

ASD-250-12.74
PID No. 109129

ODOT District 3

June, 2020

Drainage Calculations



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CARPENTER
MARTY *transportation*

TABLE OF CONTENTS

DRAINAGE AREAS

CULVERT ANALYSIS/EXTENSION

INLET SPACING

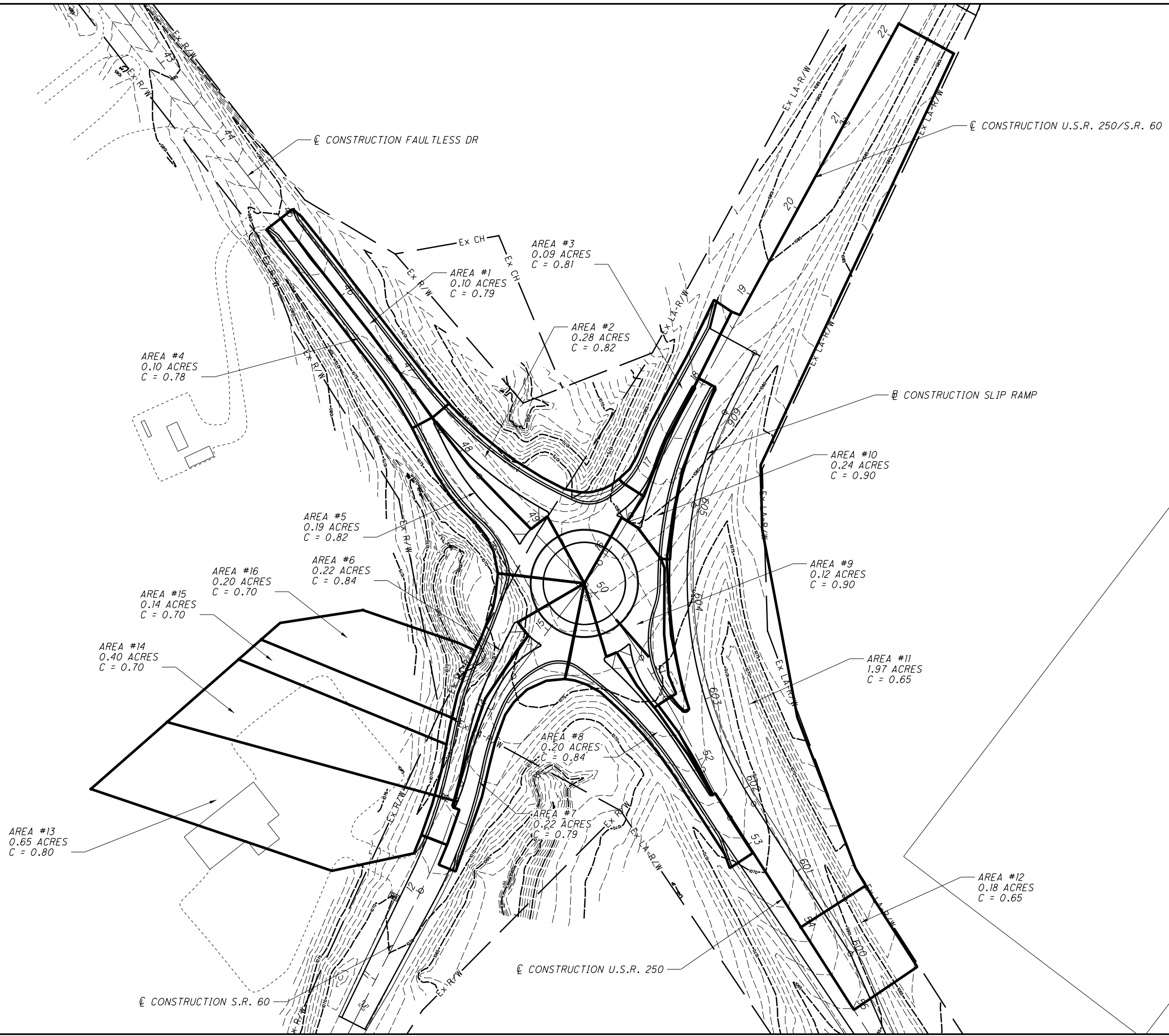
STORM SEWER DESIGN

DITCH ANALYSIS

BMP DESIGN

* Designer Note: For the Inlet spacing/spread calculations, a CB-3A was used to model a 3' curb cut.

DRAINAGE AREAS



CALCULATED
MGM
CHECKED
KAM

**DRAINAGE AREAS
CATCH BASINS AND DITCHES**

ASD-250-12.74



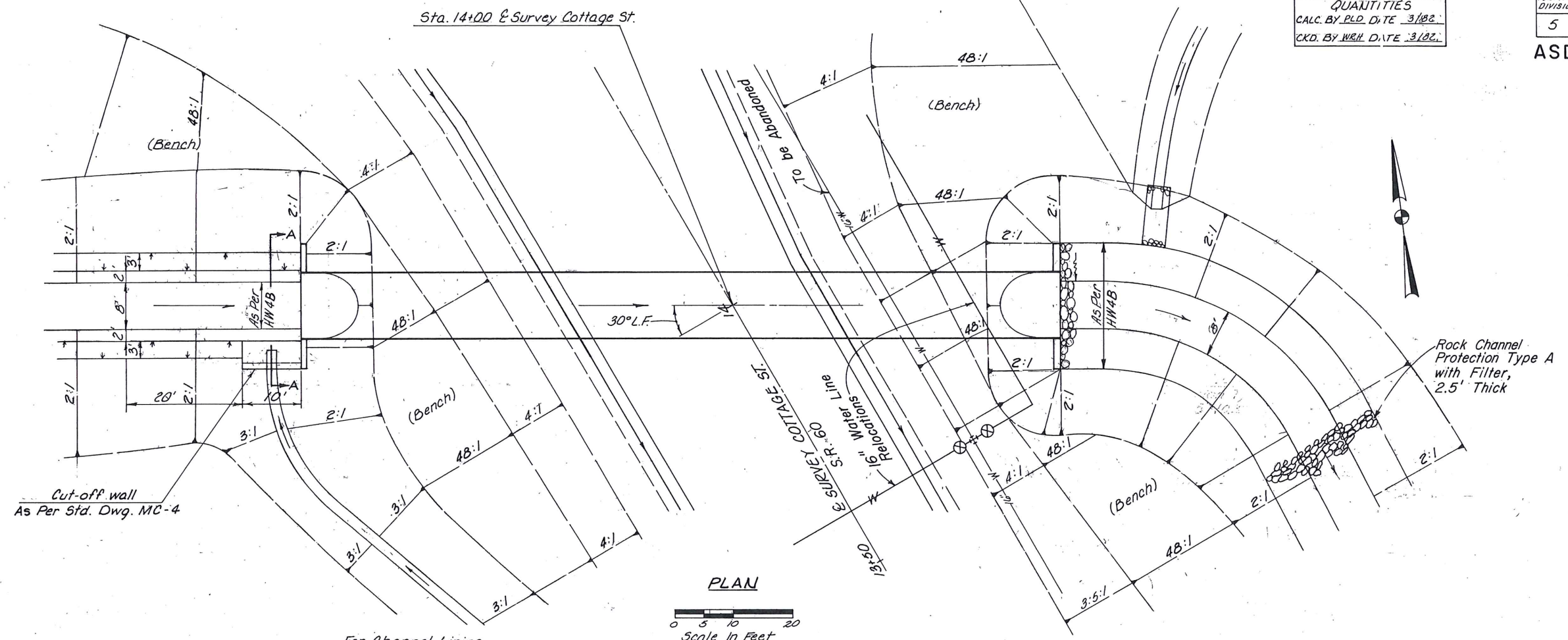
CULVERT ANALYSIS/EXTENSION

QUANTITIES
 CALC. BY P.L.D. DATE 3/82
 CKD. BY W.R.L. DATE 3/82

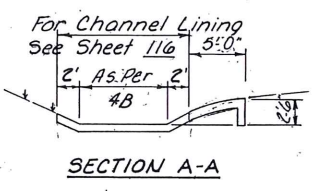
FED. RD. DIVISION	STATE	PROJECT
5	OHIO	

119
193

ASD - 250-12.75



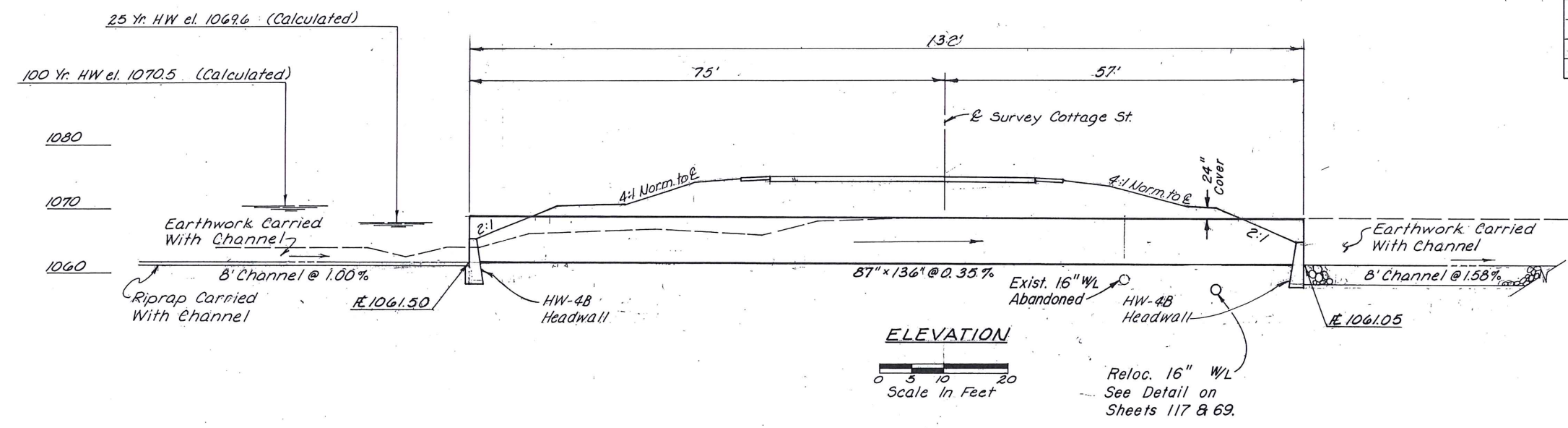
PLAN
 Scale in Feet
 0 5 10 20



For Channel Details See Sheet No. 116

QUANTITIES - CITY PARTICIPATION			
ITEM	QUAN.	UNIT	DESCRIPTION
602	1095	Cu. yd.	Concrete masonry
603	132'	Lin. Ft.	Conduit, Type A: 87" x 136" 70604, C.I. HE-II
Quantities carried to sheet no. 27			

Area = 407 Acres
 Q₂₅ = 602 cfs
 Q₁₀₀ = 882 cfs



ELEVATION
 Scale in Feet
 0 5 10 20



CULVERT ANALYSIS

PID : 109129 **Date :** 05/18/2020 **Project :** ASD-250-12.74

Location : SR 60, ASHLAND COUNTY, OH

Description : EXISTING ANALYSIS OF CULVERT UNDER SR60 AT US250

Designer : MGM

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.) :** 1061.27 **Outlet Invert Elevation (ft.) :** 1060.97
Pipe Quantity : 1
Culvert Type : Elliptical **Pipe Length (ft.) :** 134.00 **Culvert Slope (ft./ft.) :** 0.0022
Corrugation Type :
Pipe Size : 87 x 136 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.)
602.00	3.05	1068.87	1069.09	1 - A	12.22	5.31	5.06	0.0120	OUTLET*	0.00	1060.97
882.00	4.06	1071.71	1071.48	2 - E	13.25	7.25	6.13	0.0120	INLET	0.00	1060.97



UNIVERSAL CULVERT DESIGN

PID : 109129 **Date :** 05/18/2020 **Project :** ASD-250-12.74

Location : SR60, ASHLAND COUNTY, OH

Description : DESIGN OF CULVERT EXTENSION UNDER SR 60 AT USR 250

Designer : MGM

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.

Inlet Invert Elevation (ft.) : 1061.38 **Outlet Invert Elevation (ft.) :** 1060.97 **Tailwater Elevation (ft.) :** 1062.40 **Overflow Elevation (ft.) :** 1075.99
Allowable Headwater Elevation (ft.) : 1075.40 or Diameter + 2 ft. (*whichever is less*)
Pipe Length (ft.) : 182.00 **Culvert Slope (ft./ft.) :** 0.0023 **Design Manning 'n' :** 0.0120 **Buried Manning 'n' :** 0.0000
Design Discharge (cfs) : 602.00 @ 25 yrs. **Flood Discharge (cfs) :** 882.00 @ 100 yrs.

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)	
CULVERT TYPE : ELLIPTICAL			Entrance Type : Square Edge with Headwall						Entrance Loss (Ke) : 0.50					
602.00	1	82 x 128 in.	1070.0	1070.1	2 - F	12.68	5.75	5.16	0.0120	OUTLET*	0.00	D	0.00	
602.00	1	77 x 121 in.	1070.9	1070.5	2 - E	11.48	6.42	5.22	0.0120	INLET	0.00	D - 1	0.00	
602.00	1	72 x 113 in.	1072.1	1071.4	2 - E	13.15	6.00	5.25	0.0120	INLET	0.00	D - 2	0.00	
602.00	1	87 x 136 in.	1069.5	1069.8	1 - A	12.22	5.30	5.06	0.0120	OUTLET*	0.00	D + 1	0.00	
882.00	1	82 x 128 in.	1074.7	1073.5	2 - E	14.93	6.83	6.11	0.0120	INLET	0.00	F	0.00	
844.10	1	77 x 121 in.	1076.9	1075.1	2 - E	16.10	6.42	5.92	0.0120	INLET	37.90	F - 1	0.00	
752.20	1	72 x 113 in.	1079.9	1077.2	2 - E	16.43	6.00	5.61	0.0120	INLET	129.80	F - 2	0.00	
882.00	1	87 x 136 in.	1073.2	1072.4	2 - E	13.25	7.25	6.13	0.0120	INLET	0.00	F + 1	0.00	

INLET SPACING



INLET SPACING DESIGN

PID : 109129 **Date :** 03/25/2020 **Project :** ASD-250-12.74 **Location :** ASHLAND COUNTY, USR 250/ SR 60

Description : WEST LEG, LEFT SIDE, FAULTLESS DR/ NORTH LEG, LEFT SIDE, USR 250 **Designer :** MGM

Rainfall Area: B **Storm Frequency (yr.) :** 2 **Total Allow. Spread (ft.) :** 8.00 **Allowable Depth (ft.) :** 0.26

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.)	
45+00	Begin																		
47+54	CB-3A	254.00	0.79	0.10	10.00	2.30	12.30	0.0153	0.0833	0.0160	2.00	0.0000	3.47	*****	*****	0.27	0.137	1.64	Sag
18+78	Begin																		
16+80	CB-3A	198.00	0.81	0.09	5.57	1.54	10.00	0.0206	0.0833	0.0160	2.00	0.0000	3.83	0.28	0.00	0.28	0.130	1.56	
47+54	CB-3A	230.00	0.82	0.28	6.12	1.85	10.00	0.0135	0.0833	0.0160	2.00	0.0000	3.83	*****	*****	0.88	0.211	4.79	End

SUMP DATA

Total Flow (cfs) : 1.15

Ponded Depth (ft.) : 0.126

Spread on Pavement (ft.) : 6.73



INLET SPACING DESIGN

PID : 109129 **Date :** 03/25/2020 **Project :** ASD-250-12.74

Location : ASHLAND COUNTY, USR 250/ SR 60

Description : WEST LEG, RIGHT SIDE, FAULTLESS DR

Designer : MGM

Rainfall Area: B

Storm Frequency (yr.) : 2

Total Allow. Spread (ft.) : 8.00

Allowable Depth (ft.) : 0.26

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.)	
45+00	Begin																		
47+53	CB-3A	253.00	0.78	0.10	10.00	2.32	12.32	0.0150	0.0833	0.0160	2.00	0.0000	3.46	*****	*****	0.27	0.136	1.64	Sag
49+85	Begin																		
47+53	CB-3A	180.00	0.82	0.19	6.58	2.15	10.00	0.0061	0.0833	0.0160	2.00	0.0000	3.83	*****	*****	0.60	0.212	4.83	End

SUMP DATA

Total Flow (cfs) : 0.87

Ponded Depth (ft.) : 0.095

Spread on Pavement (ft.) : 4.79



INLET SPACING DESIGN

PID : 109129 **Date :** 03/25/2020 **Project :** ASD-250-12.74

Location : ASHLAND COUNTY, USR 250/ SR 60

Description : SOUTH LEG, LEFT SIDE, SR 60

Designer : MGM

Rainfall Area: B

Storm Frequency (yr.) : 5

Total Allow. Spread (ft.) : 6.00

Allowable Depth (ft.) 0.23

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.)
15+60	Begin																	
12+55	CB-3A	281.00	0.84	0.22	6.58	1.89	10.00	0.0195	0.0833	0.0160	2.00	0.0000	4.55	*****	*****	0.84	0.197	3.87 End



INLET SPACING DESIGN

PID : 109129 **Date :** 03/25/2020 **Project :** ASD-250-12.74

Location : ASHLAND COUNTY, USR 250/ SR 60

Description : SOUTH LEG, RIGHT SIDE, SR 60

Designer : MGM

Rainfall Area: B

Storm Frequency (yr.) : 5

Total Allow. Spread (ft.) : 6.00

Allowable Depth (ft.) 0.23

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.)
15+60	Begin																	
12+34	CB-3A	263.00	0.79	0.22	6.38	1.58	10.00	0.0250	0.0833	0.0160	2.00	0.0000	4.55	*****	*****	0.79	0.185	3.13 End



INLET SPACING DESIGN

PID : 109129 **Date :** 03/25/2020 **Project :** ASD-250-12.74

Location : ASHLAND COUNTY, USR 250/ SR 60

Description : EAST LEG, RIGHT SIDE, USR 250

Designer : MGM

Rainfall Area: B

Storm Frequency (yr.) : 5

Total Allow. Spread (ft.) : 6.00

Allowable Depth (ft.) 0.23

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.)
49+85	Begin																	
53+10	CB-3A	271.00	0.84	0.20	6.24	1.51	10.00	0.0293	0.0833	0.0160	2.00	0.0000	4.55	*****	*****	0.76	0.177	2.68 End



INLET SPACING DESIGN

PID : 109129 **Date :** 03/25/2020 **Project :** ASD-250-12.74

Location : ASHLAND COUNTY, USR 250/ SR 60

Description : EAST LEG, LEFT SIDE, USR 250

Designer : MGM

Rainfall Area: B

Storm Frequency (yr.) : 5

Total Allow. Spread (ft.) : 6.00

Allowable Depth (ft.) 0.23

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.)
18+00	Begin																	
16+20	CB-3A	186.00	0.90	0.12	4.89	1.06	10.00	0.0313	0.0833	0.0160	2.00	0.0417	4.55	0.49	0.00	0.49	0.149	1.78
51+30	CB-3A	147.00	0.90	0.24	4.77	0.87	10.00	0.0250	0.0833	0.0160	2.00	0.0417	4.55	*****	*****	0.98	0.199	4.00 End

STORM SEWER DESIGN



STORM SEWER SYSTEM

PID : 109129 **Date :** 05/18/2020 **Project :** ASD-250-12.74

Location : USR250, ASHLAND COUNTY, OH

Description : PROPOSED STORM SEWER, EAST SIDE OF NORTH LEG

Designer : MGM

Rainfall Area: B

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	MINUS	MINUS	MINUS	MANNING'S
				(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'
CB1	MH1	16+23		0.20	0.18	10.00	5.08	5.77	0.9	1.0	12	6.0	0.0300	1074.62	5.07	5.75	0.0011	1075.16	1077.87	2.71	2.25	CB 3A
	begin	16+25		0.20	0.18									1074.44				1075.15	1078.62			0.015
MH1	MH2	16+25		0.00	0.00	10.02	5.07	5.73	0.9	1.0	12	70.0	0.0363	1072.84	5.43	6.33	0.0011	1073.12	1078.62	5.50	4.78	MH 3
		51+11		0.20	0.18									1070.30				1071.01	1075.42			0.015
CB2	MH2	51+30		0.20	0.18	10.00	5.08	5.76	0.9	1.0	12	22.0	0.0400	1071.18	5.61	6.64	0.0011	1071.46	1074.76	3.30	2.58	CB 3A
	begin	51+11		0.40	0.36									1070.30				1071.01	1075.42			0.015
MH2	OUT	51+11		0.00	0.00	10.23	5.03	5.69	1.8	2.0	12	60.0	0.0387	1070.10	6.76	6.53	0.0044	1070.50	1075.42	4.92	4.32	MH 3
	final	51+25		0.40	0.36									1067.78				1068.59	1068.78			0.015



STORM SEWER SYSTEM

PID : 109129 **Date :** 05/18/2020 **Project :** ASD-250-12.74

Location : SR60, ASHLAND COUNTY, OH

Description : PROPOSED STORM SEWER, WEST SIDE OF SOUTH LEG

Designer : MGM

Rainfall Area: B

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 0.00

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 (acres)	Σ CA	TIME (min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
CB1	MH1	13+50	0.80	0.64	10.00	5.08	5.76	3.2	3.7	12	28.0	0.0200	1066.45	6.10	4.70	0.0142	1067.20	1069.50	2.30	2.05	CB 2-2B
	begin	13+75	0.80	0.64									1065.89				1066.80	1075.02			0.015
MH1	CB2	13+75	0.00	0.00	10.08	5.06	5.72	3.2	3.7	12	70.0	0.0200	1065.79	6.08	4.70	0.0140	1066.49	1075.02	8.53	8.23	MH 3
		14+25	0.80	0.64									1064.39				1065.30	1068.00			0.015
CB2	OUT	14+25	0.20	0.16	10.27	5.02	5.71	4.0	4.6	12	14.0	0.0400	1064.29	8.39	6.64	0.0219	1064.98	1068.00	3.02	2.71	CB 2-2B
	final	14+35	1.00	0.80									1063.73				1064.68	1064.73			0.015

DITCH ANALYSIS



DITCH ANALYSIS

PID : 109129 **Date :** 05/18/2020 **Project :** ASD-250-12.74

Location : SR 60, ASHLAND COUNTY, OH

Description : ANALYSIS OF DITCH ALONG THE NORTH SIDE OF USR 250

Designer : MGM

Rainfall Area : B

Allowable Shears

	Seed:	0.40	Jute Mat:	0.45	Temporary Mat:	1.00
Permanent Mat	Type 1:	2.00	Type 2:	3.00	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.)
54+00	55+00	L	100.00	4.00	3.00	3.00	0.0100	2.15	2.15	0.65	1.40	Seed	4.42	5	0.030	10.66	2.50	0.29	6.18	0.46	6.76
												Seed	4.93	10	0.040	10.78	2.11	0.36	6.88	0.57	7.42



DITCH ANALYSIS

PID : 109129 **Date :** 05/18/2020 **Project :** ASD-250-12.74

Location : SR 60, ASHLAND COUNTY, OH

Description : ANALYSIS OF DITCH ALONG THE WEST SIDE OF SR 60, SOUTH OF USR 250

Designer : MGM

Rainfall Area : B

Allowable Shears

	Seed:	0.40	Jute Mat:	0.45	Temporary Mat:	1.00
Permanent Mat	Type 1:	2.00	Type 2:	3.00	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.)
12+50	13+00	L	50.00	2.00	3.00	3.00	0.0100	0.87	0.87	0.80	0.70	Seed	4.48	5	0.030	10.38	2.21	0.27	3.11	0.43	4.57
												Seed	4.99	10	0.040	10.45	1.86	0.33	3.47	0.52	5.14
13+00	13+50	L	50.00	2.00	2.00	2.00	0.0100	0.40	1.27	0.70	0.98	Seed	4.42	5	0.030	10.70	2.58	0.34	4.31	0.54	4.16
												Seed	4.92	10	0.040	10.83	2.17	0.41	4.80	0.66	4.66



DITCH ANALYSIS

PID : 109129 **Date :** 05/18/2020 **Project :** ASD-250-12.74

Location : SR 60, ASHLAND COUNTY, OH

Description : ANALYSIS OF DITCH ALONG THE WEST SIDE OF SR 60, SOUTH OF USR 250

Designer : MGM

Rainfall Area : B

Allowable Shears

	Seed:	0.40	Jute Mat:	0.45	Temporary Mat:	1.00
Permanent Mat	Type 1:	2.00	Type 2:	3.00	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.)
13+75	13+50	L	25.00	2.00	2.00	2.00	0.0100	0.14	0.14	0.70	0.10	Seed	7.90	5	0.030	0.27	1.53	0.13	0.77	0.21	2.84
												Seed	8.37	10	0.040	0.32	1.28	0.16	0.82	0.26	3.02



DITCH ANALYSIS

PID : 109129 **Date :** 05/18/2020 **Project :** ASD-250-12.74

Location : SR 60, ASHLAND COUNTY, OH

Description : ANALYSIS OF DITCH ALONG THE WEST SIDE OF SR 60, SOUTH OF USR 250

Designer : MGM

Rainfall Area : B

Allowable Shears

	Seed:	0.40	Jute Mat:	0.45	Temporary Mat:	1.00
Permanent Mat	Type 1:	2.00	Type 2:	3.00	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.)
13+75	14+25	L	50.00	2.00	2.50	2.00	0.0100	0.28	0.28	0.70	0.20	Seed	7.79	5	0.030	0.44	1.88	0.19	1.53	0.30	3.37
												Seed	8.25	10	0.040	0.53	1.55	0.23	1.62	0.37	3.66

BMP DESIGN



Surveying	Engineering	Project Management
Job Name: <u>ASD-250-12.74</u>	PID No.: <u>109129</u>	
Location: <u>USR 250/SR 60 Ashland Co.</u>	Sheet: <u>1</u> of <u>1</u>	
Task: <u>BMP Calculations</u>		
Calculated By: <u>MGM</u>	Date: <u>5/28/2020</u>	
Checked By: <u>KAM</u>	Date: <u>5/29/2020</u>	

This is a redevelopment project. Therefore, treat 100% of the WQv of WQf for 20% of the project earth disturbed area.

Earth Disturbed Area (EDA) = 4.037 acres

20% EDA = 0.807 acres

Project will utilize Vegetated Filter Strips and Vegetated Biofilter for WQf.

Vegetated Filter Strip (Slip Ramp) - STA. 606+15.00 to STA. 602+97.00 (0.50 Ac.)

Vegetated Filter Strip (U.S.R. 250) - STA. 51+48.00 to STA. 52+75.00 (0.08 Ac.)

Total contributing area = 0.58 acres

Vegetated Filter Strip (S.R. 60) - STA. 11+00.00 to STA. 12+25.00

Total contributing area = 0.12 acres

Vegetated Biofilter (VBF) (U.S.R. 250) - STA. 54+00.00 to STA. 55+00.00

Total contributing area = 0.14 acres

See BMP worksheet for VBF calculations.



Post Construction - Project Summary

Project Data

		Units
Project EDA	4.037	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)	0	acres
Does Entire Site Drain to Large River (>100 sq. miles)?	No	
Water Quality Treatment Required	Yes	
Water Quantity Treatment Required	No	

Treatment Percent and Treatment Requirement

Aix (Project EDA that is inside the existing right-of-way)	4.037	acres
Ain (New Impervious Area in New Permanent R/W)	0	acres
T% (Treatment Percent)	20.00	%
Treatment Requirement	0.81	acres

BMPs Provided

BMP Name	BMP Type	Contributing Drainage Area (acres)	Contributing Drainage Area in ODOT R/W (acres)
VFS1	Vegetated Filter Strip	0.58	0.58
VFS2	Vegetated Filter Strip	0.12	0.12
VBF1	Vegetated Biofilter	2.23	0.14

Treatment Provided

Total Area with ODOT R/W Treated (acres)	0.84
Treatment Requirements (acres)	0.81
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



Ohio Department of Transportation - Office of Hydraulic Engineering

Post-Construction BMP Calculation Spreadsheet

Vegetated Filter Strip

Filter Strip	Route	Begin Station	End Station	Side	Pavement Width (FT)	Filter Strip Width (FT)	Filter Strip Slope (z:1)	Filter Strip Length (FT)	Drainage Area (acres)	Filter Strip Area (SF)	Item 659 Topsoil Volume (CY)	Item 670 Erosion Protection Area (SY)
Filter Strip #1	USR250	51+48	52+75	LT	37.4	28	6	127	0.19	3,242	40.0	360.2
Filter Strip #2	SLIP	602+97	605+50	RT	24	28	6	253	0.31	6,708	82.8	745.3
Filter Strip #3	SLIP	605+50	606+00	RT	24	25.5	6	50	0.06	1,224	15.1	136.0
Filter Strip #4	SLIP	606+00	606+15	RT	24	23	6	15	0.02	355	4.4	39.4
Filter Strip #5	SR60	11+00	11+50	RT	18	20	11	50	0.05	1,007	12.4	111.9
Filter Strip #6	SR60	11+50	12+25	RT	18	20	4	75	0.07	1,534	18.9	170.4
								0			0.0	0.0
								0			0.0	0.0
								0			0.0	0.0
								0			0.0	0.0

Total Treatment Credit Earned from Vegetated Filter Strips 0.7 acres

(Treatment is for quality only, not quantity)

BMP Design Considerations

	Answer	Design Check
1 Is the min. filter strip width 15-25 ft wide depending on L&D Table 1117-3?	Yes	Good
2 Is the slope 3:1 or flatter for 34 ft or narrower pavement drainage width	Yes	Good
3 Is the slope 6:1 or flatter for 35 - 48 ft pavement drainage width	NA	Good
4 Is the only contributing drainage to the filter strip from the road and shoulder?	Yes	Good
5 Does any concentrated flow or any outlets discharge to the filter strip?	No	Good
6 Is 4" of Item 659, Topsoil, included for the filter strip?	Yes	Good
7 Is Item 670, Slope Erosion Protection, included for the filter strip?	Yes	Good



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

Vegetated Biofilter

Location Information					Hydrology			Channel Characteristics					Analysis Results			
VBF	Route	Begin Station	End Station	Side	Total Drainage Area (acres)	EDA Treatment Credit (acres) ¹	WQ _F (cfs)	VBF Bottom Width (ft) ^{note2}	VBF Fore Slope (z:1)	VBF Back Slope (z:1)	VBF Longitudinal Slope (ft/ft)	Manning's Roughness Coefficient ³	Depth of Runoff at WQ _F (inches) ⁴	Velocity of Runoff at WQ _F (ft/sec) ⁴	Standard Ditch Width (feet) ⁵	Required Ditch Width (feet)
VBF#1	SR 60	54+00	55+00	LT	2.23	0.14	0.816	4	3	3	0.016	0.15	3.83	0.52	2	4

Total Treatment Credit Earned from VBFs (within R/W): **0.14** acres
 (Treatment is for quality only, not quantity)

Yellow: Requires Input (See instructions tab)

BMP Design Considerations

1	Do the VBF characteristics match the calculated flow and velocity checks using Manning's Equation above?	Yes	Good
2	Is the VBF a trapezoidal ditch with a flat bottom, not a radius ditch?	Yes	Good
3	Is the VBF width at least 4 feet?	Yes	Good
4	Is the depth of runoff for the WQ _F for each VBF less than or equal to 4 inches?	Yes	Good
5	Is the velocity of runoff for the WQ _F for each VBF less than or equal to 1.0 ft/sec?	Yes	Good
6	Does the "Total Drainage Area" include all onsite and off-site drainage to the VBF?	Yes	Good
7	Does each VBF include 4" of Item 659 Topsoil on the vegetated portion of the shoulder and foreslope?	Yes	Good
8	Does each VBF include Item 670, Ditch Erosion Protection?	Yes	Good
9	Are the station ranges and locations of the VBFs labeled on the Project Site Plan drawing?	Yes	Good