

FAY-435-1.52 PID 117955



Drainage Design and Post Construction Stormwater Management

Project Description:

This design build project includes minor widening and intersection improvements of State Route (SR) 435 between IR 71 and SR 729/Bluegrass Blvd. in Fayette County, Ohio inclusive of the interchange and intersection.

To address recent and future development in the area, a round-a-bout will replace the current temporarily signalized intersection of SR 729/Bluegrass Blvd and SR 435. Additionally, pavement will be added on the north side of SR 435 to provide two thru lanes for both eastbound and westbound. Auxiliary turn lanes are being added based on an interchange operation study performed under a separate contract.

Buildable Units for the project have been developed to facilitate an aggressive schedule. The roadway work is covered under two BU's; BU-4, SR 435 from I-71 to the bridge over US 35 and BU-5, from the bridge to just east of SR 729/Bluegrass Blvd. New right of way is required for the BU-5 improvements only.

The analysis of the drainage and BMPs has been separated to match the limits of BU-4 and BU-5.

BU-4 (Submitted previously under separate cover)

BU-5

DRAINAGE

Pavement drainage throughout BU-5 is mainly over the shoulder and roadside ditches. The exception to this is within the limits of the round-a-bout and splitter islands. Open culverts are utilized under roundabout approaches and driveways where required. Existing ditches and existing conduit are being maintained where they are not impacted by construction.

BMP Selection

Since BU-5 improvements will add new impervious area in new permanent RW, the BMP guidelines for New Construction Projects must be followed. Project area in existing right of way is 14.10 acres and new impervious area in new permanent right of way is 1.5 acres. This yields a treatment percentage of **27.69%** and equates to a **4.74 Acre treatment goal**. To achieve this treatment goal, runoff for the roadway will be collected via roadside ditches and then pass through an extended detention basin.

The following has been identified as a suitable BMP:

Extended Detention Basin, RAB Southeast Quadrant. Treated area in ODOT RW = 4.80 Acres.

**APPENDIX – STORM SEWER DRAINAGE COMPUTATIONS AND
STORM SEWER DRAINAGE AREA MAP**



* Right of Way draining to BMP
** Offsite draining to BMP

EXISTING CULVERT, NO WORK

EXISTING CULVERT, NO WORK

STA. 86+50 EXTEND CULVERT AND RELINE

ACREAGE ON NEXT SHEET

DA-1 4.27 AC
(0.81 PAVE
0.27 BLDG
0.60 PARKING)

DATE DATA
STATION 252+00.00
L = 58.82 50' LT
DC = 01' 38.00" 23.4
R = 3,906.53
LT = 2,256.82
T = 4,092.99
SLOPE 6%

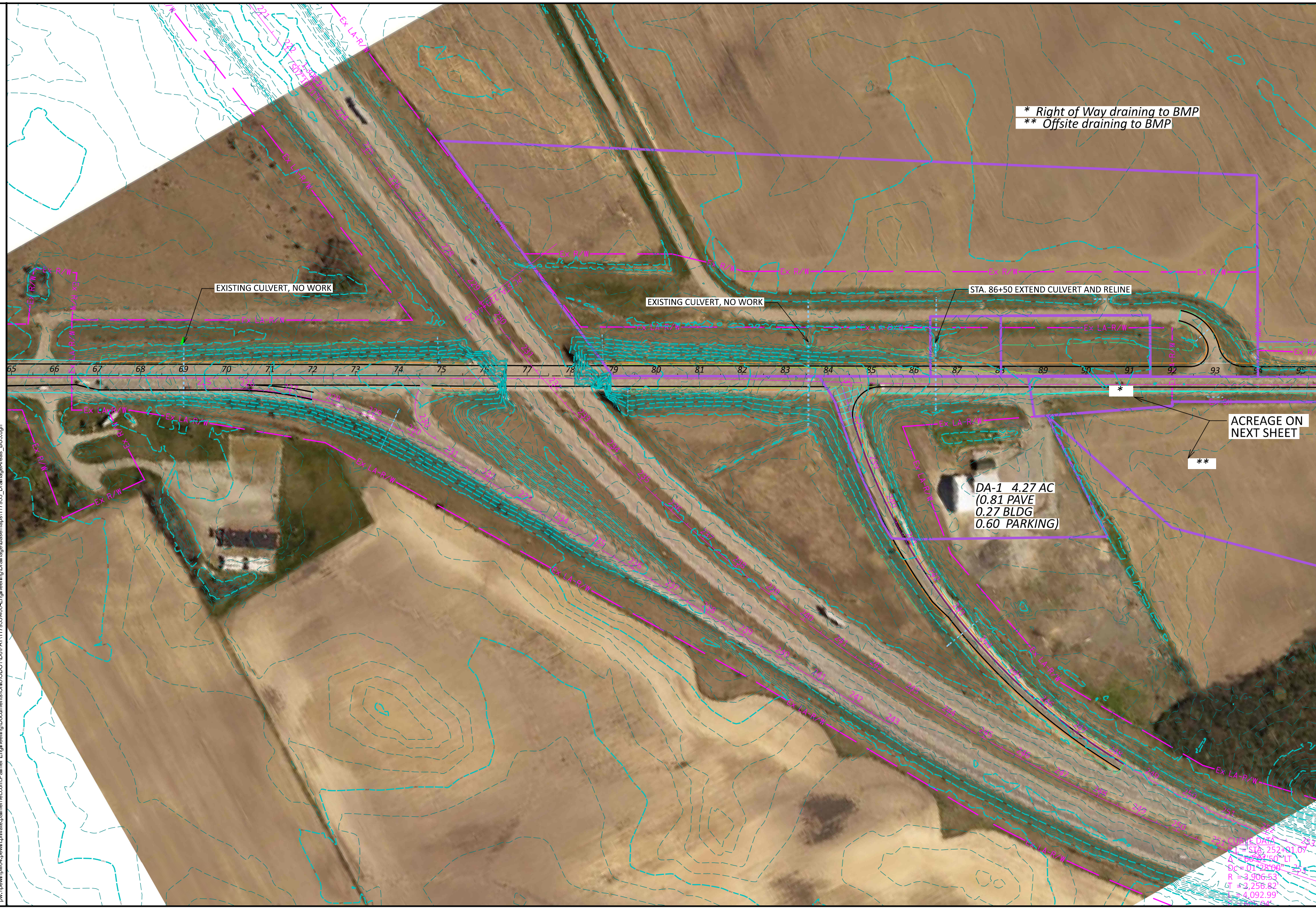
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DESIGN AGENCY

Palmer
ENGINEERING
8350 E. KEMPER RD.
SUITE B
CINCINNATI, OH 45249
513-469-1600

DESIGNER
DCJ

PROJECT ID
117955





* Right of Way draining to BMP
 ** Offsite draining to BMP



**
 20.5 AC

3.46 AC

MODEL: Drainage Area-BU5 - 2 PAPER: 17x11 (in.) DATE: 3/21/2024 TIME: 2:34:51 PM USER: demtbf
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BU-5 DRAINAGE AREAS 2 OF 2

DESIGN AGENCY

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PROJECT ID
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APPENDIX – POST CONSTRUCTION STORMWATER BMP COMPUTATIONS



Ohio Department of Transportation - Office of Hydraulic Engineering
Post-Construction BMP Calculation Spreadsheet

Post Construction - Project Summary

Project Data

		Units
Project EDA	17.12	acres
Is the Project Routine Maintenance per L&D Vol. 2, Sec. 1112.2	No	
BMPs Required?	BMPs Required	NA
Ain (New Impervious Area in New Permanent R/W)	1.5	acres
Does Entire Site Drain to Large River (>100 sq. miles)?	No	
Water Quality Treatment Required	Yes	
Water Quantity Treatment Required	Yes	

Treatment Percent and Treatment Requirement

Aix (Project EDA that is inside the existing right-of-way)	14.10	acres
Ain (New Impervious Area in New Permanent R/W)	1.5	acres
T% (Treatment Percent)	27.69	%
Treatment Requirement	4.74	acres

BMPs Provided

BMP Name	BMP Type	Contributing Drainage Area (acres)	Contributing Drainage Area in ODOT R/W (acres)
DET#1	Extended Detention Basin	25.89	5.39

Treatment Provided

Total Area with ODOT R/W Treated (acres)	5.39
Treatment Requirements (acres)	4.74
Treatment Check	Good

BMP Submittal Requirements (Per L&D, Vol. 2, Sec. 1116.2)

1. Estimated Project Earth Disturbed Area	Yes	Good
2. Treatment Percent Calculation	Yes	Good
3. BMP Selected for use	Yes	Good
4. Drainage area mapping for post-construction BMPs that show the total contributing drainage area and the amount of contributing area within ODOT right-of-way	Yes	Good
5. Plan sheets showing locations of post-construction BMP	Yes	Good
6. Calculations for each BMP	Yes	Good
7. Explanation for any area that is not treated	Yes	Good



Water Quality Flow Rate (WQ_F)

Drainage Area #1	Area (acres)	Coefficient of Runoff (C)
Tributary Area within Existing R/W	4.24	0.9
Impervious Trib. Area Outside Existing R/W	0.25	0.9
Tributary Area Land Use #3	21.40	0.3
Tributary Area Land Use #4	0.00	0.3
Total Tributary Area	25.89	0.404
BMP Type	Vegetated Biofilter	
Time of Concentration (minutes)	NA	
Intensity, i (in/hr)	0.65	
Water Quality Flow (WQ_F)	6.800	cfs

Drainage Area #2	Area (acres)	Coefficient of Runoff (C)
Tributary Area within Existing R/W		0.9
Impervious Trib. Area Outside Existing R/W		0.9
Tributary Area Land Use #3		
Tributary Area Land Use #4		
Total Tributary Area	0.00	
BMP Type		
Time of Concentration (minutes)		
Intensity, i (in/hr)		
Water Quality Flow (WQ_F)		cfs

Drainage Area #3	Area (acres)	Coefficient of Runoff (C)
Tributary Area within Existing R/W		0.9
Impervious Trib. Area Outside Existing R/W		0.9
Tributary Area Land Use #3		
Tributary Area Land Use #4		
Total Tributary Area	0.00	
BMP Type		
Time of Concentration (minutes)		
Intensity, i (in/hr)		
Water Quality Flow (WQ_F)		cfs

Drainage Area #4	Area (acres)	Coefficient of Runoff (C)
Tributary Area within Existing R/W		0.9
Impervious Trib. Area Outside Existing R/W		0.9
Tributary Area Land Use #3		
Tributary Area Land Use #4		
Total Tributary Area	0.00	
BMP Type		
Time of Concentration (minutes)		
Intensity, i (in/hr)		
Water Quality Flow (WQ_F)		cfs

Water Quality Volume (WQ_v)

Drainage Area #1	Values	Units
Tributary Area within Existing R/W	4.24	acres
Impervious Trib. Area Outside Existing R/W	0.25	acres
Pervious Trib. Area Outside Existing R/W	21.40	acres
Total Tributary Area	25.89	acres
Impervious Tributary Area	0.00	acres
Impervious fraction (i)	0.00	fraction
Volumetric Runoff Coefficient (R _v)	0.05	NA
Precipitation (P)	0.90	inches
WQ_v	0.097	ac-ft

Drainage Area #2	Values	Units
Tributary Area within Existing R/W		acres
Impervious Trib. Area Outside Existing R/W		acres
Pervious Trib. Area Outside Existing R/W		acres
Total Tributary Area	0.00	acres
Impervious Tributary Area	0.00	acres
Impervious fraction (i)		fraction
Volumetric Runoff Coefficient (R _v)	0.00	NA
Precipitation (P)	0.90	inches
WQ_v	0.000	ac-ft

Drainage Area #3	Values	Units
Tributary Area within Existing R/W		acres
Impervious Trib. Area Outside Existing R/W		acres
Pervious Trib. Area Outside Existing R/W		acres
Total Tributary Area	0.00	acres
Impervious Tributary Area	0.00	acres
Impervious fraction (i)		fraction
Volumetric Runoff Coefficient (R _v)	0.00	NA
Precipitation (P)	0.90	inches
WQ_v	0.000	ac-ft

Drainage Area #4	Values	Units
Tributary Area within Existing R/W		acres
Impervious Trib. Area Outside Existing R/W		acres
Pervious Trib. Area Outside Existing R/W		acres
Total Tributary Area	0.00	acres
Impervious Tributary Area	0.00	acres
Impervious fraction (i)		fraction
Volumetric Runoff Coefficient (R _v)	0.00	NA
Precipitation (P)	0.90	inches
WQ_v	0.000	ac-ft



Extended Detention Basin / Retention Basin

Drainage Area #	Total Tributary Area (acres)	Tributary Area within the R/W (acres)	WQ _v (ac-ft)
Det. #1	25.89	5.39	0.097

Yellow: Requires Input (See instructions tab)

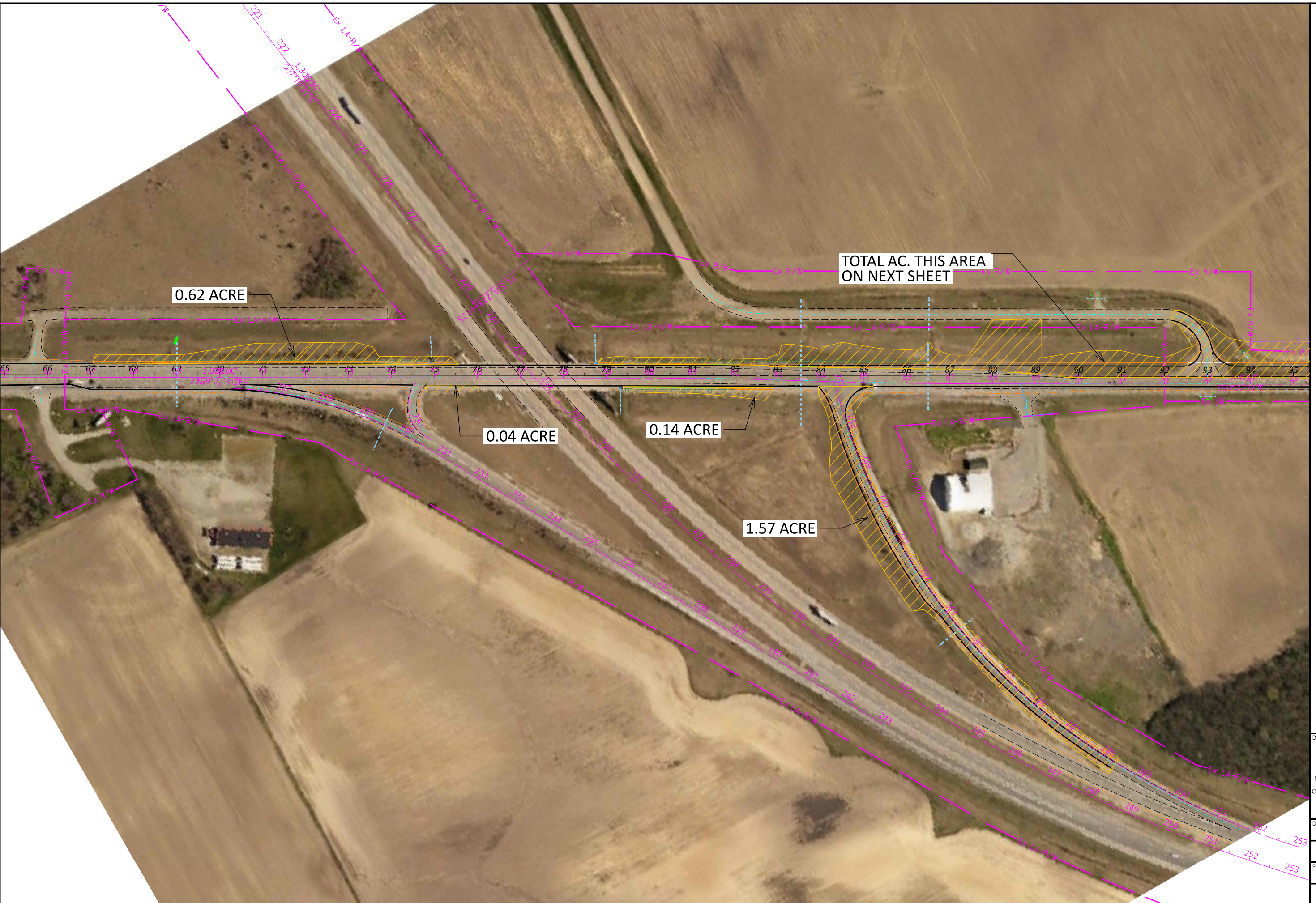
Total Treatment Credit Earned from Extended Detention (within R/W):¹

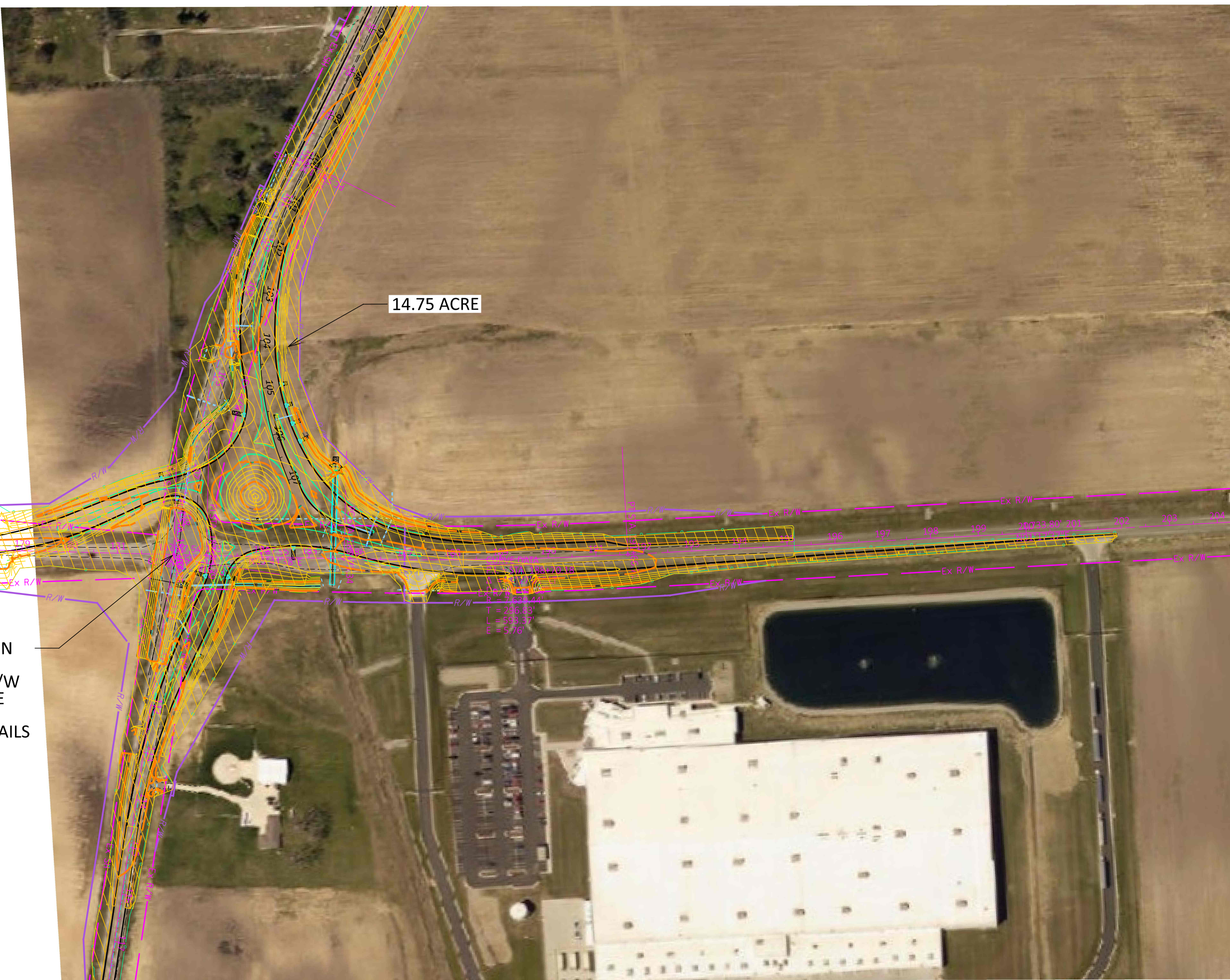
5.39	acres
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(Treatment is for quality and quantity)

	Extended Detention #1	
	Values	Notes / Checks
WQ _v (ac-ft)	0.097	Calculation
Detention or Retention	Detention	Drop Down List
Minimum WQ _v (ac-ft)	0.097	Calculation
Design WQ _v (ac-ft) ²	0.69	GOOD
Min. Time to Drain WQ _v (hrs) ³	48	By Rule
Design Time to Drain WQ _v	60	GOOD
50% WQ _v (ac-ft)	0.049	Calculation
Min. Time to Drain 50% WQ _v (hrs) ⁴	16	Calculation
Design Time to Drain 50% WQ _v	16	GOOD
Min. Forebay and Micropool Vol. (ac-ft) ⁵	0.010	Calculation
Design Forebay Volume (ac-ft)	0.010	GOOD
Design Micropool Volume (ac-ft)	0.01	GOOD
Minimum Permanent Pond Vol. (ac-ft) ⁶	0.000	Calculation
Design Permanent Pond Vol. (ac-ft)		Not required

BMP Design Considerations	Answer	Design Check
1. Is the stage/storage table and graph provided?	Yes	Good
2. Are all detention basin outlets shown in detail?	Yes	Good
3. Is a drawdown hydrograph provided?	Yes	Good
4. Has a summary of all input and output into a basin routing software been provided?	Yes	Good
5. Is scour protection provided at inlets and outlets?	Yes	Good
6. Have detention basin overflow structures (catch basin and overflow weir) been sized appropriately?	Yes	Good
7. Has tailwater been considered?	Yes	Good
8. Is the detention basin located outside of any FEMA designated floodplains?	Yes	Good
9. Are the limits of Item 670, Slope Erosion Protection, shown on the plans?	Yes	Good
10. Are anti-seep collars included in the plans?	Yes	Good
11. Has maintenance access been considered?	Yes	Good
12. Have safety concerns been considered and addressed?	Yes	Good





14.75 ACRE

BMP IS EXTENDED DETENTION
LOCATED IN S.E. QUADRANT
DRAINAGE IS 4.24 ACRE IN R/W
AND 21.65 ACRES OF OFFSITE
(WOODED AND FARMLAND)
SEE PLANS FOR SPECIFIC DETAILS

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DESIGN AGENCY

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CINCINNATI, OH 45249
513-469-1600

DESIGNER
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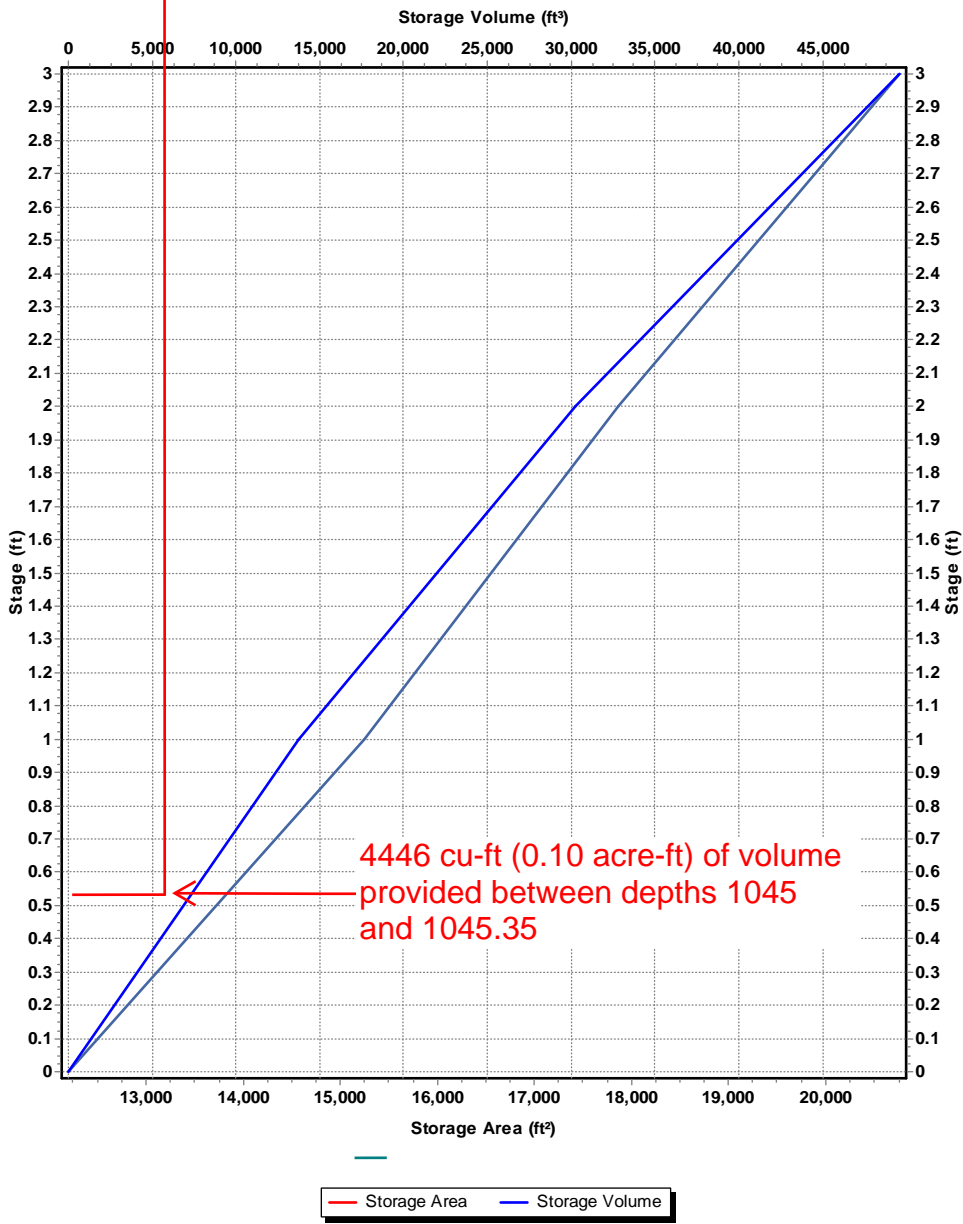
PROJECT ID
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EXTENDED DETENTION

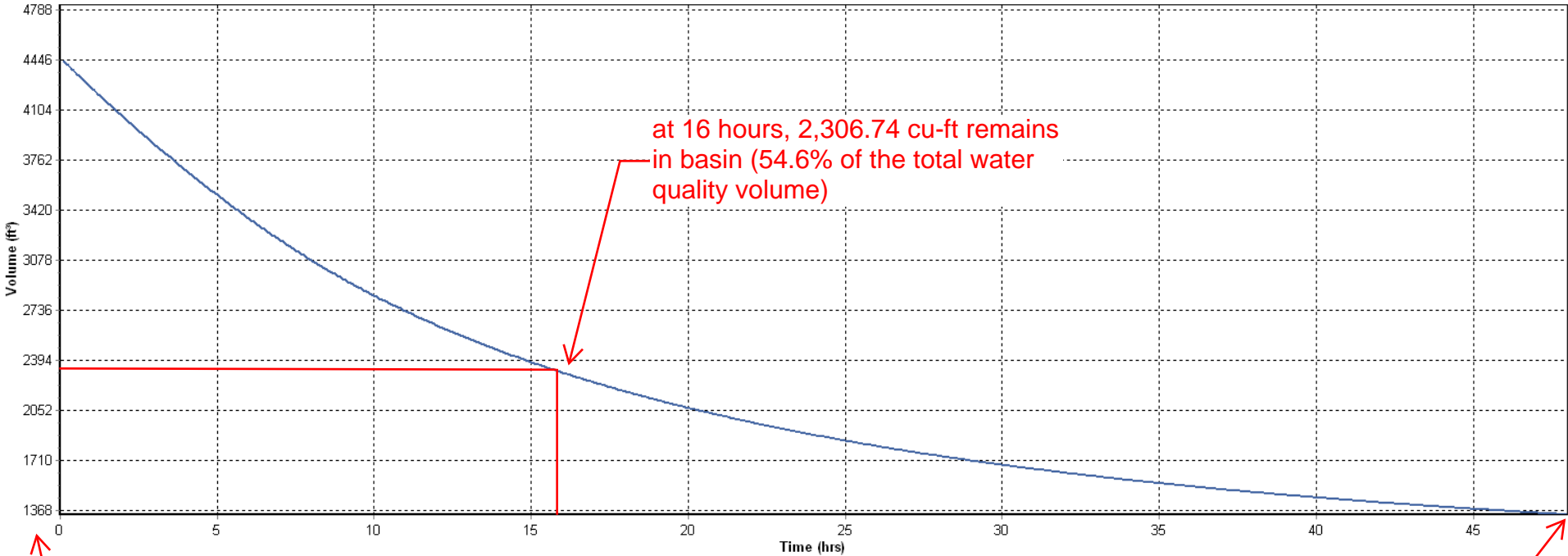
Input Values and Results Summary

Time (hrs)	Remaining Volume in WQ Basin (ft ³)	% Released from WQ Basin	Required % Released from WQ Basin	Outlet Structure Details (ODOT CB No. 2-3)	
16.0	2306.74	45.41%	< 50%	Overflow Spillway Elevation	1046.5
48.0	1336.73	68.36%	< 0 %	Grate EL.	1046.35
				Side Inlet 1 (6" tall x 36" wide)	1045.35
Total WQv	4225.31	cft		Side Inlet 2 (6" tall x 36" wide)	1045.35
Water Surface Elevation Containing WQv	1045.35	ft		3" Perforated Pipe Orifice Cap	1045.073
				4" Perforated Pipe In (Bottom of Water Quality Basin)	1045
				15" Pipe out	1044.7
				6" Underdrain In	1044

Storage Area Volume Curves



Volume Remaining In Water Quality Basin Over 48 Hours



Note that y axis does not extend down to 0

at 48 hours, 1,336.73 cu-ft remains in basin (31.6% of the total water quality volume)

APPENDIX – PAVEMENT DRAINAGE COMPUTATIONS



INLET SPACING DESIGN

By-Pass Lane and West Leg Departure

PID : 117955 Date : 02/27/2024 Project : FAY-435

Location : SR 435 Fayette County

Description : Roadway Improvements along SR 435 between I-71 and SR 729/Bluegrass Blvd

Designer : DCJ

Rainfall Area: C

Storm Frequency (yr.) : 5

Total Allow. Spread (ft.) : 8.00

Allowable Depth (ft.) 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
405+25	I-2-6	350.00	0.90	0.38	10.00	3.18	13.18	0.0100	0.0800	0.0156	2.00	0.0000	4.27	0.98	0.48	1.46	0.249	7.73
105+60	CB-3A	165.00	0.90	0.26	10.00	1.49	11.49	0.0100	0.0800	0.0156	2.00	0.0000	4.54	1.15	0.39	1.54	0.253	7.98
405+65	I-2-6	50.00	0.90	0.12	10.00	0.47	10.54	0.0100	0.0800	0.0156	2.00	0.0000	4.71	*****	*****	0.90	0.218	5.72 Sag
406+10	I-2-6	100.00	0.90	0.14	10.00	0.96	10.96	0.0100	0.0800	0.0156	2.00	0.0000	4.64	0.64	0.12	0.76	0.208	5.05

Curb turnouts have been modeled as an I-2-6 inlet



INLET SPACING DESIGN

North Leg Approach

PID : 117955 **Date :** 02/27/2024 **Project :** FAY-435

Location : SR 435 Fayette County

Description : Roadway Improvements along SR 435 between I-71 and SR 729/Bluegrass Blvd

Designer : DCJ

Rainfall Area: C

Storm Frequency (yr.) : 5

Total Allow. Spread (ft.) : 8.00

Allowable Depth (ft.) : 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
385+40	CB-3A	95.00	0.89	0.14	10.00	0.92	10.95	0.0100	0.0800	0.0156	2.00	0.0000	4.64	0.57	0.01	0.58	0.191	3.96
386+10	CB-3A	65.00	0.90	0.07	10.00	0.68	10.68	0.0100	0.0800	0.0156	2.00	0.0000	4.69	0.30	0.00	0.30	0.152	1.90
407+50	I-2-6	120.00	0.90	0.20	10.00	1.14	11.14	0.0100	0.0800	0.0156	2.00	0.0000	4.60	0.68	0.15	0.83	0.212	5.36

Curb turnouts have been modeled as an I-2-6 inlet



INLET SPACING DESIGN

North Leg Departure

PID : 117955 **Date :** 02/27/2024 **Project :** FAY-435 **Location :** SR 435 FAYette County

Description : Roadway Improvements along SR 435 between I-71 and SR 729/Bluegrass Blvd **Designer :** DCJ

Rainfall Area: C **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
286+50	CB-3A	110.00	0.90	0.08	10.00	1.23	11.23	0.0080	0.0800	0.0156	2.00	0.0000	4.59	0.33	0.00	0.33	0.163	2.18
284+50	I-2-6	140.00	0.90	0.19	10.00	1.49	11.49	0.0080	0.0800	0.0156	2.00	0.0000	4.54	*****	*****	0.78	0.216	5.57 Sag

Curb turnouts have been modeled as an I-2-6 inlet



INLET SPACING DESIGN

East Leg Approach

PID : 117955 **Date :** 02/27/2024 **Project :** FAY-435 **Location :** SR 435 Fayette County

Description : Roadway Improvements along SR 435 between I-71 and SR 729/Bluegrass Blvd **Designer :** DCJ

Rainfall Area: C **Storm Frequency (yr.) :** 5 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.) :** 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
5+00	I-2-6	250.00	0.83	0.47	10.00	2.22	12.22	0.0100	0.0800	0.0156	2.00	0.0000	4.42	*****	*****	1.72	0.261	8.47	Sag

Curb turnouts have been modeled as an I-2-6 inlet



INLET SPACING DESIGN

East Leg Departure

PID : 117955 **Date :** 02/27/2024 **Project :** FAY-435

Location : SR 435 Fayette County

Description : Roadway Improvements along SR 435 between I-71 and SR 729/Bluegrass Blvd

Designer : DCJ

Rainfall Area: C

Storm Frequency (yr.) : 5

Total Allow. Spread (ft.) : 8.00

Allowable Depth (ft.) : 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
110+60	CB-3A	150.00	0.90	0.09	10.00	1.20	11.20	0.0180	0.0800	0.0156	2.00	0.0000	4.59	0.37	0.00	0.37	0.146	1.83
209+40	I-2-6	120.00	0.86	0.25	10.00	0.86	10.86	0.0180	0.0800	0.0156	2.00	0.0000	4.66	*****	*****	1.00	0.206	4.96 Sag

Curb turnouts have been modeled as an I-2-6 inlet



INLET SPACING DESIGN

South Leg Approach

PID : 117955 **Date :** 02/27/2024 **Project :** FAY-435

Location : SR 435 Fayette County

Description : Roadway Improvements along SR 435 between I-71 and SR 729/Bluegrass Blvd

Designer : DCJ

Rainfall Area: C

Storm Frequency (yr.) : 5

Total Allow. Spread (ft.) : 8.00

Allowable Depth (ft.) : 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
5+00	I-2-6	250.00	0.90	0.22	10.00	2.64	12.64	0.0080	0.0800	0.0156	2.00	0.0000	4.35	*****	*****	0.86	0.222	5.99	Sag

Curb turnouts have been modeled as an I-2-6 inlet



INLET SPACING DESIGN

South Leg Departure

PID : 117955 **Date :** 02/27/2024 **Project :** FAY-435

Location : SR 435 Fayette County

Description : Roadway Improvements along SR 435 between I-71 and SR 729/Bluegrass Blvd

Designer : DCJ

Rainfall Area: C

Storm Frequency (yr.) : 5

Total Allow. Spread (ft.) : 8.00

Allowable Depth (ft.) : 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
5+00	I-2-6	250.00	0.88	0.26	10.00	2.77	12.77	0.0070	0.0800	0.0156	2.00	0.0000	4.33	*****	*****	0.99	0.236	6.84	Sag

Curb turnouts have been modeled as an I-2-6 inlet



INLET SPACING DESIGN

West Leg Approach

PID : 117955 **Date :** 02/27/2024 **Project :** FAY-435

Location : SR 435 Fayette County

Description : Roadway Improvements along SR 435 between I-71 and SR 729/Bluegrass Blvd

Designer : DCJ

Rainfall Area: C

Storm Frequency (yr.) : 5

Total Allow. Spread (ft.) : 8.00

Allowable Depth (ft.) : 0.42

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
203+75	CB-3A	180.00	0.90	0.15	10.00	1.31	11.32	0.0180	0.0800	0.0156	2.00	0.0000	4.57	0.61	0.00	0.62	0.176	3.05
205+65	I-2-6	200.00	0.86	0.37	10.00	1.39	11.39	0.0180	0.0800	0.0156	2.00	0.0000	4.56	*****	*****	1.45	0.230	6.48 Sag

Curb turnouts have been modeled as an I-2-6 inlet



STORM SEWER SYSTEM

PID : 117955 **Date :** 03/19/2024 **Project :** FAY-435

Location : SR 435 Fayette County

Description : RAB West Leg Departure

Designer : DCJ

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 12.00

Tailwater Elevation (ft.): 0.00

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		To	(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
PD1P	PD1D	105+65	0.26	0.23	10.00	5.32	5.97	1.2	1.4	12	42.0	0.0119	1045.00	3.97	3.62	0.0020	1045.45	1048.00	2.55	2.00	CB 3A
	begin	105+65	0.26	0.23									1044.50				1045.25	1048.00			0.015



STORM SEWER SYSTEM

PID : 117955 Date : 03/19/2024 Project : FAY-435

Location : SR 435 Fayette County

Description :RAB North Leg

Designer : DCJ

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 12.00

Tailwater Elevation (ft.): 0.00

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		To	(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
PD3P	PD2B	286+05	0.19	0.17	10.00	5.32	5.99	0.9	1.0	12	28.0	0.0286	1046.50	5.00	5.61	0.0011	1046.80	1049.50	2.70	2.00	CB 3A
	begin	386+10	0.19	0.17									1045.70				1046.41	1049.40			0.015
PD2A	PD2B	385+40	0.14	0.13	10.00	5.32	5.91	0.7	0.7	12	66.0	0.0045	1046.00	2.37	2.24	0.0006	1046.42	1048.90	2.48	1.90	CB 3A
	begin	386+10	0.33	0.30									1045.70				1046.38	1049.40			0.015
PD2B	PD2D	386+10	0.05	0.05	10.46	5.23	5.89	1.8	2.0	12	45.0	0.0333	1045.70	6.36	6.06	0.0042	1046.11	1049.40	3.29	2.70	CB 3A
	final	386+10	0.38	0.34									1044.20				1045.00	1047.00			0.015



STORM SEWER SYSTEM

PID : 117955 **Date :** 03/19/2024 **Project :** FAY-435

Location : SR 435 Fayette County

Description : RAB East Leg Departure

Designer : DCJ

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 5

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 12.00

Tailwater Elevation (ft.): 0.00

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		To	(acres)		(min.)	(5 yrs.)	(25 yrs.)	(5 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
PD5P	PD5D	110+60	0.09	0.08	10.00	4.82	5.95	0.4	0.5	12	37.0	0.0068	1046.00	2.35	2.73	0.0002	1046.40	1049.00	2.60	2.00	CB 3A
	begin	110+40	0.09	0.08									1045.75				1046.39	1048.00			0.015



STORM SEWER SYSTEM

PID : 117955 **Date :** 03/19/2024 **Project :** FAY-435

Location : SR 435 Fayette County

Description : RAB South Leg Approach

Designer : DCJ

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 12.00

Tailwater Elevation (ft.): 0.00

JUNCTION		STATION	ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		To	(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
PD6P	PD6D	281+25	0.09	0.08	10.00	5.32	5.97	0.4	0.5	12	30.0	0.0067	1048.00	2.39	2.71	0.0002	1048.45	1051.00	2.55	2.00	CB 3A
	begin	281+25	0.09	0.08									1047.80				1048.44	1049.00			0.015



STORM SEWER SYSTEM

PID : 117955 **Date :** 03/19/2024 **Project :** FAY-435

Location : SR 435 Fayette County

Description : RAB West Leg Approach

Designer : DCJ

Rainfall Area: C

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 12.00

Tailwater Elevation (ft.): 0.00

JUNCTION		STATION		ΔAREA	ΔCA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		To		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
PD8P	PD8D	110+60		0.15	0.14	10.00	5.32	5.96	0.7	0.8	12	46.0	0.0087	1047.90	3.04	3.10	0.0007	1048.26	1049.00	0.74	0.10	CB 3A
	begin	110+40		0.15	0.14									1047.50				1048.19	1051.00			0.015

APPENDIX – DITCH DRAINAGE COMPUTATIONS



DITCH ANALYSIS

PID : 117955 **Date :** 03/01/2024 **Project :** FAY-435

Location : SR 435 from I-71 to SR 729

Description : Ditch 85+00 Left

Designer : DcJ

Rainfall Area : C

Allowable Shears

	Seed:	0.40	Jute Mat:	1.00	Temporary Mat:	1.50
Permanent Mat	Type 1:	3.00	Type 2:	4.00	Type 3:	5.00
RCP	Type B:	6.00				

(*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
88+00	91+00	L	300.00	2.00	3.00	3.00	0.0050	1.12	1.12	0.62	0.69	Seed	4.10	10	0.030	17.90	1.68	0.15	2.85	0.49	4.93
												Seed	3.57	5	0.040	18.69	1.31	0.16	2.48	0.53	5.16



DITCH ANALYSIS

PID : 117955 **Date :** 03/01/2024 **Project :** FAY-435

Location : SR 435 from I-71 to SR 729

Description : Ditch 85+00 Left

Designer : DcJ

Rainfall Area : C

Allowable Shears

	Seed:	0.40	Jute Mat:	1.00	Temporary Mat:	1.50
Permanent Mat	Type 1:	3.00	Type 2:	4.00	Type 3:	5.00
RCP	Type B:	6.00				

(*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
103+00	104+00	R	100.00	2.00	3.00	3.00	0.0050	19.00	19.00	0.56	10.64	Seed	2.33	10	0.030	45.56	2.98	0.43	24.83	1.37	10.20
												Jute Mat	2.33	10	0.040	45.69	2.40	0.48	24.78	1.55	11.31
												Jute Mat	2.03	5	0.040	45.72	2.32	0.46	21.63	1.46	10.77



DITCH ANALYSIS

PID : 117955 Date : 03/01/2024 Project : FAY-435

Location : SR 435 from I-71 to SR 729

Description : Ditch 85+00 Left

Designer : DcJ

Rainfall Area : C

Allowable Shears

	Seed:	0.40	Jute Mat:	1.00	Temporary Mat:	1.50
Permanent Mat	Type 1:	3.00	Type 2:	4.00	Type 3:	5.00
RCP	Type B:	6.00				

(*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
94+00	100+00	R	600.00	2.00	3.00	3.00	0.0050	19.00	19.00	0.56	10.64	Seed	2.24	10	0.030	48.35	2.95	0.42	23.83	1.34	10.05
												Jute Mat	2.21	10	0.040	49.15	2.37	0.47	23.56	1.52	11.10
												Jute Mat	1.93	5	0.040	49.30	2.29	0.45	20.51	1.43	10.56



DITCH ANALYSIS

PID : 117955 **Date :** 03/01/2024 **Project :** FAY-435

Location : SR 435 from I-71 to SR 729

Description : Ditch 85+00 Left

Designer : DcJ

Rainfall Area : C

Allowable Shears

	Seed:	0.40	Jute Mat:	1.00	Temporary Mat:	1.50
Permanent Mat	Type 1:	3.00	Type 2:	4.00	Type 3:	5.00
RCP	Type B:	6.00				

(*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
88+00	91+00	L	300.00	2.00	3.00	3.00	0.0050	1.12	1.12	0.62	0.69	Seed	4.10	10	0.030	17.90	1.68	0.15	2.85	0.49	4.93
												Seed	3.57	5	0.040	18.69	1.31	0.16	2.48	0.53	5.16

APPENDIX - DRAINAGE AREA Tc and C COMPUTATIONS

RAB SOUTH LEG CULVERT		
C Computation	Ac	C
Drainage Area	5.330	0.62
Subarea - 1	69043	0.90
Subarea - 2		0.50
Subarea - 3		0.30
Subarea - 4		0.70
Subarea - 5	163132	0.50

SUB AREA 86+50 CL		
C Computation	Ac	C
Drainage Area	4.010	0.67
Subarea - 1	73181	0.90
Subarea - 2		0.50
Subarea - 3		0.30
Subarea - 4		0.70
Subarea - 5	101500	0.50

SUB AREA Ditch 85+00 Lt		
C Computation	Ac	C
Drainage Area	1.120	0.62
Subarea - 1	14550	0.90
Subarea - 2		0.50
Subarea - 3		0.30
Subarea - 4		0.70
Subarea - 5	34250	0.50

SUB AREA DITCH 94+00 LT		
C Computation	Ac	C
Drainage Area	19.000	0.56
Subarea - 1	121968	0.90
Subarea - 2		0.50
Subarea - 3		0.30
Subarea - 4		0.70
Subarea - 5	705672	0.50

SUB AREA		
C Computation	Ac	C
Drainage Area	0.000	#DIV/0!
Subarea - 1		0.90
Subarea - 2		0.50
Subarea - 3		0.25
Subarea - 4		0.70
Subarea - 5		0.50

SUB AREA RAB South Leg		
C Computation	Ac	C
Drainage Area	25.890	0.31
Subarea - 1	34000	0.90
Subarea - 2	200800	0.50
Subarea - 3	893000	0.25
Subarea - 4		0.70
Subarea - 5	0	0.50

**Tc - Area OVERALL DA (TOTAL EXIST)
RAB South Leg**

Sheet Flow (Overland Flow)	
C Factor, C	0.40
Flow Length (ft), L	0
Slope of Hydraulic Grade Line (Land Slope) (%), s	1.00
To (min)	0.000

Shallow Concentrated Flow	
Flow Length (ft), L	500
Slope of Hydraulic Grade Line (Land Slope) (%), s	0.40
Intercept Coefficient, k	0.152
Average Velocity (ft/s), V	0.32
Ts (min)	26.420

Shallow Concentrated Flow	
Flow Length (ft), L	300
Slope of Hydraulic Grade Line (Land Slope) (%), s	0.80
Intercept Coefficient, k	0.100
Average Velocity (ft/s), V	0.29
Ts (min)	17.038

Shallow Concentrated Flow	
Flow Length (ft), L	800
Slope of Hydraulic Grade Line (Land Slope) (%), s	1.00
Intercept Coefficient, k	0.274
Average Velocity (ft/s), V	0.90
Ts (min)	14.831

Open Channel Flow	
Flow Length (ft), L	215
Slope of Hydraulic Grade Line (Land Slope) (%), s	1.00
Manning's Roughness Factor, n	0.025
Average Velocity (ft/s), V	2.30
Td (min)	1.558

Pipe Flow	
Flow Length (ft), L	58
Slope of Hydraulic Grade Line (Land Slope) (%), s	1.00
Manning's Roughness Factor, n	0.015
Average Velocity (ft/s), V	3.00
Td (min)	0.322

C Computation	Ac	C	Tc
Drainage Area	25.890	0.310	60
Design Storm	i	Q	
2	1.36	10.92	
5	1.67	13.40	
10	1.92	15.41	
25	2.25	18.06	
50	2.49	19.98	
100	2.71	21.75	

Tc (min) **60.170**

NOTES: Based on Equations in 1101.2.2

**Tc - Area OVERALL DA (TOTAL EXIST)
RAB East Leg**

Sheet Flow (Overland Flow)	
C Factor, C	0.40
Flow Length (ft), L	0
Slope of Hydraulic Grade Line (Land Slope) (%), s	1.00
To (min)	0.000

Shallow Concentrated Flow	
Flow Length (ft), L	500
Slope of Hydraulic Grade Line (Land Slope) (%), s	0.40
Intercept Coefficient, k	0.152
Average Velocity (ft/s), V	0.32
Ts (min)	26.420

Shallow Concentrated Flow	
Flow Length (ft), L	300
Slope of Hydraulic Grade Line (Land Slope) (%), s	0.80
Intercept Coefficient, k	0.100
Average Velocity (ft/s), V	0.29
Ts (min)	17.038

Shallow Concentrated Flow	
Flow Length (ft), L	800
Slope of Hydraulic Grade Line (Land Slope) (%), s	1.00
Intercept Coefficient, k	0.274
Average Velocity (ft/s), V	0.90
Ts (min)	14.831

Open Channel Flow	
Flow Length (ft), L	300
Slope of Hydraulic Grade Line (Land Slope) (%), s	1.00
Manning's Roughness Factor, n	0.025
Average Velocity (ft/s), V	2.30
Td (min)	2.174

Pipe Flow	
Flow Length (ft), L	158
Slope of Hydraulic Grade Line (Land Slope) (%), s	1.00
Manning's Roughness Factor, n	0.015
Average Velocity (ft/s), V	3.00
Td (min)	0.878

C Computation	Ac	C	Tc
Drainage Area	27.000	0.310	61
Design Storm	i	Q	
2	1.35	11.30	
5	1.65	13.81	
10	1.90	15.90	
25	2.23	18.67	
50	2.47	20.67	
100	2.68	22.43	

Tc (min) **61.341**

NOTES: Based on Equations in 1101.2.2

Tc - Area OVERALL DA (TOTAL EXIST)

24" Culvert at 86+50 CL

Sheet Flow (Overland Flow)	
Note: 300' Maximum Length	
C Factor, C	0.40
Flow Length (ft), L	300
Slope of Hydraulic Grade Line (Land Slope) (%), s	1.00
To (min)	21.824

Sheet Flow (Overland Flow)	
C Factor, C	0.90
Flow Length (ft), L	
Slope of Hydraulic Grade Line (Land Slope) (%), s	4.00
To (min)	0.000

Shallow Concentrated Flow	
Flow Length (ft), L	150
Slope of Hydraulic Grade Line (Land Slope) (%), s	1.00
Intercept Coefficient, k	0.275
Average Velocity (ft/s), V	0.90
Ts (min)	2.771

Shallow Concentrated Flow	
Flow Length (ft), L	
Slope of Hydraulic Grade Line (Land Slope) (%), s	3.00
Intercept Coefficient, k	0.275
Average Velocity (ft/s), V	1.56
Ts (min)	0.000

Open Channel Flow	
Flow Length (ft), L	350
Slope of Hydraulic Grade Line (Land Slope) (%), s	0.50
Manning's Roughness Factor, n	0.025
Average Velocity (ft/s), V	2.00
Td (min)	2.917

Pipe Flow	
Flow Length (ft), L	
Slope of Hydraulic Grade Line (Land Slope) (%), s	
Manning's Roughness Factor, n	
Average Velocity (ft/s), V	3.00
Td (min)	0.000

C Computation	Ac	C	Tc
Drainage Area	4.010	0.670	28
Design Storm	i	Q	
2	2.38	6.39	
5	2.88	7.74	
10	3.27	8.79	
25	3.77	10.13	
50	4.12	11.07	
100	4.43	11.90	

Tc (min) **27.511**

NOTES: Based on Equations in 1101.2.2

Tc - Area OVERALL DA (TOTAL EXIST)

Ditch sta 94+00 Left

Sheet Flow (Overland Flow)	
Note: 300' Maximum Length	
C Factor, C	0.40
Flow Length (ft), L	300
Slope of Hydraulic Grade Line (Land Slope) (%), s	0.30
To (min)	32.600

Sheet Flow (Overland Flow)	
C Factor, C	0.90
Flow Length (ft), L	
Slope of Hydraulic Grade Line (Land Slope) (%), s	4.00
To (min)	0.000

Shallow Concentrated Flow	
Flow Length (ft), L	150
Slope of Hydraulic Grade Line (Land Slope) (%), s	1.00
Intercept Coefficient, k	0.275
Average Velocity (ft/s), V	0.90
Ts (min)	2.771

Shallow Concentrated Flow	
Flow Length (ft), L	
Slope of Hydraulic Grade Line (Land Slope) (%), s	3.00
Intercept Coefficient, k	0.275
Average Velocity (ft/s), V	1.56
Ts (min)	0.000

Open Channel Flow	
Flow Length (ft), L	1500
Slope of Hydraulic Grade Line (Land Slope) (%), s	0.30
Manning's Roughness Factor, n	0.025
Average Velocity (ft/s), V	2.50
Td (min)	10.000

Pipe Flow	
Flow Length (ft), L	
Slope of Hydraulic Grade Line (Land Slope) (%), s	
Manning's Roughness Factor, n	
Average Velocity (ft/s), V	3.00
Td (min)	0.000

C Computation	Ac	C	Tc
Drainage Area	19.000	0.560	45
Design Storm	i	Q	
2	1.68	17.88	
5	2.06	21.92	
10	2.35	25.00	
25	2.75	29.26	
50	3.02	32.13	
100	3.27	34.79	

Tc (min) **45.371**

NOTES: Based on Equations in 1101.2.2

**APPENDIX –
EXISTING CULVERT COMPUTATIONS**



CULVERT ANALYSIS

PID : 117955 **Date :** 03/01/2024 **Project :** FAY-435

Location : SR 435 BETWEEN I-71 AND SR 729

Description : RAB EAST LEG

Designer : DCJ

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 1 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 1043.50 **Outlet Invert Elevation (ft.) :** 1043.30

Pipe Quantity : 1

Culvert Type : Circular Smooth **Pipe Length (ft.) :** 96.00 **Culvert Slope (ft./ft.) :** 0.0021

Corrugation Type :

Pipe Size : 24 in.

Design Manning 'n' : (default)

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.2000

	FLOW (cfs.)	HEAD LOSS (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
25 yr	18.67	1.21	1046.00	1046.29	2 - F	7.12	2.00	1.56	0.0120	OUTLET**	0.00	1043.30
	20.55	1.47	1046.22	1046.58	2 - F	7.51	2.00	1.63	0.0120	OUTLET**	0.00	1043.30
100 yr	22.43	1.75	1046.47	1046.89	2 - F	7.93	2.00	1.69	0.0120	OUTLET**	0.00	1043.30



CULVERT ANALYSIS

PID : 117955 **Date :** 03/01/2024 **Project :** FAY-435

Location : SR 435 BETWEEN I-71 AND SR 729

Description : RAB SOUTH LEG

Designer : DCJ

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 1 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 1044.70 **Outlet Invert Elevation (ft.) :** 1044.50

Pipe Quantity : 1

Culvert Type : Circular Smooth **Pipe Length (ft.) :** 100.00 **Culvert Slope (ft./ft.) :** 0.0020

Corrugation Type :

Pipe Size : 24 in.

Design Manning 'n' : (default)

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.2000

	FLOW (cfs.)	HEAD LOSS (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
25 yr	18.06	1.16	1047.13	1047.42	2 - F	7.00	2.00	1.53	0.0120	OUTLET**	0.00	1044.50
	19.91	1.40	1047.34	1047.71	2 - F	7.38	2.00	1.60	0.0120	OUTLET**	0.00	1044.50
100 yr	21.75	1.68	1047.58	1048.01	2 - F	7.77	2.00	1.67	0.0120	OUTLET**	0.00	1044.50
	23.60	1.97	1047.84	1048.33	2 - F	8.19	2.00	1.72	0.0120	OUTLET**	0.00	1044.50



CULVERT ANALYSIS

PID : 117955 **Date :** 03/01/2024 **Project :** FAY-435

Location : SR 435 BETWEEN I-71 AND SR 729

Description : DRIVE PIPE 104+20 RT

Designer : DCJ

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 1 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 1047.50 **Outlet Invert Elevation (ft.) :** 1047.13

Pipe Quantity : 1

Culvert Type : Circular Smooth **Pipe Length (ft.) :** 58.00 **Culvert Slope (ft./ft.) :** 0.0064

Corrugation Type :

Pipe Size : 15 in.

Design Manning 'n' : (default)

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.2000

	FLOW (cfs.)	HEAD LOSS (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
25 yr	4.20	0.56	1048.73	N/A	1 - C	5.00	0.81	0.83	0.0120	INLET	0.00	1047.13
100 yr	5.20	0.90	1048.93	1048.95	1 - A	5.34	0.95	0.92	0.0120	OUTLET*	0.00	1047.13