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The site is located on the northeast side of Evansville on Green River Road, approximately 4700 feet north of the Green River Road and Morgan Avenue intersection.

The 12.12 acre site is located on flat ground which has been previously cultivated for row crops. The site drains mainly in a westerly direction to the Green River Road storm sewer system.

All storm sewers are designed to handle the runoff from a 25 year storm event.

Storm detention shall be provided in Basin A, a wet basin in the back of Lot 6. Basin A shall discharge through a 24" RCP. It shall store the difference between the 25 year developed storm and the 10 year undeveloped storm. The allowable site discharge has been lowered from Q_{10} =8.7 cfs to 7.9 cfs. An orifice plate shall be provided at the upstream end of pipe structure P #629 with an opening of 11.08 inches in diameter, or equivalent. Pipe structure P #629 shall be a 21 inch RCP at a minimum slope of 0.3% (capacity = 10.25 cfs) to convey the discharge from the orifice outlet without restriction.

The required amount of storage for the entire subdivision is .99 acre/ft. An emergency spillway elevation has been set at 383.5, running from Basin "A" along the west property line of lot 6, then along the north property line of lots 1-5, and then along the west property line of lot 1 to Green River Road. We are discharging our emergency overflow system to Green River Road because we have no existing swales or ditches to discharge into.

BASIN SUMMARY	BASIN A
Primary Discharge	24" RCP
Emergency Spillway	2' x 0.68'
Top of Berm Elevation	384.18'
Emergency Spillway Elevation	383.5'
Primary Pipe Invert	381.0'

Based on the most recent soil survey of Vanderburgh County, the majority of the site is comprised of various silty loams. The following soil types are indicated to be within the 12.12 acre site boundary: Evansville silt loam (Ev); Zipp silty clay (Zp).

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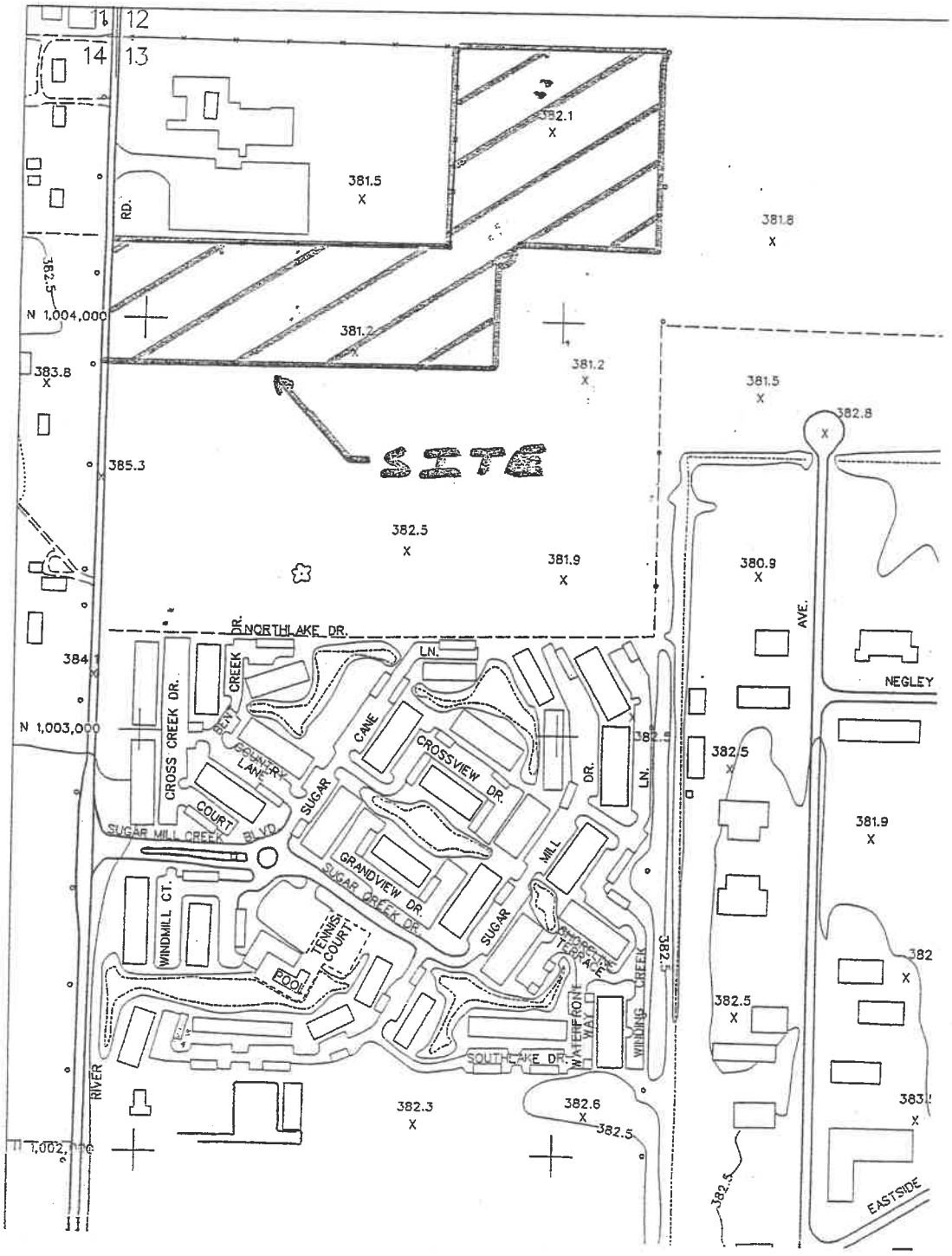
SCALE: 1"=400'



SOIL SURVEY OF

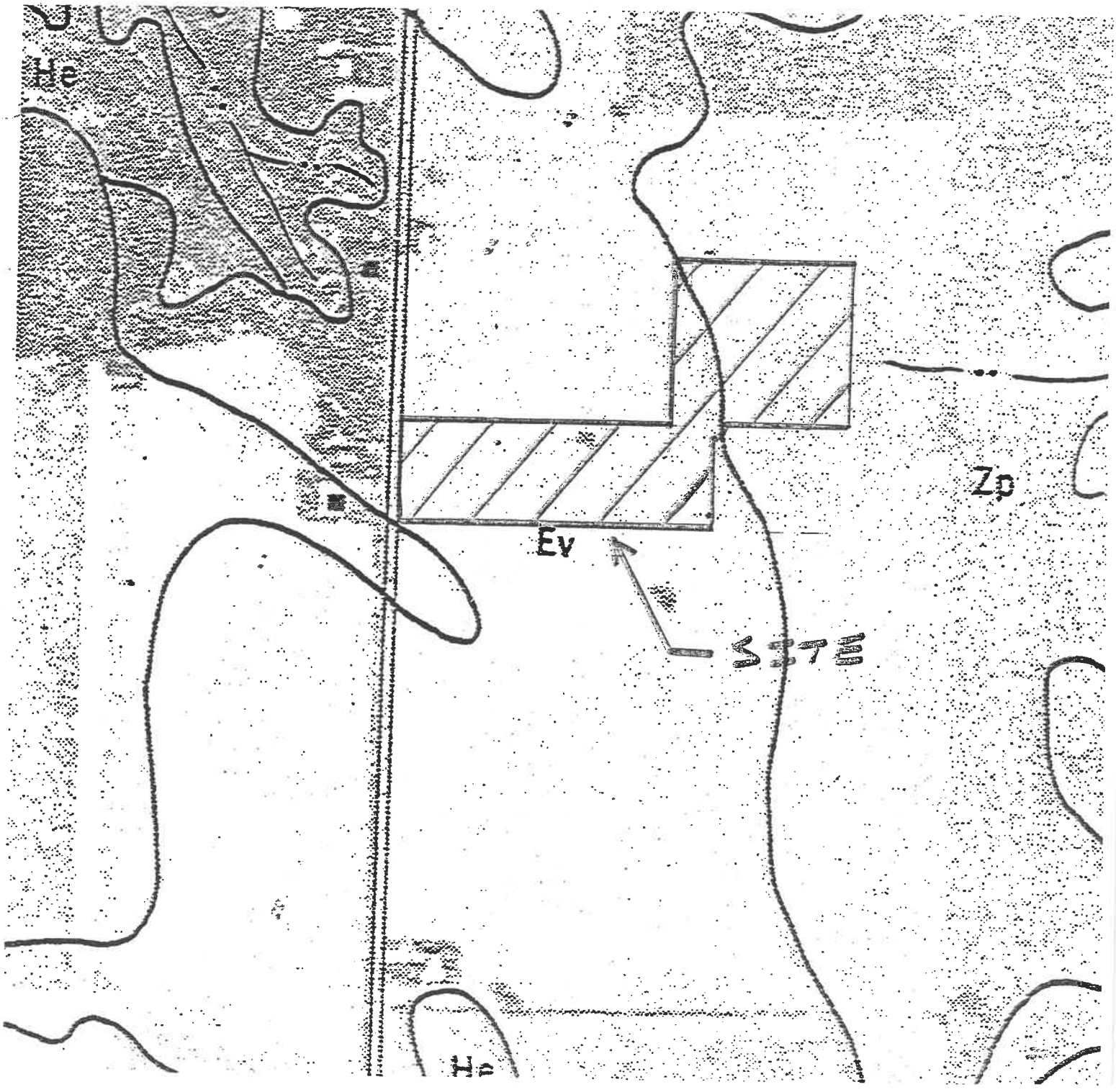
Vanderburgh County, Indiana

United States Department of Agriculture
Soil Conservation Service
In cooperation with

Purdue University Agricultural
Experiment Station

BCH COMMERCIAL SUBDIVISION

SCALE: 1"=400'



GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. Other information is given in tables as follows:

Acreage and extent, table 1, page 11.
Predicted yields, table 2, page 40.
Tree and shrub groups, table 3, page 50.
Wildlife, table 4, page 52.
Recreation, table 5, page 54.
Engineering, tables 6, 7, and 8, pages 58, 60, and 66.

Map symbol	Mapping unit	Described on page	Capability unit		Tree and shrub group
			Symbol	Page	Number
AlB2	Alford silt loam, 2 to 6 percent slopes, eroded	11	IIe-3	41	III
AlC2	Alford silt loam, 6 to 12 percent slopes, eroded	11	IIIe-3	43	III
AlC3	Alford silt loam, 6 to 12 percent slopes, severely eroded	12	IVe-3	45	III
AlD3	Alford silt loam, 12 to 18 percent slopes, severely eroded	12	VIe-1	46	III
Ba	Bartle silt loam	15	IIw-3	42	II
Bd	Birds silt loam	16	IIIw-10	44	I
Bo	Bonnie silt loam	16	IIIw-10	44	I
Br	Borrow pits	16	VIIe-3	46	IV
Ev	Evansville silt loam	17	IIw-1	41	I
Gn	Ginat silt loam	17	IIIw-12	45	I
Gu	Gullied land	17	VIIe-4	47	IV
He	Henshaw silt loam	19	IIw-2	42	II
HoA	Hosmer silt loam, 0 to 2 percent slopes	20	IIw-5	43	II
HoB2	Hosmer silt loam, 2 to 6 percent slopes, eroded	20	IIe-7	41	II
HoB3	Hosmer silt loam, 2 to 6 percent slopes, severely eroded	20	IIIe-7	43	II
HoC2	Hosmer silt loam, 6 to 12 percent slopes, eroded	20	IIIe-7	43	II
HoC3	Hosmer silt loam, 6 to 12 percent slopes, severely eroded	21	IVe-7	45	II
HoD3	Hosmer silt loam, 12 to 18 percent slopes, severely eroded	21	VIe-1	46	II
Ht	Huntington silty clay loam	22	I-2	41	III
Hu	Huntington fine sandy loam, sandy variant	22	I-2	41	III
IoA	Iona silt loam, 0 to 2 percent slopes	23	I-1	41	III
IoB2	Iona silt loam, 2 to 6 percent slopes, eroded	23	IIe-3	41	III
Iv	Iva silt loam	23	IIw-2	42	II
Ln	Lindside silty clay loam	24	I-2	41	III
Ma	Made land	24	VIIe-3	46	IV
MkB2	Markland silt loam, 2 to 6 percent slopes, eroded	24	IIIe-11	43	II
MkC2	Markland silt loam, 6 to 18 percent slopes, eroded	24	IVe-11	45	II
MlC3	Markland silty clay loam, 6 to 18 percent slopes, severely eroded	25	VIe-1	46	II
Mr	McGary silt loam	26	IIIw-6	44	II
MuA	Muren silt loam, 0 to 2 percent slopes	27	I-1	41	III
MuB2	Muren silt loam, 2 to 6 percent slopes, eroded	27	IIe-3	41	III
Nw	Newark silty clay loam	28	IIw-7	43	I
Pa	Patton silty clay loam	28	IIw-1	41	I
PrB	Princeton fine sandy loam, 2 to 6 percent slopes	28	IIe-11	41	III
Ra	Ragsdale silt loam	29	IIw-1	41	I
Rh	Rahm silty clay loam	29	IIw-7	43	I
Rs	Reesville silt loam	30	IIw-2	42	II
ScA	Sciotoville silt loam, 0 to 2 percent slopes	30	IIw-5	43	II
ScB2	Sciotoville silt loam, 2 to 6 percent slopes, eroded	31	IIe-7	41	II
St	Stendal silt loam	31	IIw-7	43	I
UnB2	Uniontown silt loam, 2 to 6 percent slopes, eroded	32	IIe-3	41	III
Wa	Wakeland silt loam	32	IIw-7	43	I
Wb	Weinbach silt loam	33	IIw-3	42	II
WeD2	Wellston silt loam, 12 to 18 percent slopes, eroded	34	IVe-5	45	III
WeD3	Wellston silt loam, 12 to 18 percent slopes, severely eroded	34	VIe-1	46	III
WeE2	Wellston silt loam, 18 to 25 percent slopes, eroded	34	VIe-1	46	III

Map symbol	Mapping unit	Described on page	Capability unit		Tree and shrub group
			Symbol	Page	Number
WeF	Wellston silt loam, 25 to 50 percent slopes	34	VIIe-1	46	III
WhA	Wheeling loam, 0 to 2 percent slopes	35	I-1	41	III
WhB2	Wheeling loam, 2 to 6 percent slopes, eroded	35	IIe-3	41	III
Wm	Wilbur silt loam	36	I-2	41	III
Wo	Woodmere silty clay loam	36	I-2	41	III
ZaC2	Zanesville silt loam, 6 to 12 percent slopes, eroded	37	IIIe-7	43	II
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded	37	IVe-7	45	II
ZaD2	Zanesville silt loam, 12 to 18 percent slopes, eroded	38	IVe-7	45	II
ZaD3	Zanesville silt loam, 12 to 18 percent slopes, severely eroded	38	VIe-1	46	II
Zp	Zipp silty clay	38	IIIw-2	44	I

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	6.063	6.625	7.208	7.936	8.469
10 MIN	4.863	5.380	5.925	6.616	7.126
15 MIN	4.029	4.515	5.033	5.697	6.194
30 MIN	2.837	3.226	3.646	4.194	4.608
60 MIN	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

TABLE 803

UNDEVELOPED RUNOFF COEFFICIENTS (C_u)

SURFACE TYPE:

WOODLAND, TURFED MEADOWS
ROUGH PASTURE, FALLOW BRUSH:

SLOPE:	
Less than 2%	C = 0.12
2% to 5%	C = 0.24
5+% to 10%	C = 0.36
Over 10%	C = 0.48

CULTIVATED FIELDS:

Less than 2%	C = 0.20
2% to 5%	C = 0.35
5+% to 10%	C = 0.50
Over 10%	C = 0.65

TABLE 804

DEVELOPED RUNOFF COEFFICIENTS (C_d)

SURFACE TYPE:

PAVEMENT, ROOFTOP
OTHER IMPERVIOUS SURFACES:

Less than 2%	C = 0.92
2% to 5%	C = 0.94
5+% to 10%	C = 0.96
Over 10%	C = 0.98

LAWNS WITH TURF:

Less than 2%	C = 0.15
2% to 5%	C = 0.25
5+% to 10%	C = 0.40
Over 10%	C = 0.55

ALL WATER SURFACES
BASINS, PONDS & LAKES:

C = 1.00

TABLE 1002

TYPICAL VALUES OF MANNING'S "n"

TYPE OF MATERIAL	MANNING'S "n"	MAX. VELOCITY
CLOSED CONDUITS/CULVERTS:		
PVC; STORM SEWER GRADES	0.010	15 fps
CONCRETE (circular or elliptical)	0.011	15 fps
SMOOTH FLOW HDPE	0.010	15 fps
PRECAST CONCRETE BOXES	0.013	15 fps
C.1 or D.1 S.J. Type/Cement Lined	0.013	15 fps

CORRUGATED METAL PIPE:	CIRC. WELD	SPIRAL WELD	
Unpaved	0.024	0.021	7 fps
25% Paved	0.021	0.018	7 fps
50% Paved	0.018	0.015	7 fps
100% Paved	0.013	0.013	7 fps
OTHER CONCRETE CULVERTS		0.013	

OPEN CHANNELS:	
CONCRETE, Trowel Finish	0.013
CONCRETE, Broom or Float Finish	0.015
GUNITE	0.018
RIPRAP, Placed	0.030
RIPRAP, Dumped	0.035
GABIONS	0.028
NEW EARTH	0.025
MATURE EARTH, Some Weeds	0.030
MATURE, Dense Weeds	0.040
MATURE, Weeds & Brush	0.040
SWALE, Grass Cover	0.035

OTHER "n" VALUES SHALL BE TAKEN FROM MANUFACTURERS' DATA.

3.2.1 - Determination of Runoff Coefficient, C

Values of the runoff coefficient are given in Table 3.2.1 for rural areas and Table 3.2.2 for urban areas. Table 3.2.2 presents runoff coefficients for particular types of urban areas and Table 3.2.3 gives coefficients which are used to compute a weighted C based on the actual percentage of lawns, streets, roofs, etc. The determination of the runoff coefficient is illustrated in Example 3.2.1.

Table 3.2.1
Rural Runoff Coefficients (Schwab et al., 1966)

	Soil Texture		
Vegetation and Topography	Open Sandy Loam	Clay and Silt Loam	Tight Clay
Woodland			
Flat 0-5% slope	0.10	0.30	0.40
Rolling 5-10% slope	0.25	0.35	0.50
Hilly 10-30% slope	0.30	0.50	0.60
Pasture			
Flat	0.10	0.30	0.40
Rolling	0.16	0.36	0.55
Hilly	0.22	0.42	0.60
Cultivated			
Flat	0.30	0.50	0.60
Rolling	0.40	0.60	0.70
Hilly	0.52	0.72	0.82

As mentioned before, this coefficient represents the runoff-rainfall ratio and includes many factors such as type of cover, soil types, infiltration, evaporation, evapo-transpiration, and any antecedent moisture condition. For many years it has been known that C actually does not remain constant during a storm (Horner, 1910). The strong dependence on "engineering judgment" in selecting a runoff coefficient is one of the main weaknesses of the rational method.

Table 3.2.2
Urban Runoff Coefficients for the Rational Method (ASCE, 1992)

Description of Area	Runoff Coefficients
Business	
Downtown	0.70 to 0.95
Neighborhood	0.50 to 0.70
Residential	
Single-family	0.30 to 0.50
Multi-units, detached	0.40 to 0.60
Multi-units, attached	0.60 to 0.75
Residential (suburban)	0.25 to 0.40
Apartment	0.50 to 0.70
Industrial	
Light	0.50 to 0.80
Heavy	0.60 to 0.90
Parks, cemeteries	0.10 to 0.25
Playgrounds	0.20 to 0.35
Railroad yard	0.20 to 0.35
Unimproved	0.10 to 0.30

Table 3.2.3
Values Used to Determine a Composite Runoff Coefficient for an Urban Area (ASCE, 1992)

Character of Surface	Runoff Coefficients
Pavement	
Asphalt and Concrete	0.70 to 0.95
Brick	0.70 to 0.85
Roofs	0.75 to 0.95
Lawns, sandy soil	
Flat, 2 percent	0.05 to 0.10
Average, 2 to 7 percent	0.10 to 0.15
Steep, 7 percent	0.15 to 0.20
Lawns, heavy soil	
Flat, 2 percent	0.13 to 0.17
Average, 2 to 7 percent	0.18 to 0.22
Steep, 7 percent	0.25 to 0.35
Water Impoundment	1.00

Table 3.2.4 (cont'd)

Kerby (1959)

$$t_c = K\ (L\ N\ s^{-0.5})^{0.467}$$

where K is equal to 0.83 (US Customary units) or 1.44 (Metric units), L is the length of flow in ft (m), s is the average slope of overland flow, ft/ft (m/m), and N is the retardance roughness coefficient given in Table 3.2.5.

The length used in the equation is the straight-line distance from the most distant point of the watershed to the outlet, measured parallel to the slope of the land until a well-defined channel is reached. Watersheds of less than 10 acres were used to calibrate the model; slopes were less than 1%; N values were 0.8 and less and surface flow dominated (McCuen, 1989).

Izzard (1946)

$$t_c = \frac{K(Bi + c')\ L^{\frac{1}{3}}}{s^{\frac{1}{3}}\ i^{\frac{2}{3}}}$$

where K is equal to 41.025 for U.S. customary units (113.391 for metric), B is equal to 0.0007 for U.S custumary units (0.00027 for metric), c′ is the retardance coefficient given in Table 3.2.7, *i* is the rainfall intensity; in/hr (cm/hr); L is the length of flow path in ft (m), and s is the slope of overland flow path, ft/ft (m/m).

The product of *i* and L must be less than 500 in-ft/hr (390 cm-m/hr) to consider using this formula. In addition, well defined channels should **not** be present. This method was developed in laboratory experiments for the overland flow on roadway and turf surfaces.

Table 3.2.5
Values of N for Kerby's Formula (Kerby, 1959)

Type of Surface	N
Smooth impervious surface	0.02
Smooth bare packed soil	0.10
Poor grass, cultivated row crops or moderately rough bare surface	0.20
Deciduous timberland	0.60
Pasture or Overage grass	0.40
Conifer timberland, deciduous timberland with deep forest litter or dense grass	0.80

Table 3.2.6
Manning's *n* Roughness Coefficients for Sheet Flow (Engman, 1983)

Type of Surface	*n*
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (with no residue)	0.05
Cultivated soils	
Cover ≤ 20%	0.06
Cover ≥ 20%	0.17
Grass	
Short grass, prairie	0.15
Dense grass	0.24
Bermudagrass	0.41
Range	0.13
Woods	
Light underbrush	0.40
Dense underbrush	0.80

Table 3.2.7
Values of c for Izzard's Formula

Surface	c´
Smooth asphalt surface	0.007
Concrete pavement	0.012
Tar and gravel pavement	0.017
Closely clipped sod	0.046
Dense bluegrass turf	0.060

3.2.3 - Application of the Rational Method

The following procedure is used to apply the Rational Method.

Step 1: Determine the contributing basin area A (acres or hectares) by using USGS topographical maps, Indiana county drainage maps, maps developed from a survey of the area, or plans made specifically for the basin. This area is found by using a planimeter or digitizer.

Step 2: By the use of Table 3.2.1 for rural areas or Table 3.2.2 for urban areas, estimate the appropriate value of C. If the land use is mixed, a composite C value is estimated from Table 3.2.3 or is determined by:

Un-developed Drainage

Lots 1-5	Total Area = 276,733 S.F. = 6.35 Ac.			
Surface			C	N
Cultivated field (0-2%)	276,733 S.F. =	6.35 Ac.	0.20	0.20

Weighted c =	0.200		
Weighted N =	0.200		
L =	350	Ft.	
H =	0.5	Ft.	
S =	0.0014	Ft./Ft.	
tc =	27.76	Minutes	(Min. 5 minutes)
I(10) =	3.418	In./Hr.	
Q(10) =	4.34	CFS	

Developed Drainage

Lots 1-5	Total Area = 276,733 S.F. = 6.35 Ac.				
Surface				C	N
Impervious	1 Total 235,223 S.F. =	235,223 S.F. =	5.40 Ac.	0.92	0.02
Lawn (0-2%)	41,510 S.F. =		0.95 Ac.	0.15	0.40
Water	0 S.F. =		0.00 Ac.	1.00	0.00
Misc.	S.F. =		0.00 Ac.		

Weighted c =	0.805		
Weighted N =	0.077		
L =	350	Ft.	
H =	2.5	Ft.	
S =	0.0071	Ft./Ft.	
tc =	12.21	Minutes	(Min. 5 minutes)
I(25) =	5.531	In./Hr.	
Q(25) =	28.27	CFS	

Un-developed Drainage

Lot 6	Total Area = 251,242 S.F. = 5.77 Ac.			
Surface			C	N
Cultivated field (0-2%)	251,242 S.F. =	5.77 Ac.	0.20	0.20

Weighted c =	0.200		
Weighted N =	0.200		
L =	350	Ft.	
H =	1.0	Ft.	
S =	0.0029	Ft./Ft.	
tc =	23.62	Minutes	(Min. 5 minutes)
I(10) =	3.774	In./Hr.	
Q(10) =	4.35	CFS	

Developed Drainage

Lot 6	Total Area = 251,242 S.F. = 5.77 Ac.			
Surface			C	N
Impervious	1 Total 125,267 S.F. = 125,267 S.F. =	2.88 Ac.	0.92	0.02
Lawn (0-2%)	125,975 S.F. =	2.89 Ac.	0.15	0.40
Water	0 S.F. =	0.00 Ac.	1.00	0.00
Misc.	S.F. =	0.00 Ac.		

Weighted c =	0.534		
Weighted N =	0.211		
L =	350	Ft.	
H =	2.5	Ft.	
S =	0.0071	Ft./Ft.	
tc =	19.53	Minutes	(Min. 5 minutes)
I(25) =	4.614	In./Hr.	
Q(25) =	14.21	CFS	

VANDERBURGH COUNTY DRAINAGE BOARD
FORM 800

PROJECT: BCH Subdivision Lots 1-5 — DETENTION FACILITY DESIGN RETURN PERIOD: 25 YRS

DESIGNER: Morley and Assoc. 3792-1 — RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA:	6.35	ACRES
TIME OF CONCENTRATION (UNDEVELOPED WATERSHED):	27.76	MINUTES
RAINFALL INTENSITY (Iu):	3.418	INCHES/HR
UNDEVELOPED RUNOFF COEFFICIENT (Cu):	0.2	
UNDEVELOPED RUNOFF RATE (O = Cu*Iu*A):	4.34	CFS
DEVELOPED RUNOFF COEFFICIENT (Cd):	0.805	

STORM DURATION Td (HRS)	RAINFALL INTENSITY Id (INCH/HR)	INFLOW RATE I(Td) (Cd*Id*A) (CFS)	OUTFLOW RATE O (Cu*Iu*A) (CFS)	STORAGE RATE I(Td)-O (CFS)	REQUIRED STORAGE (Td)-O)*Td/12 (ACRE-FT)
0.08	7.208	36.85	3.95	32.90	0.228
0.17	5.925	30.29	3.95	26.34	0.366
0.25	5.033	25.73	3.95	21.78	0.454
0.33	4.571	23.36	3.95	19.41	0.539
0.42	4.108	21.00	3.95	17.05	0.592
0.50	3.646	18.64	3.95	14.69	0.612
0.58	3.385	17.30	3.95	13.35	0.649
0.67	3.123	15.97	3.95	12.02	0.668
0.75	2.862	14.63	3.95	10.68	0.667
0.83	2.601	13.29	3.95	9.34	0.649
0.92	2.339	11.96	3.95	8.01	0.612
1.00	2.078	10.62	3.95	6.67	0.556
1.25	1.909	9.76	3.95	5.81	0.605
1.50	1.739	8.89	3.95	4.94	0.617
1.75	1.570	8.02	3.95	4.07	0.594
2.00	1.400	7.16	3.95	3.21	0.534
2.50	1.210	6.18	3.95	2.23	0.465
3.00	1.019	5.21	3.95	1.26	0.315
4.00	0.836	4.27	3.95	0.32	0.108

PEAK STORAGE (ACRE/FT):	0.67
PEAK STORAGE (CUBIC FT):	29,078

VANDERBURGH COUNTY DRAINAGE BOARD
FORM 800

PROJECT: BCH Subdivision Lots 1-5 — DETENTION FACILITY DESIGN RETURN PERIOD: 100 YRS
DESIGNER: MORLEY & ASSOC. 3792-1 — RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA:	6.35	ACRES
TIME OF CONCENTRATION (UNDEVELOPED WATERSHED):	27.76	MINUTES
RAINFALL INTENSITY (Iu):	3.418	INCHES/HR
UNDEVELOPED RUNOFF COEFFICIENT (Cu):	0.2	
UNDEVELOPED RUNOFF RATE (O = Cu*Iu*A):	4.34	CFS
DEVELOPED RUNOFF COEFFICIENT (Cd):	0.805	

STORM DURATION Td (HRS)	RAINFALL INTENSITY Id (INCH/HR)	INFLOW RATE I(Td) (Cd*Id*A) (CFS)	OUTFLOW RATE O (Cu*Iu*A) (CFS)	STORAGE RATE I(Td)-O (CFS)	REQUIRED STORAGE (Td)-O)*Td/12 (ACRE-FT)
0.08	8.469	43.29	3.95	39.34	0.273
0.17	7.126	36.43	3.95	32.48	0.451
0.25	6.194	31.66	3.95	27.71	0.577
0.33	5.665	28.96	3.95	25.01	0.695
0.42	5.137	26.26	3.95	22.31	0.775
0.50	4.608	23.55	3.95	19.60	0.817
0.58	4.284	21.90	3.95	17.95	0.872
0.67	3.960	20.24	3.95	16.29	0.905
0.75	3.636	18.58	3.95	14.63	0.915
0.83	3.311	16.93	3.95	12.98	0.901
0.92	2.987	15.27	3.95	11.32	0.865
1.00	2.663	13.61	3.95	9.66	0.805
1.25	2.444	12.49	3.95	8.54	0.890
1.50	2.224	11.37	3.95	7.42	0.927
1.75	2.005	10.25	3.95	6.30	0.918
2.00	1.785	9.12	3.95	5.17	0.862
2.50	1.538	7.86	3.95	3.91	0.815
3.00	1.291	6.60	3.95	2.65	0.662
4.00	1.062	5.43	3.95	1.48	0.493

PEAK STORAGE (ACRE/FT):	0.93
PEAK STORAGE (CUBIC FT):	40,394

VANDERBURGH COUNTY DRAINAGE BOARD
FORM 800

PROJECT: BCH Subdivision Lot 6 — DETENTION FACILITY DESIGN RETURN PERIOD: 25 YRS

DESIGNER: Morley and Assoc. 3792-1 — RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA:	5.77	ACRES
TIME OF CONCENTRATION (UNDEVELOPED WATERSHED):	23.62	MINUTES
RAINFALL INTENSITY (Iu):	3.774	INCHES/HR
UNDEVELOPED RUNOFF COEFFICIENT (Cu):	0.2	
UNDEVELOPED RUNOFF RATE (O = Cu*Iu*A):	4.36	CFS
DEVELOPED RUNOFF COEFFICIENT (Cd):	0.534	

STORM DURATION Td (HRS)	RAINFALL INTENSITY Id (INCH/HR)	INFLOW RATE I(Td) (Cd*Id*A) (CFS)	OUTFLOW RATE O (Cu*Iu*A) (CFS)	STORAGE RATE I(Td)-O (CFS)	REQUIRED STORAGE (Td)-O)*Td/12 (ACRE-FT)
0.08	7.208	22.21	3.95	18.26	0.127
0.17	5.925	18.26	3.95	14.31	0.199
0.25	5.033	15.51	3.95	11.56	0.241
0.33	4.571	14.08	3.95	10.13	0.281
0.42	4.108	12.66	3.95	8.71	0.302
0.50	3.646	11.23	3.95	7.28	0.303
0.58	3.385	10.43	3.95	6.48	0.315
0.67	3.123	9.62	3.95	5.67	0.315
0.75	2.862	8.82	3.95	4.87	0.304
0.83	2.601	8.01	3.95	4.06	0.282
0.92	2.339	7.21	3.95	3.26	0.249
1.00	2.078	6.40	3.95	2.45	0.204
1.25	1.909	5.88	3.95	1.93	0.201
1.50	1.739	5.36	3.95	1.41	0.176
1.75	1.570	4.84	3.95	0.89	0.129
2.00	1.400	4.31	3.95	0.36	0.061
2.50	1.210	3.73	3.95	-0.22	-0.047
3.00	1.019	3.14	3.95	-0.81	-0.203
4.00	0.836	2.58	3.95	-1.37	-0.458

PEAK STORAGE (ACRE/FT):	0.32
PEAK STORAGE (CUBIC FT):	13,730

VANDERBURGH COUNTY DRAINAGE BOARD
FORM 800

PROJECT: BCH Subdivision Lot 6 — DETENTION FACILITY DESIGN RETURN PERIOD: 100 YRS
DESIGNER: MORLEY & ASSOC. 3792-1 — RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA:	5.77	ACRES
TIME OF CONCENTRATION (UNDEVELOPED WATERSHED):	23.62	MINUTES
RAINFALL INTENSITY (Iu):	3.774	INCHES/HR
UNDEVELOPED RUNOFF COEFFICIENT (Cu):	0.2	
UNDEVELOPED RUNOFF RATE (O = Cu*Iu*A):	4.36	CFS
DEVELOPED RUNOFF COEFFICIENT (Cd):	0.534	

STORM DURATION Td (HRS)	RAINFALL INTENSITY Id (INCH/HR)	INFLOW RATE I(Td) (Cd*Id*A) (CFS)	OUTFLOW RATE O (Cu*Iu*A) (CFS)	STORAGE RATE I(Td)-O (CFS)	REQUIRED STORAGE I(Td)-O)*Td/12 (ACRE-FT)
0.08	8.469	26.09	3.95	22.14	0.154
0.17	7.126	21.96	3.95	18.01	0.250
0.25	6.194	19.08	3.95	15.13	0.315
0.33	5.665	17.46	3.95	13.51	0.375
0.42	5.137	15.83	3.95	11.88	0.412
0.50	4.608	14.20	3.95	10.25	0.427
0.58	4.284	13.20	3.95	9.25	0.450
0.67	3.960	12.20	3.95	8.25	0.458
0.75	3.636	11.20	3.95	7.25	0.453
0.83	3.311	10.20	3.95	6.25	0.434
0.92	2.987	9.20	3.95	5.25	0.401
1.00	2.663	8.21	3.95	4.26	0.355
1.25	2.444	7.53	3.95	3.58	0.373
1.50	2.224	6.85	3.95	2.90	0.363
1.75	2.005	6.18	3.95	2.23	0.325
2.00	1.785	5.50	3.95	1.55	0.258
2.50	1.538	4.74	3.95	0.79	0.164
3.00	1.291	3.98	3.95	0.03	0.007
4.00	1.062	3.27	3.95	-0.68	-0.226

PEAK STORAGE (ACRE/FT):	0.46
PEAK STORAGE (CUBIC FT):	19,966

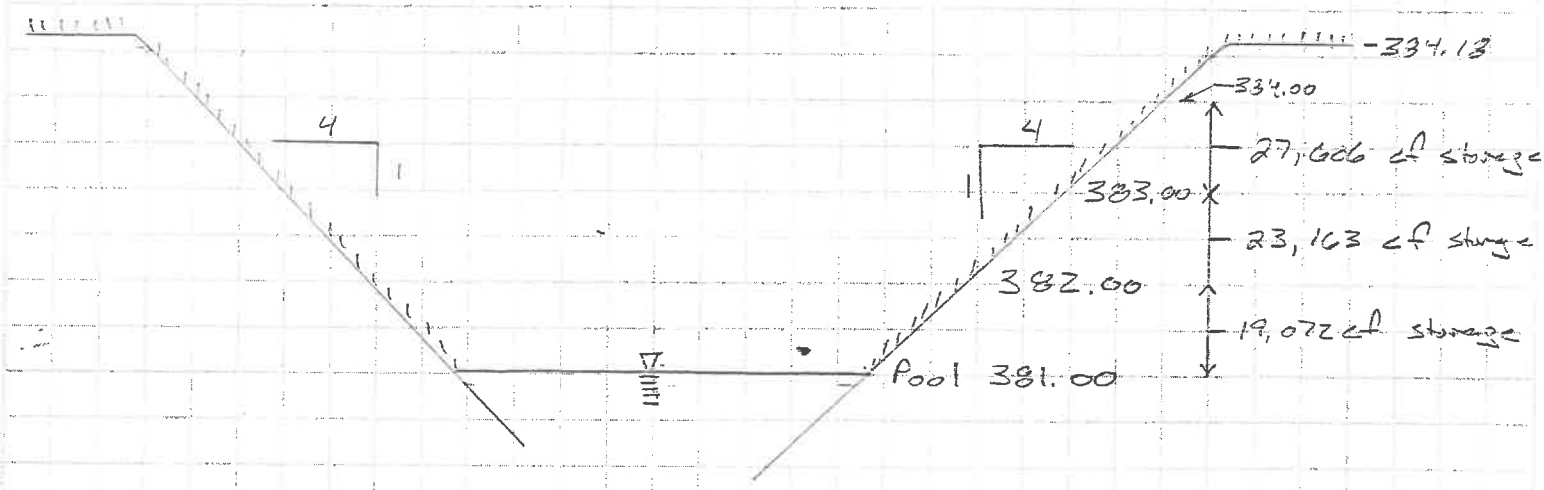
Morley and Associates INC.
CONSULTING ENGINEERS/LAND SURVEYORS/ARCHITECTS
605 S.E. MARTIN LUTHER KING, JR. BLVD
EVANSVILLE, IN. 47713 (812) 464-9585 FAX (812) 464-2514

Project BCH

Sheet ____ of ____

Project No. 3792-1 Date 1-12-98 By JEM

Basin A Storage Summary



25-year storm required storage = 42,898 cf ⇒ elevation 383.02

100-year storm required storage = 60,360 cf ⇒ elevation 383.68

Developed Drainage Sub-Basin

Sub-Basin: A	Total Area = 11,845 S.F. = 0.27 Ac.				
Surface				C	N
Impervious	0 S.F. =	0.00	Ac.	0.92	0.02
Roadway	8,012 S.F. =	0.18	Ac.	0.92	0.02
Lawn (0-2%)	3,834 S.F. =	0.09	Ac.	0.15	0.40
Misc.	S.F. =	0.00	Ac.		

Weighted c =	0.671		
Weighted N =	0.143		
L =	250	Ft.	
H =	1.25	Ft.	
S =	0.0050	Ft./Ft.	
tc =	15.14	Minutes	(Min. 5 minutes)
I(25) =	5.020	In./Hr.	
Q(25) =	0.92	CFS	

Developed Drainage Sub-Basin

Sub-Basin: B	Total Area = 103,812 S.F. = 2.38 Ac.				
Surface				C	N
Impervious	81,430 S.F. =	1.87	Ac.	0.92	0.02
Roadway	8,012 S.F. =	0.18	Ac.	0.92	0.02
Lawn (0-2%)	14,370 S.F. =	0.33	Ac.	0.15	0.40
Misc.	S.F. =	0.00	Ac.		

Weighted c =	0.813		
Weighted N =	0.073		
L =	350	Ft.	
H =	2.50	Ft.	
S =	0.0071	Ft./Ft.	
tc =	11.88	Minutes	(Min. 5 minutes)
I(25) =	5.590	In./Hr.	
Q(25) =	10.84	CFS	

Developed Drainage Sub-Basin

Sub-Basin: C	Total Area = 111,755 S.F. = 2.57 Ac.				
Surface				C	N
Impervious	87,941 S.F. =	2.02 Ac.		0.92	0.02
Roadway	8,295 S.F. =	0.19 Ac.		0.92	0.02
Lawn (0-2%)	15,519 S.F. =	0.36 Ac.		0.15	0.40
Misc.	S.F. =	0.00 Ac.			

Weighted c =	0.813		
Weighted N =	0.073		
L =	370	Ft.	
H =	2.50	Ft.	
S =	0.0068	Ft./Ft.	
tc =	12.36	Minutes	(Min. 5 minutes)
I(25) =	5.504	In./Hr.	
Q(25) =	11.48	CFS	

Developed Drainage Sub-Basin

Sub-Basin: D	Total Area = 12,139 S.F. = 0.28 Ac.				
Surface				C	N
Impervious	0 S.F. =	0.00 Ac.		0.92	0.02
Roadway	8,295 S.F. =	0.19 Ac.		0.92	0.02
Lawn (0-2%)	3,844 S.F. =	0.09 Ac.		0.15	0.40
Misc.	S.F. =	0.00 Ac.			

Weighted c =	0.676		
Weighted N =	0.140		
L =	280	Ft.	
H =	1.40	Ft.	
S =	0.0050	Ft./Ft.	
tc =	15.83	Minutes	(Min. 5 minutes)
I(25) =	4.956	In./Hr.	
Q(25) =	0.93	CFS	

Developed Drainage Sub-Basin

Sub-Basin: E	Total Area = 20,503 S.F. = 0.47 Ac.				
Surface				C	N
Impervious	12,315 S.F. =	0.28	Ac.	0.92	0.02
Roadway	6,014 S.F. =	0.14	Ac.	0.92	0.02
Lawn (0-2%)	2,173 S.F. =	0.05	Ac.	0.15	0.40
Misc.	S.F. =	0.00	Ac.		

Weighted c =	0.838		
Weighted N =	0.060		
L =	280	Ft.	
H =	2.50	Ft.	
S =	0.0089	Ft./Ft.	
tc =	9.31	Minutes	(Min. 5 minutes)
I(25) =	6.230	In./Hr.	
Q(25) =	2.46	CFS	

Developed Drainage Sub-Basin

Sub-Basin: F	Total Area = 17,041 S.F. = 0.39 Ac.				
Surface				C	N
Impervious	0 S.F. =	0.00	Ac.	0.92	0.02
Roadway	10,672 S.F. =	0.25	Ac.	0.92	0.02
Lawn (0-2%)	6,369 S.F. =	0.15	Ac.	0.15	0.40
Misc.	S.F. =	0.00	Ac.		

Weighted c =	0.632		
Weighted N =	0.162		
L =	285	Ft.	
H =	1.43	Ft.	
S =	0.0050	Ft./Ft.	
tc =	17.05	Minutes	(Min. 5 minutes)
I(25) =	4.843	In./Hr.	
Q(25) =	1.20	CFS	

Developed Drainage Sub-Basin

Sub-Basin: G	Total Area = 251,242 S.F. = 5.77 Ac.				
Surface				C	N
Impervious	125,267 S.F. =	2.88	Ac.	0.92	0.02
Roadway	0 S.F. =	0.00	Ac.	0.92	0.02
Lawn (0-2%)	125,975 S.F. =	2.89	Ac.	0.15	0.40
Misc.	S.F. =	0.00	Ac.		

Weighted c =	0.534		
Weighted N =	0.211		
L =	350	Ft.	
H =	2.50	Ft.	
S =	0.0071	Ft./Ft.	
tc =	19.53	Minutes	(Min. 5 minutes)
I(25) =	4.614	In./Hr.	
Q(25) =	14.21	CFS	

MORLEY AND ASSOCIATES INC.
STORM SEWER DESIGN SHEET - RATIONAL METHOD

PROJECT: BCH Commercial Subdivision
OUR PROJECT # 97-3792-1 DATE: 1/8/97
MANNINGS n 0.011 DESIGN PERIOD: 25 YEARS

LINE NO.	UPSTREAM MANHOLE	STR. #	DOWNSTREAM MANHOLE	LENGTH (ft)	Cj	Aj (ac.)	CjAj	SUM CjAj	Tj (min)	Tcum (min)	I (in/hr)	Q (cfs)	PIPE DIA. (in)	PIPE SLOPE (ft/ft)	PIPE CAP. (cfs)	VELOCITY (ft/sec)	TRAVEL TIME (min)
1	600	601	602	31.9	0.53	5.77	3.08	3.08	19.53	19.53	4.614	14.22	24	0.0030	14.64	4.66	0.11
1	602	603	606	396.3	0.00	0.00	0.00	3.08	0.00	19.64	4.604	14.18	24	0.0030	14.64	4.66	1.42
1	606	607	608	63.5	0.00	0.00	0.00	3.08	0.00	21.06	4.473	13.78	24	0.0030	14.64	4.66	0.23
1	612	611	610	86.8	0.63	0.39	0.25	0.25	17.05	17.05	4.843	1.19	12	0.0050	2.98	3.79	0.38
1	610	609	608	7.0	0.84	0.47	0.39	0.64	9.31	17.43	4.808	3.08	12	0.0300	7.29	9.29	0.01
1	608	613	614	203.5	0.00	0.00	0.00	3.72	0.00	21.29	4.452	16.57	30	0.0030	26.54	5.41	0.63
1	614	615	616	328.5	0.00	0.00	0.00	3.72	0.00	21.91	4.394	16.35	30	0.0030	26.54	5.41	1.01
1	620	619	618	39.0	0.68	0.28	0.19	0.19	15.83	15.83	4.956	0.94	12	0.0050	2.98	3.79	0.17
1	618	617	616	7.0	0.81	2.57	2.09	2.28	12.36	16.00	4.940	11.26	15	0.0300	13.22	10.78	0.01
1	616	621	622	250.0	0.00	0.00	0.00	6.00	0.00	22.93	4.300	25.80	30	0.0030	26.54	5.41	0.77
1	626	625	624	39.0	0.67	0.27	0.18	0.18	15.14	15.14	5.020	0.91	12	0.0050	2.98	3.79	0.17
1	624	623	622	7.0	0.81	2.38	1.93	2.12	11.88	15.31	5.004	10.59	15	0.0300	13.22	10.78	0.01
1	622	627	628	207.5	0.00	0.00	0.00	8.12	0.00	23.70	4.229	34.32	36	0.0030	43.16	6.11	0.57
1	628	629	630	128.5	See orifice calculation sheets included in report.							7.90	21	0.0030	10.25	4.26	

BCH COMMERCIAL SUBDIVISION
3792-1

Detention Basin Outlet

Control structure located at storm manhole STMH #628.

Allowable Discharge Rate = 7.9 cfs

Available Headwater Elevation = 383.02 (25 Year Elevation)

Invert Elevation @ STMH # 628 = 376.56

Available Headwater = 6.46 ft.

Determine size of vertically arranged orifice for above conditions.

VERTICAL ORIFICE CALCULATIONS

Q =	7.90 cfs
Cd =	0.60
g =	32.20 ft/sec**2
h =	6.460 ft
d =	0.924 ft
A =	0.670 sq.ft.

Required Orifice Opening Area = 0.670 S.F.
Equivalent Diameter Orifice = 11.08 In.

An orifice plate shall be provided at the upstream end of pipe structure P #629 with an opening of 11.08 inches in diameter, or equivalent.
Pipe structure P #629 shall be a 21 inch RCP at a minimum slope of 0.3% (capacity = 10.25 cfs) to convey the discharge from the orifice outlet without restriction.