Troubleshooting Erosion and Sediment Control

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December 3, 2019

Presentation Agenda

- Conducting a Plan Review
- Implementing the Plans
- Field Issues & Solutions

Plan Review Mindset

Conducting a Plan Review

Plan Review Foundation & Tools

Local Ordinances

Soil Erosion & Sedimentation Control

- Permit & inspect land-disturbing activities

Stormwater

- Plan Reviews & permit issuance

Watershed Protection

- Buffer determinations & surface water classifications

Flood Damage Prevention

- Special Flood Hazard Areas & Flood Damage

Plan Review Foundation & Tools

Plan Review Checklist

WATERSHED PROTECTION DEPARTMENT
P.O. Box 548
Pittsboro, NC 27312
PHONE: (919) 545-8343

Phone: (919) 548-8268 • E-mail: morgan.dewitt@chathamnc.org • Website: www.chathamnc.org

Soil Erosion and Sedimentation Control
Checklist for Plan Submittals

The following information should be provided for all erosion control plan submittals.
Mark NA for any items that are not applicable.

General Information
___ Name of Project
___ Name, address, and phone number of owner
___ Registered Engineer's/Landscaper's/Land Surveyor's Seal
___ Registered Engineer's/Landscaper's/Land Surveyor's name, address, phone
___ Permit Application & Financial Ownership/Responsibility Form
___ Parcel numbers
___ Zoning of property
___ Total acres of all property to have disturbance
___ Disturbed acres
___ Land-disturbing Permit fee ($250 per acre)
___ Plan review fee ($250 per acre)

Plan Features
___ Vicinity Map (1"=2,000', Subdivision phase for residential plans)
___ North arrow
___ Scale
___ Property lines & adjoining property owners
___ Legend
___ Existing and Proposed Contours
___ Limits of disturbance (should include all utilities to be installed)
___ Existing roads, buildings, utilities, etc.
___ Proposed roads, buildings, utilities, etc.
___ Phased erosion control plans
___ Construction sequence (site overall)
___ Construction sequence (stream crossing)
___ Soils map
___ Drainage areas map
___ Lot drainage, lot & building numbers
___ Retaining Wall: (include grading and drainage, profiles, location and wall number)
___ Rock outcrops, seeps, springs
___ Wetlands
___ 100-year floodplain limits and elevations
___ Easements
___ Streams, lakes, ponds, drainage ways, etc.
___ Riparian buffers
___ Borrow/Waste Areas
___ Parking/staging areas
___ Material Storage
___ Soil stockpile locations

Erosion and Sediment Control Measures
___ Construction entrance(s)
___ Silt fence (only for areas less than one acre, and not in concentrated flow)
___ Silt fence rock outlets
___ Temporary Diversion Ditches
___ Check Dams
___ Slope drains with inlet & outlet protection (primarily where slope drains enter basin)
___ Inlet Protection
___ Clean water conveyance(s) (where applicable)
___ Concrete Washouts
___ Standard details for all measures
___ Seed and sod specifications chart(s)
___ Skimmer basins (dimensions, volume, and surface area)
___ Size, type, and invert elevations for all storm sewer
___ Rock bench for skimmers
___ Ditch profiles with lining requirements & supporting calculations
___ Permanent liners in channels/ditch lines
___ Temporary liners in diversion ditches
___ Energy Dissipaters (sizes, dimensions, lining requirements & supporting calculations)
___ Label slopes greater than 3:1 for stabilization
___ Temporary stream crossing details and sequence
___ Other proposed measures & necessary calculations

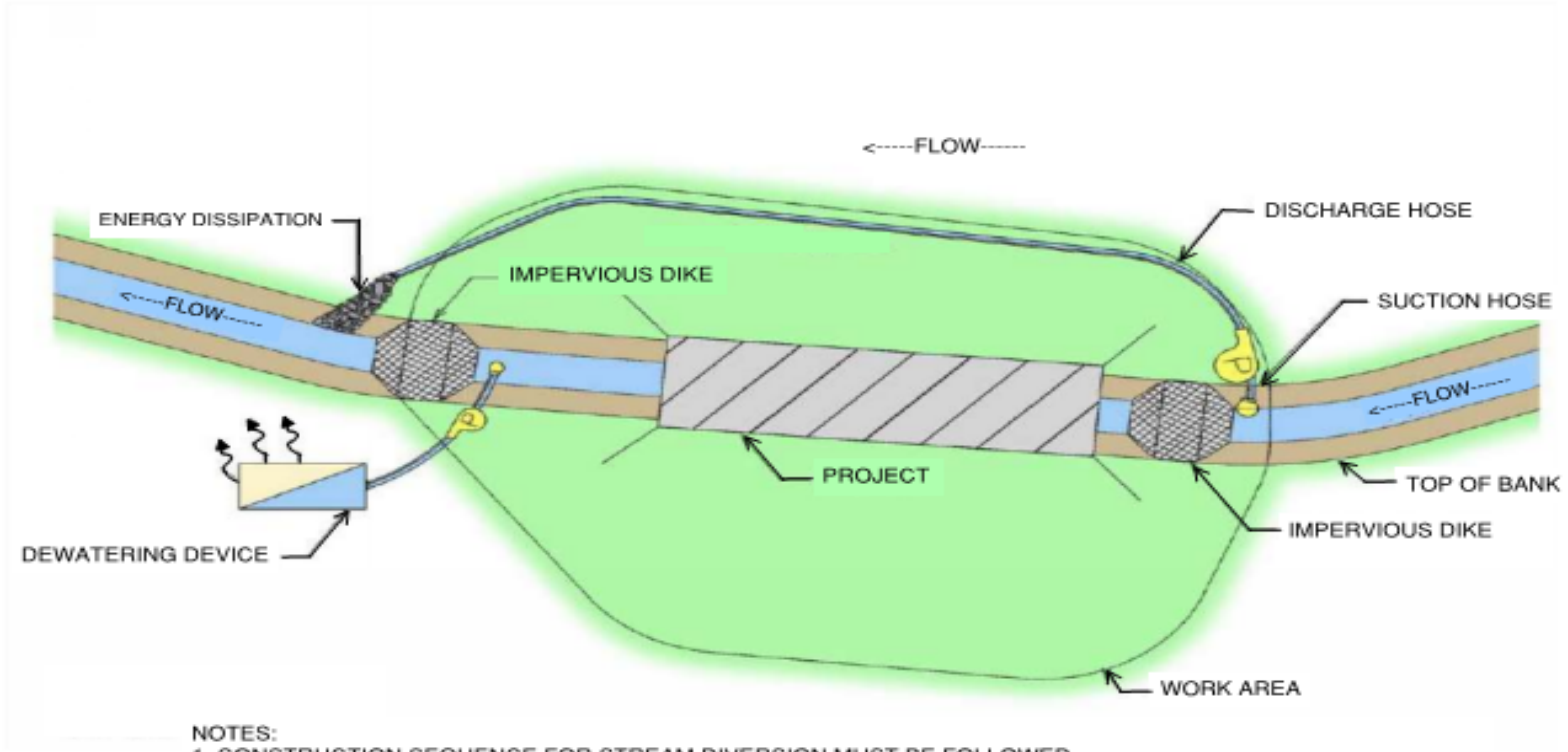
Other Requirements
___ Design calculations for culverts, storm sewers, and channels
___ Design calculations for sediment basins/traps
___ Fill in drainage easement (channel evaluation/design)
___ Stormwater plan (greater than 20,000 ft^2 disturbed), if applicable
___ Floodplain development permit, if applicable
___ Permit and flood study required (work in floodway), if applicable
___ Army Corp. of Engineers Section 404 Permit, if applicable
___ NCDEQ 401 Certification, if applicable
___ Chatham County/Pittsboro Planning
(Buffer authorizations, construction plan approval, etc.), if applicable
___ NCDOT permits and approvals, if applicable
___ NCG01 Ground Stabilization and Materials Handling Plan Sheet from NCDEQ webpage
(projects subject to NPDES)
___ NCG01 Inspection, Recordkeeping and Reporting Plan Sheet from NCDEQ webpage
(projects subject to NPDES)

NCDEQ's webpage with NCG01 updates:
https://deq.nc.gov/NCG01

https://www.chathamnc.org/home/showdocument?id=44302

Plan Review Foundation & Tools

Local Erosion Control Details, NCDEQ ESC&P Design Manual



NOTES:
1. CONSTRUCTION SEQUENCE FOR STREAM DIVERSION MUST BE FOLLOWED.
2. BE SURE TO ANCHOR ALL PUMPS AND PIPES SECURELY.
3. PERIODICALLY CHECK PUMP FOR ADEQUATE FUEL SUPPLY AND REMOVE ANY BLOCKAGES THAT MAY OCCUR.
4. BE SURE TO HAVE AN EXTRA PUMP AND AN EXTRA SILT BAG ON SITE IN CASE OF FAILURES.
5. SILT BAG MUST BE USED IN DEWATERING OPERATION. SEE SILT BAG DETAIL FOR USE WITH PUMP.
6. DISCHARGE FROM SILT BAG SHOULD NOT CAUSE EROSION.

CHATHAM COUNTY
NORTH CAROLINA
WATERSHED PROTECTION DEPARTMENT

STREAM DIVERSION - BYPASS PUMPING

DETAIL NUMBER
2018-024
SHEET 1 of 1

Chatham County

Soil Erosion & Sedimentation Control Ordinance

- 164.05 Mandatory Standards
- 164.06 Slope Standards
- 164.16 Design & Performance Standards

Mandatory Standards

- Protection of Property
  - All reasonable measures
- Riparian Buffers
  - Applied & never < 30ft

Mandatory Standards

Buffer Rules: Inside vs. Outside Jordan Lake Watershed

Inside

AND no subdivision being proposed	
Streams	All NRCS & USGS "blue line" – 50 ft
Wetlands	None
Other*	Lakes, Ponds, and Reservoirs – 50 ft
*within natural drainage features	

Created after Dec. 2, 2008 OR subdivision being proposed		
Streams	Ephemeral	30 ft
	Intermittent	50 ft
	Perennial	100 ft
Wetlands	50 ft	
Ponds*	50 ft	
*fed by/discharges into stream that scores ≥19 pts. w/in 50 ft of pond		

Outside

Created before Dec. 2, 2008 & no subdivision being proposed	
Streams	All USGS "blue line" - 50 ft
Wetlands	None
Other	Rivers & on streams w/in 2,500 ft of those rivers – 100 ft

Created after Dec. 2, 2008 OR subdivision being proposed		
Streams	Ephemeral	30 ft
	Intermittent	50 ft
	Perennial	100 ft
Wetlands	50 ft	
Ponds*	50 ft	
*fed by/discharges into stream that scores ≥19 pts. w/in 50 ft of pond		

Mandatory Standards

- Graded Slopes & Fills
  - Never > 2:1
  - Stabilization w/matting for 3:1
- Fill Material
  - Acceptable & free of materials considered landfilling

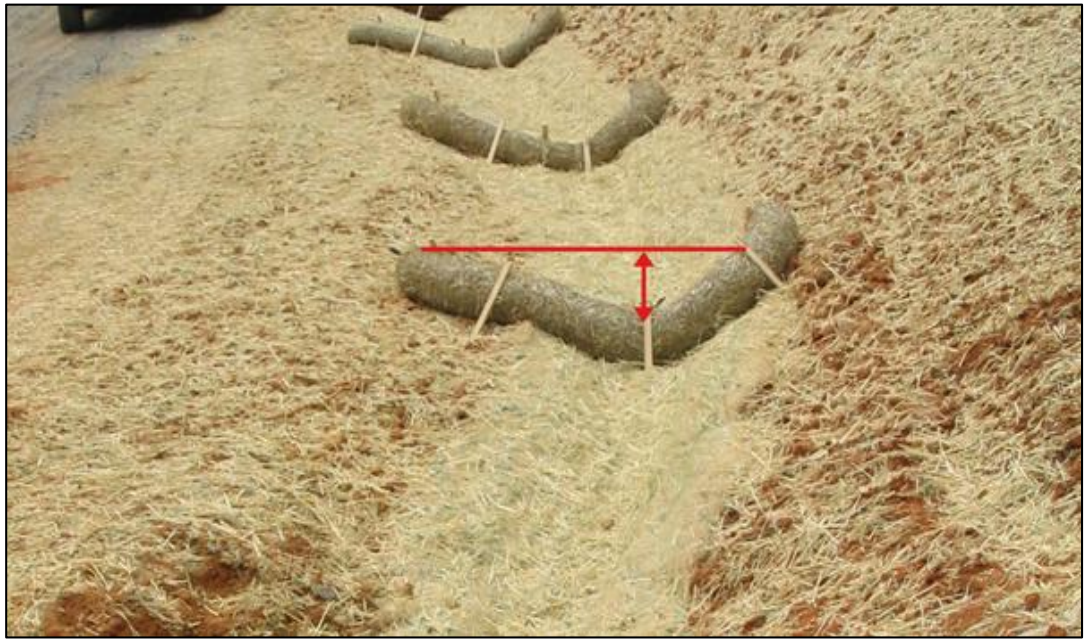
Source: Massachusetts DEP

Mandatory Standards

- Stormwater Outlet Protection
  - Stream banks & channels downstream protected
  - Post construction performance standard
  - Plans show permanent SCM & conversions specified
  - Other permits & plans provided

Mandatory Standards

- More Restrictive Rules Apply
- Ground Cover
  - After phases of grading & periods of inactivity
- Erosion & Sedimentation Control Devices
  - Sufficient to retain sediment onsite



Slope Standards

- Provisions for gradual, moderate, and steep slopes
  - ESC devices & stabilization
  - Phasing of LDA

Gradual	Not > 15 acres
Moderate	Not > 10 acres
Steep	Not > 1 acre

  - Scales & contours

Source: udfcd.org

Design & Performance Standards

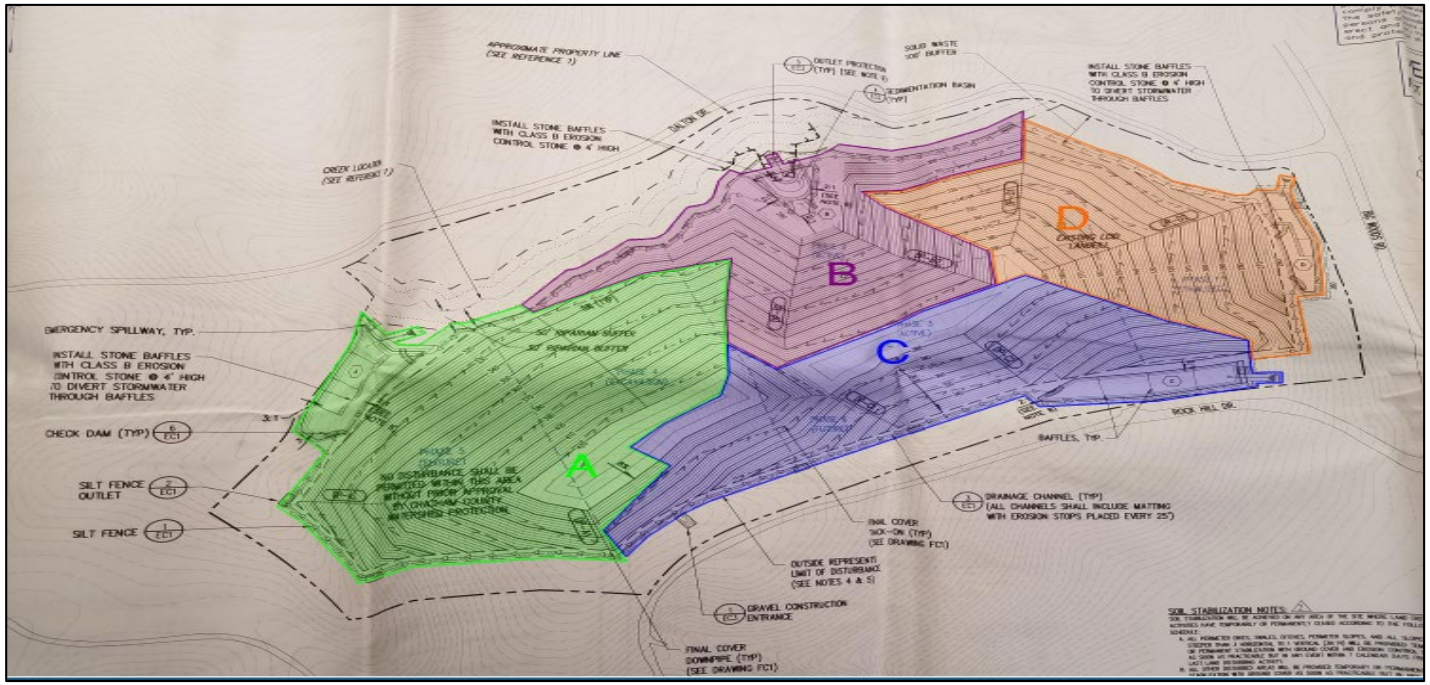
Temporary Erosion and Sedimentation Control Devices

- Must be designed using set criteria from the Chatham County SESC Ordinance
- Or the NC Erosion & Sediment Control Planning and Design Manual
- More restrictive standards apply

Design & Performance Standards

Temporary Erosion and Sedimentation Control Devices

- Drainage Area – max 10 acres



Design & Performance Standards

Temporary Erosion and Sedimentation Control Devices

- Slopes – max 2:1
- Stabilization – 7 calendar days for any device

Design & Performance Standards

Temporary Erosion and Sedimentation Control Devices

- Runoff:
  - Minimum 0.5 rational C value
  - Highest intensity/shortest time of concentration
  - Peak rate of runoff from 25-yr storm

TABLE 1. Drain Areas and Curve Numbers.

Area ID	Area (acres)	Description*	SCS CN* (CN)	Weighted CN	Rational Runoff Coefficient (C)**
Post-Developed Conditions					
A	8.7	Open Space - Good Grass Cover - HSG B (CN = 69)	75	*23.25*	0.50
B	5.6	Open Space - Good Grass Cover - HSG B (CN = 69)	75	*14.90*	0.50
C	7.8	Open Space - Good Grass Cover - HSG B (CN = 69)	75	*20.62*	0.50
D	6.1	Open Space - Good Grass Cover - HSG B (CN = 69)	75	*16.23*	0.50
Sum =	28.2	acres	Avg. CN =	75	0.50

* Descriptions and CN values based on SCS documentation.

** Based Malcom's conversion equation: C = 0.02 x CN -1.

***§164.16 requires a minimum rational runoff coefficient of 0.5. A SCS CN of 75 has been applied as the regulatory minimum.

Subcatchment A: Area A

[49] Hint: Tc<2dt may require smaller dt

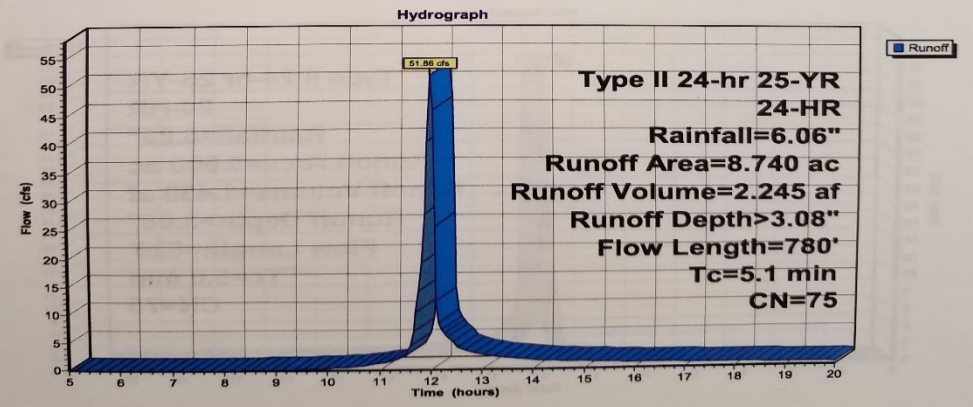
Runoff = 51.86 cfs @ 11.96 hrs, Volume= 2.245 af, Depth> 3.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-YR, 24-HR Rainfall=6.06"

Area (ac)	CN	Description
8.740	75	Chatham Co. Min
8.740		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	100	0.3300	0.38		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.53"
0.6	400	0.0500	10.52	105.22	**Channel Flow,** Area= 10.0 sf Perim= 10.8' r= 0.93' n= 0.030 Earth, grassed & winding
0.1	280	0.3300	41.37	129.96	**Circular Channel (pipe),** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Corrugated PE, smooth interior
5.1	780	Total			

Subcatchment A: Area A



Design & Performance Standards

Temporary Erosion and Sedimentation Control Devices

- Volume – traps & basin use design volume = 3,600 ft^3/disturbed acre
- Surface Area – traps & basin use min. 435 ft^2/ft^3/sec of inflow from design storm
- Baffles
  - 1 row/10 feet
  - No less than 3
  - Must pass through at least 3
  - Porous material (no silt fence)

Design & Performance Standards

Temporary Erosion and Sedimentation Control Devices

- Swales & Ditches
  - Designed to convey runoff from 2 & 10 yr, 24-hr storms in a stable manner
  - Calcs required for velocity and flow rate of vegetated & bare soil condition
  - Velocities must not exceed rates in Maximum Permissible Velocities Tables

Maximum Permissible Velocities Table		
Material	*F.P.S.*	*M.P.S.*
Alluvial silts (colloidal)	5.0	1.5
Alluvial silts (non-colloidal)	3.5	1.1
Coarse gravel (non-colloidal)	6.0	1.8
Cobbles and shingles	5.5	1.7
Fine gravel	5.0	1.5

Maximum Permissible Velocities Table		
Material	*F.P.S.*	*M.P.S.*
Fine sand (non-colloidal)	2.5	0.8
Graded, loam to cobbles (non-colloidal)	5.0	1.5
Graded, silt to cobbles (colloidal)	5.5	1.7
Ordinary firm loam	3.5	1.1
Sandy loam (non-colloidal)	2.5	0.8
Shales and hard pans	6.0	1.8
Silt loam (non-colloidal)	3.0	0.9
Stiff clay (very colloidal)	5.0	1.5

Design & Performance Standards

Temporary Erosion and Sedimentation Control Devices

- Cut/Fill limitations - may be imposed for cut/fill per acre, based on Pre. vs. Post conditions
- High Quality Water zones – design/performance standards in Chatham SESC Ordinance shall apply as min. standards in HQW zones.

Initial Approach

What's around? Impacts? Current groundcover?

Existing Conditions

Proposed Conditions

Initial Approach

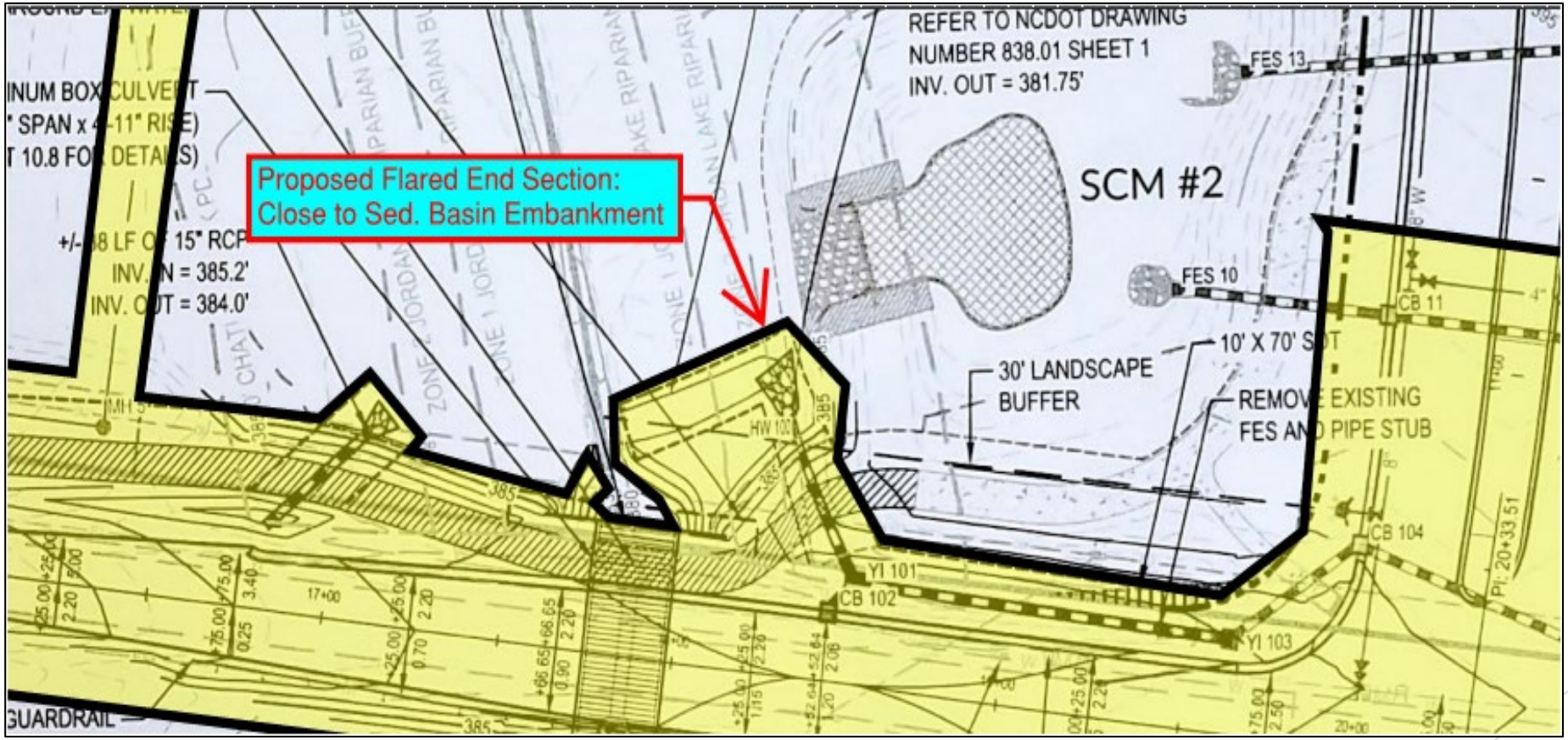
Where's all the water going? How's it getting there?

Existing Conditions

Erosion Control Stage

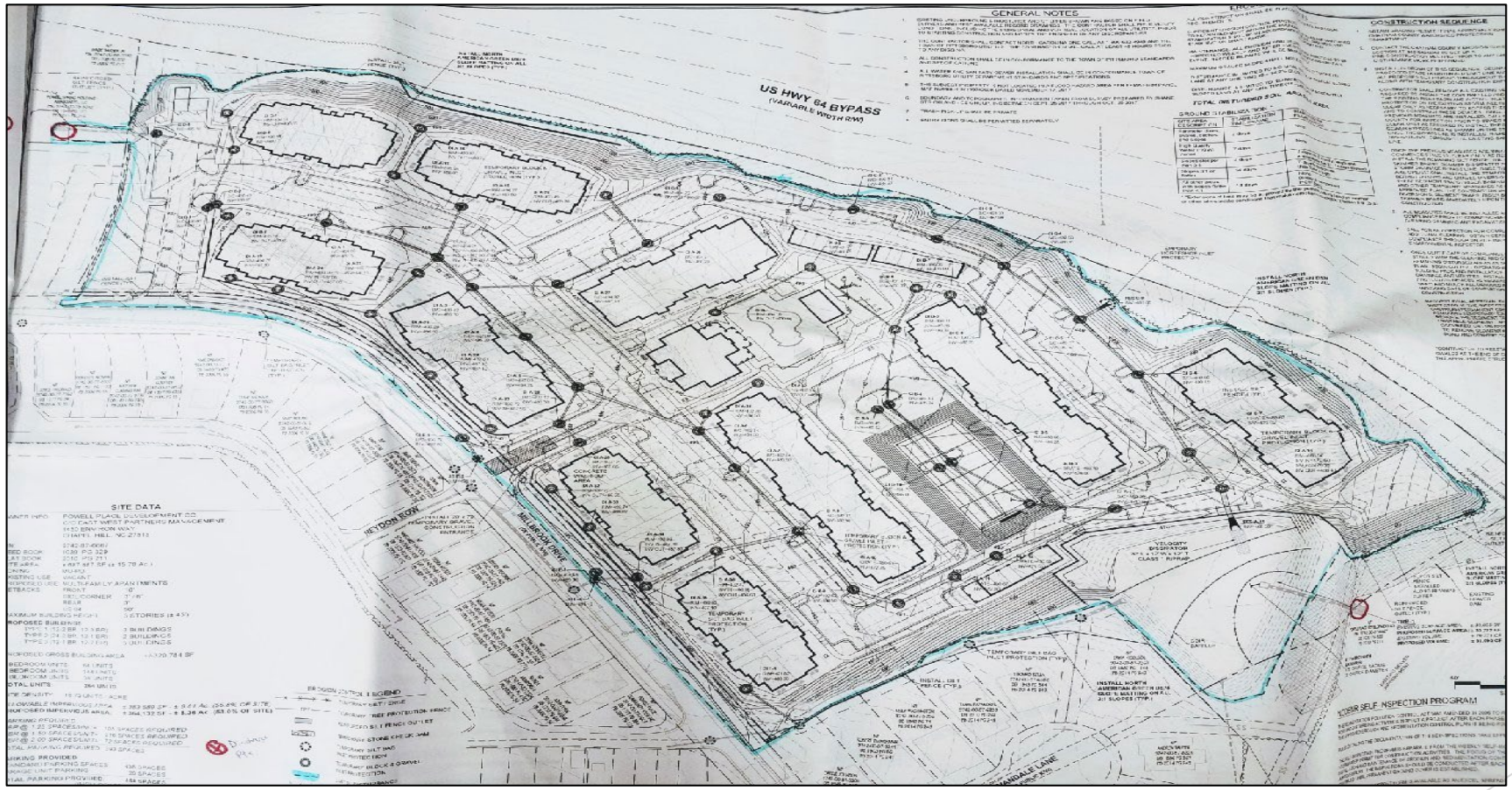
Initial Approach

Do the plans under review overlap with any existing projects?



Initial Approach

Is everything that is proposed shown on the plans?



Example: 12 Proposed Buildings above.

Initial Approach

Does the Construction Sequence make sense and does it include all work proposed?

Common Issues

- X Sequence too general
- X Stream crossing not included
- X Stabilization not indicated
- X Timing of temporary to permanent conversions

In More Detail

Skimmer Basins

	Requirement
Drawdown	2-5 days (based on skimmer & orifice sizes)
Skimmer	Required for DA > 1 acre
Depth	Min. 2 ft.
Length:Width	Between 2:1 and 6:1
Slopes	3:1 preferred (2:1 allowed w/matting)
Basin Inlets	Transition w/slope drain, etc.
Emergency Spillway	Required, dimensions based on calcs

In More Detail

Skimmer Basins

Skimmer – Size & Orifice

Procedure

First determine the desired dewatering time in days (t_d) and the volume (V) of water to be released in that time period. Dividing the volume in cubic feet by the dewatering time in days gives a flow rate Q_d in cubic feet per day.

$$Q_d = V / t_d \quad (ft^3/day)$$

Next determine the head on the skimmer orifice. Table 6.64a has the values for various sizes of the Faircloth skimmer.

Table 6.64a Head on orifice of various skimmer sizes

Skimmer Size (in.)	Head on Orifice (ft.)
1.5	0.125
2	0.167
2.5	0.208
3	0.25
4	0.333
5	0.333
6	0.417
8	0.5

The desired orifice diameter (D) in inches can now be calculated using the equation

$$D = \sqrt{Q_d / (2310 * \sqrt{H})} \quad \text{(inches)}$$

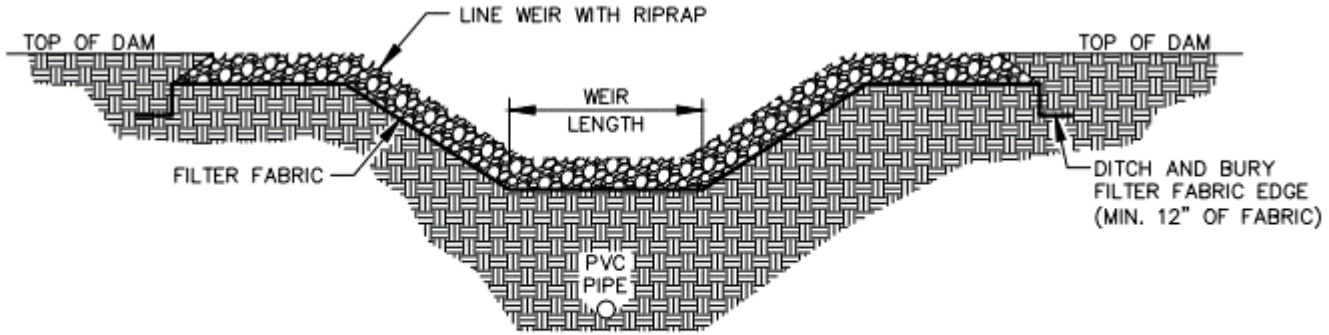
Source: NCDEQ ESC&P Design Manual

Emergency Spillway

DESIGN OF SPILLWAYS

DRAINAGE AREA (ACRES)	WEIR LENGTH [1] (FT)
1	4.0
2	6.0
3	8.0
4	10.0
5	12.0

[1] DIMENSIONS SHOWN ARE MINIMUM



WEIR CROSS SECTION

In More Detail

Skimmer Basins

- Basin depth important
- Baffles can end up underwater

In More Detail

Skimmer Basins

Basin Inlets = Stable

- Upslope & downslope end

Basin Outlet = Stable

- Pad sufficient w/supporting calcs

Source: Minnesota Stormwater Manual

In More Detail

Skimmer Basins

- Rip rap pad under skimmer

In More Detail

Routed Runoff

- Stable conveyances

To basin

From basin

In More Detail

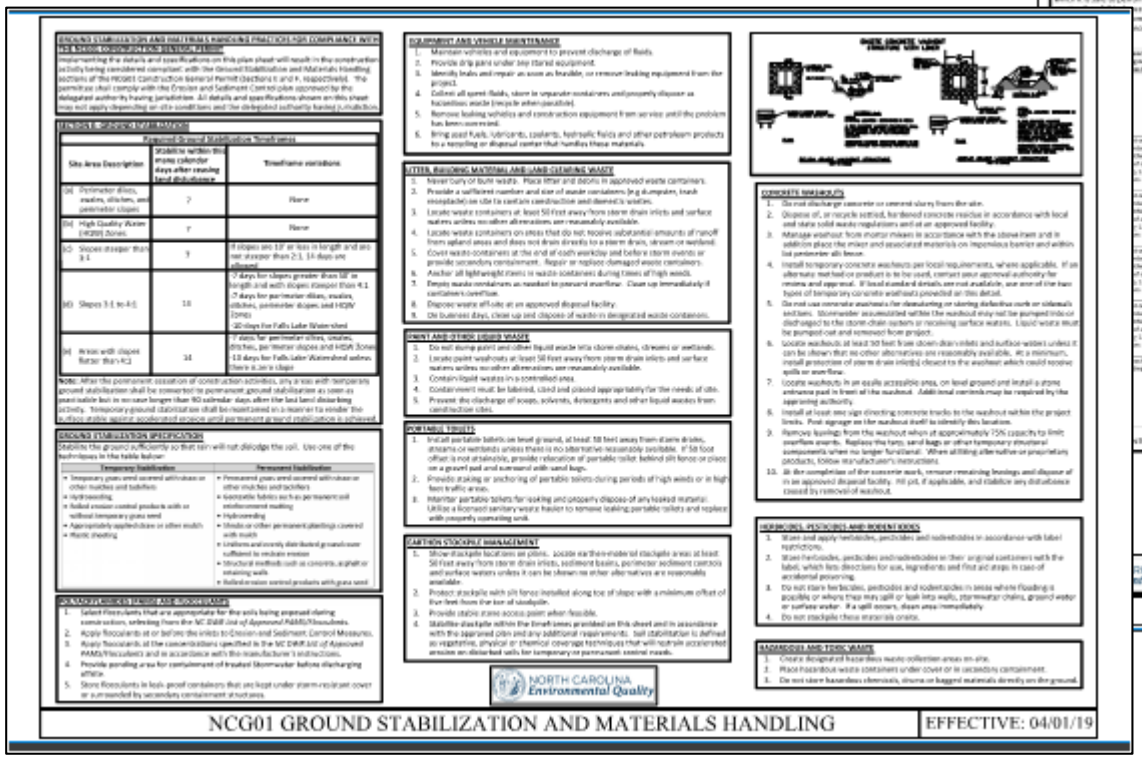
Account for & Control Run-on

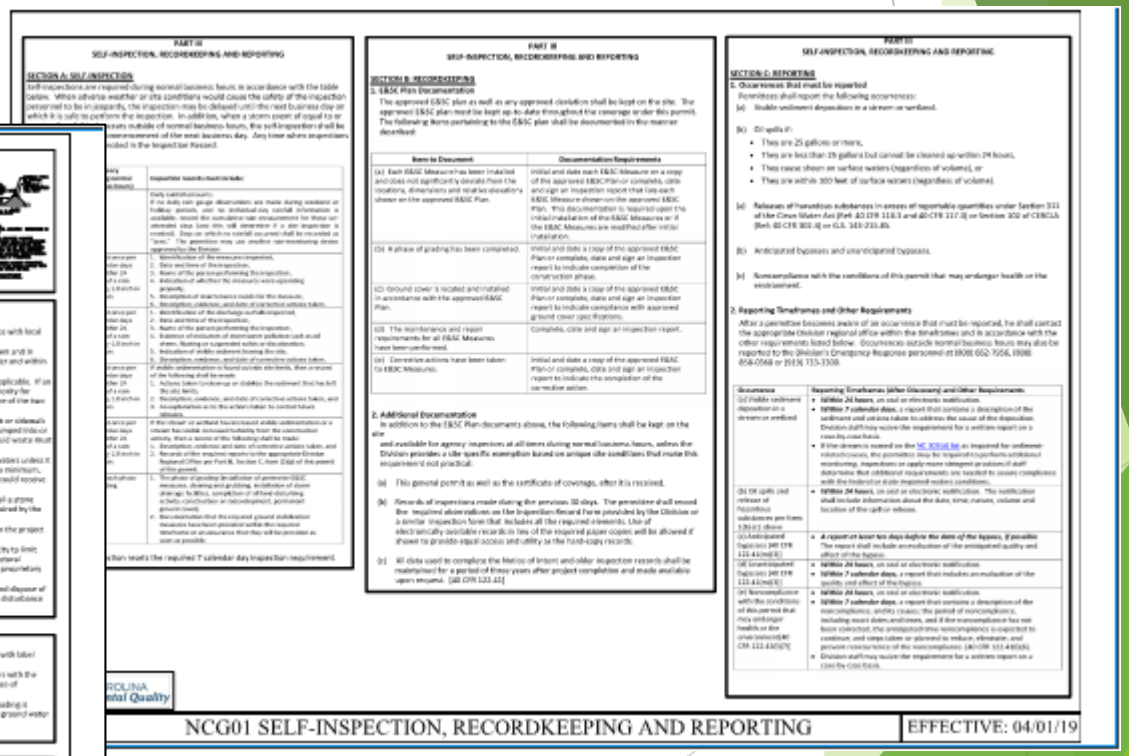
- Divert clean water
- Route to stable outlet

In More Detail

NCG01

- Both compliance sheets provided by NCDEQ included with details
  - Ground Stabilization & Materials Handling
  - Inspection, Recordkeeping, and Reporting





In More Detail

NCG01

- https://deq.nc.gov/ncg01

Home | Permits & Rules | Outreach & Education | Energy & Climate | Conservation | News | About

Sample Plan Sheets

Below are sample plan sheets that provide guidance on complying with key portions of the NCG01 Permit. These sample plan sheets provide more detail than is provided in the NCG01 permit. Permittees are not required to use the sample plan sheets; they convey one way that the objectives set forth in the permit may met.

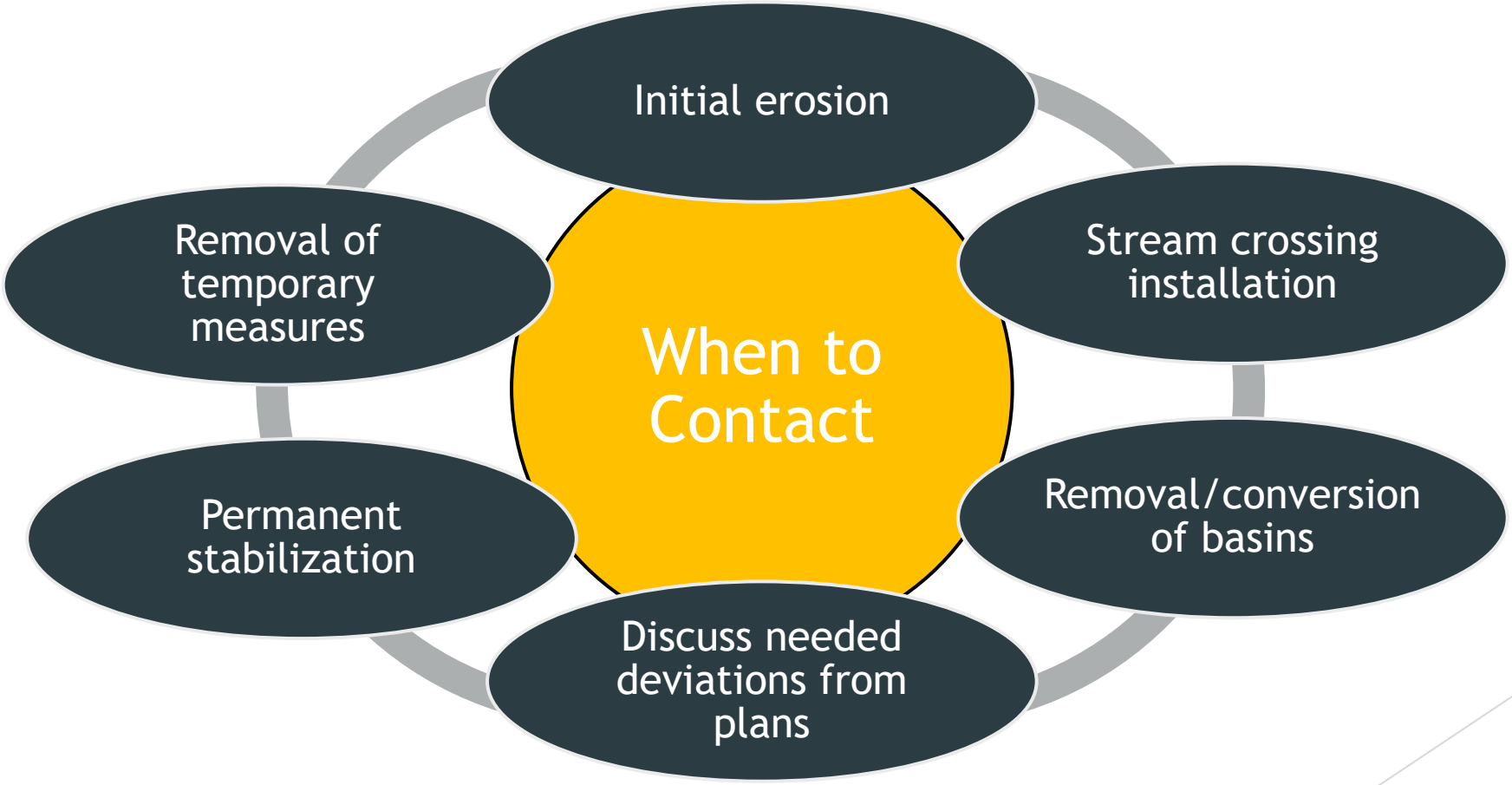
Sample_Plan_Sheet_Topic	Provides_Guidance_to_Comply_With			
Ground Stabilization and Materials Handling	Part II of the NCG01 permit for topics that may not be addressed in the E&SC Plan.	.pdf	CAD	CAD 2013
Inspection, Recordkeeping and Reporting	Part III of the NCG01 permit and requirements for draw down of sediment basins (II-G.4).	.pdf	CAD	CAD 2013

Where the Rubber Hits the Road

Implementing the Plans

Preconstruction Meeting

Preconstruction Meeting



Preconstruction Meeting

- What is required to be onsite
  - Permits & Plans
  - Self-Inspection Reports (https://deq.nc.gov/ncg01)
  - Rain gauge

Initial Erosion

- Basins

Initial Erosion

- Basin Outlet

Initial Erosion

- Stable conveyances

Initial Erosion

- Perimeter Controls, Stabilization

Routine Inspections & Maintenance

Routine Inspections & Maintenance

Routine Inspections & Maintenance

Routine Inspections & Maintenance

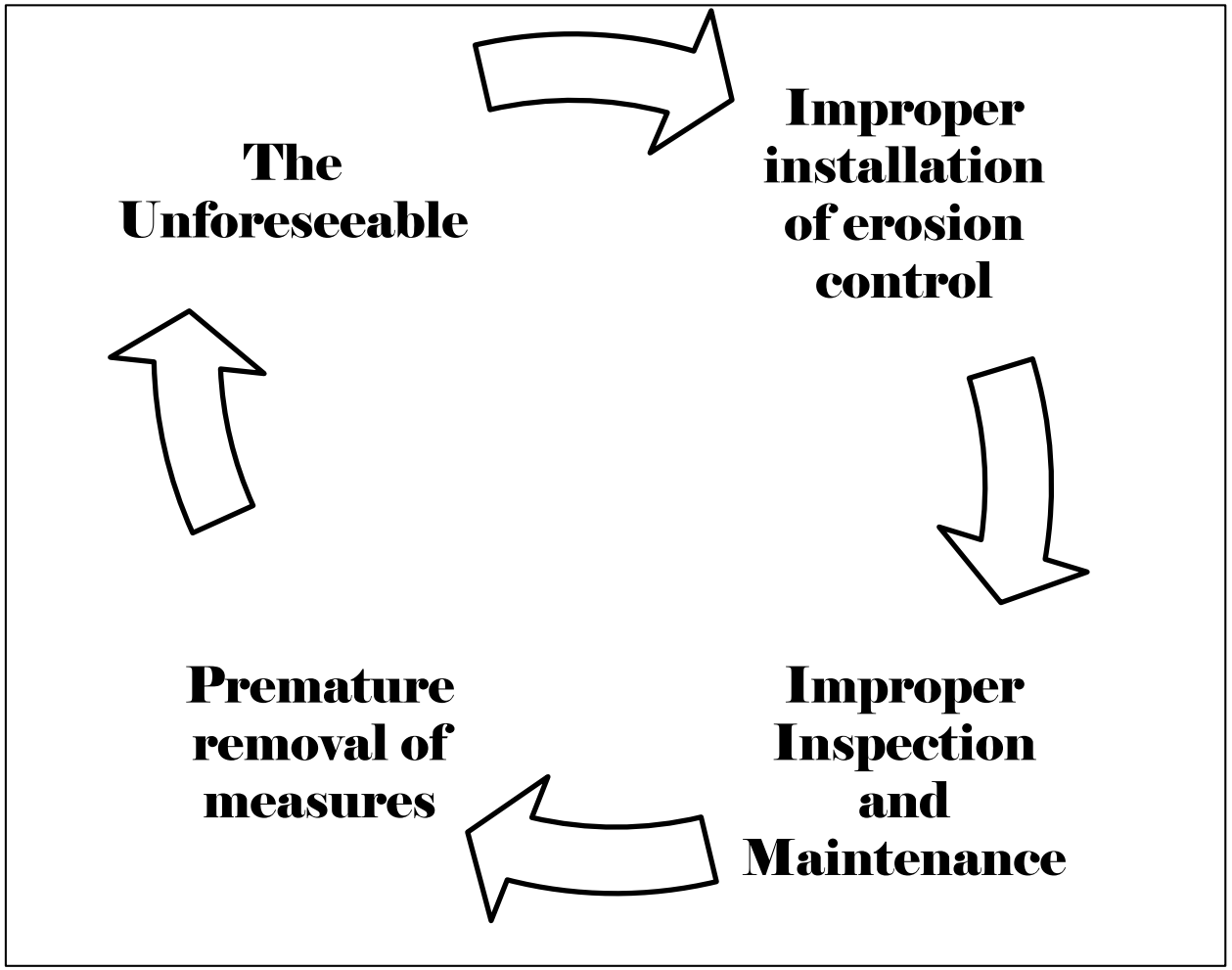
Routine Inspections & Maintenance

Permanent Stabilization

Monkey Wrenches

Field Issues & Solutions

Field Issues



Field Issues

Issue

- Run-on & steep slopes present difficulty in stabilization

Solution

- Use alternative reinforced methods

Field Issues

Issue

- Significant runoff to stream crossing

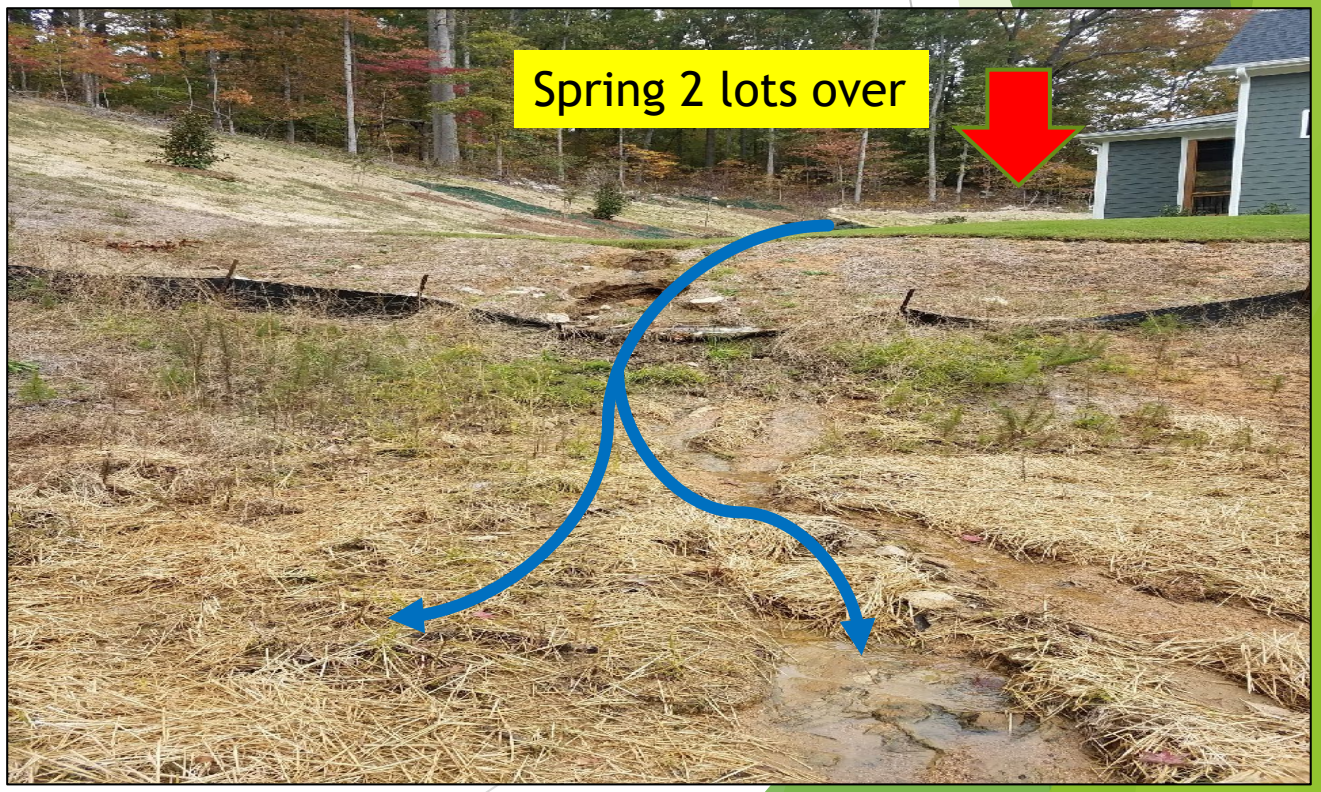
Solution

- Stabilized water bars draining to outlets
- Proper protections at stream area

Field Issues

Issue

- Springs & Run-on



Field Issues

Solution

- Engineered storm drainage system, reinforced matting, & temporary controls in the meantime

Field Issues

Issue

- Can’t establish vegetation past road culvert outlet pipe

Solution

- Replace seed/matting with geotextile & rip rap

Field Issues

Issue

- Turbid water at basin outlet, but clean water coming out of skimmer

Solution

- Adequate pad size, stabilize surrounding areas

Every Stage Counts…

Planning

Communication

Implementation

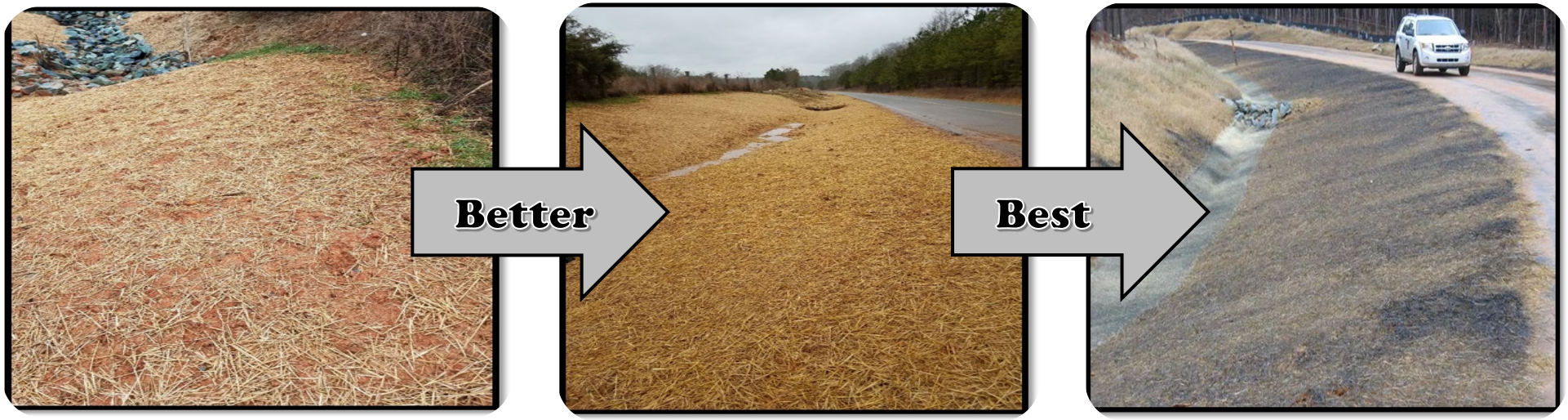
Maintenance

Stabilization

#1 Field Solution = STABILIZE!!!

Stabilization

Seed, straw, tack, matting



Chatham County

Watershed Protection Department

- https://www.chathamnc.org/government/departments-programs/watershed-protection

Questions?

North Carolina Erosion and Sediment Control Design Workshop

December 3, 2019

NC STATE UNIVERSITY
Crop & Soil Sciences

NORTH CAROLINA Department of Environmental Quality

IECA Southeast Chapter

Please Remember to Complete the End of Workshop Evaluation

(separate from the PDH sponsor evaluation)

bit.ly/Raleigh2019-ESC-Eval