



# TRANSMITTAL

TO:	FROM:
Scott Lindebak, PE CFM	Trevor Kurth, PE CFM
COMPANY:	DATE:
City of Wichita	10-30-12
ADDRESS:	PROJECT:
8 <sup>th</sup> Floor City Hall	North High 2nd
CITY/ STATE:	PROJECT NUMBER:
Wichita, Kansas	

RE:  
North High 2<sup>nd</sup> Drainage Plan

VIA: DELIVERY

We are sending you  ATTACHED  UNDER SEPARATE COVER

PLANS  PRINTS  SHOP DRAWINGS  SAMPLES  SPECS  
 COPY OF LETTER  CHANGE ORDER  DISK  OTHER

COPIES	DATE	DESCRIPTION
1	10-30-12	North High 2 <sup>nd</sup> Drainage Plan

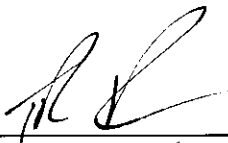
URGENT  FOR APPROVAL  FOR YOUR INFO  FOR REVIEW & COMMENT

APPROVED, AS NOTED  REVISE AS NOTED  REVISE AND RETURN

AS REQUESTED  PLEASE REPLY  FOR BIDS DUE

NOTES/ COMMENTS:

Scott,  
Please review and let me know of any questions or concerns!  
Thanks.

SIGNED:   
Trevor R. Kurth, P.E. CFM

Copy: file

ENGINEERING  
SURVEYING  
PLANNING  
LANDSCAPE  
ARCHITECTURE

B a u g h m a n  
C o m p a n y , P . A .  
315 Ellis Street  
Wichita, Kansas 67203  
P 316.262.7271  
F 316.262.0149



DRAINAGE PLAN  
**NORTH HIGH 2<sup>ND</sup>**  
**ADDITION**  
TO  
WICHITA, SEDGWICK COUNTY, KANSAS

**PREPARED BY**



**29 OCTOBER 2012**

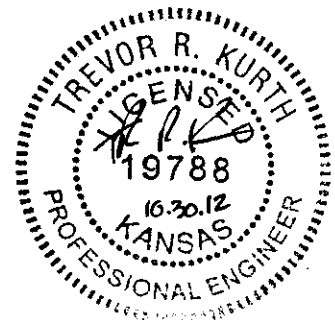


# DRAINAGE PLAN NORTH HIGH 2ND ADDITON

## FINAL REPORT

Prepared by Baughman Company, P.A.  
29 October 2012

By Trevor R. Kurth, P.E., CFM  
N. Brent Wooten, P.E., L.S.



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# PROJECT NARRATIVE

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## **EXISTING CONDITIONS**

The site is located just north of the existing North High School along the Little Arkansas River. The site is currently platted and developed as a residential area with homes, accessory structures, streets, utilities, and driveways. The area relatively flat and ultimately drains into the river with no detention or water quality. There is storm water sewer in the area and drains directly into the river. A portion of this plat, located along the south, is currently a portion of the tennis courts and football field/track.

The property lies within a FEMA SFHA Zone X-Shaded as of this report. The drainage patterns as defined above can be seen on the Aerial (Exhibit 2).

## **PROPOSED CONDITIONS**

The property is being platted as one large lot and will adjoin the existing North High School facilities. The existing structures, streets, and utilities will be removed and redeveloped into sports fields and facilities. The final site plan is not complete; however, a representation has been shown on the Drainage Plan and exhibits.

The site is expected to drain, generally, as the existing site does today. There is storm water sewer located along the north and south which will continue to convey runoff directly to the river. We expect sheet flow across the sports fields and then in the generally direction of the storm water sewer. Since the site will be re-graded and the existing pavement removed, we expect more infiltration and less runoff. This would be apparent in only the curve number selection and would be represented as pervious areas.

For a half-scale copy of the Plat, see Exhibit 3.

## **OFFSITE CONDITIONS**

The area is generally flat is served by City storm water sewer on the north and south sides of the site. The storm sewer drains directly into the west adjacent Little Arkansas River. The surrounding properties appear to also be flat and drain via sheet/gutter flow to the west and into the SWS system.

The overall site location and drainage patterns can be seen with the site location plotted as Exhibit 1.

# EXISTING CONDITIONS RUNOFF CALCULATIONS

## **DRAINAGE METHODS & STANDARDS**

The following methods and standards, although not a complete list, were used in calculating the existing conditions runoff values.

- STORM SERIES
  - 24-hour; 2-yr, 5-yr, 10-yr, 25-yr, 100-yr Storm Events Modeled
  - 2-yr Rainfall Depth = 3.5 in
  - 10-yr Rainfall Depth = 5.3 in
  - 100-yr Rainfall Depth = 7.9 in
  
- FLOW DATA
  - Areas per LIDAR data, USGS Quadrangle Sheet, Aerial Photos, and Site Visits
  - SCS Curve Number used for Existing Flows (composite computed using %)
  - Time of Concentration: Lag Method (minimum 15 min)

## **SITE CHARACTERISTICS**

The site is currently platted as residential lots and is fully developed as residential housing with streets, utilities, and structures. This area was first developed in the early 1900's. Paved streets and utilities would follow and exist in this area today. The area is relatively flat and is served along the north and south by underground storm water sewer which drains directly into the Little Arkansas River.

The existing site characteristics can be seen from the aerial exhibit (Exhibit 2).

## **EXISTING CONDITIONS HYDROLOGIC ANALYSIS**

The existing site was analyzed for existing runoff peak flows as well as existing impervious areas. Based on aerial images, it appears that the existing site is approximately covered by 163,800 ft<sup>2</sup> of impervious areas. These impervious areas include structures, patios, driveways, and roads. Based on this impervious cover, a composite Curve Number of 87 was used. This was due to the above as well as the site lying in Type B soils. The entire site drains, ultimately, to the west and into the Little Arkansas River.

## **DOWNSTREAM DRAINAGE CAPACITY**

The site drains to the Little Arkansas River to the west of the property. The river is controlled upstream for peak flow and is not expected to rise above its banks throughout the storm series. Since the flow is controlled upstream, and this property has been developed for many years, we expect the current FEMA study to be accurate for this reach.

The surrounding streets, which accept sheet flow and convey runoff to the storm water sewers, appears to be flat and may stand water. The storm water sewer currently serving the area consists of a 24" RCP on the north and an 18" along the south. There appears to be adequate overflow to the river to the west in the case of plugging or failure of the system.

# POST-DEVELOPMENT HYDROLOGIC ANALYSIS

## DRAINAGE METHODS & STANDARDS

The following methods and standards, although not a complete list, were used in developing the drainage and grading plans.

- STORM SERIES
  - 24-hour; 2-yr, 5-yr, 10-yr, 25-yr, 50-yr, 100-yr Storm Events Modeled
  - Hydrograph Method utilized for Developed Flows
  - CN = 80 (Soil Type B – Disturbed Pervious Area)
  - Time of Concentration; Lag Method, minimum Tc = 15min
  
- GRADING CONSTRAINTS TO BE OBSERVED AT SITE PLAN
  - Grading will be provided at site plan
  - Match all existing perimeter grades

## DEVELOPED CONDITIONS HYDROLOGIC ANALYSIS

The current plan is to demolish and level the existing site and construct athletic fields and accessory buildings to serve the adjacent North High School. At this time, the site plan has not been finalized. The site plan depicted herein is subject to change, but will provide a baseline for analysis for this drainage plan. The site is expected to remove the impervious area and replace it with mostly pervious area in the form of a baseball diamond, softball field, football practice field, and additional tennis courts.

A conservative curve number of 80 was used based on disturbed pervious areas in type B soils. We do not anticipate any detention on this site due to the site reducing the overall impervious area and will thus decrease the peak runoff and volume as compared to the existing site. The site, when using the preliminary site plan, will reduce the peak flows by approximately 10% during the 100-year storm event.

## DISCHARGE POINTS SUMMARY

The site will continue to discharge to the north, west, and south; all of which eventually drains to the Little Arkansas River. The site will continue to utilize the storm water sewer systems along the north and south of the property. We anticipate a private system to either tie into these systems or discharge directly into the Little Arkansas River upon development.

## WATER QUALITY

The site, upon development into athletic fields, will reduce the existing impervious area. The site will not provide water quality treatment due to this reduction. According to the City ordinance, no water quality treatment is necessary onsite if the development can reduce the impervious area by at least 20%. The site is currently 163,800 ft<sup>2</sup>; therefore, the site can add up to 131,140 ft<sup>2</sup> without providing water quality protection. We anticipate adding some impervious area, site plan specific, when the site is fully developed. This may include tennis courts, small parking areas, concessions stands, and sidewalks. These amenities can be added without triggering the water quality treatment requirement as long as they do not exceed the 20% reduction as noted above for a redevelopment area.

**DOWNSTREAM CHANNEL PROTECTION**

No downstream channel protection will be required on this site. Downstream channel protection is required when the site will produce a larger volume of runoff during the 1-year storm event; since this flow is considered the channel forming volume. This site, when reducing the impervious area, will reduce the volume across the storm series and thus will inherently reduce the channel forming velocities.

**POTENTIAL UPSTREAM/DOWNSTREAM IMPACTS**

With this site reducing the amount of impervious area, being a redevelopment area, the site will produce less runoff peak flow and volume after development. By reducing flows and volumes across the storm series we do not expect any downstream impacts with this development.

# FLOODPLAIN SUBMITTAL

## SOURCE OF FLOODPLAIN INFORMATION

The site lies within a FEMA Zone X - Shaded. The location of the property, on FEMA FIRM Panel 355 of 700 for Sedgwick County, Kansas, effective February 2, 2007, is attached as Exhibit 6.

## FEDERAL, STATE, & LOCAL PERMITTING

### US ARMY CORPS OF ENGINEERS

There does not appear to be any jurisdictional waters of the US on this site.

### KANSAS DEPT OF AGRICULTURE – DWR PERMITTING

There does not appear to be any DWR permitting needed on the proposed site at this time.

### FEMA

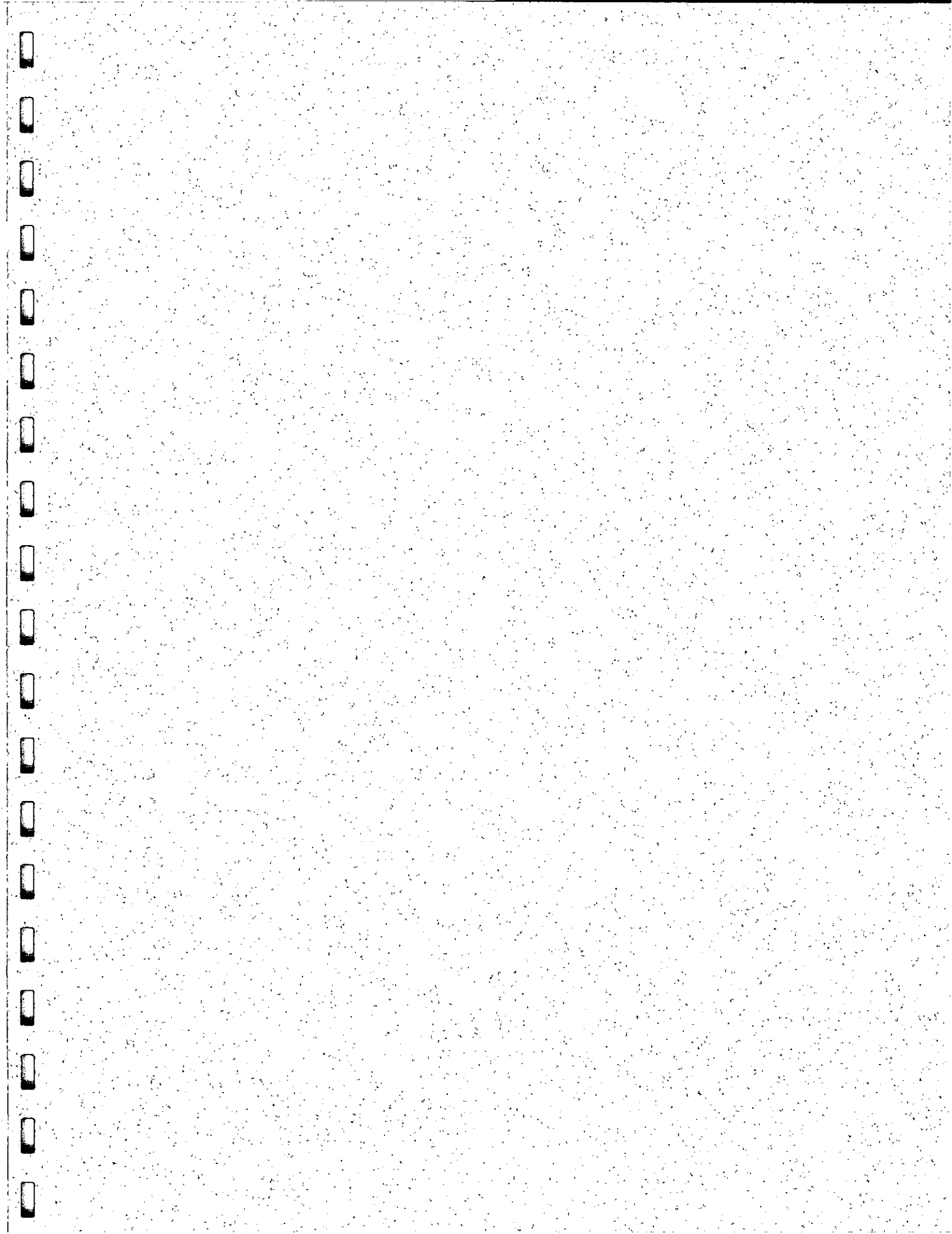
There is no mapped floodplain located upon the proposed site. Therefore, no FEMA permitting is expected at this time.

### KANSAS DEPT OF TRANSPORTATION

No ROW permit is expected with this development.

### SEDGWICK COUNTY PERMITTING

There does not appear to be any Sedgwick County permitting needed at this time.



## **EXHIBITS**

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**EXHIBIT 1: Site Location Map**

**EXHIBIT 2: Aerial Photo Exhibit with Lidar Topography**

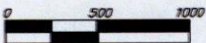
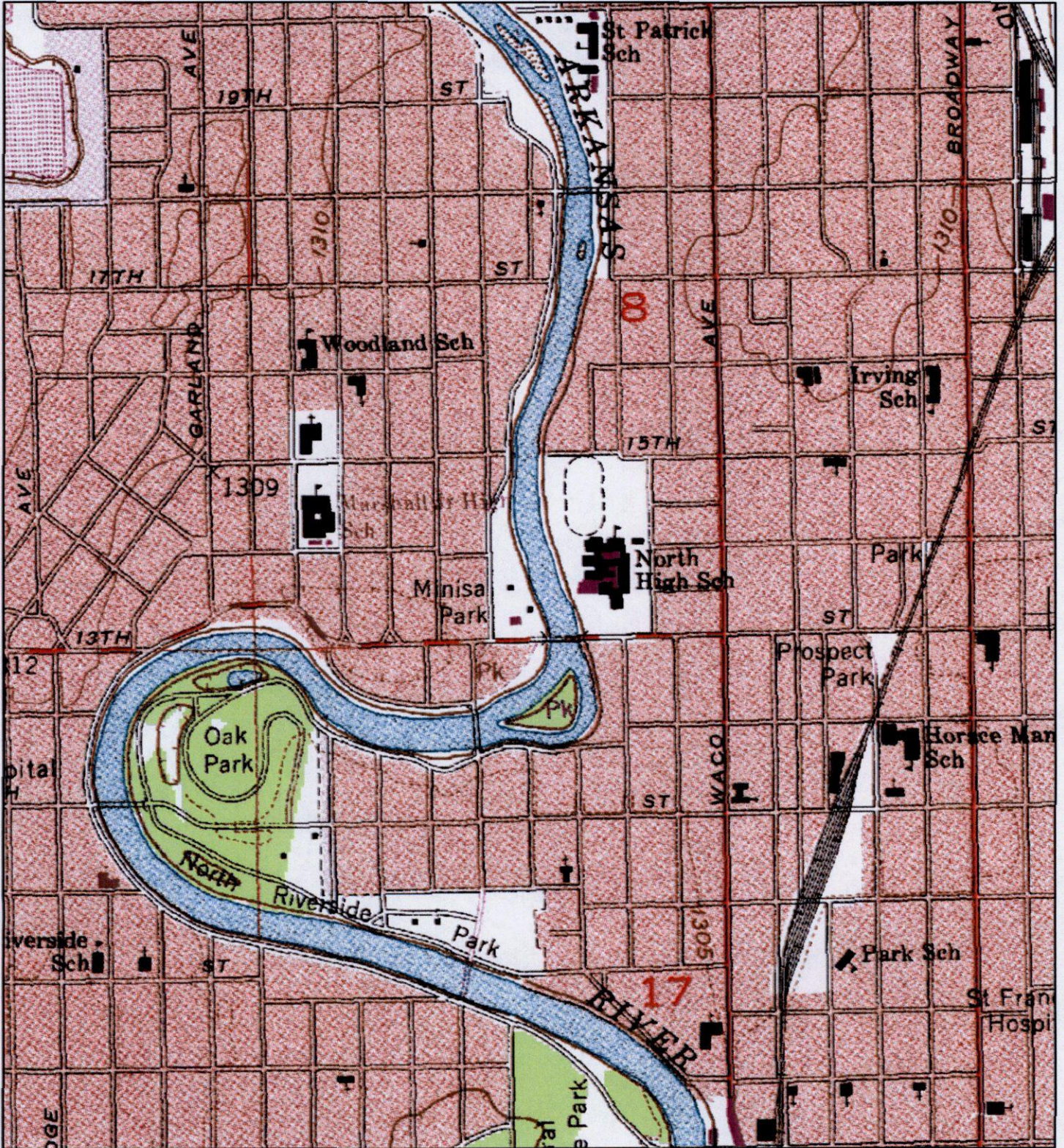
**EXHIBIT 3: Plat – Half Scale**

**EXHIBIT 4: Drainage Plan – Half Scale**

**EXHIBIT 5: Existing Impervious Area**

**EXHIBIT 6: Floodplain Location (FIRM)**

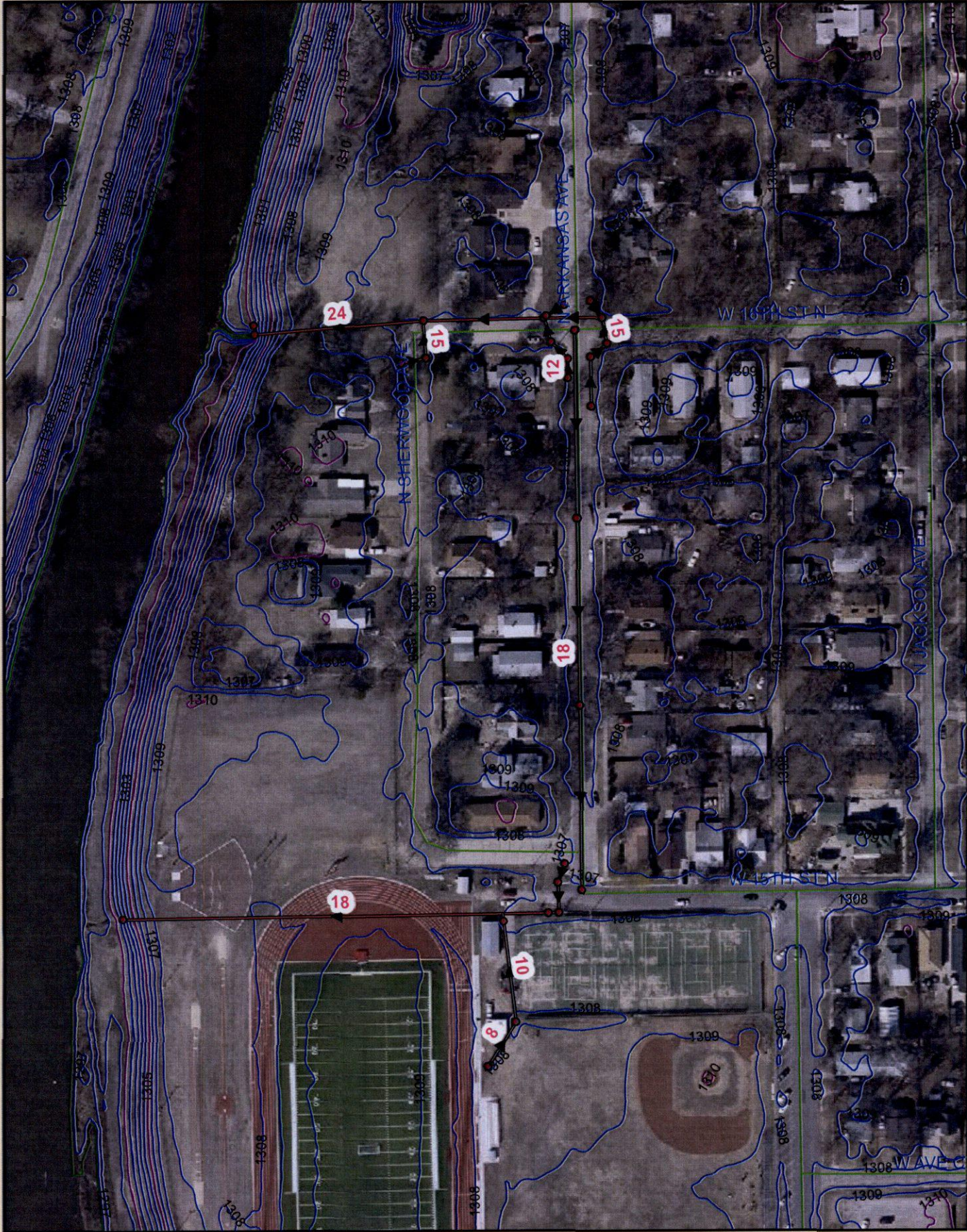
SITE LOCATION MAP  
**NORTH HIGH 2ND ADDITION**  
 WICHITA, SEDGWICK COUNTY, KANSAS



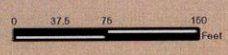
**SITE LOCATION MAP**  
**NORTH HIGH 2ND ADDITION**

29 OCT 2012


**Baughman Company, P.A.**  
 315 Ellis St. Wichita, KS 67211 P 316.62.7271 F 316.262.0149  
 ENGINEERING | SURVEYING | PLANNING | LANDSCAPE ARCHITECTURE



### North High 2nd Addition



# ONE-STEP FINAL PLAT

## NORTH HIGH SCHOOL 2ND ADDITION

### WICHITA, SEDGWICK COUNTY, KANSAS

This plot of "NORTH HIGH SCHOOL 2ND ADDITION", Wichita, Sedgwick County, Kansas has been submitted to and approved by the Wichita-Sedgwick County Metropolitan Area Planning Commission, Wichita, Kansas.

Dated this \_\_\_\_\_ day of \_\_\_\_\_, 2012.

Wichita-Sedgwick County Metropolitan Area Planning Commission

\_\_\_\_\_ , Chair  
David Dennis

\_\_\_\_\_ , Secretary  
John L. Schiegel

This plat approved and all dedications shown hereon accepted by the City Council of the City of Wichita, Kansas, this \_\_\_\_\_ day of \_\_\_\_\_, 2012.

\_\_\_\_\_ , Mayor  
Carl Brewer

\_\_\_\_\_ , City Clerk  
Karen Sublett

Reviewed in accordance with K.S.A. 58-2005 on this \_\_\_\_\_ day of \_\_\_\_\_, 2012.

Fricia L. Robello, L.S. #1246  
Deputy County Surveyor  
Sedgwick County, Kansas

Entered on transfer record this \_\_\_\_\_ day of \_\_\_\_\_, 2012.

\_\_\_\_\_ , County Clerk  
Kelly B. Arnold

State of Kansas) SS This is to certify that this plat has been  
Sedgwick County) filed for record in the office of the Registrar of Deeds, this day  
of \_\_\_\_\_, 2012 at \_\_\_\_\_ o'clock \_\_\_\_\_ M, and is duly recorded.

\_\_\_\_\_ , Registrar of Deeds  
Bill Meek

\_\_\_\_\_ , Deputy  
Tonya Buckingham

State of Kansas) SS The foregoing instrument acknowledged before  
Sedgwick County) me, this \_\_\_\_\_ day of \_\_\_\_\_, 2012, by Lynn Rogers, President  
of the United School District No. 253, Wichita, Sedgwick County, Kansas,  
on behalf of the unified school district.

My App't. Exp. \_\_\_\_\_ , Notary Public  
\_\_\_\_\_ , Notary Public

**NORTH HIGH SCHOOL  
2ND ADDITION**

Baughman Company, P.A.  
13110 W. 15th St., Wichita, KS 67204  
PH: 316.261.1111 FAX: 316.261.1112  
www.baughman.com

We, Baughman Company, P.A., Surveyors in Sedgwick County and state do hereby certify that we have surveyed and plotted "NORTH HIGH SCHOOL 2ND ADDITION", Wichita, Sedgwick County, Kansas and that the accompanying plat is a true and correct exhibit of the property surveyed, described as follows: Lots 2, 3, and 4, on Sherwood Avenue, and Lot 2, on Rochester Avenue, Sherwood's Sub-division of Lots 2, 4, 6, 8, 10, 12, and 14, in Reserve D, Sherwood's Addition, Wichita, Kansas, together with that part of vacated Sherwood Avenue (Ordinance 3823) lying north of and abutting the following described line: Beginning at the southwest corner of said Lot 3, thence westerly 60 feet to the southeast corner of said Lot 4, and thence ending TOGETHER with odd Lots 1 through 35, inclusive, together with even Lots 2 through 28, inclusive, Sherwood's Second Addition to Wichita, Kansas, except a portion of said even Lots 2 through 28, TOGETHER with even Lots 2 through 12, inclusive, together with odd Lots 1 through 7, inclusive, together with Reserve "A", Woods Subdivision of Lots 30, 32, 34, 36, on Sherwood Second Addition to Wichita, Kansas, except that part taken for street in Condemnation Case #A-32158, TOGETHER with even Lots 2 through 22, inclusive, on Arkansas Ave., Anderson's Addition to Wichita, Kansas, except the west 15 feet thereof taken for street purposes, together with Lot 24, on Arkansas Ave., in said Anderson's Addition, except the west 15 feet thereof taken for street purposes and except the south 20 feet thereof taken for street purposes, TOGETHER with even Lots 2 through 26, inclusive, on Arkansas Ave., Roosevelt Addition to the City of Wichita, Kansas, except the west 15 feet thereof taken for street purposes, TOGETHER with the following described tract: Beginning 76.3 feet south and 210 feet west of the northeast corner of the Southwest Quarter of Section 8, Township 27 South, Range 1 East of the Sixth Principal Meridian, Sedgwick County, Kansas; thence south 60 feet to the northeast corner of Lot 2, Sherwood Avenue, Sherwood's Second Addition to Wichita, Kansas; thence west on the north line of said Lot 2, 153.81 feet to the east line of City Property; thence northeasterly along the east line of City Property to a point west of beginning, thence east to beginning, Sedgwick County, Kansas, TOGETHER with the following described tract: A tract in the Southwest Quarter of Section 8, Township 27 South, Range 1 East of the Sixth Principal Meridian, Sedgwick County, Kansas, described as follows: Beginning at a point 690 feet south and 210 feet west of the northeast corner of said Southwest Quarter, thence south 73 feet, thence west 153.81 feet, thence northeasterly along a curve concave to the west, having a radius of 1828.8 feet to a point 103.15 feet west of beginning, thence east 103.15 feet to the point of beginning, Sedgwick County, Kansas, TOGETHER with the following described tract: Beginning 30 feet south and 15 feet west of Lot 26, as originally platted in Johnston and Brown's Addition to the City of Wichita, Kansas, on Arkansas Avenue; thence west 135 feet; thence south 133 feet more or less to the northwest corner of Lot 1, in Sherwood's Second Addition to the City of Wichita, Kansas, on Sherwood Avenue; thence east 135 feet to Arkansas Avenue; thence north 133 feet to the place of beginning, except the south 65 feet thereof (being in the Southwest Quarter of Section 8, Township 27 South, Range 1 East of the Sixth Principal Meridian, Sedgwick County, Kansas), TOGETHER with a tract in the Southwest Quarter of Section 8, Township 27 South, Range 1 East of the Sixth Principal Meridian, Sedgwick County, Kansas described as: The south 65 feet of a tract beginning at the northeast corner of Lot 1, in Sherwood's Second Addition to Wichita, Kansas; thence north 113 feet, thence west 135 feet; thence south 133 feet; thence east 135 feet to beginning, and TOGETHER with street and alley dedications lying within the above described tracts.

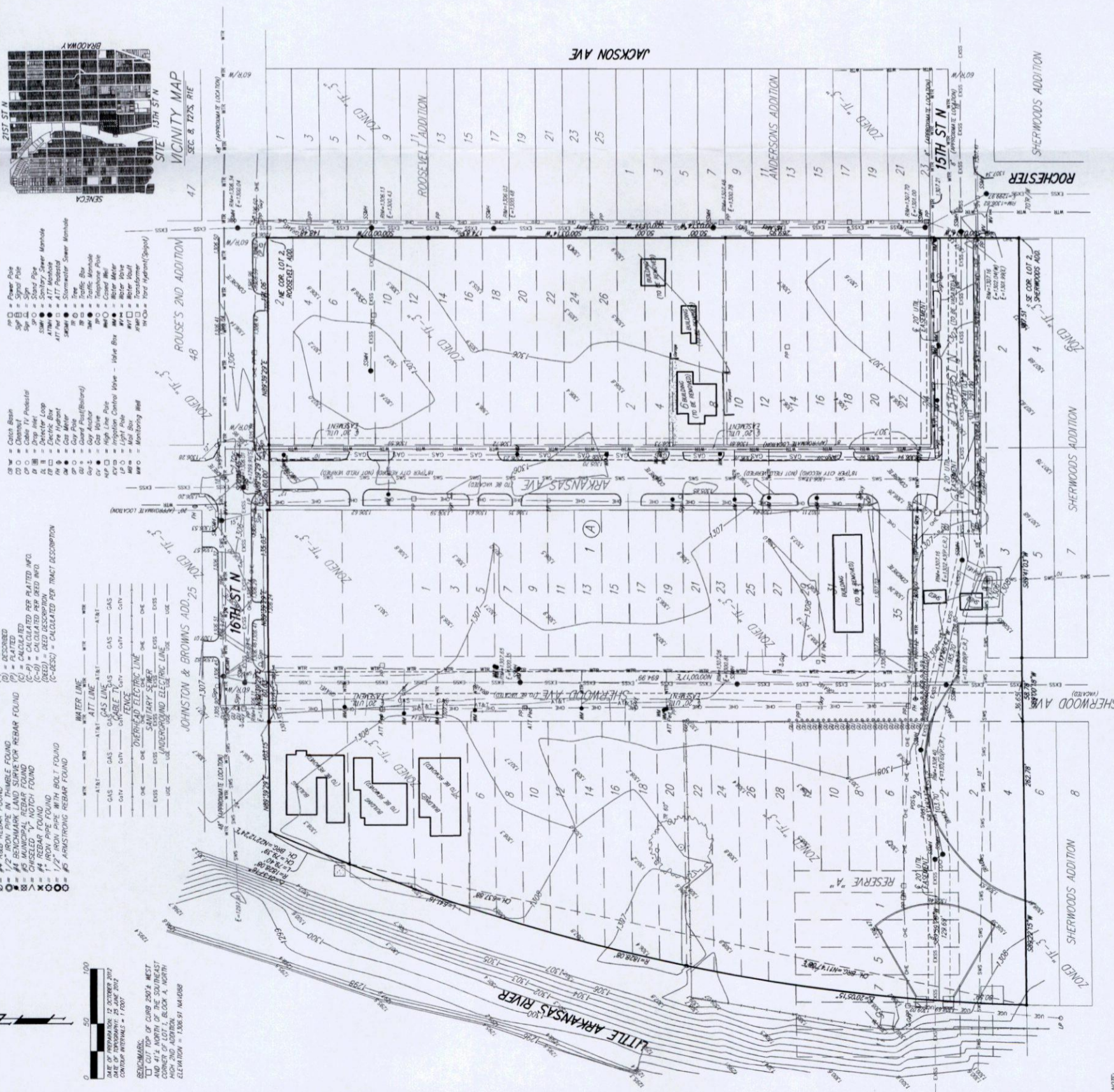
Existing public easements and dedications being vacated by virtue of K.S.A. 12-512b. All being situated in the Southeast Quarter and the Southwest Quarter of Section 8, Township 27 South, Range 1 East of the Sixth Principal Meridian, Sedgwick County, Kansas.

Baughman Company, P.A.  
\_\_\_\_\_ , Surveyor  
Michael G. Conroy

Know all men by these presents that we the undersigned, have caused the land in the surveyors certificate to be platted into a Lot and a Block, to be known as "NORTH HIGH SCHOOL 2ND ADDITION", Wichita, Sedgwick County, Kansas. The utility easements are hereby granted as indicated for the construction and maintenance of all public utilities. The drainage and utility easements are hereby granted as indicated for drainage purposes and for the construction and maintenance of all public utilities. The drainage easements are hereby granted as indicated for drainage purposes. The Minimum Building Pad Elevations for the lowest opening to the structures on Lot 1, Block A shall be 1305.0 MAUD88.

United School District No. 253  
Wichita, Sedgwick County, Kansas

Lynn Rogers  
President

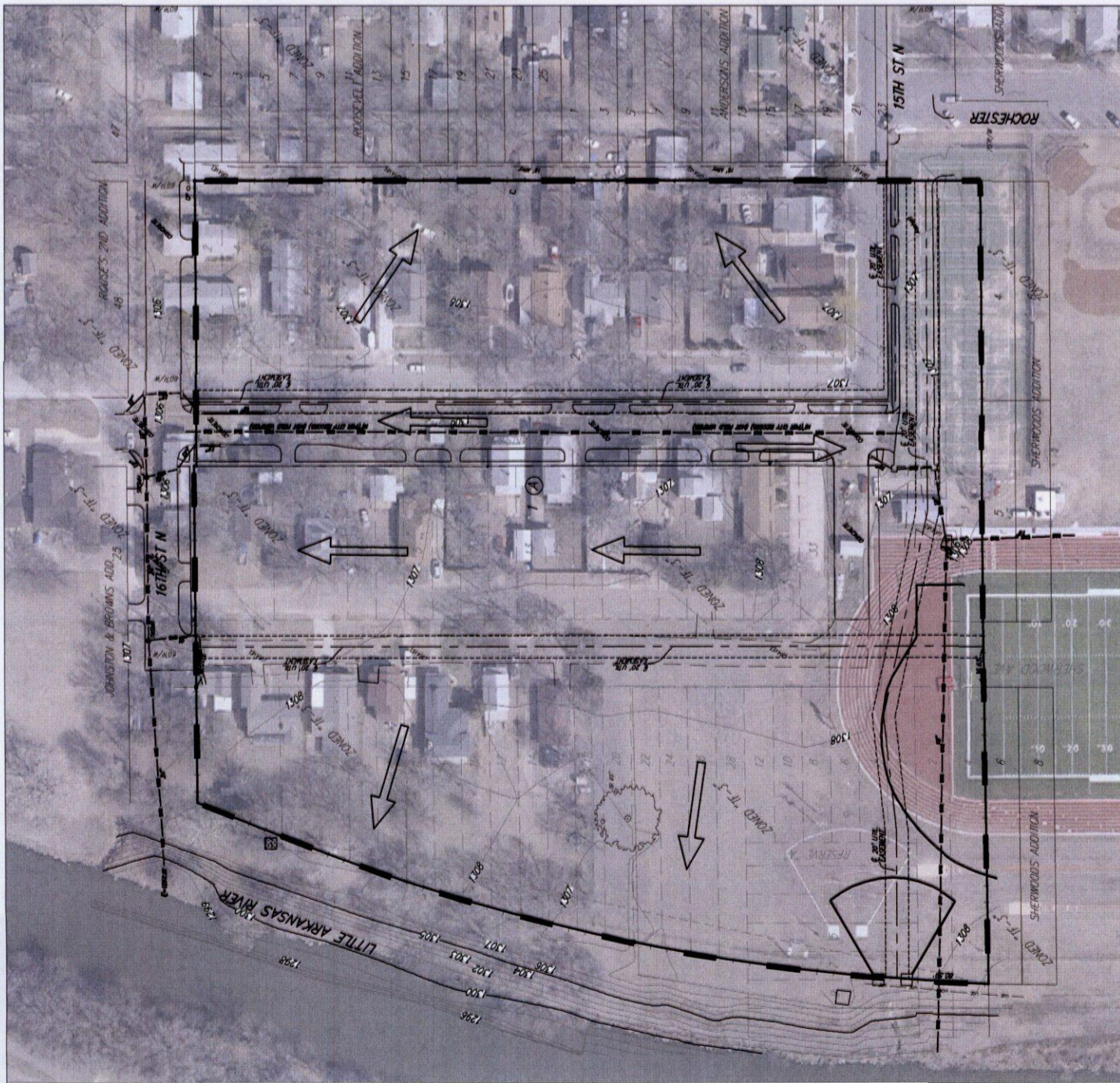


NOTE: The grading plan for drainage has been developed for this subdivision and is in file with the City of Wichita, Kansas. All drainage easements, right-of-way, or reserves and remain of established grades or easements shall be shown on this plat. No obstructions which impede the flow of this drainage system shall be allowed.

# DRAINAGE PLAN

## NORTH HIGH SCHOOL 2ND ADDITION

### WICHITA, SEDGWICK COUNTY, KANSAS



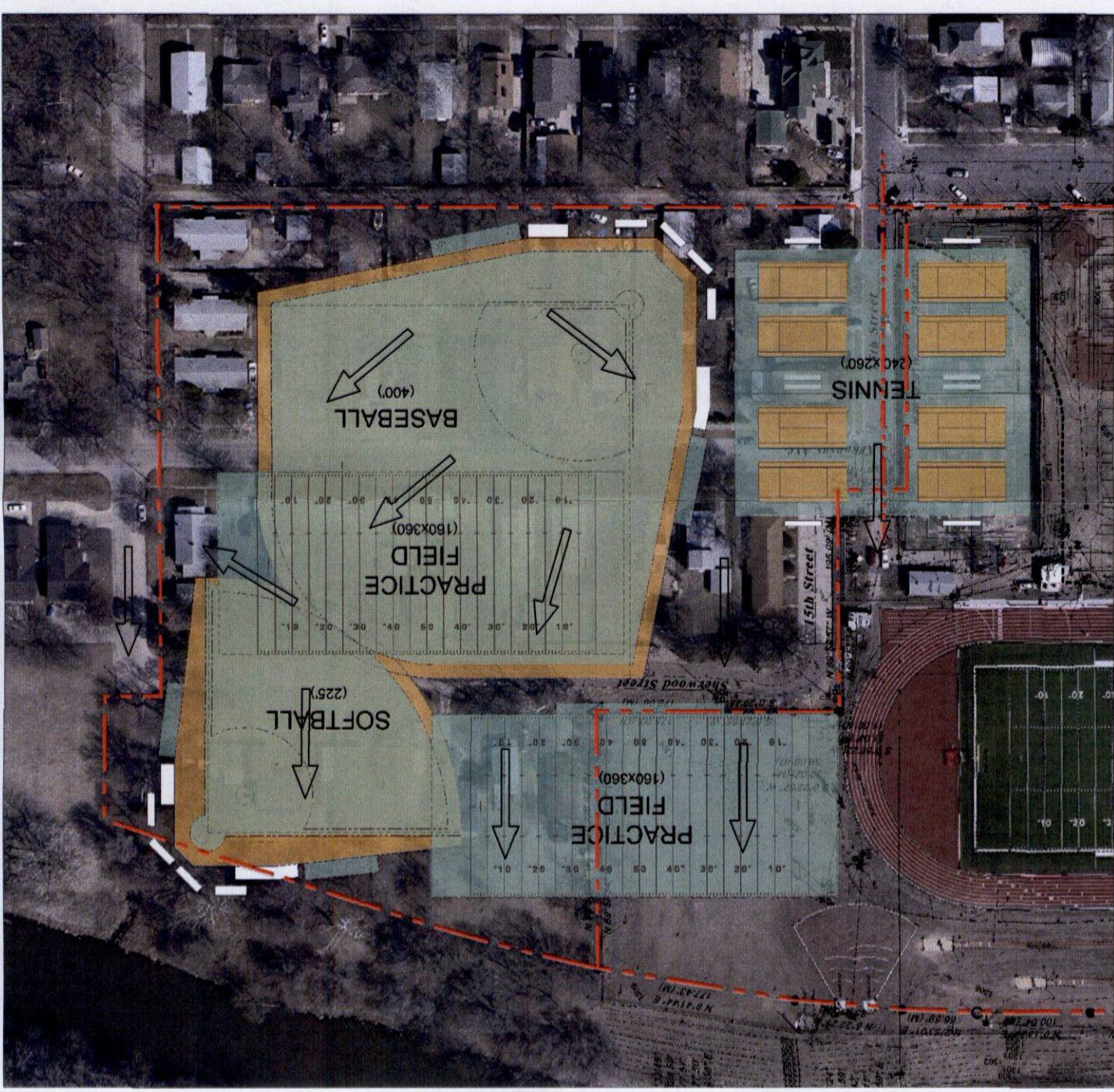
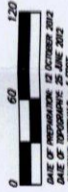
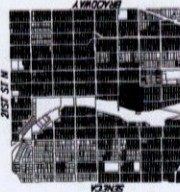
#### EXISTING CONDITIONS

<b>EXISTING SITE</b>
DA = 10.4 acres
CN = 87
Ic = 15 mph
Q <sub>2</sub> = 29 cfs
Q <sub>3</sub> = 40 cfs
Q <sub>10</sub> = 46 cfs
Q <sub>100</sub> = 78 cfs

\*assuming a 20% impervious cover

EXISTING IMPERVIOUS AREA = ±163,800 SF

NOTE: The proposed site can add up to ±131,040 SF of impervious area without providing water quality treatment. This is due to meeting the City SW WQ requirements of reducing the existing impervious cover by at least 20%.



#### PROPOSED CONDITIONS

<b>PROPOSED SITE</b>
DA = 10.4 acres
CN = 87
Ic = 15 mph
Q <sub>2</sub> = 21 cfs
Q <sub>3</sub> = 32 cfs
Q <sub>10</sub> = 40 cfs
Q <sub>100</sub> = 70 cfs

\*assuming a 20% impervious cover

NOTES: This site lies within a FEMA FLOOD HAZARD ZONE as of this date per FEMA FIRM Panel 3352 of 700, for Wichita, Sedgwick County, Kansas, effective February 2, 2002.

The site will generally drain as the existing site does - utilizing the SWWS in 16th Street on the north side and SWWS along the south on USD property.

The site plan, as shown, is preliminary in nature, and may change prior to final site construction. Therefore, no grading or drainage patterns have been finalized.

## DRAINAGE PLAN

### NORTH HIGH SCHOOL 2ND ADDITION

28 OCT 2012  
 Baughman Company, P.A.  
 1515 E. W. WILSON, SUITE 201E, WICHITA, KS 67202 P: 316-262-7171 F: 316-262-4919  
 Baughman  
 ARCHITECTURE | ENGINEERING | PLANNING | LANDSCAPE ARCHITECTURE



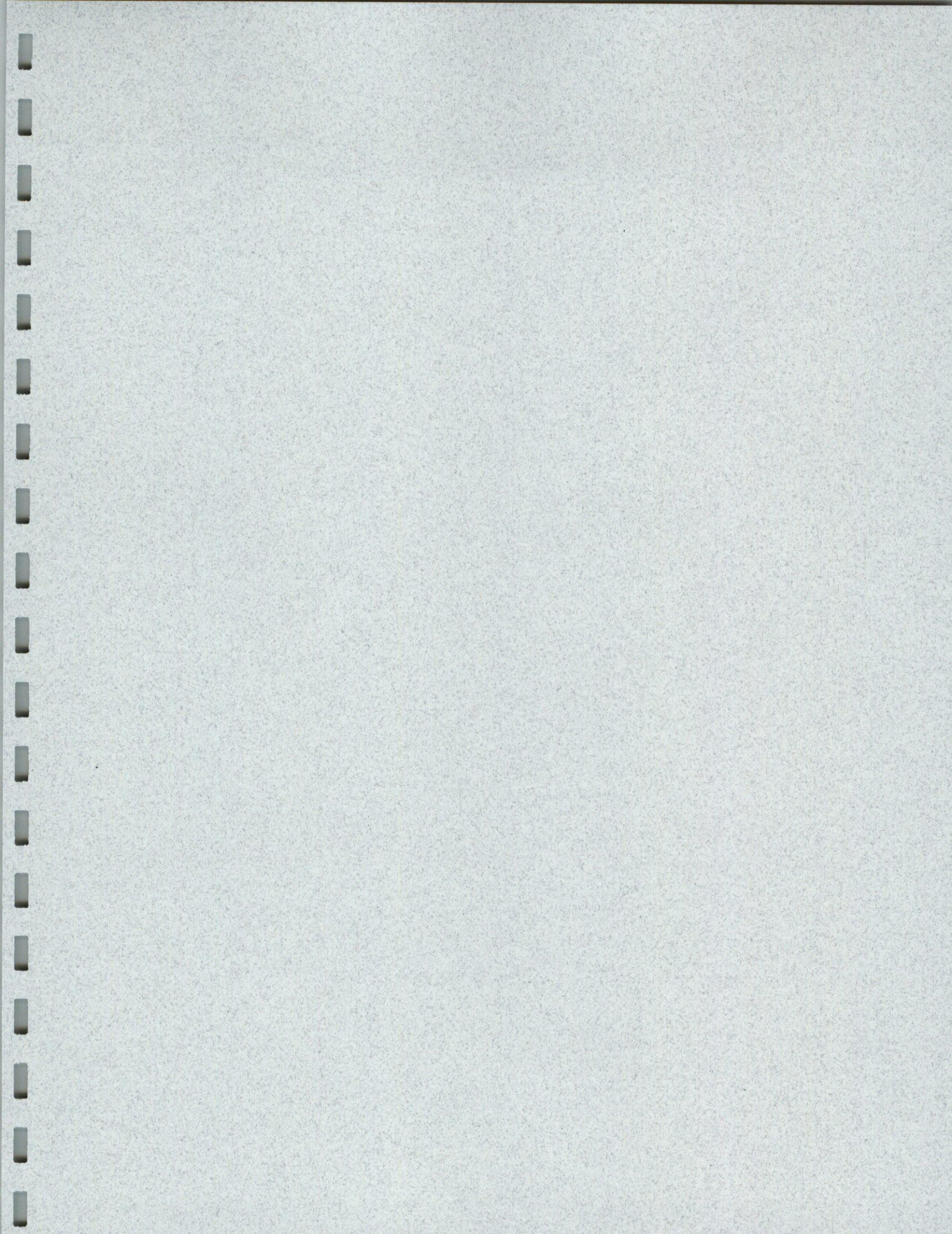
**Impervious Area**  
163,800 sq ft



### North High 2nd - Impervious Area



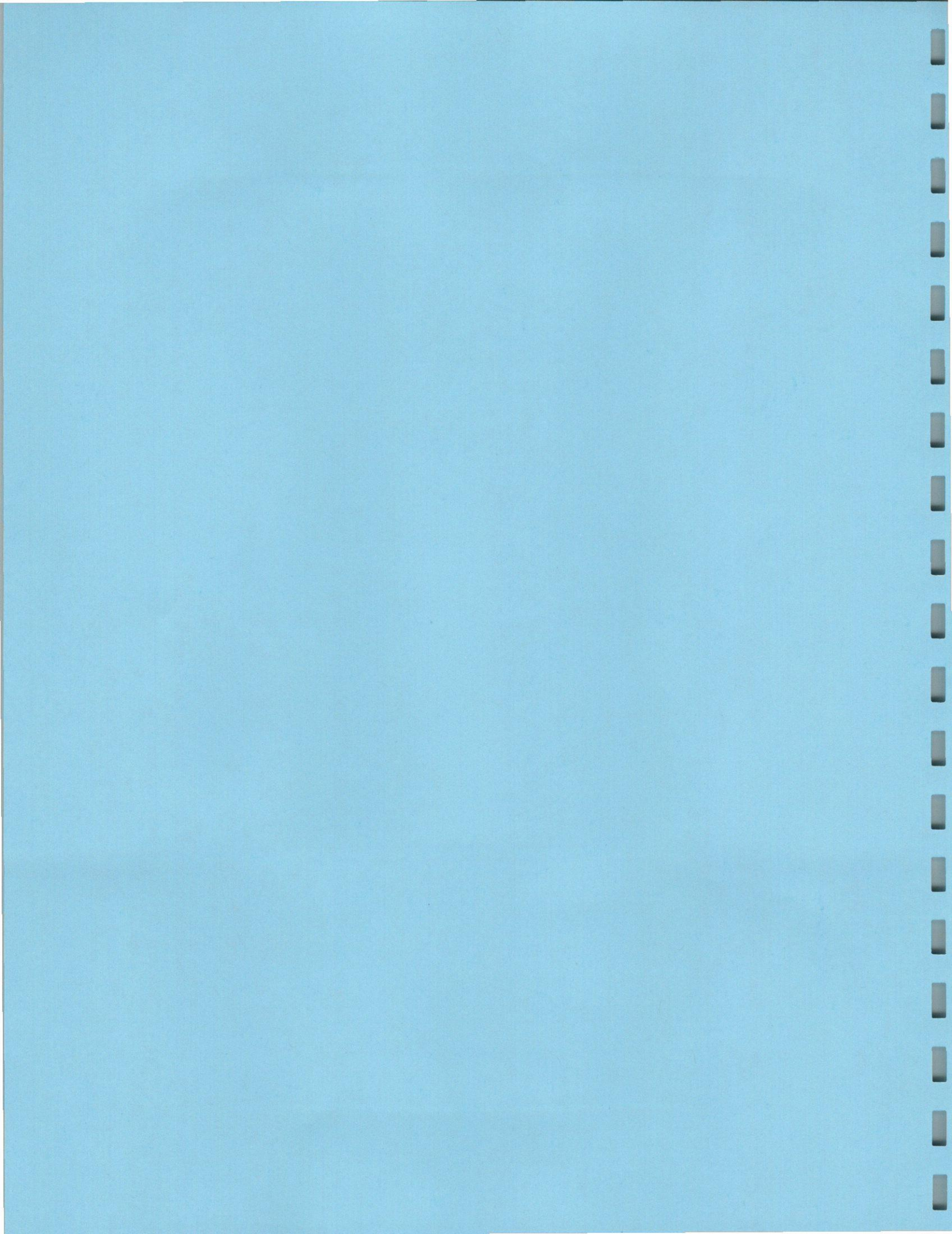




## **SUPPORTING CALCULATIONS**

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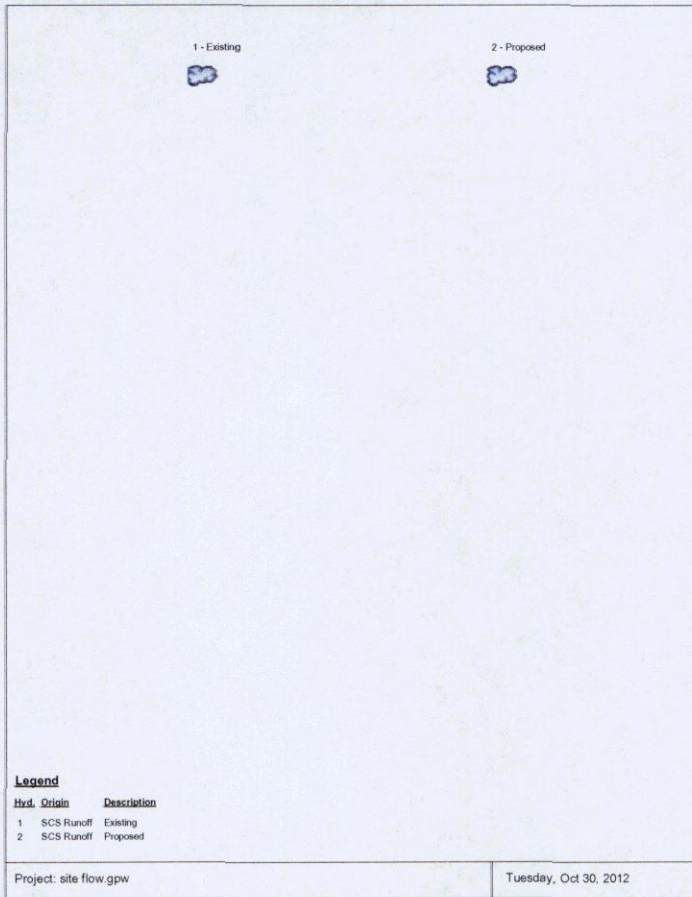
### **APPENDIX A :      HydraFlow Hydrographs                                  Site Flow**



**HydraFlow Hydrographs**  
Site Flow

# Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6



# Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

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	-----	20.56	28.52	4.164	40.07	48.19	58.62	67.86	78.21	Existing
2	SCS Runoff	-----	14.19	21.40	1.292	32.32	40.22	50.52	59.76	70.19	Proposed

Proj. file: site flow.gpw      Tuesday, Oct 30, 2012

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	28.52	2	722	80,331	-----	-----	-----	Existing
2	SCS Runoff	21.40	2	722	60,232	-----	-----	-----	Proposed

site flow.gpw      Return Period: 2 Year      Tuesday, Oct 30, 2012

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

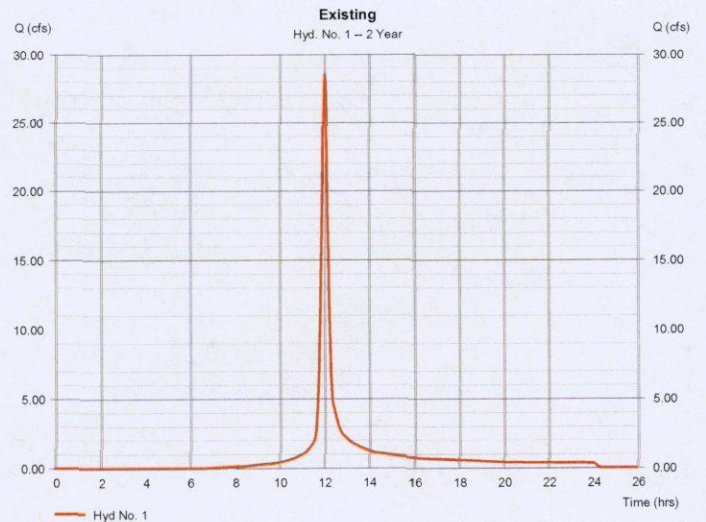
Tuesday, Oct 30, 2012

## Hyd. No. 1

Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 28.52 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 80,331 cuft
Drainage area	= 10.400 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(6,000 x 80) + (3,800 x 98)] / 10,400



# Hydrograph Report

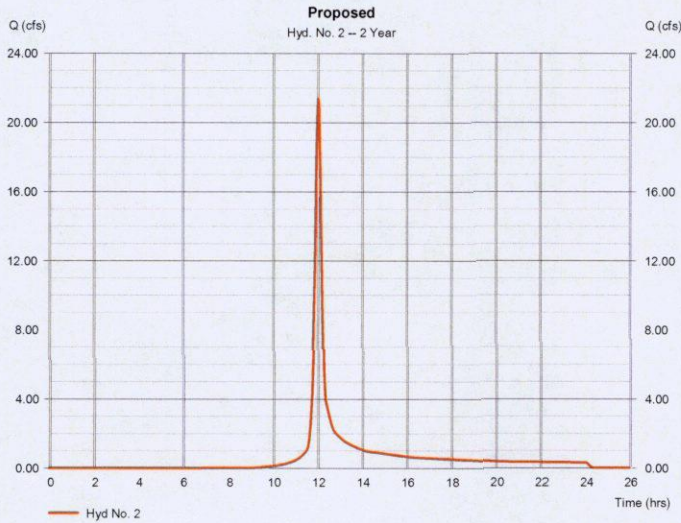
Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Tuesday, Oct 30, 2012

## Hyd. No. 2

Proposed

Hydrograph type	= SCS Runoff	Peak discharge	= 21.40 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 60,232 cuft
Drainage area	= 10.400 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Summary Report

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total stage used (cuft)	Hydrograph Description
1	SCS Runoff	40.07	2	722	114,066	-----	-----	-----	Existing
2	SCS Runoff	32.32	2	722	90,605	-----	-----	-----	Proposed

site flow.gpw      Return Period: 5 Year      Tuesday, Oct 30, 2012

# Hydrograph Report

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

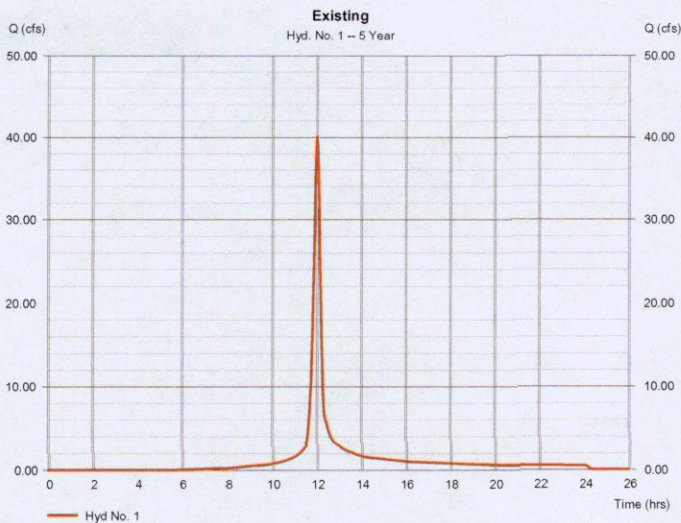
Tuesday, Oct 30, 2012

## Hyd. No. 1

Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 40.07 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 114,066 cuft
Drainage area	= 10.400 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 4.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(6,000 x 80) + (3,800 x 98)] / 10.400



# Hydrograph Report

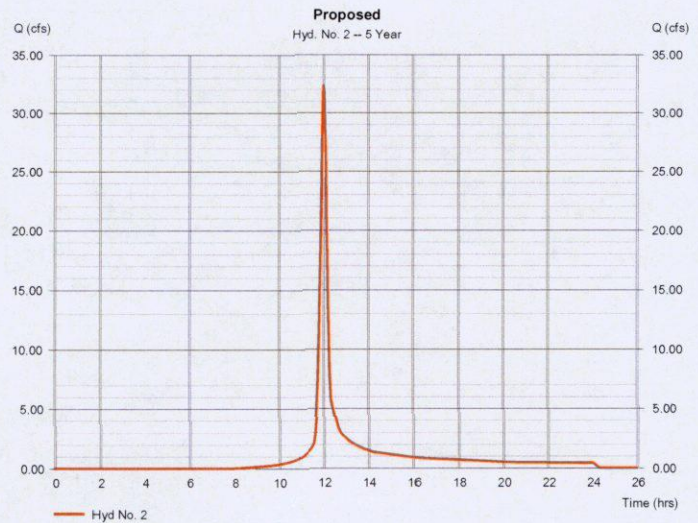
Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Tuesday, Oct 30, 2012

## Hyd. No. 2

Proposed

Hydrograph type	= SCS Runoff	Peak discharge	= 32.32 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 90,605 cuft
Drainage area	= 10.400 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 4.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Summary Report

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	48.19	2	722	138,252	-----	-----	-----	Existing
2	SCS Runoff	40.22	2	722	112,930	-----	-----	-----	Proposed

site flow.gpw      Return Period: 10 Year      Tuesday, Oct 30, 2012

# Hydrograph Report

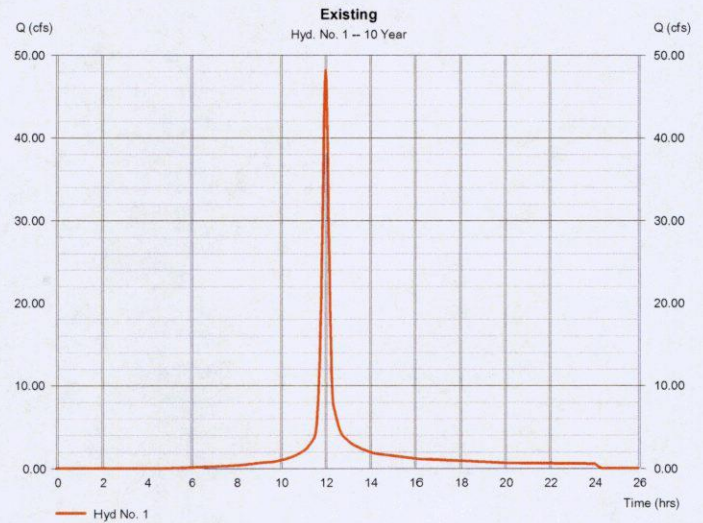
Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

## Hyd. No. 1

Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 48.19 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 138,252 cuft
Drainage area	= 10.400 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 5.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(6.000 x 80) + (3.800 x 98)] / 10.400



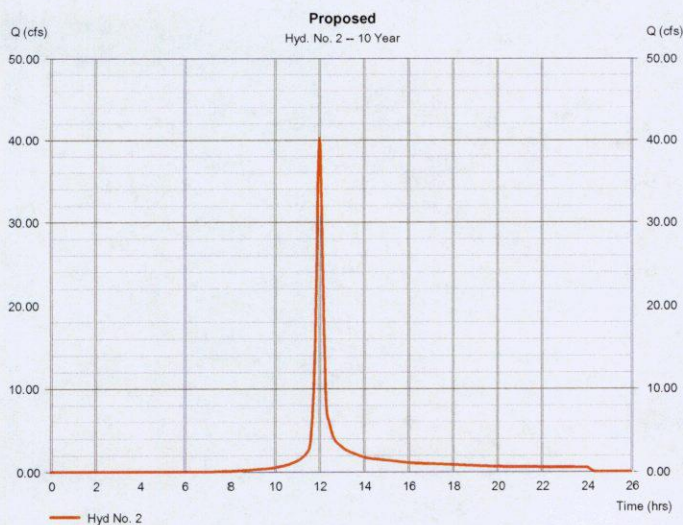
# Hydrograph Report

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

## Hyd. No. 2

Proposed

Hydrograph type	= SCS Runoff	Peak discharge	= 40.22 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 112,930 cuft
Drainage area	= 10.400 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 5.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Summary Report

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	58.02	2	722	169,794	-----	-----	-----	Existing
2	SCS Runoff	50.52	2	722	142,507	-----	-----	-----	Proposed

site flow.gpw      Return Period: 25 Year      Tuesday, Oct 30, 2012

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

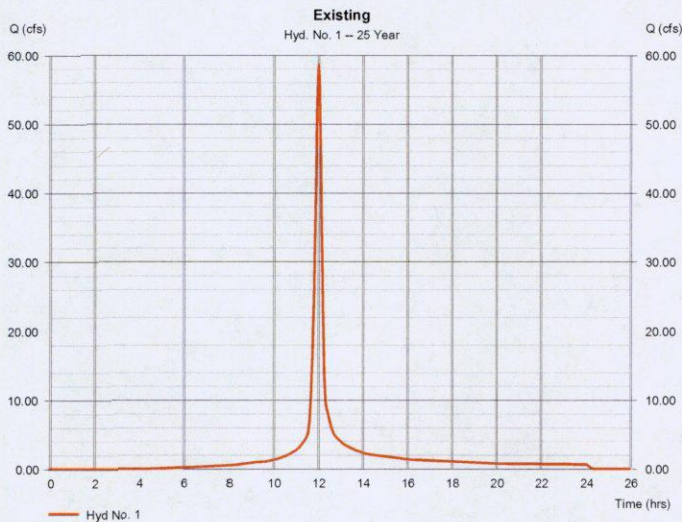
Tuesday, Oct 30, 2012

## Hyd. No. 1

### Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 58.62 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 169,794 cuft
Drainage area	= 10.400 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(6,000 x 80) + (3,800 x 98)] / 10,400



# Hydrograph Report

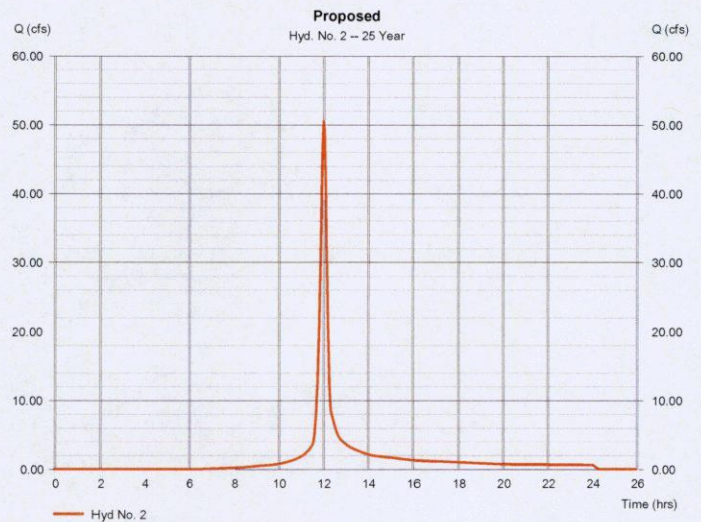
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

Tuesday, Oct 30, 2012

## Hyd. No. 2

### Proposed

Hydrograph type	= SCS Runoff	Peak discharge	= 50.52 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 142,507 cuft
Drainage area	= 10.400 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	67.86	2	722	198,128	-----	-----	-----	Existing
2	SCS Runoff	58.76	2	722	169,400	-----	-----	-----	Proposed

site flow.gpw      Return Period: 50 Year      Tuesday, Oct 30, 2012

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v6

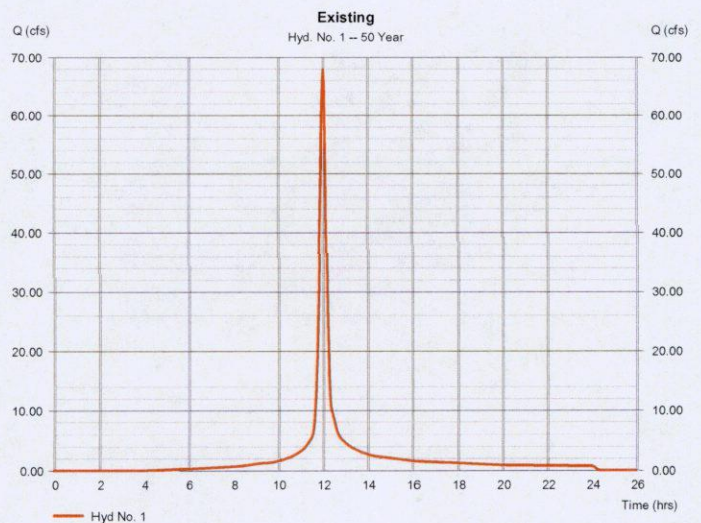
Tuesday, Oct 30, 2012

## Hyd. No. 1

### Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 67.86 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 198,128 cuft
Drainage area	= 10.400 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(6,000 x 80) + (3,800 x 98)] / 10,400

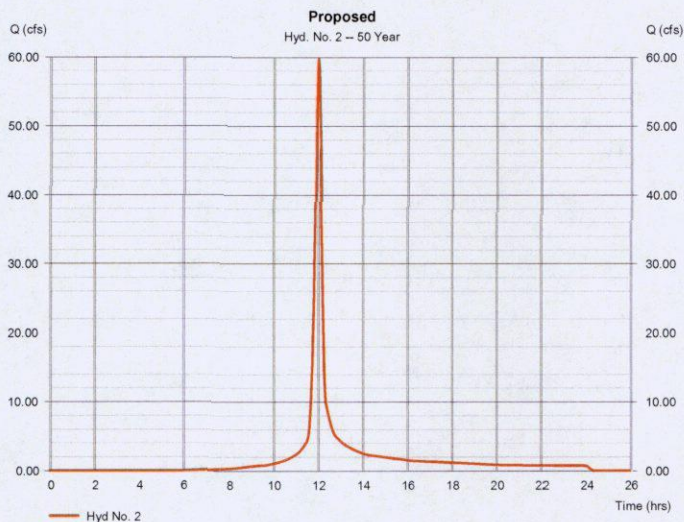


# Hydrograph Report

## Hyd. No. 2

Proposed

Hydrograph type	= SCS Runoff	Peak discharge	= 59.76 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 169,400 cuft
Drainage area	= 10.400 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	78.21	2	722	230,239	-----	-----	-----	Existing
2	SCS Runoff	70.19	2	722	200,154	-----	-----	-----	Proposed

site flow.gpw      Return Period: 100 Year      Tuesday, Oct 30, 2012

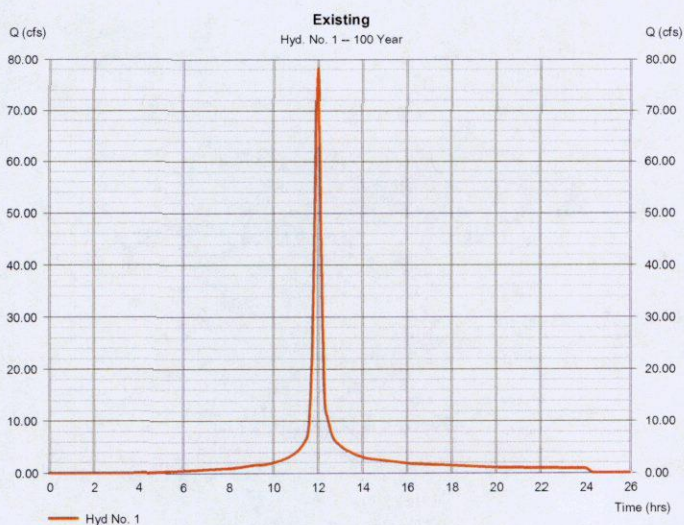
# Hydrograph Report

## Hyd. No. 1

Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 78.21 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 230,239 cuft
Drainage area	= 10.400 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 7.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(6.000 x 80) + (3.800 x 98)] / 10.400

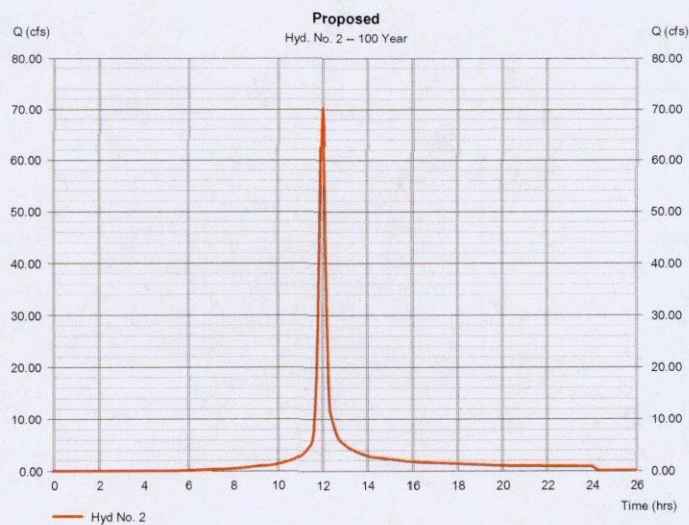


# Hydrograph Report

## Hyd. No. 2

Proposed

Hydrograph type	= SCS Runoff	Peak discharge	= 70.19 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 200,154 cuft
Drainage area	= 10.400 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 7.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	27.8907	9.8000	0.7047	-----
2	70.3137	14.3000	0.8944	-----
3	1.2000	0.1000	0.0000	-----
5	52.6224	11.2000	0.7497	-----
10	55.1841	11.1000	0.7229	-----
25	60.7012	11.1000	0.7068	-----
50	66.9222	11.3000	0.7004	-----
100	62.2794	10.1000	0.6924	-----

File name: wch\_IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	4.18	3.40	2.90	2.55	2.29	2.08	1.91	1.78	1.66	1.56	1.48	1.40
2	5.57	4.54	3.85	3.35	2.97	2.67	2.43	2.23	2.06	1.92	1.80	1.69
3	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
5	6.52	5.33	4.55	3.90	3.57	3.24	2.97	2.75	2.57	2.41	2.27	2.15
10	7.40	6.09	5.22	4.60	4.13	3.76	3.46	3.21	3.00	2.82	2.67	2.53
25	8.51	7.03	6.05	5.35	4.81	4.39	4.05	3.76	3.52	3.32	3.14	2.98
50	9.47	7.86	6.78	6.00	5.41	4.94	4.56	4.24	3.98	3.75	3.55	3.37
100	10.31	8.53	7.37	6.53	5.90	5.40	5.00	4.66	4.37	4.13	3.92	3.73

Tc = time in minutes. Values may exceed 60.

Precip. file name: wch\_24hr.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.80	3.50	1.20	4.50	5.20	6.10	6.90	7.80
SCS 6-hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

Watershed Model Schematic ..... 1

Hydrograph Return Period Recap ..... 2

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5 - Year

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        Hydrograph No. 1, SCS Runoff, Existing..... 7

        Hydrograph No. 2, SCS Runoff, Proposed..... 8

10 - Year

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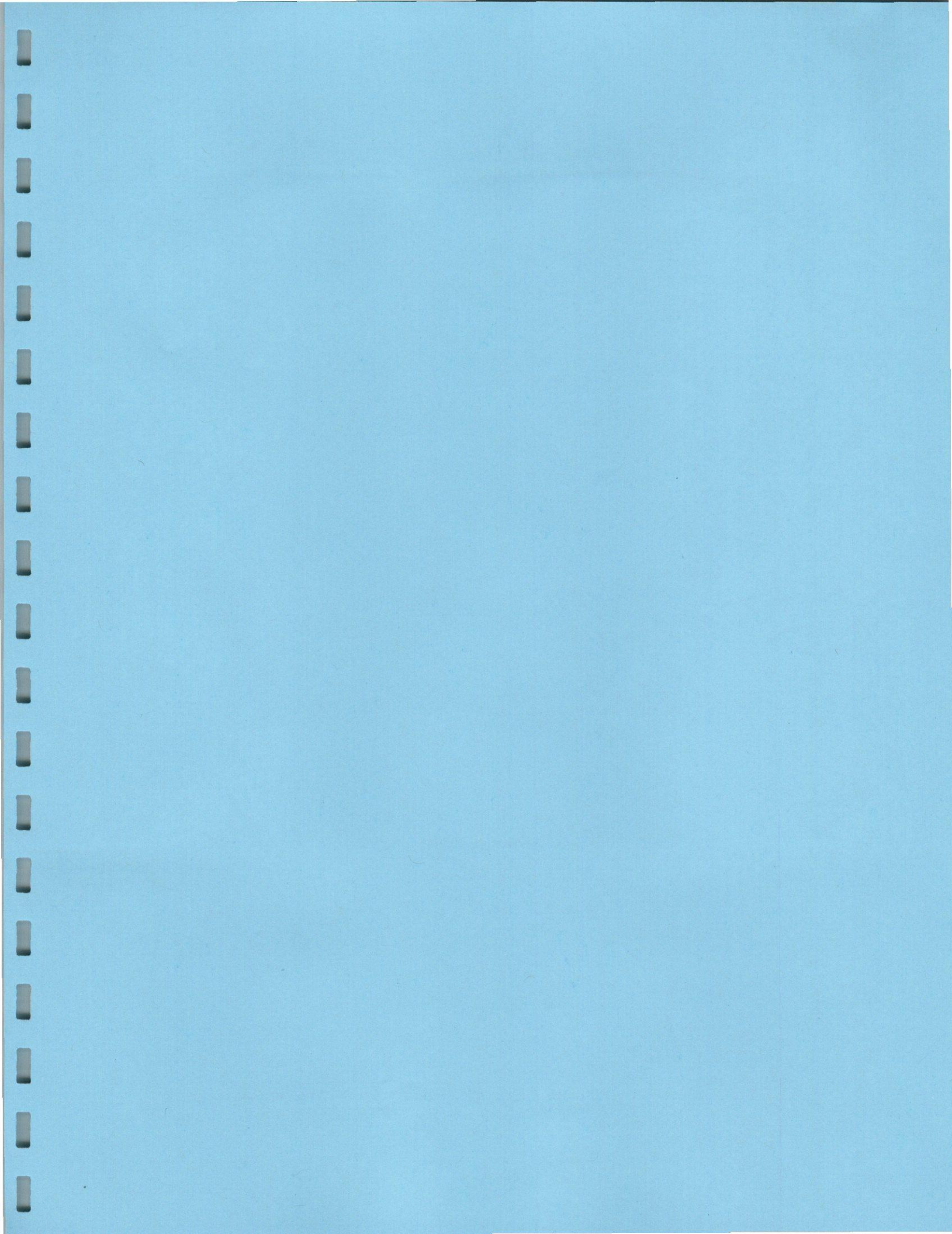
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**Drainage Plan**  
1:60 Scale