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Sample Erosion a Sedimentation Control Plan

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Sample Erosion and Sedimentation Control Plan

Attached is a sample erosion and sedimentation control plan based on one from the files of the state of North Carolina. The site is located in the Piedmont region. The plan was modified to demonstrate the application of a variety of erosion and sedimentation control practices commonly used through out the State.

This sample plan was developed in detail for instructive purposes. The specific number of maps, practices, drawings, specifications, and calculations required depends on the size and complexity of the development. The designer should select the most practical and effective practices to control erosion and prevent sediment from leaving the site. The plan should be organized and presented in a clear, concise manner. Sufficient design and background in formation should be included to facilitate review by erosion control personnel. Construction details should be precise and clear for use by an experience general contractor.

An acceptable erosion and sedimentation control plan must contain:

1. brief narrative
2. construction schedule
3. maintenance plan
4. vicinity map
5. site topographic map
6. site development plan
7. erosion and sedimentation control plan drawing
8. detail drawings and specifications
9. vegetative plan
10. supporting calculations
11. financial responsibility/ownership form
12. checklist

SAMPLE

EROSION AND SEDIMENTATION CONTROL PLAN

ABC INDUSTRIES, INC.

DEAL, N.C.

SEPTEMBER 1988

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NARRATIVE

Project Description

The purpose of the project is to construct two large commercial buildings with associated paved roads and parking area. Another building will be added in the future. Approximately 6 acres will be disturbed during this construction period. The site is 11.1 acres located in Granville county, 2 miles north of Deal, NC, off Terri Road (see Vicinity Map).

Site Description

The site has rolling topography with slopes generally 4 to 6%. Slopes steepen to 10 to 20% in the northwest portion of the property where a small, healed-over gully serves as the principal drainageway for the site. The site is now covered with volunteer heavy, woody vegetation, predominantly pines, 15 to 20 ft high. There is no evidence of significant erosion under present site conditions. The old drainage gully indicates severe erosion potential and receives flow from 5 acres of woods off-site. There is one large oak tree, located in the western central portion of the property, and a buffer area, fronting Terri Road, that will be protected during construction.

Adjacent Property

Land use in the vicinity is commercial/industrial. The land immediately to the west and south has been developed for industrial use. Areas to the north and east are undeveloped and heavily wooded, primarily in volunteer pine. Hocutt Creek, the off-site outlet for runoff discharge, is presently a well-stabilized, gently-flowing perennial stream. Sediment control measures will be taken to prevent damage to Hocutt Creek. Approximately 5 acres of wooded area to the east contribute runoff into the construction area.

Soils

The soil in the project area is mapped as Creedmore sandy loam in B and C slope classes. Creedmoor soils are considered moderately well to somewhat poorly drained with permeability rates greater than 6 inches/hour at the surface but less than 0.1 inches/hour in the subsoil. The subsurface is pale brown sandy loam, 6 inches thick. The subsoil consists of a pale brown and brownish yellow sandy clay loam ranging to light gray clay, 36 inches thick. Below 36 inches is a layer of fine sandy loam to 77 inches. The soil erodibility factor (K value) ranges from 0.20 at the surface to 0.37 in the subsoil.

Due to the slow permeability of the subsoil that will be exposed during grading, a surface wetness problem with high runoff is anticipated following significant rainfall events. No groundwater problem is expected. The tight clay in the subsoil will make vegetation difficult to establish. A small amount of topsoil exists on-site and will be stockpiled for use in landscaping.

Planned Erosion and Sedimentation Control Practices

1. Sediment Basin -- Practice 6.61

   A sediment basin will be constructed in the northwest corner of the property. All water from disturbed areas, about 6 acres, will be directed to the basin before leaving the site. (NOTE: The undisturbed areas to the east and north could have been diverted, but this was not proposed because it would have required clearing to the property line to build the diversion and the required outlet structure.) See pages 7.11 - 7.13 for details and pages 7.35 - 7.37 for supporting calculations.

2. Temporary Gravel Construction Entrance/Exit -- Practice 6.06

   A temporary gravel construction entrance will be installed near the north-west corner of the property. During wet weather it may be necessary to wash vehicle tires at this location. The entrance will be graded so that runoff water will be directed to an inlet protection structure and away from the steep fill area to the north. See page 7.13 for specifications.

3. Temporary Block and Gravel Drop Inlet Protection -- Practice 6.52

   A temporary block and gravel drop inlet protection device will be installed at the drop inlet located on the south side of the construction entrance. Runoff from the device will be directed into the sediment basin. (NOTE: The presence of this device reduces the sediment load on the sediment basin and provides sediment protection for the pipe. In addition, sediment removal at this point is more convenient than from the basin.) See page 7.14 for specifications.

4. Temporary Diversions -- Practice 6.20

   Temporary diversions will be constructed above the 3:1 cut slopes south of Buildings A and B to prevent surface runoff from eroding these banks. (NOTE: Sediment-free water may be diverted away from the project sediment basin.) A temporary diversion will be constructed near the middle of the disturbed area to break up this long, potentially erosive slope should the grading operation be temporarily discontinued. A temporary diversion will be constructed along the top edge of the fill slope at the end of each day during the filling operation to protect the fill slope. This temporary diversion will outlet to the existing undisturbed channel near the north edge of the construction site and/or to the temporary inlet protection device at the construction entrance as the fill elevation increases. See page 7.15 for specifications and pages 7.49 - 7.50 for supporting calculations.

5. Level Spreader -- Practice 6.40

   A level spreader will serve as the outlet for the diversion east of Building A and south of Building B. The area below the spreader is relatively smooth and heavily vegetated with a slope of approximately 4%. See page 7.16 for specifications.

6. Tree Preservation and Protection -- Practice 6.05

   A minimum 2.0 ft high protective fence will be erected around the large oak tree at the dripline to prevent damage during construction. Sediment fence materials

may be used for this purpose. See page 7.17 for specifications.

7. Land Grading -- Practice 6.02

Heavy grading will be required on approximately 6 acres. The flatter slope after grading will reduce the overall erosion potential of the site. The buildings will be located on the higher cut areas, and the access road and open landscaped areas will be located on fill areas. See pages 7.17 - 7.18 for specifications.

All cut slopes will be 3:1 or flatter to avoid instability due to wetness, provide fill material, give an open area around the buildings, and allow vegetated slopes to be mowed. Cut slopes will be fine graded immediately after rough grading; the surface will be disked and vegetated according to the Vegetation Plan (pages 7.30 - 7.32).

Fill slopes will be 2:1 with fill depths as much as 12 to 15 ft. Fill will be placed in layers not to exceed 9 inches in depth and compacted. (NOTE: Fills of this depth should have detailed compaction specifications in the general construction contract. These specifications are not part of the erosion and sedimentation control plan.)

The fill slope in the north portion of the property is the most vulnerable area to erosion on the site. Temporary diversions will be maintained at the top of this fill slope at all times, and the filling operation will be graded to prevent overflow to the north. Filling will be done as a continuous operation until final grade is reached. The paved road located on the fill will be sloped to the south and will function as a permanent diversion. The area adjacent to the roads and parking area will be graded to conduct runoff to the road culverts. Runoff water from the buildings will be guttered to the vegetated channels. The finished slope face to the north will not be back-bladed. The top 2 to 6 inches will be left in a loose and roughened condition. Plantings will be protected with mulch, as specified in the Vegetation Plan.

A minimum 15-ft undisturbed buffer zone will be maintained around the perimeter of the disturbed area. (NOTE: This will reduce water and wind erosion, help contain sediment, reduce dust, and reduce final landscaping costs.)

8. Temporary Sediment Trap -- Practice 6.60

A small sediment trap will be constructed at the intersection of the existing road ditch and channel number 3 to protect the road ditch. Approximately 2 acres of disturbed area will drain into this trap. See pages 7.19 - 7.20 for specifications and pages 7.48 - 7.49 for calculations.

9. Sediment Fence -- Practice 6.62

A sediment fence will be constructed around the topsoil stockpile and along the channel berm adjacent to the deep cut area as necessary to prevent sediment from entering the channels. See page 7.20 - 7.21 for specifications.

10. Sod Drop Inlet Protection -- Practice 6.53

Permanent sod drop inlet protection will replace the temporary block and gravel

structure when the contributing drainage area has been permanently seeded and mulched. See pages 7.21 - 7.22 for specifications.

11. Grass-Lined Channel -- Practice 6.30
Grass-lined channels with temporary straw-net liners will be constructed around Buildings A and B to collect and convey site water to the project's sediment basin. See pages 7.22 - 7.24 for specifications and pages 7.37 - 7.41 for calculations.

Should the disturbed areas adjoining the channels not be stabilized at the time the channels are vegetated, a sediment fence will be installed adjacent to the channel to prevent channel siltation.

12. Riprap-Lined and Paved Channels -- Practice 6.31
A riprap channel will be constructed in the old gully along the north side of the property starting in the northwest corner after all other construction is complete. This channel will replace the old gully as the principal outlet from the site. See pages 7.25 7.26 for specifications and pages 7.41 - 7.43 for calculations.

13. Construction Road Stabilization -- Practice 6.80
As soon as final grade is reached on the entrance road, the subgrade will be sloped to drain to the south and stabilized with a 6-inch course of NC DOT standard size ABC stone. The parking area and its entrance road will also be stabilized with ABC stone to prevent erosion and dust during the construction of the buildings prior to paving. See pages 7.26 - 7.27 for specifications.

14. Outlet Stabilization Structure -- Practice 6.41
A riprap apron will be located at the outlet of the three culverts to prevent scour. See pages 7.27 - 7.28 for specifications and page 7.48 for calculations.

15. Surface Roughening -- Practice 6.03
The 3:1 cut slopes will be lightly roughened by disking just prior to vegetating, and the surface 4 to 6 inches of the 2:1 fill slopes will be left in a loose condition and grooved on the contour. See page 7.29 for specifications.

16. Surface stabilization will be accomplished with vegetation and mulch as specified in the vegetation plan. One large oak tree southwest of Building A and a buffer area between the parking lot and Terri Road will be preserved. Roadway and parking lot base courses will be installed as soon as finished grade is reached.

17. Dust control is not expected to be a problem due to the small area of exposure, the undisturbed perimeter of trees around the site, and the relatively short time of exposure (not to exceed 9 months). Should excessive dust be generated, it will be controlled by sprinkling.

CONSTRUCTION SCHEDULE

1. Obtain plan approval and other applicable permits.

2. Flag the work limits and mark the oak tree and buffer area for protection.

3. Hold preconstruction conference at least one week prior to starting construction.

4. Install sediment basin as the first construction activity.

5. Install storm drain with block and gravel inlet protection at construction entrance/exit.

6. Install temporary gravel construction entrance/exit.

7. Construct temporary diversions above proposed building sites. Install level spreader and sediment trap and vegetate disturbed areas.

8. Complete site clearing except for the old gully channel in the northwest portion of the site. This area will be cleared during last construction phase for the installation of the riprap channel liner.

9. Clear waste disposal area in northeast corner of property, only as needed.

10. Rough grade site, stockpile topsoil, construct channels, install culverts and outlet protection, and install sediment fence as needed. Maintain diversions along top of fill slope daily. NOTE: A temporary diversion will be constructed across the middle of the graded area to reduce slope length and the bare areas mulched should grading be discontinued for more than 3 weeks.

11. Finish the slopes around buildings as soon as rough grading is complete. Leave the surface slightly roughened and vegetate and mulch immediately.

12. Complete final grading for roads and parking and stabilize with gravel.

13. Complete final grading for buildings.

14. Complete final grading of grounds, topsoil critical areas, and permanently vegetate, landscape, and mulch.

15. Install riprap outlet channel and extend riprap to pipe outlet under entrance road.

16. All erosion and sediment control practices will be inspected weekly and after rainfall events. Needed repairs will be made immediately.

17. After site is stabilized, remove all temporary measures and install permanent vegetation on the disturbed areas.

18. Estimated time before final stabilization--9 months.

MAINTENANCE PLAN

1. All erosion and sediment control practices will be checked for stability and operation following every runoff-producing rainfall but in no case less than once every week. Any needed repairs will be made immediately to maintain all practices as designed.

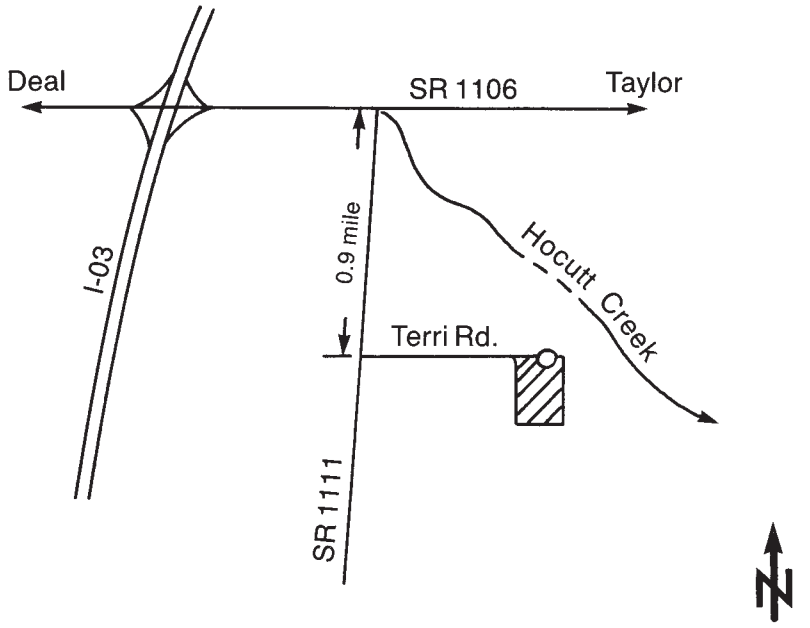
2. The sediment basin will be cleaned out when the level of sediment reaches 2.0 ft below the top of the riser. Gravel will be cleaned or replaced when the sediment pool no longer drains properly.

3. Sediment will be removed from the sediment trap and block and gravel inlet protection device when storage capacity has been approximately 50% filled. Gravel will be cleaned or replaced when the sediment pool no longer drains properly.

4. Sediment will be removed from behind the sediment fence when it becomes about 0.5 ft deep at the fence. The sediment fence will be repaired as necessary to maintain a barrier.

5. All seeded areas will be fertilized, reseeded as necessary, and mulched according to specifications in the vegetative plan to maintain a vigorous, dense vegetative cover.

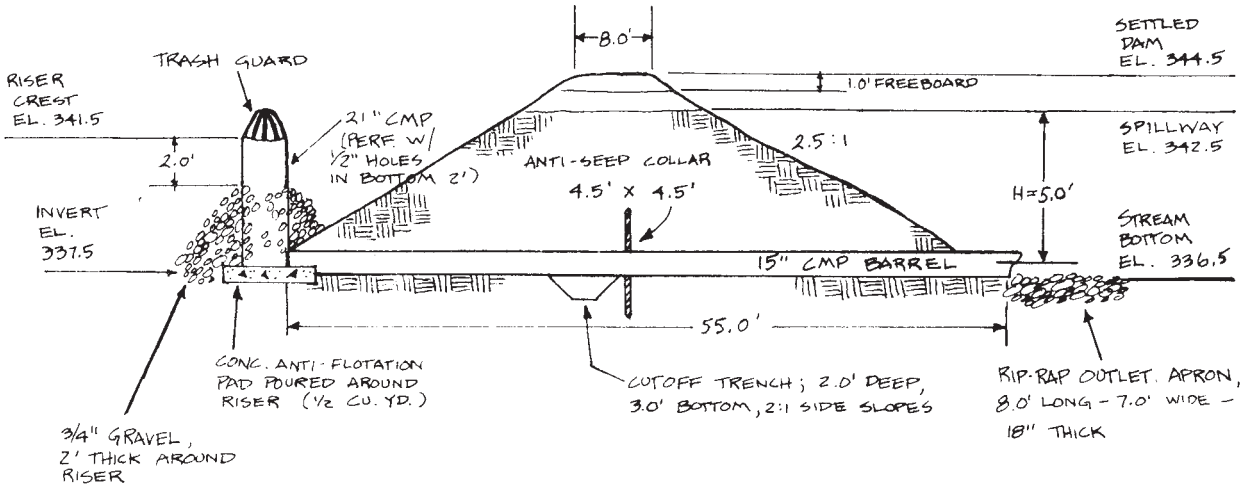
VICINITY MAP

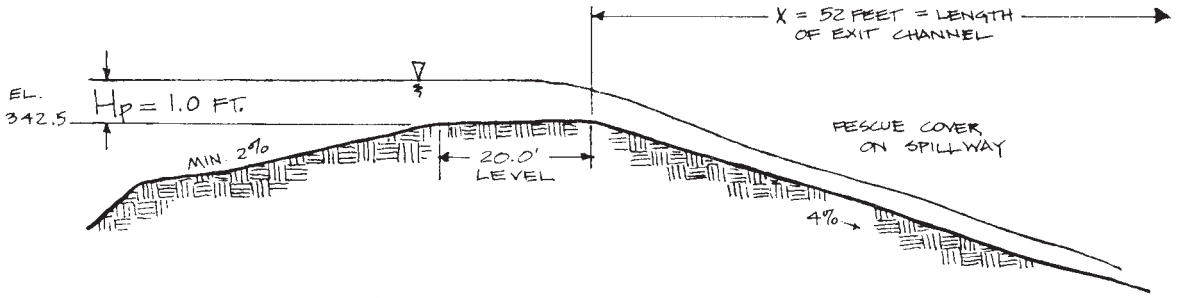


Granville, N.C.

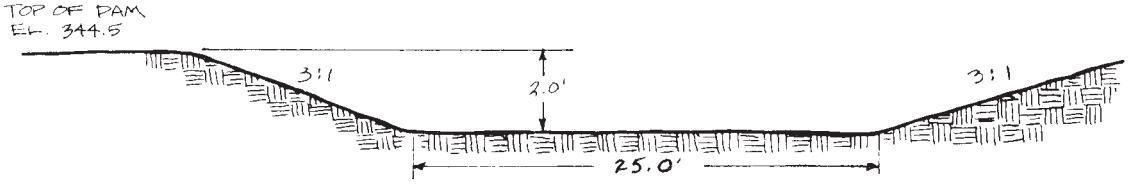
DETAIL DRAWINGS AND SPECIFICATIONS

1. SEDIMENT BASIN





SPILLWAY PROFILE



SPILLWAY : CROSS SECTION AT CONTROL SECTION

(1.) CONSTRUCTION SPECIFICATIONS :

1. CLEAR AND GRUB FOUNDATION FOR EMBANKMENT AND EXCAVATE THE AREA FOR THE RIPRAP OUTLET PAD. AREA TO BE 8.0' LONG, 7.0' WIDE AND 1.5' DEEP. (NOTE: THIS EXCAVATION WILL SERVE AS A SEDIMENT TRAP WHILE STRUCTURE IS BEING BUILT.)

2. EXCAVATE CUTOFF TRENCH ALONG EMBANKMENT CENTERLINE AND UP ABUTMENTS TO ELEVATION 344.0 AS SHOWN. KEEP TRENCH DRY WHEN BACKFILLING AND COMPACTING.

3. USE SEDIMENT POOL AREA AS SOURCE OF FILL MATERIAL FOR THE DAM. MATERIAL SHOULD BE CLEAN MINERAL SOIL, FREE OF ROOTS, WOODY MATERIAL, ROCKS OR OTHER OBJECTIONABLE MATERIAL. SCARIFY FOUNDATION AND PLACE FILL IN LAYERS NOT TO EXCEED 8" OVER THE ENTIRE LENGTH OF DAM. COMPACT BY HEAVY WHEEL EQUIPM NT. THE ENTIRE SURFACE OF EACH LAYER MUST BE TRAVERSED BY AT LEAST ONE WHEEL OF THE COMPACTION EQUIPMENT. THE FILL MATERIAL MUST BE MOIST BUT NOT SO WET THAT WATER CAN BE SQUEEZED FROM IT.

4. PERFORATE 24" CMP RISER WITH 1/2" HOLES SPACED 3" APART IN EACH OUTSIDE VALLEY TO WITHIN 2.0' OF THE TOP. SECURE TRASH RACK TO RISER TOP. MAXIMUM OPENING BETWEEN BARS OF RACK NOT TO EXCEED 3".

5. SECURELY ATTACH THE RISER TO THE BARREL AND ALL OTHER PIPE JOINTS WITH ROD AND LUG CONNECTOR BANDS WITH RUBBER GASKETS TO ASSURE WATER TIGHTNESS. PLACE THE BARREL AND RISER ON A SMOOTH, FIRM FOUNDATION, PLACE FILL AROUND THE PIPE IN 4" LAYERS AND HAND COMPACT. TAKE CARE NOT TO RAISE THE PIPE FROM FIRM CONTACT WITH ITS FOUNDATION WHEN COMPACTING UNDER PIPE HAUNCHES.

6. SECURE ONE STANDARD CORRUGATED METAL ANTI-SEEP COLLAR AROUND BARREL. MAKE SURE CONNECTION IS WATERTIGHT. HAND COMPACT AROUND ANTI-SEEP COLLAR.

7. PLACE A MINIMUM OF 2 FT. OF HAND COMPACTED BACKFILL OVER PIPE BEFORE CROSSING IT WITH CONSTRUCTION EQUIPMENT.

8. ANCHOR RISER IN PLACE WITH 1/2 YD^3 CONCRETE PAD POURED AROUND RISER.

9. PLACE 3/4" GRAVEL (D.O.T. #5 WASHED STONE) OVER THE PERFORATED HOLES APPROXIMATELY 2" THICK.

10. INSTALL EMERGENCY SPILLWAY IN UNDISTURBED SOIL TO THE LINES AND GRADES SHOWN IN DRAWINGS.

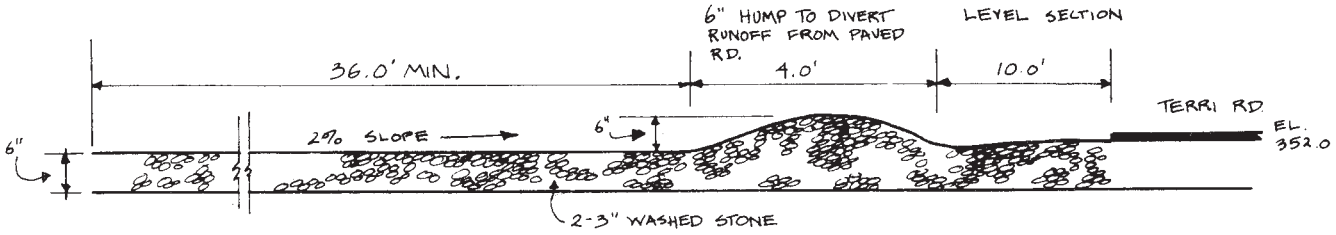
11. PLACE CLASS A EROSION CONTROL STONE OVER FILTER FABRIC ON LEVEL GRADE FOR RIPRAP APRON AT PIPE OUTLET. TOP OF RIPRAP TO BE SAME ELEVATION AS OUTLET CHANNEL BOTTOM. NO OVERFALL.

12. CLEAR SEDIMENT POOL AREA TO ELEVATION 341.5 AFTER THE EMBANKMENT IS COMPLETE.

13. VEGETATE ALL DISTURBED AREAS (EXCEPT THE SEDIMENT POOL) IN ACCORDANCE WITH THE VEGETATIVE PLAN.

14. SEDIMENT TO BE REMOVED FROM BASIN WHEN THE LEVEL IS WITHIN 2.0' OF THE TOP OF THE RISER. (SAME LEVEL AS TOP OF GRAVEL.)

2. TEMPORARY GRAVEL CONSTRUCTION ENTRANCE



GRAVEL ENTRANCE/EXIT: WIDTH — 15.0', FLARED TO 25.0' AT ROAD
LENGTH — 50.0'
GRADE — 2.0%

(2.) CONSTRUCTION SPECIFICATIONS

1. CLEAR THE ENTRANCE/EXIT AREA OF ALL VEGETATION, ROOTS, AND OTHER OBJECTIONABLE MATERIAL.

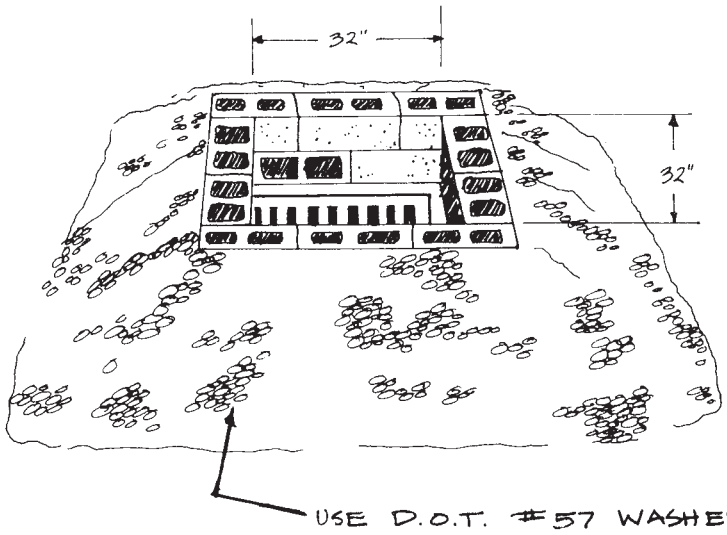
2. GRADE THE ROAD FOUNDATION SO THAT THE ENTRANCE/EXIT WILL HAVE A CROSS SLOPE TO THE SOUTH AND ALL RUNOFF WILL DRAIN TO THE BLOCK AND GRAVEL DROP INLET PROTECTION STRUCTURE.

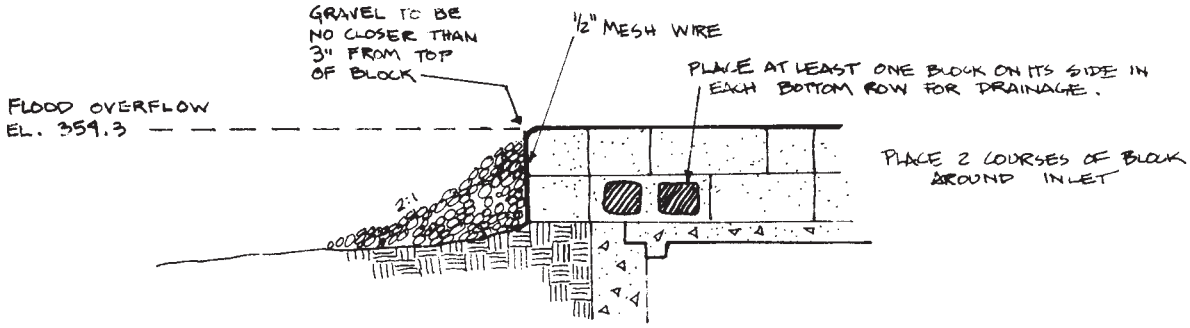
3. PLACE STONE TO THE DIMENSIONS, GRADE AND ELEVATION SHOWN.

4. USE WASHED STONE 2" TO 3" IN SIZE.

NOTE: MAINTAIN THE GRAVEL PAD IN A CONDITION TO PREVENT MUD OR SEDIMENT FROM LEAVING THE SITE. SHOULD MUD BE TRACKED OR WASHED ONTO TERRI ROAD, IT MUST BE REMOVED IMMEDIATELY.

3. TEMPORARY BLOCK AND GRAVEL DROP INLET PROTECTION





(3.) CONSTRUCTION SPECIFICATIONS

1. LAY CONCRETE BLOCKS ON FIRM, SMOOTH FOUNDATION EXCAVATED 3" BELOW STORM DRAIN TOP. PLACE BLOCKS AGAINST DRAIN INLET FOR LATERAL SUPPORT.

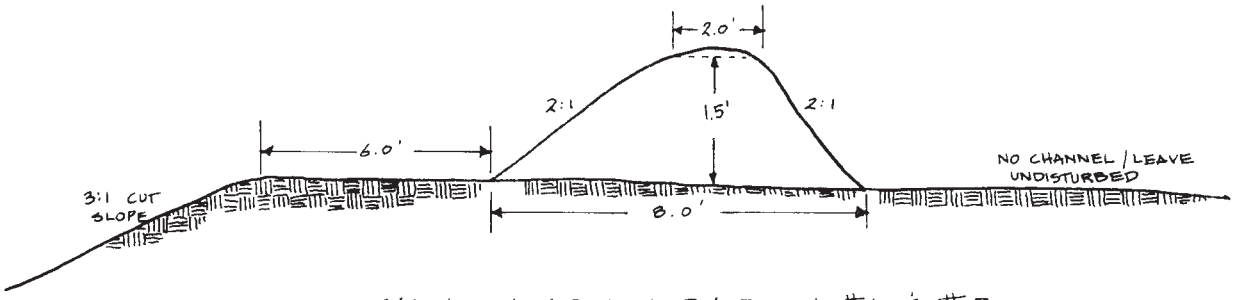
2. PLACE AT LEAST ONE CONCRETE BLOCK ON ITS SIDE IN EACH BOTTOM ROW OF BLOCKS.

3. PLACE WIRE MESH WITH ½" OPENINGS OVER ALL BLOCK OPENINGS USED FOR DRAINAGE.

4. USE D.O.T. #57 WASHED STONE TO REDUCE FLOW RATE BUT ALLOW DRAINAGE. PLACE STONE ON 2:1 SLOPE TO WITHIN 3" OF TOP OF BLOCK.

5. ANY SOIL LEFT EXPOSED BETWEEN THE BLOCK AND CONCRETE DRAIN INLET SHOULD BE FILLED WITH 3" DIAMETER STONE TO PREVENT WASHING WHEN WATER FLOWS OVER BLOCKS INTO DRAIN.

4. TEMPORARY DIVERSIONS



TYPICAL X-SECTION DIVERSION #1 & #2

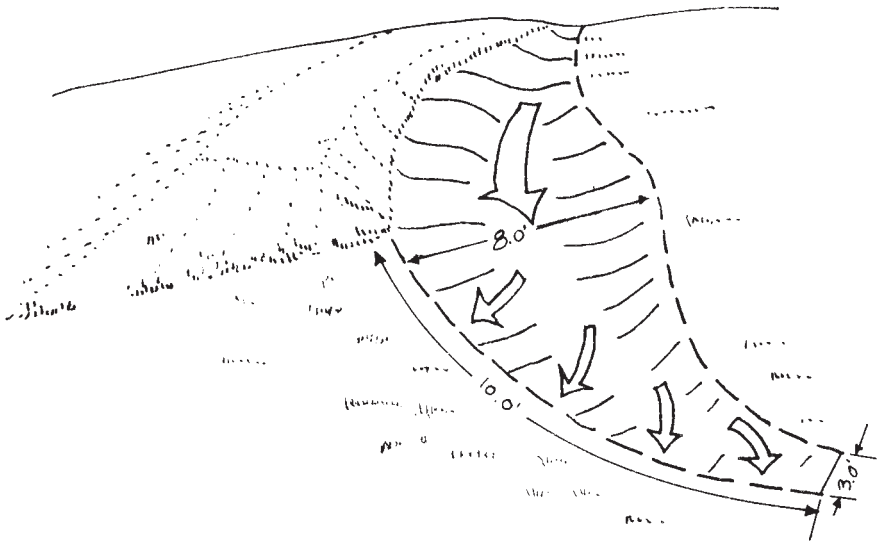
DIVERSION #1 — GRADE = 2%
LENGTH = 450'

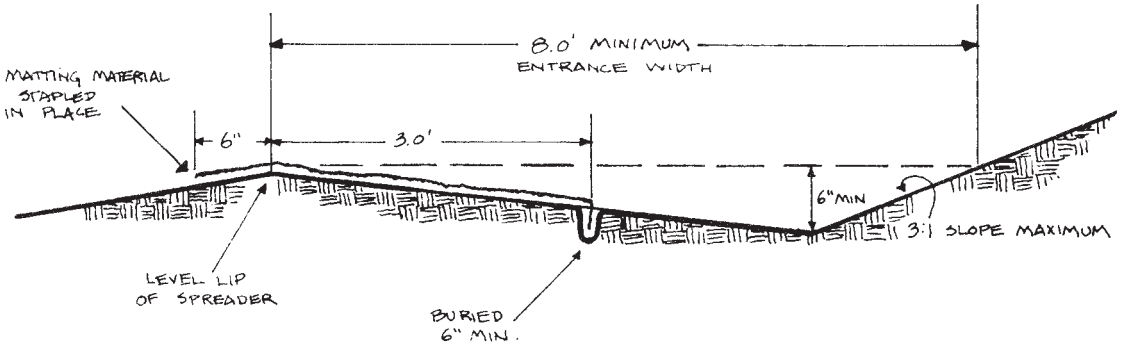
DIVERSION #2 — GRADE = 0.5%
LENGTH = 400'

(4.) CONSTRUCTION SPECIFICATIONS

1. REMOVE ALL TREES, BRUSH & STUMPS FROM DIVERSION FOUNDATION.
2. CONSTRUCT RIDGE TO FULL DIMENSIONS SHOWN — ALLOW 10% FOR SETTLING.
3. COMPACT RIDGE BY WHEELS OF CONSTRUCTION EQUIPMENT.
4. ENSURE THAT THE TOP OF THE DIVERSION IS ON DESIGN GRADE OR HIGHER AT ALL POINTS.
5. SEED AND MULCH IMMEDIATELY AFTER CONSTRUCTION. SEE VEGETATIVE PLAN.

5. LEVEL SPREADER





CROSS SECTION

(5.) CONSTRUCTION SPECIFICATIONS

1. FIBERGLASS MATTING, 4.0 FT. WIDE, SHOULD EXTEND 6" OVER THE LEVEL LIP AND BE BURIED 6" DEEP AT THE LOWER EDGE.

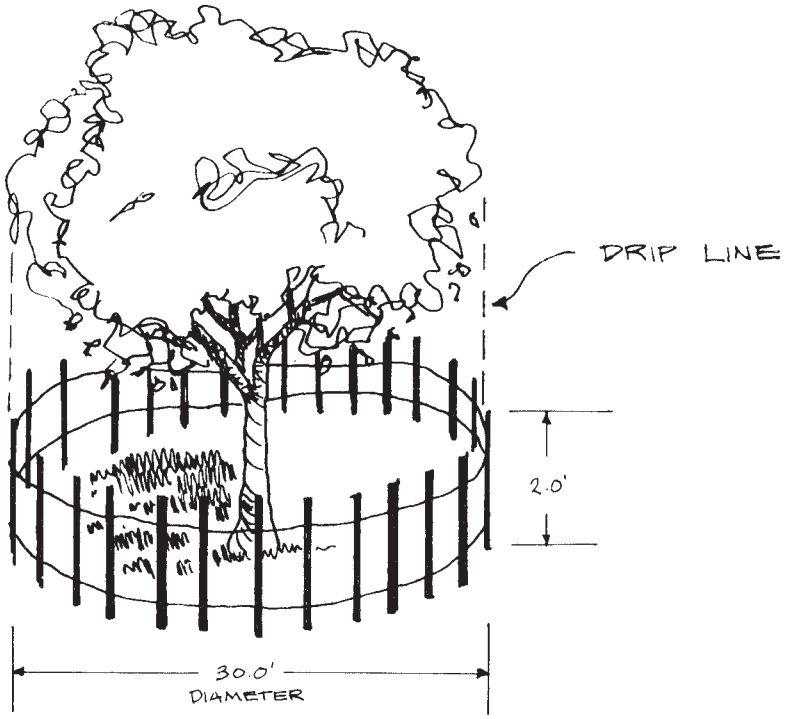
2. ENSURE THAT THE SPREADER LIP IS LEVEL THROUGHOUT ITS LENGTH.

3. CONSTRUCT THE LEVEL SPREADER ON UNDISTURBED SOIL (NOT ON FILL.)

4. CONSTRUCT A TRANSITION SECTION FROM THE DIVERSION TO BLEND SMOOTHLY TO THE WIDTH AND DEPTH OF THE SPREADER.

5. IMMEDIATELY AFTER CONSTRUCTION, APPROPRIATELY SEED AND MULCH THE ENTIRE DISTURBED AREA OF THE SPREADER. SEE VEGETATIVE PLAN.

6. TREE PRESERVATION & PROTECTION



NOTE: SEDIMENT FENCE MATERIAL MAY BE USED TO BUILD FENCE.

- DRIVE STAKES FIRMLY INTO GROUND – AT LEAST 12"

7. LAND GRADING

1. FINISHED LAND SURFACES WILL BE GRADED AS SHOWN ON SITE DEVELOPMENT PLAN.

2. CUT SLOPES WILL BE 3:1 OR FLATTER FOR MAINTENANCE BY MOWING AND ROUGHENED FOR VEGETATIVE ESTABLISHMENT.

3. THE HIGH FILL SLOPE ON THE NORTH WILL NOT BE STEEPER THAN 2:1 AND ROUGHENED BY GROOVING ACROSS THE SLOPE.

4. TOPSOIL WILL BE REMOVED FROM AREAS TO BE GRADED AND FILLED AND IT WILL BE STOCKPILED IN LOCATIONS SHOWN.

5. AREAS TO BE FILLED WILL BE CLEARED AND GRUBBED.

6. FILL WILL BE PLACED IN LAYERS NOT TO EXCEED 9" AND COMPACTED AS REQUIRED IN THE SPECIFICATIONS FOR THE DEVELOPMENT PLAN (NOT A PART OF SEDIMENT CONTROL PLAN.)

7. FROZEN MATERIAL OR SOFT, HIGHLY COMPRESSIBLE MATERIAL WILL NOT BE USED AS FILL.

8. FILL WILL NOT BE PLACED ON A FROZEN SURFACE.

9. ROAD AND PARKING SURFACES WILL BE SLOPED AS SHOWN ON SITE DEVELOPMENT PLAN TO CONTROL RUNOFF.

10. LAND ADJOINING PAVED AREAS WILL BE SLOPED NO STEEPER THAN 6:1 AND GRADED TO DRAIN AS SHOWN.

11. SURFACE RUNOFF FROM BUILDINGS WILL BE COLLECTED IN GUTTERS AND PIPED TO CHANNELS 1, 2, 3 AND 4.

12. DIVERSIONS WILL BE INSTALLED ABOVE CUT SLOPES PRIOR TO LAND CLEARING AND GRADING.

13. A DIVERSION WILL BE MAINTAINED AT ALL TIMES ABOVE THE FILL SLOPE TO PREVENT OVERFLOW ON THIS STEEP AREA.

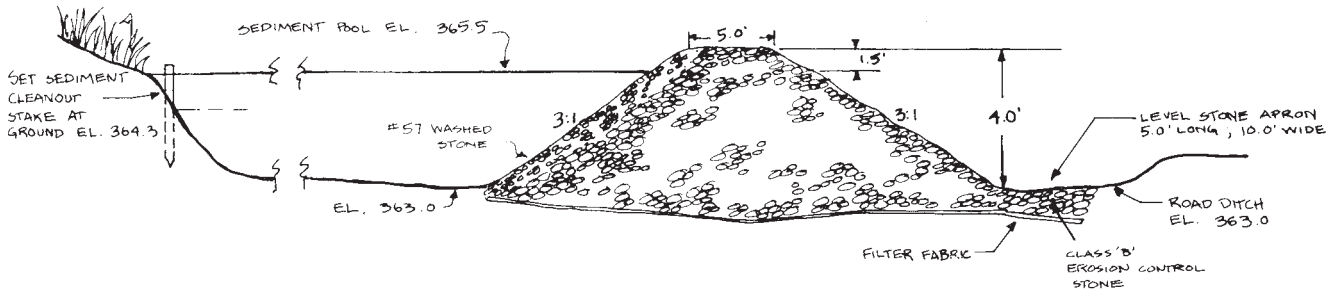
14. CUTTING AND FILLING WILL BE DONE AS A CONTINUOUS OPERATION UNTIL FINAL GRADE IS REACHED. SHOULD GRADING BE TEMPORARILY DISCONTINUED, A TEMPORARY DIVERSION WILL BE CONSTRUCTED ACROSS THE MIDDLE OF THE DISTURBED AREA TO BREAK UP THE LONG SLOPE TO THE NORTH.

15. AS SOON AS FINAL GRADES ARE REACHED THE GRADED AREAS WILL BE STABILIZED IN ACCORDANCE WITH THE VEGETATIVE PLAN.

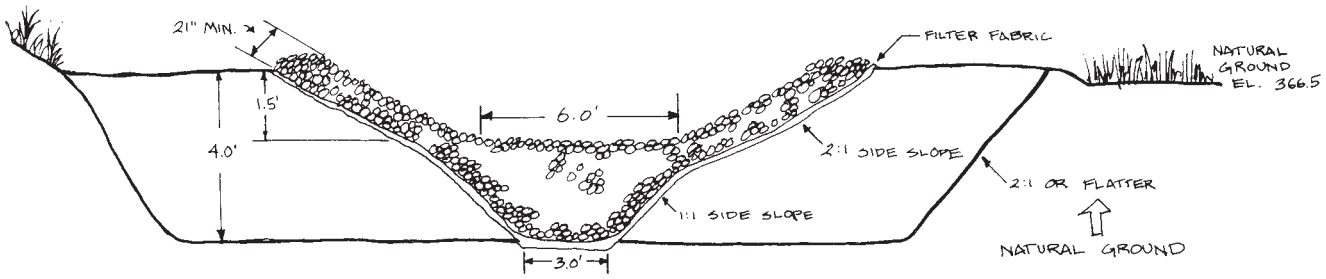
16. AN UNDISTURBED AREA WILL BE LEFT AS A BUFFER AROUND THE ENTIRE GRADED SITE EXCEPT AT ROAD ENTRANCE AND CHANNEL #3 OUTLET.

17. WHEN THE DEVELOPED SITE HAS BEEN PROPERLY STABILIZED, ALL THE TEMPORARY SEDIMENT AND EROSION CONTROL MEASURES WILL BE REMOVED, THE DISTURBED AREA GRADED TO BLEND WITH THE SURROUNDING AREA, AND VEGETATED.

8. TEMPORARY SEDIMENT TRAP



CROSS SECTION



STONE SECTION

(8.) CONSTRUCTION SPECIFICATIONS

1. CLEAR, GRUB AND STRIP THE AREA UNDER THE EMBANKMENT OF ALL VEGETATION AND ROOT MAT.
2. CLEAR POND AREA BELOW ELEVATION 365.5
3. USE FILL MATERIAL FREE OF ROOTS, WOODY VEGETATION AND ORGANIC MATTER. PLACE FILL IN LIFTS NOT TO EXCEED 9" AND MACHINE COMPACT.
4. CONSTRUCT DAM AND STONE SPILLWAY TO DIMENSIONS, SLOPES AND ELEVATIONS SHOWN.
5. ENSURE THAT THE SPILLWAY CREST IS LEVEL AND AT LEAST 1.5' BELOW THE TOP OF THE DAM AT ALL POINTS.
6. STONE USED FOR SPILLWAY SECTION — CLASS "B" EROSION CONTROL STONE.

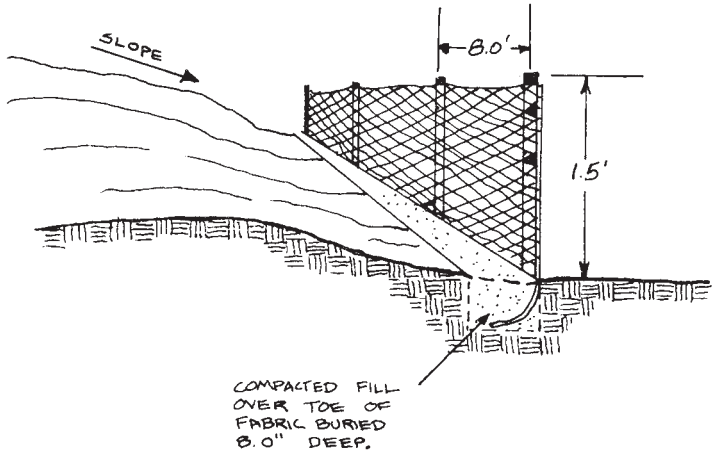
7. STONE USED ON INSIDE SPILLWAY FACE TO CONTROL DRAINAGE — P.O.T. # 57 WASHED STONE.

8. EXTEND STONE OUTLET SECTION TO VEGETATED ROAD DITCH ON ZERO GRADE WITH TOP ELEVATION OF STONE LEVEL WITH BOTTOM OF DRAIN.

9. ENSURE THAT THE TOP OF THE DAM AT ALL POINTS IS 0.5' ABOVE NATURAL SURROUNDING GROUND.

10. STABILIZE THE EMBANKMENT AND ALL DISTURBED AREA ABOVE THE SEDIMENT POOL AS SHOWN IN THE VEGETATION PLAN.

9. SEDIMENT FENCE



(9.) CONSTRUCTION SPECIFICATIONS

1. CONSTRUCT SEDIMENT FENCE ON LOW SIDE OF TOPSOIL STOCKPILE TO PREVENT SEDIMENT FROM BEING WASHED INTO THE DRAINAGE SYSTEM. FENCE TO EXTEND AROUND APPROXIMATELY 70% OF THE PERIMETER OF THE STOCKPILE.

2. LOCATE POSTS DOWNSLOPE OF FABRIC TO HELP SUPPORT FENCING.

3. BURY TOE OF FENCE APPROXIMATELY 8" DEEP TO PREVENT UNDERCUTTING.

4. WHEN JOINTS ARE NECESSARY, SECURELY FASTEN THE FABRIC AT A SUPPORT POST WITH OVERLAP TO THE NEXT POST.

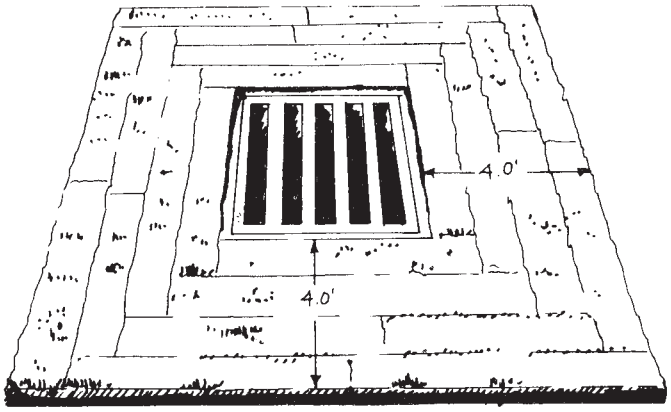
5. FILTER FABRIC TO BE OF NYLON, POLYESTER, PROPYLENE OR ETHYLENE YARN WITH EXTRA STRENGTH — 50 LB/LIN. IN. (MINIMUM) — AND WITH A FLOW RATE OF AT LEAST 0.3 GAL./FT^2/MINUTE. FABRIC SHOULD CONTAIN ULTRAVIOLET RAY INHIBITORS AND STABILIZERS.

6. POST TO BE 4" DIAMETER PINE WITH A MIMUMUM LENGTH OF 4' FEET.

NOTE: IF HIGH CUT SLOPES ADJOINING CHANNELS 1, 2, AND 3 ARE NOT ADEQUATELY STABILIZED BEFORE CHANNEL IS CONSTRUCTED, A SEDIMENT FENCE SHOULD BE LOCATED ON THE CHANNEL BERM TO PREVENT SEDIMENT FROM ENTERING THE CHANNEL SYSTEM. THE FENCE SHOULD BE INSTALLED AS SHOWN ABOVE ALONG THE ENTIRE UNSTABLE AREA ADJOINING THE CHANNEL.

10. SOD DROP INLET PROTECTION

AFTER THE CONTRIBUTING DRAINAGE AREA HAS BEEN PERMANENTLY STABILIZED, THE BLOCK AND GRAVEL STRUCTURE WILL BE REMOVED AND PERMANENT SOD LAID AROUND THE DROP INLET.

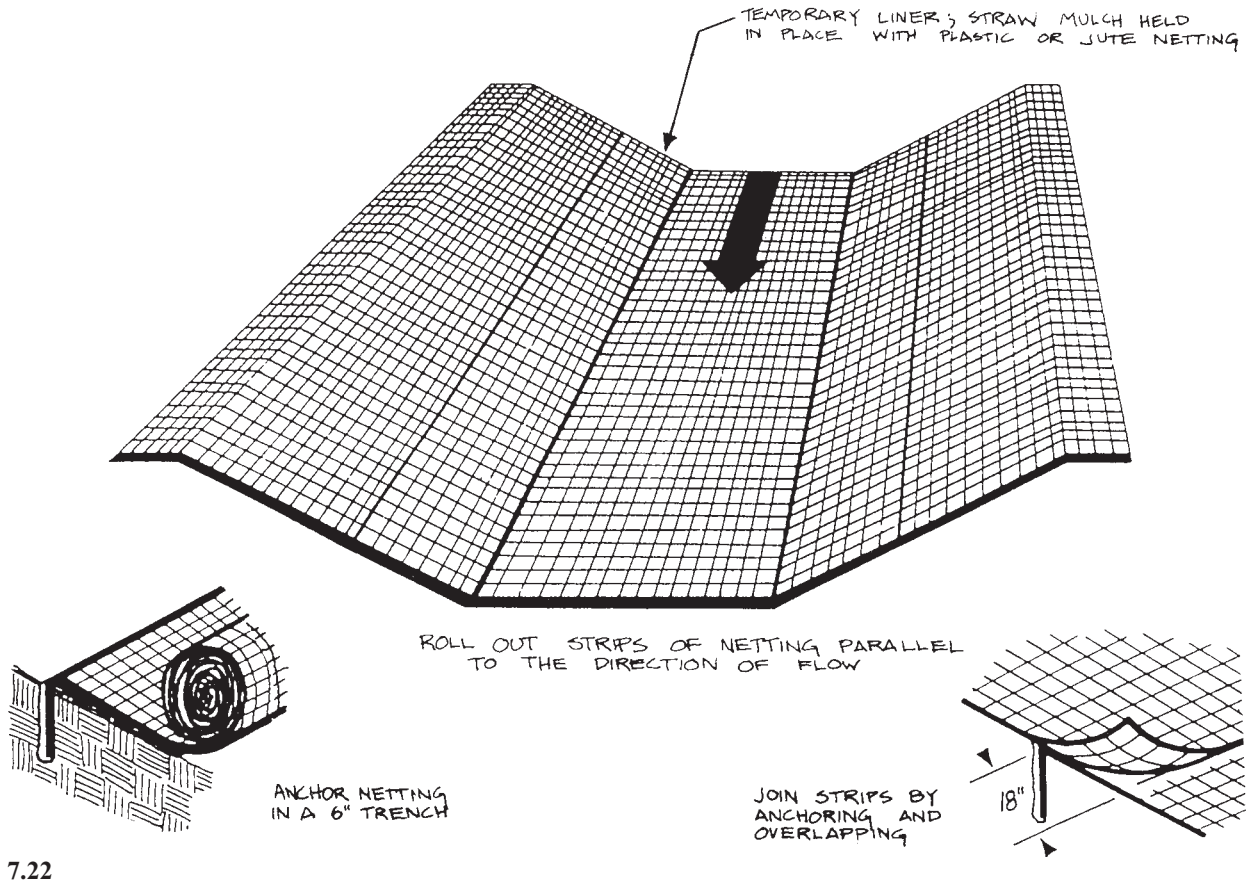


FOUR 1-FOOT WIDE STRIPS OF TALL FESCUE SOD ON EACH SIDE OF THE DROP INLET

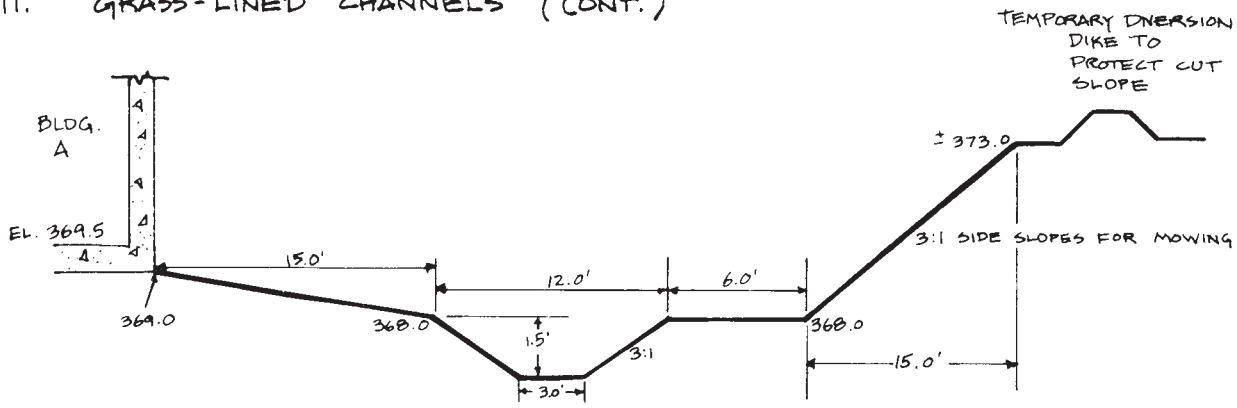
(10.) CONSTRUCTION SPECIFICATIONS

1. RAKE SOIL SURFACE TO BREAK GROUND CRUST; LEAVE SURFACE UNIFORM AND WATER LIGHTLY.
2. LAY SOD IN A STAGGERED PATTERN AS SHOWN WITH STRIPS BUTTED TIGHTLY AGAINST EACH OTHER.
3. BUTTING — ANGLED ENDS CAUSED BY CUTTING MUST BE MATCHED CORRECTLY.
4. ROLL SOD TO PROVIDE FIRM SOIL CONTACT.
5. IRRIGATE UNTIL SOIL IS WET TO ABOUT 4" BELOW THE SOD.
6. KEEP SOD MOIST UNTIL SOD TAKES ROOT.

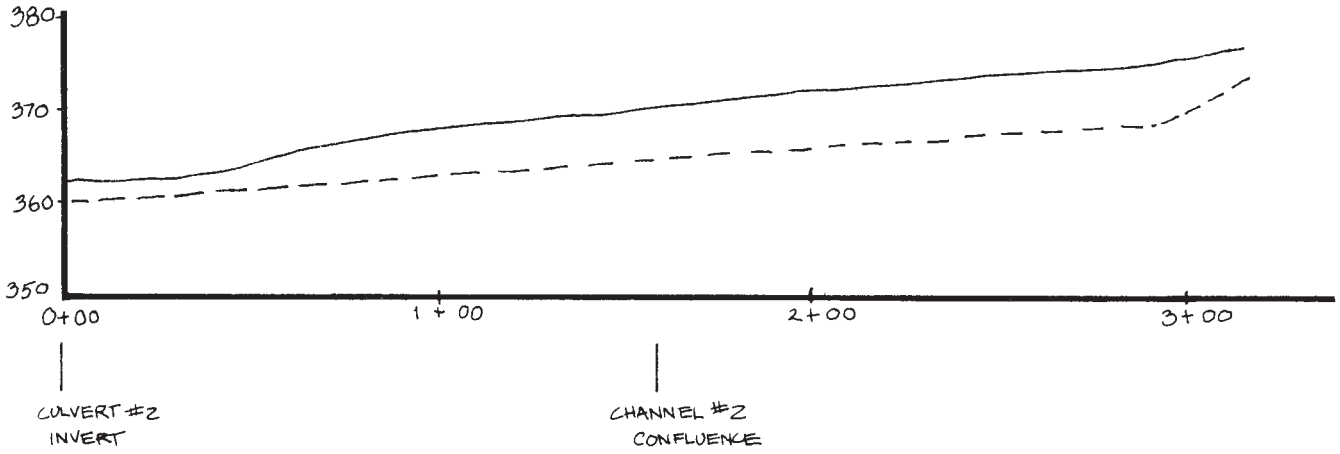
11. GRASS-LINED CHANNELS



11. GRASS-LINED CHANNELS (CONT.)



TYPICAL CROSS SECTION;
ALL CHANNELS (DEPTH AND TOP WIDTH WILL VARY BASED ON GROUND ELEVATION)



PROFILE – CHANNEL #1

CHANNEL #1

GRADE : 2%
LENGTH : 350'
BEGINNING GRADE EL : 359.5
– AT OUTLET – INVERT OF CULVERT #2

CHANNEL #2

GRADE : 1.75%
LENGTH : 230'
BEGINNING GRADE EL : 362.7
– AT INTERSECTION W/ CHANNEL #1

CHANNEL #3

GRADE : 1%
LENGTH : 450'
BEGINNING GRADE ELEVATION : 362.0
– CULVERT INVERT UNDER TERRI ROAD

CHANNEL #4

GRADE : 1.1%
LENGTH : 160'
BEGINNING GRADE EL. : 364.8
– AT OUTLET – EXISTING STABLE CHANNEL BOTTOM

(11.) CONSTRUCTION SPECIFICATIONS

1. EXCAVATE THE CHANNEL AND SHAPE IT TO AN EVEN CROSS-SECTION AS SHOWN. WHEN STAKING INDICATE A 0.2' OVERCUT AROUND THE CHANNEL PERIMETER FOR SILTING AND BULKING.

2. GRADE SOIL AWAY FROM CHANNEL SO THAT SURFACE WATER MAY ENTER FREELY.

3. APPLY LIME, FERTILIZER AND SEED TO THE CHANNEL AND ADJOINING AREAS IN ACCORDANCE WITH THE VEGETATION PLAN.

4. SPREAD STRAW MULCH AT THE RATE OF 100 LB/1000 FT^2.

5. HOLD MULCH IN PLACE IMMEDIATELY AFTER SPREADING WITH A PLASTIC NETTING INSTALLED AS SHOWN.

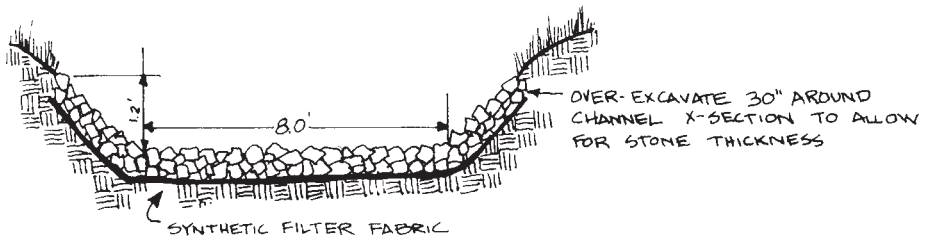
6. START LAYING THE NET FROM THE TOP OF THE UPSTREAM END OF THE CHANNEL AND UNROLL IT DOWN GRADE. DO NOT STRETCH NETTING.

7. BURY THE UPSLOPE END AND STAPLE THE NET EVERY 12" ACROSS THE TOP END, EVERY 3 FT. AROUND THE EDGES AND ACROSS THE NET SO THAT THE STRAW IS HELD CLOSELY AGAINST THE SOIL. HOWEVER, DO NOT STRETCH THE NETTING WHEN STAPLING.

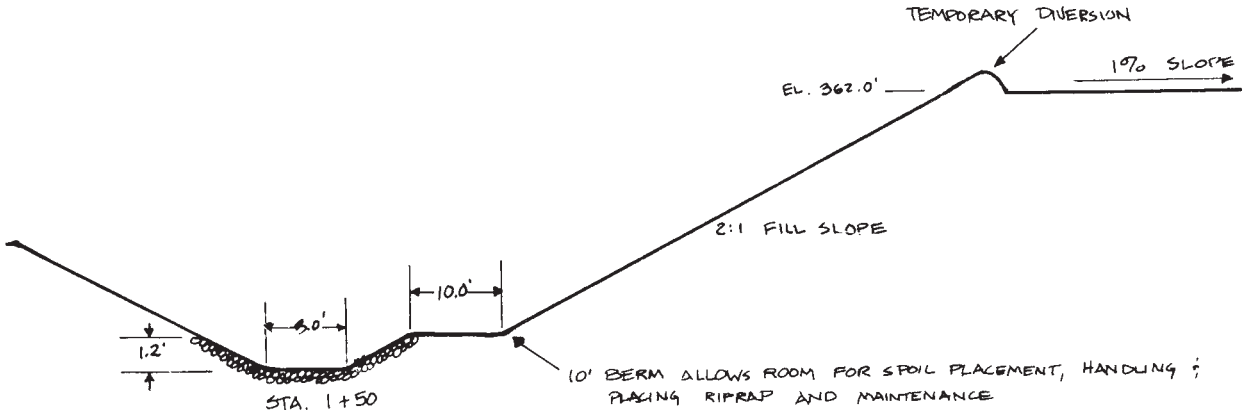
8. NETTING STRIPS SHOULD BE JOINED TOGETHER ALONG THE SIDES WITH A 3" OVERLAP AND STAPLED TOGETHER.

9. TO JOIN ENDS OF STRIPS, INSERT THE NEW ROLL OF NET IN A TRENCH AS WITH UPSLOPE END AND OVERLAP IT 18" WITH THE PREVIOUSLY LAID UPPER ROLL. TURN UNDER 6" OF THE 18" OVERLAP AND STAPLE EVERY 12" ACROSS THE END.

12. RIPRAP CHANNEL

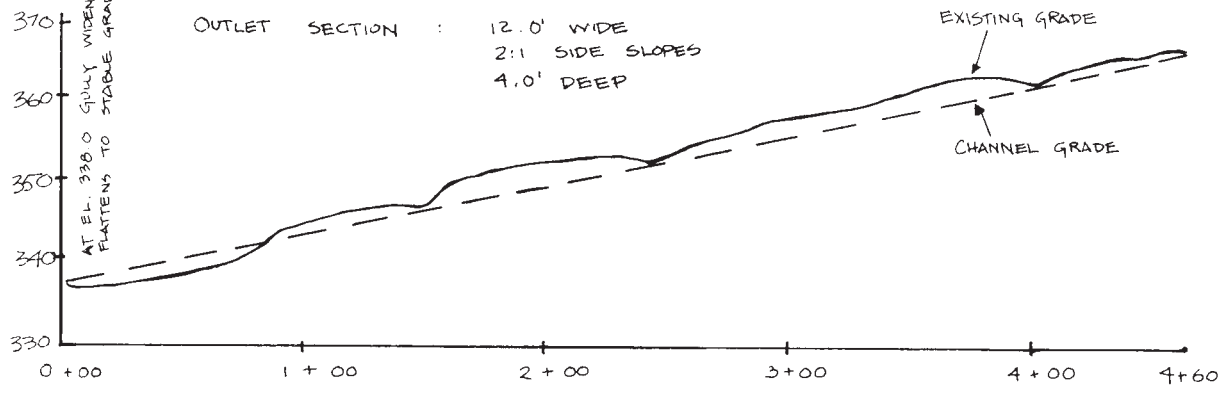


TYPICAL CROSS SECTION



TYPICAL CROSS SECTION

CHANNEL GRADE : 0.060
LENGTH : 460'
RIPRAP : d_{50} = 12" dmax = 18"
STONE THICKNESS : 27"
OUTLET SECTION : 12.0' WIDE
2:1 SIDE SLOPES
4.0' DEEP



CHANNEL PROFILE

(12.) CONSTRUCTION SPECIFICATIONS

(1). CLEAR THE FOUNDATION OF ALL TREES, STUMPS, AND ROOTS.

2. EXCAVATE THE BOTTOM AND SIDES OF THE CHANNEL 30" BELOW GRADE AT ALL POINTS TO ALLOW FOR THE PLACEMENT OF RIPRAP AS SHOWN IN THE TYPICAL X-SECTION.

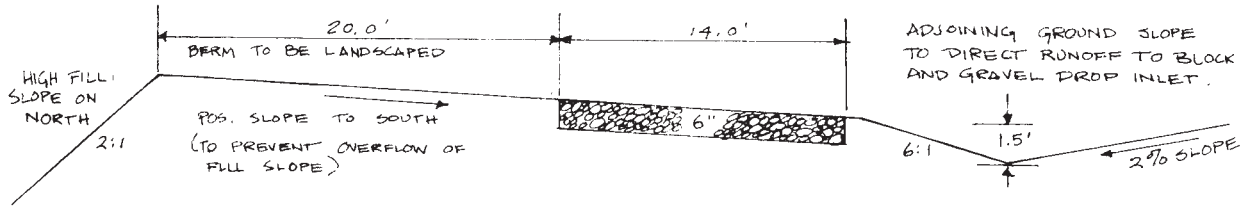
3. INSTALL EXTRA STRENGTH FILTER FABRIC ON THE BOTTOM AND SIDES OF THE CHANNEL FOUNDATION, PLACING THE UPSTREAM FABRIC OVER THE DOWNSTREAM FABRIC WITH AT LEAST A 1.0' OVERLAP ON ALL JOINTS. THE FABRIC IS TO BE SECURELY HELD IN PLACE WITH METAL PINS.

4. PLACE RIPRAP EVENLY TO THE LINES AND GRADES SHOWN ON THE DRAWINGS AND STAKED IN THE FIELD. RIPRAP TO BE PLACED IMMEDIATELY FOLLOWING THE INSTALLATION OF THE FILTER FABRIC.

5. RIPRAP TO MEET SPECIFICATION FOR D.O.T. CLASS 2 RIPRAP.

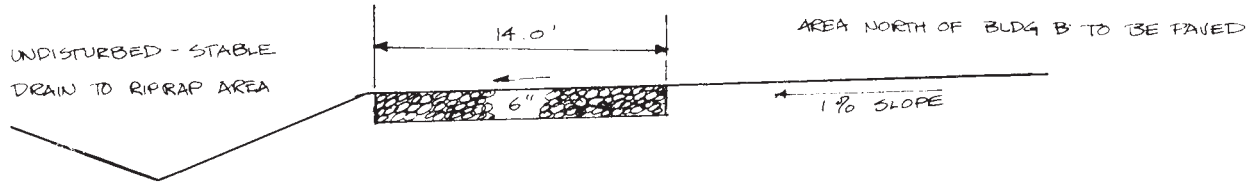
6. VEGETATE ALL DISTURBED AREAS FOLLOWING SPECIFICATIONS SHOWN IN THE VEGETATIVE PLAN.

13. CONSTRUCTION ROAD STABILIZATION



TYPICAL X-SECTION ENTRANCE ROAD

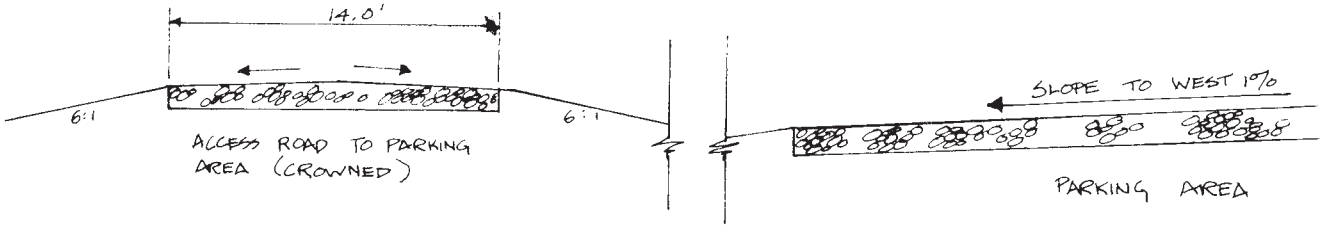
(TERRI RD. EAST TO CHANNEL #1)



TYPICAL X-SECTION ENTRANCE ROAD

(FROM CHANNEL #1 EAST TO EAST END OF BLDG. B)

13. CONST. RD. STABILIZATION (CONT.)



TYPICAL CROSS-SECTION ACCESS ROAD

(13) CONSTRUCTION SPECIFICATIONS

1. CLEAR ROAD BED AND PARKING AREAS OF ALL VEGETATION, ROOTS AND OTHER OBJECTIONABLE MATERIAL.

2. PROVIDE SURFACE DRAINAGE AS SHOWN.

3. SPREAD 6" COURSE OF P.O.T. "ABC" CRUSHED STONE EVENLY OVER THE FULL WIDTH OF ROAD AND PARKING AREA AND SMOOTH TO AVOID DEPRESSIONS.

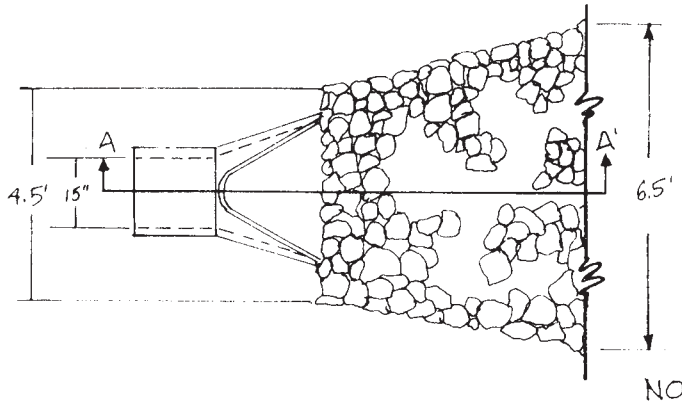
4. VEGETATE ALL DISTURBED AREAS ADJOINING ROADS AND PARKING AS SOON AS GRADING IS COMPLETE IN ACCORDANCE WITH THE VEGETATION PLAN.

14. OUTLET STABILIZATION STRUCTURES

OUTLET PROTECTION FOR CULVERT #1

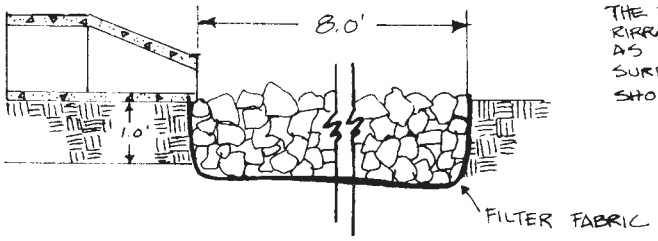
(FOR RIPRAP PROTECTION USE CLASS A OR CLASS B EROSION CONTROL STONE)

PLAN



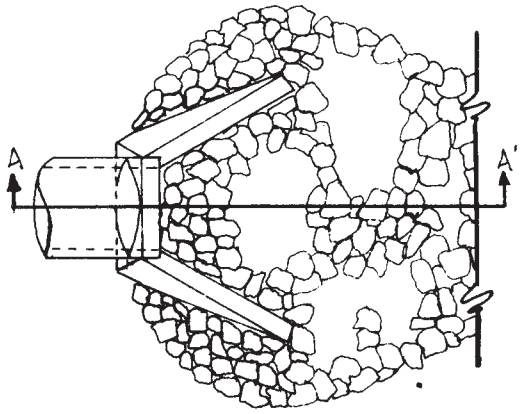
NOTE: APRON TO BE PLACED LEVEL WITH THE TOP SURFACE OF RIPRAP AT SAME LEVEL AS SURROUNDING LAND SURFACE — NO OVERFALL SHOULD EXIST.

SECTION A-A'

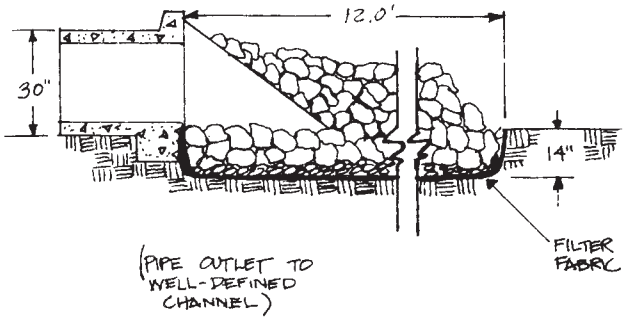


OUTLET PROTECTION FOR CULVERT #2

(LINE CHANNEL TO TOP OF BANKS FOR A DISTANCE OF 12.0' DOWNSTREAM. USE CLASS B EROSION CONTROL STONE.)



PLAN



SECTION A-A'

NOTE: APRON TO BE PLACED LEVEL WITH THE TOP SURFACE OF RIPRAP AT SAME ELEVATION AS SIDES AND BOTTOM OF CHANNEL. NO CHANNEL OVERFALL OR RESTRICTION IN CHANNEL CROSS-SECTION SHOULD EXIST.

(14.) CONSTRUCTION SPECIFICATIONS

1. EXCAVATE BELOW CHANNEL OUTLET AND WIDEN CHANNEL TO THE REQUIRED RIPRAP THICKNESS FOR EACH APRON. FOUNDATION TO BE CUT TO ZERO GRADE AND SMOOTHED.

2. PLACE FILTER CLOTH ON BOTTOM AND SIDES OF PREPARED FOUNDATION. ALL JOINTS TO OVERLAP A MINIMUM OF 1.0'.

3. EXERCISE CARE IN RIPRAP PLACEMENT TO AVOID DAMAGE TO FILTER FABRIC.

4. PLACE RIPRAP ON ZERO GRADE — TOP OF RIPRAP TO BE LEVEL WITH EXISTING OUTLET — NO OVERFALL AT ENDS.

5. RIPRAP TO BE HARD, ANGULAR, WELL GRADED CLASS B EROSION CONTROL STONE.

6. IMMEDIATELY AFTER CONSTRUCTION STABILIZE ALL DISTURBED AREAS WITH VEGETATION AS SHOWN IN VEGETATIVE PLAN.

15. SURFACE ROUGHENING

A. — 2:1 FILL SLOPE

1. PLACE FILL IN LIFTS NOT TO EXCEED 9" AND COMPACT.
2. LEAVE FACE OF FILL SLOPE LOOSE AND UNCOMPACTED — 4-6" DEEP — DO NOT BACK BLADE IN FINAL GRADING.
3. GROOVE ON CONTOUR — GROOVES APPROX. 3" DEEP + 12" APART.
4. VEGETATE IMMEDIATELY AFTER GROOVING.

B. — 3:1 CUT SLOPE

1. GROOVE BY DISCING TO EVEN SURFACE FOR MAINTENANCE BY MOWING.
2. GROOVES APPROX. 1" - 2" DEEP AND 10" APART.
3. VEGETATE IMMEDIATELY AFTER DISCING. SEE VEGETATIVE PLAN.

VEGETATIVE PLAN

Seedbed Preparation (SP)

SP-1 Fill slopes 3:1 or steeper to be seeded with a hydraulic seeder (permanent seedings)

1) Leave the last 4-6 inches of fill loose and uncompacted, allowing rocks, roots, large clods and other debris to remain on the slope.

2) Roughen slope faces by making grooves 2-3 inches deep, perpendicular to the slope.

3) Spread lime evenly over slopes at rates recommended by soil tests.

SP-2 Fill slopes 3:1 or steeper (temporary seedings)

1) Leave a loose, uncompacted surface. Remove large clods, rocks, and debris which might hold netting above the surface.

2) Spread lime and fertilizer evenly at rates recommended by soil tests.

3) Incorporate amendments by roughening or grooving soil surface on the contour.

SP-3 High-maintenance turf

1) Remove rocks and debris that could interfere with tillage and the production of a uniform seedbed.

2) Apply lime and fertilizer at rates recommended by soil tests; spread evenly and incorporate to a depth of 2-4” with a farm disk or chisel plow.

3) Loosen the subgrade immediately prior to spreading topsoil by disking or scarifying to a depth of at least 2 inches.

4) Spread topsoil to a depth of 2-4 inches and cultipack.

5) Disk or harrow and rake to produce a uniform and well-pulverized surface.

6) Loosen surface just prior to applying seed.

SP-4 Gentle or flat slopes where topsoil is not used.

1) Remove rocks and debris.

2) Apply lime and fertilizer at rates recommended by soil tests; spread evenly and incorporate into the top 6” with a disk, chisel plow, or rotary tiller.

3) Break up large clods and rake into a loose, uniform seedbed.

4) Rake to loosen surface just prior to applying seed.

Seeding Methods (SM)

SM-1 Fill slopes steeper than 3:1 (permanent seedings)

Use hydraulic seeding equipment to apply seed and fertilizer, a wood fiber mulch at 45 lb/1,000 ft^2, and mulch tackifer.

SM-2 Gentle to flat slopes or temporary seedings

1) Broadcast seed at the recommended rate with a cyclone seeder, drop spreader, or cultipacker seeder.

2) Rake seed into the soil and lightly pack to establish good contact.

Mulch (MU)

MU-1 Steep slopes (3:1 or greater)

In mid-summer, late fall or winter, apply 100 lb/1,000 ft^2 grain straw, cover with netting and staple to the slope. In spring or early fall use 45 lb/1,000 ft^2 wood fiber in a hydroseeder slurry.

MU-2 High-maintenance vegetation and temporary seedings

Apply 90 lb/1,000 ft^2 (4,000 lb/acre) grain straw and tack with 0.1 gal/yd^2 asphalt (11 gal/1,000 ft^2).

MU-3 Grass-lined channels

Install excelsior mat in the channel, extend up the channel banks to the highest calculated depth of flow, and secure according to manufacturer's specifications.

On channel shoulders, apply 100 lb/1,000 ft^2 grain straw and anchor with 0.1 gal/yd^2 (11 gal/1,000 ft^2) asphalt.

Maintenance (MA)

MA-1 Refertilize in late winter or early spring the following year. Mow as desired.

MA-2 Keep mowed to a height of 2-4 inches. Fertilize with 40 lb/acre (1 lb/1,000 ft^2) nitrogen in winter and again the following fall.

MA-3 Inspect and repair mulch and lining. Refertilize in late winter of the following year with 150 lb/acre 10-10-10 (3.5 lb/1,000ft^2). Mow regularly to a height of 3-4 inches.

MA-4 Topdress with 10-10-10 fertilizer if growth is not fully adequate.

MA-5 Topdress with 50 lb/acre (1 lb/1,000 ft^2) nitrogen in March. If cover is needed through the following summer, overseed with 50 lb/acre Kobe lespedeza.

TABLE 1: VEGETATIVE PLAN[1]

Area No.[2]	Description	Season[3]	Seeding Mixture: Permanent lb/ac	Seeding Mixture: Temporary lb/ac	Seedbed Preparation	Seeding Method	Mulch	Maintenance	Notes
1	Steep slopes (3:1); low maintenance	Spring or fall	Tall fescue 100 Kobe lespedeza 10 Bahiagrass 25 Rye grain 40		SP-1	SM-1	MU-1	MA-1	Permanent mixture also used for low-maint. areas (4). Overseed winter plantings of rye with Kobe lespedeza in March if grading is not complete.
		Summer		German millet 40	SP-2	SM-2		MA-5	
		Winter		Rye grain 120					
2	High-maintenance turf	Spring		Rye grain 120 Kobe lespedeza50	SP-3	SM-2	MU-2	MA-4	Tall fescue can be seeded in spring - increase rate to 250 lb/ac. Temp. seeding for fall is the same as for winter.
		Summer		German millet 40					
		Fall	Tall fescue blend200					MA-2	
		Winter		Rye grain 120				MA-5	
3	Grassed channels with side slopes 3:1	Fall-Spring	Tall fescue 200 Rye grain 40		SP-4	SM-2	MU-3	MA-3	
		Summer	Tall fescue 200 German millet 10						
4	Low-maintenance areas	Spring or Fall	Tall fescue 100 Kobe lespedeza 10 Bahiagrass 25 Rye grain 40		SP-4	SM-2	MU-2	MA-1	For temporary seeding in spring or fall see 5 below.
		Summer	Tall fescue 100 Kobe lespedeza 10 Bermudagrass 15 German millet 10					MA-5	Use these specs for temporary diversions.
		Winter		Rye grain 120					
5	Areas requiring cover for less than 1 year	Spring		Rye grain 120 Kobe lespedeza50	SP-4	SM-2	MU-2	MA-4	Treat temporary diversions as low-maintenance, permanent (area 4)
		Summer		German millet 40					
		Fall & Winter		Rye grain 120 Kobe lespedeza50				MA-5	Include topsoil stockpiles here

[1] Column entries for seedbed preparation, seeding method, mulch, and maintenance refer to Attachment 1.

[2] Area numbers are designated on map.

[3] Spring (Feb. 1 - Apr. 15), Summer (Apr. 15 - Aug. 20), Fall (Aug. 20 - Oct. 25), Winter (Oct. 25 - Jan.).

SUPPORTING CALCULATIONS

RUNOFF CALCULATIONS

Method: Peak Discharge Method SCS Technical Release No. 55, Urban Hydrology for Small Watersheds

NOTE: Other acceptable methods such as Rational Method may also be used.

Calculate peak runoff rate for site during development--Design point outlet at northwest property corner.

Site information:

1) Site location: South Granville County
2) Hydrologic soil group for Creedmore sandy loam: C
3) Approximate hydraulic length: 650 feet
4) Average watershed slope: 5%
5) 11 acres in site; 9.6 acres contributing runoff to construction area at outlet in N.W. corner
6) Off-site runoff into project area: 5 acres woods and open land.

1. Weighted curve number (CN) (Table 8.03b)

Land Use	Percent	CN	Product
Newly graded	62.5	93	58.13
Woods or forest, good cover	37.5	70	26.25
	100.0		84.38

Weighted CN = 84.38, use 85.

2. Rainfall (Figures 8.03h and 8.03j):
2-yr, 24-hr. storm: 3.6 in.
10-yr, 24-hr. storm: 5.6 in.

3. Calculate Runoff Depth (Table 8.03c):

Runoff depth 2,24 = 2.06 in.
Runoff depth 10,24 = 3.87 in.

4. Calculate Peak Discharge Rate

a. No adjustment for watershed shape, impervious area, channel improvements, or ponding are required. Adjustment for slope will be made.

b. Peak runoff rate moderate slope = 12.5 cfs/inch of runoff from D.A. = 9.6 acs (Figure 8.03p):

c. Multiply discharge/ inch of runoff by runoff depth

$Q_{2,24}$ = 12.5 cfs/inch runoff x 2.06 in = 26 cfs

$Q_{10,24}$ = 12.5 cfs/inch runoff x 3.87 in = 48 cfs

--A graph of peak discharge rate vs. area was developed from Figures 8.03o and 8.03p to facilitate the design of waterways, diversions and other practices whose design specifications are based on peak flows from areas less than the entire site (Exhibit 4).

d. Adjust peak discharge rate for actual watershed slope (Table 8.03d):

$Q_{2,24}$ = 26 cfs x 1.04 = 27.0 cfs

$Q_{10,24}$ = 48 cfs x 1.04 = 50.0 cfs

e. Add off-site runoff that will enter site from the east from woods and open land.

5 acres - $Q_{10,24}$ = 21 cfs

Total$Q_{10,24}$ = 50 + 21 = 71 cfs

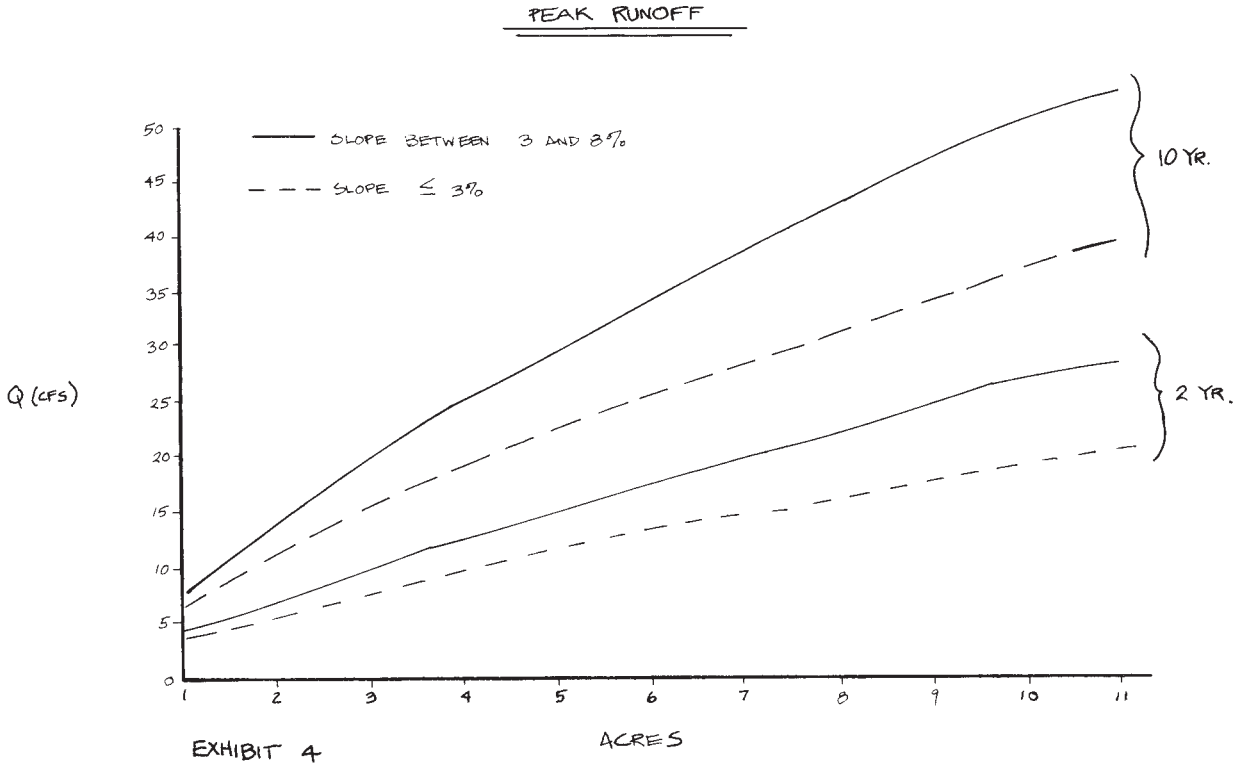


EXHIBIT 4

SEDIMENT BASIN DESIGN

1. All runoff from subwatersheds 1, 2, and 3 (9.6 acres) will enter the basin. Determine the peak flows of the 10-year, 24 hour storm $Q_{10,24}$.

   a) Peak flow (See Sheet 1, Runoff calculations): $Q_{10,24}$ = 50.0 cfs
   Add in off-site contributions that must pass through basin = 21.0 cfs
   71.0 cfs total

2. Determine basin volume:

   a) Minimum required sediment volume (Std. and Spec. 6.61):
   V = 1800 ft^3/acre x (9.6 + 5) acres = 26,280 ft^3.

3. Determine shape of basin:

   a) By examining contours on site map before channel installation or other modification:

Elevation (ft)	Area (ft^2)	Depth (ft)	Storage (ft^3)
338	3200	0.5	800
339	5400	1.5	5,100
340	9000	2.5	12,300
341	9600	3.5	21,600
342	11400	4.5	32,100
343	13300	5.5	44,450

   Elevation 341.5 yields 26,850 ft^3 of storage for sediment--meets design requirement.

4. Principal spillway design (cmp pipe spillway) for temporary basin:
   Set principal spillway crest at top of required sediment pool, elev. 341.5.

   a) The minimum capacity of principal spillway should be 0.2 cfs per acre of drainage area (Std. & Spec. 6.61, principal spillway).

   Q_{min} = 9.6 acres + 5 acres x 0.2 cfs = 2.9 ~3 cfs

   NOTE: Developer had 15" cm pipe available - larger than minimum pipe sizes are preferred when practical to reduce frequency of emergency spillway operation.

   Pipe flow is determined for water at the crest of the emergency spillway 1 ft above the riser inlet. Tailwater assumed at middle of pipe.

   H = 5.0 ft -- See sketch (page 7.11)
   barrel length = 55 ft
   Q_{pipe} = 7.78 cfs x 1.10 = 8.6 cfs (Table 8.07a)

   Determine riser requirement. From Figure 8.07b, riser: 21 in. diameter matches 15" pipe barrel.

   Determine capacity of cmp riser. From Figure 8.07b for h = 1.0 ft, Q_{riser} = 17 cfs; $Q_{riser} > Q_{pipe}$ pipe flow governs.

5. Emergency Spillway Design

Set emergency spillway elevation 1.0 ft above principal spillway or elev. 342.5

a) Capacity
$Q_e = Q_{10,24} - Q_p$
$Q_e =$ 71.0cfs - 9.4 cfs = 61.6 cfs (9.4 = principal spillway discharge at H = 6.0 ft = design stage for emergency spillway flow.)

b) Dimensions for earth spillway from Table 8.07c. Soil borings indicate that soil of the spillway is resistant to erosion.

NOTE: For site desirable stage in spillway 1.0 ft.

Q= 60 cfs
H_p =1.05 ft
b= 24 ft

Use 25 ft bottom.

Add 1 ft freeboard minimum.
Set top of dam 1.0 ft above design stage of emergency spillway or elev. 344.5.

c) Antiseep collars
1) not closer than 2 feet to a pipe joint
2) 1 collar 4.5′ x 4.5′ (Std. & Spec. 6.61, sediment basin)

6. Anchor principal spillway

Downward force = 1.1 x upward force

Required net $1.1 \times 5 \text{ ft} \times \frac{(24 \text{ inches}/12 \text{ inches/ft})^2}{4} \times \pi \times 62.4 \text{ lb/ft}^3 = 1078 \text{ lb}$

Use concrete [1] = 13 ft^3 or approx. 1/2 yd^3 = 1140 lbs.

[1] Use buoyant weight of concrete for net downward force it exerts.

7. Dewatering the basin:

Perforate the riser with ¼ to ½ inch holes spaced 3 inches apart. Cover the perforated section with a ¾ inch gravel filter 2 feet thick

8. Trash guard to be firmly fastened to the top of the riser.

9. Embankment design:

8 foot top width, 2.5:1 side slopes, settled top elevation = 344.5
Constructed top elevation 344.5 + 0.7 ft (10% settlement) = 345.2 at center grading to 344.5 at abutments.

From soil borings--cut off trench should be excavated into the tight gray subsoil. Trench dimensions 2.0 to 3.0 ft deep; 3.0 ft wide with 1:1 side slopes.

GRASS LINED CHANNELS

Procedure given in Appendices 8.05 used in design.

1. **Channel #1**

Although channel #1 receives flow from channel #2 midway in its length, it will be designed as a single reach instead of 2 separate reaches. The flow in the upper reach will be considerably less than the design flow, but for consistency in dimensions, grade, and appearance the upper reach will not be designed separately. Final design is based on the removal of the temporary diversions.

a) Estimate drainage area and determine peak flow into channel #1.

Area = 1.9 acre
Average slope of drainage area: 3%
$Q_{10,24}$ = 10.0 cfs (Exhibit 4)

Off-site contributions : Flow from channel #2 = 7.4 cfs

For design purpose $Q_{10,24}$ = 10.0 cfs + 7.4 cfs = 17.4 cfs

b) Proposed channel grade = 2%
c) Proposed vegetation: Tall Fescue
d) Soil: Creedmore (easily erodible)
e) Permissible velocity: (V_p) 4.5 ft/s (Table 8.05a)
f) Retardance class: "B" unmowed, "D" mowed (Table 8.05c).
g) Trapezoidal Channel dimensions:
designing for low retardance condition (retardance class D) design to meet V_p

$A = Q/V$; 17.4 cfs/4.5 ft/sec = 3.87 ft^2

Try bottom width = 3.0 ft

Z = 3
$A = bd + Zd^2$
$P = b + 2d\sqrt{z^2+1}$
An iterative solution using Figure 8.05c to relate hydraulic radius depth to Manning's n proceeds as follows: Manning's equation is used to check velocities.

d (ft)	A (ft^2)	R (ft)	n	V (fps)	Q (cfs)	Comments
0.8	4.32	0.54	0.043	3.25	14.0	$V<V_p$ OK, $Q<Q_{10}$, too small, try deeper channel
0.9	5.13	0.59	0.042	3.53	18.1	$V<V_p$ OK, $Q>Q_{10}$, OK

now design for high retardance (class B)

Try d = 1.5 ft and trial V = 3.0 ft/sec

d (ft)	A (ft^2)	R (ft)	V_t (fps)	n	V (fps)	Q (cfs)	Comments
1.5	11.25	0.90	3.0	0.08	2.5		
	reduce trial V		2.0	0.11	1.8		
			1.6	0.12	1.6	18.4	$Q>Q_{10}$ OK

h) Evaluate need for temporary liner:

The channel will be protected from upland flow by a diversion during construction. This reduces the contributing drainage area when evaluating the need for temporary liners.

Area = 1.4 acre
Average Slope = 1%
V_p = 2.0 ft/sec

$Q_{2,24}$ = 4.1 cfs (Exhibit 4)

Off-site contribution: Flow from channel #2 = 3.5 cfs for $Q_{2,24}$

For design of temporary liner: $Q_{2,24}$ = 4.1 cfs + 3.5 cfs = 7.6 cfs

Use basic "n" value for channels cut in earth = 0.02 (Table 8.05b).

Using Manning's equation:

b (ft)	d (ft)	A (ft^2)	P (ft)	R (ft)	V (fps)	Q (cfs)	Comments
3	0.40	1.68	5.53	0.304	4.76	8.00	$Q > Q_2$, OK, $V > V_p$, needs protection

Velocity > 2.0 fps channel requires temporary liner.

i) Calculate shear stress for Q_2

T = yds where y = unit weight of water (62.4 lb/ft^3)
d = flow depth (ft)
s = channel gradient (ft/ft)

T = (62.4) (0.40) (.02) = 0.50 lb/ft^2

Fiberglass roving is an acceptable lining; however, use straw with net to provide additional protection as well as mulch for seeding. n = 0.033 (Table 8.05e); T_d = 1.45 (Table 8.05g)

b (ft)	d (ft)	A (ft^2)	R (ft)	V (fps)	Q (cfs)	T (lbs/ft^2)	Comments
3	0.6	2.88	0.42	3.6	10.3	0.75	$T<T_d$ $Q>Q_2$ OK where T_d = allowable shear stress

Channel Summary:
Trapezoidal shape, z=3, b=3 ft, d=1.5 ft, grade=2%
Temporary liner: straw with net

2. **Channel #3**

Channel design capacity to include flow that will be diverted from south during construction because diversion may be removed when construction is complete.

a) Estimate drainage area and determine peak flows in ditch #3.

Area ~ 2 acres
Avg. slope of drainage area = 4%

$Q_{10,24}$ = 13.5 cfs (Exhibit 4)

Off-site contribution: none

b) Proposed channel grade: = 1%
c) Proposed vegetative cover: Tall Fescue
d) Soil: Creedmore (easily erodible)
e) Permissible velocity for established vegetation: 4.5 ft/s (Table 8.05a)
f) Retardance class "B" unmowed, "D" mowed (Table 8.05c)
g) Trapezoidal Channel: z=3

By the same method as channel #1:

Description	b (ft)	d (ft)	A (ft^2)	R (ft)	V (fps)	Q (cps)	Comments
cut (D)	3.0	1.2	7.42	0.748	2.7	21.1	$Q > Q_{10}$, $V < V_p$
uncut (B)	3.0	1.7	13.77	1.00	1.0	13.8	$Q > Q_{10}$

h) Evaluate Temporary Liner Requirements:

Determine velocity and depth of flow for 2-yr, 24-hr storm. Because the channel will be protected by a temporary diversion, the drainage area contributing the flow during construction is reduced to 1.15 acre $Q_{2,24}$ = 3.7 cfs.

Using Manning's equation with "n" = 0.02 (Table 8.05b)

d (ft)	A (ft^2)	R (ft)	V (fps)	Q (cfs)	Comments
0.32	1.27	0.25	2.96	3.76	$Q>Q_2$, $V>V_p$, needs protection

Velocity >2.0 fps is excessive for bare soil conditions, requires temporary liner.

i. Calculate shear stress in channel at depth associated with $Q_{2,24.}$

T = yds = (62.4) (0.32) (0.01) = 0.20 lb/ft^2

Jute net is an acceptable temporary liner (Table 8.05g), however straw with net will provide additional protection as well as mulch for seeding.

Channel #3 Summary:
Trapezoidal channel, z=3, b=3 ft, d=1.7 ft, grade=1%
Temporary liner: straw with net

3. Channel #2

a) Estimate drainage area and determine peak flows into channel #2

Area = 0.8 acres

Average slope of drainage area ~ 3.5% (moderate)
$Q_{10,24}$ = 3.6 cfs (Exhibit 4)

Offsite contribution: None
Because diversion will protect entire channel during construction, overland flow contributing to $Q_{2,24}$ peak flow will be negligible.

$Q_{10,24}$ = 3.6 cfs

b) Proposed channel grade = 1.75%
c) Proposed vegetative cover = Tall Fescue
d) Soil: Creedmore (easily erodible)
e) Permissible velocity: 4.5 ft/s (Table 8.05a)
f) Retardance class: "B" unmowed, "D" mowed (Table 8.05c).
g) Trapezoidal channel, b=2 ft, z=3

Description	b (ft)	d (ft)	A (ft^2)	R (ft)	Q (cfs)	V (fps)	Comments
cut (D)	2.0	1.0	5.00	0.60	14.5	2.90	$Q > Q_{10}$, $V < V_p$
uncut (B)	2.0	1.4	8.68	0.80	8.19	0.94	$Q > Q_{10}$

h) Evaluate temporary liner requirements: Not necessary, negligible Q_2 flow.

Channel #2 Summary:
Trapezoidal channel: b = 2 ft, z = 3, d = 1.25 ft, grade = 1.75%
Temporary liner: none required.
Straw mulch tacked with asphalt could be used to facilitate vegetative establishment. However, since all other channels need temporary liner (mulch with netting) use the same materials for channel #2.

4. Channel #4

a) Estimate drainage area and determine peak flow into ditch #4.

Area = 0.75 acre
Average slope of drainage area: 0.5%

$Q_{10,24}$ = 5.8 cfs (Exhibit 4)

b) Proposed channel grade = 1.1%
c) Proposed vegetative cover = Tall fescue
d) Soil: Creedmore (easily erodible)
e) Permissible velocity: 4.5 ft/s (Table 8.05a)

f) Retardance Class: "B" unmowed, "D" mowed (Table 8.05c)

g) Trapezoidal channel dimensions: z = 3

By same method as channel #1:

Description	b (ft)	d (ft)	A (ft^2)	R (ft)	V (fps)	Q (cps)	Comments
cut (D)	2.0	1.00	5.00	0.60	1.95	9.75	$Q>Q_{10}$, V_p, OK
uncut (B)	2.0	1.7	12.1	0.95	0.60	7.3	$Q>Q_{10}$, OK

h) Evaluate temporary liner requirements:

Using Manning's equation with "n" = 0.02 (Table 8.05b)

$Q_{2,24}$ = 3.1 cfs

d (ft)	A (ft^2)	R (ft)	V (fps)	Q (cfs)	Comments
0.35	1.07	0.25	3.10	3.32	$Q>Q_2$, $V>V_p$, needs protection

Velocity > 2 fps: requires temporary liner.

i) Calculate shear stress for $Q_{2,24}$ conditions.

$T = yds = (62.4)\ (0.35)\ (0.011) = 0.24\ lb/ft^2$

Jute net is an appropriate temporary channel liner (Table 8.05e); however, straw with net will provide more erosion protection, better mulch for seeding, and will be consistent with channels #1 and #3.

Channel #4 Summary: z = 3, b = 3, d = 1.5 ft, grade = 1.1%
Temporary liner: straw with net

[1]**NOTE:** For uniformity of construction make channel bottom 3.0' wide same as all other channels even though design only requires a 2.0' bottom width.

RIPRAP CHANNELS

a) Estimate on-site direct runoff from drainage area and calculate peak flow, add flow from channels #2, #1, #4.

Area = 3.74 acres
Average slope of drainage area: 4% moderate

$Q_{10,24}$ = 23.2 cfs (Exhibit 4)

Channels	$Q_{10,24}$
2	7.4 cfs
1	9.2 cfs
4	5.8 cfs
	22.4 cfs

Other flow contributions:
Off-site contribution: 21 cfs

Design flow: $Q_{10,24}$ = 23.2 cfs + 22.4 cfs + 21 cfs = 66.6 cfs

b) Proposed channel grade: 6%
c) Proposed liner: riprap
d) Trapezoidal channel is designed with capacity to meet design flow. Riprap liner requirements are then analyzed. First estimate a trial riprap size of 6 inches. For flow of the expected depth range of 1 to 2 ft, n = 0.044 (Table 8.05f) and T_d = 2.5 (Table 8.05g); z=2

Channel dimensions:

b (ft)	d (ft)	A (ft^2)	n	S	V (fps)	Q (cfs)
6	1.2	10.1	0.044	0.06	7.6	77.3

e) Determine riprap requirements

T = yds = (62.4) (1.2) (0.06) = 4.49
where y = unit weight of water (62.4 lb/ft^3)
d = flow depth (ft)
s = channel gradient (ft/ft)

Since T_d < T, select a larger stone size and a larger bottom width. Try b = 8 ft, d_{50}, = 12 in. From Table 8.05g T_d = 5.00; from Table 8.05f n = 0.060.

b (ft)	d (ft)	A (ft^2)	R (ft)	Q (cfs)	T (lb/ft^2)	Comment
8	1.2	12.48	0.93	72.3	4.5	$Q>Q_{10}$, $T<T_d$, OK

Since the side slopes are steeper than 3:1, the d_{50} must be adjusted:
-- Determine boundary shear from Figure 8.05h: B/d = 6.67, z = 2, K = 0.78.
-- Determine angle of respose from Figure 8.05g: for crushed rock d_{50} = 1.00 ft angle of repose = 42.4 degrees.
-- Determine critical shear on side to shear on bottom from Figure 8.05i: for angle of repose = 42.4 degrees and z = 2, K_2 = 0.74.
Adjustment:
$d_{50} = d_{50} \times K_1/K_2$ = (12 inches) 0.78/0.74 = 12.65 inches
-- $d_{max} = 1.5 \times d_{50}$ = (1.5) (12.65) ~ 19.0 inches--Use DOT class 2 riprap
Thickness of riprap (installed below finished grade)
$1.5 \times d_{max}$ = (1.5) (19.0) = 28.5--Use 30 inches
Straight channel, therefore bend stability doesn't need to be evaluated.

f) Filter blanket: Use synthetic filter fabric, overlap edges 12 inches and anchor overlap with pins spaced 3 feet.

Outlet Stability Evaluation:

Velocity at the end of the riprap channel on 6% of grade is 3.8 ft/sec. A natural run serves as the outlet for the riprap channel. The drainageway is approximately 12 ft wide with gradually sloping banks and is well stabilized with natural vegetation. It empties into Hocutt Creek on an average grade of 1.5 % for a distance of approximately 500 ft. The riprap channel will be widened to 12.0 ft and terminate on a nearly level grade for a distance of 10.0 ft. Exit velocity will be less than 3.0 ft/sec for the 10-yr storm flow due to flat grade and estimated tailwater depth of 2 ft. Estimated allowable exit velocity based on soils and vegetation is 4.0 ft/sec.

CULVERT DESIGNS

1) Culvert #2--under roadway between buildings A&B

a) Design information:
Q_{25} (design discharge to protect road from flooding) = 36 cfs
Length (L) = 40 ft
Slope (S_o) = 0.013 ft/ft
Allowable Headwater Depth (AHW) = 4 ft
Culvert type:RCP Groove end headwall
Ke = 0.2
n = 0.012

Receiving watercourse: trapezoidal, riprap lined channel

Side slope (z) = 2:1
n = 0.07
Channel slope (S_o) = 0.06 ft/ft

Tailwater (TW_{25}) = 1.7 ft

b) Using the method in "Design of Culverts" NRCD-Land Quality Section, complete Exhibit 5. Select a 30-inch culvert. To improve hydraulics at 90 degree intersection of culvert and channel, recess culvert outlet a minimum of 5.0 ft so that the culvert does not discharge directly into the channel bank.

2) Culvert #1 – under road to parking lot

a) Design information:
Q_{25} = 6.2 cfs
Length (L) =40 ft
Slope (S_o) = 0.0125 ft/ft
Allowable Headwater Depth (AHW) = 2 ft
Culvert type: RCP Groove end headwall
Ke = 0.2
n = 0.012
Tailwater (TW_{25}) = 0.4 ft

b) Using the method referenced above complete Exhibit 6. Select a 15-inch culvert.

3) Culvert #3 – under entrance road

a) Design information:

Q_{25} = 20 cfs
Length (L) =75 ft
Slope (S_o) = 0.013 ft/ft
Allowable Headwater Depth (AHW) = 5 ft
Culvert type:RCP Groove end headwall
Ke = 0.2
n = 0.012
Tailwater (TW_{25}) = 1.3 ft

b) Using the method referenced above complete Exhibit 7. Select a 21-inch culvert.

[1]**NOTE:** There are a number of acceptable culvert design procedures available.

PROJECT: ABC INDUSTRIES

DESIGNER: D. M.

DATE: 1 · 4 · 88

HYDROLOGIC AND CHANNEL INFORMATION

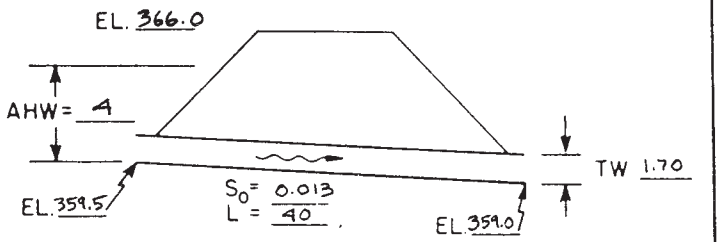
Q_1 = _____ TW_1 = _____

Q_2 = 36 C.F.S. TW_2 = 1.7 FT.

SKETCH

CULVERT #2 BTWN. BLDGS. A + B

STATION: _____



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$											
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
GROOVE END W/ HEADWALL RCP	36	30"	1.4	3.5	0.2	1.2	2.0	2.3	1.7	2.3	0.5	3.0	3.5	11.2		INLET CONTROL
	36	27"	1.85	4.16	0.2				1.7							HW TOO HIGH
																USE 30"

SUMMARY & RECOMMENDATIONS: OUTLET STABILIZATION STRUCTURE NEEDED TO REDUCE VELOCITY AND CONTROL EROSION.

EXHIBIT 5

PROJECT: ABC INDUSTRIES

DESIGNER: D.M.

DATE: 1·4·88

HYDROLOGIC AND CHANNEL INFORMATION

Q_1 = _____

Q_2 = 6.2 CFS

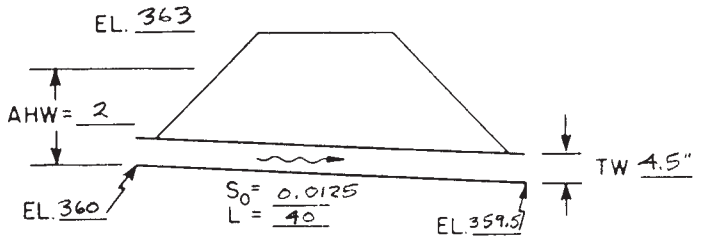
TW_1 = _____

TW_2 = _____

SKETCH

CULVERT #1 UNDER ROAD TO PARKING LOT

STATION: _____



MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING H.W.	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL HW = H + h_o − LS_o											
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
GROOVE END W/ HEADWALL	6.2	15"	1.33	1.66	0.2	0.9	0.9	1.1	0.4	1.1	0.5	1.5	1.66	5.0		INLET CONTROL
	6.2	12"	2.3	2.3												HW TOO HIGH – USE 15"

SUMMARY & RECOMMENDATIONS: OUTLET STABILIZATION STRUCTURE NEEDED TO REDUCE VELOCITY AND CONTROL EROSION.

EXHIBIT 6

PROJECT: ABC INDUSTRIES

DESIGNER: D.M.

DATE: 1.4.88

HYDROLOGIC AND CHANNEL INFORMATION

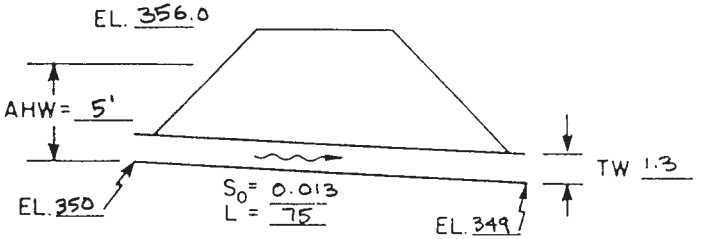
Q_1 = ____ TW_1 = ____

Q_2 = 20 TW_2 = 1.3

SKETCH

CULVERT #3 UNDER ENTRANCE ROAD

STATION: ____



MEAN STREAM VELOCITY = ____

MAX. STREAM VELOCITY = ____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING H.W.	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$											
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
GROOVE END W/ HEADWALL	20	24"	1.3	2.6	0.2	1.4	1.6	1.8	1.3	1.8	1.0	2.2	2.6	9.2		INLET CONDITION GOVERNS
	20	21"	1.9	3.3	0.2	2.3	1.6	1.7	1.3	1.7	1.0	3.0	3.3	8.0		USE 21"

SUMMARY & RECOMMENDATIONS: OUTLET PIPE TO EXTEND INTO SEDIMENT BASIN AND CONNECT TO RIPRAP CHANNEL WHEN IT IS INSTALLED. USE TEMPORARY RIPRAP PAD TO PREVENT SCOUR HOLE IN SEDIMENT BASIN. INLET TO HAVE POURED CONC. RISER & GRATE W/ INLET ELEVATION OF 353.0.

EXHIBIT 7

RIPRAP OUTLET PROTECTION

Riprap Outlet Protection for Culvert #1

Q_{Design} = 6.2 cfs
Pipe diameter = 15 inches
Tailwater = 0.4', no defined channel, minimum tailwater conditions
Length of apron = 8 feet (Figure 8.06a)
d_{50} = 4 inches (Figure 8.06a)
d_{max} = 1.5 x d_{50} = 6 inches
Depth of riprap (laid flush with ground surface) = 1.5 x d_{max} = 9 inches = Use 1.0'
Upstream apron width = 3.0 x pipe diameter = 4.5 ft
Downstream apron width = apron length + pipe diameter = 6.5 ft
Use Class A erosion stone - (Note Class B may be used to be same as riprap for culvert #2)

Riprap Outlet Protection for Culvert #2

Q_{Design} = 36 cfs
Pipe diameter = 30 inches
Tailwater = 1.7 feet
Length of apron = 12 feet (Figure 8.06b)
d_{50} = 6 inches (Figure 8.06b)
d_{max} = 1.5 x d_{max} = 9 inches
Depth of riprap (laid flush with ground surface) = 1.5 x d_{max} ~ 14 inches
Upstream apron width = 3.0 x pipe diameter = 7.5 ft
Downstream apron width = apron length + pipe diameter = 12.5 ft

Riprap Outlet Protection for Culvert #3

Q_{Design} = 20 cfs
Pipe diameter = 24 inches
Use Class B erosion stone 18" thick
Riprap apron to extend to riprap channel to prevent erosion on steep fill slope. Install temporary riprap outlet pad 6' wide and 10' long at end of pipe in sediment basin. Use Class B erosion control stone or D.O.T. class 2 riprap. (Same as riprap channel)

NOTE: Filter fabric to be placed under all riprap outlet structures to prevent soil movement.

SEDIMENT TRAP

a) Location: intersection of channel #3 and roadside ditch

b) Drainage areas: ~ 2 acres

c) Trap capacity:

Required sediment volume = 1800 ft^3 x 2 acre = 3600 ft^3 (Practice Standard 6.61)

Excavate so that pool bottom elevation = 363 ft (the same elevation as the roadside ditch). This gives a pool 2.5 feet deep fits site provides the required volume and allows the pool to drain.

Using trapezoidal rule approximation, surface area = volume / (0.4 x max. pool depth)

Area = 3.600 / (0.4 x 2.5) = 3600 ft^3

d) Embankment:

4.0 ft high
5 ft top width
3:1 side slopes; machine compacted and keyed into ground surface under dam and abutments

e) Stone outlet section:

Bottom width: 6 ft.
Spillway depth: 1.5 ft.
Side slopes: 2:1 and 21 inches thick
Stone size: d_{50} = 9 inches, d_{max} = 14 inches; 1 foot thick layer of 3/4 inch gravel placed on inside (upstream) face of stone section
Synthetic filter cloth to be placed under the entire stone outlet section to the top of the dam.

TEMPORARY DIVERSIONS

Diversion #1

Drainage area: 1.8 acres
Land use: woods
Soil hydrology group: C
$Q_{10,24}$: 8 cfs

Land slope toward diversion ~4%

Try minimal practical dike cross section; 1.5 ft high ridge; 2:1 slope
Estimated capacity at depth = 1.0 ft; area = 13 ft^2;
grade = 2%; "C" retardance; V = 1.2 fps;
Q_A = 16 cfs
$Q_A > Q_{10,24}$ selected cross section is ok

Diversion #2

Drainage area: 1.2 acres
Land use: woods
Soil hydrologic group: C
$Q_{10,24}$: 5 cfs

Land slope toward diversion ~4%

Use same minimum cross section as diversion #1.

Estimated capacity at depth = 1.0 ft; area = 13 ft^2;
grade = 0.5%; "C" retardance; V = 0.8 fps;
Q_A = 10 cfs
$Q_A > Q_{10,24}$ selected cross section is ok

FINANCIAL RESPONSIBILITY/OWNERSHIP FORM
SEDIMENTATION POLLUTION CONTROL ACT

No person may initiate any land-disturbing activity on one or more contiguous acres as covered by the Act before this form and an acceptable erosion and sedimentation control plan haved been completed and approved by the Land Quality Section, N.C. Department of Environment, Health and Natural Resources. (Please type or print and, if question is not applicable, place N/A in the blank.)

Part A.

1. Project Name ABC Industries, Inc. -- Home Office and Warehouse

2. Location of land-disturbing activity: County Granville, City or Township Deal, NC, and Highway / Street Terri Road

3. Approximate date land-disturbing activity will be commenced: 10/28/87

4. Purpose of development (residential, commercial, industrial, etc.) : commercial

5. Approximate acreage of land to be disturbed or uncovered : 6 acres

6. Has an erosion and sedimentation control plan been filed ?Yes xx No _____

7. Person to contact should sediment control issues arise during land-disturbing activity.

Name John A. Jones Telephone (919) 100-0000

8. Landowner (s) of Record (Use blank page to list additional owners.):

ABC Industries, Inc.	
Name (s)	
P.O. Box 1111	666 Woodhouse Way
Current Mailing Address	Current Street Address
Deal NC 20000	Deal NC 20000
City State Zip	City State Zip

9. Recorded in Deed Book No. 010 Page No. 001

Part B.

1. Person (s) or firms (s) who are financially responsible for this land-disturbing activity (Use the blank page to list additional persons or firms):

ABC Industries, Inc.	
Name of Person (s) or Firm (s)	
P.O. Box 1111	666 Woodhouse Way
Mailing Address	Street Address
Deal NC 20000	Deal NC 20000
City State Zip	City State Zip
Telephone (919) 000-0000	Telephone

2. (a) If the Financially Responsible Party is a Corporation give name and street address of the Registered Agent.

John A. Jones
Name

	1111 Clay Street
Mailing Address	Street Address
	Deal NC 20000
City State Zip	City State Zip
	919-100-0000
Telephone	Telephone

(b) If the Financially Responsible Party is a Partnership give the name and street address of each General Partner (Use blank page to list additional partners.):

Name

Mailing Address	Street Address
City State Zip	City State Zip
Telephone	Telephone

The above information is true and correct to the best of my knowledge and belief and was provided by me under oath. (This form must be signed by the financially responsible person if an individual or his attorney-in-fact or if not an individual by an officer, director, partner, or registered agent with authority to execute instruments for the finanacially responsible person). I agree to provide corrected information should there be any change in the information provided herein.

John A. Jones	Registered Agent
Type or print name	Title or Authority
John A. Jones	September 1, 1987
Signature	Date

I, Sam B. Smith, a Notary Public of the County of Granville

State of North Carolina, hereby certify that John A. Jones appeared personally before me this day and being duly sworn acknowledged that the above form was executed by him.

Witness my hand and notarial seal, this 1st day of September, 19 87.

Seal

Sam B. Smith
Notary

My commission expires 10/1/88

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT & NATURAL RESOURCES
LAND QUALITY SECTION

EROSION and SEDIMENTATION CONTROL PLAN PRELIMINARY REVIEW CHECKLIST

The following items shall be incorporated with respect to specific site conditions, in an erosion & sediment control plar

LOCATION INFORMATION

_____ Project location (roads, streets, landmarks)
_____ North arrow and scale

GENERAL SITE FEATURES (Plan elements)

_____ Legend: North arrow, scale, etc.
_____ Property lines
_____ Existing contours (topographic lines)
_____ Proposed contours
_____ Limits of disturbed area (provide acreage total, delineate limits, and label)
_____ Planned and existing building locations and elevations
_____ Planned & existing road locations & elevations
_____ Lot and/or building numbers
_____ Geologic features: rock outcrops, seeps, springs, wetland and their limits, streams, lakes, ponds, dams, etc.
_____ Easements and drainage ways
_____ Profiles of streets, utilities, ditch lines, etc.
_____ Stockpiled topsoil or subsoil locations
_____ If the same person conducts the land-disturbing activity & any related borrow or waste activity, the related borrow or waste activity shall constitute part of the land-disturbing activity unless the borrow or waste activity is regulated under the Mining Act of 1971, or is a landfill regulated by the Division of Waste Management. If the land-disturbing activity and any related borrow or waste activity are not conducted by the same person, they shall be considered separate land-disturbing activities and must be permitted either thru the Sedimentation Pollution Control Act as a **one-use borrow site** or through the Mining Act.
_____ Required Army Corps 404 permit and Water Quality 401 certification (e.g. stream disturbances over 150 linear feet)

EROSION CONTROL MEASURES (on plan)

_____ Legend
_____ Location of temporary measures
_____ Location of permanent measures
_____ Construction drawings and details for temporary and permanent measures
_____ Maintenance requirements of measures
_____ Contact person responsible for maintenance

SITE DRAINAGE FEATURES

_____ Existing and planned drainage patterns (include off-site areas that drain through project)
_____ Method of determination of and calculations for Acreage of land being disturbed
_____ Size and location of culverts and sewers
_____ Soil information: type, special characteristics
_____ Soil information below culvert storm outlets

STORMWATER CALCULATIONS

_____ Pre-construction runoff calculations for each outlet from the site (at peak discharge points)
_____ Design calculations for peak discharges of runoff (including the construction phase & the final runoff coefficients of the site)
_____ Design calcs of culverts and storm sewers
_____ Discharge and velocity calculations for open channel and ditch flows (easement & right-of-ways)
_____ Design calcs of cross sections and method of stabilization of existing and planned channels (include temporary linings)
_____ Design calcs and construction details of energy dissipators below culvert and storm sewer outlets (diameters & apron dimensions)
_____ Design calcs and dimension of sediment basins
_____ Surface area and settling efficiency information for proposed sediment traps and/or basins

VEGETATIVE STABILIZATION

_____ Area & acreage to be vegetatively stabilized
_____ Method of soil preparation
_____ Seed type & rates (temporary & permanent)
_____ Fertilizer type and rates
_____ Mulch type and rates

NOTE: Plan should include provisions for groundcover on exposed slopes within 21 calendar days following completion of any phase of grading; permanent groundcover for all disturbed areas within 15 working days or 90 calendar days (whichever is shorter) following completion of construction or development.

FINANCIAL RESPONSIBILITY/OWNERSHIP FORM

_____ Completed, signed & notarized FR/O Form
_____ Accurate application fee ($50.00 per acre rounded up the next acre with no ceiling amount)
_____ Certificate of assumed name, if the owner is a partnership
_____ Name of Registered Agent (if applicable)
_____ Copy of the most current Deed for the site

NOTE: For the Express Permitting Option, inquire at the local Regional Office for availability.

NARRATIVE AND CONSTRUCTION SEQUENCE

_____ Narrative describing the nature & purpose of the construction activity
_____ Construction sequence related to erosion and sediment control (including installation of critical measures prior to the initiation of the land-disturbing activity & removal of measures after