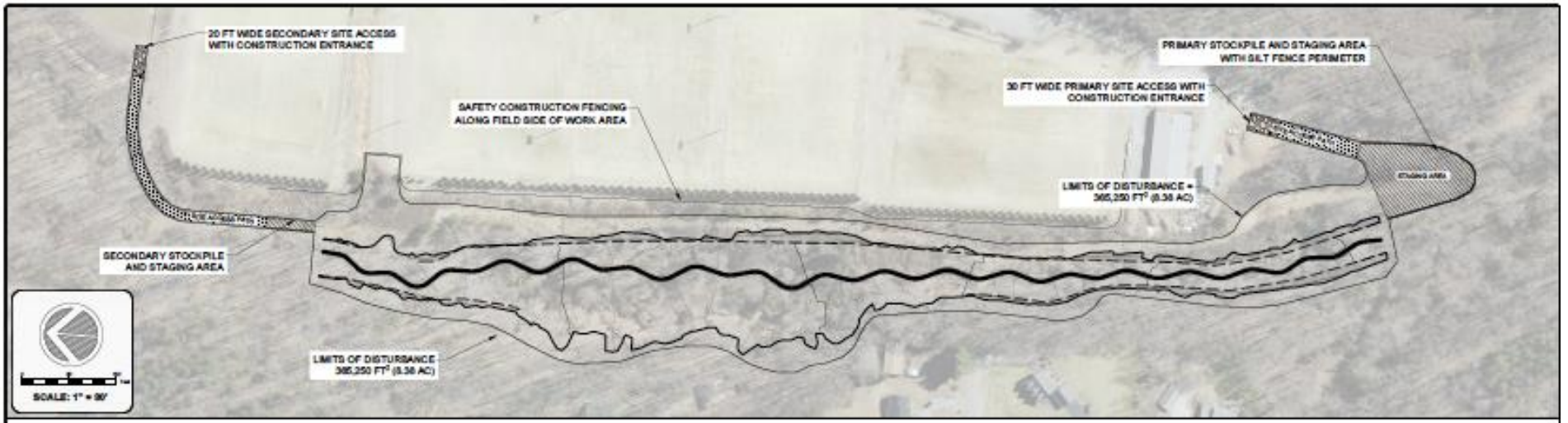
Construction of Stream Restoration Projects

1. Site Preparation
2. Grading
3. Structures
4. Site Stabilization

Best Construction Practices

- Tracked equipment
- Well maintained equipment
- Spill management plan
- Staged construction phases to limit exposure

Erosion & Sediment Control Plan



CONSTRUCTION SCHEDULE

A. OBTAIN EROSION AND SEDIMENTATION PLAN APPROVAL AND ALL OTHER APPLICABLE PERMITS.
B. NOTIFY INSPECTOR FROM WINSTON SALEM REGIONAL OFFICE OF DEQ PRIOR TO DISTURBANCE.
C. POST CERTIFICATE OF APPROVAL FOR LAND DISTURBANCE AT SITE.
D. INSTALL RAIN GAUGE AND PREPARE INSPECTION FORMS AS DESCRIBED ABOVE.
E. FLAG THE WORK LIMITS AND STAKE OUT THE EXTENTS AND ELEVATIONS OF THE PROJECT.
F. LOCATE ALL UNDERGROUND UTILITIES WITHIN THE WORKSITE.
G. HOLD PRE-CONSTRUCTION MEETING PRIOR TO STARTING CONSTRUCTION.
H. INSTALL CONSTRUCTION ENTRANCES, CONSTRUCTION / SAFETY FENCE AND SILT FENCE PER THE ATTACHED PLAN SHEETS AND DETAILS.
I. INSPECT EROSION AND SEDIMENTATION CONTROL PRACTICES DAILY AND AFTER SIGNIFICANT RAINFALL EVENTS. MAKE NEEDED REPAIRS IMMEDIATELY.
J. STOCKPILE MATERIALS FOR STREAM WORK (E.G., BOULDERS, LOGS, WOODY DEBRIS) OUTSIDE OF THE RIPARIAN ZONE (AT LEAST 30 FEET FROM THE TOP OF BANK).
K. TO THE EXTENT PRACTICABLE, WORK STRATEGY FROM UPSTREAM TO DOWNSTREAM THROUGHOUT THE PROJECT REACHES. CONTRACTOR SHALL LIMIT STREAMBANK DISTURBANCE TO AREAS THAT CAN BE COMPLETED AND STABILIZED DURING ONE DAY OF WORK. DURING BACKSIDE OF DISTURBANCE, FOLLOW THE FOLLOWING STEPS:
   - AS NEEDED TO IMPLEMENT BANK GRADING, REMOVE VEGETATION. DO NOT REMOVE WOLTY, NON-NATIVE VEGETATION FROM AREAS WHERE NO GRADING OR STRUCTURE INSTALLATION WILL OCCUR. STOCKPILE VEGETATION FOR REPLANTING, AS APPROPRIATE.
   - AS SHOWN ON PLANS, BEGIN CONSTRUCTED SLOPES ARE BACKCUT AT 3:1 SLOPE OR FLATTER, UNLESS DIRECTED OTHERWISE BY THE ENGINEER. WHEN POSSIBLE, PERFORM WORK FROM STREAMBANK IN ORDER TO MINIMIZE TIME SPENT WORKING IN THE CHANNEL.
   - INSTALL IN-STREAM STRUCTURES, RIPARIAN FEATURES, AND STREAMBANK PROTECTION PER THE PLANS. WHEN POSSIBLE, PERFORM WORK FROM STREAMBANK IN ORDER TO MINIMIZE TIME SPENT WORKING IN THE CHANNEL.
   - INSTALL COIR STREAMBANK MATTING, TEMPORARY AND PERMANENT MULCHING AND SEEDING ON ALL DISTURBED SURFACES ON THE STREAMBANK UP TO THE TOP OF BANK.
L. ANY AREA DISTURBED WITHIN 30 FEET FROM THE TOP OF THE STREAM BANK SHALL BE PROVIDED WITH TEMPORARY GROUND COVER SPECIFIED IN THE VEGETATION PLAN WITHIN 10 CALENDAR DAYS, UNLESS AUTHORIZED BY THE DIVISION OF WATER QUALITY PERMIT NOS 0-010000.
M. ONCE SITE IS STABILIZED, REMOVE AND DISPOSE OF ALL NON-BIODEGRADABLE EROSION CONTROL DEVICES.
N. NOTIFY INSPECTOR FROM WINSTON SALEM REGIONAL OFFICE OF DEQ AFTER STABILIZATION.
O. WHEN APPROPRIATE, INSTALL PERMANENT VEGETATION PER PLANTING PLANS.

BASIC PLAN

DURING PROJECT IMPLEMENTATION, EMPIRE CONSERVATION MEASURES WILL BE IMPLEMENTED TO REDUCE SEDIMENTATION AND OTHER POLLUTANTS IN SURFACE WATERS DOWNSTREAM. THE DESIGN ATTEMPTS TO MINIMIZE SEDIMENTATION AND OTHER POTENTIALLY NEGATIVE IMPACTS THROUGH THE FOLLOWING PRACTICES:

- THE CONTRACTOR WILL BE REQUIRED TO STAGE AND STORE EQUIPMENT AND MATERIALS IN THE DESIGNATED AREAS SHOWN ON THE APPROVED E&SC PLAN.
- EQUIPMENT WILL BE WELL MAINTAINED, CLEANED PRIOR TO MOBILIZATION, AND CHECKED DAILY FOR LEAKS OF PETROLEUM PRODUCTS.
- FUELING WILL BE PERFORMED IN A CONTAINED AREA OUTSIDE OF THE RIPARIAN ZONE.
- THE CONTRACTOR WILL BE REQUIRED TO STAGE WORK SUCH THAT DISTURBED AREAS WILL BE STABILIZED IN PHASES WITH MATTING, MULCH AND BIODEGRADABLE (COIR) EROSION CONTROL MATTING (WHERE APPROPRIATE).
- ALL TIMBER, UTILITIES AND OTHER SITE FEATURES WILL BE PROTECTED UNLESS MARKED FOR REMOVAL OR RELOCATION.
- ALL WORK ADJACENT TO STREAM WATERS WILL BE CONDUCTED IN A DRY WORK AREA TO THE EXTENT POSSIBLE.
- APPROPRIATELY SIZED EQUIPMENT WILL BE UTILIZED TO PREVENT EXCESSIVE COMPACTING AND MINIMIZE CLEARING.

SITE ACCESS AND STAGING

SITE ACCESS WILL BE VIA EXISTING HARDWIRED GRAVEL ROADS ON THE VERY BRANCH SPORTS COMPLEX, AS SHOWN ON THE APPROVED BASIC PLAN. TWO STAGING AREAS FOR EQUIPMENT AND MATERIALS WILL BE CREATED. ONE STAGING AREA WILL BE LOCATED NEAR THE UPSTREAM END OF THE PROJECT. THE OTHER WILL BE NEAR THE DOWNSTREAM END. STANDARD CONSTRUCTION ENTRANCES WILL BE INSTALLED AT EACH ACCESS POINT. SILT FENCE WILL BE INSTALLED ALONG THE STREAM SIDE OF EACH STAGING AREA.

SILT FENCE

PRIOR TO ANY SOIL DISTURBANCE, SILT FENCE WILL BE INSTALLED ON THE SITE AS INDICATED ON APPROVED BASIC PLAN AND THIS DETAIL. SILT FENCE WILL BE LOCATED ALONG DOWN SLOPE SIDE OF THE STAGING AND ACCESS AREAS. SILT FENCE MUST ALSO BE PLACED ALONG ANY KNOWN TEMPORARY STOCKPILE AREAS DURING EXCAVATION AND GRADING ACTIVITIES, AT THE END OF THE PROJECT, WHEN ALL DISTURBED AREAS HAVE BEEN STABILIZED, ALL SILT FENCE WILL BE REMOVED. MATERIAL SPECIFICATIONS, INSTALLATION PROCEDURES, AND MAINTENANCE SHALL CONFORM TO SECTION 6.62 OF THE NORTH CAROLINA SEDIMENT CONTROL PLANNING AND DESIGN MANUAL, INCLUDING THE CONSTRUCTION DETAIL.

PUMP AROUND OPERATIONS

A TEMPORARY PUMP AROUND SYSTEM SHALL BE INSTALLED IF WORK IS TO TAKE PLACE WITHIN THE CHANNEL AND ACTIVE BASE FLOW IS OBSERVED. LITTLE BASE FLOW HAS BEEN OBSERVED TO DATE. NO WORK SHALL OCCUR IN THE CHANNEL DURING STORM FLOWS. THE PUMP SHALL BE ADEQUATELY SIZED TO HANDLE CURRENT FLOW CONDITIONS IN THE CHANNEL.

STREAMBANK MATTING

NORTH AMERICAN GREEN S150 (1/4 EQUIVALENT) MATTING WILL BE USED ALONG NEWLY GRADED STREAM BANK SECTIONS. MATTING WILL NOT CONTAIN SYNTHETIC (PLASTIC) MATERIALS. MATTING WILL BE INSTALLED BEGINNING AT THE TOE OF STREAMBANK TO THE BANKFULL STAGE AND WELL EXTEND ABOVE THE BANKFULL STAGE BY A MINIMUM OF THREE FEET. THE UPPER EDGE OF MATTING WILL BE TRENCHED IN AND STAKED AS SPECIFIED IN THE PLANS. A COMBINATION OF 12-INCH AND 24-INCH WOODEN STAKES WILL BE USED TO SECURE THE MATTING IN PLACE.

DUST CONTROL

EXPOSED BOILER LEVEL SURFACES WILL BE KEPT MOIST DURING DRY CONDITIONS TO MINIMIZE THE POTENTIAL FOR WIND EROSION AND DUST ACCUMULATION.

EXCAVATION

THE STREAM RESTORATION PROJECT WILL NOT CREATE ADDITIONAL POINT SOURCES OF STORMWATER. THE INTENT OF THE PROJECT IS TO IMPROVE OVERALL WATER QUALITY IN MIRIAM CREEK AND DOWNSTREAM SURFACE WATERS BY STABILIZING ERODING STREAMBANKS, PROVIDING FLOODPLAIN STORAGE, AND PROMOTING APPROPRIATE RIPARIAN VEGETATION. ALL CONSTRUCTION ACTIVITIES WILL CONFORM TO NORTH CAROLINA GENERAL STORMWATER PERMIT NCG-010000.

SPECIFICALLY:

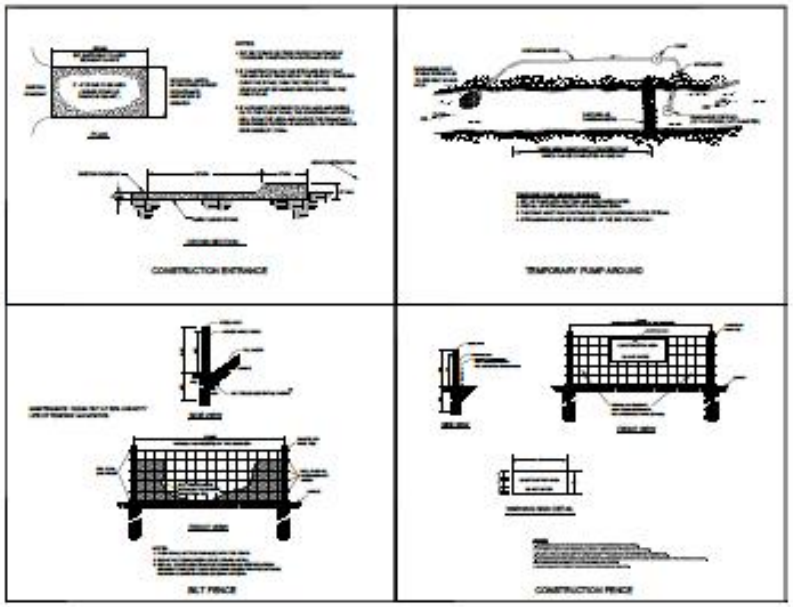
- SOIL STABILIZATION SHALL BE ACHIEVED ON ANY AREA OF A SITE WHERE LAND DISTURBING ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED ACCORDING TO THE FOLLOWING SCHEDULE: 1) ALL PERIMETER DIKES, BASINS, DITCHES, PERIMETER SLOPES AND ALL SLOPES STEEPER THAN 3 HOR.(3H:1V) TO 1 VERTICAL (3 : 1) SHALL BE PROVIDED TEMPORARY OR PERMANENT STABILIZATION WITH GROUND COVER AS SOON AS PRACTICABLE BUT IN ANY EVENT WITHIN 7 CALENDAR DAYS FROM THE LAST LAND DISTURBING ACTIVITY.
- ALL OTHER DISTURBED AREAS SHALL BE PROVIDED TEMPORARY OR PERMANENT STABILIZATION WITH GROUND COVER AS SOON AS PRACTICABLE BUT IN ANY EVENT WITHIN 14 CALENDAR DAYS FROM THE LAST LAND DISTURBING ACTIVITY.

ALL INSPECTION AND REPORTING WILL CONFORM TO NORTH CAROLINA GENERAL STORMWATER PERMIT NCG-010000. SPECIFICALLY, MINIMUM SELF INSPECTION AND REPORTING REQUIREMENTS ARE AS FOLLOWS:

A. A RAIN GAUGE SHALL BE MAINTAINED IN GOOD WORKING ORDER ON THE SITE.
B. A WRITTEN RECORD OF THE DAILY RAINFALL AMOUNTS SHALL BE RETAINED AND ALL RECORDS SHALL BE MADE AVAILABLE TO DEQ OR AUTHORIZED AGENT UPON REQUEST. IF NO DAILY RAIN GAUGE OBSERVATIONS ARE MADE DURING WEEKEND OR HOLIDAY PERIODS, AND NO INDIVIDUAL DAY RAINFALL INFORMATION IS AVAILABLE, THE CUMULATIVE RAIN MEASUREMENT FOR THOSE UN-ATTENDED DAYS WILL DETERMINE IF A SITE INSPECTION IS NEEDED. (NOTE: IF NO RAINFALL OCCURRED, THE PERMITTEE MUST RECORD "ZERO")
C. EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSPECTED TO ENSURE THAT THEY ARE OPERATING CORRECTLY. INSPECTION RECORDS MUST BE MAINTAINED FOR EACH INSPECTION EVENT AND FOR EACH MEASURE. AT A MINIMUM, INSPECTION OF MEASURES MUST OCCUR AT THE FREQUENCY INDICATED IN ALL EROSION AND SEDIMENTATION CONTROL MEASURES MUST BE INSPECTED BY OR UNDER THE DIRECTION OF THE PERMITTEE AT LEAST ONCE EVERY SEVEN CALENDAR DAYS, AND IN ALL EROSION AND SEDIMENT CONTROL MEASURES MUST BE INSPECTED BY OR UNDER THE DIRECTION OF THE PERMITTEE WITHIN 48 HOURS AFTER ANY STORM EVENT OF GREATER THAN 0.50 INCHES OF RAIN PER 24 HOUR PERIOD. INSPECTIONS ARE ONLY REQUIRED TO BE MADE DURING NORMAL BUSINESS HOURS. WHEN ADVERSE WEATHER CONDITIONS WOULD CAUSE THE SAFETY OF THE INSPECTION PERSONNEL TO BE IN JEOPARDY, THE INSPECTION DAY MAY BE DELAYED UNTIL IT IS DEEMED SAFE TO PERFORM THESE DUTIES. TIMES WHEN INSPECTIONS WERE DELAYED BECAUSE OF SAFETY ISSUES SHOULD BE NOTED IN THE INSPECTION RECORD. IF THE INSPECTION CANNOT BE DONE ON THAT DAY, IT MUST BE COMPLETED ON THE FOLLOWING BUSINESS DAY.
D. TWENTY-FOUR HOUR REPORTING FOR VISIBLE SEDIMENT DEPOSITION: 1) THE PERMITTEE SHALL REPORT TO THE DIVISION OF WATER QUALITY CENTRAL OFFICE OR THE APPROPRIATE REGIONAL OFFICE ANY VISIBLE SEDIMENT BEING DEPOSITED IN ANY STREAM OR WETLAND OR ANY NON-COMPLIANCE WHICH MAY ENDANGER HEALTH OR THE ENVIRONMENT. ANY INFORMATION SHALL BE PROVIDED ORALLY OR ELECTRONICALLY WITHIN 24 HOURS FROM THE TIME THE PERMITTEE BECAME AWARE OF THE CIRCUMSTANCES. 2) A WRITTEN SUBMISSION SHALL BE PROVIDED TO THE APPROPRIATE REGIONAL OFFICE OF THE DIVISION OF WATER QUALITY WITHIN 5 DAYS OF THE TIME THE PERMITTEE BECOMES AWARE OF THE CIRCUMSTANCES. THE WRITTEN SUBMISSION SHALL CONTAIN A DESCRIPTION OF THE SEDIMENT DEPOSITION AND ACTIONS TAKEN TO ADDRESS THE CAUSE OF THE DEPOSITION. THE DIVISION OF WATER QUALITY STAFF MAY WAIVE THE REQUIREMENT FOR A WRITTEN REPORT ON A CASE BY CASE BASIS.
E. RECORDS OF INSPECTIONS MADE DURING THE PREVIOUS 30 DAYS SHALL REMAIN ON THE SITE AND AVAILABLE FOR AGENCY INSPECTORS AT ALL TIMES DURING NORMAL WORKING HOURS. UNLESS THE DIVISION OF WATER QUALITY PROVIDES A SITE SPECIFIC EXEMPTION BASED ON UNIQUE SITE CONDITIONS THAT MAKE THIS REQUIREMENT NOT PRACTICAL, CLOSE RECORDS MUST BE MAINTAINED FOR A PERIOD OF THREE YEARS AFTER PROJECT COMPLETION AND MADE AVAILABLE UPON REQUEST. THE ENCLOSED MUST PROVIDE THE DETAILS OF EACH INSPECTION INCLUDING OBSERVATIONS, AND ACTIONS TAKEN IN ACCORDANCE WITH THIS PERMIT. THE PERMITTEE SHALL RECORD THE REQUIRED OBSERVATIONS AND MONITORING ORMATION ON THE INSPECTION RECORD FORM PROVIDED BY THE DIVISION OR A SIMILAR INSPECTION FORM THAT IS INCLUSIVE OF ALL OF THE ELEMENTS CONTAINED IN THE DIVISION'S FORM. USE OF ELECTRONICALLY AVAILABLE RECORDS IN LIEU OF THE REQUIRED PAPER COPIES FOR INSPECTION WILL BE ALLOWABLE IF SHOWN TO PROVIDE EQUAL ACCESS AND UTILITY AS THE HARD COPY RECORDS. INSPECTION RECORDS MUST INCLUDE: AT A MINIMUM, THE FOLLOWING: 1) IDENTIFICATION OF THE CONTROL MEASURES INSPECTED, 2) DATE AND TIME OF THE INSPECTION, 3) NAME OF THE PERSON PERFORMING THE INSPECTION, 4) INDICATION OF WHETHER THE MEASURES WERE OPERATING PROPERLY, 5) DESCRIPTION OF ANY MAINTENANCE NEEDED FOR THE MEASURE, 6) CORRECTIVE ACTIONS TAKEN (TYPE OF ACTIONS TAKEN, AS WELL AS THE DATE AND NAMES OF CREWS), AND 7) RECORDS OF VISIBLE SEDIMENTATION FOUND OUTSIDE THE SITE LIMITS. INSPECTION RECORDS MUST INCLUDE: 1) AN EXPLANATION AS TO THE ACTIONS TAKEN TO CONTROL FUTURE RELEASES, 2) ACTIONS TAKEN TO CLEAN UP OR STABILIZE THE SEDIMENT THAT HAS LEFT THE SITE LIMITS AND THE ACTIONS TAKEN, 3) VISIBLE SEDIMENTATION FOUND IN STREAMS OR WETLANDS. ALL INSPECTIONS SHOULD INCLUDE EVALUATION OF STREAMS OR WETLANDS (WATER OR OFFSITE WHERE ACCESSIBLE) TO DETERMINE IF VISIBLE SEDIMENTATION HAS OCCURRED.

MAINTENANCE OF BMP MEASURES

ALL EROSION CONTROL AND SEDIMENTATION MEASURES WILL BE INSPECTED DAILY AND AFTER SIGNIFICANT RAIN EVENTS BY THE ON SITE ENGINEER OR THE CONTRACTOR. THE CONTRACTOR WILL ENSURE THAT ALL INSTALLATIONS ARE FUNCTIONING PROPERLY AT THE END OF EACH WORK DAY. INSPECTION REQUIREMENTS, AS DETAILED IN THE STORMWATER SECTION, WILL BE FOLLOWED. ONCE THE SITE IS STABILIZED, ALL NON-BIODEGRADABLE EROSION CONTROL DEVICES WILL BE REMOVED AND PROPERLY DISPOSED OF BY THE CONTRACTOR.



1. Site Preparation

- Construction entrance
- Silt fence
- Staging & stockpile
- Temporary crossings
- Stream flow diversions

Silt Fence

- Metal Posts 8 feet apart
- Reinforcing wire backing (14 ga. w/ 6-inch mesh)
- Bury fence at least 8 inches deep

Staging and Stockpile

Stockpile Area

Silt fence & seeding

Temporary Stream Crossing

- Rock ford
- Culvert
- Portable log mat
- Spanning structures

Stream Flow Diversion

- Open channel
- Pipe
- Pump around
- Instream diversion
- Work in wet

Pump Around: Match pump to 2 x base flow

Multiple pumps

Pump discharge downstream

Special Stilling Basin: Filter Bag

Problem? How to remove full bag?

Flow Diversions – Working in the Wet

Flow Diversions – Working in the Wet

Work From the Top of Bank

Work From the Top of Bank

Limit the disturbed area

2. Grading

1. Stage project to limit exposed areas
2. Use temporary ground cover
3. Use track equipment if possible
4. Keep stormwater runoff away from site

Clearing & Grubbing
Followed by Survey Stakeout

Organized Staging Areas

3. Structures

1. Build according to design
2. Check elevations (*twice*)
3. Footer boulders and backer logs
4. Seal structures to prevent piping
    - “Chink” rock structures
    - Filter fabric for all structures

Laser Level for Grade Check

Laser Level for Grade Check

Chinking Boulders to Prevent Piping

Geotextile Curtain to Prevent Piping

4. Site Stabilization

- Temporary ground cover (mulch & matting)
- Permanent ground cover (vegetation)
- Prepare for rain!

Temporary Erosion Control

- Soil prep, seed, straw
- Biodegradable matting (coir, 700g)
- Wood stakes

Straw Mulch: 75% cover (2 tons/acre)

Hydroseeder (mulch, seed, fertilizer)

Matting

- Biodegradable (coir, jute, excelsior, straw)
- Seed and straw UNDER matting
- Keep matting relaxed
- Stakes: wood or biodegradable plastic

Matting

Erosion Control Blankets

Straw Single Synthetic Net

Straw Double Synthetic Net

Straw Double Jute Net

Coir / Straw Double Jute Net

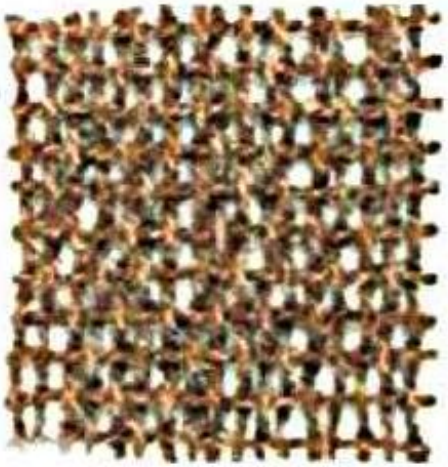
Coir / Straw Double Synthetic Net

Coir Double Jute Net

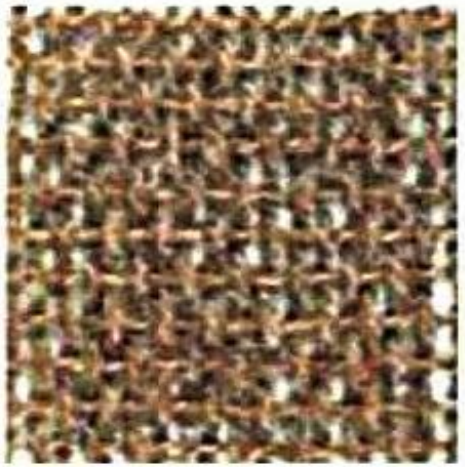
Coir Double Synthetic Net

Heavy Duty Excelsior Double Net

Erosion Control Mats



Woven Bristle Coir Mat 70



Woven Bristle Coir Mat 90

Spun Jute Yarn Mat

Heavy Coir Woven Mesh Mat 60

No Plastic!

Each Day:

Seed, straw, matting

Temporary Erosion Control Matting (coir 700g)

Seed and straw under

3 Weeks Later

Large stakes at toe of slope

Irrigation if Needed

Vegetation – Streamside Forest

- Native plants
- Grasses, shrubs, trees
- Live stakes, bare roots, containers, transplants

Plan for Success

1. Plan for floods -- immediately & often – site should be storm ready
2. Plan for dry weather
3. Plan for vegetation maintenance
4. Expect the Unexpected