

NAPOLÉAN OHIO

Project: Napoleon Travel Center
Location: Napoleon, Ohio
Calculation by: Dennis Bell 7-27-04

Entire Site

Gross Area (acres): 5.0
 Exist. Impervious Area (At, SF): -
 Gross Area (At, SF): 216,057.6
 Pavement Area (SF): 139,989.0
 Building Area (SF): 9,900.0
 Total Net Impervious Area (SF): 149,889.0
 Net Pervious Area (CAp): 19,850.6
 Cw: 0.716
 Allowable Q: 2.976
 Actual Q: 2.793

905 American Rd

Detention Volume Required:

tc (min)	t25	CWA	Qin Q25	Qout	Qin-Qout	Volume CF
20	4.4	3.553	15.631	0.000	15.631	18757.7
25	4.0	3.553	14.210	0.000	14.210	21315.5
30	3.4	3.553	12.079	0.000	12.079	21741.8
35	3.2	3.553	11.368	0.000	11.368	23873.4
40	2.8	3.553	9.947	0.000	9.947	23873.4
50	2.4	3.553	8.526	0.000	8.526	25578.6
60	2.1	3.553	7.460	0.000	7.460	26857.6
70	1.8	3.553	6.395	0.000	6.395	26857.6
80	1.7	3.553	6.039	0.000	6.039	28989.1
90	1.5	3.553	5.329	0.000	5.329	28776.0
100	1.4	3.553	4.974	0.000	4.974	29841.7

Design Detention Volume (Cubic Feet): 29841.7

Pond Size: 8370.0 (Bottom Surface Area)
 1.0 factor
4.685 Depth (feet - Calculated)

Meter Line Sizing:

Meter Line Length (ft): 471.0 Pipe Area: 0.545138889
 Meter Line Slope (%): 0.10 Wetted Perimeter: 2.616666667
 Meter Line Size (in): 10
 Pipe 'n': 0.013
 Ke: 0.5 Hydraulic Radius (R): 0.208333333
 Maximum Head assumed (ft): 4.0 (R*4/3): 0.278

Head	H*2g	1+Kc	V*2	V	Pipe Area	Flow - CFS
4.0	257.6	9.8101356	26.25855651	5.1243103	0.545138889	2.793

PROJECT: PILOT - NAPOLEAN, OHIO
 PR. NO.: 6059
 FILE: 6059DET DATE: 6/23/2006

WORKSHEET FOR DETENTION FACILITY - 25 YEAR POSTDEVELOPMENT STORM

ORIGINAL CALCULATION (RECREATION)

RELEASE RATE (PRE-DEVELOPMENT):		
TIME OF $I_{10} =$	CONC. = 18 MIN 4.40 IN/HR	$Q_0 = CIA = (0.30)(2.0)(5.0)$ = 3.0 CFS

STORAGE VOLUME DETERMINATION:				50 YEAR	10 YEAR				
RUNOFF FACTOR	STORM DURATION	STORM DURATION	RAINFALL INTENSITY	DRAINAGE AREA	INFLOW RATE	RELEASE RATE	STORAGE RATE	STORAGE REQUIRED	STORAGE REQUIRED
C	T	T	I (50)	A	$Q_i = CI A$	Q_0	$(Q_i - Q_0)$	$[(Q_i - Q_0) * T] / 12$	
	MIN	HR	IN/HR	AC	CFS	CFS	CFS	(AC-FT)	(CF)
0.71	20	0.333	4.4	5.0	15.620	0.00	15.620	0.4335	18881
0.71	25	0.417	4.0	5.0	14.200	0.00	14.200	0.4935	21495
0.71	30	0.500	3.4	5.0	12.070	0.00	12.070	0.5029	21907
0.71	35	0.583	3.2	5.0	11.360	0.00	11.360	0.5519	24041
0.71	40	0.666	2.8	5.0	9.940	0.00	9.940	0.5517	24031
0.71	50	0.833	2.4	5.0	8.520	0.00	8.520	0.5914	25763
0.71	60	1.000	2.1	5.0	7.455	0.00	7.455	0.6213	27062
0.71	70	1.166	1.8	5.0	6.390	0.00	6.390	0.6209	27046
0.71	80	1.333	1.7	5.0	6.035	0.00	6.035	0.6704	29202
0.71	90	1.500	1.5	5.0	5.325	0.00	5.325	0.6656	28995
0.71	100	1.667	1.4	5.0	4.970	0.00	4.970	0.6904	30075

Volume Required: 30075 CF
 Volume Provided: 6370.0 SF BOTTOM SURFACE AREA X 4.72 FT deep provides 30075 CF

ACTUAL RELEASE RATE:							HEAD, h	Qa	
	Co	DIAM., D	AREA, A	WS ELEV	INV ELEV	RADIUS	WS-INV+RAD	$(2gh)^{1/2}$	$CoA(2gh)^{1/2}$
		IN	FT ²	FT	FT	FT	FT	FT/SEC	CFS
ORIF. 1	0.61	10.0	0.545	956.0	952	0.417	4.417	16.87	5.611

PROJECT: PILOT - NAPOLEAN, OHIO
 PR. NO.: 6059
 FILE: 6059DET DATE: 6/23/2006

WORKSHEET FOR DETENTION FACILITY - 25 YEAR POSTDEVELOPMENT STORM

EXISTING SITE PLUS NEW DEVELOPMENT

RELEASE RATE (PRE-DEVELOPMENT):		
TIME OF $t_{10} =$	CONC. = 18 MIN 4.40 IN/HR	$Q_0 = CIA = (0.30)(2.0)(5.0)$ = 3.0 CFS

STORAGE VOLUME DETERMINATION:				50 YEAR	10 YEAR				
RUNOFF FACTOR	STORM DURATION	STORM DURATION	RAINFALL INTENSITY	DRAINAGE AREA	INFLOW RATE	RELEASE RATE	STORAGE RATE	STORAGE REQUIRED	STORAGE REQUIRED
C	T	T	I (50)	A	$Q_i = CI A$	Q_0	$(Q_i - Q_0)$	$[(Q_i - Q_0) * T] / 12$	
	MIN	HR	IN/HR	AC	CFS	CFS	CFS	(AC-FT)	(CF)
0.71	20	0.333	4.4	6.0	18.744	0.00	18.744	0.5201	22658
0.71	25	0.417	4.0	6.0	17.040	0.00	17.040	0.5921	25794
0.71	30	0.500	3.4	6.0	14.484	0.00	14.484	0.6035	26288
0.71	35	0.583	3.2	6.0	13.632	0.00	13.632	0.6623	28849
0.71	40	0.666	2.8	6.0	11.928	0.00	11.928	0.6620	28837
0.71	50	0.833	2.4	6.0	10.224	0.00	10.224	0.7097	30915
0.71	60	1.000	2.1	6.0	8.946	0.00	8.946	0.7455	32474
0.71	70	1.166	1.8	6.0	7.668	0.00	7.668	0.7451	32455
0.71	80	1.333	1.7	6.0	7.242	0.00	7.242	0.8045	35043
0.71	90	1.500	1.5	6.0	6.390	0.00	6.390	0.7988	34794
0.71	100	1.667	1.4	6.0	5.964	0.00	5.964	0.8285	36089

PEAK

Volume Required: 30075 CF
 Volume Provided: 6370.0 SF BOTTOM SURFACE AREA X 4.72 FT deep provides 30075 CF

ACTUAL RELEASE RATE:							HEAD, h		Q_a
	C_o	DIAM., D	AREA, A	WS ELEV	INV ELEV	RADIUS	WS-INV+RAD	$(2gh)^{1/2}$	$C_o A (2gh)^{1/2}$
		IN	FT ²	FT	FT	FT	FT	FT/SEC	CFS
ORIF. 1	0.61	10.0	0.545	956.0	952	0.417	4.417	16.87	5.611

Jun. 20. 2006 4:40PM

No. 3743 P. 2/2

NAPOLEAN, OHIO

Project: Napoleon Travel Center
 Location: Napoleon, Ohio
 Calculation by: Dennis Bell 7-27-04

Entire Site

Gross Area (acres):	5.0
Exist. Impervious Area (A _i , SF):	-
Gross Area (A _t , SF):	216,057.8
Pavement Area (SF):	139,869.0
Building Area (SF):	9,800.0
Total Net Impervious Area (SF):	149,869.0
Net Pervious Area (CA _p):	19,650.8
C _w :	0.716
Allowable Q:	2.976
Actual Q:	2.793

Detention Volume Required:

tc (min)	I ₂₅	CWA	Q _{in} Q ₂₅	Q _{out}	Q _{in} -Q _{out}	Volume CF
20	4.4	3.553	15.631	0.000	15.631	18757.7
25	4.0	3.553	14.210	0.000	14.210	21315.5
30	3.4	3.553	12.079	0.000	12.079	21741.8
35	3.2	3.553	11.368	0.000	11.368	23873.4
40	2.8	3.553	9.647	0.000	9.647	23873.4
50	2.4	3.553	8.526	0.000	8.526	25578.6
60	2.1	3.553	7.460	0.000	7.460	26657.8
70	1.8	3.553	6.395	0.000	6.395	26657.8
80	1.7	3.553	6.039	0.000	6.039	26669.1
90	1.5	3.553	5.329	0.000	5.329	28776.0
100	1.4	3.553	4.974	0.000	4.974	28841.7

Design Detention Volume (Cubic Feet): 28841.7

Pond Size: 8370.0 (Bottom Surface Area)
 1.0 Factor
 4.685 Depth (feet - Calculated)

Meter Line Sizing:

Meter Line Length (ft):	471.0	Pipe Area:	0.545138889
Meter Line Slope (%):	0.10	Wetted Perimeter:	2.616668667
Meter Line Size (in):	10		
Pipe 'n':	0.013		
Ke:	0.5	Hydraulic Radius (R):	0.208333333
Maximum Head assumed (ft):	4.0	(R ^{4/3}):	0.278

Head	H ^{2g}	1+K _e	V ²	V	Pipe Area	Flow - CFS
4.0	257.6	9.8101355	26.25856651	5.1243103	0.54513889	2.793

--	--	--	--	--	--	--

0001
NAPOLÉAN OHIO

Project: Napoleon Travel Center
Location: Napoleon, Ohio
Calculation by: Dennis Bell 7-27-04

Entire Site

Gross Area (acres): 5.0
 Exist. Impervious Area (At, SF): -
 Gross Area (At, SF): 216,057.6
 Pavement Area (SF): 139,989.0
 Building Area (SF): 9,900.0
 Total Net Impervious Area (SF): 149,889.0
 Net Pervious Area (CAp): 19,850.6
 Cw: 0.716
 Allowable Q: 2.976
 Actual Q: 2.793

Detention Volume Required:

tc (min)	t25	CwA	Qin Q25	Qout	Qin-Qout	Volume CF
20	4.4	3.553	15.631	0.000	15.631	18757.7
25	4.0	3.553	14.210	0.000	14.210	21315.5
30	3.4	3.553	12.079	0.000	12.079	21741.8
35	3.2	3.553	11.368	0.000	11.368	23873.4
40	2.8	3.553	9.947	0.000	9.947	23873.4
50	2.4	3.553	8.526	0.000	8.526	25578.6
60	2.1	3.553	7.460	0.000	7.460	26857.6
70	1.8	3.553	6.395	0.000	6.395	26857.6
80	1.7	3.553	6.039	0.000	6.039	28989.1
90	1.5	3.553	5.329	0.000	5.329	28776.0
100	1.4	3.553	4.974	0.000	4.974	29841.7

Design Detention Volume (Cubic Feet): 29841.7

Pond Size: 8976.0 (Bottom Surface Area)
 1.0 factor
 4.685 Depth (feet - Calculated)

Meter Line Sizing:

Meter Line Length (ft): 471.0 Pipe Area: 0.545138889
 Meter Line Slope (%): 0.10 Wetted Perimeter: 2.616666667
 Meter Line Size (in): 10
 Pipe 'n': 0.013
 Ke: 0.5 Hydraulic Radius (R): 0.208333333
 Maximum Head assumed (ft): 4.0 (R*4/3): 0.278

Head	H*2g	1+Ke	V*2	V	Pipe Area	Flow - CFS
4.0	257.6	9.8101356	26.25855651	5.1243103	0.545138889	2.793

[Empty box]

PROJECT: PILOT - NAPOLEAN, OHIO
 PR. NO.: 6059
 FILE: 6059DET DATE: 6/23/2006

WORKSHEET FOR DETENTION FACILITY - 25 YEAR POSTDEVELOPMENT STORM

ORIGINAL CALCULATION (RECREATION)

RELEASE RATE (PRE-DEVELOPMENT):		
TIME OF $I_{10} =$	CONC. = 18 MIN 4.40 IN/HR	$Q_0 = CIA = (0.30)(2.0)(5.0)$ = 3.0 CFS

STORAGE VOLUME DETERMINATION:				50 YEAR	10 YEAR				
RUNOFF FACTOR	STORM DURATION	STORM DURATION	RAINFALL INTENSITY	DRAINAGE AREA	INFLOW RATE	RELEASE RATE	STORAGE RATE	STORAGE REQUIRED	STORAGE REQUIRED
C	T	T	I (50)	A	$Q_i = CI A$	Q_0	$(Q_i - Q_0)$	$[(Q_i - Q_0) * T] / 12$	
	MIN	HR	IN/HR	AC	CFS	CFS	CFS	(AC-FT)	(CF)
0.71	20	0.333	4.4	5.0	15.620	0.00	15.620	0.4335	18881
0.71	25	0.417	4.0	5.0	14.200	0.00	14.200	0.4935	21495
0.71	30	0.500	3.4	5.0	12.070	0.00	12.070	0.5029	21907
0.71	35	0.583	3.2	5.0	11.360	0.00	11.360	0.5519	24041
0.71	40	0.666	2.8	5.0	9.940	0.00	9.940	0.5517	24031
0.71	50	0.833	2.4	5.0	8.520	0.00	8.520	0.5914	25763
0.71	60	1.000	2.1	5.0	7.455	0.00	7.455	0.6213	27062
0.71	70	1.166	1.8	5.0	6.390	0.00	6.390	0.6209	27046
0.71	80	1.333	1.7	5.0	6.035	0.00	6.035	0.6704	29202
0.71	90	1.500	1.5	5.0	5.325	0.00	5.325	0.6656	28995
0.71	100	1.667	1.4	5.0	4.970	0.00	4.970	0.6904	30075

Volume Required: 30075 CF
 Volume Provided: 6370.0 SF BOTTOM SURFACE AREA X 4.72 FT deep provides 30075 CF

ACTUAL RELEASE RATE:							HEAD, h		Q_a
	C_o	DIAM., D	AREA, A	WS ELEV	INV ELEV	RADIUS	WS-INV+RAD	$(2gh)^{1/2}$	$C_o A (2gh)^{1/2}$
		IN	FT ²	FT	FT	FT	FT	FT/SEC	CFS
ORIF. 1	0.61	10.0	0.545	956.0	952	0.417	4.417	16.87	5.611

PROJECT: PILOT - NAPOLEAN, OHIO
 PR. NO.: 8058
 FILE: 6059DET DATE: 6/23/2006

WORKSHEET FOR DETENTION FACILITY - 25 YEAR POSTDEVELOPMENT STORM

ORIGINAL CALCULATION (RECREATION)

RELEASE RATE (PRE-DEVELOPMENT):		
TIME OF CONC. = 18 MIN		$Q_0 = CIA = (0.30)(2.0)(5.0)$
$I_{18} = 4.40$ IN/HR		$= 3.0$ CFS

STORAGE VOLUME DETERMINATION:				50 YEAR	10 YEAR				
RUNOFF FACTOR	STORM DURATION	STORM DURATION	RAINFALL INTENSITY	DRAINAGE AREA	INFLOW RATE	RELEASE RATE	STORAGE RATE	STORAGE REQUIRED	STORAGE REQUIRED
C	T	T	I (50)	A	$Q_i = CIA$	Q_0	$(Q_i - Q_0)$	$((Q_i - Q_0) * T) / 12$	
	MIN	HR	IN/HR	AC	CFS	CFS	CFS	(AC-FT)	(CF)
0.71	20	0.333	4.4	5.0	15.620	0.00	15.620	0.4335	18881
0.71	25	0.417	4.0	5.0	14.200	0.00	14.200	0.4935	21495
0.71	30	0.500	3.4	5.0	12.070	0.00	12.070	0.5029	21907
0.71	35	0.583	3.2	5.0	11.360	0.00	11.360	0.5519	24041
0.71	40	0.666	2.8	5.0	9.940	0.00	9.940	0.6517	24031
0.71	50	0.833	2.4	5.0	8.520	0.00	8.520	0.5914	25763
0.71	60	1.000	2.1	5.0	7.455	0.00	7.455	0.6213	27062
0.71	70	1.166	1.8	5.0	6.390	0.00	6.390	0.6209	27046
0.71	80	1.333	1.7	5.0	6.035	0.00	6.035	0.6704	29202
0.71	90	1.500	1.5	5.0	5.325	0.00	5.325	0.6656	28995
0.71	100	1.667	1.4	5.0	4.970	0.00	4.970	0.6904	30075

Volume Required: 30075 CF
 Volume Provided: 6370.0 SF BOTTOM SURFACE AREA X 4.72 FT deep provides 30075 CF

ACTUAL RELEASE RATE:									
	C_0	DIAM., D	AREA, A	WS ELEV	INV ELEV	RADIUS	HEAD, h	$(2gh)^{1/2}$	Q_a
		IN	FT ²	FT	FT	FT	FT	FT/SEC	CFS
ORIF. 1	0.81	10.0	0.545	956.0	952	0.417	4.417	16.87	5.611

PROJECT: PILOT - NAPOLEAN, OHIO
 PR. NO.: 8059
 FILE: 6059DET2 DATE: 6/23/2006

WORKSHEET FOR DETENTION FACILITY - 25 YEAR POSTDEVELOPMENT STORM

EXISTING SITE PLUS NEW DEVELOPMENT

RELEASE RATE (PRE-DEVELOPMENT):
 TIME OF CONC. = 18 MIN $Q_0 = CIA = (0.30)(2.0)(5.0) = 3.0 \text{ CFS}$
 $I_{10} = 4.40 \text{ IN/HR}$

STORAGE VOLUME DETERMINATION:				50 YEAR		10 YEAR			
RUNOFF FACTOR	STORM DURATION	STORM DURATION	RAINFALL INTENSITY	DRAINAGE AREA	INFLOW RATE	RELEASE RATE	STORAGE RATE	STORAGE REQUIRED	STORAGE REQUIRED
C	T	T	I (50)	A	$Q_i = CIA$	Q_0	$(Q_i - Q_0)$	$[(Q_i - Q_0) \cdot T] / 12$	
	MIN	HR	IN/HR	AC	CFS	CFS	CFS	(AC-FT)	(CF)
0.71	20	0.333	4.4	6.0	18.744	0.00	18.744	0.5201	22658
0.71	25	0.417	4.0	6.0	17.040	0.00	17.040	0.5921	25794
0.71	30	0.500	3.4	6.0	14.484	0.00	14.484	0.6035	26288
0.71	35	0.583	3.2	6.0	13.632	0.00	13.632	0.6623	28849
0.71	40	0.666	2.8	6.0	11.928	0.00	11.928	0.6620	28837
0.71	50	0.833	2.4	6.0	10.224	0.00	10.224	0.7097	30915
0.71	60	1.000	2.1	6.0	8.946	0.00	8.946	0.7455	32474
0.71	70	1.166	1.8	6.0	7.668	0.00	7.668	0.7451	32455
0.71	80	1.333	1.7	6.0	7.242	0.00	7.242	0.8045	35043
0.71	90	1.500	1.5	6.0	6.390	0.00	6.390	0.7988	34794
0.71	100	1.667	1.4	6.0	5.964	0.00	5.964	0.8285	36089

PEAK

Volume Required: 30075 CF
 Volume Provided: 7646.0 SF BOTTOM SURFACE AREA X 4.72 FT deep provides 36089 CF

ACTUAL RELEASE RATE:									
	C_0	DIAM. D	AREA, A	WS ELEV	INV ELEV	RADIUS	HEAD, h		Q_b
		IN	FT ²	FT	FT	FT	WS-INV+RAD	$(2gh)^{1/2}$	$C_0 A (2gh)^{1/2}$
							FT	FT/SEC	CFS
ORIF. 1	0.61	10.0	0.545	956.0	952	0.417	4.417	16.87	5.611

PROJECT: PILOT - NAPOLEAN, OHIO
 PR. NO.: 6059
 FILE: 6059DET2 DATE: 6/23/2006

WORKSHEET FOR DETENTION FACILITY - 25 YEAR POSTDEVELOPMENT STORM

EXISTING SITE PLUS NEW DEVELOPMENT

RELEASE RATE (PRE-DEVELOPMENT):		
TIME OF $t_{10} =$	CONC. = 18 MIN 4.40 IN/HR	$Q_0 = CIA = (0.30)(2.0)(5.0)$ = 3.0 CFS

STORAGE VOLUME DETERMINATION:				50 YEAR	10 YEAR				
RUNOFF FACTOR	STORM DURATION	STORM DURATION	RAINFALL INTENSITY	DRAINAGE AREA	INFLOW RATE	RELEASE RATE	STORAGE RATE	STORAGE REQUIRED	STORAGE REQUIRED
C	T	T	I (50)	A	$Q_i = CI A$	Q_0	$(Q_i - Q_0)$	$[(Q_i - Q_0) * T] / 12$	
	MIN	HR	IN/HR	AC	CFS	CFS	CFS	(AC-FT)	(CF)
0.71	20	0.333	4.4	6.0	18.744	0.00	18.744	0.5201	22658
0.71	25	0.417	4.0	6.0	17.040	0.00	17.040	0.5921	25794
0.71	30	0.500	3.4	6.0	14.484	0.00	14.484	0.6035	26288
0.71	35	0.583	3.2	6.0	13.632	0.00	13.632	0.6623	28849
0.71	40	0.666	2.8	6.0	11.928	0.00	11.928	0.6620	28837
0.71	50	0.833	2.4	6.0	10.224	0.00	10.224	0.7097	30915
0.71	60	1.000	2.1	6.0	8.946	0.00	8.946	0.7455	32474
0.71	70	1.166	1.8	6.0	7.668	0.00	7.668	0.7451	32455
0.71	80	1.333	1.7	6.0	7.242	0.00	7.242	0.8045	35043
0.71	90	1.500	1.5	6.0	6.390	0.00	6.390	0.7988	34794
0.71	100	1.667	1.4	6.0	5.964	0.00	5.964	0.8285	36089

PEAK

Volume Required: 30075 CF
 Volume Provided: 7646.0 SF BOTTOM SURFACE AREA X 4.72 FT deep provides 36089 CF

ACTUAL RELEASE RATE:									
	C_0	DIAM., D	AREA, A	WS ELEV	INV ELEV	RADIUS	HEAD, h	$(2gh)^{1/2}$	Q_a
		IN	FT ²	FT	FT	FT	FT	FT/SEC	$C_0 A (2gh)^{1/2}$
									CFS
ORIF. 1	0.61	10.0	0.545	956.0	952	0.417	4.417	16.87	5.611