

MEMO

TO: Project Bidders

FROM: Kelly Sifford, AICP

DATE: December 28, 2017

SUBJECT: Bidding Instructions for the repair of the constructed wetland at JM Robinson High School.

Engineering plans for the repair of the constructed wetland at JM Robinson High School are attached. **Bids will be accepted until January 8th at 5pm.** They may be emailed to Kelly Sifford at kfsifford@cabarruscounty.us or delivered to 65 Church St S, Concord, NC 28025. Plans sent by US mail should be sent to Cabarrus County Planning and Development Department, Attn: Kelly Sifford, P.O. Box 707, Concord, NC 28026. Any questions regarding the project should be directed to Daniel McClellan at 704-920-3301.

This project will be managed by a state Soil and Water Engineer and a preconstruction meeting will be held on site prior to work beginning. The Contractor is required to ensure that all employees have criminal background checks and pose no risk to the student population. Each person working on site must have a valid ID and check in and out in the front office through the Lobby Guard System daily. Must have the following insurance requirements:

Cabarrus County Minimum Insurance Coverage Requirements

Coverage	Low Risk Profile	Medium Risk Profile (County's Standard Requirement)	High Risk Profile	Specialty	Encroachment	Premises Lease
Commercial General Liability	\$1,000,000 Combined Single Limit (CSL) per occurrence for bodily injury and/or property damage	\$1,000,000/\$2,000,000 *	\$1,000,000/\$2,000,000 *	\$1,000,000*	\$1,000,000	\$1,000,000
Products/Completed Operation Explosion, Collapse & Underground (XCU)	As above	As above If any, limit To Be Determined	As above If any, TBD	As Above If any, TBD		
Automobile Liability (hired & non-owned or Any Auto on the COI)	\$1,000,000 CSL per occurrence	\$1,000,000*	\$1,000,000*	\$1,000,000*	n/a	n/a
**Workers' Compensation	Statutory	Statutory	Statutory	Statutory	n/a	Statutory
**Employers Liability	100/500/100	500/500/500 *	500/500/500*	500/500/500*	n/a	100/500/100
**Waiver of Subrogation on WC	Required if available	Required if available	Required	Required	n/a	n/a
Umbrella Liability	n/a	n/a	\$2,000,000+	\$9,000,000+	n/a	n/a
Professional Liability <i>may be required on a risk profile</i> depending on nature of services provided by contract. Coverage required for professional service such as accountant, attorney, architect, design, engineering and most consultants	\$1,000,000 per occurrence	\$1,000,000	TBD	TBD	n/a	n/a
Environmental/Pollution Liability required if demolition, use of hazardous materials or environmentally sensitive	n/a	\$1,000,000*	\$1,000,000+*	\$1,000,000+*	n/a	n/a
Fidelity Bond (loss of money or other property due to dishonest acts). Only for Contracts such as Banking, Janitorial, Fund Raising, TPA's and similar	TBD	Amount depends on exposure to loss	TBD	TBD	n/a	n/a
Other Coverage As Required	TBD	TBD	TBD	TBD	n/a	n/a
Bid, Performance & Payment Bonds	TBD	TBD	TBD	TBD	n/a	n/a

* A combination of Umbrella/Excess and primary limit may be used to provide coverage for the amount shown.
** **Workers Compensation is required if the contractor/vendor has employees.** Owner Waiver is acceptable for a Sole Proprietor, Partners or LLC that has no employees. Corporation owner/officers are employees under NC Workers' Compensation Act

	Low Risk Exposure	Standard Risk	High Risk Exposure	Specialty
Common Service for Risk Profile includes but is not necessarily limited to service shown.	Desk Top Publishing Mail Sorting Word Processing Copying Landscaping (minor, no trees, no electrical or excavation) Microfilm services Small low risk repair or service jobs (usually those jobs <30 days duration and <\$500) Tennis Instructor Yoga Instructor	Appliance Repair Asbestos Removal (small project) Carpentry Carpet Cleaners Concrete Work Drywall Contractor Excavation (minor) Fence Installation Fire Extinguisher Testing Fork Lift Repair Electrical Repair Elevator Maintenance HVAC Janitorial Landscaping (minor excavation) Medical/Psychology, Counseling, Etc. Painting Paving Contractors Parks & Recreation renovation Pest Control Plumbing Pool Cleaning Purchase of Goods or Service Refrigeration Roofing (1 story small project) Tree Maintenance Trade Contractors	Charters Excavation (large) Fireworks Displays Hi Tech equipment installation. Landscaping (major excavation, large equipment) Large Construction Painting above 1 story Road Contractor Roofing (large project) Power Lines Sewer Contractor Welding (large project)	Asbestos Removal Crane Service Demolition Environmental Hazard Heavy Construction Sensitive Equipment

Personal & Professional Service includes but is not necessarily limited to service shown.	Appraiser (Comm Dev) Disc Jockey Discussion Leader Proofreader Landscape Design (small project) Title Search Firm (Comm Dev)	Accountant Advertising Agencies Other Appraisers Architect (small project) Attorney Consultants (most projects) Designer (most projects) EAP Insurance Brokers Instructor (physical activity) Landscape Design (other) Lobbyists Programmers Researcher Temporary Services	Architect (large project) Consultants (large project) Medical Services	Project or contract determined to require higher limits
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Certificates of Insurance should include the following:

1. Cabarrus County
2. Contract must represent Cabarrus County which includes its officers, officials, agents and employees. If not then the Certificate must reflect its officers, officials, agents and employees as an additional insured
3. Disclose any self-insured retention (allowed only if pre-approved by County).
4. Designate the Cabarrus County Attn: Risk Management Department, PO Box 707, Concord, NC 28026 as certificate holder.
5. Provide that the County shall be notified by the agent or insurer. The vendor is responsible notifying the County of any cancellations.
6. Certificate should be forwarded directly from the insurance agent or insurance carrier
7. Contractors or vendors insurance shall be primary over any other insurance available to the County.
8. Contractors agent or insurer shall provide the County with the additional insured language. The additional insured endorsement form to be requested is CG20 10 11 85 (if not available please notify Risk Management)
-other acceptable forms CG2010 0704 and CG 2037 0704 combined

Contract insurance requirements must be met. Receipt of a non-compliant certificate, other documentation of insurance or policies by the County or any of its representatives does **NOT** constitute a waiver of the vendor/contractor's obligation to fulfill the insurance requirements of the County.

It is recognized that a purchase order for the routine procurement of goods may not explicitly state insurance requirements. However, departments should review each acquisition to identify potential risks that may require the imposition of insurance requirements. The County's failure to request or demand evidence of insurance shall not constitute a waiver of any insurance requirement.

Those parties who do not meet the minimum requirements for insurance coverage may ask for an exception through the User department. A

* A combination of Umbrella/Excess and primary limit may be used to provide coverage for the amount shown.

** Workers Compensation is required if the contractor/vendor has employees. Owner Waiver is acceptable for a Sole Proprietor, Partners or LLC that has no employees. Corporation owner/officers are employees under NC Workers' Compensation Act

certificate of insurance for the maximum limits of coverage that are carried by the vendor must be submitted to the Cabarrus County, Risk Manager along with a detailed explanation of services and/or products to be provided to the County by the vendor. The User Department should be prepared to answer the following questions when requesting an exception:

1. What activities will take place?
2. Who could be harmed?
3. What property could be damaged and how severely?
4. What is the maximum exposure (worst case scenario) for the activity?
5. What is the maximum likely loss for the activity?
6. Is there a possible pollution exposure?
7. Are crowds or bystanders/passersby likely to be involved?
8. Will inherently dangerous activities be involved?
9. How likely is the County to be a defendant in the event of a loss?
10. Are other contractors/vendors available to do the work that have the County minimum limits?
11. What are the cost of the work (bid, contract or PO price) and the duration of the work?
12. What is the cost to the vendor to increase coverage to the County's requirement?

The request will be reviewed by the County's Risk Manager for a determination as to whether an exception will be made. Failure to obtain an exception will eliminate the requesting party as a vendor.

Insurance requirements subject to change without notice.

Sealed Plans for the JM Robinson constructed wetland restoration

Please contact Daniel McClellan at
704-920-3303 with any questions.

Client: Jay Robinson HS
 County: Cabarrus
 Practice: Stormwater Wetland
 Calculated By: CMS
 Checked By: _____

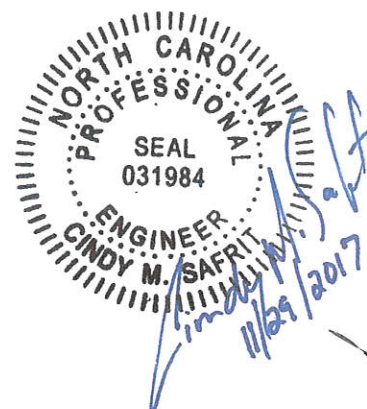
State: NC
 Date: 2/13/2017
 Date: _____

Farm Field Diverted

Drainage Area: 10 Acres (provided from RCN Calculator)
 Curve Number: 77 (provided from RCN Calculator)
 Watershed Length: 1000 Feet
 Watershed Slope: 4.71 Percent
 Time of Concentration: .267 Hours (calculated value)
 Rainfall Type: II

Storm Number	1	2	3	4	5	6	7
Frequency (yrs)	1	2	5	10	25	50	100
24-Hr rainfall (in)	2.87	3.47	4.35	5.05	6.00	6.75	7.53
Ia/P Ratio	0.21	0.17	0.14	0.12	0.10	0.09	0.08
Used	0.21	0.17	0.14	0.12	0.10	0.10	0.10
Runoff (in)	0.98	1.41	2.09	2.66	3.48	4.14	4.85
(ac-ft)	0.82	1.18	1.74	2.22	2.90	3.45	4.04
Unit Peak Discharge (cfs/acre/in)	1.024	1.053	1.081	1.096	1.111	1.111	1.111
Peak Discharge (cfs)	10	15	23	29	39	46	54

Warning: - RCN data inconsistent or different from Basic data.



Curve number Computation

Client: Jay Robinson HS
 County: Cabarrus State: NC
 Practice: Stormwater Wetland
 Calculated By: CMS Date: 2/13/2017
 Checked By: _____ Date: _____

COVER DESCRIPTION	Acres (CN)			
	Hydrologic Soil Group			
	A	B	C	D
FULLY DEVELOPED URBAN AREAS (Veg Estab.)				
Streets and roads	-	-	0.33(92)	-
Paved; open ditches (w/right-of-way)	-	-	-	.55(89)
Dirt (w/ right-of-way)	-	-	-	-
OTHER AGRICULTURAL LANDS				
Brush - brush, weed, grass mix fair	-	-	-	7.51(77)
Woods good	-	-	1.8(70)	-
Total Area (by Hydrologic Soil Group)			2.13	8.06
TOTAL DRAINAGE AREA: 10.19 Acres			WEIGHTED CURVE NUMBER: 77	



Weir Flow Formula Solution

Participant: Jay M. Robinson HS
Location: Pitts School Road
County: County, North Carolina
Designer: CMS
Date: 11/29/2017

Checker: _____
Date: _____

Hydraulics Formula, Version 2.2.1

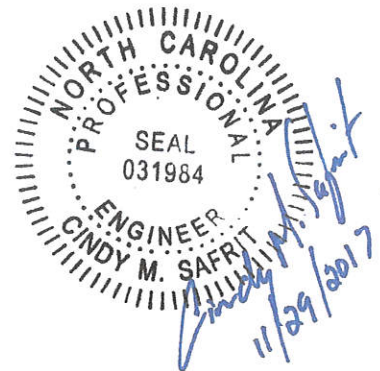
Weirs 10 acres Drainage

Weir Coefficient (C): 3.1

Length of Weir: 10 in.

Head on Weir: 1 ft.

Weir Capacity: 31.00 cfs $\rightarrow$ 10 year storm



Weir Flow Formula Solution

Participant: Jay M. Robinson HS
Location: Pitts School Road
County: County, North Carolina
Designer: CMS
Date: 11/29/2017

Checker: _____
Date: _____

Hydraulics Formula, Version 2.2.1

Weirs 10 acres Drainage

Weir Coefficient (C): 3.1
Length of Weir: 10 in.
Head on Weir: 1.5 ft.

Weir Capacity: 56.95 cfs - over 100 year storm
with 0.5ft freeboard
remaining.



Client: Jay Robinson HS
 County: Cabarrus
 Practice: Stormwater Wetland
 Calculated By: CMS
 Checked By: _____

State: NC

Date: 2/13/2017

Date: _____

*Diverted Area
 flow for diversion
 and trap channel*

Drainage Area: 16 Acres (provided from RCN Calculator)
 Curve Number: 74 (provided from RCN Calculator)
 Watershed Length: 1000 Feet
 Watershed Slope: 4.71 Percent
 Time of Concentration: 0.29 Hours (calculated value)
 Rainfall Type: II

Storm Number	1	2	3	4	5	6	7
Frequency (yrs)	1	2	5	10	25	50	100
24-Hr rainfall (in)	2.87	3.47	4.35	5.05	6.00	6.75	7.53
Ia/P Ratio	0.24	0.20	0.16	0.14	0.12	0.10	0.09
Used	0.24	0.20	0.16	0.14	0.12	0.10	0.10
Runoff (in)	0.83	1.22	1.86	2.40	3.18	3.82	4.51
(ac-ft)	1.11	1.63	2.48	3.20	4.24	5.09	6.01
Unit Peak Discharge (cfs/acre/in)	0.954	0.988	1.021	1.039	1.056	1.067	1.070
Peak Discharge (cfs)	13	19	30	40	54	65	77

Warning: - RCN data inconsistent or different from Basic data.

Curve number Computation

Client: Jay Robinson HS
 County: Cabarrus State: NC
 Practice: Stormwater Wetland
 Calculated By: CMS Date: 2/13/2017
 Checked By: _____ Date: _____

COVER DESCRIPTION	Acres (CN)			
	Hydrologic Soil Group			
	A	B	C	D
OTHER AGRICULTURAL LANDS				
Pasture, grassland or range good	-	-	14.78(74)	-
Woods good	-	-	0.97(70)	-
Total Area (by Hydrologic Soil Group)			15.75	
TOTAL DRAINAGE AREA: 15.75 Acres			WEIGHTED CURVE NUMBER: 74	

Client: Jay Robinson HS
 County: Cabarrus
 Practice: Stormwater Wetland
 Calculated By: CMS
 Checked By: _____

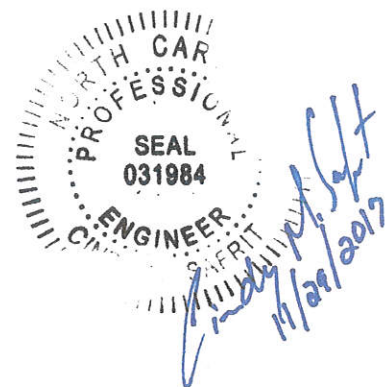
State: NC
 Date: 2/13/2017
 Date: _____

*With out
farm field
diverted*

Drainage Area: 26 Acres (provided from RCN Calculator)
 Curve Number: 75 (provided from RCN Calculator)
 Watershed Length: 1000 Feet
 Watershed Slope: 4.71 Percent
 Time of Concentration: .283 Hours (calculated value)
 Rainfall Type: II

Storm Number	1	2	3	4	5	6	7
Frequency (yrs)	1	2	5	10	25	50	100
24-Hr rainfall (in)	2.87	3.47	4.35	5.05	6.00	6.75	7.53
Ia/P Ratio	0.23	0.19	0.15	0.13	0.11	0.10	0.09
Used	0.23	0.19	0.15	0.13	0.11	0.10	0.10
Runoff (in)	0.88	1.28	1.93	2.49	3.28	3.93	4.62
(ac-ft)	1.91	2.77	4.18	5.40	7.11	8.52	10.01
Unit Peak Discharge (cfs/acre/in)	0.977	1.009	1.040	1.058	1.074	1.083	1.083
Peak Discharge (cfs)	22	34	52	68	92	111	130

Warning: - RCN data inconsistent or different from Basic data.



Curve number Computation

Client: Jay Robinson HS
 County: Cabarrus State: NC
 Practice: Stormwater Wetland
 Calculated By: CMS Date: 2/13/2017
 Checked By: _____ Date: _____

COVER DESCRIPTION	Acres (CN)			
	Hydrologic Soil Group			
	A	B	C	D
FULLY DEVELOPED URBAN AREAS (Veg Estab.)				
Streets and roads	-	-	0.33(92)	-
Paved; open ditches (w/right-of-way)	-	-	-	.55(89)
Dirt (w/ right-of-way)	-	-	-	-
OTHER AGRICULTURAL LANDS				
Pasture, grassland or range good	-	-	14.78(74)	-
Brush - brush, weed, grass mix fair	-	-	-	7.51(77)
Woods good	-	-	2.77(70)	-
Total Area (by Hydrologic Soil Group)			17.88	8.06
TOTAL DRAINAGE AREA: 25.94 Acres		WEIGHTED CURVE NUMBER: 75		



Handwritten signature and date:
 Andy M. Saff
 11/29/2017

Trapezoidal Channel Section

Participant: Jay M. Robinson HS
Location: Pitts School Road
County: County, North Carolina
Designer: CMS
Date: 11/29/2017

Checker: _____
Date: _____

Hydraulics Formula, Version 2.2.1

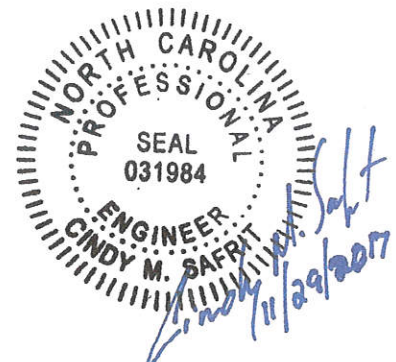
Diversion

Slope: 0.029 ft/ft
'n' value: 0.04

Hydraulic Radius: 0.55
Area: 6.97 sq ft
Velocity: 4.22 ft/sec
Capacity: 29.44 cfs
10 yr storm

Sideslope: 2:1
Bottom Width: 10 ft
Depth of Flow: .62 ft. + 0.3 Ft freeboard = 0.92 Ft or
Width @ surface 12 ft

1 ft from Flow to
Berm.



Trapezoidal Channel Section

Participant: Jay M. Robinson HS
Location: Pitts School Road
County: County, North Carolina
Designer: CMS
Date: 11/29/2017

Checker: _____
Date: _____

Hydraulics Formula, Version 2.2.1

Class 1 12" Rip Rap Channel

Slope: .1 ft/ft
'n' value: 0.078 → Class 1 rip rap
12" dia

Hydraulic Radius: 0.54
Area: 7.49 sq ft
Velocity: 3.97 ft/sec
Capacity: 29.76 cfs

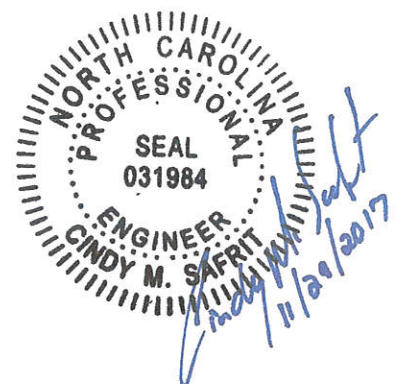
Sideslope: 3:1
Bottom Width: 10 ft
Depth of Flow: .63 ft.
Width @ surface 14 ft

✓ shear stress

$$62.4 \times .1 \times 0.63 = 3.9 \text{ lb/ft}^2$$

$$\text{Permissible Shear Stress} = 4 \text{ lb/ft}^2$$

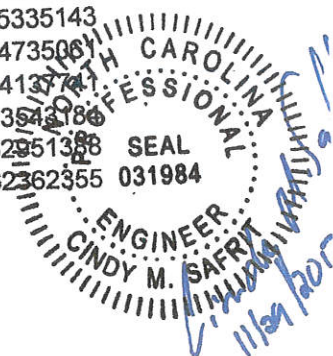
$$\text{minimum thickness} = 18"$$



Check of drawdown time

2" PVC

Time (min)	Height T	Q	Change in Volume	Change in Height	New Height
0	0.83	0.095629024	86.0661217	0.04802797	0.95197203
15	0.951972	0.014422636	12.98037273	0.007243512	0.94472852
30	0.944729	0.014367661	12.9308949	0.007215901	0.93751262
45	0.937513	0.014312685	12.88141671	0.007188291	0.93032433
60	0.930324	0.014257709	12.83193815	0.00716068	0.92316365
75	0.923164	0.014202732	12.78245923	0.007133069	0.91603058
90	0.916031	0.014147755	12.73297993	0.007105458	0.90892512
105	0.908925	0.014092778	12.68350026	0.007077846	0.90184727
120	0.901847	0.0140378	12.63402022	0.007050234	0.89479704
135	0.894797	0.013982822	12.5845398	0.007022623	0.88777442
150	0.887774	0.013927843	12.53505899	0.006995011	0.88077941
165	0.880779	0.013872864	12.4855778	0.006967398	0.87381201
180	0.873812	0.013817885	12.43609622	0.006939786	0.86687222
195	0.866872	0.013762905	12.38661424	0.006912173	0.85996005
210	0.85996	0.013707924	12.33713188	0.00688456	0.85307549
225	0.853075	0.013652943	12.28764911	0.006856947	0.84621854
240	0.846219	0.013597962	12.23816594	0.006829334	0.83938921
255	0.839389	0.01354298	12.18868237	0.00680172	0.83258749
270	0.832587	0.013487998	12.13919839	0.006774106	0.82581338
285	0.825813	0.013433016	12.089714	0.006746492	0.81906689
300	0.819067	0.013378032	12.0402292	0.006718878	0.81234801
315	0.812348	0.013323049	11.99074398	0.006691263	0.80565675
330	0.805657	0.013268065	11.94125833	0.006663649	0.7989931
345	0.798993	0.01321308	11.89177226	0.006636034	0.79235707
360	0.792357	0.013158095	11.84228576	0.006608418	0.78574865
375	0.785749	0.01310311	11.79279884	0.006580803	0.77916785
390	0.779168	0.013048124	11.74331147	0.006553187	0.77261466
405	0.772615	0.012993137	11.69382367	0.006525571	0.76608909
420	0.766089	0.01293815	11.64433542	0.006497955	0.75959113
435	0.759591	0.012883163	11.59484672	0.006470339	0.75312079
450	0.753121	0.012828175	11.54535758	0.006442722	0.74667807
465	0.746678	0.012773187	11.49586798	0.006415105	0.74026297
480	0.740263	0.012718198	11.44637792	0.006387488	0.73387548
495	0.733875	0.012663208	11.3968874	0.00635987	0.72751561
510	0.727516	0.012608218	11.34739641	0.006332252	0.72118336
525	0.721183	0.012553228	11.29790495	0.006304634	0.71487872
540	0.714879	0.012498237	11.24841302	0.006277016	0.70860171
555	0.708602	0.012443245	11.1989206	0.006249398	0.70235231
570	0.702352	0.012388253	11.14942771	0.006221779	0.69613053
585	0.696131	0.01233326	11.09993432	0.00619416	0.68993637
600	0.689936	0.012278267	11.05044045	0.00616654	0.68376983
615	0.68377	0.012223273	11.00094608	0.006138921	0.67763091
630	0.677631	0.012168279	10.9514512	0.006111301	0.67151961
645	0.67152	0.012113284	10.90195582	0.006083681	0.66543593
660	0.665436	0.012058289	10.85245994	0.00605606	0.65937987
675	0.65938	0.012003293	10.80296353	0.006028439	0.65335143
690	0.653351	0.011948296	10.75346661	0.006000818	0.64735061
705	0.647351	0.011893299	10.70396916	0.005973197	0.64137741
720	0.641377	0.011838301	10.65447119	0.005945575	0.63542184
735	0.635432	0.011783303	10.60497267	0.005917954	0.62951388
750	0.629514	0.011728304	10.55547362	0.005890331	0.62362355



765	0.623624	0.011673304	10.50597403	0.005862709	0.61776084
780	0.617761	0.011618304	10.45647389	0.005835086	0.61192576
795	0.611926	0.011563304	10.40697319	0.005807463	0.60611829
810	0.606118	0.011508302	10.35747193	0.005779839	0.60033845
825	0.600338	0.0114533	10.30797011	0.005752215	0.59458624
840	0.594586	0.011398297	10.25846771	0.005724591	0.58886165
855	0.588862	0.011343294	10.20896474	0.005696967	0.58316468
870	0.583165	0.01128829	10.15946119	0.005669342	0.57749534
885	0.577495	0.011233286	10.10995705	0.005641717	0.57185362
900	0.571854	0.01117828	10.06045231	0.005614092	0.56623953
915	0.56624	0.011123274	10.01094698	0.005586466	0.56065306
930	0.560653	0.011068268	9.961441043	0.00555884	0.55509422
945	0.555094	0.011013261	9.911934493	0.005531213	0.54956301
960	0.549563	0.010958253	9.862427325	0.005503587	0.54405942
975	0.544059	0.010903244	9.812919534	0.00547596	0.53858346
990	0.538583	0.010848235	9.763411113	0.005448332	0.53313513
1005	0.533135	0.010793225	9.713902055	0.005420704	0.52771443
1020	0.527714	0.010738214	9.664392354	0.005393076	0.52232135
1035	0.522321	0.010683202	9.614882003	0.005365448	0.5169559
1050	0.516956	0.01062819	9.565370996	0.005337819	0.51161809
1065	0.511618	0.010573177	9.515859326	0.005310189	0.5063079
1080	0.506308	0.010518163	9.466346985	0.00528256	0.50102534
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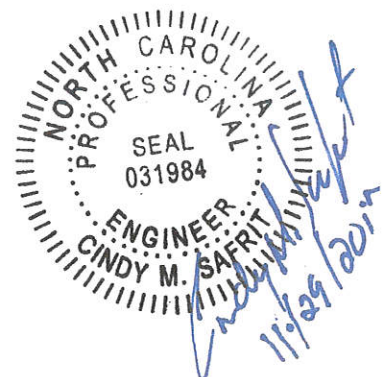


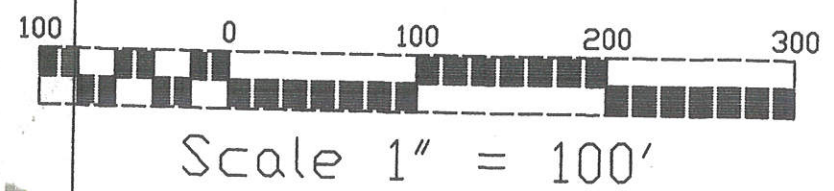
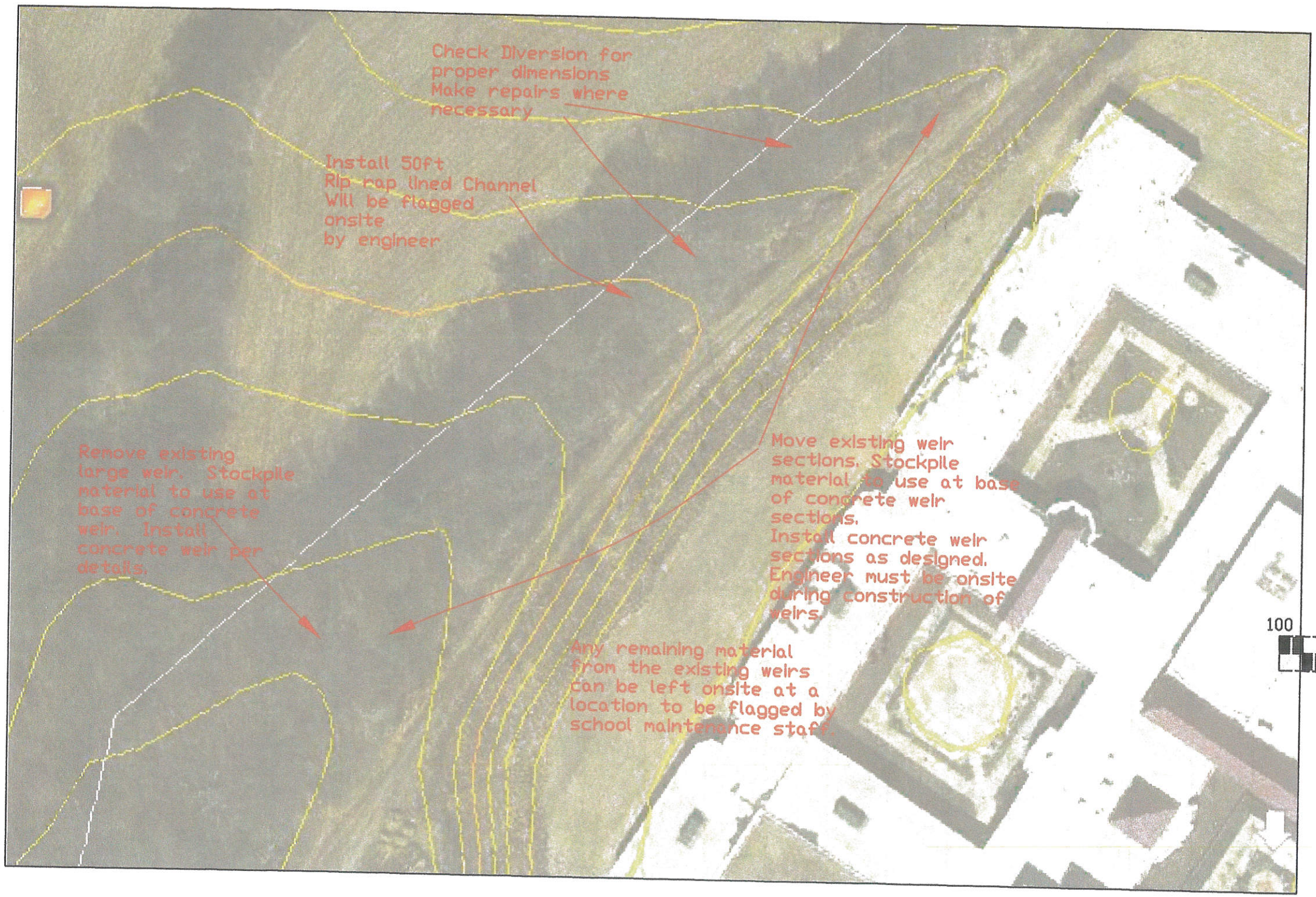
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✓
Drawdown
≈ 48 hours





PROFESSIONAL SEAL
NORTH CAROLINA
031984
ENGINEER
CINDY M. SAFRIT
Cindy M. Safrt
11/29/2017



STATE OF NORTH CAROLINA
DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES
DIVISION OF SOIL AND WATER CONSERVATION
Western Piedmont Technical Services
P.O. Box 845, Mocksville, NC 27028
PHONE: 704-754-0566

Jay M. Robinson HS
Site Plan
Cabarrus County, North Carolina

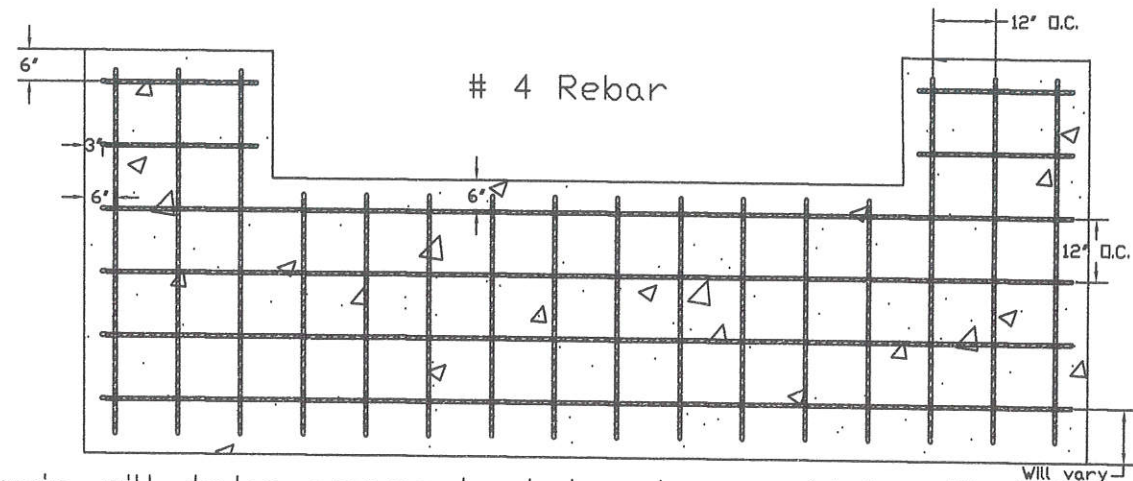
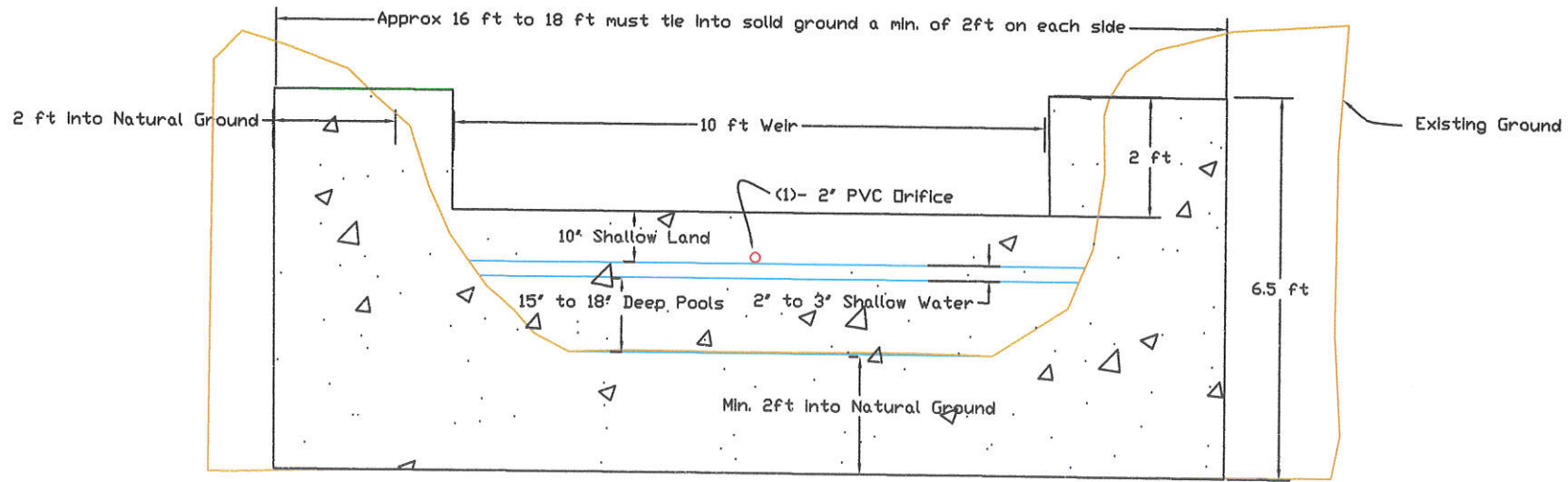
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PROJECT #:	SCALE: NTS
DRAWN BY: CM Safrt	DATE: 2/13/2017
CHECKED BY:	DATE:
SHEET NO. 1 OF 4	FILENAME: Robinson

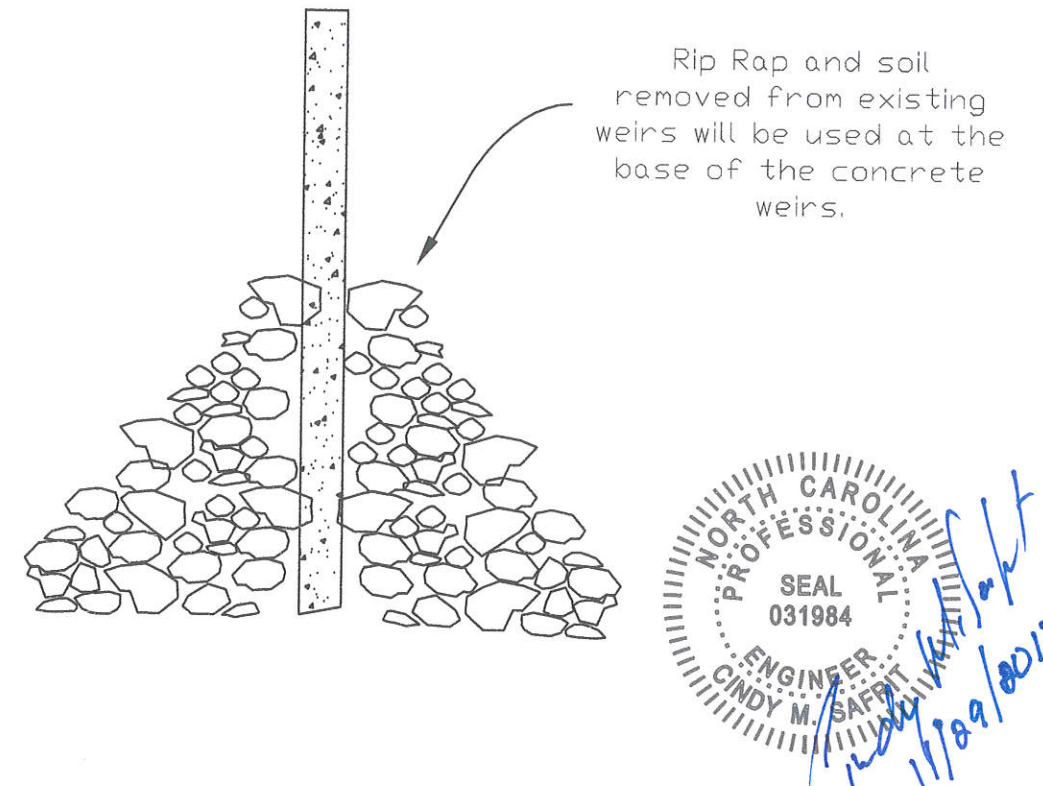
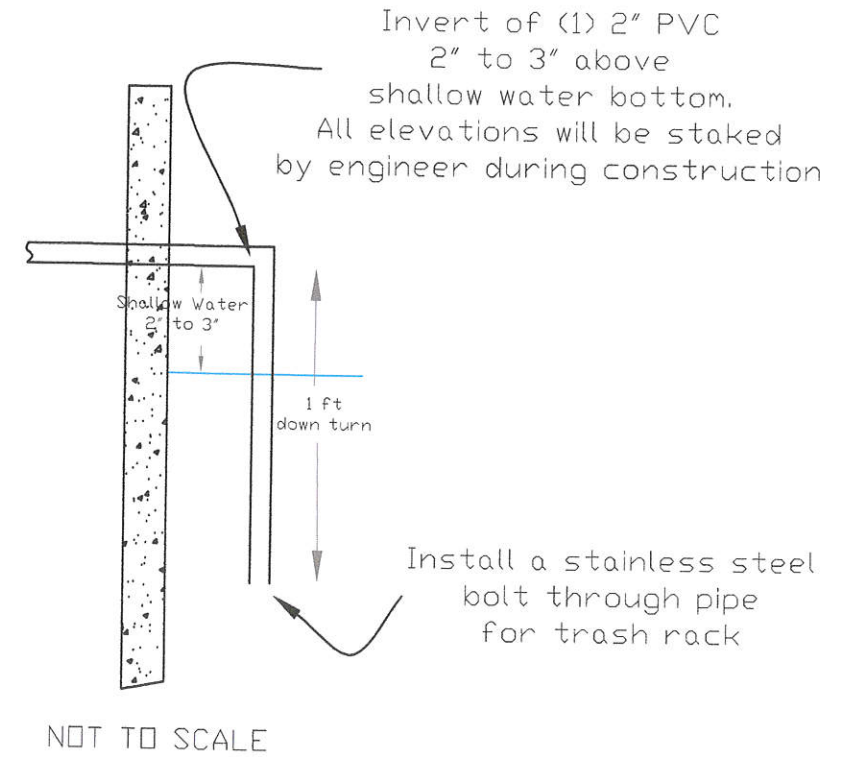
Concrete Weir Section

10 ft weir can be flashboard or concrete
Approximate dimensions 16' - 18' long x 6.5' high x 8" thick
11 weir sections of approximately this size to be installed
All weirs will be slightly different and may require a little
less or a little more material.

1 large weir at end to be replaced approximately
30' long x 8' high x 8" thick



Each weir will take approximately	Large Weir will take approximately
(4) - 15 1/2 to 18 ft	(6) - 30 ft
(6) - 5 to 6 ft	(12) - 8 ft
(10) - 3 1/2 to 4 1/2 ft	(10) - 6 ft
(4) - 2 1/2 to 4 1/2 ft	(4) - 8 ft
2.4 cu yds of 4000 psi concrete	9.5 cu yds of 4000 psi concrete



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Jay M. Robinson HS
Concrete Weir Detail
Cabarrus County, North Carolina

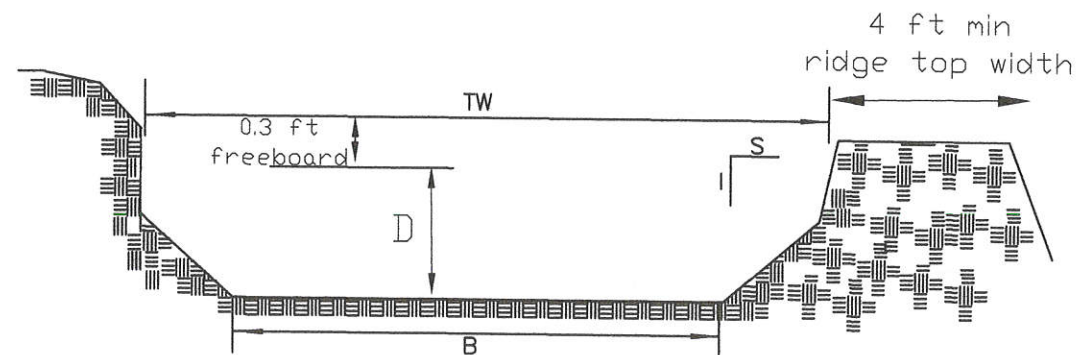
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PROJECT #:	SCALE: NTS
DRAWN BY: CM Safr-it	DATE: 2/13/2017
CHECKED BY:	DATE:
SHEET NO. 2 OF 4	FILENAME: Robins

NORTH CAROLINA
 PROFESSIONAL
 SEAL
 031984
 ENGINEER
 CINDY M. SAFFERT

Cindy M. Saffert
 1/18/09

TYPICAL DIVERSION CHANNEL CROSS SECTION

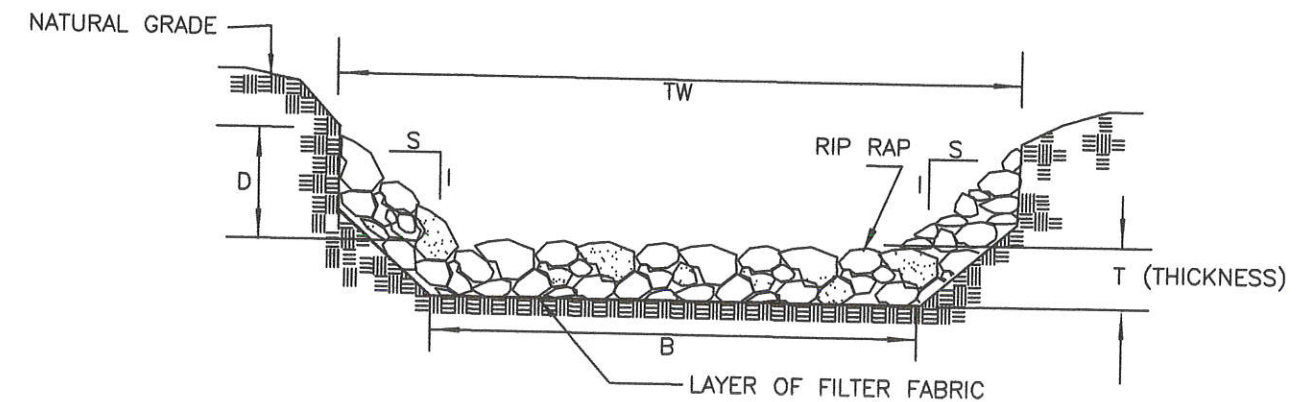


Diversion	B Bottom Width	S Side Slopes	Liner	Approximate Length
Diversion 1	10 ft	2 : 1	N/A	100 ft of repair

Diversion	V Velocity estab. veg	Capacity	TW Top Width	D Depth of Flow	D Overall
Diversion 1	4.22 ft/sec	29.44 ft/sec	14 ft	0.63'	0.63' depth + 0.3' freeboard = 0.92 ft

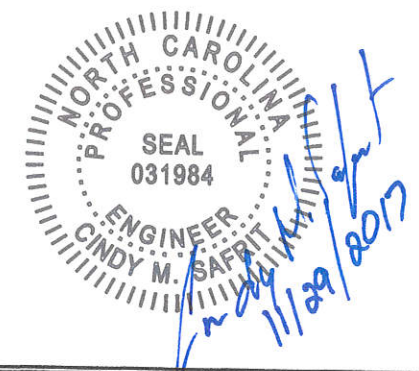
Diversion is existing.
There are a few places that need
maintenance. Check depth and
berm, repair as needed.
Seed and tack mulch in disturbed areas.

TYPICAL RIP RAP LINED CHANNEL CROSS SECTION



Channel	B Bottom Width	S1 Side Slopes	D Depth	Liner	Class 1 Rip Rap & Geotextile
Channel 1	10'	3:1	0.63' flow 1 ft min overall depth	Class 1 Rip Rap 12" diameter	45 cu yds 135 sq yds

Channel	T Stone Thickness	TW Top Width	Velocity 10 yr	Capacity	Length
Channel 1	18"	16'	3.97 ft/sec	29.76 cfs	50'



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Jay M. Robinson HS
Construction Detail
Cabarrus County, North Carolina

REVISIONS			
NO.	BY	DATE	DESCRIPTION
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PROJECT #:	SCALE: NTS
DRAWN BY: CM Safrit	DATE: 2/13/2017
CHECKED BY:	DATE:
SHEET NO. 3 OF 4	FILENAME: Robinson

SHALLOW WATER PLANTS

Common Name	Scientific Name	Comments
Arrow Arum	Peltandra virginica	Elegant arrowhead shaped leaves and interesting green flowers on a clump forming plant.
Pickereelweed	Pontederia cordata	Upright plant producing numerous 3' tall spikes topped with blue flowers all summer. Tough and attractive.
Lizard's Tail	Saururus cernuus	Spreading perennial that will grow in shallow standing water and wet soils. Pendant spikes of white flowers in late spring and summer.
Duck Potato	Sagittaria latifolia	Tough emergent aquatic with arrowhead shaped leaves and spikes of white flowers produced throughout summer. Reproduces rapidly.
Soft Rush	Juncus effusus	Common rush found throughout NC. 2'-3' tall with dark green spiky foliage. Green flowers are to brown seed pods throughout summer. Near evergreen.
Woolgrass	Scirpus cyperinus	Large 3' - 4' tall and wide clumps forming bulrush producing wooly green flower heads in summer that age to an attractive rusty brown as seed mature

DROUGHT TOLERANT PLANTS

Common Name	Scientific Name	Comments
Soft Rush	Juncus effusus	Perennial
Joe Pye Weed	Hibiscus moscheutos	Perennial
Rose Mallow	Hibiscus moscheutos	Perennial
Iron weed	Vernonia novaboracensis	Perennial
Blue Flag Iris	Iris virginica	Perennial
Blue Star	Amsonia tabernaemontana	Shrub
Buttonbush	Cephalanthus occidentalis	Shrub
Virginia Willow	Itea virginica	Shrub
Possumhaw	Viburnum nudum	Shrub
Winterberry	Ilex verticillata	Shrub
Green Hawthorn	Crataegus viridis	Small Tree
Possumhaw	Ilex decidua	Small Tree
Sweet Bay	Magnolia virginiana	Small Tree
River Birch	Betula nigra	Tree
Bald Cypress	Taxodium distichum	Tree

DEEP WATER PLANTS

Common Name	Scientific Name	Comments
American Lotus	Nelumbo lutea	Bold Plant with foliage and flower stems standing 4' - 6' above water's surface. Large, showy yellow flowers produced throughout summer.
Spatterdock - Cow Lily	Nuphar luteum	Heart shaped leaves float on water's surface, 1' - 2' wide, globe shaped, yellow flowers are born throughout summer.
Fragrant Water Lily	Nymphaea odorata	Rounded, heart shaped leaves float on water's surface. Large, white, sweetly fragrant flowers open throughout summer.

Perennial

* It should be noted that if the water level in the wetland is not consistent and normally drains in between rain events, the deep water plants should be avoided.

UPLAND WATER PLANTS

Common Name	Scientific Name	Comments
Swamp Milkweed	Asclepias incarnata	Pink flower in early summer. Larval food of monarch butterflies
Joe Pye Weed	Eupatorium fistulosum	Masses of rosy-mauve flowers in late summer-fall attract butterflies.
Swamp Sunflower	Helianthus angustifolius	Towers of 3' wide golden sunflowers in fall-attracts butterflies.
Red Star Hibiscus	Hibiscus coccineus	Tough, clump forming, sturdy plant with star shaped red flowers in summer.
Rose Mallow	Hibiscus moscheutos	Tough, durable plants with huge white, pink or rose flowers in summer.
Cardinal Flower	Lobelia cardinalis	Tall spikes of crimson red flowers in late summer and fall- attracts hummingbirds and butterflies.
Soft Rush	Juncus effusus	Common rush found throughout NC. 2' tall with dark green spiky foliage. Green flowers are to brown seed pods throughout summer.

SEAL
031984
ENGINEER
CINDY M. SAFRIT
11/29/2017



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Jay M. Robinson HS
Plant List
Cabarrus County, North Carolina

REVISIONS			
NO.	BY	DATE	DESCRIPTION
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PROJECT #:	SCALE: NTS
DRAWN BY: CM Safrut	DATE: 2/13/2017
CHECKED BY:	DATE:
SHEET NO. 4 OF 4	FILENAME: Robinson