# USE OF ELECTRIC FENCING TO DETER BLACK AND GRIZZLY BEARS FROM THE NORMAN WELLS DUMP

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# ABSTRACT

A solar powered electric fence was constructed around the dump site at Norman Wells, NWT. This dump was an attractant to black and grizzly bears during the summer months each year. A direct relationship was suspected between these dump habituated bears and the annual problem of black bears in the town of Norman Wells. The electric fence was successful in deterring most black bears from gaining access to the main garbage disposal area. A few bears did, and may always, succeed in penetrating the electric fence. A contingency plan will be developed for dealing with these individuals. Continued monitoring of bear activity and behavior at the dump and in the town of Norman Wells over several years post-electrification is required to determine the ultimate effectiveness of the electric fence.

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# INTRODUCTION

Black bears (*Ursus americanus*) are widely distributed over the forested portion of the Northwest Territories (NWT) (Banfield 1974). Black bears in the NWT usually avoid human activity with only occasional problems around communities and remote bush camps. However, black bears have used the dump at Norman Wells for as long as the village has existed (E. Hodgson, pers. comm.). Official problem bear records are not available for much of this time, but observations by personnel from the Department of Renewable Resources during the last ten years indicate regular use by black bears of the present dump situated 4 km northeast of the town. As many as 15 black bears have been observed simultaneously at the dump. At least two grizzly bears (*Ursus arctos*) have been observed periodically during the last five summers. Both black and grizzly bears have been observed at the site together, a situation seldom reported at other locations where the species are sympatric.

Although the number of black bears using the dump each summer is unknown, marking by the Department of Renewable Resources indicated that a large fraction of bears captured at the dump were repeat visitors from one or more previous years (Clarkson, in prep.). Some of the marked bears and other, non-dump bears came into the village. An average of 50 bear complaints per summer were received by the Department from 1985 to 1990. These complaints resulted in an average of 7 bears being destroyed each summer. Clarkson (in prep.) found that 43% of black bears handled as

problem bears in the Norman Wells area were eventually killed. About 30% of the bears killed were known to be at least periodic users of the dump. It appeared, therefore, that a bear-dump-village cycle had developed and bears had learned to associate the availability of food with human activity.

The presence of numerous habituated bears around Norman Wells posed several problems: 1) responding to bear complaints in the village was a constant drain on staff time, especially during the busy summer season when the Department has additional other responsibilities, 2) the bear-dump situation had become a safety problem because of village residents visiting the dump to discard refuse and to simply view the bears, and 3) the spectacle of bears feeding placidly in the dump, may have fostered a false impression of bears and their danger potential.

In September 1990, the Town of Norman Wells renovated the dump in response to concerns about a more progressive system of waste management. This consisted primarily of garbage separation, more efficient covering of the degradable portion, and better entrance and exit of the dump site. At the same time, the Department of Renewable Resources submitted a proposal to the Village Office designed to stop or greatly restrict access to the dump by bears. This involved the construction of a solar powered electric fence around the entire perimeter of the dump. It was hoped that by reducing the access to the dump there would be fewer habituated bears within 2-3 years. Consequently, public safety at the dump

would be improved and there would be fewer habituated bears causing problems in the village each summer.

Electric fencing has long been recognized as an effective means of deterring wild animals from specific attractants (Storer et al. 1938; McAtee 1939; Hunt 1985). Electric fencing used alone, or in conjunction with other aversive agents, has proven effective in deterring black and grizzly bears from bush camps and apiaries (Gilbert and Roy 1975; Hunt 1985; Davies and Rockwell 1986). Boddick (1978), Hunt (1985), and Davies and Rockwell (1986) described electric fence designs for small areas. Electric fencing has also been used very effectively to deter black and grizzly bears at several large dump sites in western Canada in conjunction with existing chain-link fencing (J. Marley, pers. comm.). However, a simple, multi-strand electric fence has never been tested at a large dump used by habituated bears (J. Marley, pers. comm.).

This report describes the electric fence design used at the Norman Wells dump and its effectiveness in deterring bears during two summers of operation.

# MATERIALS AND METHODS

## Electric Fence - Construction

The total cost of fencing 4.2 ha (Fig. 1) at the Norman Wells dump was $21,700. Cost was inflated, however, because of the considerable experimentation that occurred. Appendix A lists all materials, and the unit costs of more specialized items, used in construction of the electric fence at the Norman Wells dump. Quantities and types of materials used will vary depending on the size of area fenced, type of public access, and the substrate at a particular location.

There was a 5 m wide cleared area between the fenceline and the forest that surrounded the dump on three sides (Fig. 1). This was to minimize the likelihood of grounding caused by contact with vegetation and bears stumbling into the fence without warning when they approached from the forest side. Fence-post holes were drilled at 6.5 m intervals to a depth of 1 m (Fig. 2) except where buried steel prevented drilling. At these locations fence-posts were mounted in cement. Corner and gate posts were braced using horizontal posts and wire braces (Figs. 3 & 4). Seven strands of high tensile wire were strung between the posts for a total height of 1.6 m (Fig. 2). The first four strands from the bottom were staggered on either side of each post (Fig. 2). The two positive strands (outside perimeter) were attached to the posts by pin-lock

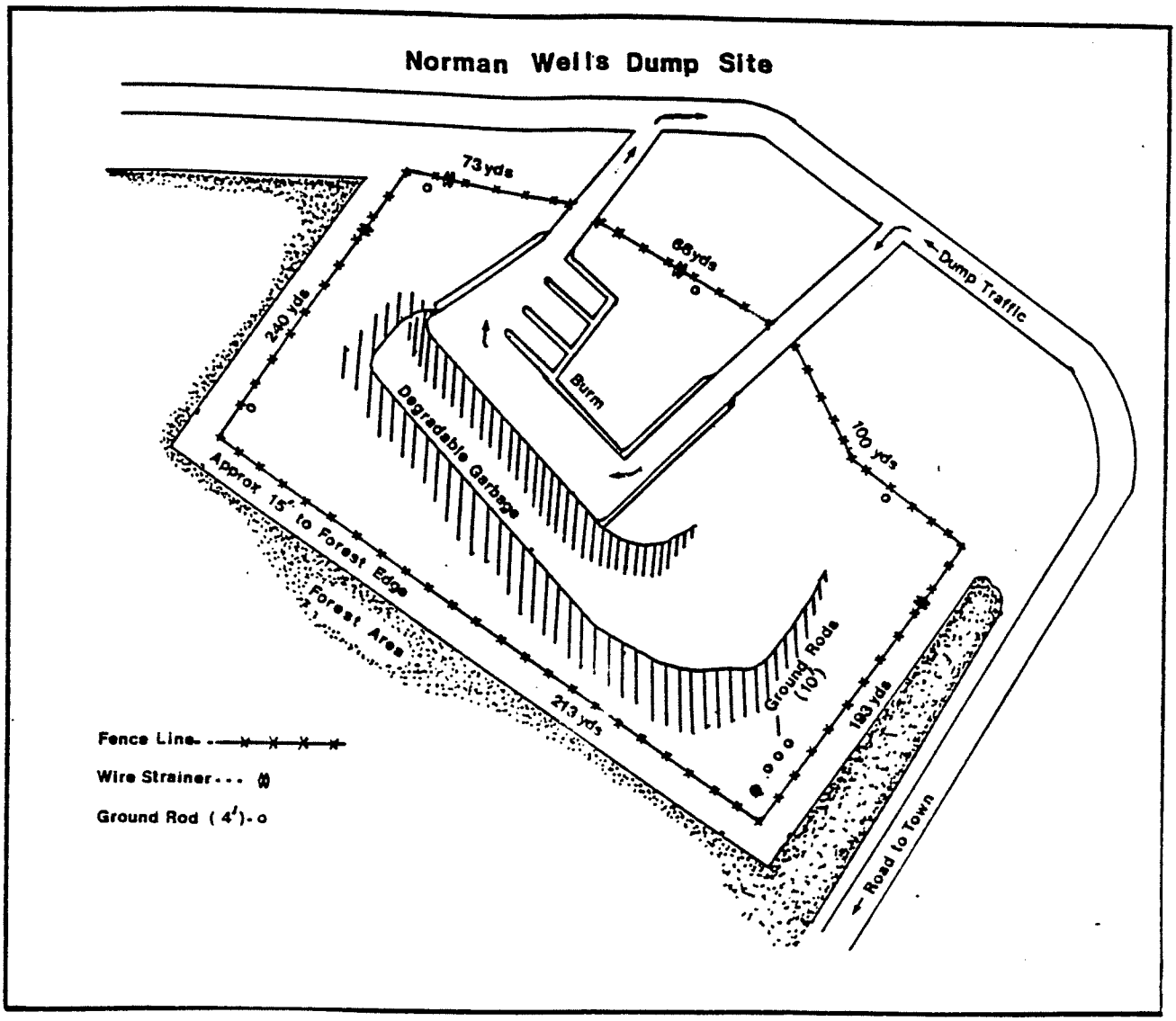


Figure 1. Entrance and exit points and the garbage disposal area within the electric fence at the Norman Wells dump.

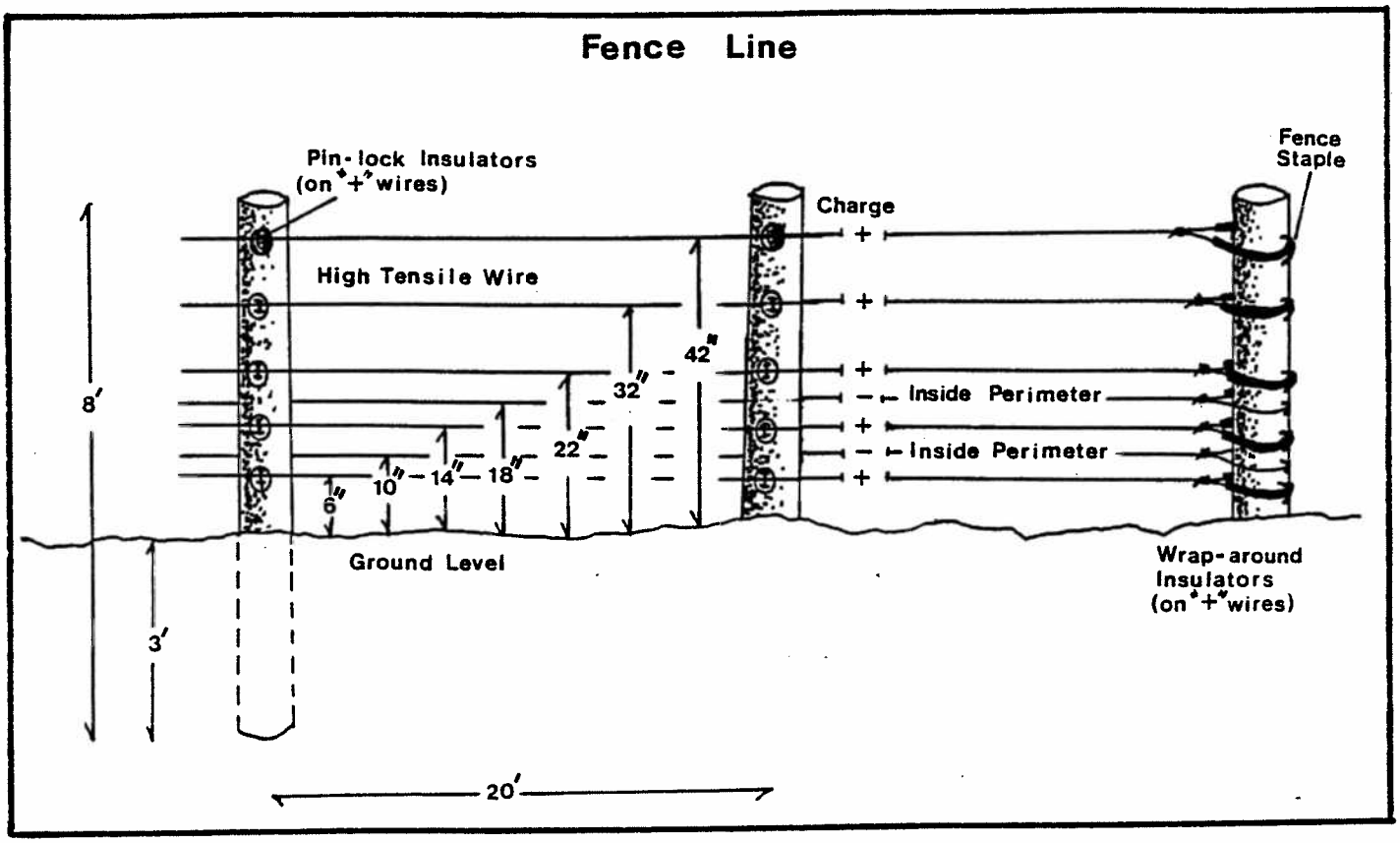


Figure 2. Design of the electric fenceline at the Norman Wells dump.

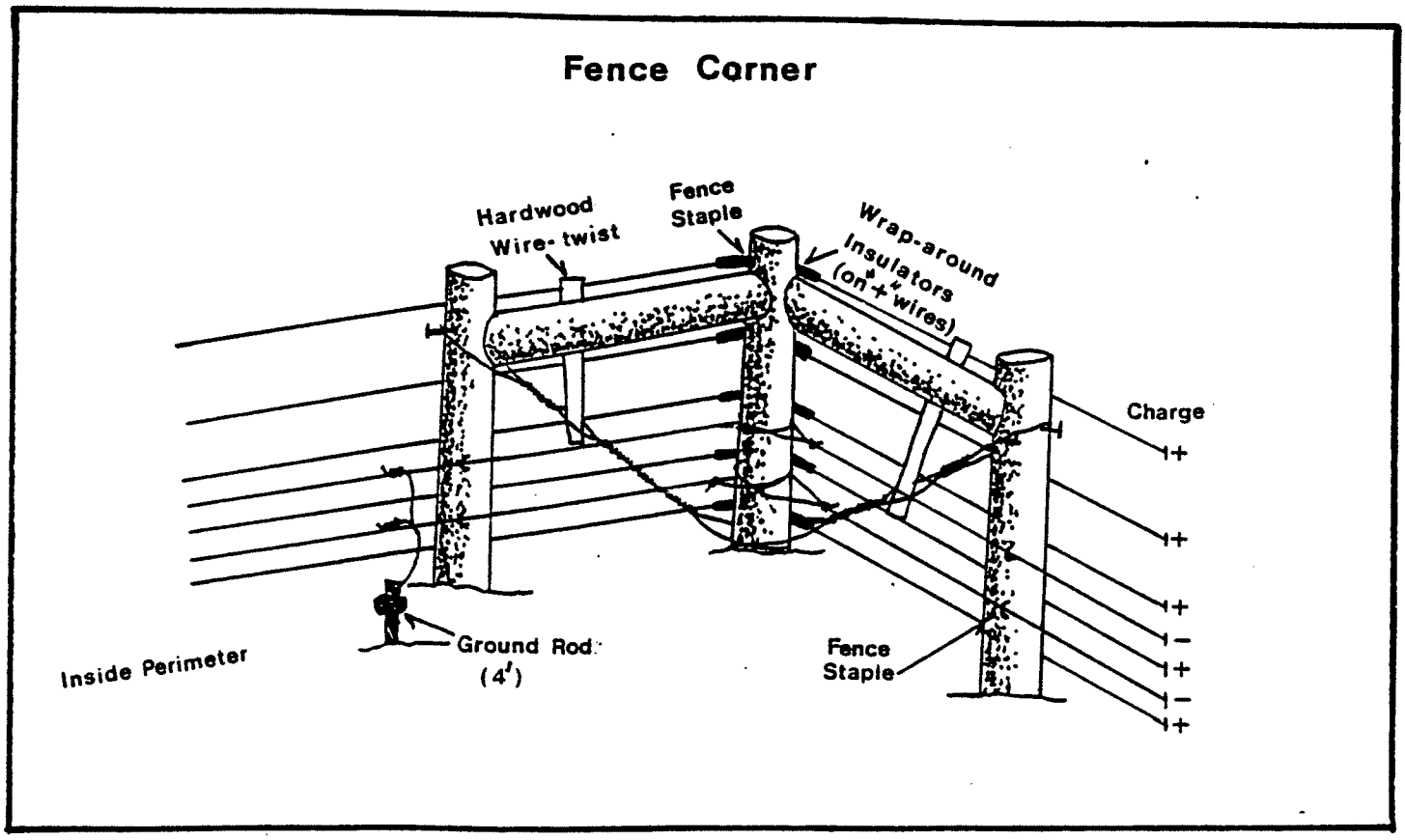


Figure 3. Design of corners along the electric fence at the Norman Wells dump.

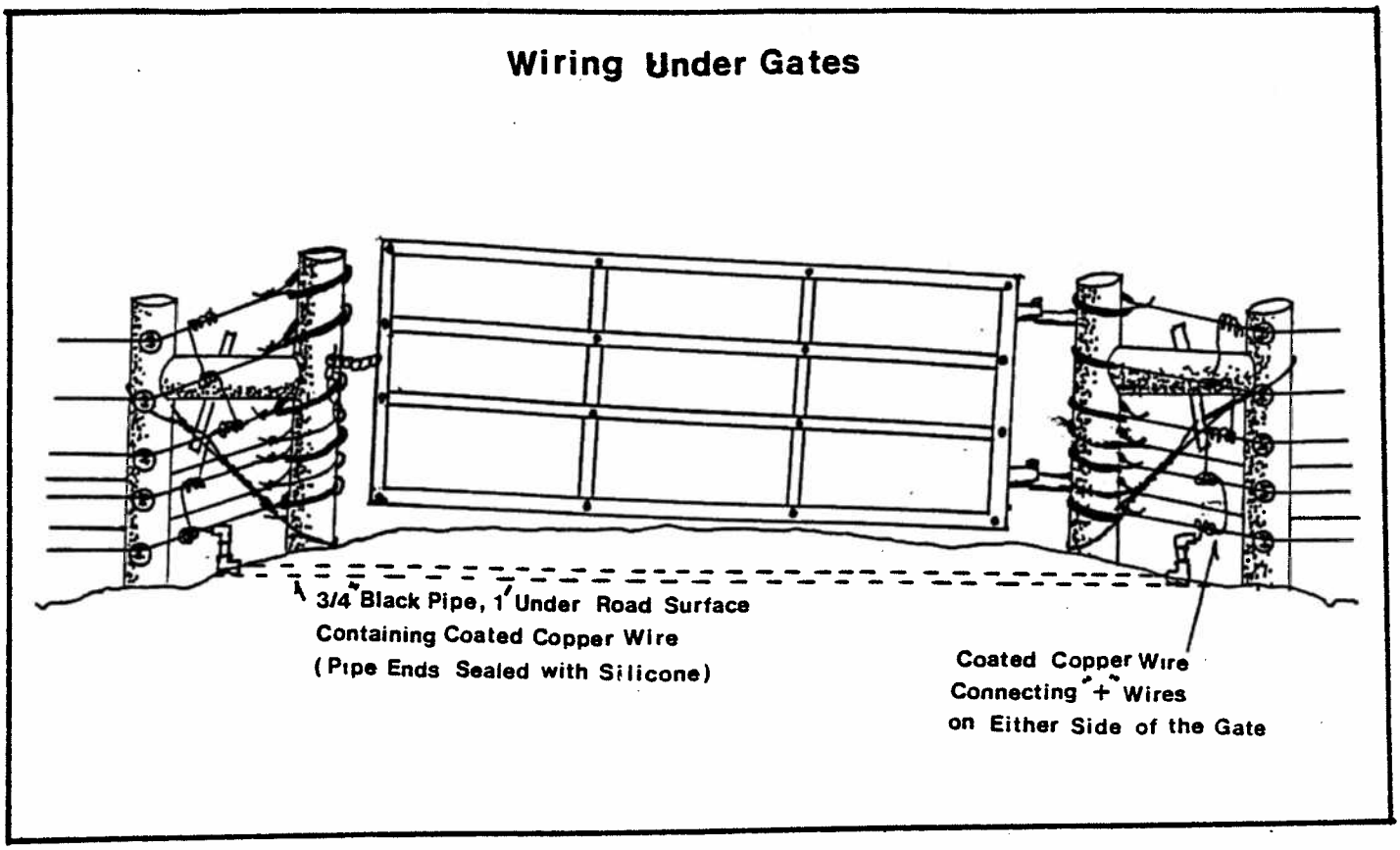


Figure 4. Design of the entrance and exit gates along the electric fence at the Norman Wells dump.

insulators and the two negative strands (inside perimeter) were attached with fencing staples and grounded with 2.5 m iron rods (Fig. 3). Each strand was tightened with ratchet/spring type strainers which also served as shock absorbers (Fig. 5). Punctured sardine cans were hung from the second strand to serve as a focal point for the bears' attention and to increase the likelihood of shocking bears before they attempted to penetrate the fence (Fig. 5). Uneven areas below the bottom strand were filled with vertically mounted fibreglass rods and rubble (Fig. 6). Calcium chloride was spread under the fence along the driest parts of the fenceline in order to enhance grounding should a bear come into contact with the strands at these points. The bottom strands were checked periodically for any vegetation or wind-blown refuse contacting them which could cause grounding. The solar powered charger was mounted on a post within a corner of the fenced area and grounded with three 2.5 m deep iron rods (Fig. 7).

The Norman Wells dump is open on a 24 hr. basis and the continuous daylight at Norman Wells (65° 16') during the summer months meant that industrial and domestic use of the dump occurred at almost any time of the day. It was anticipated that bears would quickly learn to gain access to the dump at the entrance and exit points (Fig. 1). Because cost and practicality prohibited a permanent guarding of these points, manually operated gates (5 m long) were installed (Fig. 8). The gates were electrified with four positively charged wires interconnected at the hinge end (Fig. 8).

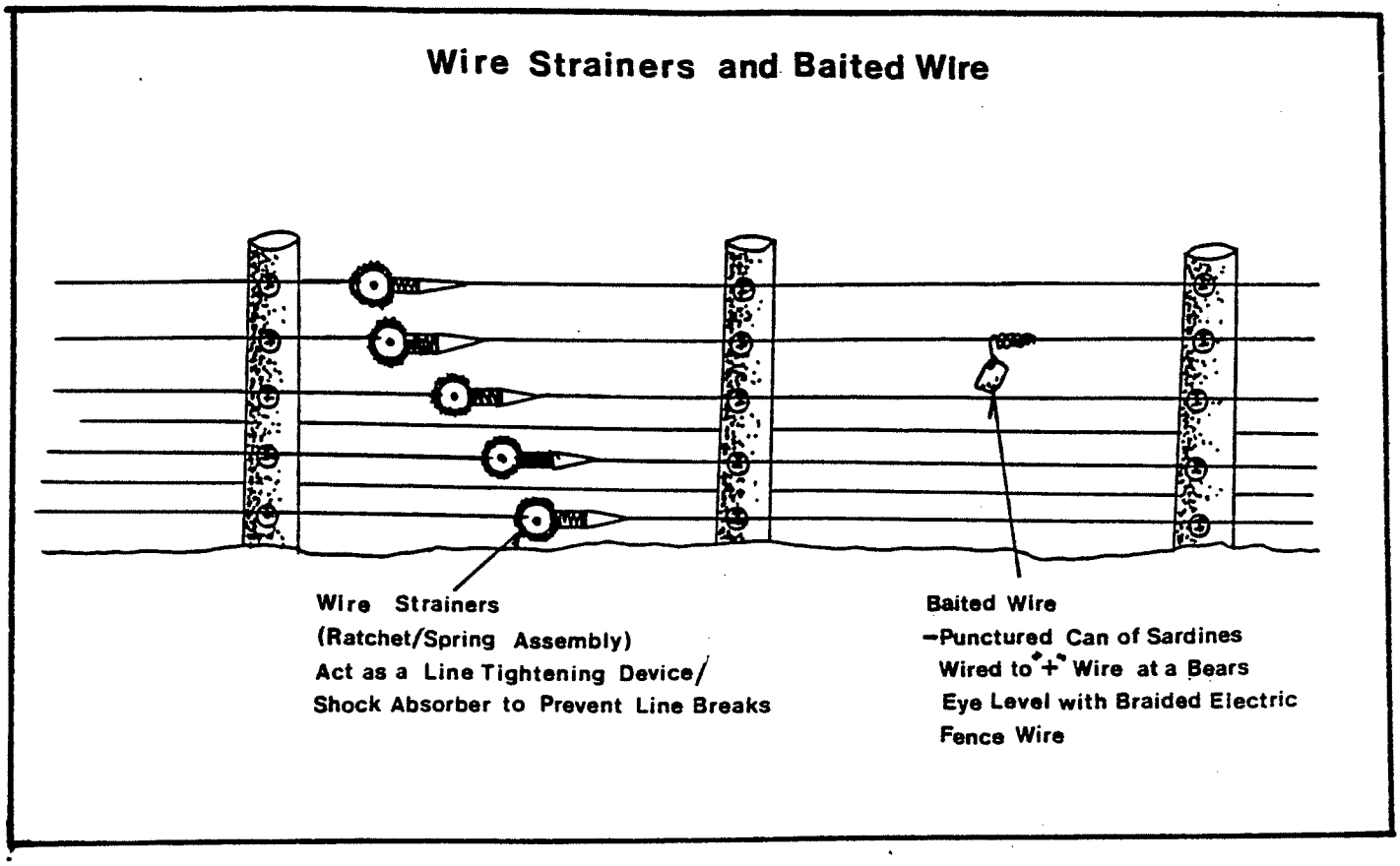


Figure 5. Wire strainer and bait location along the electric fence at the Norman Wells dump.

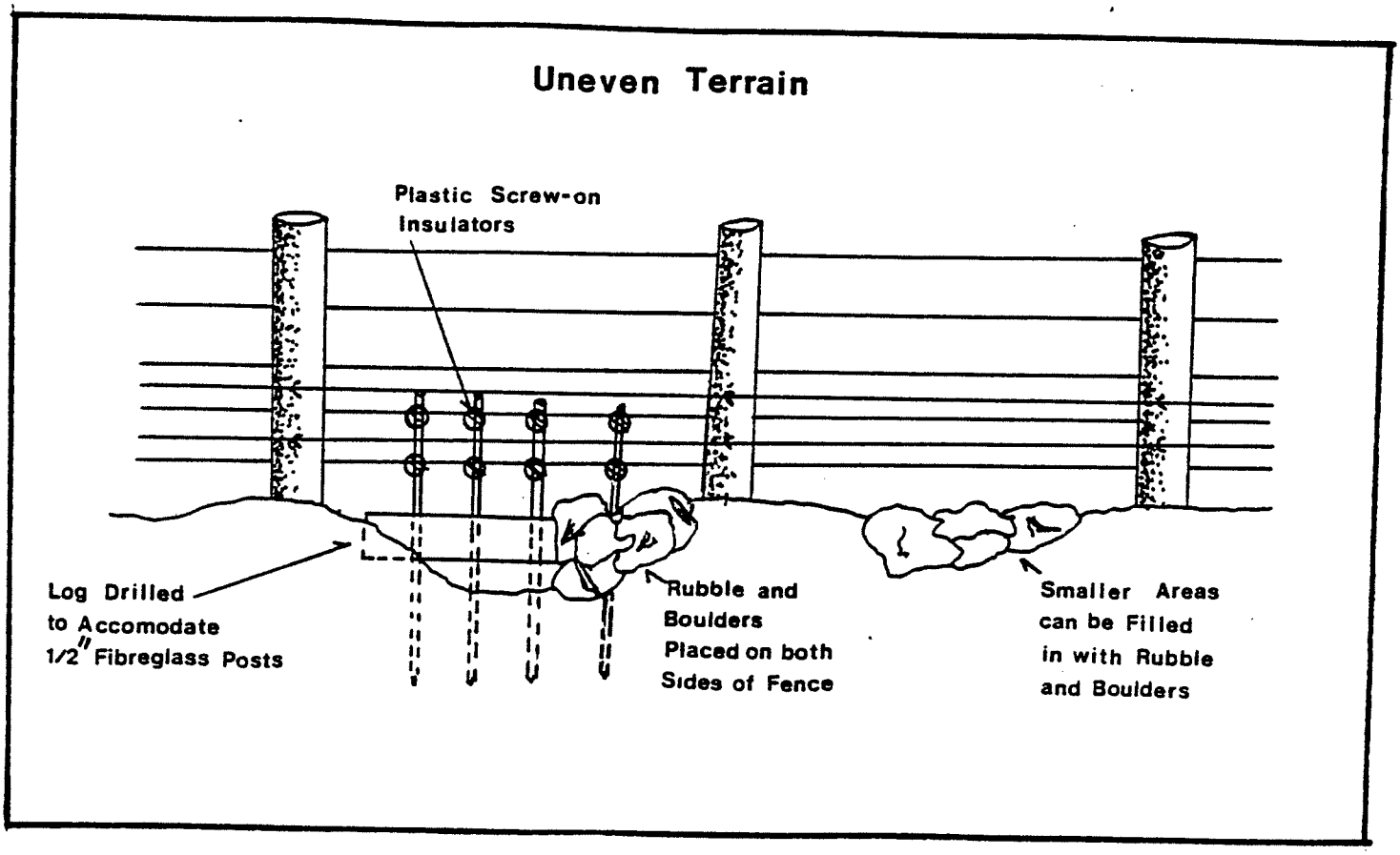


Figure 6. Infill of uneven areas under the electric fence at the Norman Wells dump.

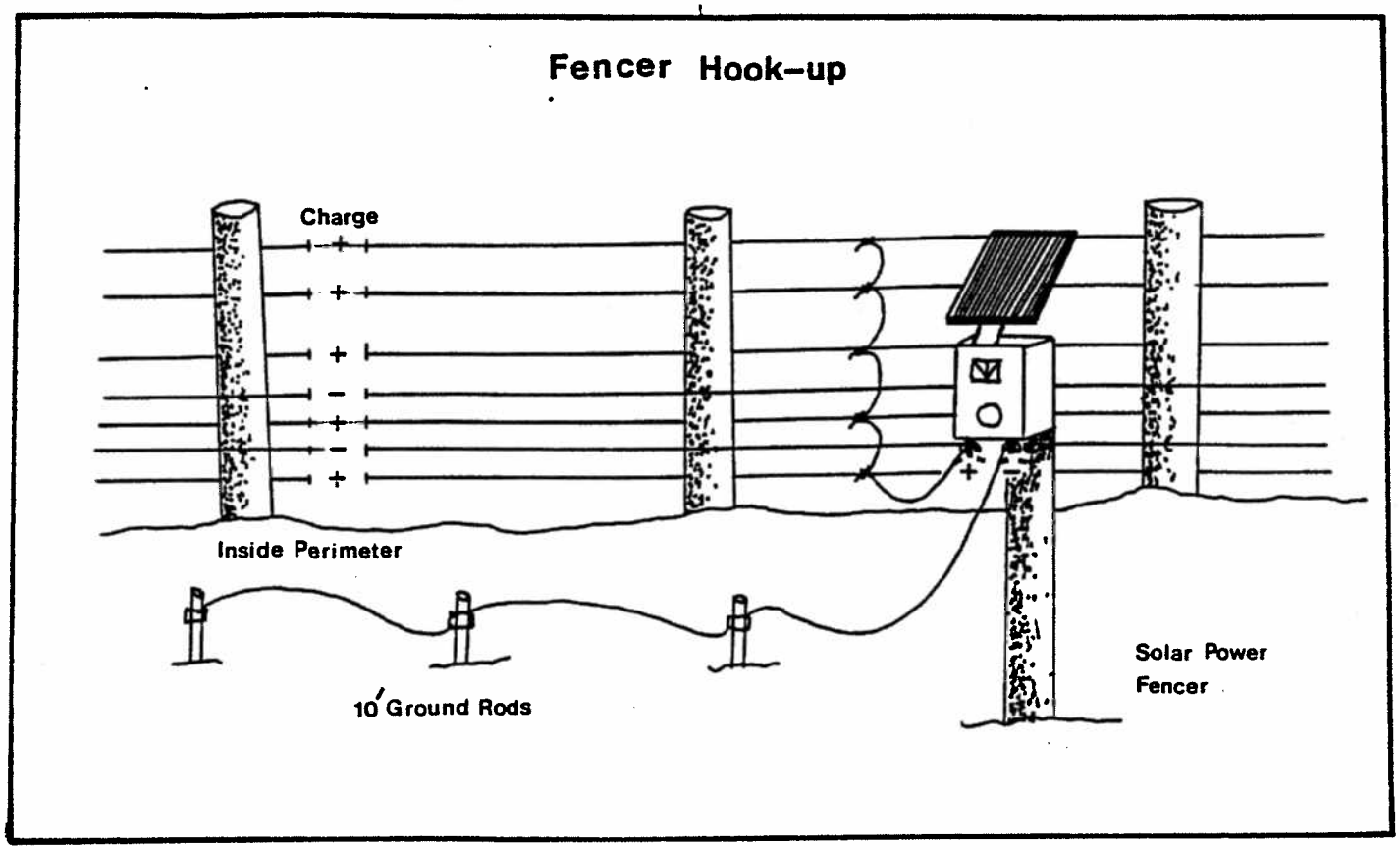


Figure 7. Mounting and grounding of the solar powered generator at the Norman Wells dump.

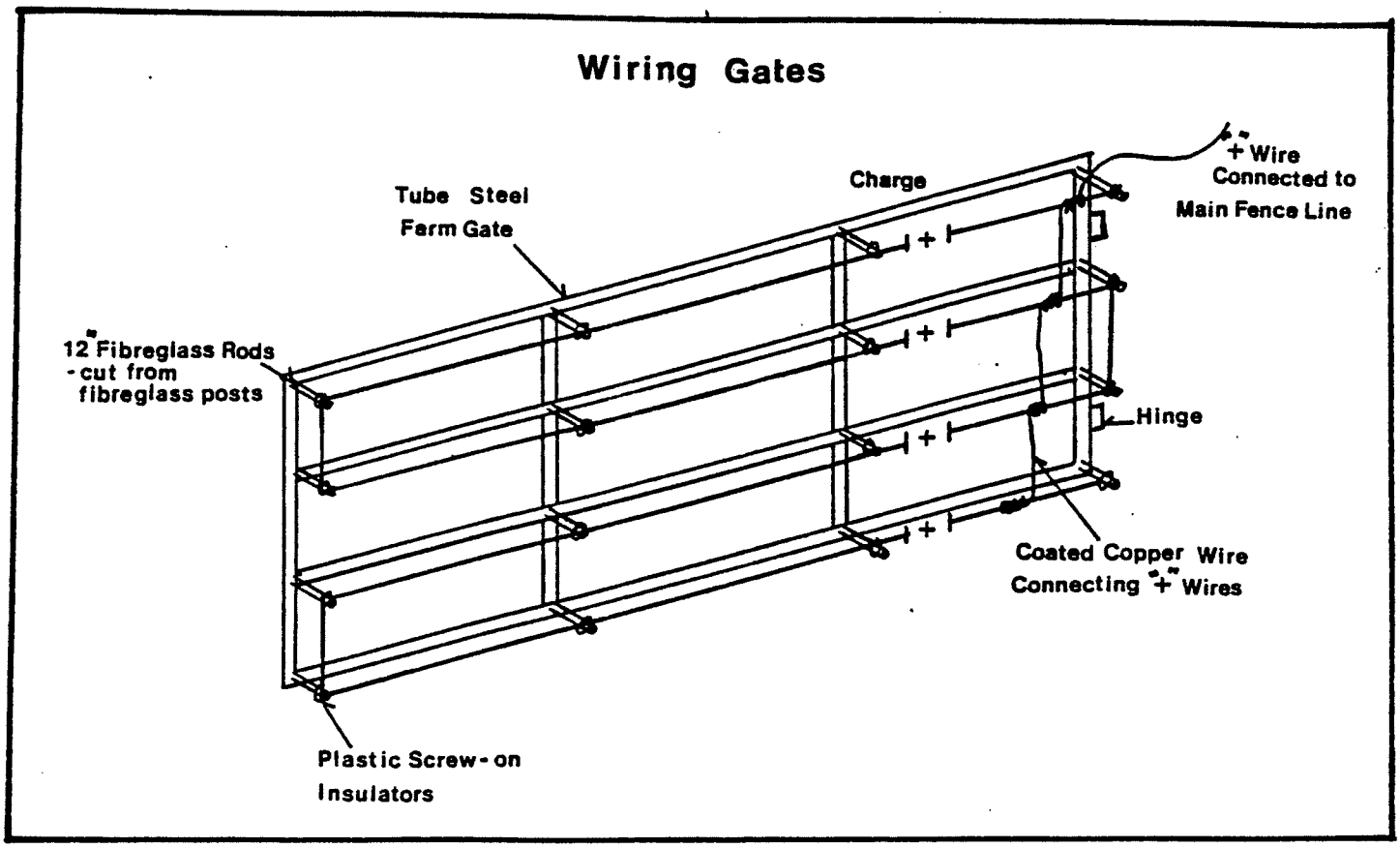


Figure 8. Design of gates and gate electric wiring for the electric fence at the Norman Wells dump.

Bear Locations Relative to the Dump

In July and August 1989 and 1990, black bears were immobilized with Telazol (tiletamine/zolazepam, A.H. Robbins & Co., Richmond, VA.) administered by Cap-chur darts (Palmer Chemical and Equipment Co., Douglasville, GA.) following dosage recommendations of Boever (1977). All bears were captured as free-ranging individuals or in mobile barrel traps. Radio-collars were attached to a sample of immobilized bears (151 mHz, Telonics, Mesa, Az.; Lotek Engineering, Aurora, Ont.). Coloured ear flagging was attached to each bear for future visual identification. Most trapping and all radio-collaring of black bears was conducted at the Norman Wells dump.

Radio-collared bears were subsequently relocated by triangulation from the limited road network in the vicinity of the dump. Relocating was conducted at irregular intervals during July-September of both years. In addition, during periodic checks Departmental staff kept a record of all bears observed in the recently deposited garbage or in the open area surrounding it (Fig. 1).

After construction of the electric fence, the dump was monitored daily from 14-31 July 1991 using a point sampling technique (Dunbar 1976). The presence of any bears both inside and outside the electric fence was recorded at 15 min. intervals. Observation periods were 0900-1100 hrs. and 1600-1800 hrs. each day. Observations were made 300 m from the dump from a road overlooking the dump site. In 1992, the dump was once again

monitored from the same site. The monitoring period was 1 July-7 August. As in 1991, a time sampling technique was used, however, sampling periods were 4 hr and sampling was spread evenly between mornings (0800-1200), afternoons (1200-1800), and evenings (1800-2400).

## Public Relations

Prior to construction of the electric fence, meetings were held with town administrators and concerned public in order that they were fully informed of all facets of design, construction, operation, and maintenance of the fence. Signs were erected at the dump to briefly describe the project and ask public cooperation, particularly in closing gates upon departure from the dump. Information items were also prepared for the local newspaper.

# RESULTS

## Electric Fence Operation

The electric fence was charged with approximately 6500 volts and 4-6 amperes. Although the substrate at the Norman Wells dump varied from moist, former muskeg in the lower sections to crushed shale over a clay base in the upper sections, successful grounding was achieved along all sections of the fence. Small amounts of vegetation and wind-blown refuse contacting the positive strands of the fence did not cause any noticeable current drainage as indicated by the maximum charge sustained by the solar charger throughout the entire period of operation.

Public cooperation was excellent in closing gates. Most dump users entered and exited the dump by means of the entrance gate only. Most left the gate open while depositing refuse inside the enclosure, but almost always closed the gate when leaving. The short period the gate was open did not result in problems with bears attempting to gain access to the dump.

## Response by Bears

The fence was constructed during May 1991 and electrified on 13 June 1991. Before electrification, several bears were observed in the dump. These bears had learned to use the ungated entrance and exit. Although we did not quantify the bear activity around

the dump at that time, it was likely that these bears were continuing the pattern of regular dump use observed in previous years. In 1989 and 1990, limited radio-tracking suggested that bears which initiated use of the dump in early June stayed in the immediate vicinity of the dump for much of the summer. In 1989, all six radio-collared bears were relocated within 1 km of the dump an average of 5.7 continuous weeks.

Within an hour of first electrifying the fence on 13 June, 2 black bears contacted the fence and were deterred. For the next week, several bears continued to approach the fence, although they showed much caution toward it. It was likely that these bears too had contacted the fence when we were not present. Five black bears were known to have entered the dump immediately after the fence was electrified by either going through the fence or through the entrance and exit points which were not gated until 17 June. Most were extremely averse to going back through the fence when we approached from the inside. Two marked bears repeatedly jumped over the fence (1.2 m) and were shot. Ten black bears were captured outside the fence and relocated by helicopter.

During 32 observation periods (63 h) in July 1991, black bears were observed 20% of the time outside the fence, either in the open area between the fence and surrounding forest or on the hillside 300-500 m north of the fence. Black bears were observed inside the fence only once (0.4% of the time); this was a mother with cubs of the year. It was not possible to determine with certainty how many different bears were involved because most were not radio-collared

or ear-tagged. No bears were observed in the dump upon arrival for each morning monitoring period and an average of only .2 bears were observed in the dump upon arrival for each afternoon monitoring period (n=16 periods both mornings and afternoons). In contrast, during June-September in 1989 and 1990 an average of 2.6 and 2.9 bears respectively were observed in the dump when it was visited by Departmental staff (n=27 and 12 visits respectively). Of the bears observed in the dump during each visit in 1989 and 1990, an average of 79% and 74% respectively had been marked by the Department.

During 28 observation periods (112 h) in July/August 1992, black bears were observed outside the fence less time (11% of observation time) than in 1991. Black bears were observed inside the fence only 1.4% of the time, however, all of this was attributable to one bear that remained in the dump for nearly 2 hours after gaining access through a gate left open by the public. Black bears were observed significantly more often during evening than either morning or afternoon (51%, 16%, and 33% of bear observations respectively) ($X^2$=15.3, P<.001).

At least 2 grizzly bears were seen separately inside the fence on several different occasions in August 1991 by both Departmental staff and the public. How these bears penetrated the electric fence was unknown. In late August, one of the grizzlies was captured and relocated 130 km southwest of Norman Wells. This was a young male weighing 215 kg. In 1992, a grizzly bear was seen outside the fence one evening (10 July) and after the study period 1-2 grizzlies were reported outside the fence by the public.

Wolves were observed 11% and 7% of the time each year respectively, and all of these were outside the fence.

# DISCUSSION

## Electric Fence

There are several potential advantages to electric fencing, all of which were realized in the Norman Wells project. They are:

1) The system was inexpensive compared to other passive deterrent techniques such as heavy fencing.

2) Construction was relatively straightforward although actual construction time (3-4 weeks) was longer than originally anticipated.

3) The system required little maintenance.

4) Valuable on-site expertise was provided from the supplier which greatly facilitated construction.

Public cooperation was excellent during the first year of this project. Regular checks by the Department and the regular monitoring in July 1991 indicated that nearly all dump visitors closed the gates upon leaving. Consequently, plans for power assisted gates were deferred for the remainder of the year. Furthermore, there was no tampering with the system including the generator located below and out of sight from the main dump area.

Bear Deterrence

Although 5 black bears were persistent and occasionally successful in penetrating the fence, their persistence consisted of pushing through the strands and jumping over the fence. At no time did bears attempt to dig under the fence or climb it or the posts. The electric fence, however, will probably never be completely effective in deterring all bears from the dump. Regular monitoring of the dump by trained staff and quick response to public concerns will be required. More direct methods of bear deterrence (e.g., plastic slugs, noisemakers) must be in place and will be necessary for bears that routinely penetrate the fence. The most persistent offenders will most likely have to be shot and a process must be in place for deciding exactly what level of persistence a bear must reach before this occurs.

Most of the black bears relocated or shot after the fence was first electrified in 1991 were probably regular visitors to the dump. If these bears had remained in the area it is likely that more attempted penetrations would have been observed. Whether this would have resulted in more bears getting through the fence will never be known. Despite this potential bias in our observations, we remain confident that electric fencing around the Norman Wells dump proved effective in deterring black bears from the dump in 1991 and again during the following summer.

The deterrence of bears from the dump did not result in greater than average numbers of bears frequenting the village.

Complaints received by the Department about bears in the village (38) and bears killed in the village (6) were similar to the last several years. In 1992, there were only 16 complaints and only 1 bear was killed in the village. Monitoring for another two years is required before any final conclusions can be made concerning the relationship between denying bears access to food at the dump and the number of bears appearing in the village.

## CONCLUSIONS & RECOMMENDATIONS

1) Electric fencing around the Norman Wells dump successfully deterred most black bears from accessing the main garbage deposition area.

2) A few black bears succeeded in repeatedly penetrating the electric fence, especially during the first year of operation. The electric fence will likely never be effective in deterring all black bears and a contingency plan should be in place for dealing with the relatively few bears that are successful in penetrating the fence.

3) The ultimate effectiveness of the electric fence will be known after a minimum of 2-3 years monitoring the dump and reassessing data on bear activity, both at the dump and in the village.

4) Advantages realized by the electric fence around the Norman Wells dump were the relative inexpense, straightforward construction, little post-construction maintenance, and on-site expertise provided by the supplier.

5) The public information effort was well received and dump users cooperated exceptionally well in ensuring that the fence operated effectively.

## ACKNOWLEDGEMENTS

We wish to thank Mr. Jeff Marley (Margo Supplies Ltd., Calgary, Alta.) for his valuable assistance with the construction of the electric fence. Thanks also go to the Village of Norman Wells administration for their cooperation and assistance with this project. Funding for this work was supplied by the Department of Renewable Resources (Demonstration Project Funding) and the Northern Oil and Gas Action Plan (Indian and Northern Affairs Canada). T. Plummer provided reliable observations at the dump after the fence construction. P. Clarkson kindly reviewed an earlier draft of this report and provided valuable criticism.

## PERSONAL COMMUNICATIONS

E. Hodgson, Hunters' and Trappers' Association, Norman Wells, NWT.

J. Marley, Margo Supplies Ltd., Calgary, Alta.

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# APPENDIX A

## Materials Used

Parmak Magnum 12-volt solar electric fencer.....$435.25
3 m iron ground rods and connections (x3)
12.5 gauge high tensile fence wire
Round braided electric fence wire (for gates and hanging bait)
Light plastic-coated copper wire (for gates, under gates, and grounding)
Pin-lock, nail-on insulators.....$7.00/25
Plastic screw-on insulators for 1 cm fiberglass rods
Wrap around insulators (for corners and line ends)
Wire stainers (ratchet type)(x20 for this fence).....$3.95 ea.
Alminum crimping sleaves (for high tensile wire connections and line ends)
Crimping pliers
Heavy duty wire cutters
Fence stapler
Fence wire dispenser
2.5 in Ardox nails
2.5 m peeled and treated wooden fence posts (12 cm diameter).....$5.00 ea.
1 cm fiberglass rods (for blocking holes under fence)
Tube steel farm gate (x2 for this fence).....$150.00 ea.