

DRAINAGE REPORT
FOR
FIRST CHRISTIAN CHURCH

OWNER: FIRST CHRISTIAN CHURCH
121 WALNUT STREET
EVANSVILLE, IN 47708

PREPARED BY: PROFESSIONAL CONSULTANTS, INC.
401 NW FIRST STREET
EVANSVILLE, IN 47708

*Prelim Passed 7/28/03
D. Board
Beck*

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SURVEYOR'S OFFICE
7/17/03 4:50pm PWP

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Section A

Project Description

Section B

Undeveloped/Developed Watershed Calculations

Form 800

Table 807 -- Rainfall Intensity -- Duration -- Frequency Table for Evansville

Hydro Program Input Data

Hydro Program Output

Section A – Project Description

This project is located along State Highway 57 north of the intersection of SH 57 and Oakhill Road. The address for the property will be on Beaumont Ave. but as yet has not been assigned. The lot is an undeveloped 14.00 acre lot with an eastern frontage on SH 57 with the Windemere Development to the north and west. A private parcel is located to the south.

The undeveloped lot slopes generally from the west to east with two exit points from the lot. The major drainage is along the southern boundary. This flow carries runoff from an area upstream of the lot, through the lot and exits through an existing box culvert under SH 57. This flow terminates in Firlick Creek. The other drainage flows from west to east along the northern boundary and turns north at the eastern boundary of the lot. This runoff flows under Beaumont Ave. through an existing culvert and terminates in an existing sedimentation pond.

The runoff for the 10 yr storm from the undeveloped lot is 10.83 cfs. The runoff coefficient is 0.24 and intensity is 3.23 in/hr. The time of concentration as calculated using the Kerby Formula is 30.2 minutes.

This site will be developed for First Christian Church to provide a new worship facility, multi-purpose building, shelter house and parking lot. A maintenance shed may be added at a later date and is shown on the drawings. At this time it is anticipated that only the shelter house and the parking lot will be developed. However, drainage calculations consider the full development of the lot.

The developed drainage is designed such that the entire hard surface area drains to the north drainage system. A basin will be provided to attain the required storage volume as calculated on Form 800. The 25 yr storm produces a runoff of 0.34 ac-ft to the basin. The outflow of the basin for the design storm is 0.35 cfs.

The basin is an incised structure with a permanent pool elevation of 391.0' and a maximum depth at pool of 5'. The pool volume is 2.3 ac-ft. The water surface elevation for the design storm is 391.64' with a volume of 2.68 ac-ft. This provides a stored storm runoff volume of 0.38 ac-ft which is more than the required volume of 0.35 ac-ft. The discharge from the pond is carried by a 12" diameter CMP with an orifice plate with a 6" diameter hole. This plate is designed such that the invert of the 6" hole is at elevation 391.0' and the plate extends only halfway over the CMP opening. This leaves the upper half of the 12" CMP open to handle flows from larger storms.

Section B

PROFESSIONAL CONSULTANTS, INC.

engineering • design • construction management
P.O. Box 3485
112 INGLE STREET
Tel. No. 812-425-4264
EVANSVILLE, INDIANA

Project FIRST CHRISTIAN CHURCH
SITE DRAINAGE Sheet 1 of
Order No. 20030167 Date 6/30/03 By JWB

UNDEVELOPED

KERBY FORMULA →
$$L_c = K(LN/S^5)^{.467}$$
$$= .827(1050(.24)/.02^5)^{.467}$$
$$= 30.2 \text{ MIN.}$$

K = .827
L = 1050'
N = .24
S = $\frac{\Delta}{L} = \frac{20'}{1050'} = .02$
 $\Delta = 409 - 389 = 20'$

$L_{10} = 3.23 \text{ in/hr}$

WATERSHED AREA = 13.97 AC

RUNOFF RATE = CIA = $(.24)(3.23 \text{ in/hr})(13.97 \text{ AC}) = \underline{10.83 \text{ cfs}}$

DEVELOPED

	"A"	"C _N "
PAVED AREA	1.99	.92
BLDG	.92	.92
MEADOWS/LAWNS	11.06	.24

WEIGHTED C_N = .38

SEE FORM 800 FOR REQUIRED RETENTION VOLUME.

REQ'D VOL ≥ .36 AC-FT = 15,681 cf

PROVIDED VOL ≥ .38 AC-FT = 16,553 cf

FORM 800

This form must be completed and submitted with all drainage plans.

Project **First Christian Church** Detention Facility Design Return Period **25** yrs
 Designer **Professional Consultants, Inc.** Release Rate Return Period **25** yrs
 Watershed Area **14** acres
 Time of Concentration (Undeveloped Watershed) **30.2** minutes
 Rainfall Intensity (i_u) **3.23** inches/hr
 Undeveloped Runoff Coefficient (C_u) **0.24**
 Undeveloped Runoff Flow ($O=C_u i_u A_u$) **10.85** cfs
 Developed Runoff Coefficient (C_d) **0.38**

Storm Duration t_d (hrs.)	Rainfall Intensity i_d (inches/hr)	Inflow Rate $I(t_d)$ ($C_d i_d A_d$) (cfs)	Outflow Rate O ($C_u i_u A_u$) (cfs)	Storage Rate $I(t_d)-O$ (cfs)	Required Storage $(I(t_d)-O)t_d/12$ (acre-ft)
0.08	7.208	38.35	10.85	27.49	0.18
0.17	5.925	31.52	10.85	20.67	0.29
0.25	5.033	26.78	10.85	15.92	0.33
0.50	3.646	19.40	10.85	8.54	0.36
1.00	2.078	11.05	10.85	0.20	0.02
2.00	1.400	7.45	10.85	-3.40	-0.57
3.00	1.019	5.42	10.85	-5.43	-1.36
4.00	0.836	4.45	10.85	-6.41	-2.14
5.00	0.684	3.64	10.85	-7.21	-3.01
6.00	0.589	3.13	10.85	-7.72	-3.86
7.00	0.516	2.75	10.85	-8.11	-4.73
8.00	0.463	2.46	10.85	-8.39	-5.59
9.00	0.415	2.21	10.85	-8.65	-6.48
10.00	0.379	2.02	10.85	-8.84	-7.36

TABLE 807

RAINFALL INTENSITY-DURATION-FREQUENCY TABLE FOR EVANSVILLE

INTENSITY IN INCHES PER HOUR

STORM DURATION		STORM RETURN PERIOD IN YEARS				
		5	10	25	50	100
5	MIN .08 Hrs	6.063	6.625	7.208	7.936	8.469
10	MIN .17 Hrs	4.863	5.380	5.925	6.616	7.126
15	MIN .25 Hrs	4.029	4.515	5.033	5.697	6.194
30	MIN .5 Hrs	2.837	3.226	3.646	4.194	4.608
60	MIN 1.0 Hrs	1.549	1.819	2.078	2.412	2.663
2.0	HRS	1.053	1.230	1.400	1.620	1.785
3.0	HRS	0.774	0.899	1.019	1.175	1.291
4.0	HRS	0.632	0.736	0.836	0.965	1.062
5.0	HRS	0.524	0.606	0.684	0.785	0.861
6.0	HRS	0.453	0.522	0.589	0.676	0.741
7.0	HRS	0.399	0.459	0.516	0.591	0.647
8.0	HRS	0.358	0.412	0.463	0.530	0.581
9.0	HRS	0.323	0.370	0.415	0.472	0.516
10	HRS	0.297	0.339	0.379	0.431	0.470
11	HRS	0.276	0.314	0.351	0.399	0.435
12	HRS	0.259	0.296	0.331	0.376	0.410
13	HRS	0.245	0.280	0.314	0.357	0.390
14	HRS	0.233	0.267	0.299	0.341	0.372
15	HRS	0.220	0.252	0.281	0.320	0.349
16	HRS	0.209	0.238	0.266	0.302	0.329
17	HRS	0.198	0.225	0.251	0.284	0.310

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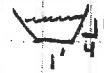
Project FIRST CHRISTIAN CHURCH

SITE DRAINAGE

Sheet 4 of

Order No. 20030167 Date 7/2/03 By JWB

POND SPILLWAY DISCHARGE TABLE



EL.	Q (cfs)	A (sf)
391	0	0
391.5	2.3	1.5
392	11.6	5
392.5	31.4	10.5
393.0	64.4	18.0

SLOPE = .5%
 n = .03

POND AREAS

EL. (ft)	A (sf)	H (ft)
386	12456 (.28ac)	0
387	15249 (.35)	1
388	18143 (.42)	2
389	21136 (.48)	3
390	24231 (.56)	4
391	27246 (.62)	5
392	30722 (.70)	6
393	34118 (.78)	7

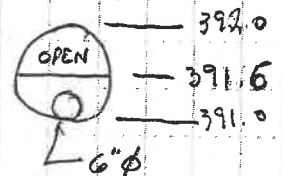
POND SPILLWAY DISCH. TABLE

12" ϕ CMP w/ 8" ORIFICE

EL.	Q
391	0
391.5	.4
392	.92
392.5	1.24
393.0	1.50

12" ϕ CMP w/ 6" ϕ ORIFICE

EL.	Q
391	0
391.5	.27
392	1.32
392.5	1.8
393	2.19



POND WATERSHED

$\Delta = 34'$
 $L = 1200'$

	A.	C _n	RET.
WATER SURFACE	.62 AC	.1	100
LAWN/MEADOW	5.41 AC	.25	.12
BLDG/PAVING	1.62 AC	.94	.12
	<u>7.65 AC</u>		

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FCC.OUT

***** FIRST CHRISTIAN CHURCH 6" ORIFICE *****

WATERSHED DATA:

COMPLEX AREA (ACRES)	CN	MINIMUM RETENTION (IN/HR.)	DESCRIPTION
0.62	100	0.00	WS
5.41	24	0.12	GR
2.19	92	0.12	HS

THE WATERSHED AREA IS 8.22 ACRES.
 THE WEIGHTED CURVE NUMBER IS 48 'CN'.
 THE MINIMUM RETENTION RATE IS .11 IN./HR.
 THE WATERCOURSE LENGTH IS 1200 FEET.
 THE ELEVATION DIFFERENCE IS 34 FEET.
 THE TIME OF CONCENTRATION IS .2 IN/HR.

STORAGE-DISCHARGE RELATIONSHIP TABLE

ELEVATION (FEET)	AREA (ACRES)	VOLUME (ACRE-FEET)	DISCHARGE (CFS)
386.00	0.28	0.0	0
387.00	0.35	0.3	0
388.00	0.42	0.7	0
389.00	0.48	1.1	0
390.00	0.56	1.7	0
391.00	0.62	2.3	0
391.60	0.67	2.6	0
392.00	0.70	2.9	1
392.50	0.74	3.3	2
393.00	0.78	3.7	2

THE 25 YEAR, 24 HOUR PRECIPITATION IS 5.4 INCHES.
 THE BASE FLOW RATE IS .1 CFS.

EXCESS RAINFALL DETERMINATION TABLE

TIME ENDING	CUMULATIVE % OF STORM	CUMULATIVE RAINFALL	INCREMENTAL RAINFALL	DIRECT RUNOFF CUMULATIVE	INCREMENTAL	INCREMENTAL LOSS
0	0.0	0.00	0.00	0.00	0.00	0.00
1	1.1	0.06	0.06	0.00	0.00	0.06
2	2.2	0.12	0.06	0.00	0.00	0.06
3	3.5	0.19	0.07	0.00	0.00	0.07
4	4.8	0.26	0.07	0.00	0.00	0.07
5	6.4	0.35	0.09	0.00	0.00	0.09
6	8.0	0.43	0.09	0.00	0.00	0.09
7	10.0	0.54	0.11	0.00	0.00	0.11
8	12.0	0.65	0.11	0.00	0.00	0.11
9	14.7	0.79	0.15	0.00	0.00	0.15
10	18.1	0.98	0.18	0.00	0.00	0.18
11	23.5	1.27	0.29	0.00	0.00	0.29
12	66.3	3.58	2.31	0.16	0.16	2.15
13	77.2	4.17	0.59	0.31	0.15	0.44
14	82.0	4.43	0.26	0.39	0.08	0.18

FCC .OUT						
15	0.0	4.59	0.16	0.44*	0.05*	0.11*
16	0.0	4.75	0.16	0.49*	0.05*	0.11*
17	0.0	4.85	0.10	0.49*	0.00*	0.10*

*MINIMUM RETENTION RATE APPLIED

TOTAL DIRECT RUNOFF IS .3374408 ACRE-FEET.

ROUTING HYDROGRAPH TABLE

TIME (HOURS)	RUNOFF (CFS)	DISCHARGE (CFS)	TIME (HOURS)	RUNOFF (CFS)	DISCHARGE (CFS)
0.00	-42	0	14.25	0	0
0.25	-42	0	14.50	0	0
0.50	-41	0	14.75	0	0
0.75	-40	0	15.00	0	0
1.00	-39	0	15.25	0	0
1.25	-38	0	15.50	0	0
1.50	-37	0	15.75	0	0
1.75	-36	0	16.00	0	0
2.00	-35	0	16.25	0	0
2.25	-34	0	16.50	0	0
2.50	-33	0	16.75	0	0
2.75	-32	0	17.00	0	0
3.00	-32	0	17.25	0	0
3.25	-31	0	17.50	0	0
3.50	-30	0	17.75	0	0
3.75	-29	0	18.00	0	0
4.00	-28	0	18.25	0	0
4.25	-27	0	18.50	0	0
4.50	-26	0	18.75	0	0
4.75	-25	0	19.00	0	0
5.00	-24	0	19.25	0	0
5.25	-23	0	19.50	0	0
5.50	-23	0	19.75	0	0
5.75	-22	0	20.00	0	0
6.00	-21	0	20.25	0	0
6.25	-20	0	20.50	0	0
6.50	-19	0	20.75	0	0
6.75	-18	0	21.00	0	0
7.00	-17	0	21.25	0	0
7.25	-16	0	21.50	0	0
7.50	-15	0	21.75	0	0
7.75	-14	0	22.00	0	0
8.00	-13	0	22.25	0	0
8.25	-13	0	22.50	0	0
8.50	-12	0	22.75	0	0
8.75	-11	0	23.00	0	0
9.00	-10	0	23.25	0	0
9.25	-9	0	23.50	0	0
9.50	-8	0	23.75	0	0
9.75	-7	0	24.00	0	0
10.00	-6	0	25.00	0	0
10.25	-5	0	26.00	0	0
10.50	-4	0	27.00	0	0
10.75	-4	0	28.00	0	0
11.00	-3	0	29.00	0	0
11.25	-2	0	30.00	0	0
11.50	-1	0	31.00	0	0
11.75	0	0	32.00	0	0

			FCC.OUT		
12.00	5	0	33.00	0	0
12.25	2	0	34.00	0	0
12.50	2	0	35.00	0	0
12.75	1	0	36.00	0	0
13.00	1	0	37.00	0	0
13.25	1	0	38.00	0	0
13.50	1	0	39.00	0	0
13.75	1	0	40.00	0	0
14.00	1	0	41.00	0	0

AT THE MAXIMUM DISCHARGE OF 0 CFS, THE WATER SURFACE ELEVATION WAS 391.64 FEET FOR 2.68 ACRE-FEET OF STORAGE.

THE PEAK RUNOFF RATE WAS 5 CFS AFTER 12.06 HOURS. WHEN THE HYDROGRAPHS TERMINATED, THE TOTAL DISCHARGE HAD BEEN 1 ACRE-FEET WHICH IS OVER 90 PERCENT OF THE TOTAL INFLOW OF 1 ACRE-FEET.

HYDROGRAPH PLOT

FLOW (CFS)	0	1	2	3	4	5	6
TIME (HRS)	0						
I	0						
I	0						
I	0						
I	0						
I	1						
I	0						
I	0						
I	0						
I	0						
I	2						
I	0						
I	0						
I	0						
I	0						
I	3						
I	0						
I	0						
I	0						
I	0						
I	4						
I	0						
I	0						
I	0						
I	0						

FCC.OUT

13	0	I
	0	I
	0	I
14	0	I
	0	I
	0	I
15	0	I
	0	I
	0	I
	0	I
16	0	I
	0	I
	I	0
	I	0
17	I	0
	I	0
	I	0
	I	0
18	I	0
	I	0
	I	0
19	I	0
	I	0
	I	0
20	I	0
	I	0
	I	0
21	I	0
	I	0
	I	0
	I	0
	I	0

		FCC.OUT
22	I0	
	I0	
	I0	
23	I0	
	I0	
	I0	
24	I0	
25	I0	
26	I0	
27	I0	
28	I0	
29	I0	
30	I0	
31	I0	
32	I0	
33	I0	
34	I0	
35	I0	
36	I0	
37	I0	
38	I0	
39	I0	
40	O	
41	O	

.....|.....|.....|.....|.....|.....|

NOTE TIME SCALE CHANGE AFTER 24 HOURS.
 INFLOW IS PLOTTED 'I', OUTFLOW IS PLOTTED 'O'.