Fencing
FACTSHEET

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ELK EXCLUSION USING WOVEN WIRE FENCING

This factsheet outlines the use of woven wire to exclude elk in high pressure areas such as feed storage yards. Two designs are outlined with options and cost estimates. Refer to Factsheet 307.252-2 for electric fencing to exclude elk.

INTRODUCTION

Elk damage to crop land and feed storage yards is a very serious problem in BC, especially in areas such as the Peace River, East Kootenays and recently the McBride valley. Two basic fence types can be used.

ELECTRIC FENCE

This is a psychological barrier which is low cost but may not be 100% effective in high elk pressure areas such as feed storage yards.

Electric fences have proven successful around large areas such as crop fields. There are definite cost advantages when fencing these large areas that usually have low to medium elk pressure. Refer to **Factsheet 307.252-2**.

WOVEN WIRE FENCE

This is a physical barrier that can be very effective but is more expensive than an electric fence. It is best suited to high-pressure areas such as feed storage yards. Two designs are outlined below.

DESIGN A (minimum) — **8 feet woven wire**

Total Height:	8 feet
Woven wire:	20/96/12 knotted joint *20 horizontal wires *96 inch height *12 inch spaced vertical wires
Line Posts:	3 to 4 inch by 12 feet
Braces Posts:	4 to 5 inch by 12 feet

ALTERNATIVE DESIGNS

Alternatives to a one piece woven wire design are:

- 4 or 5 ft woven wire with strands of wire above
- 2 pieces of 4 ft woven wire one over the other

While these options can reduce costs, they should be selected to match the amount of elk pressure.

FENCE POST HEIGHT EXTENSIONS

Height extensions to posts (on existing posts or to reduce the cost of new posts) may be successful if:

- extensions are adequately sized
- connection to the existing post is adequate
- existing posts have been set deep enough; (up to 1/3 of new fence height in ground); depth on existing posts may be insufficient

DESIGN B (high pressure) — **8 feet woven wire with larger posts**; (plus optional 2 to 3 single strands of high tensile smooth wire above woven wire)

Total Height:	9 1/2 to 10 feet
Woven wire:	20/96/12, knotted joint *20 horizontal wires *96 inch height *12 inch spaced vertical wires
Line Posts:	4 to 5 inch by 12 feet
Brace Posts:	5 to 6 inch by 12 feet
Optional Top Wires:	2 single strands spaced 9/9 inches or, 3 single strands spaced 8/8/8 inches

(note, these top wires may require either 14 foot posts or extensions onto 12 foot posts)

WOVEN WIRE DESIGN

All wires are 12 1/2 ga. galvanized steel (some variation is possible); some woven wire uses high tensile steel for greater strength. Additions can be made to these two designs for added control:

To resist elk jumping over the wire

- extra strands above the woven wire
- **DO NOT** use material such as boards as a horizontal top rail; this will give elk a well defined reference point and increase their tendency to jump

To resist high elk pressure on the wire

- use knotted joint woven wire as **Design A** and **B**
- wire with 6 inch spaced verticals is available but is more expensive and not likely needed

Figure 1 shows a woven wire elk fence with one extra top wire.

Figure 1 Typical Elk Exclusion Fence Using Woven Wire

WOVEN WIRE JOINTS

Two types of joints are available where line (horizontal) and stay wires (vertical) cross: **hinge**,and **knotted**.

A **hinge joint**, Figure 2, below, is made with separate short lengths of stay wire and allows the fence to "fold" under pressure. However, the wire wrap can come loose allowing the stay wire to separate from the line wire.

Figure 2 Hinged Joint Woven Wire

A **knotted joint**, Figure 3, below, is made with a one piece continuous stay wire and separate knotting wire. This joint will not separate easily and is the preferred choice because of the extra security of the joints.

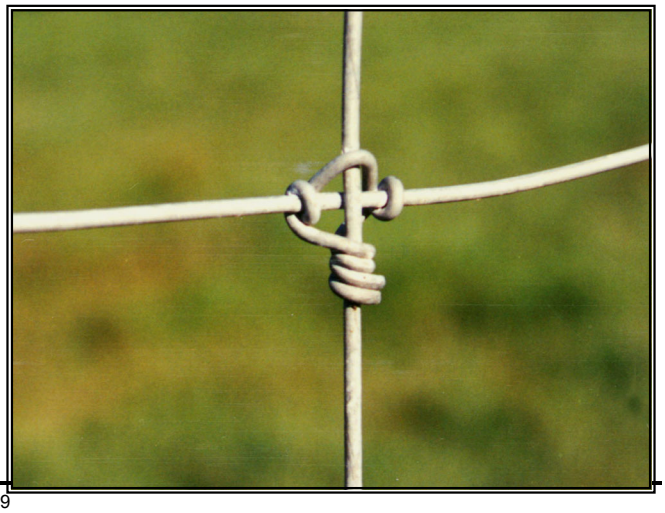

Figure 3 Knotted Joint Woven Wire

INSTALLING WOVEN WIRE

The following points are important when installing woven wire fences:

- Place the wire on the elk side of the line posts. Ensure the wire is flush with the ground and there are no gaps due to terrain irregularities.

- Join woven wire by using a wrap-splice, Figure 4 below. Leave 4 to 6 inches of line wire beyond the end stay. Lay together the end stay wires of each of the two sections to be spliced, then wrap the free ends tightly around the line wire with pliers or splicing tool.

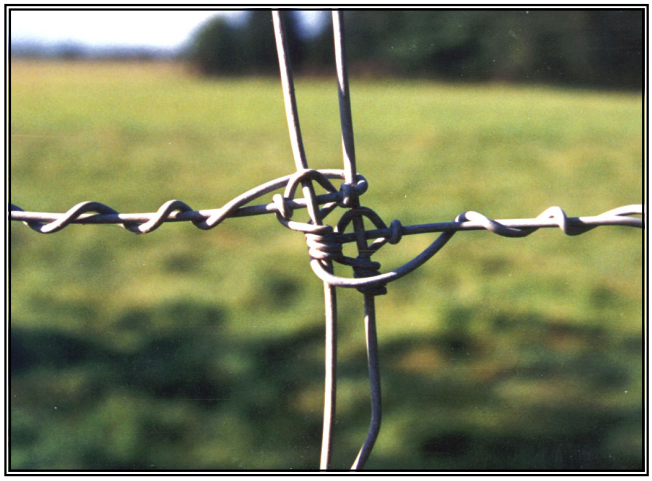

Figure 4 Splicing Woven Wire

- An alternative splice is a compression sleeve. See our **Factsheet 307.131-1**.

- Tension woven wire to remove only 1/3 to 1/2 of the tension curve from the line wires, as shown in Figure 5 below.

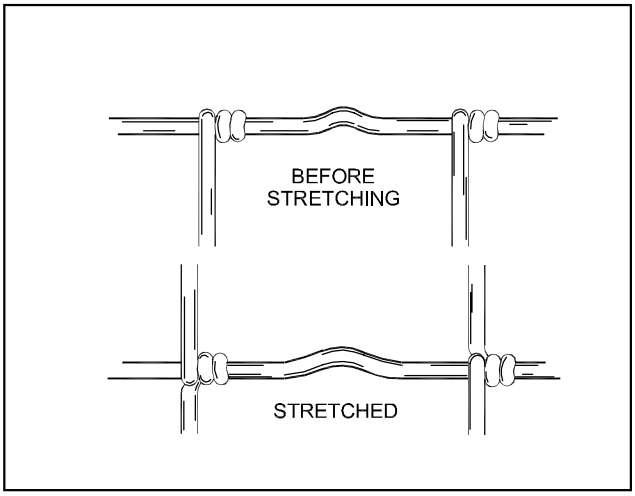

Figure 5 Tensioning Woven wire

- Tensioning may be done from the end post (then stapling wire tight onto brace post) or from a braced dummy post set 6 ft. to 8 ft. beyond the brace. Extreme caution is necessary if using a tractor for tensioning because of the operator hazard as well as possible over-tensioning.

- When tying off woven wire at the end brace, take the free end of each line wire around the end post and wrap on itself, as shown in Figure 6 below. **DO NOT** depend only on staples to hold the fence wire tension.

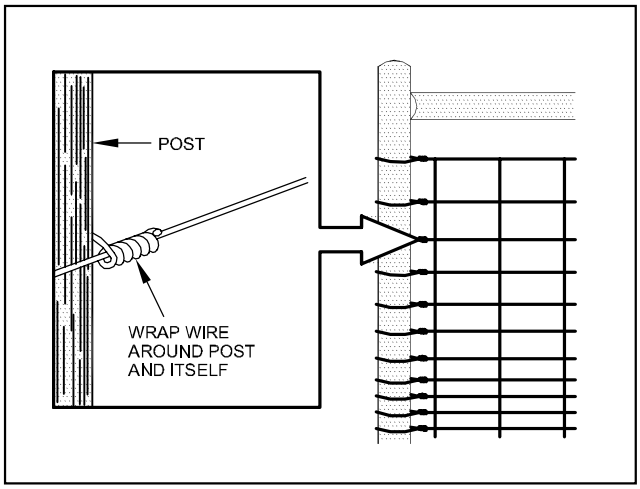

Figure 6 Tying Off Woven Wire

- **DO NOT** drive the staples "home"on line posts. The wire should be free to move.

- For maximum pull-out resistance, rotate staples so as to cross the grain of the post (reducing post splitting) and to ensure the two legs of the staple spread out and away from each other.

- Individual htsw strands are tensioned to 200 lbs. and knotted or spliced according to **Factsheet. 307.131-1.**

FENCE LINE POSTS

The following is recommended:

Design A Line Post- 3 to 4 inch by 12 feet long

Design B Line Post- 4 to 5 inch by 12 feet long

- "3 to 4 inch" means the post diameter range
- use pressure treated posts
- set posts a minimum of 3 feet into the ground
- space according to the terrain: up to 15 feet apart average; up to 20 feet apart in level terrain
- extensions may be required on **Design B** posts

FENCE BRACE ASSEMBLIES

Braces are the foundation and anchor of a good fence - using good construction methods will protect the orchard or vineyard and ensure a long life fence.

Note good brace construction in Figure 7, below:

- posts are set in ground 3 1/2 to 4 feet
- the horizontal rail is not notched into the driven posts, but is connected using 3/8 inch rebar into pre-drilled holes
- the height of the rail is approximately 3/4 of the fence height
- braces are set at a maximum of 660 feet apart
- use inline braces if no corners are needed

End Braces: 2 posts at 4 to 5 inch minimum (preferred 5 to 6 inch) by 12 feet long (optional to use a 10 foot brace post and a 12 foot tie post to reduce costs) set 3 1/2 to 4 feet minimum into the ground, 1 rail at 4 to 5 inch by 10 feet long.

This single span brace is sufficient for most conditions. In poor soils (sandy, wet, etc.), use a double-span brace assembly: three driven posts and two rails with the wire tie-off on the centre post.

Inline Braces: Use an end brace (for runs greater then 660 feet) with brace wires in both directions.

Corner Braces: For 90° corners, use a brace of three driven posts and two rails. (Optional if the wires are being tied off – build two separate end braces of 4 driven posts and 2 rails).

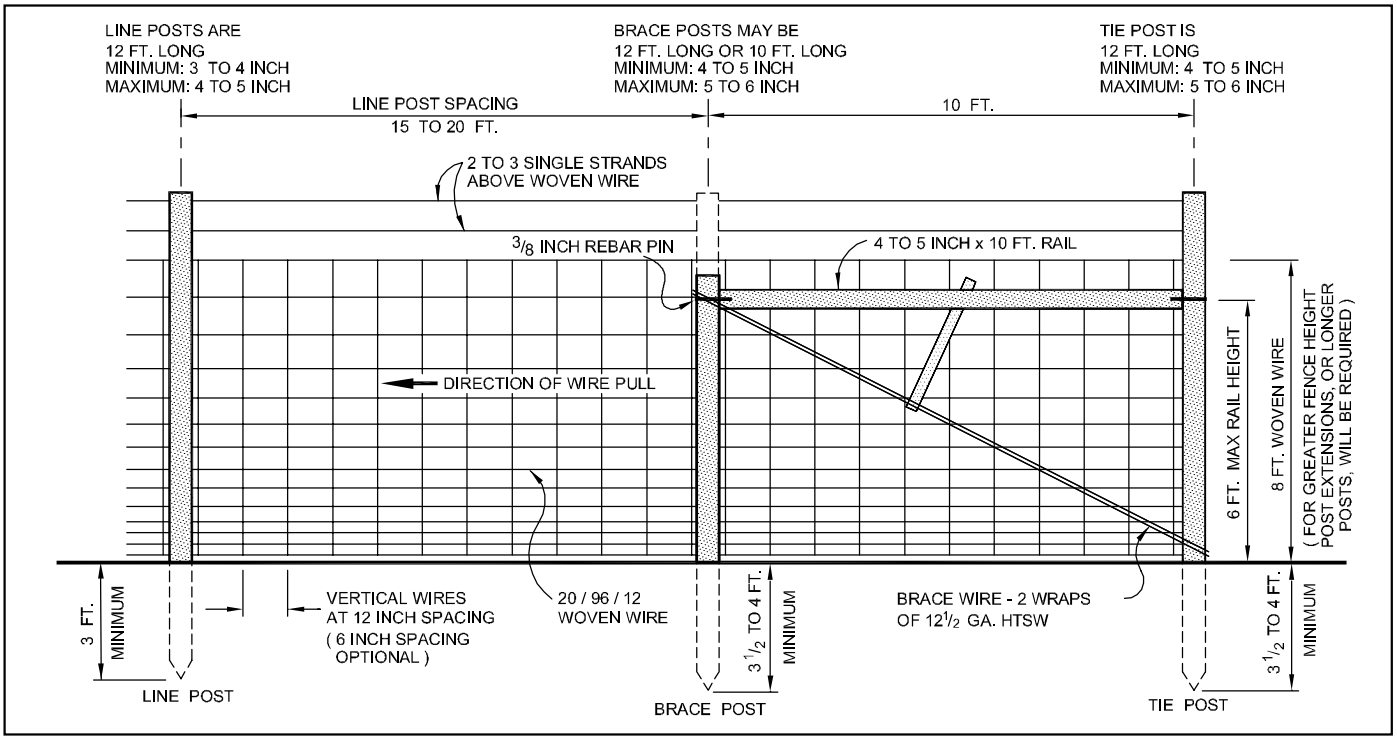

Figure 7 **Typical Line Fence and End Brace Design for Woven wire Elk Fence**

FENCE EFFECTIVENESS

Fencing out elk driven by hunger is quite different from fencing commercial livestock. The other options the elk may have for food, such as unfenced neighbouring fields, will affect how they will pressure a fence. At some hunger threshold, elk may breach almost any fence design.

FENCE COSTS

The following Tables 1 to 6 (pages 5 to 7) outline material and labour costs estimates. One example is shown on page 7. A worksheet for material costs is filled out on page 8, with a blank copy on page 9.

Table 1 MATERIAL COSTS FOR WOVEN WIRE ELK LINE FENCE

(LINE FENCE: WIRE, LINE POSTS, STAPLES)

			Estimated Cost
WIRE Both designs use the same woven wire to a height of 8 foot			
DESIGN A (minimum):			
20/96/12 woven wire	$380/roll	$ 1.15/foot	
• 20 line wires			
• 96 inch height (8 foot)			**$ 1.15 / foot**
• 12 inch spaced verticals			
• knotted joint construction			
• 330 foot rolls; 386 pounds roll weight			
DESIGN B (high wildlife pressure):			
20/96/12 woven wire (as above)		$ 1.15/foot	
plus three single strands of high tensile smooth wire (htsw)			
• 3 strands at $0.02/foot per strand		$ 0.06 foot	
• staples	3 per line post @ $0.015 each	$ 0.01 foot	
• wooden extensions	1 per line post @ $0.50	$ 0.03 foot	**$ 1.25 / foot**
LINE POSTS			
DESIGN A	3 to 4 inch top x 12 feet (in a bundle of 90 posts)		**$ 6.00 each**
DESIGN B	4 to 5 inch top x 12 feet (in a bundle of 60 posts)	$ 9.20 ea	**$ 10.20 each**
	plus 2 x 4 x 2 feet wood extensions with 3, 4 inch nails	$ 1.00 ea	
STAPLES			
• minimum 2 inch long, slash point, galvanized			**$ 0.015 each**
• consider barbed staples for superior pullout resistance			

Table 2 MATERIAL COSTS PER FOOT FOR WOVEN WIRE ELK LINE FENCE

LINE FENCE MATERIAL COST PER FOOT				MATERIAL COST PER 15 FEET	MATERIAL COST PER FT POSTS @ 15FEET	MATERIAL COST PER FT POSTS @ 20FEET
	15 ft of wire	1 post	12 staples	line posts wire and staples	average conditions (line fence only)	good conditions (line fence only)
DESIGN A woven wire	**$ 17.25**	**$ 6.00**	**$ 0.18**	**$ 23.43**	**$ 1.56 / foot**	**$ 1.46 / foot**
DESIGN B woven wire w/larger posts & optional htsw	**$ 18.75**	**$ 10.20**	**$ 0.18**	**$ 29.13**	**$ 1.95 / foot**	**$ 1.77 / foot**

Table 3 BRACE & GATE MATERIAL COSTS FOR WOVEN WIRE ELK FENCE

END BRACE MATERIAL COST – A standard end brace consists of two vertical posts (set a min of 3 1/2 ft into the ground) and one horizontal rail (located up from the ground 2/3 to 3/4 of the fence height). The rail is pinned to the two posts and a wire is tightened diagonally. An inline brace is the same but with the second brace wire.

- **Design A** 2 posts 4 to 5 inch x 12 feet $ 9.20 ea. (bundle price) $ 18.40
- **Design B** 2 posts 5 to 6 inch x 12 feet $ 16.00 ea. (bundle price) $ 32.00

• 1 rail 4 to 5 inch x 10 feet	$ 7.30 ea. (single price)	$ 7.30	
• 2 – 3/8 rebar pins	0.16 ea.	$ 0.32	
• 50 feet of 12 1/2 ga. htsw	0.03/ft	$ 1.50	$ 10.12
• 4 feet of 2 x 2 (twist stick)	0.14/ft	$ 0.56	
• 5 + 24 staples	0.015 ea.	$ 0.44	

$ 29 each end brace (Design A)

or

$ 42 each end brace (Design B)

CORNER BRACE MATERIAL COST – A standard corner brace consists of two end braces that share a corner post (i.e.: there are three driven posts and two horizontal rails). As the materials for a corner brace include that of two end braces less one post, the material costs are:

- **Design A** two end braces at $ 29 (minus one post at $ 9.20) $ 49 ea.
- **Design B** two end braces at $ 42 (minus one post at $ 16.00) $ 68 ea.

$ 49 each corner brace (Design A)
or
$68 each corner brace (Design B)

GATES – Gates will vary from home built wooden to purchased metal frames, covered with woven wire. Gate size is 16 feet wide by 8 feet high.

$250 each gate

Table 4 ESTIMATING LABOUR COSTS FOR WOVEN WIRE ELK FENCE

(Labour cost may vary widely depending on the terrain, soil conditions, the amount of fence being constructed, access, etc).

LABOUR FOR LINE FENCE CONSTRUCTION • Assume labour is between 40% to 60% of the total installed cost. • Using an average of 50%, labour cost is the same as material cost. (at 40%, labour cost is material cost x 2/3; at 60%, labour cost is material cost x 3/2) • For every $1000 of materials, labour could vary from $666 to $1500, with $1000 as an average	**Estimate at 50%** **(labour is equal to materials)**
LABOUR FOR BRACE CONSTRUCTION • End brace and Corner brace labour estimate equal to material cost	**Estimate at 50%** **(labour is equal to materials)**
LABOUR FOR GATE INSTALLATION • Hinges installed and gate hung estimate	**Estimate $ 100 each gate**

Table 5 ESTIMATING WOVEN WIRE ELK FENCE INSTALLED COSTS

To use this table the amount of line fence, the number of braces, gates, etc must be known. It uses information from Tables 2, 3 and 4. Refer to the Example below.

INSTALLED LINE FENCE

Design A		Posts at 15 feet	Posts at 20 feet
• Materials	(Table 2)	$ 1.56/foot	$ 1.46/foot
• Labour @ 50%	(Table 4)	$ 1.56/foot	$ 1.46/foot
		$ 3.12/foot	**$ 2.92/foot**

$ 2.92 to $ 3.12 per foot (Design A line fence installed)

Design B		Posts at 15 feet	Posts at 20 feet
• Materials	(Table 2)	$ 1.95/foot	$ 1.77/foot
• Labour @ 50%	(Table 4)	$ 1.95/foot	$ 1.77/foot
		$ 3.90/foot	**$ 3.54/foot**

$ 3.54 to $ 3.90 per foot (Design B line fence installed)

INSTALLED BRACES

	Design A	Design B
• End brace materials (Table 3)	$ 29 each	$ 42 each
• End brace labour @ 50% (Table 4)	$ 29 each	$ 42 each
	$ 58 each	**$ 84 each**

$ 58 to $ 84 each end brace installed

• Corner brace materials (Table 3)	$ 49 each	$ 68 each
• Corner brace labour @ 50% (Table 4)	$ 49 each	$ 68 each
	$ 98 each	**$ 136 each**

$ 98 to $ 136 each corner brace installed

EXAMPLE ESTIMATING WOVEN WIRE ELK FENCE INSTALLED COSTS

This is an example cost estimate using the information from the first five tables. A worksheet on page 8 shows how material costs can be tabulated for this example. A blank worksheet is provided on page 9 to be used for your fence estimation.

The following example is for installation of an elk fence (high elk pressure, as in a feed storage yard) when the entire fence layout is known.

This is for a **Design B** fence with **15 foot post spacing**.

USE TABLE 5

Assume a feed storage yard with the fence line measured and laid out:
1,000 feet of line fence, 4 corner braces, 4 end braces for 2 gates.

LINE FENCE:	materials and labour is $ 3.90 per foot x 1,000 feet	**$ 3900**
CORNER BRACES:	materials and labour is $ 136 each x 4 corner braces	**$ 544**
END BRACES:	materials and labour is $ 84 each x 4 end braces	**$ 336**
GATE:	materials and labour is $ 250 + $ 100 per gate x 2 gates	**$ 700**
	TOTAL:	**$ 5480**
	COST PER FOOT :	**$ 5.48 per foot**

WORKSHEET FOR WOVEN WIRE ELK FENCE MATERIAL COSTS

(USING EXAMPLE FENCE COST ESTIMATION FROM PAGE 7)

WIRE	Wire Type	Size	Feet of Wire Required	Feet of Wire per Roll	Number of Rolls	$ Each Roll	Total Wire Cost
	woven wire	20/96/12	1,000	330	3	$ 380	$ 1140
	htsw	12.5 ga	3,000	3750	1	$ 75	$ 75

LINE POSTS	Wood Post Type	Post Size	Feet of Fence	Post Spacing	Line Posts	$ Each Line Post	Total Line Post Cost
	☑ treated ☑ pointed ☑ domed	4/5 x 12 ft	1,000	15 feet	65	$ 9.20	$ 598
extensions	2 x 4 by 2 ft plus 3, 4 inch nails: 1 set per line post				65 sets	$ 1.00	$ 65

BRACE POSTS	Wood Post Type	* Post Size	Number of Brace Post	Total Posts	$ Each Brace Post	Total Brace Post Cost
	☑ treated ☑ pointed ☑ domed	5/6 x 12 ft	4 corner (12) 4 end (8)	20	$ 16	$ 320

BRACE RAILS	Wood Rail Type	Rail Size	Number of Rails	Total Rails	$ Each Rail	Total Rail Cost
	☑ treated ☐ untreated	4/5 x 10 ft	4 corners (8) 4 ends (4)	12	$ 7.30	$ 88

STAPLES	Size & Type	Number Per Post	Number of Posts	Number of Staples	$ Each Staple	Total Staple Cost
	2 inch slash point	10	85	850	$ 0.015	$ 13

GATES	Size	Type	Number of Gates	$ Each Gate	Total Gate Cost
	16 ft x 8 ft	Prefab steel	2	$ 250	$ 500

TOTAL MATERIAL COSTS	Wire	Line Posts	Brace Posts	Brace Rails	Staples	Gates	Total Material Cost
	$ 1140 + $ 75	$ 663	$ 320	$ 88	$ 13	$ 500	$ 2799

* If 5/6 x 10 and 5/6 x 12 posts are used: 5/6 x 12 tie posts: 4 corners (4); 4 ends (4) @ $16 ea.
5/6 x 10 brace posts: 4 corners (8); 4 ends (4) @ $12 ea. = $48 savings

WORKSHEET FOR WOVEN WIRE ELK FENCE MATERIAL COSTS

(USING EXAMPLE FENCE COST ESTIMATION FROM PAGE 7)

WIRE	Wire Type	Size	Feet of Wire Required	Feet of Wire per Roll	Number of Rolls	$ Each Roll	Total Wire Cost
	woven wire	20/96/12		330		$	$
	htsw	12.5 ga		3750		$	$

LINE POSTS	Wood Post Type	Post Size	Feet of Fence	Post Spacing	Line Posts	$ Each Line Post	Total Line Post Cost
	☐ treated ☐ pointed ☐ domed					$	$
extensions	2 x 4 by 2 ft plus 3, 4 inch nails: 1 set per line post					$	$

BRACE POSTS	Wood Post Type	* Post Size	Number of Brace Post	Total Posts	$ Each Brace Post	Total Brace Post Cost
	☐ treated ☐ pointed ☐ domed				$	$

BRACE RAILS	Wood Rail Type	Rail Size	Number of Rails	Total Rails	$ Each Rail	Total Rail Cost
	☐ treated ☐ untreated	4/5 x 10 ft			$	$

STAPLES	Size & Type	Number Per Post	Number of Posts	Number of Staples	$ Each Staple	Total Staple Cost
	2 inch slash point	10			$ 0.015	$

GATES	Size	Type	Number of Gates	$ Each Gate	Total Gate Cost
	16 ft x 8 ft			$	$

TOTAL MATERIAL COSTS	Wire	Line Posts	Brace Posts	Brace Rails	Staples	Gates	Total Material Cost
	$	$	$	$	$	$	$

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