MACRO STORM WATER DRAINAGE STUDY

COLBERN ROAD INVESTMENTS
COMMERCIAL DEVELOPMENT
NE QUADRANT COLBERN & RICE ROADS

Site Acreage: 23.93 Acres

Lee's Summit, MO

PREPARED BY:

ENGINEERING SOLUTIONS
ENGINEERING & SURVEYING
50 S.E. 30th Street Lee's Summit, MO 64082
816.623.9888 • engineeringsolutionskc.com

STATE OF MISSOURI
MATTHEW J. SCHLICHT
NUMBER PE-2006019708
PROFESSIONAL ENGINEER

Matthew J. Schlicht, PE

Revision

Date	Comment	By

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3. GENERAL INFORMATION

This storm study has been prepared to evaluate potential hydrologic impacts related to the proposed commercial development at the NE quadrant of Colbern and Rice Roads at ultimate buildout and recommend improvements if required to mitigate any anticipated negative impacts. The proposed project will be constructed in phases. The study will address ultimate buildout conditions for the entire development. It is anticipated that the Development will consist of 5 commercial lots with one common 7.01 acre detention tract. There are currently no known commercial users. The study will use a neighborhood commercial curve number of 94 which equates to a proposed land usage of 85% impervious to allow a variety of uses. The existing property currently consists of mainly prairie land with a large pond located in the northeast corner of the property. The Development will utilize enclosed storm sewer to convey runoff to the existing pond. The existing pond will be utilized to detain and attenuate excess storm water runoff. See Exhibit A for an aerial image of the proposed project site along with an aerial image of the surrounding area. The Development consists of approximately 23.93 acres.

3.1 FEMA FLOODPLAIN DETERMINATION

The property is located in an Area of Minimal Flood Hazard, Zone X, according to FEMA Firm Map Number 29095C0430G, dated January 20, 2017.

See Exhibit B for a FIRMette which includes the proposed project site.

3.2 NRCS SOIL CLASSIFICATION

Soil classifications published by the United States Department of Agriculture/National Resources Conservation Service (USDA/NRCS) website for Jackson County, Missouri, Version 22, May 29, 2020. The existing site contains five major soil types:

10000	Arisburg Silt Loam, 1 to 5 Percent Slopes Hydrologic Soils Group (HSG): Type C
10117	Sampsel Silty Clay Loam, 5 to 9 Percent Slopes HSG: Type C/D
10120	Sharpsburg Silt Loam, 2 to 5 Percent Slopes HSG: Type C
10128	Sharpsburg-Urban Land Complex, 2 to 5 Percent Slopes HSG: Type D
30080	Greenton Silty Clay Loam, 5 to 9 Percent Slopes HSG: Type C/D

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

4. METHODOLOGY

The study utilized existing city contours to create the Existing Drainage Area Map. The study conforms to the requirements of the City of Lee's Summit, Missouri "Design and Construction Manual" and all applicable codes and criteria referred to therein, unless stated otherwise.

Using the above criteria, the proposed site was evaluated using the Soil Conservation Service, SCS TR-55 method to calculate storm runoff volumes, peak rates of discharge, pre and post developed hydrographs and required storage volumes for detention facilities. TR-55 was first introduced in 1975 by the SCS particularly for small urbanizing watersheds. The analysis contains results for the 2, 10 and 100-year design storms.

Hydraflow Hydrographs Extension for AutoCAD Civil 3D was utilized to model the various SCS TR-55 stormwater rainfall runoff events. The following SCS TR-55 Unit Hydrograph variables were utilized;

- AMC II Soil Moisture Conditions
- 24-Hour SCS Type II Rainfall Distribution (Shape Factor 484)
- SCS Runoff Curve Numbers per SCS TR-55 (Tables 2-2a to 2-2c)

Time of Concentration has been calculated using the following formulas:

- Sheet Flow (Max. 100 LF): APWA 5602.5 Time Inlet, $T_I = 1.8 * (1.1-C) * L^{1/2} / S^{1/3}$
- Shallow Concentrated Flow: SCS TR-55 Appendix F: Unpaved V=16.1345(S)^0.5
  Paved V=20.3282(S)^0.5
  Shallow Concentrated Travel Time (min): SCS TR-55 Eq-3-1, $T_t = L / V \times 60$
- Channel Flow Improved: Manning's Equation (Full Flow)
  Channel Flow Unimproved: APWA 5602.7.A. Travel Time, Table 5602-6

Avg. Channel Slope (%)	Velocity (fps)
< 2	7
2 to 5	10
>5	15

5. EXISTING CONDITIONS ANALYSIS

The existing site consists of mainly prairie land with a few trees lining the north property boundary. The site contains three sub-basins referred to as the West Sub-basin, South Sub-basin and East Sub-basin for the purposes of this report. Each Sub-basin drains to a Point of Interest which corresponds to its given sub-basin drainage area, i.e., West Sub-basin drains to Point of Interest (POI) West. The Existing Drainage Area Map is located in Exhibit D. Following is a brief description of each sub-basin.

West Sub-basin is generally located on the western portion of the property adjacent to Rice Road, south of the Post Office. Runoff drains to the west via sheet and shallow concentrated flow. The runoff is intercepted by a road side ditch running along Rice Road for further conveyance downstream to the north. The sub-basin consists of 2.31 acres all of which are onsite. The West POI is located in the Rice Road drainage ditch.

South Sub-basin is generally located on the southern portion of the property adjacent to Colbern Road, just west of the Public Library. Runoff drains to the south via sheet flow. Runoff is intercepted by Colbern Road and conveyed to the east via an enclosed storm sewer system. The South POI will consist of the south property line adjacent to Colbern Road in lieu of a specific point discharge due to the geometry of the sub-basin and nature of the drainage. The sub-basin consists of 0.47 acres.

East Sub-basin is the last and largest sub-basin making up the remainder of the site. Runoff drains to the northeast via sheet and shallow concentrated flow to the existing pond located in the northeast corner of the property. Runoff leaves the site via the pond spillway located in the northeast corner of the pond and property. Runoff is conveyed downstream via a natural channel on the adjacent property to the north. The East POI will be located at the existing pond spillway. The sub-basin contains 14.73 acres. The pond tract contains 7.01 acres and is not included in the East Sub-basin. The pond tract will remain undeveloped and therefore will not be accounted for in any hydraulic calculations.

The following tables summarize the results of the Existing Conditions analysis. A complete breakdown of TR-55 unit hydrographs may be found in Exhibit E.

Table 5-1 Existing Conditions Sub-basin Data

Sub-basin	Area (ac.)	CN	Tc (min.)
West	2.31	74	11.7
South	0.47	74	5
East	14.73	74	10.5

Table 5-2 Existing Conditions Sub-basin/Point of Interest Peak Discharge Rates

Sub-basin	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)
West	4.31	8.91	16.32
South	1.08	2.20	3.98
East	27.49	56.82	104.05

Per APWA 5608.4 and City of Lee's Summit criteria, post development peak discharge rates from the site shall not exceed those indicated below:

- 50% storm peak rate less than or equal to 0.5 cfs per site acre
- 10% storm peak rate less than or equal to 2.0 cfs per site acre
- 1% storm peak rate less than or equal to 3.0 cfs per site acre

Allowable release rates were calculated at each point of interest. Due to the geography of the site there are no offsite areas draining through the developable areas of the site. The 7.01 acre detention tract will not be developed therefore this area was not accounted. The use of the area-discharge ratio method to account for offsite tributaries was not required.

Allowable Release Example Calculations:

West Sub-basin (2-Yr): (2.31 x 0.5) = 1.16 cfs

Table 5-3 Existing Conditions Sub-basin/Point of Interest Allowable Peak Discharge Release Rates

Sub-basin	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)
West	1.16	4.62	6.93
South	0.24	0.94	1.41
East	7.37	29.46	44.19

6. PROPOSED CONDITIONS ANALYSIS

The Development will consist of various commercial land usages. The runoff coefficient used for the entire site will be 94 which equates to 85% impervious land. The proposed site will continue to consist of three distinct sub-basins referred to as the West Sub-basin, South Sub-basin and East Sub-basin for the purposes of this report. Each sub-basin peak runoff rate will be calculated at a given Point of Interest which corresponds to its given sub-basin drainage area, i.e., West Sub-basin drains to Point of Interest (POI) West. The Proposed Drainage Area Map is located in Exhibit F. Following is a brief description of each sub-basin.

West Sub-basin will be reduced considerably due to the proposed development. The sub-basin will contain 0.25 acres of peripheral undeveloped area along Rice Road.

South Sub-basin will be reduced by more than half of its existing condition. The sub-basin will contain 0.21 acres of peripheral undeveloped area along Colbern Road.

East Sub-basin will increase in land area due to the proposed development. The area lost by the west and south sub-basins will contribute to the east. The East Sub-basin will contain 17.05 acres of commercial development. An enclosed storm sewer system will be installed in the development conveying storm water runoff to the retention pond located in the northeast corner of the property. The existing pond will be modified with a new outlet control device in the northeast corner and a new emergency spillway along the north berm to meet the City's current storm water design standards. These improvements will be detailed further as the project proceeds past the preliminary stages.

The following tables summarize the results of the Proposed Conditions analysis for all three sub-basins.

Table 6-1 Proposed Conditions Sub-basin Data

Sub-basin	Area (ac.)	Composite CN	Tc (min.)
West	0.25	74	8.2
South	0.21	74	5
East	17.05	94	13.1

Table 6-2 Proposed Conditions Sub-basin/Point of Interest Peak Discharge Rates

Sub-basin	Q2 (cfs)	Q10 (cfs)	Q100 (cfs)
West	0.52	1.06	1.92
South	0.48	0.98	1.78
East	64.14	99.07	149.77

As shown above in Table 6-2 the East Sub-basin will require attenuation measures to meet allowable peak discharge rates as shown in Table 5-3. The South Sub-basin is a minor peripheral area that will continue to free release sheet flow to the Colbern Road enclosed storm sewer system. The proposed runoff is less than half of the existing condition for all storm events. A formal waiver will be requested for the South Sub-basin once the final report has been accepted. The West and South Sub-basins will not be improved and are minor peripheral areas that will not be discussed any further in this report.

6.1 RETENTION

The existing pond located in the northeast corner of the property will be modified to allow attenuation of the proposed increase in storm water runoff from the proposed Development. Following are a list of preliminary design parameters for the retention system.

Designation: East Retention Basin
Type: Earthen Basin
Side Slopes: 5:1 TBD
Bottom Slope: N/A
Basin Bottom Elevation: TBD
Basin Top Berm Elevation: 950.00 (Verify)
Basin Volume: TBD
Pond Surface Area: 5.20 acres @ 947.00 (Verify)
Outlet Pipe: 24" HDPE, FL (In) = 945.00, FL (Out) = 944.00, L=70', S=1.43%
Emergency Spillway: Earthen Broad Crested Weir, Crest Elevation=948.00, Crest Length=500.00'
Consecutive 100-YR Q=149.77 cfs Emergency Spillway HGL=948.24, Freeboard=1.76'

The Retention Basin Plan is located in Exhibit G. See Table 6-4 for a summary of retention basin data.

Table 6-4 Proposed Conditions Detention Basin Data

	Peak Q In (cfs)	Tp In (min.)	Peak Q Out (cfs)	Tp Out (min)	Peak W.S.E.	Max. Storage Vol. (cf)
Basin C1						
2-Year	64.14	721	1.89	883	945.57	121,729
10-Year	99.07	721	4.15	817	945.87	186,193
100-Year	149.77	721	8.33	785	946.29	279,329

As shown in the table above all proposed peak flowrates have been attenuated. See Table 6-5 below for a summary of proposed peak discharge rates at the East POI. Hydrographs tributary to each point of interest have been combined to determine subsequent peak discharge rates.

Table 6-5 Proposed Conditions Post Detention Point of Interest Peak Discharge Rates

Point of Interest	**Q2 (cfs)**	**Q10 (cfs)**	**Q100 (cfs)**
East	1.89	4.15	8.33

As can be seen in the above table all peak discharge rates attributable to the Development have been attenuated below allowable release rates outlined in Table 5-3.

Table 6-6 below provides a comparison of runoff data between Proposed, Existing and Allowable Release Rates at each Point of Interest.

Table 6-6 Point of Interest Peak Discharge Comparison

POI	Condition	**Q2 (cfs)**	**Q10 (cfs)**	**Q100 (cfs)**
East	Proposed	1.89	4.15	8.33
	Existing	27.49	56.82	104.05
	Difference	-26.6	-52.67	-95.72
	Allowable	7.37	29.46	44.19
	Difference	-5.48	-25.31	-35.86

Peak discharge rates at the East POI will be reduced below allowable for all design storms analyzed.

7. 40 HOUR EXTENDED DETENTION/INFILTRATION BMP

In addition to mitigation of peak flow rates, APWA Section 5608.4 also requires 40 hour extended detention of runoff from the local 90% mean annual event (1.37"/24-hour rainfall). The proposed detention facility will release the water quality event over a period of 40-72 hours. In the hydrograph report the 1-year storm event has been assigned the water quality rainfall runoff value of 1.37 inches. The 1-year hydrograph for the East Sub-basin will drain within 40-72 hours as proposed.

8. CONCLUSIONS & RECOMMENDATIONS

This macro storm water drainage study reveals that the proposed development will not generate any negative downstream hydraulic impacts. The existing pond will be modified to provide required attenuation of the East Sub-basin as outlined in the body of this report. As more information is received about the existing pond through field survey and visit options like a principal spillway will be investigated in lieu of an outlet pipe.

In conclusion, proposed peak discharge rates for each point of interest are below allowable release rates for all regulatory design storms with the exception of the South Sub-basin. A formal waiver will be requested after the acceptance of the proposed project. The study is in conformance with all applicable City of Lee's Summit standards and criteria therefore Engineering Solutions recommends approval of this macro storm water drainage study.

Exhibit A

Aerial Image
&
Aerial Image of Surrounding Area


470
NE Rice Rd
Midland Marble & Granite
PROJECT SITE
United States Postal Service
Summit Self Storage
NE Rice Rd
Mid-Continent Public Library...
NE Colbern Rd
NE Colbern Rd
NE Colbern Rd
NE Colbern Rd
NE Colbern Rd
Phillips 66
© 2021 Google

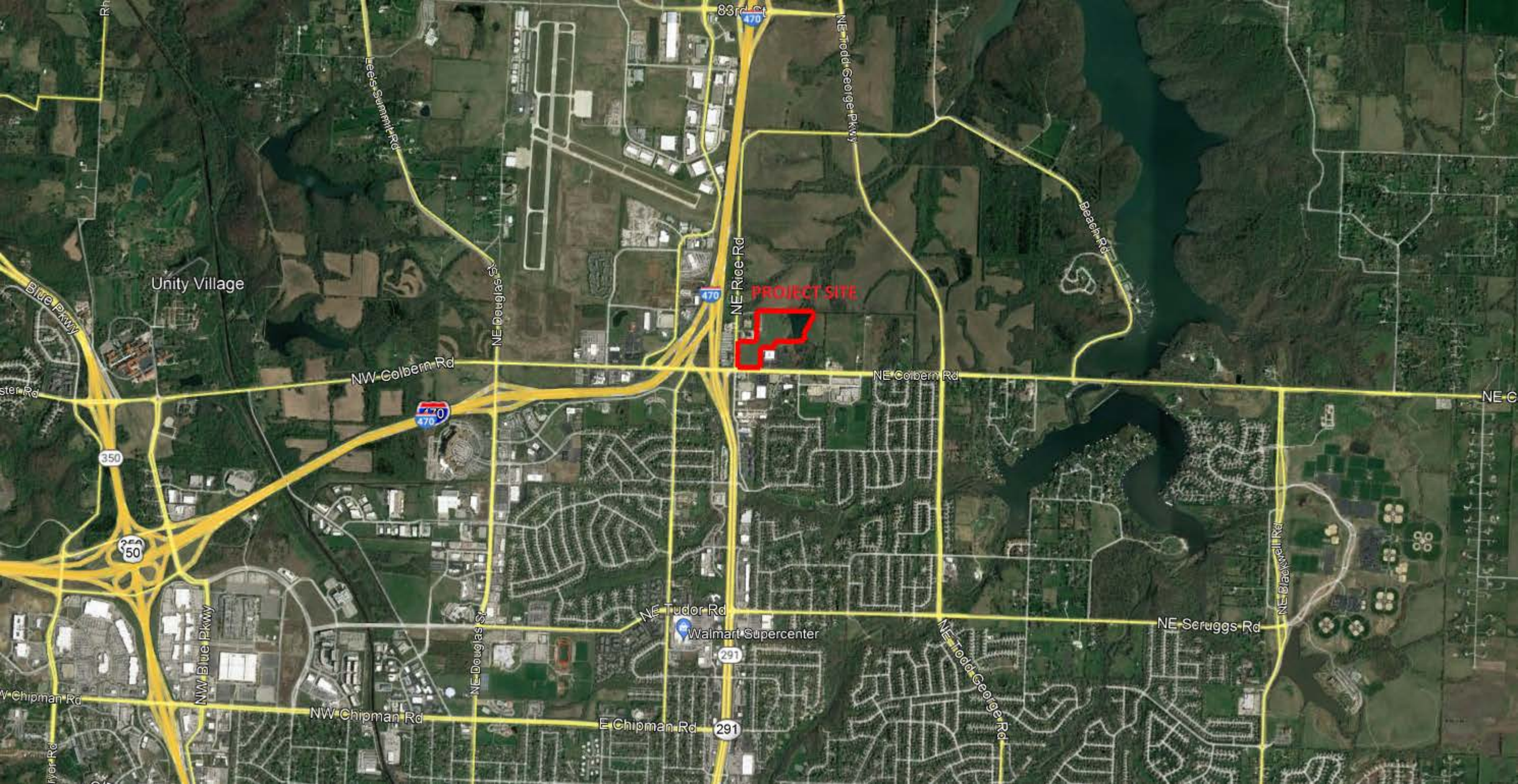

PROJECT SITE
Unity Village
NE Rice Rd
NE Douglas St
Lee's Summit Rd
NE Todd George Pkwy
Beach Rd
NW Colbern Rd
NE Colbern Rd
Blue Pkwy
NW Blue Pkwy
NE Tudor Rd
Walmart Supercenter
NE Scruggs Rd
NE Blackwell Rd
NW Chipman Rd
E Chipman Rd
470
291
350
50

Exhibit B

FEMA FIRMette

National Flood Hazard Layer FIRMette

94°21'49"W 38°57'3"N

94°21'11"W 38°56'35"N

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

1:6,000

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

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 9/1/2021 at 11:46 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 C

NRCS Soil Classification Report

United States Department of Agriculture

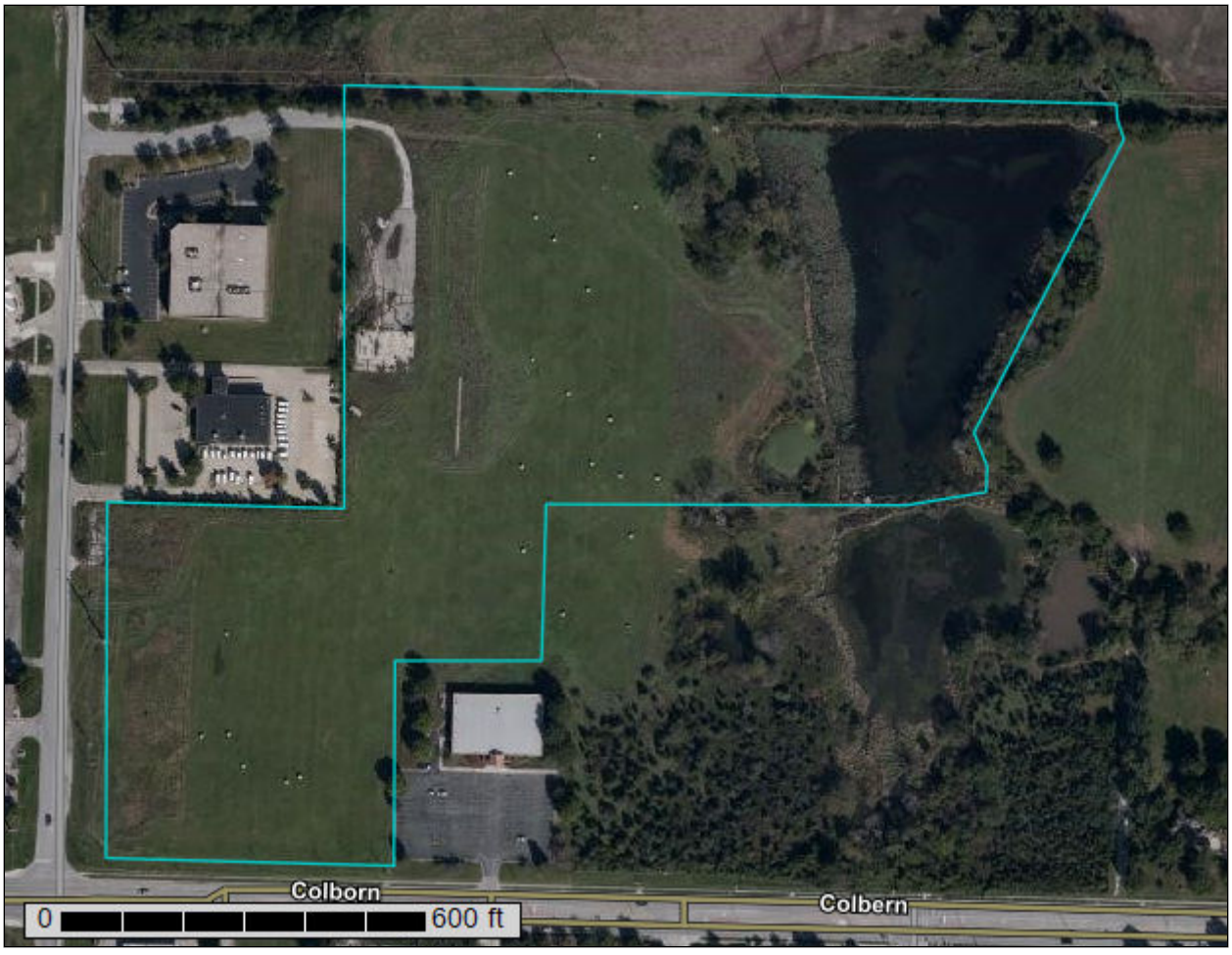
NRCS

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

NE Quadrant Colbern & Rice Roads



September 1, 2021

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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Contents

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: 1:3,300 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 45 90 180 270

Feet
0 150 300 600 900

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
10000	Arisburg silt loam, 1 to 5 percent slopes	0.0	0.1%
10117	Sampsel silty clay loam, 5 to 9 percent slopes	7.8	30.6%
10120	Sharpsburg silt loam, 2 to 5 percent slopes	0.5	2.0%
10128	Sharpsburg-Urban land complex, 2 to 5 percent slopes	16.9	66.1%
30080	Greenton silty clay loam, 5 to 9 percent slopes	0.3	1.2%
Totals for Area of Interest		**25.6**	**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

10000—Arisburg silt loam, 1 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2w22b
Elevation: 610 to 1,130 feet
Mean annual precipitation: 39 to 43 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 177 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Arisburg and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arisburg

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess

Typical profile

Ap - 0 to 6 inches: silt loam
A - 6 to 13 inches: silt loam
Bt - 13 to 19 inches: silty clay loam
Btg - 19 to 56 inches: silty clay loam
BCg - 56 to 79 inches: silty clay loam

Properties and qualities

Slope: 1 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R107BY007MO - Loess Upland Prairie Amorpha canescens/ Andropogon gerardii-Zizia aurea Leadplant/Big Bluestem-Golden Zizia
Hydric soil rating: No

Minor Components

Greenton

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: No

Sharpsburg

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: No

Haig

Percent of map unit: 3 percent
Landform: Flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: R109XY001MO - Claypan Summit Prairie
Hydric soil rating: Yes

10117—Sampsel silty clay loam, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2qkzz
Elevation: 600 to 900 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: Prime farmland if drained

Map Unit Composition

Sampsel and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sampsel

Setting

Landform: Hillslopes

Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex, concave
Parent material: Residuum weathered from shale

Typical profile

Ap - 0 to 13 inches: silty clay loam
Bt - 13 to 80 inches: silty clay

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly 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 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: R109XY010MO - Interbedded Sedimentary Upland Savanna
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

10120—Sharpsburg silt loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2yy7v
Elevation: 1,000 to 1,300 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: All areas are prime farmland

Map Unit Composition

Sharpsburg and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sharpsburg

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve

Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loess

Typical profile

Ap - 0 to 6 inches: silt loam
A - 6 to 16 inches: silty clay loam
Bt1 - 16 to 22 inches: silty clay loam
Bt2 - 22 to 46 inches: silty clay loam
BC - 46 to 58 inches: silty clay loam
C - 58 to 79 inches: silty clay loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 45 to 50 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: No

Minor Components

Higginsville, eroded

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: No

Sibley

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: No

10128—Sharpsburg-Urban land complex, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2ql09
Elevation: 1,000 to 1,300 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: All areas are prime farmland

Map Unit Composition

Sharpsburg and similar soils: 60 percent
Urban land: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sharpsburg

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess

Typical profile

A - 0 to 17 inches: silt loam
Bt - 17 to 55 inches: silty clay loam
C - 55 to 60 inches: silty clay loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: 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 35 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Ecological site: R109XY002MO - Loess Upland Prairie
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve

Interpretive groups

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

30080—Greenton silty clay loam, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2xjd9
Elevation: 640 to 1,120 feet
Mean annual precipitation: 35 to 41 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 177 to 209 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Greenton and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Greenton

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess over residuum weathered from limestone and shale

Typical profile

Ap - 0 to 12 inches: silty clay loam
Bt - 12 to 28 inches: silty clay
2Bt - 28 to 30 inches: silty clay
2C - 30 to 79 inches: silty clay

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly 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 12 to 30 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 supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: No

Minor Components

Sampsel

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: Yes

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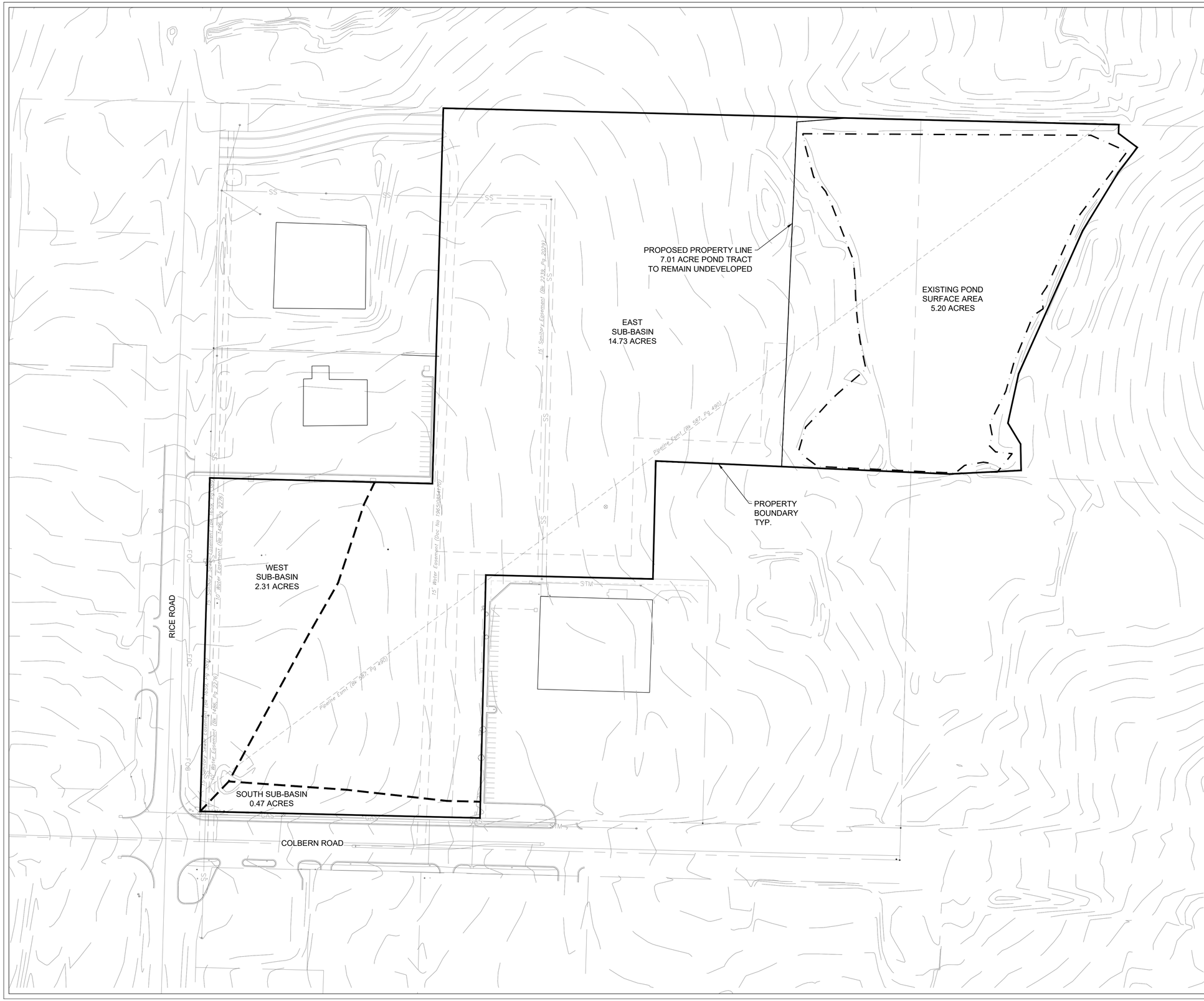
Exhibit D

Existing Drainage Area Map



North

0 40' 80' 160'

EXISTING DRAINAGE MAP

SCALE: 1" = 80'

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Surveying 2005000319-D
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Engineering E-1695
Surveying LS-218
Oklahoma
Engineering 6254
Nebraska
Engineering CA2821

COLBERN ROAD INVESTMENTS
LEE'S SUMMIT, JACKSON COUNTY, MISSOURI

Project: Colbern Road Investments
Issue Date: September, 2021

Existing Drainage Map
Construction Plans for:
Colbern Road Investments
Lee's Summit, Jackson County, Missouri

Matthew J. Schlicht
MO PE 2006019708
KS PE 19071
OK PE 25226
NE PE E-14335

REVISIONS

Exhibit

Exhibit E

Complete Hydraflow Report
&
Emergency Spillway
Broad Crested Weir Analysis

Hydraflow Table of Contents

Watershed Model Schematic

Legend

Hyd.	Origin	Description
1	SCS Runoff	EX WEST
2	SCS Runoff	EX SOUTH
3	SCS Runoff	EX EAST
4	SCS Runoff	PROP WEST
5	SCS Runoff	PROP SOUTH
6	SCS Runoff	PROP EAST
7	Reservoir	PROP EAST ROUTED

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	------	0.151	4.312	-------	-------	8.911	-------	-------	16.32	EX WEST
2	SCS Runoff	------	0.043	1.083	-------	-------	2.203	-------	-------	3.979	EX SOUTH
3	SCS Runoff	------	0.965	27.49	-------	-------	56.82	-------	-------	104.05	EX EAST
4	SCS Runoff	------	0.020	0.518	-------	-------	1.056	-------	-------	1.923	PROP WEST
5	SCS Runoff	------	0.019	0.484	-------	-------	0.984	-------	-------	1.778	PROP SOUTH
6	SCS Runoff	------	19.68	64.14	-------	-------	99.07	-------	-------	149.77	PROP EAST
7	Reservoir	6	0.231	1.887	-------	-------	4.151	-------	-------	8.331	PROP EAST ROUTED

Hydrograph Summary Report

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

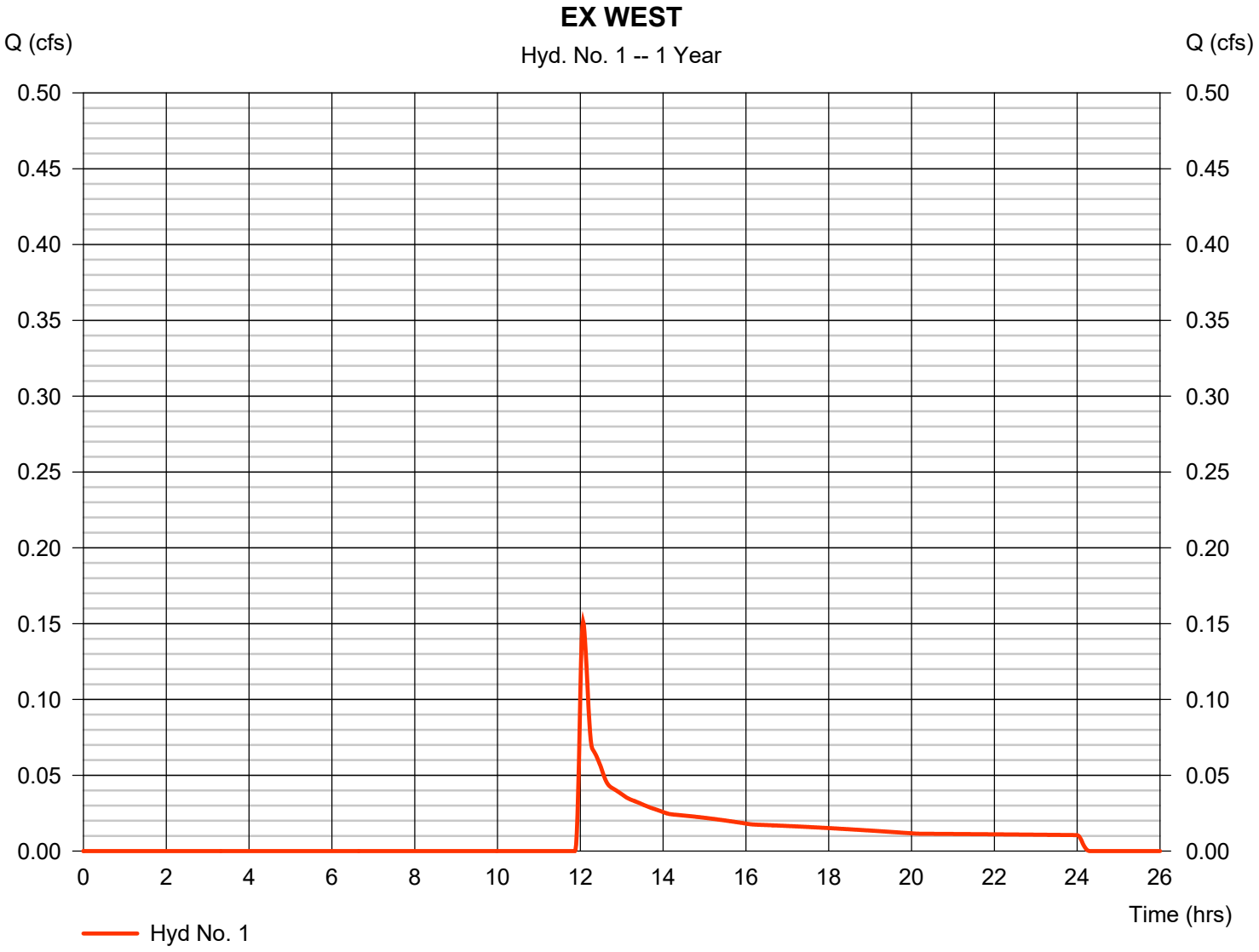
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.151	1	724	909	------	------	------	EX WEST
2	SCS Runoff	0.043	1	721	187	------	------	------	EX SOUTH
3	SCS Runoff	0.965	1	724	5,797	------	------	------	EX EAST
4	SCS Runoff	0.020	1	722	94	------	------	------	PROP WEST
5	SCS Runoff	0.019	1	721	84	------	------	------	PROP SOUTH
6	SCS Runoff	19.68	1	721	50,000	------	------	------	PROP EAST
7	Reservoir	0.231	1	1418	23,200	6	945.19	40,790	PROP EAST ROUTED

Hydrograph Report

Hyd. No. 1

EX WEST

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.151 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.07 hrs
Time interval	=	1 min	Hyd. volume	=	909 cuft
Drainage area	=	2.310 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.70 min
Total precip.	=	1.37 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

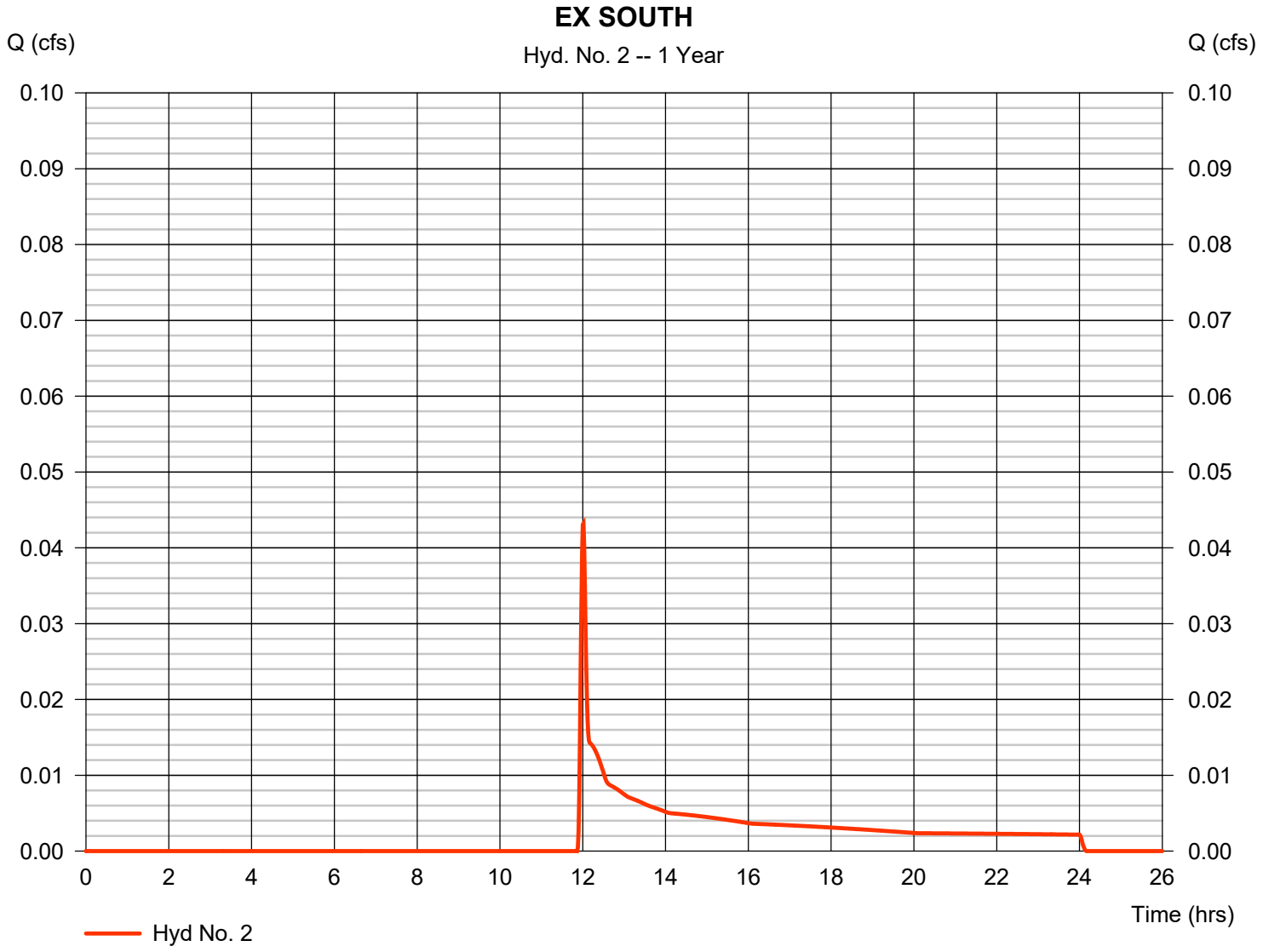


Hydrograph Report

Hyd. No. 2

EX SOUTH

Hydrograph type	= SCS Runoff	Peak discharge	= 0.043 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.02 hrs
Time interval	= 1 min	Hyd. volume	= 187 cuft
Drainage area	= 0.470 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 1.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

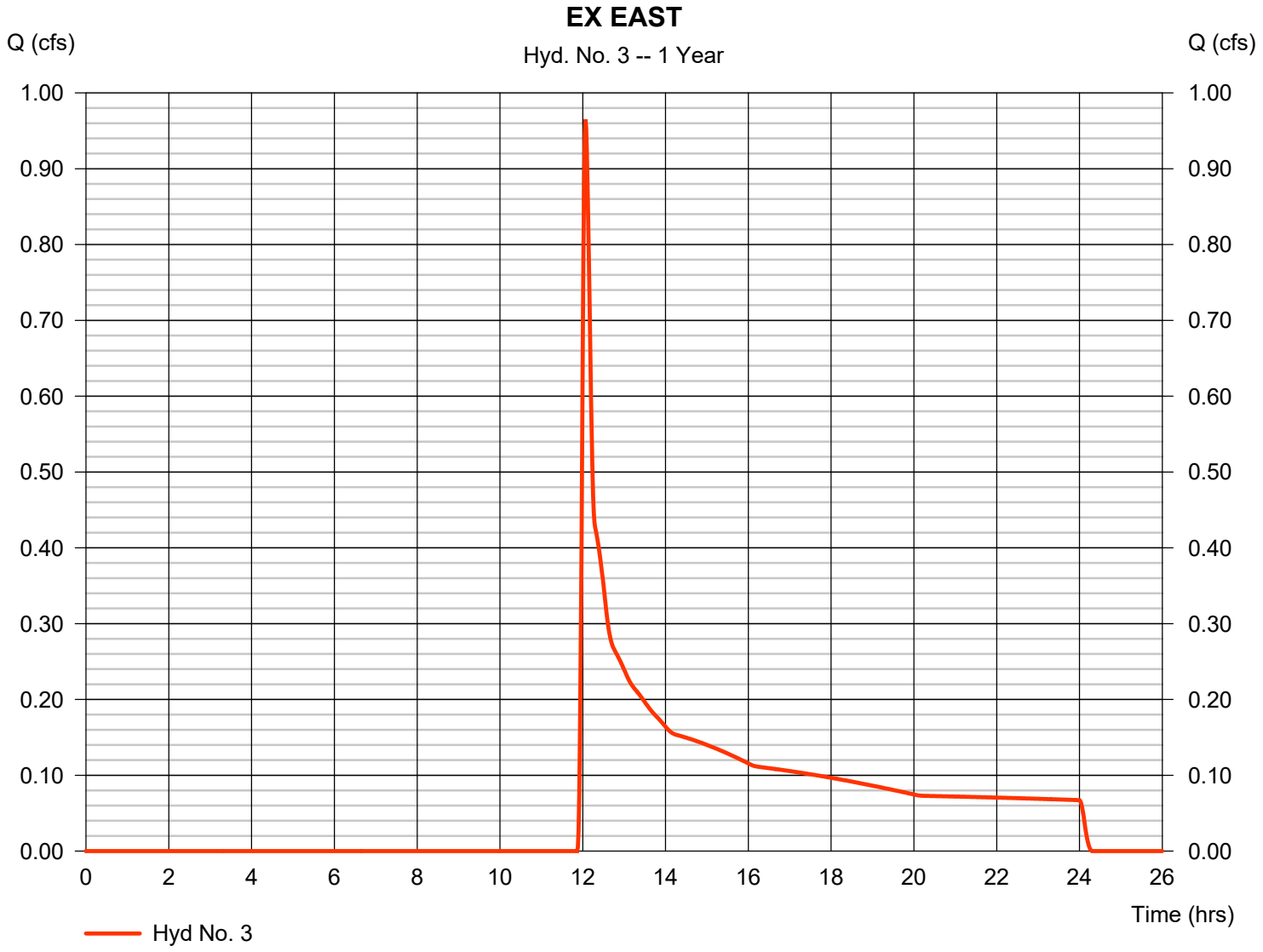


Hydrograph Report

Hyd. No. 3

EX EAST

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.965 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.07 hrs
Time interval	=	1 min	Hyd. volume	=	5,797 cuft
Drainage area	=	14.730 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.50 min
Total precip.	=	1.37 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

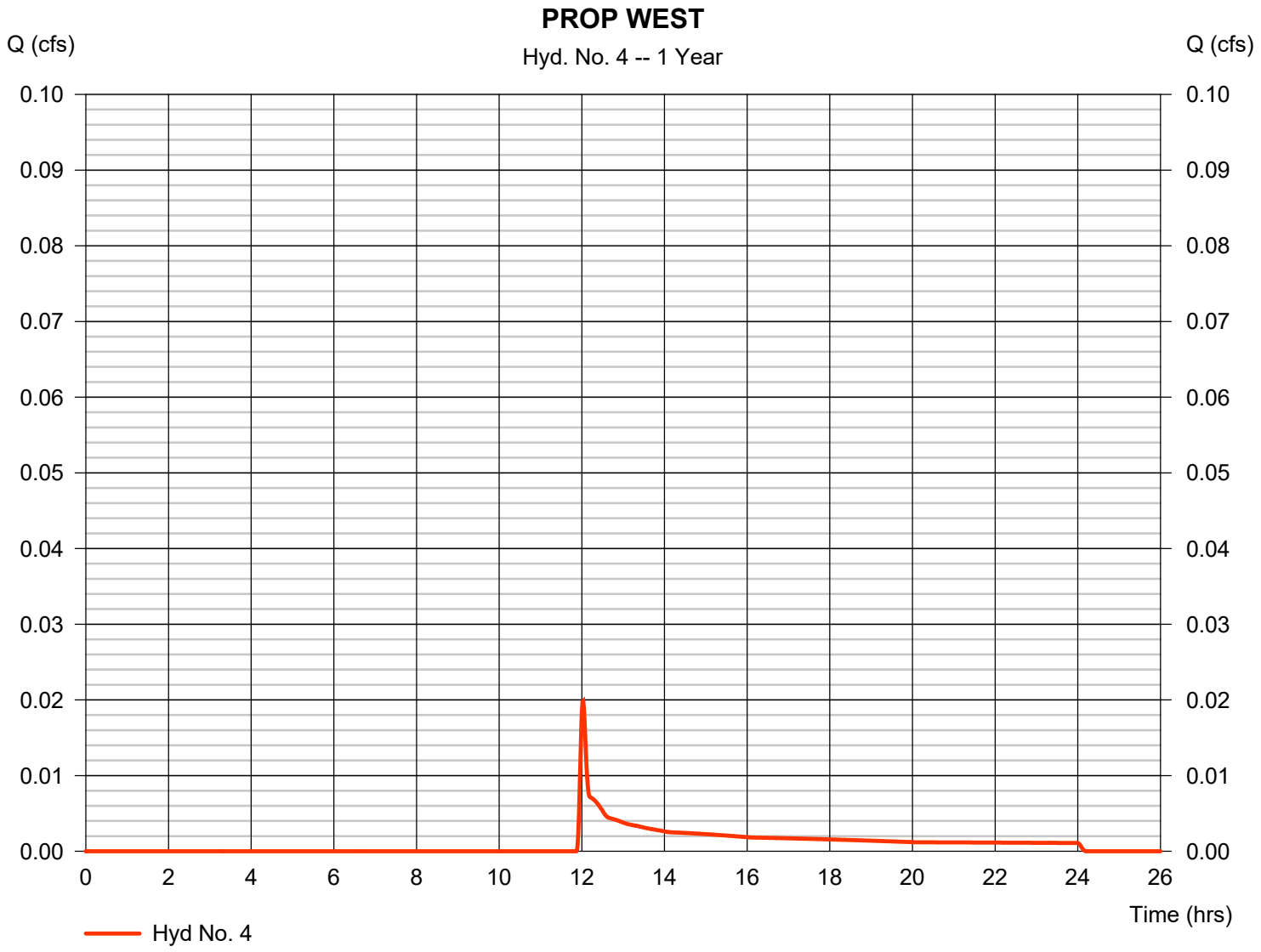


Hydrograph Report

Hyd. No. 4

PROP WEST

Hydrograph type	= SCS Runoff	Peak discharge	= 0.020 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.03 hrs
Time interval	= 1 min	Hyd. volume	= 94 cuft
Drainage area	= 0.250 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.20 min
Total precip.	= 1.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

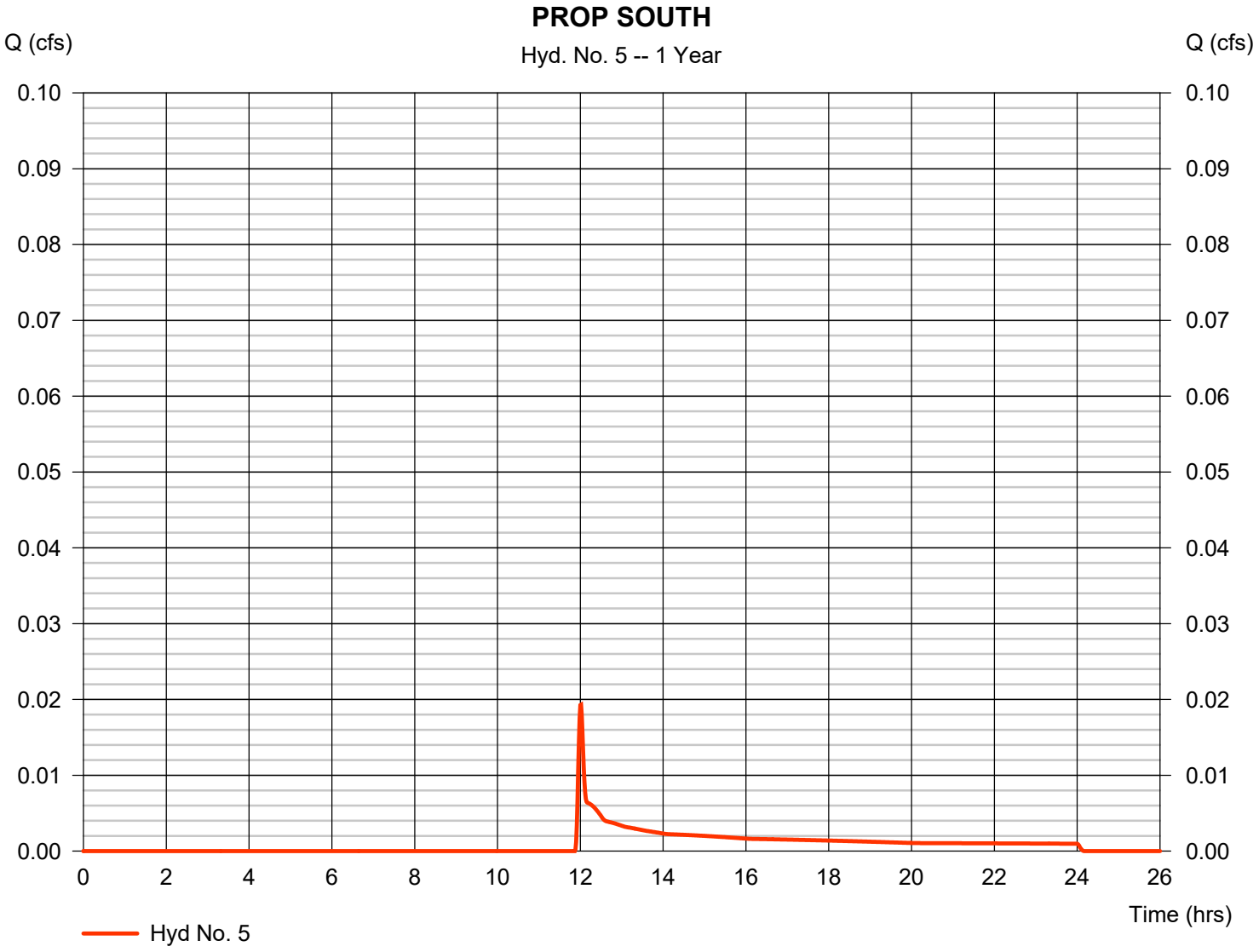


Hydrograph Report

Hyd. No. 5

PROP SOUTH

Hydrograph type	= SCS Runoff	Peak discharge	= 0.019 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.02 hrs
Time interval	= 1 min	Hyd. volume	= 84 cuft
Drainage area	= 0.210 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 1.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

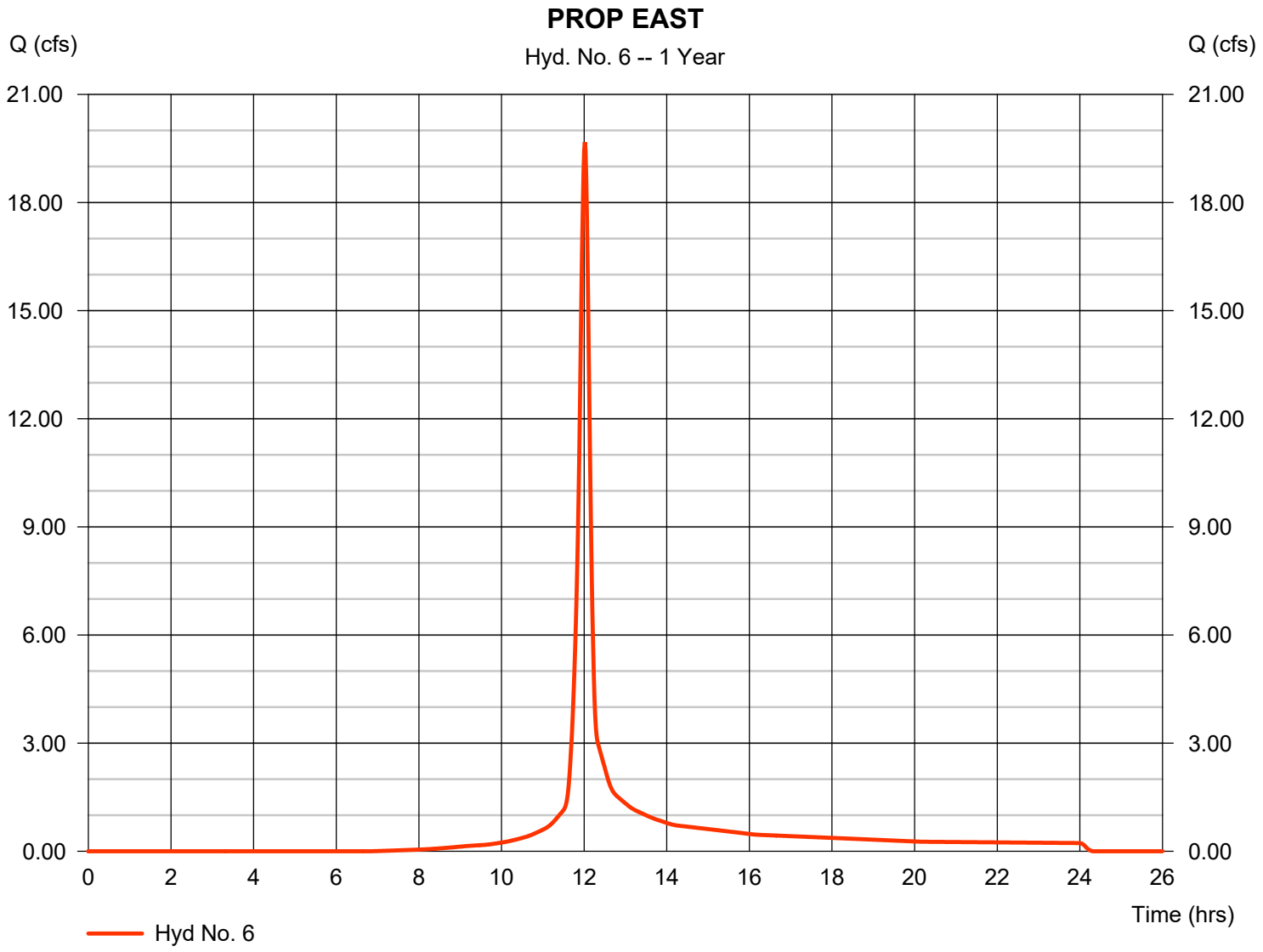


Hydrograph Report

Hyd. No. 6

PROP EAST

Hydrograph type	= SCS Runoff	Peak discharge	= 19.68 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.02 hrs
Time interval	= 1 min	Hyd. volume	= 50,000 cuft
Drainage area	= 17.050 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.10 min
Total precip.	= 1.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



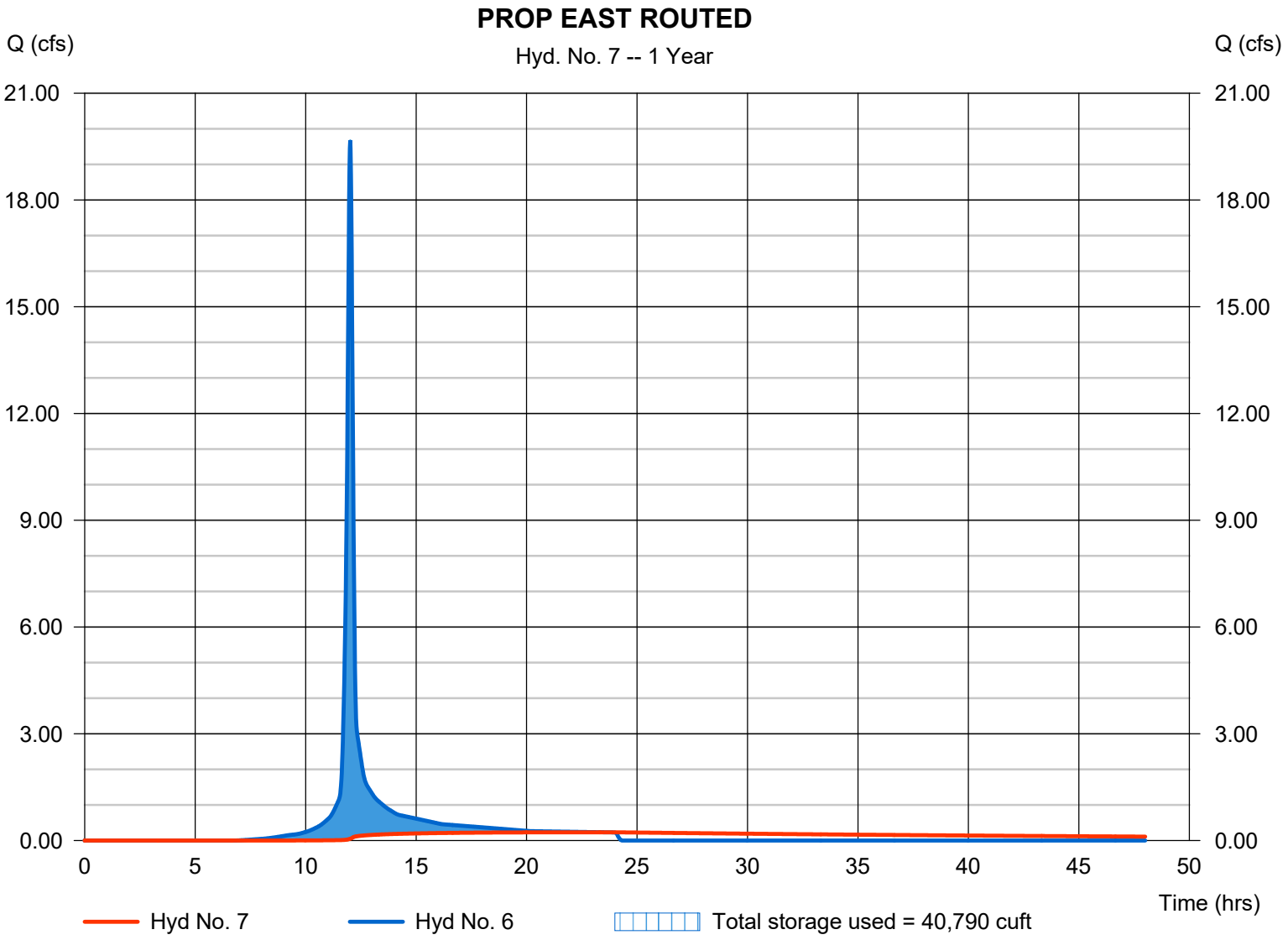
Hydrograph Report

Hyd. No. 7

PROP EAST ROUTED

Hydrograph type	=	Reservoir	Peak discharge	=	0.231 cfs
Storm frequency	=	1 yrs	Time to peak	=	23.63 hrs
Time interval	=	1 min	Hyd. volume	=	23,200 cuft
Inflow hyd. No.	=	6 - PROP EAST	Max. Elevation	=	945.19 ft
Reservoir name	=	EX. POND	Max. Storage	=	40,790 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - EX. POND

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 945.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	945.00	212,459	0	0
1.00	946.00	217,093	214,776	214,776
2.00	947.00	221,778	219,436	434,212

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 945.00	0.00	0.00	0.00
Length (ft)	= 70.00	0.00	0.00	0.00
Slope (%)	= 1.43	0.00	0.00	n/a
N-Value	= .010	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 500.00	0.00	0.00	0.00
Crest El. (ft)	= 948.00	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	945.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.00	214,776	946.00	5.36 ic	---	---	---	0.00	---	---	---	---	---	5.359
2.00	434,212	947.00	15.12 ic	---	---	---	0.00	---	---	---	---	---	15.12

Hydrograph Summary Report

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

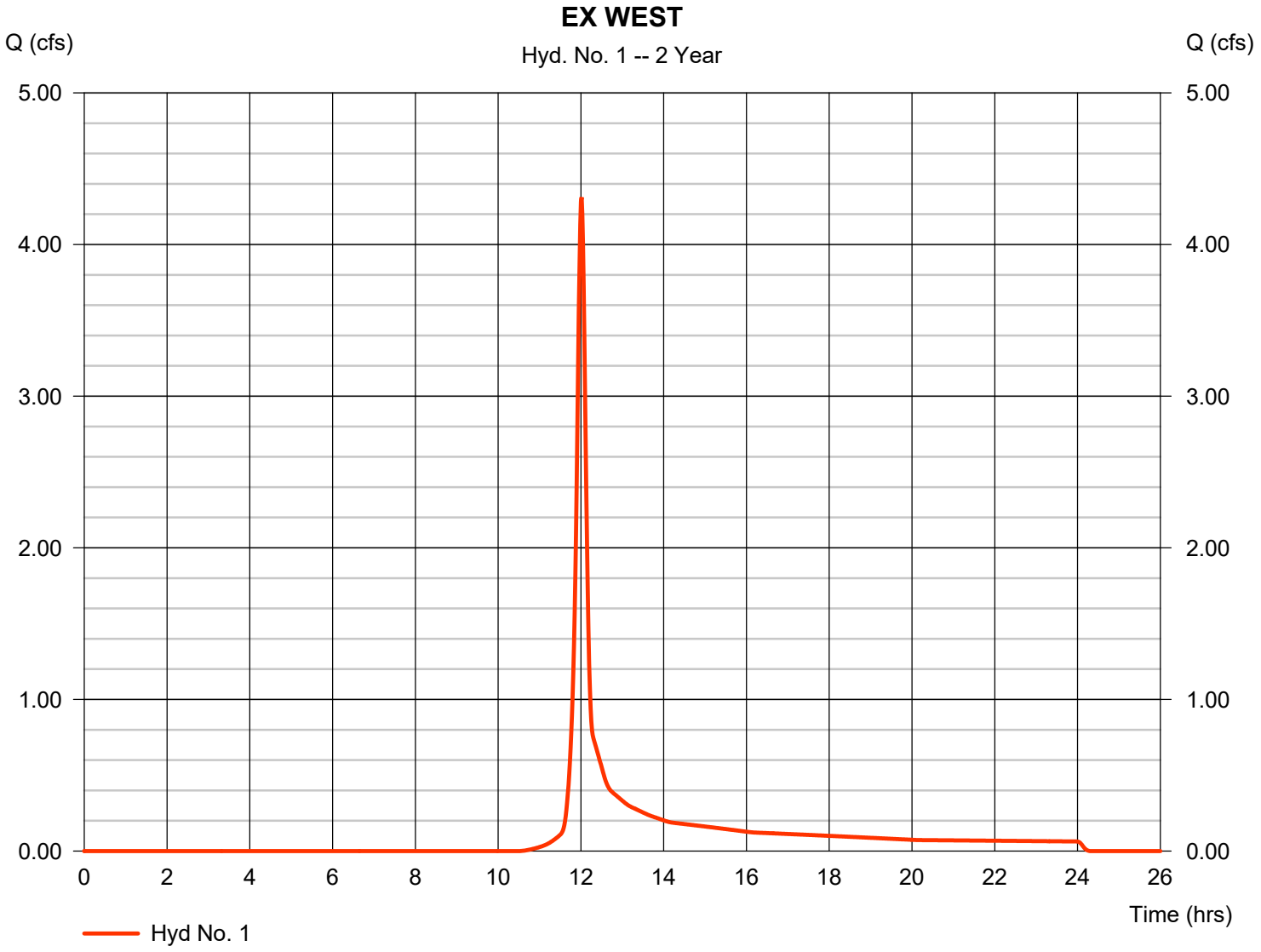
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.312	1	721	10,583	------	------	------	EX WEST
2	SCS Runoff	1.083	1	718	2,182	------	------	------	EX SOUTH
3	SCS Runoff	27.49	1	721	67,482	------	------	------	EX EAST
4	SCS Runoff	0.518	1	719	1,097	------	------	------	PROP WEST
5	SCS Runoff	0.484	1	718	975	------	------	------	PROP SOUTH
6	SCS Runoff	64.14	1	721	172,759	------	------	------	PROP EAST
7	Reservoir	1.887	1	883	126,565	6	945.57	121,729	PROP EAST ROUTED

Hydrograph Report

Hyd. No. 1

EX WEST

Hydrograph type	= SCS Runoff	Peak discharge	= 4.312 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.02 hrs
Time interval	= 1 min	Hyd. volume	= 10,583 cuft
Drainage area	= 2.310 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 11.70 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

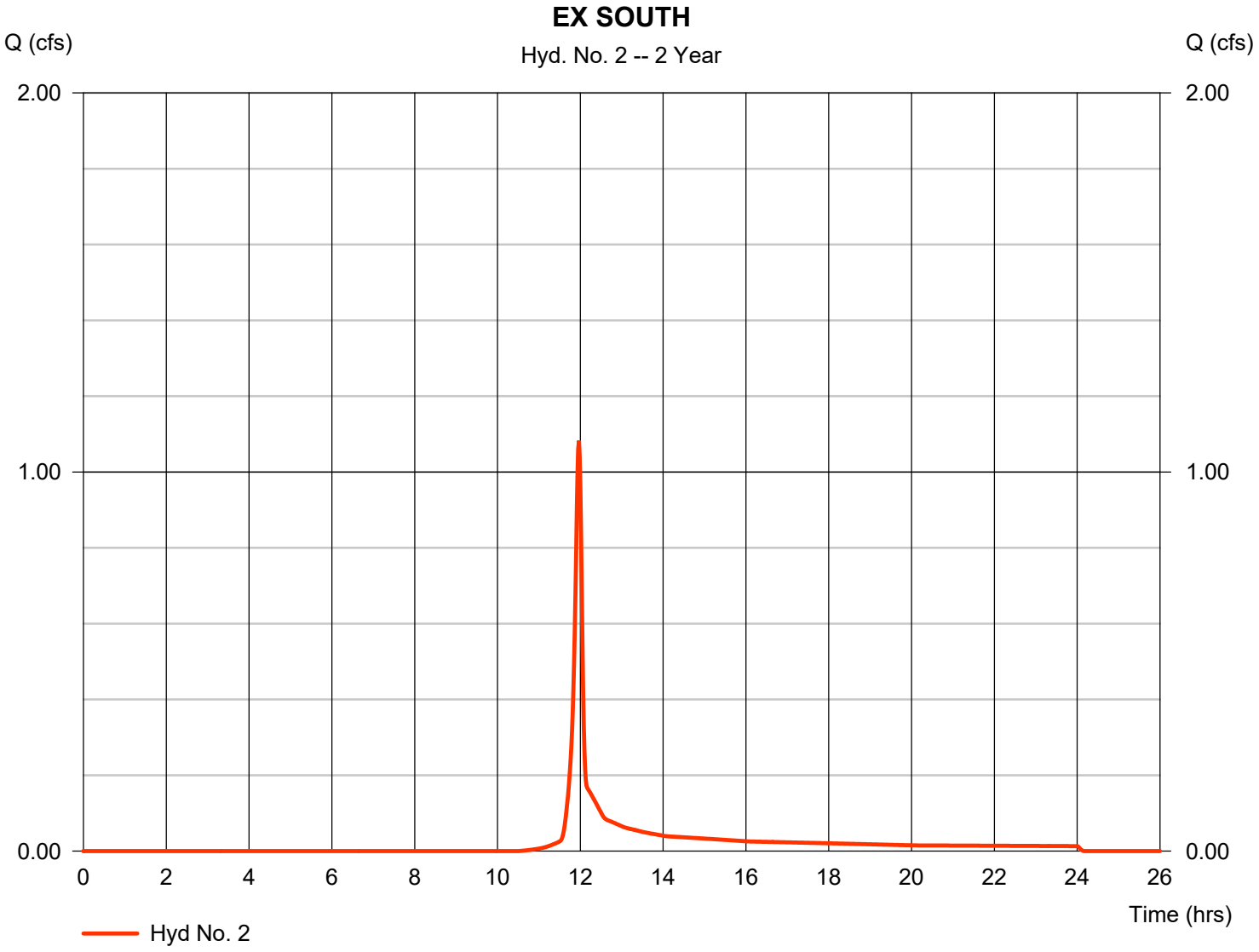


Hydrograph Report

Hyd. No. 2

EX SOUTH

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.083 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.97 hrs
Time interval	=	1 min	Hyd. volume	=	2,182 cuft
Drainage area	=	0.470 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

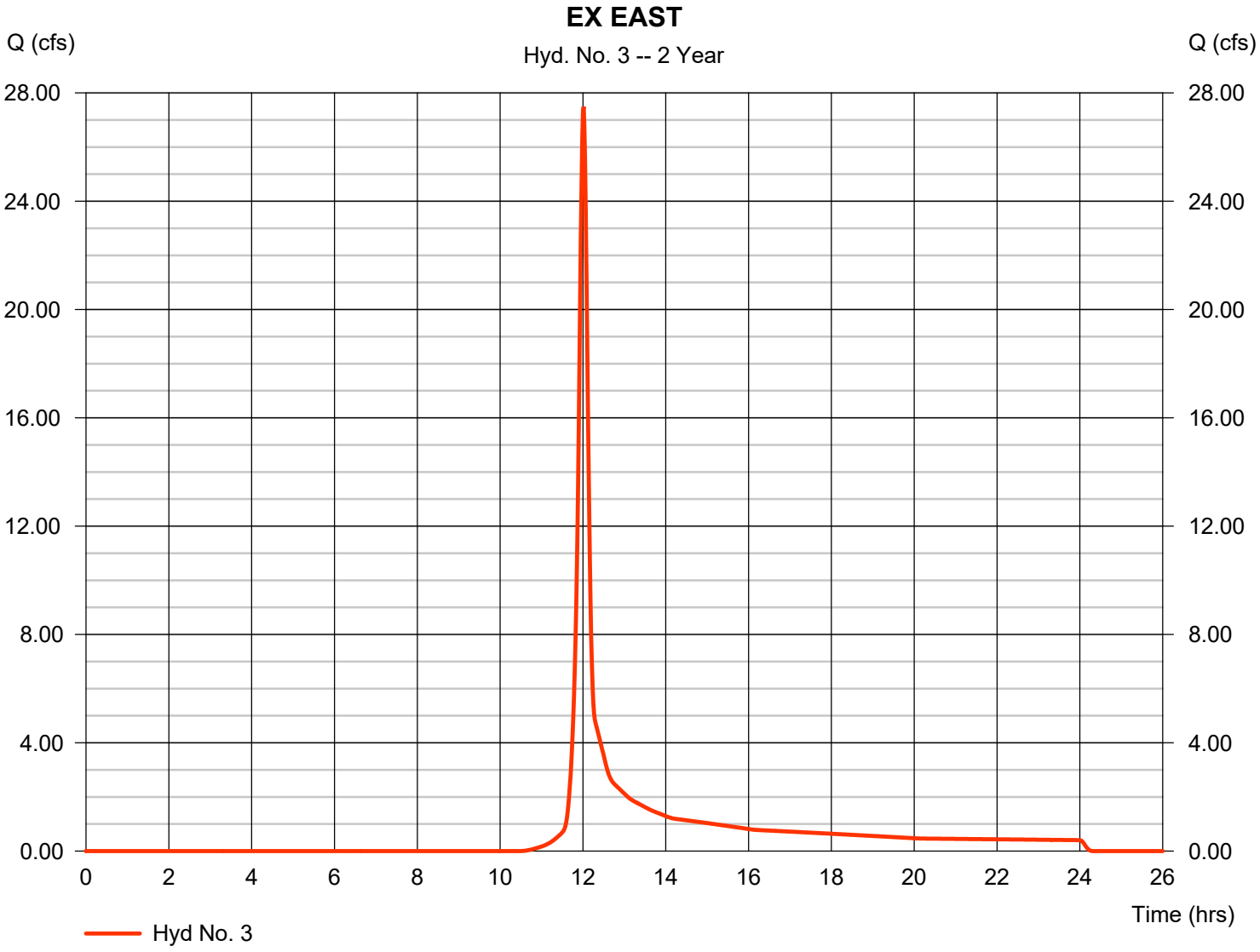


Hydrograph Report

Hyd. No. 3

EX EAST

Hydrograph type	=	SCS Runoff	Peak discharge	=	27.49 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.02 hrs
Time interval	=	1 min	Hyd. volume	=	67,482 cuft
Drainage area	=	14.730 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.50 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

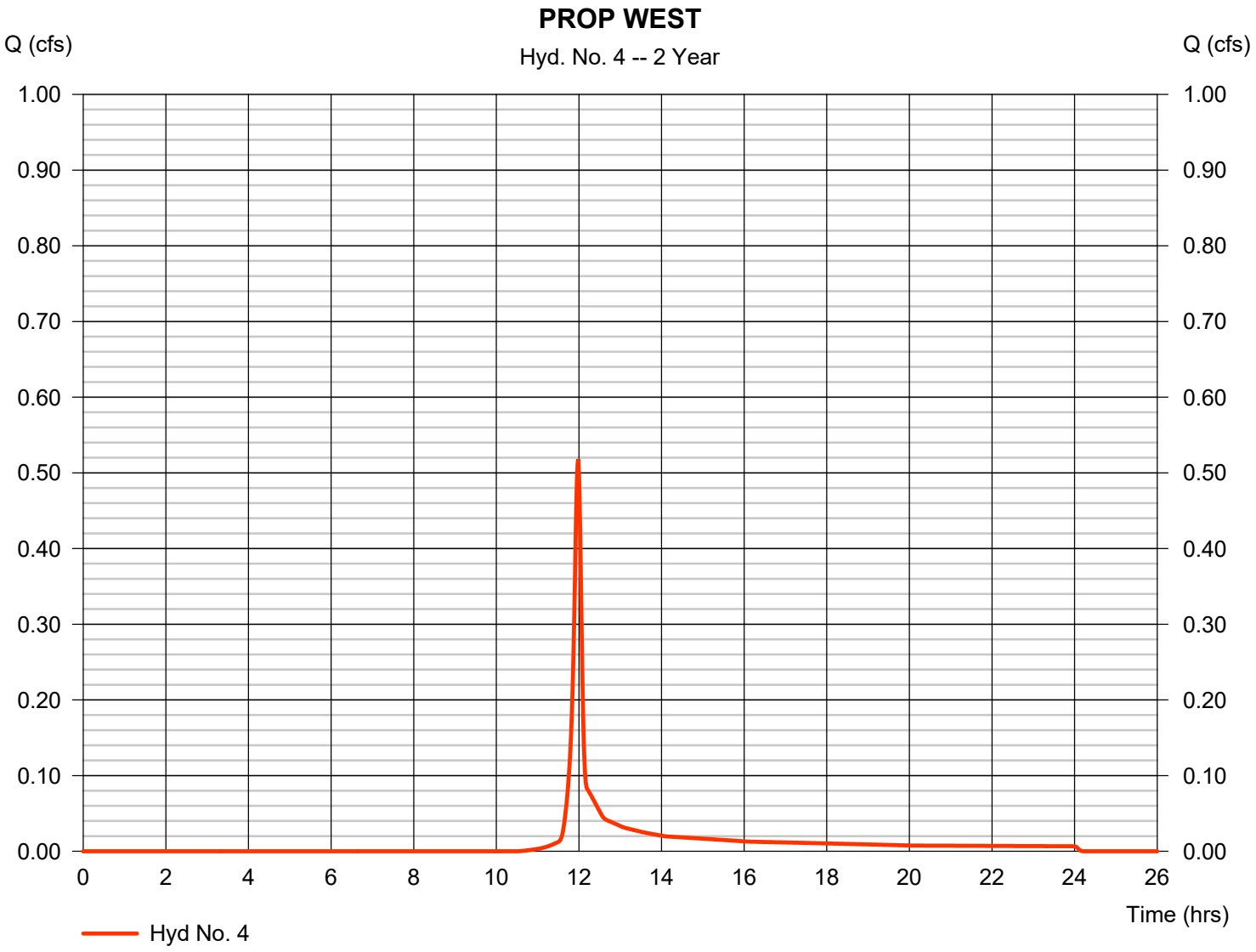


Hydrograph Report

Hyd. No. 4

PROP WEST

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.518 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.98 hrs
Time interval	=	1 min	Hyd. volume	=	1,097 cuft
Drainage area	=	0.250 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	8.20 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

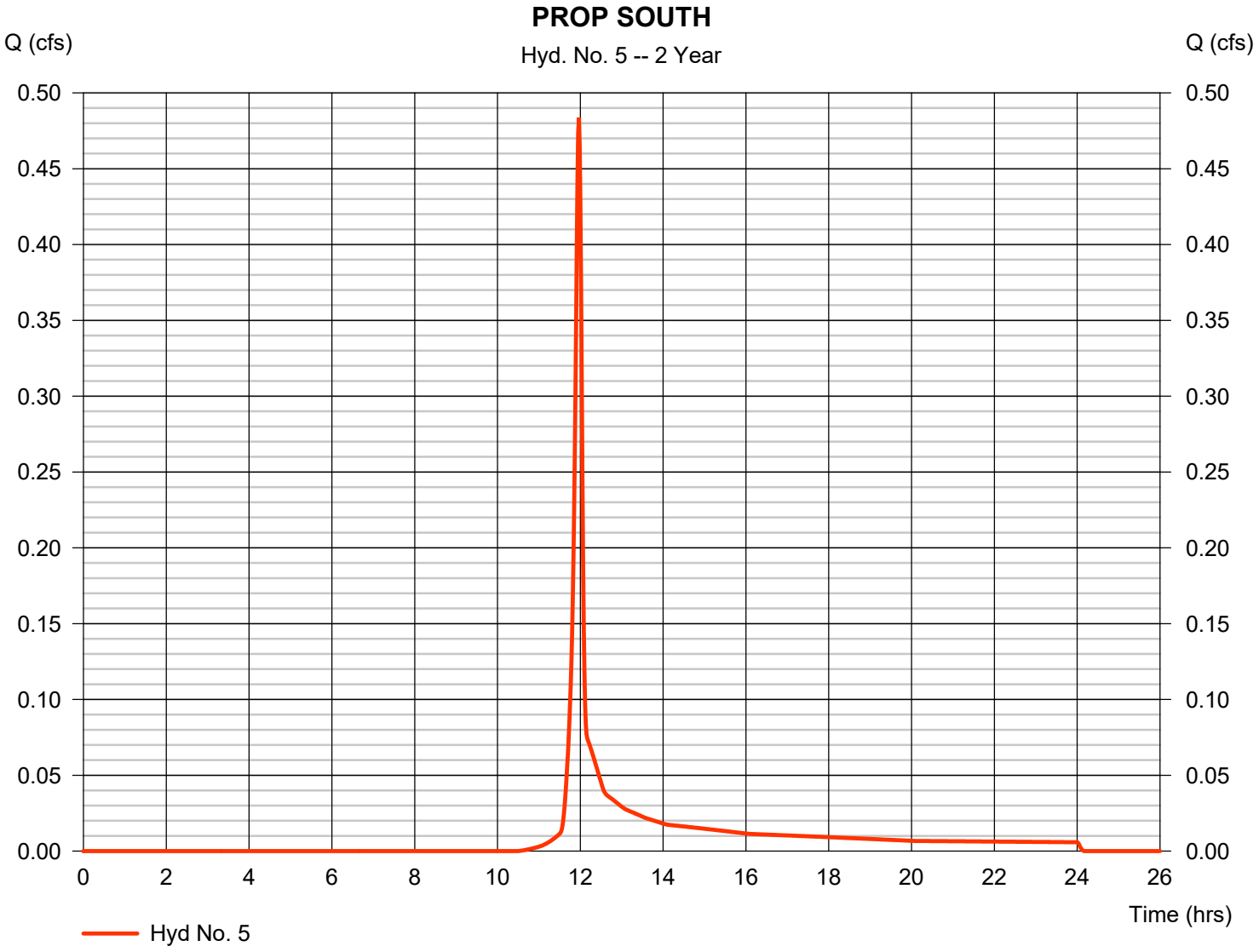


Hydrograph Report

Hyd. No. 5

PROP SOUTH

Hydrograph type	= SCS Runoff	Peak discharge	= 0.484 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 1 min	Hyd. volume	= 975 cuft
Drainage area	= 0.210 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

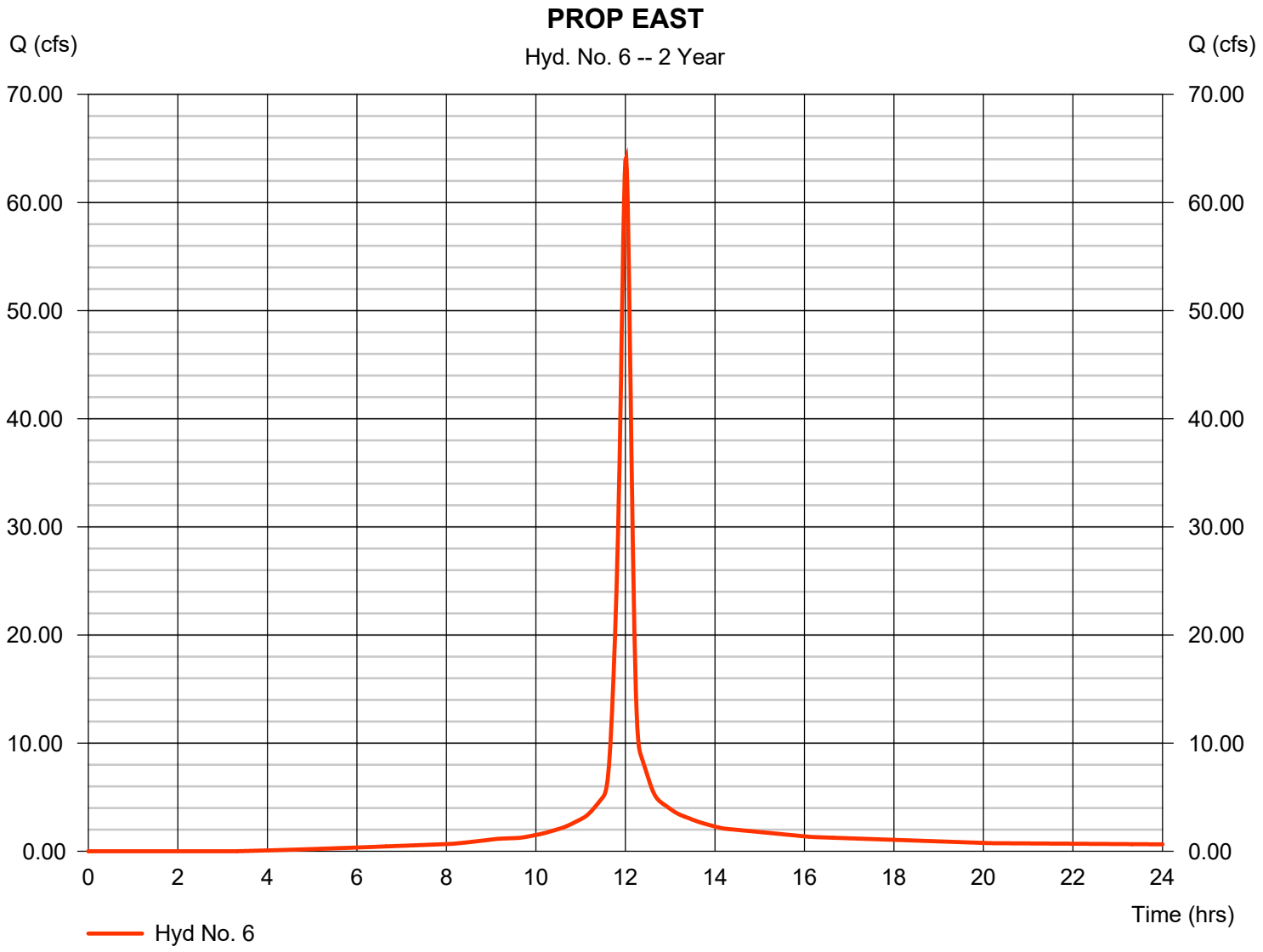


Hydrograph Report

Hyd. No. 6

PROP EAST

Hydrograph type	=	SCS Runoff	Peak discharge	=	64.14 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.02 hrs
Time interval	=	1 min	Hyd. volume	=	172,759 cuft
Drainage area	=	17.050 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	13.10 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



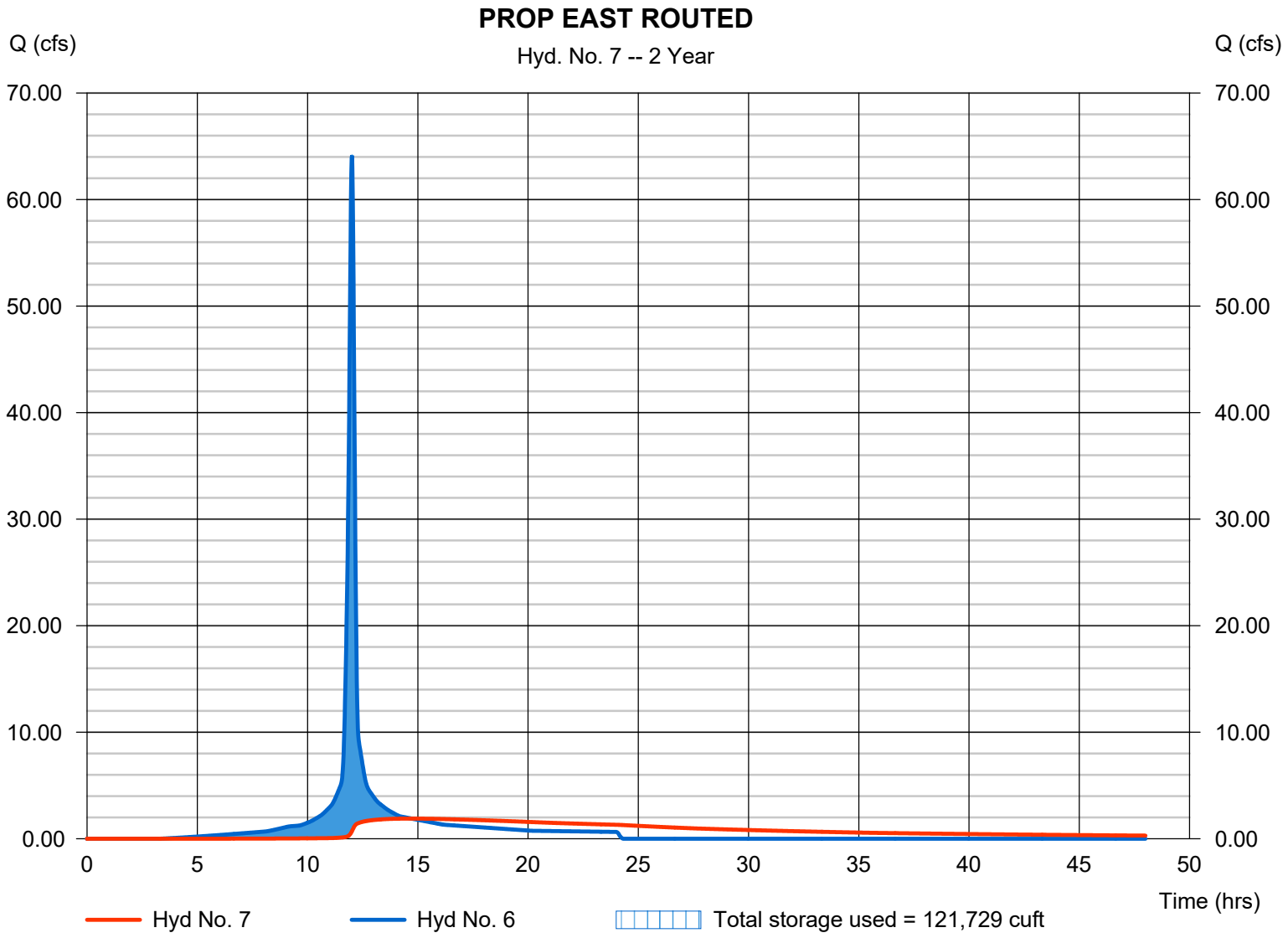
Hydrograph Report

Hyd. No. 7

PROP EAST ROUTED

Hydrograph type	=	Reservoir	Peak discharge	=	1.887 cfs
Storm frequency	=	2 yrs	Time to peak	=	14.72 hrs
Time interval	=	1 min	Hyd. volume	=	126,565 cuft
Inflow hyd. No.	=	6 - PROP EAST	Max. Elevation	=	945.57 ft
Reservoir name	=	EX. POND	Max. Storage	=	121,729 cuft

Storage Indication method used.



Hydrograph Summary Report

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

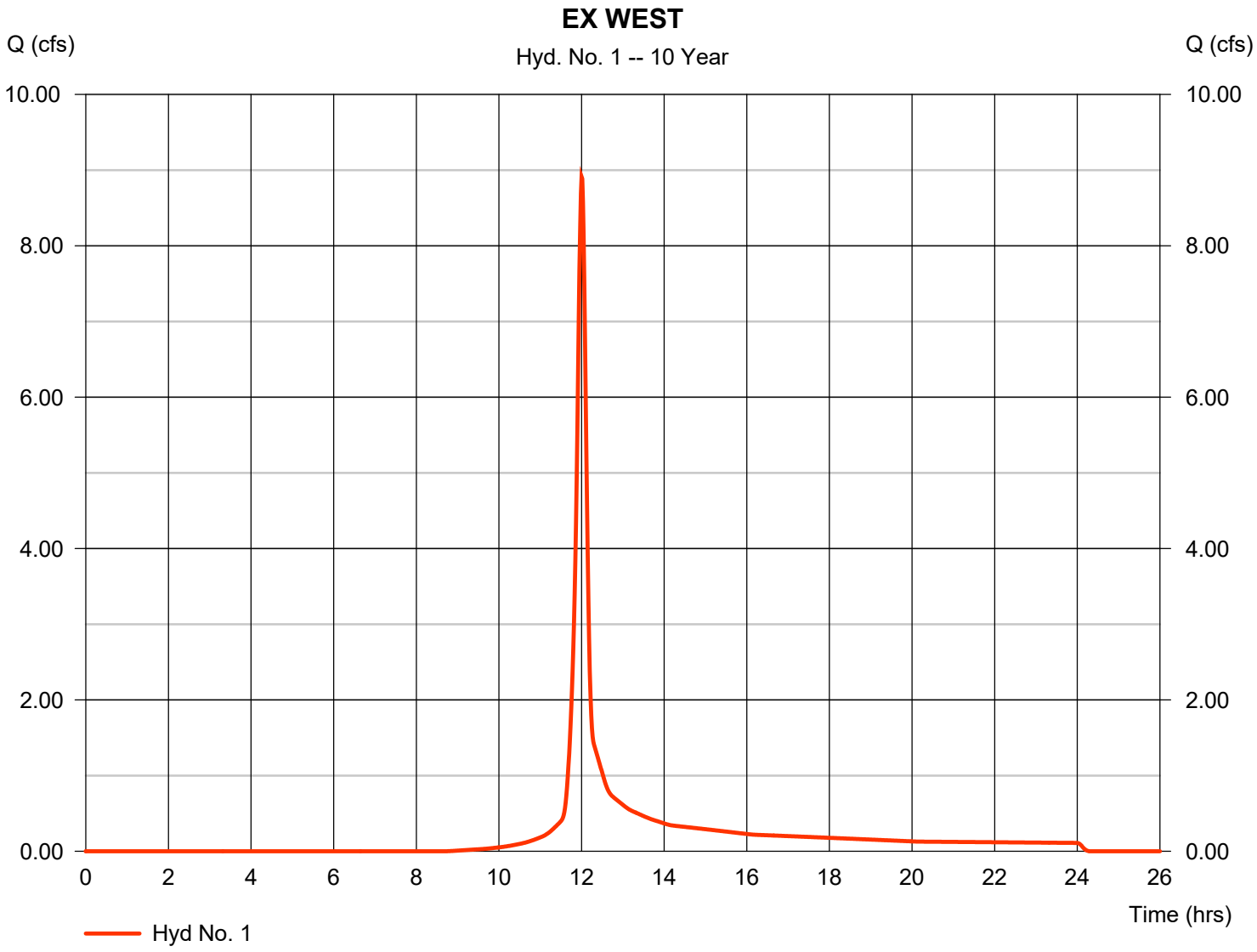
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	8.911	1	720	21,549	------	------	------	EX WEST
2	SCS Runoff	2.203	1	718	4,442	------	------	------	EX SOUTH
3	SCS Runoff	56.82	1	720	137,411	------	------	------	EX EAST
4	SCS Runoff	1.056	1	718	2,234	------	------	------	PROP WEST
5	SCS Runoff	0.984	1	718	1,985	------	------	------	PROP SOUTH
6	SCS Runoff	99.07	1	721	274,488	------	------	------	PROP EAST
7	Reservoir	4.151	1	817	222,109	6	945.87	186,193	PROP EAST ROUTED

Hydrograph Report

Hyd. No. 1

EX WEST

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.911 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.00 hrs
Time interval	=	1 min	Hyd. volume	=	21,549 cuft
Drainage area	=	2.310 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.70 min
Total precip.	=	5.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

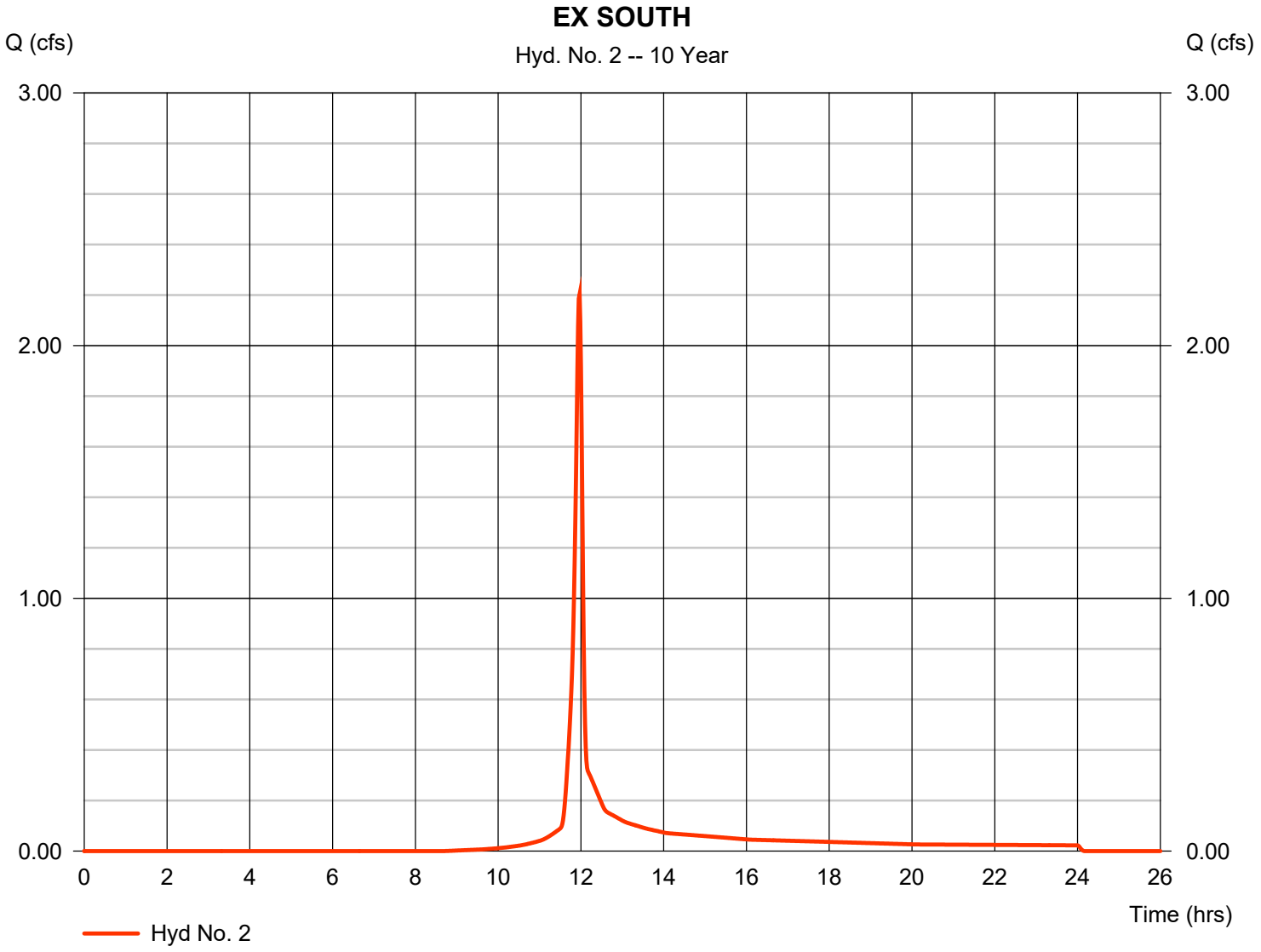


Hydrograph Report

Hyd. No. 2

EX SOUTH

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.203 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.97 hrs
Time interval	=	1 min	Hyd. volume	=	4,442 cuft
Drainage area	=	0.470 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

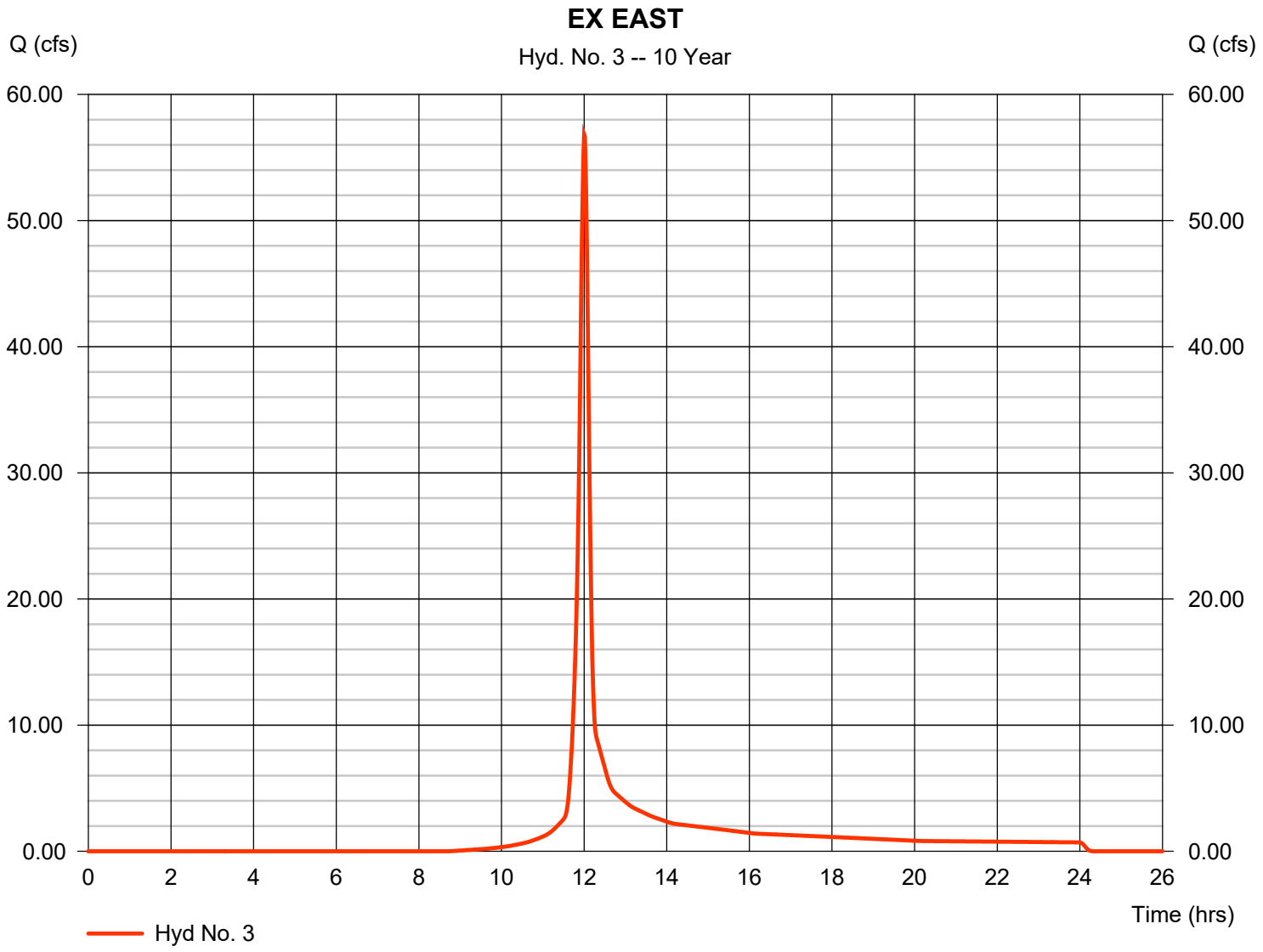


Hydrograph Report

Hyd. No. 3

EX EAST

Hydrograph type	=	SCS Runoff	Peak discharge	=	56.82 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.00 hrs
Time interval	=	1 min	Hyd. volume	=	137,411 cuft
Drainage area	=	14.730 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.50 min
Total precip.	=	5.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

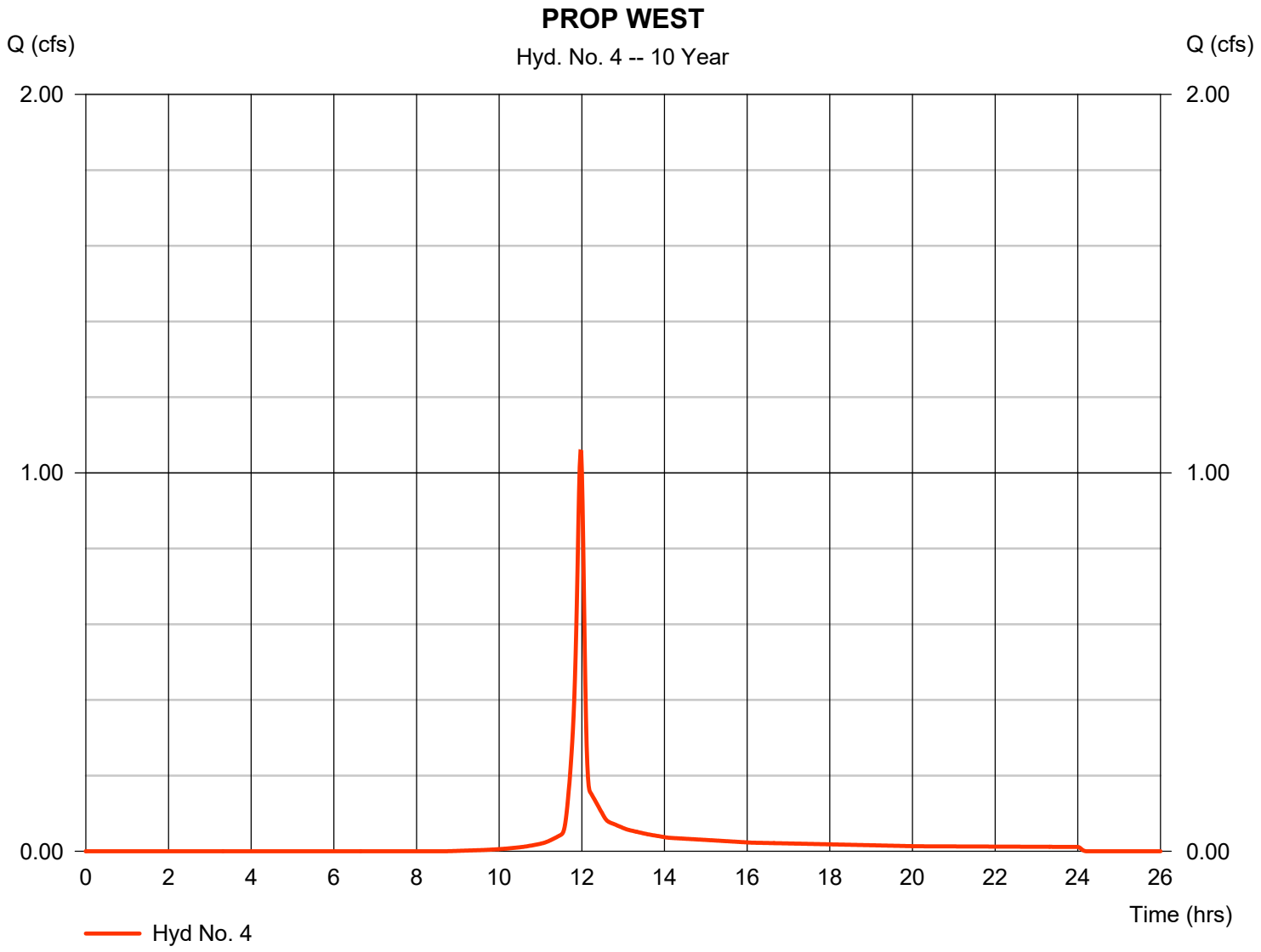


Hydrograph Report

Hyd. No. 4

PROP WEST

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.056 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.97 hrs
Time interval	=	1 min	Hyd. volume	=	2,234 cuft
Drainage area	=	0.250 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	8.20 min
Total precip.	=	5.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

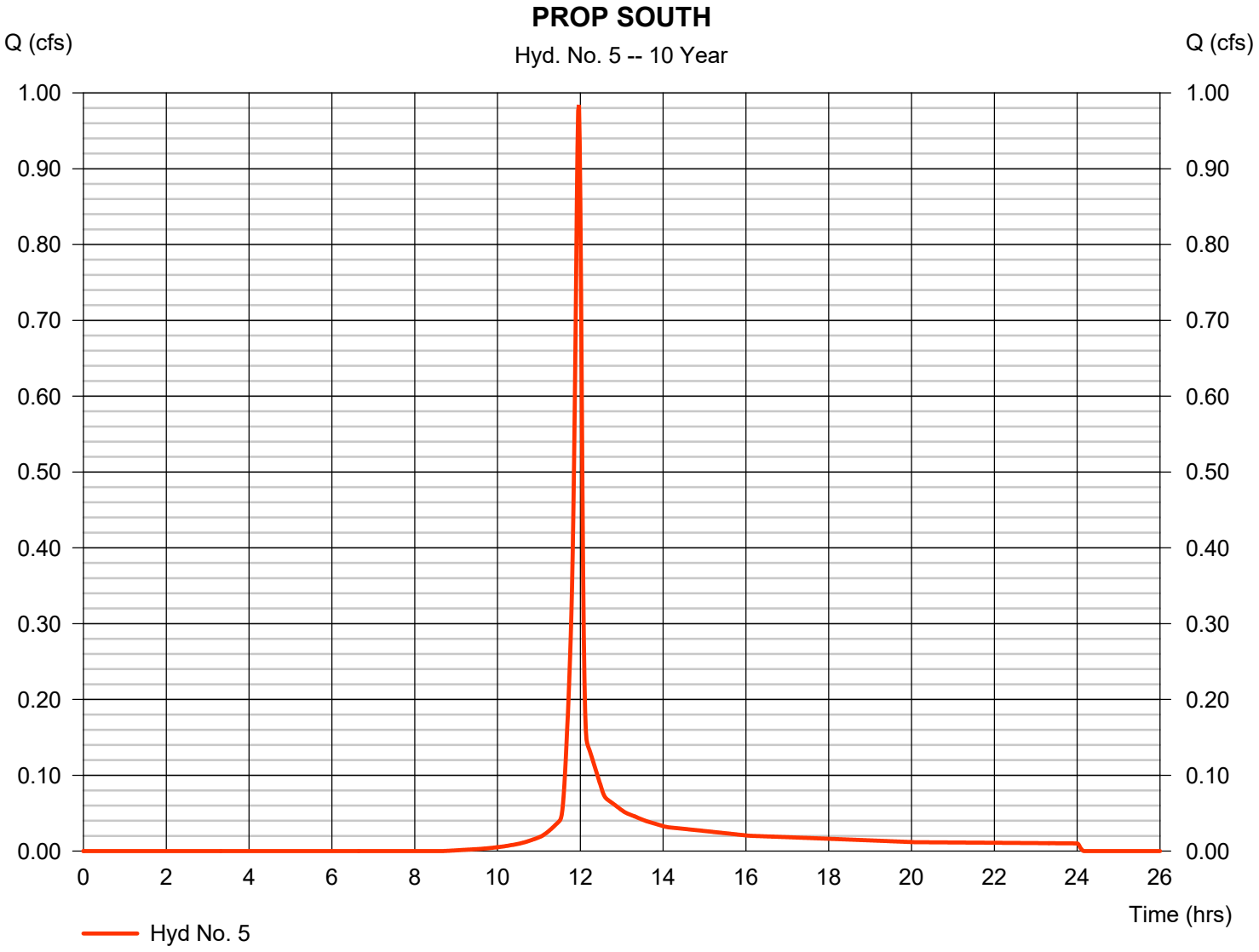


Hydrograph Report

Hyd. No. 5

PROP SOUTH

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.984 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.97 hrs
Time interval	=	1 min	Hyd. volume	=	1,985 cuft
Drainage area	=	0.210 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

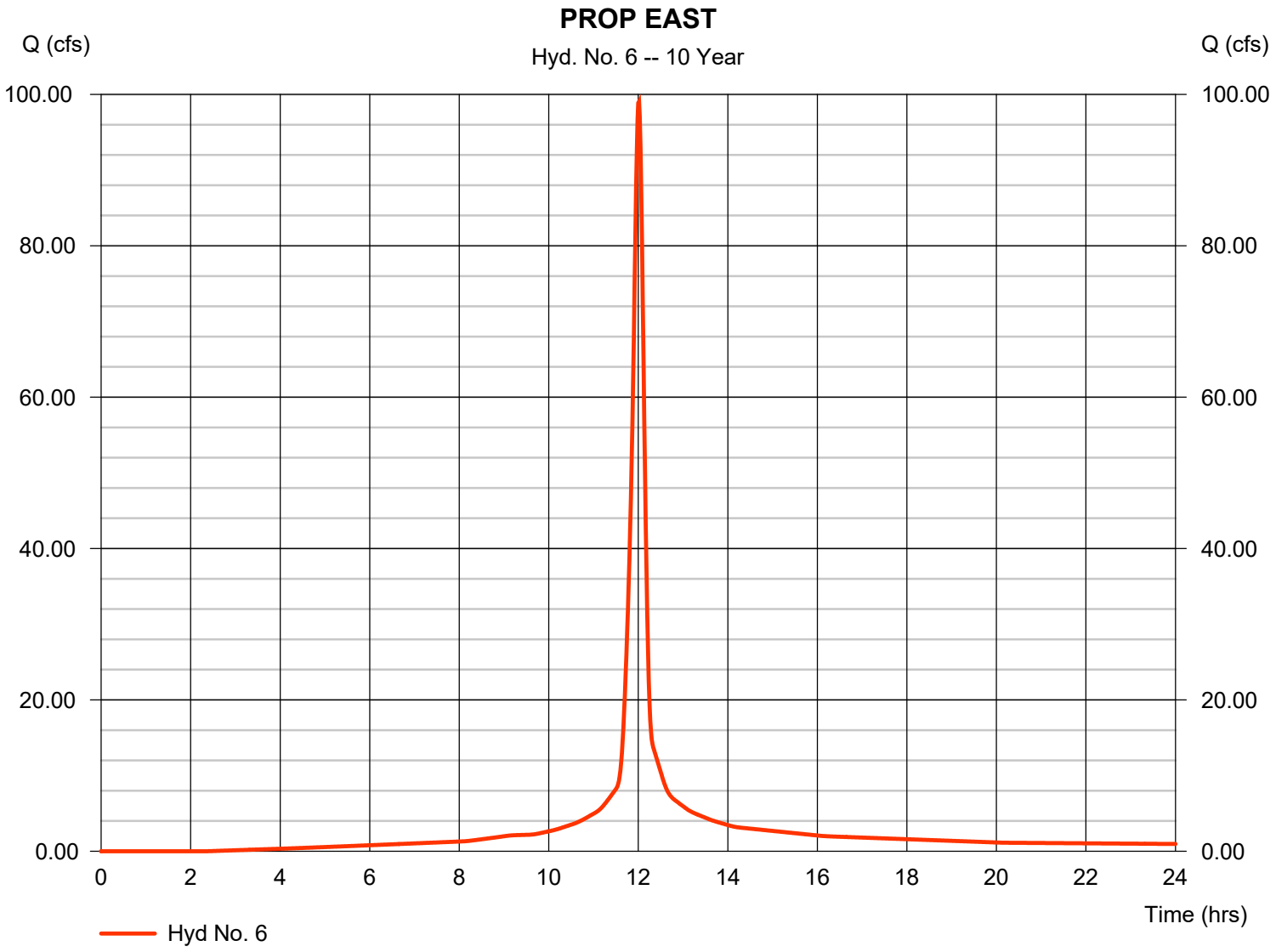


Hydrograph Report

Hyd. No. 6

PROP EAST

Hydrograph type	= SCS Runoff	Peak discharge	= 99.07 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.02 hrs
Time interval	= 1 min	Hyd. volume	= 274,488 cuft
Drainage area	= 17.050 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.10 min
Total precip.	= 5.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



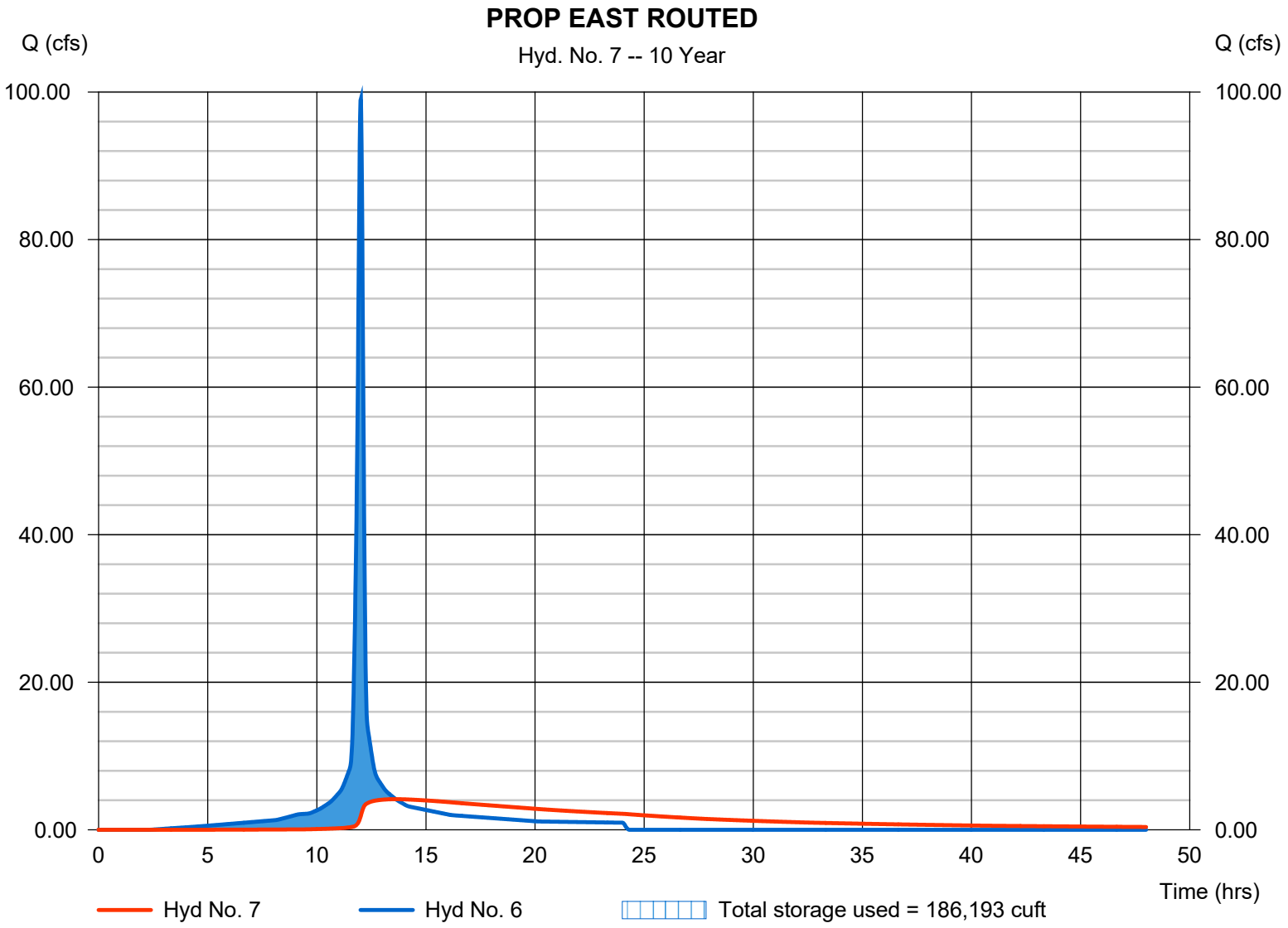
Hydrograph Report

Hyd. No. 7

PROP EAST ROUTED

Hydrograph type	=	Reservoir	Peak discharge	=	4.151 cfs
Storm frequency	=	10 yrs	Time to peak	=	13.62 hrs
Time interval	=	1 min	Hyd. volume	=	222,109 cuft
Inflow hyd. No.	=	6 - PROP EAST	Max. Elevation	=	945.87 ft
Reservoir name	=	EX. POND	Max. Storage	=	186,193 cuft

Storage Indication method used.



Hydrograph Summary Report

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

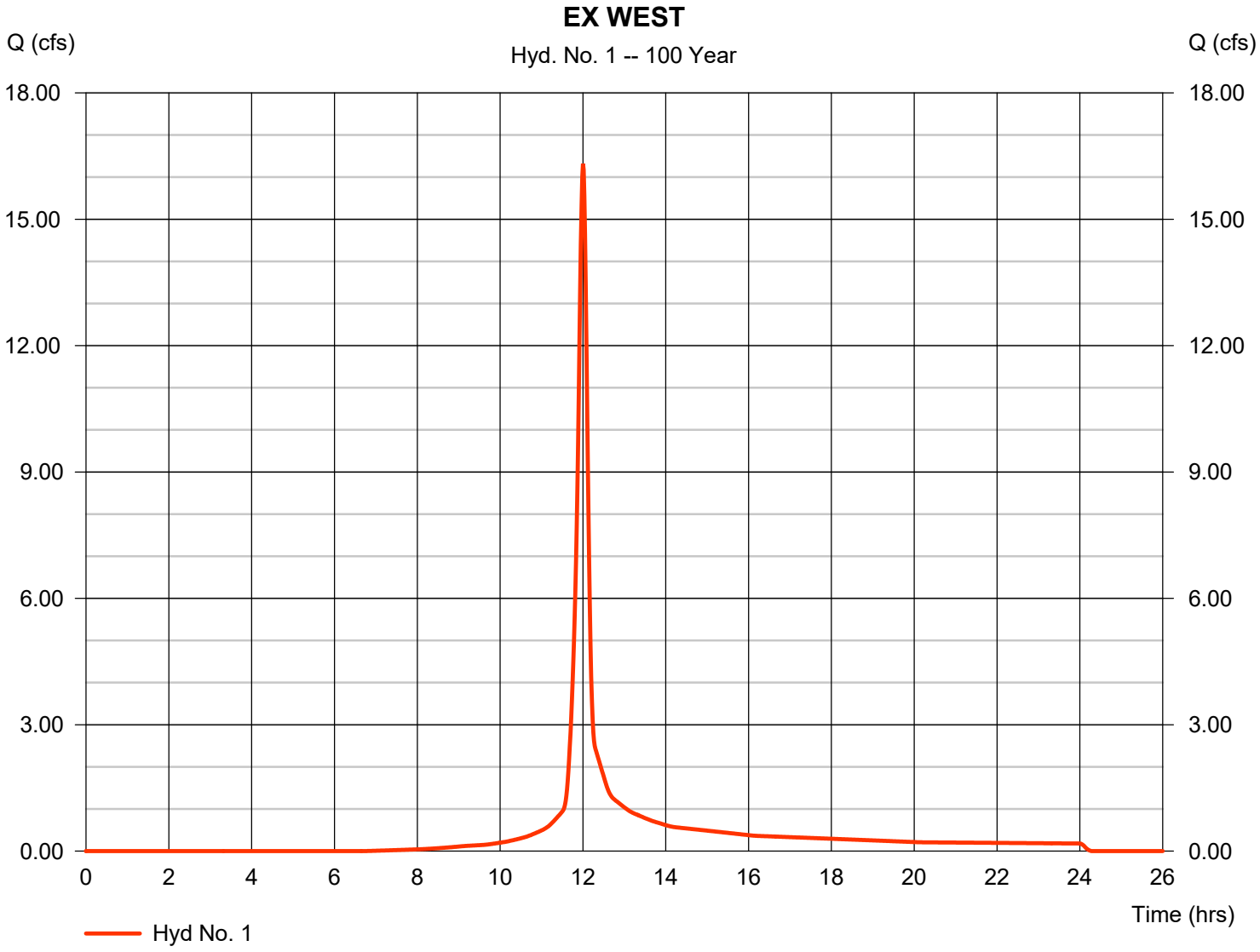
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	16.32	1	720	39,759	------	------	------	EX WEST
2	SCS Runoff	3.979	1	717	8,196	------	------	------	EX SOUTH
3	SCS Runoff	104.05	1	720	253,525	------	------	------	EX EAST
4	SCS Runoff	1.923	1	718	4,122	------	------	------	PROP WEST
5	SCS Runoff	1.778	1	717	3,662	------	------	------	PROP SOUTH
6	SCS Runoff	149.77	1	721	425,476	------	------	------	PROP EAST
7	Reservoir	8.331	1	785	367,772	6	946.29	279,329	PROP EAST ROUTED

Hydrograph Report

Hyd. No. 1

EX WEST

Hydrograph type	=	SCS Runoff	Peak discharge	=	16.32 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.00 hrs
Time interval	=	1 min	Hyd. volume	=	39,759 cuft
Drainage area	=	2.310 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.70 min
Total precip.	=	7.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

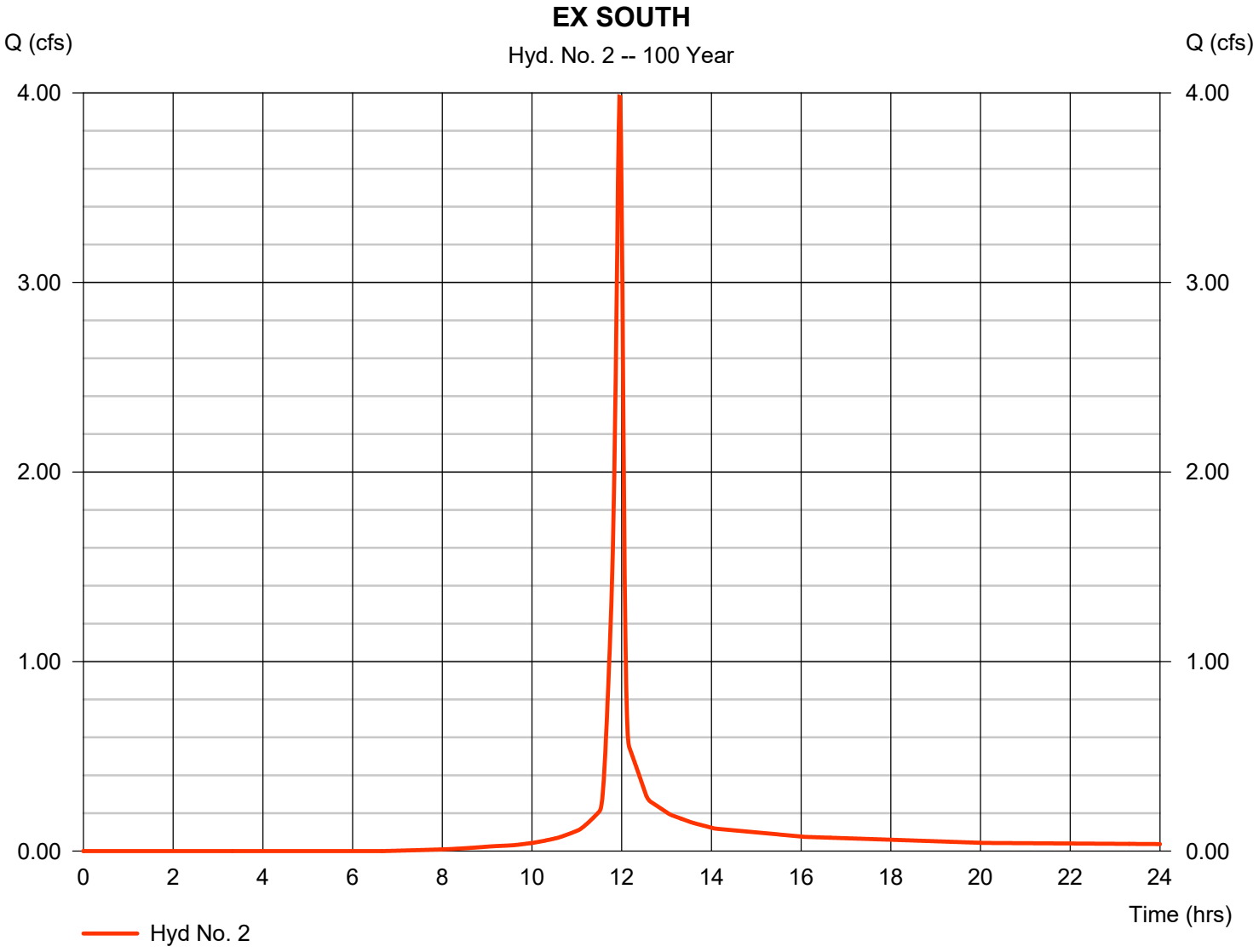


Hydrograph Report

Hyd. No. 2

EX SOUTH

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.979 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.95 hrs
Time interval	=	1 min	Hyd. volume	=	8,196 cuft
Drainage area	=	0.470 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

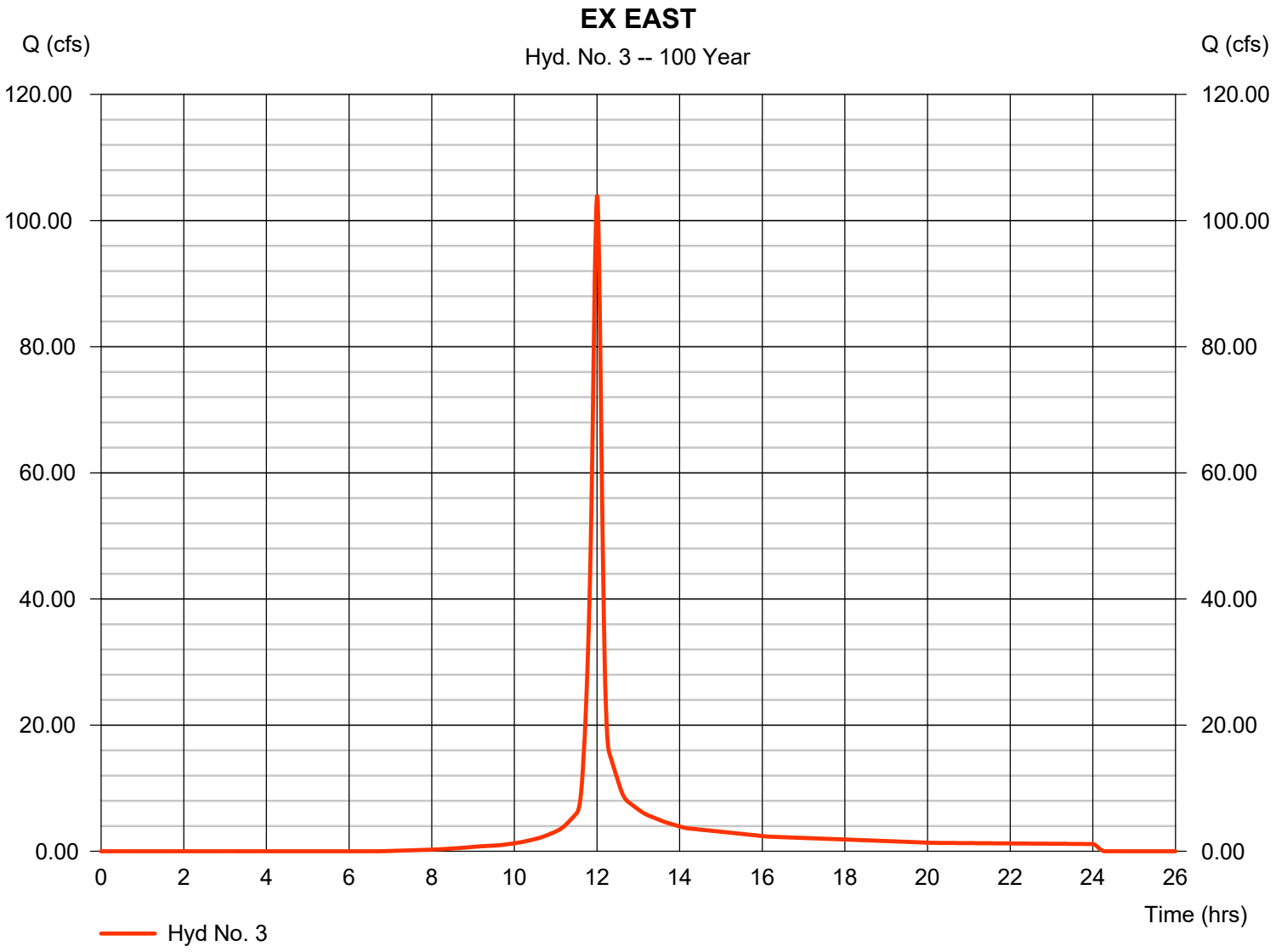


Hydrograph Report

Hyd. No. 3

EX EAST

Hydrograph type	=	SCS Runoff	Peak discharge	=	104.05 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.00 hrs
Time interval	=	1 min	Hyd. volume	=	253,525 cuft
Drainage area	=	14.730 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.50 min
Total precip.	=	7.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

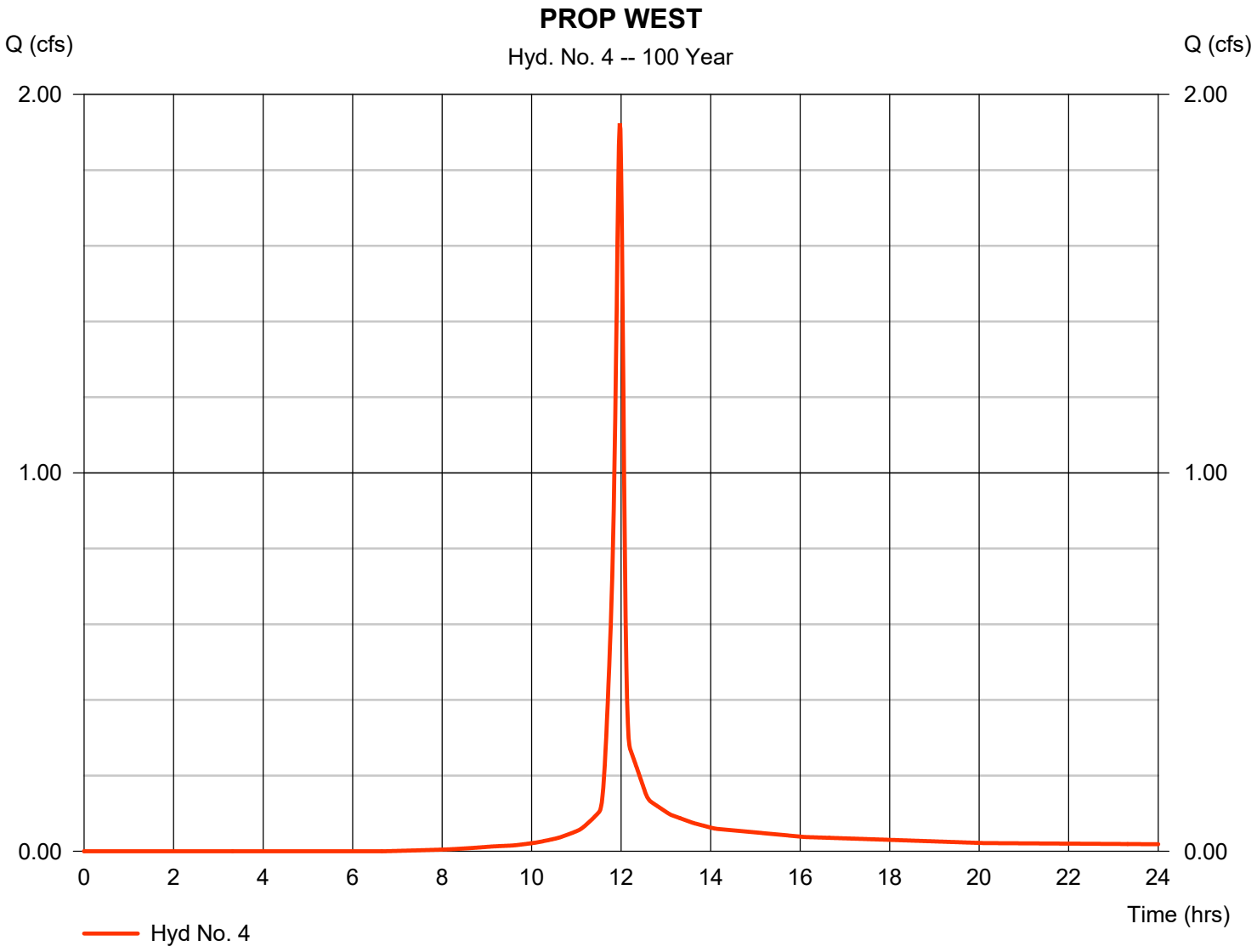


Hydrograph Report

Hyd. No. 4

PROP WEST

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.923 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.97 hrs
Time interval	=	1 min	Hyd. volume	=	4,122 cuft
Drainage area	=	0.250 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	8.20 min
Total precip.	=	7.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

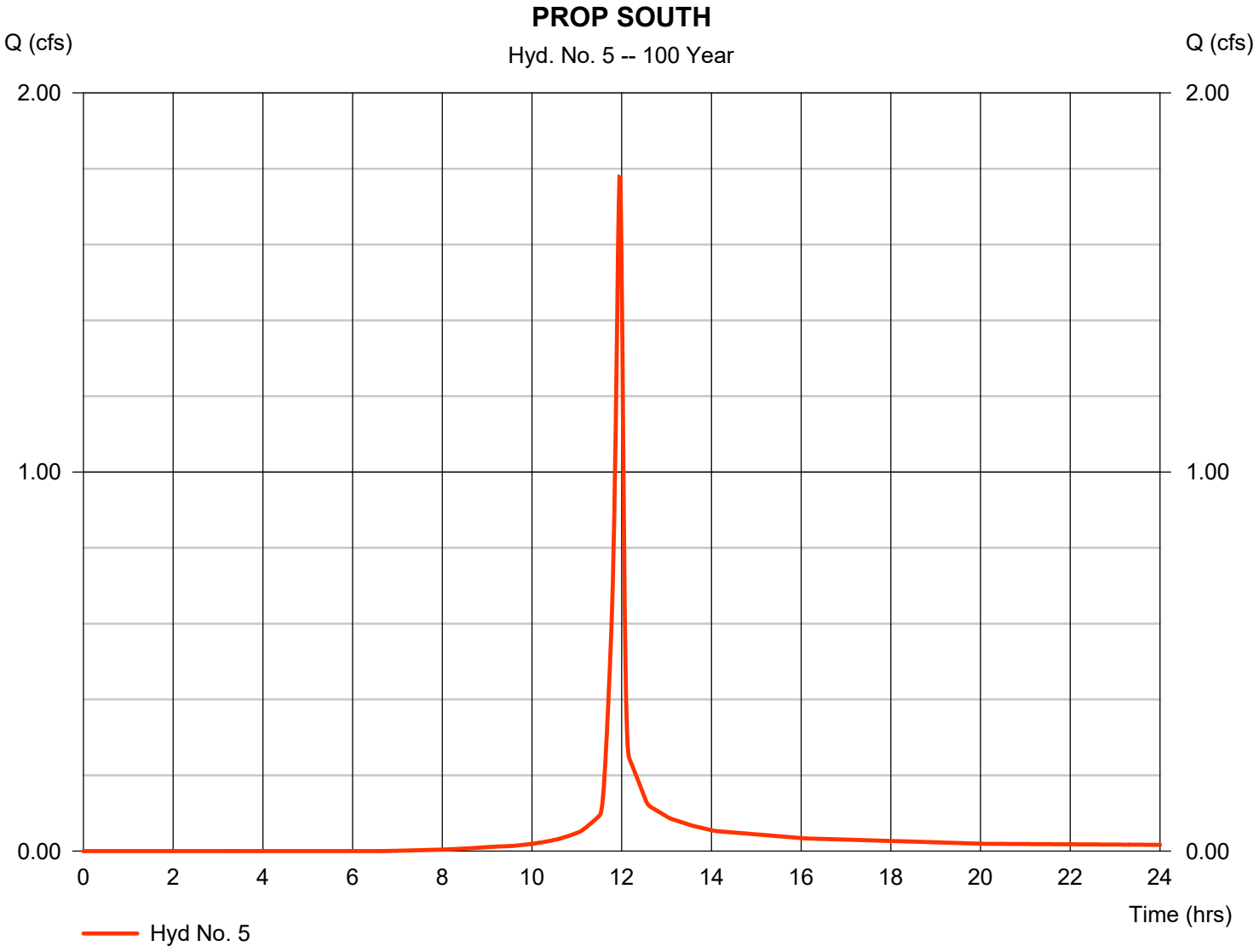


Hydrograph Report

Hyd. No. 5

PROP SOUTH

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.778 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.95 hrs
Time interval	=	1 min	Hyd. volume	=	3,662 cuft
Drainage area	=	0.210 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

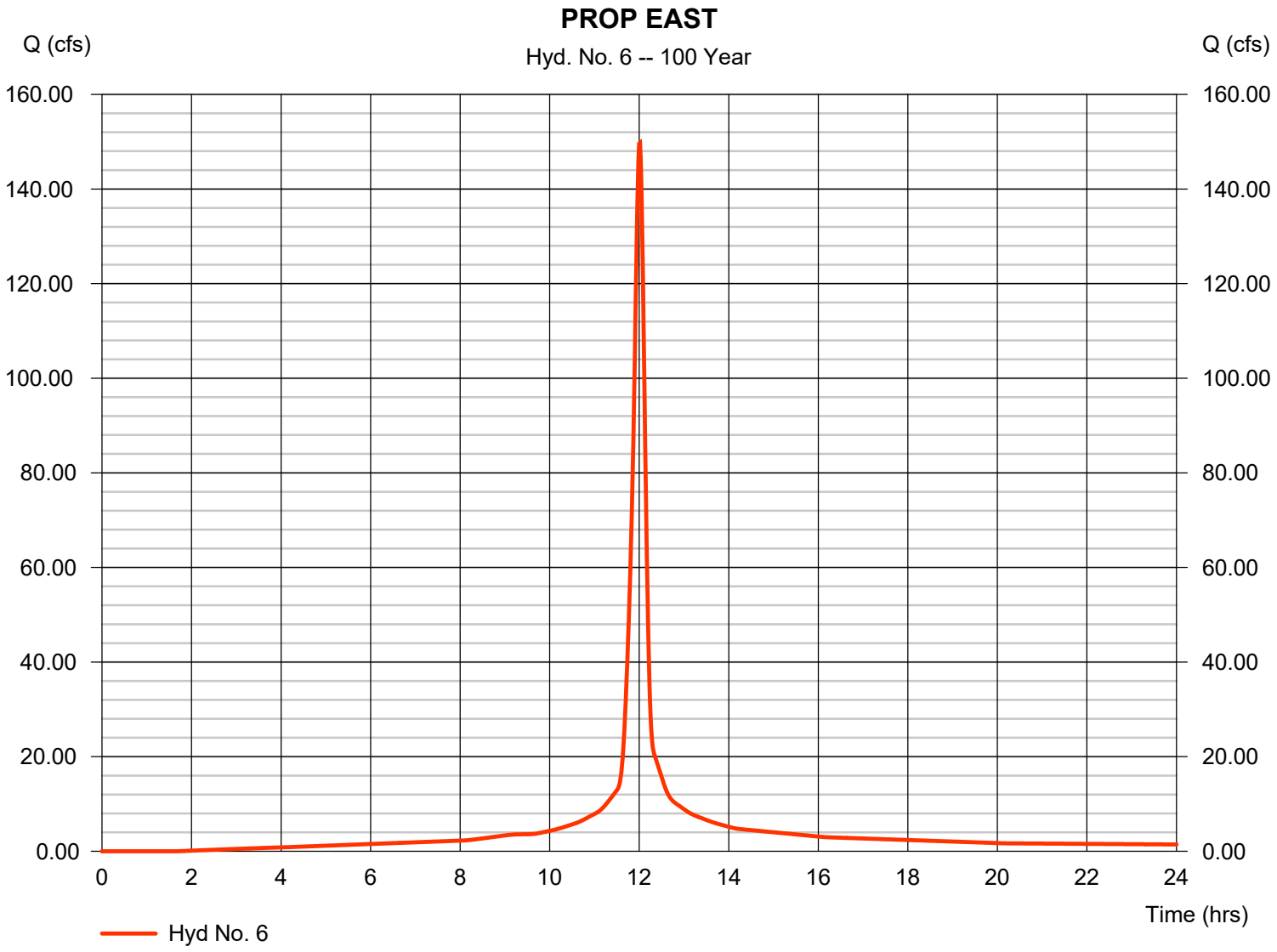


Hydrograph Report

Hyd. No. 6

PROP EAST

Hydrograph type	=	SCS Runoff	Peak discharge	=	149.77 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.02 hrs
Time interval	=	1 min	Hyd. volume	=	425,476 cuft
Drainage area	=	17.050 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	13.10 min
Total precip.	=	7.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



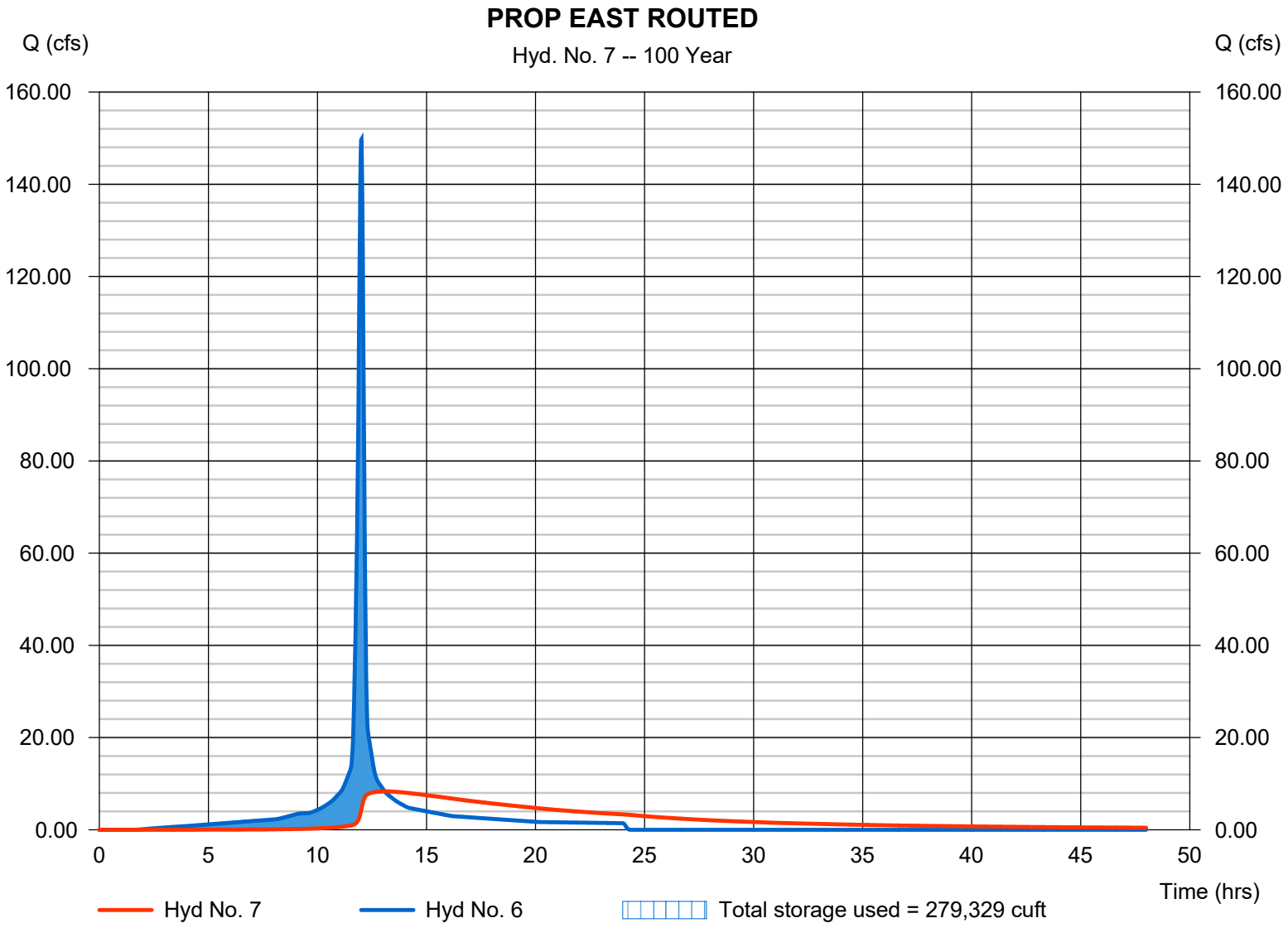
Hydrograph Report

Hyd. No. 7

PROP EAST ROUTED

Hydrograph type	=	Reservoir	Peak discharge	=	8.331 cfs
Storm frequency	=	100 yrs	Time to peak	=	13.08 hrs
Time interval	=	1 min	Hyd. volume	=	367,772 cuft
Inflow hyd. No.	=	6 - PROP EAST	Max. Elevation	=	946.29 ft
Reservoir name	=	EX. POND	Max. Storage	=	279,329 cuft

Storage Indication method used.



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	3.25	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

Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Sep 2 2021

EMERGENCY SPILLWAY

Rectangular Weir

Crest	= Broad
Bottom Length (ft)	= 500.00
Total Depth (ft)	= 1.50

Calculations

Weir Coeff. Cw	= 2.60
Compute by:	Known Q
Known Q (cfs)	= 149.77

Highlighted

Depth (ft)	= 0.24
Q (cfs)	= 149.77
Area (sqft)	= 118.30
Velocity (ft/s)	= 1.27
Top Width (ft)	= 500.00

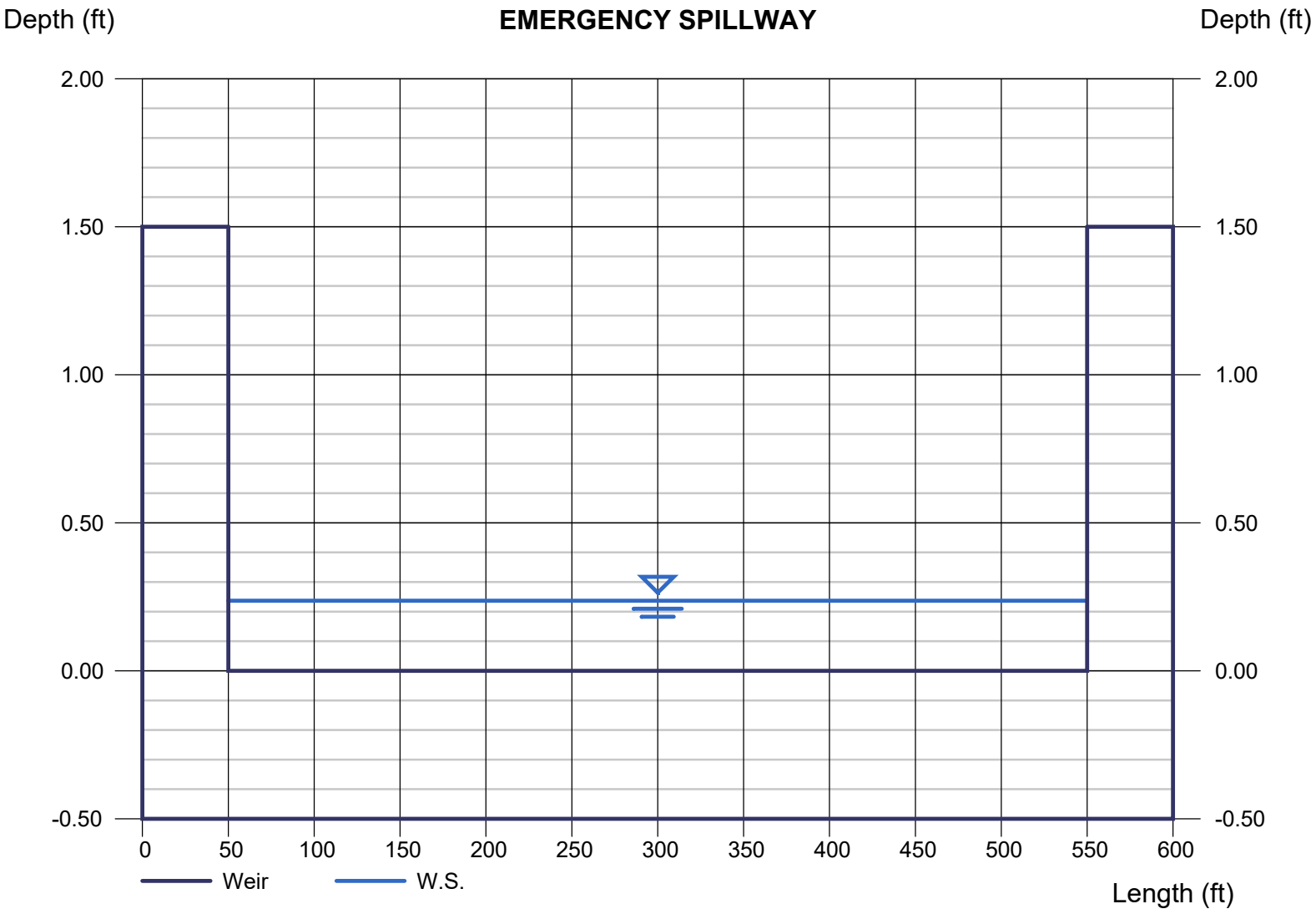


Exhibit F

Proposed Drainage Area Map

PROPOSED DRAINAGE MAP

SCALE: 1" = 80'

0 40' 80' 160'

North

NORTH POI

PROPOSED PROPERTY LINE
7.01 ACRE POND TRACT
TO REMAIN UNDEVELOPED

EXISTING POND
SURFACE AREA
5.20 ACRES

EAST
SUB-BASIN
17.05 ACRES

WEST POI

WEST
SUB-BASIN
0.25 ACRES

PROPERTY
BOUNDARY
TYP.

RICE ROAD

COLBERN ROAD

SOUTH
SUB-BASIN
0.21 ACRES

SOUTH POI

15' Sanitary Easement (Bk. 2238, Pg. 2029)

Egeline Gas Line (Bk. 587, Pg. 490)

15' Water Easement (Doc. No. 1995054479)

Sanitary Sewer Easement (Bk. 2238, Pg. 2029)

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Surveying 2005000319-D
Kansas
Engineering E-1695
Surveying LS-218
Oklahoma
Engineering 6254
Nebraska
Engineering CA2821

COLBERN ROAD INVESTMENTS
LEE'S SUMMIT, JACKSON COUNTY, MISSOURI

Project: Colbern Road Investments
Issue Date: September, 2021

Proposed Drainage Map
Construction Plans for:
Colbern Road Investments
Lee's Summit, Jackson County, Missouri

Matthew J. Schlicht
MO PE 2006019708
KS PE 19071
OK PE 25226
NE PE E-14335

REVISIONS

Exhibit

Exhibit G

Retention Basin Plan

EMERGENCY SPILLWAY
500 LF BROAD CRESTED WEIR
CREST ELEVATION = 948.00
TOP BERM = 950.00

24" HDPE OUTLET PIPE
LENGTH = 70'
FL IN = 945.00
FL OUT = 944.00
SLOPE = 1.43%

EXISTING POND
SURFACE AREA
5.20 ACRES

(Bk 587, Pg 490)

ST ST ST ST ST ST ST

North

0 20' 40' 80'

RETENTION PLAN
SCALE: 1" = 40'

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REVISIONS

Exhibit