

STORM SEWER CALCULATIONS

**LAKE VIEW ESTATES
DYERSVILLE, IOWA**

ENGINEER

BUESING & ASSOCIATES, INC.

Engineers & Surveyors

1212 LOCUST STREET

DUBUQUE, IA 52001

(563) 556-4389

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May 23, 2024

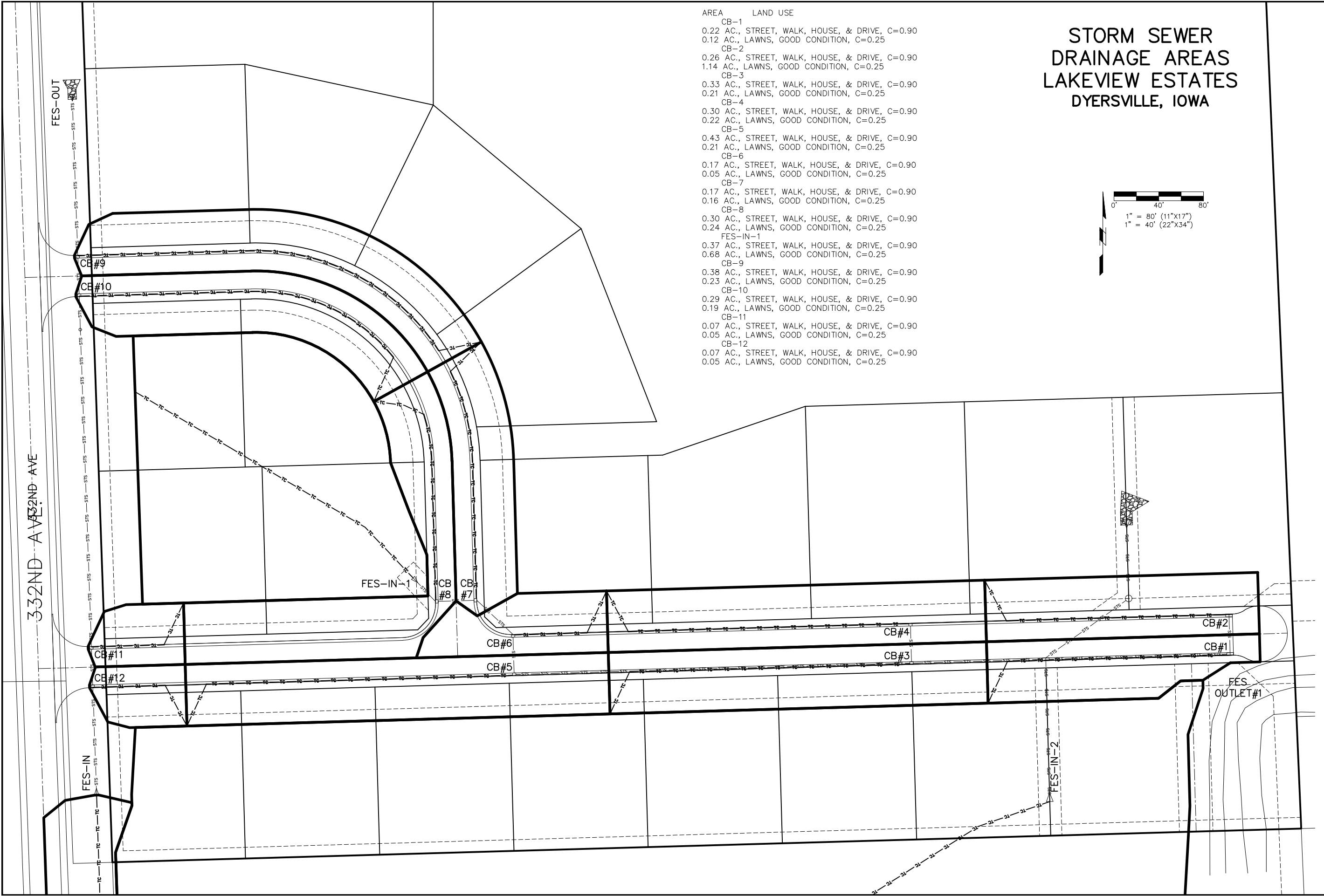
STORM SEWER CALCULATIONS LAKE VIEW ESTATES

Lake View Estates is a proposed residential development in the City of Dyersville, Iowa, consisting of 21 residential lots. (Please see the Improvement Plans and Final Plat of Lake View Estates). These proposed residential lots are around 1/2 acre in size.

Haestad Methods, StormCad, and Flow Master, are the software that was used for these calculations. HydroCAD software was used in calculating the Time of Concentration. The subdivision was broken into 2 sub projects as shown in these calculations. The first sub project is the main part of the proposed subdivision, and the second sub project, is the ditch along 332nd Ave.

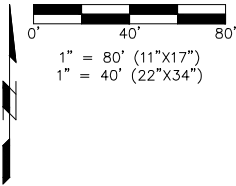
For the first sub project, there are several catch basins in sump conditions and therefore the 100 year storm event was used to size the pipes. Both the 10 year and 100 year storm events have been included. For FES-IN-2, the storm water that would overtop the 332nd Ave. ditch has been added as "Additional Carryover". For the 10 year storm event the additional carryover is 1.16 cfs, and for the 100 year storm event it is 12.76 cfs. Please note that where 12" pipes are being used, both 12" and 15" pipes were modeled, at various slopes, but cleaning velocities could not be achieved with a 15" pipe. Ultimately, 12" pipes were chosen, with the slope set at the maximum cleaning velocity. The results can be seen in this report.

For the second sub project both the 10 and 100 year storm events were analyzed, but only the 10 year storm event has been included, as that is what was used to size the pipes, as the capacity of the ditch upstream from these pipes (south of this development), could not carry the 10 year storm event before it overtopped and ran to the east into the FarmTek property. Please note that the calculations show that there is 24.4 cfs coming to FES-IN (FES INLET) during a 10 year storm event, and 36.0 cfs coming to FES-IN during a 100 year storm event, but the calculations for the ditch capacity show that it can only handle 23.24 cfs, before it overtops and runs to the east into the FarmTek property, prior to getting to FES-IN. The results can be seen in this report.



AREA	LAND USE
CB-1	0.22 AC., STREET, WALK, HOUSE, & DRIVE, C=0.90
CB-2	0.12 AC., LAWNS, GOOD CONDITION, C=0.25
CB-3	0.26 AC., STREET, WALK, HOUSE, & DRIVE, C=0.90
CB-4	1.14 AC., LAWNS, GOOD CONDITION, C=0.25
CB-5	0.33 AC., STREET, WALK, HOUSE, & DRIVE, C=0.90
CB-6	0.21 AC., LAWNS, GOOD CONDITION, C=0.25
CB-7	0.30 AC., STREET, WALK, HOUSE, & DRIVE, C=0.90
CB-8	0.22 AC., LAWNS, GOOD CONDITION, C=0.25
CB-9	0.43 AC., STREET, WALK, HOUSE, & DRIVE, C=0.90
CB-10	0.21 AC., LAWNS, GOOD CONDITION, C=0.25
CB-11	0.17 AC., STREET, WALK, HOUSE, & DRIVE, C=0.90
CB-12	0.05 AC., LAWNS, GOOD CONDITION, C=0.25
FES-IN-1	0.17 AC., STREET, WALK, HOUSE, & DRIVE, C=0.90
FES-IN-2	0.16 AC., LAWNS, GOOD CONDITION, C=0.25
FES-OUT	0.30 AC., STREET, WALK, HOUSE, & DRIVE, C=0.90
FES-OUTLET#1	0.24 AC., LAWNS, GOOD CONDITION, C=0.25

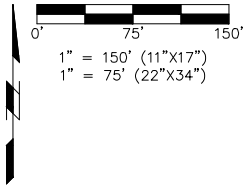
STORM SEWER
DRAINAGE AREAS
LAKEVIEW ESTATES
DYERSVILLE, IOWA



SHEET TITLE	PROJECT	NO.	DATE	REVISIONS	DRAWN BY:
STORM SEWER DRAINAGE AREAS LAKEVIEW ESTATES DYERSVILLE, IOWA	PREPARED FOR: LAKEVIEW ESTATES LLC C/O BILL HERMSEN 2104 332ND AVE. DYERSVILLE, IA 52040	23225	2/1/24	4/30/24	TPL
1/3			SCALE:	5/23/24	CHECKED BY:
			SEE BAR	SCALE	PJN



STORM SEWER
DRAINAGE AREAS
LAKEVIEW ESTATES
DYERSVILLE, IOWA



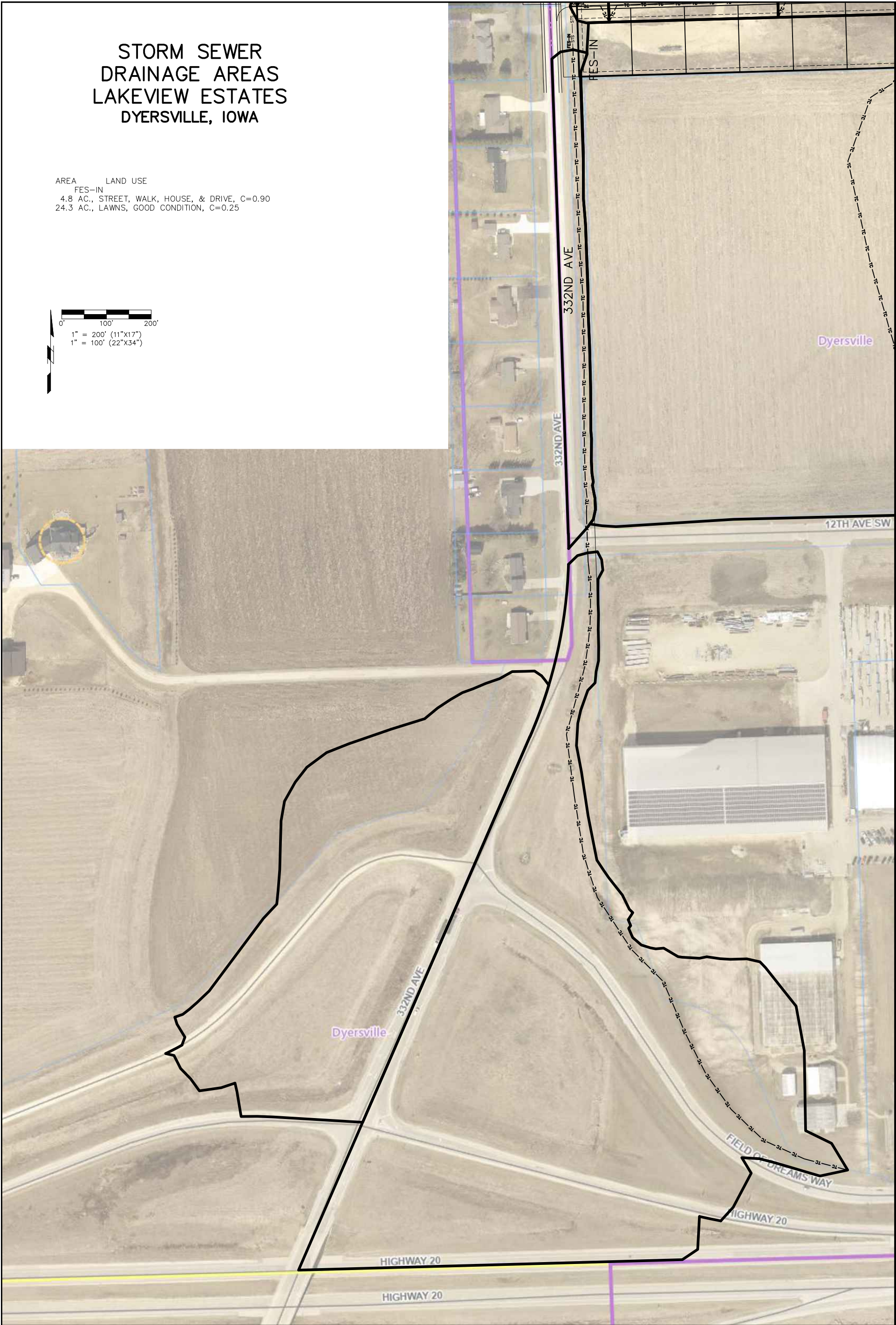
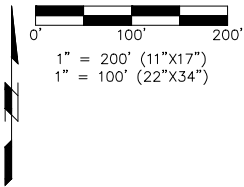
AREA LAND USE
FES-IN-2
0.37 AC., STREET, WALK, HOUSE, & DRIVE, C=0.90
1.89 AC., LAWNS, GOOD CONDITION, C=0.25
22.04 AC., STRAIGHT ROW CROPS, GOOD CONDITION, C=0.50

SHEET TITLE	PROJECT	NO. 23225	DATE		REVISIONS		DRAWN BY:	
			5/23/24				TPL	
STORM SEWER DRAINAGE AREAS LAKEVIEW ESTATES DYERSVILLE, IOWA	PREPARED FOR: LAKEVIEW ESTATES LLC C/O BILL HERMSEN 2104 332ND AVE. DYERSVILLE, IA 52040		SCALE:				CHECKED BY:	
			SEE BAR				PJN	

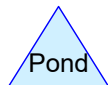
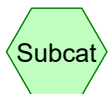
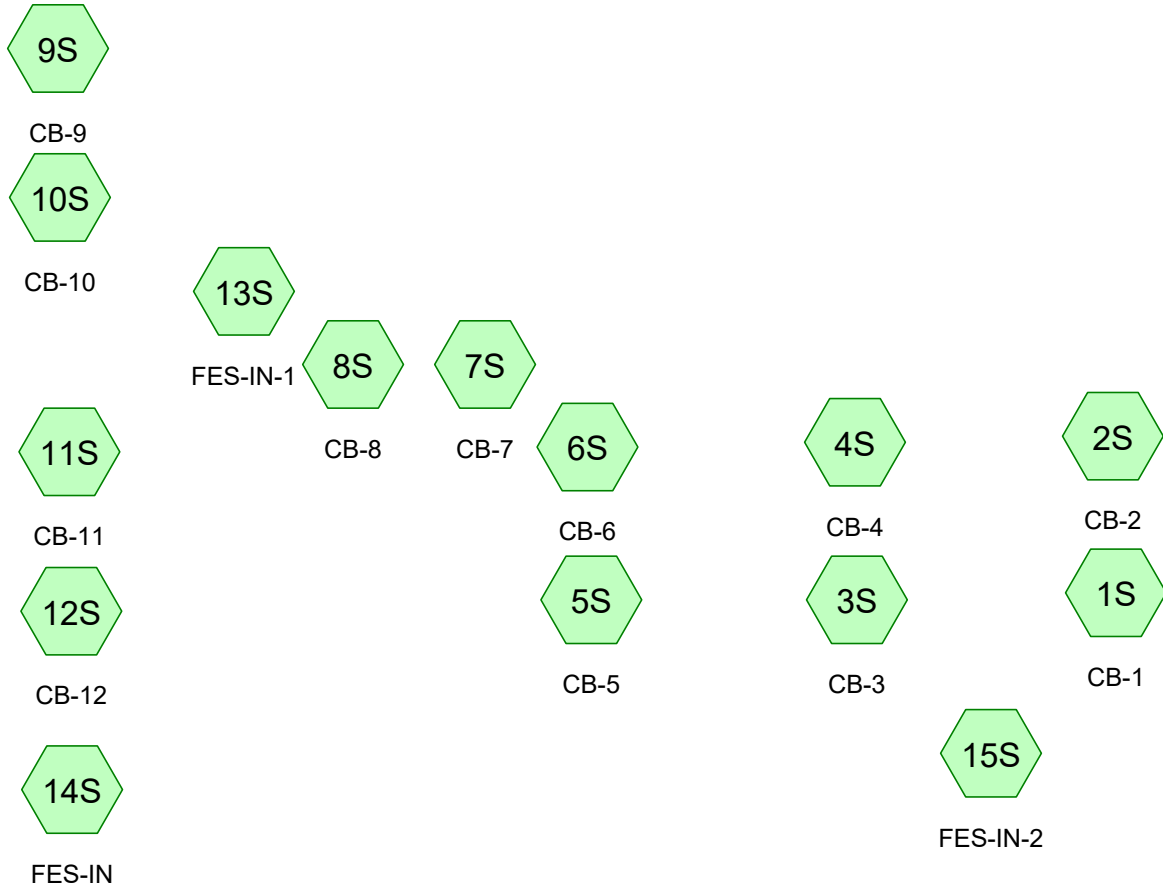
BUESING
ASSOCIATES INC.
ENGINEERS AND SURVEYORS
1212 LOCUST ST. DUBUQUE, IA
(563) 556-4389

STORM SEWER
DRAINAGE AREAS
LAKEVIEW ESTATES
DYERSVILLE, IOWA

AREA LAND USE
FES-IN
4.8 AC., STREET, WALK, HOUSE, & DRIVE, C=0.90
24.3 AC., LAWNS, GOOD CONDITION, C=0.25



3/3	SHEET TITLE	PROJECT	NO. 23225	 BUESING & ASSOCIATES INC. <i>ENGINEERS AND SURVEYORS</i> 1212 LOCUST ST, DUBUQUE, IA (563) 556-4389	DATE	REVISIONS	DRAWN BY:
	STORM SEWER DRAINAGE AREAS LAKEVIEW ESTATES DYERSVILLE, IOWA	PREPARED FOR: LAKEVIEW ESTATES LLC C/O BILL HERMSEN 2104 332ND AVE. DYERSVILLE, IA 52040			4/30/24	5/23/24	TPL
					SCALE:		CHECKED BY:
					SEE BAR SCALE		PJN



TCs

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Type II 24-hr 10yr Rainfall=4.31"

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Summary for Subcatchment 1S: CB-1

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.31"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	41	0.0200	0.14		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 2.91"
1.6	196	0.0100	2.03		Shallow Concentrated Flow, Street Paved Kv= 20.3 fps
6.6	237	Total			

Summary for Subcatchment 2S: CB-2

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.31"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	41	0.0200	0.14		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 2.91"
1.6	196	0.0100	2.03		Shallow Concentrated Flow, Street Paved Kv= 20.3 fps
6.6	237	Total			

Summary for Subcatchment 3S: CB-3

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.31"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	41	0.0200	0.14		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 2.91"
2.1	251	0.0100	2.03		Shallow Concentrated Flow, Street Paved Kv= 20.3 fps
7.1	292	Total			

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Type II 24-hr 10yr Rainfall=4.31"

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Summary for Subcatchment 4S: CB-4

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.31"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	41	0.0200	0.14		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 2.91"
2.1	251	0.0100	2.03		Shallow Concentrated Flow, Street Paved Kv= 20.3 fps
7.1	292	Total			

Summary for Subcatchment 5S: CB-5

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.31"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	41	0.0200	0.14		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 2.91"
2.2	274	0.0100	2.03		Shallow Concentrated Flow, Street Paved Kv= 20.3 fps
7.2	315	Total			

Summary for Subcatchment 6S: CB-6

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.31"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	41	0.0200	0.14		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 2.91"
0.5	65	0.0100	2.03		Shallow Concentrated Flow, Street Paved Kv= 20.3 fps
5.5	106	Total			

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Type II 24-hr 10yr Rainfall=4.31"

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Summary for Subcatchment 7S: CB-7

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.31"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	38	0.0200	0.13		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 2.91"
1.7	206	0.0100	2.03		Shallow Concentrated Flow, Street Paved Kv= 20.3 fps
6.4	244	Total			

Summary for Subcatchment 8S: CB-8

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.31"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	46	0.0200	0.14		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 2.91"
1.4	167	0.0100	2.03		Shallow Concentrated Flow, Street Paved Kv= 20.3 fps
6.9	213	Total			

Summary for Subcatchment 9S: CB-9

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.31"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	39	0.0200	0.13		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 2.91"
2.9	354	0.0100	2.03		Shallow Concentrated Flow, Street Paved Kv= 20.3 fps
7.7	393	Total			

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Type II 24-hr 10yr Rainfall=4.31"

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Summary for Subcatchment 10S: CB-10

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.31"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	43	0.0200	0.14		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 2.91"
2.5	299	0.0100	2.03		Shallow Concentrated Flow, Street Paved Kv= 20.3 fps
7.7	342	Total			

Summary for Subcatchment 11S: CB-11

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.31"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	41	0.0200	0.14		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 2.91"
0.5	65	0.0100	2.03		Shallow Concentrated Flow, Street Paved Kv= 20.3 fps
5.5	106	Total			

Summary for Subcatchment 12S: CB-12

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.31"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	41	0.0200	0.14		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 2.91"
0.5	65	0.0100	2.03		Shallow Concentrated Flow, Street Paved Kv= 20.3 fps
5.5	106	Total			

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Type II 24-hr 10yr Rainfall=4.31"

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Summary for Subcatchment 13S: FES-IN-1

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.31"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	100	0.0100	0.12		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 2.91"
4.8	201	0.0100	0.70		Shallow Concentrated Flow, Lawn Short Grass Pasture Kv= 7.0 fps
18.4	301	Total			

Summary for Subcatchment 14S: FES-IN

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.31"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.6	100	0.0070	0.11		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 2.91"
28.5	1,000	0.0070	0.59		Shallow Concentrated Flow, Lawn Short Grass Pasture Kv= 7.0 fps
2.6	531	0.0170	3.47	26.37	Channel Flow, Ditch Area= 7.6 sf Perim= 19.3' r= 0.39' n= 0.030 Earth, grassed & winding
0.1	110	0.0130	12.77	90.70	Channel Flow, pipe Area= 7.1 sf Perim= 9.4' r= 0.76' n= 0.011 Concrete pipe, straight & clean
5.4	985	0.0130	3.03	23.06	Channel Flow, ditch Area= 7.6 sf Perim= 19.3' r= 0.39' n= 0.030 Earth, grassed & winding
52.2	2,726	Total			

Summary for Subcatchment 15S: FES-IN-2

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.31"

TCs

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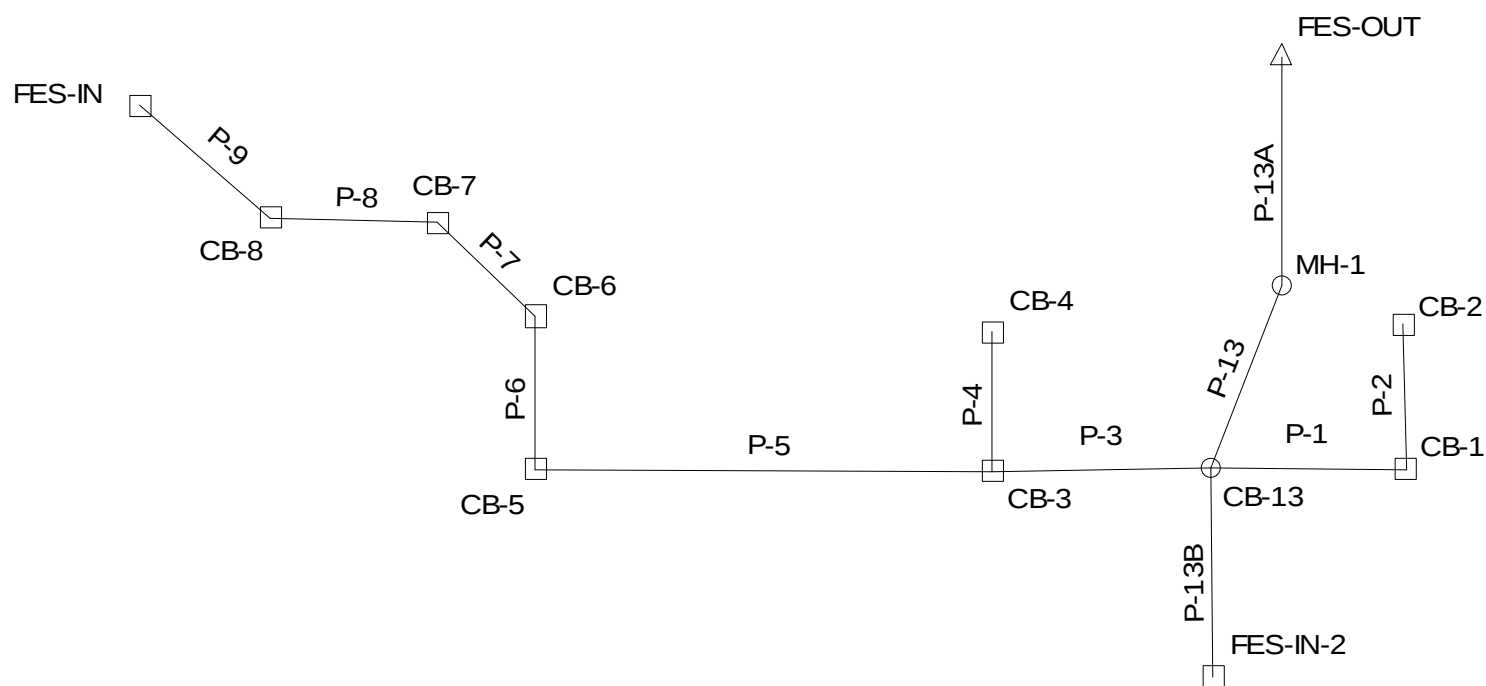
Type II 24-hr 10yr Rainfall=4.31"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0	100	0.0100	0.11		Sheet Flow, Row-Crops Cultivated: Residue>20% n= 0.170 P2= 2.91"
19.4	1,050	0.0100	0.90		Shallow Concentrated Flow, Row-Crops Cultivated Straight Rows Kv= 9.0 fps
34.4	1,150	Total			

Scenario: Base



Scenario: Base

Node-Report-10yr

Label	Inlet	Structure Type	Structure Diameter (ft)	Rim Elevation (ft)	Sump Elevation (ft)	Inlet Location	Longitudinal Slope (ft/ft)	Time of Concentration (min)	Inlet Area (acres)	Inlet C	Inlet CA (acres)	Headloss Method	Headloss Coefficient	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gutter Ditch Depth (ft)	Gutter Ditch Spread (ft)	Total Flow To Inlet (cfs)	Total Intercepted Flow (cfs)	Capture Efficiency (%)	Total Bypassed Flow (cfs)	Bypass Target	Additional Carryover (cfs)	Additional Flow (cfs)	Total System Flow (cfs)
FES-IN	Generic Default 100	Inlet		953.00	948.00	In Sag		18.10	1.05	0.48	0.50	Standard	0.50	948.71	948.59	0.00	0.00	2.20	2.20	100.0	0.00		0.00	0.00	2.20
CB-8	Combination 101-B	Inlet		950.36	946.39	In Sag		6.80	0.54	0.61	0.33	Standard	0.60	947.32	947.18	0.19	5.66	1.98	1.98	100.0	0.00		0.00	0.00	3.63
CB-7	Combination 101-B	Inlet		950.36	946.13	In Sag		6.30	0.33	0.58	0.19	Standard	0.60	947.15	946.97	0.14	4.09	1.17	1.17	100.0	0.00		0.00	0.00	4.46
CB-6	Combination 101-B	Inlet		950.04	945.80	In Sag		5.40	0.22	0.75	0.17	Standard	0.60	946.88	946.77	0.13	3.77	1.03	1.03	100.0	0.00		0.00	0.00	5.15
CB-5	Combination 101-B	Inlet		950.04	945.54	In Sag		7.10	0.64	0.69	0.44	Standard	0.80	946.77	946.48	0.22	6.71	2.62	2.62	100.0	0.00		0.00	0.00	7.03
CB-4	Combination 101-B	Inlet		948.18	944.42	In Sag		7.00	0.52	0.63	0.33	Standard	0.50	945.14	945.01	0.19	5.65	1.94	1.94	100.0	0.00		0.00	0.00	1.94
CB-2	Combination 104-B	Inlet		946.68	943.24	In Sag		6.50	0.40	0.67	0.27	Standard	0.50	943.89	943.78	0.17	5.02	1.63	1.63	100.0	0.00		0.00	0.00	1.63
CB-3	Combination 101-B	Inlet		948.18	943.68	In Sag		7.00	0.54	0.65	0.35	Standard	0.60	945.06	944.80	0.19	5.85	2.09	2.09	100.0	0.00		0.00	0.00	9.61
FES-IN-2	Generic Default 100	Inlet		948.77	943.77	In Sag		34.40	24.30	0.49	11.83	Standard	0.50	946.40	945.83	0.00	0.00	37.06	37.06	100.0	0.00		1.16	0.00	37.06
CB-1	Combination 104-B	Inlet		946.68	942.18	In Sag		6.50	0.34	0.67	0.23	Standard	0.60	943.07	942.92	0.15	4.53	1.38	1.38	100.0	0.00		0.00	0.00	3.00
CB-13		Junction	6.00	948.33	938.83							Standard	1.00	942.07	941.03										45.41
MH-1		Junction	6.00	948.40	936.40							Standard	0.60	939.03	938.50										45.31
FES-OUT		Outlet		940.72	935.72									937.44	937.44										45.23

Scenario: Base

Pipe-Report-10yr

Label	Section Size	Section Shape	Material	Mannings n	Upstream Node	Upstream Invert Elevation (ft)	Length (ft)	Constructed Slope (ft/ft)	Downstream Node	Downstream Invert Elevation (ft)	Bend Angle (degrees)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Energy Grade Line In (ft)	Energy Grade Line Out (ft)	Full Capacity (cfs)	Total System Flow (cfs)	Average Velocity (ft/s)
P-9	15 inch	Circular	Concrete	0.013	FES-IN	948.00	29.00	0.052069	CB-8	946.49	45.00	948.59	947.32	948.82	947.42	14.74	2.20	3.20
P-8	18 inch	Circular	Concrete	0.013	CB-8	946.39	32.00	0.005000	CB-7	946.23	45.00	947.18	947.15	947.41	947.31	7.43	3.63	3.54
P-7	18 inch	Circular	Concrete	0.013	CB-7	946.13	44.60	0.005157	CB-6	945.90	45.00	946.97	946.88	947.27	947.09	7.54	4.46	4.02
P-6	24 inch	Circular	Concrete	0.013	CB-6	945.80	32.00	0.005000	CB-5	945.64	90.00	946.77	946.77	946.95	946.89	16.00	5.15	3.11
P-5	24 inch	Circular	Concrete	0.013	CB-5	945.54	352.30	0.004996	CB-3	943.78	0.00	946.48	945.06	946.84	945.23	15.99	7.03	4.07
P-4	12 inch	Circular	Concrete	0.013	CB-4	944.42	32.00	0.020000	CB-3	943.78	90.00	945.01	945.06	945.26	945.16	5.04	1.94	3.23
P-2	12 inch	Circular	Concrete	0.013	CB-2	943.24	32.00	0.030000	CB-1	942.28	45.00	943.78	943.07	944.00	943.16	6.17	1.63	3.10
P-3	24 inch	Circular	Concrete	0.013	CB-3	943.68	115.50	0.005022	CB-13	943.10	34.00	944.80	944.21	945.24	944.66	16.03	9.61	5.35
P-13B	30 inch	Circular	Concrete	0.013	FES-IN-2	943.77	126.00	0.037619	CB-13	939.03	56.00	945.83	942.07	946.97	942.95	79.55	37.06	8.05
P-1	15 inch	Circular	Concrete	0.013	CB-1	942.18	158.80	0.004975	CB-13	941.39	146.00	942.92	942.09	943.16	942.37	4.56	3.00	4.11
P-13	36 inch	Circular	Concrete	0.013	CB-13	938.83	88.30	0.025255	MH-1	936.60	56.00	941.03	939.03	942.07	939.88	105.99	45.41	7.80
P-13A	42 inch	Circular	Concrete	0.013	MH-1	936.40	68.00	0.010000	FES-OUT	935.72	0.00	938.50	937.44	939.38	938.88	100.60	45.31	8.57

Scenario: Base

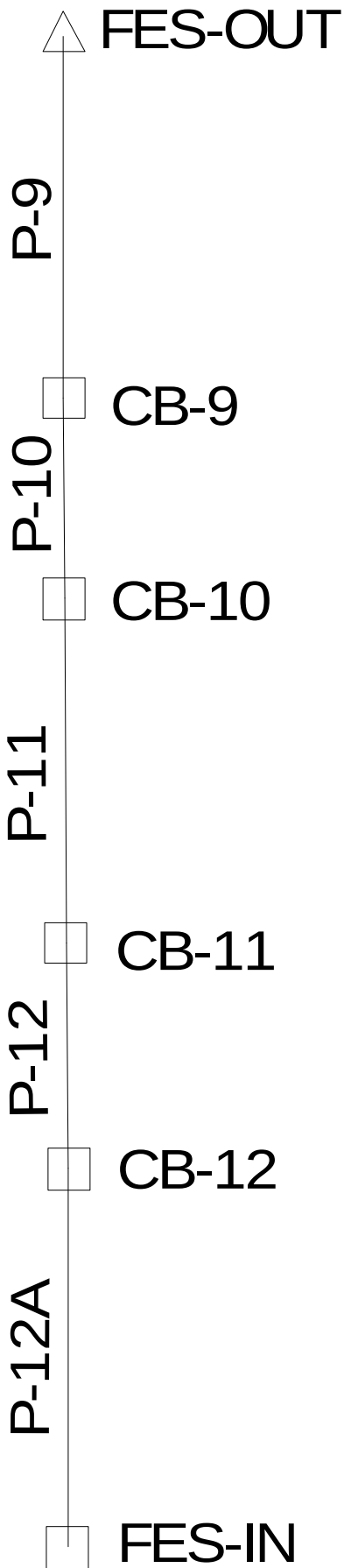
Node-Report-100yr

Label	Inlet	Structure Type	Structure Diameter (ft)	Rim Elevation (ft)	Sump Elevation (ft)	Inlet Location	Longitudinal Slope (ft/ft)	Time of Concentration (min)	Inlet Area (acres)	Inlet C	Inlet CA (acres)	Headloss Method	Headloss Coefficient	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gutter Ditch Depth (ft)	Gutter Ditch Spread (ft)	Total Flow To Inlet (cfs)	Total Intercepted Flow (cfs)	Capture Efficiency (%)	Total Bypassed Flow (cfs)	Bypass Target	Additional Carryover (cfs)	Additional Flow (cfs)	Total System Flow (cfs)
FES-IN	Generic Default 100	Inlet		953.00	948.00	In Sag		18.10	1.05	0.48	0.50	Standard	0.50	948.88	948.73	0.00	0.00	3.26	3.26	100.0	0.00		0.00	0.00	3.26
CB-8	Combination 101-B	Inlet		950.36	946.39	In Sag		6.80	0.54	0.61	0.33	Standard	0.60	947.70	947.57	0.24	7.14	2.90	2.90	100.0	0.00		0.00	0.00	5.38
CB-7	Combination 101-B	Inlet		950.36	946.13	In Sag		6.30	0.33	0.58	0.19	Standard	0.60	947.52	947.35	0.17	5.20	1.72	1.72	100.0	0.00		0.00	0.00	6.61
CB-6	Combination 101-B	Inlet		950.04	945.80	In Sag		5.40	0.22	0.75	0.17	Standard	0.60	947.21	947.10	0.16	4.78	1.51	1.51	100.0	0.00		0.00	0.00	7.64
CB-5	Combination 101-B	Inlet		950.04	945.54	In Sag		7.10	0.64	0.69	0.44	Standard	0.80	947.08	946.72	0.28	8.44	3.84	3.84	100.0	0.00		0.00	0.00	10.42
CB-4	Combination 101-B	Inlet		948.18	944.42	In Sag		7.00	0.52	0.63	0.33	Standard	0.50	945.77	945.67	0.24	7.13	2.85	2.85	100.0	0.00		0.00	0.00	2.85
CB-2	Combination 104-B	Inlet		946.68	943.24	In Sag		6.50	0.40	0.67	0.27	Standard	0.50	944.71	944.64	0.21	6.35	2.39	2.39	100.0	0.00		0.00	0.00	2.39
CB-3	Combination 101-B	Inlet		948.18	943.68	In Sag		7.00	0.54	0.65	0.35	Standard	0.60	945.46	945.15	0.25	7.38	3.06	3.06	100.0	0.00		0.00	0.00	14.29
FES-IN-2	Generic Default 100	Inlet		948.77	943.77	In Sag		34.40	24.30	0.49	11.83	Standard	0.50	948.28	946.89	0.00	0.00	65.79	65.79	100.0	0.00		12.76	0.00	65.79
CB-1	Combination 104-B	Inlet		946.68	942.18	In Sag		6.50	0.34	0.67	0.23	Standard	0.60	944.50	944.38	0.19	5.73	2.02	2.02	100.0	0.00		0.00	0.00	4.39
CB-13		Junction	6.00	948.33	938.83							Standard	1.00	943.64	941.58										78.23
MH-1		Junction	6.00	948.40	936.40							Standard	0.60	940.02	939.16										78.12
FES-OUT		Outlet		940.72	935.72									938.13	938.13										78.03

Scenario: Base

Pipe-Report-100yr

Label	Section Size	Section Shape	Material	Mannings n	Upstream Node	Upstream Invert Elevation (ft)	Length (ft)	Constructed Slope (ft/ft)	Downstream Node	Downstream Invert Elevation (ft)	Bend Angle (degrees)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Energy Grade Line In (ft)	Energy Grade Line Out (ft)	Full Capacity (cfs)	Total System Flow (cfs)	Average Velocity (ft/s)
P-9	15 inch	Circular	Concrete	0.013	FES-IN	948.00	29.00	0.052069	CB-8	946.49	45.00	948.73	947.70	949.03	947.81	14.74	3.26	3.54
P-8	18 inch	Circular	Concrete	0.013	CB-8	946.39	32.00	0.005000	CB-7	946.23	45.00	947.57	947.52	947.78	947.69	7.43	5.38	3.46
P-7	18 inch	Circular	Concrete	0.013	CB-7	946.13	44.60	0.005157	CB-6	945.90	45.00	947.35	947.21	947.63	947.47	7.54	6.61	4.16
P-6	24 inch	Circular	Concrete	0.013	CB-6	945.80	32.00	0.005000	CB-5	945.64	90.00	947.10	947.08	947.29	947.24	16.00	7.64	3.35
P-5	24 inch	Circular	Concrete	0.013	CB-5	945.54	352.30	0.004996	CB-3	943.78	0.00	946.72	945.46	947.17	945.67	15.99	10.42	4.56
P-4	12 inch	Circular	Concrete	0.013	CB-4	944.42	32.00	0.020000	CB-3	943.78	90.00	945.67	945.46	945.87	945.67	5.04	2.85	3.62
P-2	12 inch	Circular	Concrete	0.013	CB-2	943.24	32.00	0.030000	CB-1	942.28	45.00	944.64	944.50	944.78	944.64	6.17	2.39	3.04
P-3	24 inch	Circular	Concrete	0.013	CB-3	943.68	115.50	0.005022	CB-13	943.10	34.00	945.15	944.46	945.67	945.07	16.03	14.29	6.02
P-13B	30 inch	Circular	Concrete	0.013	FES-IN-2	943.77	126.00	0.037619	CB-13	939.03	56.00	946.89	943.64	949.68	946.44	79.55	65.79	13.40
P-1	15 inch	Circular	Concrete	0.013	CB-1	942.18	158.80	0.004975	CB-13	941.39	146.00	944.38	943.64	944.58	943.84	4.56	4.39	3.58
P-13	36 inch	Circular	Concrete	0.013	CB-13	938.83	88.30	0.025255	MH-1	936.60	56.00	941.58	940.02	943.64	941.92	105.99	78.23	11.29
P-13A	42 inch	Circular	Concrete	0.013	MH-1	936.40	68.00	0.010000	FES-OUT	935.72	0.00	939.16	938.13	940.59	940.03	100.60	78.12	10.33



Scenario: Base

Node-Report-10yr

Label	Inlet	Structure Type	Structure Diameter (ft)	Rim Elevation (ft)	Sump Elevation (ft)	Inlet Location	Longitudinal Slope (ft/ft)	Time of Concentration (min)	Inlet Area (acres)	Inlet C	Inlet CA (acres)	Headloss Method	Headloss Coefficient	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gutter Ditch Depth (ft)	Gutter Ditch Spread (ft)	Total Flow To Inlet (cfs)	Total Intercepted Flow (cfs)	Capture Efficiency (%)	Total Bypassed Flow (cfs)	Bypass Target	Additional Carryover (cfs)	Additional Flow (cfs)	Total System Flow (cfs)
FES-IN	Generic Default 10C	Inlet		953.44	948.44	In Sag		52.20	29.10	0.36	10.40	Standard	0.50	950.50	950.12	0.00	0.00	24.40	24.40	100.0	0.00		0.00	0.00	24.40
CB-12	Combination 101-B	Inlet		952.14	947.14	On Grade	0.010000	5.50	0.12	0.63	0.08	Standard	0.50	949.20	948.83	0.12	3.54	0.47	0.44	93.4	0.03	FES-OUT	0.00	0.00	24.47
CB-11	Combination 101-B	Inlet		952.14	946.64	On Grade	0.010000	5.50	0.12	0.16	0.02	Standard	0.50	948.70	948.33	0.07	2.10	0.12	0.12	100.0	1.63e-5	FES-OUT	0.00	0.00	24.48
CB-10	Combination 101-B	Inlet		949.00	944.50	On Grade	0.010000	7.70	0.48	0.64	0.31	Standard	0.50	946.76	946.49	0.20	5.87	1.81	1.37	75.7	0.44	FES-OUT	0.00	0.00	24.68
CB-9	Combination 101-B	Inlet		949.00	944.25	On Grade	0.010000	7.70	0.61	0.65	0.40	Standard	0.50	946.40	946.06	0.22	6.47	2.34	1.68	71.6	0.66	FES-OUT	0.00	0.00	25.29
FES-OUT		Outlet		948.53	943.53									945.24	945.24										25.15

Scenario: Base

Pipe-Report-10yr

Label	Section Size	Section Shape	Material	Mannings n	Upstream Node	Upstream Invert Elevation (ft)	Length (ft)	Constructed Slope (ft/ft)	Downstream Node	Downstream Invert Elevation (ft)	Bend Angle (degrees)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Energy Grade Line In (ft)	Energy Grade Line Out (ft)	Full Capacity (cfs)	Total System Flow (cfs)	Average Velocity (ft/s)
P-12A	30 inch	Circular	Concrete	0.013	FES-IN	948.44	96.00	0.012500	CB-12	947.24	0.00	950.12	949.20	950.87	949.74	45.86	24.40	6.43
P-12	30 inch	Circular	Concrete	0.013	CB-12	947.14	32.00	0.012500	CB-11	946.74	0.00	948.83	948.70	949.58	949.25	45.86	24.47	6.44
P-11	30 inch	Circular	Concrete	0.013	CB-11	946.64	313.00	0.006518	CB-10	944.60	0.00	948.33	946.76	949.08	947.22	33.11	24.48	6.19
P-10	30 inch	Circular	Concrete	0.013	CB-10	944.50	32.00	0.004687	CB-9	944.35	0.00	946.49	946.40	947.03	946.91	28.08	24.68	5.81
P-9	30 inch	Circular	Concrete	0.013	CB-9	944.25	144.00	0.005000	FES-OUT	943.53	0.00	946.06	945.24	946.75	946.02	29.00	25.29	6.85

332nd Ditch

Worksheet for Irregular Channel

Project Description	
Worksheet	Irregular Channel
Flow Element	Irregular Channel
Method	Manning's Formul
Solve For	Discharge

Input Data	
Slope	013000 ft/ft
Water Surface Elev.	951.05 ft

Options	
Current Roughness Method	aved Lotter's Method
Open Channel Weighting	aved Lotter's Method
Closed Channel Weighting	Horton's Method

Results	
Mannings Coeffic	0.030
Elevation Range	951.51 to 951.05
Discharge	23.24 cfs
Flow Area	7.6 ft ²
Wetted Perimeter	19.29 ft
Top Width	19.20 ft
Actual Depth	0.54 ft
Critical Elevation	951.00 ft
Critical Slope	0.018439 ft/ft
Velocity	3.04 ft/s
Velocity Head	0.14 ft
Specific Energy	951.19 ft
Froude Number	0.85
Flow Type	Subcritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+21	0+40	0.030

Natural Channel Points	
Station (ft)	Elevation (ft)
0+21	951.05
0+23	950.53
0+28	950.58
0+33	950.51
0+36	950.70
0+40	951.05