DRAINAGE PLAN

HARVEST RIDGE COMMERCIAL ADDITION

WICHITA, SEDGWICK COUNTY, KANSAS

Prepared By

BAUGHMAN COMPANY, P.A.
ENGINEERING, SURVEYING & PLANNING
316/262-7271 FAX 316/262-0149 WICHITA, KANSAS 67211

October 27, 2003

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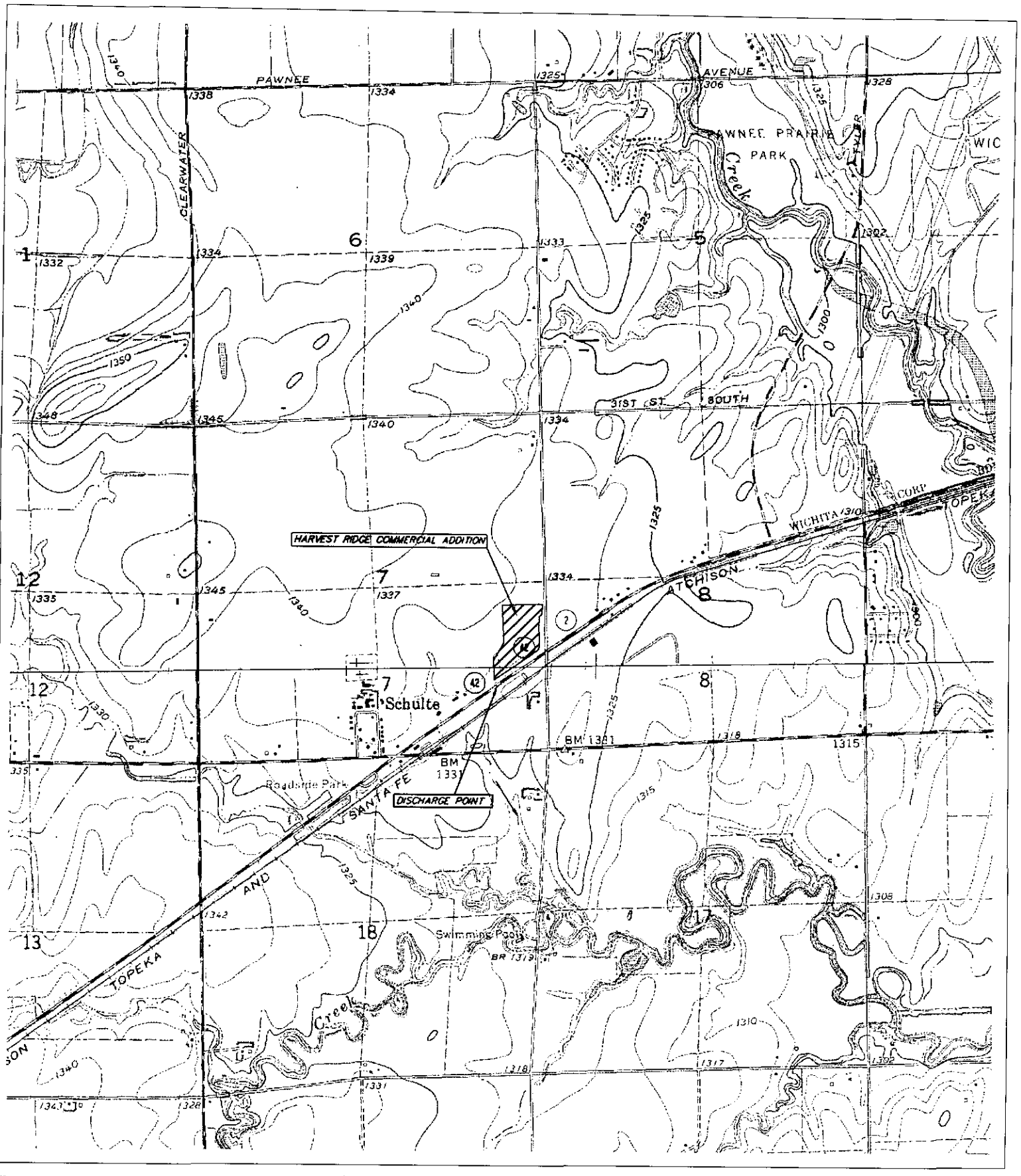
NARRATIVE

This report provides information and supporting documentation to support the "Drainage Plan" for the property located in the Southeast Quarter of Section 7, T-28-S, R-1-W in Sedgwick County, Kansas.

The "Drainage Plan" being submitted herein in intended to serve as a guide for the design of streets and storm water sewer improvements to the proposed development. Modifications to structures, pipes, etc. may be made as necessary during the final design in order to obtain the most economical design and construction possible.

The stormwater sewer system within this proposed development has been designed to convey the 5-year rainfall event. Calculations have also been performed to check the design during the 100-yr event.

A detention facility has been provided off-site that works jointly with the residential development to the north and west to restrict the discharge. The original routing for the pond in Harvest Ridge Addition did not include the discharge of any of the commercial corner. The routing was adjusted to compensate for the additional drainage for about half of the commercial development. The one hundred-year water surface on the pond increased by approximately 0.7 feet compared to the water surface computed in the Harvest Ridge Addition drainage plan. The new water surface elevation is still below the minimum pad elevation of the residential. The pond's design storm water surface does not encroach outside of the reserve and drainage easement that was established with the plat.



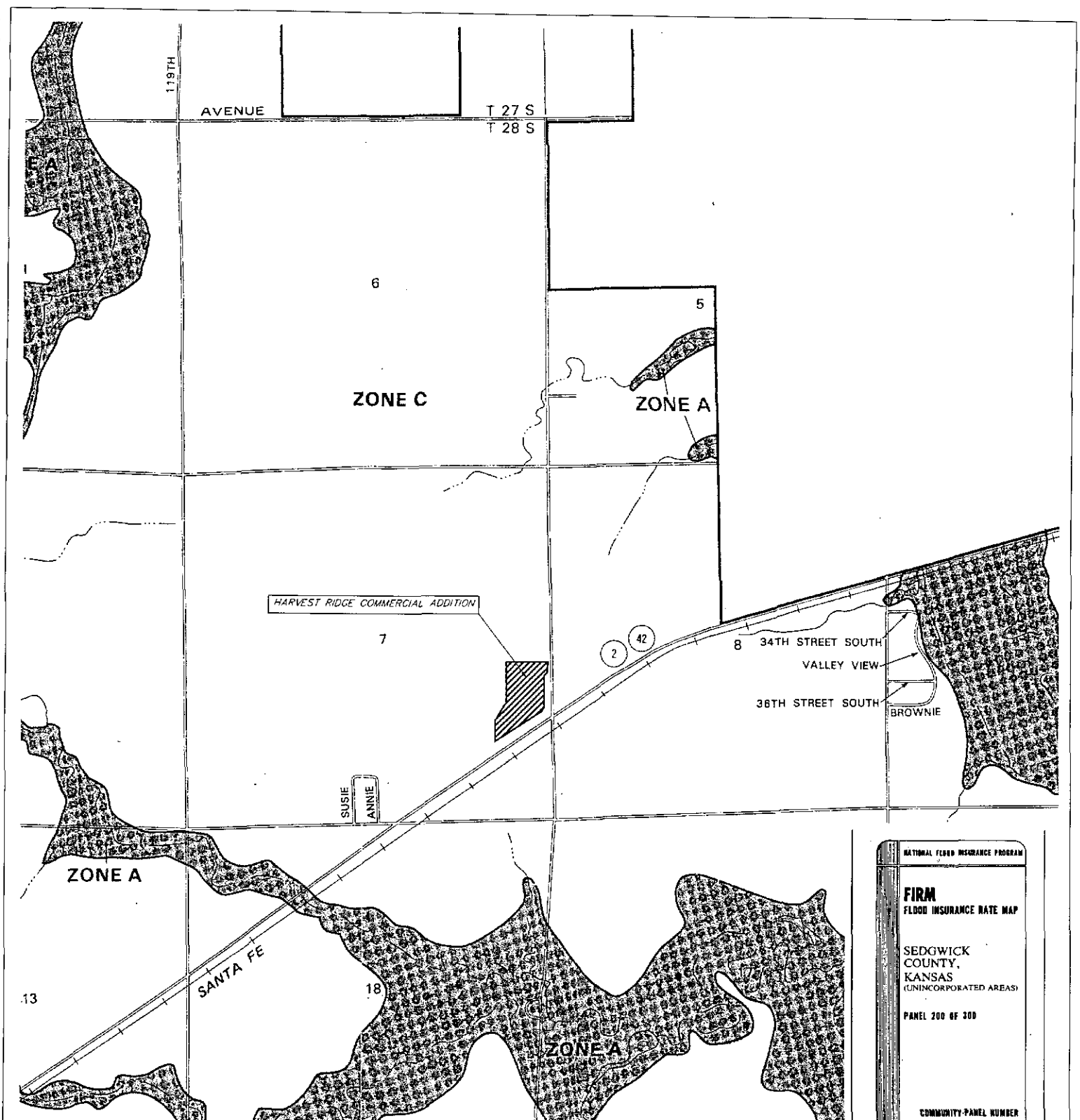
HARVEST RIDGE COMMERCIAL ADDITION

Wichita, Sedgwick County, Kansas

USGS QUADRANGLE

SCALE: 1" = 2000'

BAUGHMAN COMPANY P.A.



HARVEST RIDGE COMMERCIAL ADDITION

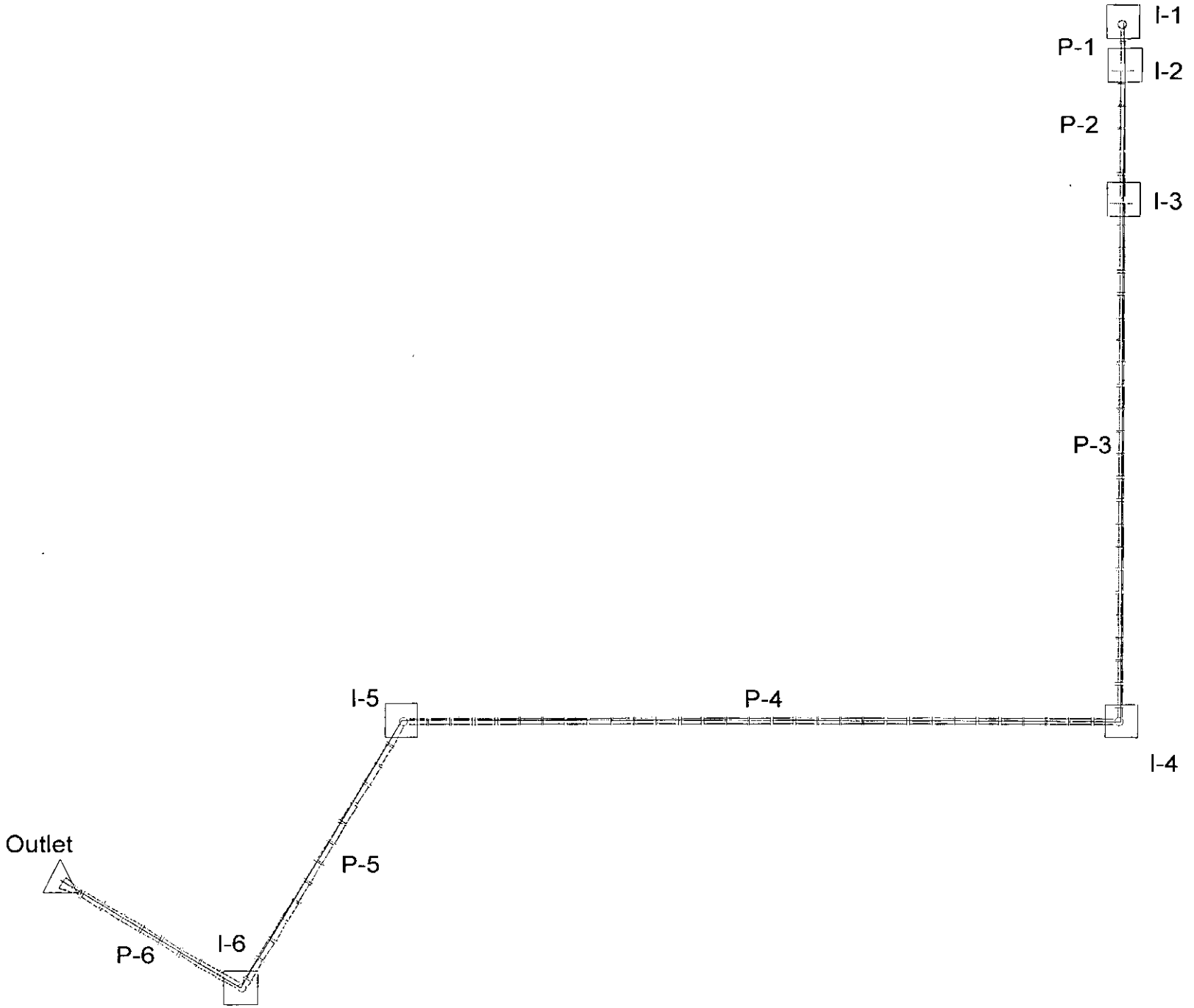
Wichita, Sedgwick County, Kansas

FEMA FLOODPLAIN LOCATION MAP

SCALE: 1" = 2000'

BAUGHMAN COMPANY P.A.

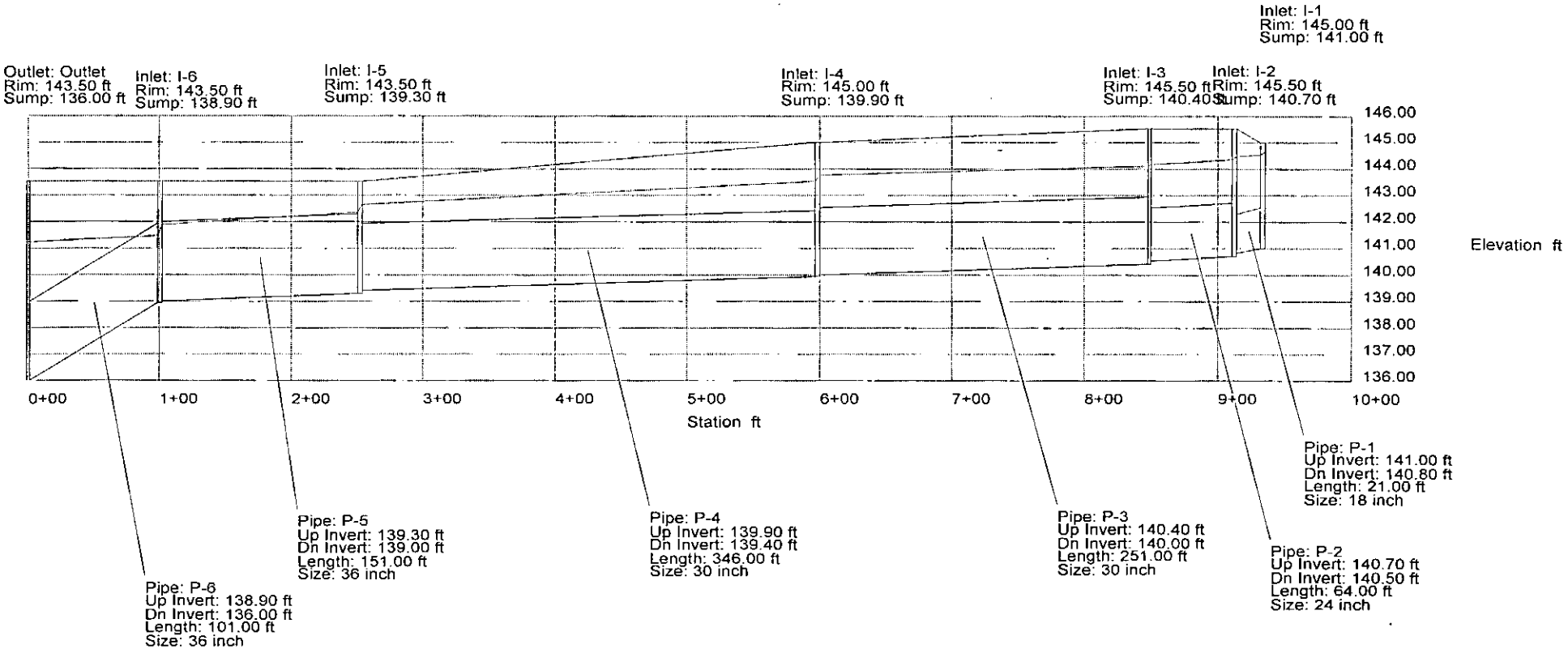
StormCad Hydraulic Calculations



Project Title: HARVEST RIDGE COMMERCIAL ADDITION
f:\...\project2.stm
10/27/03 03:42:29 PM

Baughman Company, P.A.
 37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Project Engineer: Baughman Company, P.A.
StormCAD v1.0

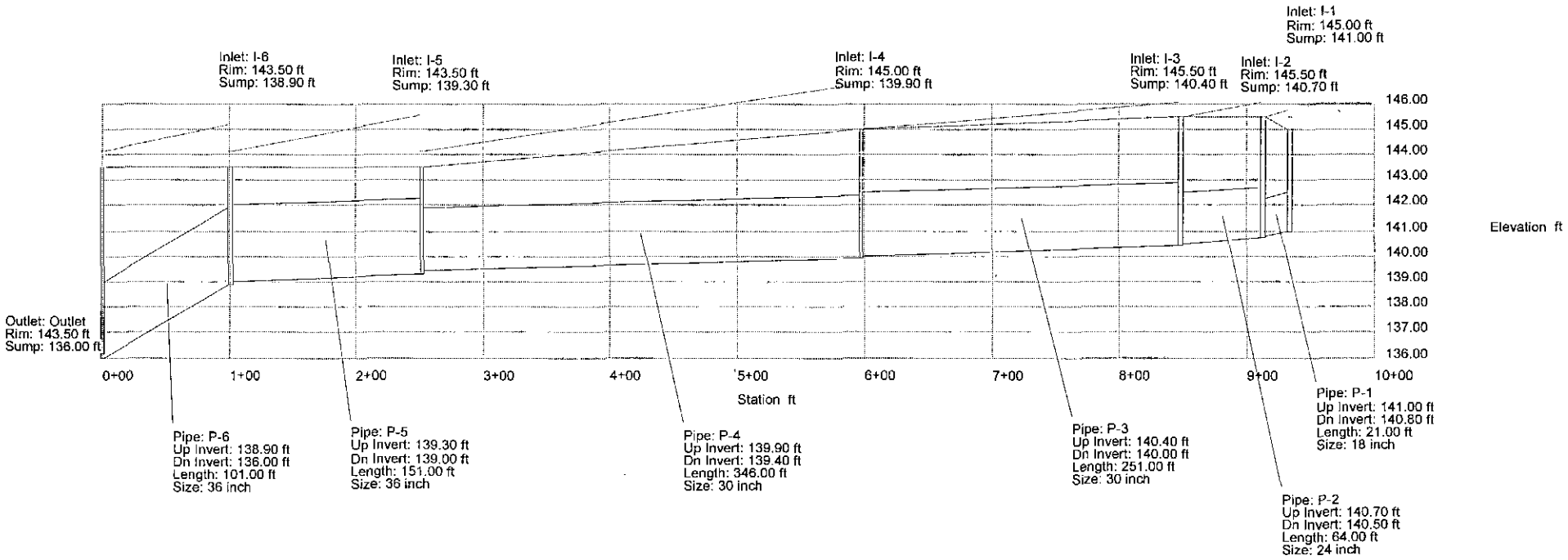

Outlet: Outlet
Rim: 143.50 ft
Sump: 136.00 ft
Inlet: I-6
Rim: 143.50 ft
Sump: 138.90 ft
Inlet: I-5
Rim: 143.50 ft
Sump: 139.30 ft
Inlet: I-4
Rim: 145.00 ft
Sump: 139.90 ft
Inlet: I-3
Rim: 145.50 ft
Sump: 140.40 ft
Inlet: I-2
Rim: 145.50 ft
Sump: 140.70 ft
Inlet: I-1
Rim: 145.00 ft
Sump: 141.00 ft
146.00
145.00
144.00
143.00
142.00
141.00
140.00
139.00
138.00
137.00
136.00
Elevation ft
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
10+00
Station ft
Pipe: P-6
Up Invert: 138.90 ft
Dn Invert: 136.00 ft
Length: 101.00 ft
Size: 36 inch
Pipe: P-5
Up Invert: 139.30 ft
Dn Invert: 139.00 ft
Length: 151.00 ft
Size: 36 inch
Pipe: P-4
Up Invert: 139.90 ft
Dn Invert: 139.40 ft
Length: 346.00 ft
Size: 30 inch
Pipe: P-3
Up Invert: 140.40 ft
Dn Invert: 140.00 ft
Length: 251.00 ft
Size: 30 inch
Pipe: P-2
Up Invert: 140.70 ft
Dn Invert: 140.50 ft
Length: 64.00 ft
Size: 24 inch
Pipe: P-1
Up Invert: 141.00 ft
Dn Invert: 140.80 ft
Length: 21.00 ft
Size: 18 inch

The Node Report

Node	Inlet Area (acres)	Weighted Roughness Coefficient	Inlet TC (min)	System Intensity (in/hr)	Additional Flow (cfs)	Discharge (cfs)	Ground Elevation (ft)	HGL In (ft)	HGL Out (ft)
I-1	1.61	0.85	15.00	4.56	6.20	6.20	145.00	144.62	144.52
I-2	1.52	0.85	15.00	4.55	5.90	12.10	145.50	144.45	144.33
I-3	0.79	0.85	15.00	4.51	3.10	15.20	145.50	144.15	144.08
I-4	1.44	0.85	15.00	4.34	5.60	20.80	145.00	143.73	143.51
I-5	4.30	0.85	15.00	4.19	16.50	37.30	143.50	142.62	142.31
I-6	0.67	0.85	15.00	4.14	2.60	39.90	143.50	141.87	141.45
Outlet	N/A	N/A	N/A	4.12	N/A	N/A	143.50	141.20	141.20

The Pipe Report

Pipe	Upstream Node	Downstream Node	Discharge (cfs)	Constructed Slope (ft/ft)	Length (ft)	Section Size	Roughness	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream HGL (ft)	Downstream HGL (ft)
P-1	I-1	I-2	6.20	0.009524	21.00	18 inch	0.013	141.00	140.80	145.00	145.50	144.52	144.45
P-2	I-2	I-3	12.10	0.003125	64.00	24 inch	0.013	140.70	140.50	145.50	145.50	144.33	144.15
P-3	I-3	I-4	15.20	0.001594	251.00	30 inch	0.013	140.40	140.00	145.50	145.00	144.08	143.73
P-4	I-4	I-5	20.80	0.001445	346.00	30 inch	0.013	139.90	139.40	145.00	143.50	143.51	142.62
P-5	I-5	I-6	37.30	0.001987	151.00	36 inch	0.013	139.30	139.00	143.50	143.50	142.31	141.87
P-6	I-6	Outlet	39.90	0.028713	101.00	36 inch	0.013	138.90	136.00	143.50	143.50	141.45	141.20


Inlet: I-1
Rim: 145.00 ft
Sump: 141.00 ft
Inlet: I-6
Rim: 143.50 ft
Sump: 138.90 ft
Inlet: I-5
Rim: 143.50 ft
Sump: 139.30 ft
Inlet: I-4
Rim: 145.00 ft
Sump: 139.90 ft
Inlet: I-3
Rim: 145.50 ft
Sump: 140.40 ft
Inlet: I-2
Rim: 145.50 ft
Sump: 140.70 ft
146.00
145.00
144.00
143.00
142.00
141.00
140.00
139.00
138.00
137.00
136.00
Elevation ft
Outlet: Outlet
Rim: 143.50 ft
Sump: 136.00 ft
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
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Length: 64.00 ft
Size: 24 inch
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Length: 21.00 ft
Size: 18 inch

The Node Report

Node	Inlet Area (acres)	Weighted Roughness Coefficient	Inlet TC (min)	System Intensity (in/hr)	Additional Flow (cfs)	Discharge (cfs)	Ground Elevation (ft)	HGL In (ft)	HGL Out (ft)
I-1	1.61	0.91	15.00	4.56	10.80	10.80	145.00	145.50	145.50
I-2	1.52	0.91	15.00	4.55	10.20	21.00	145.50	145.50	145.50
I-3	0.79	0.91	15.00	4.53	5.30	26.30	145.50	145.50	145.50
I-4	1.44	0.91	15.00	4.43	9.70	36.00	145.00	145.00	145.00
I-5	4.30	0.91	15.00	4.34	28.80	64.80	143.50	144.10	144.10
I-6	0.67	0.91	15.00	4.30	4.50	69.30	143.50	144.10	144.10
Outlet	N/A	N/A	N/A	4.28	N/A	N/A	143.50	144.10	144.10

The Pipe Report

Pipe	Upstream Node	Downstream Node	Discharge (cfs)	Constructed Slope (ft/ft)	Length (ft)	Section Size	Roughness	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream HGL (ft)	Downstream HGL (ft)
P-1	I-1	I-2	10.80	0.009524	21.00	18 inch	0.013	141.00	140.80	145.00	145.50	145.72	145.50
P-2	I-2	I-3	21.00	0.003125	64.00	24 inch	0.013	140.70	140.50	145.50	145.50	146.05	145.50
P-3	I-3	I-4	26.30	0.001594	251.00	30 inch	0.013	140.40	140.00	145.50	145.00	146.03	145.00
P-4	I-4	I-5	36.00	0.001445	346.00	30 inch	0.013	139.90	139.40	145.00	143.50	146.77	144.10
P-5	I-5	I-6	64.80	0.001987	151.00	36 inch	0.013	139.30	139.00	143.50	143.50	145.53	144.10
P-6	I-6	Outlet	69.30	0.028713	101.00	36 inch	0.013	138.90	136.00	143.50	143.50	145.19	144.10

PondPack Hydrology Routing

Post-Development Run

Table of Contents (continued)

Table of Contents

MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID SEDGWICK.RNQ WICHITA 24HR

Return Event	Total Depth in	Rainfall Type	RNF File	RNF ID
A....2	3.5000	Synthetic Curve	SCSTYPES	TypeII 24hr
A....5	4.5000	Synthetic Curve	SCSTYPES	TypeII 24hr
A..100	7.9000	Synthetic Curve	SCSTYPES	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Storage Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond ac-ft
4X2 RCBC	JCT	2	1.207		12.0800	16.24		
4X2 RCBC	JCT	5	1.848		12.0800	25.07		
4X2 RCBC	JCT	100	4.270		12.0800	57.13		
6X3 RCBC	JCT	2	8.266		12.4000	59.97		
6X3 RCBC	JCT	5	13.148		12.3200	98.86		
6X3 RCBC	JCT	100	32.241		12.3200	249.91		
COMMERCIAL	AREA	2	1.207		12.0800	16.24		
COMMERCIAL	AREA	5	1.848		12.0800	25.07		
COMMERCIAL	AREA	100	4.270		12.0800	57.13		
EAST BASIN	AREA	2	13.122		12.0600	188.49		
EAST BASIN	AREA	5	20.469		12.0400	297.65		
EAST BASIN	AREA	100	48.697		12.0400	704.20		
LAKE IN	POND	2	13.122		12.0600	188.49		
LAKE IN	POND	5	20.469		12.0400	297.65		
LAKE IN	POND	100	48.697		12.0400	704.20		
LAKE OUT	POND	2	11.554		14.4600	9.30	140.46	7.501
LAKE OUT	POND	5	18.665		13.5400	19.37	141.19	11.369
LAKE OUT	POND	100	46.347		13.0800	53.05	144.12	27.948

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Storage Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond ac-ft
WEST BASIN	AREA	2	8.266		12.4000	59.97		
WEST BASIN	AREA	5	13.148		12.3200	98.86		
WEST BASIN	AREA	100	32.241		12.3200	249.91		
*WOODBOX	JCT	2	21.026		12.3000	72.12		
*WOODBOX	JCT	5	33.661		12.3000	123.83		
*WOODBOX	JCT	100	82.857		12.3000	320.21		

File.... C:\HAESTAD\PPKW\RAINFALL\SEDGWICK.RNQ
Title... Job title was not entered.

DESIGN STORMS SUMMARY

Design Storm File,ID = SEDGWICK.RNQ WICHITA 24HR

Storm Tag Name = A....2

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 3.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = A....5

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeII 24hr
Storm Frequency = 5 yr
Total Rainfall Depth= 4.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = A..100

Data Type, File, ID = Synthetic Storm SCSTYPES.RNF TypeII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 7.9000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

File.... F:\HYDRO\PROJECTS\HARVEST RIDGE COMMERCIAL ADDITION\PRO2.PPW

TIME OF CONCENTRATION CALCULATOR

Segment #1: Tc: TR-55 Shallow

Hydraulic Length	2150.00 ft
Slope	.005600 ft/ft
Unpaved	
Avg.Velocity	1.21 ft/sec

Segment #1 Time: .4946 hrs

Segment #2: Tc: TR-55 Sheet

Mannings n	.1500
Hydraulic Length	100.00 ft
2yr, 24hr P	3.6000 in
Slope	.005000 ft/ft
Avg.Velocity	.10 ft/sec

Segment #2 Time: .2681 hrs

Total Tc: .7627 hrs

File.... F:\HYDRO\PROJECTS\HARVEST RIDGE COMMERCIAL ADDITION\PRO2.PPW

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

File.... F:\HYDRO\PROJECTS\HARVEST RIDGE COMMERCIAL ADDITION\PRO2.PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Shallow

Hydraulic Length	2150.00	ft
Slope	.005600	ft/ft
Unpaved		
Avg.Velocity	1.21	ft/sec

Segment #1 Time: .4946 hrs

Segment #2: Tc: TR-55 Sheet

Mannings n	.1500	
Hydraulic Length	100.00	ft
2yr, 24hr P	3.6000	in
Slope	.005000	ft/ft
Avg.Velocity	.10	ft/sec

Segment #2 Time: .2681 hrs

==========
Total Tc: .7627 hrs
==========

File.... F:\HYDRO\PROJECTS\HARVEST RIDGE COMMERCIAL ADDITION\PRO2.PPW

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

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V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

File.... F:\HYDRO\PROJECTS\HARVEST RIDGE COMMERCIAL ADDITION\PRO2.PPW

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
SUBDIVISION	74	105.000			74.00
COMMERCIAL	91	10.330			91.00
COMPOSITE AREA & WEIGHTED CN --->		115.330			75.52 (76)

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 24.0000 hrs Rain Depth = 3.5000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\HYDRO\PROJECTS\HARVEST RIDGE COMMERCIAL ADDITION\
HYG File - ID = K42_PRO.HYG - COMMERCIAL A....2
Tc = .3000 hrs
Drainage Area = 9.670 acres Runoff CN= 78

==========

Computational Time Increment	=	.04000 hrs
Computed Peak Time	=	12.0800 hrs
Computed Peak Flow	=	16.25 cfs
Time Increment for HYG File	=	.0200 hrs
Peak Time, Interpolated Output	=	12.0801 hrs
Peak Flow, Interpolated Output	=	16.24 cfs

==========

DRAINAGE AREA

ID:None Selected
CN = 78
Area = 9.670 acres
S = 2.8205 in
0.2S = .5641 in

Cumulative Runoff

1.4974 in
1.207 ac-ft

HYG Volume... 1.207 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .30000 hrs (ID: None Selected)
Computational Incr, Tm = .04000 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak,	qp =	36.52 cfs
Unit peak time	Tp =	.20000 hrs
Unit receding limb,	Tr =	.80000 hrs
Total unit time,	Tb =	1.00000 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 5 year storm
Duration = 24.0000 hrs Rain Depth = 4.5000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\HYDRO\PROJECTS\HARVEST RIDGE COMMERCIAL ADDITION\
HYG File - ID = K42_PRO.HYG - COMMERCIAL A....5
Tc = .3000 hrs
Drainage Area = 9.670 acres Runoff CN= 78

==========
Computational Time Increment = .04000 hrs
Computed Peak Time = 12.0800 hrs
Computed Peak Flow = 25.07 cfs

Time Increment for HYG File = .0200 hrs
Peak Time, Interpolated Output = 12.0801 hrs
Peak Flow, Interpolated Output = 25.07 cfs
==========

DRAINAGE AREA

ID:None Selected
CN = 78
Area = 9.670 acres
S = 2.8205 in
0.2S = .5641 in

Cumulative Runoff

2.2928 in
1.848 ac-ft

HYG Volume... 1.848 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .30000 hrs (ID: None Selected)
Computational Incr, Tm = .04000 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 36.52 cfs
Unit peak time Tp = .20000 hrs
Unit receding limb, Tr = .80000 hrs
Total unit time, Tb = 1.00000 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 24.0000 hrs Rain Depth = 7.9000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\HYDRO\PROJECTS\HARVEST RIDGE COMMERCIAL ADDITION\
HYG File - ID = K42_PRO.HYG - COMMERCIAL A..100
Tc = .3000 hrs
Drainage Area = 9.670 acres Runoff CN= 78

==========
Computational Time Increment = .04000 hrs
Computed Peak Time = 12.0800 hrs
Computed Peak Flow = 57.13 cfs

Time Increment for HYG File = .0200 hrs
Peak Time, Interpolated Output = 12.0801 hrs
Peak Flow, Interpolated Output = 57.13 cfs
==========

DRAINAGE AREA

ID:None Selected
CN = 78
Area = 9.670 acres
S = 2.8205 in
0.2S = .5641 in

Cumulative Runoff

5.2987 in
4.270 ac-ft

HYG Volume... 4.270 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .30000 hrs (ID: None Selected)
Computational Incr, Tm = .04000 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 36.52 cfs
Unit peak time Tp = .20000 hrs
Unit receding limb, Tr = .80000 hrs
Total unit time, Tb = 1.00000 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 24.0000 hrs Rain Depth = 3.5000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\HYDRO\PROJECTS\HARVEST RIDGE COMMERCIAL ADDITION\
HYG File - ID = K42_PRO.HYG - EAST BASIN A....2
Tc = .2500 hrs
Drainage Area = 115.330 acres Runoff CN= 76

==========
Computational Time Increment = .03333 hrs
Computed Peak Time = 12.0667 hrs
Computed Peak Flow = 188.70 cfs

Time Increment for HYG File = .0200 hrs
Peak Time, Interpolated Output = 12.0601 hrs
Peak Flow, Interpolated Output = 188.49 cfs
==========

DRAINAGE AREA

ID:EAST BASIN
CN = 76
Area = 115.330 acres
S = 3.1579 in
0.2S = .6316 in

Cumulative Runoff

1.3653 in
13.122 ac-ft

HYG Volume... 13.122 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .25000 hrs (ID: EAST BASIN)
Computational Incr, Tm = .03333 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 522.70 cfs
Unit peak time Tp = .16667 hrs
Unit receding limb, Tr = .66667 hrs
Total unit time, Tb = .83333 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 5 year storm
Duration = 24.0000 hrs Rain Depth = 4.5000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\HYDRO\PROJECTS\HARVEST RIDGE COMMERCIAL ADDITION\
HYG File - ID = K42_PRO.HYG - EAST BASIN A....5
Tc = .2500 hrs
Drainage Area = 115.330 acres Runoff CN= 76

==========
Computational Time Increment = .03333 hrs
Computed Peak Time = 12.0333 hrs
Computed Peak Flow = 297.92 cfs

Time Increment for HYG File = .0200 hrs
Peak Time, Interpolated Output = 12.0401 hrs
Peak Flow, Interpolated Output = 297.65 cfs
==========

DRAINAGE AREA

ID:EAST BASIN
CN = 76
Area = 115.330 acres
S = 3.1579 in
0.2S = .6316 in

Cumulative Runoff

2.1298 in
20.469 ac-ft

HYG Volume... 20.469 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .25000 hrs (ID: EAST BASIN)
Computational Incr, Tm = .03333 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 522.70 cfs
Unit peak time Tp = .16667 hrs
Unit receding limb, Tr = .66667 hrs
Total unit time, Tb = .83333 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 24.0000 hrs Rain Depth = 7.9000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\HYDRO\PROJECTS\HARVEST RIDGE COMMERCIAL ADDITION\
HYG File - ID = K42_PRO.HYG - EAST BASIN A..100
Tc = .2500 hrs
Drainage Area = 115.330 acres Runoff CN= 76

==========
Computational Time Increment = .03333 hrs
Computed Peak Time = 12.0333 hrs
Computed Peak Flow = 706.93 cfs

Time Increment for HYG File = .0200 hrs
Peak Time, Interpolated Output = 12.0401 hrs
Peak Flow, Interpolated Output = 704.20 cfs
==========

DRAINAGE AREA

ID:EAST BASIN
CN = 76
Area = 115.330 acres
S = 3.1579 in
0.2S = .6316 in

Cumulative Runoff

5.0670 in
48.698 ac-ft

HYG Volume... 48.697 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .25000 hrs (ID: EAST BASIN)
Computational Incr, Tm = .03333 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 522.70 cfs
Unit peak time Tp = .16667 hrs
Unit receding limb, Tr = .66667 hrs
Total unit time, Tb = .83333 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 24.0000 hrs Rain Depth = 3.5000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\HYDRO\PROJECTS\HARVEST RIDGE COMMERCIAL ADDITION\
HYG File - ID = K42_PRO.HYG - WEST BASIN A....2
Tc = .7627 hrs
Drainage Area = 80.000 acres Runoff CN= 74

==========
Computational Time Increment = .10169 hrs
Computed Peak Time = 12.4065 hrs
Computed Peak Flow = 60.01 cfs

Time Increment for HYG File = .0200 hrs
Peak Time, Interpolated Output = 12.4001 hrs
Peak Flow, Interpolated Output = 59.97 cfs
==========

DRAINAGE AREA

ID:None Selected
CN = 74
Area = 80.000 acres
S = 3.5135 in
0.2S = .7027 in

Cumulative Runoff

1.2399 in
8.266 ac-ft

HYG Volume... 8.266 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .76270 hrs (ID: West Basin)
Computational Incr, Tm = .10169 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 118.85 cfs
Unit peak time Tp = .50846 hrs
Unit receding limb, Tr = 2.03386 hrs
Total unit time, Tb = 2.54232 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 5 year storm
Duration = 24.0000 hrs Rain Depth = 4.5000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\HYDRO\PROJECTS\HARVEST RIDGE COMMERCIAL ADDITION\
HYG File - ID = K42_PRO.HYG - WEST BASIN A....5
Tc = .7627 hrs
Drainage Area = 80.000 acres Runoff CN= 74

==========
Computational Time Increment = .10169 hrs
Computed Peak Time = 12.3048 hrs
Computed Peak Flow = 98.92 cfs

Time Increment for HYG File = .0200 hrs
Peak Time, Interpolated Output = 12.3201 hrs
Peak Flow, Interpolated Output = 98.86 cfs
==========

DRAINAGE AREA

ID:None Selected
CN = 74
Area = 80.000 acres
S = 3.5135 in
0.2S = .7027 in

Cumulative Runoff

1.9723 in
13.149 ac-ft

HYG Volume... 13.148 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .76270 hrs (ID: West Basin)
Computational Incr, Tm = .10169 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 118.85 cfs
Unit peak time Tp = .50846 hrs
Unit receding limb, Tr = 2.03386 hrs
Total unit time, Tb = 2.54232 hrs

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 24.0000 hrs Rain Depth = 7.9000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\HYDRO\PROJECTS\HARVEST RIDGE COMMERCIAL ADDITION\
HYG File - ID = K42_PRO.HYG - WEST BASIN A..100
Tc = .7627 hrs
Drainage Area = 80.000 acres Runoff CN= 74

==========
Computational Time Increment = .10169 hrs
Computed Peak Time = 12.3048 hrs
Computed Peak Flow = 250.76 cfs

Time Increment for HYG File = .0200 hrs
Peak Time, Interpolated Output = 12.3201 hrs
Peak Flow, Interpolated Output = 249.91 cfs
==========

DRAINAGE AREA

ID:None Selected
CN = 74
Area = 80.000 acres
S = 3.5135 in
0.2S = .7027 in

Cumulative Runoff

4.8363 in
32.242 ac-ft

HYG Volume... 32.241 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .76270 hrs (ID: West Basin)
Computational Incr, Tm = .10169 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 118.85 cfs
Unit peak time Tp = .50846 hrs
Unit receding limb, Tr = 2.03386 hrs
Total unit time, Tb = 2.54232 hrs

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Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
139.00	-----	5.0000	.0000	.000	.000
145.00	-----	6.1000	16.6227	33.245	33.245

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 139.00 ft
Increment = .50 ft
Max. Elev.= 145.00 ft

Spot Elevations, ft
144.00

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Culvert-Circular	CV	--->	TW	139.000	145.000
Weir-Rectangular	WR	--->	BX	144.000	145.000
Culvert-Box	BX	--->	TW	141.500	145.000

TW SETUP, DS Channel

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OUTLET STRUCTURE INPUT DATA

Structure ID	=	CV	
Structure Type	=	Culvert-Circular	
No. Barrels	=	1	
Barrel Diameter	=	3.0000	ft
Upstream Invert	=	139.00	ft
Dnstream Invert	=	137.00	ft
Horiz. Length	=	650.00	ft
Barrel Length	=	650.00	ft
Barrel Slope	=	.00308	ft/ft

OUTLET CONTROL DATA...

Mannings n	=	.0130	
Ke	=	.5000	(forward entrance loss)
Kb	=	.007228	(per ft of full flow)
Kr	=	.5000	(reverse entrance loss)
HW Convergence	=	.001	+/- ft

INLET CONTROL DATA...

Equation form	=	1	
Inlet Control K	=	.0098	
Inlet Control M	=	2.0000	
Inlet Control c	=	.03980	
Inlet Control Y	=	.6700	
T1 ratio (HW/D)	=	1.159	
T2 ratio (HW/D)	=	1.305	
Slope Factor	=	-.500	

Use unsubmerged inlet control Form 1 equ. below T1 elev.
Use submerged inlet control Form 1 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control, interpolate between flows at T1 & T2...

At T1 Elev =	142.48 ft	--->	Flow =	42.85	cfs
At T2 Elev =	142.92 ft	--->	Flow =	48.97	cfs

OUTLET STRUCTURE INPUT DATA

Structure ID	=	WR
Structure Type	=	Weir-Rectangular
# of Openings	=	1
Crest Elev.	=	144.00 ft
Weir Length	=	20.00 ft
Weir Coeff.	=	2.600000

Weir TW effects (Use adjustment equation)

OUTLET STRUCTURE INPUT DATA

Structure ID = BX
Structure Type = Culvert-Box

No. Barrels	=	1
Barrel Height	=	4.00 ft
Barrel Width	=	2.00 ft
Upstream Invert	=	141.50 ft
Dnstream Invert	=	141.00 ft
Horiz. Length	=	170.00 ft
Barrel Length	=	170.00 ft
Barrel Slope	=	.00294 ft/ft

OUTLET CONTROL DATA...

Mannings n	=	.0130
Ke	=	.5000 (forward entrance loss)
Kb	=	.008457 (per ft of full flow)
Kr	=	.5000 (reverse entrance loss)
HW Convergence	=	.001 +/- ft

INLET CONTROL DATA...

Equation form	=	1
Inlet Control K	=	.0260
Inlet Control M	=	1.0000
Inlet Control c	=	.03850
Inlet Control Y	=	.8100
T1 ratio (HW/D)	=	1.177
T2 ratio (HW/D)	=	1.425
Slope Factor	=	-.500

Use unsubmerged inlet control Form 1 equ. below T1 elev.
Use submerged inlet control Form 1 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control, interpolate between flows at T1 & T2...
At T1 Elev = 146.21 ft ---> Flow = 56.00 cfs
At T2 Elev = 147.20 ft ---> Flow = 64.00 cfs

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...

Maximum Iterations	=	30
Min. TW tolerance	=	.01 ft
Max. TW tolerance	=	.01 ft
Min. HW tolerance	=	.01 ft
Max. HW tolerance	=	.01 ft
Min. Q tolerance	=	.10 cfs
Max. Q tolerance	=	.10 cfs

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RATING TABLE FOR ONE OUTLET TYPE

Structure ID = CV (Culvert-Circular)

Mannings open channel maximum capacity: 39.80 cfs
Upstream ID = (Pond Water Surface)
DNstream ID = TW (Pond Outfall)

WS Elev, ft	Device Q, cfs	Tail Water TW Elev, ft	Converge +/-ft	Notes / Computation Messages
139.00	.00	Free Outfall		WS below an invert; no flow.
139.50	1.18	Free Outfall		BACKWATER CONTROL.. Vh= .088ft hwDi= .367ft Lbw= 650.0ft
140.00	4.50	Free Outfall		BACKWATER CONTROL.. Vh= .196ft hwDi= .706ft Lbw= 650.0ft
140.50	9.69	Free Outfall		BACKWATER CONTROL.. Vh= .302ft hwDi= 1.047ft Lbw= 650.0ft
141.00	16.38	Free Outfall		BACKWATER CONTROL.. Vh= .403ft hwDi= 1.395ft Lbw= 650.0ft
141.50	24.27	Free Outfall		BACKWATER CONTROL.. Vh= .486ft hwDi= 1.771ft Lbw= 650.0ft
142.00	32.63	Free Outfall		BACKWATER CONTROL.. Vh= .543ft hwDi= 2.186ft Lbw= 650.0ft
142.50	39.85	Free Outfall		BACKWATER CONTROL.. Vh= .563ft hwDi= 2.656ft Lbw= 650.0ft
143.00	43.50	Free Outfall		FULL FLOW...Lfull=99.48ft Vh=.588ft HL=1.306ft
143.50	45.77	Free Outfall		FULL FLOW...Lfull=320.58ft Vh=.651ft HL=2.487ft
144.00	48.12	Free Outfall		FULL FLOW...Lfull=431.95ft Vh=.720ft HL=3.329ft
144.50	50.46	Free Outfall		FULL FLOW...Lfull=495.82ft Vh=.792ft HL=4.026ft
145.00	52.74	Free Outfall		FULL FLOW...Lfull=536.03ft Vh=.865ft HL=4.649ft

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = WR (Weir-Rectangular)

Upstream ID = (Pond Water Surface)
DNstream ID = BX (Culvert-Box)

Pond WS. Elev. ft	Device Q cfs	(into) HW HGL ft	Converge DS HGL ft	Next DS HGL ft	DS HGL Error +/-ft	Q SUM Error +/-cfs	DS Chan. TW ft	TW Error +/-ft
139.00	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
139.50	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
140.00	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
140.50	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
141.00	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
141.50	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
142.00	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
142.50	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
143.00	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
143.50	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
144.00	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
144.50	18.29	144.50	Free	143.92	.000	.000	Free Outfall	
		H=.50; Htw=.00; Qfree=18.29;						
145.00	30.75	145.00	144.82	144.96	.140	.000	Free Outfall	
		H=1.00; Htw=.82; Qfree=51.48;						

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RATING TABLE FOR ONE OUTLET TYPE

Structure ID = BX (Culvert-Box)

Mannings open channel maximum capacity: 42.74 cfs
UPstream ID = WR (Weir-Rectangular)
DNstream ID = TW (Pond Outfall)

Pond WS. Elev. ft	Device Q cfs	(into) HW HGL ft	Converge DS HGL ft	Next DS HGL ft	DS HGL Error +/-ft	Q SUM Error +/-cfs	DS Chan. TW ft	TW Error +/-ft
139.00	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
139.50	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
140.00	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
140.50	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
141.00	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
141.50	.00	...	...	...	...	...	Free Outfall	
		WS below an invert; no flow.						
142.00	.00	141.50	Free	Free	.000	.000	Free Outfall	
142.50	.00	141.50	Free	Free	.000	.000	Free Outfall	
143.00	.00	141.50	Free	Free	.000	.000	Free Outfall	
143.50	.00	141.50	Free	Free	.000	.000	Free Outfall	
144.00	.00	141.50	Free	Free	.000	.000	Free Outfall	
144.50	18.29	143.92	Free	Free	.000	.000	Free Outfall	
		BACKWATER CONTROL.. Vh= .378ft hwDi= 1.853ft Lbw= 170.0ft						
145.00	30.75	144.96	Free	Free	.000	.000	Free Outfall	
		BACKWATER CONTROL.. Vh= .504ft hwDi= 2.700ft Lbw= 170.0ft						

***** COMPOSITE OUTFLOW SUMMARY ****

WS Elev, Total Q		Converge		Notes
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
139.00	.00	Free Outfall		(no Q: CV,WR,BX)
139.50	1.18	Free Outfall		CV (no Q: WR,BX)
140.00	4.50	Free Outfall		CV (no Q: WR,BX)
140.50	9.69	Free Outfall		CV (no Q: WR,BX)
141.00	16.38	Free Outfall		CV (no Q: WR,BX)
141.50	24.27	Free Outfall		CV (no Q: WR,BX)
142.00	32.63	Free Outfall		CV (no Q: WR,BX)
142.50	39.85	Free Outfall		CV (no Q: WR,BX)
143.00	43.50	Free Outfall		CV (no Q: WR,BX)
143.50	45.77	Free Outfall		CV (no Q: WR,BX)
144.00	48.12	Free Outfall		CV (no Q: WR,BX)
144.50	68.75	Free Outfall		CV,WR,BX
145.00	83.49	Free Outfall		CV,WR,BX