MACRO STORM WATER DRAINAGE STUDY

Winterset Cedar Creek

SITE ACREAGE: 3.69 ACRES

Lee's Summit, MO

PREPARED BY:

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Revision

Date	Comment	By
9-8-20	Revised per City Comments Dated September 8, 2020	AEP
9-22-20	Revised per City Comments Dated September 15, 2020	AEP

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3.0 General Information

The proposed Winterset Cedar Creek single-family residential subdivision is to be located in the southwest quarter of the southwest quarter of Section 2, Township 47 North, Range 32 West, Lee's Summit, Jackson County, Missouri. The proposed development would be adjacent to Winterset Park and consist of an extension of SW Winter Road. The proposed development area is 3.69 acres. The proposed improvements would consist of five lots, a road extension with terminating cul-de-sac in addition to associated utility infrastructure. The property is currently wooded and does not contain any onsite detention systems, BMPs nor water bodies. Runoff from the north side of the property is tributary to Cedar Creek and runoff from the south side of the property is tributary to an unnamed branch of Cedar Creek. The confluence of Cedar Creek and Tributary C1 to Cedar Creek constitutes the Point of Interest (POI) for the subject project. The POI is adjacent to the property and represents the place where all contributing runoff from the project may be accounted. The POI is also the point at which the project sub-basins may be compared to the rest of the Cedar Creek Watershed. Exhibit A at the end of the report contains an aerial view of the existing project site. The proposed Site Plan may be found in Exhibit B. The overall Watershed Map for the proposed project may be found in Exhibit C.

3.1 Purpose

The purpose of the memorandum is to determine if any negative impacts due to storm water runoff from the proposed improvements are anticipated downstream due to the 2, 10, 100 and 1.37" water quality storm.

3.2 Scope

Determine Proximity of Property to Cedar Creek.
Determine Location of Property within the Overall Cedar Creek Watershed.
Determine the Pre verse Post Development Peak Flows for the 2, 10, 100 and Water Quality Storms at the POI.

4.0 Methodology

The memorandum conforms to KC Metro Area APWA Section 5600 requirements in addition to all other applicable codes and requirements of the City of Lee's Summit, Missouri.

5.0 FEMA Floodplain Determination

The property is located in an Area of Minimal Flood Hazard, Zone X, according to FEMA Firm Map Number 29095C0416G, effective January 20, 2017.

See Exhibit D for a FIRMette which includes the proposed project site. Note the large regulatory floodplain and floodway present on both Cedar Creek and Tributary C1 to Cedar Creek adjacent to the proposed project site.

6.0 NRCS Soil Classification

Soil classifications are published by the United States Department of Agriculture/National Resources Conservation Service (USDA/NRCS) and made available via their website. Data was taken from the web soil survey for Jackson County, Missouri, Version 22, May 29, 2020. The existing site contains one major soil type:

10082 Snead-Rock Outcrop Complex, 14 to 30 percent slopes
Hydrologic Soils Group (HSG): Type D

See Exhibit E for a detailed soils report of the proposed project site.

7.0 Sub-basin/Watershed Analysis

The overall watershed map for the project was developed to determine both the proximity of the project to the receiving stream and the location of the project in the overall watershed. See Exhibit C for a depiction of the Overall Watershed Map for the project. The overall watershed is approximately 6,290 +/- acres with the majority of the watershed being developed. The subject property encompasses 3.69 acres and accounts for approximately 0.06% of the overall watershed. The terrain consists of a Snead-Rock outcrop complex with steep slopes and high runoff rates per the NRCS soils report.

The proposed development is located adjacent to Cedar Creek on the north and an unnamed branch tributary to Tributary C1 to Cedar Creek on the south. The proposed development is located approximately 430' south of Cedar Creek. The south sub-basin of the project extends 6,000+ feet south from Cedar Creek and includes all lands contributing runoff to Tributary C1 to Cedar Creek. The development is located in the lower $1/10^{th}$ of the sub-basin and is located adjacent to

Cedar Creek. The following table summarizes the results of the Existing Conditions Analysis for the proposed project sub-basin. The hydrologic data used in this analysis is in line with the FEMA Flood Insurance Study for the watershed, see Exhibit G for FIS reference data. The highlighted FIS data is approximately at the POI.

Table 1 - Existing Conditions Sub-basin & Hydrologic Data at the POI

Sub-basin	POI	Area (ac.)	CN	Tc (min.)	Q(1.37") (cfs)	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)
Existing	Confluence	5042	85	242.0	319.42	1999.69	3560.08	5916.63

The following table summarizes the results of the Proposed Conditions Analysis. A complete Hydraflow Report may be found in Exhibit F which contains both Existing and Proposed Hydrologic Data.

Table 2 - Proposed Conditions Sub-basin & Hydrologic Data at the POI

Sub-basin	POI	Area (ac.)	CN	Tc (min.)	Q(1.37") (cfs)	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)
Prop. Project	Confluence	3.69	82	16.94	1.031	7.97	14.50	24.35
Prop. Remainder	Confluence	5038.31	85	242.0	319.19	1998.23	3557.48	5912.31
Prop. Combined	Confluence	5042			319.27	1998.59	3558.09	5913.27

As discussed, the data shown in the above tables confirms that the development of the subject project due to its location in the watershed will reduce the overall peak flow rates at the POI for all regulatory storm events including the 1.37" water quality storm. The reduction in peak flow may be attributed to the time variance of contributing areas within the watershed.

Table 3 below provides a comparison of runoff data between Proposed and Existing Conditions for the Proposed Development.

Table 3 - Point of Interest Discharge Comparison

	Condition	Q1.37" (cfs)	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)
POI Confluence	Proposed	319.27	1998.59	3558.09	5913.27
	Existing	319.42	1999.69	3560.08	5916.63
	Difference	-0.15	-1.10	-1.99	-3.36

As shown in the Table above all proposed peak flows will be attenuated below existing peak flows for all regulatory design storm events. Therefore the development and free release of runoff from this property will not create any negative downstream hydraulic impacts but will reduce the required carrying capacity of downstream elements providing increased freeboard. Due to the large size of the sub-basin and the minimal size of the proposed development the proposed peak flow generated during the water quality storm will not create deleterious conditions to downstream conveyance elements.

8.0 Conclusion

No further developments will be directly downstream and adjacent to Winterset Cedar Creek. Based on the size, geometry, soil characteristics and downstream position of the property in its sub-basin the free release of proposed peak flows will provide attenuation below existing conditions for all regulatory design storms including the 1.37" water quality storm. We recommend the free release of runoff from all storm water events. The study is in conformance with all applicable City of Lee's Summit standards and criteria.

Waiver Requests:

1) KCAPWA Section 5608 Stormwater Detention and Retention, 5608.4 Performance Criteria, C. Release Rates, 1. Comprehensive Control, a. Post-Development Peak Discharge Rates for the 50%, 10% and 1% Storms. We request this criterion be waived based on the peak discharge reduction outlined in the report.

2) KCAPWA Section 5608 Stormwater Detention and Retention, 5608.4 Performance Criteria, C. Release Rates, 1. Comprehensive Control, b. 40-hour Extended Detention. We request this criterion be waived based on the peak discharge reduction in addition to the minimal volume attributed from the subject property compared to the overall watershed.

Exhibit A
Project Aerial View

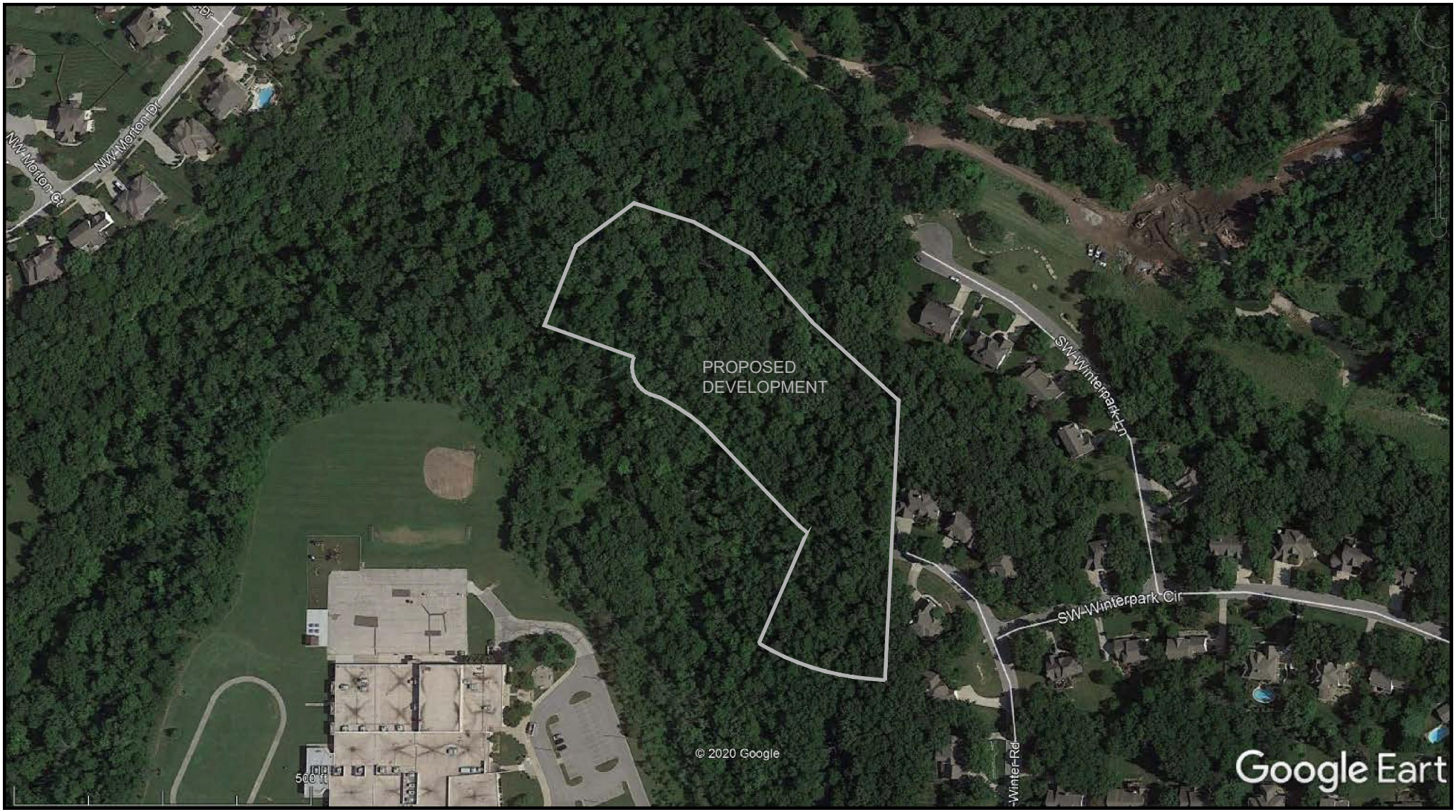
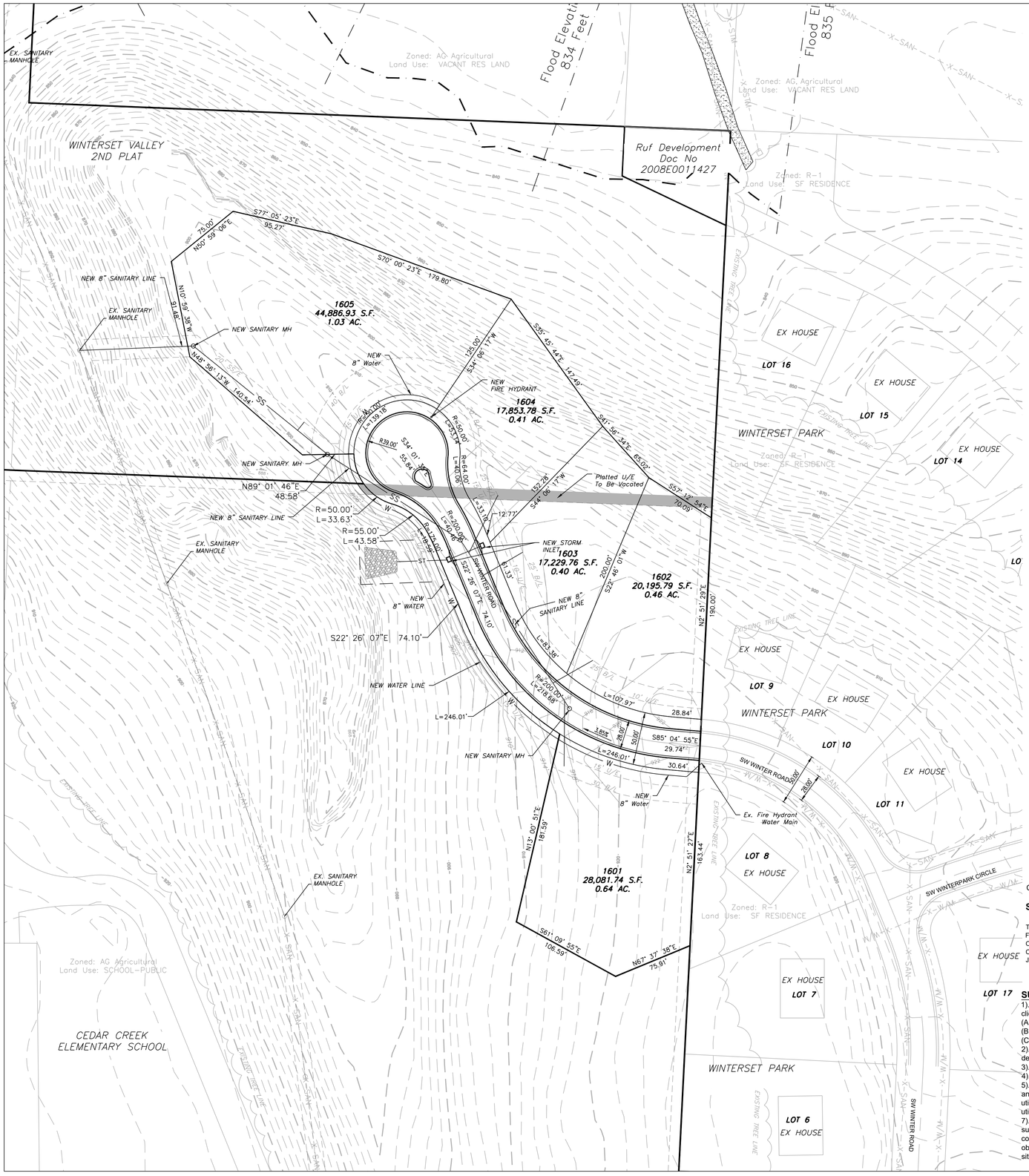
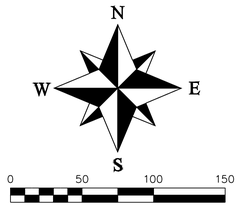
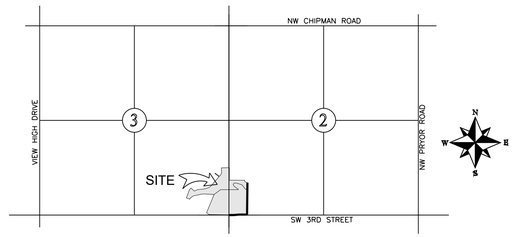

PROPOSED
DEVELOPMENT
NW Morton Dr
NW Morton Ct
SW Winterpark Ln
SW Winterpark Cir
Winter Rd
500 ft
© 2020 Google
Google Eart

Exhibit B
Proposed Site Plan

Preliminary Development Plan
THE RIDGE AT WINTERSET SUMMIT
A Replat of Tract B2, Winterset Valley - 2nd Plat and Lot 1-A, Lee's Summit West Elementary
Part of Section 2 & 3, Township 47 North, Range 32 West
Lee's Summit, Jackson County, Missouri







LOCATION MAP
SECTION 2 & 3 -T47N-R32W
Not to Scale

BOUNDARY DESCRIPTION

A tract of land being located in Section 2 and Section 3, Township 47 North, Range 32 West, in Jackson County, Missouri being more particularly described as follows

Tract B2, WINTERSET VALLEY 2ND PLAT, a subdivision as recorded in the Office of the Recorder, Jackson County, Missouri,

EXCEPT

A tract of land being part of Tract B2, WINTERSET VALLEY –2ND PLAT, a subdivision in Lee's Summit, Jackson County, Missouri, described as follows: Beginning at the Northeast corner of said Tract B2, said corner also being the Northwest corner of WINTERSET PARK, a subdivision in Lee's Summit, Jackson County, Missouri; thence South 02 degrees 51 minutes 13 seconds West along the West line of said subdivision 89.23 feet to the Northwest corner of Lot 16 of said WINTERSET PARK; thence North 64 degrees 29 minutes 06 seconds West 108.37 feet; thence North 02 degrees 51 minutes 13 seconds East 46.37 feetto a point on the North line of said Tract B2; thence South 87 degrees 46 minutes 53 seconds East along said North line 100.01 feet to the point of beginning.

and

Lot 1–A, Lee's Summit West Elementary, a subdivision as recorded in the Office of the Recorder, Jackson County, Missouri

LEGEND

These standard symbols will be found in the drawing.

- ● Set 1/2" Rebar & Cap
- ◎ Found Survey Monument (As Noted)
- (#) Exception Document Location
- —x—x—x—x— Existing Fence Line – Chain Link
- –x–W/M–x–W/M– Existing Water Line
- –x–SAN–x–SAN– Existing Sanitary Sewer Main
- –x–STM–x–STM– Existing Storm Sewer
- —GAS— Existing Gas Line
- —UT—UT— Existing Underground Telephone
- —E— Existing Underground Electric
- —ST—ST—ST— Proposed Storm Sewer
- —SS— Proposed Sanitary Sewer
- —W—W—W— Proposed 8" D.I.P. Water

Current Zoning: R-1, Single Family Residential / AG, Agricultural

SURVEY AND PLAT NOTES:

THE SUBJECT PROPERTY SURVEYED LIES WITHIN A FLOOD ZONE DESIGNATED ZONE (X), AREAS LOCATED OUTSIDE THE 100 YEAR FLOOD PLAIN, PER F.E.M.A. MAP, COMMUNITY PANEL NO. 29095C0416G EFFECTIVE DATE: JANUARY 20, 2017.

SURVEYOR'S GENERAL NOTES:

1). This survey is based upon the following information provided by the client or researched by this surveyor.
(A). Final Plat of CEDAR CREEK ELEMENTARY SCHOOL
(B). Final Plat of LEE'S SUMMIT WEST ELEMENTARY SCHOOL
(C). Final Plat of WINTERSET VALLEY - 2ND PLAT
2). This survey meets or exceeds the accuracy standards of a (SUBURBAN) Property Boundary Survey as defined by the Missouri Standards for Property Boundary Surveys.
3). No Title report was furnished
4). Bearings shown hereon are based upon bearings described in the legal description
5). This company assumes no responsibility in the location of existing utilities within the subject premises. This is an above-ground survey. The underground utilities, if shown, are based on information provided by the various utility companies and these locations should be considered approximate. There may be additional underground utilities not shown on this drawing. Dig Rite Ticket #150071203, 150071179, 150071171
7). Subsurface and environmental conditions were not surveyed or examined or considered as a part of this survey. No evidence or statement is made concerning the existence of underground or overhead conditions, containers or facilities that may affect the use or development of this property. No attempt has been made to obtain or show data concerning existence, size, depth, conditions, capacity or location of any utility existing on the site, whether private, municipal or public owned.

Proposed Preliminary Plat

The Ridge at Winterset Summit Development Area

Proposed		
Total Plat Area	2,028,856.87 sf (46.58 Acres)	
Residential Site Area	154,804.45 sf (3.55 Acres)	
School Site Area	1,116,264.84 sf (25.63 Acres)	
Common Site Area	757,787.58 sf (17.40 Acres)	
Residential Lots	5	
Density	1.45 lots per acre	
Proposed Usage		
Lots 1601 – 1605	Single Family Residential	
Setbacks	Front Yard	Varies By Lot 20 Feet Minimum (See Plat Drawing)
	Rear Yard	30 Feet
	Side Yard	7.5 Feet
Lot 1606 Setbacks	Lee's Summit R-7 School District	
	Front Yard	40 Feet
	Rear Yard	30 Feet
	Side Yard	7.5 Feet
Tract A	Both ownership and maintenance of the Common Area tract is dedicated to the The Ridge at Winterset Summit Home Owner's Association	

Lots 1601 – 1605 will be part of the The Ridge at Winterset Summit Home Owner's Association.

Lot 1606 will be owned and maintained by the Lee's Summit R–7 School District

UTILITIES:
THE INFORMATION CONCERNING THE EXISTENCE, LOCATION, SIZE OR TYPE OF MATERIALS OF UNDERGROUND UTILITIES SHOWN HEREON, WHICH ARE NOT VISIBLE FROM THE SURFACE, HAS BEEN COMPILED FROM THE RECORDS OF THE VARIOUS UTILITY COMPANIES OR OTHER SOURCES OF INFORMATION AND HAS NOT BEEN VERIFIED IN THE FIELD BY THIS COMPANY. WHERE RECORD MEASUREMENTS WERE NOT AVAILABLE, THE LOCATION OF THESE UNDERGROUND LINES WAS SCALED FROM THE COMPANY'S RECORDS. THIS INFORMATION IS NOT TO BE CONSTRUED AS ACCURATE, COMPLETE NOR EXACT. ANY INFORMATION CONCERNING UNDERGROUND UTILITIES SHOWN HEREON MUST BE CONFIRMED BY THE DESIGN PROFESSIONAL PRIOR TO DESIGNING ANY IMPROVEMENTS WHICH MAY BE AFFECTED BY THIS INFORMATION OR BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION ACTIVITY.

OIL - GAS WELLS
ACCORDING TO EDWARD ALTON MAY JR'S ENVIRONMENTAL IMPACT STUDY OF ABANDONED OIL AND GAS WELLS IN LEE'S SUMMIT, MISSOURI IN 1995, THERE ARE NOT OIL AND GAS WELLS WITHIN 185 FEET OF THE PROPERTY AS SURVEYED HEREON.

REVISIONS

DATE	

Part of Section 2 & 3
Township 47 North, Range 32 West
Lee's Summit, Jackson County, Missouri

Preliminary Development Plan

SHEET	SECTION	TOWNSHIP	RANGE	COUNTY	JOB NO.
1 OF 1	2 & 3	47 N	32 W	Jackson	Winterset

DRAWN BY: M. Schlicht, PLS, PE
DATE OF PREPARATION: August 7, 2020
SCALE: 1"=50'

PROFESSIONAL SEAL

ENGINEERING SOLUTIONS
ENGINEERING & SURVEYING
50 SE 30TH STREET
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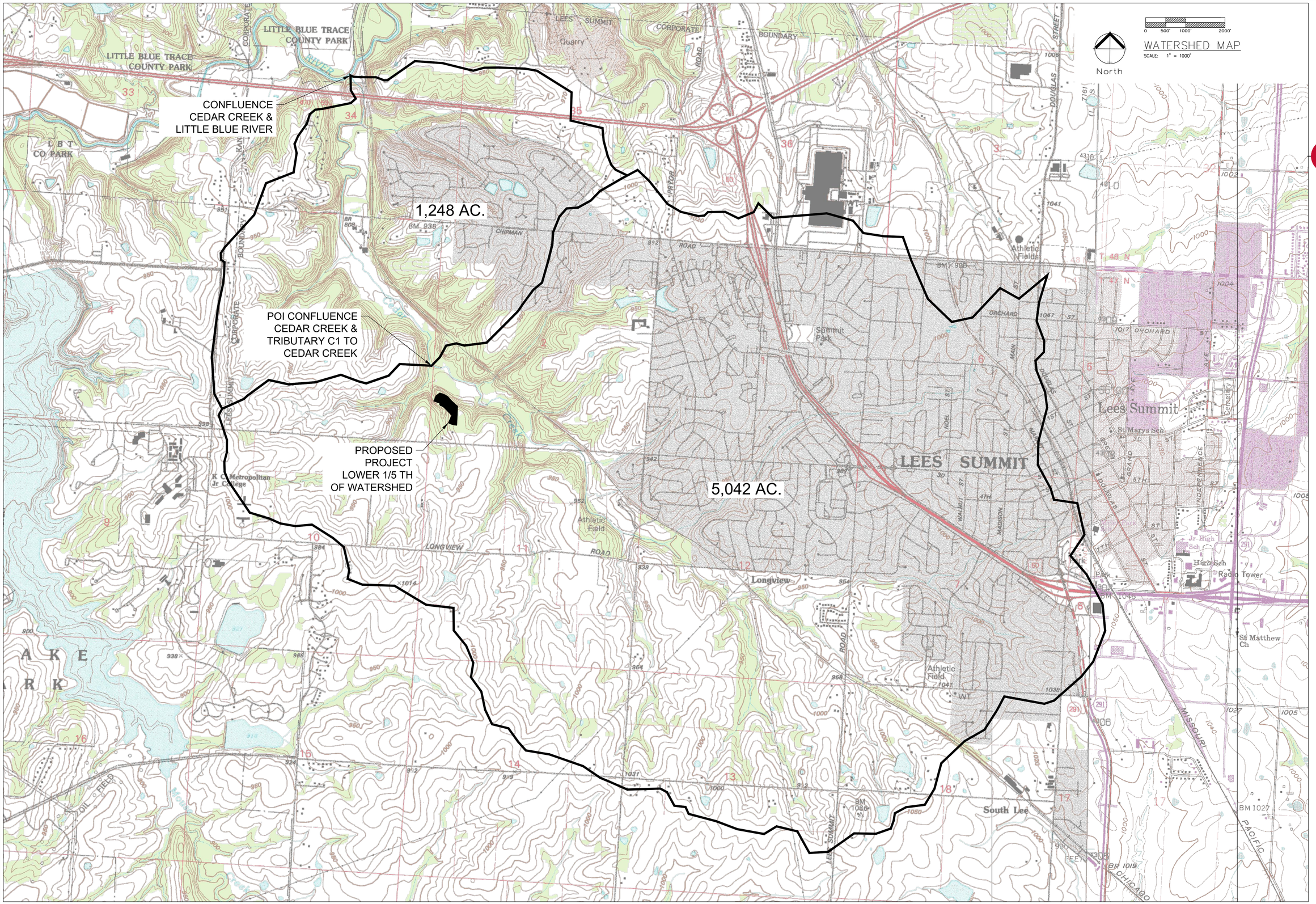
Exhibit C
Overall Watershed Map



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Professional Registration
Missouri
Engineering 2005032186-D
Surveying 2005008319-D
Kansas
Engineering E-1695
Surveying LS-218
Oklahoma
Engineering 6254
Nebraska
Engineering CA2821

Winterset Cedar Creek
Lee's Summit, Jackson County, Missouri

Project: Winterset Cedar Creek
Issue Date: January 16, 2020

Watershed Map
Construction Plans for:
Winterset Cedar Creek
Lee's Summit, Jackson County, Missouri

Matthew J. Schlicht
MO PE 2006019708
KS PE 19071
OK PE 25226

REVISIONS

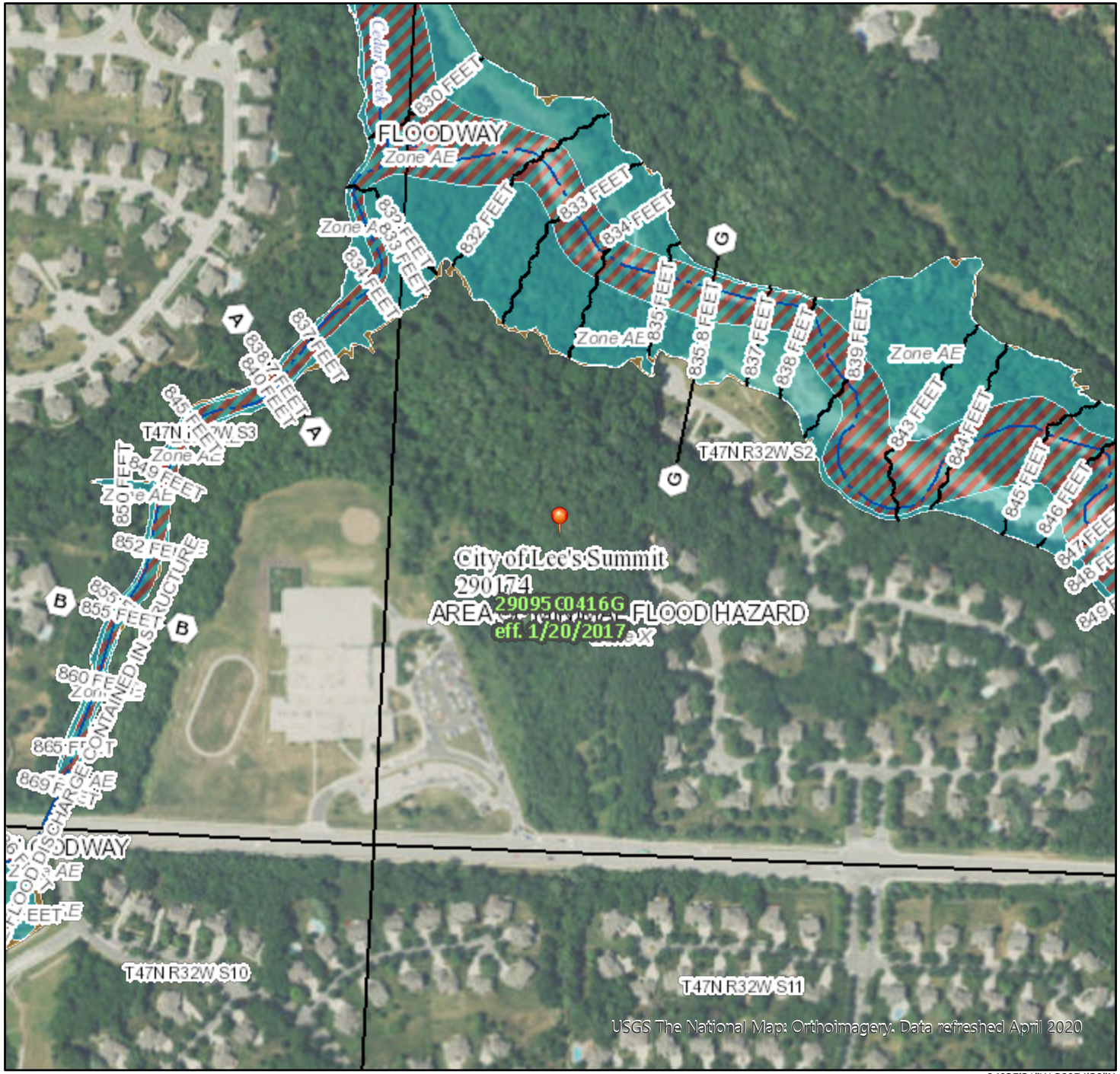
EXHIBIT

Exhibit D
FIRMette

National Flood Hazard Layer FIRMette

FEMA

94°26'8"W 38°55'7"N



94°25'31"W 38°54'39"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/4/2020 at 11:10 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Exhibit E
NRCS Soils Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Jackson County, Missouri

August 4, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,260 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 22, May 29, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 6, 2019—Nov 16, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10141	Snead-Rock outcrop complex, 14 to 30 percent slopes	3.2	100.0%
Totals for Area of Interest		**3.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Jackson County, Missouri

10141—Snead-Rock outcrop complex, 14 to 30 percent slopes

Map Unit Setting

National map unit symbol: 2ql0p
Elevation: 600 to 1,100 feet
Mean annual precipitation: 33 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 177 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Snead and similar soils: 70 percent
Rock outcrop: 15 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Snead

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from calcareous shale

Typical profile

Ap - 0 to 3 inches: silty clay loam
Bw - 3 to 24 inches: silty clay
Cr - 24 to 80 inches: bedrock

Properties and qualities

Slope: 14 to 30 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R109XY012MO - Interbedded Sedimentary Backslope Savanna
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: No

Description of Rock Outcrop

Typical profile

R - 0 to 80 inches: bedrock

Properties and qualities

Slope: 14 to 30 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Sampsel

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Convex
Across-slope shape: Concave
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

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Exhibit F
Hydraflow Report

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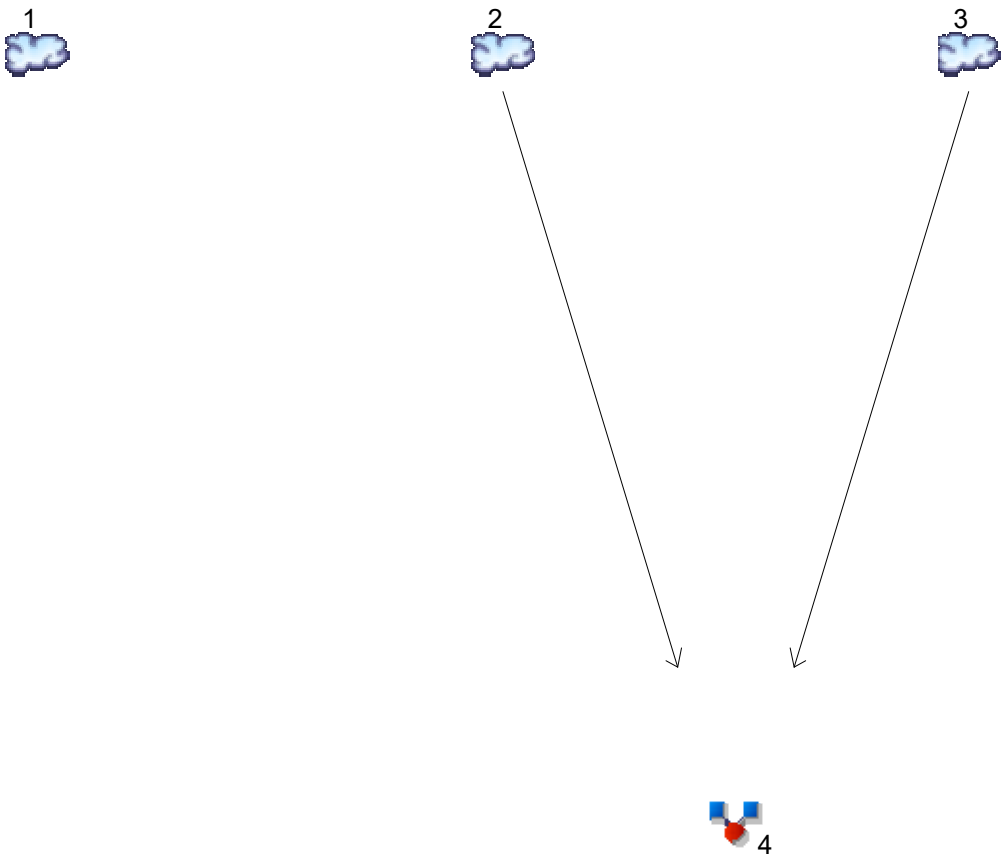
Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	Existing Sub-basin
2	SCS Runoff	Proposed Project
3	SCS Runoff	Remainder Proposed Sub-basin
4	Combine	Proposed Sub-basin

Hydrograph Return Period Recap

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	------	319.42	1999.69	-------	-------	3560.08	-------	-------	5916.63	Existing Sub-basin
2	SCS Runoff	------	1.031	7.968	-------	-------	14.50	-------	-------	24.35	Proposed Project
3	SCS Runoff	------	319.19	1998.23	-------	-------	3557.48	-------	-------	5912.31	Remainder Proposed Sub-basin
4	Combine	2, 3	319.27	1998.59	-------	-------	3558.09	-------	-------	5913.27	Proposed Sub-basin

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

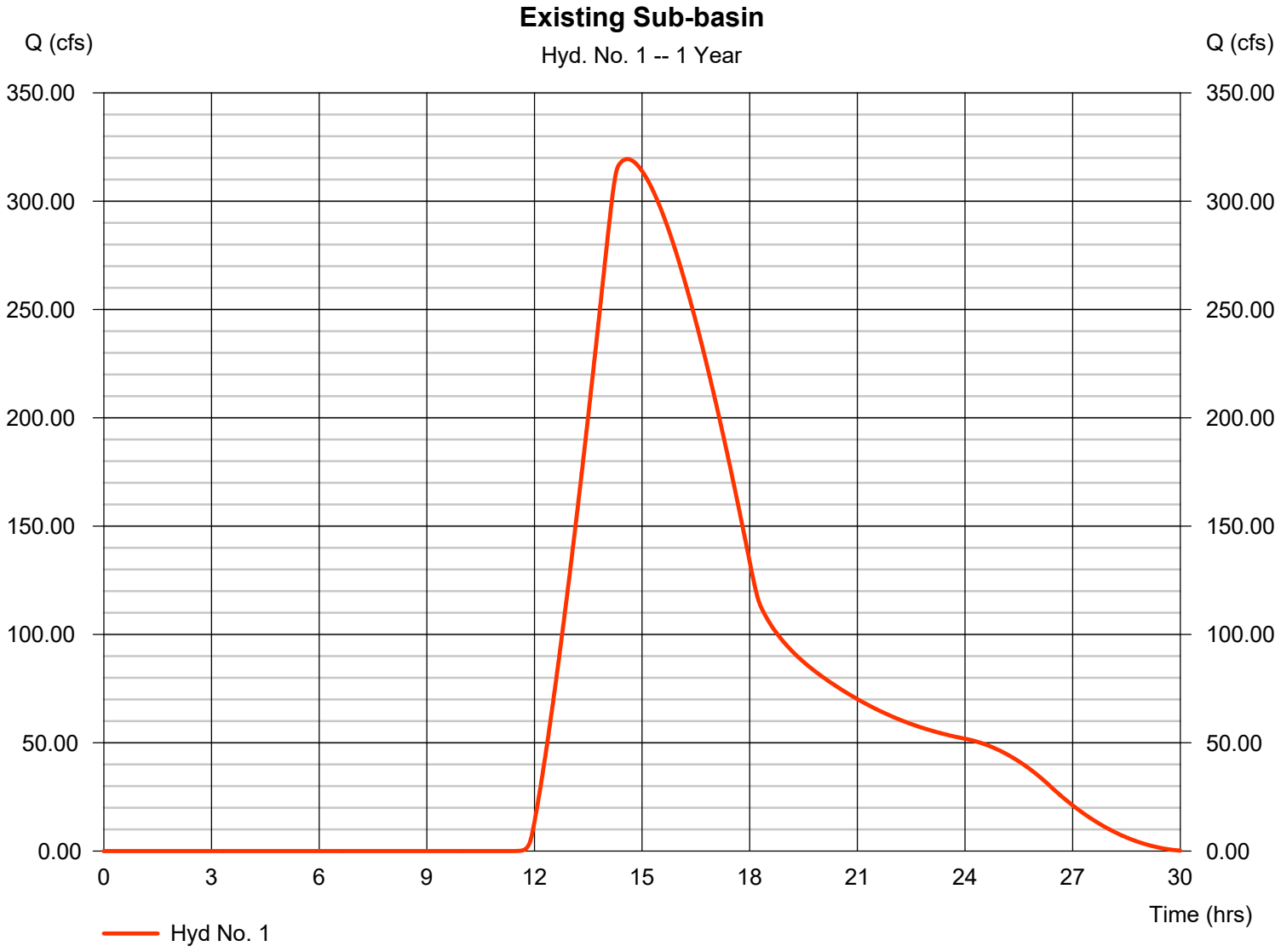
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	319.42	1	875	6,799,870	------	------	------	Existing Sub-basin
2	SCS Runoff	1.031	1	726	3,672	------	------	------	Proposed Project
3	SCS Runoff	319.19	1	875	6,794,926	------	------	------	Remainder Proposed Sub-basin
4	Combine	319.27	1	875	6,798,591	2, 3	------	------	Proposed Sub-basin

Hydrograph Report

Hyd. No. 1

Existing Sub-basin

Hydrograph type	= SCS Runoff	Peak discharge	= 319.42 cfs
Storm frequency	= 1 yrs	Time to peak	= 14.58 hrs
Time interval	= 1 min	Hyd. volume	= 6,799,870 cuft
Drainage area	= 5042.000 ac	Curve number	= 85
Basin Slope	= 1.4 %	Hydraulic length	= 18972 ft
Tc method	= LAG	Time of conc. (Tc)	= 242.00 min
Total precip.	= 1.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

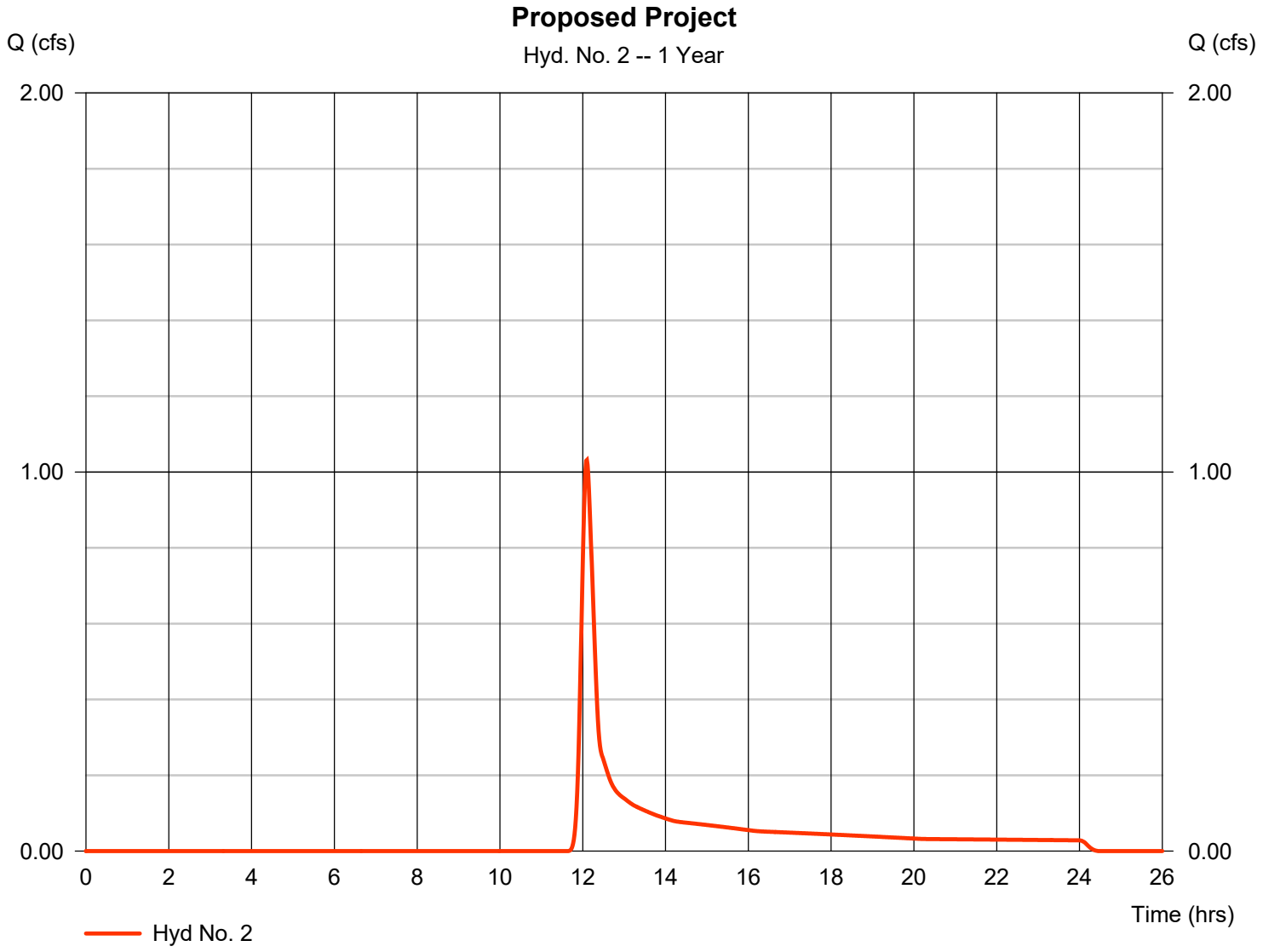


Hydrograph Report

Hyd. No. 2

Proposed Project

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.031 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.10 hrs
Time interval	=	1 min	Hyd. volume	=	3,672 cuft
Drainage area	=	3.690 ac	Curve number	=	82
Basin Slope	=	6.4 %	Hydraulic length	=	1565 ft
Tc method	=	LAG	Time of conc. (Tc)	=	16.94 min
Total precip.	=	1.37 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

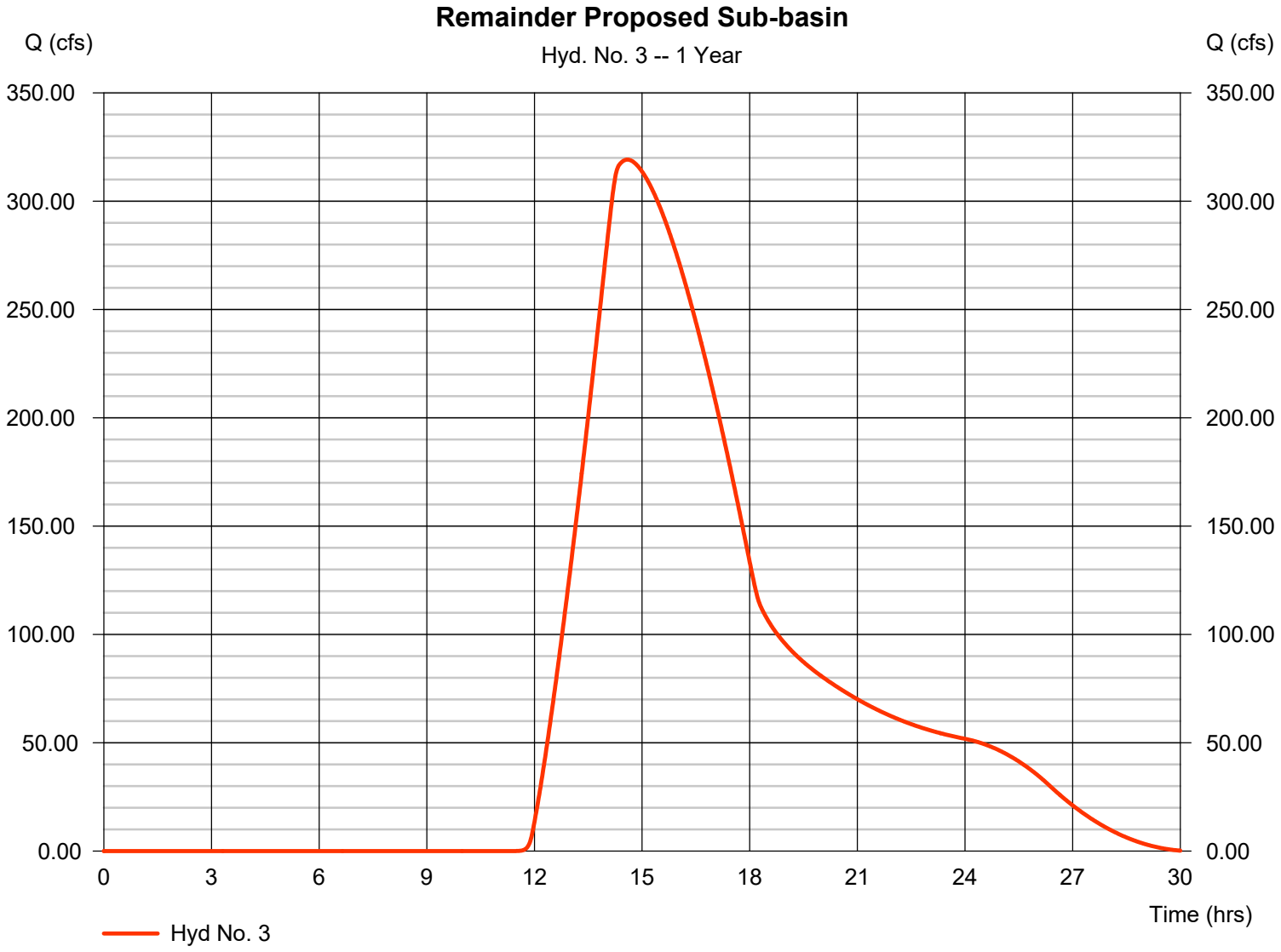


Hydrograph Report

Hyd. No. 3

Remainder Proposed Sub-basin

Hydrograph type	= SCS Runoff	Peak discharge	= 319.19 cfs
Storm frequency	= 1 yrs	Time to peak	= 14.58 hrs
Time interval	= 1 min	Hyd. volume	= 6,794,926 cuft
Drainage area	= 5038.310 ac	Curve number	= 85
Basin Slope	= 1.4 %	Hydraulic length	= 18972 ft
Tc method	= LAG	Time of conc. (Tc)	= 242.00 min
Total precip.	= 1.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

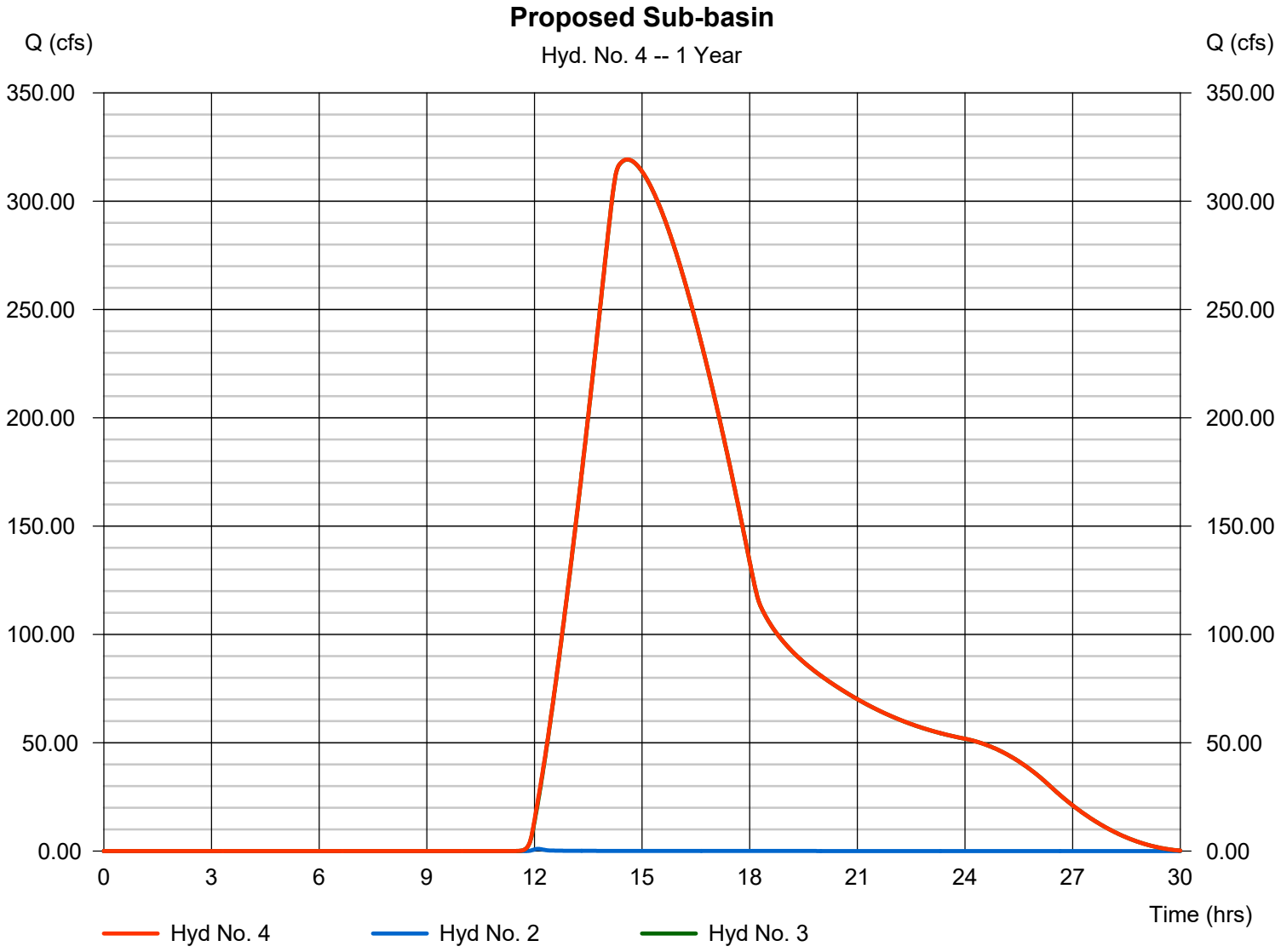


Hydrograph Report

Hyd. No. 4

Proposed Sub-basin

Hydrograph type	=	Combine	Peak discharge	=	319.27 cfs
Storm frequency	=	1 yrs	Time to peak	=	14.58 hrs
Time interval	=	1 min	Hyd. volume	=	6,798,591 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	5042.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

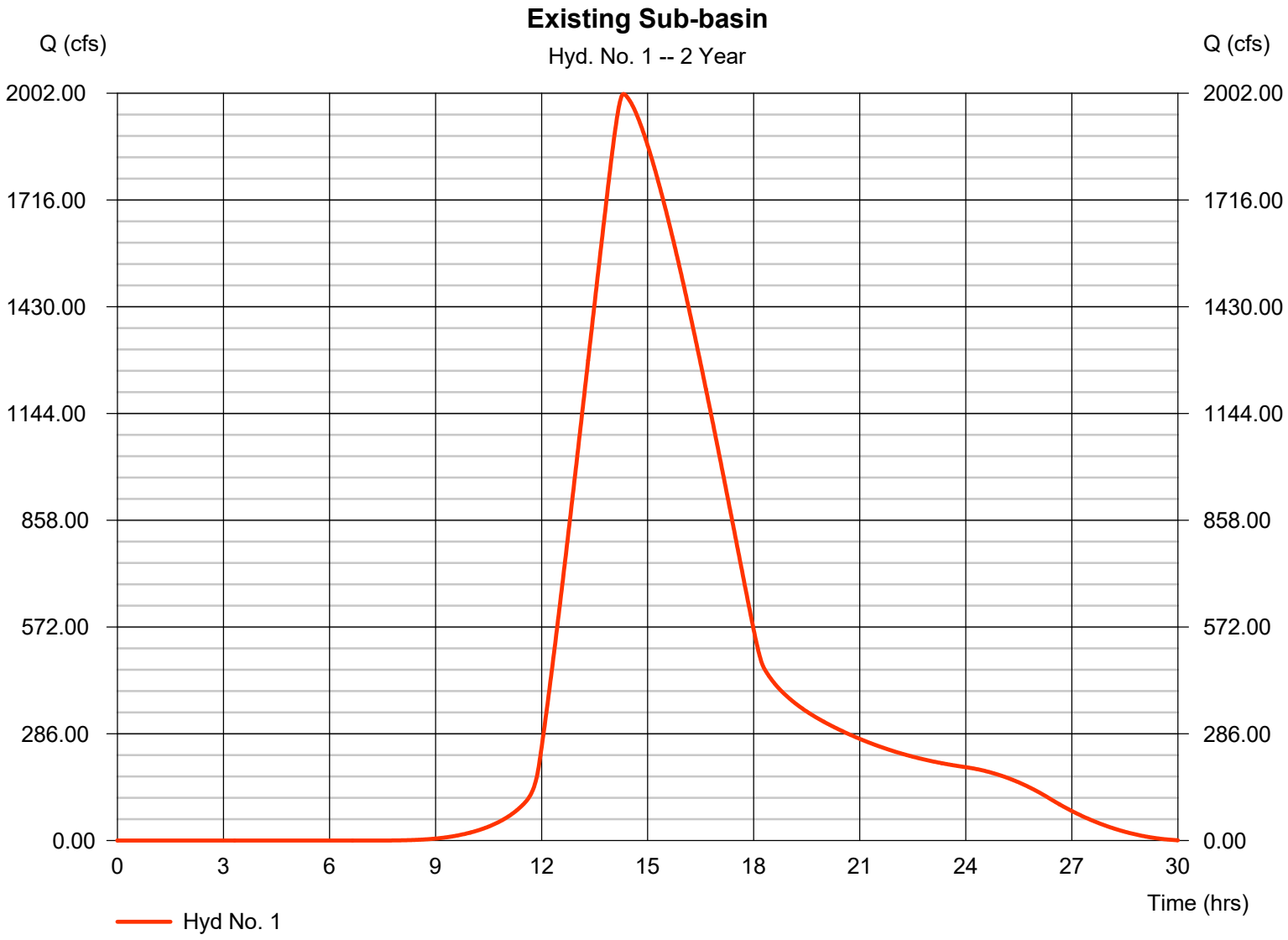
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1999.69	1	859	36,872,352	------	------	------	Existing Sub-basin
2	SCS Runoff	7.968	1	724	23,606	------	------	------	Proposed Project
3	SCS Runoff	1998.23	1	859	36,845,540	------	------	------	Remainder Proposed Sub-basin
4	Combine	1998.59	1	859	36,869,120	2, 3	------	------	Proposed Sub-basin

Hydrograph Report

Hyd. No. 1

Existing Sub-basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	1999.69 cfs
Storm frequency	=	2 yrs	Time to peak	=	14.32 hrs
Time interval	=	1 min	Hyd. volume	=	36,872,352 cuft
Drainage area	=	5042.000 ac	Curve number	=	85
Basin Slope	=	1.4 %	Hydraulic length	=	18972 ft
Tc method	=	LAG	Time of conc. (Tc)	=	242.00 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

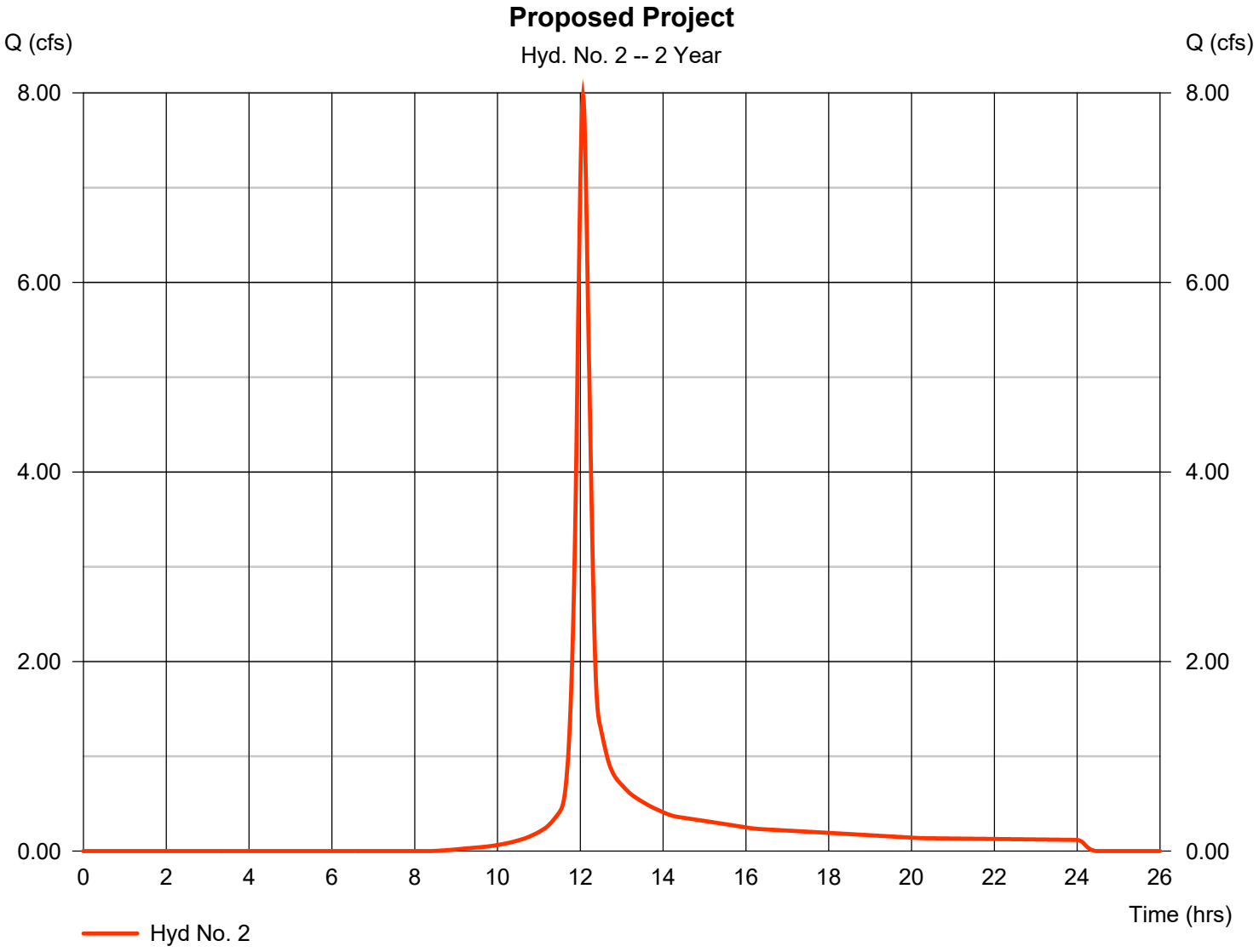


Hydrograph Report

Hyd. No. 2

Proposed Project

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.968 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.07 hrs
Time interval	=	1 min	Hyd. volume	=	23,606 cuft
Drainage area	=	3.690 ac	Curve number	=	82
Basin Slope	=	6.4 %	Hydraulic length	=	1565 ft
Tc method	=	LAG	Time of conc. (Tc)	=	16.94 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

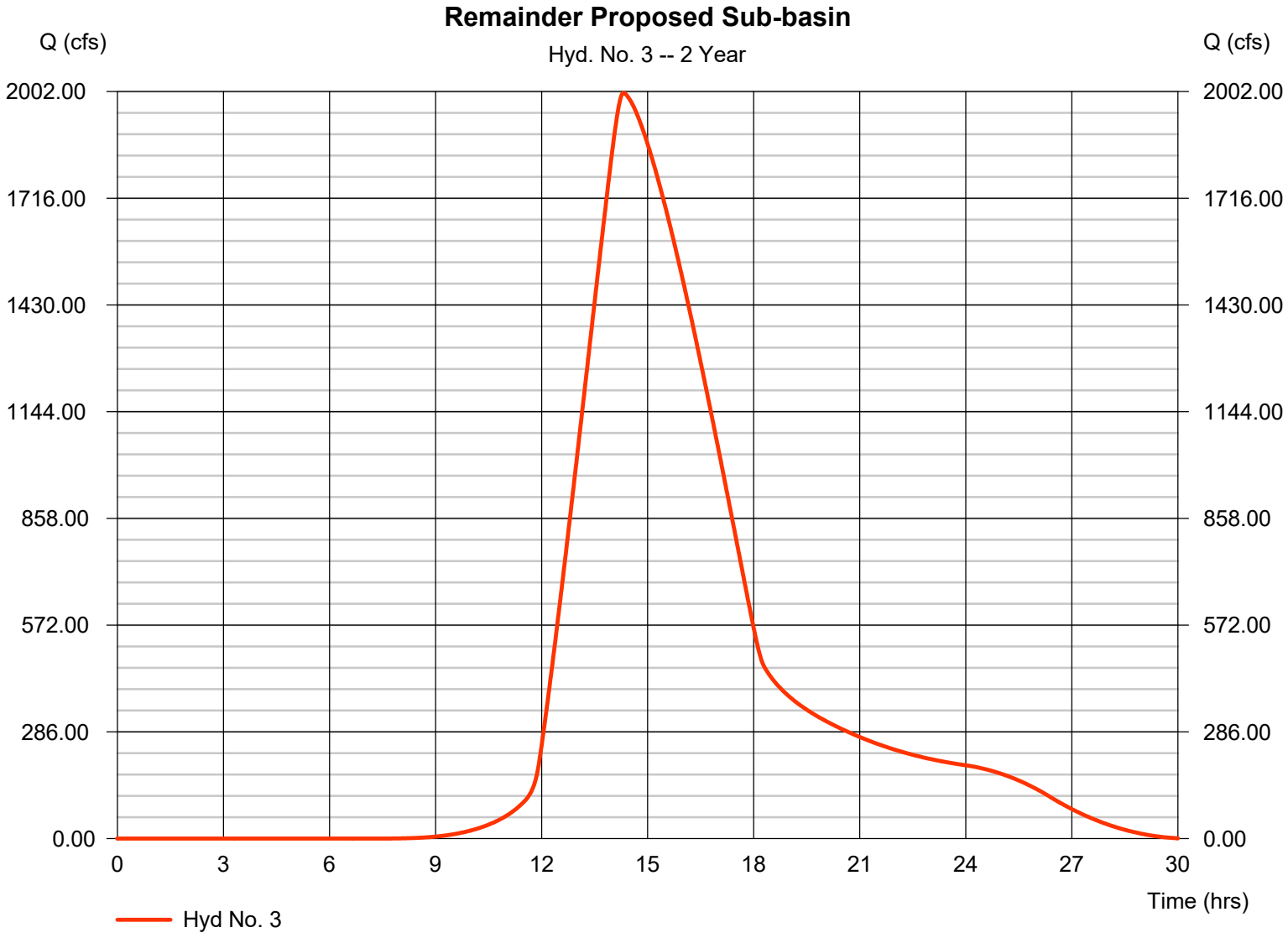


Hydrograph Report

Hyd. No. 3

Remainder Proposed Sub-basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	1998.23 cfs
Storm frequency	=	2 yrs	Time to peak	=	14.32 hrs
Time interval	=	1 min	Hyd. volume	=	36,845,540 cuft
Drainage area	=	5038.310 ac	Curve number	=	85
Basin Slope	=	1.4 %	Hydraulic length	=	18972 ft
Tc method	=	LAG	Time of conc. (Tc)	=	242.00 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

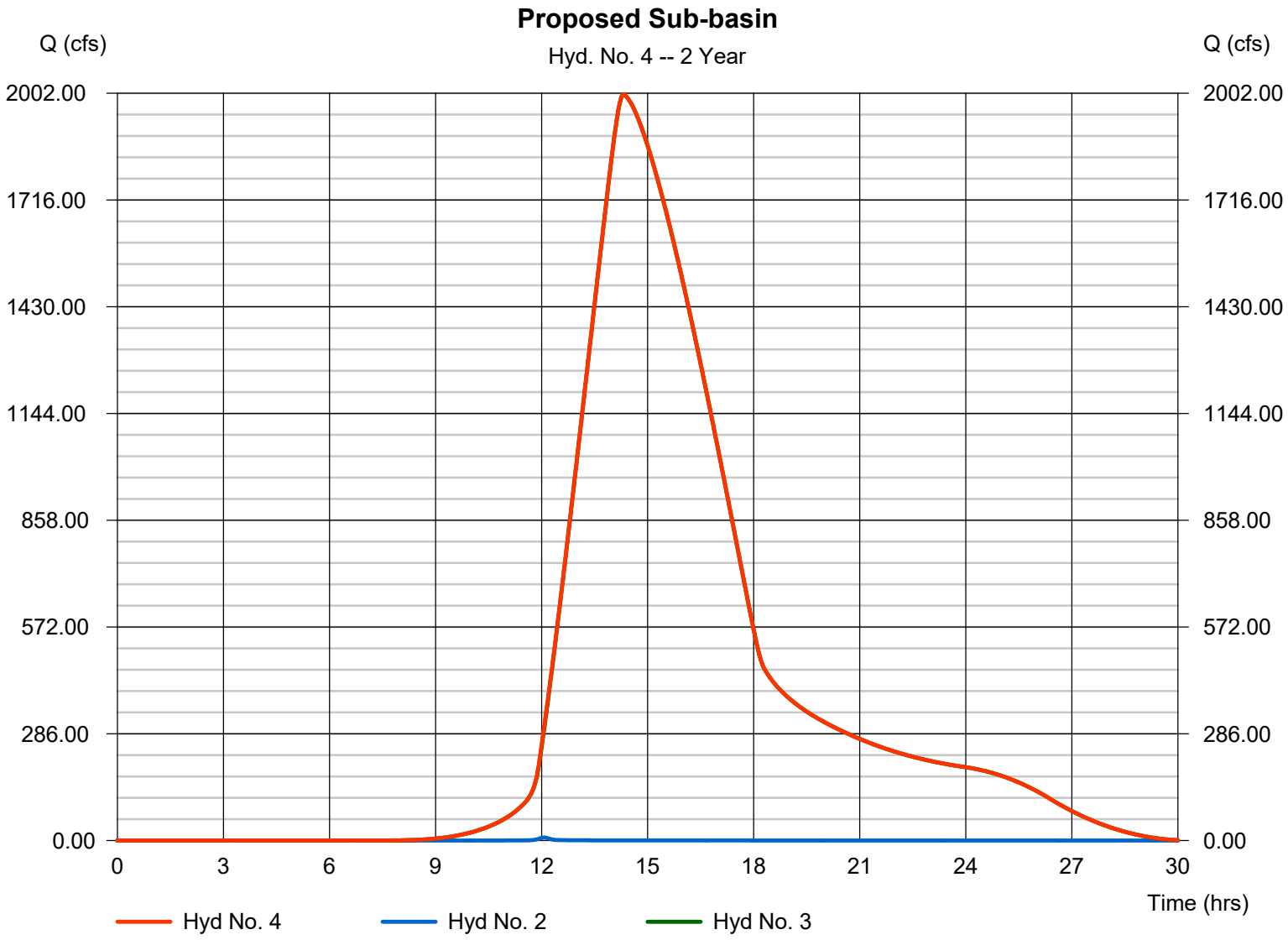


Hydrograph Report

Hyd. No. 4

Proposed Sub-basin

Hydrograph type	=	Combine	Peak discharge	=	1998.59 cfs
Storm frequency	=	2 yrs	Time to peak	=	14.32 hrs
Time interval	=	1 min	Hyd. volume	=	36,869,120 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	5042.000 ac



Hydrograph Summary Report

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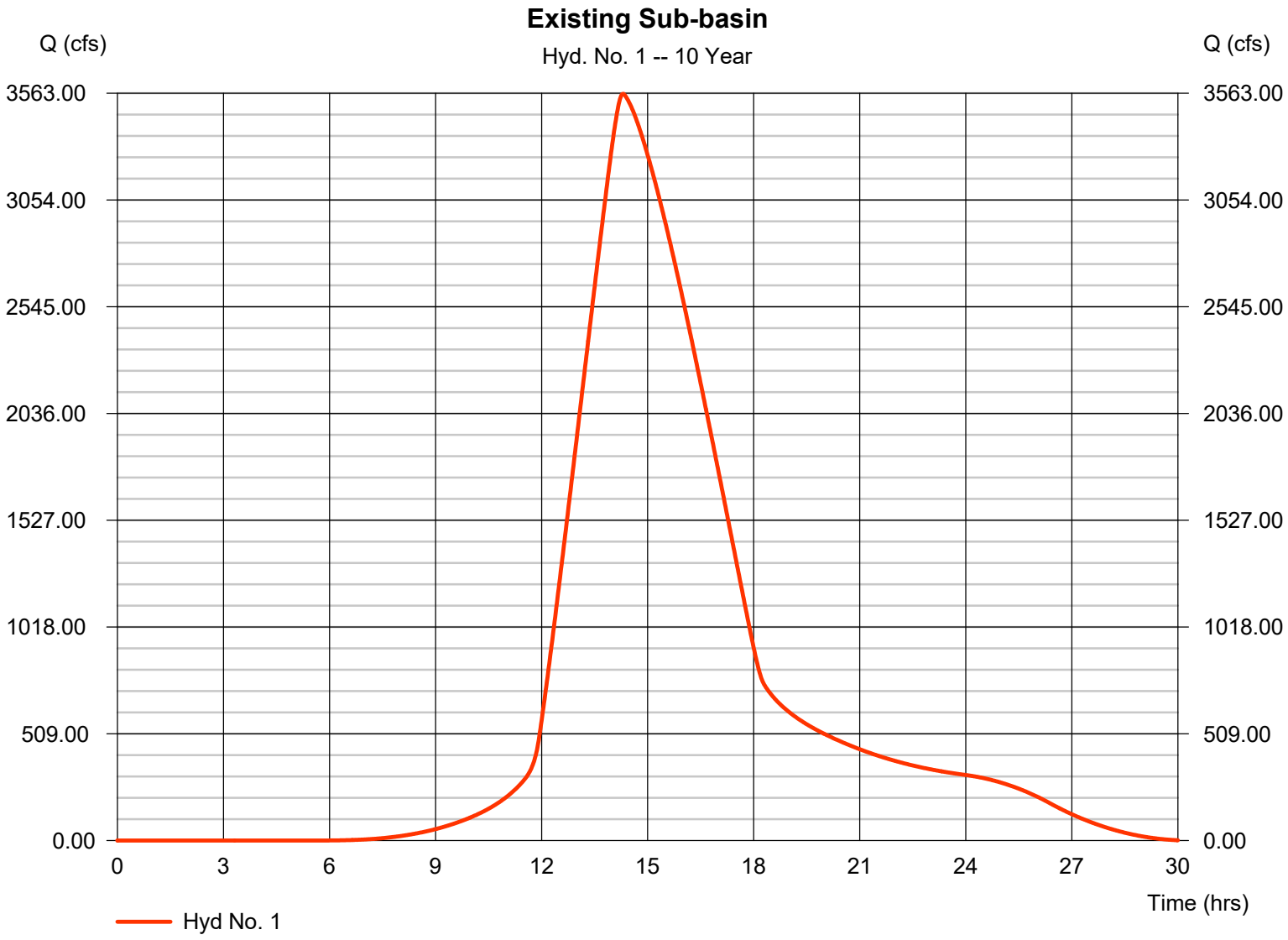
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	3560.08	1	858	64,978,248	------	------	------	Existing Sub-basin
2	SCS Runoff	14.50	1	724	43,152	------	------	------	Proposed Project
3	SCS Runoff	3557.48	1	858	64,930,932	------	------	------	Remainder Proposed Sub-basin
4	Combine	3558.09	1	858	64,974,080	2, 3	------	------	Proposed Sub-basin

Hydrograph Report

Hyd. No. 1

Existing Sub-basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	3560.08 cfs
Storm frequency	=	10 yrs	Time to peak	=	14.30 hrs
Time interval	=	1 min	Hyd. volume	=	64,978,248 cuft
Drainage area	=	5042.000 ac	Curve number	=	85
Basin Slope	=	1.4 %	Hydraulic length	=	18972 ft
Tc method	=	LAG	Time of conc. (Tc)	=	242.00 min
Total precip.	=	5.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

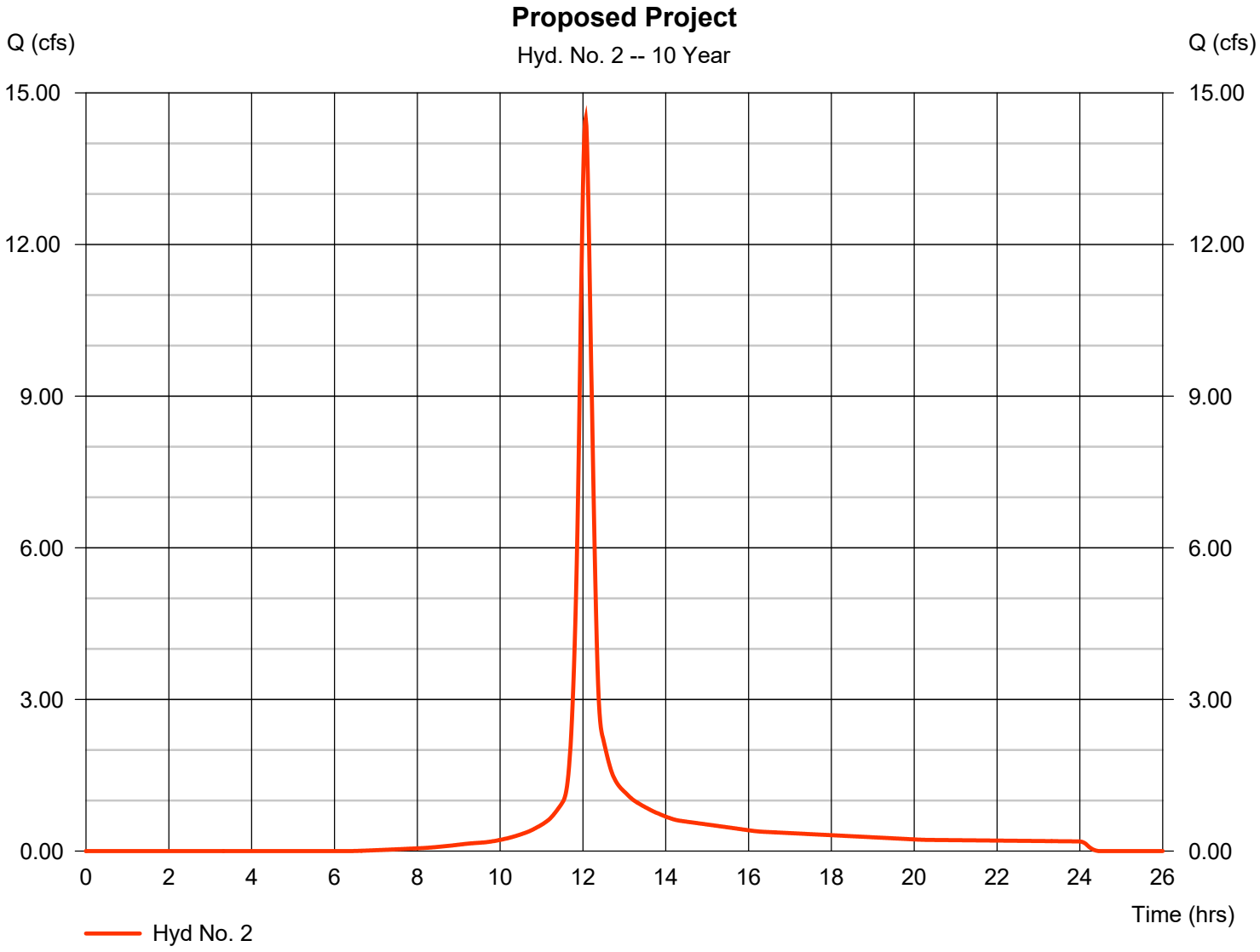


Hydrograph Report

Hyd. No. 2

Proposed Project

Hydrograph type	=	SCS Runoff	Peak discharge	=	14.50 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.07 hrs
Time interval	=	1 min	Hyd. volume	=	43,152 cuft
Drainage area	=	3.690 ac	Curve number	=	82
Basin Slope	=	6.4 %	Hydraulic length	=	1565 ft
Tc method	=	LAG	Time of conc. (Tc)	=	16.94 min
Total precip.	=	5.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

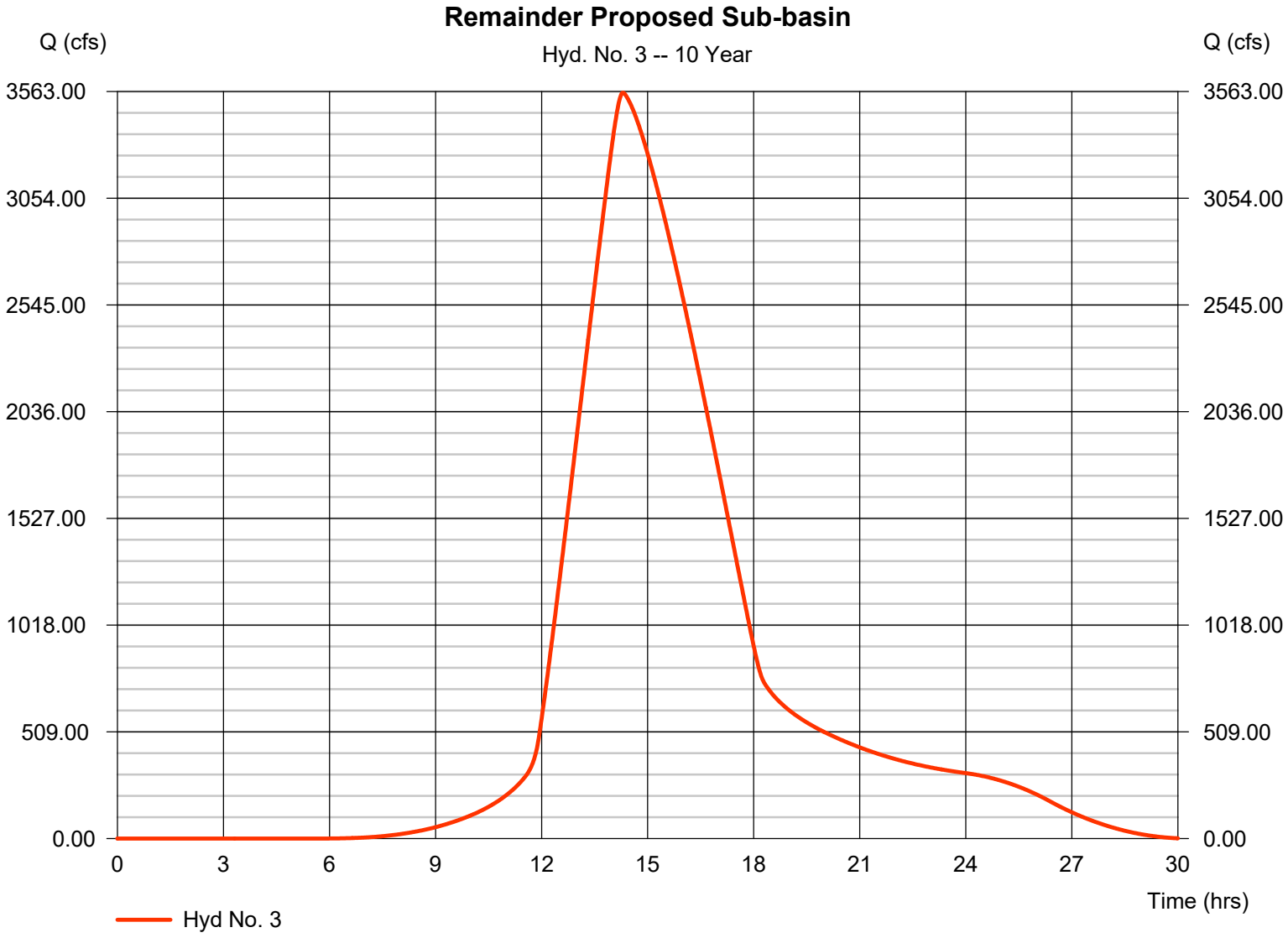


Hydrograph Report

Hyd. No. 3

Remainder Proposed Sub-basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	3557.48 cfs
Storm frequency	=	10 yrs	Time to peak	=	14.30 hrs
Time interval	=	1 min	Hyd. volume	=	64,930,932 cuft
Drainage area	=	5038.310 ac	Curve number	=	85
Basin Slope	=	1.4 %	Hydraulic length	=	18972 ft
Tc method	=	LAG	Time of conc. (Tc)	=	242.00 min
Total precip.	=	5.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

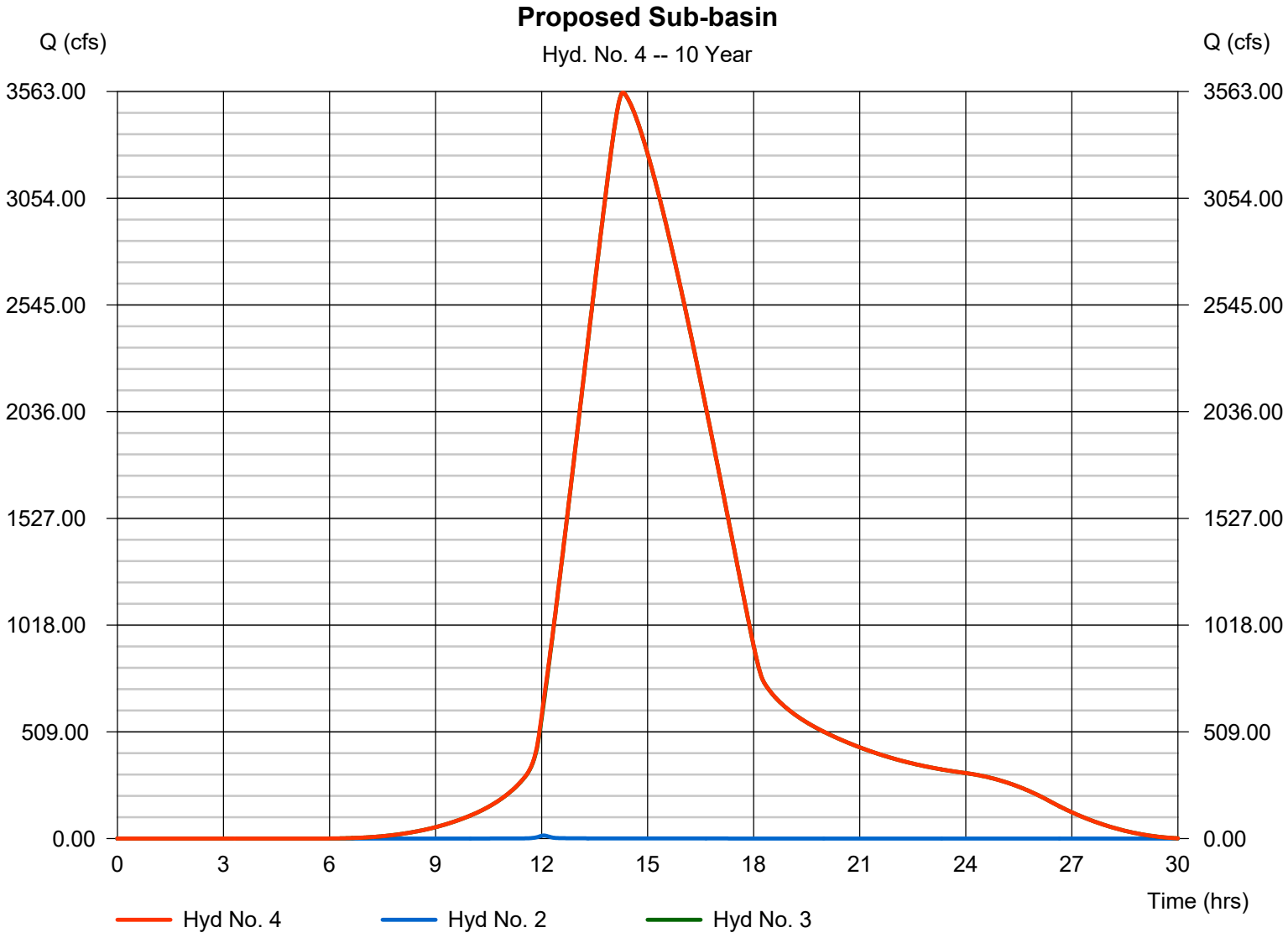


Hydrograph Report

Hyd. No. 4

Proposed Sub-basin

Hydrograph type	=	Combine	Peak discharge	=	3558.09 cfs
Storm frequency	=	10 yrs	Time to peak	=	14.30 hrs
Time interval	=	1 min	Hyd. volume	=	64,974,080 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	5042.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

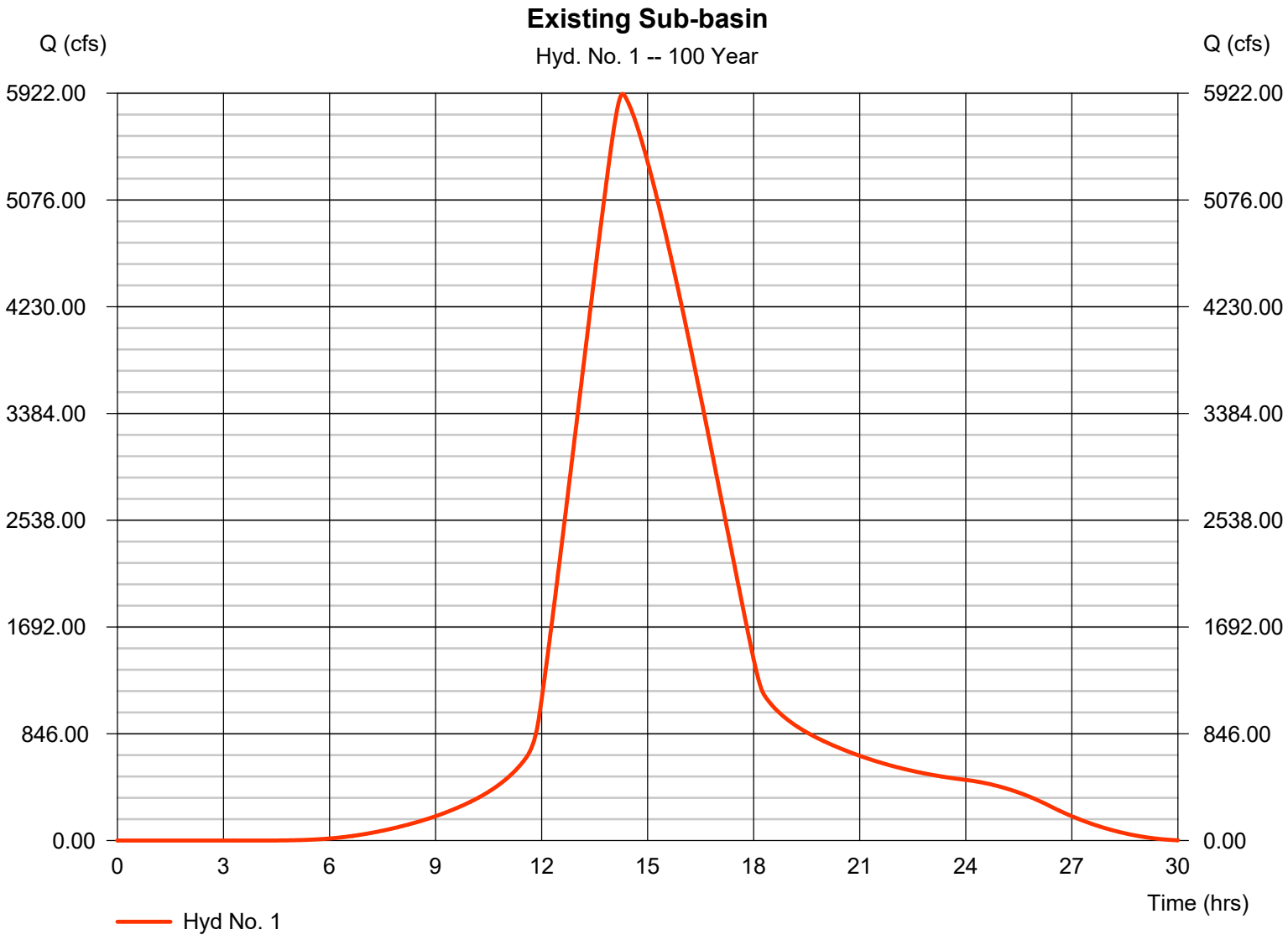
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	5916.63	1	857	108,331,176	------	------	------	Existing Sub-basin
2	SCS Runoff	24.35	1	724	73,833	------	------	------	Proposed Project
3	SCS Runoff	5912.31	1	857	108,252,224	------	------	------	Remainder Proposed Sub-basin
4	Combine	5913.27	1	857	108,326,024	2, 3	------	------	Proposed Sub-basin

Hydrograph Report

Hyd. No. 1

Existing Sub-basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	5916.63 cfs
Storm frequency	=	100 yrs	Time to peak	=	14.28 hrs
Time interval	=	1 min	Hyd. volume	=	108,331,176 cuft
Drainage area	=	5042.000 ac	Curve number	=	85
Basin Slope	=	1.4 %	Hydraulic length	=	18972 ft
Tc method	=	LAG	Time of conc. (Tc)	=	242.00 min
Total precip.	=	7.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

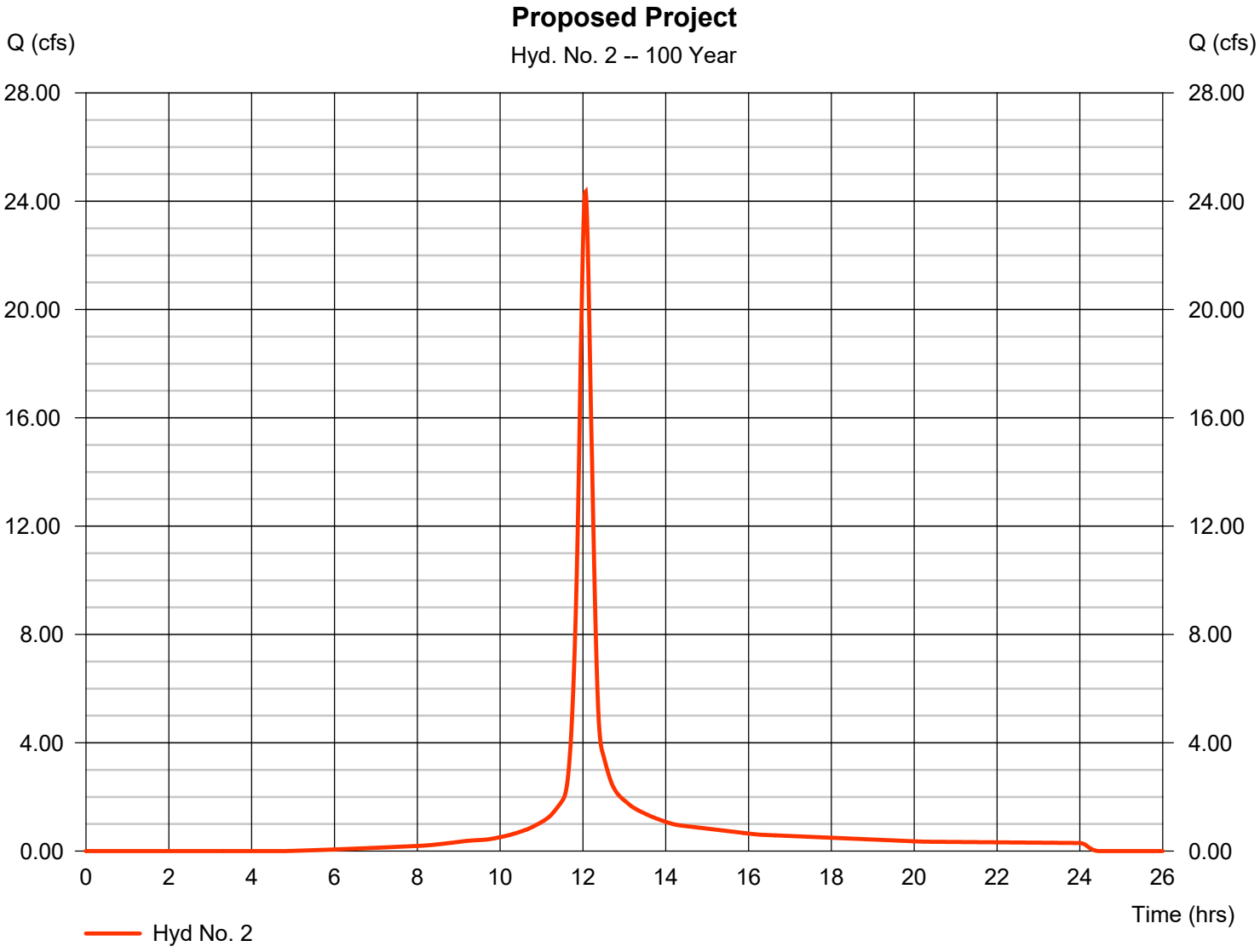


Hydrograph Report

Hyd. No. 2

Proposed Project

Hydrograph type	=	SCS Runoff	Peak discharge	=	24.35 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	1 min	Hyd. volume	=	73,833 cuft
Drainage area	=	3.690 ac	Curve number	=	82
Basin Slope	=	6.4 %	Hydraulic length	=	1565 ft
Tc method	=	LAG	Time of conc. (Tc)	=	16.94 min
Total precip.	=	7.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

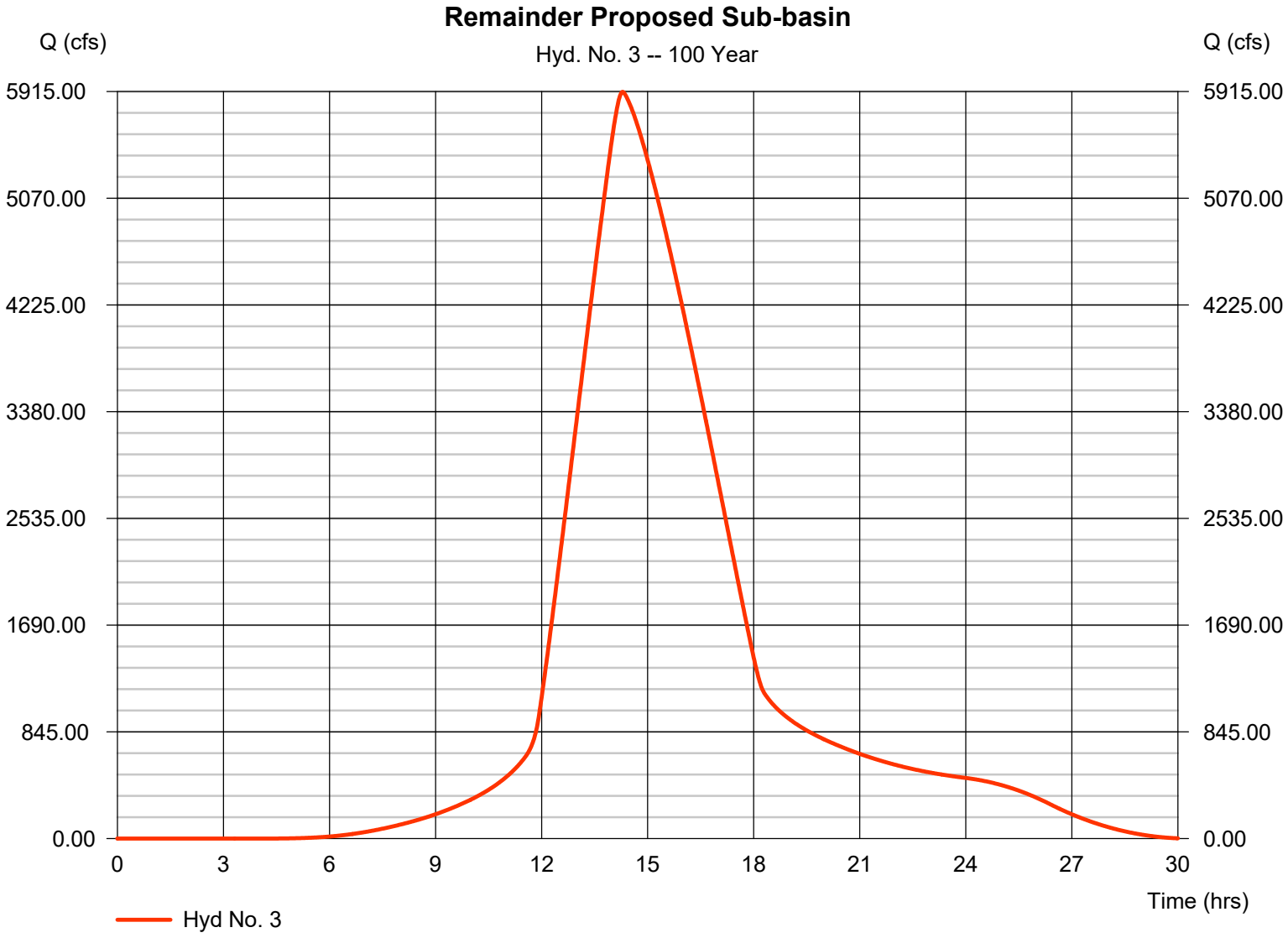


Hydrograph Report

Hyd. No. 3

Remainder Proposed Sub-basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	5912.31 cfs
Storm frequency	=	100 yrs	Time to peak	=	14.28 hrs
Time interval	=	1 min	Hyd. volume	=	108,252,224 cuft
Drainage area	=	5038.310 ac	Curve number	=	85
Basin Slope	=	1.4 %	Hydraulic length	=	18972 ft
Tc method	=	LAG	Time of conc. (Tc)	=	242.00 min
Total precip.	=	7.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

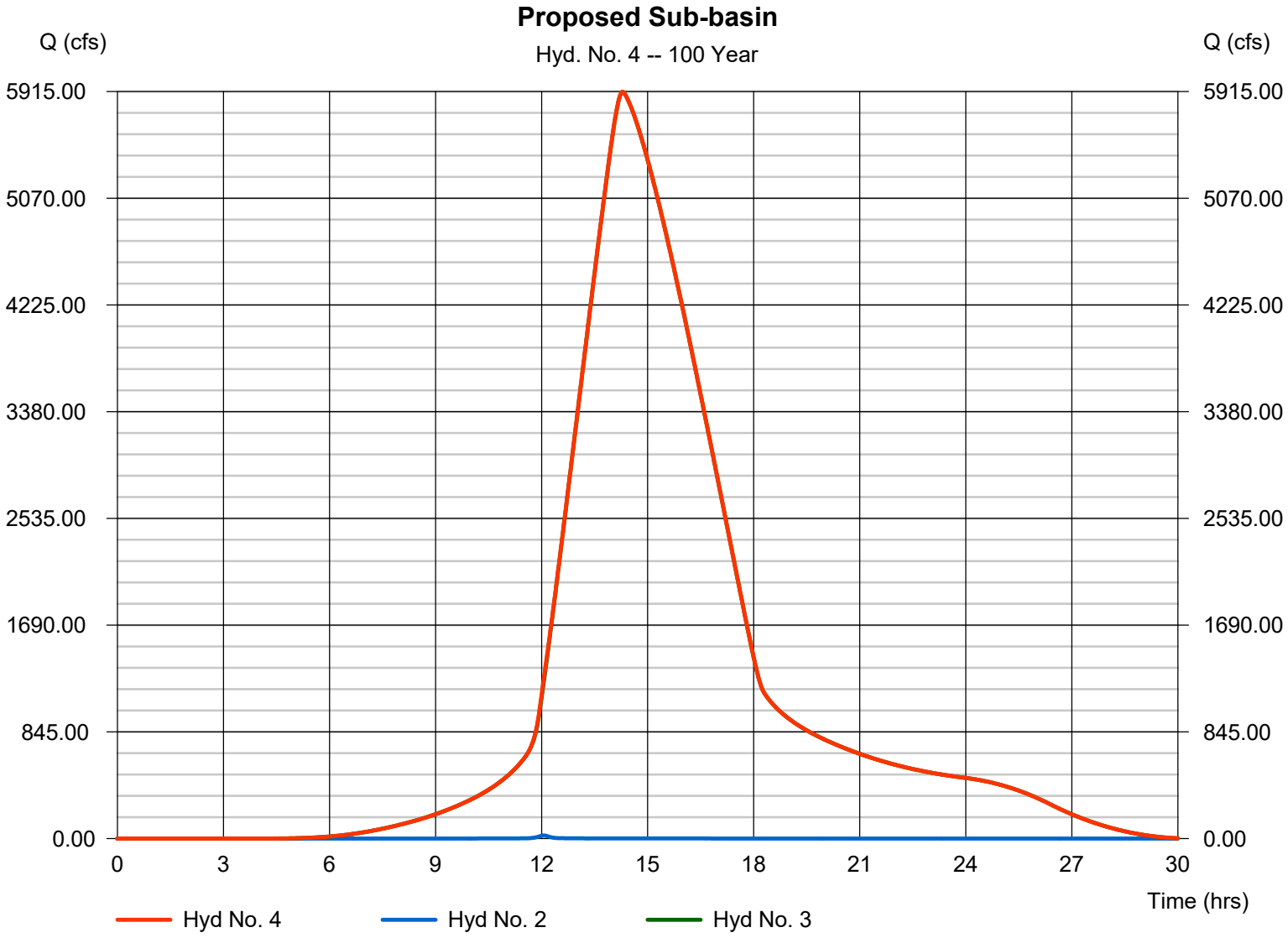


Hydrograph Report

Hyd. No. 4

Proposed Sub-basin

Hydrograph type	=	Combine	Peak discharge	=	5913.27 cfs
Storm frequency	=	100 yrs	Time to peak	=	14.28 hrs
Time interval	=	1 min	Hyd. volume	=	108,326,024 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	5042.000 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	64.1474	17.7000	0.8922	--------
2	95.7859	19.2000	0.9317	--------
3	0.0000	0.0000	0.0000	--------
5	118.7799	19.1000	0.9266	--------
10	125.1300	18.2000	0.9051	--------
25	158.9867	18.7000	0.9180	--------
50	171.2459	18.3000	0.9078	--------
100	187.3624	18.1000	0.9031	--------

File name: KCMO.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	3.96	3.31	2.86	2.52	2.25	2.04	1.87	1.72	1.60	1.49	1.40	1.32
2	4.92	4.13	3.56	3.14	2.81	2.54	2.32	2.14	1.98	1.85	1.73	1.63
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.23	5.23	4.51	3.98	3.56	3.22	2.94	2.71	2.52	2.35	2.20	2.07
10	7.27	6.09	5.26	4.63	4.14	3.75	3.43	3.16	2.93	2.74	2.57	2.42
25	8.70	7.30	6.30	5.54	4.96	4.49	4.10	3.78	3.51	3.27	3.07	2.89
50	9.83	8.24	7.11	6.26	5.60	5.07	4.64	4.27	3.97	3.70	3.47	3.27
100	11.00	9.21	7.95	7.00	6.26	5.67	5.19	4.78	4.44	4.14	3.89	3.66

Tc = time in minutes. Values may exceed 60.

Precip. file name: Z:\acad\KCMO.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	1.37	3.50	0.00	3.30	5.20	6.00	6.80	7.70
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	2.49	3.10	0.00	4.01	4.64	5.52	6.21	6.90
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	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

Exhibit G
FEMA FIS Data

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
BURLINGTON CREEK (CONT'D)						
Just downstream of Tom Watson Parkway	0.4	955	N/A	1,288	1,535	1,943
BURLINGTON CREEK TRIBUTARY 1						
Just downstream of Northwest 62nd Terrace	0.4	955	N/A	1,289	1,535	1,943
BURLINGTON CREEK TRIBUTARY 2						
Approximately 1,000 feet upstream of the confluence with Burlington Creek	0.5	650	N/A	1,014	1,302	1,806
Approximately 1,500 feet upstream of the confluence with Burlington Creek	0.5	524	N/A	817	1,050	1,462
BURR OAK CREEK						
Approximately 1,500 feet downstream of Northwest Pink Hill Road	4.3	1,400	N/A	2,900	3,600	5,200
At Northwest Pink Hill road	1.7	800	N/A	1,700	2,100	3,000
BURR OAK CREEK TRIBUTARY						
Approximately 500 feet upstream of confluence with Burr Oak Creek	1.6	610	N/A	1,200	1,500	2,200
CEDAR CREEK						
At confluence with Little Blue River	*	3,900	N/A	5,780	6,750	8,240
At Northwest Chipman Road	*	3,840	N/A	5,710	6,680	8,180
Approximately 0.8 miles upstream of Northwest Chipman Road	*	3,470	N/A	5,130	5,990	7,310

*Data not available.

TABLE 3 – SUMMARY OF DISCHARGES (CONT'D)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK ANNUAL CHANCE DISCHARGES (CFS) 10-Percent Annual Chance	4-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent Annual-Chance
CEDAR CREEK (CONT'D)						
Approximately 1,870 feet downstream of Southwest 3rd Street	*	2,760	N/A	4,070	4,740	5,780
Approximately 580 feet upstream of Southwest Pryor Drive	*	1,710	N/A	2,520	2,900	3,540
Approximately 1,040 feet downstream of Union Pacific Railroad	*	1,480	N/A	2,140	2,470	2,990
Approximately 990 feet upstream of Union Pacific Railroad	*	1,040	N/A	1,500	1,720	2,090
Approximately 580 feet downstream of Southwest Lakeview Boulevard	*	536	N/A	766	869	1,050
CRACKERNECK CREEK						
At confluence with Little Blue River	6.7	4,610	N/A	7,580	9,180	15,370
DYKE BRANCH						
At confluence with Indian Creek	6.9	4,250	5,030	5,850	7,330	9,520
At Holmes Road	6.9	4,240	5,010	5,810	7,320	9,510
At Bannister Road	6.8	4,220	4,990	5,740	7,290	9,470
Approximately 800 ft upstream of Bannister Road	6.7	4,210	4,980	5,720	7,270	9,450
Approximately 2200 feet downstream of Wornall Road	6.5	4,160	4,920	5,660	7,190	9,340
Approximately 775 feet downstream of Wornall Road	6.4	4,140	4,900	5,650	7,200	9,350
Approximately 580 feet downstream of Wornall Road	5.9	4,010	4,750	5,470	6,950	9,000

*Data not available.