U.S. ARMY CORPS OF ENGINEERS ®

Little Rock District

SEDIMENT AND EROSION CONTROL GUIDELINES FOR PIPELINE PROJECTS

Table of Contents

SEDIMENTATION

AMD EROSION CONTROL GUIDELINES

FOR PIPELINE PROJECTS

1.0 INTRODUCTION

The following Sedimentation and Erosion Control Guidelines are based upon acceptable practices in the Little Rock District, U.S. Army Corps of Engineers. All pipeline projects crossing waters of the United States in the Little Rock District shall be constructed using these guidelines. These practices include constructing temporary and permanent erosion and sedimentation control devices properly; stabilizing earthwork; seeding and sedimentation control devices; and maintaining these until the land is permanently stabilized.

One of the most important erosion and sedimentation control considerations is construction time frame. The time between initial disturbances and post construction stabilization is a critical element in minimizing adverse impacts to the environment.

2.0 PROJECTS IN WATERS OF THE UNITED STATES

Pipeline projects crossing waters of the United States are subject to regulation under Section 10 of the *Rivers and Harbors Act of 1899* and Section 404 of the *Clean Water Act*. Section 10 requires permits to authorize certain structures or work in or affecting navigable waters of the United States. Section 404 requires permits for the discharge of dredged or fill materials into waters of the United States. Wetlands are considered waters of the United States and also require Section 404 permits for crossings. The area of pipeline projects which must maintain erosion control in connection with Department of the Army permits are all crossings of waters of the United States and the slopes which drain directly to the waterway.

2.1 STREAM AND RIVER CROSSINGS

During construction, various preventative measures may be implemented to reduce and minimize impacts to stream and river environments. This section will present the conventional methods and techniques that will be used when crossing streams, rivers, and wetlands.

For pipeline crossings of streams or creeks utilizing conventional open-cut trenching techniques, two (2) plans are proposed for sediment control in the stream or creek bed.

Plan #1 is used when streams are small and perhaps intermittent, usually these streams are not considered navigable. Plan #2 is used when a stream has greater velocities and the flow must be maintained. It is used on streams/creeks that are considered navigable by the U.S. Army Corps of Engineers.

Plan #1 is proposed when the stream bed has solid rock and silt or mud present. This plan requires straw bales/silt screening be installed across the entire width of the stream downstream of the construction (trench) area. The straw bales/silt screenings are held in place by installing wire cables and or stakes downstream of the straw bales/silt screening. Sediment controls are installed prior to any construction activities in the stream bed and remain in place until all construction activities in the stream bed are completed. All ground contours are returned to their original condition. Figures 1A and 1B (Appendix) illustrates Plan #1.

If the flow of the stream is too swift to maintain silt screening, additional measures are required. An effective method which can be used is a water dam. Water dams function like small cofferdams. They can be placed where it is necessary to stop, slow, or manage the movement of water. They are temporary barriers built of “inner” tubes of water contained within heavy duty tubing. It can be used virtually in all locations including remote and uneven terrain and does not contribute to sedimentation in the stream.

Plan #2 is proposed when the stream has sufficient flow to prevent the implementation of silt screens across the entire width of the stream. This plan uses a turbidity curtain which is custom designed for the proposed work area. It may be used alone or as a sediment control encircling a cofferdam. The turbidity curtain has a flotation boom and a weighted bottom load line which allows sediment to settle to the stream bed from the bank thus minimizing the impact of equipment in the stream. All ground contours are returned to their original condition. Figures 2A, 2B, and 2C (Appendix) depict turbidity curtains for Plan #2.

If conventional trenching methods cannot be used, the directional drilling method may be used on major river and stream crossings and environmentally sensitive areas. When directional drilling is required as part of Department of the Army Permit, it shall be specified in the permit letter. This method of installing pipelines is well documented as having the least negative impact on environmentally sensitive areas and wetlands. Plans for directional-drilled crossings shall include the location of boring sites and temporary work areas for welding line pipe, as well as the drilling rig and other necessary equipment. The area from the boring sites to the water’s edge normally will not be disturbed; however, if clearing of this area is needed, and this area is a wetland, it will be done using hand tools. If dozers, graders or other mechanical equipment will be utilized in clearing, and if the area is a wetland, an additional Department of the Army permit is required for such clearing. Silt fencing will be erected near the river’s bank to prohibit the introduction of silt or debris into the water. Additional straw or hay bales will be incorporated to prevent introduction of silt or sedimentation from the boring sites into the water.

Where the pipeline crosses a waterway either by the open-cut method or the directional drill method, straw bales and silt fencing will be used until the revegetation program has matured sufficiently to stop the flow of silt into the water. Silt fencing and hay bales will be erected prior to any other ground disturbing activity. Fences and silt barrier hay bales will be maintained and remain in place as long as required to minimize any negative impacts on water quality. Permanent revegetation will proceed as rapidly as possible after pipeline operations are completed at the crossings.

On river and stream crossings where the open-cut (trench) method is employed, the dredged or excavated material will be kept to a minimum. The work shall be conducting in such a manner to minimize turbidity of the water in the work area and downstream. Excavation of the pipeline trench will not result in the relocation of any existing stream or river channel or restrict stream flow. Any temporary fill placed in the stream such as for road crossing shall be constructed of wooden mats or clean non-eroding material and shall be properly maintained to minimize erosion and degradation of water quality (Appendix, Fig 3A and 3B). Additional Department of the Army permits are required for temporary fills such as road crossings and cofferdams. Sufficient waterway openings such as culverts shall be provided to allow for the passage of expected high flow.

Any temporary fill or excess excavated material from the stream or riverbed will be removed and disposed of in an approved area. If additional fill material is required for bank stabilization, these materials will be obtained from an approved borrow pit.

2.2 WETLAND CROSSINGS

Construction across wetlands should be performed so that the disturbance of wetland vegetation is minimized. After construction, the wetland crossing must be restored to preconstruction bottom contours and maintained in wetland vegetation. If proper construction procedures are followed and the hydrology of the site is not adversely affected, the wetland should naturally revegetate.

Construction methods should minimize the extent of construction equipment usage in wetland areas. Trenching equipment and backfilling equipment working in wetlands shall be placed on mats or mud boards.

One approach would be to prefabricate sections of pipe on dry ground and pull them into place between mud boards which would support construction equipment. Using this same technique, mud boards would also be used to support trenching and backfilling equipment. Spoil can be side cast in a ridge along the pipe trench. Gaps 50 to 1000 feet wide shall be left at intervals of about 500 feet to provide for natural circulation or drainage of water. The top 6 to 12 inches of the trench is required to be backfilled with topsoil from the trench. Excess backfill shall be disposed of on dry land rather than in wetlands. In no instance shall additional fill be placed on any wetland or flood plain area.

In addition, wetlands adjacent to streams will be protected so that they are not adversely impacted by pipeline construction in the streams. These wetlands will not be used for storage, waste, access, parking, borrow material, or any other construction support activity.

3.0 SEDIMENTATION AND EROSION CONTROL

For pipeline projects requiring a Department of the Army permit, the following generic temporary and permanent measures for erosion control are outlined as appropriate methods to follow. The most important measure of erosion control is minimizing the period of time between right-of-way clearing and final restoration. Inadequate erosion control methods, especially on pipelines constructed in steep, hilly regions creates the potential to introduce large amounts of sediment and silt into streams or wetlands at the base of the slopes. Any slope draining into the project crossing greater than 10 percent will have appropriate erosion control measures to minimize erosion.

Temporary measures for erosion control include mechanical barriers to confine sediment and block its entry into the waterway, and temporary seeding methods to revegetate raw earth left exposed during construction. Permanent measures for erosion control involve grading to previous contours, permanent revegitation methods, and follow-up inspections to monitor the success of seeding, with additional seeding if necessary.

3.1 TEMPORARY MEASURES

During pipeline construction, various preventative measures may be required to minimize the potential for soil erosion and stream siltation. Minimizing the time of exposure of disturbed ground is a primary objective. It is extremely important that any soil or stream disturbances of the work area be stabilized as work is proceeding. This section outlines the methods to be used where impacts to waters of the United States have the potential to be significant. These measures are temporary in nature and some of them may be removed after all construction activities are complete. Others may be retained in place when permanent controls are implemented.

3.1.1 SEDIMENT BARRIERS

Natural vegetation acts as an effective filter medium to remove silt from surface run-off. The use of natural vegetation is the most cost-effective means of sediment control and generally results in less overall disturbance to the land than other methods. This technique is therefore applied wherever practical. In areas where natural vegetation is not present or where it is not sufficient to attain the needed removal of silt, installation of sediment barriers is required.

Sediment Barriers are typically *Straw Bale Filters* or *Silt Fences*. They are typically installed across and/or at the foot of a slope or at the outlet or a diversionary structure. Sediment barriers are designed to remove silt from surface run-off. Bale filters are constructed of bales which are securely bound. The bales are embedded at least four inches into the soil and each bale firmly held in place by two stakes driven at least 1 ½ feet into the ground. Bales tightly abut adjacent bales. Straw bales are effective in areas where the support stakes can be driven adequately into the ground. The strings are not placed in contact with the ground. Figure 4 (Appendix) illustrates the design and application of a straw bale filter.

Silt fences consist of fence posts spaced no more than ten feet apart and driven a minimum of two feet into the ground. The above-ground height of the fence posts are no less than two feet. A metal mesh fence with six-inch are smaller openings is fastened to the fence posts to reinforce the silt fence fabric. The mesh fence stands at least two feet above ground and is buried at least four inches below ground. Silt fence fabric which is reinforced (e.g. Envirofence) may be used without a wire mesh support in low flow areas. Figure 5 (Appendix) shows a typical reinforced fabric silt fence design. In streams and in areas where high flow may be encountered, the silt fence always has a wire mesh to support the fabric. On gentle slopes, the fence need not be reinforced with wire mesh and may be supplemented with hay or straw bales as a primary barrier to aid in collecting silt and potential sedimentation from entering ditch lines and waterways. Sediment should be removed from silt fences when it has been deposited to a depth of 1/3 of the fence. Any silt or sediment removed from the erosion control devices should not be deposited where it will erode into waters of the United States.

Neither straw bales, nor silt fences are very durable when they must be continually moved for equipment to pass through. When bales or fences are not practical, interceptor dikes (discussed below) can be very effective.

3.1.2 INTERCEPTOR DIKES

Interceptor Dikes act as a barrier to run-off water. Earthen berm dikes are better suited to rocky terrain and steep slopes, than either straw bales or silt fences, especially during long rain events. Interceptor dikes interrupt and divert storm water flow of the right-of-way. The dikes are typically constructed with earth-filled sacks or mounded compacted earth and rock. On long slopes, a series of dikes are used. Spacing depends on the severity of the slope. The maximum spacing or interceptor dikes are given in Table 1. These distances may be shortened as situations dictate but shall not be lengthened. Properly used, interceptor dikes prevent storm water run-off from causing extensive erosion of the slope. The drainage area above interceptor dike is stabilized to prevent excessive silt from entering and collecting in the diversion channel. The interceptor dikes are to be extended across the slope into the natural vegetation of either side of the right-of-way. Run-off water is filtered at the outlet end of the dike by a bale filter or silt fence. Sediment should be removed from interceptor dikes when it has been deposited to a depth of half of the dike. Figure 6A (Appendix) illustrates the conceptual design of a terrace or simple diversion berm. A more elaborate design, including a level spreader for dispersing the water flow, is shown in Figure 6b (Appendix).

Trench Plugs are typically used in conjunction with diversion dikes and filter structures. Used in this manner, the trench plug prevents surface run-off from circumventing an interceptor dike by flowing down the trench. Spacing for these installations is related to the severity of right-of-way slopes. Maximum spacing for trench plugs are identical to the spacing requirements for interceptor dikes and are given in Table 1.

TABLE 1

Spacing of Interceptor Dikes and Trench Plugs

Slope	Spacing
5% – 15%	150 feet
15% - 30%	100 feet
30% & or greater	50 feet

3.1.3 TRENCH PLUGS (Breakers)

Trench Plugs or *Ditch Breakers* are similar to interceptor dikes in purpose and construction. They are typically constructed of earth-filled sacks (or suitable alternatives such as synthetic foam). Trench plugs prevent erosive run-off velocities from developing in the trench in the same manner that diversion berms accomplish this goal on the disturbed right-of -way. The trench plug serves to form a catch basin for run-off in the trench, trapping the soil and preventing it from being washed out of the trench. Spacing for these installations is related to the severity of right-of-way slopes. Guideline spacing for trench plugs are identical to the spacing requirements for the interceptor dikes given in Table 1.

3.1.4 TRENCH DEWATERING

Storm water which collects in the trench can be controlled through the use of trench plugs. Water removed from the trench must have the silt removed before it is allowed to enter a natural water body. If time and circumstances permit, the water may be allowed to sit on the trench until the silt settles out. If the water must be removed immediately, it will be filtered. Where appropriate, filtration may be performed by natural vegetation. In the absence of adequate natural vegetation, filtration is accomplished using a bale filter or silt fence. In general, the use of a settling basin to allow silt to filter out is used only when no other options are available. Figure 7 (Appendix) illustrates a typical settling basin.

3.1.5 DIVERSION DITCHES

Diversion Ditches are excavated or graded at selected locations to control soil erosion. They are generally installed above the back slope of cuts to divert run-off to natural drainage channels and to prevent the ground water from running down the cut slope. They may be required along the top of embankments to prevent water from eroding the soil from the slopes before permanent erosion items can take hold.

3.1.6 SEDIMENT BASINS

Sediment Basins are constructed by excavating and grading a storage area to detain sediment-laden run-off from disturbing area long enough to allow sediment to settle out. Straw bale filter barriers or filter fabric barriers shall be used in conjunction with sediment basins when needed. Sedimentation basins shall be removed and obliterated without increasing erosion at the completion of the project. They can be used with other erosion controls in steep areas to greatly decrease sedimentation to streams. Figure 8 (Appendix) illustrates the typical design of a sediment basin.

3.1.7 FLEXIBLE DOWNDRAINS

Temporary *Downdrains* can be installed wherever extremely steep drainage-ways having potentially significant flow are cut by right-of-way excavation and severe erosion of the cut face is likely. Flexible closed conduit type or rigid open conduit type downdrain is installed in accordance with the manufacturer's instructions. The downdrain should be designed and situated such that no by-passing of run-off or leakage occurs. Downdrains should discharge into a stilling basin lines with a 4 inch layer of riprap or other suitable material. Figure 9 (Appendix) illustrates the design of a flexible downdrain.

3.1.8 NONVEGETATIVE SOIL STABILIZATION

Temporary, *Nonvegetative Soil Stabilization* is employed to provide protection against excessive soil erosion over a short time period (less than one year). The method employed is, in general, site-specific. Nonvegetative soil stabilization is used to reinforce vegetative measures and is not required where vegetative stabilization provides adequate long-term soil protection. In general, nonvegetative methods are required in areas which will experience high water flows or could experience high run-off velocities (disturbed slopes steeper than 2:1). Methods employed include *Mulching, Brush Barriers*, *Netting*, *Matting* and *Stone Coverage*.

Mulching is a temporary measure used as a deterrent to soil erosion. A determination to place a mulch cover may be made when erosion control is necessary to stabilize slopes or when revegeatation cannot take place quickly enough for proper erosion control.

Mulch consists of straw, hay, or salt hay applied at an appropriate rate (e.g. 70-115 pounds per 1000 square feet (1.5 – 2.5 tons/acre) is typical). Mulch anchoring is implemented promptly where applicable and should be achieved by one of the following methods:

(1) Peg and Twine
(2) Mulch Nettings, Erosion Control, Fabric, Jute Matting (Figure 10, Appendix)
(3) Mulch Anchoring Tools (wood stakes or metal staples)

Brush Barriers are constructed by piling, shaping, and tying brush to form barriers in areas where it is necessary to impede the flow of water carrying silt.

Netting and Matting consists of biodegradable wood fibers, jute yarn, or other materials interwoven with knitted nylon or vinyl monofilament material. It is fastened to the slope with wood stakes or metal staples.

Stone is used to protect a soil surface from being eroded by flowing water. It may be used as a temporary or permanent measure. Stone may be used at such places as flume pipes of downdrain outlets, channel banks and/or bottoms, and disturbed areas subject to the movement of heavy equipment. It should be designed for the slope and width of the stream. Consideration should be given to expected flows in choosing the size and depth of stones.

3.1.9 TEMPORARY SEEDING AND REVEGETATION

In addition to structural control measures, temporary seeding, revegetation, and fertilization are necessary to prevent erosion during and after construction. All disturbed areas are temporarily seeded. Soil to be stockpiled for more than 30 days or disturbed areas on which there will be no construction for 3 months shall be stabilized by temporary seeding. Suggested temporary seeding rates and mixtures are often available from the authorized soil conservation agency in that area.

The need for temporary revegetation of a pipeline occurs when new lines are established during the spring-summer period. If new lines are established in the fall-winter period, a permanent revegetation plan will be used. If the need arises to temporarily revegetate an area during the cool season, it is recommended that a mixture of Austrian winter pea, rye, oats, and wheat be used. This mixture provides considerable height diversity, erosion control and a seed supply to wildlife that will have greater benefits than any single winter planted crop. Generally, fescue is not considered to have any valuable benefits for wildlife. If applicable, fertilizer and lime should be applied at a standard rate recommended for the region by an authorized agency.

The combination of milo, millets, and a suitable mixture incorporated into the temporary revegetation plan provides an excellent structural diversity to the pipeline and should have good benefits in controlling erosion. By combining a variety of annuals, quality seed supplies will be available for a longer period compared to any single crop. Most of the seeds recommended for temporary revegetation can be planted with a broadcast seeder after last frost through July.

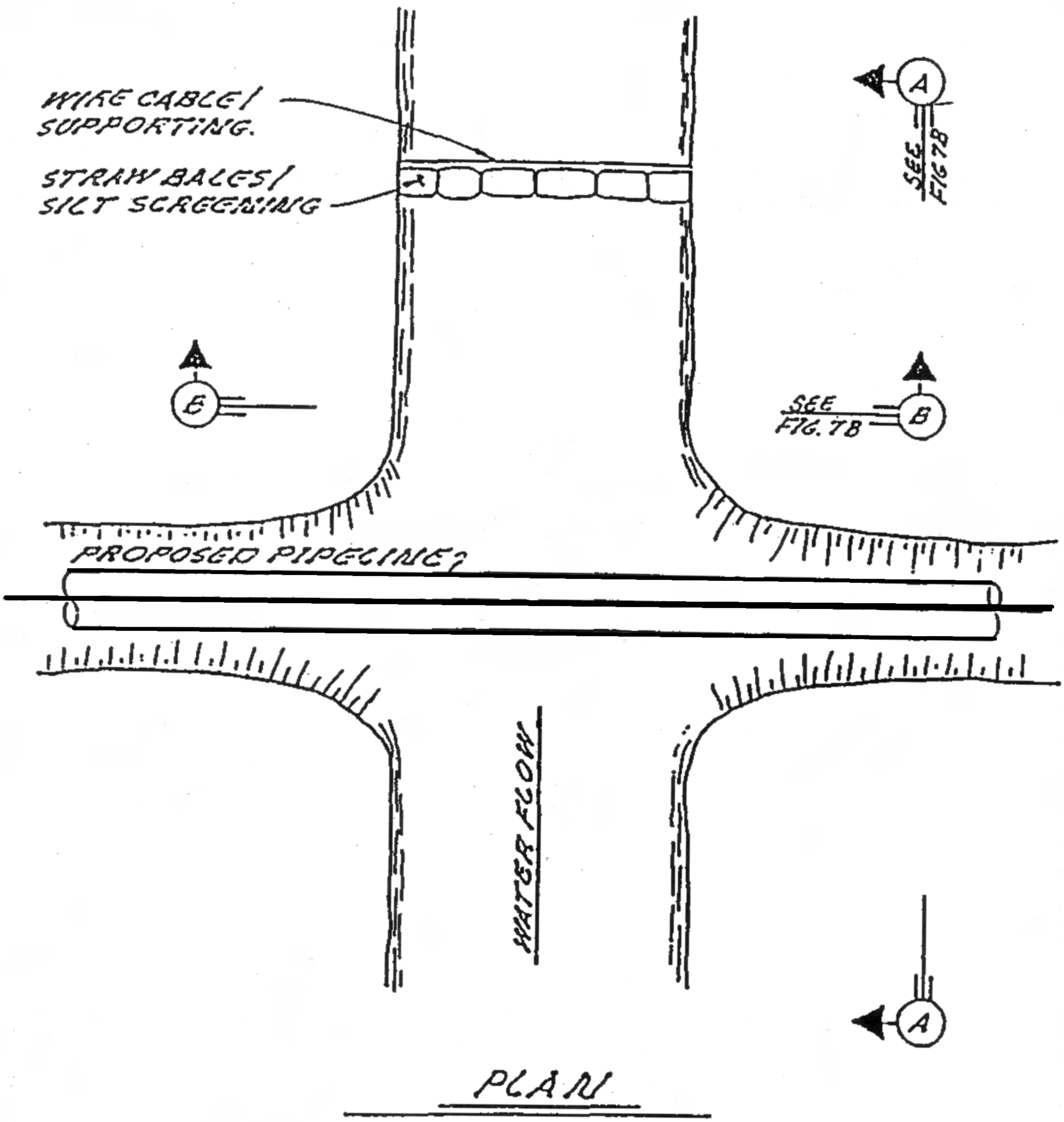
An alternative to temporary seeding and revegetation is mulching. In extremely steep slopes, temporary seeding may also require mulching to establish revegetation. A discussion of mulching techniques and rates is given above, under *Nonvegetative Soil Stabilization*.

3.2 PERMANENT RESTORATION MEASURES

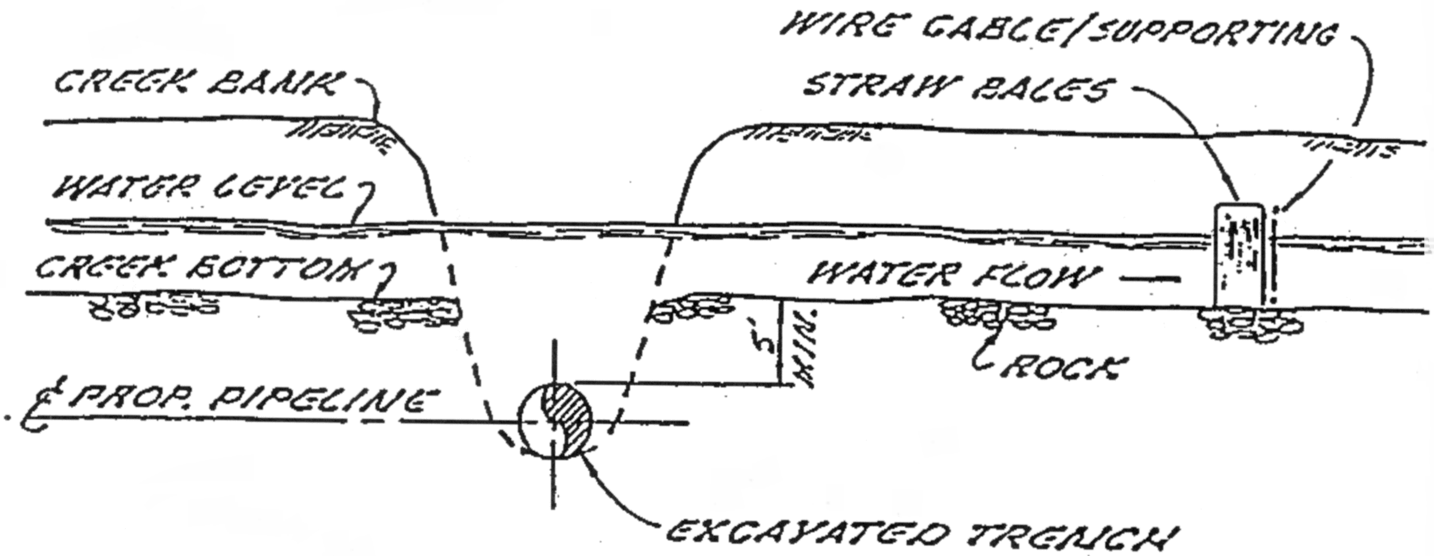
Restoration measures are permanent controls to assure that vegetation is reestablished and significant post construction erosion is avoided. In addition, slopes and waterways within the project area are restored to preconstruction contours. Restoration of each pipeline crossing of a water of the United States must begin as soon as possible following construction. In large projects the time between initial clearing and grubbing and post construction should be designed for final restoration within 14 days of the completion of construction. Clean-up and restoration activities can be summarized by the following general categories. They should be adapted for the specific conditions of the project.

(1) Construct interceptor dikes where needed. This may require leaving dikes used for temporary measures or the installation of additional ones.
(2) Fertilize and lime slopes as needed.
(3) Select seed appropriate for the season of construction and the area. A mixture of seeds (two to five species) is best.

(4) On slopes where vegetative stabilization alone is insufficient, employ nonvegetative stabilization (e.g. mulching). Extremely steep slopes may require matting with staling or lining with more durable materials (e.g. bags of quickrete).
(5) Put sediment barriers such as hay bales, fabric fence or a combination of these where drains and ditches allow sediment to enter the waterway or wetland.
(6) If necessary stabilize the stream banks. Place appropriate materials such as riprap or stapled matting when excessive stream velocities may be encountered.
(7) Remove temporary structures which are not necessary and are not biodegradable. Silt fences installed across a stream downstream of the work site would be an example.
(8) Be prepared to monitor and maintain erosion control measures until stabilization of the area has been accomplished satisfactorily.

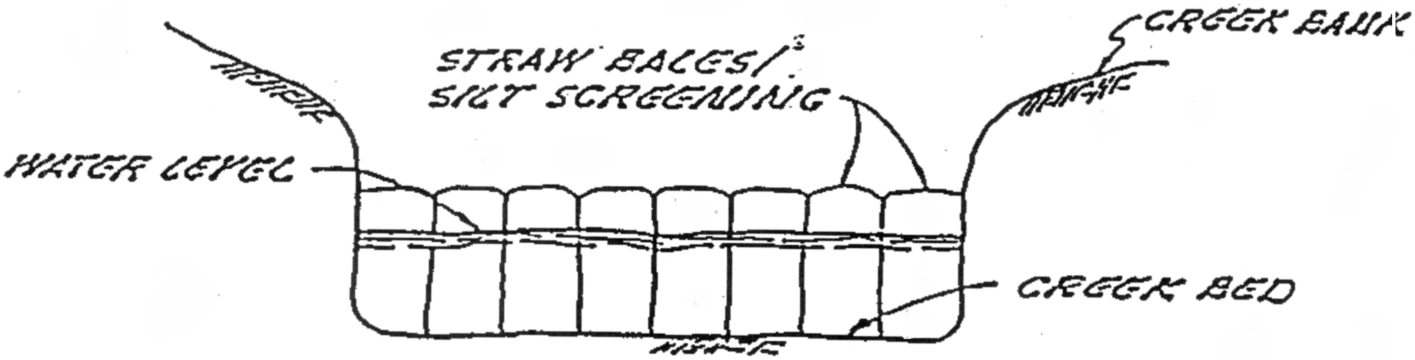


Plan 1
Figure 1A



SECTION "A-A"

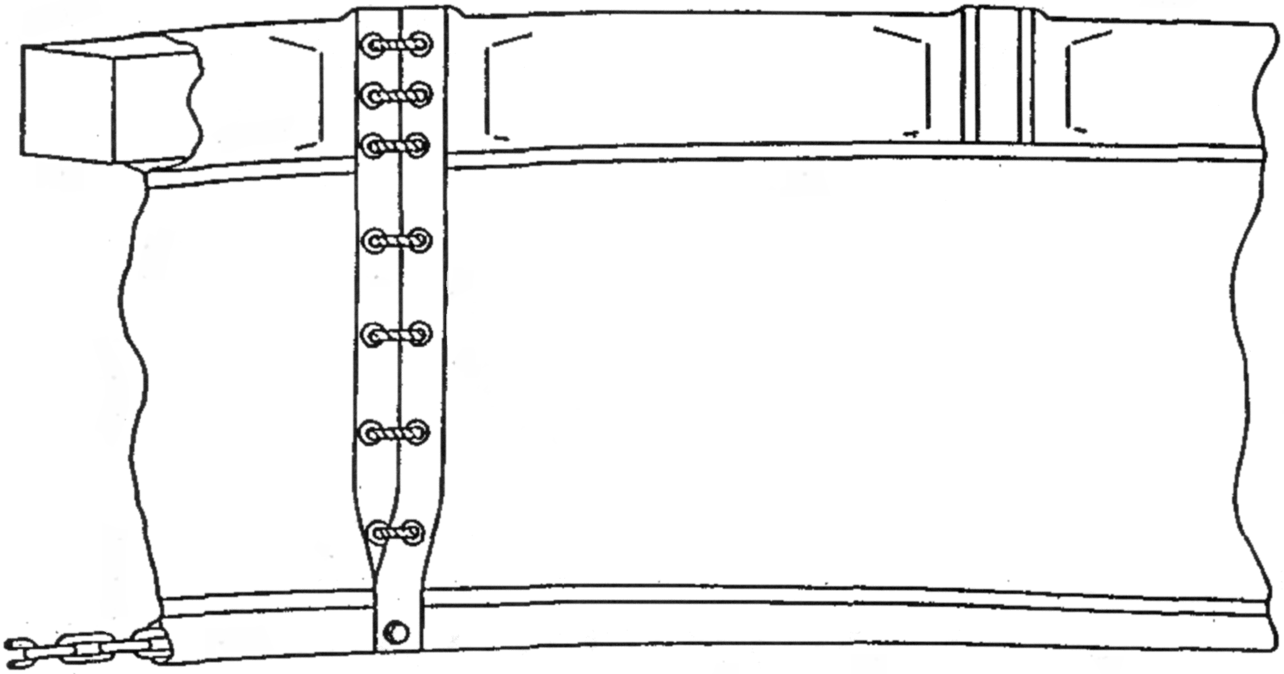
(FROM FIG 7A)



SECTION "B-B"

(FROM FIG.7A)

Plan 1
Figure 1B



LIGHTWEIGHT

TURBIDITY CURTAIN

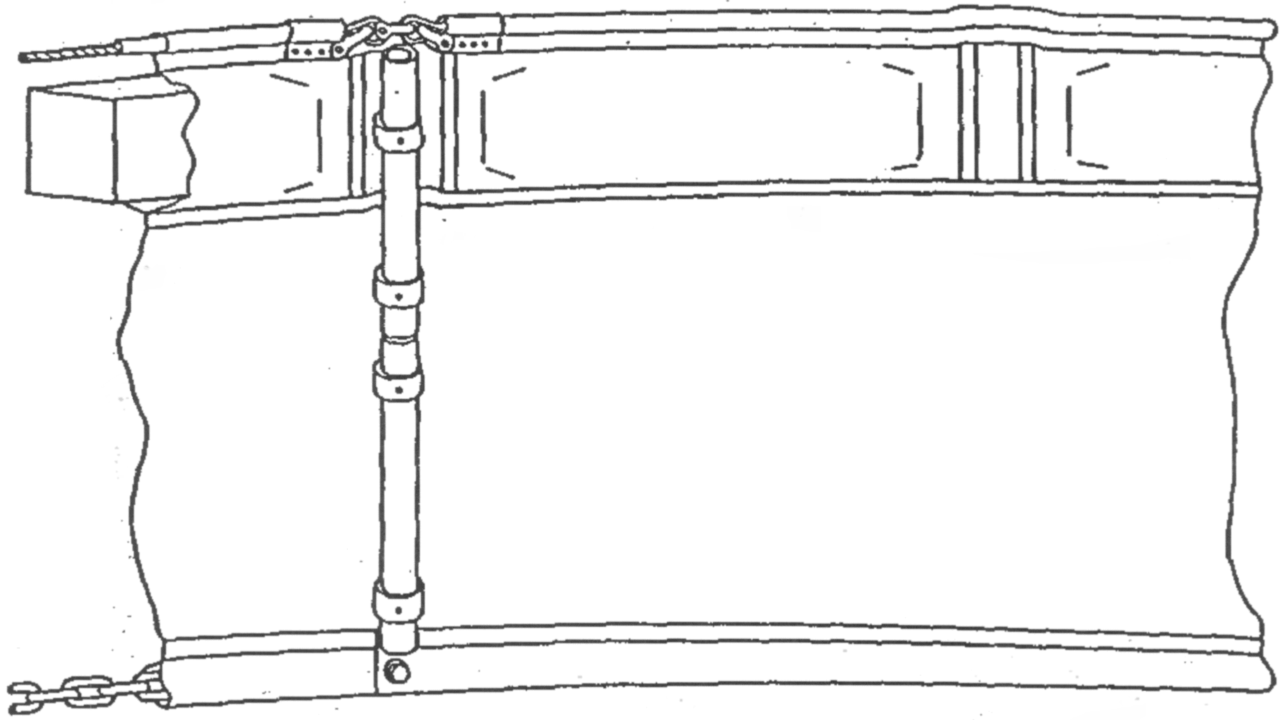
APPLICATION:

Calm waters with little current such as lakes, ponds, canals, and shoreline areas.

SPECIFICATIONS

FABRIC	Polyester reinforced vinyl high visibility yellow.	BALLAST/ LOAD LINE	1/4" galvanized chain (.7lbs/ft).
CONNECTOR	Sections are laced together through grommets and load lines are bolted together.		
FLOTATION	6" expanded polystyrene over 9lb/ft buoyancy.		

Plan 2
Figure 2A



MIDDLEWEIGHT

TURBIDITY CURTAIN

APPLICATION:

Rivers, streams, open lakes and exposed shorelines with moderate current moving in one direction.

SPECIFICATIONS

FABRIC	Polyester reinforced vinyl high visibility yellow 18 oz/yd^2 weight.	BOTTOM LOAD LINE/BALLAST	5/16" galvanized chain (1.1 lbs/ft).
CONNECTOR	Shackled and bolted load lines with slotted reinforced PVC pipe for fabric closure.	TOP LOAD LINE	5/16" galvanized wire rope enclosed in heavy tubing.
FLOTATION	8" expanded polystyrene over 19 lbs/ft buoyancy.		

Plan 2
Figure 2B

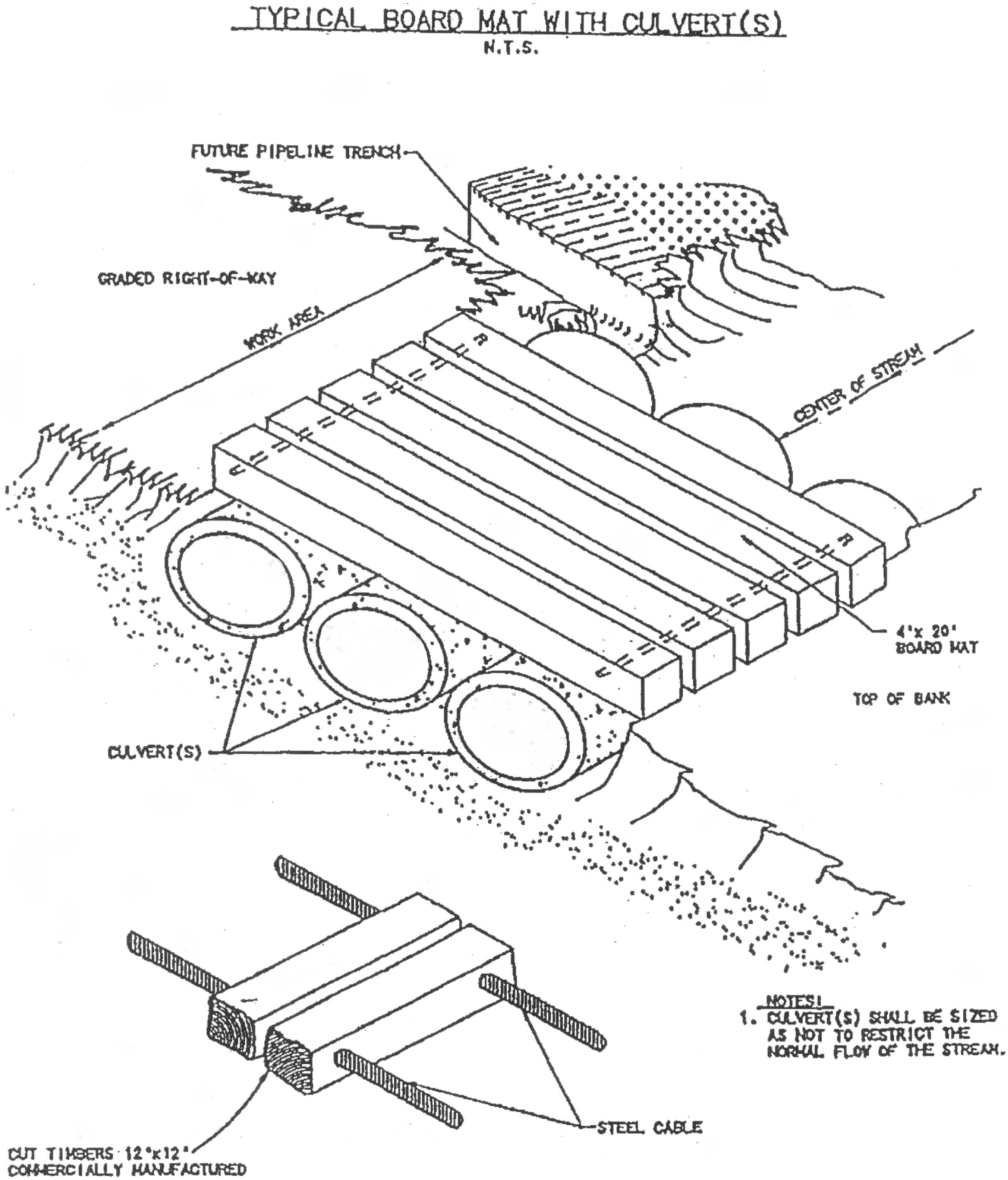
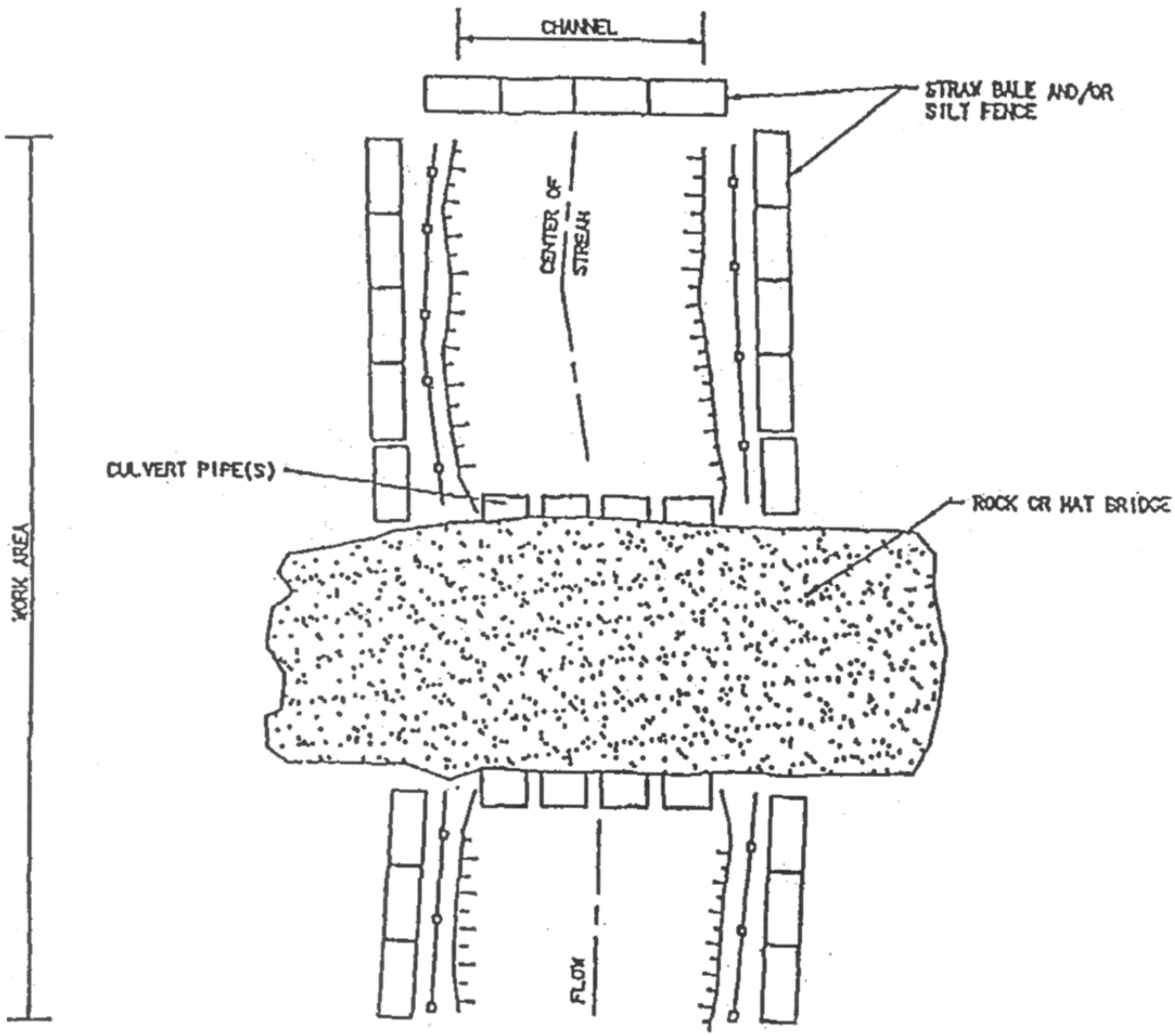

TYPICAL BOARD MAT WITH CULVERT(S)
N.T.S.
FUTURE PIPELINE TRENCH
GRADED RIGHT-OF-WAY
WORK AREA
CENTER OF STREAM
4'x 20'
BOARD MAT
TOP OF BANK
CULVERT(S)
NOTES:
1. CULVERT(S) SHALL BE SIZED AS NOT TO RESTRICT THE NORMAL FLOW OF THE STREAM.
STEEL CABLE
CUT TIMBERS 12"x12"
COMMERCIALLY MANUFACTURED

Figure 3A

TYPICAL ROCK OR MAT BRIDGE WITH CULVERT(S)

N.T.S.



NOTE:

1. USE AS MANY CULVERT PIPE(S) AS REQUIRED TO ENSURE NORMAL STREAM FLOW IS NOT OBSTRUCTED BY ROCK OR MAT BRIDGE.

Figure 3B

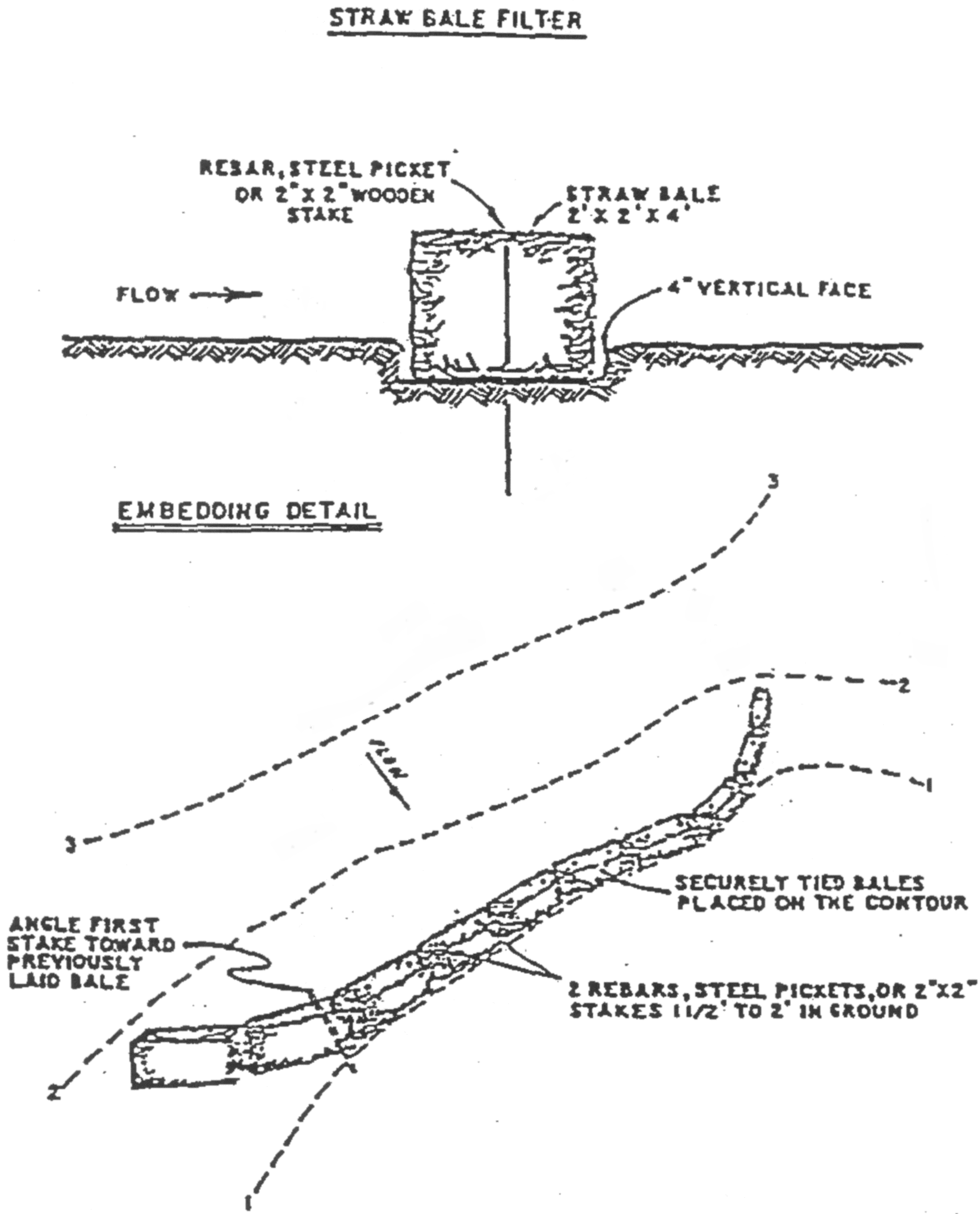

STRAW BALE FILTER
REBAR, STEEL PICKET OR 2" X 2" WOODEN STAKE
STRAW BALE 2' X 2' X 4'
FLOW
4" VERTICAL FACE
EMBEDDING DETAIL
FLOW
3
2
1
SECURELY TIED BALES PLACED ON THE CONTOUR
ANGLE FIRST STAKE TOWARD PREVIOUSLY LAID BALE
2 REBARS, STEEL PICKETS, OR 2"X2" STAKES 1 1/2' TO 2' IN GROUND

Figure 4

ENVIROFENCE SILT BARRIER

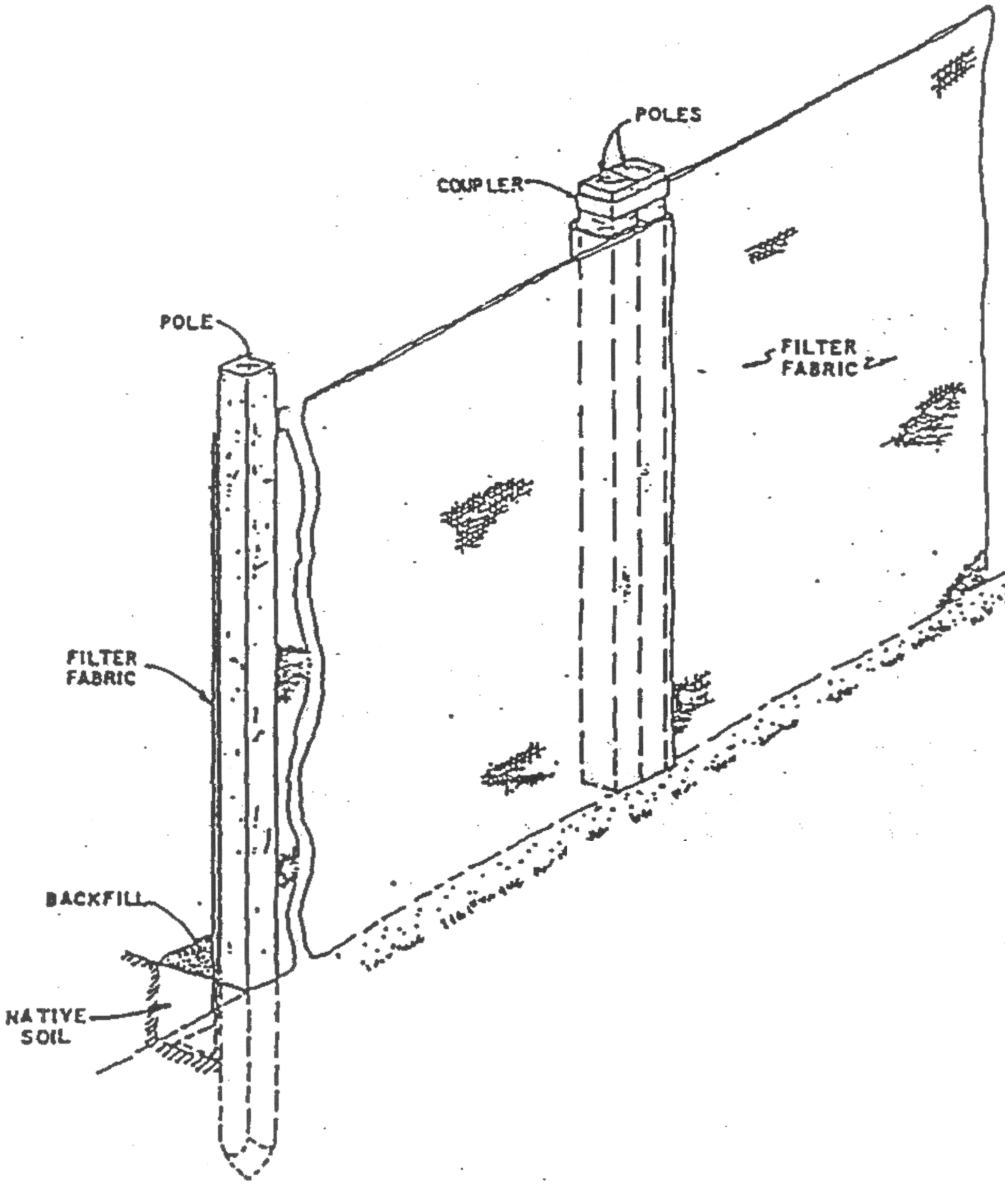
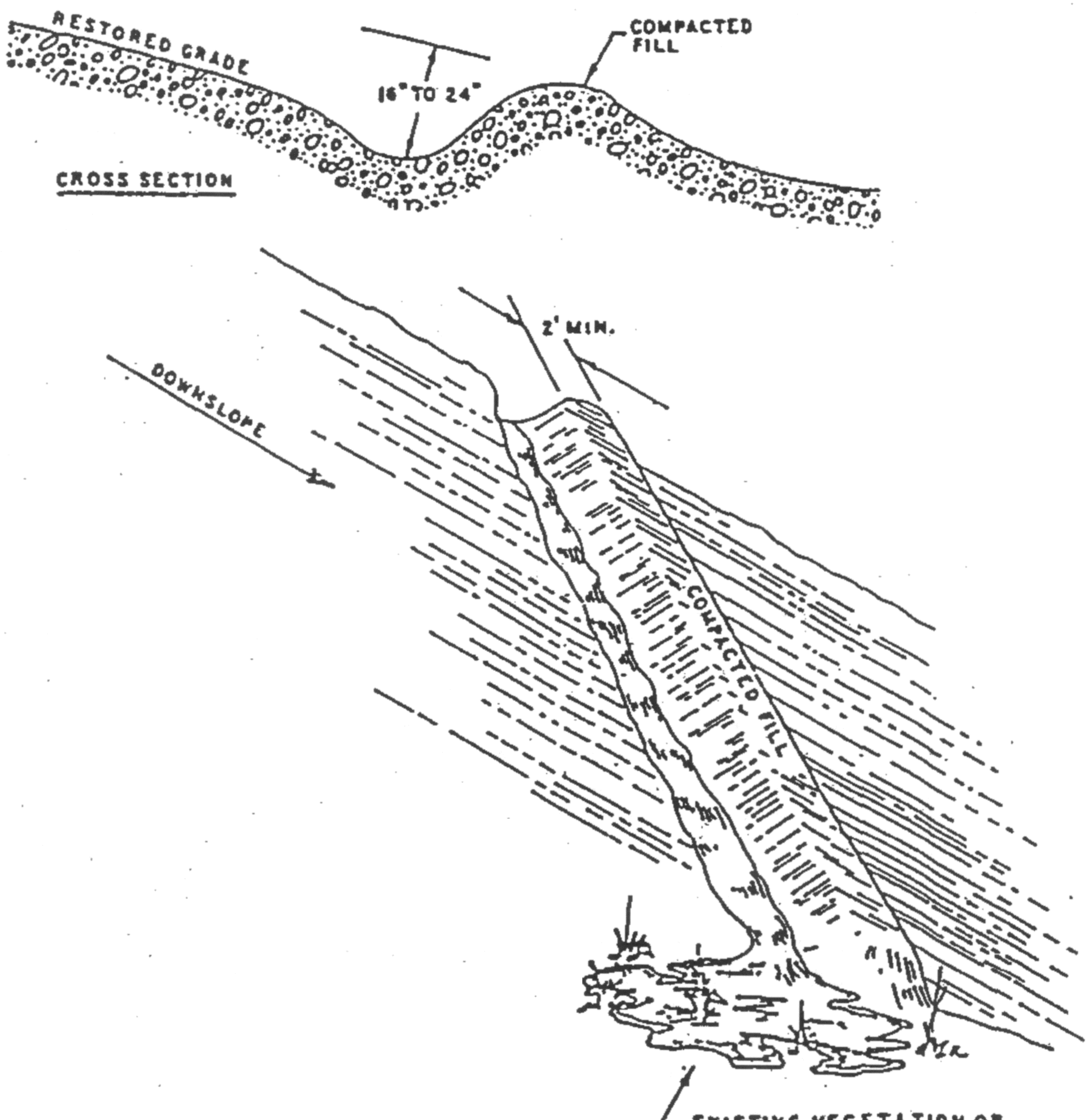


Figure 5

TERRACE

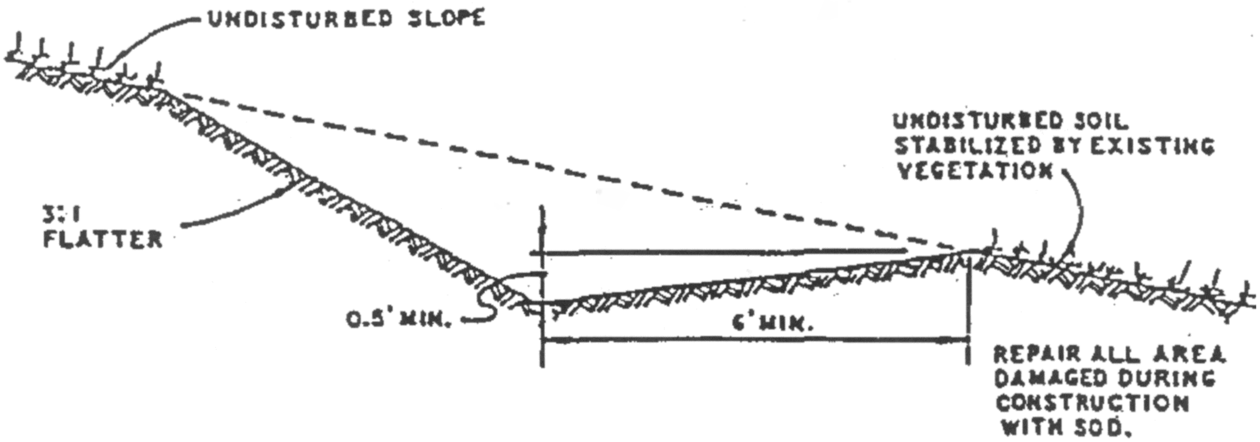


GENERAL NOTES

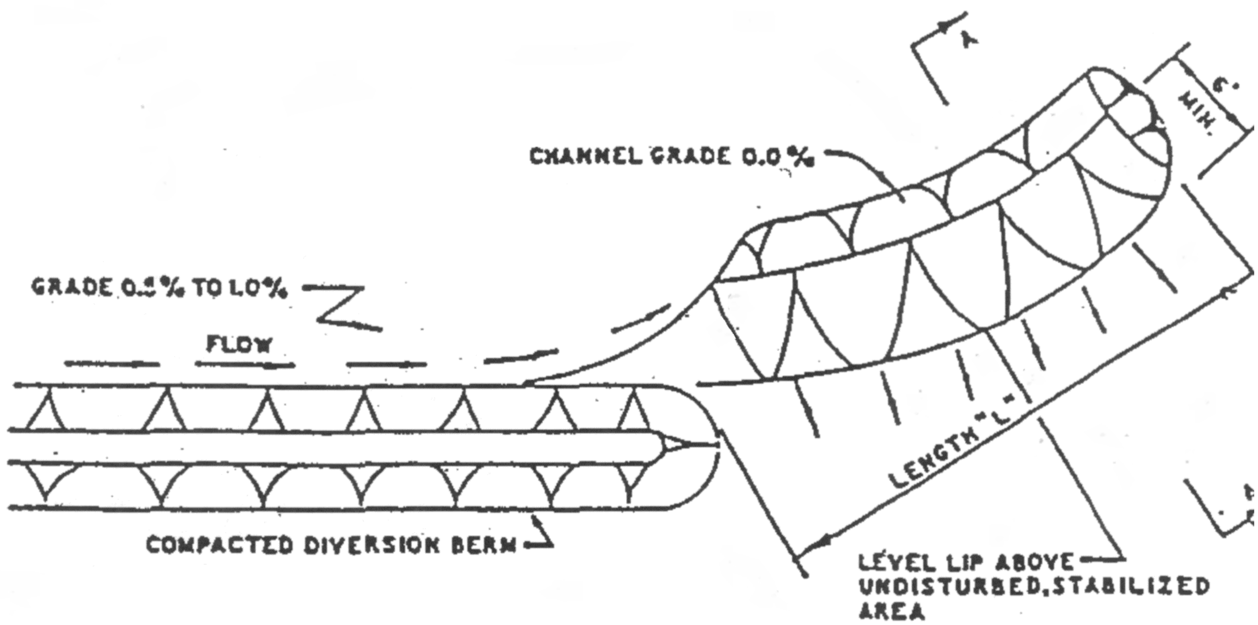
1. NOT TO SCALE
2. INSTALL ON SLOPING TERRAIN
3. MAINTAIN THROUGHOUT CONSTRUCTION
4. OUTLET INTO AREAS STABILIZED BY EXISTING VEGETATION OR INSTALL STAKED STRAW BALES
5. CONTOUR TO ALLOW PASSAGE OF CONSTRUCTION EQUIPMENT
6. MINIMUM 2% LATERAL SLOPE

Figure 6A

LEVEL SPREADER & DIVERSION BERM DETAIL

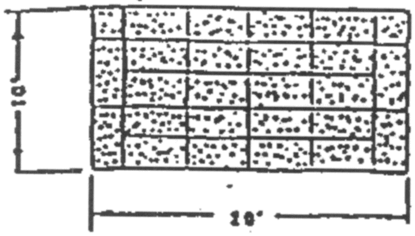


SECTION "A-A" LEVEL SPREADER



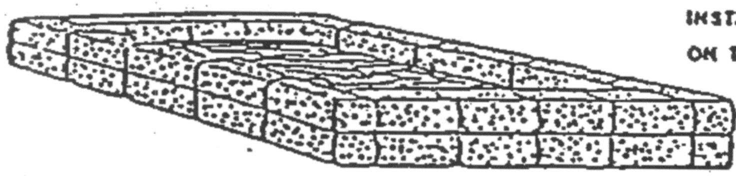
Designed Q_{10} (cfs)	Minimum Length ("L" in Feet)
Up to 10	15'
11 to 20	20
21 to 30	26
31 to 40	34
41 to 50	44
51 to 60	56
61 to 70	70
71 to 80	85
81 to 90	100

Figure 6B



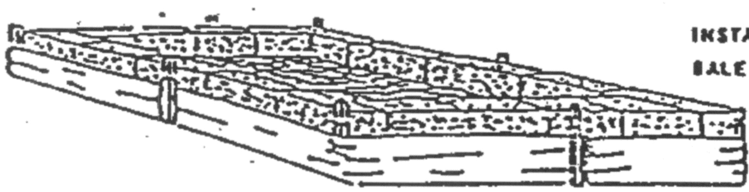
STEP 1

ARRANGE STRAW BALES ON LEVEL LAND TIGHTLY PACKED AS SHOWN TO COVER MINIMUM AREA OF 200 SQUARE FEET, AND SIZED TO HANDLE THE ACTUAL FLOW.



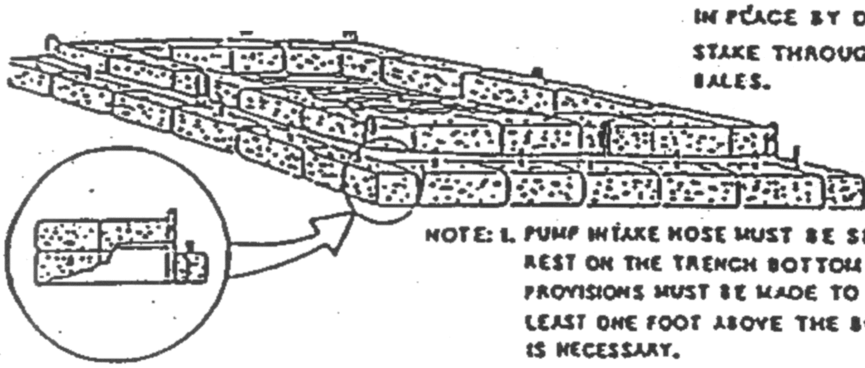
STEP 2

INSTALL ANOTHER LAYER OF STRAW BALES ON THE OUTER EDGE AS SHOWN.



STEP 3

INSTALL SILT FENCE ALL AROUND THE STRAW BALE STRUCTURE AS SHOWN. DIG IN SILT FENCE 6".



STEP 4

INSTALL ANOTHER LAYER OF STRAW BALES ON THE OUTSIDE OF THE SILT FENCE AND SECURE IN PLACE BY DRIVING A REBAR OR WOODEN STAKE THROUGH EACH OF THE OUTER STRAW BALES.

NOTE: 1. PUMP INTAKE HOSE MUST BE SECURED AND NOT BE ALLOWED TO REST ON THE TRENCH BOTTOM THROUGHOUT DEWATERING. PROVISIONS MUST BE MADE TO ELEVATE THE INLET HOSE TO AT LEAST ONE FOOT ABOVE THE BOTTOM UNTIL BOTTOM DEWATERING IS NECESSARY.

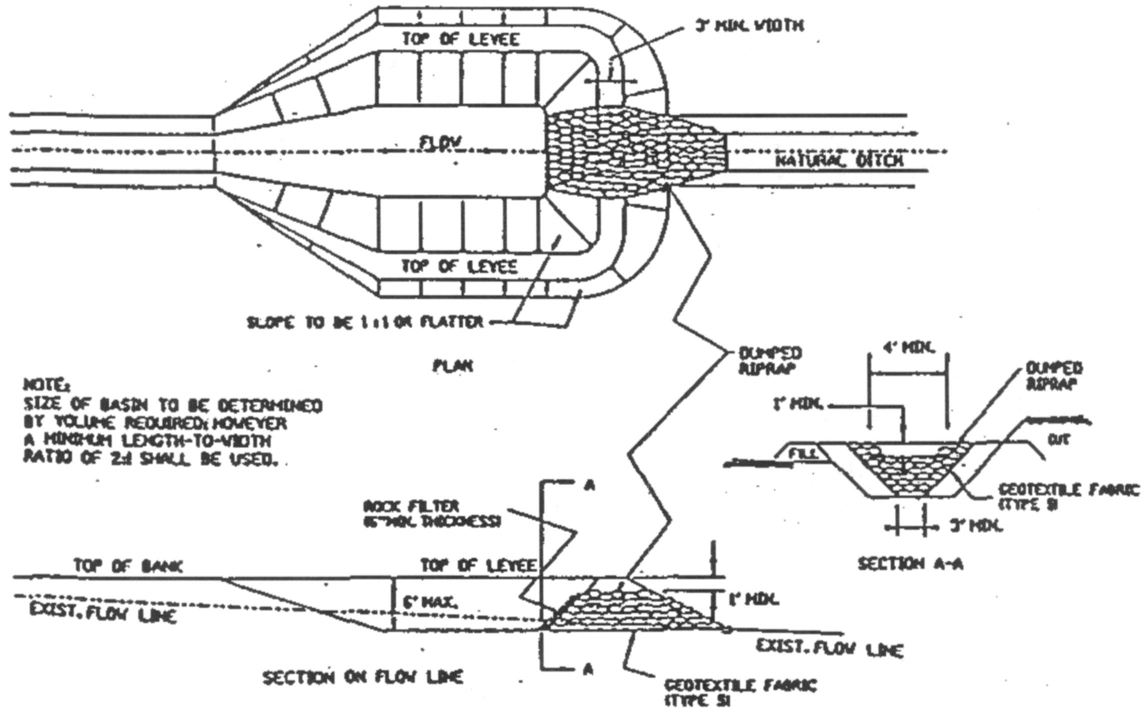
2. WHEN SILT FENCE STAKES CANNOT BE DRIVEN INTO GROUND, LINE THE BOTTOM AND EXTERIOR OF STRAW BALES WITH GEOTEXTILE FABRIC.

EROSION CONTROL DURING PIPELINE DITCH DEWATERING

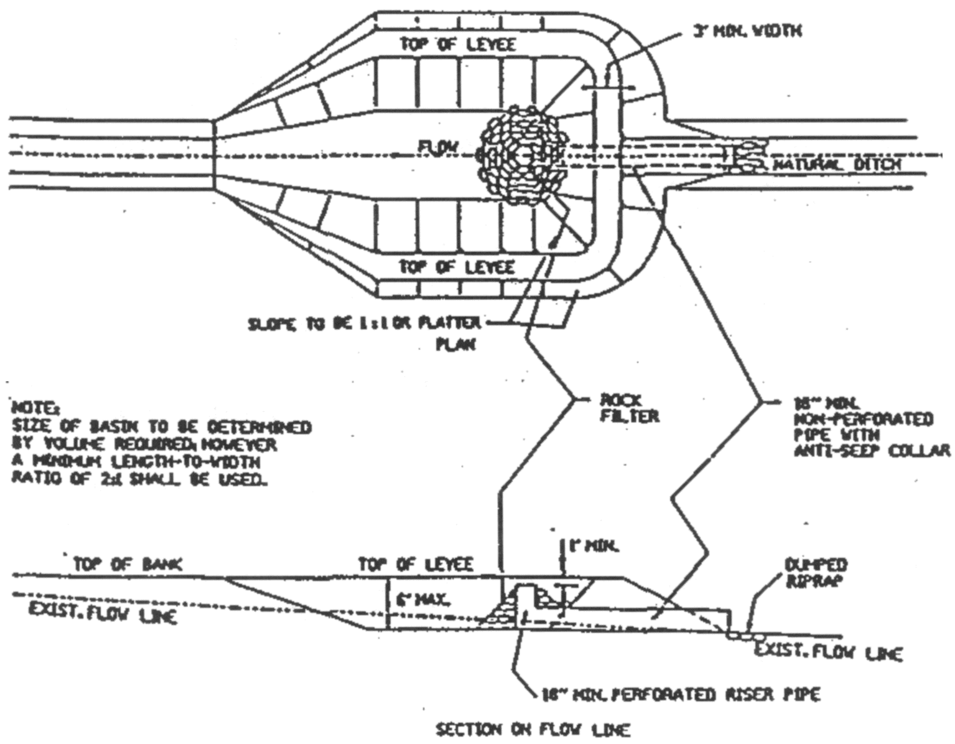
FOR SLOPING AREAS WITH SPARSE VEGETATION

SETTLING BASIN

Figure 7



SEDIMENT BASIN WITH RIPRAP OUTLET



SEDIMENT BASIN WITH PIPE OUTLET

Figure 8

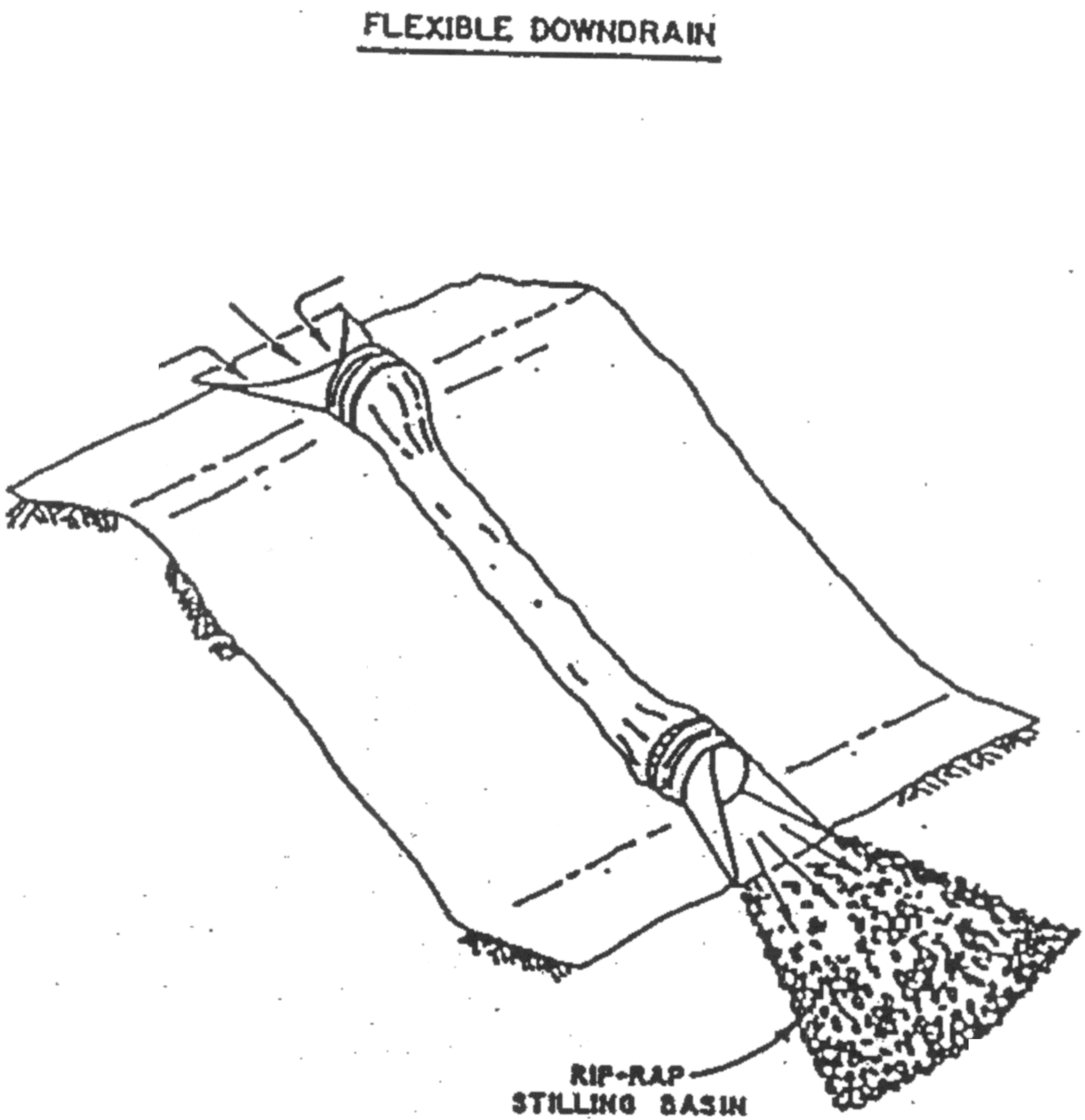


Figure 9

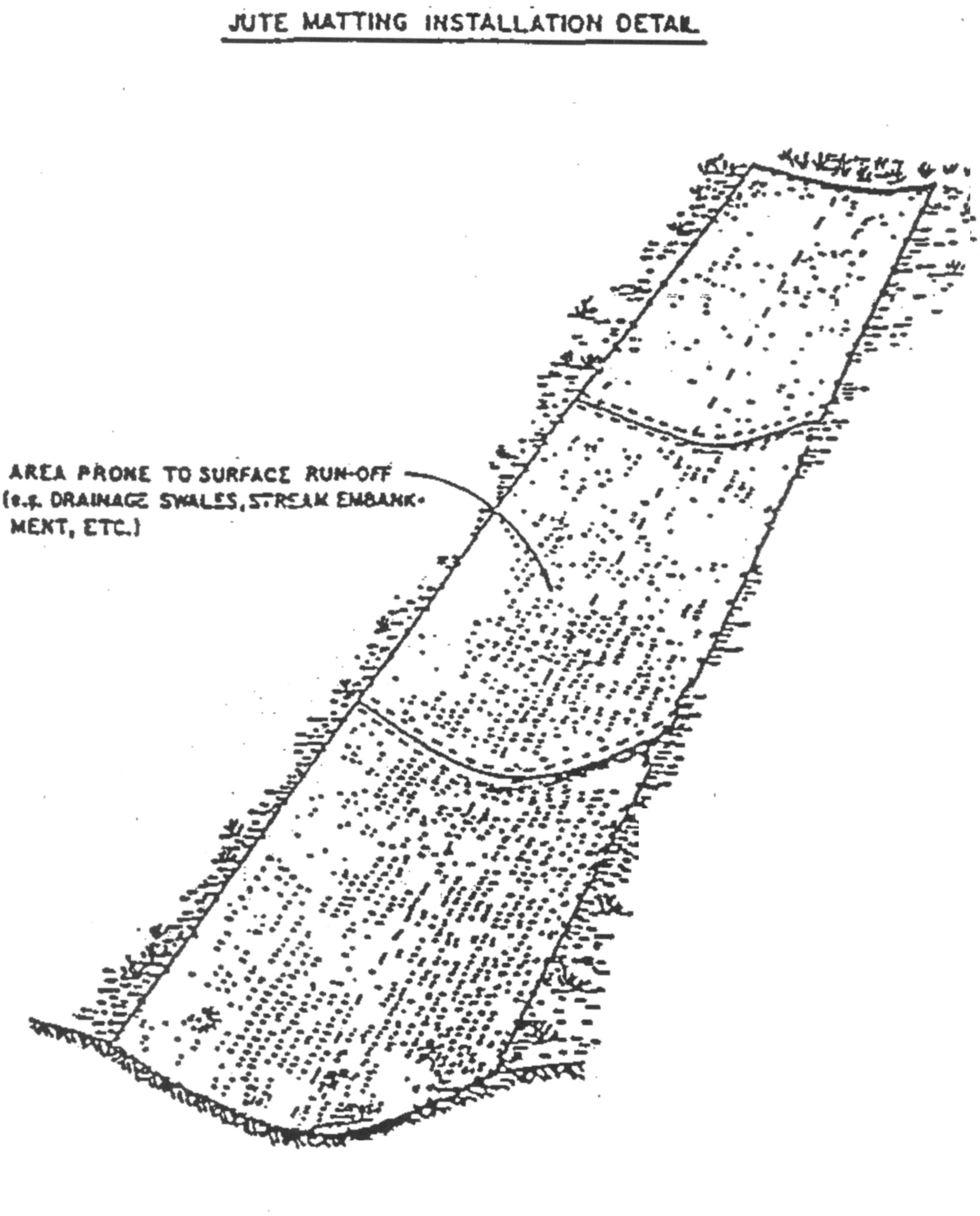

JUTE MATTING INSTALLATION DETAIL
AREA PRONE TO SURFACE RUN-OFF
(e.g. DRAINAGE SWALES, STREAM EMBANK-
MENT, ETC.)

Figure 10