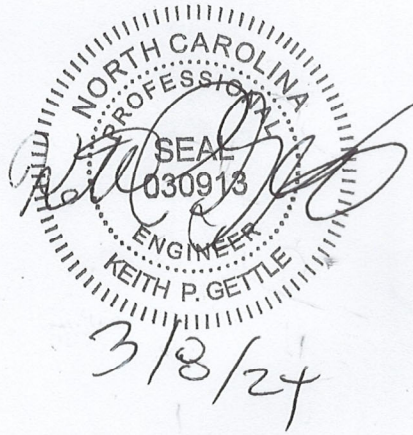
StorageMax
901 Proctor

Zebulon, NC
Wake County

EROSION CONTROL CALCULATIONS

July 1, 2023
Revised: January 17, 2024
Revised: March 8, 2024



Prepared for:

Robert High Development, LLC
324 Greenville Ave.
Wilmington, NC 28403

StorageMax
Erosion Control

Project Name:	**StorageMax**
Project Address:	**901 Proctor Ave. Zebulon, NC**
Pins:	**2706217463**
Latitude: **Longitude:**	**35.840297** **-78.315683**
Zoning:	**Heavy Commercial (HC)**
River Basin:	**Neuse**
Watershed:	**Moccasin Creek**
HUC:	**03020203**
Developer:	**Robert High Development, LLC 324 Greenville Ave. Wilmington, NC 28403**
Telephone:	**(919) 604-0505**
Email:	**Storit@AOL.com**

Site Description

The project consists of a single parcel located at the intersection of Proctor Avenue and Shepard School Road near downtown Zebulon. The lot is approximately 6.40 acres (278,836 sq feet). The parcel is vacant with grassy vegetation and wooded area along the property lines. There is 0 sq ft of existing impervious area on the site. The project will consist of commercial buildings and the impervious area will be 3.64 acres, or approximately 56% of the gross site.

Road widening along Shepard School Road is included with the project as a requirement of the Town of Zebulon and the impervious area is approximately 0.40 acres. The BMP design accounts for the impervious area within the right of way.

Erosion Control

Analysis for the skimmer basins used the NCDEQ Tool to size the skimmer and sediment basins.

Total disturbance is approximately 5.93 acres on site and 0.64 acres in the Shepard School Road right-of way.

The site does not have an area of wetlands and is not located within a flood zone as noted per FEMA map 3720270600K, Dated July 19, 2022. However, there is an intermittent stream located along the Southeast portion of the site and an offsite pond on an adjacent north parcel. No grading activities or disturbance is planned within the buffers.

STORAGE MAX APRON DESIGN

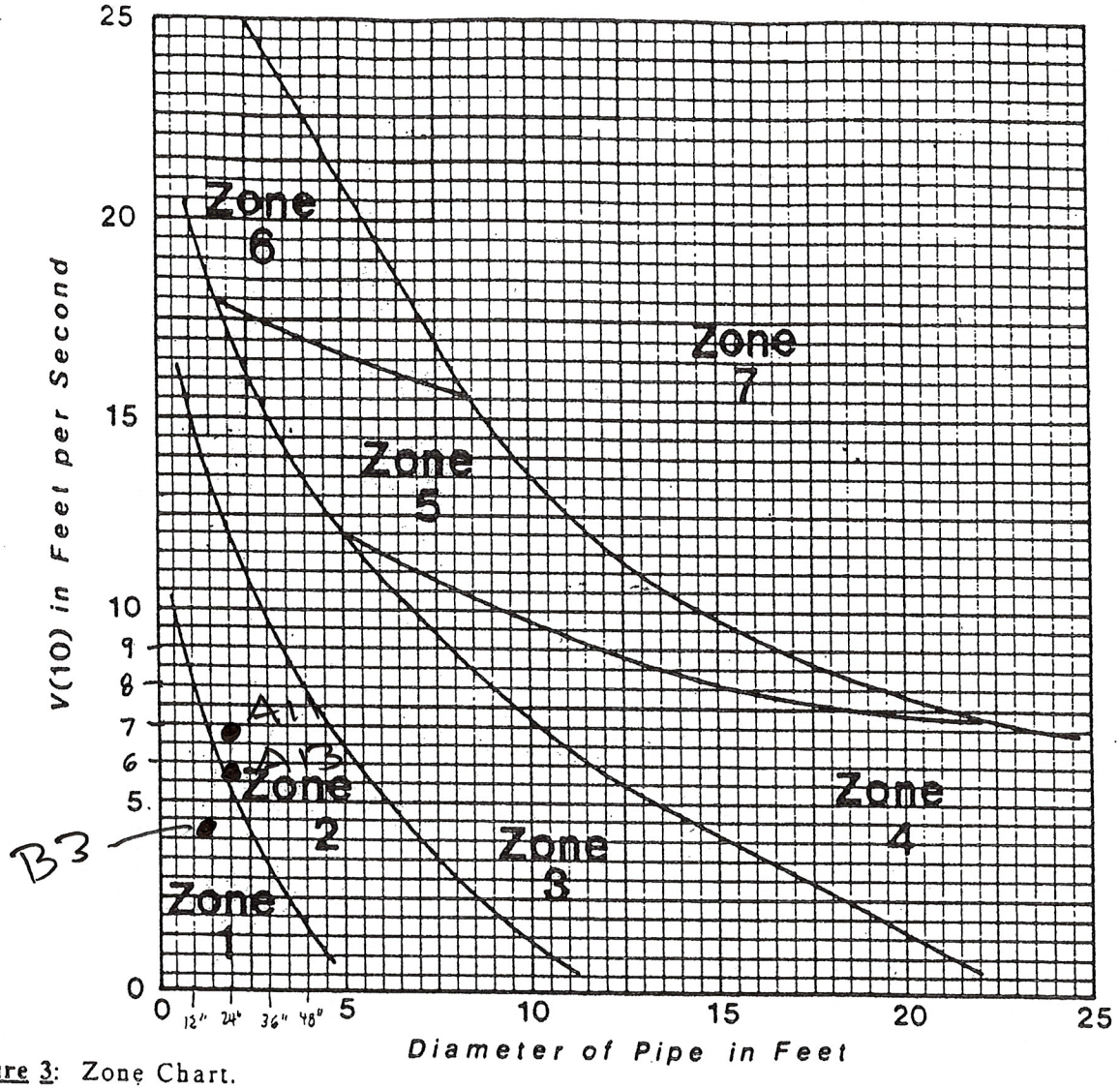


Figure 3: Zone Chart.

ZONE	APRON MATERIAL	CLASS OF STONE	SIZE OF STONE	LENGTH OF APRON	MINIMUM THICKNESS OF STONE
1	STONE	FINE	3"	4 X D	9"
2	STONE	LIGHT	6"	6 X D	12"
3	STONE	MEDIUM	13"	8 X D	18"
4	STONE	HEAVY	23"	8 X D	30"
5	STONE	HEAVY	23"	10 X D	30"
6	STONE	HEAVY	23"	12 X D	30"
7	REQUIRES LARGER STONE OR ANOTHER TYPE OF DEVICE, SUCH AS A STILLING BASIN, IMPACT STRUCTURE, ETC. DESIGN IS BEYOND THE SCOPE OF THIS PROCEDURE.				

Figure 4: Apron Dimensions

CHART 2: Precalculated Apron Sizes for Maximum TW Conditions

Apron Sizing Based on NCDENR Charts for Sizing

ZONE 1 APRONS - Class A Erosion Control Stone

Pipe Diameter	Inlet			Outlet		
	L	W	T	L	W	T
inch	ft	ft	inch	ft	ft	inch
12	3	3	12	4	3	12
15	3.75	3.75	12	5	3.75	12
18	4.5	4.5	12	6	4.5	12
24	6	6	12	8	6	12
30	7.5	7.5	12	10	7.5	12
36	9	9	12	12	9	12
42	10.5	10.5	12	14	10.5	12
48	12	12	12	16	12	12
54	13.5	13.5	12	18	13.5	12
60	15	15	12	20	15	12

B3

ZONE 2 APRONS - Class B Erosion Control Stone

Pipe Diameter	Inlet			Outlet		
	L	W	T	L	W	T
inch	ft	ft	inch	ft	ft	inch
12	3	3	18	6	3.4	18
15	3.75	3.75	18	7.5	4.25	18
18	4.5	4.5	18	9	5.1	18
24	6	6	18	12	6.8	18
30	7.5	7.5	18	15	8.5	18
36	9	9	18	18	10.2	18
42	10.5	10.5	18	21	11.9	18
48	12	12	18	24	13.6	18
54	13.5	13.5	18	27	15.3	18
60	15	15	18	30	17	18

A13

A11

ZONE 3/4 APRONS - Class 1 Rip Rap

Pipe Diameter	Inlet			Outlet		
	L	W	T	L	W	T
inch	ft	ft	inch	ft	ft	inch
12	4	3	24	8	4.2	24
15	5	3.75	24	10	5.25	24
18	6	4.5	24	12	6.3	24
24	8	6	24	16	8.4	24
30	10	7.5	24	20	10.5	24
36	12	9	24	24	12.6	24
42	14	10.5	24	28	14.7	24
48	16	12	24	32	16.8	24
54	18	13.5	24	36	18.9	24
60	20	15	24	40	21	24

ZONE 5 APRONS - Class 2 Rip Rap

Pipe Diameter	Inlet			Outlet		
	L	W	T	L	W	T
inch	ft	ft	inch	ft	ft	inch
12	5	3	36	10	5	36
15	6.25	3.75	36	12.5	6.25	36
18	7.5	4.5	36	15	7.5	36
24	10	6	36	20	10	36
30	12.5	7.5	36	25	12.5	36
36	15	9	36	30	15	36
42	17.5	10.5	36	35	17.5	36
48	20	12	36	40	20	36
54	22.5	13.5	36	45	22.5	36
60	25	15	36	50	25	36

A11 APRON DESIGN

Line	Pipe Size	Q	Inv Elev Dn	HGL Dn	Depth Dn	Area Dn	Veloc Dn	Vel Hd Dn	EGL Dn	Line Length	Inv Elev Up	HGL Up	Depth Up	Area Up	Veloc Up	Vel Hd Up	EGL Up	Sf Dn	Sf Up	Sf Ave
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/ s)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/ s)	(ft)	(ft)	(%)	(%)	(%)
1	24	16.51	311.00	312.46	1.46	2.46	6.70	0.70	313.16	90.000	311.51	313.15	1.64	2.75	5.99	0.56	313.71	0.679	0.534	0.606
2	24	11.75	311.61	313.71	2.00	3.14	3.74	0.22	313.92	57.000	311.90	313.85	1.95	3.12	3.77	0.22	314.07	0.270	0.239	0.255
3	24	9.17	312.00	314.18	0.00	0.00	2.92	0.00	314.18	161.000	312.86	314.40	0.00**	0.00	3.53	0.00	314.40	0.000	0.000	0.000
4	18	6.22	312.96	314.50	0.00	0.00	3.52	0.00	314.50	184.000	313.88	315.09	0.00**	0.00	4.08	0.00	315.09	0.000	0.000	0.000
5	18	3.57	313.98	315.24	0.00	0.00	2.25	0.00	315.24	103.000	314.50	315.35	0.00**	0.00	3.46	0.00	315.35	0.000	0.000	0.000
6	15	3.06	314.60	315.63	0.00	0.00	2.84	0.00	315.63	18.000	314.70	315.65	0.00**	0.00	3.06	0.00	315.65	0.000	0.000	0.000
7	12	1.04	314.80	315.85	0.00	0.00	1.32	0.00	315.85	122.000	315.41	315.98	0.00**	0.00	2.25	0.00	315.98	0.000	0.000	0.000
8	24	5.30	311.61	313.71	0.00	0.00	1.69	0.00	313.71	18.000	311.71	313.71	0.00**	0.00	1.69	0.00	313.71	0.000	0.000	0.000
9	24	4.36	311.81	313.74	0.00	0.00	1.40	0.00	313.74	76.000	312.19	312.92	0.00**	0.00	4.18	0.00	312.92	0.000	0.000	0.000
10	18	2.55	312.29	312.92	0.00	0.00	3.61	0.00	312.92	95.000	312.70	313.33	0.00**	0.00	3.62	0.00	313.33	0.000	0.000	0.000

Notes: ** Critical depth.

Line	Energy Loss	JLC Coeff	Minor Loss	Line ID
	(ft)	(K)	(ft)	
1	0.546	1.00	0.56	A10-A11
2	0.145	1.50	0.33	A6-A10
3	0.000	0.50	n/a	A5-A6
4	0.000	0.59	n/a	A4-A5
5	0.000	1.50	n/a	A3-A4
6	0.000	1.35	n/a	A2-A3
7	0.000	1.00	n/a	A1-A2
8	0.000	0.70	n/a	A9-A10
9	0.000	0.82	n/a	A8-A9
10	0.000	1.00	n/a	A7-A8

A 13

ARRON DESIGN

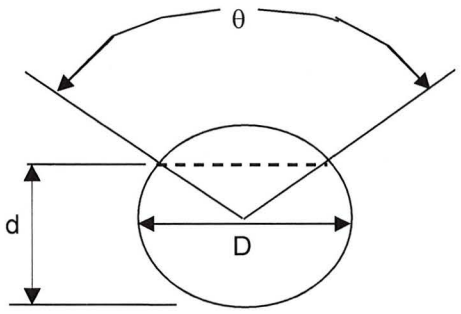
MANNING'S EQUATION FOR PIPE FLOW

Project: Zebulon StorageMax Location: BMP Outlet

By: Date:

Chk. By: Date: mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	24	inches
d=	22	inches
n=	0.013	mannings coeff
θ=	67.1	degrees
S=	0.005	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
3.02	5.11	0.59	5.69	17.15

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

Created by: Mike O'Shea

B3 ARRON DESIGN

Line	Pipe Size	Q	Inv Elev Dn	HGL Dn	Depth Dn	Area Dn	Veloc Dn	Vel Hd Dn	EGL Dn	Line Length	Inv Elev Up	HGL Up	Depth Up	Area Up	Veloc Up	Vel Hd Up	EGL Up	Sf Dn	Sf Up	Sf Ave
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/ s)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/ s)	(ft)	(ft)	(%)	(%)	(%)
1	15	2.95	307.65	308.34	0.69	0.70	4.25	0.28	308.62	143.000	308.24	309.10	0.87	0.92	3.22	0.16	309.27	0.602	0.300	0.451
2	15	0.98	308.43	309.18	0.75	0.33	1.27	0.14	309.33	90.200	309.00	309.39 j	0.39**	0.33	3.01	0.14	309.53	0.000	0.000	0.000

Notes: ** Critical depth.; j-Line contains hyd. jump; z-Zero Junction Loss

Line	Energy Loss	JLC Coeff	Minor Loss	Line ID
	(ft)	(K)	(ft)	
1	0.645	0.50	0.08	B2-B3
2	0.000	1.00 z	n/a	B1-B2

Channel Design Calculations

Channel	Drain Area, ac	Channel Length, ft	Channel Drop, ft	C	Q10 I, in/hr	Flow cfs	Channel Slope, ft/ft	n	Side Slope:1	Bottom Width, ft	Depth of Flow, ft	Velocity fps	Liner
TD1	1.26	290	8	0.55	5.38	3.7	0.0276	0.024	3.00	0.0	0.55	4.18	Jute Mesh
TD2	1.25	155	1	0.55	5.38	9.1	0.0065	0.020	3.00	0.0	0.93	3.47	Jute Mesh
TD3	1.12	211	2	0.55	5.38	3.3	0.0095	0.020	3.00	0.0	0.60	3.11	Jute Mesh
TD4	0.68	229	4	0.55	5.38	2.0	0.0175	0.020	3.00	0.0	0.44	3.46	Jute Mesh
TD5	0.45	306	6	0.55	5.38	1.3	0.0196	0.020	3.00	0.0	0.37	3.26	Jute Mesh

Temporary Sediment Trap 3

Okay

0.44	Disturbed Area (Acres)	
5.38	Peak Flow from 10-year Storm (cfs)	
1584	Required Volume ft^3	
2344	Required Surface Area ft^2	
34.2	Suggested Width ft	
68.5	Suggested Length ft	
40	Trial Top Width at Spillway Invert ft	
60	Trial Top Length at Spillway Invert ft	
2	Trial Side Slope Ratio Z:1	
2	Trial Depth ft	(1.5 feet below grade + 2 to 3.5 feet above grade)
32	Bottom Width ft	
52	Bottom Length ft	
1664	Bottom Area ft^2	
4043	Actual Volume ft^3	**Okay**
2400	Actual Surface Area ft^2	**Okay**
10	Trial Weir Length ft	
0.5	Trial Depth of Flow ft	
10.6	Spillway Capacity cfs	**Okay**

Skimmer Basin 1

Okay

4.83	Disturbed Area (Acres)	
5.38	Peak Flow from 10-year Storm (cfs)	
8694	Required Volume ft^3	
1749	Required Surface Area ft^2	
29.6	Suggested Width ft	
59.1	Suggested Length ft	
82	Trial Top Width at Spillway Invert ft	
52	Trial Top Length at Spillway Invert ft	
2	Trial Side Slope Ratio Z:1	
2.5	Trial Depth ft	(2 to 3.5 feet above grade)
72	Bottom Width ft	
42	Bottom Length ft	
3024	Bottom Area ft^2	
9068	Actual Volume ft^3	**Okay**
4264	Actual Surface Area ft^2	**Okay**
10	Trial Weir Length ft	
0.5	Trial Depth of Flow ft	
10.6	Spillway Capacity cfs	**Okay**
2	Skimmer Size (inches)	
0.2	Head on Skimmer (feet)	
1.5	Orifice Size (1/4 inch increments)	
3.74	Dewatering Time (days)	
	Suggest about 3 days	

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8

Temporary Sediment Basin 2

Okay

1.1	Disturbed Area (Acres)
5.38	Peak Flow from 10-year Storm (cfs)

1980	Required Volume ft^3
2344	Required Surface Area ft^2
34.2	Suggested Width ft
68.5	Suggested Length ft

35	Trial Top Width at Spillway Invert ft	
68	Trial Top Length at Spillway Invert ft	
3	Trial Side Slope Ratio Z:1	
2	Trial Depth ft (2 to 13 feet above grade)	
23	Bottom Width ft	
56	Bottom Length ft	
1288	Bottom Area ft^2	
3620	Actual Volume ft^3	**Okay**
2380	Actual Surface Area ft^2	**Okay**

Use Spillway Capacity Sheet to Size Primary and Emergency Spillways

2	Skimmer Size (inches)
0.05	Head on Skimmer (feet)
1	Orifice Size (1/4 inch increments)
3.83	Dewatering Time (days)
	Suggest about 3 days

Skimmer Size (Inches)
1.5
2
2.5
3
4
5
6
8