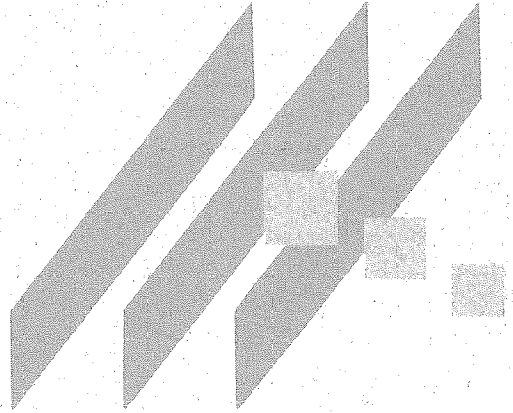


MKEC ENGINEERING CONSULTANTS, INC.

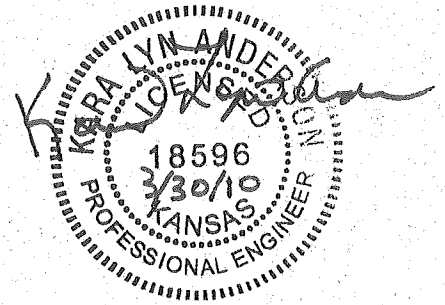


DRAINAGE REPORT

FOR

MONARCH LANDING 3RD ADDITION
Wichita, Kansas

MARCH 2010



DRAINAGE REPORT

FOR

MONARCH LANDING 3RD ADDITION
Wichita, Kansas

MARCH 2010

Tab 0. Checklist



Public Works, Engineering Division Final Drainage Plan Submittal Checklist

Reviewer: _____	Date: _____
Subdivision Name: _____	Location: _____
Total Land Area Of Ownership: _____ Acres	
Type: _____ Residential _____ Commercial _____ Industrial _____ Recreation _____ Municipal _____ Other	
Applicant: _____	Contact: _____ Phone #: _____
Engineer: _____	Contact: _____ Phone #: _____

Please check the appropriate box:

I = Included; NA = Non-Applicable; R= Required prior to development
(If "NA" is checked, an explanation must be entered)

Tab 1. Project Narrative	Applicant			Engr	
	I	NA	Explanation / Location in Plan	I	NA
A. Site Location Map, using USGS Map					
B. Discussion of development, existing conditions, and proposed impacts on stormwater, wetland, riparian, and flood plain					
C. Discussion of offsite conditions					
D. Summary of runoff calculations (pre/post development) No increase in peak discharge for all storm series					
E. Narrative description of the type and function of the permanent best management practices that are incorporated into the site design					
F. Copy of the plat					
G. Preliminary grading plan (The final grading plan shall be sealed, signed and dated prior to Engineering receiving the final sanitary sewer plans. One plan sheet and PDF shall be submitted to the Subdivision Engineer.)					
H. Professional Engineer seal, signature and date on cover of report					
I. CD of drainage plan in PDF format (one file) and one paper copy bound with this checklist included behind the cover					

Tab 2. Existing Conditions Runoff Calculations	Applicant			Engr	
	I	NA	Explanation / Location in Plan	I	NA
A. Copy of applicable orthophoto showing proposed project boundaries (preferable in color)					
B. Runoff Method (Rational, Hydrograph Method, or other approved methods by Engineering)					
C. Existing topography (no greater than 2-foot contours, 1-foot recommend)					
D. Total Site Area and Total Impervious Area (acres)					
E. Benchmarks used for site control					
F. Streams, creeks, and waterway labeled					
G. Predominant soils from USDA soil surveys, and/or on site soil borings					
H. Location and boundaries of natural features such as wetlands, lakes, and ponds with the normal water elevation noted					
I. Location of existing roads, buildings, parking lots and other impervious areas.					



J. Location of existing utilities (e.g., water, sewer, gas, electric) and easements					
K. Location of existing conveyance systems such as storm drains, inlets, catch basins, channels, swales, and areas of overland flow					
L. Flow paths					
M. Location and dimensions of existing channels, bridges or culvert crossings					
N. Existing conditions hydrologic analysis for runoff rates, volumes and velocities showing methodologies used and supporting calculations (2, 5, 10, 25 & 100 year, 24-hour storm events) or Critical Duration					
O. Assumed pre-developed runoff curve numbers					
P. Existing time of concentrations used in calculations					
Q. Evaluate immediate downstream drainage capacity, not to exceed more than 0.25 miles downstream of site					
R. Existing structural elevations (e.g., invert of pipes, manholes, etc.)					
S. Cross-section data for open channels					
T. Ground water elevations, if applicable					

Tab 3. Post-Development Hydrologic Analysis	Applicant			Engr	
	I	NA	Explanation / Location in Plan	I	NA
A. Proposed (post-development) conditions hydrologic and hydraulic analysis for runoff rates, volumes, HGL, and velocities showing the methodologies used and supporting calculations for all applicable design storms (2, 5, 10, 25 & 100 year, 24-hour storm events)					
B. Proposed time of concentrations used in calculations					
C. Assumed post-developed runoff curve numbers					
D. Proposed contours for detention facilities (to equal area used in outlet rating curves)					
E. Preliminary sizing calculations for stormwater controls including contributing drainage area, storage, and outlet configuration					
F. Stage-storage-discharge or outlet rating curves and inflow and outflow hydrographs for storage facilities					
G. Final analysis of potential upstream/downstream impact/effects of project, where necessary					
H. Existing and proposed structural elevations (e.g., invert of pipes, manholes, etc.)					
I. Design water surface elevations and normal pool elevation for ponds.					
J. Typical detail for outlet structures, embankments, spillways, grade control structures, conveyance channels, etc. To include height, width, elevation, and/or diameter.					
K. Proposed limits of clearing and grading					
L. Location of existing and proposed roads, buildings, parking lots and other impervious areas.					
M. Location of existing and proposed utilities (e.g., water, sewer) and easements					
N. Location of existing and proposed conveyance systems such as storm drains, inlets, catch basins, channels, swales, and areas of overland flow					
O. Preliminary location and dimensions of proposed channel modifications, such as bridge or culvert crossings					



P. Preliminary selection and location of stormwater controls					
Q. Emergency overflow structure' s flow path					
R. Detention facility provides one-foot of freeboard above the HWL and emergency outfall shown (top of berm elevation shown)					
S. The 100-year 24-hour HWL delineated on the plan for detention pond					
T. Lowest opening elevations table on the plat for structures located adjacent to channels or ponds					
U. Stormwater Management Facilities located within a Reserve					
V. Maintenance responsibility of stormwater management facility shall be specified in the platters text. (e.g. HOA, Lot Owners Association, or lot)					
W. Off-site drainage easements or agreements required, where necessary					

Tab 4. Floodplain Submittal	Applicant			Engr	
	I	NA	Explanation / Location in Plan	I	NA
A. Provide source of flood profile					
B. Nearest base flood elevations					
C. Delineation of pre-developed regulatory floodplain/floodway limits					
D. Delineation of post-developed regulatory floodplain and floodway limits					
E. Floodplain boundary determination per elevation (project limits shown)					
F. Provide source of floodway data table and discharges					
G. Provide all hydrologic and hydraulic study information for site-specific floodplain studies, unnumbered Zone A area elevation determinations and flood plain map revisions or required permits					
H. Provide regulatory floodway and four natural profile models (10,50,100, and 500-yr) for existing and future watershed conditions					
I. Location of floodplain/floodway limits and relationship of site to upstream/downstream properties (floodplain limits to be per elevation and scaled location)					
J. Flood plains and floodways located within a Reserve, where necessary					

Tab 5. Federal, State and Local Permits (to be provided prior to construction unless otherwise specified)	Applicant			Engr	
	I/R	NA	Explanation / Location in Plan	I/R	NA
A. US Army Corps of Engineers - Regulatory program permits (404 water quality certification)					
B. Kansas Department of Agriculture - Division of Water Resources Permits (Stream Obstruction, Channel Change, Flood Plain Fill, Levee, Water Appropriations, Dam safety permit, etc.)					
C. Federal Emergency Management Agency (FEMA) Letter of Map Changes (LOMA, LOMR, LOMR-f, CLOMR, etc.) Shall be included and approved when project modifies the limits of the floodway.					
D. Kansas Department of Transportation					
E. Sedgwick County Right-of-way Permit					

Tab 1. Project Narrative

Location

The subject property is in the City of Wichita, Sedgwick County, Kansas. The proposed development is north of 21st Street North and west of 159th Street North. The site lies in the southeast quarter of Section 1, Township 27 South, Range 2 East. Monarch Landing Addition borders the site to the west. The plat area is 14.9 acres. The site is shown on the USGS Map, Appendix 1.1.

Discussion of Development

Monarch Landing 3rd is currently undeveloped agricultural land. It will develop as residential lots 1/3 acre in size. The land south of the plat and north of 21st Street North will develop as commercial in the future. The proposed site is shown on the plat, Appendix 1.2

Drainage Summary

Pre-Development

Monarch Landing 3rd currently drains both to the south and to the east. The site is in two of the drainage basins from the original Monarch Landing Drainage Report. The northern part of the site is in Watershed D and the southern portion of the site is in Watershed A. Watershed D drains from west to east and outlets into the roadside ditch along 159th Street North. Watershed A drains from north to south and flows under 21st Street North through an existing 3'x4' RCB. Pre-development flow rates, prior to Monarch Landing Addition, for both of these basins are shown in Table 1.1.

Post-Development

The portion of Monarch Landing 3rd Addition in Watershed D will drain to the north into a proposed detention pond near the northeast corner of the site. The pond will reduce peak flow rates to the existing roadside ditch along 159th Street at or below pre-project conditions. Watershed A will continue to drain into a pond constructed with Monarch Landing Addition and additional detention will be constructed in bioswales in the commercial development. Preliminary lot layout and grading are shown in the Preliminary Lot Grading Plan, Appendix 1.3.

Table 1.1. Comparison of Pre and Post-Development Flow Rates

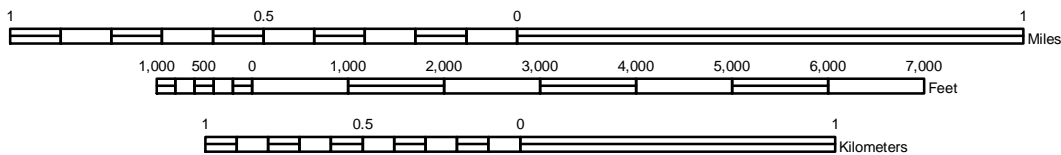
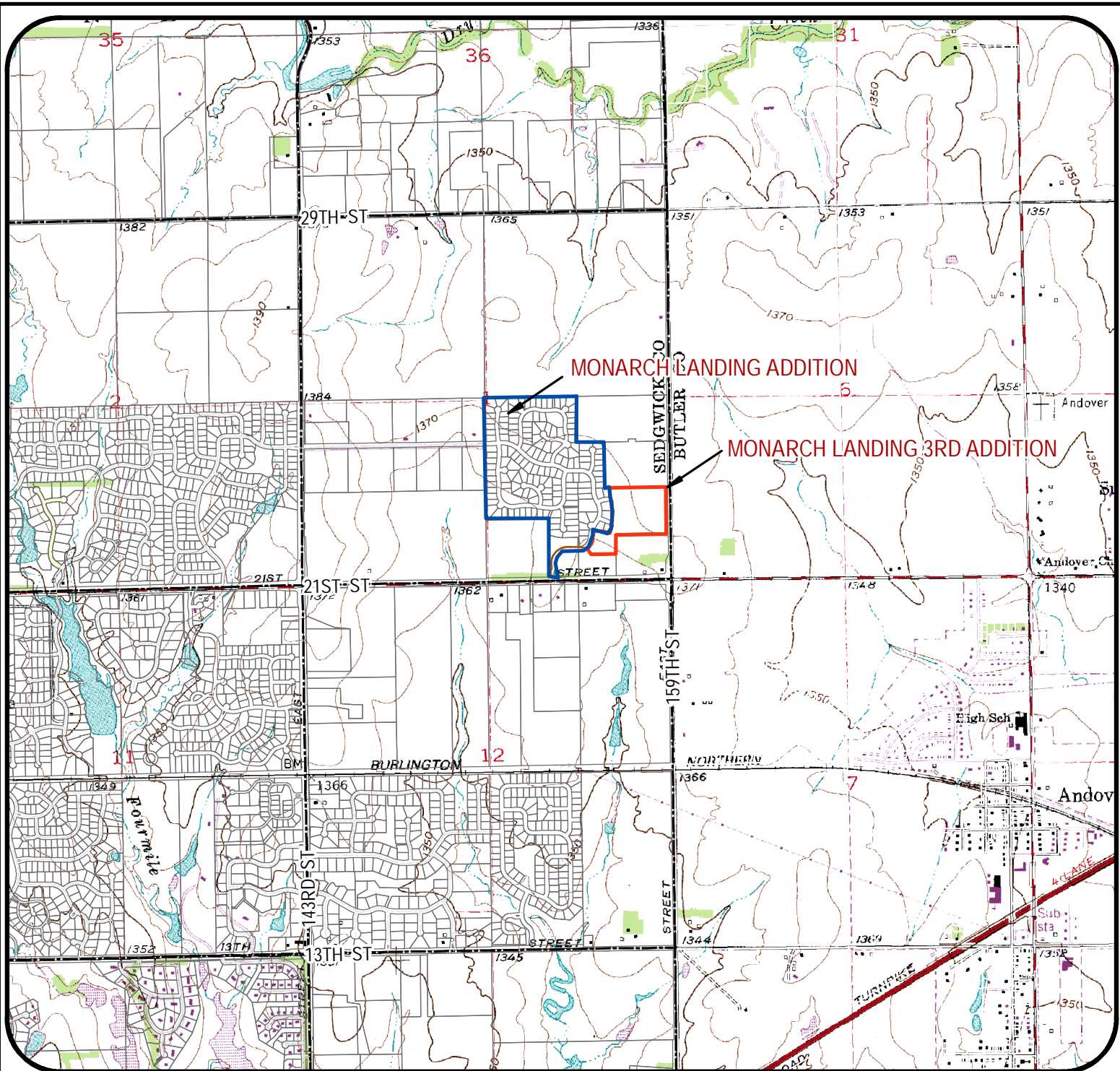
Description	Design Storm Flows (cfs)				
	2-Yr	5-Yr	10-Yr	25-Yr	100-Yr
Pre-Project Watershed A	34.9	54.6	68.0	88.4	118.3
Post-Project Watershed A	34.6	46.5	59.4	77.8	106.5
Pre-Project Watershed D	15.7	24.4	30.3	39.5	52.9
Post-Project Watershed D	15.5	24.3	30.1	39.1	51.6

Best Management Practices

The site will be seeded or sodded after construction of grading and utilities are complete. During construction curb protection, inlet protection and other erosion protection devices will be used to prevent soil from leaving the site. The site will be seeded and sodded upon completion of construction. Riprap will protect storm sewer outfalls.

Appendix 1.1

USGS Quadrangle Map



J:\CIVIL\062010\DWG\drng\DRNG-NRCS-USGS.mxd

MONARCH LANDING 3RD ADDITION

Project Name:
USGS - Sedgwick & Bulter County, KS

Sheet Title:

	CMJ	MARCH 2010
	Drawn By: KLA	Date: 06201
	Design / Review:	Job No.:

Appendix 1.2

Plat

FINAL PLAT

MONARCH LANDING THIRD ADDITION

AN ADDITION TO WICHITA, SEDGWICK COUNTY, KANSAS

CERTIFICATE OF SURVEY

I, Gregory J. Allison, a registered land surveyor in Kansas, do hereby certify that I have been in responsible charge of surveying and plating of "MONARCH LANDING THIRD ADDITION" on additional Wichita, Sedgwick County, Kansas, into both Block Reserves and Streets, the same being recorded, set forth in the accompanying plat and described herein.

A tract of land lying in the Southeast Quarter, Section 1, Township 27 South, Range 2 East, of the 6th Principal Meridian, Wichita, Sedgwick County, Kansas; said tract being more particularly described as follows:

BEGINNING at the northwest corner of said Southeast Quarter; thence along the north line of said Southeast Quarter on a Kansas coordinate system 1983 south zone bearing of N88°59'39"E, 1326.81 feet to the northeast corner of the Northwest Quarter of said Southeast Quarter; thence along the east line of said Northwest Quarter S00°35'58"E, 666.09 feet; thence N89°58'38"E, 394.03 feet; thence S00°34'25"E, 416.71 feet to the northeast corner of Lot 5, Block 5, Monarch Landing Addition, on addition to Wichita, Sedgwick County, Kansas; thence along the northerly line of said addition for the next fifteen (15) courses S88°58'38"W, 17466 feet to a point on a non-tangent curve to the right; thence along said curve to the right 30.31 feet to a point on a non-tangent curve to the left; said curve to the right having a central angle of 0°06'53.1", a radius of 284.00 feet; and a long chord distance of 30.29 feet; bearing S29°47'38"W; thence along said non-tangent curve to the left 172.37 feet; said curve having a central angle of 47°42'34.4", a radius of 207.00 feet; and a long chord distance of 167.43 feet; bearing N62°10'03.5"W; thence S88°58'38"W, 130.03 feet to a point on a curve to the right; thence along said curve 99.89 feet to a point on a reverse curve; said curve to the right having a central angle of 34°04'00", a radius of 168.00 feet; and a long chord distance of 98.42 feet; bearing N23°59'22"W; thence along said reverse curve 68.86 feet; said reverse curve having a central angle of 10°19'44.4", a radius of 382.00 feet; and a long chord distance of 68.77 feet; bearing N62°07'14"W; thence S22°42'34"W, 205.21 feet; thence N2°8'03"00"W, 281.19 feet; thence N81°17'26"W, 356.43 feet; thence N42°16'53"W, 130.00 feet; thence S33°57'08"W, 258.36 feet; thence S89°29'14"W, 148.03 feet to a point on a non-tangent curve to the left; thence along said curve 22.32 feet; said curve having a central angle of 0°39'30", a radius of 678.20 feet; and a long chord distance of 22.32 feet; bearing N04°11'07"44" thence S84°39'23"W, 64.00 feet; thence S97°27'44"W, 139.24 feet to the southwest near corner of said addition; thence along the southerly line of said addition bearing of S00°38'46"E, 139.24 feet to the southwest near corner of said addition; thence along the north line of said Northwest Quarter of the Southeast Quarter of said Southeast Quarter; thence along said west line N00°32'16"W, 1207.02 feet to the POINT OF BEGINNING.

I hereby certify that the details of this plat are correct to the best of my knowledge and belief this _____ day of _____, 2008.

Gregory J. Allison, PE, LS #1237
MKEC Engineering Consultants, Inc.
411 North Webb Road
Wichita, Kansas 67206

Know all men by these presents that the undersigned property owner of the land above set forth in the Registered Land Surveyor's Certificate, have caused the same to be surveyed and platted into Lots, Blocks, Reserves and Streets the same to be known as "MONARCH LANDING THIRD ADDITION", on addition to Wichita, Sedgwick County, Kansas.

Especially for the construction and maintenance of public utilities and drainage as indicated on the accompanying plat are hereby granted to the public.

The streets are hereby dedicated to and for the use of the public.

Reserves "A", and "B" are platted for utilities confined by easements, drainage, sidewalks, landscaping, irrigation, open space, and monument. The Reserves shall be owned and maintained by a homeowner's association and are reserved for uses stated.

A drainage plan has been developed for this plat. Drainage easements, right-of-way or reserve shall remain at established grades or as modified with the approval of the applicable City or County Engineer, and undisturbed to allow for the convenience of storm water.

OWNER'S CERTIFICATE

MONARCH LANDING, LLC, a Kansas limited liability company

Kevin Mullin, President
Kevin Mullin, President
Rishie Development Corporation, manager
STATE OF KANSAS, SEDGWICK COUNTY) ss

This instrument was acknowledged before me on this _____ day of _____, 2008, by Kevin Mullin, President, Rishie Development Corporation, manager, Monarch Landing, LLC, a Kansas limited liability company.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal, the day and year last above written.

My Term Expires: _____ Notary Public _____ Notary Public _____

MORTGAGE CERTIFICATE

INTRUST Bank, N.A. holders of a mortgage on the above described property, do hereby consent to the plat of "MONARCH LANDING THIRD ADDITION".
INTRUST Bank, N.A.

Gary D. Schmitt, Executive Vice President
Executive Vice President

This instrument was acknowledged before me on this _____ day of _____, 2008, by Gary D. Schmitt, Executive Vice President, INTRUST Bank, N.A.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal, the day and year last above written.

My Term Expires: _____ Notary Public _____ Notary Public _____

PLANNING COMMISSION CERTIFICATE

This plat of "MONARCH LANDING THIRD ADDITION" has been submitted to and approved by the Wichita, Sedgwick County Metropolitan Area Planning Commission, Wichita, Kansas.

Dated this _____ day of _____, 2008

WICHITA-SEDGWICK COUNTY METROPOLITAN AREA PLANNING COMMISSION

Dorell A. Downing, Chair

John L. Salsburg, Secretary

GOVERNING BODY CERTIFICATE

The dedications shown on this plat are hereby accepted and this plat is hereby approved by the governing body of the City of Wichita, Kansas.

Dated this _____ day of _____, 2008

At the direction of the City Council.

Carl Brewer, Mayor

Karen Salsburg, City Clerk

TRANSFER RECORD

STATE OF KANSAS, SEDGWICK COUNTY) ss
Entered on transfer record this _____ day of _____, 2008

Don Brace, County Clerk

REGISTER OF DEEDS CERTIFICATE

This is to certify that this instrument was filed for record in the Register of Deeds office, this _____ day of _____, 2008, at _____ o'clock _____ M., and is duly recorded.

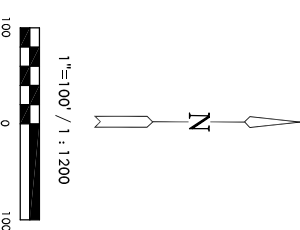
Bill Meek, Register of Deeds

Tonya E. Buckingham, Deputy

COUNTY SURVEYOR

Reviewed in accordance with K.S.A. 58-2005 on this _____ day of _____, 2008.

Tricia L. Robello, LS #1746
Deputy County Surveyor
Sedgwick County, Kansas



Basis of Bearings: Kansas coordinate system 1983 south zone bearing of S00°38'46"E along the E. Line of SE 1/4, Sec. 1, T27S, R2E, 6th P.M.



MINIMUM PAD ELEVATIONS		
LOWEST OPENINGS		
LOTS (inclusive)	BLOCK	ELEVATION (NGVD)
25 and 26	1	1370.6
12 - 16	3	1370.6

LEGEND

- ▲ = Section Corner Monument Found
- ⊙ = Found 3/8" rebar w/ MKEC CLS 39 Id. cap unless otherwise noted
- = Set 3/8" Rebar w/ MKEC CLS 39 Id. cap
- (P) = Platted
- (M) = Measured
- (D) = Record description or deed
- (CM) = Calculated from measured
- (CD) = Calculated from record description or deed

BENCH MARK

- BMH#2 Railroad spike in north side of power pole 924' east and 50' south of the south quarter corner, Sec. 1, T27S, R2E
- BMH#5 Railroad spike in north side of power pole 1040' west and 51' south of the southeast corner, Sec. 1, T27S, R2E

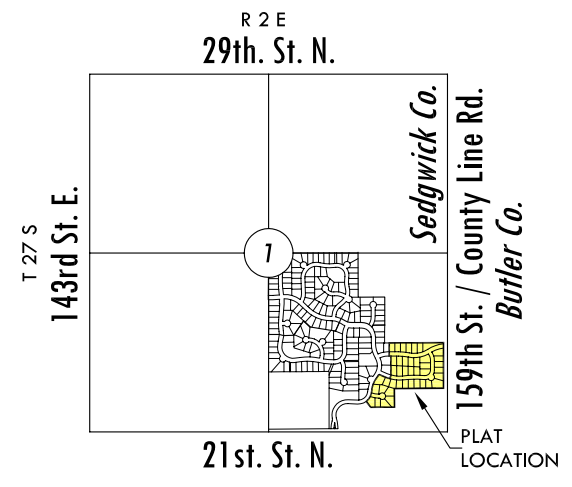
MKEC
ENGINEERING
CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316-684-9600

Appendix 1.3

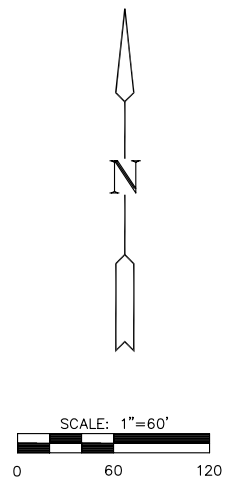
Preliminary Grading Plan



- LEGEND**
- ☉ - CONIFEROUS TREE
 - ☼ - DECIDUOUS TREE
 - SN - SIGN
 - PH - POWER POLE
 - ELEC. BOX - ELECTRIC BOX
 - LP - LIGHT POLE
 - FH - FIRE HYDRANT
 - WV - WATER VALVE
 - WM - WATER METER
 - SC - SECTION CORNER
 - BM - BENCHMARK
 - - - - - EASEMENT
 - - - - - BUILDING SETBACK
 - - - - - FENCE
 - - - - - STORM SEWER PIPE
 - - - - - WATER LINE
 - - - - - SANITARY SEWER LINE
 - - - - - GAS LINE
 - - - - - GAS PIPELINE
 - - - - - TELEPHONE LINE
 - - - - - UNDERGROUND ELEC.
 - - - - - OVERHEAD ELECTRIC
 - - - - - FIBER OPTIC CABLE
 - - - - - DRAINAGE SUB BASIN
 - - - - - DRAINAGE BASIN
 - - FLOW ARROW
 - A17 - AREA FOR SWS SIZING



VICINITY MAP



MONARCH LANDING
MONARCH LANDING 3RD ADDITION
WICHITA, KANSAS
LOT GRADING PLAN

DATE	MARCH 2010
REVISED	

DESIGN BY	KLA
DRAWN BY	CMJ
CHECKED BY	GJA

SHEET NUMBER	1
--------------	---

J:\Civil\062010\dwg\3RD\DRNG\062010_LGP.dwg

Tab 2. Existing Conditions

Description

The site is 14.9 acres of which zero acres are impervious area under existing conditions. The site is shown on the aerial photograph, Appendix 2.1. The site is shown on the Existing Conditions Map in Appendix 2.2.

FEMA Floodplains

The platted area is located in Zone X, areas outside of the 500-year flood, as shown on the Sedgwick County Kansas February 2, 2007 Map Number 20173C0385E, Appendix 2.3. The Arkansas River is west of the site. The nearest FEMA floodplains are approximately 3/4 mile north or south of the site .

Soils

According to the NRCS (SCS) Sedgwick County Soil Survey, Appendix 2.4, soils on the site are:

- Gossel silty clay, 0 to 1 percent slopes, HSG "D"
- Rosehill silty clay, 1 to 3 percent slopes, HSG "D"

Hydraulic Soil Group "D" was used for calculations for the basin which includes the site.

Drainage Calculations

Runoff Method

The site was modeled using the SCS Hydrograph method in Hydraflow Hydrographs by AutoCAD 3D 2009, Appendix 2.5. The model was originally created for the *Monarch Landing Addition Drainage Report*.

Rainfall

The rainfall information used is from the Kansas Department of Transportation Rainfall Depth Tables for Kansas Counties June 1997. The rainfall values used are shown in Table 2.1.

Table 2.1. 24-Hour Rainfall Depths.

	2-Yr	5-Yr	10-Yr	25-Yr	100-Yr
Sedgwick	3.50	4.53	5.24	6.24	7.80

Time of Concentration

Time of concentration was calculated using the FAA method. Weighted curve numbers were calculated to represent the land usage of the basins. Calculations are in Appendix 2.6.

Table 2.2. Existing Times of Concentration and Curve Numbers

Basin Name	Area (ac)	T_c (min)	Curve Number
Watershed A	39.1	54.6	80.0
Watershed D	13.1	39.2	80.0

Curve Numbers

A weighted average of various land uses on site were used for each basin. The curve number used for pre-developed conditions is 80 for conditions. The curve numbers are shown in Table 2.2.

Drainage Patterns

The northern portion of the site drains from west to east into a roadside ditch along 159th Street North. This area is in Watershed D as shown on the Existing Conditions Map, Appendix 2.2. The southern portion of the site is part of Watershed A and drains from north to south. A portion of Watershed A, Watershed A1 drains into an existing pond constructed with the Monarch Landing Addition. The site is in Watershed A. Monarch Landing 3rd Addition lies in Watershed A2. Flow from these two sub-basins combines and flows into an existing 3'x4' RCB under 21st Street North. The flow in of the RCB is 1363.4 and the RCB was analyzed using Hydraflow Express by AutoCAD 2009, Appendix 2.7. Under existing conditions, the RCB overtops during a 100-year design storm.

Table 2.3. Pre-Development Flow Rates

Description	Design Storm Flows (cfs)				
	2-Yr	5-Yr	10-Yr	25-Yr	100-Yr
Watershed A	34.9	54.6	68.0	88.4	118.3
Watershed D	15.7	24.4	30.3	39.5	52.9

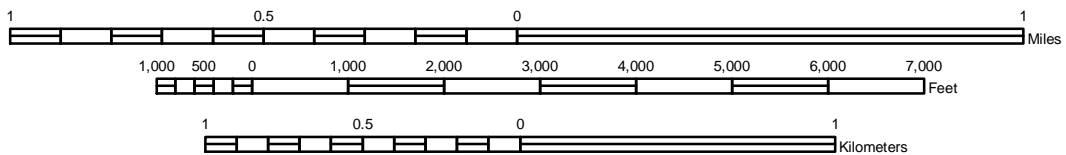
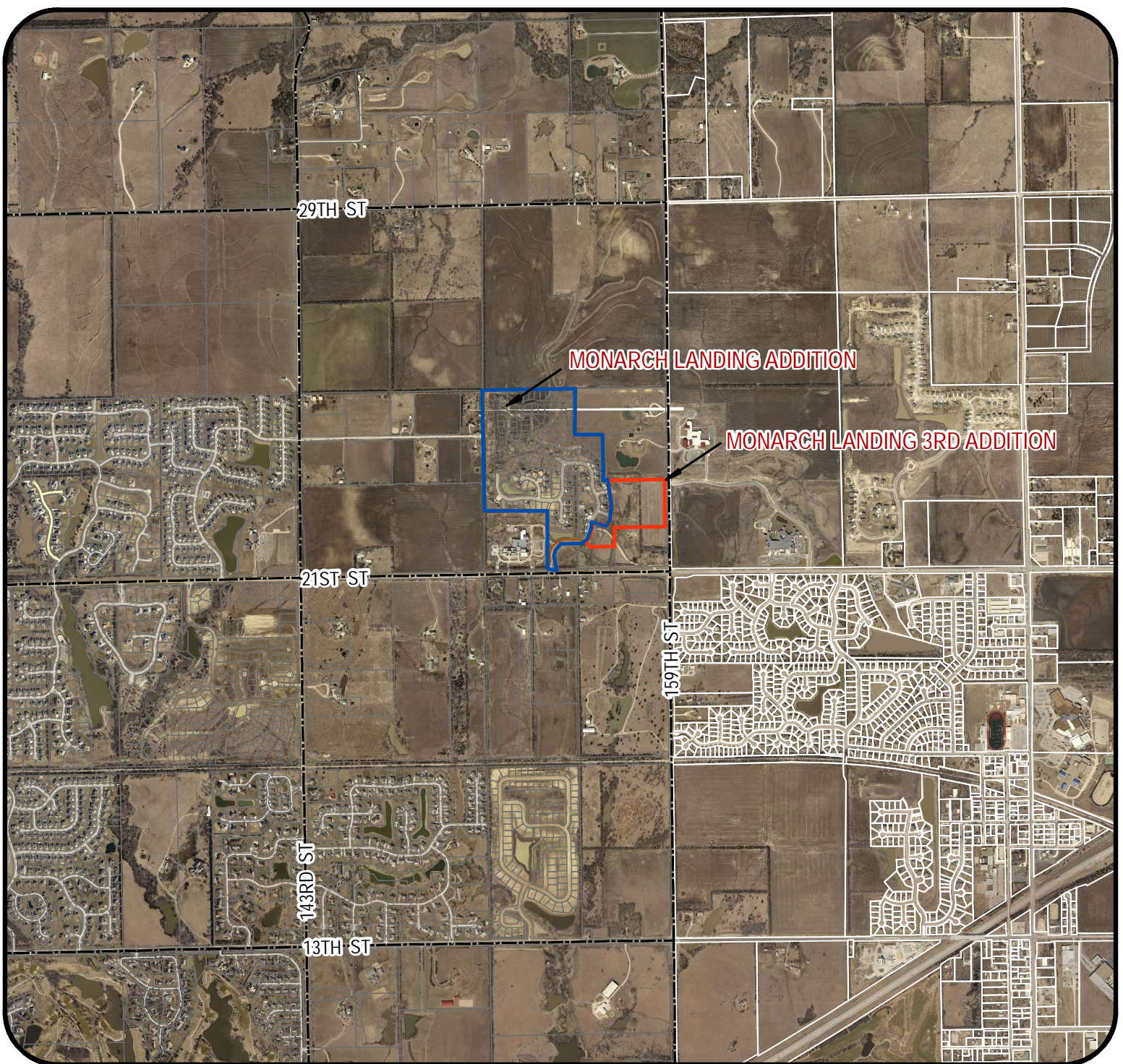
Utilities

A portion of the backyard stormwater sewer system was constructed with the Monarch Landing Addition. Connections to sanitary sewer and water were also constructed with the Monarch Landing Addition along the west side of the property.

Groundwater Elevations

According to the Kansas Water Well Records, the static water level in the area ranges from 18 feet to 60 feet deep.

Appendix 2.1
Aerial Photograph



J:\CIVIL\06201\DWG\drng\DRNG-AERIAL.mxd

MONARCH LANDING 3RD ADDITION

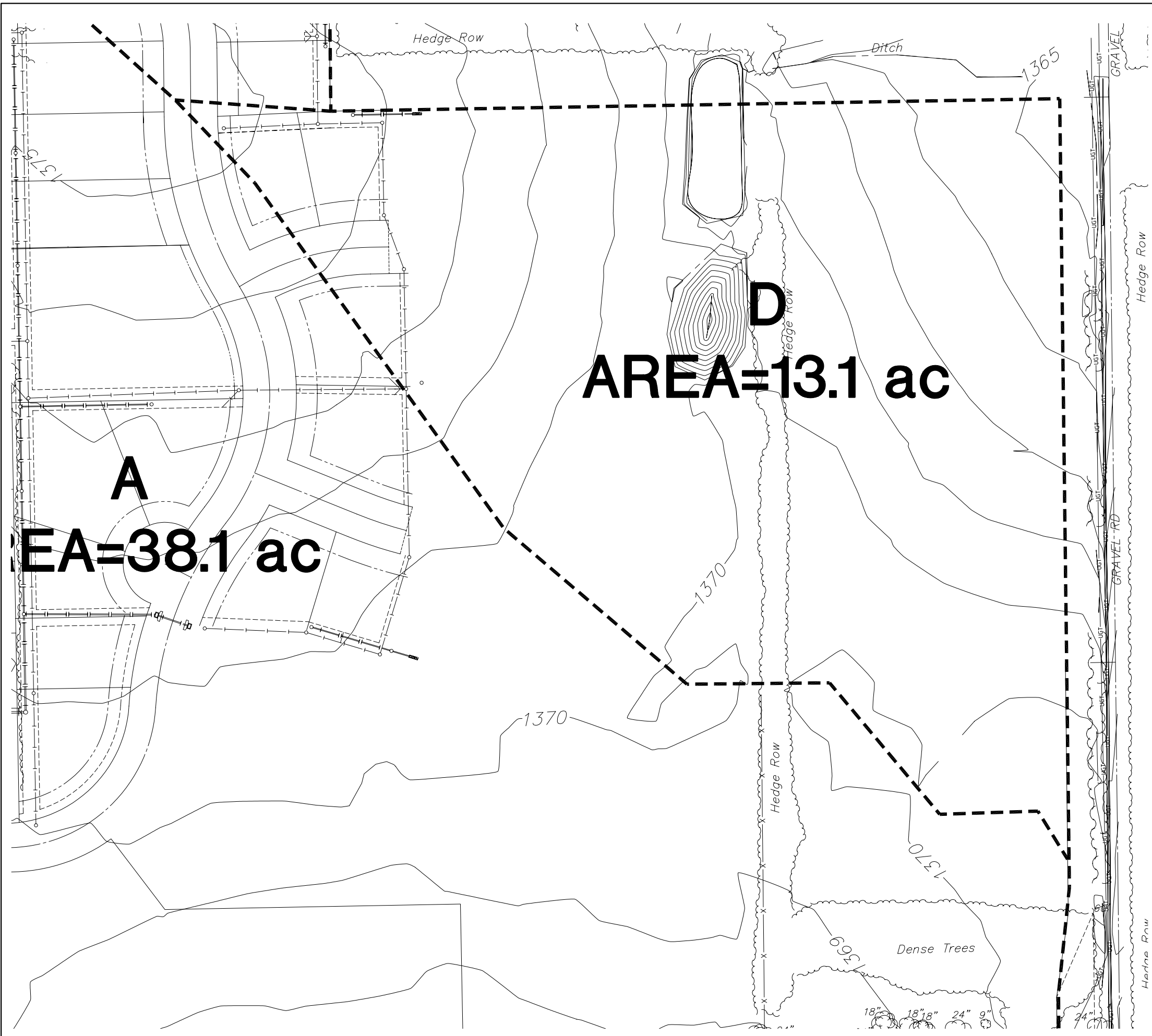
Project Name:
AERIAL - Sedgwick & Bulter County, KS
 Sheet Title:

CMJ
 Drawn By:
 KLA
 Design / Review:

MARCH 2010
 Date:
 06201
 Job No.:

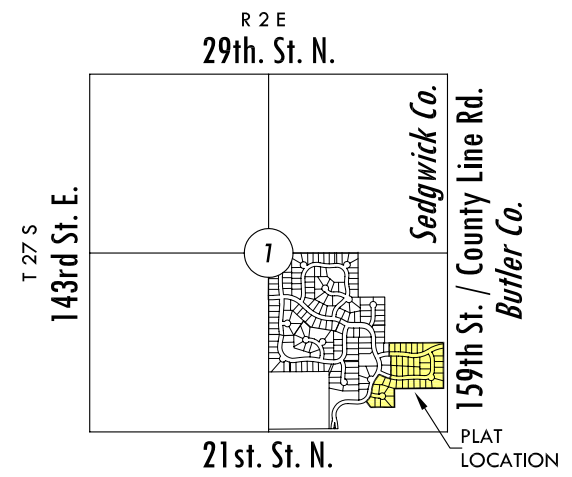
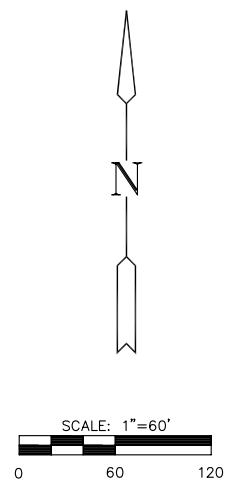
Appendix 2.2

Existing Conditions Map



LEGEND

- ⊗ - CONIFEROUS TREE
- - DECIDUOUS TREE
- ⊙ - SIGN
- ⊕ - POWER POLE
- ⊞ - ELECTRIC BOX
- ⊙ - LIGHT POLE
- ⊕ - FIRE HYDRANT
- ⊙ - WATER VALVE
- ⊙ - WATER METER
- ⊙ - SECTION CORNER
- ⊙ - BENCHMARK
- - - - - EASEMENT
- - - - - BUILDING SETBACK
- - - - - FENCE
- - - - - STORM SEWER PIPE
- - - - - WATER LINE
- - - - - SANITARY SEWER LINE
- - - - - GAS LINE
- - - - - GAS PIPELINE
- - - - - TELEPHONE LINE
- - - - - UNDERGROUND ELEC.
- - - - - OVERHEAD ELECTRIC
- - - - - FIBER OPTIC CABLE
- - - - - DRAINAGE SUB BASIN
- - - - - DRAINAGE BASIN
- - - - - FLOW ARROW
- - - - - AREA FOR SWS SIZING



VICINITY MAP

BENCH MARKS

- BM#2 Railroad spike in north side of power pole, 924' east and 50' south of the South Quarter corner, Sec. 1, T27S, R2E. Elev. = 1372.64 NGVD 29
- BM#5 Railroad spike in north side of power pole, 1040' west and 51' south of the southeast corner, Sec. 1, T27S, R2E. Elev. = 1368.50 NGVD 29

DATE	MARCH 2010
REVISED	

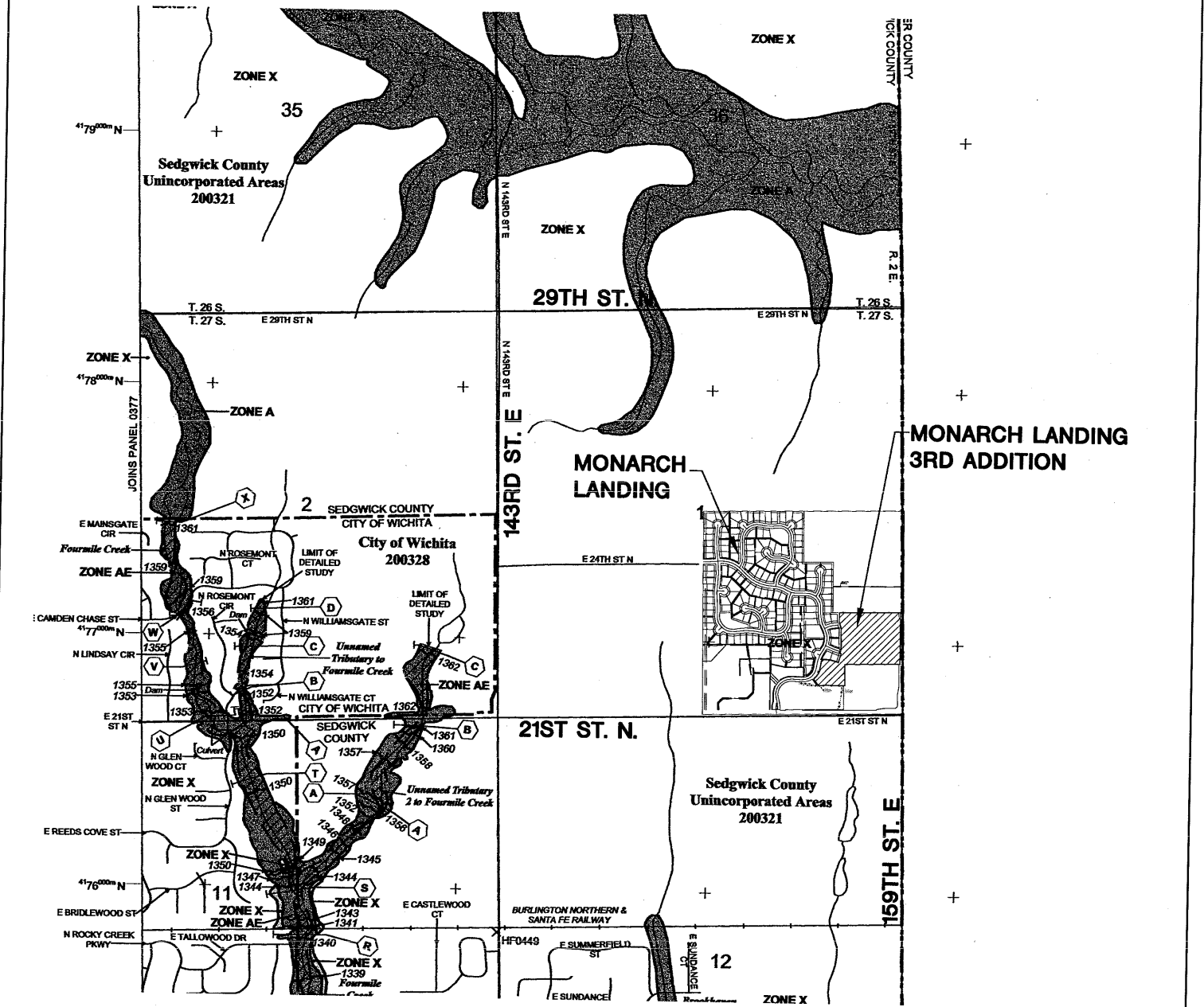
DESIGN BY	KLA
DRAWN BY	CMJ
CHECKED BY	GJA

SHEET NUMBER	1
--------------	---

J:\Civil\062010\dwg\3RD DRNG\062010_EXIST_COND.dwg

Appendix 2.3

Flood Insurance Rate Map (FIRM)



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0385E

FIRM
FLOOD INSURANCE RATE MAP

SEDGWICK COUNTY, KANSAS AND INCORPORATED AREAS

PANEL 385 OF 700
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

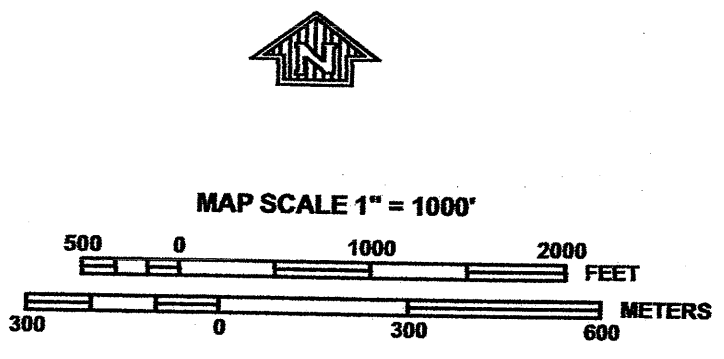
COMMUNITY	NUMBER	PANEL	SUFFIX
SEDGWICK COUNTY	200321	0385	E
WICHITA, CITY OF	200328	0385	E

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER 20173C0385E

EFFECTIVE DATE FEBRUARY 2, 2007

Federal Emergency Management Agency



MKEC
ENGINEERING CONSULTANTS, INC.

MONARCH LANDING 3RD ADDITION
PROJECT NAME

FIRM MAP
SEDGWICK & BUTLER COUNTY, KANSAS
SHEET TITLE

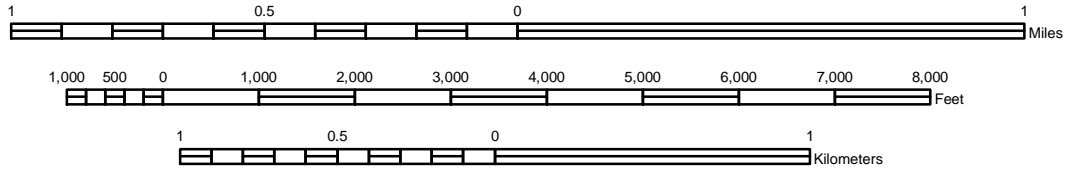
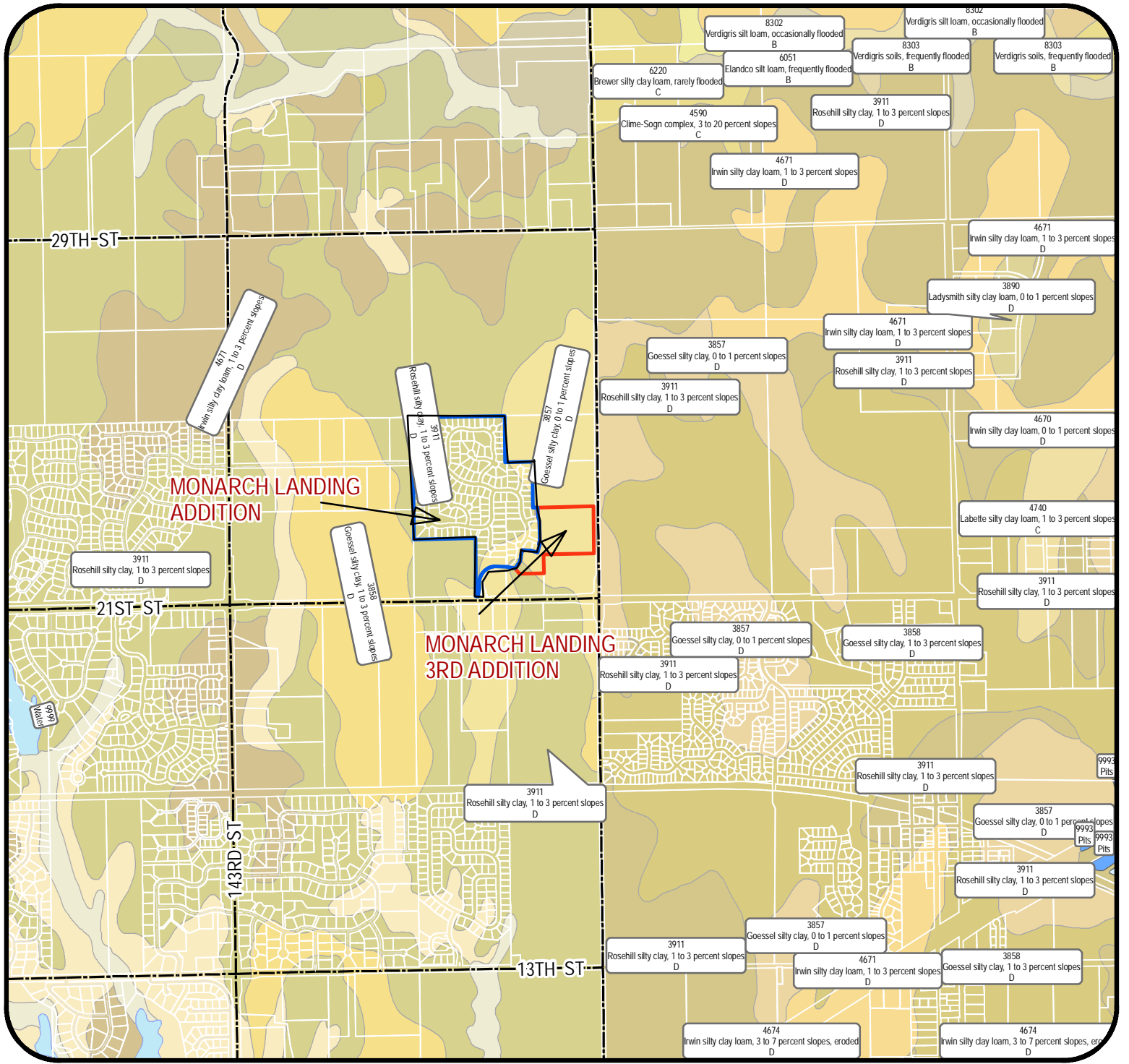
KLA DESIGN BY:	CMJ DRAWN BY:	GJA CHECKED BY:
MARCH 2010 DATE	06201 JOB NO.	1 / 1 SHEET/OF

411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

J:\Civil\06201\dwg\3RD\DRNG\FIRM

Appendix 2.4

Soil Survey



J:\Civil\106201\dwg\3rd\DRNG\ncrs-soll.mxd

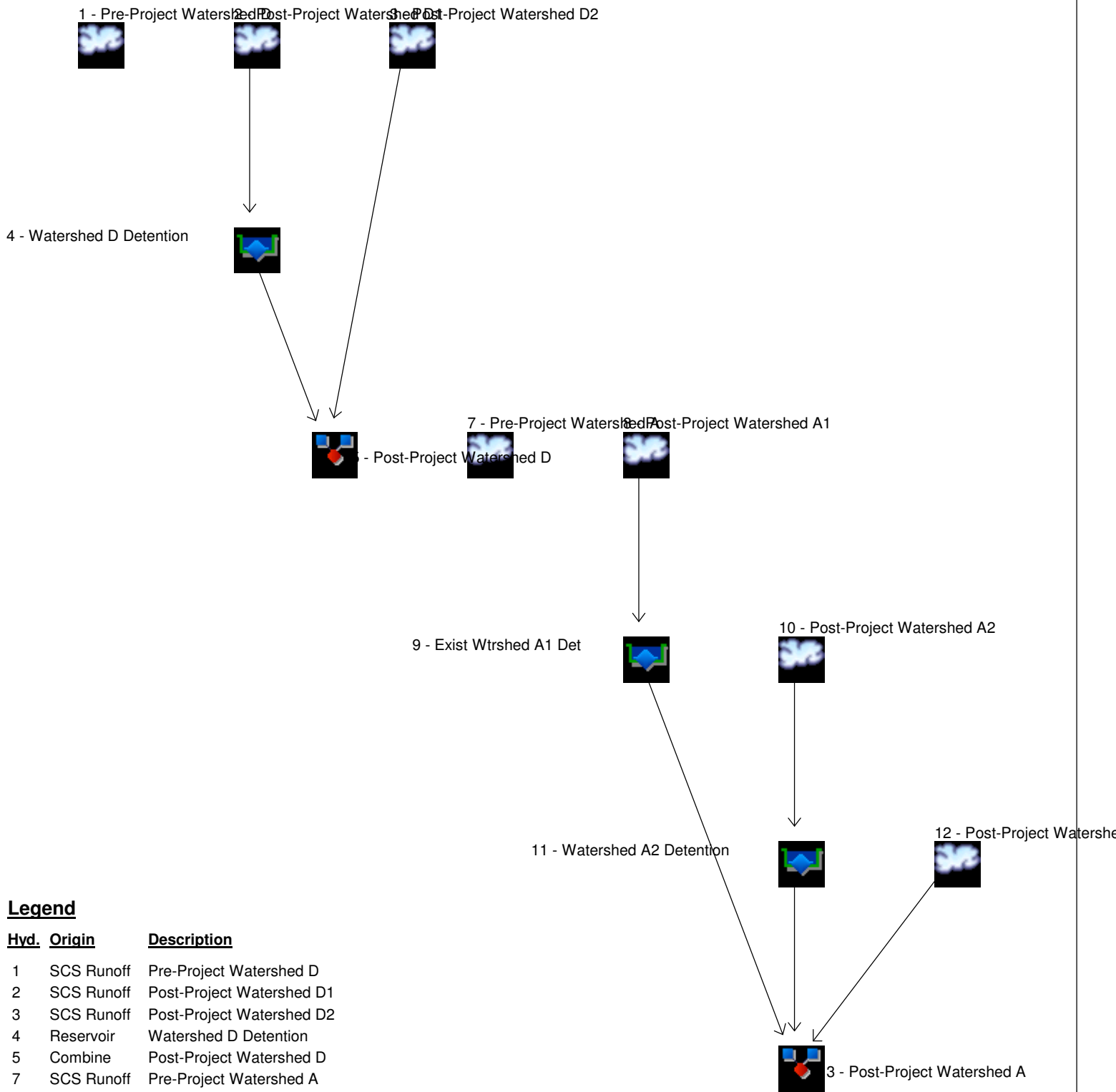
MONARCH LANDING 3RD ADDITION	
Project Name:	
Soil Survey - Sedgwick County, KS	
Sheet Title:	
	CMJ
	MARCH 2010
	Drawn By: KLA
Date: 06201	
Design / Review:	Job No.:

Appendix 2.5

Hydraflow Hydrographs Output

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066



Legend

Hyd.	Origin	Description
1	SCS Runoff	Pre-Project Watershed D
2	SCS Runoff	Post-Project Watershed D1
3	SCS Runoff	Post-Project Watershed D2
4	Reservoir	Watershed D Detention
5	Combine	Post-Project Watershed D
7	SCS Runoff	Pre-Project Watershed A
8	SCS Runoff	Post-Project Watershed A1
9	Reservoir	Exist Wtrshed A1 Det
10	SCS Runoff	Post-Project Watershed A2
11	Reservoir	Watershed A2 Detention
12	SCS Runoff	Post-Project Watershed A3
13	Combine	Post-Project Watershed A

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	-----	-----	15.65	-----	24.38	30.30	39.50	-----	52.87	Pre-Project Watershed D
2	SCS Runoff	-----	-----	18.22	-----	26.43	31.85	39.99	-----	51.57	Post-Project Watershed D1
3	SCS Runoff	-----	-----	2.637	-----	3.810	4.582	5.740	-----	7.386	Post-Project Watershed D2
4	Reservoir	2	-----	15.06	-----	23.65	29.32	37.45	-----	49.55	Watershed D Detention
5	Combine	3, 4	-----	15.52	-----	24.28	30.07	39.10	-----	51.64	Post-Project Watershed D
7	SCS Runoff	-----	-----	34.92	-----	54.62	67.99	88.43	-----	118.34	Pre-Project Watershed A
8	SCS Runoff	-----	-----	21.63	-----	31.61	38.29	48.35	-----	62.70	Post-Project Watershed A1
9	Reservoir	8	-----	1.928	-----	9.736	16.49	27.16	-----	38.75	Exist Wtrshed A1 Det
10	SCS Runoff	-----	-----	10.31	-----	14.63	17.46	21.70	-----	27.72	Post-Project Watershed A2
11	Reservoir	10	-----	4.702	-----	11.50	15.39	19.99	-----	26.73	Watershed A2 Detention
12	SCS Runoff	-----	-----	30.73	-----	41.25	48.09	58.29	-----	72.78	Post-Project Watershed A3
13	Combine	9, 11, 12	-----	34.55	-----	46.50	59.42	77.75	-----	106.54	Post-Project Watershed A

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	15.65	6	738	1.822	-----	-----	-----	Pre-Project Watershed D
2	SCS Runoff	18.22	6	732	2.102	-----	-----	-----	Post-Project Watershed D1
3	SCS Runoff	2.637	6	720	0.186	-----	-----	-----	Post-Project Watershed D2
4	Reservoir	15.06	6	744	2.102	2	1366.50	0.343	Watershed D Detention
5	Combine	15.52	6	744	2.288	3, 4	-----	-----	Post-Project Watershed D
7	SCS Runoff	34.92	6	750	5.280	-----	-----	-----	Pre-Project Watershed A
8	SCS Runoff	21.63	6	750	3.225	-----	-----	-----	Post-Project Watershed A1
9	Reservoir	1.928	6	900	3.063	8	1367.87	2.10	Exist Wtrshed A1 Det
10	SCS Runoff	10.31	6	732	1.190	-----	-----	-----	Post-Project Watershed A2
11	Reservoir	4.702	6	762	1.190	10	1367.85	0.315	Watershed A2 Detention
12	SCS Runoff	30.73	6	732	3.663	-----	-----	-----	Post-Project Watershed A3
13	Combine	34.55	6	732	7.916	9, 11, 12	-----	-----	Post-Project Watershed A
Monarch Landing 3rd.gpw					Return Period: 2 Year			Tuesday, Mar 30, 2010	

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	24.38	6	738	2.815	-----	-----	-----	Pre-Project Watershed D
2	SCS Runoff	26.43	6	732	3.055	-----	-----	-----	Post-Project Watershed D1
3	SCS Runoff	3.810	6	720	0.270	-----	-----	-----	Post-Project Watershed D2
4	Reservoir	23.65	6	744	3.055	2	1366.90	0.451	Watershed D Detention
5	Combine	24.28	6	744	3.325	3, 4	-----	-----	Post-Project Watershed D
7	SCS Runoff	54.62	6	750	8.160	-----	-----	-----	Pre-Project Watershed A
8	SCS Runoff	31.61	6	744	4.726	-----	-----	-----	Post-Project Watershed A1
9	Reservoir	9.736	6	798	4.564	8	1368.38	2.67	Exist Wtrshed A1 Det
10	SCS Runoff	14.63	6	732	1.700	-----	-----	-----	Post-Project Watershed A2
11	Reservoir	11.50	6	750	1.700	10	1368.11	0.387	Watershed A2 Detention
12	SCS Runoff	41.25	6	732	4.986	-----	-----	-----	Post-Project Watershed A3
13	Combine	46.50	6	744	11.250	9, 11, 12	-----	-----	Post-Project Watershed A
Monarch Landing 3rd.gpw					Return Period: 5 Year			Tuesday, Mar 30, 2010	

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	30.30	6	738	3.498	-----	-----	-----	Pre-Project Watershed D
2	SCS Runoff	31.85	6	732	3.693	-----	-----	-----	Post-Project Watershed D1
3	SCS Runoff	4.582	6	720	0.327	-----	-----	-----	Post-Project Watershed D2
4	Reservoir	29.32	6	744	3.693	2	1367.08	0.496	Watershed D Detention
5	Combine	30.07	6	744	4.020	3, 4	-----	-----	Post-Project Watershed D
7	SCS Runoff	67.99	6	750	10.140	-----	-----	-----	Pre-Project Watershed A
8	SCS Runoff	38.29	6	744	5.736	-----	-----	-----	Post-Project Watershed A1
9	Reservoir	16.49	6	792	5.573	8	1368.64	2.97	Exist Wtrshed A1 Det
10	SCS Runoff	17.46	6	732	2.039	-----	-----	-----	Post-Project Watershed A2
11	Reservoir	15.39	6	744	2.039	10	1368.18	0.410	Watershed A2 Detention
12	SCS Runoff	48.09	6	732	5.856	-----	-----	-----	Post-Project Watershed A3
13	Combine	59.42	6	738	13.468	9, 11, 12	-----	-----	Post-Project Watershed A
Monarch Landing 3rd.gpw					Return Period: 10 Year			Tuesday, Mar 30, 2010	

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	39.50	6	732	4.556	-----	-----	-----	Pre-Project Watershed D
2	SCS Runoff	39.99	6	732	4.666	-----	-----	-----	Post-Project Watershed D1
3	SCS Runoff	5.740	6	720	0.413	-----	-----	-----	Post-Project Watershed D2
4	Reservoir	37.45	6	738	4.666	2	1367.29	0.558	Watershed D Detention
5	Combine	39.10	6	738	5.079	3, 4	-----	-----	Post-Project Watershed D
7	SCS Runoff	88.43	6	750	13.206	-----	-----	-----	Pre-Project Watershed A
8	SCS Runoff	48.35	6	744	7.277	-----	-----	-----	Post-Project Watershed A1
9	Reservoir	27.16	6	780	7.114	8	1368.97	3.36	Exist Wtrshed A1 Det
10	SCS Runoff	21.70	6	732	2.554	-----	-----	-----	Post-Project Watershed A2
11	Reservoir	19.99	6	744	2.554	10	1368.30	0.441	Watershed A2 Detention
12	SCS Runoff	58.29	6	732	7.164	-----	-----	-----	Post-Project Watershed A3
13	Combine	77.75	6	738	16.832	9, 11, 12	-----	-----	Post-Project Watershed A
Monarch Landing 3rd.gpw					Return Period: 25 Year			Tuesday, Mar 30, 2010	

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	52.87	6	732	6.112	-----	-----	-----	Pre-Project Watershed D
2	SCS Runoff	51.57	6	732	6.074	-----	-----	-----	Post-Project Watershed D1
3	SCS Runoff	7.386	6	720	0.538	-----	-----	-----	Post-Project Watershed D2
4	Reservoir	49.55	6	738	6.074	2	1367.54	0.639	Watershed D Detention
5	Combine	51.64	6	738	6.612	3, 4	-----	-----	Post-Project Watershed D
7	SCS Runoff	118.34	6	744	17.718	-----	-----	-----	Pre-Project Watershed A
8	SCS Runoff	62.70	6	744	9.513	-----	-----	-----	Post-Project Watershed A1
9	Reservoir	38.75	6	774	9.350	8	1369.37	3.92	Exist Wtrshed A1 Det
10	SCS Runoff	27.72	6	732	3.297	-----	-----	-----	Post-Project Watershed A2
11	Reservoir	26.73	6	738	3.297	10	1368.40	0.478	Watershed A2 Detention
12	SCS Runoff	72.78	6	732	9.036	-----	-----	-----	Post-Project Watershed A3
13	Combine	106.54	6	738	21.683	9, 11, 12	-----	-----	Post-Project Watershed A
Monarch Landing 3rd.gpw					Return Period: 100 Year			Tuesday, Mar 30, 2010	

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

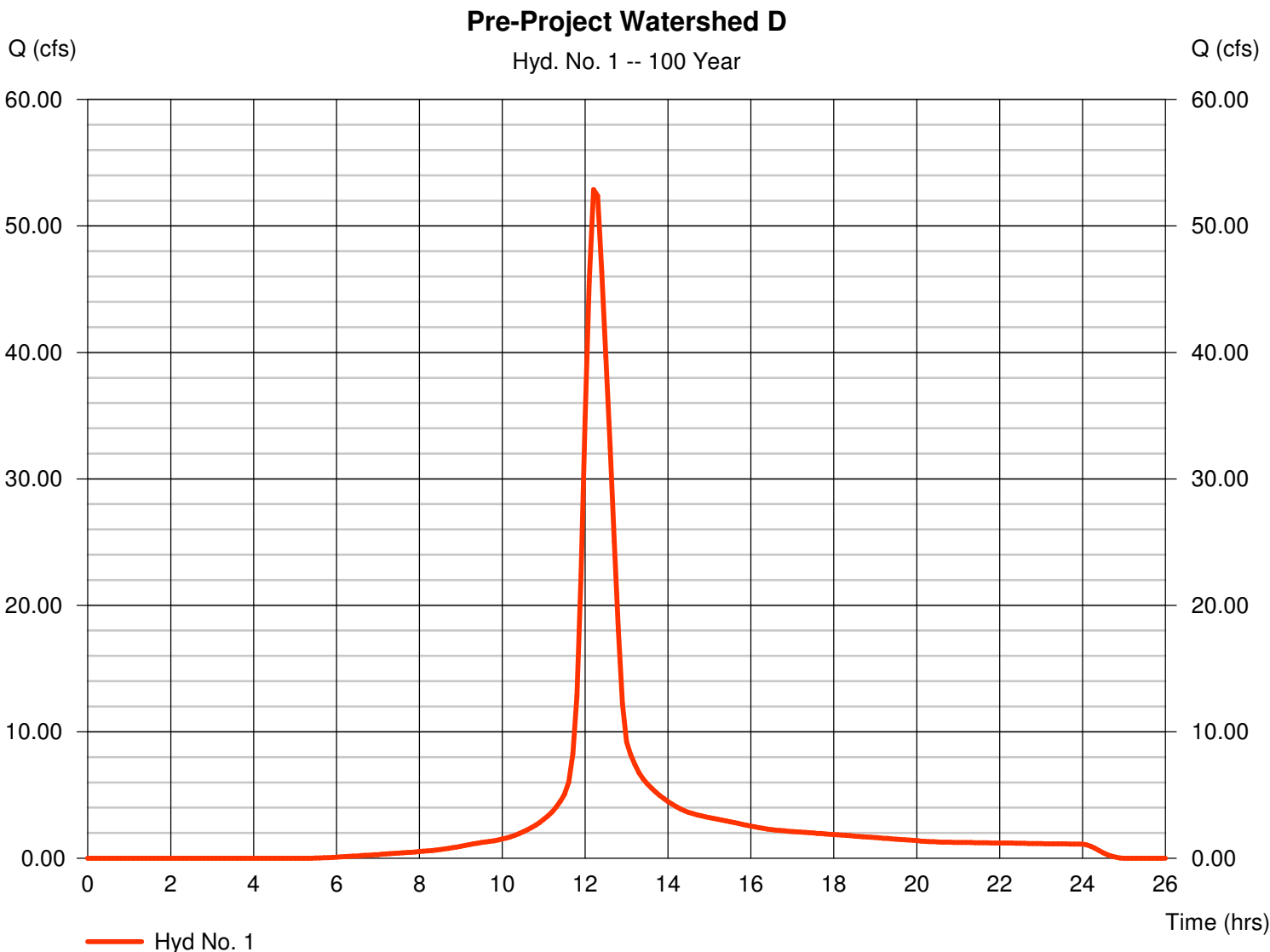
Tuesday, Mar 30, 2010

Hyd. No. 1

Pre-Project Watershed D

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 6 min
 Drainage area = 13.080 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

Peak discharge = 52.87 cfs
 Time to peak = 12.20 hrs
 Hyd. volume = 6.112 acft
 Curve number = 80
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 39.20 min
 Distribution = Type II
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

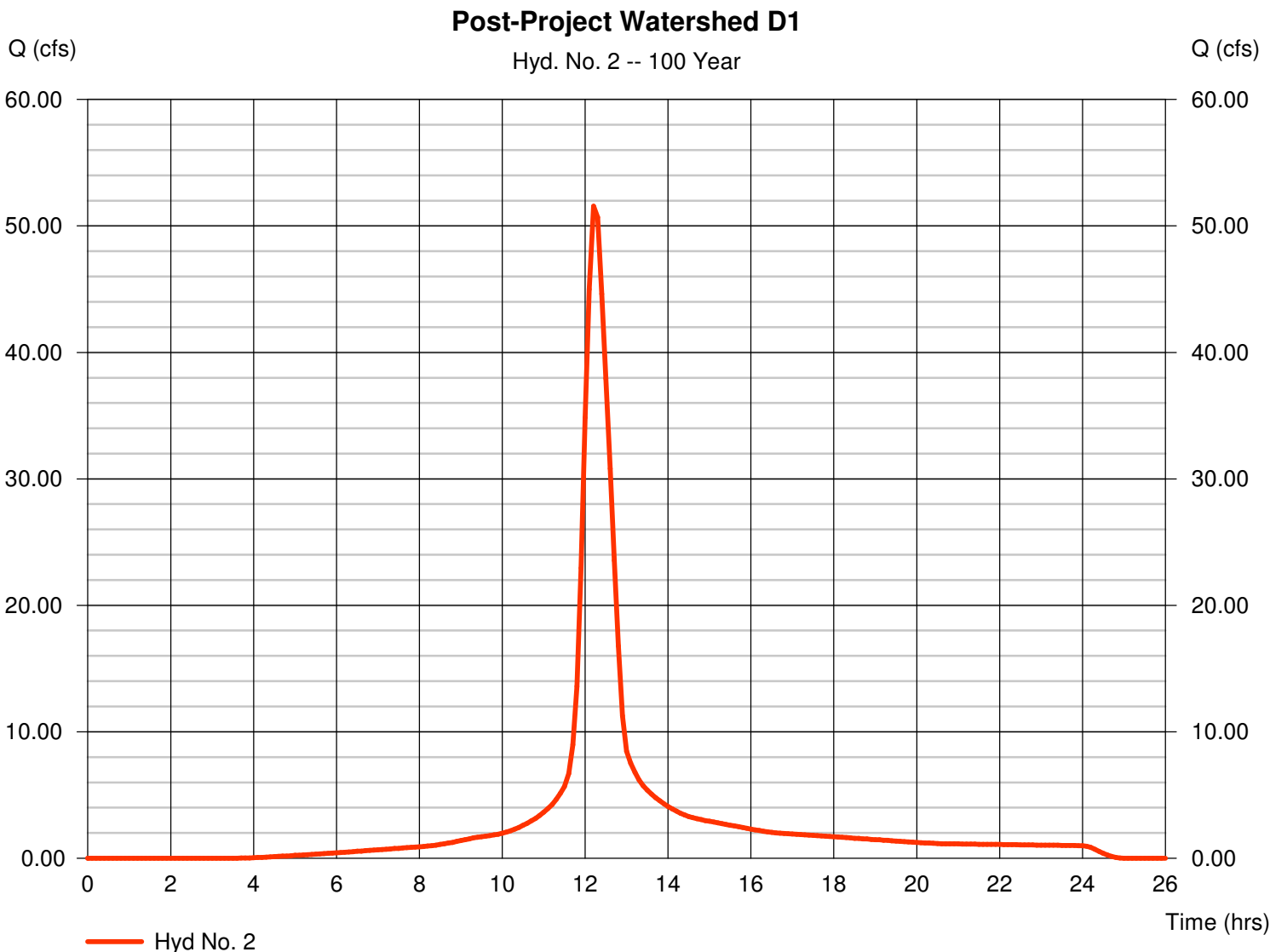
Tuesday, Mar 30, 2010

Hyd. No. 2

Post-Project Watershed D1

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 6 min
 Drainage area = 11.300 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

Peak discharge = 51.57 cfs
 Time to peak = 12.20 hrs
 Hyd. volume = 6.074 acft
 Curve number = 87
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 36.80 min
 Distribution = Type II
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

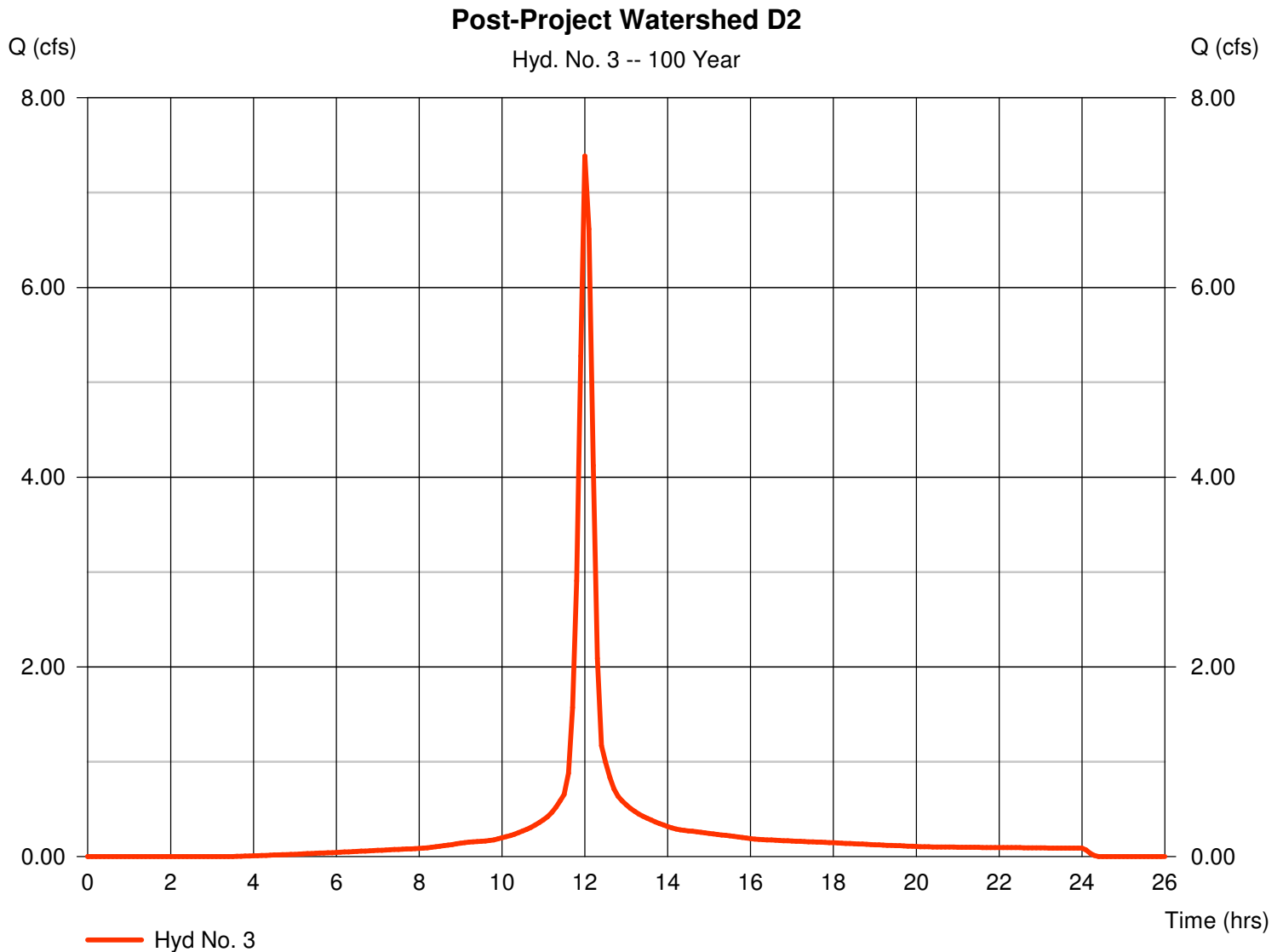
Tuesday, Mar 30, 2010

Hyd. No. 3

Post-Project Watershed D2

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 6 min
 Drainage area = 1.100 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

Peak discharge = 7.386 cfs
 Time to peak = 12.00 hrs
 Hyd. volume = 0.538 acft
 Curve number = 87
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 15.00 min
 Distribution = Type II
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

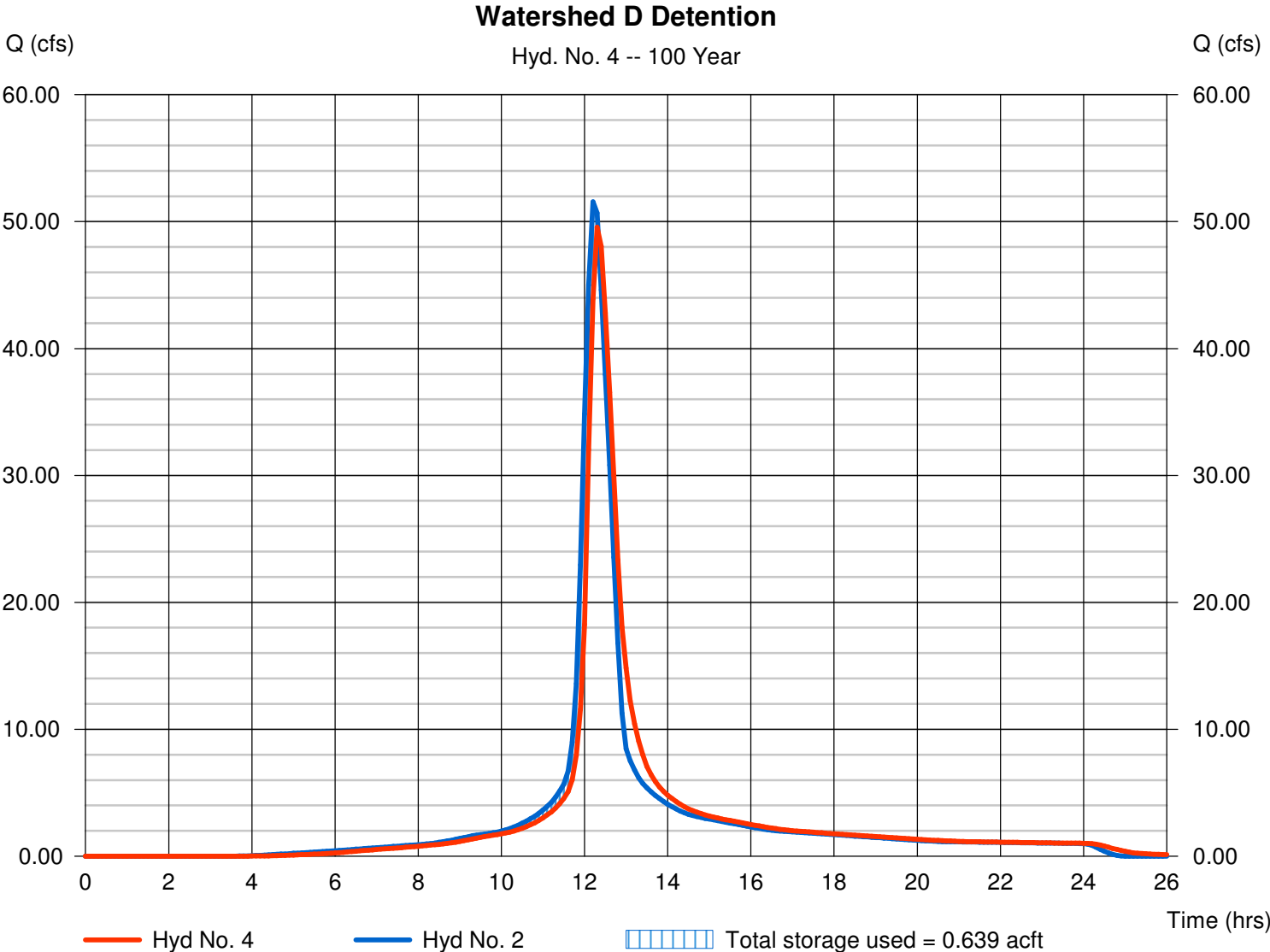
Tuesday, Mar 30, 2010

Hyd. No. 4

Watershed D Detention

Hydrograph type	= Reservoir	Peak discharge	= 49.55 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.30 hrs
Time interval	= 6 min	Hyd. volume	= 6.074 acft
Inflow hyd. No.	= 2 - Post-Project Watershed D1	Max. Elevation	= 1367.54 ft
Reservoir name	= Watershed D Detention	Max. Storage	= 0.639 acft

Storage Indication method used.



Pond Report

Pond No. 1 - Watershed D Detention

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Beginning Elevation = 1365.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	1365.00	8,475	0.000	0.000
1.00	1366.00	10,381	0.216	0.216
2.00	1367.00	12,420	0.261	0.477
3.00	1368.00	14,593	0.310	0.787

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.50	6.50	0.00	0.00
Crest El. (ft)	= 1365.00	1366.70	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Rect	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000	(by Wet area)		
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	1365.00	---	---	---	---	0.00	0.00	---	---	---	---	0.000
0.10	0.022	1365.10	---	---	---	---	0.26	0.00	---	---	---	---	0.263
0.20	0.043	1365.20	---	---	---	---	0.74	0.00	---	---	---	---	0.744
0.30	0.065	1365.30	---	---	---	---	1.37	0.00	---	---	---	---	1.367
0.40	0.086	1365.40	---	---	---	---	2.11	0.00	---	---	---	---	2.105
0.50	0.108	1365.50	---	---	---	---	2.94	0.00	---	---	---	---	2.942
0.60	0.130	1365.60	---	---	---	---	3.87	0.00	---	---	---	---	3.868
0.70	0.151	1365.70	---	---	---	---	4.87	0.00	---	---	---	---	4.874
0.80	0.173	1365.80	---	---	---	---	5.95	0.00	---	---	---	---	5.955
0.90	0.194	1365.90	---	---	---	---	7.11	0.00	---	---	---	---	7.105
1.00	0.216	1366.00	---	---	---	---	8.33	0.00	---	---	---	---	8.325
1.10	0.242	1366.10	---	---	---	---	9.60	0.00	---	---	---	---	9.604
1.20	0.268	1366.20	---	---	---	---	10.94	0.00	---	---	---	---	10.94
1.30	0.294	1366.30	---	---	---	---	12.34	0.00	---	---	---	---	12.34
1.40	0.321	1366.40	---	---	---	---	13.79	0.00	---	---	---	---	13.79
1.50	0.347	1366.50	---	---	---	---	15.29	0.00	---	---	---	---	15.29
1.60	0.373	1366.60	---	---	---	---	16.85	0.00	---	---	---	---	16.85
1.70	0.399	1366.70	---	---	---	---	18.45	0.00	---	---	---	---	18.45
1.80	0.425	1366.80	---	---	---	---	20.10	0.68	---	---	---	---	20.78
1.90	0.451	1366.90	---	---	---	---	21.80	1.93	---	---	---	---	23.73
2.00	0.477	1367.00	---	---	---	---	23.55	3.56	---	---	---	---	27.10
2.10	0.508	1367.10	---	---	---	---	25.33	5.48	---	---	---	---	30.81
2.20	0.539	1367.20	---	---	---	---	27.16	7.65	---	---	---	---	34.82
2.30	0.570	1367.30	---	---	---	---	29.04	10.06	---	---	---	---	39.10
2.40	0.601	1367.40	---	---	---	---	30.95	12.68	---	---	---	---	43.63
2.50	0.632	1367.50	---	---	---	---	32.91	15.49	---	---	---	---	48.39
2.60	0.663	1367.60	---	---	---	---	34.90	18.48	---	---	---	---	53.38
2.70	0.694	1367.70	---	---	---	---	36.93	21.64	---	---	---	---	58.57
2.80	0.725	1367.80	---	---	---	---	39.00	24.97	---	---	---	---	63.97
2.90	0.756	1367.90	---	---	---	---	41.11	28.45	---	---	---	---	69.56
3.00	0.787	1368.00	---	---	---	---	43.26	32.08	---	---	---	---	75.34

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

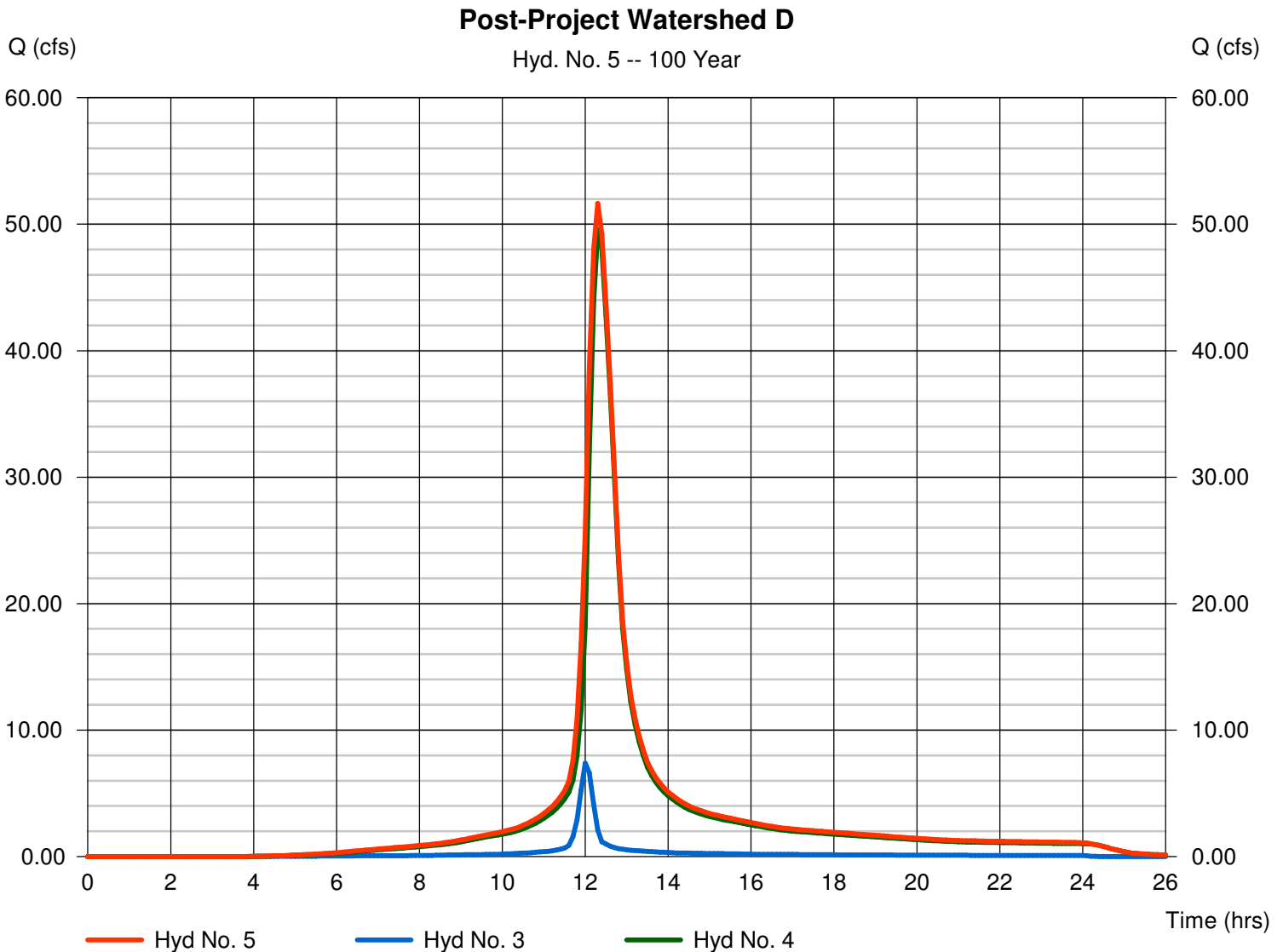
Tuesday, Mar 30, 2010

Hyd. No. 5

Post-Project Watershed D

Hydrograph type = Combine
 Storm frequency = 100 yrs
 Time interval = 6 min
 Inflow hyds. = 3, 4

Peak discharge = 51.64 cfs
 Time to peak = 12.30 hrs
 Hyd. volume = 6.612 acft
 Contrib. drain. area = 1.100 ac



Hydrograph Report

Hyd. No. 7

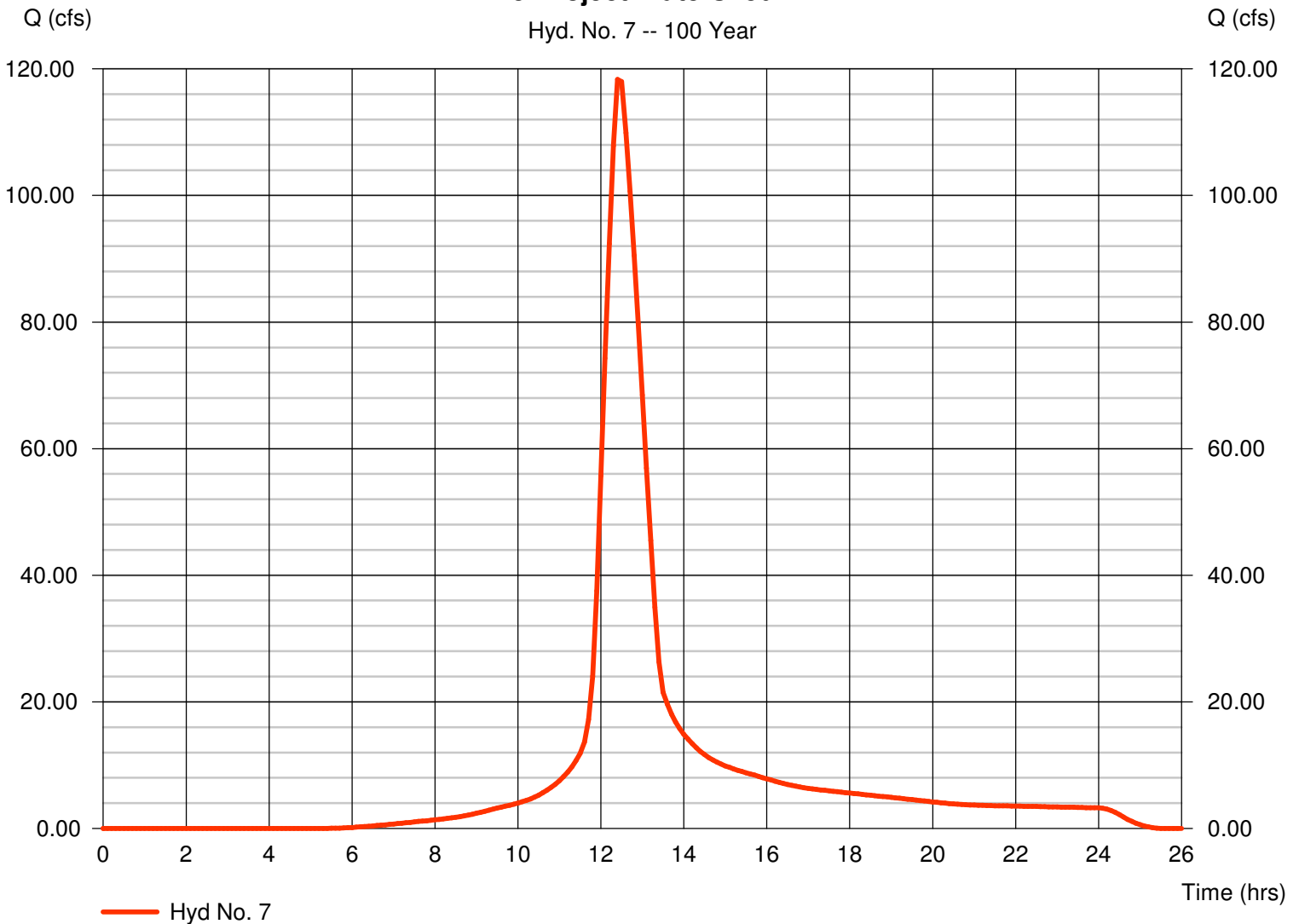
Pre-Project Watershed A

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 6 min
Drainage area = 39.100 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 7.80 in
Storm duration = 24 hrs

Peak discharge = 118.34 cfs
Time to peak = 12.40 hrs
Hyd. volume = 17.718 acft
Curve number = 80
Hydraulic length = 0 ft
Time of conc. (Tc) = 54.60 min
Distribution = Type II
Shape factor = 484

Pre-Project Watershed A

Hyd. No. 7 -- 100 Year



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

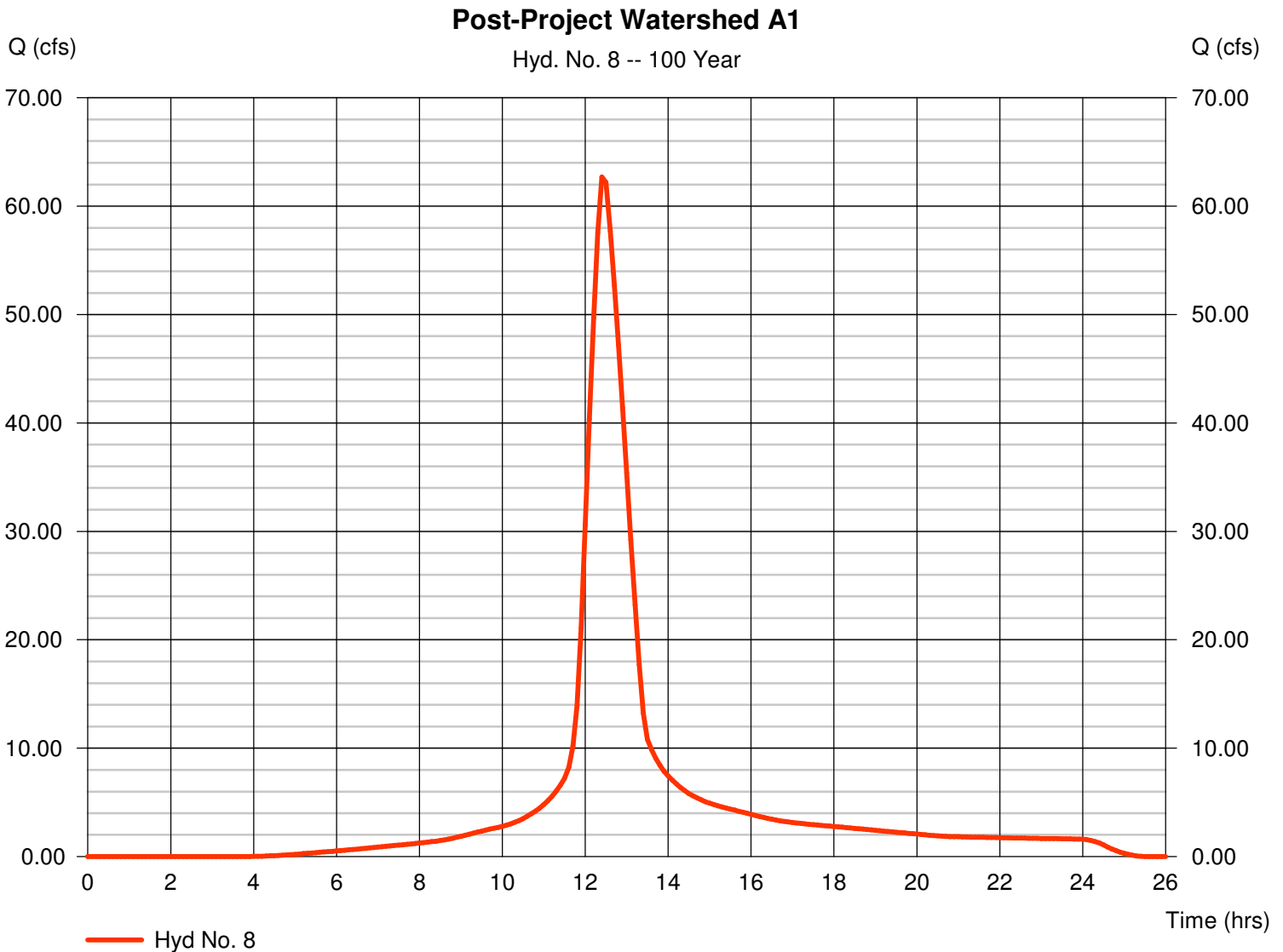
Tuesday, Mar 30, 2010

Hyd. No. 8

Post-Project Watershed A1

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 6 min
 Drainage area = 18.600 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

Peak discharge = 62.70 cfs
 Time to peak = 12.40 hrs
 Hyd. volume = 9.513 acft
 Curve number = 86
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 55.80 min
 Distribution = Type II
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

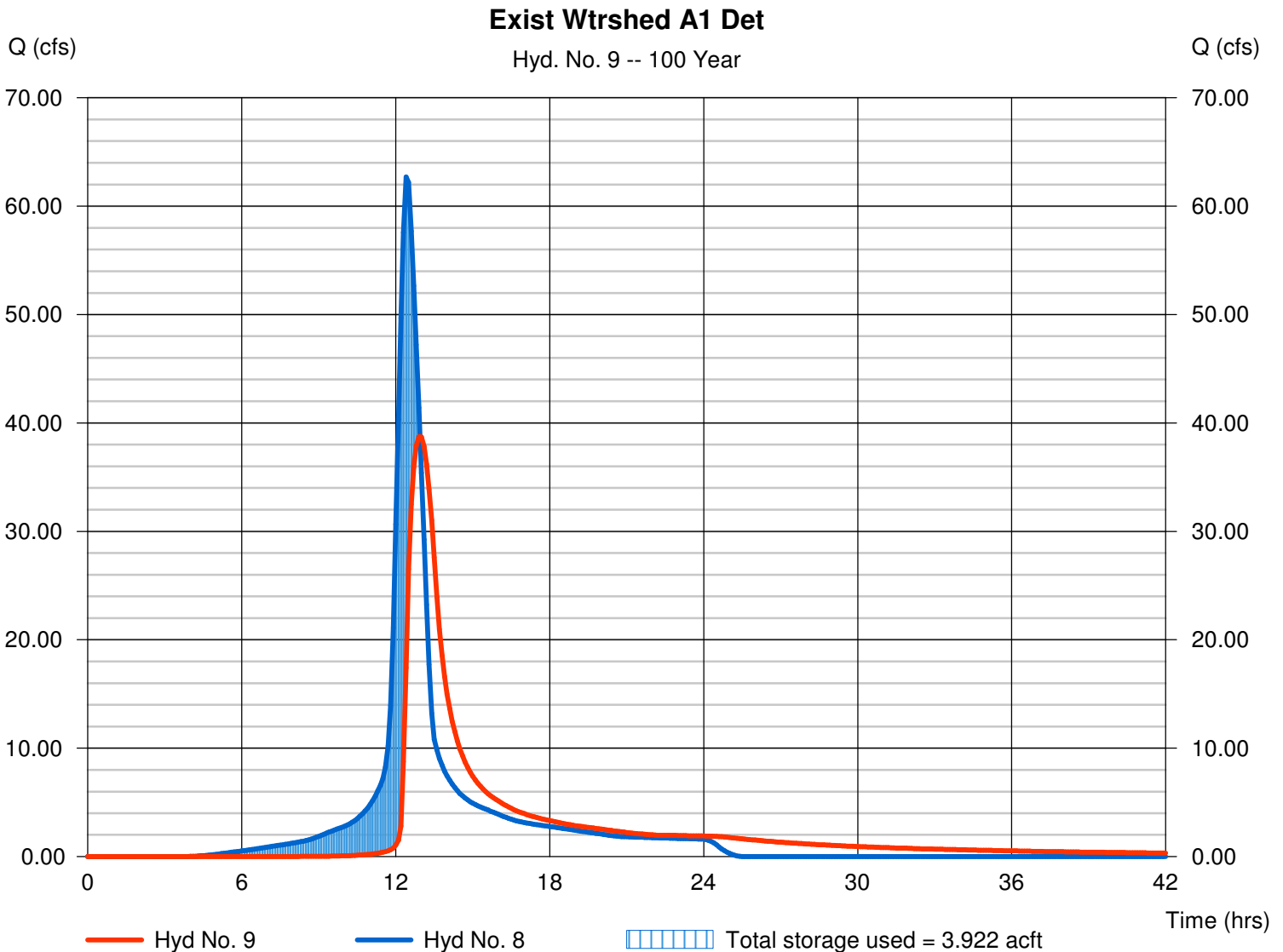
Tuesday, Mar 30, 2010

Hyd. No. 9

Exist Wtrshed A1 Det

Hydrograph type	= Reservoir	Peak discharge	= 38.75 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.90 hrs
Time interval	= 6 min	Hyd. volume	= 9.350 acft
Inflow hyd. No.	= 8 - Post-Project Watershed A1	Max. Elevation	= 1369.37 ft
Reservoir name	= Existing Detention Pond	Max. Storage	= 3.922 acft

Storage Indication method used.



Pond Report

Pond No. 2 - Existing Detention Pond

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Beginning Elevation = 1365.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	1365.50	31,608	0.000	0.000
0.50	1366.00	33,332	0.373	0.373
1.50	1367.00	40,392	0.845	1.217
2.50	1368.00	47,273	1.005	2.223
3.50	1369.00	55,038	1.173	3.396
4.50	1370.00	71,886	1.452	4.848

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 2	0	0	0
Invert El. (ft)	= 1365.50	0.00	0.00	0.00
Length (ft)	= 115.00	0.00	0.00	0.00
Slope (%)	= 0.24	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 6.00	0.00	0.00	0.00
Crest El. (ft)	= 1367.90	1365.50	0.00	0.00
Weir Coeff.	= 3.33	0.22	3.33	3.33
Weir Type	= Rect	10 degV	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000	(by Wet area)		
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	1365.50	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.05	0.037	1365.55	0.00	---	---	---	0.00	0.00	---	---	---	---	0.000
0.10	0.075	1365.60	0.00	---	---	---	0.00	0.00	---	---	---	---	0.001
0.15	0.112	1365.65	0.00	---	---	---	0.00	0.00	---	---	---	---	0.002
0.20	0.149	1365.70	0.00	---	---	---	0.00	0.00	---	---	---	---	0.004
0.25	0.186	1365.75	0.00	---	---	---	0.00	0.01	---	---	---	---	0.007
0.30	0.224	1365.80	0.00	---	---	---	0.00	0.01	---	---	---	---	0.011
0.35	0.261	1365.85	0.00	---	---	---	0.00	0.02	---	---	---	---	0.016
0.40	0.298	1365.90	0.00	---	---	---	0.00	0.02	---	---	---	---	0.023
0.45	0.335	1365.95	0.00	---	---	---	0.00	0.03	---	---	---	---	0.030
0.50	0.373	1366.00	0.00	---	---	---	0.00	0.04	---	---	---	---	0.039
0.60	0.457	1366.10	0.00	---	---	---	0.00	0.06	---	---	---	---	0.062
0.70	0.542	1366.20	0.00	---	---	---	0.00	0.09	---	---	---	---	0.091
0.80	0.626	1366.30	0.00	---	---	---	0.00	0.13	---	---	---	---	0.127
0.90	0.711	1366.40	0.00	---	---	---	0.00	0.17	---	---	---	---	0.171
1.00	0.795	1366.50	0.00	---	---	---	0.00	0.22	---	---	---	---	0.222
1.10	0.880	1366.60	0.00	---	---	---	0.00	0.28	---	---	---	---	0.282
1.20	0.964	1366.70	0.00	---	---	---	0.00	0.35	---	---	---	---	0.350
1.30	1.049	1366.80	0.00	---	---	---	0.00	0.43	---	---	---	---	0.428
1.40	1.133	1366.90	0.00	---	---	---	0.00	0.51	---	---	---	---	0.515
1.50	1.217	1367.00	0.00	---	---	---	0.00	0.61	---	---	---	---	0.612
1.60	1.318	1367.10	0.00	---	---	---	0.00	0.72	---	---	---	---	0.719
1.70	1.419	1367.20	0.00	---	---	---	0.00	0.84	---	---	---	---	0.836
1.80	1.519	1367.30	0.00	---	---	---	0.00	0.96	---	---	---	---	0.965
1.90	1.620	1367.40	0.00	---	---	---	0.00	1.10	---	---	---	---	1.105
2.00	1.720	1367.50	0.00	---	---	---	0.00	1.26	---	---	---	---	1.256
2.10	1.821	1367.60	0.00	---	---	---	0.00	1.42	---	---	---	---	1.418
2.20	1.921	1367.70	0.00	---	---	---	0.00	1.59	---	---	---	---	1.593
2.30	2.022	1367.80	0.00	---	---	---	0.00	1.78	---	---	---	---	1.781
2.40	2.122	1367.90	0.00	---	---	---	0.00	1.98	---	---	---	---	1.981
2.50	2.223	1368.00	0.67 oc	---	---	---	0.63	2.19	---	---	---	---	2.825
2.60	2.340	1368.10	1.84 oc	---	---	---	1.79	2.42	---	---	---	---	4.206
2.70	2.457	1368.20	3.29 oc	---	---	---	3.28	2.66	---	---	---	---	5.941
2.80	2.575	1368.30	5.13 oc	---	---	---	5.05	2.91	---	---	---	---	7.965
2.90	2.692	1368.40	7.22 oc	---	---	---	7.06	3.18	---	---	---	---	10.24
3.00	2.809	1368.50	9.37 oc	---	---	---	9.28	3.46	---	---	---	---	12.74
3.10	2.926	1368.60	11.72 oc	---	---	---	11.70	3.76	---	---	---	---	15.45
3.20	3.044	1368.70	14.32 oc	---	---	---	14.29	4.07	---	---	---	---	18.36

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Existing Detention Pond

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
3.30	3.161	1368.80	17.06 oc	---	---	---	17.05	4.39	---	---	---	---	21.44
3.40	3.278	1368.90	19.97 oc	---	---	---	19.97	4.73	---	---	---	---	24.70
3.50	3.396	1369.00	23.05 oc	---	---	---	23.05	5.09	---	---	---	---	28.14
3.60	3.541	1369.10	26.02 oc	---	---	---	26.02 s	5.46	---	---	---	---	31.47
3.70	3.686	1369.20	28.56 oc	---	---	---	28.56 s	5.85	---	---	---	---	34.41
3.80	3.831	1369.30	30.89 oc	---	---	---	30.89 s	6.25	---	---	---	---	37.14
3.90	3.977	1369.40	33.04 oc	---	---	---	33.04 s	6.67	---	---	---	---	39.71
4.00	4.122	1369.50	35.04 oc	---	---	---	35.04 s	7.10	---	---	---	---	42.15
4.10	4.267	1369.60	36.91 oc	---	---	---	36.90 s	7.56	---	---	---	---	44.46
4.20	4.412	1369.70	38.64 oc	---	---	---	38.64 s	8.02	---	---	---	---	46.67
4.30	4.558	1369.80	40.28 oc	---	---	---	40.28 s	8.51	---	---	---	---	48.79
4.40	4.703	1369.90	41.81 oc	---	---	---	41.81 s	9.01	---	---	---	---	50.82
4.50	4.848	1370.00	43.26 oc	---	---	---	43.26 s	9.54	---	---	---	---	52.80

...End

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

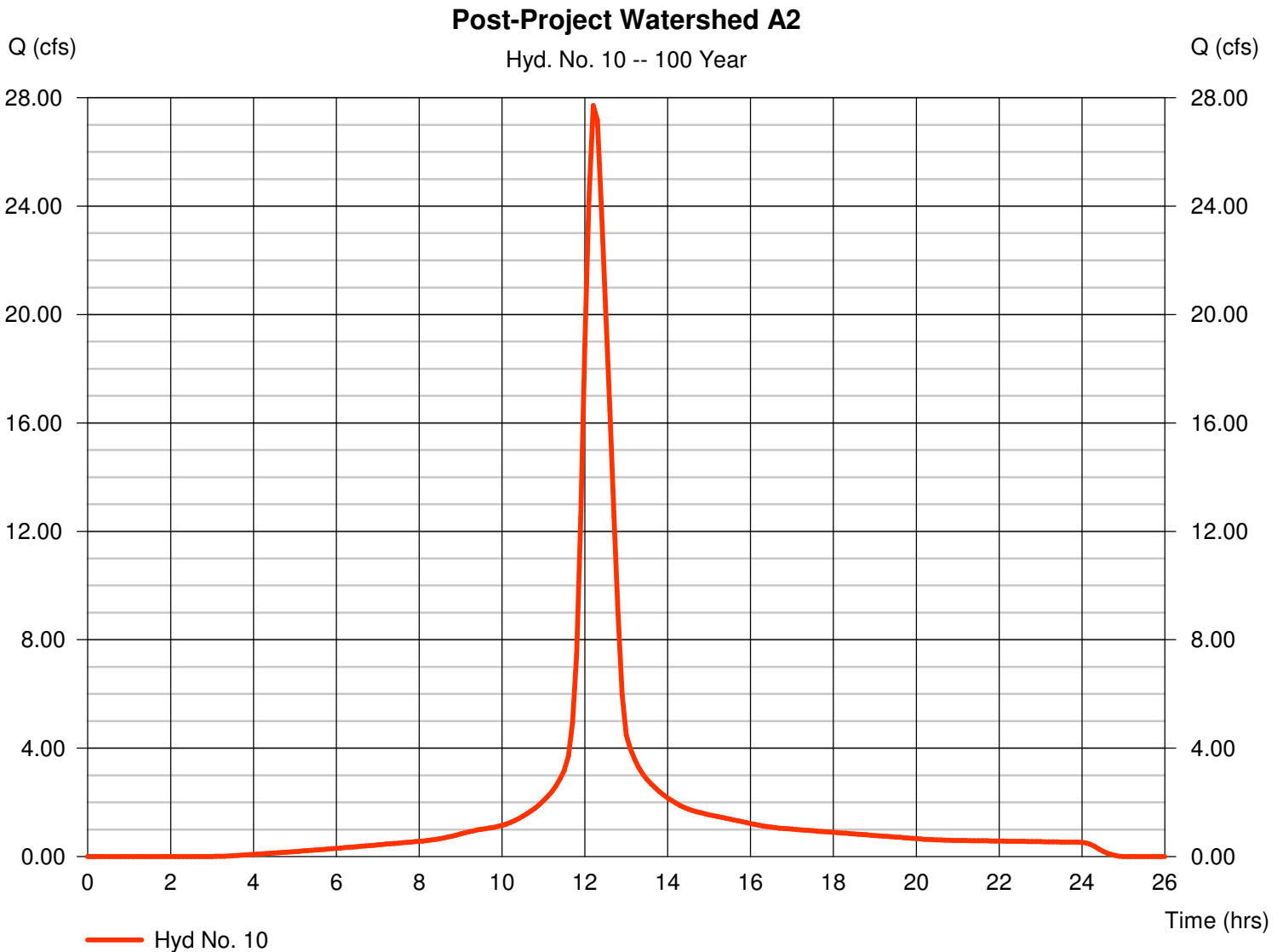
Tuesday, Mar 30, 2010

Hyd. No. 10

Post-Project Watershed A2

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 6 min
 Drainage area = 5.900 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 7.80 in
 Storm duration = 24 hrs

Peak discharge = 27.72 cfs
 Time to peak = 12.20 hrs
 Hyd. volume = 3.297 acft
 Curve number = 89.1
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 32.80 min
 Distribution = Type II
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Tuesday, Mar 30, 2010

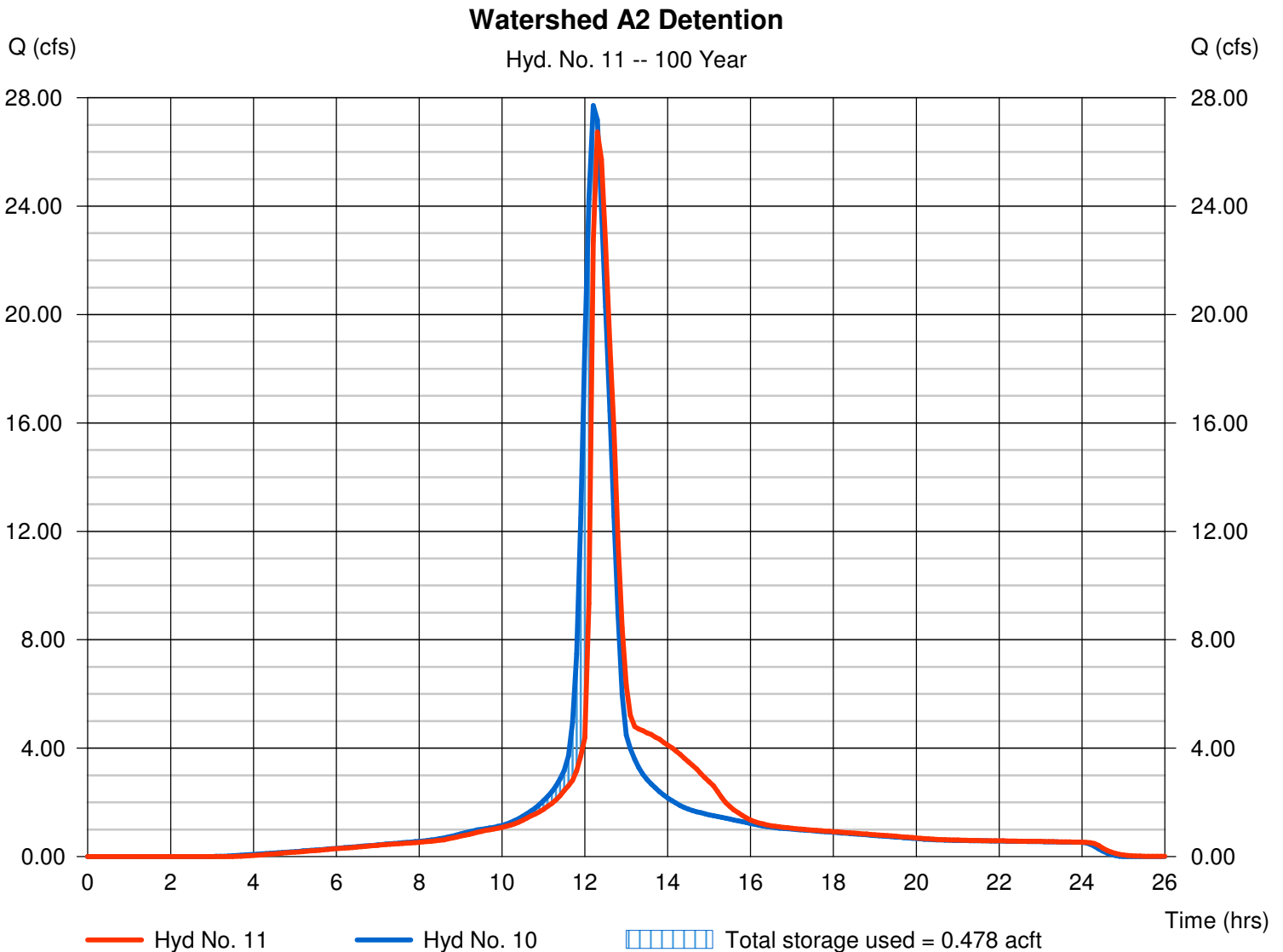
Hyd. No. 11

Watershed A2 Detention

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 6 min
Inflow hyd. No. = 10 - Post-Project Watershed A2
Reservoir name = Watershed A2 Detention

Peak discharge = 26.73 cfs
Time to peak = 12.30 hrs
Hyd. volume = 3.297 acft
Max. Elevation = 1368.40 ft
Max. Storage = 0.478 acft

Storage Indication method used.



Pond Report

Pond No. 3 - Watershed A2 Detention

Pond Data

Trapezoid - Bottom L x W = 600.0 x 0.1 ft, Side slope = 4.00:1, Bottom elev. = 1365.50 ft, Depth = 3.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	1365.50	60	0.000	0.000
0.35	1365.85	1,748	0.007	0.007
0.70	1366.20	3,452	0.021	0.028
1.05	1366.55	5,171	0.035	0.063
1.40	1366.90	6,907	0.049	0.111
1.75	1367.25	8,657	0.063	0.174
2.10	1367.60	10,424	0.077	0.250
2.45	1367.95	12,206	0.091	0.341
2.80	1368.30	14,004	0.105	0.447
3.15	1368.65	15,818	0.120	0.566
3.50	1369.00	17,647	0.134	0.701

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 30.00	12.00	0.00	0.00
Span (in)	= 30.00	12.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 1365.50	1365.50	0.00	0.00
Length (ft)	= 50.00	1.00	0.00	0.00
Slope (%)	= 0.20	0.20	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 25.00	Inactive	0.00	0.00
Crest El. (ft)	= 1367.90	1365.50	0.00	0.00
Weir Coeff.	= 3.33	0.33	3.33	3.33
Weir Type	= Riser	15 degV	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	1365.50	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.04	0.001	1365.54	0.01 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.005
0.07	0.001	1365.57	0.02 oc	0.02 ic	---	---	0.00	---	---	---	---	---	0.020
0.11	0.002	1365.61	0.05 oc	0.05 ic	---	---	0.00	---	---	---	---	---	0.045
0.14	0.003	1365.64	0.08 oc	0.08 ic	---	---	0.00	---	---	---	---	---	0.078
0.18	0.004	1365.68	0.13 oc	0.12 ic	---	---	0.00	---	---	---	---	---	0.120
0.21	0.004	1365.71	0.19 oc	0.17 ic	---	---	0.00	---	---	---	---	---	0.169
0.25	0.005	1365.75	0.25 oc	0.23 ic	---	---	0.00	---	---	---	---	---	0.228
0.28	0.006	1365.78	0.31 oc	0.31 ic	---	---	0.00	---	---	---	---	---	0.306
0.32	0.007	1365.82	0.39 oc	0.37 ic	---	---	0.00	---	---	---	---	---	0.371
0.35	0.007	1365.85	0.47 oc	0.45 ic	---	---	0.00	---	---	---	---	---	0.454
0.39	0.009	1365.89	0.57 oc	0.54 ic	---	---	0.00	---	---	---	---	---	0.544
0.42	0.011	1365.92	0.62 oc	0.62 ic	---	---	0.00	---	---	---	---	---	0.625
0.46	0.014	1365.96	0.74 oc	0.74 ic	---	---	0.00	---	---	---	---	---	0.742
0.49	0.016	1365.99	0.87 oc	0.84 ic	---	---	0.00	---	---	---	---	---	0.835
0.53	0.018	1366.03	1.01 oc	0.94 ic	---	---	0.00	---	---	---	---	---	0.942
0.56	0.020	1366.06	1.09 oc	1.06 ic	---	---	0.00	---	---	---	---	---	1.062
0.60	0.022	1366.10	1.25 oc	1.17 ic	---	---	0.00	---	---	---	---	---	1.171
0.63	0.024	1366.13	1.34 oc	1.29 ic	---	---	0.00	---	---	---	---	---	1.294
0.67	0.026	1366.17	1.43 oc	1.43 ic	---	---	0.00	---	---	---	---	---	1.430
0.70	0.028	1366.20	1.62 oc	1.54 ic	---	---	0.00	---	---	---	---	---	1.539
0.74	0.032	1366.24	1.72 oc	1.68 ic	---	---	0.00	---	---	---	---	---	1.677
0.77	0.035	1366.27	1.82 oc	1.81 ic	---	---	0.00	---	---	---	---	---	1.810
0.80	0.039	1366.31	1.93 oc	1.93 ic	---	---	0.00	---	---	---	---	---	1.929
0.84	0.042	1366.34	2.04 oc	2.04 ic	---	---	0.00	---	---	---	---	---	2.039
0.87	0.045	1366.38	2.27 oc	2.16 ic	---	---	0.00	---	---	---	---	---	2.161
0.91	0.049	1366.41	2.39 oc	2.28 ic	---	---	0.00	---	---	---	---	---	2.276
0.94	0.052	1366.45	2.39 oc	2.39 ic	---	---	0.00	---	---	---	---	---	2.388
0.98	0.056	1366.48	2.51 oc	2.51 ic	---	---	0.00	---	---	---	---	---	2.510
1.02	0.059	1366.52	2.64 oc	2.59 ic	---	---	0.00	---	---	---	---	---	2.586
1.05	0.063	1366.55	2.77 oc	2.64 ic	---	---	0.00	---	---	---	---	---	2.637
1.09	0.068	1366.59	2.77 oc	2.73 ic	---	---	0.00	---	---	---	---	---	2.730
1.12	0.072	1366.62	2.90 oc	2.78 ic	---	---	0.00	---	---	---	---	---	2.778

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Watershed A2 Detention

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
1.16	0.077	1366.66	2.90 oc	2.87 ic	---	---	0.00	---	---	---	---	---	2.867
1.19	0.082	1366.69	3.03 oc	2.91 ic	---	---	0.00	---	---	---	---	---	2.912
1.23	0.087	1366.73	3.03 oc	3.00 ic	---	---	0.00	---	---	---	---	---	2.997
1.26	0.092	1366.76	3.17 oc	3.04 ic	---	---	0.00	---	---	---	---	---	3.040
1.30	0.097	1366.80	3.17 oc	3.12 ic	---	---	0.00	---	---	---	---	---	3.122
1.33	0.102	1366.83	3.17 oc	3.17 ic	---	---	0.00	---	---	---	---	---	3.170
1.37	0.106	1366.87	3.31 oc	3.24 ic	---	---	0.00	---	---	---	---	---	3.241
1.40	0.111	1366.90	3.31 oc	3.31 ic	---	---	0.00	---	---	---	---	---	3.311
1.44	0.118	1366.94	3.45 oc	3.35 ic	---	---	0.00	---	---	---	---	---	3.355
1.47	0.124	1366.97	3.45 oc	3.43 ic	---	---	0.00	---	---	---	---	---	3.429
1.51	0.130	1367.01	3.60 oc	3.47 ic	---	---	0.00	---	---	---	---	---	3.466
1.54	0.136	1367.04	3.60 oc	3.54 ic	---	---	0.00	---	---	---	---	---	3.537
1.58	0.143	1367.08	3.60 oc	3.60 ic	---	---	0.00	---	---	---	---	---	3.601
1.61	0.149	1367.11	3.75 oc	3.64 ic	---	---	0.00	---	---	---	---	---	3.642
1.65	0.155	1367.15	3.75 oc	3.71 ic	---	---	0.00	---	---	---	---	---	3.710
1.68	0.161	1367.18	3.75 oc	3.75 ic	---	---	0.00	---	---	---	---	---	3.750
1.72	0.168	1367.22	3.90 oc	3.81 ic	---	---	0.00	---	---	---	---	---	3.810
1.75	0.174	1367.25	3.90 oc	3.87 ic	---	---	0.00	---	---	---	---	---	3.874
1.79	0.181	1367.29	4.06 oc	3.91 ic	---	---	0.00	---	---	---	---	---	3.906
1.82	0.189	1367.32	4.06 oc	3.97 ic	---	---	0.00	---	---	---	---	---	3.970
1.86	0.197	1367.36	4.06 oc	4.03 ic	---	---	0.00	---	---	---	---	---	4.032
1.89	0.204	1367.39	4.21 oc	4.06 ic	---	---	0.00	---	---	---	---	---	4.063
1.93	0.212	1367.43	4.21 oc	4.12 ic	---	---	0.00	---	---	---	---	---	4.124
1.96	0.220	1367.46	4.21 oc	4.18 ic	---	---	0.00	---	---	---	---	---	4.184
2.00	0.227	1367.50	4.21 oc	4.21 ic	---	---	0.00	---	---	---	---	---	4.214
2.03	0.235	1367.53	4.37 oc	4.27 ic	---	---	0.00	---	---	---	---	---	4.272
2.07	0.243	1367.57	4.37 oc	4.33 ic	---	---	0.00	---	---	---	---	---	4.331
2.10	0.250	1367.60	4.37 oc	4.37 ic	---	---	0.00	---	---	---	---	---	4.373
2.14	0.260	1367.64	4.53 oc	4.41 ic	---	---	0.00	---	---	---	---	---	4.415
2.17	0.269	1367.67	4.53 oc	4.47 ic	---	---	0.00	---	---	---	---	---	4.471
2.21	0.278	1367.71	4.53 oc	4.53 ic	---	---	0.00	---	---	---	---	---	4.527
2.24	0.287	1367.74	4.70 oc	4.55 ic	---	---	0.00	---	---	---	---	---	4.554
2.28	0.296	1367.78	4.70 oc	4.61 ic	---	---	0.00	---	---	---	---	---	4.608
2.31	0.305	1367.81	4.70 oc	4.66 ic	---	---	0.00	---	---	---	---	---	4.662
2.35	0.314	1367.85	4.70 oc	4.70 ic	---	---	0.00	---	---	---	---	---	4.699
2.38	0.323	1367.88	4.87 oc	4.74 ic	---	---	0.00	---	---	---	---	---	4.741
2.42	0.332	1367.92	5.03 oc	4.77 ic	---	---	0.16	---	---	---	---	---	4.923
2.45	0.341	1367.95	5.73 oc	4.71 ic	---	---	0.93	---	---	---	---	---	5.634
2.49	0.352	1367.99	6.82 oc	4.58 ic	---	---	2.06	---	---	---	---	---	6.645
2.52	0.362	1368.02	7.95 oc	4.45 ic	---	---	3.46	---	---	---	---	---	7.915
2.56	0.373	1368.06	9.48 oc	4.25 ic	---	---	5.08	---	---	---	---	---	9.336
2.59	0.383	1368.09	10.99 oc	4.05 ic	---	---	6.90	---	---	---	---	---	10.94
2.63	0.394	1368.13	12.78 oc	3.76 ic	---	---	8.89	---	---	---	---	---	12.65
2.66	0.405	1368.16	14.52 oc	3.43 ic	---	---	11.05	---	---	---	---	---	14.48
2.70	0.415	1368.20	16.35 oc	2.97 ic	---	---	13.35	---	---	---	---	---	16.32
2.73	0.426	1368.23	17.91 oc	2.14 ic	---	---	15.77 s	---	---	---	---	---	17.91
2.77	0.436	1368.27	18.98 oc	1.90 ic	---	---	17.08 s	---	---	---	---	---	18.97
2.80	0.447	1368.30	21.16 oc	1.92 ic	---	---	19.24 s	---	---	---	---	---	21.16
2.84	0.459	1368.34	23.35 oc	1.94 ic	---	---	21.40 s	---	---	---	---	---	23.34
2.87	0.471	1368.37	25.49 oc	1.95 ic	---	---	23.54 s	---	---	---	---	---	25.49
2.91	0.483	1368.41	27.60 oc	1.95 ic	---	---	25.65 s	---	---	---	---	---	27.59
2.94	0.495	1368.44	29.65 oc	1.94 ic	---	---	27.70 s	---	---	---	---	---	29.64
2.98	0.507	1368.48	31.63 oc	1.93 ic	---	---	29.70 s	---	---	---	---	---	31.63
3.01	0.519	1368.51	33.56 oc	1.91 ic	---	---	31.65 s	---	---	---	---	---	33.56
3.05	0.530	1368.55	35.42 oc	1.89 ic	---	---	33.53 s	---	---	---	---	---	35.42
3.08	0.542	1368.58	37.22 oc	1.86 ic	---	---	35.35 s	---	---	---	---	---	37.22
3.12	0.554	1368.62	38.96 oc	1.84 ic	---	---	37.11 s	---	---	---	---	---	38.95
3.15	0.566	1368.65	40.61 oc	1.81 ic	---	---	38.79 s	---	---	---	---	---	40.61
3.19	0.580	1368.69	42.22 oc	1.78 ic	---	---	40.43 s	---	---	---	---	---	42.22
3.22	0.593	1368.72	43.78 oc	1.75 ic	---	---	42.02 s	---	---	---	---	---	43.77
3.26	0.607	1368.76	45.28 oc	1.73 ic	---	---	43.55 s	---	---	---	---	---	45.28
3.29	0.620	1368.79	46.73 oc	1.70 ic	---	---	45.03 s	---	---	---	---	---	46.73
3.33	0.634	1368.83	48.13 oc	1.67 ic	---	---	46.46 s	---	---	---	---	---	48.13
3.36	0.647	1368.86	49.49 oc	1.64 ic	---	---	47.85 s	---	---	---	---	---	49.49
3.40	0.661	1368.90	50.81 oc	1.61 ic	---	---	49.19 s	---	---	---	---	---	50.80
3.43	0.674	1368.93	52.08 oc	1.58 ic	---	---	50.49 s	---	---	---	---	---	52.07
3.47	0.687	1368.97	53.32 oc	1.55 ic	---	---	51.76 s	---	---	---	---	---	53.31
3.50	0.701	1369.00	54.51 oc	1.52 ic	---	---	52.97 s	---	---	---	---	---	54.50

...End

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Tuesday, Mar 30, 2010

Hyd. No. 12

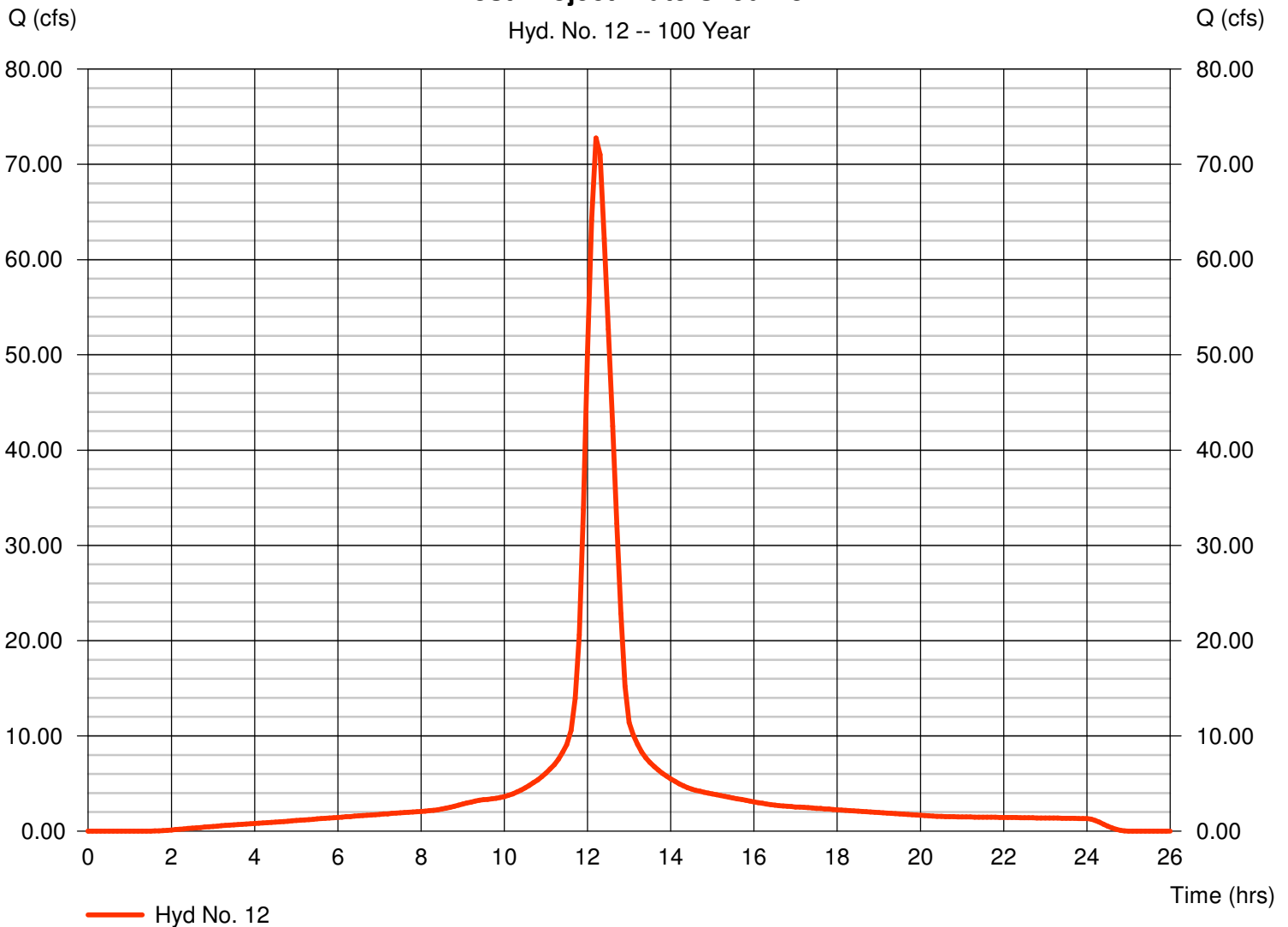
Post-Project Watershed A3

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 6 min
Drainage area = 14.600 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 7.80 in
Storm duration = 24 hrs

Peak discharge = 72.78 cfs
Time to peak = 12.20 hrs
Hyd. volume = 9.036 acft
Curve number = 95
Hydraulic length = 0 ft
Time of conc. (Tc) = 32.80 min
Distribution = Type II
Shape factor = 484

Post-Project Watershed A3

Hyd. No. 12 -- 100 Year



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Tuesday, Mar 30, 2010

Hyd. No. 13

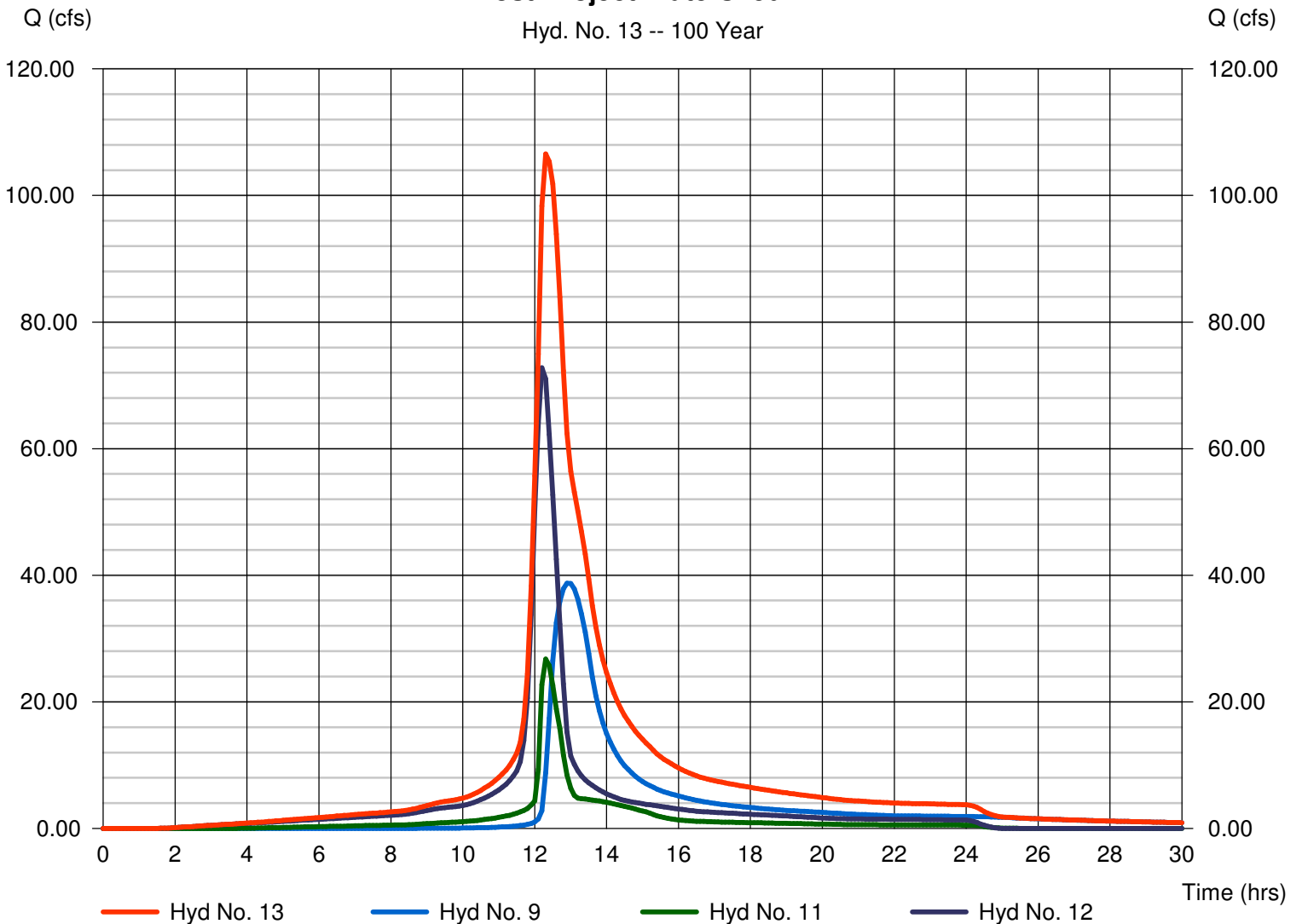
Post-Project Watershed A

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 6 min
Inflow hyds. = 9, 11, 12

Peak discharge = 106.54 cfs
Time to peak = 12.30 hrs
Hyd. volume = 21.683 acft
Contrib. drain. area = 14.600 ac

Post-Project Watershed A

Hyd. No. 13 -- 100 Year



Appendix 2.6

Time of Concentration and Curve Number Calculations

Time of Concentration Calculations by the FAA method
Monarch Landing 3rd Addition

$$T_c = \frac{(1.1-C)L^{1/2}}{100 S^{1/3}}$$

Area Name	Land Use	Soil Group	Maximum Elevation	Minimum Elevation	Flow Length (L)	Rational Runoff Coefficient, C				Time of Concentration (min), T _c				Time of Concentration (hr), T _c				CN
						2-Year	5-Year	10-Year	100-Year	2-Year	5-Year	10-Year	100-Year	2-Year	5-Year	10-Year	100-Year	
PRE DEVELOPMENT																		
A	Agricultural - Pasture - Slopes 1-4%	D	1376.3	1364.0	1799	0.32	0.37	0.47	0.67	67.6	63.3	54.6	37.3	1.1266	1.0544	0.9099	0.6211	80.0
D	Agricultural - Pasture - Slopes 1-4%	D	1375.5	1364.0	1177	0.32	0.37	0.47	0.67	48.5	45.4	39.2	26.8	0.8090	0.7572	0.6534	0.4460	80.0
POST DEVELOPMENT																		
A1	Residential - 1/3 Acre	D	1373.0	1369.0	1518	0.46	0.50	0.59	0.73	70.0	65.6	55.8	40.5	1.1668	1.0939	0.9298	0.6745	86.0
A2	Business - Neighborhood	D	1370.0	1368.0	893	0.68	0.69	0.73	0.80	37.2	36.3	32.8	26.6	0.6200	0.6052	0.5462	0.4428	89.1
A3	Business - Neighborhood	D	1370.0	1368.0	895	0.68	0.69	0.73	0.80	37.3	36.4	32.8	26.6	0.6211	0.6064	0.5472	0.4437	89.1
D1	Residential - 1/4 Acre	D	1371.0	1364.0	1438	0.50	0.54	0.62	0.76	52.1	48.6	41.6	29.5	0.8677	0.8098	0.6941	0.4917	87.0
D2	Schools	D	1372.0	1363.0	1024	0.49	0.51	0.56	0.66	36.7	35.5	32.5	26.5	0.6113	0.5913	0.5412	0.4410	95.0

SCS Runoff Curve Number Calculations

3/30/2010 8:10 AM

Project Name: Monarch Landing 3rd Addition
 Basin: Pre-Project Watershed A

Total Area = 38.1 Acres
Total Area = 0.0595 sq. mi.
Composite Curve Number = 80.00

Land Use	Percent Impervious	Area/CN			
		Hydrological Soil Group			
		A	B	C	D
Cultivated land without conservation treatment	0	72	81	88	91
Cultivated land with conservation treatment	0	62	71	78	81
Pasture or range land - poor condition	0	68	79	86	89
Pasture or range land - good condition	0	39	61	74	80
Meadow - good condition	0	30	58	71	78
Wood or Forest land - thin stand, poor cover, no mulch	0	45	66	77	83
Wood or Forest land - good cover	0	25	55	70	77
Open spaces - good condition - grass cover on 75% or more of area	0	39	61	74	80
Open spaces - fair condition - grass cover on 50-75% of area	0	49	69	79	84
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential - 1/8 acre or less	65	77	85	90	92
Residential - 1/4 acre	38	61	75	83	87
Residential - 1/3 acre	30	57	72	81	86
Residential - 1/2 acre	25	54	70	80	85
Residential - 1 acre	20	51	68	79	84
Paved Parking lots, roofs, driveways, etc.	-	98	98	98	98
Streets and roads - paved with curbs and storm sewers	-	98	98	98	98
Streets and roads - gravel	-	76	85	89	91
Streets and roads - dirt	-	72	82	87	89
Lake/Pond	100	100	100	100	100

SCS Runoff Curve Number Calculations

3/30/2010 8:10 AM

Project Name: Monarch Landing 3rd Addition
 Basin: Pre-Project Watershed D

Total Area = 13.1 Acres
Total Area = 0.0204 sq. mi.
Composite Curve Number = 80.00

Land Use	Percent Impervious	Area/CN			
		Hydrological Soil Group			
		A	B	C	D
Cultivated land without conservation treatment	0	72	81	88	91
Cultivated land with conservation treatment	0	62	71	78	81
Pasture or range land - poor condition	0	68	79	86	89
Pasture or range land - good condition	0	39	61	74	80
Meadow - good condition	0	30	58	71	78
Wood or Forest land - thin stand, poor cover, no mulch	0	45	66	77	83
Wood or Forest land - good cover	0	25	55	70	77
Open spaces - good condition - grass cover on 75% or more of area	0	39	61	74	80
Open spaces - fair condition - grass cover on 50-75% of area	0	49	69	79	84
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential - 1/8 acre or less	65	77	85	90	92
Residential - 1/4 acre	38	61	75	83	87
Residential - 1/3 acre	30	57	72	81	86
Residential - 1/2 acre	25	54	70	80	85
Residential - 1 acre	20	51	68	79	84
Paved Parking lots, roofs, driveways, etc.	-	98	98	98	98
Streets and roads - paved with curbs and storm sewers	-	98	98	98	98
Streets and roads - gravel	-	76	85	89	91
Streets and roads - dirt	-	72	82	87	89
Lake/Pond	100	100	100	100	100

SCS Runoff Curve Number Calculations

3/30/2010 8:10 AM

Project Name: Monarch Landing 3rd Addition
 Basin: Post-Project Watershed A1

Total Area = 18.6 Acres
Total Area = 0.0291 sq. mi.
Composite Curve Number = 86.00

Land Use	Percent Impervious	Area/CN			
		Hydrological Soil Group			
		A	B	C	D
Cultivated land without conservation treatment	0	72	81	88	91
Cultivated land with conservation treatment	0	62	71	78	81
Pasture or range land - poor condition	0	68	79	86	89
Pasture or range land - good condition	0	39	61	74	80
Meadow - good condition	0	30	58	71	78
Wood or Forest land - thin stand, poor cover, no mulch	0	45	66	77	83
Wood or Forest land - good cover	0	25	55	70	77
Open spaces - good condition - grass cover on 75% or more of area	0	39	61	74	80
Open spaces - fair condition - grass cover on 50-75% of area	0	49	69	79	84
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential - 1/8 acre or less	65	77	85	90	92
Residential - 1/4 acre	38	61	75	83	87
Residential - 1/3 acre	30	57	72	81	86
Residential - 1/2 acre	25	54	70	80	85
Residential - 1 acre	20	51	68	79	84
Paved Parking lots, roofs, driveways, etc.	-	98	98	98	98
Streets and roads - paved with curbs and storm sewers	-	98	98	98	98
Streets and roads - gravel	-	76	85	89	91
Streets and roads - dirt	-	72	82	87	89
Lake/Pond	100	100	100	100	100

SCS Runoff Curve Number Calculations

3/30/2010 8:10 AM

Project Name: Monarch Landing 3rd Addition
 Basin: Post-Project Watershed A2

Total Area = 5.9 Acres
Total Area = 0.0092 sq. mi.
Composite Curve Number = 89.05

Land Use	Percent Impervious	Area/CN			
		Hydrological Soil Group			
		A	B	C	D
Cultivated land without conservation treatment	0	72	81	88	91
Cultivated land with conservation treatment	0	62	71	78	81
Pasture or range land - poor condition	0	68	79	86	89
Pasture or range land - good condition	0	39	61	74	80
Meadow - good condition	0	30	58	71	78
Wood or Forest land - thin stand, poor cover, no mulch	0	45	66	77	83
Wood or Forest land - good cover	0	25	55	70	77
Open spaces - good condition - grass cover on 75% or more of area	0	39	61	74	80
Open spaces - fair condition - grass cover on 50-75% of area	0	49	69	79	84
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential - 1/8 acre or less	65	77	85	90	92
Residential - 1/4 acre	38	61	75	83	87
Residential - 1/3 acre	30	57	72	81	86
Residential - 1/2 acre	25	54	70	80	85
Residential - 1 acre	20	51	68	79	84
Paved Parking lots, roofs, driveways, etc.	-	98	98	98	98
Streets and roads - paved with curbs and storm sewers	-	98	98	98	98
Streets and roads - gravel	-	76	85	89	91
Streets and roads - dirt	-	72	82	87	89
Lake/Pond	100	100	100	100	100

SCS Runoff Curve Number Calculations

3/30/2010 8:10 AM

Project Name: Monarch Landing 3rd Addition
 Basin: Post Project Watershed A3

Total Area = 14.6 Acres
Total Area = 0.0228 sq. mi.
Composite Curve Number = 95.00

Land Use	Percent Impervious	Area/CN			
		Hydrological Soil Group			
		A	B	C	D
Cultivated land without conservation treatment	0	72	81	88	91
Cultivated land with conservation treatment	0	62	71	78	81
Pasture or range land - poor condition	0	68	79	86	89
Pasture or range land - good condition	0	39	61	74	80
Meadow - good condition	0	30	58	71	78
Wood or Forest land - thin stand, poor cover, no mulch	0	45	66	77	83
Wood or Forest land - good cover	0	25	55	70	77
Open spaces - good condition - grass cover on 75% or more of area	0	39	61	74	80
Open spaces - fair condition - grass cover on 50-75% of area	0	49	69	79	84
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential - 1/8 acre or less	65	77	85	90	92
Residential - 1/4 acre	38	61	75	83	87
Residential - 1/3 acre	30	57	72	81	86
Residential - 1/2 acre	25	54	70	80	85
Residential - 1 acre	20	51	68	79	84
Paved Parking lots, roofs, driveways, etc.	-	98	98	98	98
Streets and roads - paved with curbs and storm sewers	-	98	98	98	98
Streets and roads - gravel	-	76	85	89	91
Streets and roads - dirt	-	72	82	87	89
Lake/Pond	100	100	100	100	100

SCS Runoff Curve Number Calculations

3/30/2010 8:10 AM

050 Monarch Landing 3rd Addition
 Basin: Post-Project Watershed D1

Total Area = 8.9 Acres
 Total Area = 0.0139 sq. mi.
 Composite Curve Number = 87.00

Land Use	Percent Impervious	Area/CN			
		Hydrological Soil Group			
		A	B	C	D
Cultivated land without conservation treatment	0	72	81	88	91
Cultivated land with conservation treatment	0	62	71	78	81
Pasture or range land - poor condition	0	68	79	86	89
Pasture or range land - good condition	0	39	61	74	80
Meadow - good condition	0	30	58	71	78
Wood or Forest land - thin stand, poor cover, no mulch	0	45	66	77	83
Wood or Forest land - good cover	0	25	55	70	77
Open spaces - good condition - grass cover on 75% or more of area	0	39	61	74	80
Open spaces - fair condition - grass cover on 50-75% of area	0	49	69	79	84
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential - 1/8 acre or less	65	77	85	90	92
Residential - 1/4 acre	38	61	75	83	87
Residential - 1/3 acre	30	57	72	81	86
Residential - 1/2 acre	25	54	70	80	85
Residential - 1 acre	20	51	68	79	84
Paved Parking lots, roofs, driveways, etc.	-	98	98	98	98
Streets and roads - paved with curbs and storm sewers	-	98	98	98	98
Streets and roads - gravel	-	76	85	89	91
Streets and roads - dirt	-	72	82	87	89
Lake/Pond	100	100	100	100	100

SCS Runoff Curve Number Calculations

3/30/2010 8:10 AM

Project Name: Monarch Landing 3rd Addition
 Basin: Post-Project Watershed D2

Total Area = 5.5 Acres
Total Area = 0.0085 sq. mi.
Composite Curve Number = 95.00

Land Use	Percent Impervious	Area/CN			
		Hydrological Soil Group			
		A	B	C	D
Cultivated land without conservation treatment	0	72	81	88	91
Cultivated land with conservation treatment	0	62	71	78	81
Pasture or range land - poor condition	0	68	79	86	89
Pasture or range land - good condition	0	39	61	74	80
Meadow - good condition	0	30	58	71	78
Wood or Forest land - thin stand, poor cover, no mulch	0	45	66	77	83
Wood or Forest land - good cover	0	25	55	70	77
Open spaces - good condition - grass cover on 75% or more of area	0	39	61	74	80
Open spaces - fair condition - grass cover on 50-75% of area	0	49	69	79	84
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential - 1/8 acre or less	65	77	85	90	92
Residential - 1/4 acre	38	61	75	83	87
Residential - 1/3 acre	30	57	72	81	86
Residential - 1/2 acre	25	54	70	80	85
Residential - 1 acre	20	51	68	79	84
Paved Parking lots, roofs, driveways, etc.	-	98	98	98	98
Streets and roads - paved with curbs and storm sewers	-	98	98	98	98
Streets and roads - gravel	-	76	85	89	91
Streets and roads - dirt	-	72	82	87	89
Lake/Pond	100	100	100	100	100

Appendix 2.7

Hydraflow Express Output of 21st Street RCB

Culvert Report

Existing 3x4 RCB Under 21st Street North

Invert Elev Dn (ft) = 1363.20
 Pipe Length (ft) = 111.50
 Slope (%) = 0.18
 Invert Elev Up (ft) = 1363.40
 Rise (in) = 36.0
 Shape = Box
 Span (in) = 48.0
 No. Barrels = 1
 n-Value = 0.013
 Inlet Edge = Sq Edge
 Coeff. K,M,c,Y,k = 0.061, 0.75, 0.04, 0.8, 0.5

Embankment

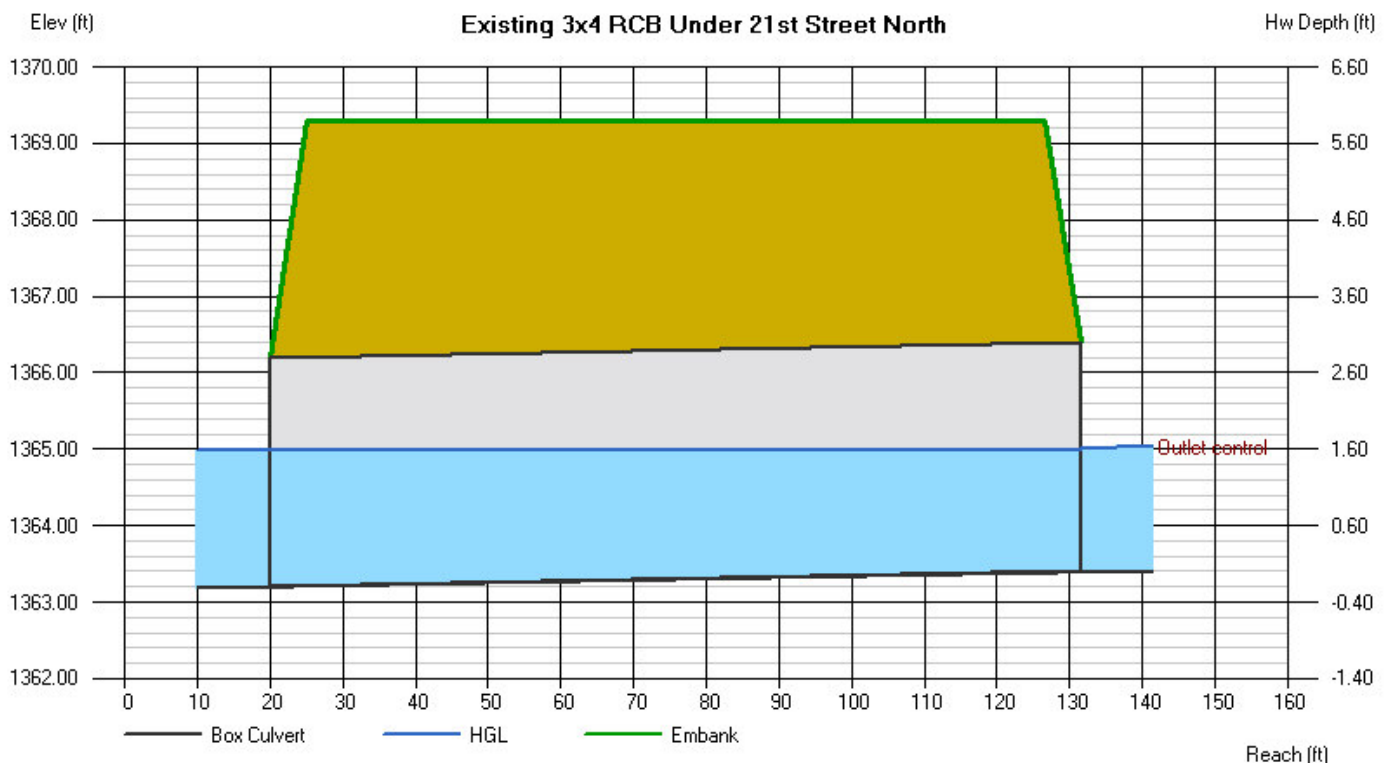
Top Elevation (ft) = 1369.30
 Top Width (ft) = 101.50
 Crest Width (ft) = 100.00

Calculations

Qmin (cfs) = 0.00
 Qmax (cfs) = 120.00
 Tailwater Elev (ft) = (dc+D)/2

Highlighted

Qtotal (cfs) = 10.00
 Qpipe (cfs) = 10.00
 Qovertop (cfs) = 0.00
 Veloc Dn (ft/s) = 1.40
 Veloc Up (ft/s) = 1.56
 HGL Dn (ft) = 1364.99
 HGL Up (ft) = 1365.00
 Hw Elev (ft) = 1365.02
 Hw/D (ft) = 0.54
 Flow Regime = Outlet Control



Q			Veloc		Depth		HGL	
Total	Pipe	Over	Dn	Up	Dn	Up	Dn	Up
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)
10.00	10.00	0.00	1.40	1.56	21.48	19.21	1364.99	1365.00
20.00	20.00	0.00	2.55	2.78	23.52	21.61	1365.16	1365.20
30.00	30.00	0.00	3.57	3.76	25.23	23.92	1365.30	1365.39
40.00	40.00	0.00	4.49	4.59	26.75	26.17	1365.43	1365.58
50.00	50.00	0.00	5.33	5.28	28.16	28.41	1365.55	1365.77
60.00	60.00	0.00	6.11	5.84	29.47	30.80	1365.66	1365.97
70.00	70.00	0.00	6.84	6.30	30.71	33.36	1365.76	1366.18
80.00	80.00	0.00	7.53	6.67	31.89	35.98	1365.86	1366.40
90.00	90.00	0.00	8.18	7.50	33.02	36.00	1365.95	1366.65
100.00	100.00	0.00	8.79	8.33	34.11	36.00	1366.04	1366.80
110.00	110.00	0.00	9.38	9.17	35.17	36.00	1366.13	1366.93
120.00	113.50	6.50	9.58	9.46	35.53	36.00	1366.16	1366.98

HGL	
Hw	Hw/D
(ft)	
1365.02	0.54
1365.26	0.62
1365.50	0.70
1365.89	0.83
1366.29	0.96
1366.80	1.13
1367.16	1.25
1367.58	1.39
1368.05	1.55
1368.58	1.73
1369.16	1.92
1369.38	1.99

Tab 3. Post-Development Conditions

Description

The site is 14.9 acres which will be developed as 1/3 acre residential lots. A detention pond will be constructed near the northeast corner of the site. Residential streets will connect the development to 159th Street North and Monarch Landing Addition.

Drainage Calculations

Runoff Method

The site was modeled using the SCS Hydrograph method in Hydraflow Hydrographs by AutoCAD 3D 2009, Appendix 2.5. The model was originally created for the *Monarch Landing Drainage Report*. The model contains both the existing conditions and post-development model.

Rainfall

The rainfall information used is from the Kansas Department of Transportation Rainfall Depth Tables for Kansas Counties June 1997. The rainfall values used are shown in Table 3.1.

Table 3.1. 24-Hour Rainfall Depths.

	2-Yr	5-Yr	10-Yr	25-Yr	100-Yr
Sedgwick	3.50	4.53	5.24	6.24	7.80

Time of Concentration

Time of concentration was calculated using the FAA method. Calculations are in Appendix 2.6.

Table 3.2. Post-Development Times of Concentration and Curve Numbers

Basin Name	Area (ac)	T _c (min)	Curve Number
Watershed A1	18.6	55.8	86.0
Watershed A2	5.9	32.8	89.1
Watershed A3	14.6	32.8	95.0
Watershed D1	11.3	36.8	87.0
Watershed D2	1.1	15.0	87.0

Curve Numbers

Weighted curve numbers were calculated to represent the land usage of the basins. A curve number of 95 was used to represent future commercial development in Watersheds A2 and A3. A curve number of 86 represents the residential. The curve numbers are shown in Table 3.2.

Drainage Patterns

The site will continue to drain in two directions. Watershed A has been divided into 3 sub-watersheds. Watershed A1 drains to a detention pond constructed with the Monarch Landing Addition. A pond was constructed with the Monarch Landing Addition. Details of this pond are in Table 3.1. Flow from this pond drains to the south to the existing 3'x4' RCB under 21st Street North. Watershed A2 drains the backyards of a portion of the residential lots and also a portion of the commercial lots. The commercial lots will provide detention in bioswales. This detention facility outlets to the south and combines with Watershed A1 and A3 to flow to the existing RCB under 21st Street. In the northern portion of the site, Watershed D has been divided into 2 sub-watersheds. Watershed D1 drains into a detention pond near the northeast corner of the site and Watershed D2 drains offsite into the roadside ditch along 159th Street. Details of this detention pond are shown in Table 3.2.

Peak runoff flow rates to 21st Street have been decreased from pre-project flow rates. Runoff to the roadside ditch along 159th Street has been reduced to pre-project flow. A summary of the post-project flow rates is in Table 3.3.

Table 3.1. Detention Pond A1 Details

Detention A1	Design Storms				
	2-Yr	5-Yr	10-Yr	25-Yr	100-Yr
Water Surface Elevation (ft)	1367.9	1368.4	1368.6	1369.0	1369.4
Storage (ac-ft)	2.1	2.7	3.0	3.4	3.9
Flow In (cfs)	21.6	31.6	38.3	48.4	62.7
Flow Out (cfs)	1.9	9.7	16.5	27.2	38.8
Outlet Structure	10° V-Notched Weir at 1365.5 and a 6' Rectangular Weir 1367.9				

Table 3.2. Detention Pond D1 Details

Detention D1	Design Storms				
	2-Yr	5-Yr	10-Yr	25-Yr	100-Yr
Water Surface Elevation (ft)	1366.5	1366.9	1367.1	1367.3	1367.5
Storage (ac-ft)	0.34	0.45	0.50	0.56	0.64
Flow In (cfs)	18.2	26.4	31.9	40.0	51.6
Flow Out (cfs)	15.1	23.7	29.3	37.5	49.6
Outlet Structure	Notched Rectangular Weir with 2.5' Opening at 1365.0 and 9' Opening at 1366.7				

Table 3.3. Post-Development Flow Rates

Description	Design Storm Flows (cfs)				
	2-Yr	5-Yr	10-Yr	25-Yr	100-Yr
Watershed A	34.6	46.5	59.4	77.8	106.5
Watershed D	15.5	24.3	301	39.1	51.6

Utilities

Storm Water Sewer

Proposed storm water sewer will convey runoff from backyards and streets into the proposed detention ponds. The proposed utilities are shown on the Drainage and Utility Plan, Appendix 3.1. Pipe sizing calculations were done using Hydraflow Storm Sewers by AutoCAD 2009, Appendix 3.2. The storm water sewer system has been sized to convey at least the 2-year design storm. Emergency escape routes will be designed to allow surface flow of storms larger than the pipe system can handle. Escape routes will be maintained on the north side and the east side of Lot 1 to direct excess storm water to the channel.

Water

Existing water service is provided on the portions of Boxthorn and Camden Chase that are constructed. Proposed water will tie into these lines and service the remainder of the development.

Sanitary Sewer

A sanitary sewer main was constructed with the Monarch Landing Addition. An existing sanitary sewer line runs along the west side of the site. Proposed sanitary sewer will tie into this line and will service the lots from the backyards.

Minimum Lowest Opening

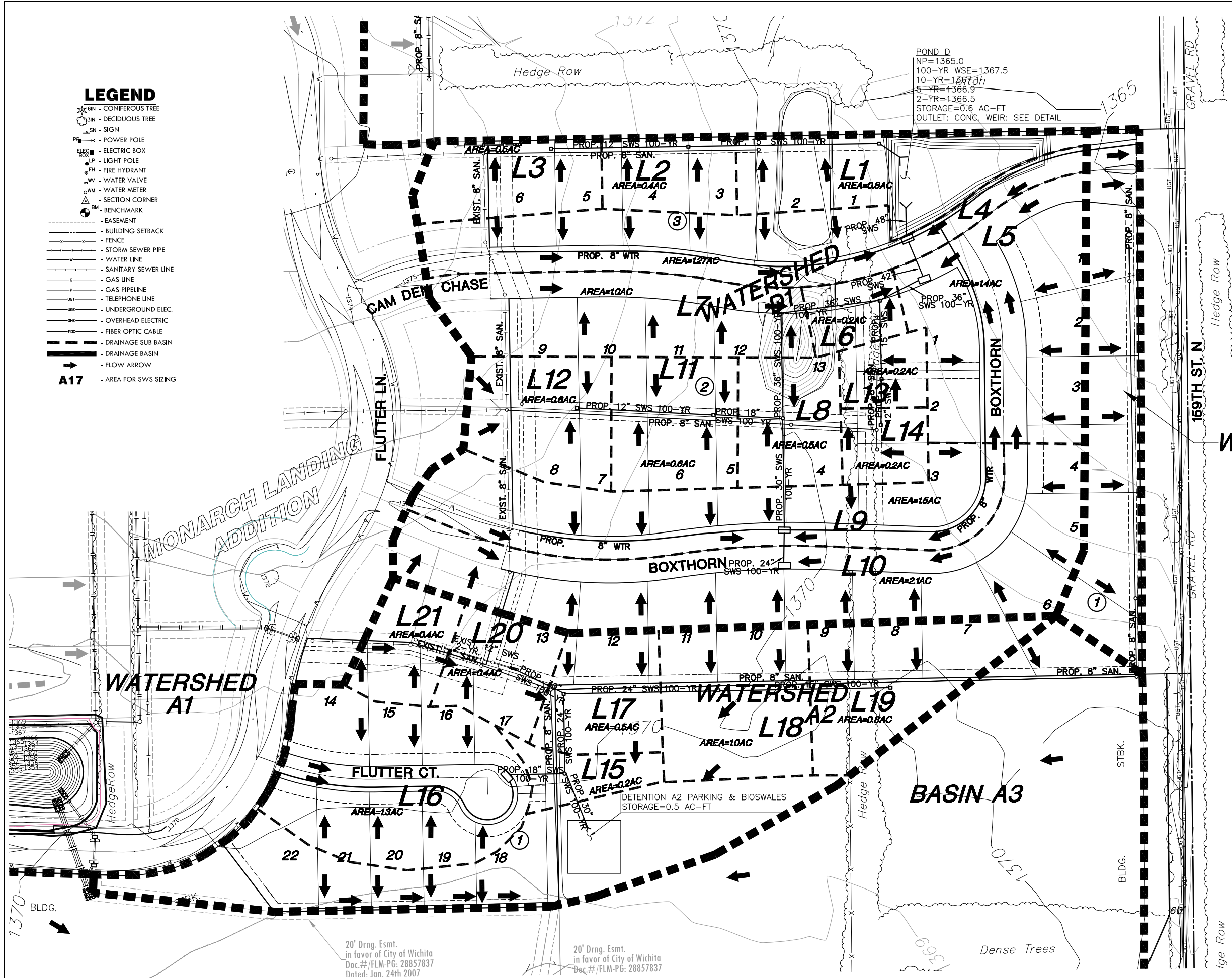
Lot 1 Block 3 will have a minimum lowest opening of 1370.5. The lots adjacent to the Detention Pond A1 are already constructed with a lowest opening of 1372.8 on Lot 20 Block 1 and 1372.4 on Lot 21 Block 1 of Monarch Landing Addition.

Appendix 3.1

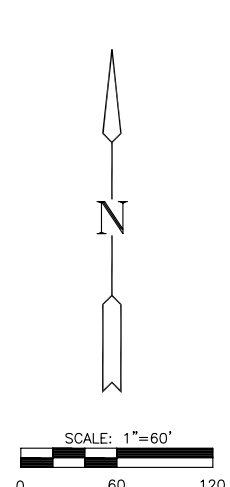
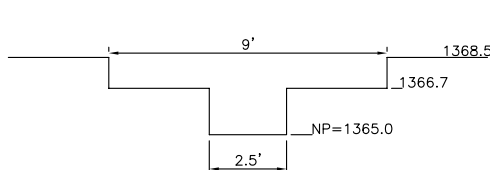
Drainage and Utility Plan

LEGEND

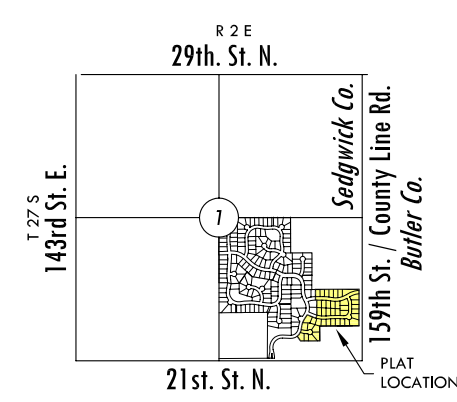
- ⊗ 6IN - CONIFEROUS TREE
- ⊙ 3IN - DECIDUOUS TREE
- SN - SIGN
- PP - POWER POLE
- ELEC. BOX - ELECTRIC BOX
- LP - LIGHT POLE
- FH - FIRE HYDRANT
- WV - WATER VALVE
- WM - WATER METER
- SC - SECTION CORNER
- BM - BENCHMARK
- E - EASEMENT
- BUILDING SETBACK
- - - FENCE
- - - STORM SEWER PIPE
- - - WATER LINE
- - - SANITARY SEWER LINE
- - - GAS LINE
- - - GAS PIPELINE
- - - TELEPHONE LINE
- - - UNDERGROUND ELEC.
- - - OVERHEAD ELECTRIC
- - - FIBER OPTIC CABLE
- - - DRAINAGE SUB BASIN
- - - DRAINAGE BASIN
- FLOW ARROW
- A17 - AREA FOR SWS SIZING



DETENTION D WEIR DETAIL



WATERSHED D2



VICINITY MAP

MKEC
ENGINEERING
CONSULTANTS, INC.

411 N. WEBB ROAD
WICHITA, KS. 67206
316-684-9600

MONARCH LANDING
MONARCH LANDING 3RD ADDITION
WICHITA, KANSAS
DRAINAGE & UTILITY PLAN

DATE
MARCH 2010

REVISED

DESIGN BY
KLA

DRAWN BY
CMJ

CHECKED BY
GJA

SHEET NUMBER
1

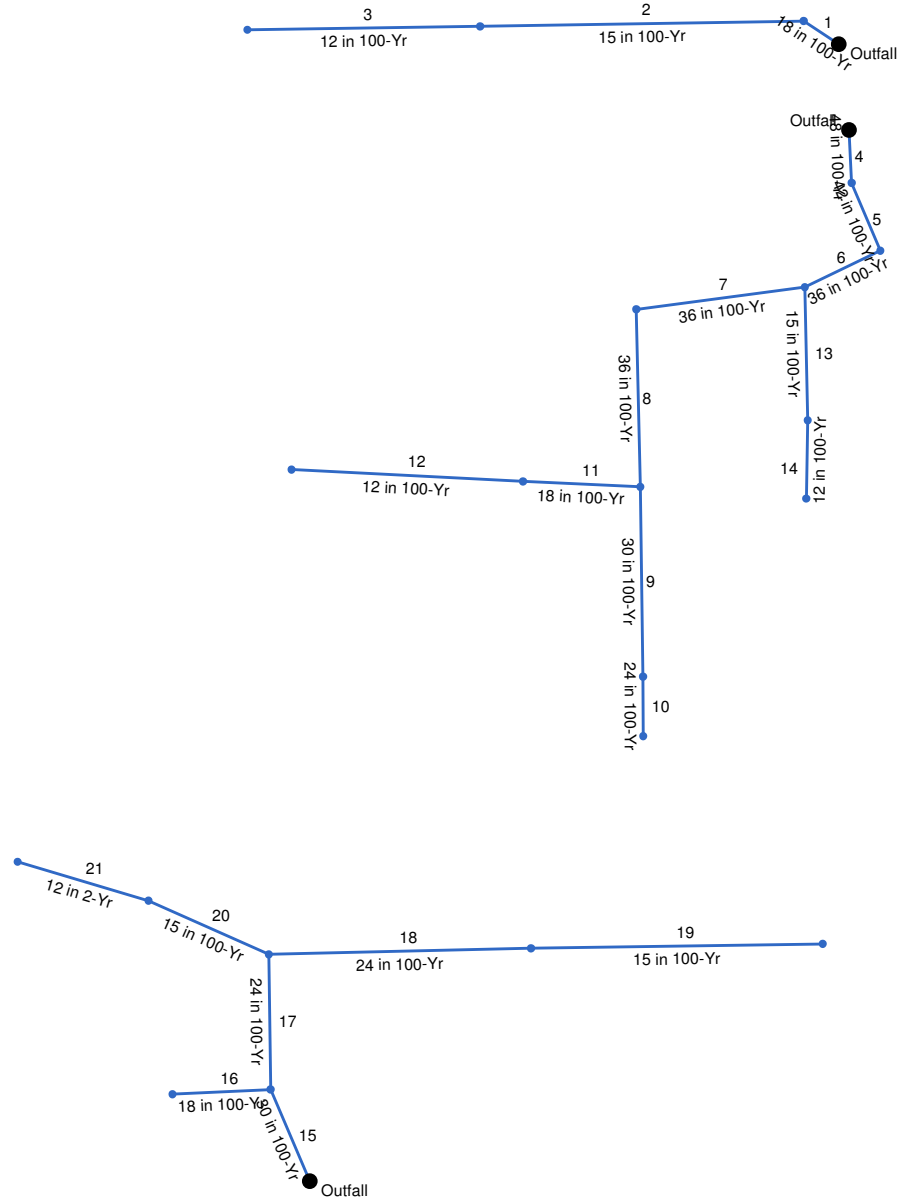
20' Drng. Esmt.
in favor of City of Wichita
Doc.#/FLM-PG: 28857837
Dated: Jan. 24th 2007

20' Drng. Esmt.
in favor of City of Wichita
Doc.#/FLM-PG: 28857837

Appendix 3.2

Hydraflow Storm Sewers

Monarch Landing 3rd



Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data							Line ID	
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line shape	N value (n)	J-loss coeff (K)		Inlet/ Rim El (ft)
1	End	30.709	-146.425	DrGrt	0.00	0.80	0.59	15.0	1362.00	0.39	1362.12	18	Cir	0.013	0.93	1368.00	18 in 100-Yr
2	1	237.182	-34.502	DrGrt	0.00	0.40	0.59	15.0	1362.30	0.40	1363.25	15	Cir	0.013	0.50	1370.00	15 in 100-Yr
3	2	170.595	0.092	DrGrt	0.00	0.50	0.59	15.0	1363.40	0.40	1364.08	12	Cir	0.013	1.00	1373.00	12 in 100-Yr
4	End	38.978	87.008	Curb	0.00	1.30	0.59	15.0	1362.00	0.41	1362.16	48	Cir	0.013	0.59	1368.00	48 in 100-Yr
5	4	53.818	-19.901	Curb	0.00	1.40	0.59	15.0	1362.30	0.41	1362.52	42	Cir	0.013	1.50	1368.00	42 in 100-Yr
6	5	61.473	87.191	Curb	0.00	0.20	0.59	15.0	1362.70	0.41	1362.95	36	Cir	0.013	1.39	1368.20	36 in 100-Yr
7	6	124.578	18.149	Curb	0.00	1.00	0.59	15.0	1363.10	0.40	1363.60	36	Cir	0.013	1.49	1368.70	36 in 100-Yr
8	7	130.056	-83.798	DrGrt	0.00	0.50	0.59	15.0	1363.70	0.40	1364.22	36	Cir	0.013	1.50	1370.00	36 in 100-Yr
9	8	139.077	0.614	Curb	0.00	1.50	0.59	15.0	1364.40	0.40	1364.96	30	Cir	0.013	0.50	1370.00	30 in 100-Yr
10	9	43.581	0.258	Curb	0.00	2.10	0.59	15.0	1364.60	0.39	1364.77	24	Cir	0.013	1.00	1370.00	24 in 100-Yr
11	8	86.129	94.087	DrGrt	0.00	0.60	0.59	15.0	1365.15	0.41	1365.50	18	Cir	0.013	0.50	1370.00	18 in 100-Yr
12	11	169.872	0.166	DrGrt	0.00	0.60	0.59	15.0	1365.90	0.40	1366.58	12	Cir	0.013	1.00	1370.70	12 in 100-Yr
13	6	97.642	-65.596	DrGrt	0.00	0.20	0.59	15.0	1362.85	0.40	1363.24	15	Cir	0.013	0.50	1372.00	15 in 100-Yr
14	13	57.399	2.331	DrGrt	0.00	0.20	0.59	15.0	1363.60	0.40	1363.83	12	Cir	0.013	1.00	1369.00	12 in 100-Yr
15	End	72.900	-113.157	DrGrt	0.00	0.20	0.59	15.0	1365.50	0.40	1365.79	30	Cir	0.013	1.47	1370.00	30 in 100-Yr
16	15	71.858	-69.578	Curb	0.00	1.30	0.59	15.0	1365.90	0.40	1366.19	18	Cir	0.013	1.00	1370.00	18 in 100-Yr
17	15	99.123	22.460	DrGrt	0.00	0.50	0.59	15.0	1365.90	0.40	1366.30	24	Cir	0.013	2.08	1370.30	24 in 100-Yr
18	17	192.195	89.394	DrGrt	0.00	1.00	0.59	15.0	1365.90	0.40	1366.67	24	Cir	0.013	0.50	1370.00	24 in 100-Yr
19	18	213.797	0.429	DrGrt	0.00	0.80	0.59	15.0	1367.05	0.40	1367.91	15	Cir	0.013	1.00	1370.00	15 in 100-Yr
20	17	96.573	-65.356	DrGrt	0.00	0.40	0.59	15.0	1365.95	0.40	1366.34	15	Cir	0.013	0.50	1369.40	15 in 100-Yr
21	20	100.000	-7.349	DrGrt	0.00	0.40	0.59	15.0	1366.70	0.45	1367.15	12	Cir	0.013	1.00	1369.40	12 in 2-Yr

Monarch Landing 3rd

Number of lines: 21

Date: 03-30-2010

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.	Junction Type
1	18 in 100-Yr	6.97	18	Cir	30.709	1362.00	1362.12	0.391	1367.50*	1367.64*	0.22	1367.86	End	DropGrate
2	15 in 100-Yr	3.81	15	Cir	237.182	1362.30	1363.25	0.401	1367.95*	1368.78*	0.07	1368.85	1	DropGrate
3	12 in 100-Yr	2.17	12	Cir	170.595	1363.40	1364.08	0.399	1368.88*	1369.52*	0.12	1369.64	2	DropGrate
4	48 in 100-Yr	38.60	48	Cir	38.978	1362.00	1362.16	0.411	1367.50*	1367.53*	0.09	1367.62	End	Curb-Horiz
5	42 in 100-Yr	33.57	42	Cir	53.818	1362.30	1362.52	0.409	1367.62*	1367.68*	0.28	1367.96	4	Curb-Horiz
6	36 in 100-Yr	28.08	36	Cir	61.473	1362.70	1362.95	0.407	1367.96*	1368.07*	0.34	1368.41	5	Curb-Horiz
7	36 in 100-Yr	25.99	36	Cir	124.578	1363.10	1363.60	0.401	1368.44*	1368.63*	0.31	1368.95	6	Curb-Horiz
8	36 in 100-Yr	22.24	36	Cir	130.056	1363.70	1364.22	0.400	1369.00*	1369.15*	0.23	1369.38	7	DropGrate
9	30 in 100-Yr	15.54	30	Cir	139.077	1364.40	1364.96	0.403	1369.38*	1369.58*	0.08	1369.66	8	Curb-Horiz
10	24 in 100-Yr	9.13	24	Cir	43.581	1364.60	1364.77	0.390	1369.68*	1369.75*	0.13	1369.88	9	Curb-Horiz
11	18 in 100-Yr	5.10	18	Cir	86.129	1365.15	1365.50	0.406	1369.40*	1369.61*	0.06	1369.67	8	DropGrate
12	12 in 100-Yr	2.61	12	Cir	169.872	1365.90	1366.58	0.400	1369.67*	1370.58*	0.17	1370.75	11	DropGrate
13	15 in 100-Yr	1.70	15	Cir	97.642	1362.85	1363.24	0.399	1368.63*	1368.69*	0.01	1368.71	6	DropGrate
14	12 in 100-Yr	0.87	12	Cir	57.399	1363.60	1363.83	0.401	1368.72*	1368.75*	0.02	1368.77	13	DropGrate
15	30 in 100-Yr	18.55	30	Cir	72.900	1365.50	1365.79	0.398	1367.07	1367.36	n/a	1367.90 i	End	DropGrate
16	18 in 100-Yr	5.65	18	Cir	71.858	1365.90	1366.19	0.403	1367.90*	1368.11*	0.16	1368.27	15	Curb-Horiz
17	24 in 100-Yr	12.62	24	Cir	99.123	1365.90	1366.30	0.404	1367.90	1368.17	0.55	1368.72	15	DropGrate
18	24 in 100-Yr	7.57	24	Cir	192.195	1365.90	1366.67	0.401	1368.90*	1369.11*	0.05	1369.16	17	DropGrate
19	15 in 100-Yr	3.48	15	Cir	213.797	1367.05	1367.91	0.402	1369.16*	1369.78*	0.12	1369.90	18	DropGrate
20	15 in 100-Yr	3.41	15	Cir	96.573	1365.95	1366.34	0.404	1368.87*	1369.14*	0.06	1369.20	17	DropGrate
21	12 in 2-Yr	1.74	12	Cir	100.000	1366.70	1367.15	0.450	1369.24*	1369.48*	0.08	1369.56	20	DropGrate

Monarch Landing 3rd

Number of lines: 21

Run Date: 03-30-2010

NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; i - Inlet control.

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 (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	30.709	0.80	1.70	0.59	0.47	1.00	15.0	17.3	6.9	6.97	6.56	3.94	18	0.39	1362.00	1362.12	1367.50	1367.64	1365.00	1368.00	18 in 100-Yr
2	1	237.182	0.40	0.90	0.59	0.24	0.53	15.0	16.0	7.2	3.81	4.09	3.10	15	0.40	1362.30	1363.25	1367.95	1368.78	1368.00	1370.00	15 in 100-Yr
3	2	170.595	0.50	0.50	0.59	0.30	0.30	15.0	15.0	7.4	2.17	2.25	2.77	12	0.40	1363.40	1364.08	1368.88	1369.52	1370.00	1373.00	12 in 100-Yr
4	End	38.978	1.30	9.60	0.59	0.77	5.66	15.0	18.1	6.8	38.60	92.04	3.07	48	0.41	1362.00	1362.16	1367.50	1367.53	1365.00	1368.00	48 in 100-Yr
5	4	53.818	1.40	8.30	0.59	0.83	4.90	15.0	17.9	6.9	33.57	64.32	3.49	42	0.41	1362.30	1362.52	1367.62	1367.68	1368.00	1368.00	42 in 100-Yr
6	5	61.473	0.20	6.90	0.59	0.12	4.07	15.0	17.6	6.9	28.08	42.53	3.97	36	0.41	1362.70	1362.95	1367.96	1368.07	1368.00	1368.20	36 in 100-Yr
7	6	124.578	1.00	6.30	0.59	0.59	3.72	15.0	17.0	7.0	25.99	42.25	3.68	36	0.40	1363.10	1363.60	1368.44	1368.63	1368.20	1368.70	36 in 100-Yr
8	7	130.056	0.50	5.30	0.59	0.30	3.13	15.0	16.4	7.1	22.24	42.17	3.15	36	0.40	1363.70	1364.22	1369.00	1369.15	1368.70	1370.00	36 in 100-Yr
9	8	139.077	1.50	3.60	0.59	0.89	2.12	15.0	15.3	7.3	15.54	26.02	3.17	30	0.40	1364.40	1364.96	1369.38	1369.58	1370.00	1370.00	30 in 100-Yr
10	9	43.581	2.10	2.10	0.59	1.24	1.24	15.0	15.0	7.4	9.13	14.13	2.90	24	0.39	1364.60	1364.77	1369.68	1369.75	1370.00	1370.00	24 in 100-Yr
11	8	86.129	0.60	1.20	0.59	0.35	0.71	15.0	15.9	7.2	5.10	6.69	2.89	18	0.41	1365.15	1365.50	1369.40	1369.61	1370.00	1370.00	18 in 100-Yr
12	11	169.872	0.60	0.60	0.59	0.35	0.35	15.0	15.0	7.4	2.61	2.25	3.32	12	0.40	1365.90	1366.58	1369.67	1370.58	1370.00	1370.70	12 in 100-Yr
13	6	97.642	0.20	0.40	0.59	0.12	0.24	15.0	15.9	7.2	1.70	4.08	1.39	15	0.40	1362.85	1363.24	1368.63	1368.69	1368.20	1372.00	15 in 100-Yr
14	13	57.399	0.20	0.20	0.59	0.12	0.12	15.0	15.0	7.4	0.87	2.25	1.11	12	0.40	1363.60	1363.83	1368.72	1368.75	1372.00	1369.00	12 in 100-Yr
15	End	72.900	0.20	4.60	0.59	0.12	2.71	15.0	18.0	6.8	18.55	25.87	5.72	30	0.40	1365.50	1365.79	1367.07	1367.36	1368.00	1370.00	30 in 100-Yr
16	15	71.858	1.30	1.30	0.59	0.77	0.77	15.0	15.0	7.4	5.65	6.67	3.20	18	0.40	1365.90	1366.19	1367.90	1368.11	1370.00	1370.00	18 in 100-Yr
17	15	99.123	0.50	3.10	0.59	0.30	1.83	15.0	17.6	6.9	12.62	14.37	4.07	24	0.40	1365.90	1366.30	1367.90	1368.17	1370.00	1370.30	24 in 100-Yr
18	17	192.195	1.00	1.80	0.59	0.59	1.06	15.0	16.3	7.1	7.57	14.32	2.41	24	0.40	1365.90	1366.67	1368.90	1369.11	1370.30	1370.00	24 in 100-Yr
19	18	213.797	0.80	0.80	0.59	0.47	0.47	15.0	15.0	7.4	3.48	4.10	2.83	15	0.40	1367.05	1367.91	1369.16	1369.78	1370.00	1370.00	15 in 100-Yr
20	17	96.573	0.40	0.80	0.59	0.24	0.47	15.0	15.8	7.2	3.41	4.10	2.78	15	0.40	1365.95	1366.34	1368.87	1369.14	1370.30	1369.40	15 in 100-Yr
21	20	100.000	0.40	0.40	0.59	0.24	0.24	15.0	15.0	7.4	1.74	2.39	2.21	12	0.45	1366.70	1367.15	1369.24	1369.48	1369.40	1369.40	12 in 2-Yr

Monarch Landing 3rd

Number of lines: 21

Run Date: 03-30-2010

NOTES: Intensity = 62.28 / (Inlet time + 10.10) ^ 0.66; Return period = 100 Yrs. ; c = cir e = ellip b = box

Tab 4. Floodplain Submittal

There are no FEMA floodplains on this site.

Tab 5. Permits

US Army Corps of Engineers

There are no wetlands on site, therefore no permits are required.

Kansas Department of Agriculture

The site does not change any waterways or provide detention, therefore division of water resources permits.

Federal Emergency Agency (FEMA)

There are no FEMA floodplains on site, therefore no LOMC applications are required.

Kansas Department of Transportation

There are no state highways on site.

Sedgwick County Right-of-way Permit

Not applicable.