

STONE LUXURY LIVING
DRAINAGE CALCULATIONS – SUMMARY
7/20/2022

DESCRIPTION OF PROJECT

Stone Luxury Living is an approximately 7.74 Acre development located in the City of Bryant, Arkansas south of Hwy.5/N old Stagecoach road. There is one large drainage basin on the site.

Stormwater Calculations were prepared with the intent to comply with the City of Bryant's Drainage Code. The primary intent of this analysis is to produce a drainage system adequately sized to convey post development runoff while attenuating post development discharge levels equal to or less than pre development flows.

Hydraulic calculations were made using the Rational Method. Design frequencies were analyzed for 2, 5, 10, 25, 50, and 100 year return periods.

These calculations are divided into the following sections:

Summary of Drainage Basins

Summary of Inlets

Summary of Pipes

Storage Summary

Appendices

Exhibit A – Pre-Development Drainage Basins

Exhibit B – Post-Development Drainage Basins

STONE LUXURY LIVING
DRAINAGE CALCULATIONS – SUMMARY
7/20/2022

SUMMARY OF DRAINAGE BASINS

PRE-DEVELOPMENT CONDITIONS

The entire area for pre-existing drainage area of the site drains to a ditch to the southwest. This site has concrete paved roads and mobile homes.

POST-DEVELOPMENT CONDITIONS

This site is being developed into duplex houses. Slopes range from 1% to 4%. Post-developed runoff coefficient is lower than pre-developed runoff coefficient.

SUMMARY OF INLETS

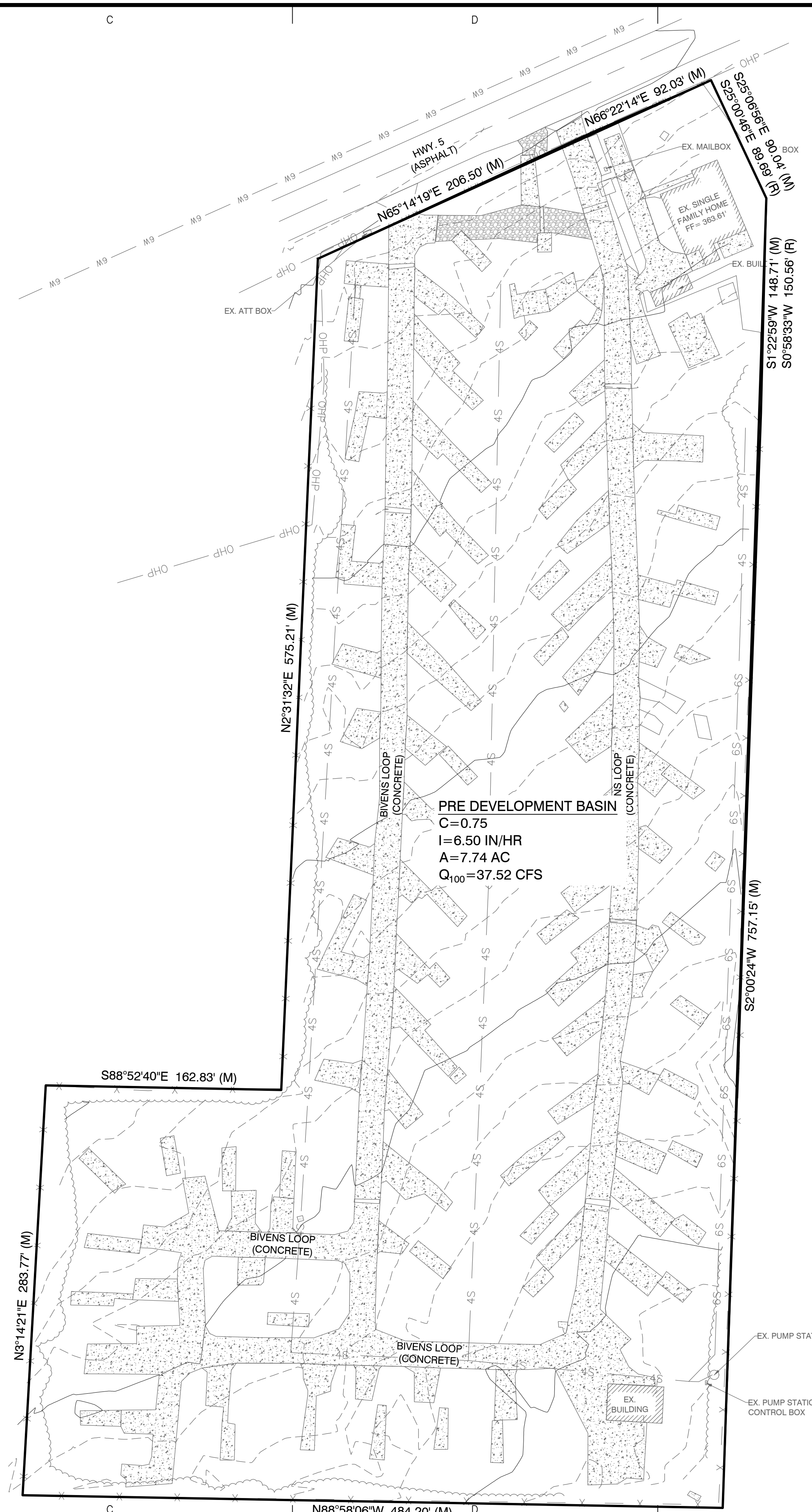
On the drainage plan you will see labels for all of the inlets for these calculations. The flows shown are for the 25-year return storm. The distance from the face of the curb to the center of the street is 15 feet.

SUMMARY OF PIPES

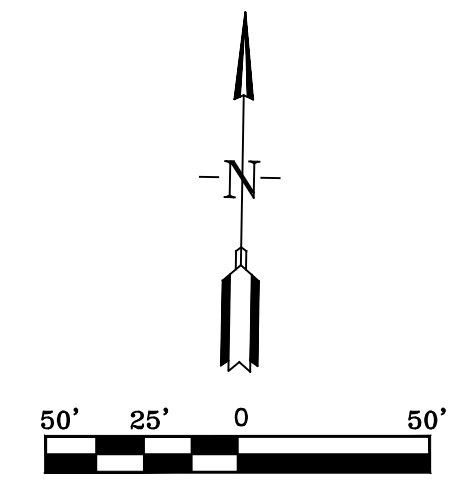
All pipes used in this project are HDPE and RCP. Therefore, a Manning's of 0.012 was used on all pipes in the analysis.

STORAGE SUMMARY

Storage is not required.

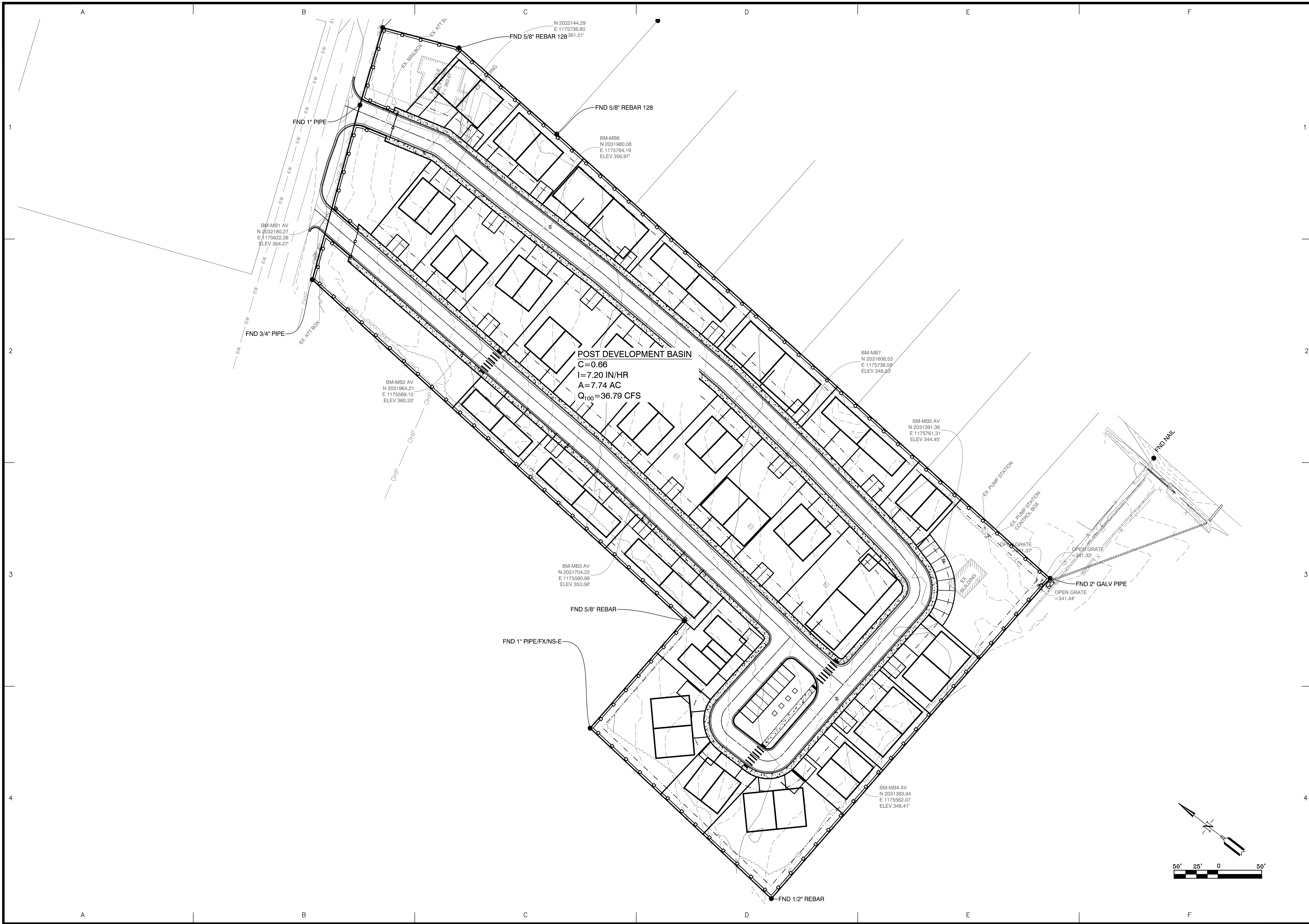


PRE DEVELOPMENT BASIN
 C=0.75
 I=6.50 IN/HR
 A=7.74 AC
 Q₁₀₀=37.52 CFS

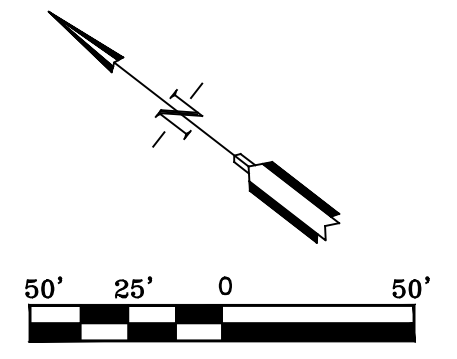


BY		REVISION	
DATE			
Designing our client's success GarNat Engineering, LLC P.O. Box 116 Benton, AR 72018 Ph (501) 408-4650 garnatengineering@gmail.com			
STONE LUXURY LIVING BRYANT, ARKANSAS			
CONTENTS:			
PRE DEVELOPMENT BASIN			
PROJECT NO:		22070	
DATE:		JUNE 2, 2022	
SHEET NO:		1.0	

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POST DEVELOPMENT BASIN
 C=0.66
 I=7.20 IN/HR
 A=7.74 AC
 Q₁₀₀=36.79 CFS



BY	
REVISION	
DATE	
<p>Designing our client's success</p> <p>GarNat Engineering, LLC</p> <p>3825 Mt Carmel Rd Bryant, AR 72022 garnatengineering@gmail.com</p>	
<p>STONE LUXURY LIVING</p> <p>PLANNED UNIT DEVELOPMENT</p> <p>CITY OF BRYANT</p> <p>SALINE COUNTY, ARKANSAS</p>	
<p>PRELIMINARY</p>	
<p>CONTENTS:</p> <p style="text-align: center;">POST DEVELOPMENT BASIN</p>	
PROJECT NO:	22070
DATE:	JUNE 2022
SHEET NO:	2.0

A:\Projects\2022\Projects\22070 Stone Luxury Living Manufactured Park_C2I Rezone EIRs_Consolidated_Enterprises_Inc_2018_Hwy_5\Drawings\GDMA\Design\22070 Stone Luxury Living_Saline County_Salvage_2022_Hwy_5 Rezone Loop Design_02-20-2022.dwg

Stormwater Calcs - Stone Luxury Living Manufactured Park
Using Rational Method

Pre-development

Calculated Tc values - Drainage Basin 1

$$T_c = \frac{56 * L^{.6} * n^{.6}}{i^{.4} * S^{.3}} \text{ seconds}$$

L1 = 100 feet
n1 = 0.15 Sheet Flow
S1 = 0.02 ft/ft
I_{assumed} = 5.30 inches
T_{Ccalculated} = 472 seconds
T_{Ccalculated} = 7.86 minutes

Tc = 20.88 minutes
I = 5.30 inches

Use Tc = 21.00 minutes

L1 = 185 feet
n1 = 0.03 Grass, Natural S
S1 = 0.03 ft/ft
I_{assumed} = 5.30 inches
T_{Ccalculated} = 230 seconds
T_{Ccalculated} = 3.84 minutes

Tc for 25-yr Storm from Exhibit 400-1 of Bryant Drainage Manual
i for 25-yr Storm from Exhibit 400-1 of Bryant Drainage Manual

I₁₀₀ = 6.5 Inches
I₅₀ = 5.9 Inches
I₂₅ = 5.30 Inches

L1 = 100 feet
n1 = 0.013 Concrete
S1 = 0.03 ft/ft
I_{assumed} = 5.30 inches
T_{Ccalculated} = 96 seconds
T_{Ccalculated} = 1.61 minutes

I₁₀₀ = 4.8 Inches
I₅₀ = 4.3 Inches
I₂₅ = 3.6 Inches

L1 = 575 feet
n1 = 0.03 Grass, Natural Streams More Stones & Weeds
S1 = 0.03 ft/ft
I_{assumed} = 5.30 inches
T_{Ccalculated} = 454 seconds
T_{Ccalculated} = 7.57 minutes

**Stormwater Calcs - Stone Luxury Living Manufactured Park
Using Rational Method**

Post-development

Calculated Tc values - Drainage Basin 1

$$T_c = \frac{56 * L^{.6} * n^{.6}}{i^{.4} * S^{.3}} \text{ seconds}$$

L1 = 100 feet
 n1 = 0.15 Sheet Flow
 S1 = 0.02 ft/ft
 I_{assumed} = 6.00 inches
 T_{Ccalculated} = 449 seconds
 T_{Ccalculated} = 7.48 minutes

Tc = 14.97 minutes
 I = 6.00 inches

Use Tc = **15.00** minutes

$$T_c = \frac{16 * L^{.6} * n^{.6}}{i^{.4} * S^{.3}} \text{ seconds}$$

L1 = 710 feet
 n1 = 0.013 Asphalt
 S1 = 0.025 ft/ft
 I_{assumed} = 6.00 inches
 T_{Ccalculated} = 314 seconds
 T_{Ccalculated} = 5.23 minutes

Tc for 25-yr Storm from Exhibit 400-1 of Bryant Drainage Manual
 i for 25-yr Storm from Exhibit 400-1 of Bryant Drainage Manual

I₁₀₀ = 7.2 Inches
 I₅₀ = 6.6 Inches
 I₂₅ = 6.0 Inches

L1 = 140 feet
 n1 = 0.013 Culvert
 S1 = 0.016 ft/ft
 I_{assumed} = 6.00 inches
 T_{Ccalculated} = 135 seconds
 T_{Ccalculated} = 2.26 minutes

I₁₀ = 5.4 Inches
 I₅ = 4.8 Inches
 I₂ = 4.1 Inches

Stormwater Calcs - Stone Luxury Living Manufactured Park
using Rational Method

Pre-development

Calculated C values - Drainage Basin 1

	Area	C ₁₀₀	C ₅₀	C ₂₅	C ₁₀	C ₅	C ₂
Gravel	0.04	0.65	0.55	0.5	0.35	0.3	0.25
Greenspace	3.59	0.49	0.45	0.42	0.38	0.36	0.33
Roof	1.94	0.97	0.92	0.88	0.83	0.8	0.75
Concrete	2.17	0.97	0.92	0.88	0.83	0.8	0.75
Total Area =	7.74	0.75	0.70	0.66	0.62	0.59	0.55

(C values taken from Table 400-2 of City of Bryant Drainage Manual)

Pasture/Range, Average, 2-7%

Mobile Home/Roof

Concrete/Roof

Stormwater Calcs - Stone Luxury Living Manufactured Park
using Rational Method

Post-development

Calculated C values - Drainage Basin 1

	Area	C ₁₀₀	C ₅₀	C ₂₅	C ₁₀	C ₅	C ₂
Sidewalk and Parking Area	1.13	0.97	0.92	0.88	0.83	0.8	0.75
Roof	1.31	0.7	0.65	0.6	0.5	0.45	0.4
Green Space	3.96	0.46	0.42	0.39	0.35	0.32	0.29
Road	1.34	0.95	0.9	0.86	0.81	0.77	0.73
Total Area =	7.74	0.66	0.62	0.58	0.53	0.49	0.45

(C values taken from Table 400-2 of City of Bryant Drainage Manual)

Concrete
Roof
Grass-Good Condition, Average 2-7%
Asphalt

Stormwater Calcs - Stone Luxury Living Manufactured Park
Existing Culverts Capacity

OUTLET CULVERT

Pipe	From	To	Design Flow (cfs):	Slope (ft/ft):	Diameter (inches)	No. Pipes	Manning's	Area Full (sf)	Wetted Perimeter Full (ft)	Hydraulic Radius Full (ft)	Flow Capacity (cfs)	
16" HDPE	North	South		0.0106		16	1	0.012	1.40	4.189	0.33333333	8.55

GRAVEL DRIVEWAY CULVERT

Pipe	From	To	Design Flow (cfs):	Slope (ft/ft):	Diameter (inches)	No. Pipes	Manning's	Area Full (sf)	Wetted Perimeter Full (ft)	Hydraulic Radius Full (ft)	Flow Capacity (cfs)	
18" CMP	North	South		0.0188		18	1	0.024	1.77	4.712	0.375	7.79
REVERSE GRADE												

SHOBE ROAD

Pipe	From	To	Design Flow (cfs):	Slope (ft/ft):	Diameter (inches)	No. Pipes	Manning's	Area Full (sf)	Wetted Perimeter Full (ft)	Hydraulic Radius Full (ft)	Flow Capacity (cfs)	
24" RCP	WEST	EAST		0.0389		24	1	0.012	3.14	6.283	0.5	48.34

Stormwater Calcs - Stone Luxury Living Manufactured Park

Existing Ditch Capacity

Mannings equation for ditch **Last Section**

n= 0.022 based on n for open channel earth with short grass, few weeds

Width							
Depth (ft)	Bottom (ft)	Top (ft)	area (ft ²)	rH	slope (ft/ft)	Velocity (ft/s)	Q (cfs)
1.18	0.00	6.60	3.89	0.52	1.250%	4.91	19.11

Mannings equation for ditch **First Section**

n= 0.022 based on n for open channel earth with short grass, few weeds

Width							
Depth (ft)	Bottom (ft)	Top (ft)	area (ft ²)	rH	slope (ft/ft)	Velocity (ft/s)	Q (cfs)
1.4	0.00	6.50	4.55	0.51	1.500%	5.32	24.21

Mannings equation for ditch **Gravel Driveway Culvert**

n= 0.022 based on n for open channel earth with short grass, few weeds

Width							
Depth (ft)	Bottom (ft)	Top (ft)	area (ft ²)	rH	slope (ft/ft)	Velocity (ft/s)	Q (cfs)
1.5	0.00	8.00	6.00	0.63	1.500%	6.11	36.67

Stormwater Calcs - Stone Luxury Living Manufactured Park
Proposed Culverts

Pipe	From	To	Design Flow (cfs):	Slope (ft/ft):	Diameter (inches)	No. Pipes	Manning's	Area Full (sf)	Wetted Perimeter Full (ft)	Hydraulic Radius Full (ft)	Flow Capacity (cfs)	% Capacity
18" HDPE	CI-12	CI-11	1.87	0.0100	18	1	0.012	1.77	4.712	0.375	11.38	16%
18" HDPE	CI-11	CI-9	3.82	0.0220	18	1	0.012	1.77	4.712	0.375	16.88	23%
18" HDPE	CI-10	CI-9	1.53	0.0100	18	1	0.012	1.77	4.712	0.375	11.38	13%
18" HDPE	CI-9	CI-8	7.03	0.0170	18	1	0.012	1.77	4.712	0.375	14.84	47%
18" HDPE	CI-8	CI-7	9.03	0.0110	18	1	0.012	1.77	4.712	0.375	11.94	76%
18" HDPE	CI-7	CI-6	13.63	0.0190	18	1	0.012	1.77	4.712	0.375	15.69	87%
18" HDPE	CI-1	CI-2	1.68	0.0100	18	1	0.012	1.77	4.712	0.375	11.38	15%
18" HDPE	CI-2	CI-3	4.47	0.0250	18	1	0.012	1.77	4.712	0.375	17.99	25%
18" HDPE	CI-4	CI-3	1.87	0.0100	18	1	0.012	1.77	4.712	0.375	11.38	16%
18" HDPE	CI-3	CI-5	6.34	0.0120	18	1	0.012	1.77	4.712	0.375	12.47	51%
18" HDPE	CI-5	CI-6	8.29	0.0150	18	1	0.012	1.77	4.712	0.375	13.94	59%
24" HDPE	CI-6	JB-1	27.27	0.0130	24	1	0.012	3.14	6.283	0.5	27.94	98%

GRAVEL DRIVEWAY CULVERT

29"X18" RCAP	NORTH	SOUTH	27.27	0.0150	24	1	0.012	3.14	6.283	0.5	30.02	91%
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Stormwater Calcs - Stone Luxury Living Manufactured Park
using Rational Method
Post Development Flowrates

CI-1

$Q_{10} =$ 1.68 CFS
 $c =$ 0.53
 $i =$ 7.20 in/hr
 $A =$ 0.44 acres

CI-2

$Q_{10} =$ 2.79 CFS
 $c =$ 0.53
 $i =$ 7.20 in/hr
 $A =$ 0.73 acres

CI-3

$Q_{10} =$ 2.48 CFS
 $c =$ 0.53
 $i =$ 7.20 in/hr
 $A =$ 0.65 acres

CI-4

$Q_{10} =$ 1.07 CFS
 $c =$ 0.53
 $i =$ 7.20 in/hr
 $A =$ 0.28 acres

CI-5

$Q_{10} =$ 2.52 CFS
 $c =$ 0.53
 $i =$ 7.20 in/hr
 $A =$ 0.66 acres

CI-6

$Q_{10} =$ 1.72 CFS
 $c =$ 0.53
 $i =$ 7.20 in/hr
 $A =$ 0.45 acres

CI-7

$Q_{10} =$ 2.79 CFS
 $c =$ 0.53
 $i =$ 7.20 in/hr
 $A =$ 0.73 acres

CI-8

$Q_{10} =$ 1.68 CFS
 $c =$ 0.53
 $i =$ 7.20 in/hr
 $A =$ 0.44 acres

CI-9

$Q_{10} =$ 1.72 CFS
 $c =$ 0.53
 $i =$ 7.20 in/hr
 $A =$ 0.45 acres

CI-10

$Q_{10} =$ 1.53 CFS
 $c =$ 0.53
 $i =$ 7.20 in/hr
 $A =$ 0.40 acres

CI-11

$Q_{10} =$ 1.95 CFS
 $c =$ 0.53
 $i =$ 7.20 in/hr
 $A =$ 0.51 acres

CI-12

$Q_{10} =$ 1.87 CFS
 $c =$ 0.53
 $i =$ 7.20 in/hr
 $A =$ 0.49 acres

Stormwater Calcs - Stone Luxury Living Manufactured Park - CURB INLETS

10-YEAR STORM

Area #	Area	I	C	Weir			Required L (ft)	Actual L (ft)	
				Q	Q=3.0LY ^{1.5}	Y (ft)			
				(cfs)	Q (cfs)				
CI-1	0.44	7.20	0.53	1.68	1.68	0.49	1.63	4	4' box
CI-2	0.73	7.20	0.53	2.79	2.79	0.49	2.71	4	4' box
CI-3	0.65	7.20	0.53	2.48	2.48	0.49	2.41	4	4' box
CI-4	0.49	7.20	0.53	1.87	1.87	0.49	1.82	4	4' box
CI-5	0.51	7.20	0.53	1.95	1.95	0.49	1.89	4	4' box
CI-6	0.40	7.20	0.53	1.53	1.53	0.49	1.48	4	4' box
CI-7	0.73	7.20	0.53	2.79	2.79	0.49	2.71	4	4' box
CI-8	0.44	7.20	0.53	1.68	1.68	0.49	1.63	4	4' box
CI-9	0.45	7.20	0.53	1.72	1.72	0.49	1.67	4	4' box
CI-10	0.40	7.20	0.53	1.53	1.53	0.49	1.48	4	4' box
CI-11	0.51	7.20	0.53	1.95	1.95	0.49	1.89	4	4' box
CI-12	0.49	7.20	0.53	1.87	1.87	0.49	1.82	4	5' box