL.
4. NAILS SHALL BE SET FLUSH WITH SURFACE OF THE WOOD. BOLT HOLES SHALL BE DRILLED FOR SNUG FIT. HOLES FOR LAG SCREWS SHALL BE BORED WITH A BIT NOT LARGER THAN THE SHAFT OF THE SCREW AT THE BASE OF THE THREADS. WASHERS SHALL BE USED FOR BOLT HEADS AND NUTS THAT WOULD OTHERWISE BE IN CONTACT CONTACT WITH WOOD. NAILS, BOLTS, SCREWS, NUTS, WASHERS, AND OTHER HARDWARE SHALL BE AN APPROPRIATE GRADE OF STEEL AND SHALL BE GALVANIZED.
5. IF LIVESTOCK WILL HAVE ACCESS TO STRUCTURE PROVIDE RUB RAILS SUCH AS TWO 2x10 BOARDS ON THE DOWNWIND SIDE TO PROTECT STRUCTURE FROM LIVESTOCK DAMAGE.

MATERIALS

ITEM	UNIT	QUANTITY
POSTS	EA	
3000PSI CONCRETE	CF	
GIRTS	EA	
PANELING	EA	
FASTENERS	EA	

OPERATION AND MAINTENANCE

INSPECT WINDBREAK ANNUALLY AND FOLLOWING SIGNIFICANT WIND EVENTS, REPAIR AS NEEDED.

Date:
Designed:
Drawn:
Checked:
Approved:

County, Minnesota

Fabricated Livestock Windbreak

Permanent

United States Department of Agriculture

Natural Resources Conservation Service

File Name

MN-ENG-0294.dwg

Eng. Job Class

5/9/2020

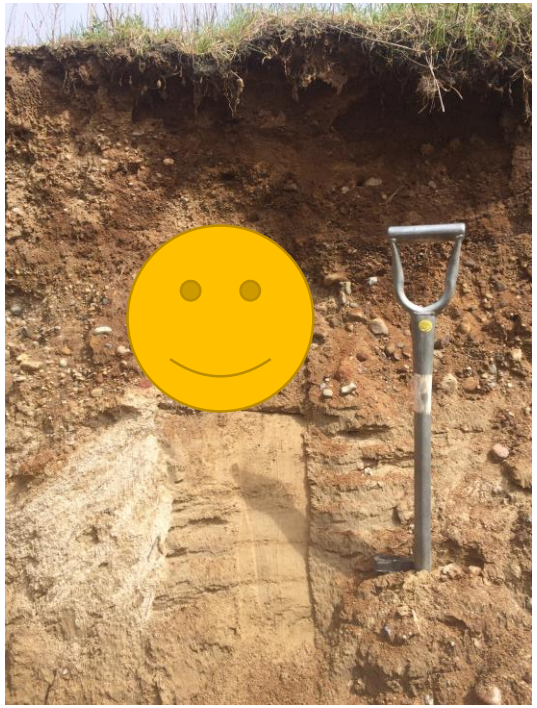
Sheet ___ of ___

Permeant Posts

Post are embedded in concrete, 16” dia. auger hole.

Post depth depends on height of windbreak and spacing between posts. Use drawing chart.

Soils need to be strong enough so they will be able to “hold” the posts in place and prevent them from tilting under wind forces. 125lb/cf unit weight required for standard drawings. Want drained and coarse soils. No mucks, marls, soft clays.



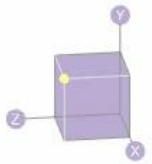
Structural Design

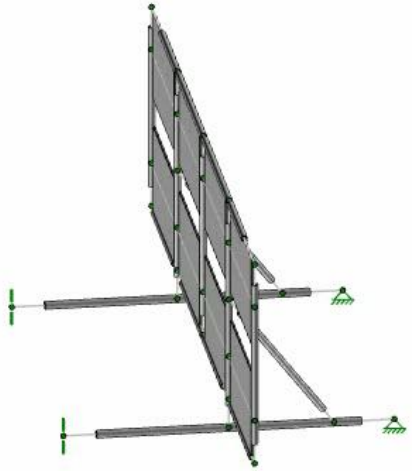
Wind speed>pressure>pressure collected by the panels>panels transfer it to the verts> girts>posts>soil.

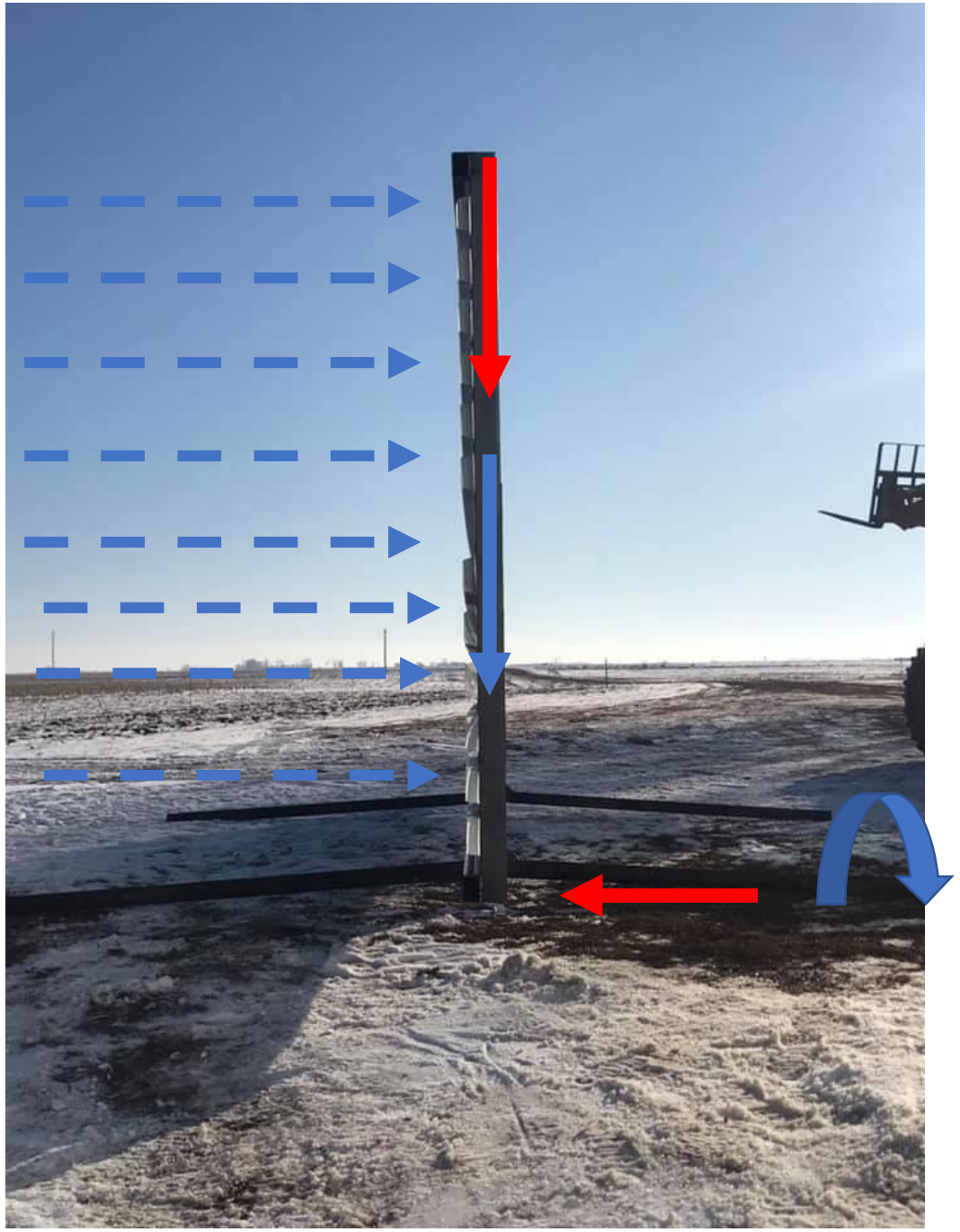
Posts, verticals, girts, braces are checked to see they will not break under design wind load. Mc/I<0.6Fy

Structural members designed for 90mph design speed.

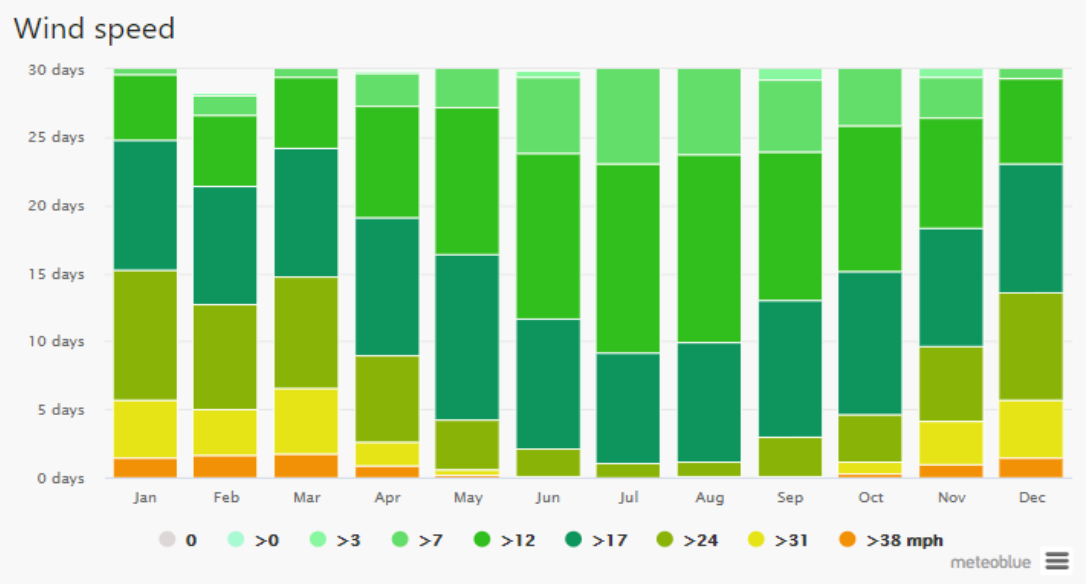
Portable windbreaks are additionally checked for sliding and overturning at design wind speeds. M=0, Fx=0







How much wind speed do we need to design for?

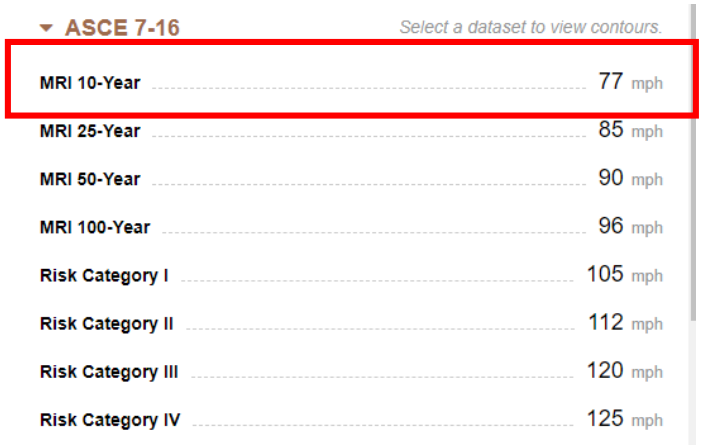


Number of Days With Wind Speeds Higher than X, Bruce MN

Summary

Temperature (° F)	Max	Average	Min
Max Temperature	37	26.06	1
Avg Temperature	32.47	18.49	-4.68
Min Temperature	32	9.03	-15
Dew Point (° F)	**Max**	**Average**	**Min**
Dew Point	32	14.12	-22
Precipitation (Inches)	**Max**	**Average**	**Min**	**Sum**
Precipitation	0.00	0.00	0.00	0.00
Snowdepth	0.00	0.00	0.00	0.00
Wind	**Max**	**Average**	**Min**
Wind	36	8.52	0
Gust Wind	45	4.41	0
Sea Level Pressure	**Max**	**Average**	**Min**
Sea Level Pressure	29.26	28.54	27.8

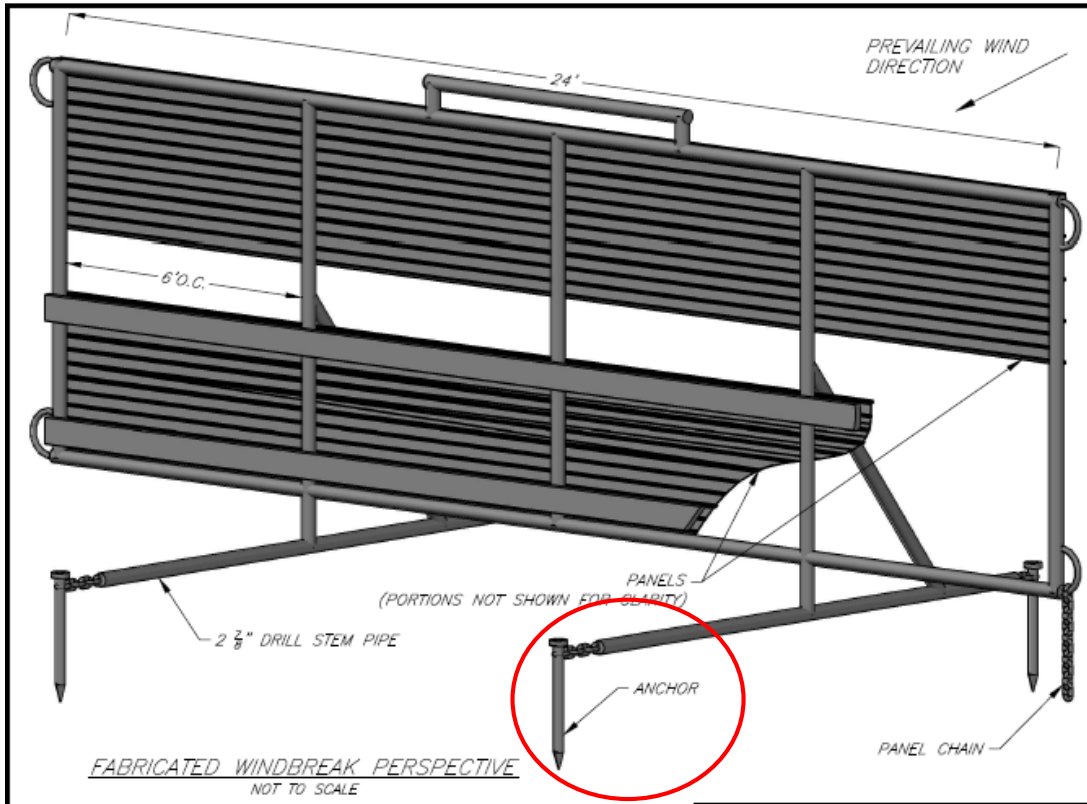
January 2020 Wind Speed Data, Bruce MN



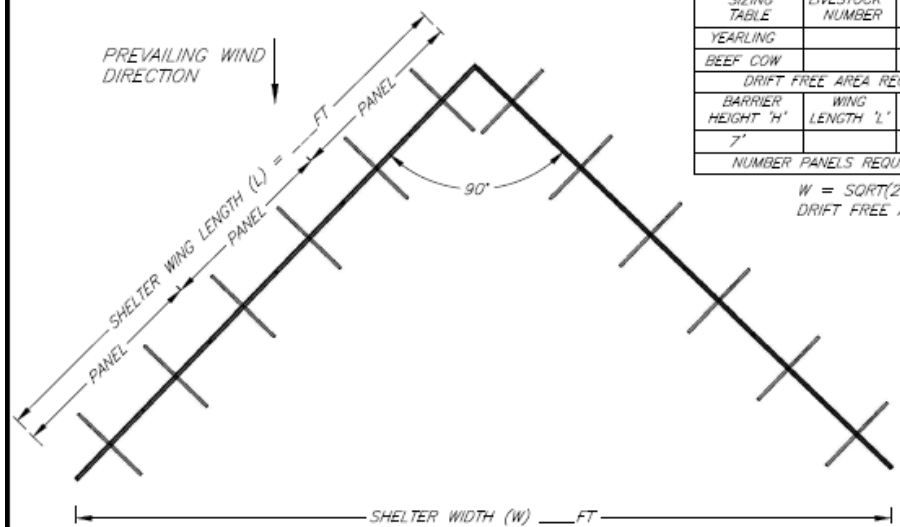
Wind Speeds Return Interval for Minnesota

In summary,

- Wind speeds greater than 30mph routinely occur each month.
- 10 year wind speed in 77mph. 10% of annual exceedance, 65% 10yr exceedance.
- Very heavy portable windbreak required for 77mph.
- Reconcile providing a windbreak that will last for the practice lifespan and won't injure livestock, but doesn't take a D5 dozer to pull around?



FABRICATED WINDBREAK PERSPECTIVE
NOT TO SCALE

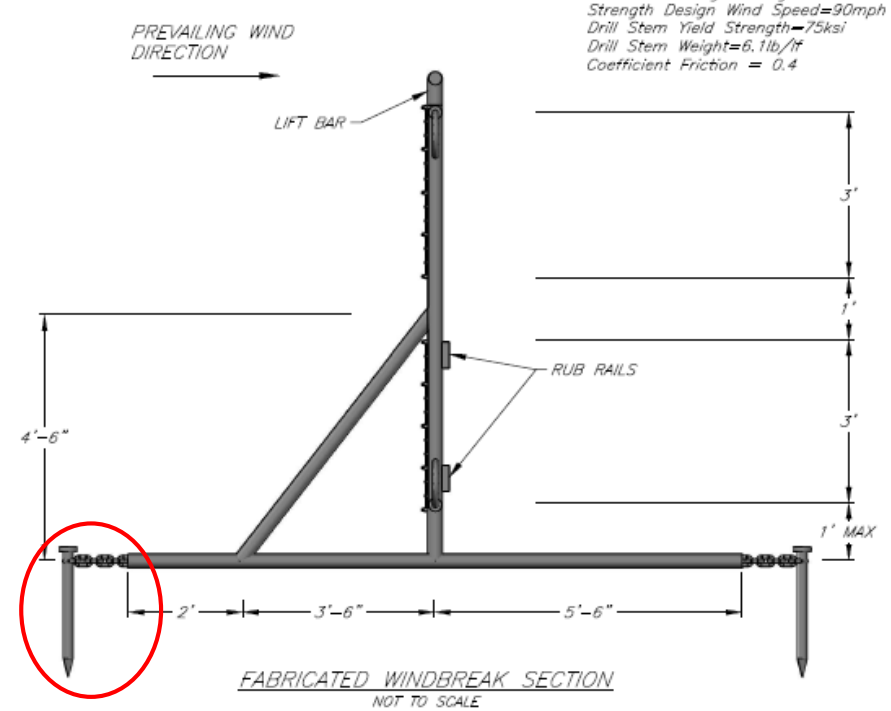


FABRICATED WINDBREAK PLAN
NOT TO SCALE

SIZING TABLE	LIVESTOCK NUMBER	AREA PER ANIMAL (SF)	AREA REQD (SF)
YEARLING		35	
BEEF COW		50	
DRIFT FREE AREA REQD (SF)			
BARRIER HEIGHT 'H'	WING LENGTH 'L'	SHELTER WIDTH 'W'	DRIFT FREE AREA (SF)
7'			
NUMBER PANELS REQUIRED (CT)			

$W = SQRT(2L^2)$, W MUST BE $\leq 15H$
DRIFT FREE AREA = $1/2L^2 + 4.25\ WH$

Design Assumptions
Allowable Strength Design
Strength Design Wind Speed=90mph
Drill Stem Yield Strength=75ksi
Drill Stem Weight=6.1lb/lf
Coefficient Friction = 0.4



FABRICATED WINDBREAK SECTION
NOT TO SCALE

NOTES AND SPECIFICATIONS

1. PLACE PANELS IN 90° V SHAPE IN DIRECTION OF PREVAILING WINDS AS SHOWN.
2. ALL PIPE SHALL BE 2 3/8" STANDARD DRILL STEM STEEL PIPE. PIPE MUST HAVE A MINIMUM REMAINING BODY WALL OF 70% (4.91LB/LF), BE CLEAN ENOUGH TO PERMIT INSPECTION, AND REASONABLY ROUND, STRAIGHT, AND FREE FROM DEFECTS WHICH MIGHT IMPAIR PIPE STRENGTH.
3. ALL JOINTS NOTCHED AND WELDED WITH OBVIOUS STRENGTH EQUAL TO THE STRENGTH OF THE PIPE. WELDS SHALL BE CONTINUOUS, EXTEND THE FULL LENGTH OF THE JOINT, AND FREE OF SURFACE FLAWS INCLUDING CRACKS, POROSITY, AND UNFILLED CRATERS.
4. CORRUGATED "SUPERSTEEL" SHALL BE 100% SOLID, MIN. 22 GAUGE, AND GALVANIZED OR FACTORY COATED. ATTACH TO WINDWARD SIDE OF DRILL STEM WITH GALVANIZED SELF TAPPING SCREWS. RUBBER WASHERS RECOMMENDED.
5. APPROXIMATE PANEL WEIGHT 960LBS. PANELS REQUIRE ANCHORING TO PREVENT OVERTURNING AND SLIDING, MIN. 140LB PULLOUT RESISTANCE AND 450LBS SLIDING RESISTANCE PER EACH LEG TIP. ONE 1/2"ø SMOOTH STEEL PIN DRIVEN 24" PLUM INTO MEDIUM STIFF SOIL AND CHAINED TO TIP OF EACH LEG PROVIDES THESE CAPACITIES. DESIGN WINDS SPEEDS ARE AS FOLLOWS:
   - OVERTURNING WITHOUT ANCHORAGE = 65mph
   - SLIDING WITHOUT ANCHORAGE = 35mph
   - OVERTURNING WITH ANCHORAGE = 80mph
   - SLIDING WITH ANCHORAGE = 80mph
6. CHAINING PANELS TOGETHER IS RECOMMENDED FOR INCREASED OVERTURNING AND SLIDING RESISTANCE.
7. PROVIDE LIFT BAR OR ALTERNATIVE FOR MOVING PANELS.
8. OPERATIONS AND MAINTENANCE: INSPECT PANELS ANNUALLY AND AFTER SIGNIFICANT WIND EVENTS; ADJUST ANCHORING AND REPAIR AS NEEDED.

MATERIALS

ITEM	PER PANEL	TOTAL
2 3/8" STEEL DRILL STEM PIPE	119 LF	
36"Wx24'L PANELS 22GA SUPERSTEEL GALVANIZED/FACTORY PAINTED	2 EA	
SELF TAPPING SCREWS	100 CT	
2x10 WOOD RUB RAIL	48 LF	
ANCHORS 1/2"ø 24"L SMOOTH PINS	4 CT	
CHAIN	10 LF	

Date
Designed:
Drawn:
Checked:
Approved:

Fabricated Livestock Windbreak
Portable

County, Minnesota

United States Department of Agriculture
USDA
Natural Resources Conservation Service

File Name
MN-ENG-0298.dwg

Eng. Job Class

4/19/2020

Sheet ___ of ___

Portable Staking (Anchors)

Likely that during a year the design wind speeds will be exceeded for unanchored portable windbreaks. Concern for risk to stock, placement near roads, property lines, structures, use in high wind advisories.

To approach this issue there are two sets of design speeds, on unanchored and one anchored. Producer is made aware of design limitations and is prepared to manage the risk to stock and structure.

“APPROXIMATE PANEL WEIGHT 960LBS. PANELS REQUIRE ANCHORING TO PREVENT OVERTURNING AND SLIDING, MIN. 140LB PULLOUT RESISTANCE AND 450LBS SLIDING RESISTANCE PER EACH LEG TIP. ONE SMOOTH STEEL PIN DRIVEN 24” PLUM INTO MEDIUM STIFF SOIL AND CHAINED TO TIP OF EACH LEG PROVIDES THESE CAPACITIES. DESIGN WINDS SPEEDS ARE AS FOLLOWS:”

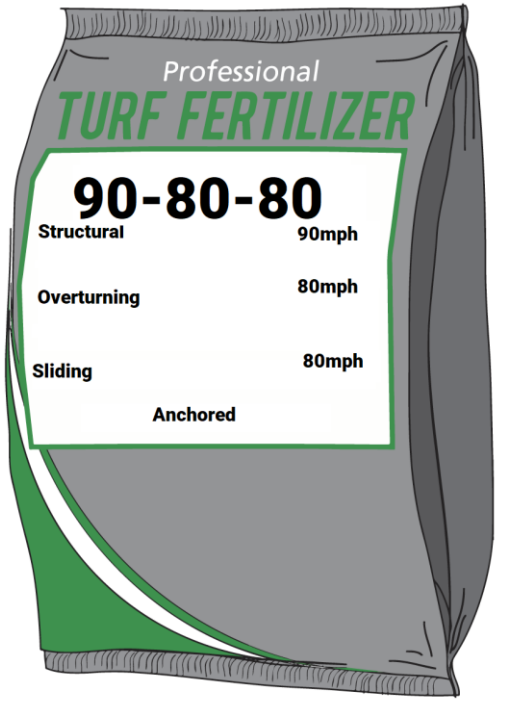
OVERTURING WITHOUT ANCHORAGE = 65MPH

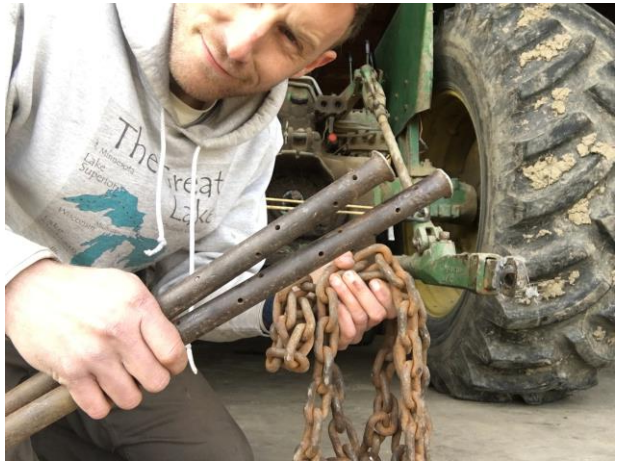
SLIDING WITHOUT ANCHROAGE = 33MPH

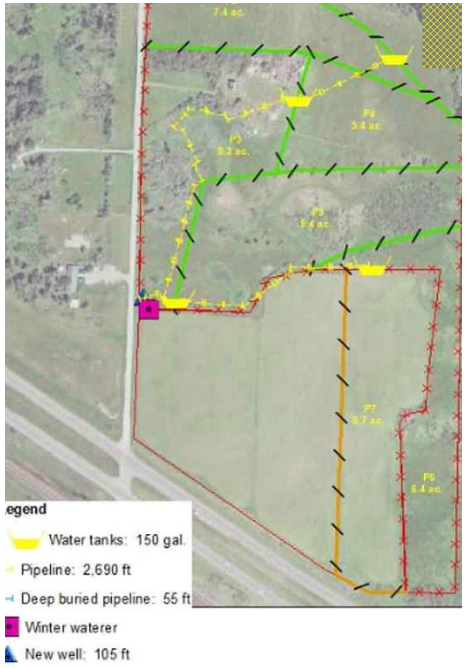
OVERTURING WITH ANCHORAGE = 80MPH

SLIDING WITH ANCHROAGE = 80MPH

Chain and anchors are part of the standard drawing and required to be on hand when asbuilting. Four ½” diameter 2’ stakes. “Rebar pins”, “outdoor party tent stakes.” ($25-100/per panel)

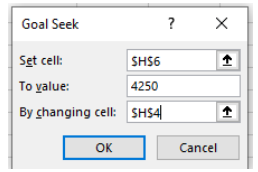


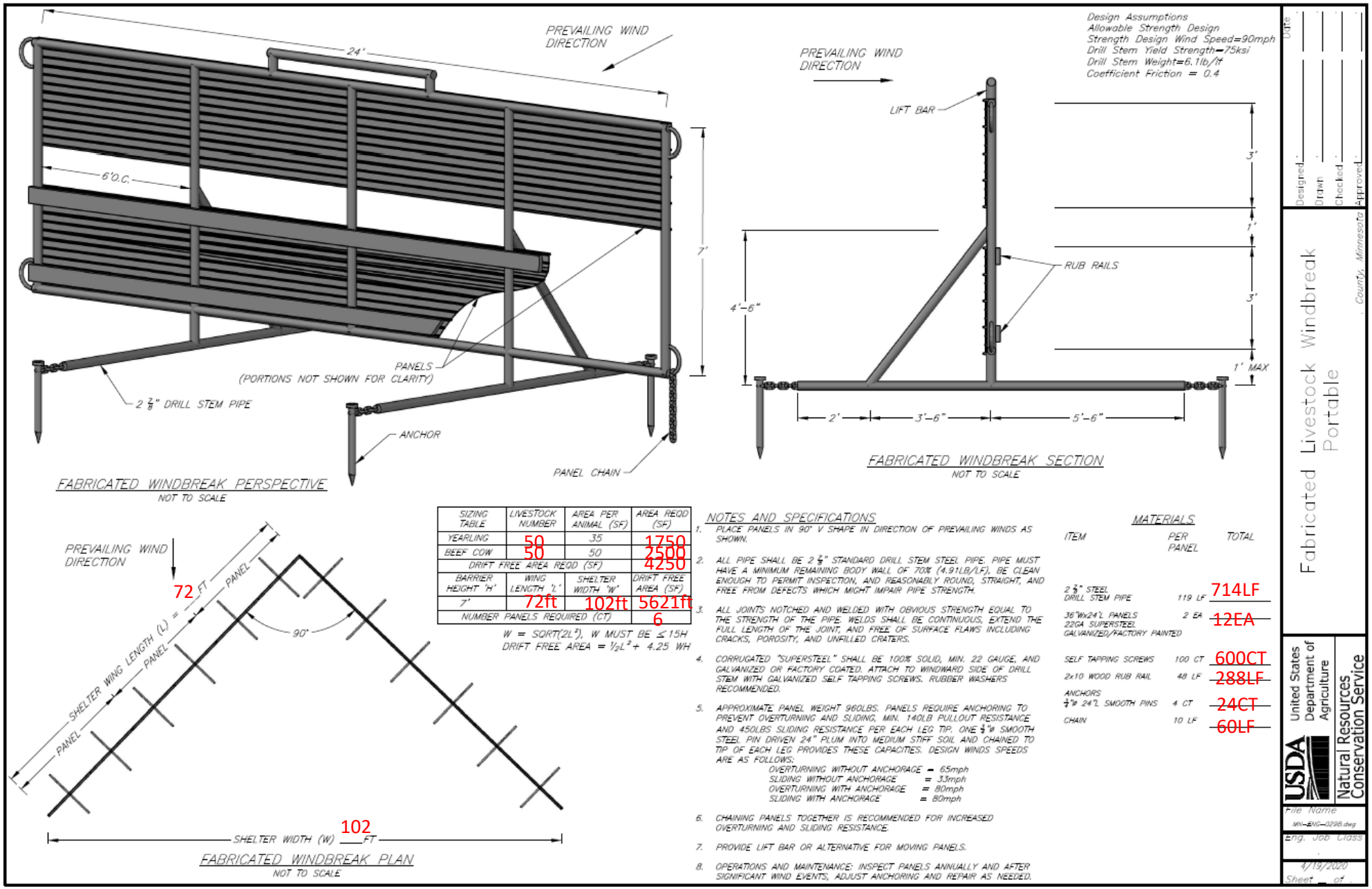




Example 50cow/calf pair portable

1. 50 cow @ 50sf/cow(std) = 2500sf required
2. 50 calf @ 35sf/cow(std) = 1750sf required
3. 2500sf + 1750sf = 4250sf required.
4. Pick an L and calculate area provided, keep trying until you provide at least the area required
    1. Let L = 30', W = SQRT($2L^2$) = 42.4', check W<15H (std) 42.4'< 105' yes it is!
    2. H = 7', cannot change panel height but can have up to a 1' max ground gap. Recommend use 7' for consistency.
    3. Drift free area = 1/2L2 + 4.25HD = 1/2(42.4')2 + 4.25(42.4')(7') = 1712sf, too small. Goal Seek
    4. Reiterate and we find L needs to be at least 59'.
    5. Panels are 24' standard length so lets round up 59'/24' and times by two for 2 wings, 6 panels.





SIZING TABLE	LIVESTOCK NUMBER	AREA PER ANIMAL (SF)	AREA REQD (SF)
YEARLING	50	35	1750
BEEF COW	50	50	2500
DRIFT FREE AREA REQD (SF)			4250
BARRIER HEIGHT 'H'	WING LENGTH 'L'	SHELTER WIDTH 'W'	DRIFT FREE AREA (SF)
7'	72ft	102ft	5621ft
NUMBER PANELS REQUIRED (CT)			6

$W = SQRT(2L^3)$, W MUST BE $\leq 15H$
DRIFT FREE AREA $= 1/2L^2 + 4.25\ WH$

NOTES AND SPECIFICATIONS

1. PLACE PANELS IN 90° V SHAPE IN DIRECTION OF PREVAILING WINDS AS SHOWN.
2. ALL PIPE SHALL BE 2 7/8" STANDARD DRILL STEM STEEL PIPE. PIPE MUST HAVE A MINIMUM REMAINING BODY WALL OF 70% (4.91LB/LF). BE CLEAN ENOUGH TO PERMIT INSPECTION, AND REASONABLY ROUND, STRAIGHT, AND FREE FROM DEFECTS WHICH MIGHT IMPAIR PIPE STRENGTH.
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   - OVERTURNING WITHOUT ANCHORAGE = 65mph
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MATERIALS

ITEM	PER PANEL	TOTAL
2 7/8" STEEL DRILL STEM PIPE	119 LF	714LF
36"Wx24'L PANELS 22GA SUPERSTEEL GALVANIZED/FACTORY PAINTED	2 EA	~~12EA~~
SELF TAPPING SCREWS	100 CT	600CT
2x10 WOOD RUB RAIL	48 LF	~~288LF~~
ANCHORS 3/4"ø 24'L SMOOTH PINS	4 CT	~~24CT~~
CHAIN	10 LF	~~60LF~~

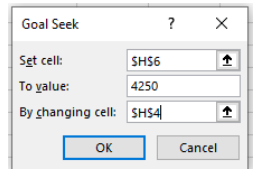
Fabricated Livestock Windbreak Portable
County, Minnesota
Designed: Drawn: Checked: Approved: Date:
United States Department of Agriculture
Natural Resources Conservation Service
File Name MN-ENG-0298.dwg
Eng. Job Class
4/19/2020
Sheet of

Steps to implement

1. Animal numbers to protect Grazing plan.
2. Determine size Drawing has area to determine size.
3. Determine site Looking at grazing plan, verify,
   1. Wind direction
   2. Setbacks
      - 100 feet from any surface water bodies,
      - 150 feet from an up-gradient well,
      - 300 feet from a down-gradient well.
4. Assemble design Drawing and other design package items as needed.
5. Preconstruction
   1. Emphasis materials kinds and sizes are correct.
   2. Paneling is galv. or painted.
   3. Anchors and chain on hand.
6. Check/Asbuilt
   1. Materials are right kind and size.
   2. Welds and connections sturdy.
   3. Anchors and chain on hand.

Example 50cow/calf pair permanent

1. 50 cow @ 50sf/cow(std) = 2500sf required
2. 50 calf @ 35sf/cow(std) = 1750sf required
3. 2500sf + 1750sf = 4250sf required.
4. Pick an L and calculate area provided, keep trying until you provide at least the area required
    1. Let H = 8'. Usually shorter is a cost savings.
    2. Try for 8" dia. posts them seem to be readily obtainable, they can only be done at 8' max spacing (drawing). 8" dia. posts at 8' spacing will require 5' embeddment. (drawing)
    3. Let L = 56', an equal divisor of 8' spacing for ease of construction. W = SQRT($2L^2$) = 79', check W<15H (std) 79'< 120' ok.
    4. Drift free area = 1/2L2 + 4.25HD = 1/2(56')2 + 4.25(56')(8') = 4260sf nearly exactly what is required... 🔥🔥🔥

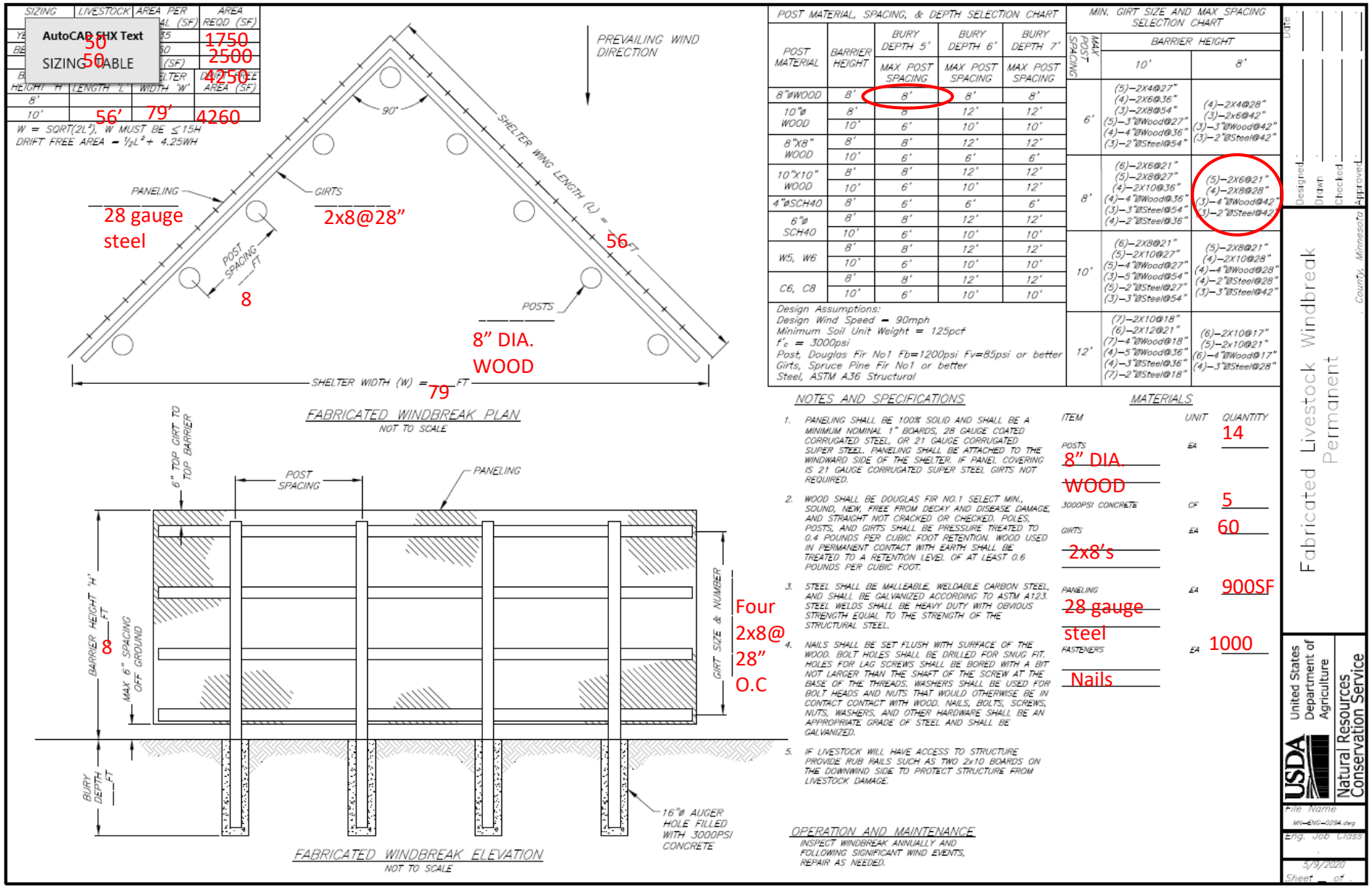


Example 50cow/calf pair permanent, continued

5. Pick paneling, lets choose 28 gauge corrugated steel. This paneling requires horizontal members as support(girts).

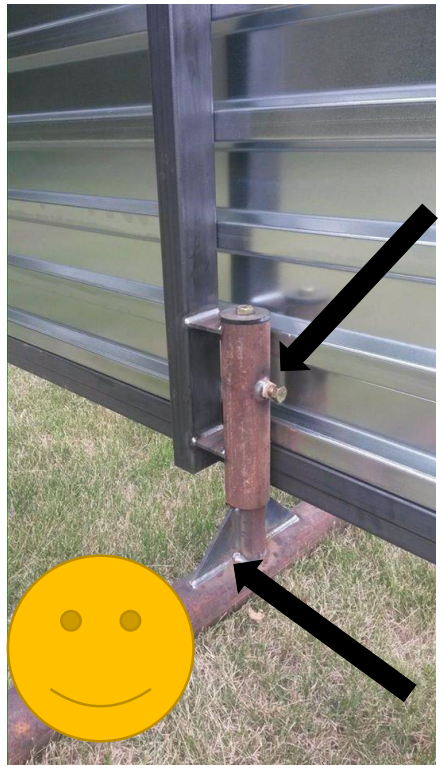
6. Pick girts, for 8’ tall at 8’ spacing we have four options. Lets choose the 2”x8” boards at 28” on center, 4 horizonal rows in total for the 8’ tall windbreak.

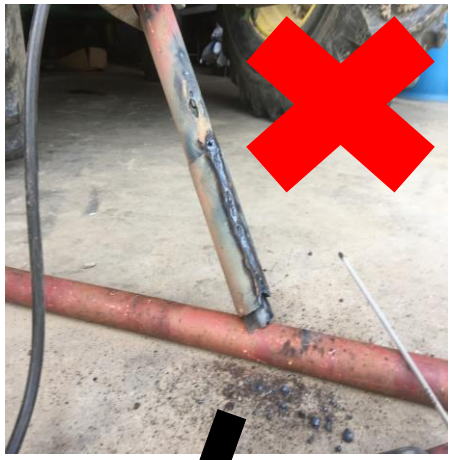
7. Final Configuration,
    1. 8’ height with two wings, each 56’ long.
    2. Posts are 8” dia. posts on 8’ spacings and made of treated Douglas Fir Grade No 1 or better. Each embedded in 16” dia. holes filled with 3000psi concrete.
    3. Girts are four rows of 2”x8” boards at 28” on center and SPF or better.
    4. Paneling is 28 gauge corrugated steel either painted or galvanized.



Steps to implement

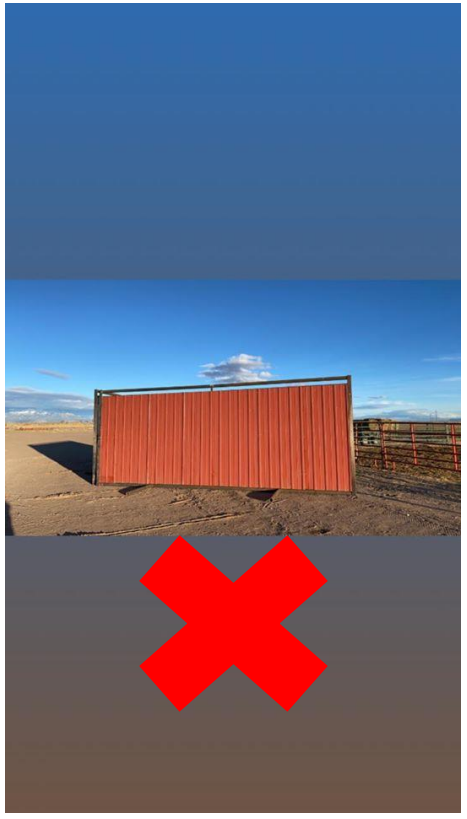
1. Animal numbers to protect Grazing plan
2. Determine size Drawing has area to determine size.
3. Determine site Looking at grazing plan. Verify,
    1. Wind direction
    2. Topo
    3. Soils
    4. Setbacks
        - 100 feet from any surface water bodies,
        - 150 feet from an up-gradient well,
        - 300 feet from a down-gradient well.
4. Determine exact configuration
5. Assemble design Coversheet, plan view with layout dimensions, other.
    1. Spec
6. Preconstruction
    1. Emphasis material kinds are correct.
7. Check/Asbuilt
    1. Materials are right kind and size.
    2. Post embedment and spacing .
    3. Girt spacing.
    4. Paneling painted or galv.
    5. Connections sturdy.

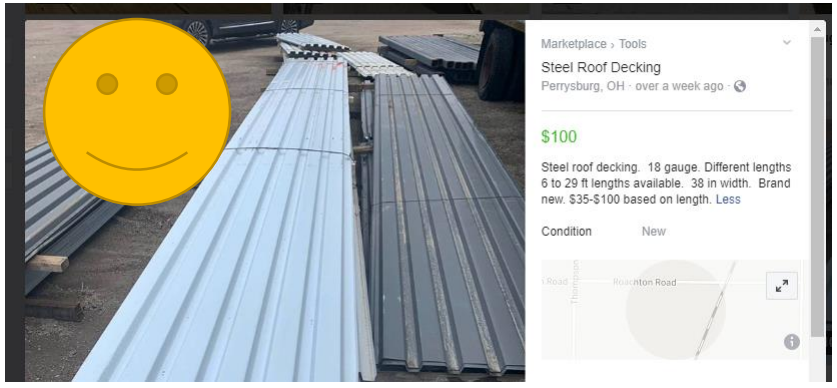




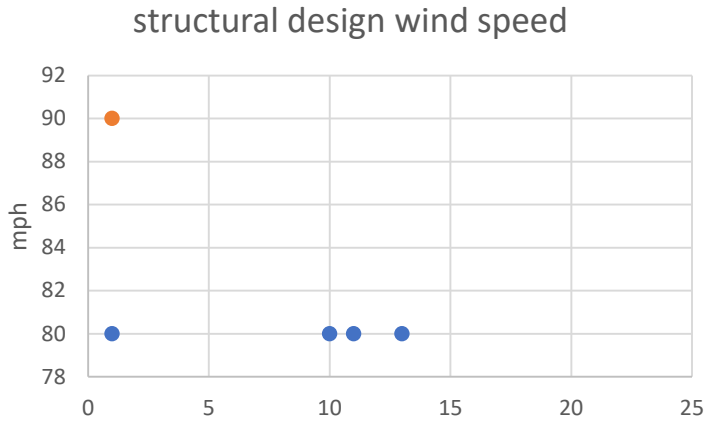

T.H. Custom Mfg
(605) 553-2299

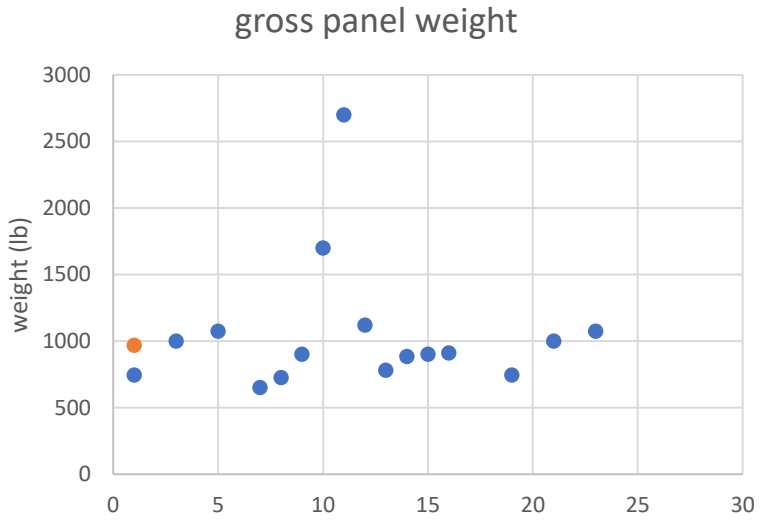

Producer by Desmet, SD sent us this photo after a storm that uprooted trees... panels where in a line together.
C+W
e panels flipped, one wrecked. C&w welding panel slid is all. Had to be around 80mph gust or spinning involved
CHAT

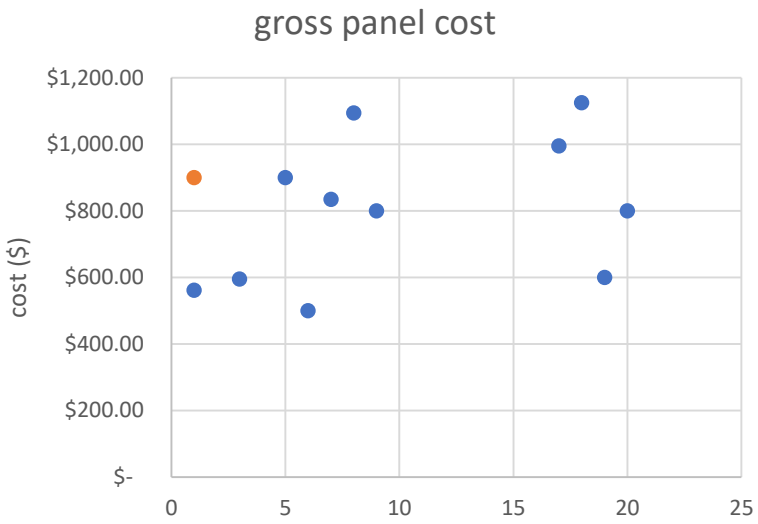


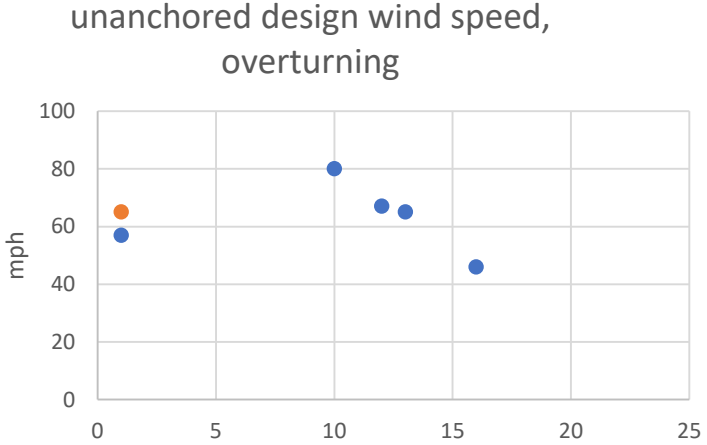

Marketplace › Tools
Steel Roof Decking
Perrysburg, OH · over a week ago ·
$100
Steel roof decking. 18 gauge. Different lengths 6 to 29 ft lengths available. 38 in width. Brand new. $35-$100 based on length. Less
Condition New

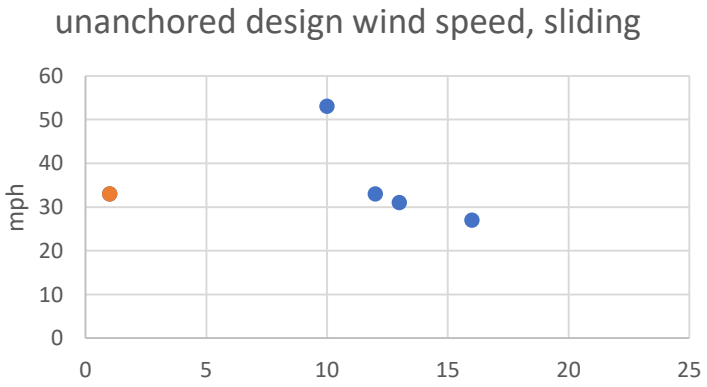
Portable Comparison and Fabricator











- NRCS design intended for local fabricators to build a configuration that meets standard, have not yet seen any in MN with their own configuration. Other states have fabricators with own configurations.
- Want a tube notcher, can do it without using templates.
- Materials sourcing takes effort.

Possible Questions

Why is this portable so heavy? "The weight of the structure is pretty much the only thing keeping it from moving. Wind speeds can get pretty high in Minnesota (30mph usually exceeded during winter months) and we want this to be a good grazing tool for at least 10years and safe for stock and structures. Commercial panels range from 600lbs to 1200lbs, with most around 900lb. Ours weighs 960lbs.

Do I really need anchors? "Yes you do, it would be great not to have them but we designed the panels with a balance between heavy to prevent movement and light for portability. Recognize your panels hold up to lower wind speeds when anchored (about 30mph) and those wind speeds are often exceeded each month. In certain situations you may want to stake them to reduce risk of tipping; high wind advisories, close to a road or house. It is up to you on when and if to stake, but the stakes and chains need to be on hand when asbuilting/checkout. They can be had for about $25-100 on Prime, big box stores, some folks even have pins/chain on hand already. We always recommend chaining panels together, two tie points each side of panel.

Can commercial products be used? "Commercial windbreaks can be considered for use. Like our standard drawing windbreaks they need to meet the standard for cost share, which involves having a technical basis to show they can withstand wind speeds here in Minnesota and be a quality product for grazing. Standard drawings were developed to save folks from doing this work themselves." At this time folks can bring specifics on the proposed commercial products to grazing team, will need the panel weight, dimensions, porosity, materials used (what type of wood and steel) and their dimensions for discussion on if a commercial product meets the practice standard.

Can I remove the diagonal brace? "No, that brace provides stability at the stem connection and helps transfer thousands of lbs of force from the panel to the legs. Weight is pretty important for the panel, anything that reduces weight is probably a no go. Other tweaks, like modifying lift bar, adding connection plates and laps, adding bounce to the legs, detachable legs is on the table.