

I.R. 75 DRAINAGE CALCULATIONS

BUT IR 75/VAR/5.22/VAR
STATE OF OHIO
BETHEL TOWNSHIP
COUNTY OF MIAMI

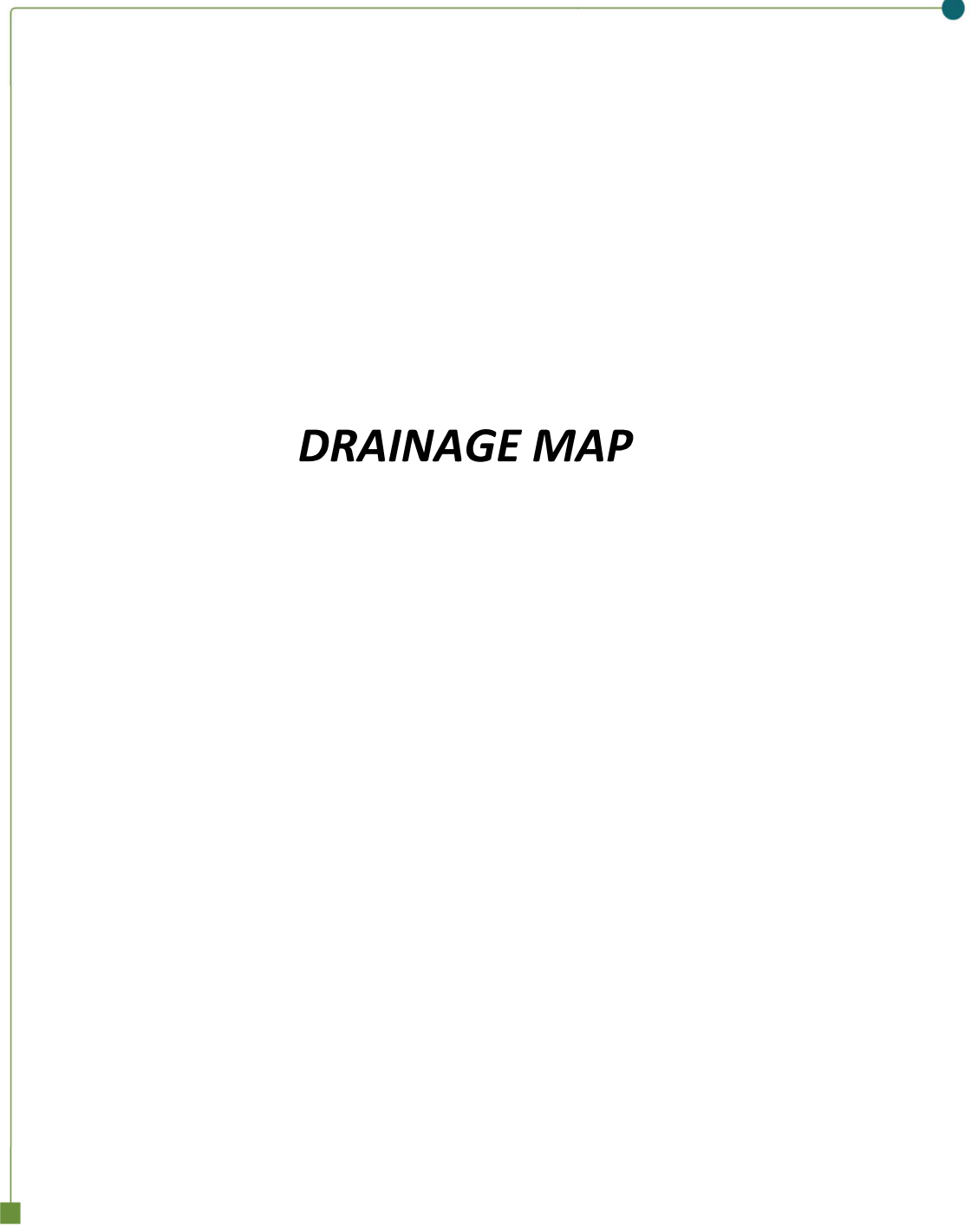
DATE: 08/29/2025
PREPARED FOR

Ohio Department of Transportation – District 8
505 S. State Route 741
Lebanon, Ohio 45036



22999 Forbes Road, Suite B
Cleveland, OH 44146
Phone: 440-439-1999
www.cvelimited.com

REVIEW COMPLETE	
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R/W	
SURVEY	
TRAFFIC	
UTILITIES	
OTHER	
OTHER	

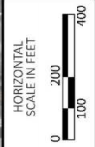
A thin, dark green line starts at a small green square in the bottom left corner, extends vertically upwards, then turns 90 degrees to the right and extends horizontally across the top of the page. A small teal circle is located at the end of this horizontal line.

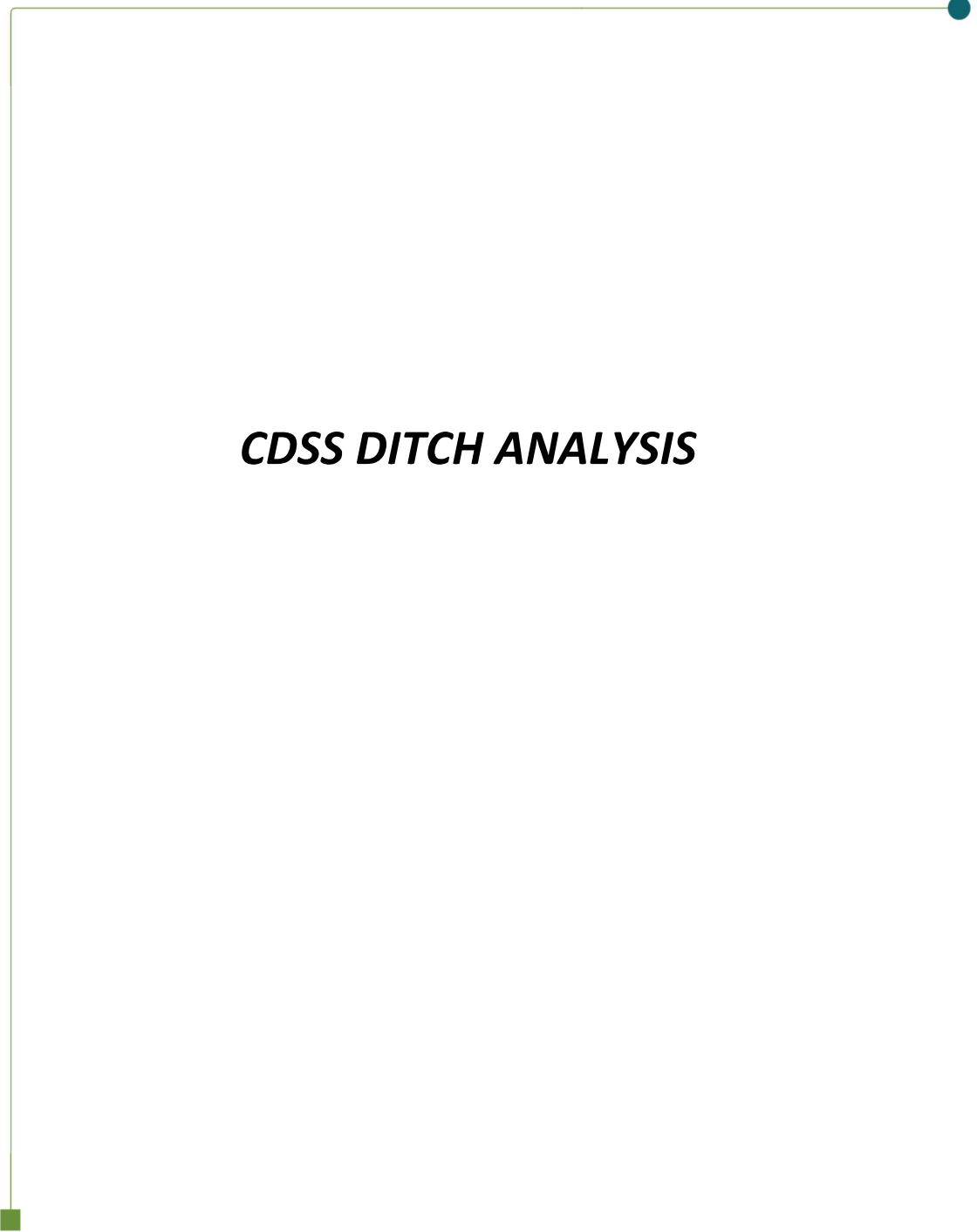
DRAINAGE MAP



DRAINAGE AREA MAP
I.R. 75

DESIGN AGENCY	
 CHAGRON VALLEY ENGINEERING, LTD.	
DESIGNER	
RHB	
REVIEWER	
SDK 8/29/25	
PROJECT ID	
117275	
SHEET TOTAL	
P.1	1





CDSS DITCH ANALYSIS



DITCH ANALYSIS

PID : 117275 **Date :** 08/29/2025 **Project :** BUT IR 75/VAR/5.22/VAR **Location :** IR-75

Description : SB IR 75 - Left Ditch Analysis STA 275+01.08 to STA 282+00

Designer : SDK

Rainfall Area : C

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.)
282+00	278+50	L	350.00	4.00	6.00	4.00	0.0154	0.91	0.91	0.68	0.62	Seed	3.66	5	0.030	17.86	1.98	0.22	2.26	0.22	6.24
												Seed	4.05	10	0.040	18.37	1.67	0.27	2.50	0.28	6.78
278+50	275+01	L	349.00	4.00	6.00	6.00	0.0040	0.92	1.83	0.62	1.19	Seed	3.27	5	0.030	21.86	1.41	0.11	3.88	0.42	9.06
												Seed	3.57	10	0.040	23.14	1.17	0.13	4.25	0.51	10.14



DITCH ANALYSIS

PID : 117275 **Date :** 08/29/2025 **Project :** BUT IR 75/VAR/5.22/VAR **Location :** IR-75

Description : SB IR 75 - Right Ditch Analysis STA 275+01.07 to STA 283+06.69

Designer : SDK

Rainfall Area : C

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.)
283+07	279+00	R	407.00	4.00	3.00	6.00	0.0084	0.95	0.95	0.62	0.59	Seed	3.52	5	0.030	19.12	1.58	0.13	2.08	0.26	6.30
												Seed	3.89	10	0.040	19.86	1.34	0.16	2.29	0.32	6.84
279+00	275+01	R	399.00	4.00	3.00	6.00	0.0078	0.79	1.74	0.66	1.11	Seed	3.20	5	0.030	22.67	1.82	0.17	3.55	0.35	7.15
												Seed	3.49	10	0.040	24.08	1.53	0.21	3.88	0.43	7.86



DITCH ANALYSIS

PID : 117275 **Date :** 08/29/2025 **Project :** BUT IR 75/VAR/5.22/VAR **Location :** IR-75

Description : SB IR 75 - Right Ditch Analysis STA 283+07 to STA 289+07

Designer : SDK

Rainfall Area : C

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.)
289+07	286+00	R	307.00	4.00	3.00	6.00	0.0137	0.72	0.72	0.64	0.46	Seed	3.66	5	0.030	17.85	1.75	0.17	1.69	0.20	5.78
												Seed	4.05	10	0.040	18.34	1.49	0.21	1.87	0.25	6.21
286+00	283+07	R	293.00	4.00	3.00	6.00	0.0123	0.69	1.41	0.62	0.89	Seed	3.42	5	0.030	20.20	2.03	0.22	3.04	0.28	6.55
												Seed	3.76	10	0.040	21.13	1.72	0.27	3.34	0.35	7.14



DITCH ANALYSIS

PID : 117275 **Date :** 08/29/2025 **Project :** BUT IR 75/VAR/5.22/VAR **Location :** IR-75

Description : SB IR 75 - Right Ditch Analysis STA 289+07 to STA 291+05

Designer : SDK

Rainfall Area : C

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.)
291+05	289+07	R	198.00	4.00	3.00	6.00	0.0111	0.46	0.46	0.64	0.29	Seed	3.72	5	0.030	17.28	1.41	0.11	1.10	0.16	5.47
												Seed	4.13	10	0.040	17.67	1.21	0.14	1.22	0.20	5.84



DITCH ANALYSIS

PID : 117275 **Date :** 08/29/2025 **Project :** BUT IR 75/VAR/5.22/VAR **Location :** IR-75

Description : NB IR 75 - Left Ditch Analysis STA 275+05 to STA 283+50

Designer : SDK

Rainfall Area : C

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.)
283+50	279+50	L	400.00	4.00	3.00	6.00	0.0085	0.95	0.95	0.62	0.59	Seed	3.53	5	0.030	19.03	1.59	0.13	2.08	0.25	6.28
												Seed	3.90	10	0.040	19.75	1.35	0.17	2.30	0.31	6.83
279+50	275+05	L	445.00	4.00	3.00	6.00	0.0074	1.05	2.00	0.63	1.25	Seed	3.18	5	0.030	22.91	1.85	0.17	3.98	0.38	7.39
												Seed	3.47	10	0.040	24.36	1.55	0.21	4.34	0.46	8.15



DITCH ANALYSIS

PID : 117275 **Date :** 08/29/2025 **Project :** BUT IR 75/VAR/5.22/VAR **Location :** IR-75

Description : NB IR 75 - Left Ditch Analysis STA 283+50 to STA 292+08.32 (Off-site)

Designer : SDK

Rainfall Area : C

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.)
291+05	288+00	L	305.00	4.00	3.00	6.00	0.0111	0.96	0.96	0.65	0.62	Seed	3.67	5	0.030	17.74	1.80	0.17	2.29	0.25	6.24
												Seed	4.06	10	0.040	18.23	1.52	0.21	2.54	0.31	6.78
288+00	283+50	L	450.00	4.00	3.00	6.00	0.0133	1.06	2.02	0.34	0.98	Seed	3.33	5	0.030	21.14	2.14	0.24	3.28	0.29	6.60
												Seed	3.65	10	0.040	22.25	1.80	0.30	3.59	0.36	7.20



DITCH ANALYSIS

PID : 117275 **Date :** 08/29/2025 **Project :** BUT IR 75/VAR/5.22/VAR **Location :** IR-75

Description : NB IR 75 - Right Ditch Analysis STA 283+10.66 to STA 276+50

Designer : SDK

Rainfall Area : C

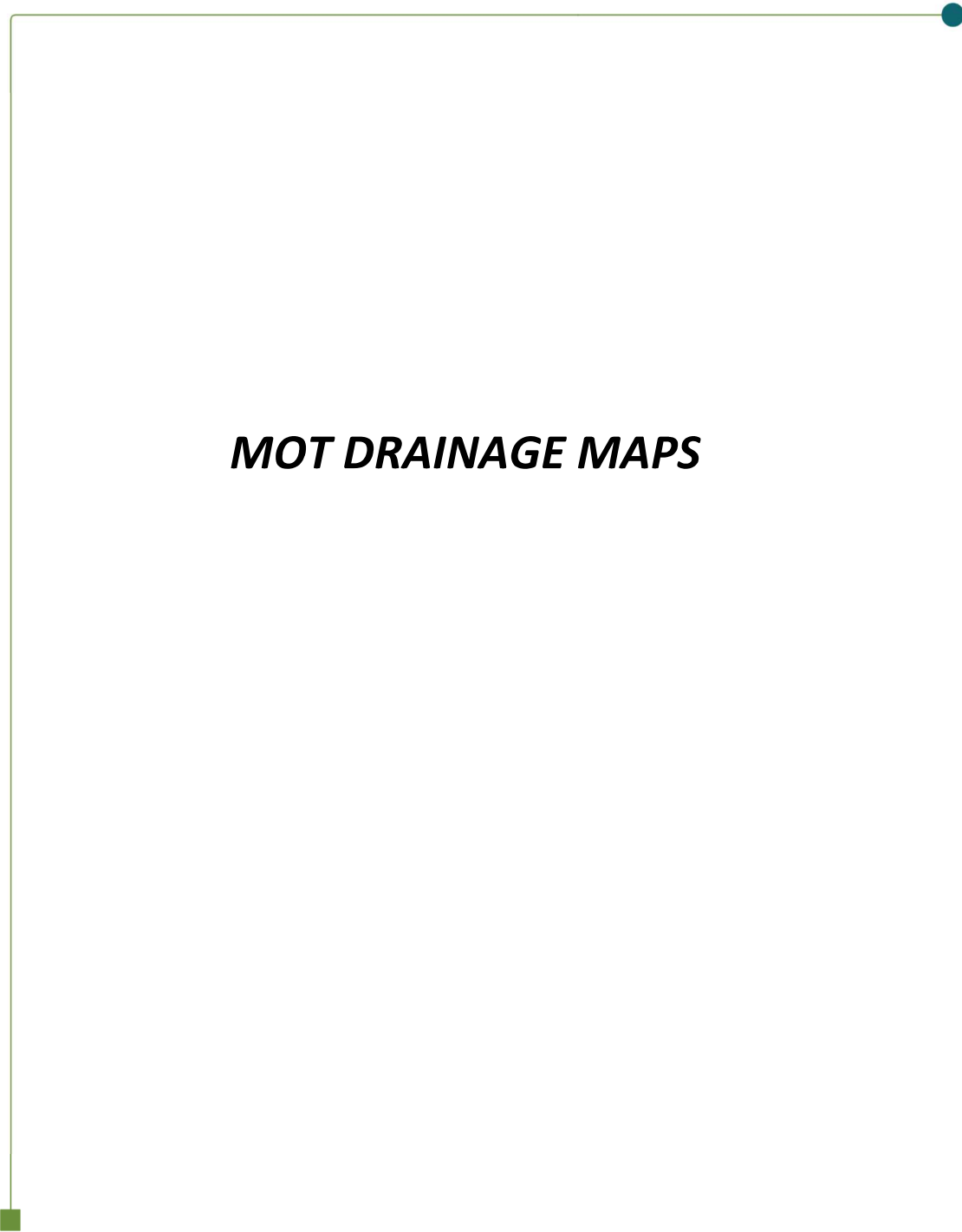
Allowable Shears

	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.)
283+00	279+00	L	400.00	4.00	6.00	4.00	0.0123	1.41	1.41	0.64	0.90	Seed	3.62	5	0.030	18.15	2.05	0.22	3.27	0.29	6.92
												Seed	4.01	10	0.040	18.73	1.73	0.28	3.62	0.36	7.60
279+00	276+50	L	250.00	4.00	6.00	6.00	0.0072	0.79	2.20	0.66	1.42	Seed	3.40	5	0.030	20.36	1.85	0.18	4.84	0.41	8.87
												Seed	3.73	10	0.040	21.37	1.54	0.22	5.32	0.49	9.93

A thin green line starts from a small green square at the bottom left, goes vertically up, then horizontally right to a small green circle at the top right.

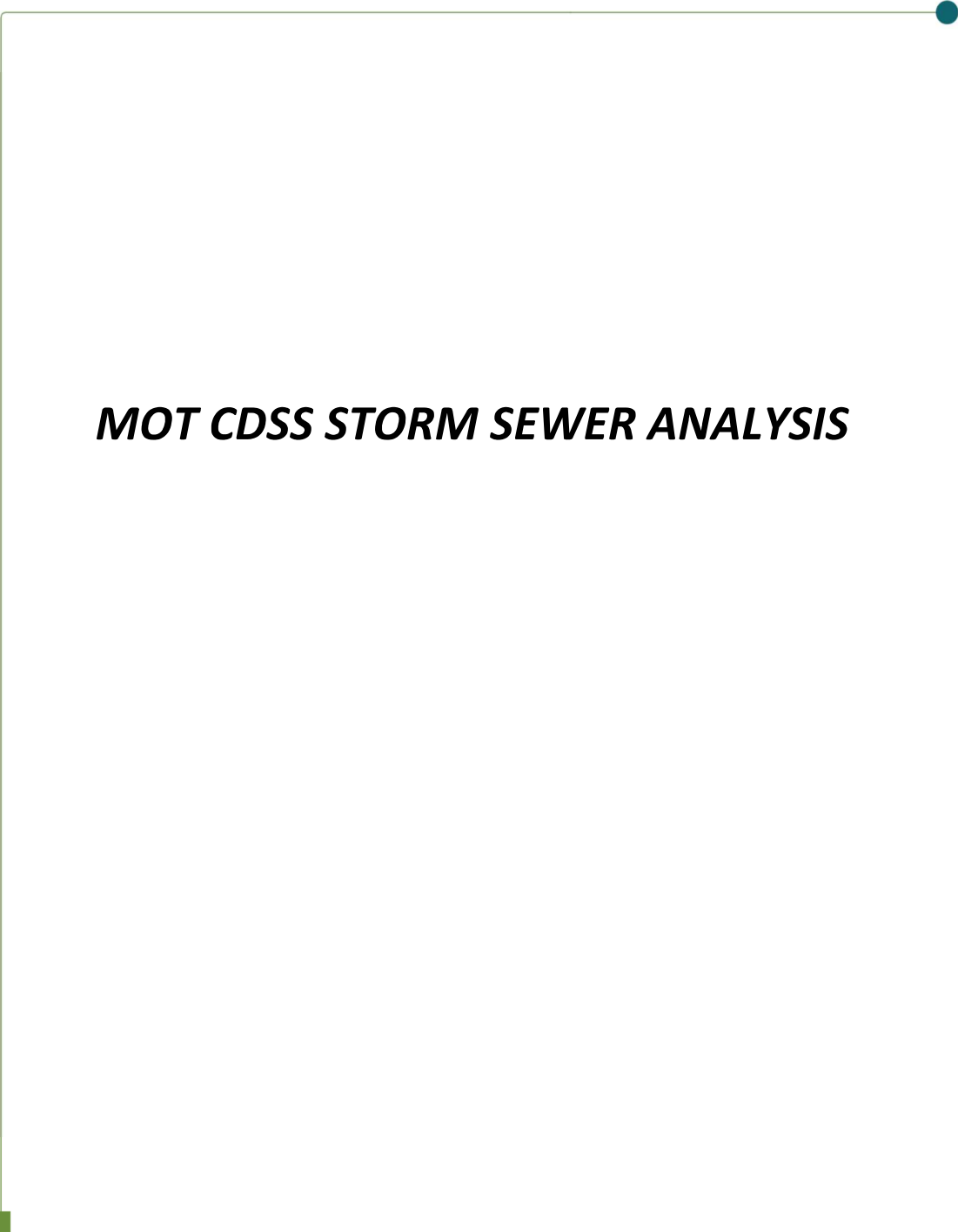
MOT DRAINAGE MAPS



Drainage Area Map I.R. 75 Phase 1

DESIGN AGENCY	
 CHAGRIN VALLEY ENGINEERING, LTD.	
DESIGNER	RHB
REVIEWER	
SDK	8/29/25
PROJECT ID	117275
SHEET	TOTAL
P.1	2



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MOT CDSS STORM SEWER ANALYSIS



STORM SEWER SYSTEM

PID : 117275 **Date :** 08/29/2025 **Project :** BUT 75

Location : BUTLER COUNTY

Description : STA. 13+60 TO STA. 2+97

Designer : RHB

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 From	STATION To	From To	ΔAREA Σ AREA (acres)	ΔCA Σ CA	BEGIN TIME (min.)	RAINFALL INTENSITY				DISCHARGE (cfs.)			PIPE			F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'
						(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)												
J11	J12	13+60	3.84	2.96	15.00	4.47	5.07	13.2	15.0	30	97.8	0.0335	846.03	10.40	69.94	0.0018	846.85	851.30	4.45	2.77	CB 5			
	begin	12+58	3.84	2.96									842.76				844.66	851.53						0.015
J12	D3	12+58	0.00	0.00	15.16	4.45	4.94	13.2	14.6	30	352.1	0.0091	842.74	6.47	36.46	0.0017	843.89	851.53	7.64	6.29	MH 3			
		9+00	3.84	2.96									839.54				841.43	846.54						0.015
D3	J14	9+00	1.93	1.49	16.06	4.33	4.83	19.2	21.5	30	372.6	0.0131	839.54	8.19	43.85	0.0036	840.83	846.54	5.71	4.50	CB 2-3			
		5+41	5.77	4.44									834.64				836.68	838.54						0.015
D1	J14	5+30	1.50	1.19	10.00	5.32	6.00	6.3	7.1	12	45.1	0.1914	843.78	16.94	14.53	0.0530	844.29	847.24	2.95	2.46	CB 2-2B			
	begin	5+41	7.27	5.63									835.15				836.14	847.62						0.015
J14	J17	5+41	2.45	1.69	16.82	4.23	4.78	31.0	35.0	36	240.8	0.0201	834.05	10.79	88.16	0.0037	835.42	838.54	3.12	1.49	CB 2-2B			
	final	2+97	9.72	7.32									829.21				831.67	832.21						0.015



STORM SEWER SYSTEM

PID : 117275 **Date :** 08/29/2025 **Project :** BUT 75

Location : BUTLER COUNTY

Description : STA. 21+90 to STA. 22+75

Designer : RHB

Rainfall Area: C

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.)	INTENSITY (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'
J9	J10	21+90		3.60	2.77	15.00	4.47	5.03	12.4	13.9	24	171.8	0.0097	852.58	6.52	20.73	0.0051	853.84	855.80	1.96	1.22	CB 2-2B
	begin	22+75		3.60	2.77									850.92				852.59	852.92			0.015



STORM SEWER SYSTEM

PID : 117275 **Date :** 08/29/2025 **Project :** BUT-75

Location : Butler County

Description : STA. 33+63 TO STA. 29+65

Designer : RHB

Rainfall Area: C

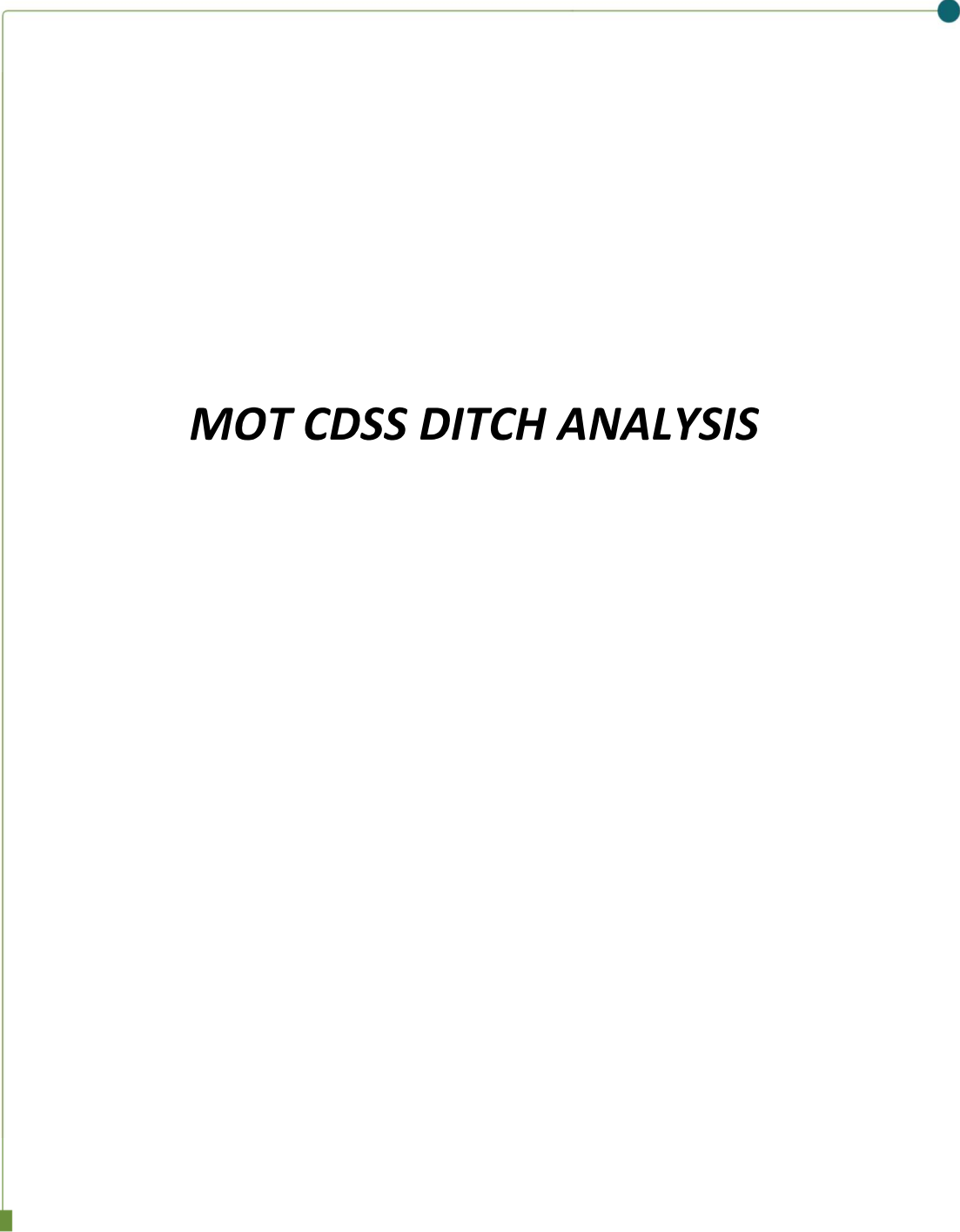
Just Full Capacity Frequency (yrs.) : 10

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 (acres)	Σ CA	TIME (min.)	INTENSITY (10 yrs.) (25 yrs.)	(cfs.) (10 yrs.) (25 yrs.)	(cfs.) (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'	
D9	J2	33+63	2.05	1.31	15.00	4.43	5.21	5.8	6.8	21	301.0	0.0166	870.38	6.60	19.06	0.0025	871.13	874.62	3.49	2.49	CB 2-2B
	begin	30+66	2.05	1.31									865.37				866.73	868.17			0.015
J2	J3	30+66	0.00	0.00	15.76	4.33	5.15	5.7	6.8	21	100.8	0.0067	865.37	4.67	12.05	0.0024	866.35	869.13	2.78	2.01	MH 3
	final	29+65	2.05	1.31									864.70				866.05	865.96			0.015



MOT CDSS DITCH ANALYSIS



DITCH ANALYSIS

PID : 117275 **Date :** 08/29/2025 **Project :** BUT IR 75/VAR/5.22/VAR **Location :** IR-75

Description : Phase 1 - Crossover Ditch Analysis STA 5+50 to STA 10+00

Designer : SDK

Rainfall Area : C

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.)
10+00	8+00	R	200.00	2.00	3.00	3.00	0.0182	0.48	0.48	0.75	0.36	Seed	3.81	5	0.030	16.52	2.16	0.27	1.37	0.23	3.41
												Seed	4.23	10	0.040	16.81	1.82	0.33	1.52	0.29	3.75
8+00	5+50	R	250.00	2.00	4.00	12.00	0.0226	1.02	1.50	0.75	1.13	Seed	3.63	5	0.030	18.09	2.63	0.47	4.09	0.33	7.33
												Jute Mat	3.59	5	0.040	18.45	2.12	0.53	4.04	0.38	8.06
												Temp. Mat	3.59	5	0.040	18.45	2.12	0.53	4.04	0.38	8.06
												Temp. Mat	4.01	10	0.040	18.69	2.19	0.56	4.51	0.40	8.37



DITCH ANALYSIS

PID : 117275 **Date :** 08/29/2025 **Project :** BUT IR 75/VAR/5.22/VAR **Location :** IR-75

Description : Phase 1 - Crossover Left Ditch Analysis STA 7+00 to STA 9+00 **Designer :** SDK

Rainfall Area : C

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.)
7+00	9+00	L	200.00	2.00	3.00	3.00	0.0006	0.84	0.84	0.75	0.63	Seed	3.48	5	0.030	19.58	0.70	0.03	2.19	0.74	6.45
												Seed	3.82	10	0.040	20.50	0.58	0.03	2.41	0.89	7.33



DITCH ANALYSIS

PID : 117275 **Date :** 08/29/2025 **Project :** BUT IR 75/VAR/5.22/VAR **Location :** IR-75

Description : Phase 1 - Crossover Left Ditch Analysis STA 9+00 to STA 20+00

Designer : SDK

Rainfall Area : C

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.)
20+00	15+00	L	500.00	2.00	3.00	3.00	0.0126	2.24	2.24	0.77	1.72	Seed	3.66	5	0.030	17.78	2.92	0.45	6.32	0.58	5.47
												Jute Mat	3.59	5	0.040	18.44	2.36	0.52	6.20	0.66	5.96
												Temp. Mat	3.59	5	0.040	18.44	2.36	0.52	6.20	0.66	5.96
												Temp. Mat	4.05	10	0.040	18.33	2.43	0.55	6.99	0.70	6.20
15+00	9+00	L	600.00	2.00	3.00	3.00	0.0103	1.53	3.77	0.77	2.90	Seed	3.28	5	0.030	21.65	3.04	0.48	9.54	0.74	6.46
												Jute Mat	3.22	5	0.040	22.41	2.45	0.54	9.35	0.84	7.06
												Temp. Mat	3.22	5	0.040	22.41	2.45	0.54	9.35	0.84	7.06
												Temp. Mat	3.66	10	0.040	22.19	2.53	0.58	10.62	0.90	7.37



DITCH ANALYSIS

PID : 117275 **Date :** 08/29/2025 **Project :** BUT IR 75/VAR/5.22/VAR **Location :** IR-75

Description : Phase 1 - Crossover Left Ditch Analysis STA 22+00 to STA 35+50

Designer : SDK

Rainfall Area : C

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.)
35+50	31+00	L	450.00	2.00	3.00	3.00	0.0104	2.44	2.44	0.78	1.90	Seed	3.68	5	0.030	17.62	2.80	0.41	7.01	0.64	5.83
												Jute Mat	3.62	5	0.040	18.24	2.26	0.47	6.88	0.73	6.37
												Temp. Mat	3.62	5	0.040	18.24	2.26	0.47	6.88	0.73	6.37
												Temp. Mat	4.07	10	0.040	18.14	2.33	0.50	7.75	0.77	6.63
31+00	26+00	L	500.00	2.00	3.00	3.00	0.0099	1.51	3.95	0.78	3.08	Seed	3.35	5	0.030	20.91	3.06	0.48	10.33	0.78	6.67
												Jute Mat	3.29	5	0.040	21.54	2.46	0.55	10.15	0.88	7.31
												Temp. Mat	3.29	5	0.040	21.54	2.46	0.55	10.15	0.88	7.31
												Temp. Mat	3.74	10	0.040	21.34	2.55	0.58	11.51	0.94	7.63
26+00	22+00	L	400.00	2.00	3.00	3.00	0.0148	1.16	5.11	0.78	3.99	Seed	3.15	5	0.030	23.30	3.73	0.72	12.54	0.78	6.66
												Jute Mat	3.11	5	0.040	23.72	3.01	0.82	12.41	0.89	7.32
												Temp. Mat	3.11	5	0.040	23.72	3.01	0.82	12.41	0.89	7.32
												Temp. Mat	3.54	10	0.040	23.46	3.11	0.87	14.13	0.94	7.65



DITCH ANALYSIS

PID : 117275 **Date :** 08/29/2025 **Project :** BUT IR 75/VAR/5.22/VAR **Location :** IR-75

Description : Phase 1 - Crossover Right Ditch Analysis STA 33+50 to STA 38+50

Designer : SDK

Rainfall Area : C

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.)
38+50	36+00	R	250.00	2.00	3.00	3.00	0.0081	1.46	1.46	0.64	0.93	Seed	3.76	5	0.030	16.93	2.12	0.24	3.52	0.48	4.88
												Seed	4.17	10	0.040	17.31	1.77	0.30	3.90	0.59	5.51
36+00	33+50	R	250.00	2.00	3.00	3.00	0.0062	0.59	2.05	0.64	1.31	Seed	3.55	5	0.030	18.91	2.07	0.23	4.65	0.59	5.56
												Seed	3.90	10	0.040	19.69	1.73	0.28	5.12	0.72	6.29



DITCH ANALYSIS

PID : 117275 **Date :** 08/29/2025 **Project :** BUT IR 75/VAR/5.22/VAR **Location :** IR-75

Description : Phase 2 - Crossover Left Ditch Analysis STA 6+50 to STA 20+00 **Designer :** SDK

Rainfall Area : C

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.)
20+00	15+50	L	450.00	2.00	3.00	3.00	0.0130	1.51	1.51	0.74	1.12	Seed	3.66	5	0.030	17.78	2.63	0.37	4.10	0.46	4.76
												Seed	4.05	10	0.040	18.33	2.20	0.46	4.53	0.56	5.36
15+50	11+00	L	450.00	2.00	3.00	3.00	0.0090	1.27	2.78	0.74	2.06	Seed	3.38	5	0.030	20.54	2.66	0.37	6.96	0.66	5.95
												Seed	3.71	10	0.040	21.64	2.21	0.45	7.63	0.79	6.75
11+00	6+50	L	450.00	2.00	3.00	3.00	0.0073	1.49	4.27	0.74	3.16	Seed	3.15	5	0.030	23.26	2.70	0.37	9.95	0.82	6.94
												Seed	3.42	10	0.040	24.93	2.23	0.45	10.82	0.98	7.88



DITCH ANALYSIS

PID : 117275 **Date :** 08/29/2025 **Project :** BUT IR 75/VAR/5.22/VAR **Location :** IR-75

Description : Phase 2 - Crossover Left Ditch Analysis STA 22+00 to STA 37+00

Designer : SDK

Rainfall Area : C

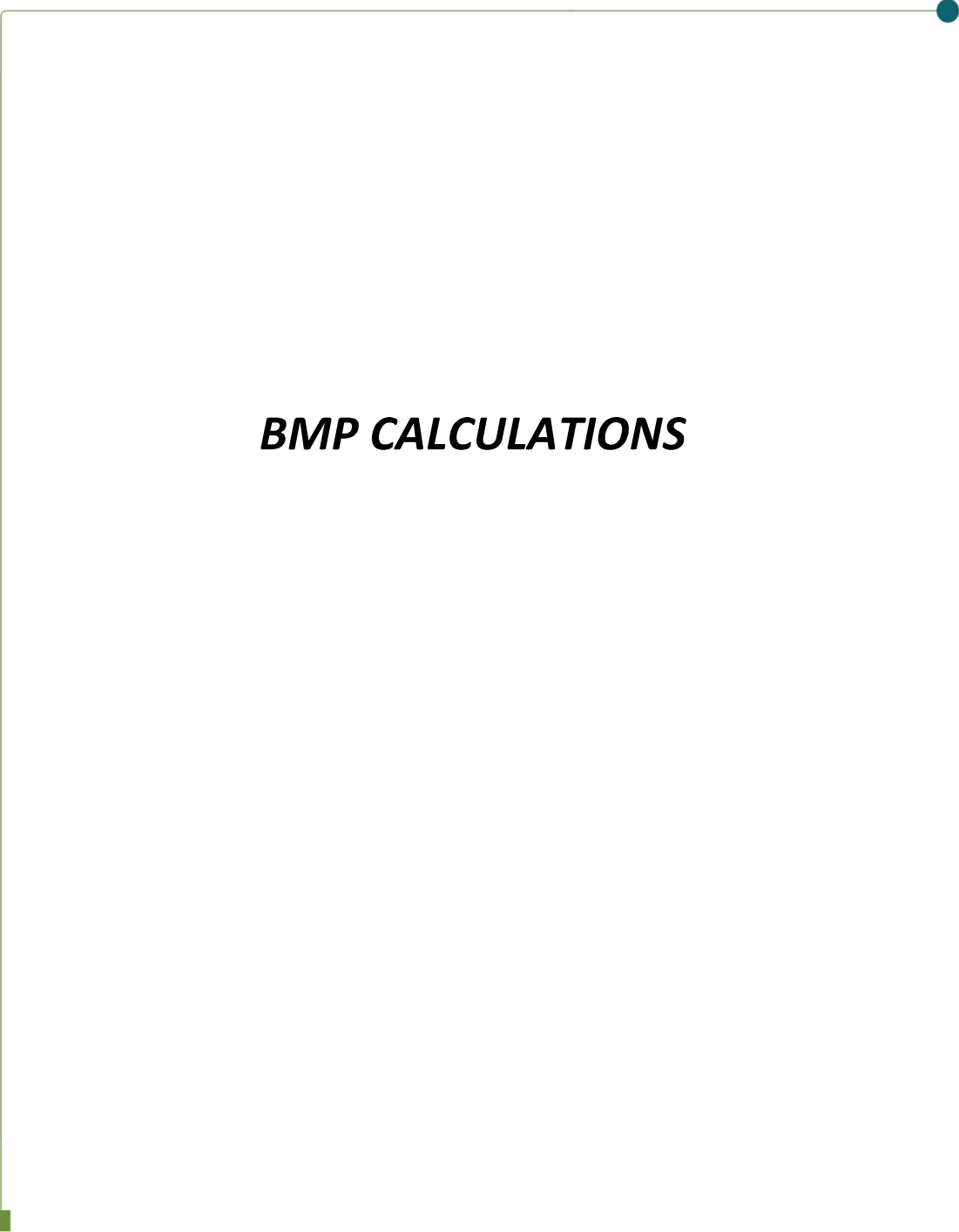
Allowable Shears

	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.)
37+00	32+00	L	500.00	2.00	3.00	3.00	0.0109	2.19	2.19	0.72	1.58	Seed	3.64	5	0.030	18.01	2.70	0.39	5.74	0.57	5.43
												Seed	4.02	10	0.040	18.61	2.25	0.47	6.34	0.69	6.15
32+00	26+50	L	550.00	2.00	3.00	3.00	0.0096	1.71	3.90	0.72	2.81	Seed	3.34	5	0.030	21.05	2.94	0.45	9.37	0.75	6.50
												Jute Mat	3.27	5	0.040	21.77	2.37	0.51	9.19	0.85	7.12
												Temp. Mat	3.27	5	0.040	21.77	2.37	0.51	9.19	0.85	7.12
												Temp. Mat	3.65	10	0.040	22.28	2.44	0.54	10.25	0.90	7.38
26+50	22+00	L	450.00	2.00	3.00	3.00	0.0147	1.80	5.70	0.72	4.10	Seed	3.11	5	0.030	23.75	3.74	0.72	12.77	0.78	6.71
												Jute Mat	3.08	5	0.040	24.22	3.01	0.82	12.62	0.89	7.37
												Temp. Mat	3.08	5	0.040	24.22	3.01	0.82	12.62	0.89	7.37
												Temp. Mat	3.45	10	0.040	24.66	3.10	0.87	14.14	0.94	7.66

A thin green line starts from a small green square at the bottom left, goes vertically up, then horizontally right to a small teal dot at the top right.

BMP CALCULATIONS



Ohio Department of Transportation - Office of Hydraulic Engineering

Post-Construction BMP Calculation Spreadsheet

Post Construction - Project Summary

Project Data

		Units
Project EDA	16.22	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)	16.22	acres
Ain (New Impervious Area in New Permanent R/W)	0	acres
T% (Treatment Percent)	20.00	%
Treatment Requirement	3.24	acres

BMPs Provided

BMP Name	BMP Type	Contributing Drainage Area (acres)	Contributing Drainage Area in ODOT R/W (acres)
VBF01	Vegetated Biofilter	2	2
VBF02	Vegetated Biofilter	2.03	2.03
VBF03	Vegetated Biofilter	1.89	1.89
VBF04	Vegetated Biofilter	1.41	1.41

Treatment Provided

Total Area with ODOT R/W Treated (acres)	7.33
Treatment Requirements (acres)	3.24
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	2.00	0.9
Impervious Trib. Area Outside Existing R/W	0.00	0.9
Tributary Area Land Use #3	0.00	0.5
Tributary Area Land Use #4	0.00	0.3
Total Tributary Area	2.00	0.900
BMP Type	Vegetated Biofilter	
Time of Concentration (minutes)	NA	
Intensity, i (in/hr)	0.65	
Water Quality Flow (WQ _F)	1.170	cfs

Drainage Area #2	Area (acres)	Coefficient of Runoff (C)
Tributary Area within Existing R/W	2.03	0.9
Impervious Trib. Area Outside Existing R/W	0.00	0.9
Tributary Area Land Use #3	0.00	0.5
Tributary Area Land Use #4	0.00	0.3
Total Tributary Area	2.03	0.900
BMP Type	Vegetated Biofilter	
Time of Concentration (minutes)	NA	
Intensity, i (in/hr)	0.65	
Water Quality Flow (WQ _F)	1.188	cfs

Drainage Area #3	Area (acres)	Coefficient of Runoff (C)
Tributary Area within Existing R/W	1.89	0.9
Impervious Trib. Area Outside Existing R/W	0.00	0.9
Tributary Area Land Use #3	0.00	0.5
Tributary Area Land Use #4	0.00	0.3
Total Tributary Area	1.89	0.900
BMP Type	Vegetated Biofilter	
Time of Concentration (minutes)	NA	
Intensity, i (in/hr)	0.65	
Water Quality Flow (WQ _F)	1.106	cfs

Drainage Area #4	Area (acres)	Coefficient of Runoff (C)
Tributary Area within Existing R/W	1.41	0.9
Impervious Trib. Area Outside Existing R/W	0.00	0.9
Tributary Area Land Use #3	0.00	0.5
Tributary Area Land Use #4	0.00	0.3
Total Tributary Area	1.41	0.900
BMP Type	Vegetated Biofilter	
Time of Concentration (minutes)	NA	
Intensity, i (in/hr)	0.65	
Water Quality Flow (WQ _F)	0.825	cfs



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	IR 75	275+13	277+00	LT	2.00	2.00	1.170	8	3	6	0.007	0.15	3.99	0.37	4	8
VBF#2	IR 75	283+60	290+00	LT	2.03	2.03	1.188	6	3	6	0.013	0.15	3.96	0.48	4	6
VBF#3	IR 75	275+13	277+00	RT	1.89	1.89	1.106	8	3	6	0.008	0.15	3.81	0.37	4	8
VBF#4	IR 75	283+15	285+00	RT	1.41	1.41	0.825	5	3	6	0.012	0.15	3.61	0.43	4	5
												0.15				
												0.15				
												0.15				
												0.15				
												0.15				
												0.15				

Total Treatment Credit Earned from VBFs (within R/W): 7.33 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