StorageMax
901 Proctor

Zebulon, NC
Wake County

EROSION CONTROL
CALCULATIONS

July 1, 2023
Revised: January 17, 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: **35.840297**
Longitude: **-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 6.50 acres (283,140 sq feet). The parcel is vacant with grassy vegetation and a wooded area along the property lines. There is 0 sq ft of existing impervious area on the site. The project will consist of a commercial building and the impervious area post development 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.

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.
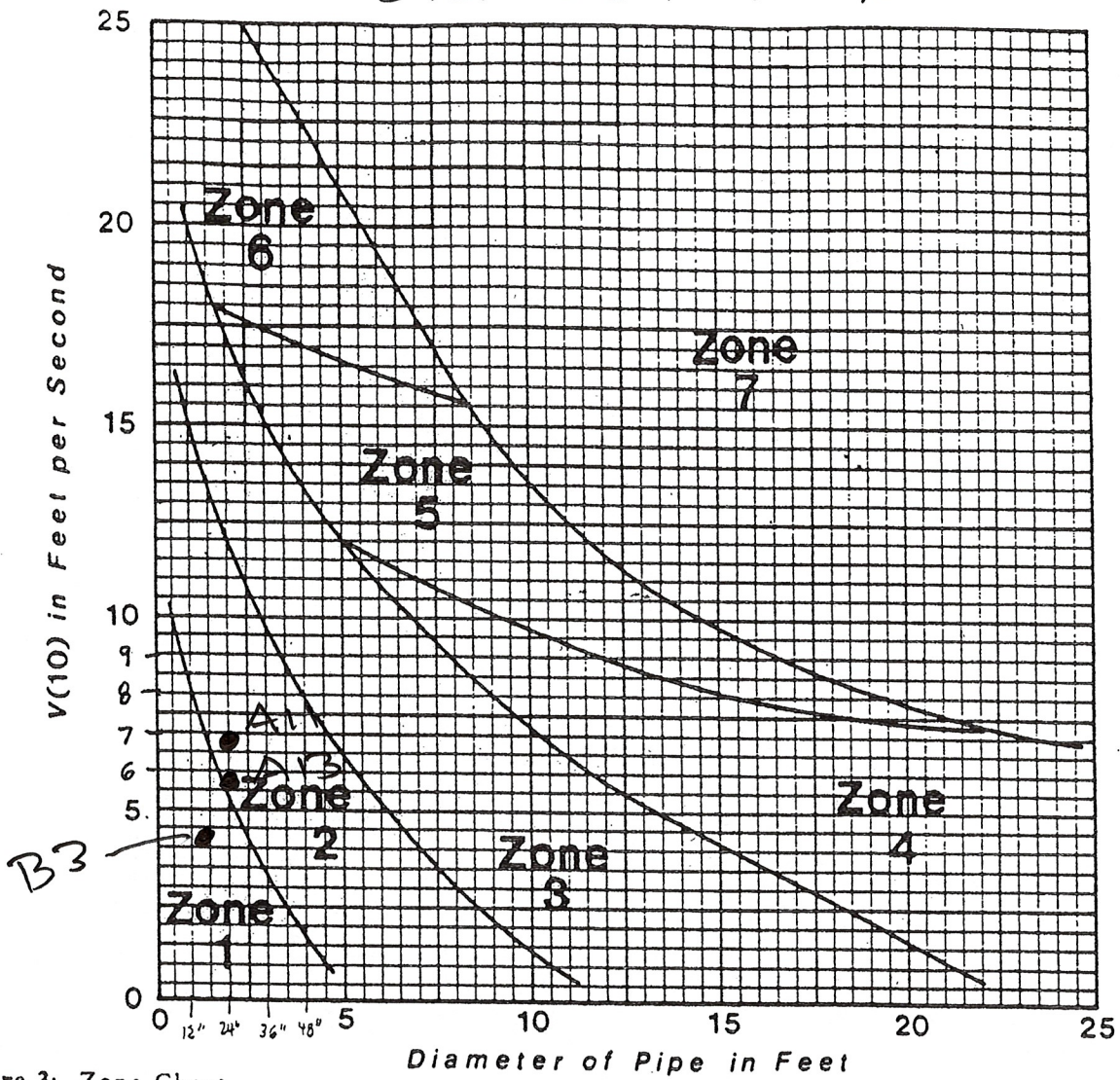
Figure 3: Zone Chart.

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		
inch	L ft	W ft	T inch	L ft	W ft	T 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

(handwritten: B3 — outlet L=5, W=3.75, T=12 circled)

ZONE 2 APRONS - Class B Erosion Control Stone

Pipe Diameter	Inlet			Outlet		
inch	L ft	W ft	T inch	L ft	W ft	T 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

(handwritten: A)3 and A)11 — outlet L=9, W=5.1 and L=12, W=6.8 circled)

ZONE 3/4 APRONS - Class 1 Rip Rap

Pipe Diameter	Inlet			Outlet		
inch	L ft	W ft	T inch	L ft	W ft	T 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		
inch	L ft	W ft	T inch	L ft	W ft	T 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

All Apron Design

Line	Pipe Size (in)	Q (cfs)	Inv Elev Dn (ft)	HGL Dn (ft)	Depth Dn (ft)	Area Dn (sqft)	Veloc Dn (ft/s)	Vel Hd Dn (ft)	EGL Dn (ft)	Line Length (ft)	Inv Elev Up (ft)	HGL Up (ft)	Depth Up (ft)	Area Up (sqft)	Veloc Up (ft/s)	Vel Hd Up (ft)	EGL Up (ft)	Sf Dn (%)	Sf Up (%)	Sf Ave (%)
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 (ft)	JLC Coeff (K)	Minor Loss (ft)	Line ID
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

A13

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
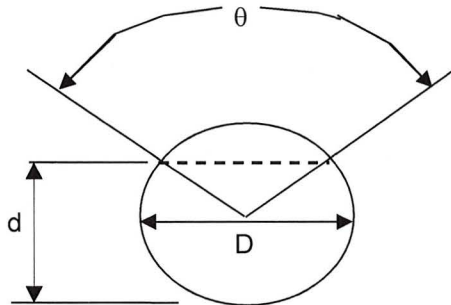
INPUT

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

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

			Solution to Mannings Equation			Manning's n-values	
Area,ft²	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs		PVC	0.01
3.02	5.11	0.59	5.69	17.15		PE (<9"dia)	0.015
						PE (>12"dia)	0.02
						PE(9-12"dia)	0.017
						CMP	0.025
						ADS N12	0.012
Created by: Mike O'Shea						HCMP	0.023
						Conc	0.013

B3 ARRON DESIGN

Line	Pipe Size (in)	Q (cfs)	Inv Elev Dn (ft)	HGL Dn (ft)	Depth Dn (ft)	Area Dn (sqft)	Veloc Dn (ft/s)	Vel Hd Dn (ft)	EGL Dn (ft)	Line Length (ft)	Inv Elev Up (ft)	HGL Up (ft)	Depth Up (ft)	Area Up (sqft)	Veloc Up (ft/s)	Vel Hd Up (ft)	EGL Up (ft)	Sf Dn (%)	Sf Up (%)	Sf Ave (%)
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 (ft)	JLC Coeff (K)	Minor Loss (ft)	Line ID
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