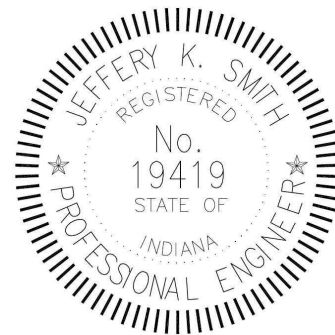


Final Drainage Report for

**Rumple Buildings at
Hurricane Industrial
Park - Lots 3 & 17**

Dated: July 15, 2024



Calculations Prepared By:


PROJECTS plus

1257 Airport Parkway, Suite A
Greenwood, Indiana 46143

OFFICE (317) 882-5003
FAX (317) 882-1082

LAND PLANNING • ENGINEERING • SURVEYING • PROJECT MANAGEMENT

Certified By:


Jeffery K. Smith, P.E. 19419 7/15/24

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TECHNICAL INFORMATION DATA

Development Conditions:

The proposed building for Rumble Buildings is located at 1401 Amy Ln., Franklin, IN 46131 on lots 3 & 17 in the Hurricane Industrial Park Section 3 in the City of Franklin, Johnson County, Indiana. Existing ground cover is grass with soil hydrologic groups type 'B' and 'C'. The proposed development includes the construction of three 2,880 S.F. buildings and a 4,320 S.F. building, with concrete drives and asphalt pavement. Drainage will be provided by a combination of sheet flow, storm sewer culverts and drainage swales. Additional construction activities include a sanitary sewer laterals, domestic water service lines, and other utility connections to the buildings.

The drainage watershed for the site is part of an approved drainage system for Hurricane Industrial Park, prepared by Steven B. Williams, Franklin Engineering Dated February 20, 2001. The approved drainage report had a post-development runoff coefficient of 0.60 for the entire subdivision. The existing detention pond located within the industrial park was designed and built to provide detention for lots 3 & 17. The project site is located within Basin 'A' in the drainage basin map depicted within the "Approved Post-Development, Detention and Storm Sewer Calculations" section of this report.

In 2011, the City of Franklin requested updated detention pond calculations when lots #9 and #10 were being developed, and it became apparent that the original approved coefficient was not conservative enough for an industrial subdivision. Therefore, a new drainage coefficient and calculations were prepared by Projects Plus, with the runoff coefficient being established for all existing and future post-development runoffs. A coefficient of 0.74 was determined for the overall development and a coefficient of 0.74 was determined for lots 3 & 17, with a maximum impervious coverage of 85% assumed.

The calculations listed below for the proposed development project is to verify that the site is under the allowable impervious coverage and runoff coefficient.

Lot 3 & 17 – 2.03 acres

Proposed and existing impervious (detention pond) = 1.37 acres

Grass Area = 0.66 acres

Weighted 'C' = $[(1.37 \times 0.85) + (0.66 \times 0.20)] / 2.03$

Weighted 'C' = $0.64 < 0.74$

The proposed runoff coefficient for lot #3 & 17 is less than the weighted coefficient for future developments included in the Projects Plus report, no additional detention is required for this project.

Water Quality Methodology:

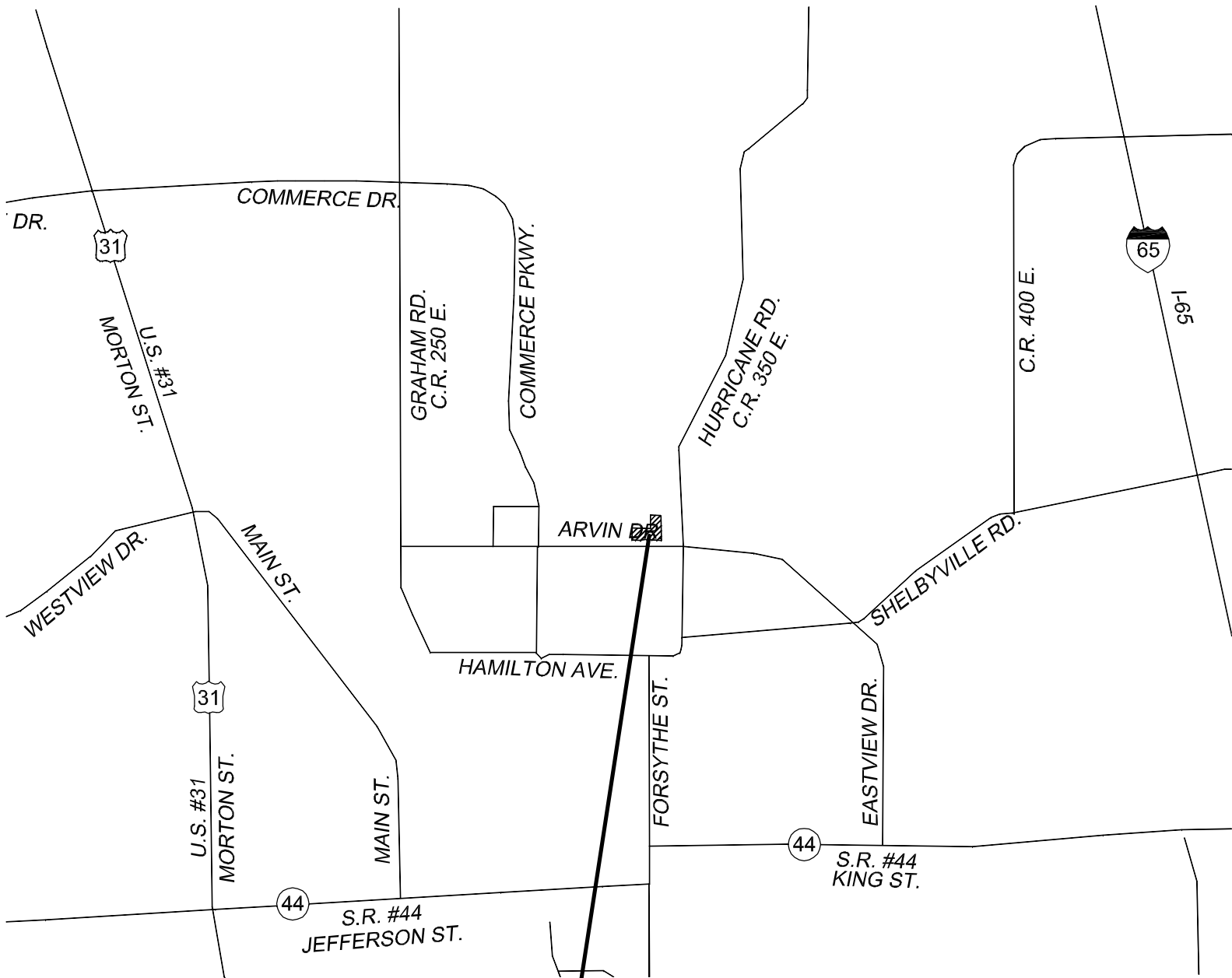
Water Quality for the site will be achieved by routing the storm runoff to the existing detention pond, which will provide treatment in addition to the existing vegetated swale which will provide pre-treatment prior to release to the detention pond. The wet detention pond acts as a permanent stormwater control structure providing both detention and treatment of contaminated stormwater runoff. The ponds natural physical, biological and chemical processes then work to remove pollutants.

Engineering Methodology:

The storm sewer system was designed using the HYDRAFLOW Storm Sewer Module. Discharge rates for each inlet were calculated using the “Rational Method” and input into the HYDRAFLOW Storm Sewer Module to calculate the velocity, capacity, hydraulic grade line, gutter and inlet spreads for each storm sewer system. A weighted coefficient was computed for all storm basins in accordance with Chapter 6.19 of the City of Franklin General Drainage Standards. Individual times of concentration were calculated using Manning Equation. The storm sewer system is sized for a 10-year storm runoff event with no surcharging.

Stormwater Pollution Prevention:

The land disturbing activities will be greater than 1 acre, so an IDEM Construction Stormwater General Permit (CSGP) submittal is required. A Stormwater Pollution Prevention Plan (SWPPP) with an activities schedule will be submitted as part of the construction plans. Standard maintenance schedules and details will be included. All swales and pond banks will be mulch-seeded and have an erosion control blanket installed. All drainage easements will be mulch-seeded and the rights-of-way will be temporary seeded. A perimeter filter fence will be installed where needed as well as at all ditch inlets.



SITE LOCATION



LOCATION MAP

AS SHOWN
ON THE
APPROVED
MAP

HERITAGE SOUTH



LOT #8

LOT #9

LOT #10

LOT #7

AMY LANE

LOT #6

LOT #11

LOT #12

LOT #13

LOT #2

LOT #5

LOT #14

HURRICANE INDUSTRIAL
PARK, SECTION 3

LOT #4

DETENTION
POND

LOT #1

AMY LANE

LOT #15

PROPOSED SITE

HURRICANE RD.

ARVIN DR.

National Flood Hazard Layer FIRMette



86°2'52"W 39°29'52"N

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

Without Base Flood Elevation (BFE)
Zone A, V, A99

With BFE or Depth
Zone AE, AO, AH, VE, AR

Regulatory Floodway

SPECIAL FLOOD HAZARD AREAS

0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile
Zone X

Future Conditions 1% Annual Chance Flood Hazard
Zone X

Area with Reduced Flood Risk due to Levee. See Notes.
Zone X

Area with Flood Risk due to Levee
Zone D

OTHER AREAS OF FLOOD HAZARD

NO SCREEN

Area of Minimal Flood Hazard
Zone X

Effective LOMRs

Area of Undetermined Flood Hazard
Zone D

OTHER AREAS

GENERAL STRUCTURES

Channel, Culvert, or Storm Sewer

Levee, Dike, or Floodwall

Cross Sections with 1% Annual Chance Water Surface Elevation

Coastal Transect

Base Flood Elevation Line (BFE)

Limit of Study

Jurisdiction Boundary

Coastal Transect Baseline

Profile Baseline

Hydrographic Feature

OTHER FEATURES

Digital Data Available

No Digital Data Available

Unmapped

MAP PANELS

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **2/9/2023 at 9:54 AM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

0 250 500 1,000 1,500 2,000 Feet 1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020



SOILS MAP

Hours	Minutes	Return Period - Rainfall Intensity (in/hr)					
		2	5	10	25	50	100
0.08	5	4.75	6.14	6.99	8.08	8.83	9.69
0.17	10	3.63	4.75	5.48	6.40	7.07	7.77
0.25	15	2.97	3.92	4.55	5.34	5.94	6.53
0.5	30	1.98	2.64	3.09	3.65	4.10	4.50
1	60	1.25	1.67	1.96	2.31	2.62	2.88
2	120	0.76	1.02	1.20	1.40	1.59	1.75
3	180	0.56	0.75	0.88	1.03	1.17	1.29
6	360	0.33	0.44	0.52	0.60	0.68	0.75
12	720	0.20	0.26	0.30	0.35	0.39	0.43
24	1440	0.11	0.15	0.17	0.20	0.22	0.25

Hours	Minutes	Return Period - Rainfall Depth (in)					
		2	5	10	25	50	100
0.08	5	0.40	0.51	0.58	0.67	0.74	0.81
0.17	10	0.61	0.79	0.91	1.07	1.18	1.30
0.25	15	0.74	0.98	1.14	1.34	1.49	1.63
0.5	30	0.99	1.32	1.55	1.83	2.05	2.25
1	60	1.25	1.67	1.96	2.31	2.62	2.88
2	120	1.52	2.04	2.40	2.80	3.18	3.50
3	180	1.68	2.25	2.64	3.09	3.51	3.87
6	360	1.98	2.64	3.12	3.60	4.08	4.50
12	720	2.40	3.12	3.60	4.20	4.68	5.16
24	1440	2.64	3.60	4.08	4.80	5.28	6.00

TABLE 202-02: IDF and IDD Tables for Indianapolis, IN

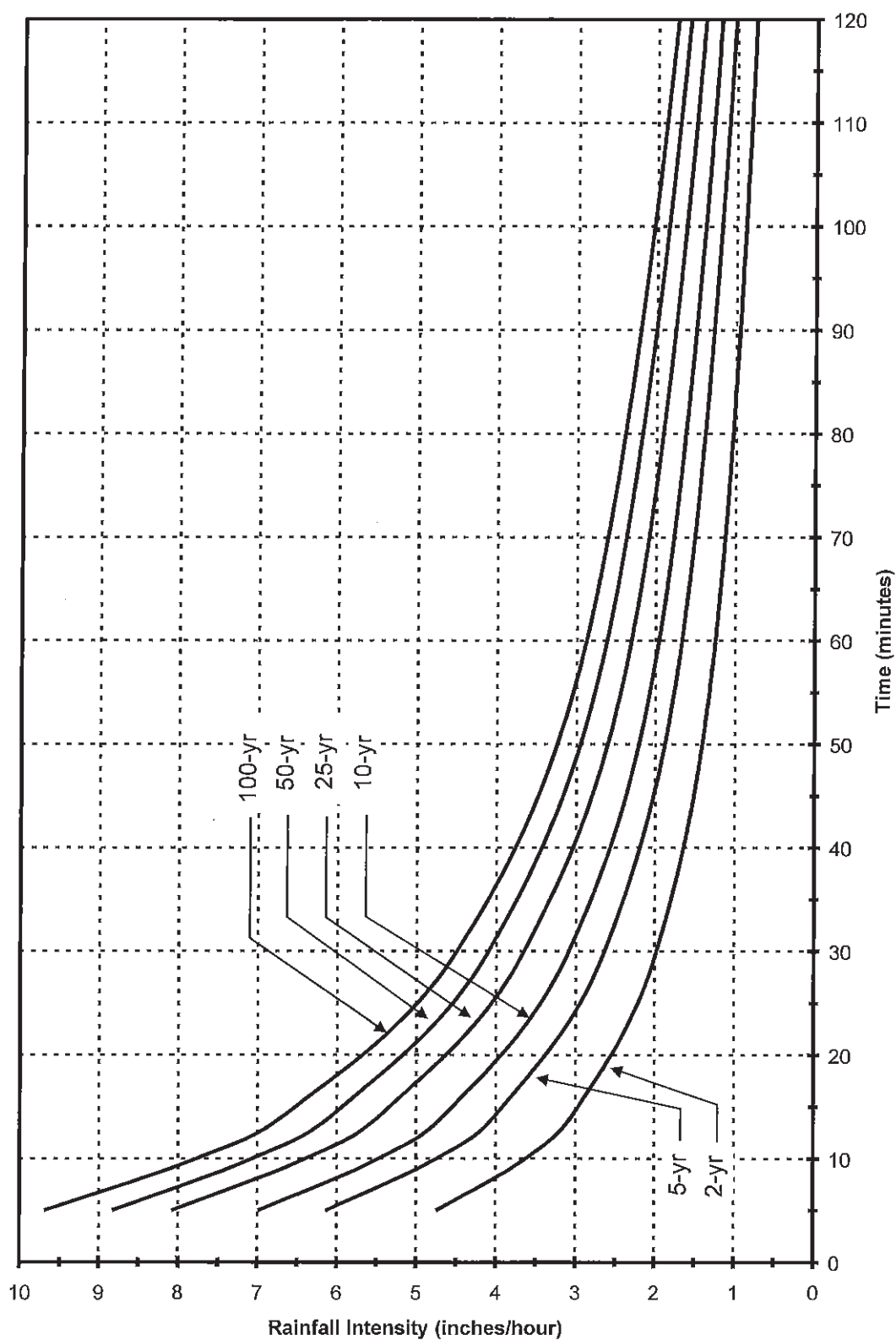


FIGURE 202-01: Indianapolis IDF Curve

Surface Description	n
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated Soils:	
Residue cover $\leq 20\%$	0.06
Residue cover $> 20\%$	0.17
Grass:	
Short grass prairie	0.15
Dense grasses	0.24
Bermuda grass	0.41
Range (natural)	0.13
Woods:	
Light underbrush	0.40
Dense underbrush	0.80

TABLE 203-01: Roughness coefficients (Manning's n) for sheet flow

<u>TYPE OF SURFACE</u>	<u>RUNOFF COEFFICIENT</u> ®
<u>Non-Urban Areas</u>	
Bare earth	0.55
Steep grassed areas (slope 2:1)	0.60
Turf meadows	0.25
Forested areas	0.20
Cultivated fields	0.30
<u>Urban Areas</u>	
All watertight roof surfaces	0.90
Pavement	0.85
Gravel	0.85
Impervious soils (heavy)	0.55
Impervious soils (with turf)	0.45
Slightly pervious soil	0.25
Slightly pervious soil (with turf)	0.20
Moderately pervious soil	0.15
Moderately pervious soil (with turf)	0.10
Business, Commercial & Industrial	0.85
Apartments & Townhouses	0.70
Schools & Churches	0.55
Single Family Lots < 10,000 SF	0.45
Lots < 12,000 SF	0.45
Lots < 17,000 SF	0.40
Lots > ½ acre	0.35
Park, Cemetery or Unimproved Area	0.30

TABLE 204-01: Runoff Coefficients® for Use in the Rational Method

[Absence of an entry indicates the feature is not a concern. The symbol < means less than; > means greater than]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	
Brookston: Br.....	B/D	Frequent	Brief	Dec-May	0-1.0	Apparent	Dec-May	High.
Crosby: CrA.....	C	None			1.0-3.0	Apparent	Jan-Apr	High.
¹ CrB2: Crosby part.....	C	None			1.0-3.0	Apparent	Jan-Apr	High.
Miami part.....	B	None			>6.0			Moderate.
Eel: Ee.....	C	Frequent	Brief	Oct-Jun	3.0-6.0	Apparent	Jan-Apr	High.
Fox: FoA, FoB2, ¹ FxC2.....	B	None			>6.0			Moderate.
Genesee: Ge.....	B	Frequent	Brief	Oct-Jun	>6.0			Moderate.
Hennepin: HeF.....	B	None			>6.0			Moderate.
Martinsville: MgA, MgB2.....	B	None			>6.0			Moderate.
Miami: MmA, MmB2, MmC2, ¹ MxD2, MxE2.....	B	None			>6.0			Moderate.
Ockley: OcA, OcB2.....	B	None			>6.0			Moderate.
Rensselaer: Re.....	B/D	None			0-1.0	Apparent	Dec-May	High.
Shoals: Sh.....	C	Frequent	Brief	Oct-Jun	1.0-3.0	Apparent	Jan-Apr	High.
Sleeth: Sk.....	C	None			1.0-3.0	Apparent	Jan-Apr	High.
Sloan: Sn.....	B/D	Frequent	Long	Oct-Jun	0-0.5	Apparent	Nov-Jun	High.
Urban land: ¹ Ub: Brookston part.....	B/D	Frequent	Brief	Dec-May	0-1.0	Apparent	Dec-May	High.
¹ Uc: Crosby part.....	C	None			1.0-3.0	Apparent	Jan-Apr	High.
¹ UfA: Fox part.....	B	None			>6.0			Moderate.
¹ UfC: Fox part.....	B	None			>6.0			Moderate.
¹ Ug: Genesee part.....	B	Frequent	Brief	Oct-Jun	>6.0			Moderate.
¹ UmB: Miami part.....	B	None			>6.0			Moderate.
¹ UmC: Miami part.....	B	None			>6.0			Moderate.
¹ Uw: Westland part.....	B/D	Frequent	Brief	Dec-May	0-1.0	Apparent	Dec-May	High.
Westland: We.....	B/D	Frequent	Brief	Dec-May	0-1.0	Apparent	Dec-May	High.
Whitaker: Wh.....	C	None			1.0-3.0	Apparent	Jan-Apr	High.

¹ This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 205-01: Soil and Water Features for Marion County, Indiana
(SOURCE: NRCS, Soil Survey of Marion county, Indiana, 1991)

Cover Description	Curve Numbers for Hydrologic Soil Groups				
Cover Type and Hydrologic Condition	Average Percent ² Impervious Area	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) ²		68	79	86	89
Poor condition (grass cover < 50%)		49	69	79	84
Fair condition (grass cover 50% to 75%)		39	61	74	80
Good condition (grass cover > 75%)					
Impervious Areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and Roads:					
Paved; curbs and storm drains (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Urban Districts:					
Commercial and Business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential Districts by Average Lot Size:					
0.125 acre or less (townhouses)	65	77	85	90	92
0.25 acre	38	61	75	83	87
0.33 acre	30	57	72	81	86
0.50 acre	25	54	70	80	85
1.00 acre	20	51	68	79	84
2.00 acre	12	46	65	77	82
Developing Urban Areas					
Newly graded areas (pervious area only, no vegetation)		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in <i>Table 205-04</i>).					

¹ Average runoff condition, and $I_a = 0.2S$

² The average percent impervious area shown was used to develop the composite CNs. Other assumptions are as follows: Impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. If the impervious area is not connected, the NRCS method has an adjustment to reduce the effect.

³ CNs shown are equivalent to those of pasture. Composite CNs may be computed for other combinations of open space cover type.

TABLE 205-02: Runoff Curve Numbers for Urban Areas

(SOURCE: 210-VI-TR-55, Second Ed., June 1986)

Cover Description	Curve Numbers for Hydrologic Soil Groups			
Cover Type and Hydrologic Condition	A	B	C	D
Cultivated Land (Row Crops)	72	81	88	91
With conservation treatment	62	71	78	81
Without conservation treatment				
Pasture or Range Land	68	79	86	89
Poor condition	39	61	74	80
Good condition				
Meadow	30	58	71	78
Good condition				
Wood or Forest Land				
Thin stand, poor cover, no mulch	45	66	77	83
Good cover	25	55	70	77

TABLE 205-03: Runoff Curve Numbers for Undeveloped Areas
(SOURCE: 210-VI-TR-55, Second Ed., June 1986)

Cover Description	Curve Numbers for Hydrologic Soil Groups			
Cover Type and Hydrologic Condition	A	B	C	D
Pasture, grassland or range with continuous forage for grazing.				
Poor	68	79	86	89
Fair	49	69	79	84
Good	39	61	74	80
Meadow with continuous grass, protected from grazing and generally mowed for hay.	30	58	71	78
Brush/brush-weed-grass mixture with brush being the major element.				
Poor	48	67	77	83
Fair	35	56	70	77
Good	30	48	65	73
Woods and grass combination (orchard or tree farm).				
Poor	57	73	82	86
Fair	43	65	76	82
Good	32	58	72	79
Woods				
Poor	45	66	77	83
Fair	36	60	73	79
Good	30	55	70	77
Farmsteads	59	74	82	86

TABLE 205-04: Runoff Curve Numbers for Agricultural Lands
(SOURCE: 210-VI-TR-55, Second Ed., June 1986)

Approved Post-Development, Detention and Storm Sewer Calculations

**Prepared by Steven B. Williams, Franklin Engineering
for the
Hurricane Industrial Park
Dated February 20, 2001**

HURRICANE INDUSTRIAL PARK
DRAINAGE REPORT
REVISED: OCTOBER 2, 2000
REV: 2-20-01

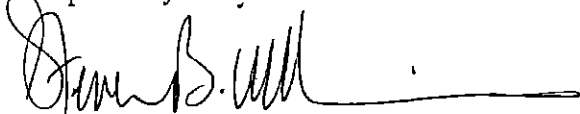
Original Conditions:

Onsite A = 24 Acres
C = .4 cropland D = 1200' H = 12' S = 1%
T = 30 min.
 $I_{10} = 3.1$
 $Q_{10} = 24 (.4) 3.1 = 30 \text{ cfs}$

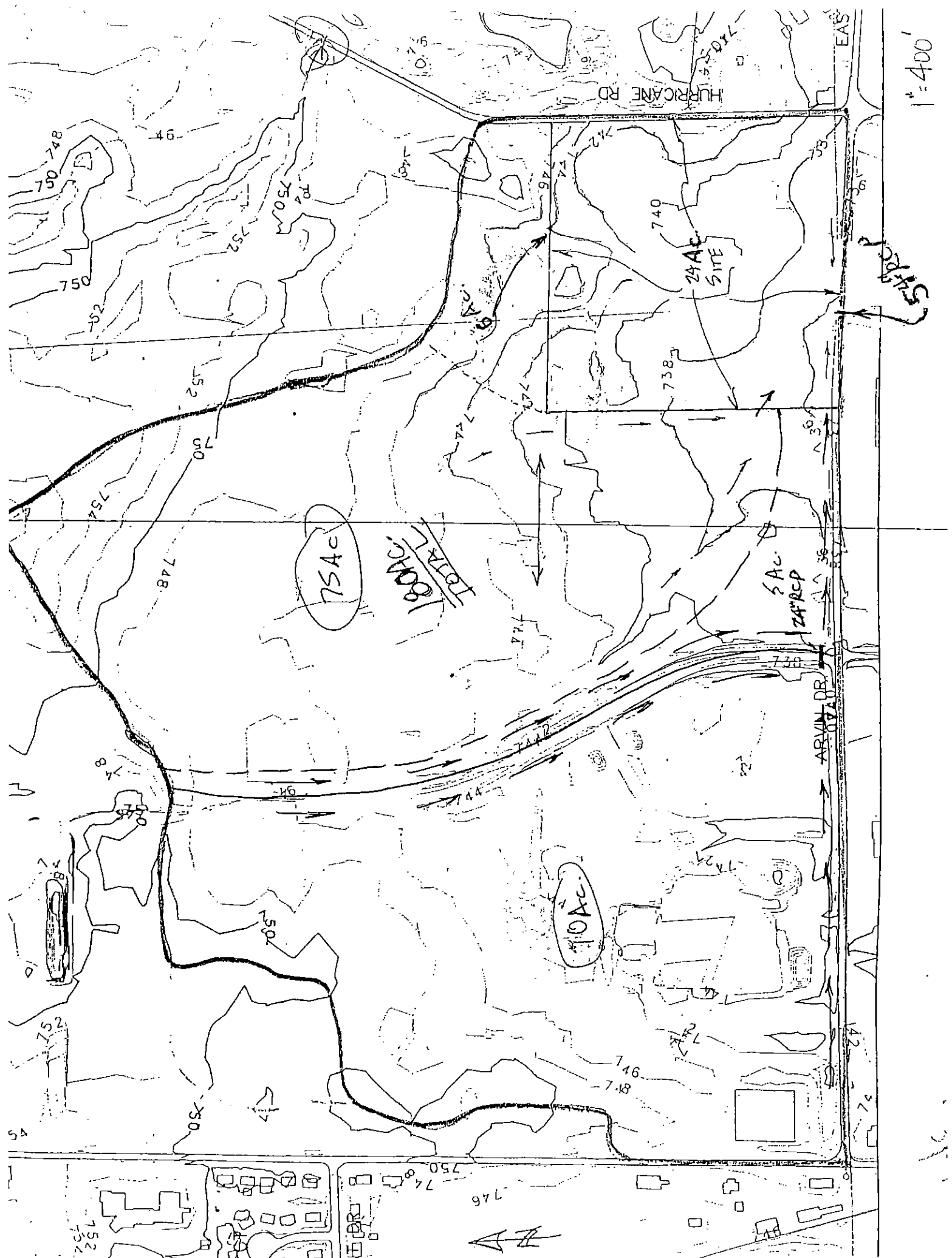
Future Conditions:

Onsite A = 24 Acres
C = .6 (estimated) D = 1500' C = .3 S = 1%
T = 40 min.
 $I_{100} = 3.9$
 $3.9 (.6) (24) = 56 \text{ cfs}$
Required Storage = 26 cfs
Area to Pond = 81 Acres (offsite) & 18.3 Acres (onsite) = 99.3 acres
81 Acres @ C = .4 CA = 32.4
18.3 Acres @ C = .6 CA = 11.0
TOTAL CA = 43.4
D = 4500' C = .3 S = .5%
Tc = 77 min.
 $I_{10} = 1.87$ $I_{100} = 2.72$
 $Q_{100} \text{ to Pond} = 2.72 (43.4) = 118 \text{ cfs}$
Use 24" RCP @ .3% restrictive outlet pipe
@ HW/D = 3.375 Qcap 36.5 cfs
Peak Storage Required = 8 acre/feet
Storage Provided in pond and ditches = 8 acre/feet
Flow Stored at Peak = 80 cfs
Area to 36" east-west pipe under road = 82 acres
75 acres @ C = .4 CA = 30
7 Acres @ C = .6 CA = 4.2
TOTAL CA = 34.2
 $Q = 34.2 (1.87) = 63.9 \text{ cfs}$
Qcap 36" = 63.6 cfs
Qcap 54" RCP = 120 cfs
Flow to 54" = 63.3 + 38.1 + 5 + 5 = 111.4 cfs

Prepared by:

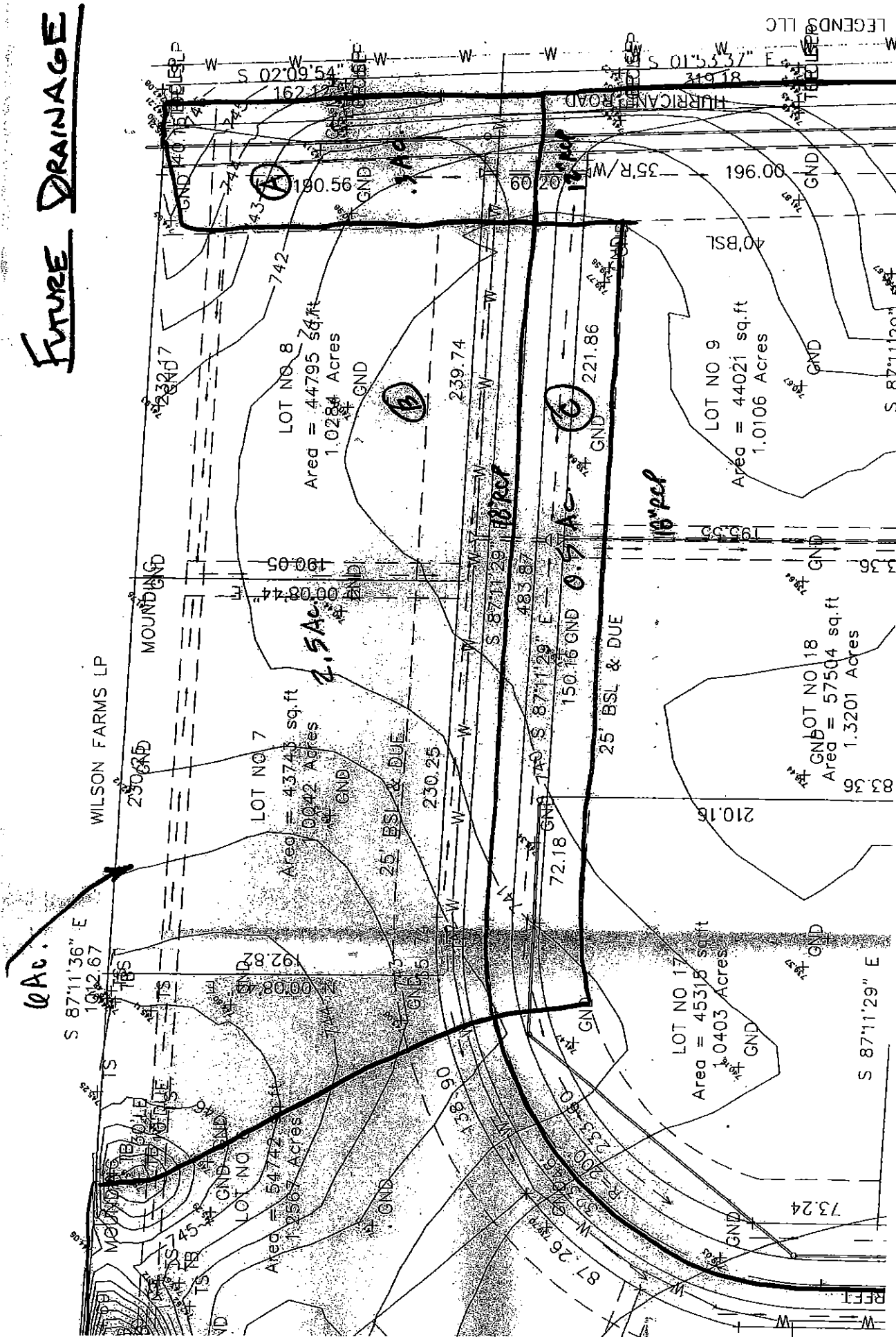

Steven B. Williams





1" = 400'

6A2



Project D&S HURRICANE PARK Detention Facility Design Return Period 100 yrs.
Designer SBW Release Rate Return Period 10 yrs.

Watershed Area 180 acres
Time of Concentration (undeveloped watershed) 77 minutes
Rainfall Intensity (i_U) 1.87 inches/hr
Undeveloped Runoff Coefficient (C_U) 0.4
Undeveloped Runoff Rate ($Q = C_U i_U A_U$) 135 cfs
Developed Runoff Coefficient (C_D) 0.6

Storm Duration t_d (hrs)	Rainfall Intensity i_d (inches/hr)	Inflow Rate $I(t_d)$ $(C_D i_d A_D)$ (cfs) $CA = 43.4$	Outflow Rate O $(C_U i_U A_U)$ (cfs) 38.1	Storage Rate $I(t_d) - O$ (cfs)	Required Storage $\left[I(t_d) - O \right] \frac{t_d}{12}$ (acre-ft)
0.17					
0.25					
0.33					
0.42					
0.50	4.50	195.3		157.2	6.5
0.67					
0.83					
1.00	3.00	130.2		92.1	7.6
1.25					
1.50					
1.75					
2.00	2.00	86.8		48.7	8.0 ← PEAK
2.25					
2.50					
2.75					
3.00	1.50	65.1		27.0	6.7
3.25					
4.00	1.30	56.4		18.3	6.0

Figure 6.2 Computation Sheet for Detention Storage
Calculations Using the Rational Method

OUTLET STRUCTURE REPORT

RECORD NUMBER : 1
 TYPE : CIRCULAR CONCRETE w/ square edge w/ headwall
 DESCRIPTION : 54"RCP

[RATING CURVE LIMIT]

Minimum Elevation..... = 729.60 (ft)
 Maximum Elevation..... = 735.00 (ft)
 Elevation Increment..... = 0.10 (ft)

[OUTLET STRUCTURE INFORMATION]

Circular Radius..... = 2.25000 (ft)
 Culvert Invert Elevation..... = 729.59998 (ft)
 Slope..... = 0.00000
 Manning's N-value..... = 0.01300
 Orifice Coefficient..... = 0.60000
 Tailwater..... = 730.29999 (ft)
 Number barrels..... = 1

[UNSUBMERGED EQUATION]

$H/Diam = H_c/Diam + K * (Q/(A * Diam^{0.5}))^N - 0.5 * S^2$
 Coefficient K..... = 0.00980
 coefficient M..... = 2.00000

[SUBMERGED EQUATION]

$H/Diam = c * (Q/(A * Diam^{0.5}))^Z + Y - 0.5 * S^2$
 Coefficient c..... = 0.03980
 Coefficient Y..... = 0.67000

[DEFINITIONS]

H = Headwater depth above inlet control section invert, (ft)
 Diam = Interior height of culvert barrel, (ft)
 Hc = Specific head at critical depth $(d_c + V_c^2/2g)$, (ft)
 Q = Discharge, (cuft/s)
 A = Full cross sectional area of culvert barrel, (sqft)
 S = Culvert barrel slope, (ft/ft)

OUTLET STRUCTURE REPORT

RECORD NUMBER : 1
TYPE : CIRCULAR CONCRETE w/ square edge w/ headwall
DESCRIPTION : 54"RCP

(Culvert Weir Discharge Value vs. Stage)
(the elevation increment is 1.0)

STAGE	ELEVATION (ft)	FLOW (cfs)
3.00	732.60	23.20
4.00	733.60	67.64
5.00	734.60	104.78

OUTLET STRUCTURE REPORT

RECORD NUMBER : 2
 TYPE : CIRCULAR CONCRETE w/ square edge w/ headwall
 DESCRIPTION : 24" RCP

[Culvert Weir Discharge Value vs. Stage]
 (the elevation increment is 1.0)

STAGE	ELEVATION (ft)	FLOW (cfs)
1.00	732.25	0.45
2.00	733.25	11.93
3.00	734.25	20.07
4.00	735.25	25.70
5.00	736.25	30.14
6.00	737.25	34.00
7.00	738.25	37.47
7.25	738.50	38.1

OUTLET STRUCTURE REPORT

RECORD NUMBER : 2
 TYPE : CIRCULAR CONCRETE w/ square edge w/ headwall
 DESCRIPTION : 34"RCP

[RATING CURVE LIMIT]

Minimum Elevation..... = 731.25 (ft)
 Maximum Elevation..... = 738.50 (ft)
 Elevation Increment..... = 0.10 (ft)

[OUTLET STRUCTURE INFORMATION]

Circular Radius..... = 1.00000 (ft)
 Culvert Invert Elevation..... = 731.25000 (ft)
 Slope..... = 0.00300
 Manning's N-value..... = 0.01300
 Orifice Coefficient..... = 0.60000
 Tailwater..... = 731.13000 (ft)
 Number barrels..... = 1

[UNSUBMERGED EQUATION]

$H/Diam = H_c/Diam + K * (Q/(A*Diam^{0.5}))^M - 0.5*S^2$
 Coefficient K..... = 0.00980
 coefficient M..... = 2.00000

[SUBMERGED EQUATION]

$H/Diam = c*(Q/(A*Diam^{0.5}))^Z + Y - 0.5*S^2$
 Coefficient c..... = 0.03980
 Coefficient Y..... = 0.67000

[DEFINITIONS]

H = Headwater depth above inlet control section invert, (ft)
 Diam = Interior height of culvert barrel, (ft)
 Hc = Specific head at critical depth ($d_c + V_c^2/2g$), (ft)
 Q = Discharge, (cuft/s)
 A = Full cross sectional area of culvert barrel, (sqft)
 S = Culvert barrel slope, (ft/ft)

OUTLET STRUCTURE REPORT

RECORD NUMBER : 3
 TYPE : CIRCULAR CONCRETE w/ square edge w/ headwall
 DESCRIPTION : 36" RCP

[RATING CURVE LIMIT]

Minimum Elevation..... = 729.80 (ft)
 Maximum Elevation..... = 735.00 (ft)
 Elevation Increment..... = 0.10 (ft)

[OUTLET STRUCTURE INFORMATION]

Circular Radius..... = 1.50000 (ft)
 Culvert Invert Elevation..... = 729.79999 (ft)
 Slope..... = 0.00500
 Manning's N-value..... = 0.01300
 Orifice Coefficient..... = 0.60000
 Tailwater..... = 729.59998 (ft)
 Number barrels..... = 1

[UNSUBMERGED EQUATION]

$H/Diam = H_c/Diam + K * (Q/(A*Diam^{0.5}))^M - 0.5*S^2$
 Coefficient K..... = 0.00980
 coefficient M..... = 2.00000

[SUBMERGED EQUATION]

$H/Diam = c * (Q/(A*Diam^{0.5}))^Z + Y - 0.5*S^2$
 Coefficient c..... = 0.03980
 Coefficient Y..... = 0.67000

[DEFINITIONS]

H = Headwater depth above inlet control section invert, (ft)
 Diam = Interior height of culvert barrel, (ft)
 Hc = Specific head at critical depth ($d_c + V_c^2/2g$), (ft)
 Q = Discharge, (cutf/s)
 A = Full cross sectional area of culvert barrel, (sqft)
 S = Culvert barrel slope, (ft/ft)

OUTLET STRUCTURE REPORT

RECORD NUMBER : 3
 TYPE : CIRCULAR CONCRETE w/ square edge w/ headwall
 DESCRIPTION : 36"RCP ~~---STRUCTURE---~~

{Culvert Weir Discharge Value vs. Stage}
 {the elevation increment is 1.0}

STAGE	ELEVATION (ft)	FLOW (cfs)
2.00	731.80	12.71
3.00	732.80	33.84
4.00	733.80	50.09
5.00	734.80	61.35
6.20	736.00	43.6

RAINFALL INTENSITY VALUES

Indianapolis, Indiana

Duration (Minutes)	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
5	4.50	5.50	6.30	7.30	8.00	8.50
6	4.30	5.30	6.00	7.00	7.70	8.20
7	4.10	5.10	5.75	6.75	7.40	7.90
8	3.90	4.90	5.50	6.50	7.10	7.60
9	3.70	4.70	5.25	6.25	6.80	7.30
10	3.50	4.50	5.00	6.00	6.50	7.00
15	2.90	3.70	4.40	5.10	5.60	6.10
20	2.50	3.30	3.80	4.50	5.00	5.50
25	2.25	2.95	3.45	4.05	4.50	5.00
30	2.00	2.60	3.10	3.60	4.00	4.50
40	1.65	2.25	2.60	3.10	3.50	3.90
50	1.45	2.00	2.30	2.75	3.10	3.40
60	1.25	1.75	2.10	2.50	2.70	3.00
120	0.78	1.10	1.30	1.60	1.70	2.00
180	0.58	0.80	1.00	1.20	1.30	1.50
240	0.47	0.65	0.80	0.95	1.10	1.30

For Additional Values See Referenced Publications

Values taken from graph prepared by U.S. Department of Commerce
Weather Bureau based on recorded rainfalls from 1903 to 1951
See Technical Paper No. 25, Page 14, or Indiana State Highway
Commission Hydraulic Design of Drainage Culverts, Page 35

OVERLAND FLOW AND RUN-OFF COEFFICIENT

FIGURE 5.3

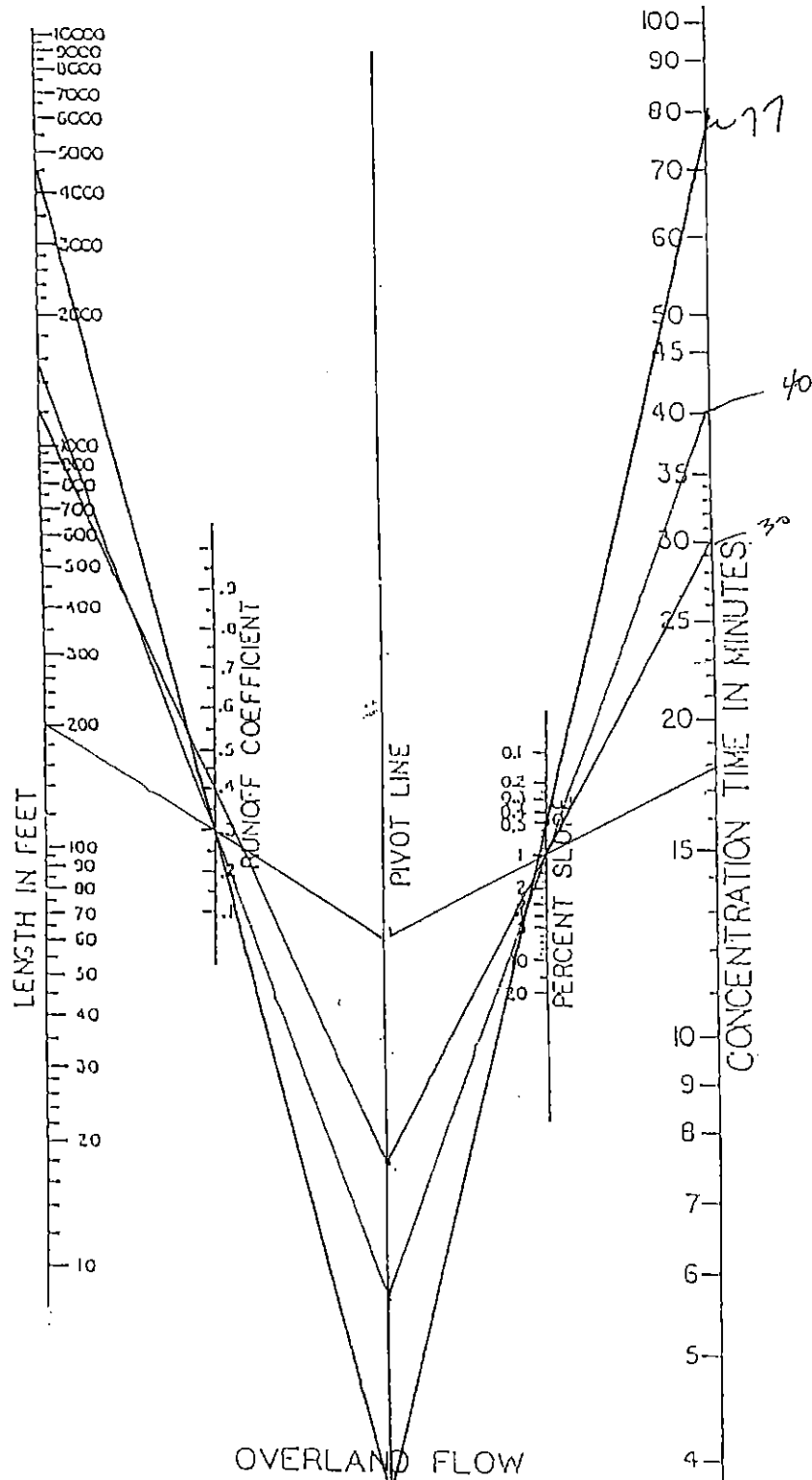


FIGURE 5

FLOW FOR CIRCULAR PIPE FLOWING FULL
BASED ON MANNING'S EQUATION $n=0.013$

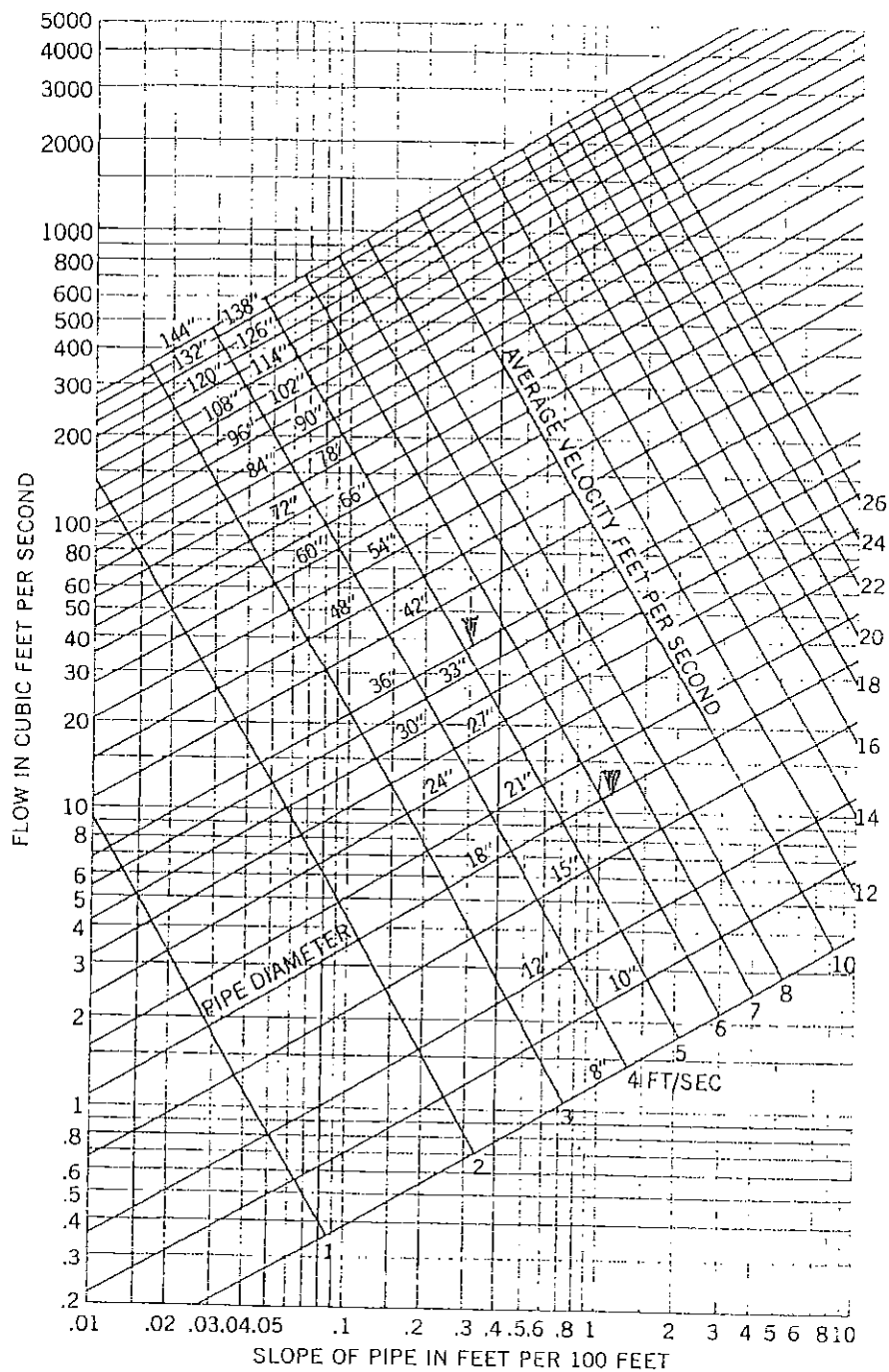
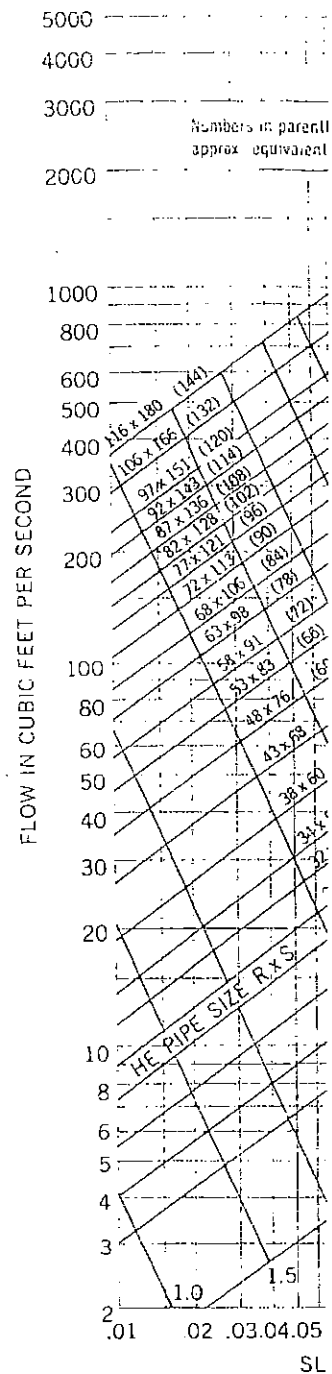


FIGURE 6

FLOW FOR HORI
BASED (



[illegible]

Reference:

Additional Detention Pond Calculations

**Prepared by Projects Plus
for the
Hurricane Industrial Park - Lots 9 & 10
Dated April 11, 2011**

Hurricane Industrial

Storm Sewer Calculations

		Ac.	%		"C"	
LOT #1	"C" Factor = Lawn	0.32	13%	0.132	x	0.15 = 0.02
	Asphalt	1.56	64%	0.645	x	0.85 = 0.55
	Roof	0.54	22%	0.223	x	0.90 = 0.20
Area =	Cultivated Field	0.00	0%	0.000	x	0.30 = 0.00
2.42 Acres						Weighted 'C' 0.77
LOT #2	"C" Factor = Lawn	0.54	23%	0.234	x	0.15 = 0.04
	Asphalt	1.23	53%	0.532	x	0.85 = 0.45
	Roof	0.54	23%	0.234	x	0.90 = 0.21
Area =	Cultivated Field	0.00	0%	0.000	x	0.30 = 0.00
2.31 Acres						Weighted 'C' 0.70
LOT #15	"C" Factor = Lawn	0.50	43%	0.435	x	0.15 = 0.07
	Asphalt	0.46	40%	0.400	x	0.85 = 0.34
	Roof	0.19	17%	0.165	x	0.90 = 0.15
Area =	Cultivated Field	0.00	0%	0.000	x	0.30 = 0.00
1.15 Acres						Weighted 'C' 0.55
LOT #16	"C" Factor = Lawn	0.56	49%	0.487	x	0.15 = 0.07
	Asphalt	0.43	37%	0.374	x	0.85 = 0.32
	Roof	0.16	14%	0.139	x	0.90 = 0.13
Area =	Cultivated Field	0.00	0%	0.000	x	0.30 = 0.00
1.15 Acres						Weighted 'C' 0.52
Lot #3,6-8 11-12,17	"C" Factor = Lawn	1.37	15%	0.150	x	0.15 = 0.02
	Asphalt	7.74	85%	0.850	x	0.85 = 0.72
	Roof	0.00	0%	0.000	x	0.90 = 0.00
Area =	Cultivated Field	0.00	0%	0.000	x	0.30 = 0.00
9.11 Acres						Weighted 'C' 0.74
Lots # 13-16	"C" Factor = Lawn	1.24	25%	0.250	x	0.15 = 0.04
	Asphalt	3.72	75%	0.750	x	0.85 = 0.64
	Roof	0.00	0%	0.000	x	0.90 = 0.00
Area =	Cultivated Field	0.00	0%	0.000	x	0.30 = 0.00
4.96 Acres						Weighted 'C' 0.68
Lots # 9-10	"C" Factor = Lawn	0.74	29%	0.290	x	0.15 = 0.04
	Asphalt	1.31	51%	0.514	x	0.85 = 0.44
	Roof	0.50	20%	0.196	x	0.90 = 0.18
Area =	Cultivated Field	0.00	0%	0.000	x	0.30 = 0.00
2.55 Acres						Weighted 'C' 0.66
	Lawn	5.27	22%	0.223	x	0.15 = 0.03
	Asphalt	16.45	70%	0.696	x	0.85 = 0.59
	Roof	1.93	8%	0.082	x	0.90 = 0.07
	Cultivated Field	0.00	0%	0.000	x	0.30 = 0.00
						Weighted 'C' 0.70

EXCITING
LOTS

**FUTURE
Dev.**

CURRENT
DEV.

- AVERAGE 'C'
FOR DEVELOPMENT

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	53.30	1	40	127,912	----	-----	-----	Offsite - Frnk Eng
2	Rational	24.94	1	24	35,909	----	-----	-----	Onsite - Frnk Eng
3	Combine	61.61	1	40	163,821	1, 2	-----	-----	Total to Pond
4	Reservoir	23.13	1	63	163,476	3	734.48	111,407	Thru Pond
7	Rational	53.30	1	40	127,912	----	-----	-----	Offsite - Frnk Eng
8	Rational	29.09	1	24	41,894	----	-----	-----	Onsite - revised Proj +
9	Combine	62.99	1	40	169,806	7, 8	-----	-----	Total to Pond
10	Reservoir	23.81	1	62	169,459	9	734.58	114,967	Thru Pond
10009post-dra.gpw					Return Period: 2 Year			Monday, Apr 11 2011, 12:10 PM	

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	83.45	1	40	200,284	----	-----	-----	Offsite - Frnk Eng
2	Rational	38.76	1	24	55,816	----	-----	-----	Onsite - Frnk Eng
3	Combine	96.37	1	40	256,100	1, 2	-----	-----	Total to Pond
4	Reservoir	30.60	1	65	255,737	3	736.09	176,734	Thru Pond
7	Rational	83.45	1	40	200,284	----	-----	-----	Offsite - Frnk Eng
8	Rational	45.22	1	24	65,119	----	-----	-----	Onsite - revised Proj +
9	Combine	98.53	1	40	265,403	7, 8	-----	-----	Total to Pond
10	Reservoir	31.16	1	65	265,039	9	736.24	183,416	Thru Pond
10009post-dra.gpw					Return Period: 10 Year			Monday, Apr 11 2011, 12:10 PM	

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	122.09	1	40	293,027	---	-----	-----	Offsite - Frnk Eng
2	Rational	56.20	1	24	80,922	---	-----	-----	Onsite - Frnk Eng
3	Combine	140.83	1	40	373,949	1, 2	-----	-----	Total to Pond
4	Reservoir	37.34	1	68	373,565	3	738.09	269,751	Thru Pond
7	Rational	122.09	1	40	293,027	---	-----	-----	Offsite - Frnk Eng
8	Rational	65.56	1	24	94,409	---	-----	-----	Onsite - revised Proj +
9	Combine	143.95	1	40	387,436	7, 8	-----	-----	Total to Pond
10	Reservoir	37.97	1	68	387,051	9	738.30	280,257	Thru Pond
10009post-dra.gpw					Return Period: 100 Year			Monday, Apr 11 2011, 12:10 PM	

Hydrograph Report

Hydroflow Hydrographs by Intelsolve

Monday, Apr 11 2011, 12:14 PM

Hyd. No. 7

Offsite - Frnk Eng

Hydrograph type = Rational
Storm frequency = 100 yrs
Drainage area = 81.0 ac
Intensity = 3.768 in/hr
IDF Curve = MARION IDF

Peak discharge = 122.09 cfs
Time Interval = 1 min
Runoff coeff. = 0.4
Tc by User = 40 min
Asc/Rec limb fact = 1/1

Hydrograph Volume = 293,027 cuft
(Printed values = 50% of Qp)

Hydrograph Discharge Table

Time - (hrs)	Outflow (cfs)	Time - (hrs)	Outflow (cfs)
0.33	61.05	0.90	79.36
0.35	64.10	0.92	76.31
0.37	67.15	0.93	73.26
0.38	70.20	0.95	70.20
0.40	73.25	0.97	67.15
0.42	76.31	0.98	64.10
0.43	79.36		
0.45	82.41		
0.47	85.47	...End	
0.48	88.52		
0.50	91.57		
0.52	94.62		
0.53	97.68		
0.55	100.73		
0.57	103.78		
0.58	106.83		
0.60	109.88		
0.62	112.94		
0.63	115.99		
0.65	119.04		
0.67	122.09 <<		
0.68	119.04		
0.70	115.99		
0.72	112.94		
0.73	109.88		
0.75	106.83		
0.77	103.78		
0.78	100.73		
0.80	97.68		
0.82	94.62		
0.83	91.57		
0.85	88.52		
0.87	85.47		
0.88	82.41		

Hydrograph Report

Hydroflow Hydrographs by Intelsolve

Monday, Apr 11 2011, 12:15 PM

Hyd. No. 8

Onsite - revised Proj +

Hydrograph type = Rational
Storm frequency = 100 yrs
Drainage area = 18.3 ac
Intensity = 5.118 in/hr
IDF Curve = MARION IDF

Peak discharge = 65.56 cfs
Time Interval = 1 min
Runoff coeff. = 0.7
Tc by User = 24 min
Asc/Rec limb fact = 1/1

Hydrograph Volume = 94,409 cuft
(Printed values = 50% of Qp)

Hydrograph Discharge Table

Time - (hrs)	Outflow (cfs)
0.20	32.78
0.22	35.51
0.23	38.24
0.25	40.98
0.27	43.71
0.28	46.44
0.30	49.17
0.32	51.90
0.33	54.64
0.35	57.37
0.37	60.10
0.38	62.83
0.40	65.56 <<
0.42	62.83
0.43	60.10
0.45	57.37
0.47	54.64
0.48	51.90
0.50	49.17
0.52	46.44
0.53	43.71
0.55	40.98
0.57	38.24
0.58	35.51
0.60	32.78

...End

Hydrograph Report

Hydroflow Hydrographs by Intelsolve

Monday, Apr 11 2011, 12:16 PM

Hyd. No. 9

Total to Pond

Hydrograph type = Combine
Storm frequency = 100 yrs
Inflow hyds. = 7, 8

Peak discharge = 143.95 cfs
Time interval = 1 min

Hydrograph Volume = 387,436 cuft
(Printed values = 50% of Qp)

Hydrograph Discharge Table

Time (hrs)	Hyd. 7 + (cfs)	Hyd. 8 = (cfs)	Outflow (cfs)
0.38	70.20	62.83	133.03
0.40	73.25	65.56 <<	138.82
0.42	76.31	62.83	139.14
0.43	79.36	60.10	139.46
0.45	82.41	57.37	139.78
0.47	85.47	54.64	140.10
0.48	88.52	51.90	140.42
0.50	91.57	49.17	140.74
0.52	94.62	46.44	141.06
0.53	97.68	43.71	141.38
0.55	100.73	40.98	141.70
0.57	103.78	38.24	142.02
0.58	106.83	35.51	142.35
0.60	109.88	32.78	142.67
0.62	112.94	30.05	142.99
0.63	115.99	27.32	143.31
0.65	119.04	24.59	143.63
0.67	122.09 <<	21.85	143.95 <<
0.68	119.04	19.12	138.16
0.70	115.99	16.39	132.38

...End

Hydrograph Report

Hydroflow Hydrographs by Intelsolve

Monday, Apr 11 2011, 12:18 PM

Hyd. No. 10

Thru Pond

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 9
Max. Elevation = 738.30 ft

Peak discharge = 37.97 cfs
Time interval = 1 min
Reservoir name = Detention Pond
Max. Storage = 280,257 cuft

Storage Indication method used:

Outflow hydrograph volume = 387,051 cuft
(Printed values = 50% of Qp)

Hydrograph Discharge Table

Time (hrs)	Inflow (cfs)	Elevation (ft)	Civ A (cfs)	Civ B (cfs)	Civ C (cfs)	Civ D (cfs)	Wr A (cfs)	Wr B (cfs)	Wr C (cfs)	Wr D (cfs)	Exfil (cfs)	Outflow (cfs)
0.90	79.36	737.96	36.93									36.93
0.92	75.31	738.01	37.08									37.08
0.93	73.26	738.06	37.22									37.22
0.95	70.20	738.10	37.35									37.35
0.97	67.15	738.14	37.45									37.45
0.98	64.10	738.17	37.57									37.57
1.00	61.05	738.20	37.66									37.66
1.02	57.99	738.22	37.74									37.74
1.03	54.94	738.25	37.80									37.80
1.05	51.89	738.27	37.86									37.86
1.07	48.84	738.28	37.90									37.90
1.08	45.79	738.29	37.94									37.94
1.10	42.73	738.30	37.96									37.96
1.12	39.68	738.30	37.97									37.97
1.13	36.63	738.30 <<	37.97									37.97 <<
1.15	33.58	738.30	37.96									37.96
1.17	30.52	738.29	37.94									37.94
1.18	27.47	738.28	37.91									37.91
1.20	24.42	738.27	37.87									37.87
1.22	21.37	738.25	37.81									37.81
1.23	18.31	738.23	37.75									37.75
1.25	15.26	738.20	37.67									37.67
1.27	12.21	738.18	37.59									37.59
1.28	9.16	738.14	37.49									37.49
1.30	6.10	738.11	37.38									37.38
1.32	3.05	738.07	37.26									37.26
1.33	0.00	738.03	37.13									37.13
1.35	0.00	737.98	36.99									36.99
1.37	0.00	737.93	36.84									36.84

...End

Pond No. 1 - Detention Pond

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	731.00	26,323	0	0
1.00	732.00	29,098	27,711	27,711
2.00	733.00	32,500	30,799	58,510
3.00	734.00	36,500	34,500	93,010
4.00	735.00	39,500	38,000	131,010
5.00	736.00	43,500	41,500	172,510
6.00	737.00	46,000	44,750	217,260
7.00	738.00	49,500	47,750	265,010
7.50	738.50	51,000	25,125	290,135

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 731.00	0.00	0.00	0.00
Length (ft)	= 30.00	0.00	0.00	0.00
Slope (%)	= 0.30	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

[illegible]

Storm Sewer Calculations

Hurricane Industrial lots 3/17

Storm Sewer Calculations

STR. #	Weighted "C" Factor =	Building	Ac.	(%)	Coefficient	
601		Building	0.06	15.4	x 0.85 =	0.13
		Pavement	0.23	59.0	x 0.85 =	0.50
		Lawn/Grass/Woods	0.10	25.6	x 0.20 =	0.05
Area =					Weighted 'C'	0.68
0.39 Acres						

"T/c" =

$$1. \text{ Sheet Flow } T.C. = \frac{0.007}{2.64^{0.50}} \times \left(\frac{0.17}{1.00\%^{0.40}} \times 34 \right)^{0.80} = 6.64 \text{ Minutes}$$

2. Shallow Concentrated

$$\text{Unpaved: } T.C. = 16.135 \times 1.10\%^{0.5} = 1.69 \text{ ft/sec} \\ = \frac{80 \text{ feet}}{1.69 \text{ ft/sec}} = 0.79 \text{ Minutes}$$

$$\text{Paved: } T.C. = 20.328 \times 2.00\%^{0.5} = 2.87 \text{ ft/sec} \\ = \frac{58 \text{ feet}}{2.87 \text{ ft/sec}} = 0.34 \text{ Minutes}$$

T/c Total= 7.8 Minutes

Min. 5.00 Minutes

STR. #	Weighted "C" Factor =	Building	Ac.	(%)	x	Coefficient	
602		Building	0.02	15.4	x	0.85 =	0.13
		Pavement	0.09	69.2	x	0.85 =	0.59
		Lawn/Grass/Woods	0.02	15.4	x	0.20 =	0.03
Area =						Weighted 'C'	0.75
0.13 Acres							

"T/c" =

$$1. \text{ Sheet Flow } T.C. = \frac{0.007}{2.64^{0.50}} \times \left(\frac{0.17}{1.00\%^{0.40}} \times 40 \right)^{0.80} = 7.56 \text{ Minutes}$$

2. Shallow Concentrated

$$\text{Unpaved: } T.C. = 16.135 \times 0.50\%^{0.5} = 1.14 \text{ ft/sec} \\ = \frac{0 \text{ feet}}{1.14 \text{ ft/sec}} = 0.00 \text{ Minutes}$$

$$\text{Paved: } T.C. = 20.328 \times 6.00\%^{0.5} = 4.98 \text{ ft/sec} \\ = \frac{47 \text{ feet}}{4.98 \text{ ft/sec}} = 0.16 \text{ Minutes}$$

T/c Total= 7.7 Minutes

Min. 5.00 Minutes

		Ac.	(%)	Coefficient		
STR. #	Weighted "C" Factor =	Building	0.00	0.0	x 0.85 =	0.00
603		Pavement	0.02	25.0	x 0.85 =	0.21
		Lawn/Grass/Woods	0.06	75.0	x 0.20 =	0.15
	Area =	Weighted 'C'				
0.08 Acres		0.36				

"T/c" =

$$1. \text{ Sheet Flow } T.C. = \frac{0.007}{2.64^{0.50}} \times \left(\frac{0.17}{1.00\%^{0.40}} \times 14 \right)^{0.80} = 3.26 \text{ Minutes}$$

2. Shallow Concentrated

$$\text{Unpaved: } T.C. = 16.135 \times 1.50\%^{0.5} = 1.98 \text{ ft/sec} \\ = \frac{68 \text{ feet}}{1.98 \text{ ft/sec}} = 0.57 \text{ Minutes}$$

$$\text{Paved: } T.C. = 20.328 \times 0.50\%^{0.5} = 1.44 \text{ ft/sec} \\ = \frac{0 \text{ feet}}{1.44 \text{ ft/sec}} = 0.00 \text{ Minutes}$$

T/c Total= 3.8 Minutes

Min. 5.00 Minutes

Hurricane Industrial lots 3/17

Storm Sewer Calculations

STR. #	Weighted "C" Factor =		Ac.	(%)	Coefficient	
601		Building	0.00	0.0	x 0.85 =	0.00
		Pavement	0.00	0.0	x 0.85 =	0.00
		Lawn/Grass/Woods	0.05	100.0	x 0.20 =	0.20
Area =					Weighted 'C'	0.20
0.05 Acres						

"T/c" =

$$1. \text{ Sheet Flow } T.C. = \frac{0.007}{2.64^{0.50}} \times \left(\frac{0.17}{10.00\%^{0.40}} \times 21 \right)^{0.80} = 1.80 \text{ Minutes}$$

2. Shallow Concentrated

$$\text{Unpaved: } T.C. = 16.135 \times 1.00\%^{0.5} = 1.61 \text{ ft/sec}$$

$$= \frac{48 \text{ feet}}{1.61 \text{ ft/sec}} = 0.50 \text{ Minutes}$$

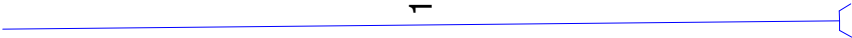
$$\text{Paved: } T.C. = 20.328 \times 0.30\%^{0.5} = 1.11 \text{ ft/sec}$$

$$= \frac{0 \text{ feet}}{1.11 \text{ ft/sec}} = 0.00 \text{ Minutes}$$

$$T/c \text{ Total} = 2.3 \text{ Minutes}$$

$$\text{Min. } 5.00 \text{ Minutes}$$

Hydraflow Plan View



Project file: 24009 600-601 Storm Design.stm	IDF file: MARION.IDF	No. Lines: 1	07-10-2024

Hydraflow Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	Dns line No.
1	601	1.59	12 c	144.0	735.50	736.00	0.347	736.03	736.78	0.00	End
Project File: 24009 600-601 Storm Design		IDF File: MARION.IDF				Total No. Lines: 1			Run Date: 07-10-2024		
NOTES: c = circular; e = elliptical; b = box; Return period = 10 Yrs.; * Indicates surcharge condition.											

Hydraflow Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID	
Line	To Line		Incr	Total		Inlet (min)	Syst (min)	Incr	Total					Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)		
1	End	144.0	0.39	0.39	0.68	0.27	0.27	8.0	8.0	6.0	1.59	2.10	3.07	12	0.35	736.00	735.50	736.78	736.03	738.00	0.00	601	
Project File: 24009 600-601 Storm Design.stm						IDF File: MARION.IDF						Total number of lines: 1						Run Date: 07-10-2024					
NOTES: Intensity = 57.92 / (Inlet time + 9.10) ^ 0.80; Return period = 10 Yrs. ; Initial tailwater elevation = 736.03 (ft)																							

Hydraflow Plan View



Hydraflow Summary Report

[illegible]

Hydraflow Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Inlet (min)	Syst (min)	Incr	Total					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	40.0	0.13	0.26	0.75	0.10	0.14	8.0	8.0	6.0	0.82	10.36	2.77	15	2.58	731.90	730.87	732.26	731.23	735.50	0.00	602
2	1	50.0	0.08	0.08	0.36	0.03	0.03	5.0	5.0	7.0	0.20	2.25	1.57	12	0.40	732.20	732.00	732.39	732.26	0.00	735.50	603
3	1	12.0	0.05	0.05	0.20	0.01	0.01	5.0	5.0	7.0	0.07	4.60	0.92	12	1.67	732.20	732.00	732.31	732.26	0.00	735.50	604
Project File: 24009 602-604 Storm Design.stm														IDF File: MARION.IDF				Total number of lines: 3				Run Date: 07-10-2024
NOTES: Intensity = 57.92 / (Inlet time + 9.10) ^ 0.80; Return period = 10 Yrs. ; Initial tailwater elevation = 731.23 (ft)																						

Watershed Basin Maps

Storm Sewer Basin Map

