Sample Seeding Invitation Form

SEEDING

1/ General

Grass seed shall be sown along the _____ Canal and _____ Wasteway, in the areas shown on the drawing and described below or as directed.

1/ Grass Seed

Grass seed shall be furnished by the contractor and shall be _____ _____ 2/ _____ grass (_____ 3/ _____). Germination of the grass seed furnished shall be not less than 85 percent. The grass seed used shall not contain any noxious weed seed or bermuda grass seed nor, unless approved by the contracting officer, more than one-half of one percent of other weed seed. All seed shall comply with the seed laws of the State of _____, and shall be packaged and labeled for identification.

1/ Areas to be Seeded

Unless otherwise directed, the areas to be seeded will be as follows:

a. Canals.--The areas of the top and outside slopes of embankments to natural ground surface, then to the limit of the right-of-way. Seeding will also be required on the inside finished earth prism of the canal down to the maximum water surface level, and on concrete-lined canals down to the top of the concrete lining.

1/ Insert section number.
2/ Insert common and varietal name of grass(es).
3/ Insert botanical name.

b. Wasteways and drains.--All areas on each side from the toe of the inside slope to the limit of the right-of-way.

c. Rectangular concrete chutes.--All areas on each side from the top of the concrete to the limit of the right-of-way.

d. Borrow pits.--Areas as directed.

___ Seedbed Preparation

Prior to actual seeding operations, the contractor shall prepare the area to be seeded by cultivation to a minimum depth of 4 inches unless otherwise directed. Cultivation shall not be required on areas that have been disturbed or filled to a depth of 4 inches as a result of construction activities. Cultivation of the soil may be done with farm disk, harrow, or other suitable approved equipment: Provided, That no disking, harrowing, or other special preparation will be required in rocky areas including gravel surfaced roads nor on slopes greater than 2 feet horizontal to 1 foot vertical. Disking or harrowing shall be done at right angles to the natural flow of water on the slopes unless otherwise directed by the contracting officer. Any damage to existing roadbeds, shoulders, walks, or other existing structures or areas due to the contractor's operations, shall be repaired in a satisfactory manner by and at the expense of the contractor. Following loosening of the soil as required by cultivation of compacted and cut areas the contractor shall firm the entire seedbed area to a well-consolidated soil condition by use of a roller, treader, or other approved equipment.

No separate payment will be made for preparation of the seedbed, including either the cultivating or compacting of the soil to provide a firm, well-packed seedbed, and all costs for seedbed preparation shall be included in the unit price bid in the schedule for sowing grass seed.

Bidders are urged to visit the site of the work and by their own investigations satisfy themselves as to the existing conditions affecting the amount of work to be done under each requirement of these specifications. If the bidder chooses not to visit the site or conduct investigations, he will nevertheless be charged with knowledge of conditions which reasonable inspection and investigations would have disclosed. Bidders and the contractor shall assume all responsibility for deductions and conclusions as to the difficulties in performing the work.

___ Sowing Grass Seed

The contractor shall notify the _____ _____, not less than 48 hours in advance of any seeding operations, and shall not begin the work until areas prepared or designated for seeding have been approved. Following approval of seedbed preparation, seeding shall begin immediately. The sowing of grass seed shall be done from October 1 to November 15, unless unfavorable weather, soil moisture, or seedbed conditions are prohibitive to sowing, as determined by the contracting officer: Provided, That when seedbed and moisture conditions are favorable, the contracting officer may order the contractor to

perform the sowing operations in periods other than stated above. Seeding shall not be done during windy weather or when the ground is frozen. Seed may be sown by one of the following methods:

a. Approved power-drawn drills or seeders.

b. Approved blower equipment with an adjustable disseminating device capable of maintaining a constant measured rate of discharge that will insure an even distribution of seed at the rates herein specified.

c. An approved type hydro-seeder which utilizes water as the carrying agent, and maintains a continuous agitator action that will keep the seed mixed in uniform distribution until pumped from the tank. Pump pressure shall be such as to maintain a continuous, nonfluctuating stream of slurry. Type of mulch used shall be approved prior to use. Fertilizers will be added according to rates herein specified.

Areas inaccessable to power-drawn drills or seeders shall be seeded by approved power or hand methods. Distribution of the seed shall be uniform and at the rate of ___ pounds of live pure seed per acre. Seed computation shall be based on the following formula:

$$\text{Percent of live pure seed} = \frac{\text{percent of purity x percent of germination}}{\text{100 percent}}$$

Grass drills or other similar equipment used for seeding shall be so regulated that the grass seed will be properly covered with soil to a depth not to exceed one-half inch. If the seed is applied by broadcast methods, it shall be properly covered during the same workday with soil to a depth not to exceed one-half inch by means of a harrow, treader, or packer: Provided, That on rocky areas and those areas having slopes steeper than 2 to 1, the seed coverage obtained from dragging a heavy chain, or other device that will conform to the surface, once over the seedbed shall be acceptable.

___ Measurement and Payment

a. Measurement.--Measurement for payment, for furnishing and sowing grass seed, will be made by ground slope measurement in acres of the actual surfaces of the canals, wasteways, drains, and borrow areas seeded. The total area seeded will be computed to the nearest one-half acre.

b. Payment.--Payment for furnishing and sowing grass seed will be made at the unit price per acre bid therefor in the schedule, which price shall include the cost of all labor, materials, and equipment required for preparing the seedbed; for furnishing, sowing, and covering the seed; furnishing and spreading the fertilizer; and the cost of furnishing and placing the mulch.

___ Drawings

a. List of drawings.--The following drawing is made a part of these specifications:

b. General.--The contractor shall check the drawing carefully and shall advise the contracting officer of any errors or omissions discovered.

The contractor will be furnished such additional copies of the specifications and drawings as may be required for carrying out the work.

Note: If fertilizer is to be applied as part of the grass planting, applicable specifications should be added to the sections on seedbed preparation or that on sowing the seed.

* * * * *

SEEDING

SEEDING

a. General. - The contractor shall furnish and spread commercial fertilizer, and furnish and sow grass seed mixtures on excavated canal slopes to the water surface; on other exposed excavated surfaces; on surfaces of dikes, backfill, and waste banks. All seeding operations shall be performed in accordance with the provisions of this paragraph. The limits to which the above described surfaces are to be seeded shall be as prescribed by the contracting officer. If directed, seeding of the areas lying between the outside toe of waste bank slopes or embankment slopes and the right-of-way lines, and between the canal cut and the inside toe of waste banks shall be seeded where construction operations have removed the existing grass cover, where such areas have otherwise been denuded of grass cover, or where due to other reasons grass seeding is determined to be necessary.

The contractor shall maintain the seeded areas until final acceptance thereof and any damage caused to the seeded areas by the contractor's operations shall be repaired by and at the expense of the contractor.

b. Seedbed preparation. - The contractor shall prepare the areas to be seeded to provide a firm, well-packed condition suitable for establishing grass stands just prior to sowing the seed. Where required the contractor shall scarify the ground to prepare a proper seedbed. No separate payment will be made for either compacting or scarifying areas to be seeded, and all costs of seedbed preparation shall be included in the unit price per acre bid in the schedule for seeding.

c. Seeds. - Seed and seeding mixtures shall be free of all prohibited noxious weed seed and shall not contain more than 0.5 percent by weight of restricted noxious weed seeds. Prohibited and restricted noxious weeds shall be those as classified by the State Seed Department.

All seed containers must be sealed and labeled to comply with existing North Dakota Seed Laws and Regulations or in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act, if shipped in Interstate Commerce. Origin of the seed must be from the Northern Great Plains area lying north of the

41st Parallel (41° North Latitude). The contractor shall furnish and sow a uniform seed mixture composed of the seeds listed in the following table:

Seed Requirement for 1 Acre	
Kind of seed	Pounds pure live seed/acre
Green Needlegrass	[1]5
Little Bluestem	[2]1
Side Oats Grama (Pierre or Killdeer)	[2]2
Western Wheatgrass	5
Slender Wheatgrass	5
Nurse Crop: wheat, oats, or barley	1/2 bushel

[1]Pure live seed test on Green Needlegrass shall be by Tetra test.
[2]Little Bluestem and Side Oats Grama may be substituted for each other if either seed is unavailable.

Germination tests shall not be more than 1 year old at the time of grass seeding. Mixing of seeds precludes any further germination tests so it is required that no more seed be mixed than will be sown within a year following mixing.

d. Sowing periods. - Seeding shall be done at such times of the year when climatic conditions of temperature and moisture are conducive to growth. Unless otherwise approved, seeding shall not be performed during the periods July 1 to August 15 and September 15 to November 1 of any year.

e. Mulching. - The contractor shall furnish and uniformly place after seeding a minimum of 2 tons per acre of hay or straw mulch on all seeded areas that are steeper than 4:1. Mulch material shall be reasonably free of mold or other evidence of decomposition and weed seed. Major portion of the mulch material in place shall exceed 12 inches in length. The mulch material shall be firmly anchored with an "IMCO" treader or equivalent Treader will be operated at a depth of 3 to 4 inches and crosswise to all slopes. Mulch will be anchored at 6- to 12-inch intervals across the slope. The cost of mulching shall be included in the unit price bid in the schedule for seeding.

f. Sowing seed. -

(1) Method. - The mixture specified herein shall be sown by drilling with either an approved disk or shoe-type grass drill or an approved hydroseeder, or by mechanical or hand broadcasting.

(2) Drill seeding. - If the drill seeding method is used the drill shall be regulated to uniformly distribute the seed at the rate specified herein on the areas to be seeded. Where possible to safely operate equipment as determined by the contracting officer, drilling shall be done crosswise to the general slope. The drill shall be regulated so that the seed is properly placed in the soil and covered with soil to a depth of 3/4 inch to 1 and 1/4 inches. In the event the drill is equipped with an approved fertilizer attachment which will uniformly distribute fertilizer, up to 10 pounds of the nitrogen and 50 pounds of the phosphorus may be applied simultaneously with the drilling of the seed. The balance of the nitrogen will be broadcast or drilled in prior to or after seeding of grass.

(3) Hydroseeding. - Seeding with an approved hydroseeder will be acceptable provided wind velocities permit uniform distribution of the seed and fertilizer slurry on the areas to be seeded. In hydroseeding operations the mixture of seed and the fertilizer specified herein shall be properly mixed with water to form a slurry. The slurry mixture shall be prepared immediately prior to application, and shall be promptly applied on the areas to be seeded and fertilized. Slurry mixtures prepared more than 1 hour prior to application are not acceptable. The hydroseeder shall be designed so as to insure seed and fertilizer being uniformly applied at the rates per acre specified herein. The hydroseeder shall be equipped with a paddle-type agitator and recirculation pump that will continually stir and mix the slurry to prevent settling of solids in corners and at the bottom of the tank and maintain a uniform mixture of seed, fertilizer, and water at all times during the entire seeding operation. Immediately after the slurry mixture is applied to the soil surface, the seed shall be properly covered with soil to the depths prescribed above by means of rotary hoe, Dunham packer, spike tooth harrow, or other acceptable implements as approved by the contracting officer. Covering seed by dragging a log chain or similar device will not be permitted. Seed applied around structures shall be properly covered with soil with a hand rake or float.

(4) Broadcast seeding. - Broadcast seeding with either a mechanical broadcaster or by hand is acceptable only on areas inaccessible to the basic method employed which may be either drill seeding or hydroseeding.

(a) Mechanical broadcasting. - A mechanical broadcaster of either the centrifugal type of pull type similar to fertilizer spreaders are acceptable. Any equipment of this type used for broadcast seeding shall be designed and regulated to insure that the proper seeding rate per acre specified herein is uniformly applied on areas to be seeded. When this method is used seed and fertilizer may not be applied in the same mixture simultaneously, each shall be broadcast separately.

(b) Hand broadcasting. - Hand broadcasting may be performed only on small, inaccessible areas as approved by the contracting officer. Seed application may be performed by using an approved hand broadcaster or by broadcasting the seed by hand from a sack or other suitable container. Whichever means is used, the seed shall be uniformly applied at the rates specified herein. In the employment of this method both the seed and fertilizer shall be broadcast separately.

Immediately after broadcasting the seed by either mechanical or hand methods, it shall be properly covered with soil to the depths prescribed above by means of a spike tooth harrow, rotary hoe, Dunham packer, or other acceptable implements. Covering broadcast seed by dragging a log chain or similar device will not be permitted. Seed broadcast around structures shall be covered with soil with a hand rake or float.

g. Fertilizer. - The contractor shall furnish and apply commercial fertilizer at the minimum rates per acre of 30 pounds of actual nitrogen and 50 pounds of actual phosphorus. Fertilizer may be applied prior to seeding by suitable mechanical spreaders, blowers, or hydraulic equipment. Fertilizer may also be applied when seeding as specified in Subparagraphs f.(2) and (3) above.

Dry fertilizer shall not be mixed with dry seed.

h. Hydromulching. - As an alternate to other methods of seeding, fertilizing, and mulching herein specified, application by an approved hydromulcher will be acceptable. Wood cellulose fiber mulch or other approved material to be used in hydromulching shall contain no germination or growth inhibiting factors. It shall be dyed an appropriate color to allow visual metering of its application. The mulching material shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like ground cover, which readily absorbs water, and allows infiltration to the underlying soil. Weight specifications from the suppliers, and for all applications, shall refer only to air dry

weight of the fiber, a standard equivalent to 10 percent moisture. The mulch material shall be supplied in packages marked by the manufacturer to show the air dry weight content. Suppliers shall be prepared to certify that laboratory and field testing of their product has been accomplished and that it meets all the foregoing requirements. The application by hydromulcher shall be done in the following manner: The mulching material shall be added to the water slurry in the hydraulic seeder after the proportionate quantities of grass seed and fertilizer materials. All slurry ingredients shall be mixed to form a homogeneous slurry. Slurry mixtures prepared more than 1 hour prior to application are not acceptable. Using the color of the mulch as a metering agent, the operator of the hydraulic seeder shall spray apply the slurry mixture uniformly to the prepared seedbed to correspond with per acre requirements of all materials. Wood cellulose fiber mulch shall be applied at a minimum rate of 1,000 pounds per acre. Other approved mulching material shall be applied at an equivalent effective rate per acre. The contracting officer will verify, by inspections of tank loading and spray application, that materials applied correspond with per acre requirement.

i. Measurement and payment. - Measurement, for payment, of seeding will be made along the surface of the areas actually seeded as directed. Payment for seeding will be made at the unit price per acre bid therefor in the schedule, which price shall include the cost of all labor, materials, and equipment required for preparation of seedbed; the cost of furnishing and spreading fertilizer; the cost of furnishing, sowing, and covering the seed; and the cost of furnishing and placing the mulch.

* * * * *

Weed Exclusion Devices. - Equipment for mechanical exclusion of seed and plant parts capable of reproducing the plant may be screens, weed traps, diverters within the water channel, and livestock fences. They exclude the weeds themselves or the agents which carry the weed-propagating parts of plants onto the rights-of-way and into the water channel. The use of many of these devices is closely associated with weed disposal and is discussed in more detail in that portion of the bulletin.

Weed seed screens. - Weed seeds enter farms through irrigation water, and screens have been developed which will remove seeds of the most important weeds. For simplicity, low cost, and ease of maintenance, a flat, horizontally mounted screen (fig. 21) appears to fill the requirements. (Colorado State University Agricultural Experiment Station Popular Bulletin 522-5)

If the irrigation system has a drop, the flat screen shown placed at the farm turnout can be used. The flat screens have a frame (fig. 22) with screen stretched across it and a box (fig. 23) which holds the screen frame. The box usually has high sides to control splashing and provides for overflow. The action of the water falling onto the screen causes vibration. The swirling water then pushes the trash and seeds to the sides of the screen.

Screens of this type are available commercially in several sizes. They are usually constructed of metal. However, a serviceable screen can be constructed. In this type of construction, a rigid frame using 2 by 4 lumber is recommended so that there will be little chance of sagging or warping. Since most screen material is 3 feet wide, this is a good width for the frame. The length will vary with the size needed to fit the particular site. The frame should be constructed to fit snugly into the frame box. It is not fastened to the box, since its removal may be necessary. From 6 to 8 square feet of screen area is needed for each cubic foot per second of waterflow.

The actual screen is made up of two layers - a support screen on the bottom and a fine screen on the top. The support screen (1/2-inch mesh, galvanized hardware screen) is fastened to the frame first. The fine screen (No. 24- to 32-mesh) is then fastened on top of the support screen. The No. 24- to 32-mesh screen is fine enough to screen out nearly all varieties of weed seed. To prevent corrosion, the fine screen should be of nonmetallic material - either saran plastic or Fiberglas. Both resist acid, alkali, and electrical corrosion.

In stapling the screens to the frame, it is absolutely essential to get them "drum tight" so that they will vibrate with the

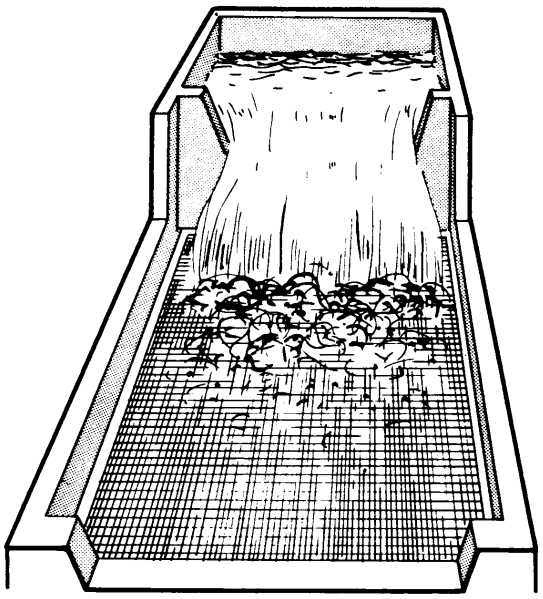


Figure 21

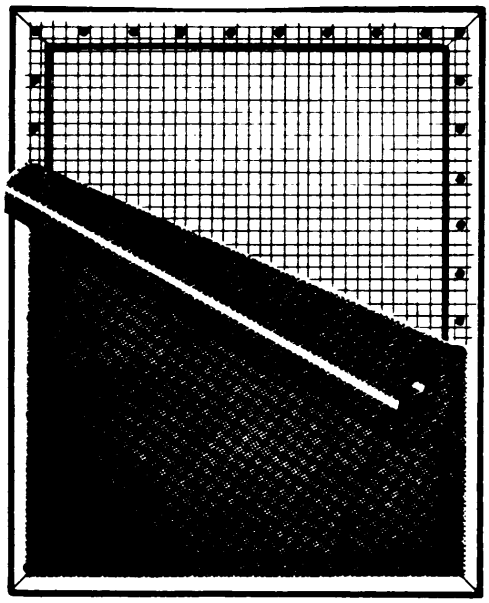


Figure 22

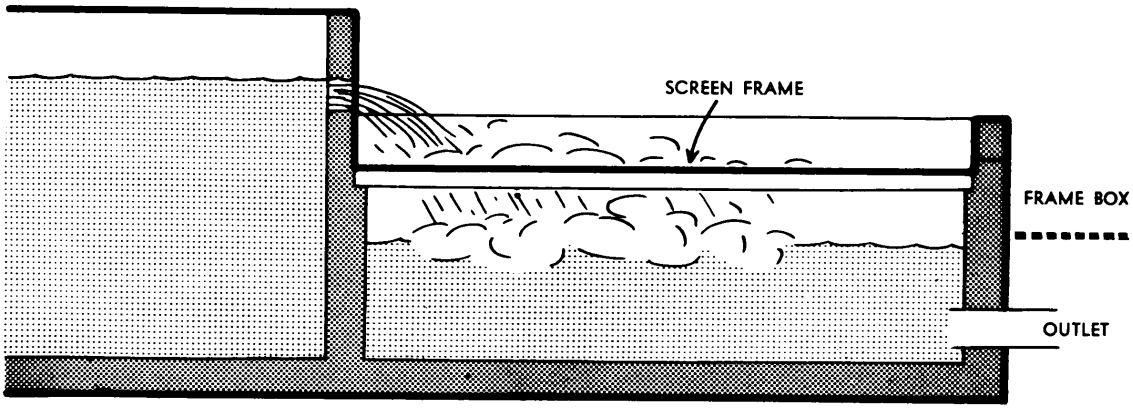


Figure 23

action of the falling water. This will bounce the sand and silt particles, and the swirling water will move them across the screen.

Many variations are possible in the frame box. Basically, it holds the screen frame below the farm turnout and includes provisions for leading the water into the farm ditches or pipelines. Boxes vary from simple posts at each corner of the screen frame to elaborate concrete structures (fig. 24). The downstream end of the box is left open for easy cleaning. The sides should be at least 6 inches high to prevent splashing and overflow.

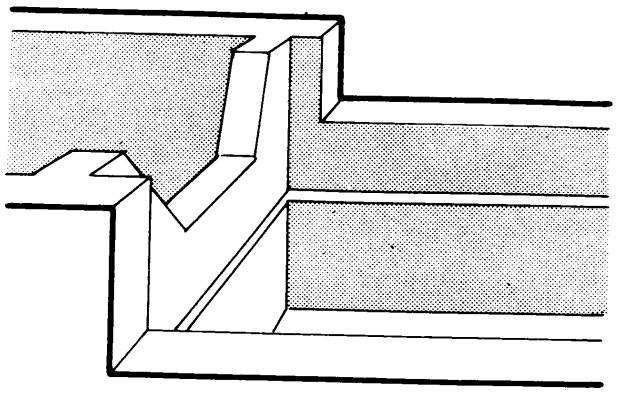


Figure 24

There should be some clearance between the screen and the water below it. Bubbles touching the screen reduce the flow of water through the screen. Screens work best when they are level. Tilting creates problems. With pipe turnouts or flumes, the water must be directed so that it will be discharged above the screen. This may require construction of a pooling box and weir.

The more screen area the water hits as it falls, the less drop needed. Increasing the width of the waterfall will lessen the amount of drop that is necessary, and flat screens can be used with as little as 3 inches of drop if a device is added to create agitation. This aids the movement of water through the screen.

Agitation may be created by an undershot water wheel, by wedges placed on the screen to divide the water, or by boards or small fluming apparatus that divide the water and drop it onto the screen in several positions.

Plastic screens may become clogged with diatoms, algae, slime molds, or bacteria. An occasional wash with a 5-percent (1 lb in 2-1/2 gal) solution of copper sulfate will usually remove the slime.

Flows of 1 to 7 cubic feet per second have been efficiently handled with one screen. Larger flows may be handled by multiple screens installed side by side. A multiple screen installation on the Columbia Basin project is shown in figures 25 and 26. This is a commercial unit, and the debris collected may be the accumulation of several days.

Figure 25

Figure 26

Flows of water greater than 10 cubic feet per second can be screened effectively, provided disposal of the seed is possible and provided a rather high initial cost and operation cost can be justified. At a still higher cost, the screens could probably be designed for fully automatic operation. The estimated cost of installing a screening plant of the simplest type to handle the flow of water to 6 farms was more than 10 times the cost of permanent installations on each farm delivery system. In addition, operation would have required at least 2 man-hours per day to clean the screens and dispose of the debris. Screening of the larger flows may be more practical where municipal and industrial water users cannot tolerate the small amount of living and dead debris present in the raw water.

Other types of weed screens have been developed and used. They include tubes, bags, and electrically operated drums. The tube type of screen shown in figure 27 is simple and economical to build, since it requires no framing or boxes for installation. However, tube-type screens are limited to sites where algae and

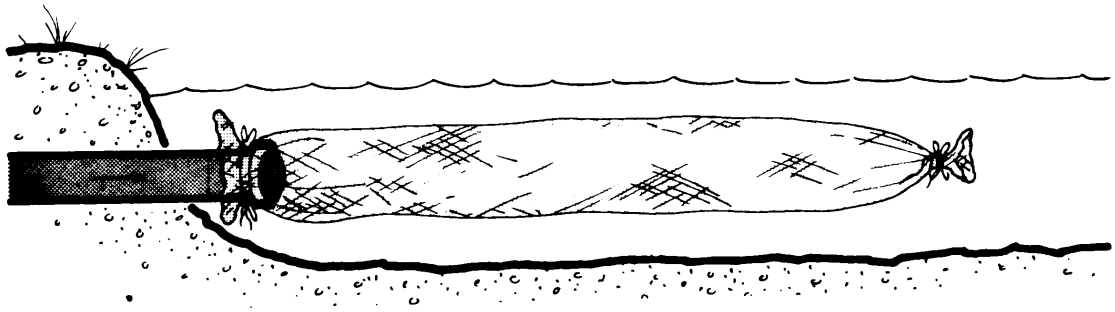


Figure 27

moss are not a problem. Tube screens can be made from No. 40-mesh, saran plastic filter cloth or similar flexible material, with two 3-foot pieces stitched into a tube. The length varies with the amount of water to be screened. A tube 10 feet long will have an effective screen area of about 60 square feet and should handle a flow of 3 cubic feet per second of water, since the requirement is 18 to 24 square feet of screen for each cubic foot per second.

A drawstring is sewn to each end permitting the tube to be opened and closed for attachment to a pipe or submerged outlet and for cleaning. Because of its length, the lower end usually can be removed from the stream and cleaned without disrupting the waterflow.

Where no fall is available, a low-lift pump may be used to lift water from the weir pool to a height of a foot or more and drop it onto a flat screen. This increases the cost of screening weed seeds, but still may be a low-cost weed control measure. Weed screens available from commercial suppliers will screen water in the absence of fall. These vary from rotating wire barrels to endless-belt-type screens. Here, again, the cost of the screening installation goes up, but the cost of the installation may be much below the cost of weed control.

A bag-type weed screen designed and constructed by a Columbia Basin project farmer for attachment to a weir structure is shown in figure 28. The metal frame at the mouth of the bag was constructed to intercept the water without interfering with the weir as a measuring device. The bag was made using saran plastic filter screen (approximately No. 40-mesh). The seams were sewn with nylon thread.

Figure 28

Herbicidal preventive methods. - Chemicals which prevent weed growth include the use of preemergence applications of herbicides, the use of copper sulfate to reduce populations of algae to a low level, and soil sterilization. Many of the materials and procedures used in the prevention of weeds are also used in their control. Equipment used in application of the materials for weed growth is discussed in that portion of this bulletin.

Soil sterilants. - Soil sterilants are particularly useful around those structures where no vegetation is desired. A farm turnout is an example of a structure that should be kept free of vegetation, partly for ease in operating the turnout by the ditchrider, and partly from hazards due to fire. Structures and hazardous areas that may become overgrown by vegetation are areas where soil sterilants may be used to advantage. Operating roads are another example of areas where soil sterilants might be used. Sterilants may be applied to any area where vegetation is not desired, but care should be taken not to eliminate desirable waterline plants that help prevent erosion by water.

There are many soil sterilants available, but care should be taken to select one that is adapted to the particular need and environmental condition.

CONTROL OF LAND WEEDS

Pasturing of Canal Rights-of-way

Pasturing of ditchbanks is an accepted and practical method of controlling weeds and utilizing forage along irrigation ditchbanks and on adjacent rights-of-way on some irrigation projects. Some project personnel are of the opinion that livestock cause too much damage to canal banks to allow pasturing of rights-of-way. In either case, the proper control of livestock requires fencing, and unless cattle guards are installed the ditchriders are confronted with delayed opening and closing of the gates.

Cattle Guards. - There is a considerable difference of opinion among O&M (operation and maintenance) and other project personnel regarding the design of cattle guards on canal operating roads. In the interest of economy, many feel that the number of cattle guards installed on the canal operating roads can be reduced. Nevertheless, it is agreed by all that cattle guards are definitely needed under certain circumstances and serve a vital purpose in expediting travel through stock-raising country.

Most field offices report that cattle guards installed in accordance with the Bureau's standard design (figs. 29a and 29b) have given generally satisfactory service, except where exceptionally heavy traffic must be accommodated. The principal objection by most field personnel to the standard design is the cost of construction. On the other hand, it is pointed out that from an O&M standpoint, the original cost may not be the important cost.

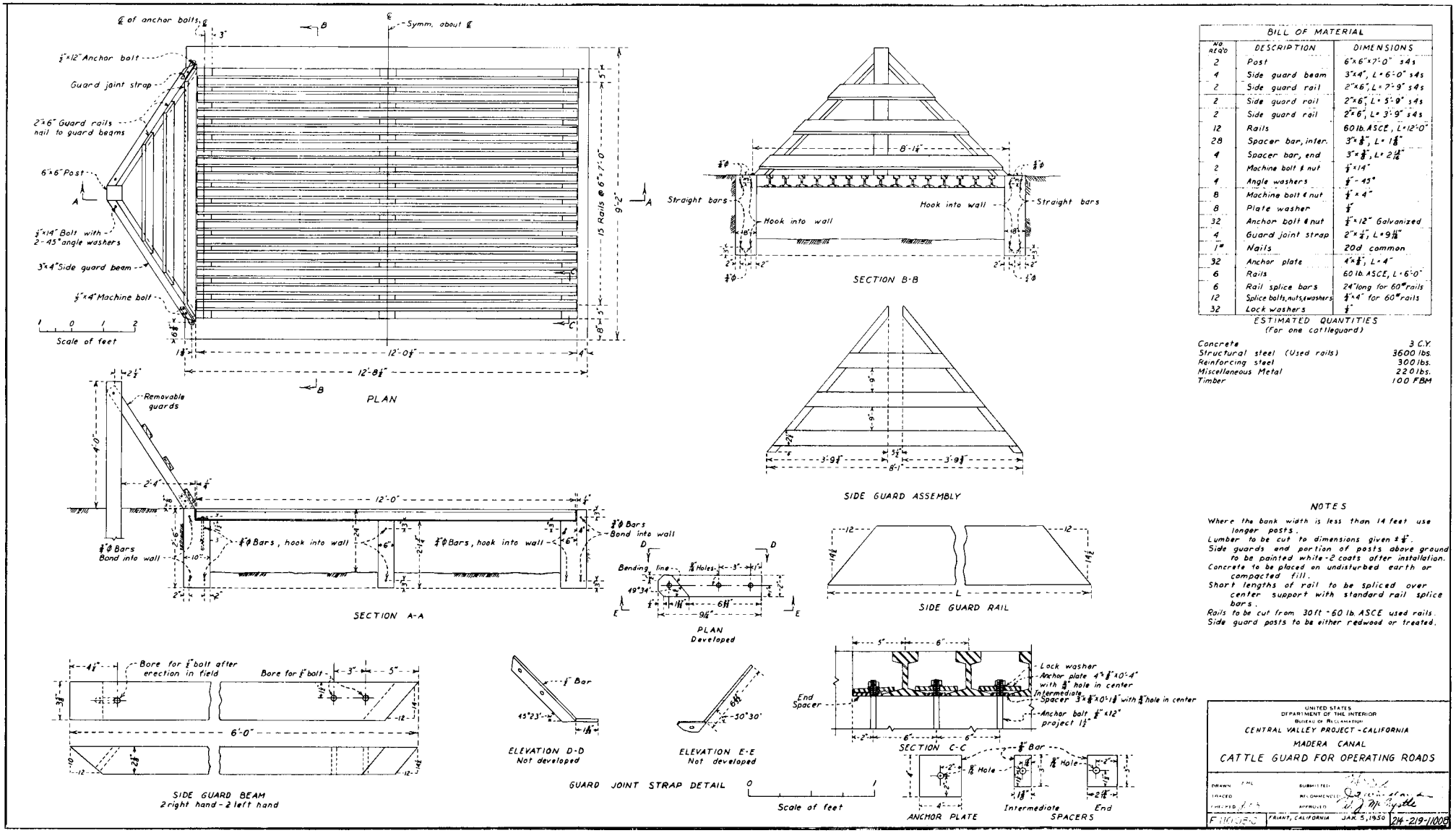
The high cost of lumber and labor and the short life of wooden structures have proven that a more costly design, one calling for concrete and steel construction as shown on figure 30, is less expensive over a period of years because of lower maintenance and replacement costs. Although many object to the original cost, there has been a tendency in replacement and repair of cattle guards to use steel and concrete construction in an effort to reduce future replacement and maintenance costs.

The design of a cattle guard should embody features that will result in the lowest possible cost for materials, labor, and construction as well as maintenance and replacement. Some of the more specific suggestions and recommendations for cattle guard designs are:

1. One standard design for cattle guards does not meet the requirements for all projects or operating conditions.

Figure 29a

Figure 29b



BILL OF MATERIAL		
No. Req'd	DESCRIPTION	DIMENSIONS
2	Post	6"x6"x7'-0" s4s
4	Side guard beam	3"x4", L=6'-0" s4s
2	Side guard rail	2"x6", L=7'-9" s4s
2	Side guard rail	2"x6", L=5'-9" s4s
2	Side guard rail	2"x6", L=3'-9" s4s
12	Rails	60 lb. ASCE, L=12'-0"
28	Spacer bar, inter.	3"x⅜", L=1⅞"
4	Spacer bar, end	3"x⅜", L=2 11/16"
2	Machine bolt & nut	½"x14"
4	Angle washers	½"-45°
8	Machine bolt & nut	½"x4"
8	Plate washer	½"
32	Anchor bolt & nut	½"x12" Galvanized
4	Guard joint strap	2"x½", L=9 11/16"
1#	Nails	20d common
32	Anchor plate	4"x⅜", L=4"
6	Rails	60 lb. ASCE, L=6'-0"
6	Rail splice bars	24" long for 60# rails
12	Splice bolts, nuts, & washers	½"x4" for 60# rails
32	Lock washers	½"

ESTIMATED QUANTITIES
(For one cattleguard)

Concrete	3 C.Y.
Structural steel (Used rails)	3600 lbs.
Reinforcing steel	300 lbs.
Miscellaneous Metal	220 lbs.
Timber	100 FBM

NOTES

Where the bank width is less than 14 feet use longer posts.
Lumber to be cut to dimensions given ±⅛".
Side guards and portion of posts above ground to be painted white - 2 coats after installation.
Concrete to be placed on undisturbed earth or compacted fill.
Short lengths of rail to be spliced over center support with standard rail splice bars.
Rails to be cut from 30 ft - 60 lb. ASCE used rails.
Side guard posts to be either redwood or treated.

Figure 30

2. Commercially available, prefabricated cattle guards should be installed wherever possible. They are manufactured in quantity and therefore less costly.

3. Narrower and less costly cattle guards could be installed on canal operating roads for passage of light traffic providing adjacent wire gates for passage of heavy equipment and traffic.

4. Where the more costly type of cattle guard must be used, as many similar guards as possible should be specified in one contract to take advantage of mass production and resulting lower cost.

5. The 24-inch pit under the deck of the cattle guard can be eliminated by using heavy railroad rails or by setting the stringers of the cattle guard deck level with the roadway and ramping the roadway over the structure.

6. Guard posts should be provided adjacent to cattle guards to eliminate damage by the passage of wide equipment over them or to prevent equipment from approaching the cattle guard at an angle.

7. Placing a cattleguard on a sharp curve should be avoided. It is difficult to approach a cattle guard in a manner that permits traffic to move through it without damage to wing guards.

8. Cattle guards should not be located on the right-of-way lines of narrow roads; rather, they should be located, wherever possible, 30 to 50 feet outside the right-of-way line. This provides an adequate turning radius for larger trucks and other heavy equipment when driving onto the O&M road. Insufficient turning radius results in high maintenance costs through the continual repair of the side guards.

9. For best results, the cattle guard should be 4 to 6 inches higher than the road grade. The approach ramps to the cattle guard should be fairly short, but consistent with the type and size of equipment using the road and the speed of the traffic. The ramps should be kept covered with fairly loose gravel, which discourages livestock from jumping over the guard.

10. In construction of wing guards, lighter material should be used - 1-inch instead of 2-inch material.

11. Wing guards should be fabricated separately and provision made for tying them to the guard posts and surface guard framing by metal strips and bolts or screws.

12. The use of mesh-type decking material for cattle guards should be avoided. Much difficulty has been encountered in breakage of the unsupported mesh.

There are other low-cost cattle guards available, such as the "auto-gates" manufactured on a commercial basis (fig. 31). These are being used extensively on some of our midwestern projects in Nebraska and Kansas.

Cattle Guard Modification. - The Kansas-Bostwick Irrigation District, headquartered at Courtland, Kans., has found through years of operation that the cattle guards on their system were too narrow for equipment travel and that the maintenance of the wing guards was time consuming and costly. Figure 32 shows an original cattle guard installation (note damage to the wing guards). To eliminate this problem, the maintenance personnel of the District are using a portion of their time during the winter months modifying the cattle guards.

The modifications consist of using two pipe deck units at each site. The outside ends of the pipe deck are bent upward to the desired height and braced to form the wing guards (fig. 33). Figure 34 shows in detail the procedure used to bend the pipe deck ends to form the wing guards, and figure 35 shows a cattle guard installation after it has been modified.

The Ainsworth Irrigation District, Nebr., has also experienced maintenance problems on the wing guards of the cattle guards on their systems. To alleviate this problem, the district maintenance personnel attach used automobile tires to the wing guard support posts to form the wing (fig. 36).

The tires are bolted to the wing guard support posts, and if struck by maintenance equipment, the tires are flexible enough to allow passage of the equipment and then return to their original position.

Curb Angles for Cattle Guards. - The Farwell unit, Middle Loup division, Missouri River Basin project, Nebr., noted that it costs considerable money to straighten and replace cattle guard wings that were damaged by traffic slipping off the cattle guards. The guards were modified to reduce the hazard to farm and project vehicles and prevent damage to the guard wings by adding curb angles as shown in figure 37.

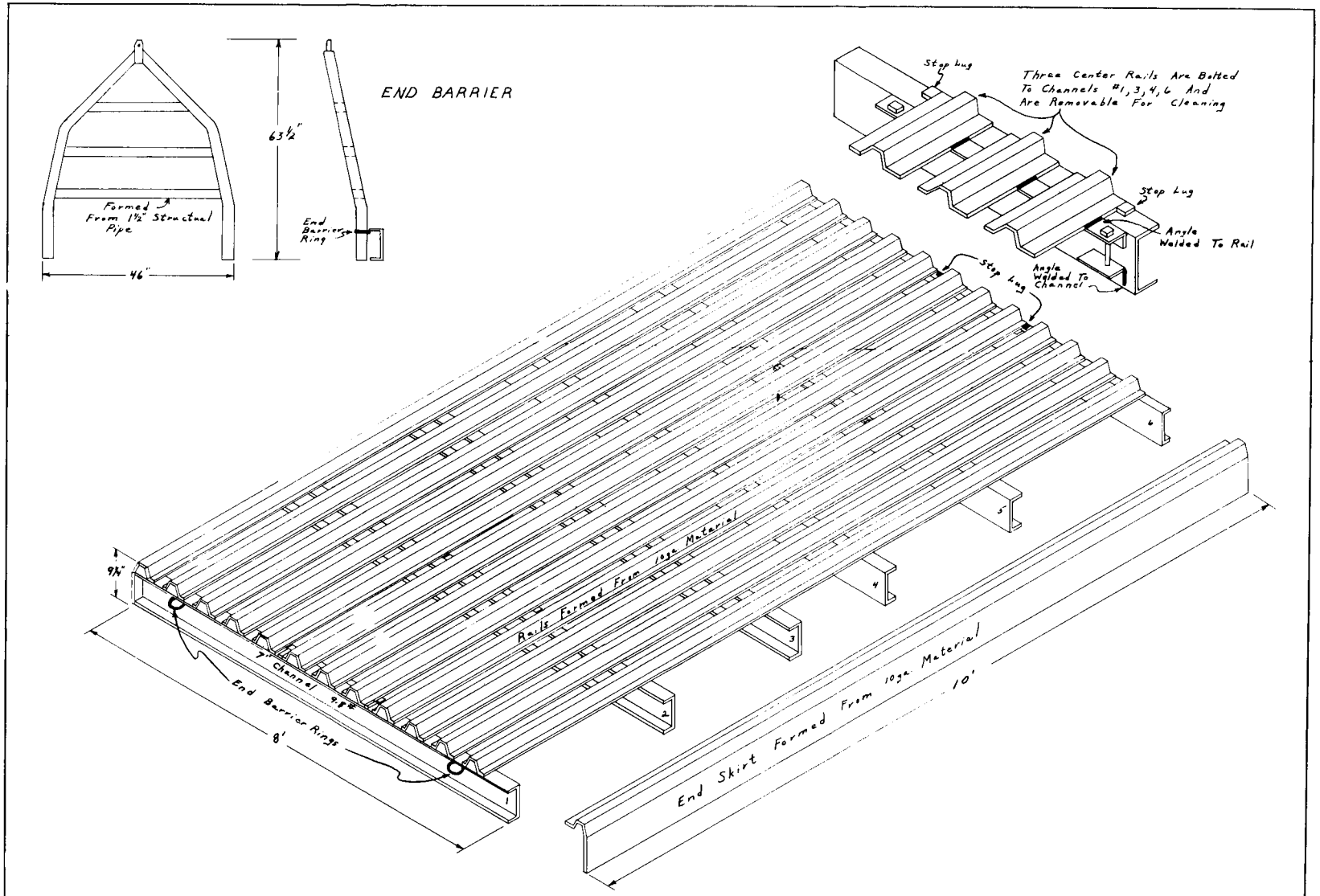

END BARRIER
Formed From 1½" Structual Pipe
46"
63½"
End Barrier Ring
Stop Lug
Three Center Rails Are Bolted To Channels #1, 3, 4, 6 And Are Removable For Cleaning
Stop Lug
Angle Welded To Rail
Angle Welded To Channel
Stop Lug
Rails Formed From 10ga. Material
9¾"
7" Channel
End Barrier Rings
8'
End Skirt Formed From 10ga. Material
10'
1
2
3
4
5
6

Figure 31

Figure 32

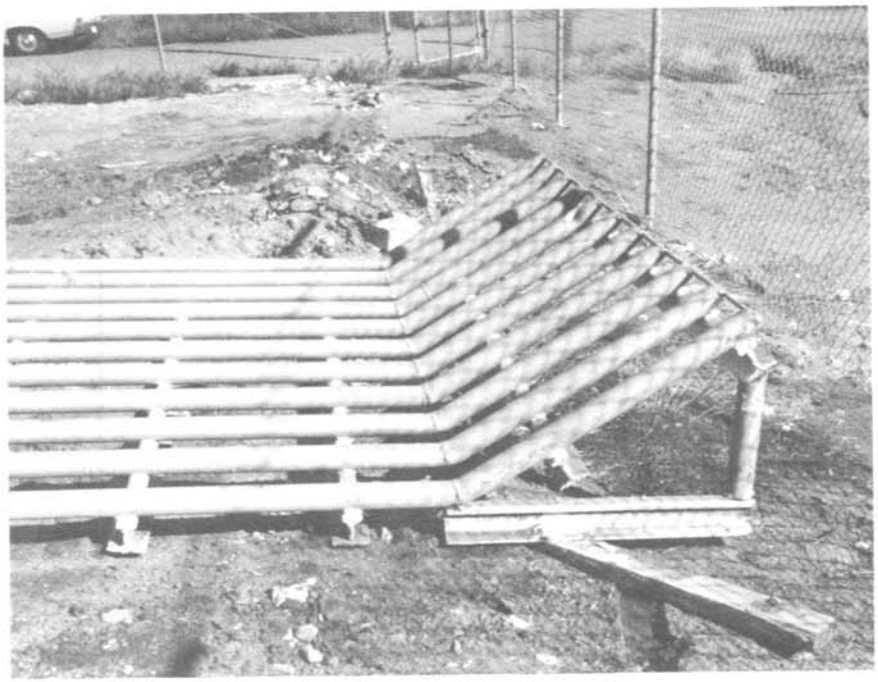


Figure 33

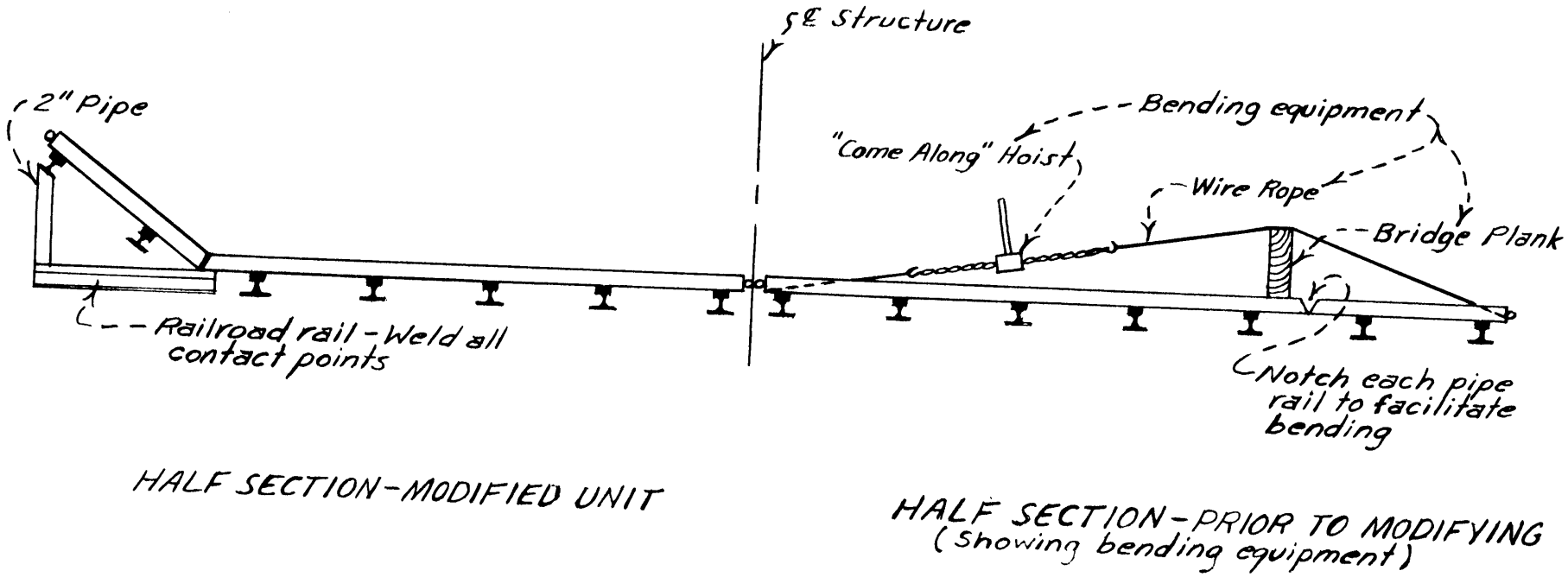

℄ Structure
2" Pipe
Bending equipment
"Come Along" Hoist
Wire Rope
Bridge Plank
Railroad rail - Weld all contact points
Notch each pipe rail to facilitate bending
HALF SECTION-MODIFIED UNIT
HALF SECTION-PRIOR TO MODIFYING
(Showing bending equipment)

Figure 34

Figure 35

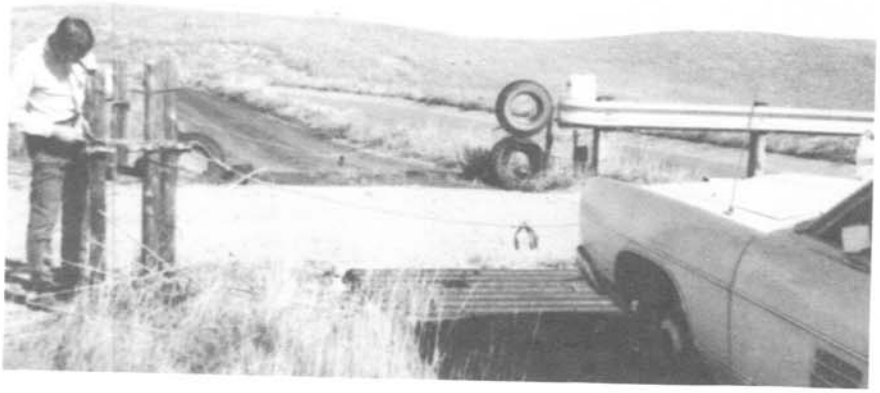


Figure 36

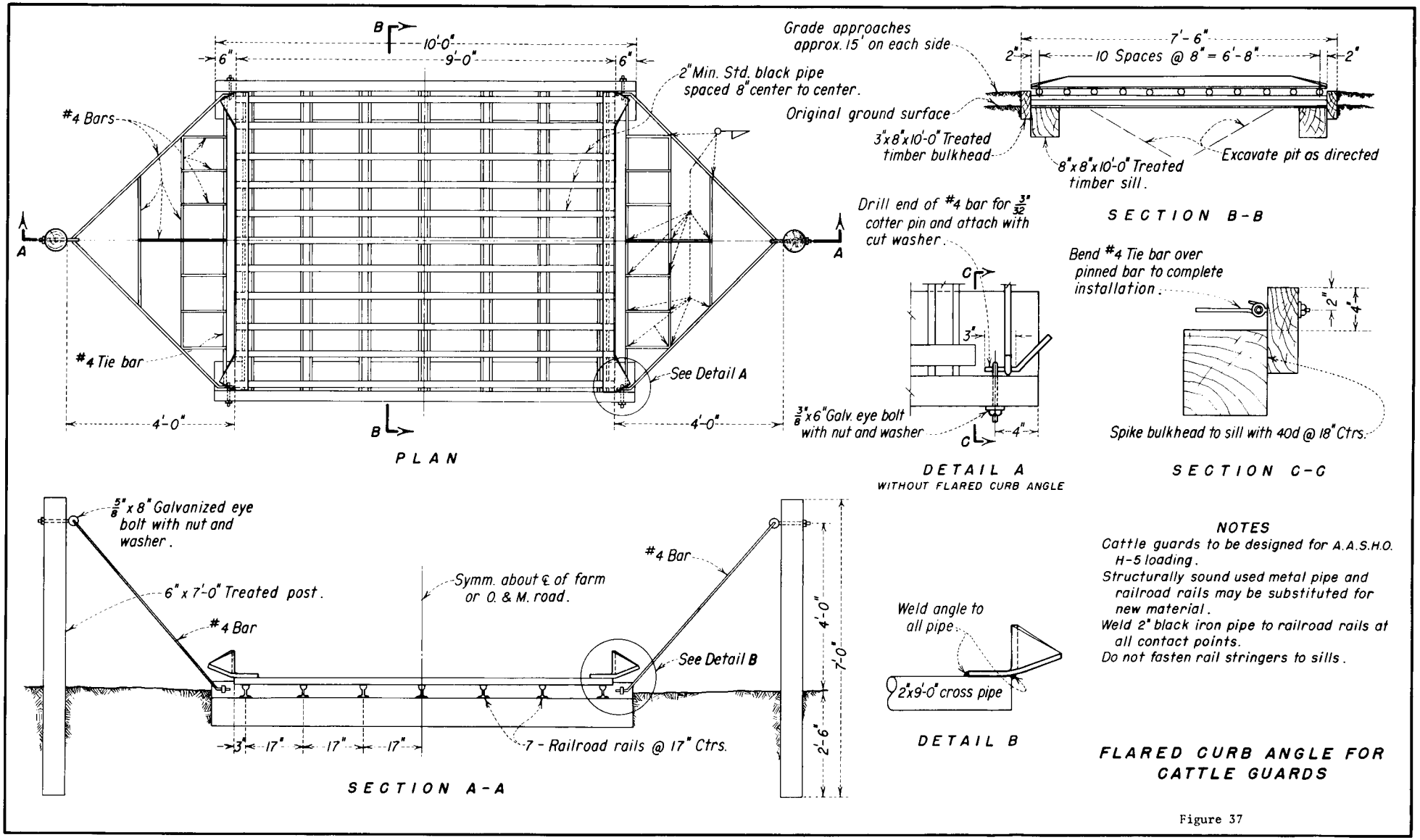

B
10'-0"
6"
9'-0"
6"
2" Min. Std. black pipe spaced 8" center to center.
#4 Bars
#4 Tie bar
See Detail A
A
A
4'-0"
4'-0"
B
PLAN
Grade approaches approx. 15' on each side
Original ground surface
3"x8"x10'-0" Treated timber bulkhead
7'-6"
2"
10 Spaces @ 8" = 6'-8"
2"
8"x8"x10'-0" Treated timber sill.
Excavate pit as directed
SECTION B-B
Drill end of #4 bar for 3/32" cotter pin and attach with cut washer.
C
3"
3/8"x6" Galv. eye bolt with nut and washer
4"
C
DETAIL A
WITHOUT FLARED CURB ANGLE
Bend #4 Tie bar over pinned bar to complete installation.
2"
4"
Spike bulkhead to sill with 40d @ 18" Ctrs.
SECTION C-C
5/8"x8" Galvanized eye bolt with nut and washer.
6"x7'-0" Treated post.
#4 Bar
Symm. about ℄ of farm or O. & M. road.
#4 Bar
See Detail B
4'-0"
7'-0"
2'-6"
3"
17"
17"
17"
7 - Railroad rails @ 17" Ctrs.
SECTION A-A
Weld angle to all pipe.
2"x9'-0" cross pipe
DETAIL B
NOTES
Cattle guards to be designed for A.A.S.H.O. H-5 loading.
Structurally sound used metal pipe and railroad rails may be substituted for new material.
Weld 2" black iron pipe to railroad rails at all contact points.
Do not fasten rail stringers to sills.
FLARED CURB ANGLE FOR CATTLE GUARDS

Figure 37

The modification uses two 3- by 3- by 1/4-inch steel angles welded onto the cattle guard and placed on each side of the traveled surface, with the steel angles' horizontal legs extending toward the centerline of the roadway. The vertical legs are alined with the ends of the bars, rails, or pipes forming the roadway portion of the guard, with the legs bent outward at each approach end so that they become horizontal in a distance of approximately 8 inches. This presents a sloping surface to the wheel of a vehicle that might be at the edge of the guard when entering or crossing the cattle guard.

Fencing Specifications. - District personnel, in most instances, construct and repair most minor and some major fencing projects; more complex work is performed under contract. The following are typical specifications for wire and chain link fences which may be used when the fencing is to be done by contract. These specifications may require modifications to meet an individual District's needs.