Kidder Compressor Station Post Construction Stormwater Management Report

PennEast Pipeline Project

Date October, 2019

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
W. MICHAEL CLARK
ENGINEER
PE082720

10/25/2019

PennEast Pipeline Project
353754-MM-EN-CO-039

Mott MacDonald
111 Wood Avenue South
Iselin, NJ 08830-4112
973-379-3400

PennEast Pipeline
Company, LLC.
835 Knitting Mills Way
Wyomissing, PA 19610
610-373-7999

Kidder Compressor Station Post Construction Stormwater Management Report

PennEast Pipeline Project

Date October, 2019

PennEast Pipeline Project
353754-MM-EN-CO-039

Issue and revision record

Revision	Date	Originator	Checkout	Approver	Descriptor
0	12/2018	P. Zhinhel	J. Dening	M. Wilcox	Issued for PADEP
1	10/2019	P. Zhinhel	J. Dening	M. Wilcox	Per PADEP comments.

Information class: **Standard**

This document is issued for the party which commissioned it and for specific purposes connected with the above-captioned project only. It should not be relied upon by any other party or used for any other purpose.

We accept no responsibility for the consequences of this document being relied upon by any other party, or being used for any other purpose, or containing any error or omission which is due to an error or omission in data supplied to us by other parties.

This document contains confidential information and proprietary intellectual property. It should not be shown to other parties without consent from us and from the party which commissioned it.

Contents

Tables

Figures

1 Executive Summary

PennEast proposes to construct, install and operate the Project facilities to provide approximately 1.1 million dekatherms per day (MMDth/d) of year-round transportation service from northern Pennsylvania to markets in New Jersey, eastern and southeastern Pennsylvania and surrounding states. The Project is designed to provide a long-term solution to bring the lowest cost natural gas available in the country, produced in the Marcellus Shale region in northern Pennsylvania, to homes and businesses in New Jersey, Pennsylvania and surrounding states.

The Project facilities include a 36-inch diameter, 115-mile mainline pipeline, extending from Luzerne County, Pennsylvania, to Mercer County, New Jersey. The Project will extend from various receipt point interconnections in the eastern Marcellus region, including interconnections with Transcontinental Gas Pipe Line Company, LLC (Transco) and gathering systems operated by Williams Partners L.P., Energy Transfer Partners, L.P. (formerly Regency Energy Partners, LP), and UGI Energy Services, LLC, in Luzerne County, Pennsylvania, to various delivery point interconnections in the heart of major northeastern natural gas-consuming markets, including interconnections with UGI Central Penn Gas, Inc., (Blue Mountain) in Carbon County, Pennsylvania, UGI Utilities, Inc. and Columbia Gas Transmission, LLC in Northampton County, Pennsylvania, and Elizabethtown Gas, NRG REMA, LLC, Texas Eastern Transmission, LP (Texas Eastern) and Algonquin Gas Transmission, LLC (Algonquin), in Hunterdon County, New Jersey. The terminus of the proposed PennEast system will be located at a delivery point with Transco in Mercer County, New Jersey.

This report provides an engineering analysis of the stormwater management practices for the Kidder Compression Station site, which is a part of the PennEast Pipeline Project. The methods of analysis included use of the stormwater modeling software Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc., Rational Method Calculations, and the associated PADEP BMP worksheets. The methods of analysis were used to demonstrate the meeting of the proposed requirements for the following facilities:

- Infiltration basins
- Swales
- Stilling basins

The resulting data for the stormwater facilities can be found in Section 4 and in the appendices. The completed model and worksheets show that the post-construction stormwater runoff does not exceed the pre-construction stormwater flows and that the volume requirements are met. The report shows that the proposed stormwater BMPs for the Kidder Compressor Station site for the PennEast pipeline will allow the proposed project to comply with the applicable regulatory requirements under Pennsylvania Code Section 102.8, and the applicable Act 167 requirements.

2 Introduction/Overview

The PennEast Pipeline Project was developed in response to market demands in New Jersey and Pennsylvania, and interest from shippers that require transportation capacity to accommodate increased demand and greater reliability of natural gas in the region. The Project will include a new pipeline and above ground facilities that will provide a new source of natural gas supply from the Marcellus Shale producing region to New Jersey and Pennsylvania.

The Kidder Compression Station site is located in the Kidder Township, Carbon County, PA. (See Figure 1 for a Location Map and Appendix I for PCSM Plan). The Kidder Compression Station site is being developed to create a metering station to support the proposed pipeline. The proposed site will include the pipeline meter and supporting equipment on a gravel pad. Stormwater management facilities are proposed to meet the regulatory requirements for this type of development.

3 Regulatory Compliance

Regulatory jurisdiction over stormwater runoff from the Kidder Compressor site falls to the Pennsylvania Department of Environmental Protection (PADEP) code under Title 25 – Environmental Protection, Chapter 102 Erosion and Sediment Control, Section 102.8 – Post-Construction Stormwater Requirements. This Post-Construction Stormwater Management Plan fulfils part of the requirements of the Erosion and Sediment Control General Permit (ESCGP-3).

The following text presents each of the requirements of Pennsylvania Code Section 102.8, incorporating the requirements of Act 167 where applicable, and indicates how they will be addressed. Regulatory requirements are shown in **bold**, and compliance is shown in *italics*.

3.1 Post-Construction Stormwater Management Plan General Requirements

(b) General PCSM planning and design. The management of post construction stormwater shall be planned and conducted to the extent practicable in accordance with the following:

This site does not have an Act 167 Watershed Management Plan; thus it is subject to the requirements of item (g)(3) of Pennsylvania Code Section 102.8. Volume must be provided as the difference between the post-development and pre-development 2-year runoff volume and the post-development peak runoff rate must not exceed pre-development peak runoff rate under any storm condition. Volume and peak flow requirements have been met with the objective to preserve the integrity of stream channels and the receiving stream.

(1) Preserve the integrity of stream channels and maintain and protect the physical, biological and chemical qualities of the receiving stream.

One of the objectives in minimizing changes in runoff volume and rate of runoff flow is to preserve the integrity of stream channels and any receiving streams. There is a perennial stream located within 150 feet of the site as well as delineated wetlands located west of the site and south of the driveway. Under existing conditions, offsite stormwater runoff flows overland across the site towards the stream and wetland areas. Under proposed conditions, stormwater runoff will be routed through a series of structural and non-structural BMPs and discharged overland towards the stream. Site runoff will be partially infiltrated in an infiltration basin before being discharged into the stream through a stilling location. The stilling basins are installed to preserve existing drainage patterns and the integrity of the receiving watercourse.

Therefore, the project falls into definition of nondischarge alternative as environmentally sound and cost-effective BMPs that individually or collectively eliminate the net change in stormwater volume, rate and quality for storm events up to and including the 2-year/24-hour storm when compared to the stormwater rate, volume and quality prior to the earth disturbance activities to maintain and protect the existing quality of the receiving surface waters of this Commonwealth.

(2) Prevent an increase in the rate of stormwater runoff.

Increases in the rate of stormwater runoff are not anticipated. Stormwater management will be provided by a series of swales, piping and two infiltration basins to attenuate peaks in post-development runoff. See Table 1.

(3) Minimize any increase in stormwater runoff volume.

Increases in stormwater runoff volume up to and including the 2-year storm are not anticipated. Stormwater management will be provided with infiltration basins to provide storage and infiltration of post-development runoff. See Table 2.

(4) Minimize impervious areas.

The site has been designed to minimize the area of disturbance, which minimizes impervious areas. Gravel is proposed in lieu of asphalt for the pad area and asphalt pavement is limited to access road and parking lot. Areas that are not gravelled will be vegetated. Given the limited site traffic (several vehicles a week), and the fact that equipment will block vehicular access to parts of the site, it is anticipated that the gravel will have some infiltrative capacity, however, it has been considered impervious in this analysis for regulatory purposes. The extents of the pad have been restricted to be minimum necessary for safe and effective operation of the station.

(5) Maximize the protection of existing drainage features and existing vegetation.

Existing drainage features and vegetation have been preserved and protected to the greatest extent practicable, by limiting disturbances to the Black Creek Tributary and wetlands associated with it and limiting the extents of the project area to the minimum necessary to accomplish the project objectives. The site features a retaining wall to the north and northeast designed to prevent disturbance within riparian zone buffer.

(6) Minimize land clearing and grading.

The site layout has been designed to minimize the area of disturbance, which minimizes land clearing and grading.

(7) Minimize soil compaction.

The site has been designed to minimize the area of disturbance, which minimizes soil compaction. Heavy construction equipment will be restricted to access roads, designated laydown areas and localized work areas. Areas to be used for PCSM BMPs will be clearly identified during construction, and the contractor will be required to prevent compaction of soils in areas that are occupied or to be occupied by PCSM BMPs.

(8) Utilize other structural or nonstructural BMPs that prevent or minimize changes in stormwater runoff.

Gravel is proposed instead of asphalt in order to minimize any increase in the rate or volume of stormwater runoff from the site, and infiltration basins (BMP) are utilized to minimize any remaining changes in stormwater runoff from pre-development to post-development.

3.1.1 Fifteen Factors of the Post-Construction Stormwater Management Plan

(f) PCSM Plan contents. The PCSM Plan must contain drawings and a narrative consistent with the requirements of this chapter. The PCSM Plan shall be designed to minimize the threat to human health, safety and the environment to the greatest extent practicable. PCSM Plans must contain at a minimum the following:

(1) The existing topographic features of the project site and the immediate surrounding area.

The proposed compressor site is located in Kidder Township (hereinafter referred to as Township), Carbon County, Pennsylvania. The total drainage area of the project site including the permanent easement and offsite drainage is 43.66 acres. The site generally drains from southeast to northwest for a majority of the site and discharges to Black Creek. See Existing Conditions figure in Appendix E for site topographic information.

(2) The types, depth, slope, locations and limitations of the soils and geologic formations.

The Kidder Compressor Station lies within the Specty Koft Formation, according to the Pennsylvania Department of Conservations and Natural Resources (PADCNR).

Based on the Natural Resources Conservation Service (NRCS) Web Soil Survey, the surficial geology within the area of interest consists predominately of the Morris channery silt loam and the Albrights very stony loam. There are minor components of Norwich soils.

The Morris channery silt loam has 0 to 8 percent slopes and is noted to be very stony. The deposit is generally mapped as 33 percent sand, 51 percent silt, and 16 percent clay. This unit has a moderate rating for the corrosion of concrete, and a high rating for the corrosion of steel. Laboratory testing of chloride and sulfate content of site soils were conducted to verify corrosivity characteristics of the soil as further detailed in Geotechnical Recommendation Report.

The excerpt in Appendix D from Table E.1, PADEP Erosion and Sediment Pollution Control Program Manual summarizes soil limitations. These limitations have been addressed through site specific testing for infiltration rates which serve as the basis of design for stormwater BMPs.

(3) The characteristics of the project site, including the past, present and proposed land uses and the proposed alteration to the project site.

Aerial images depict the Kidder Compressor site and its surroundings as forested land. There are wetlands located near the property. No stormwater facilities are present at the project site under existing conditions. As indicated earlier, the site is primarily wooded, runoff from the site ultimately outfalls into the unnamed tributary unattenuated under existing conditions.

The project proposes to construct a compressor station on approximately 5.81 acres of gravel. The area will continue to drain to existing stream that splits the site in two. Two infiltration basins will be constructed to comply with regulatory stormwater requirements.

(4) An identification of the net change in volume and rate of stormwater from preconstruction hydrology to post construction hydrology for the entire project site and each drainage area.

See Section 4 of this report for details on net change in volume and rate of stormwater runoff from pre-construction to post construction.

The summary of these net changes is provided in the Tables 1 and 2.

Infiltration volume is provided up to the 2-year storm, and peak runoff rate does not exceed preconstruction rates under the 2, 10, 50, and 100 year/24-hour storm events.

Table 1: Peak Flow Summary

Recurrence Interval (yrs)	Existing Peak Flow (cfs)	Maximum Allowable Proposed Peak Flow (cfs)	Proposed Peak Q (cfs)	Proposed Less than Allowable? (Y/N)
1	70.98	70.98	68.32	Yes
2	101.28	101.28	94.15	Yes
5	148.20	148.20	133.11	Yes
10	192.53	192.53	170.35	Yes
25	266.52	266.52	234	Yes
50	337.20	337.20	286.33	Yes
100	422.56	422.56	347.99	Yes

Table 2: Volume Summary

Recurrence Interval (yrs)	Existing Volume (cf)	Proposed Unmitigated Volume from Model (cf)	Difference between Proposed and Existing (cf)	Proposed Basins Infiltration Capacity (cf)	Adequate Infiltration Volume? (Y/N)
1-Year	77,951	144,981	67,030	97,774	Yes
2-year	111,794	187,256	75,463	97,774	Yes

(5) An identification of the location of surface waters of this Commonwealth, which may receive runoff within or from the project site and their classification under Chapter 93 (relating to water quality standards).

The site drains to unnamed Black Creek tributary, which in turn drains to the Lehigh River, see Figure 1. The site is part of the Upper Lehigh River watershed. Chapter 93.9d from the Pennsylvania Code indicates that Black Creek tributary is classified as "HQ-CWF", MF". HQ-CWF indicates the stream is high quality waters with cold water fishes maintenance or propagation, or both, of fish species including the family Salmonidae and additional flora and fauna which are indigenous to a cold water habitat. MF (migratory fishes) indicates the passage, maintenance and propagation of anadromous and catadromous fishes and other fishes which move to or from flowing waters to complete their life cycle in other waters.

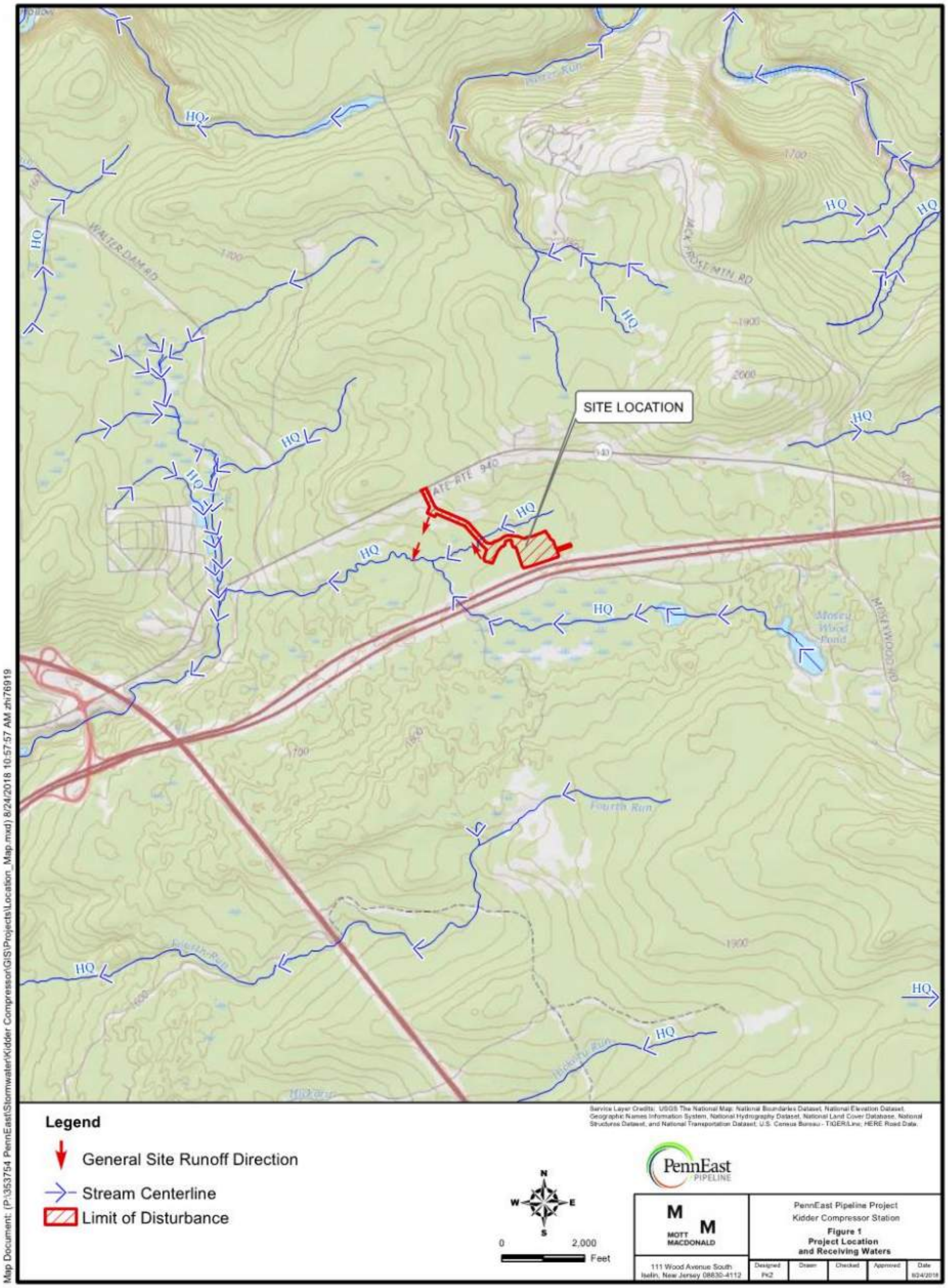


Figure 1: USGS Map showing project site and flow path to receiving waters

(6) A written description of the location and type of PCSM BMPs including construction details for permanent stormwater BMPs including permanent stabilization specifications and locations.

BMPs have been designed according to the recommendations set out in the Pennsylvania Stormwater BMP as follows:

*Infiltration basin: T*wo infiltration basins are proposed to attenuate peak stormwater runoff and provide water quality for this project site. The basins are not expected to alter the general drainage pattern, stormwater runoff from the project site will continue to ultimately outfall to the unnamed tributary. *Because* stormwater management facilities must be designed to account for offsite flows (if any), stormwater management calculations presented herein are based on the total site area of 48.684acres. *The north-basin is an infiltration basin with extended detention that will be located adjacent to the site access road near a roadway low point. This basin will strategically capture and treat roadway runoff. Two roadside swales adjacent to and immediately south of the access road will convey roadway runoff to this basin. The south-basin is an infiltration basin with extended detention that will be located adjacent to the proposed equipment pad. A series of swales, inlets and pipes will capture runoff from the pad area and convey it to the basin. It is noted that swales are proposed on downstream sides of the equipment pad to maximize the capture of stormwater runoff from the pad area and route it through the south-basin for treatment. The south-basin is designed to capture and treat stormwater runoff from the equipment pad.*

Vegetated Swale: Two additional swales are proposed north of the access road. The swale further north is a temporary swale that will divert offsite runoff from the temporary work areas during construction. This swale will be filled in at the completion of construction activities. A second swale is proposed immediately north and adjacent to the access road. This swale will capture and bypass offsite flows through twin 48" culverts under the access road and away from the north-basin. The purpose is to not increase the hydraulic load on the basin by adding stormwater runoff from the offsite and temporary work areas to be vegetated that do not require water quality or quantity treatment. Portions of these offsite areas are zoned as commercial and/or industrial per the Township's current zoning ordinance. As such, the hydraulic analyses for these swales have been performed for "full buildout" conditions.

As per discussions with PA DEP areas receiving pre-treatment by passing through other BMPs such as vegetated swales may be factored out of the loading ratios. In this case, a portion of the influent to the infiltration area will pass through a vegetated swale which will provide pre-treatment. The recommended guideline in the PA BMP Manual is Impervious Loading Ratio of 5:1 and Total Loading Ratio of 8:1, which are achieved, see Table 3. It is also noted that the hydrologic calculations on Section 4 demonstrate that the basin performance requirements are met. Very little sediment load is anticipated as the site sees minimal vehicular traffic and some of the flow reaching the basin receives pre-treatment from a vegetated swale. Properly implemented inspection and maintenance practices will verify the basin's performance.

Table 3: Basin Loading Ratios

Basin Id	Basin Floor Area (Acres)	Total Drainage Area (Acres)	Total Untreated Drainage Area (Acres)	Influent Impervious Area (Acres)	Influent Untreated Impervious Area (Acres)	Effective Loading Ratio Based on Total Area	Effective Loading Ratio Based on Influent Impervious Area
NORTH-BASIN	0.182	1.950	1.201	0.742	0.368	6.6	2.0
SOUTH-BASIN	0.945	16.514	6.152	6.876	2.912	6.5	3.1

In addition to structural BMPs, the follow non-structural PCSM BMPs are employed on the site:

- The site has been designed to minimize the area of disturbance, which minimizes impervious areas, and the extents of the gravel pad have been restricted to be minimum necessary for safe, effective operation of the station. Gravel was selected in lieu of asphalt for the pad area, the extents of the gravel were limited where possible to align with BMPs 5.7 – Reduce Impervious Cover.
- Existing drainage features and vegetated areas (forests and open space) have been preserved where possible and protected to the greatest extent practicable. By maintaining natural cover, runoff volume and peak flow increases are mitigated. Grading has been minimized, as previously discussed in accordance with BMP 5.6.1 Minimized Total Disturbed Area – Grading.
- In accordance with BMP 5.6.2 – Minimized Soil Compaction in Disturbed Areas, the site has been designed to minimize the area of disturbance, which minimizes soil compaction. Care will be taken to prevent the use of heavy machinery on stormwater BMPs and on areas of the site not being developed; the contractor will be required to prevent compaction of soils in areas that are occupied or to be occupied by PCSM BMPs.

See the Post-Construction Stormwater Management Plan drawing in Appendix I for location of infiltration basins on site and construction details of infiltration basins, outlet control structure and inlets.

(7) A sequence of PCSM BMP implementation or installation in relation to earth disturbance activities of the project site and a schedule of inspections for critical stages of PCSM BMP installation.

BMP construction and inspections will be performed based on recommendations from the Pennsylvania Stormwater BMP Manual. The overall sequence of BMP construction is as follows:

Vegetated Swales: Vegetated swales will be installed as described in the overall sequence above. This applies to the area north of the pad where the pad and existing grade effectively form a swale. The contractor will be required to prevent the compaction of soils in areas that are occupied or to be occupied by PCSM BMPs. The swales will be rough graded, then fine graded, seeded and vegetated added, and protective lining will be installed. The swales will be inspected after each rainfall between rough grading and fine grading for sediment accumulation, erosion or obstructions. Vegetation will be established as soon as possible to prevent erosion and scour. Once the tributary areas are sufficiently stabilized, temporary erosion and sediment controls will be removed. Immediately following site construction, the swales will be inspected to verify that runoff conveyance capacity meets the design capacity. If not, they will be regraded and reseeded and any damaged areas will be fully restored to confirm functionality.

Infiltration Basin: The infiltration basin will be installed as described in the overall sequence above. Prior to construction, the area of the basin will be protected from compaction by installing orange safety fencing that will be used to protect the area throughout the project. The basin will be used as a sedimentation trap during construction. Clogging of the sub-surface soils will be prevented by grading the basin to a depth of one foot above the proposed invert. The outlet control structure will then be installed, topsoil will be seeded and stabilized, and vegetated with native plantings as required. Temporary Erosion and Sediment Control measures will reduce the construction sediment load on the basin. Upon final stabilization of the upstream areas, accumulated sediment will be removed and the basin will be excavated to its final grade. If necessary, the basin bottom will be excavated to an uncompacted subgrade free from rocks and debris and will be backfilled with a layer of sand or gravel on the bottom of the basin. The contract documents require the contractor to test and amend the soil as necessary to achieve the required infiltration rate. The post-construction performance requirements have been listed on SWM Details. The basin will be inspected after any major rainfall events to confirm that it is functioning properly.

The infiltration basin will not be put into services until stabilization of disturbed area is complete to prevent sedimentation and/or damage from construction activity. Erosion and Sediment Control Measures will be installed as required during construction (refer to ESC Plan).

After completion of construction on site, the basin will be inspected after rainfall events to verify that runoff drains within 72 hours. The basin will also be inspected for accumulation of construction sediment, damage to outlet control structures, erosion control measures, signs of water contamination/spills, and slope stability in the berms. At this time, accumulated sediment will be removed from the basin if required, to restore the original cross section and infiltration capacity of the basin, and sediment will be properly disposed of.

1. At least seven (7) days before starting any earth disturbance activities, the owner and/or operator shall notify the PADEP and Carbon County Conservation District by either telephone or certified mail of the intent to commence earth disturbance activities. Attendance at a pre-construction conference is required upon request of the PADEP.
2. At least three (3) days before starting any earth disturbance activities, contractors involved in those activities shall notify the Pennsylvania One Call system at 1-800-242-1776 to det Stake out construction work limits.
3. Install stabilized rock construction entrance and erosion/sediment control barriers (ECB) where construction traffic will exit the project site onto PA Route 940.
4. Install temporary parking areas as needed in staging area PE-STA-B-09 with stabilized crushed gravel surface.

Tree Clearing (15 days)

5. Clear trees and brush; haul merchantable timber off site; chip remainder of vegetation and haul off site.

Tree Stump Remove, Topsoil Stripping, Access Road, Site Grading, and Runoff Measures (20 days)

6. Stake out remainder of temporary ECBs; install ECBs. Excavate and rough grade stormwater detention basin (North Basin), less 12 inches of depth; install outlet control structure with temporary riser at end of the PVC pipe to outlet control structure. Do not drill holes in permanent riser until final grading of North Basin is performed. engineer shall inspect installation and stabilization of temporary swale, stormwater detention basin (north basin) less 12 inches of depth, and temporary outlet control structure.
7. Grub tree stumps and roots; haul stumps off site or grind stumps and dispose of chips offsite.

8. Strip and stack topsoil; screen estimated quantity of topsoil needed for reuse and stack on site; haul surplus topsoil off site.
9. Install permanent twin 48-inch RCPs with concrete headwalls at Sta. 13+90; backfill RCPs with borrow gravel.
10. Install temporary cofferdam and pump bypass measures. Maintain base stream flow by pumping from upstream to downstream of the cofferdams. Dewater work area; water from the excavation shall be pumped to a sediment filter bag.

    Where possible, excavation shall be from the top of the stream bank, where technically feasible. Install 22-foot W x 8-foot H precast concrete box culvert, headwalls, and rip rap at Sta. 19+40; backfill structures with borrow gravel. Engineer to inspect culvert installation prior to backfilling. Upon backfilling of the completed box culvert and headwall installation, remove temporary cofferdam and pump bypass measures. Provide streambank restoration. Engineer shall inspect culvert installation.
11. Stake out access road to Sta. 29+00; excavate and fill access road to subgrade; excavate roadside swales.
12. Install drainage piping, manholes, catchbasins and inlets; excavate perimeter drainage swale in compressor pad area; install ECBs at catchbasins and inlets. Engineer to inspect elevations at catchbasisn and inlets prior to backfilling. Engineer shall inspect drainage piping, manholes, catchbasins and inlets, and swales.
13. Proof roll access road subgrade; install layer of PennDOT 2A gravel sub-base over approved subgrade; grade and roll gravel.
14. Stake out compressor pad area; excavate and fill pad to subgrade; install borrow material as needed to bring the pad to subgrade elevations.
15. Stake out office/warehouse building parking area and perimeter access road in compressor pad area; excavate and fill parking area and roadway to subgrade.
16. Proof roll perimeter road subgrade; install layer of PennDOT 2A gravel sub-base over approved subgrade; grade and roll gravel.
17. Excavate stormwater detention basin (South Basin); install outlet control structures and associated piping; install ECBs at perimeter of basin, inlets, and outlets. Engineer to inspect the sub-surface basin prior to backfilling around it. Engineer shall inspect stormwater detention basin (south basin), outlet control structures, associated piping, inlets and outlets.
18. Excavate accumulated sediment and debris in north basin and perform final grading. Cut temporary riser from end of the PVC pipe to outlet control structure and install end cap. Drill holes for permanent riser per stormwater details. Immediately seed basin and install erosion control blanket on embankment slopes. Install ECBS at perimeter of basin, inlets, and outlets. Engineer shall inspect stormwater detention basin (north basin) and permanent outlet control structure.

Excavate, Form, Pour Compressor Foundation Blocks (9 days)

19. Excavate for compressor foundation blocks (3).
20. Form, install reinforcing steel, and pour blocks.
21. Install gravel backfill and compact soil.

Excavate, Form, Pour Building Foundations (21 days)

22. Excavate for office/warehouse building foundation.
23. Form, install reinforcing steel, and pour building foundation.
24. Install gravel backfill and compact soil.
25. Under-slab utility installation.

26. Pour concrete floor slab.

Excavate, Form, Pour Remaining Foundations (21 days)

27. Excavate for gas cooler, filter separators, launcher/receiver, blowdown silencers, liquid tanks, miscellaneous foundations.
28. Form, install reinforcing steel, and pour foundations.
29. Install gravel backfill and compact soil.

Excavate, Install Plant Buried Conduit (9 days)

30. Trench excavation for buried conduit.
31. Conduit installation.
32. Encase conduit and backfill with select material.

Install Plant Power Feed, Phone, Cable, Lighting Along Access Road (4 days)

33. Utility poles installation.
34. String overhead cables.
35. Street lights installation.

Erect, Set Warehouse/Office/Control Building (24 days)

36. Building erection.

Set Compressors (3 days)

37. Installation of compressor and engines.
38. Start compressor building erection once units are set

Set Main Gas Equipment (27 days)

39. Install below grade and above grade gas piping in compressor pad area.
40. Install crushed stone surface in compressor pad area.
41. Excavate large bore pipe trenches.
42. Fabricate, install large bore and small bore piping and skids – runs to September.

Final Grading and Paving

43. Restore disturbed areas; spread topsoil; seed and mulch.
44. Install permanent security gate and fencing.
45. Install hot mixed asphalt base course and binder course.
46. Grade roadside swales; install topsoil; seed and mulch.
47. Install PennDOT 2A gravel roadway shoulders.
48. Install hot mixed asphalt wearing course (top course).

Erect Compressor Building framing and interior liner (30 days)

49. Building erection of framing and interior liner starts immediately after compressors are set
50. Install smaller mechanical and electrical equipment
51. Set electrical buildings
52. Pull and terminate wires

Final Cleanup, Demobilization, and Maintenance (38 days)

53. Maintain ECBs and repair any eroded areas; repair any areas disturbed during construction activities. Engineer to inspect final stabilization prior to removal of temporary measures.
54. Final cleanup, remove surplus and trash from site.
55. Demobilize contractor equipment.
56. Monitor and maintain seeded areas.

Remove ECBs upon establishment of vegetation.

(8) Supporting calculations.

See Appendix B for supporting calculations for hydraulic analysis and BMP design.

(9) Plan drawings.

See Post-Construction Stormwater Management Plan drawing in Appendix I.

(10) A long-term operation and maintenance schedule, which provides for inspection of PCSM BMPs, including the repair, replacement, or other routine maintenance of the PCSM BMPs to support proper function and operation. The program must provide for completion of a written report documenting each inspection and BMP repair and maintenance activities and how access to the PCSM BMPs will be provided.

A maintenance program that provides for routine inspection, as well as repair and replacement as necessary, is essential to effective and efficient operation of the proposed stormwater BMPs. Implementation of the following maintenance plan is a key component in achieving the intent of this PCSM Plan and minimizing negative impacts of stormwater runoff from the proposed facilities. The permittee and any co-permittees shall be responsible for long-term operation and maintenance of the stormwater BMPs unless a different person is identified in the Notice of Termination and has agreed to long-term operation and maintenance of the stormwater BMPs. A formal long-term operation and maintenance plan will be provided in subsequent stages of the undertaking, outlining additional details of maintenance schedules, procedures and reporting requirements.

PennEast will be responsible for the proper construction, stabilization, and maintenance of erosion and sediment controls and post-construction stormwater management facilities which include the vegetated areas. Vegetated areas will be inspected for erosion, distressed vegetation and bare ground. General maintenance will include the regular removal of debris and litter to help prevent possible damage to vegetated areas. Growth of woody vegetation will be controlled by mowing (approximately two times per year) and clearing as appropriate.

Infiltration basin:

- Inlets will be inspected and cleaned at least two times per year and after runoff events (>1 inch rainfall depth).
- Vehicles will not be parked or driven on the basin, and excessive compaction by mowers will be avoided.
- The basin will be inspected after runoff events to make sure that runoff drains down within 72 hours. The basin will also be inspected for accumulation of sediment, damage to outlet control structures, erosion control measures, and signs of water contamination/spills and slope stability in the berms. Accumulated sediment will be removed from the basin as required, the original cross section of the basin will be restored, and sediment will be properly disposed of.

Swales:

- *Maintenance activities to be performed annually and within 48 hours after every major storm event (> 1 inch rainfall depth).*
  - *Inspect and correct erosion problems, damage to vegetation, and sediment and debris accumulation (address when > 3 inches at any spot or covering vegetation).*
  - *Inspect vegetation on side slopes for erosion and formation of rills or gullies, correct as needed.*

- *Inspect for pools of standing water; dewater and discharge to an approved location and restore to design grade.*
- *Mow and trim vegetation to provide safety, aesthetics, proper swale operation, or to suppress weeds and invasive vegetation; dispose of cuttings in a local composting facility; mow only when swale is dry to avoid rutting.*
- *Inspect for litter; remove prior to mowing.*
- *Inspect for uniformity in cross-section and longitudinal slope, correct as needed.*
- *Inspect swale inlet (curb cuts, pipes, etc.) and outlet for signs of erosion or blockage, correct as needed.*

Maintenance activities to be performed as needed:

- Plant alternative grass species: Standard Upland ROW, Residential, Clover/Food Plot with ROW as listed in the E&S site restoration plans in the event of unsuccessful establishment
- *Reseed bare areas; install appropriate erosion control measures when native soil is exposed, or erosion channels are forming.*
- *Rototill and replant swale if draw down time is more than 48 hours.*
- *Inspect and correct check dams when signs of altered water flow (channelization, obstructions, erosion, etc.) are identified.*
- *Water during dry periods, fertilize, and apply pesticide only when absolutely necessary.*

Maintenance under winter conditions:

- *Inspect swale immediately after the spring melt, remove residuals (e.g. sand) and replace damaged vegetation without disturbing remaining vegetation.*
- *If roadside or parking lot runoff is directed to the swale, mulching and/or soil aeration/manipulation may be required in the spring to restore soil structure and moisture capacity and to reduce the impacts of de-icing agents.*
- *Use nontoxic, organic de-icing agents, applied either as blended, magnesium chloride-based liquid products or as pretreated salt.*
- *Use salt-tolerant vegetation in swales.*

(11) Procedures which verify that the proper measures for recycling or disposal of materials associated with or from the PCSM BMPs are in accordance with Department laws, regulations and requirements.

The responsible party (construction contractor) for earth disturbance activities must confirm that proper mechanisms are in place to control waste materials. Construction wastes include, but are not limited to, excess soil materials, damaged netting or matting, sanitary wastes, and general trash that could adversely affect or impact water quality. Measures for housekeeping of the site, materials management, and litter control should be planned and implemented throughout the life of the project.

The contractor/operator will remove, recycle or dispose from the site excess construction materials and wastes in accordance with PADEP's Solid Waste Management Regulations at 25 PA. Code 260.1 et seq., 271.1 et seq. The contractor/operator will not illegally bury, dump, or discharge any building material or wastes at the site.

Sediment removed from erosion control measures or facilities and other soils deemed unsuitable for use as fill shall be stabilized and disposed of offsite at a licensed disposal facility. Offsite disposal must comply with local, county, state and federal rules, regulations, and laws.

(12) An identification of naturally occurring geologic formations or soil conditions that may have the potential to cause pollution after earth disturbance activities are completed and PCSM BMPs are operational and development of a management plan to avoid or minimize potential pollution and its impacts.

Based on NRCS Web Soil Survey, the existing soils have a soil reaction of acidity or alkalinity (pH levels) of approximately 4.4. Upon review of PADCNR's "Geologic Units Containing Potentially Significant Acid-Producing Sulfide Minerals" map, this station site does not lie in a known region containing acid-producing soils.

(13)An identification of potential thermal impacts from post construction stormwater to surface waters of this Commonwealth including BMPs to avoid, minimize or mitigate potential pollution from thermal impacts.

Infiltration of runoff collected in infiltration basins is anticipated to mitigate thermal impacts from post construction stormwater. It is not expected that runoff collected in the infiltration basin and discharged overland to the receiving water will be retained in the basin for more than 24 hours, thus providing additional mitigation of potential thermal impacts of discharge from infiltration basins. Existing shade trees are being preserved to the greatest extent possible and excessing riprapping and concrete channels is being avoided, to minimize the heat transfer to the runoff.

(14)A riparian forest buffer management plan when required under §102.14 (relating to riparian buffer requirements).

The project is not located within 150 feet of a perennial or intermittent river, stream, or creak, or lake, pond, or reservoir. The project is located within a watershed of an Exceptional Value or High Quality, however the project will eliminate the net change in stormwater volume, rate and quality for stormwater events up to and including the 2-year/24-hour storm. The project will use various structural and non-structural BMPs to meet the water quantity and quality requirements. The peak runoffs will be attenuated with an infiltration trench. The stormwater will be routed through structural and non-structural BMPs and discharged overland towards the stream which is greater than 150' away from the site. The project falls into the definition of a non-discharge alternative. See Section 4 for compliance calculations and descriptions. Therefore, a riparian forest buffer management plan is not required.

(15)Additional information requested by the Department.

Additional information requested by the Department will be provided.

3.1.2 Post Construction Stormwater Management Plan Stormwater Analysis

This section addresses the portion of the regulations pertaining to the site-specific stormwater analysis.

(g) PCSM Plan Stormwater analysis. Except for regulated activities that require site restoration or reclamation, and small earth disturbance activities identified in subsection (n), PCSM Plans for proposed activities requiring a permit under this chapter require the following additional information:

(1) Predevelopment site characterization and assessment of soil and geology including appropriate infiltration and geotechnical studies that identify location and depths of test sites and methods used.

Infiltration tests using a double ring infiltrometer in the two test pits were conducted at the location of the proposed infiltration basins.

Per the geotechnical investigations conducted at the project site, test pits KTP-1 and KTP-2 are located within proposed north-basin. Remaining test pits are located within proposed south-basin.

At least one Infiltration test was conducted at an elevation equal to the proposed basin invert. Upon completion of the infiltration testing, the test location was excavated an additional 2 feet to further identify subsurface material and look for evidence of groundwater. Initial proposed basin invert elevations were set for North and South basins at 1735.0 feet and 1733.0 feet respectively.

The test pit elevations are summarized in a table below:

Table 4: Test Pit Summary

Basin Name	Test Pit No.	Existing Grade Elevation (feet)	Proposed BMP Invert (feet)	Infiltration Test Elevation (feet)	Excavation Depth Elevation (feet)	Depth to High Groundwater (feet)
NORTH BASIN	KTP-1	1735.9	1735.0	1735.0	1732.9	No evidence of high groundwater observed
	KTP-2	1736.3	1735.0	1735.0	1733.0	No evidence of high groundwater observed
SOUTH BASIN	KTP-3	1737.5	1733.0	1733.0	1731.0	No evidence of high groundwater observed
	KTP-4	1739.0	1733.0	1733.0	1731.0	No evidence of high groundwater observed
	KTP-5	1736.2	1733.0	1733.0	1731.0	No evidence of high groundwater observed
	KTP-6	1736.1	1733.0	1733.0	1731.0	No evidence of high groundwater observed
	KTP-7	1736.8	1733.0	1733.0	1731.0	No evidence of high groundwater observed
	KTP-8	1738.7	1733.0	1733.0	1731.0	No evidence of high groundwater observed

The test pit locations plan can be found on the site plan in Appendix I, drawings number 023-03-06-003 and 023-03-06-004. Based on the observed average infiltration rate of 1.24 inches/hr for North Basin and 1.59 inches/hr for South Basin a factor of safety of 3 was applied. The infiltration testing resulted in a design rate of 0.41 inches/hr and 0.53 inches//hr.

The results of the infiltration tests are summarized as follows:

Table 5: North Basin Infiltration Test Summary

Test Pit	Test #1	Test #2	Final Rate Used
KTP-1	0.25 inch/hr	1.50 inch/hr	0.90 inch/hr
KTP-2	1.50 inch/hr	1.75 inch/hr	1.60 inch/hr
Observed Overall Rate			1.24 inch/hr
Design Rate (Factor of Safety of 3)			0.41 inch/hr

Table 6: South Basin Infiltration Test Summary

Test Pit	Test #1	Test #2	Final Rate Used
KTP-3	1.75	0.75	1.25
KTP-4	0.5	1.75	1
KTP-5	4.5	1.75	3.12
KTP-6	0.25	2.5	1.4
KTP-7	1.5	1	1.25
KTP-8	1.5	1.5	1.5
Observed Overall Rate			1.59 inch/hr
Design Rate (Factor of Safety of 3)			0.53 inch/hr

(2) Analysis demonstrating that the PCSM BMPs will meet the volume reduction and water quality requirements specified in an applicable Department approved and current Act 167 stormwater management watershed plan; or manage the net change for storms up to and including the 2-year/24-hour storm event when compared to preconstruction runoff volume and water quality. The analysis for the 2-year/24-hour storm event shall be conducted using the following minimum criteria:

The project site is located in Carbon County, in the Upper Lehigh River watershed, which does not have an Act 167 Stormwater Management Plan. As such, the applicable runoff volume requirements are to manage the net change in volume between pre-construction and post-construction, for storms up to and including the 2-year/24-hour storm event.

The runoff volume requirements are achieved, as shown in table below.

Please see Section 4 of this report for details on the pre-development and post-development runoff volume calculations with detailed calculations provided in Appendix B.

i. **Existing predevelopment non-forested pervious areas must be considered meadow in good condition or its equivalent except for repair, reconstruction or restoration of roadways or rail lines, or construction, repair, reconstruction or restoration of utility infrastructure when the site will be returned to existing condition.**

The existing pre-developed site is mainly good condition woods with a small area of grass. For the purposes of hydraulic calculations, existing onsite grass was assumed to be meadow.

ii. **When the existing project site contains impervious area, 20% of the existing impervious area to be disturbed must be considered meadow in good condition or better, except for repair, reconstruction or restoration of roadways or rail lines, or construction, repair, reconstruction, or restoration of utility infrastructure when the site will be returned to existing condition.**

Not applicable. The existing pre-development site is mainly good condition woods with a small area of grass.

iii. **When the existing site contains impervious area and the existing site conditions have public health, safety or environmental limitations, the applicant may demonstrate to the Department that it is not practicable to satisfy the requirement in subparagraph (ii), but the stormwater volume reduction and water quality treatment will be maximized to the extent practicable to maintain and protect existing water quality and existing and designated uses.**

Not applicable. The stormwater volume reduction and water quality treatment requirements are achieved.

iv. Approaches other than that required under paragraph (2) may be proposed by the applicant when the applicant demonstrates to the Department that the alternative will either be more protective than required under paragraph (2) or will maintain and protect existing water quality and existing and designated uses by maintaining the site hydrology, water quality, and erosive impacts of the conditions prior to initiation of any earth disturbance activities.

Not applicable.

(3) Analysis demonstrating that the PCSM BMPs will meet the rate requirements specified in an applicable Department approved and current Act 167 stormwater management watershed plan; or manage the net change in peak rate for the 2, 10, 50, and 100 year/24-hour storm events in a manner not to exceed preconstruction rates.

The project site is located in Carbon County, in the Upper Lehigh River watershed. According to PADEP's eMapPA,, Carbon County does not have an Act 167 Stormwater Management Plan. As such, the applicable requirement is that the post-development peak runoff rate must not exceed pre-development peak runoff rate under the 2, 10, 50, and 100 year/24-hour storm events.

The peak runoff rate requirements are achieved; summarized in the table below. See Section 4 of this report for details on the pre-development and post-development peak runoff rate calculations.

i. Hydrologic computations or a routing analysis are required to demonstrate that this requirement has been met.

See Section 4 of this report for details on hydrologic computations that demonstrate that runoff rate requirements have been met.

ii. Exempt from this requirement are Department- approved direct discharges to tidal areas or Department-approved no detention areas.

Not applicable. Project site does not discharge to tidal areas or no-detention areas.

iii. Approaches other than that required under paragraph (3) may be proposed by the applicant when the applicant demonstrates to the Department that the alternative will either be more protective than required under paragraph (3) or will maintain and protect existing water quality and existing and designated uses by maintaining the preconstruction site hydrologic impact.

Not applicable. The requirements of paragraph (3) have been met.

(4) Identification of the methodologies for calculating the total runoff volume and peak rate of runoff and provide supporting documentation and calculations.

See Section 4 of this report for details on the pre-development and post-development peak runoff rate and total runoff volume calculation methodology, which was completed using TR-55 methodology implemented by Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013. See Appendix B for calculation documentation.

(5) Identification of construction techniques or special considerations to address soil and geologic limitations.

Methods to address potential soil limitations have been provided on the PCSM plans.

(h) PCSM implementation for special protection waters. To satisfy the anti-degradation implementation requirements in §93.4c(b) (relating to implementation of anti-degradation requirements), an earth disturbance activity that requires a permit under this chapter and for which any receiving water that is classified as High Quality or Exceptional Value under Chapter 93, the person proposing the activity shall, in the permit application, do the following:

(1) Evaluate and include non-discharge alternatives in the PCSM Plan unless a person demonstrates that non-discharge alternatives do not exist for the project.

(2) If the person makes the demonstration in paragraph (1) that non-discharge alternatives do not exist for the project, the PCSM Plan must include ABACT, except as provided in §93.4c(b)(1)(iii).

(3) For purposes of this chapter, non-discharge alternatives and ABACT and their design standards are listed in the Pennsylvania Stormwater Best Management Practices Manua,l Commonwealth of Pennsylvania, Department of Environmental Protection, No. 363-0300-002 (December 2006), as amended and updated.

The project will eliminate the net change in stormwater volume, rate and quality for stormwater events up to and including the 2-year/24-hour storm. The project will use various structural and non-structural BMPs to meet the water quantity and quality requirements. The peak runoffs will be attenuated with infiltration basins. The stormwater will be routed through a series of structural and non-structural BMPs and discharged overland towards the stream. Therefore, the project falls into definition of nondischarge alternative. See Section 4 for compliance calculations and description.

4 Hydrologic and Hydraulic Analysis

This Section outlines the hydrologic calculations that were performed in order to design the stormwater BMPs for the Kidder Compressor Station site, and to confirm that requirements for stormwater runoff volume and peak rate would be met.

4.1 Existing Conditions

The total drainage area to the point of analysis including site and offsite areas is 43.66 acres of forested and grassed land adjacent to an existing road.

An unnamed tributary flows through the site in a northeast-to-southwest direction. This tributary is part of the overall Black Creek system that ultimately discharges to the Lehigh River at the County boundary, approximately 5.3 miles southwest of the project site. The tributary within the project site is designated as a High Quality (HQ) waterbody per the PA Chapter 93 Water Quality Standards. A concrete box culvert has been designed to pass the tributary under the proposed access road. The box culvert has been sized to have a natural channel bottom per PennDOT Bridge Design (BD) – 632M standards, while passing the computed 100-year discharge without overtopping the access road. The FEMA flood insurance maps currently available for the project area are dated June 2002. Per the FEMA FIS maps, no flood hazard information is available for the tributary, although, Black Creek is studied and the limit of FEMA study is approximately 1400 ft downstream of the proposed culvert crossing. The culvert analysis report is submitted separately for reference.

Under existing conditions, the underlying soils are primarily stony loam, with stone being a major component. Approximately 11.428 acres of the total site area is comprised of Albrights very stony loam (AcB), and 32.231 acres is Morris channery silt loam (MrB). Existing condition curve numbers were assigned as per Table 2-2a from USDA's TR-55 "Urban Hydrology for Small Watersheds." The time of concentration was calculated using TR-55 methodology, and the routing is shown in the Existing Conditions figure in Appendix E. For times of concentration less than 5 minutes, a minimum time of concentration of 5 minutes was assumed. For the purposes of stormwater management calculations, a Factor of Safety = 3 has been used with the measured infiltration rates throughout this report.

Under existing conditions, the land use breakdown is given in Table 7 below. The drainage area boundaries are shown in the Existing Conditions figure in Appendix E.

Table 7: Existing Conditions Land Use

DA	Cover	Soils	HSG	Area (sf)	Area (Ac)	CN	CN*Area	Weighted CN
NORTH-BASIN	IP	AcB	D	1,690	0.039	98	3.804	98.0
	IP Total				**0.039**		**3.804**	**98.0**
NORTH-BASIN	MEAD-G	AcB	D	4,018	0.092	82	7.564	82.0
	MEAD-G Total				**0.092**		**7.564**	**82.0**
NORTH-BASIN	WO-G	AcB	D	74,078	1.701	77	130.947	77.0
NORTH-BASIN	WO-G	AcB	D	5,144	0.118	77	9.094	77.0
	WO-G Total				**1.819**		**140.041**	**77.0**
NORTH-BASIN Total					**1.950**		**151.409**	**77.7**
OFF-1	IP	MrB	D	39,472	0.906	98	88.803	98.0
	IP Total				**0.906**		**88.803**	**98.0**
OFF-1	MEAD-G	MrB	D	24,346	0.559	82	45.832	82.0

DA	Cover	Soils	HSG	Area (sf)	Area (Ac)	CN	CN*Area	Weighted CN
OFF-1	MEAD-G	MrB	D	4,092	0.094	82	7.705	82.0
	MEAD-G Total				**0.653**		**53.537**	**82.0**
OFF-1	WO-G	MrB	D	441,301	10.131	77	780.078	77.0
	WO-G Total				**10.131**		**780.078**	**77.0**
OFF-1 Total					**11.690**		**922.417**	**78.9**
OFF-2	IP	AcB	D	1,090	0.025	98	2.453	98.0
	IP Total				**0.025**		**2.453**	**98.0**
OFF-2	MEAD-G	AcB	D	9,662	0.222	82	18.190	82.0
OFF-2	MEAD-G	MrB	D	3,754	0.086	82	7.068	82.0
	MEAD-G Total				**0.308**		**25.258**	**82.0**
OFF-2	WO-G	AcB	D	383,052	8.794	77	677.113	77.0
OFF-2	WO-G	AcB	D	237,965	5.463	77	420.646	77.0
OFF-2	WO-G	MrB	D	171,664	3.941	77	303.448	77.0
	WO-G Total				**18.197**		**1401.207**	**77.0**
OFF-2 Total					**18.531**		**1428.917**	**77.1**
SOUTH-BASIN	IP	MrB	D	137	0.003	98	0.308	98.0
	IP Total				**0.003**		**0.308**	**98.0**
SOUTH-BASIN	MEAD-G	MrB	D	8,007	0.184	82	15.074	82.0
	MEAD-G Total				**0.184**		**15.074**	**82.0**
SOUTH-BASIN	WO-G	MrB	D	711,194	16.327	77	1,257.16	77.0
	WO-G Total				**16.327**		**1,257.16**	**77.0**
SOUTH-BASIN Total					**16.514**		**1,272.55**	**77.1**
Grand Total					**48.684**		**3775.288**	**77.5**

Precipitation data was obtained from NOAA Atlas 14. The rainfall data is summarized in Table 8, these rainfall depths were applied to the model as a NRCS Type II rainfall.

Table 8: 24-Hour Design Rainfall Depths

Recurrence Interval (years)	Rainfall (inches)
1	2.64
2	3.17
5	3.94
10	4.62
25	5.71
50	6.73
100	7.95

4.2 Proposed Conditions

Gravel (compacted crushed stone) is considered to be impervious, thus is has been modelled as such in the hydraulic calculations. For the design purposes, it was assumed that the entire equipment pad was compacted. Two infiltration basins are proposed to attenuate peak stormwater runoff and provide water quality for this project site. The basins are not expected to alter the general drainage pattern, stormwater runoff from the project site will continue to ultimately outfall to the unnamed tributary. Because stormwater management facilities must be designed to account for offsite flows (if any), stormwater management calculations presented herein are based on the total site area of 48.684acres.

The north-basin is an infiltration basin with extended detention that will be located adjacent to the site access road near a roadway low point. This basin will strategically capture and treat roadway runoff. Two roadside swales adjacent to and immediately south of the access road will convey roadway runoff to this basin.

Two additional swales are proposed north of the access road. The swale further north is a temporary swale that will divert offsite runoff from the temporary work areas during construction. This swale will be filled in at the completion of construction activities. A second swale is proposed immediately north and adjacent to the access road. This swale will capture and bypass offsite flows through twin 48” culverts under the access road and away from the north-basin. The purpose is to not increase the hydraulic load on the basin by adding stormwater runoff from the offsite and temporary work areas to be vegetated that do not require water quality or quantity treatment. Portions of these offsite areas are zoned as commercial and/or industrial. As such, the hydraulic analyses for these swales have been performed for “full buildout” conditions.

The south-basin is an infiltration basin with extended detention that will be located adjacent to the proposed equipment pad. A series of swales, inlets and pipes will capture runoff from the pad area and convey it to the basin. It is noted that swales are proposed on downstream sides of the equipment pad to maximize the capture of stormwater runoff from the pad area and route it through the south-basin for treatment. The south-basin is designed to capture and treat stormwater runoff from the equipment pad.

As indicated above, the two infiltration basins have been strategically located and sized to capture and treat stormwater runoff from pavement and equipment pad areas to the maximum extent practicable. The areas within the study area that will pass through either the north or south basins are designated as “NORTH-BASIN” and “SOUTH-BASIN” in the stormwater management calculations. Other areas within the study area that will flow unattenuated are designated as “OFF” areas in the stormwater management calculations. The total study area (including offsite drainage areas) is approximately 48.684acres. The north-basin will capture and treat runoff from approximately 1.950 acres out of which, 0.742 acres is paved. The south-basin will capture and treat runoff from approximately 16.514 acres out of which, 6.876 acres is paved. The remainder 25.195 acres of the study area will flow unattenuated (designed as “OFF”). Note that majority of the “OFF” areas that flow unattenuated are either wooded or meadow areas under proposed conditions. Approximately 1.877 acres of pavement areas are designated as “OFF” areas and will not reach the proposed basins. These areas are primarily located at the unnamed tributary crossing and could not be captured without placing facilities in the riparian buffer. Runoff from these areas will sheet flow down the embankment and through the woods prior to reaching the unnamed tributary. Detailed soil-cover-complex breakdown is included in the appendices of the report.

Under proposed conditions, the land use breakdown is given in Table 9 below. The drainage area boundaries are shown in the Proposed Conditions figure in Appendix F.

Table 9: Proposed Condition Land Use

DA	Cover	Soils	HSG	Area (sf)	Area (Ac)	CN	CN*Area	Weighted CN
NORTH-BASIN	IP	AcB	D	2,038	0.047	98	4.585	98.0
NORTH-BASIN	IP	AcB	D	30,283	0.695	98	68.131	98.0
	IP Total				**0.742**		**72.716**	**98.0**
NORTH-BASIN	MEAD-G	AcB	D	56	0.001	82	0.107	82.0
NORTH-BASIN	MEAD-G	AcB	D	52,554	1.206	82	98.931	82.0
	MEAD-G Total				**1.208**		**99.038**	**82.0**

DA	Cover	Soils	HSG	Area (sf)	Area (Ac)	CN	CN*Area	Weighted CN
NORTH-BASIN Total					**1.950**		**171.754**	**88.1**
OFF-1	IP	MrB	D	39,472	0.906	98	88.803	98.0
	IP Total				**0.906**		**88.803**	**98.0**
OFF-1	MEAD-G	MrB	D	113,987	2.617	82	214.576	82.0
OFF-1	MEAD-G	MrB	D	24,347	0.559	82	45.832	82.0
OFF-1	MEAD-G	MrB	D	4,093	0.094	82	7.705	82.0
	MEAD-G Total				**3.270**		**268.112**	**82.0**
OFF-1	WO-G	MrB	D	327,314	7.514	77	578.586	77.0
	WO-G Total				**7.514**		**578.586**	**77.0**
OFF-1 Total					**11.690**		**935.501**	**80.0**
OFF-2	IP	AcB	D	1,679	0.039	98	3.777	98.0
OFF-2	IP	AcB	D	14,262	0.327	98	32.085	98.0
OFF-2	IP	MrB	D	26,371	0.605	98	59.329	98.0
	IP Total				**0.971**		**95.191**	**98.0**
OFF-2	MEAD-G	AcB	D	3,480	0.080	82	6.552	82.0
OFF-2	MEAD-G	AcB	D	112,075	2.573	82	210.976	82.0
OFF-2	MEAD-G	AcB	D	218,938	5.026	82	412.143	82.0
OFF-2	MEAD-G	AcB	D	273,169	6.271	82	514.230	82.0
OFF-2	MEAD-G	AcB	D	8,146	0.187	82	15.334	82.0
OFF-2	MEAD-G	MrB	D	149,027	3.421	82	280.538	82.0
	MEAD-G Total				**17.558**		**1439.773**	**82.0**
OFF-2	WO-G	AcB	D	3.656	0.000	77	0.006	77.0
OFF-2	WO-G	AcB	D	18	0.000	77	0.032	77.0
OFF-2	WO-G	MrB	D	0.665	0.000	77	0.001	77.0
OFF-2	WO-G	MrB	D	20	0.000	77	0.035	77.0
	WO-G Total				**0.001**		**0.075**	**77.0**
OFF-2 Total					**13.506**		**1123.008**	**83.2**
SOUTH-BASIN	IP	MrB	D	137	0.003	98	0.308	98.0
SOUTH-BASIN	IP	MrB	D	299,396	6.873	98	673.572	98.0
	IP Total				**6.876**		**673.881**	**98.0**
SOUTH-BASIN	MEAD-G	MrB	D	330,403	7.585	82	621.971	82.0
SOUTH-BASIN	MEAD-G	MrB	D	8,007	0.184	82	15.074	82.0
	MEAD-G Total				**7.769**		**637.044**	**82.0**
SOUTH-BASIN	WO-G	MrB	D	81,396	1.869	77	143.881	77.0
	WO-G Total				**1.869**		**143.881**	**77.0**
SOUTH-BASIN Total					**16.514**		**1454.807**	**88.1**
Grand Total					**48.684**		**4097.100**	**84.2**

4.3 Model Development

A model was developed in the Hydraflow Hydrographs extension for AutoCAD Civil 3D v2016 to simulate existing and proposed flow. This model was used to determine the existing and proposed runoff volumes and peak runoff rates. For the North Basin, the basin's outlet control structure will be constructed with the lowest opening 1.0' above the basin invert, to drain completely in 72 hours at the design infiltration rate of 0.41 in/hr, based on the observed rate of 1.24 in/hr with a factor of safety of 3 applied. For the South Basin, the basin's outlet control structure will be constructed with the lowest opening 2.0' above the basin invert, to drain completely in 72 hours at the design infiltration rate of 0.53 in/hr, based on the observed rate of 1.59 in/hr with a factor of safety of 3 applied. The proposed flows were routed through the basins and the attenuated flow rates were calculated. Model inputs and summary and output report can be found in Appendix H.

4.4 Stormwater Management Rules Compliance

The project meets the requirements listed under the Pennsylvania code for Post-Construction Stormwater Management (PCSM) Section 102.8, requirements for runoff volume and peak rate.

4.4.1 Volume Control

A stormwater infiltration basin is utilized to provide storage and infiltration to prevent any increases in stormwater runoff volume, up to and including the 2-year/24-hour storm event using the prescribed land use characteristics, thus it meets the PADEP requirements.

The project is subject to volume controls using the first is the Design Storm Method that requires for storms up to the 2-year storm there be no increase in runoff volume as a result of this project. Because there is no other mechanism such as irrigation or rainwater harvesting, for releasing the required retention volume, infiltration capacity of infiltration basin will be employed to remove the required runoff volume.

This was accomplished by providing the required volume below the low outlet of the basins' outlet control structure, as shown in Table 10. Basin Drain time is shown in Table 11.

The low orifice in the infiltration basins was places above the invert, providing the required infiltration volume. Additional volume is infiltration within the existing infiltration basin. As such, regulatory volume control requirements are met. The required volume was achieved as follows:

Table 10: Volume Summary

Recurrence Interval (yrs)	Existing Volume (cf)	Proposed Unmitigated Volume from Model (cf)	Difference between Proposed and Existing (cf)	Proposed Basins Infiltration Capacity (cf)	Adequate Infiltration Volume? (Y/N)
1-Year	77,951	144,981	67,030	97,774	Yes
2-year	111,794	187,256	75,463	97,774	Yes

Table 11: Basin Drain Time

Basin ID	Basin Infiltration Depth (ft)	Design Infiltration Rate (in/hr)	Drain Time (hrs)	Allowable Drain Time (hrs)	Drain Time less than allowable
North	1.0	0.41	16.48	72	Yes
South	2.0	0.53	23.05	72	Yes

4.4.2 Peak Flow Control

A stormwater infiltration basin is utilized to provide storage attenuation to prevent any increases in the rate of stormwater runoff, thus it meets the PADEP requirements. The model indicates that the basin will result in a peak runoff rate under the 2, 10, 50, and 100 year/24-hour storm events that does not exceed preconstruction rates.

As previously noted the project does not have Watershed Stormwater Management Plan and the post-development peak runoff rate must be a maximum of 100% of the pre-development peak runoff rate. This was accomplished by setting the controls on the infiltration basin to control the release rate. The attenuated flows are summarized in Table 12.

Table 12: Peak Flows Summary

Recurrence Interval (yrs)	Existing Peak Flow (cfs)	Maximum Allowable Proposed Peak Flow (cfs)	Proposed Peak Q (cfs)	Proposed Less than Allowable? (Y/N)
1	70.98	70.98	68.32	Yes
2	101.28	101.28	94.15	Yes
5	148.20	148.20	133.11	Yes
10	192.53	192.53	170.35	Yes
25	266.52	266.52	234	Yes
50	337.20	337.20	286.33	Yes
100	422.56	422.56	347.99	Yes

4.4.3 Water Quality

Soil classifications were obtained from the USDA Web Soil Survey to estimate if there would be adequate infiltration. The water quality requirements were met through basin infiltration of a minimum of 0.5" of runoff from the impervious area, equivalent to 17,796 cf. This was accomplished by providing the required volume below the low outlet of the basin's outlet control structure. Compliance with water quality requirements is demonstrated using BMP Worksheet 10 in Appendix C.

BMPs utilized to comply with water quality requirements:

- 5.6.1 Minimize Total Disturbed Area. The site layout has been designed to minimize the area of disturbance and provide safe operations.
- 5.6.3 - Re-Vegetate / Re-Forest Disturbed Area. The disturbed non-graveled land will be re-vegetated with native species to transition into meadow.
- 6.7.2 Landscape Restoration, Disturbed area outside the proposed gravel pad and access drive will be replanted with native vegetation.
- 6.7.3 Soil Amendment and Restoration. The characteristic soil affected by compaction will be restored by ripping and addition of amendments such as compost or other material.

4.4.4 Swale and Pipe Design

The riprap and vegetated swales were designed based on the requirements set out in the PADEP Erosion and Sediment Pollution Control Manual. Sizing Calculations are provided in Appendix B.

Runoff coefficients were calculated for each inlet and swale drainage area based on the underlying land cover (proposed conditions) and the hydrologic soil groups. Note that DIV_SWALE and SWALE 12 receive offsite runoff from areas that are zoned as "H-C Highway Commercial" and "L-I Light Industrial" per latest Township zoning maps. Because the capacity of the conveyance system must be evaluated for “full buildout” conditions, the runoff coefficients for DIV_SWALE and SWALE 12 were calculated taking the future conditions into account.

5 Offsite Discharge Analysis

Attenuated peak flows from the subsurface basin are routed to the existing stream (existing receiving water) that runs to the south of the property as shown in the Off-site Stormwater Discharge Plan (see Appendix J). The point of discharge from the site has been designed to be stable so as not to impact offsite areas, see riprap apron and stilling basin design calculations in Appendix B. There are no additional off-site downstream stormwater discharge points or pathways that would require legal permissions, as no downstream landowners are affected by discharge of runoff from the infiltration trenches, downstream erosion is not expected, and no other properties are impacted.

Kidder Compressor Site discharges directly to the receiving water (existing stream) and does not have any additional offsite discharge points. As such, no downstream properties are affected by the proposed work and there is no downstream erosion. Proper construction and maintenance requirements are in place to support continued performance of BMPs. The overall peak flow and runoff volume has been reduced while maintaining the overall existing drainage patterns, thus fulfilling PADEP off-site discharge requirements.

6 Conclusion

As demonstrated in the sections above, the design of the proposed stormwater BMPs for the Kidder Compressor Station site for the PennEast pipeline allow the proposed project to comply with the applicable regulatory requirements under Pennsylvania Code Section 102.8.

Appendices

A. Rainfall Data

NOAA Atlas 14, Volume 2, Version 3
Location name: Kidder Twp, Pennsylvania, USA*
Latitude: 41.0816°, Longitude: -75.6658°
Elevation: 1744.44 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.330 (0.296-0.367)	0.394 (0.355-0.440)	0.474 (0.425-0.529)	0.541 (0.484-0.603)	0.632 (0.560-0.704)	0.713 (0.626-0.796)	0.800 (0.696-0.894)	0.897 (0.771-1.00)	1.05 (0.886-1.18)	1.18 (0.980-1.34)
10-min	0.515 (0.462-0.572)	0.617 (0.555-0.689)	0.741 (0.664-0.827)	0.841 (0.752-0.936)	0.977 (0.865-1.09)	1.09 (0.958-1.22)	1.22 (1.06-1.36)	1.35 (1.16-1.52)	1.56 (1.32-1.76)	1.74 (1.44-1.97)
15-min	0.633 (0.568-0.703)	0.759 (0.683-0.848)	0.915 (0.819-1.02)	1.04 (0.930-1.16)	1.21 (1.07-1.35)	1.36 (1.19-1.51)	1.51 (1.32-1.69)	1.69 (1.45-1.90)	1.95 (1.65-2.20)	2.18 (1.81-2.47)
30-min	0.844 (0.757-0.938)	1.02 (0.919-1.14)	1.26 (1.13-1.41)	1.46 (1.30-1.62)	1.73 (1.53-1.92)	1.96 (1.72-2.19)	2.21 (1.93-2.47)	2.50 (2.15-2.80)	2.93 (2.48-3.31)	3.31 (2.75-3.76)
60-min	1.03 (0.928-1.15)	1.26 (1.13-1.41)	1.59 (1.43-1.77)	1.86 (1.66-2.07)	2.25 (1.99-2.51)	2.59 (2.28-2.90)	2.98 (2.59-3.33)	3.41 (2.93-3.82)	4.08 (3.45-4.61)	4.68 (3.89-5.32)
2-hr	1.24 (1.12-1.39)	1.51 (1.36-1.69)	1.90 (1.71-2.14)	2.24 (2.01-2.52)	2.77 (2.46-3.11)	3.25 (2.87-3.65)	3.83 (3.34-4.30)	4.50 (3.88-5.06)	5.58 (4.74-6.33)	6.59 (5.50-7.53)
3-hr	1.36 (1.23-1.52)	1.65 (1.49-1.83)	2.06 (1.85-2.29)	2.41 (2.16-2.67)	2.96 (2.64-3.29)	3.48 (3.07-3.86)	4.08 (3.56-4.54)	4.79 (4.13-5.34)	5.94 (5.03-6.67)	7.01 (5.83-7.92)
6-hr	1.75 (1.57-1.97)	2.10 (1.89-2.35)	2.58 (2.32-2.90)	3.01 (2.69-3.38)	3.70 (3.28-4.14)	4.34 (3.81-4.86)	5.10 (4.43-5.72)	6.01 (5.15-6.76)	7.49 (6.30-8.49)	8.88 (7.34-10.1)
12-hr	2.18 (1.95-2.47)	2.62 (2.35-2.96)	3.24 (2.90-3.66)	3.80 (3.38-4.29)	4.69 (4.13-5.30)	5.53 (4.82-6.25)	6.53 (5.63-7.38)	7.73 (6.57-8.76)	9.69 (8.08-11.0)	11.5 (9.44-13.2)
24-hr	2.64 (2.40-2.97)	3.17 (2.88-3.57)	3.94 (3.57-4.43)	4.62 (4.17-5.18)	5.71 (5.11-6.37)	6.73 (5.97-7.46)	7.95 (6.99-8.77)	9.40 (8.19-10.3)	11.8 (10.1-12.9)	14.0 (11.9-15.2)
2-day	3.10 (2.81-3.46)	3.72 (3.38-4.16)	4.60 (4.17-5.15)	5.39 (4.87-6.01)	6.65 (5.96-7.39)	7.83 (6.96-8.66)	9.24 (8.14-10.2)	10.9 (9.52-12.0)	13.7 (11.8-14.9)	16.3 (13.8-17.7)
3-day	3.28 (2.99-3.66)	3.93 (3.58-4.39)	4.84 (4.40-5.41)	5.64 (5.12-6.29)	6.93 (6.24-7.69)	8.14 (7.27-8.99)	9.56 (8.47-10.5)	11.3 (9.88-12.3)	14.1 (12.1-15.3)	16.7 (14.2-18.1)
4-day	3.46 (3.16-3.86)	4.14 (3.78-4.62)	5.08 (4.63-5.67)	5.90 (5.37-6.57)	7.22 (6.53-7.99)	8.44 (7.58-9.31)	9.88 (8.80-10.9)	11.6 (10.2-12.7)	14.4 (12.5-15.7)	17.0 (14.6-18.6)
7-day	4.12 (3.77-4.56)	4.91 (4.49-5.45)	5.98 (5.46-6.63)	6.92 (6.29-7.65)	8.40 (7.59-9.25)	9.76 (8.76-10.7)	11.3 (10.1-12.4)	13.2 (11.7-14.4)	16.2 (14.1-17.7)	19.0 (16.3-20.6)
10-day	4.77 (4.38-5.26)	5.67 (5.20-6.25)	6.83 (6.25-7.52)	7.83 (7.14-8.61)	9.38 (8.52-10.3)	10.8 (9.74-11.8)	12.4 (11.1-13.5)	14.3 (12.7-15.6)	17.2 (15.2-18.8)	19.9 (17.3-21.6)
20-day	6.44 (5.99-7.03)	7.60 (7.05-8.28)	8.90 (8.24-9.68)	10.0 (9.25-10.9)	11.7 (10.8-12.7)	13.2 (12.1-14.3)	14.8 (13.5-16.0)	16.7 (15.2-18.1)	19.6 (17.7-21.2)	22.2 (19.8-23.9)
30-day	8.04 (7.54-8.65)	9.44 (8.84-10.1)	10.9 (10.2-11.7)	12.1 (11.3-13.0)	13.9 (12.9-14.9)	15.5 (14.3-16.5)	17.2 (15.9-18.3)	19.1 (17.6-20.4)	22.0 (20.1-23.5)	24.5 (22.2-26.2)
45-day	10.2 (9.60-10.8)	11.9 (11.2-12.6)	13.4 (12.7-14.3)	14.8 (13.9-15.7)	16.7 (15.7-17.8)	18.4 (17.2-19.5)	20.2 (18.8-21.4)	22.1 (20.6-23.5)	25.0 (23.2-26.6)	27.5 (25.3-29.2)
60-day	12.3 (11.6-13.0)	14.3 (13.5-15.1)	16.0 (15.2-17.0)	17.5 (16.6-18.6)	19.7 (18.6-20.8)	21.6 (20.3-22.8)	23.6 (22.1-24.9)	25.7 (24.1-27.2)	28.9 (26.9-30.5)	31.6 (29.2-33.4)

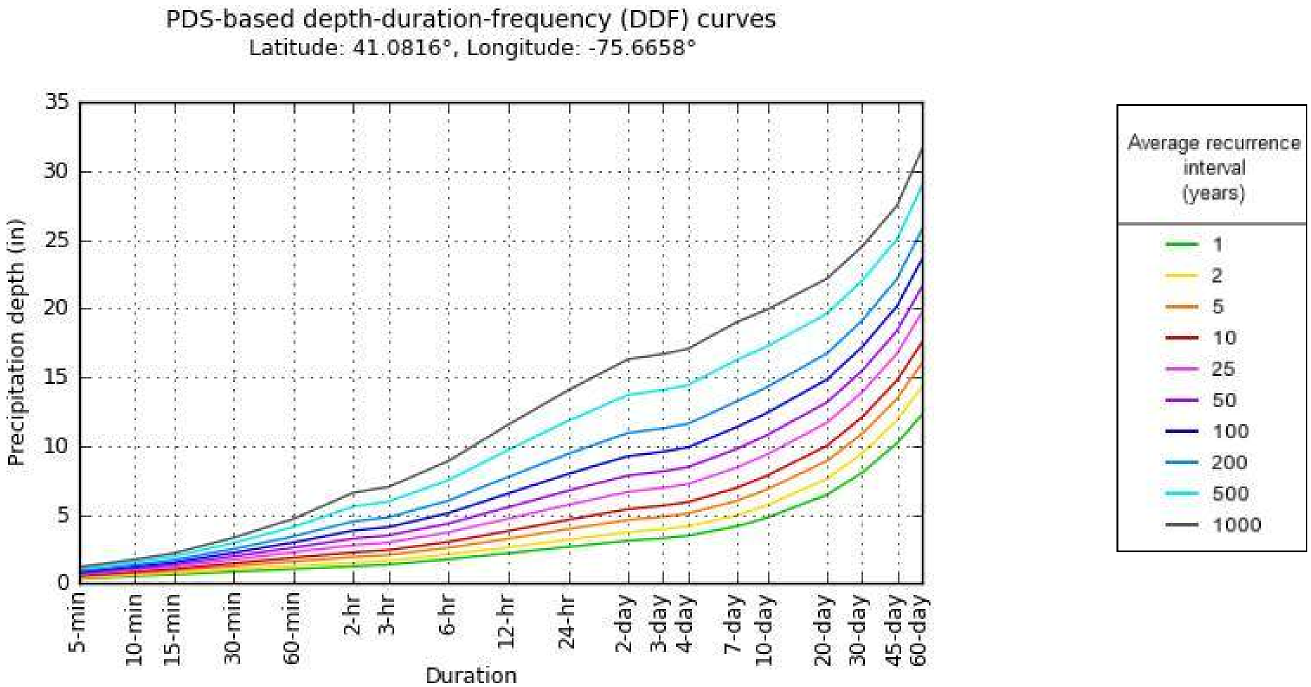
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

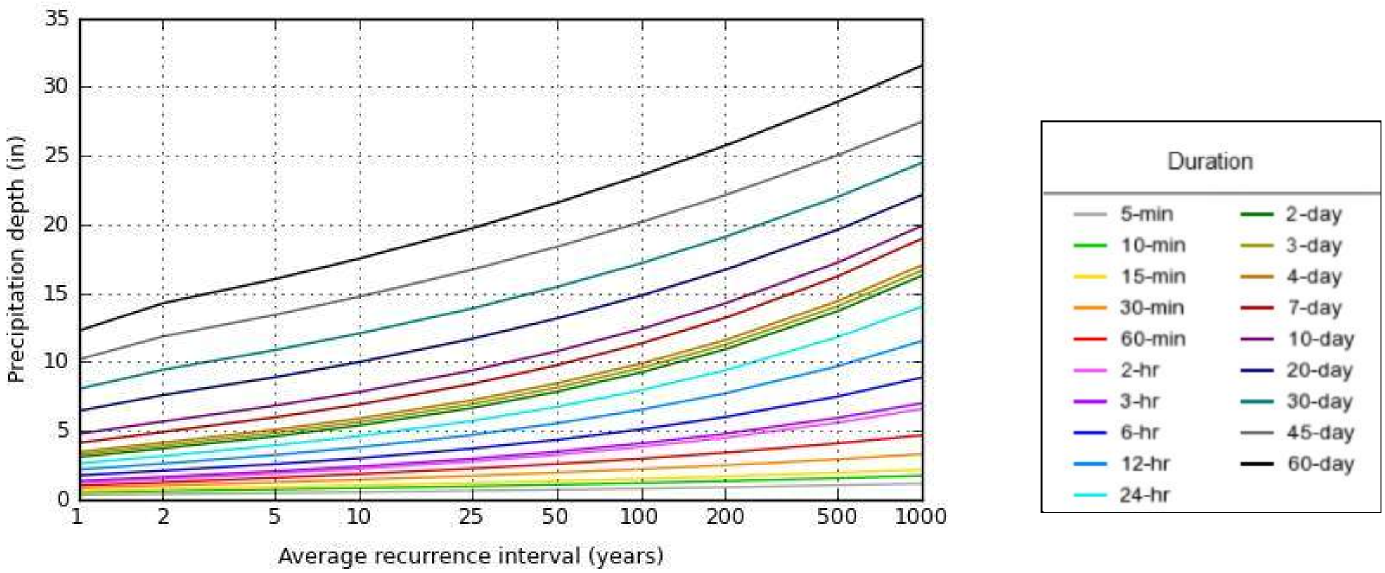
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



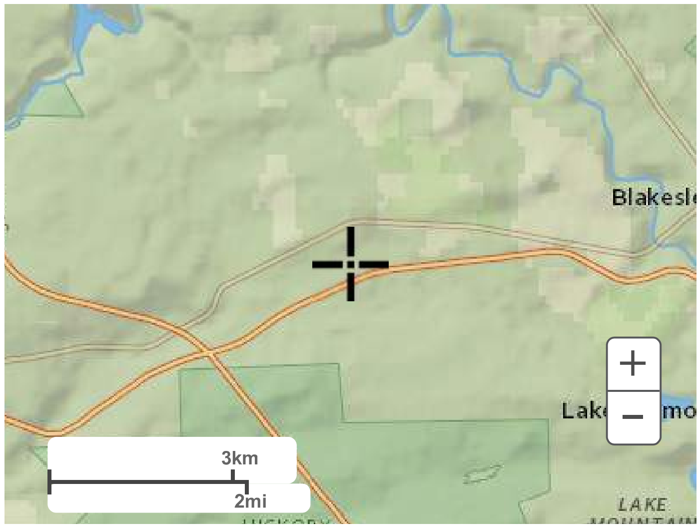


NOAA Atlas 14, Volume 2, Version 3 Created (GMT): Tue Feb 28 17:25:38 2017

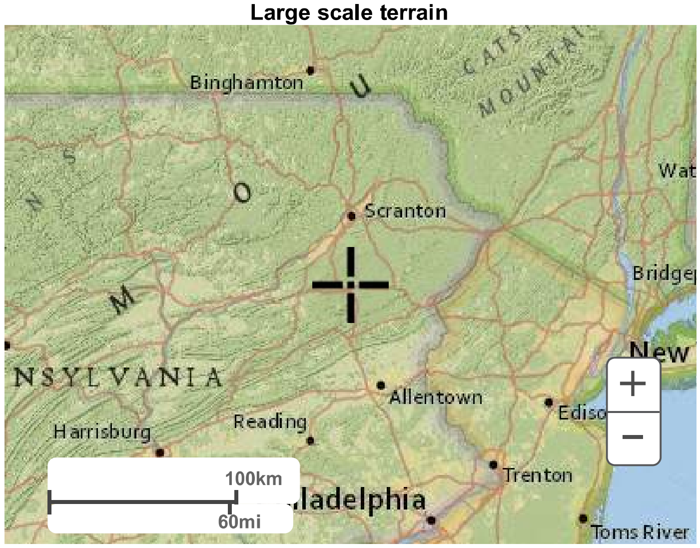
Back to Top

Maps & aerials

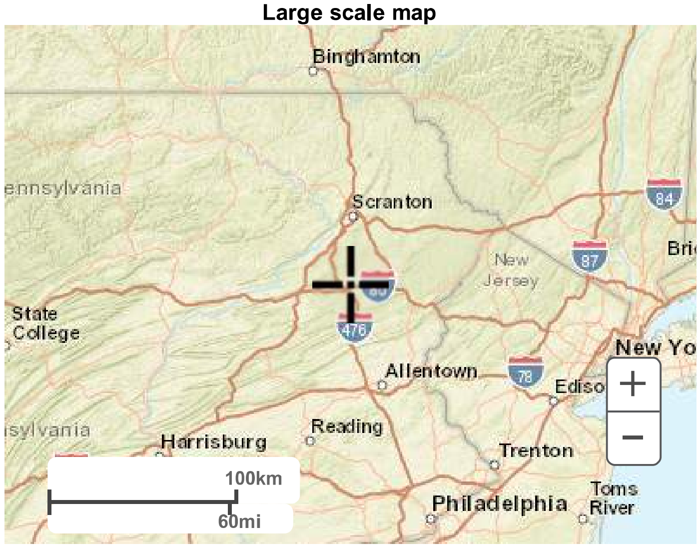
Small scale terrain



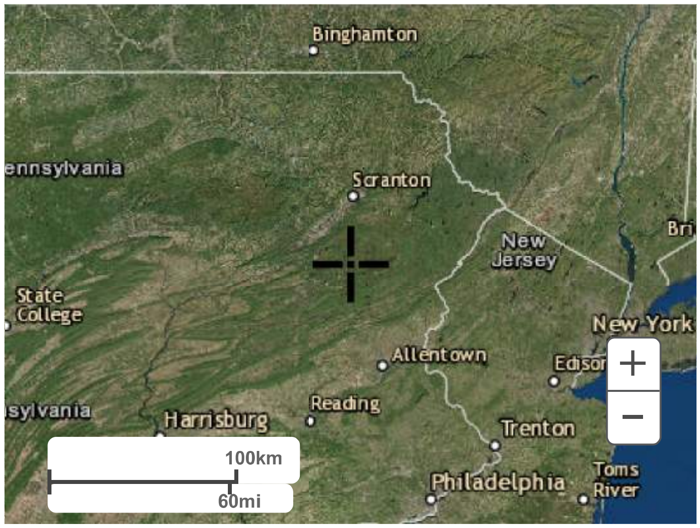
Large scale terrain



Large scale map



Large scale aerial



Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

B. Calculation Sheet

DIV_SWALE-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.4
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.17
Land slope, %	2.67
Sheet flow time, min	**26.60**
SHALLOW CONC. FLOW	
Flow length, ft	1225.88
Watercourse slope, %	4.00
Surface Description	unpaved
Velocity, ft/s	3.23
Sh. Conc. Flow time, min	**6.33**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	1
channel flow depth, ft	3.00
Channel flow length, ft	434.72
channel bed slope, %	0.69
Mannings N	0.024
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	0
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.007
top width at flow depth, ft	19.00
top width including freeboard, ft	19.00
wetted area, sq. ft	30.00
wetted peri, ft	19.97
hyd. Radius, ft	1.50
velocity, ft/s	6.76
Discharge, cfs	202.92
Theta, rad	0.01
Froudes Number	0.69
Flow Type	**subcritical**
Channel flow time, mins	**1.07**
TIME OF CONC., mins	**34.00**

SWALE 1/ IN#2-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.02
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.17
Land slope, %	2.00
Sheet flow time, min	**2.72**
SHALLOW CONC. FLOW	
Flow length, ft	69
Watercourse slope, %	0.58
Surface Description	unpaved
Velocity, ft/s	1.23
Sh. Conc. Flow time, min	**0.94**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	6
channel flow depth, ft	2.00
Channel flow length, ft	483.35
channel bed slope, %	2.00
Mannings N	0.03
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	1.04
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.020
top width at flow depth, ft	18.00
top width including freeboard, ft	24.24
wetted area, sq. ft	24.00
wetted peri, ft	18.65
hyd. Radius, ft	1.29
velocity, ft/s	8.31
Discharge, cfs	199.45
Theta, rad	0.02
Froudes Number	1.04
Flow Type	**supercritical**
Channel flow time, mins	**0.97**
TIME OF CONC., mins	**4.62**

SWALE 2/ IN#1-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.011
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.17
Land slope, %	1.20
Sheet flow time, min	**2.07**
SHALLOW CONC. FLOW	
Flow length, ft	311
Watercourse slope, %	2.12
Surface Description	paved
Velocity, ft/s	2.96
Sh. Conc. Flow time, min	**1.75**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	3
channel flow depth, ft	2.00
Channel flow length, ft	560.00
channel bed slope, %	2.00
Mannings N	0.03
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	1.02
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.020
top width at flow depth, ft	15.00
top width including freeboard, ft	21.12
wetted area, sq. ft	18.00
wetted peri, ft	15.65
hyd. Radius, ft	1.15
velocity, ft/s	7.71
Discharge, cfs	138.80
Theta, rad	0.02
Froudes Number	0.96
Flow Type	**subcritical**
Channel flow time, mins	**1.21**
TIME OF CONC., mins	**5.03**

SWALE 3/ IN#3-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.02
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.17
Land slope, %	1.65
Sheet flow time, min	**2.93**
SHALLOW CONC. FLOW	
Flow length, ft	34.57
Watercourse slope, %	15.97
Surface Description	unpaved
Velocity, ft/s	6.45
Sh. Conc. Flow time, min	**0.09**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	4
channel flow depth, ft	1.00
Channel flow length, ft	283.78
channel bed slope, %	3.47
Mannings N	0.03
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	1.04
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.035
top width at flow depth, ft	10.00
top width including freeboard, ft	16.24
wetted area, sq. ft	7.00
wetted peri, ft	10.32
hyd. Radius, ft	0.68
velocity, ft/s	7.14
Discharge, cfs	49.98
Theta, rad	0.03
Froudes Number	1.26
Flow Type	**supercritical**
Channel flow time, mins	**0.66**
TIME OF CONC., mins	**3.68**

SWALE 4/ IN#8-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.02
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.17
Land slope, %	1.33
Sheet flow time, min	**3.19**
SHALLOW CONC. FLOW	
Flow length, ft	328
Watercourse slope, %	1.46
Surface Description	paved
Velocity, ft/s	2.46
Sh. Conc. Flow time, min	**2.22**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	8
channel flow depth, ft	1.00
Channel flow length, ft	11.00
channel bed slope, %	2.00
Mannings N	0.03
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	1.04
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.020
top width at flow depth, ft	14.00
top width including freeboard, ft	20.24
wetted area, sq. ft	11.00
wetted peri, ft	14.32
hyd. Radius, ft	0.77
velocity, ft/s	5.89
Discharge, cfs	64.79
Theta, rad	0.02
Froudes Number	1.04
Flow Type	**supercritical**
Channel flow time, mins	**0.03**
TIME OF CONC., mins	**5.45**

SWALE 5/ IN#11-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.15
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.17
Land slope, %	1.33
Sheet flow time, min	**16.01**
SHALLOW CONC. FLOW	
Flow length, ft	296.35
Watercourse slope, %	3.21
Surface Description	unpaved
Velocity, ft/s	2.89
Sh. Conc. Flow time, min	**1.71**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	4
channel flow depth, ft	2.00
Channel flow length, ft	0.00
channel bed slope, %	#DIV/0!
Mannings N	0.024
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	0
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	#DIV/0!
top width at flow depth, ft	16.00
top width including freeboard, ft	16.00
wetted area, sq. ft	20.00
wetted peri, ft	16.65
hyd. Radius, ft	1.20
velocity, ft/s	#DIV/0!
Discharge, cfs	#DIV/0!
Theta, rad	#DIV/0!
Froudes Number	#DIV/0!
Flow Type	**#DIV/0!**
Channel flow time, mins	**#DIV/0!**
TIME OF CONC., mins	**17.72**

SWALE 7-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.05
Flow length, ft	77.63
2-Yr 24-Hr rainfall, in	3.17
Land slope, %	1.29
Sheet flow time, min	**3.98**
SHALLOW CONC. FLOW	
Flow length, ft	34.86
Watercourse slope, %	30.12
Surface Description	unpaved
Velocity, ft/s	8.85
Sh. Conc. Flow time, min	**0.07**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	4
channel flow depth, ft	2.00
Channel flow length, ft	297.21
channel bed slope, %	0.50
Mannings N	0.024
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	0
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.005
top width at flow depth, ft	16.00
top width including freeboard, ft	16.00
wetted area, sq. ft	20.00
wetted peri, ft	16.65
hyd. Radius, ft	1.20
velocity, ft/s	4.98
Discharge, cfs	99.68
Theta, rad	0.01
Froudes Number	0.62
Flow Type	**subcritical**
Channel flow time, mins	**0.99**
TIME OF CONC., mins	**5.04**

SWALE 7-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.4
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.17
Land slope, %	0.67
Sheet flow time, min	**46.31**
SHALLOW CONC. FLOW	
Flow length, ft	601.74
Watercourse slope, %	1.74
Surface Description	unpaved
Velocity, ft/s	2.13
Sh. Conc. Flow time, min	**4.71**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	4
channel flow depth, ft	2.00
Channel flow length, ft	297.21
channel bed slope, %	0.50
Mannings N	0.024
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	0
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.005
top width at flow depth, ft	16.00
top width including freeboard, ft	16.00
wetted area, sq. ft	20.00
wetted peri, ft	16.65
hyd. Radius, ft	1.20
velocity, ft/s	4.98
Discharge, cfs	99.68
Theta, rad	0.01
Froudes Number	0.62
Flow Type	**subcritical**
Channel flow time, mins	**0.99**
TIME OF CONC., mins	**52.01**

SWALE 8/ IN#9 -Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.05
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.17
Land slope, %	1.33
Sheet flow time, min	**6.65**
SHALLOW CONC. FLOW	
Flow length, ft	32.77
Watercourse slope, %	42.77
Surface Description	unpaved
Velocity, ft/s	10.55
Sh. Conc. Flow time, min	**0.05**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	2
channel flow depth, ft	1.00
Channel flow length, ft	212.17
channel bed slope, %	1.89
Mannings N	0.024
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	0
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.019
top width at flow depth, ft	8.00
top width including freeboard, ft	8.00
wetted area, sq. ft	5.00
wetted peri, ft	8.32
hyd. Radius, ft	0.60
velocity, ft/s	6.07
Discharge, cfs	30.34
Theta, rad	0.02
Froudes Number	1.07
Flow Type	**supercritical**
Channel flow time, mins	**0.58**
TIME OF CONC., mins	**7.28**

SWALE 9-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.15
Flow length, ft	10.13
2-Yr 24-Hr rainfall, in	3.17
Land slope, %	9.87
Sheet flow time, min	**0.83**
SHALLOW CONC. FLOW	
Flow length, ft	0
Watercourse slope, %	#DIV/0!
Surface Description	unpaved
Velocity, ft/s	#DIV/0!
Sh. Conc. Flow time, min	**#DIV/0!**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	8
channel flow depth, ft	0.48
Channel flow length, ft	679.80
channel bed slope, %	0.70
Mannings N	0.03
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	1.04
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.007
top width at flow depth, ft	10.88
top width including freeboard, ft	17.12
wetted area, sq. ft	4.53
wetted peri, ft	11.04
hyd. Radius, ft	0.41
velocity, ft/s	2.30
Discharge, cfs	10.40
Theta, rad	0.01
Froudes Number	0.58
Flow Type	**subcritical**
Channel flow time, mins	**4.94**
TIME OF CONC., mins	**5.77**

SWALE 10-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.02
Flow length, ft	7.59
2-Yr 24-Hr rainfall, in	3.18
Land slope, %	28.33
Sheet flow time, min	**0.09**
SHALLOW CONC. FLOW	
Flow length, ft	0.01
Watercourse slope, %	19500.00
Surface Description	unpaved
Velocity, ft/s	225.31
Sh. Conc. Flow time, min	**0.00**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	5
channel flow depth, ft	0.96
Channel flow length, ft	463.42
channel bed slope, %	0.45
Mannings N	0.03
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	1.04
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.005
top width at flow depth, ft	10.76
top width including freeboard, ft	17.00
wetted area, sq. ft	7.56
wetted peri, ft	11.07
hyd. Radius, ft	0.68
velocity, ft/s	2.59
Discharge, cfs	19.62
Theta, rad	0.00
Froudes Number	0.47
Flow Type	**subcritical**
Channel flow time, mins	**2.98**
TIME OF CONC., mins	**3.06**

SWALE 11-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.02
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.18
Land slope, %	1.43
Sheet flow time, min	**3.10**
SHALLOW CONC. FLOW	
Flow length, ft	109
Watercourse slope, %	1.79
Surface Description	unpaved
Velocity, ft/s	2.16
Sh. Conc. Flow time, min	**0.84**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	5
channel flow depth, ft	0.96
Channel flow length, ft	119.00
channel bed slope, %	1.76
Mannings N	0.03
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	1.04
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.018
top width at flow depth, ft	10.76
top width including freeboard, ft	17.00
wetted area, sq. ft	7.56
wetted peri, ft	11.07
hyd. Radius, ft	0.68
velocity, ft/s	5.12
Discharge, cfs	38.72
Theta, rad	0.02
Froudes Number	0.92
Flow Type	**subcritical**
Channel flow time, mins	**0.39**
TIME OF CONC., mins	**4.33**

SWALE 12-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.011
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.17
Land slope, %	4.67
Sheet flow time, min	**1.20**
SHALLOW CONC. FLOW	
Flow length, ft	139.43
Watercourse slope, %	2.15
Surface Description	unpaved
Velocity, ft/s	2.37
Sh. Conc. Flow time, min	**0.98**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	2
channel flow depth, ft	2.00
Channel flow length, ft	1130.21
channel bed slope, %	3.27
Mannings N	0.03
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	1.04
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.033
top width at flow depth, ft	14.00
top width including freeboard, ft	20.24
wetted area, sq. ft	16.00
wetted peri, ft	14.65
hyd. Radius, ft	1.09
velocity, ft/s	9.53
Discharge, cfs	152.49
Theta, rad	0.03
Froudes Number	1.19
Flow Type	**supercritical**
Channel flow time, mins	**1.98**
TIME OF CONC., mins	**4.16**

IN#4-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.011
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.17
Land slope, %	1.47
Sheet flow time, min	**1.91**
SHALLOW CONC. FLOW	
Flow length, ft	58.44
Watercourse slope, %	2.57
Surface Description	paved
Velocity, ft/s	3.26
Sh. Conc. Flow time, min	**0.30**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	2
channel flow depth, ft	1.00
Channel flow length, ft	89.30
channel bed slope, %	0.56
Mannings N	0.03
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	1.04
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.006
top width at flow depth, ft	8.00
top width including freeboard, ft	14.24
wetted area, sq. ft	5.00
wetted peri, ft	8.32
hyd. Radius, ft	0.60
velocity, ft/s	2.65
Discharge, cfs	13.23
Theta, rad	0.01
Froudes Number	0.47
Flow Type	**subcritical**
Channel flow time, mins	**0.56**
TIME OF CONC., mins	**2.77**

IN#5-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.011
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.18
Land slope, %	1.43
Sheet flow time, min	**1.92**
SHALLOW CONC. FLOW	
Flow length, ft	108
Watercourse slope, %	1.67
Surface Description	paved
Velocity, ft/s	2.62
Sh. Conc. Flow time, min	**0.69**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	5
channel flow depth, ft	0.96
Channel flow length, ft	78.00
channel bed slope, %	0.45
Mannings N	0.03
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	1.04
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.004
top width at flow depth, ft	10.76
top width including freeboard, ft	17.00
wetted area, sq. ft	7.56
wetted peri, ft	11.07
hyd. Radius, ft	0.68
velocity, ft/s	2.58
Discharge, cfs	19.52
Theta, rad	0.00
Froudes Number	0.46
Flow Type	**subcritical**
Channel flow time, mins	**0.50**
TIME OF CONC., mins	**3.11**

IN#6-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.02
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.18
Land slope, %	1.43
Sheet flow time, min	**3.10**
SHALLOW CONC. FLOW	
Flow length, ft	109
Watercourse slope, %	1.79
Surface Description	unpaved
Velocity, ft/s	2.16
Sh. Conc. Flow time, min	**0.84**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	5
channel flow depth, ft	0.96
Channel flow length, ft	119.00
channel bed slope, %	1.76
Mannings N	0.03
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	1.04
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.018
top width at flow depth, ft	10.76
top width including freeboard, ft	17.00
wetted area, sq. ft	7.56
wetted peri, ft	11.07
hyd. Radius, ft	0.68
velocity, ft/s	5.12
Discharge, cfs	38.72
Theta, rad	0.02
Froudes Number	0.92
Flow Type	**subcritical**
Channel flow time, mins	**0.39**
TIME OF CONC., mins	**4.33**

IN#7-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.02
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.18
Land slope, %	2.00
Sheet flow time, min	**2.71**
SHALLOW CONC. FLOW	
Flow length, ft	125
Watercourse slope, %	1.60
Surface Description	unpaved
Velocity, ft/s	2.04
Sh. Conc. Flow time, min	**1.02**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	5
channel flow depth, ft	0.96
Channel flow length, ft	65.00
channel bed slope, %	0.38
Mannings N	0.03
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	1.04
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.004
top width at flow depth, ft	10.76
top width including freeboard, ft	17.00
wetted area, sq. ft	7.56
wetted peri, ft	11.07
hyd. Radius, ft	0.68
velocity, ft/s	2.39
Discharge, cfs	18.08
Theta, rad	0.00
Froudes Number	0.43
Flow Type	**subcritical**
Channel flow time, mins	**0.45**
TIME OF CONC., mins	**4.19**

IN#10-Tc CALCULATIONS

SHEET FLOW	
Manning's n	0.02
Flow length, ft	150
2-Yr 24-Hr rainfall, in	3.18
Land slope, %	2.00
Sheet flow time, min	**2.71**
SHALLOW CONC. FLOW	
Flow length, ft	125
Watercourse slope, %	1.60
Surface Description	unpaved
Velocity, ft/s	2.04
Sh. Conc. Flow time, min	**1.02**
CHANNEL FLOW	
Left side slope, %	33.3333
Right side slope, %	33.3333
bottom width, ft	5
channel flow depth, ft	0.96
Channel flow length, ft	65.00
channel bed slope, %	0.38
Mannings N	0.03
Accn. Due to gravity, ft/sec2	32.2
Freeboard, ft	1.04
H:V, left	3.00
H:V, right	3.00
bed slope, ft/ft	0.004
top width at flow depth, ft	10.76
top width including freeboard, ft	17.00
wetted area, sq. ft	7.56
wetted peri, ft	11.07
hyd. Radius, ft	0.68
velocity, ft/s	2.39
Discharge, cfs	18.08
Theta, rad	0.00
Froudes Number	0.43
Flow Type	**subcritical**
Channel flow time, mins	**0.45**
TIME OF CONC., mins	**4.19**

Figure 2.10.4.2(E)
Storm Intensity - Duration - Frequency
Curves for Region 5

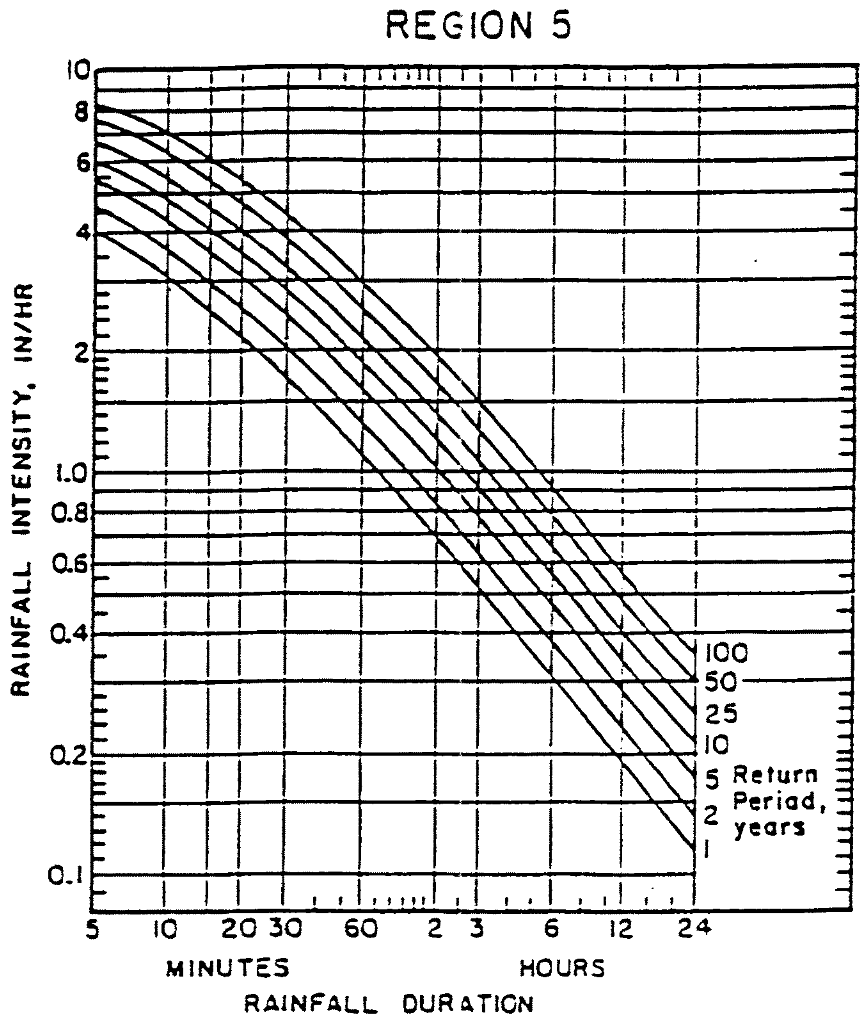


Table B-3
Runoff Coefficients

		Hydrologic Soil Group			
Land Use Description		**A**	**B**	**C**	**D**
Cultivated land					
without conservation treatment		.49	.67	.81	.88
with conservation treatment		.27	.43	.61	.67
Pasture or range land					
poor condition		.38	.63	.78	.84
good condition		.14	.25	.51	.65
Wood or forest land					
thin stand, poor cover, no mulch		.17	.34	.59	.70
good cover		.13	.22	.45	.59
Open spaces, lawns, parks, golf courses, cemeteries					
good conditions: grass cover on 75% or more of the area		.14	.25	.51	.65
fair conditions: grass cover on 50% to 75% of the area		.20	.45	.63	.74
Commercial and business areas (85% impervious)		.84	.90	.93	.96
Industrial districts (72% impervious)		.67	.81	.88	.92
Residential					
Average Lot Size	**Average % Impervious**				
1/8 acre or less	65	.59	.76	.86	.90
1/4 acre	38	.45	.55	.70	.80
1/3 acre	30	.30	.49	.67	.78
1/2 acre	25	.22	.45	.63	.74
1 acre	20	.20	.41	.63	.74
Paved parking lots, roofs, driveways, etc.		.99	.99	.99	.99
Streets and roads:					
Paved with curbs and storm sewers		.99	.99	.99	.99
Gravel		.57	.76	.84	.88
Dirt		.49	.69	.80	.84

NOTE: Values are based on SCS definitions and are average values derived by an advisory committee for this Manual.

SOURCE: New Jersey Department of Environmental Protection, Division of Water Resources - "Technical Manual for Stream Encroachment," August, 1984.

Existing site conditions of bare earth or fallow shall be considered as meadow when choosing a C value.

Editor's Note: Table B-4, Manning roughness coefficients, is on file in the Township offices.

PENNEAST-KIDDER COMPRESSOR STATION
LAND USE/LAND COVER CONDITIONS RUNOFF COEFFICIENTS INDEX
RATIONAL METHOD

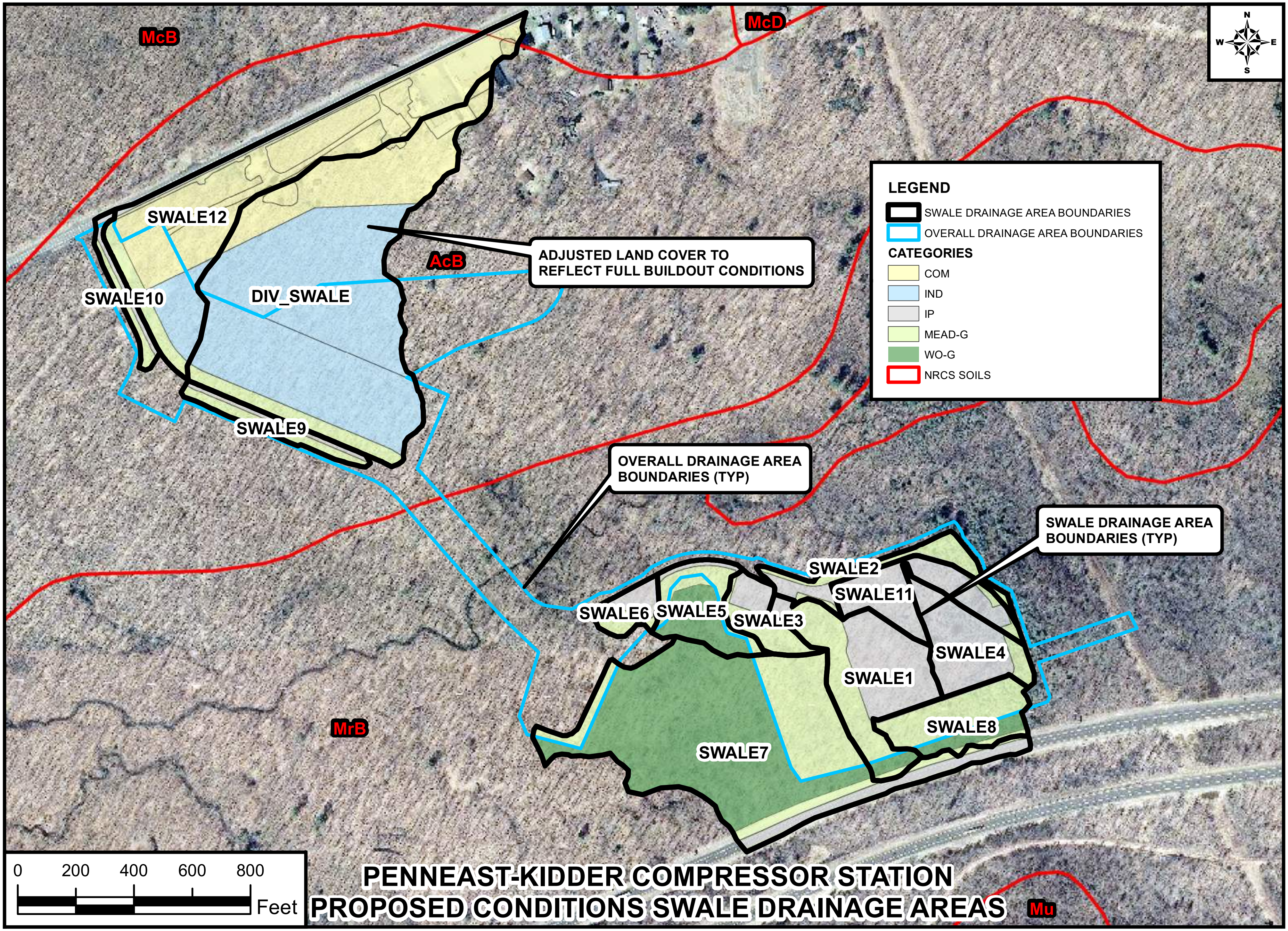
LU Index	Land Cover Description	LU Symbol	Hydrologic Soil Group (HSG)				KIDDER CODE APP. B TABLE B-3 CLASSIFICATION
			A	B	C	D	
1	WOODS-GOOD CONDITION	WO-G	0	0	0	0.59	WOOD OR FOREST LAND - GOOD CONDITION
2	MEADOW-GOOD CONDITION	MEAD-G	0.14	0.25	0.51	0.65	PASTURE - GOOD CONDITION
3	IMPERVIOUS	IP	0.99	0.99	0.99	0.99	STREETS AND ROADS: PAVED
4	OPEN SPACE-GOOD CONDITION (GRASS COVER >75%)	OS-G	0.14	0.25	0.51	0.65	OPEN SPACE GOOD CONDITION (LAWN, PARK, GOLF COURSE)
5	H-C HIGHWAY COMMERCIAL (PER ZONING MAP)	COM	0.84	0.9	0.93	0.96	COMMERCIAL (85% IMPERVIOUS)
6	L-I LIGHT INDUSTRIAL (PER ZONING MAP)	IND	0.67	0.81	0.88	0.92	INDUSTRIAL (72% IMPERVIOUS)
7	R-2 RESIDENTIAL MEDIUM DENSITY (PER ZONING MAP)	R2	0.22	0.45	0.63	0.74	RESIDENTIAL - 1/2 ACRE

PENNEAST-KIDDER COMPRESSOR STATION
EXISTING SOIL TYPES INDEX

Source: NRCS Web Soil Survey

Soil Symbol	Soil Description	HSG for Rational Method
AcB	Albrights very stony loam, 0 to 8 percent slopes	D
LkD	Leck kill very stony loam, 8 to 25 percent slopes	B
MbB2	Meckesville channery loam, 3 to 8 percent slopes, moderately eroded	C
McB	Meckesville very stony loam, 0 to 8 percent slopes	C
McD	Meckesville very stony loam, 8 to 25 percent slopes	C
MrB	Morris channery silt loam, 0 to 8 percent slopes, extremely stony	D
Mu	Muck and Peat	D
NvB	Norwich soils, 0 to 8 percent slopes, extremely stony	D
TuB	Tunkhannock gravelly loam, 3 to 8 percent slopes	A
TuC	Tunkhannock gravelly loam, 8 to 15 percent slopes	A
TuD	Tunkhannock gravelly loam, 15 to 25 percent slopes	A
W	Water	D

Notes:
1.NRCS HSG rating for AcB is C/D. A HSG of D used for calculation purposes.
2.NRCS HSG rating for Mu is A/D. A HSG of D used for calculation purposes.
3. A HSG rating of D used for Water.



PENNEAST-KIDDER COMPRESSOR STATION
PROPOSED CONDITIONS SWALE DRAINAGE AREAS

PENNEAST-KIDDER COMPRESSOR STATION									
PROPOSED CONDITIONS RUNOFF COEFFICIENT CALCULATIONS FOR PROPOSED SWALES									
ID	**DA**	**Cover**	**Soils**	**HSG**	**Area**	**Area (Acres)**	**C**	**CN*A**	**RC**
46	DIV_SWALE	COM	AcB	D	23251.413	0.534	0.96	0.512	0.96
48	DIV_SWALE	COM	AcB	D	129483.183	2.973	0.96	2.854	0.96
45	DIV_SWALE	IND	AcB	D	457745.707	10.508	0.92	9.668	0.92
47	DIV_SWALE	IP	AcB	D	3097.839	0.071	0.99	0.070	0.99
49	DIV_SWALE	MEAD-G	AcB	D	37441.162	0.860	0.65	0.559	0.65
	DIV_SWALE Total					**14.945**		**13.663**	**0.91**
13	SWALE1	IP	MrB	D	137.124	0.003	0.99	0.003	0.99
14	SWALE1	IP	MrB	D	83918.062	1.926	0.99	1.907	0.99
12	SWALE1	MEAD-G	MrB	D	2940.407	0.068	0.65	0.044	0.65
16	SWALE1	MEAD-G	MrB	D	69375.835	1.593	0.65	1.035	0.65
15	SWALE1	WO-G	MrB	D	8169.411	0.188	0.59	0.111	0.59
	SWALE1 Total					**3.777**		**3.100**	**0.82**
30	SWALE10	COM	AcB	D	403.792	0.009	0.96	0.009	0.96
31	SWALE10	IP	AcB	D	1690.943	0.039	0.99	0.038	0.99
32	SWALE10	IP	AcB	D	12176.616	0.280	0.99	0.277	0.99
33	SWALE10	MEAD-G	AcB	D	11105.278	0.255	0.65	0.166	0.65
	SWALE10 Total					**0.583**		**0.490**	**0.84**
17	SWALE11	IP	MrB	D	79941.979	1.835	0.99	1.817	0.99
18	SWALE11	MEAD-G	MrB	D	6409.719	0.147	0.65	0.096	0.65
	SWALE11 Total					**1.982**		**1.913**	**0.96**
35	SWALE12	COM	AcB	D	37886.895	0.870	0.96	0.835	0.96
36	SWALE12	COM	AcB	D	53797.814	1.235	0.96	1.186	0.96
38	SWALE12	COM	AcB	D	100314.797	2.303	0.96	2.211	0.96
43	SWALE12	COM	AcB	D	79366.053	1.822	0.96	1.749	0.96
50	SWALE12	COM	AcB	D	707.744	0.016	0.96	0.016	0.96
37	SWALE12	COM	McB	C	4938.127	0.113	0.93	0.105	0.93
42	SWALE12	COM	McB	C	382.895	0.009	0.93	0.008	0.93
34	SWALE12	IND	AcB	D	41348.951	0.949	0.92	0.873	0.92
40	SWALE12	IP	AcB	D	19751.828	0.453	0.99	0.449	0.99
41	SWALE12	IP	AcB	D	2360.037	0.054	0.99	0.054	0.99
39	SWALE12	IP	McB	C	2013.575	0.046	0.99	0.046	0.99
44	SWALE12	MEAD-G	AcB	D	26500.052	0.608	0.65	0.395	0.65
	SWALE12 Total					**8.480**		**7.927**	**0.93**
4	SWALE2	IP	MrB	D	17511.083	0.402	0.99	0.398	0.99
5	SWALE2	MEAD-G	MrB	D	33758.022	0.775	0.65	0.504	0.65
	SWALE2 Total					**1.177**		**0.902**	**0.77**
2	SWALE3	IP	MrB	D	10357.240	0.238	0.99	0.235	0.99
3	SWALE3	MEAD-G	MrB	D	33808.746	0.776	0.65	0.504	0.65
	SWALE3 Total					**1.014**		**0.740**	**0.73**
0	SWALE4	IP	MrB	D	79121.232	1.816	0.99	1.798	0.99
1	SWALE4	MEAD-G	MrB	D	10167.745	0.233	0.65	0.152	0.65
	SWALE4 Total					**2.050**		**1.950**	**0.95**
6	SWALE5	IP	MrB	D	7315.615	0.168	0.99	0.166	0.99
8	SWALE5	MEAD-G	MrB	D	27677.521	0.635	0.65	0.413	0.65
7	SWALE5	WO-G	MrB	D	42039.335	0.965	0.59	0.569	0.59

PENNEAST-KIDDER COMPRESSOR STATION									
PROPOSED CONDITIONS RUNOFF COEFFICIENT CALCULATIONS FOR PROPOSED SWALES									
ID	**DA**	**Cover**	**Soils**	**HSG**	**Area**	**Area (Acres)**	**C**	**CN*A**	**RC**
	SWALE5 Total					**1.768**		**1.149**	**0.65**
9	SWALE6	IP	MrB	D	17398.276	0.399	0.99	0.395	0.99
11	SWALE6	MEAD-G	MrB	D	11108.573	0.255	0.65	0.166	0.65
10	SWALE6	WO-G	MrB	D	71.358	0.002	0.59	0.001	0.59
	SWALE6 Total					**0.656**		**0.562**	**0.86**
21	SWALE7	IP	MrB	D	39472.060	0.906	0.99	0.897	0.99
19	SWALE7	MEAD-G	MrB	D	24346.769	0.559	0.65	0.363	0.65
20	SWALE7	MEAD-G	MrB	D	4092.896	0.094	0.65	0.061	0.65
23	SWALE7	MEAD-G	MrB	D	113986.806	2.617	0.65	1.701	0.65
22	SWALE7	WO-G	MrB	D	327314.174	7.514	0.59	4.433	0.59
	SWALE7 Total					**11.690**		**7.456**	**0.64**
25	SWALE8	IP	MrB	D	3832.513	0.088	0.99	0.087	0.99
24	SWALE8	MEAD-G	MrB	D	5067.017	0.116	0.65	0.076	0.65
27	SWALE8	MEAD-G	MrB	D	61265.835	1.406	0.65	0.914	0.65
26	SWALE8	WO-G	MrB	D	19785.088	0.454	0.59	0.268	0.59
	SWALE8 Total					**2.065**		**1.345**	**0.65**
28	SWALE9	IP	AcB	D	16253.591	0.373	0.99	0.369	0.99
29	SWALE9	MEAD-G	AcB	D	22173.531	0.509	0.65	0.331	0.65
	SWALE9 Total					**0.882**		**0.700**	**0.79**
	Grand Total					**51.069**		**41.895**	**0.82**

The "RC" value is an area averaged runoff coefficient value (arithmatic mean) calculated as:

$$RC=\frac{\sum_{i=1}^{n} C_i \ x \ Area_i}{\sum_{i=1}^{n} Area_i}$$

PENNEAST-KIDDER COMPRESSOR STATION
RATIONAL METHOD PEAK FLOW CALCULATIONS FOR PROPOSED SWALES

Return Period (Yrs) 100
Min. Time of Concentration (mins) 5 **(Unless otherwise noted below)**

DA	Area (Acres)	RC	Tc (mins)	Rainfall Intensity (in/hr)	Q (cfs)
DIV_SWALE	14.945	0.91	34.00	4.2	57.384
SWALE1	3.777	0.82	5.00	8.1	25.111
SWALE10	0.583	0.84	5.00	8.1	3.967
SWALE11	1.982	0.96	5.00	8.1	15.491
SWALE12	8.480	0.93	5.00	8.1	64.207
SWALE2	1.177	0.77	5.00	8.1	7.304
SWALE3	1.014	0.73	5.00	8.1	5.993
SWALE4	2.050	0.95	5.00	8.1	15.794
SWALE5	1.768	0.65	17.72	5.3	6.088
SWALE6	0.656	0.86	5.00	8.1	4.553
SWALE7	11.690	0.64	52.10	3.0	22.367
SWALE8	2.065	0.65	7.30	7.2	9.683
SWALE9	0.882	0.79	5.00	8.1	5.672

Note: Peak Flow calculations for SWALE12 account for full buildout conditions

TOTAL FLOW FOR SWALE1	ADD
SWALE1	25.111
SWALE8	9.683
TOTAL	**34.794**

TOTAL FLOW FOR SWALE2	ADD
SWALE2	7.304
SWALE4	15.794
SWALE11	15.491
TOTAL	**38.590**

TOTAL FLOW FOR DIV_SWALE	ADD
DIV_SWALE	57.384
SWALE12	64.207
TOTAL	**121.591**

Calculated based on full buildout conditions.
Note that this flow passes through the twin 48" cross culverts

PENNEAST-KIDDER COMPRESSOR STATION							
PROPOSED SWALE SCHEDULE							
SWALE #	**BOTTOM WIDTH (FT)**	**LEFT SIDE SLOPE (H:V)**	**RIGHT SIDE SLOPE (H:V)**	**DEPTH (FT)**	**LINING MATERIAL**	**D_{50} (IN)**	**PLACEMENT THICKNESS (IN)**
DIV_SWALE	6.0	2.5	2.0	4.0	R-3	3	9
SWALE1	6.0	3.0	3.0	2.0	TRM-435		
SWALE10	3.0	3.0	3.0	2.0	R-4	6	18
SWALE11	4.0	3.0	3.0	1.0	R-3	3	9
SWALE12	2.0	3.0	3.0	2.0	R-8	24	63
SWALE2	3.0	3.0	3.0	2.0	R-4	6	18
SWALE3	4.0	3.0	3.0	1.0	TRM-435		
SWALE4	8.0	3.0	3.0	1.0	TRM-435		
SWALE5	4.0	3.0	3.0	2.0	R-3	3	9
SWALE6	4.0	3.0	3.0	2.0	TRM-435		
SWALE7	4.0	3.0	3.0	2.0	R-4	6	18
SWALE8	2.0	3.0	3.0	1.0	R-3	3	9
SWALE9	3.0	3.0	3.0	2.0	TRM-435		

***Note: Refer to Site Plans for location of proposed swales**

PROJECT NAME:	**DIV_SWALE**	
LOCATION:	**KIDDER TOWNSHIP, CARBON COUNTY PA**	
PREPARED BY:	**DATE:**	**3/1/2017**
CHECKED BY:	**DATE:**	**3/1/2017**

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	121.59	**See attached Rational Peak Flow Calculations (Assumes Full Buildout)**
Left side slope, %	40.00	
Right side slope, %	50.00	
Bottom width, ft	6	
Channel Depth provided, ft	4	
Channel bed slope, %	0.25	
Mannings N	0.03	
Accn. Due to gravity, ft/sec2	32.2	
DESIGN METHOD FOR LINING - SHEAR STRESS		
CHECK FOR SHEAR STRESS		
H:V, left	2.50	
H:V, right	2.00	
bed slope, ft/ft	0.0025	
Calculated channel flow depth, ft	2.78	
top width at flow depth, ft	18.50	
Bottom Width:Flow Depth Ratio	2.16	**Ratio Ok**
wetted area, sq. ft	34.01	
wetted peri, ft	19.69	
hyd. Radius, ft	1.73	
velocity, ft/s	3.58	
Discharge, cfs	121.59	
Theta, rad	0.002	
Froudes Number	0.38	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	0.43	
Protective Lining	**Riprap**	
Lining required	**R-3**	
D_{50}, inches	3	**Per PA E&S Manual Chapter 6**
Placement Thickness, inches	9	**Per PA E&S Manual Chapter 6**
Adjusted Mannings N	0.03	
Calculated Critical Slope,Sc ft/ft	0.01	
0.7 Sc, ft/ft	0.01	
1.3 Sc, ft/ft	0.02	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.69	
Freeboard Provided, ft	1.22	**Freeboard Ok, Calculated<Provided**

PROJECT NAME:	**SWALE1**		
LOCATION:	**KIDDER TOWNSHIP, CARBON COUNTY PA**		
PREPARED BY:	**DATE:**	**3/1/2017**	
CHECKED BY:	**DATE:**	**3/1/2017**	

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	34.79	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	6	
Channel Depth provided, ft	2	
Channel bed slope, %	1	
Mannings N	0.06	
Accn. Due to gravity, ft/sec2	32.2	

DESIGN METHOD FOR LINING - SHEAR STRESS

CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.01	
Calculated channel flow depth, ft	1.41	
top width at flow depth, ft	14.43	
Bottom Width:Flow Depth Ratio	4.27	**Ratio Ok**
wetted area, sq. ft	14.36	
wetted peri, ft	14.89	
hyd. Radius, ft	0.96	
velocity, ft/s	2.42	
Discharge, cfs	34.79	
Theta, rad	0.010	
Froudes Number	0.36	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	0.88	
Protective Lining	**Vegetated**	
Lining required	**TRM-435**	
D_{50}, inches		
Placement Thickness, inches		
Adjusted Mannings N	0.06	
Calculated Critical Slope,Sc ft/ft	0.05	
0.7 Sc, ft/ft	0.04	
1.3 Sc, ft/ft	0.07	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	0.59	**Freeboard Ok, Calculated<Provided**

PROJECT NAME:	**SWALE2**		
LOCATION:	**KIDDER TOWNSHIP, CARBON COUNTY PA**		
PREPARED BY:	**DATE:**	**3/1/2017**	
CHECKED BY:	**DATE:**	**3/1/2017**	

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	38.59	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	3	
Channel Depth provided, ft	2	
Channel bed slope, %	2	
Mannings N	0.05	
Accn. Due to gravity, ft/sec2	32.2	

DESIGN METHOD FOR LINING - SHEAR STRESS

CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.02	
Calculated channel flow depth, ft	1.34	
top width at flow depth, ft	11.04	
Bottom Width:Flow Depth Ratio	2.24	**Ratio Ok**
wetted area, sq. ft	9.41	
wetted peri, ft	11.48	
hyd. Radius, ft	0.82	
velocity, ft/s	4.10	
Discharge, cfs	38.59	
Theta, rad	0.020	
Froudes Number	0.62	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	1.67	
Protective Lining	**Riprap**	
Lining required	**R-4**	
D_{50}, inches	6	**Per PA E&S Manual Chapter 6**
Placement Thickness, inches	18	**Per PA E&S Manual Chapter 6**
Adjusted Mannings N	0.05	
Calculated Critical Slope,Sc ft/ft	0.03	
0.7 Sc, ft/ft	0.02	
1.3 Sc, ft/ft	0.04	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	0.66	**Freeboard Ok, Calculated<Provided**

PROJECT NAME:	**SWALE3**	
LOCATION:	**KIDDER TOWNSHIP, CARBON COUNTY PA**	
PREPARED BY:	**DATE:**	**3/1/2017**
CHECKED BY:	**DATE:**	**3/1/2017**

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	5.99	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	4	
Channel Depth provided, ft	1	
Channel bed slope, %	3.47	
Mannings N	0.06	
Accn. Due to gravity, ft/sec2	32.2	
DESIGN METHOD FOR LINING - SHEAR STRESS		
CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.0347	
Calculated channel flow depth, ft	0.47	
top width at flow depth, ft	6.82	
Bottom Width:Flow Depth Ratio	8.52	**Ratio Ok**
wetted area, sq. ft	2.54	
wetted peri, ft	6.97	
hyd. Radius, ft	0.36	
velocity, ft/s	2.36	
Discharge, cfs	5.99	
Theta, rad	0.035	
Froudes Number	0.61	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	1.02	
Protective Lining	**Vegetated**	
Lining required	**TRM-435**	
D_{50}, inches		
Placement Thickness, inches		
Adjusted Mannings N	0.05	
Calculated Critical Slope,Sc ft/ft	0.06	
0.7 Sc, ft/ft	0.04	
1.3 Sc, ft/ft	0.07	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	0.53	**Freeboard Ok, Calculated<Provided**

PROJECT NAME:	**SWALE4**	
LOCATION:	**KIDDER TOWNSHIP, CARBON COUNTY PA**	
PREPARED BY:	**DATE:**	**3/1/2017**
CHECKED BY:	**DATE:**	**3/1/2017**

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	15.79	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	8	
Channel Depth provided, ft	1	
Channel bed slope, %	1.87	
Mannings N	0.06	
Accn. Due to gravity, ft/sec2	32.2	
DESIGN METHOD FOR LINING - SHEAR STRESS		
CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.0187	
Calculated channel flow depth, ft	0.68	
top width at flow depth, ft	12.10	
Bottom Width:Flow Depth Ratio	11.71	**Ratio Ok**
wetted area, sq. ft	6.87	
wetted peri, ft	12.32	
hyd. Radius, ft	0.56	
velocity, ft/s	2.30	
Discharge, cfs	15.79	
Theta, rad	0.019	
Froudes Number	0.49	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	0.80	
Protective Lining	**Vegetated**	
Lining required	**TRM-435**	
D_{50}, inches		
Placement Thickness, inches		
Adjusted Mannings N	0.06	
Calculated Critical Slope,Sc ft/ft	0.06	
0.7 Sc, ft/ft	0.04	
1.3 Sc, ft/ft	0.07	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	0.32	**Check Freeboard**

PROJECT NAME:	**SWALE5**	
LOCATION:	**KIDDER TOWNSHIP, CARBON COUNTY PA**	
PREPARED BY:	**DATE:**	**3/1/2017**
CHECKED BY:	**DATE:**	**3/1/2017**

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	6.09	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	4	
Channel Depth provided, ft	2	
Channel bed slope, %	1.87	
Mannings N	0.04	
Accn. Due to gravity, ft/sec2	32.2	

DESIGN METHOD FOR LINING - SHEAR STRESS

CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.0187	
Calculated channel flow depth, ft	0.45	
top width at flow depth, ft	6.69	
Bottom Width:Flow Depth Ratio	8.91	**Ratio Ok**
wetted area, sq. ft	2.40	
wetted peri, ft	6.84	
hyd. Radius, ft	0.35	
velocity, ft/s	2.54	
Discharge, cfs	6.09	
Theta, rad	0.019	
Froudes Number	0.67	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	0.52	
Protective Lining	**Riprap**	
Lining required	**R-3**	
D_{50}, inches	3	**Per PA E&S Manual Chapter 6**
Placement Thickness, inches	9	**Per PA E&S Manual Chapter 6**
Adjusted Mannings N	0.04	
Calculated Critical Slope,Sc ft/ft	0.04	
0.7 Sc, ft/ft	0.03	
1.3 Sc, ft/ft	0.06	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	1.55	**Freeboard Ok, Calculated<Provided**

PROJECT NAME:	**SWALE6**		
LOCATION:	**KIDDER TOWNSHIP, CARBON COUNTY PA**		
PREPARED BY:	**DATE:**	**3/1/2017**	
CHECKED BY:	**DATE:**	**3/1/2017**	

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	4.55	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	4	
Channel Depth provided, ft	2	
Channel bed slope, %	1.73	
Mannings N	0.07	
Accn. Due to gravity, ft/sec2	32.2	

DESIGN METHOD FOR LINING - SHEAR STRESS

CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.0173	
Calculated channel flow depth, ft	0.53	
top width at flow depth, ft	7.19	
Bottom Width:Flow Depth Ratio	7.52	**Ratio Ok**
wetted area, sq. ft	2.98	
wetted peri, ft	7.36	
hyd. Radius, ft	0.40	
velocity, ft/s	1.53	
Discharge, cfs	4.55	
Theta, rad	0.017	
Froudes Number	0.37	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	0.57	
Protective Lining	**Vegetated**	
Lining required	**TRM-435**	
D_{50}, inches		
Placement Thickness, inches		
Adjusted Mannings N	0.07	
Calculated Critical Slope,Sc ft/ft	0.09	
0.7 Sc, ft/ft	0.06	
1.3 Sc, ft/ft	0.11	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	1.47	**Freeboard Ok, Calculated<Provided**

PROJECT NAME:	**SWALE7**		
LOCATION:	**KIDDER TOWNSHIP, CARBON COUNTY PA**		
PREPARED BY:	**DATE:**	**3/1/2017**	
CHECKED BY:	**DATE:**	**3/1/2017**	

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	22.37	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	4	
Channel Depth provided, ft	2	
Channel bed slope, %	3.09	
Mannings N	0.05	
Accn. Due to gravity, ft/sec2	32.2	
DESIGN METHOD FOR LINING - SHEAR STRESS		
CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.0309	
Calculated channel flow depth, ft	0.89	
top width at flow depth, ft	9.32	
Bottom Width:Flow Depth Ratio	4.51	**Ratio Ok**
wetted area, sq. ft	5.91	
wetted peri, ft	9.61	
hyd. Radius, ft	0.61	
velocity, ft/s	3.79	
Discharge, cfs	22.37	
Theta, rad	0.031	
Froudes Number	0.71	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	1.71	
Protective Lining	**Riprap**	
Lining required	**R-4**	
D_{50}, inches	6	**Per PA E&S Manual Chapter 6**
Placement Thickness, inches	18	**Per PA E&S Manual Chapter 6**
Adjusted Mannings N	0.05	
Calculated Critical Slope,Sc ft/ft	0.05	
0.7 Sc, ft/ft	0.03	
1.3 Sc, ft/ft	0.06	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	1.11	**Freeboard Ok, Calculated<Provided**

PROJECT NAME:	**SWALE8**		
LOCATION:	**KIDDER TOWNSHIP, CARBON COUNTY PA**		
PREPARED BY:	**DATE:**	**3/1/2017**	
CHECKED BY:	**DATE:**	**3/1/2017**	

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	9.68	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	2	
Channel Depth provided, ft	1	
Channel bed slope, %	1	
Mannings N	0.04	
Accn. Due to gravity, ft/sec2	32.2	
DESIGN METHOD FOR LINING - SHEAR STRESS		
CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.01	
Calculated channel flow depth, ft	0.86	
top width at flow depth, ft	7.18	
Bottom Width:Flow Depth Ratio	2.32	**Ratio Ok**
wetted area, sq. ft	3.96	
wetted peri, ft	7.46	
hyd. Radius, ft	0.53	
velocity, ft/s	2.44	
Discharge, cfs	9.68	
Theta, rad	0.010	
Froudes Number	0.46	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	0.54	
Protective Lining	**Riprap**	
Lining required	**R-3**	
D_{50}, inches	3	**Per PA E&S Manual Chapter 6**
Placement Thickness, inches	9	**Per PA E&S Manual Chapter 6**
Adjusted Mannings N	0.04	
Calculated Critical Slope,Sc ft/ft	0.03	
0.7 Sc, ft/ft	0.02	
1.3 Sc, ft/ft	0.04	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	0.14	**Check Freeboard**

PROJECT NAME:	**SWALE9**		
LOCATION:	**KIDDER TOWNSHIP, CARBON COUNTY PA**		
PREPARED BY:	**DATE:**	**3/1/2017**	
CHECKED BY:	**DATE:**	**3/1/2017**	

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	5.67	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	3	
Channel Depth provided, ft	2	
Channel bed slope, %	0.7	
Mannings N	0.08	
Accn. Due to gravity, ft/sec2	32.2	

DESIGN METHOD FOR LINING - SHEAR STRESS

CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.007	
Calculated channel flow depth, ft	0.90	
top width at flow depth, ft	8.42	
Bottom Width:Flow Depth Ratio	3.32	**Ratio Ok**
wetted area, sq. ft	5.16	
wetted peri, ft	8.72	
hyd. Radius, ft	0.59	
velocity, ft/s	1.10	
Discharge, cfs	5.67	
Theta, rad	0.007	
Froudes Number	0.20	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	0.39	
Protective Lining	**Vegetated**	
Lining required	**TRM-435**	
D_{50}, inches		
Placement Thickness, inches		
Adjusted Mannings N	0.08	
Calculated Critical Slope,Sc ft/ft	0.12	
0.7 Sc, ft/ft	0.08	
1.3 Sc, ft/ft	0.15	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	1.10	**Freeboard Ok, Calculated<Provided**

PROJECT NAME:	**SWALE10**		
LOCATION:	**KIDDER TOWNSHIP, CARBON COUNTY PA**		
PREPARED BY:	**DATE:**	**3/1/2017**	
CHECKED BY:	**DATE:**	**3/1/2017**	

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	3.97	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	3	
Channel Depth provided, ft	2	
Channel bed slope, %	5.93	
Mannings N	0.07	
Accn. Due to gravity, ft/sec2	32.2	
DESIGN METHOD FOR LINING - SHEAR STRESS		
CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.0593	
Calculated channel flow depth, ft	0.40	
top width at flow depth, ft	5.41	
Bottom Width:Flow Depth Ratio	7.47	**Ratio Ok**
wetted area, sq. ft	1.69	
wetted peri, ft	5.54	
hyd. Radius, ft	0.30	
velocity, ft/s	2.35	
Discharge, cfs	3.97	
Theta, rad	0.059	
Froudes Number	0.65	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	1.49	
Protective Lining	**Riprap**	
Lining required	**R-4**	
D_{50}, inches	6	**Per PA E&S Manual Chapter 6**
Placement Thickness, inches	18	**Per PA E&S Manual Chapter 6**
Adjusted Mannings N	0.07	
Calculated Critical Slope,Sc ft/ft	0.11	
0.7 Sc, ft/ft	0.08	
1.3 Sc, ft/ft	0.15	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	1.60	**Freeboard Ok, Calculated<Provided**

PROJECT NAME:	**SWALE11**		
LOCATION:	**KIDDER TOWNSHIP, CARBON COUNTY PA**		
PREPARED BY:	**DATE:**	**3/1/2017**	
CHECKED BY:	**DATE:**	**3/1/2017**	

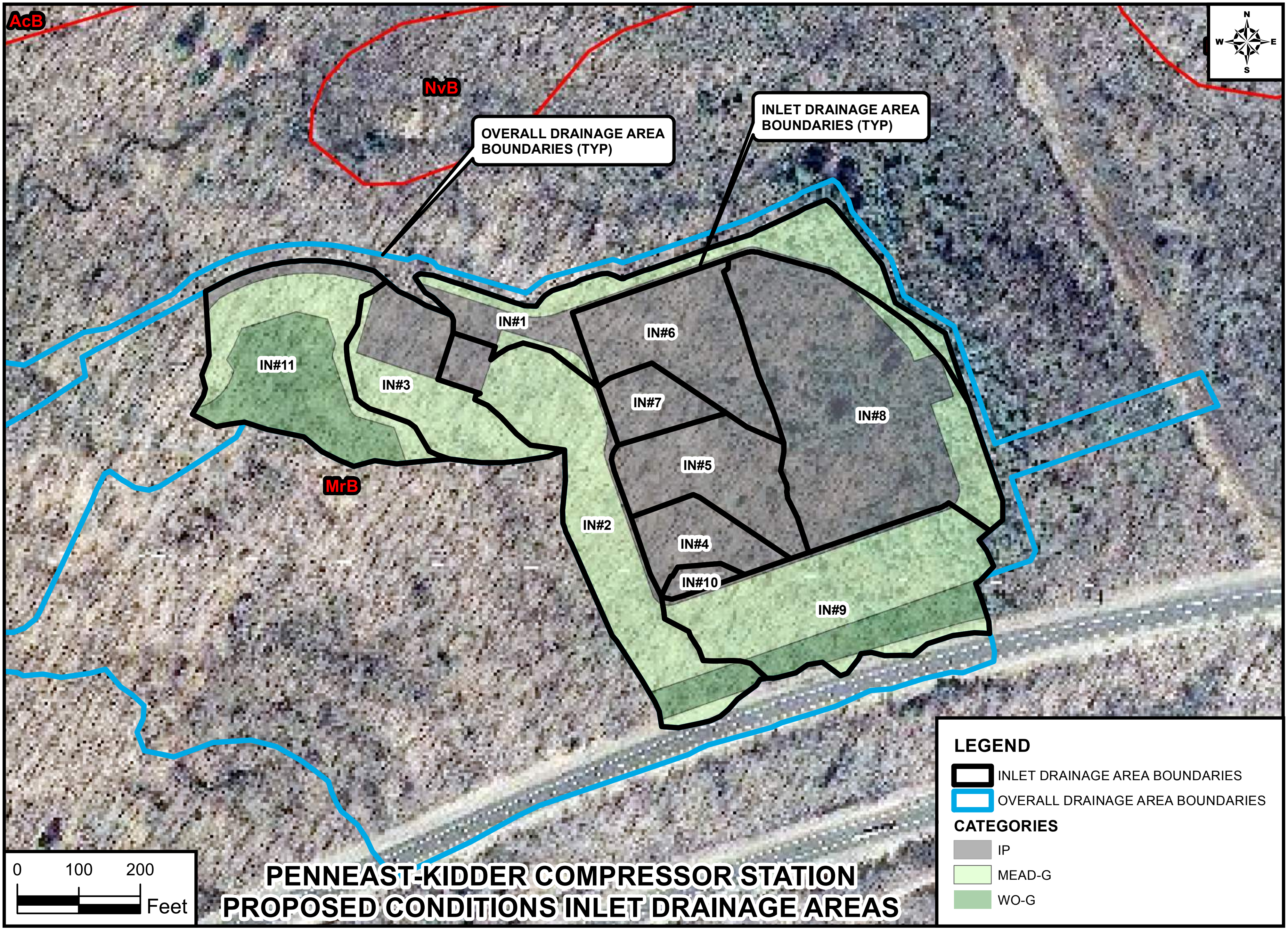
CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	15.49	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	4	
Channel Depth provided, ft	1	
Channel bed slope, %	1.27	
Mannings N	0.04	
Accn. Due to gravity, ft/sec2	32.2	

DESIGN METHOD FOR LINING - SHEAR STRESS

CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.0127	
Calculated channel flow depth, ft	0.82	
top width at flow depth, ft	8.93	
Bottom Width:Flow Depth Ratio	4.86	**Ratio Ok**
wetted area, sq. ft	5.32	
wetted peri, ft	9.20	
hyd. Radius, ft	0.58	
velocity, ft/s	2.91	
Discharge, cfs	15.49	
Theta, rad	0.013	
Froudes Number	0.57	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	0.65	
Protective Lining	**Riprap**	
Lining required	**R-3**	
D_{50}, inches	3	**Per PA E&S Manual Chapter 6**
Placement Thickness, inches	9	**Per PA E&S Manual Chapter 6**
Adjusted Mannings N	0.04	
Calculated Critical Slope,Sc ft/ft	0.03	
0.7 Sc, ft/ft	0.02	
1.3 Sc, ft/ft	0.03	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	0.18	**Check Freeboard**

PROJECT NAME:	**SWALE12**		
LOCATION:	**KIDDER TOWNSHIP, CARBON COUNTY PA**		
PREPARED BY:	**DATE:**	**3/1/2017**	
CHECKED BY:	**DATE:**	**3/1/2017**	

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	64.21	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	2	
Channel Depth provided, ft	2	
Channel bed slope, %	4.4	
Mannings N	0.08	
Accn. Due to gravity, ft/sec2	32.2	
DESIGN METHOD FOR LINING - SHEAR STRESS		
CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.044	
Calculated channel flow depth, ft	1.97	
top width at flow depth, ft	13.84	
Bottom Width:Flow Depth Ratio	1.01	**Ratio Ok**
wetted area, sq. ft	15.62	
wetted peri, ft	14.48	
hyd. Radius, ft	1.08	
velocity, ft/s	4.11	
Discharge, cfs	64.21	
Theta, rad	0.044	
Froudes Number	0.52	
Flow type	subcritical	
Shear Stress, Lb/Sq.Ft	5.42	
Protective Lining	**Riprap**	
Lining required	**R-8**	
D_{50}, inches	24	**Per PA E&S Manual Chapter 6**
Placement Thickness, inches	63	**Per PA E&S Manual Chapter 6**
Adjusted Mannings N	0.08	
Calculated Critical Slope,Sc ft/ft	0.10	
0.7 Sc, ft/ft	0.07	
1.3 Sc, ft/ft	0.13	
Stable Flow?	Stable	
Calculated Freeboard, ft	0.50	
Freeboard Provided, ft	0.03	**Check Freeboard**



PENNEAST-KIDDER COMPRESSOR STATION
PROPOSED CONDITIONS INLET DRAINAGE AREAS

PENNEAST-KIDDER COMPRESSOR STATION									
PROPOSED CONDITIONS RUNOFF COEFFICIENT CALCULATIONS FOR PIPE CAPACITY ANALYSIS									
ID	**DA**	**Cover**	**Soils**	**HSG**	**Area**	**Area (Acres)**	**CN**	**CN*A**	**Weighted CN**
12	IN#1	IP	MrB	D	17511.086	0.402	0.99	0.398	0.99
13	IN#1	MEAD-G	MrB	D	33758.022	0.775	0.65	0.504	0.65
	IN#1 Total					**1.177**		**0.902**	**0.77**
5	IN#10	IP	MrB	D	4220.211	0.097	0.99	0.096	0.99
	IN#10 Total					**0.097**		**0.096**	**0.99**
16	IN#11	IP	MrB	D	7315.615	0.168	0.99	0.166	0.99
18	IN#11	MEAD-G	MrB	D	27677.521	0.635	0.65	0.413	0.65
17	IN#11	WO-G	MrB	D	42039.335	0.965	0.59	0.569	0.59
	IN#11 Total					**1.768**		**1.149**	**0.65**
8	IN#2	IP	MrB	D	137.124	0.003	0.99	0.003	0.99
9	IN#2	IP	MrB	D	7101.989	0.163	0.99	0.161	0.99
7	IN#2	MEAD-G	MrB	D	8007.424	0.184	0.65	0.119	0.65
11	IN#2	MEAD-G	MrB	D	130641.659	2.999	0.65	1.949	0.65
10	IN#2	WO-G	MrB	D	27954.510	0.642	0.59	0.379	0.59
	IN#2 Total					**3.991**		**2.612**	**0.65**
14	IN#3	IP	MrB	D	10357.240	0.238	0.99	0.235	0.99
15	IN#3	MEAD-G	MrB	D	33808.746	0.776	0.65	0.504	0.65
	IN#3 Total					**1.014**		**0.740**	**0.73**
6	IN#4	IP	MrB	D	20663.003	0.474	0.99	0.470	0.99
	IN#4 Total					**0.474**		**0.470**	**0.99**
4	IN#5	IP	MrB	D	40448.814	0.929	0.99	0.919	0.99
	IN#5 Total					**0.929**		**0.919**	**0.99**
2	IN#6	IP	MrB	D	47316.124	1.086	0.99	1.075	0.99
	IN#6 Total					**1.086**		**1.075**	**0.99**
3	IN#7	IP	MrB	D	15316.563	0.352	0.99	0.348	0.99
	IN#7 Total					**0.352**		**0.348**	**0.99**
0	IN#8	IP	MrB	D	111747.081	2.565	0.99	2.540	0.99
1	IN#8	MEAD-G	MrB	D	16577.462	0.381	0.65	0.247	0.65
	IN#8 Total					**2.946**		**2.787**	**0.95**
	Grand Total					**13.834**		**11.098**	**0.80**

The "RC" value is an area averaged runoff coefficient value (arithmatic mean) calculated as:

$$RC=\frac{\sum_{i=1}^{n} C_i \; x \; Area_i}{\sum_{i=1}^{n} Area_i}$$

PENNEAST-KIDDER COMPRESSOR STATION
RATIONAL METHOD PEAK FLOW CALCULATIONS FOR PIPE CAPACITY ANALYSIS

Return Period (Yrs) 100
Min. Time of Concentration (mins) 5 **(Unless otherwise noted below)**

DA	Area (Acres)	RC	Tc (mins)	Rainfall Intensity (in/hr)	Q (cfs)
IN#1	1.177	0.77	5.00	8.1	7.304
IN#10	0.097	0.99	5.00	8.1	0.777
IN#11	1.768	0.65	17.72	5.3	6.088
IN#2	3.991	0.65	5.00	8.1	21.158
IN#3	1.014	0.73	5.00	8.1	5.993
IN#4	0.474	0.99	5.00	8.1	3.804
IN#5	0.929	0.99	5.00	8.1	7.446
IN#6	1.086	0.99	5.00	8.1	8.710
IN#7	0.352	0.99	5.00	8.1	2.820
IN#8	2.946	0.95	5.00	8.1	22.575

TOTAL FLOW FOR IN#2	ADD
IN#2	21.158
IN#7	2.820
IN#5	7.446
IN#4	3.804
IN#10	0.777
TOTAL	**36.004**

TOTAL FLOW FOR MH#1	ADD
IN#6	8.710
IN#2	21.158
IN#7	2.820
IN#5	7.446
IN#4	3.804
IN#10	0.777
TOTAL	**44.715**

TOTAL FLOW FOR IN#1	ADD
IN#1	7.304
IN#8	22.575
TOTAL	**29.879**

TOTAL FLOW FOR MH#6	ADD
IN#6	8.710
IN#2	21.158
IN#7	2.820
IN#5	7.446
IN#4	3.804
IN#10	0.777
IN#1	7.304
IN#8	22.575
TOTAL	**74.594**

TOTAL FLOW FOR MH#3	ADD
IN#6	8.710
IN#2	21.158
IN#7	2.820
IN#5	7.446
IN#4	3.804
IN#10	0.777
IN#1	7.304
IN#8	22.575
IN#3	5.993
TOTAL	**80.587**

***Note: Total flows at MH#4 and MH#2 are same as MH#3 as there are no flow inputs at these locations**

TOTAL FLOW FOR MH#5	ADD
IN#6	8.710
IN#2	21.158
IN#7	2.820
IN#5	7.446
IN#4	3.804
IN#10	0.777
IN#1	7.304
IN#8	22.575
IN#3	5.993
IN#11	6.088
TOTAL	**86.675**

PENNEAST-KIDDER COMPRESSOR STATION
PROPOSED DRAINAGE PIPES CAPACITY ANALYSIS

Pipe ID	P#16	
Upstream Str	IN#10	
Downstream Str	FA#4	
peak Discharge, cfs	0.78	
Pipe Diamater, in	15.00	
Manning's N	0.013	
% Slope	0.50	
diameter of pipe, d, ft	1.25	
wetted area, sf =	1.23	
wetted perimeter, P, ft =	3.93	
R =	0.31	
Slope, ft/ft =	0.005	
Full Flow Velocity, ft/s =	**3.73**	
Full Flow Q, cfs =	**4.58**	**Capacity Ok**

Pipe ID	P#26	
Upstream Str	MH#6	
Downstream Str	MH#3	
peak Discharge, cfs	74.59	
Pipe Diamater, in	33.00	
Manning's N	0.013	
% Slope	2.50	
diameter of pipe, d, ft	2.75	
wetted area, sf =	5.94	
wetted perimeter, P, ft =	8.64	
R =	0.69	
Slope, ft/ft =	0.025	
Full Flow Velocity, ft/s =	**14.12**	
Full Flow Q, cfs =	**83.85**	**Capacity Ok**

Pipe ID	P#9	
Upstream Str	IN#5	
Downstream Str	FA#2	
peak Discharge, cfs	7.45	
Pipe Diamater, in	18.00	
Manning's N	0.013	
% Slope	0.50	
diameter of pipe, d, ft	1.5	
wetted area, sf =	1.77	
wetted perimeter, P, ft =	4.71	
R =	0.38	
Slope, ft/ft =	0.005	
Full Flow Velocity, ft/s =	**4.21**	
Full Flow Q, cfs =	**7.45**	**Capacity Ok**

Pipe ID	P#3	
Upstream Str	IN#4	
Downstream Str	FA#1	
peak Discharge, cfs	3.80	
Pipe Diamater, in	15.00	
Manning's N	0.013	
% Slope	0.50	
diameter of pipe, d, ft	1.25	
wetted area, sf =	1.23	
wetted perimeter, P, ft =	3.93	
R =	0.31	
Slope, ft/ft =	0.005	
Full Flow Velocity, ft/s =	**3.73**	
Full Flow Q, cfs =	**4.58**	**Capacity Ok**

Pipe ID	P#11	
Upstream Str	IN#7	
Downstream Str	FA#3	
peak Discharge, cfs	2.82	
Pipe Diamater, in	15.00	
Manning's N	0.013	
% Slope	0.50	
diameter of pipe, d, ft	1.25	
wetted area, sf =	1.23	
wetted perimeter, P, ft =	3.93	
R =	0.31	
Slope, ft/ft =	0.005	
Full Flow Velocity, ft/s =	**3.73**	
Full Flow Q, cfs =	**4.58**	**Capacity Ok**

Pipe ID	P#10
Upstream Str	IN#6
Downstream Str	MH#1
peak Discharge, cfs	8.71
Pipe Diamater, in	18.00
Manning's N	0.013
% Slope	1.25
diameter of pipe, d, ft	1.5
wetted area, sf =	1.77
wetted perimeter, P, ft =	4.71
R =	0.38
Slope, ft/ft =	0.0125
Full Flow Velocity, ft/s =	**6.66**
Full Flow Q, cfs =	**11.78**

Capacity Ok

Pipe ID	P#5
Upstream Str	IN#2
Downstream Str	MH#1
peak Discharge, cfs	36.00
Pipe Diamater, in	30.00
Manning's N	0.013
% Slope	0.89
diameter of pipe, d, ft	2.5
wetted area, sf =	4.91
wetted perimeter, P, ft =	7.85
R =	0.63
Slope, ft/ft =	0.0089
Full Flow Velocity, ft/s =	**7.90**
Full Flow Q, cfs =	**38.80**

Capacity Ok

Pipe ID	P#4
Upstream Str	MH#1
Downstream Str	MH#3
peak Discharge, cfs	44.72
Pipe Diamater, in	30.00
Manning's N	0.013
% Slope	1.27
diameter of pipe, d, ft	2.5
wetted area, sf =	4.91
wetted perimeter, P, ft =	7.85
R =	0.63
Slope, ft/ft =	0.0127
Full Flow Velocity, ft/s =	**9.44**
Full Flow Q, cfs =	**46.35**

Capacity Ok

Pipe ID	P#15
Upstream Str	IN#3
Downstream Str	MH#3
peak Discharge, cfs	5.99
Pipe Diamater, in	18.00
Manning's N	0.013
% Slope	0.50
diameter of pipe, d, ft	1.5
wetted area, sf =	1.77
wetted perimeter, P, ft =	4.71
R =	0.38
Slope, ft/ft =	0.005
Full Flow Velocity, ft/s =	**4.21**
Full Flow Q, cfs =	**7.45**

Capacity Ok

Pipe ID	P#6	
Upstream Str	IN#1	
Downstream Str	MH#3	
peak Discharge, cfs	29.88	
Pipe Diamater, in	27.00	
Manning's N	0.013	
% Slope	1.50	
diameter of pipe, d, ft	2.25	
wetted area, sf =	3.98	
wetted perimeter, P, ft =	7.07	
R =	0.56	
Slope, ft/ft =	0.015	
Full Flow Velocity, ft/s =	**9.57**	
Full Flow Q, cfs =	**38.03**	**Capacity Ok**

Pipe ID	P#7	
Upstream Str	MH#3	
Downstream Str	MH#4	
peak Discharge, cfs	80.59	
Pipe Diamater, in	48.00	
Manning's N	0.013	
% Slope	1.00	
diameter of pipe, d, ft	4	
wetted area, sf =	12.57	
wetted perimeter, P, ft =	12.57	
R =	1.00	
Slope, ft/ft =	0.01	
Full Flow Velocity, ft/s =	**11.46**	
Full Flow Q, cfs =	**144.03**	**Capacity Ok**

Pipe ID	P#17	
Upstream Str	IN#11	
Downstream Str	MH#5	
peak Discharge, cfs	6.09	
Pipe Diamater, in	24.00	
Manning's N	0.013	
% Slope	0.50	
diameter of pipe, d, ft	2	
wetted area, sf =	3.14	
wetted perimeter, P, ft =	6.28	
R =	0.50	
Slope, ft/ft =	0.005	
Full Flow Velocity, ft/s =	**5.11**	
Full Flow Q, cfs =	**16.04**	**Capacity Ok**

Pipe ID	P#18	**OUTFALLS TO SOUTH-BASIN**
Upstream Str	MH#5	
Downstream Str	HW#3	
peak Discharge, cfs	86.68	
Pipe Diamater, in	48.00	
Manning's N	0.013	
% Slope	1.00	
diameter of pipe, d, ft	4	
wetted area, sf =	12.57	
wetted perimeter, P, ft =	12.57	
R =	1.00	
Slope, ft/ft =	0.01	
Full Flow Velocity, ft/s =	**11.46**	
Full Flow Q, cfs =	**144.03**	**Capacity Ok**

PROJECT NAME:	**EMERGENCY SPILLWAY NORTH**		
LOCATION:	**KIDDER TOWNSHIP, CARBON COUNTY PA**		
PREPARED BY:	**DATE:**	**3/2/2017**	
CHECKED BY:	**DATE:**	**3/2/2017**	

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	18.25	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	25	
Channel Depth provided, ft	1	
Channel bed slope, %	33.33	
Mannings N	0.04	
Accn. Due to gravity, ft/sec2	32.2	
DESIGN METHOD FOR LINING - SHEAR STRESS		
CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.3333	
Calculated channel flow depth, ft	0.13	
top width at flow depth, ft	25.79	
Bottom Width:Flow Depth Ratio	190.80	
wetted area, sq. ft	3.33	
wetted peri, ft	25.83	
hyd. Radius, ft	0.13	
velocity, ft/s	5.49	
Discharge, cfs	18.25	
Theta, rad	0.322	
Froudes Number	2.67	
Flow type	supercritical	
Shear Stress, Lb/Sq.Ft	2.73	
Protective Lining	**Riprap**	
Lining required	**R-5**	
D_{50}, inches	9	**Per PA E&S Manual Chapter 6**
Placement Thickness, inches	27	**Per PA E&S Manual Chapter 6**

PROJECT NAME:	**EMERGENCY SPILLWAY SOUTH**		
LOCATION:	**KIDDER TOWNSHIP, CARBON COUNTY PA**		
PREPARED BY:	**DATE:**	**3/2/2017**	
CHECKED BY:	**DATE:**	**3/2/2017**	

CHANNEL OR CHANNEL SECTION		
Temporary or Permanent (T or P)	P	
Required Capacity, Qr (cfs)	64.00	**See attached Rational Peak Flow Calculations**
Left side slope, %	33.33	
Right side slope, %	33.33	
Bottom width, ft	35	
Channel Depth provided, ft	1	
Channel bed slope, %	33.33	
Mannings N	0.04	
Accn. Due to gravity, ft/sec2	32.2	
DESIGN METHOD FOR LINING - SHEAR STRESS		
CHECK FOR SHEAR STRESS		
H:V, left	3.00	
H:V, right	3.00	
bed slope, ft/ft	0.3333	
Calculated channel flow depth, ft	0.23	
top width at flow depth, ft	36.36	
Bottom Width:Flow Depth Ratio	154.07	
wetted area, sq. ft	8.11	
wetted peri, ft	36.44	
hyd. Radius, ft	0.22	
velocity, ft/s	7.90	
Discharge, cfs	64.00	
Theta, rad	0.322	
Froudes Number	2.92	
Flow type	supercritical	
Shear Stress, Lb/Sq.Ft	4.72	
Protective Lining	**Riprap**	
Lining required	**R-7**	
D_{50}, inches	18	**Per PA E&S Manual Chapter 6**
Placement Thickness, inches	45	**Per PA E&S Manual Chapter 6**

ANTI SEEP COLLAR CALCULATIONS

BASIN ID	PIPE SIZE (IN)	SPILLWAY INV ELEV. (FT)	MAX WATER SURFACE ELEV. (FT)	DELTA FT	EMBANKMENT ANGLE Z COMPONENT	PIPE SLOPE (FT/FT)	SATURATED ZONE PIPE LENGTH, Ls (FT)	INCREASE IN FLOW PATH, Lf (FT)	MINIMUM COLLAR PROJECTION, V min (FT)	NUMBER OF COLLARS, N	COLLAR SIDE WIDTH, S (IN)
NORTH	18	1738.00	1737.07	0.93	3	0.005	6.64	7.64	1.00	1	42
SOUTH	24	1737.25	1736.75	0.5	3	0.005	3.57	4.11	0.54	1	37

Culvert Calculator Report
TWIN_48in

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	1,742.52 ft	Headwater Depth/Height	0.84
Computed Headwater Elevation	1,737.34 ft	Discharge	97.33 cfs
Inlet Control HW Elev.	1,737.01 ft	Tailwater Elevation	1,732.00 ft
Outlet Control HW Elev.	1,737.34 ft	Control Type	Entrance Control

Grades			
Upstream Invert	1,734.00 ft	Downstream Invert	1,732.00 ft
Length	65.00 ft	Constructed Slope	0.030769 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.34 ft
Slope Type	Steep	Normal Depth	1.19 ft
Flow Regime	Supercritical	Critical Depth	2.09 ft
Velocity Downstream	13.20 ft/s	Critical Slope	0.003949 ft/ft

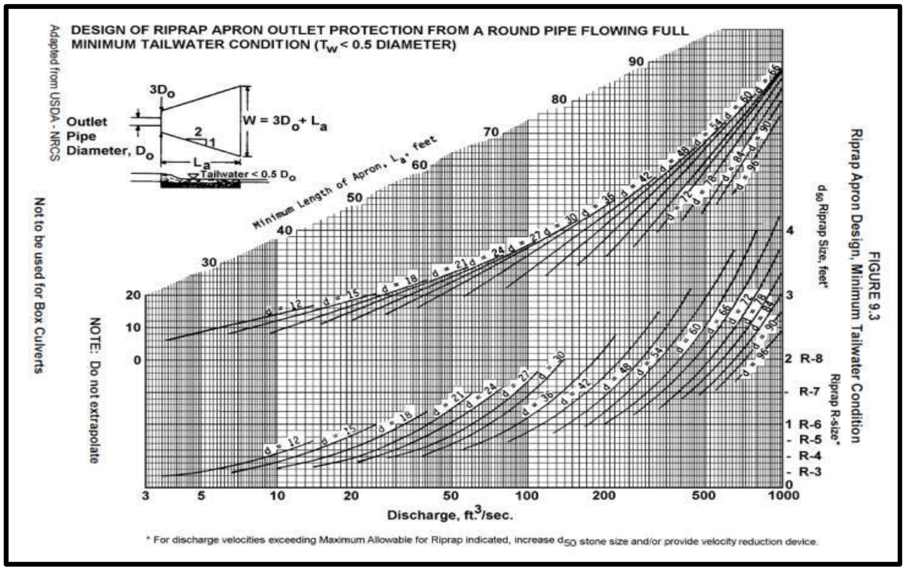
Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	4.00 ft
Section Size	48 inch	Rise	4.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	1,737.34 ft	Upstream Velocity Head	0.83 ft
Ke	0.50	Entrance Loss	0.42 ft

Inlet Control Properties			
Inlet Control HW Elev.	1,737.01 ft	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	25.1 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

RIPRAP APRON
SOUTH-BASIN 48" INCOMING PIPE

Q, cfs	144.03	**(Based on 48" pipe flowing full as the 100-year discharge is a lower value)**
Inside diameter of pipe, D ft	4	



From graph above:

Riprap Size	R-6
D_{50}, inches	12
Apron Length, ft	30
Apron Width at pipe end, ft	12
Apron Width at downstream end, W ft	42

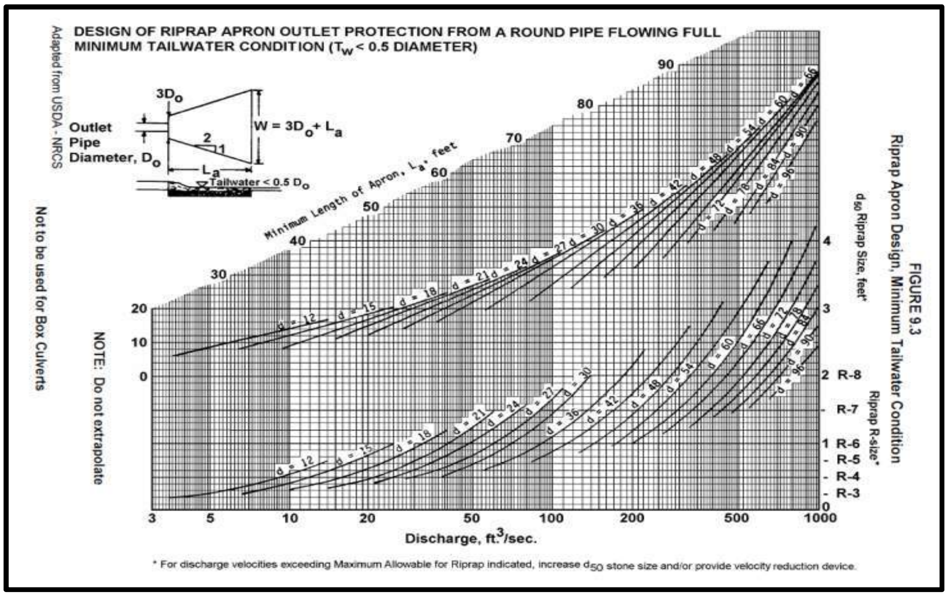
SIZING SUMMARY:

La, ft	**30**
W, ft	**42**
D_{50}, inches	**12**
Riprap Size	**R-6**
Placement Thickness, ft	**3**

RIPRAP APRON

TWIN 48" CROSS CULVERTS

Q, cfs	121.59	**(Refer to twin 48" headwater calculations)**
Inside diameter of pipe, D ft	4	



From graph above:

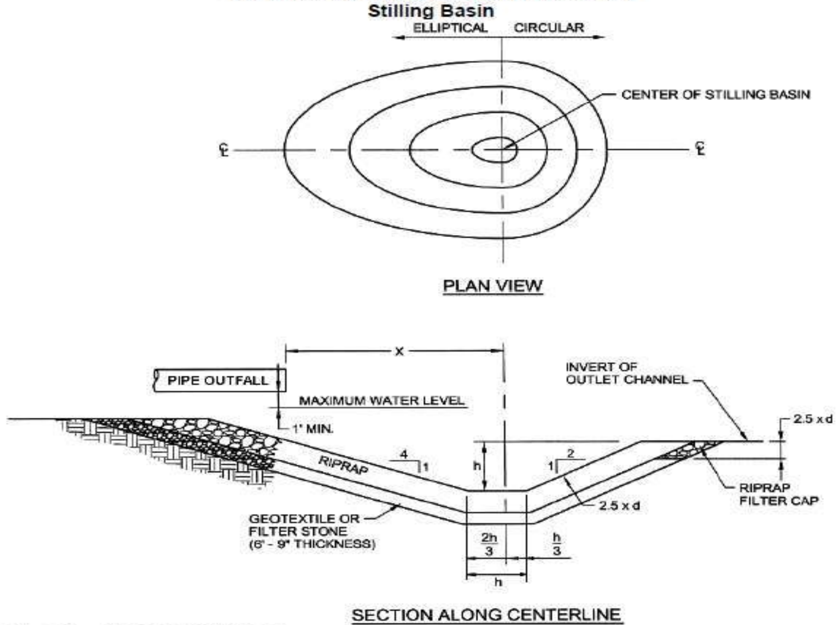
Riprap Size	R-5	
D_{50}, inches	9	
Apron Length, ft	30	
Apron Width at pipe end, ft	24	**Twin 48" pipes**
Apron Width at downstream end, W ft	54	

SIZING SUMMARY:

La, ft	**30**
W, ft	**54**
D_{50}, inches	**9**
Riprap Size	**R-5**
Placement Thickness, ft	**2.25**

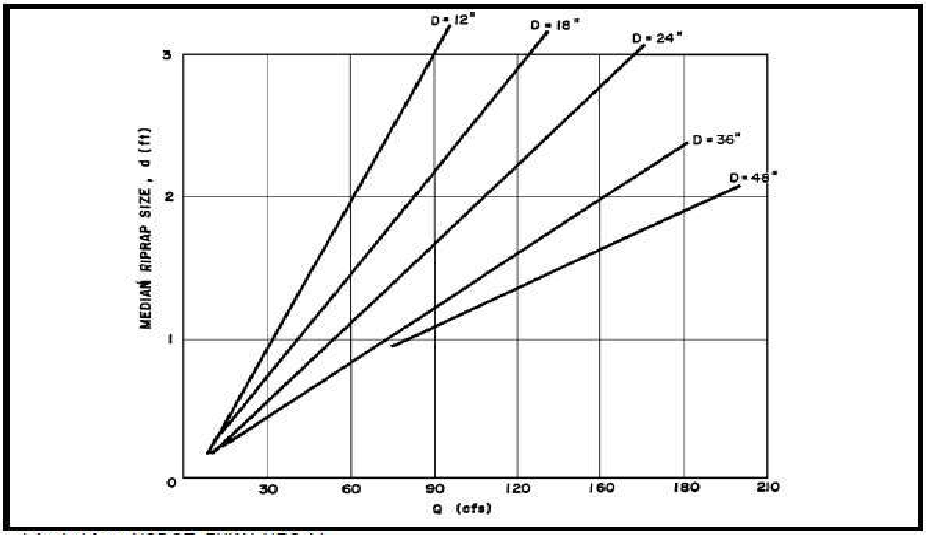
STILLING BASIN DESIGN
NORTH-BASIN OUTFALL (SB-2)

STANDARD CONSTRUCTION DETAIL # 9-4
Stilling Basin



Adapted from USDOT, FHWA HEC 14

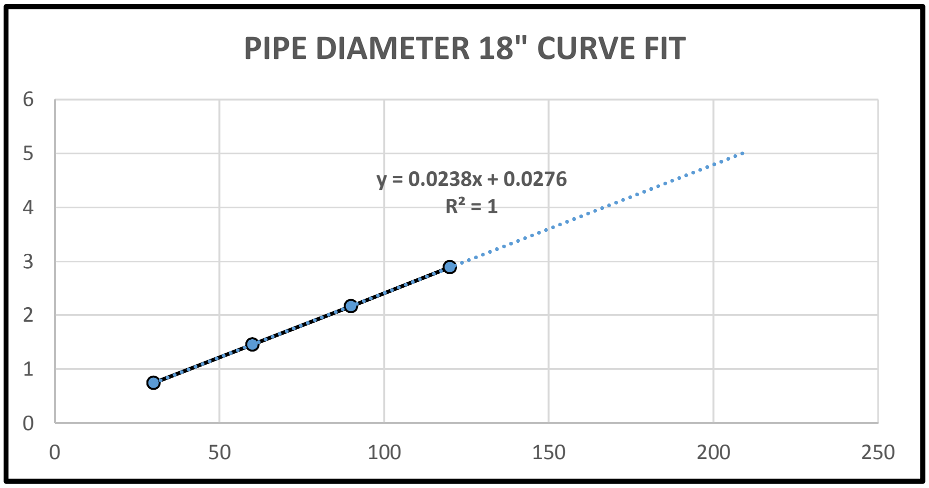
FIGURE 9.7
d_{50} Stone Size for Stilling Basins



Adapted from USDOT, FHWA HEC 14

From the Riprap Size Graph Above:

D (in)	Q (cfs)						
	30	60	90	120	160	180	210
12	0.9152	1.9724	2.973				
18	0.7436	1.4576	2.1668	2.8896			
24	0.5577	1.1144	1.6864	2.2224	2.7645		
36	0.4433	0.8294	1.2145	1.6006	1.9867	2.3753	
48			1.0858	1.3575	1.6292	1.9009	



Q, cfs	6.358	**(Refer to Hydraflow Reports for 100-year basin discharge)**
Inside diameter of pipe, D ft	1.5	
D_{50}, ft	0.18	2.15 **inches**
	3	**inches**
Use Riprap size of	**0.25**	**ft**
Required basin depth, H ft	**0.99**	
Pipe Diamater, in	18.00	
Manning's N	0.013	
% Slope	0.50	
wetted area, sf =	1.77	
wetted perimeter, P, ft =	4.71	
R =	0.38	
Slope, ft/ft =	0.005	
Full Flow Velocity, ft/s =	4.21	
Depth of Water in basin, m ft	0.99	
g, ft/sec^2	32.2	
Distance between pipe crown and WS, P ft	2.5	
X, ft	**2.35**	

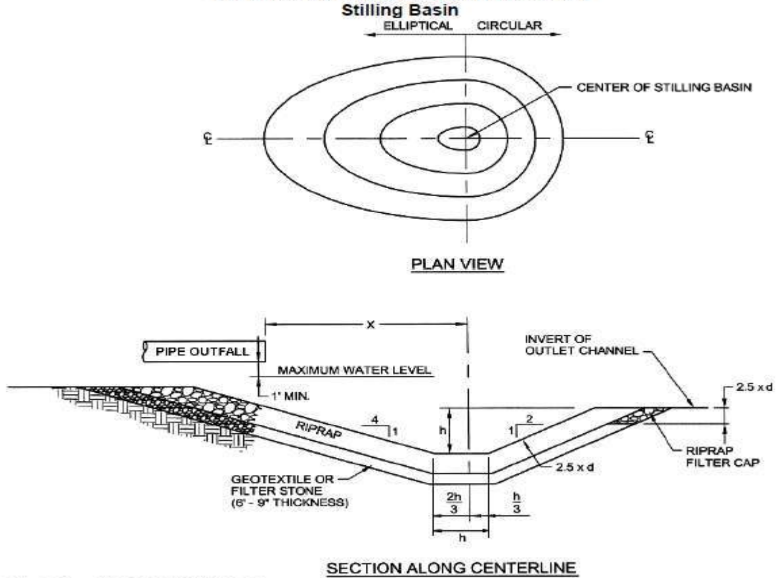
SIZING SUMMARY:

X, ft	**3**
H, ft	**1**
D_{50}, inches	**3**
Riprap Size	**R-3**
Placement Thickness, ft	**1**
Major Axis, Ft	**5**
Minor Axis, Ft	**2**

STILLING BASIN DESIGN
SOUTH-BASIN OUTFALL (SB-1)

STANDARD CONSTRUCTION DETAIL # 9-4

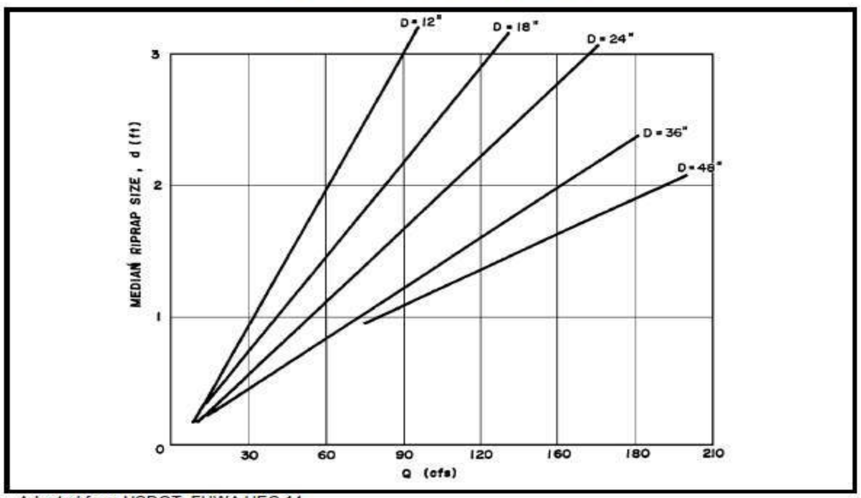
Stilling Basin



Adapted from USDOT, FHWA HEC 14

FIGURE 9.7

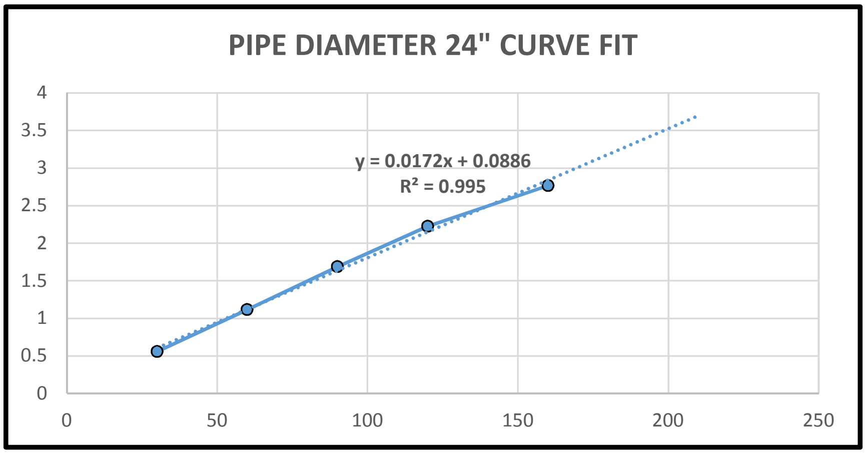
d_{50} Stone Size for Stilling Basins



Adapted from USDOT, FHWA HEC 14

From the Riprap Size Graph Above:

D (in)	Q (cfs)						
	30	**60**	**90**	**120**	**160**	**180**	**210**
12	0.9152	1.9724	2.973				
18	0.7436	1.4576	2.1668	2.8896			
24	0.5577	1.1144	1.6864	2.2224	2.7645		
36	0.4433	0.8294	1.2145	1.6006	1.9867	2.3753	
48			1.0858	1.3575	1.6292	1.9009	



Q, cfs	73.89	**(Refer to Hydraflow Reports for 100-year basin discharge)**	
Inside diameter of pipe, D ft	2		
D_{50}, ft	1.36	16.31	**inches**
	18	**inches**	
Use Riprap size of	**1.50**	**ft**	
Required basin depth, H ft	**1.82**		
Pipe Diamater, in	24.00		
Manning's N	0.013		
% Slope	0.50		
wetted area, sf =	3.14		
wetted perimeter, P, ft =	6.28		
R =	0.50		
Slope, ft/ft =	0.005		
Full Flow Velocity, ft/s =	5.11		
Depth of Water in basin, m ft	1.82		
g, ft/sec^2	32.2		
Distance between pipe crown and WS, P ft	2.5		
X, ft	**3.24**		

SIZING SUMMARY:

X, ft	**4**
H, ft	**2**
D_{50}, inches	**18**
Riprap Size	**R-7**
Placement Thickness, ft	**4**
Major Axis, Ft	**10**
Minor Axis, Ft	**5**

***Note: Outfall for South-Basin consists of three 24" barrels. Outfall protection will require three stilling basins. As such, the width has to be adjusted as below.**

Revised Major Axis, Ft	**10**
Revised Minor Axis, Ft	**15**

Swale ID	Outfall Discharge Q cuft/sec	Swale Depth D ft	TW Depth TW ft	D_{50} Calculated in	D_{50} Accepted in	Riprap Size	Apron Length L ft	Apron Depth H in
Swale 6	4.46	2.2	0.1	0.51	3.00	R-3	9	9
Swale 9	5.5	3.1	0.1	0.42	3.00	R-3	13	9

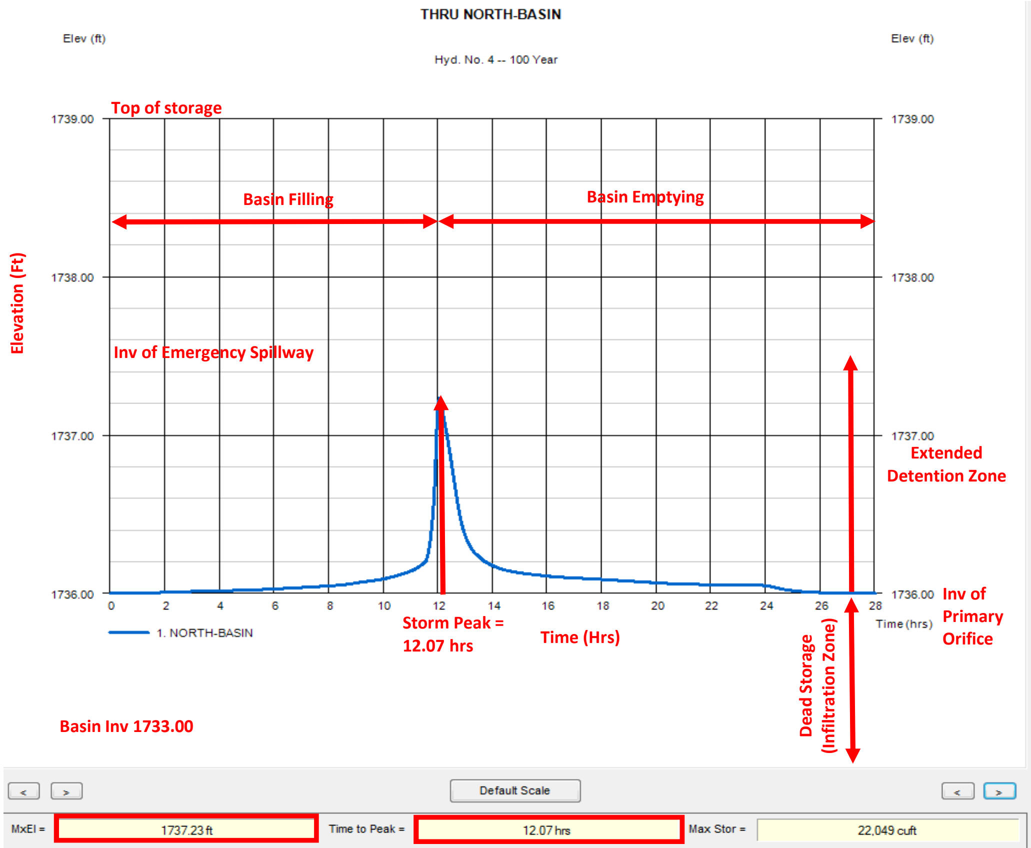
BASIN DEWATERING TIME CALCULATIONS
INFILTRATION BASIN NORTH

BASIN NAME	BASIN	
KTP-1	0.88	
KTP-2	1.6	
AVERAGE, IN/HR	1.24	
FOS	**3.00**	***BASIN FLOOD TEST HAS SAFETY FACTOR BUILT IN*
DESIGN RATE, IN/HR	**0.41**	

INFILTRATION OF STORAGE VOLUME BELOW PRIMARY ORIFICE

Basin Bottom Elevation, ft	1735.00	
Primary Orifice Elevation, ft	1736.00	
Depth Below Primary Orifice, ft	1.00	
DRAIN TIME (1)	**2.42**	***DRAIN TIME FOR DEAD STORAGE BELOW PRIMARY ORIFICE***

INFILTRATION OF STORAGE VOLUME ABOVE PRIMARY ORIFICE (THROUGH OUTLET STR)



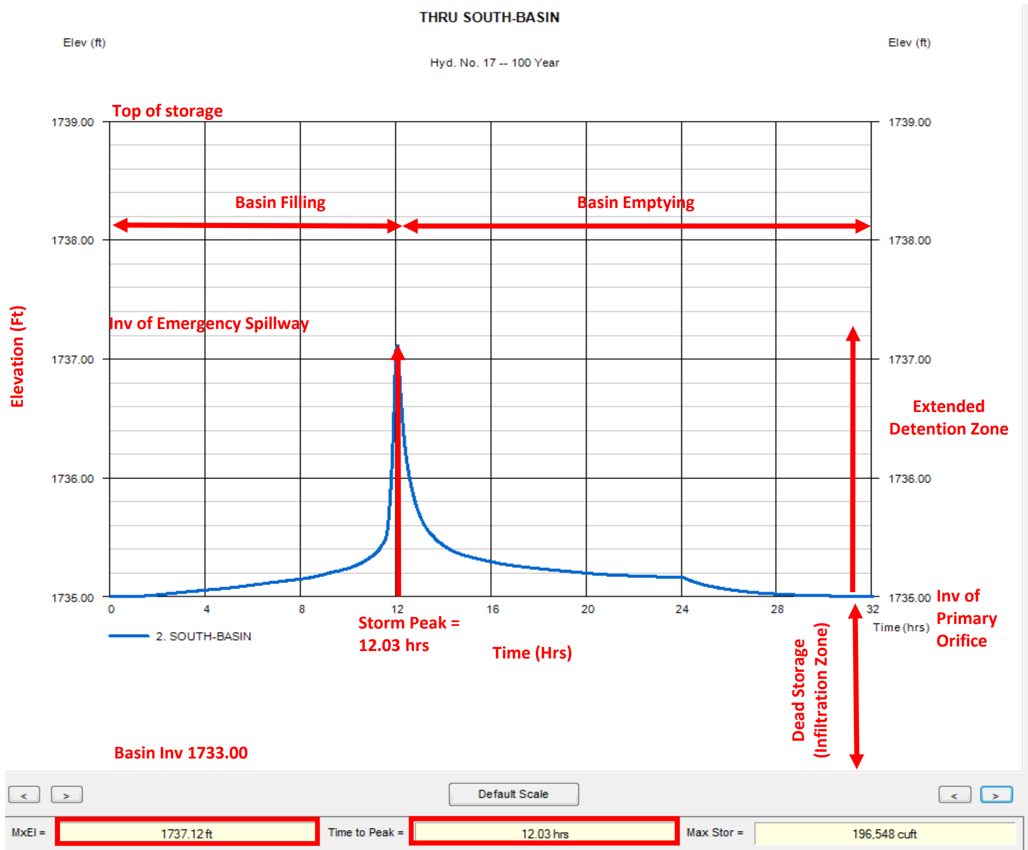
Time (hrs)	Elev (ft)
25.77	1736.01
25.80	1736.01
25.83	1736.01
25.87	1736.01
25.90	1736.01
25.93	1736.01
25.97	1736.01
26.00	1736.01
26.03	1736.01
26.07	1736.01
26.10	1736.01
26.13	1736.00
26.17	1736.00
26.20	1736.00
26.23	1736.00
26.27	1736.00
26.30	1736.00
26.33	1736.00
26.37	1736.00
26.40	1736.00
26.43	1736.00
26.47	1736.00
26.50	1736.00
26.53	1736.00
26.57	1736.00
26.60	1736.00
26.63	1736.00
26.67	1736.00

DRAIN TIME (2)	**14.06**	***DRAIN TIME FROM 100-YEAR STORM PEAK TO DEAD STORAGE ELEVATION***
TOTAL DRAIN TIME	**16.48**	

DEWATERING TIME CALCULATIONS
INFILTRATION BASIN SOUTH

BASIN NAME	BASIN	
KTP-3	1.25	
KTP-4	1	
KTP-5	3.12	
KTP-6	1.40	****BASIN FLOOD TEST HAS SAFETY FACTOR BUILT IN***
KTP-7	1.25	
KTP-8	1.50	
AVERAGE, IN/HR	1.59	
FOS	**3.00**	***DRAIN TIME FOR DEAD STORAGE BELOW PRIMARY ORIFICE***

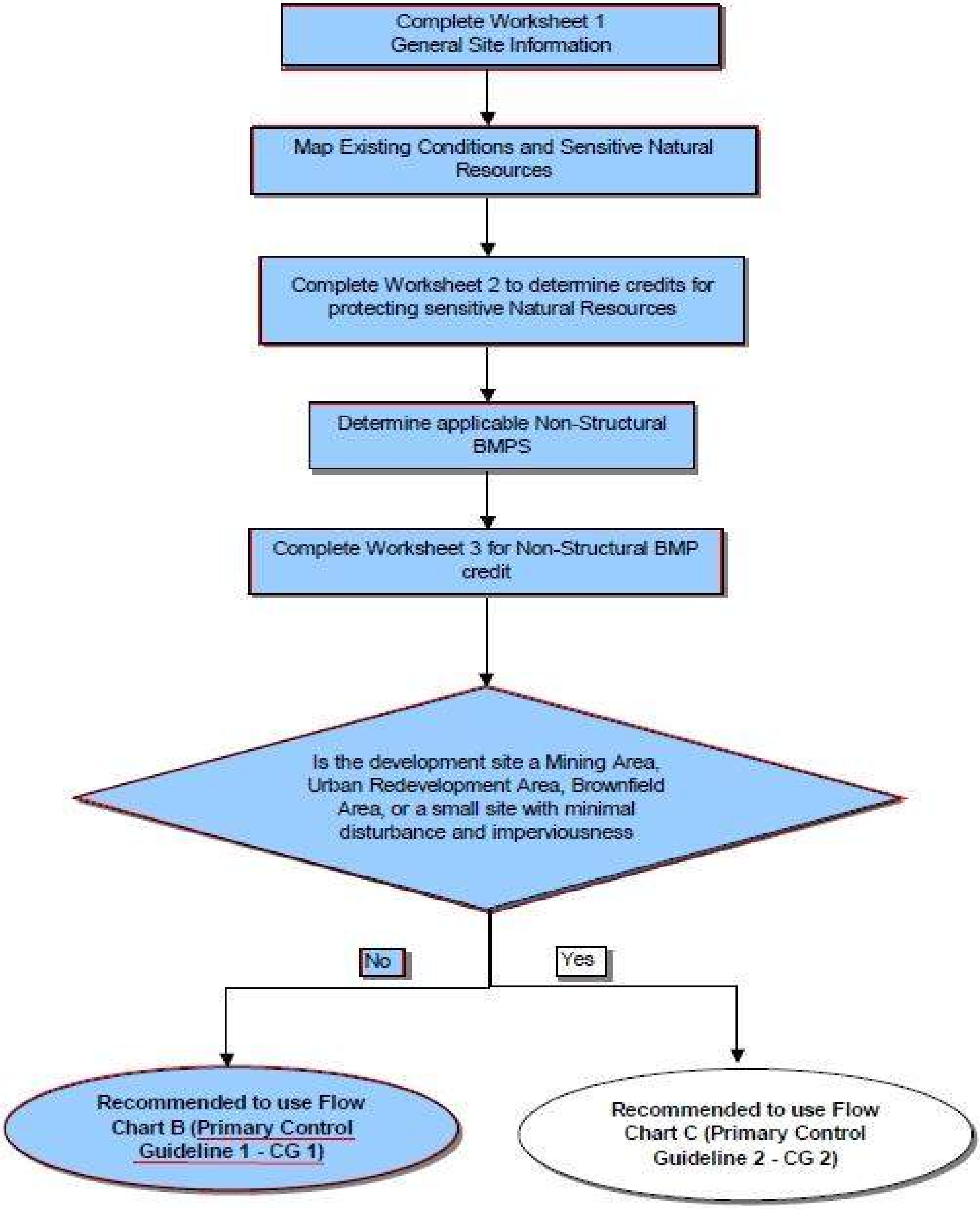
DESIGN RATE, IN/HR	**0.53**
INFILTRATION OF STORAGE VOLUME BELOW	
Basin Bottom Elevation, ft	1733.00
Primary Orifice Elevation, ft	1735.00
Depth Below Primary Orifice, ft	2.00
DRAIN TIME (1)	**3.78**
INFILTRATION OF STORAGE VOLUME ABOVE	



Time (hrs)	Elev (ft)
30.73	1735.01
30.77	1735.01
30.80	1735.01
30.83	1735.01
30.87	1735.01
30.90	1735.01
30.93	1735.01
30.97	1735.01
31.00	1735.01
31.03	1735.01
31.07	1735.01
31.10	1735.01
31.13	1735.01
31.17	1735.01
31.20	1735.01
31.23	1735.01
31.27	1735.01
31.30	1735.00
31.33	1735.00
31.37	1735.00
31.40	1735.00
31.43	1735.00
31.47	1735.00
31.50	1735.00
31.53	1735.00
31.57	1735.00
31.60	1735.00
31.63	1735.00

DRAIN TIME (2)	**19.27**
TOTAL DRAIN TIME	**23.05**

C. BMP Worksheets


Complete Worksheet 1
General Site Information
Map Existing Conditions and Sensitive Natural Resources
Complete Worksheet 2 to determine credits for protecting sensitive Natural Resources
Determine applicable Non-Structural BMPS
Complete Worksheet 3 for Non-Structural BMP credit
Is the development site a Mining Area, Urban Redevelopment Area, Brownfield Area, or a small site with minimal disturbance and imperviousness
No
Yes
Recommended to use Flow Chart B (Primary Control Guideline 1 - CG 1)
Recommended to use Flow Chart C (Primary Control Guideline 2 - CG 2)

Worksheet 1. General Site Information

Date: Oct-19

Project Name: PennEast Pipeline - Kidder Compressor Station

Municipality: Kidder Township

County: Carbon

Total Area (acres): 76.98

Major River Basin: Delaware

http://www.dep.state.pa.us/dep/deputate/watermgt/wc/default.htm - newtopics

Watershed: Upper Lehigh River

Sub-Basin: Lehigh

Nearest Surface Water(s) to Receive Runoff: Black Creek tributary

Chapter 93 - Designated Water Use: HQ-CWF, MF

http://www.pacode.com/secure/data/025/chapter93/chap93toc.html

Impaired according to Chapter 303(d) List ? Yes ☐ No ☑

http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/303d-Report.h

List Causes of Impairment:

Is project subject to, or part of:

Municipal Separate Storm Sewer System (MS4) Requirements? Yes ☐ No ☑

http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/GeneralPermits/default.htm

Existing or planned drinking water supply? Yes ☐ No ☑

If yes, distance from proposed discharge (miles): __________

Approved Act 167 Plan? Yes ☐ No ☑

http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/Approved_1.html

Existing River Conservation Plan? Yes ☐ No ☑

http://www.dcnr.state.pa.us/cs/groups/public/documents/document/d_001448.pdf

Worksheet 2. Sensitive Natural Resources

INSTRUCTIONS:

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	no	0.00	
Floodplains	no	0.00	
Riparian Areas	no	0.00	
Wetlands	no	0.00	
Woodlands	no	0.00	
Natural Drainage Ways	no	0.00	
Steep Slopes, 15%-25%	no	0.00	
Steep Slopes, over 25%	no	0.00	
Other:	no	0.00	
Other:	no	0.00	
TOTAL EXISTING:		**0.00**	**0.00**

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2)	0.00	Ac.
1.2 Area of Riparian Forest Buffer Protection	0.00	Ac.
1.3 Area of Minimum Disturbance/Reduced Grading	51.19	Ac.
TOTAL	51.19	Ac.

Site Area	*minus*	Protected Area	=	Stormwater Management Area
76.98	-	51.19	=	25.79

VOLUME CREDITS

3.1 Minimum Soil Compaction

Lawn		sq. ft	x 1/4" x 1/12 =	0	cubic ft
Meadow		sq. ft	x 1/3" x 1/12 =	0	cubic ft

3.3 Protect Existing Trees

For Trees within 100 feet of impervious area:

Tree Canopy		sq. ft	x 1/2" x 1/12 =	0	cubic ft

For Trees within 20 feet of impervious area:

Tree Canopy		sq. ft	x 1" x 1/12 =	0	cubic ft

5.1 Disconnect Roof Leaders to Vegetated Areas

For runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area		sq. ft	x 1/3" x 1/12 =	0	cubic ft

For all other disconnected roof areas

Roof Area		sq. ft	x 1/4" x 1/12 =	0	cubic ft

5.2 Disconnect Non-Roof Impervious to Vegetated Areas

For runoff directed to areas protected under 5.8.1 and 5.8.2

Impervious Area		sq. ft	x 1/3" x 1/12 =	0	cubic ft

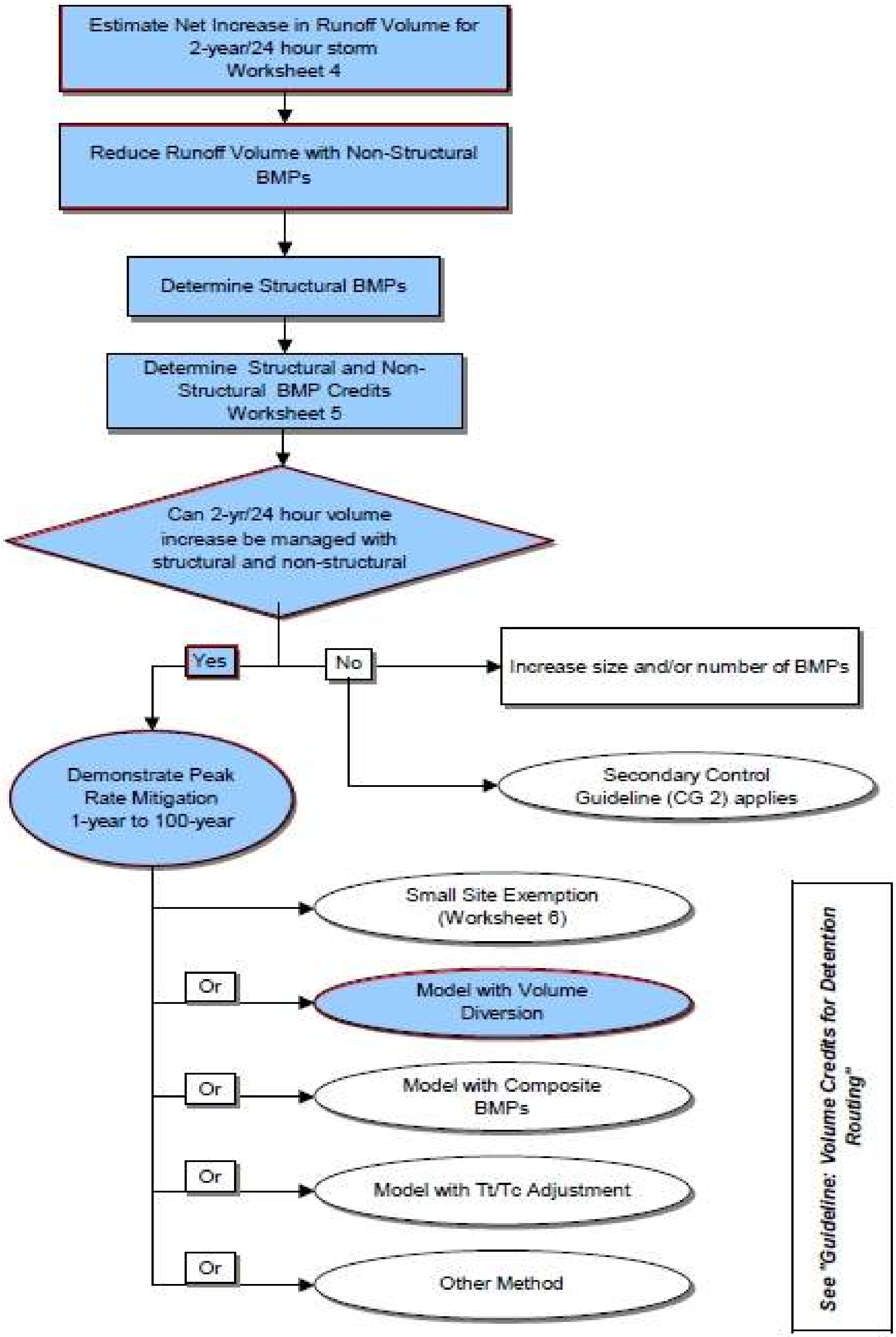
For all other disconnected areas

Impervious Area		sq. ft	x 1/4" x 1/12 =	0	cubic ft

TOTAL NON-STRUCTURAL VOLUME CREDIT* 0 cubic ft

* For use on Worksheet 5

FLOW CHART B
Control Guideline 1 Process



Worksheet 4. Change in Runoff Volume for 1-Yr Storm Event

PROJECT: PennEast Pipeline - Kidder Compressor Station
Drainage Area: 53.46 acres
1-Year Rainfall: 2.64 in

Total Site Area:* 76.98 acres
Protected Site Area: 51.19 acres
Managed Area: 25.79 acres
*- excluding temporary workspace

Existing Conditions:

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (cubic ft)
Meadow	AcB	8,722	0.20	82	2.20	0.44	1.10	801
Woods	AcB	200,452	4.60	77	2.99	0.60	0.83	13,857
Meadow	MrB	3,755	0.09	82	2.20	0.44	1.10	345
Woods	MrB	910,615	20.90	77	2.99	0.60	0.83	62,948
TOTAL:		**1,123,543**	**25.79**				**3.86**	**77,951**

Developed Conditions:

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (cubic ft)
Impervious	AcB	46,371	1.06	98	0.20	0.04	2.41	9,313
Meadow	AcB	162,776	3.74	82	2.20	0.44	1.10	14,948
Impervious	MrB	337,173	7.74	98	0.20	0.04	2.41	67,714
Meadow	MrB	577,224	13.25	82	2.20	0.44	1.10	53,006
TOTAL:		**1,123,543**	**25.79**				**7.02**	**144,981**

1-Year Volume Increase (cubic ft):	67,030

1-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) = Q = (P - 0.2S)^2 / (P + 0.8S) where

P = 1-Year Rainfall (in)

S = (1000/CN) - 10

2. Runoff Volume (CF) = Q x Area x 1/12

Q = Runoff (in)

Area = Land use area (sq. ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSG.
The use of a weighted CN value for volume calculations is not acceptable.

Note: The existing runoff volume caclulation differs from the modeled volume because the existing infiltration facility is taken into account.

Worksheet 4. Change in Runoff Volume for 2-Yr Storm Event

PROJECT: PennEast Pipeline - Kidder Compressor Station
Drainage Area: 53.46 acres
2-Year Rainfall: 3.17 in

Total Site Area:* 76.98 acres
Protected Site Area: 51.19 acres
Managed Area: 25.79 acres

*- excluding temporary workspace

Existing Conditions:

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (cubic ft)
Meadow	AcB	8,722	0.20	82	2.20	0.44	1.51	1,100
Woods	AcB	200,452	4.60	77	2.99	0.60	1.19	19,885
Meadow	MrB	3,755	0.09	82	2.20	0.44	1.51	474
Woods	MrB	910,615	20.90	77	2.99	0.60	1.19	90,334
TOTAL:		**1,123,543**	**25.79**				**5.41**	**111,794**

Developed Conditions:

Cover Type/ Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (cubic ft)
Impervious	AcB	46,371	1.06	98	0.20	0.04	2.94	11,351
Meadow	AcB	162,776	3.74	82	2.20	0.44	1.51	20,537
Impervious	MrB	337,173	7.74	98	0.20	0.04	2.94	82,540
Meadow	MrB	577,224	13.25	82	2.20	0.44	1.51	72,828
TOTAL:		**1,123,543**	**25.79**				**8.90**	**187,256**

2-Year Volume Increase (cubic ft):	75,463

2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) = Q = (P - 0.2S)^2 / (P + 0.8S) where

P = 1-Year Rainfall (in)

S = (1000/CN) - 10

2. Runoff Volume (CF) = Q x Area x 1/12

Q = Runoff (in)

Area = Land use area (sq. ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSG.
The use of a weighted CN value for volume calculations is not acceptable.

Note: The existing runoff volume caclulation differs from the modeled volume because the existing infiltration facility is taken into account.

Worksheet 5. Structural BMP Volume Credits

PROJECT: PennEast Pipeline - Kidder Compressor Station
SUB-BASIN: Lehigh

Required Control Volume (cubic ft) - from Worksheet 4:	75,463
Non-structural Volume Credit (cubic ft) - from Worksheet 3:	- 0
Structural Volume Requirement (cubic ft) *(Required Control Volume minus Non-structural Credit)*	75,463

Proposed BMP		Area (sq. ft)	Storage Volume (cubic ft)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin	49,092	97,774
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden / Bioretention		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other			

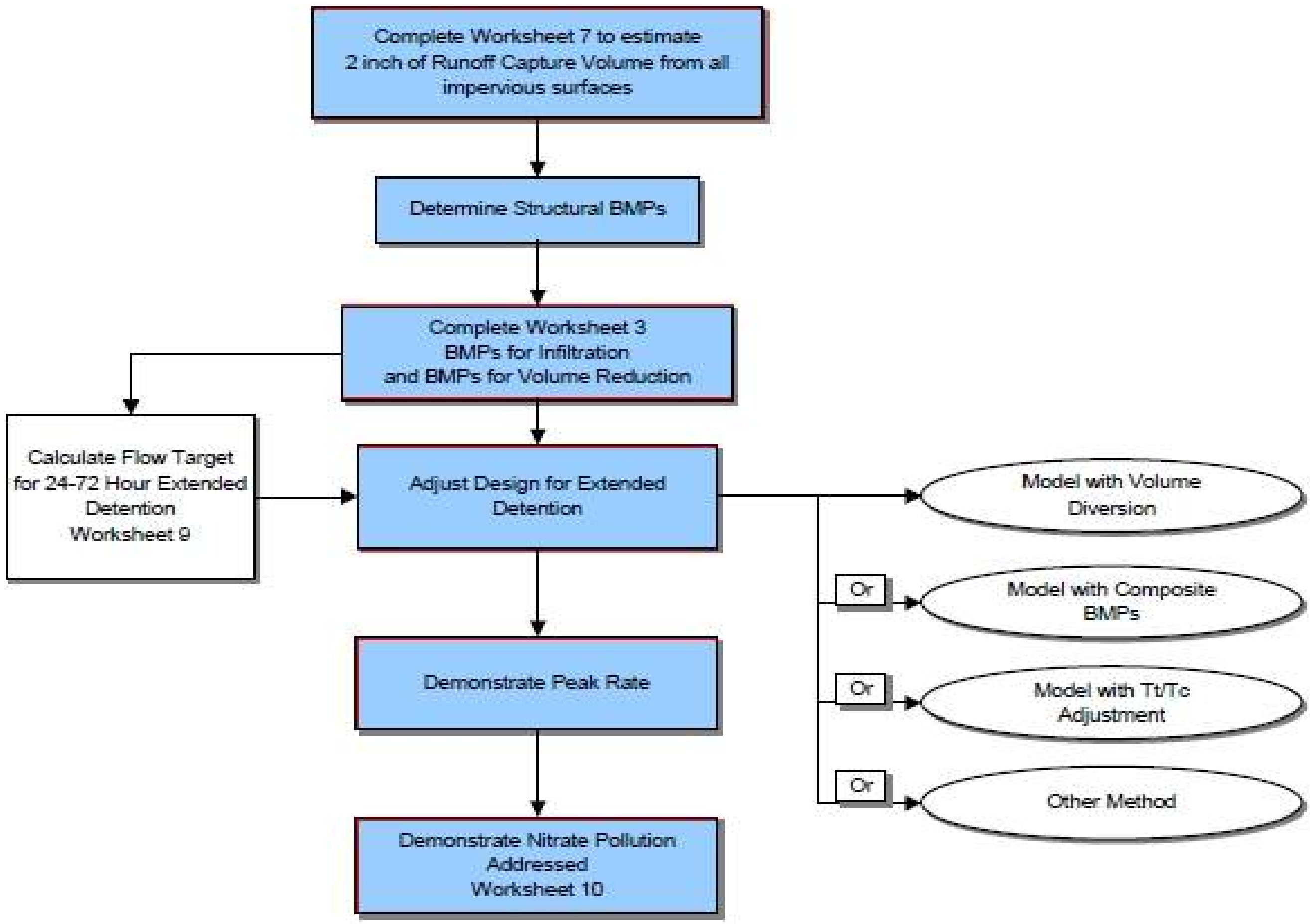
Total Structural Volume (cubic ft): 97,774

Structural Volume Requirement (cubic ft): 75,463

DIFFERENCE 22,311 cubic ft

Note: The infiltration volume provided is significantly larger than the worksheet voume because it is based on the modeled runoff volumes which account for the existing infiltration facility.

FLOW CHART C
Control Guideline 2 Process



Since the Act 167 Plan requires complinace with CG1 and CG2 Flow Chart C and Worksheets 7 and 8 have been included.

Worksheet 7. Calculation of Runoff Volume (PRV and EDV) for CG-2 Only

PROJECT: PennEast Pipeline - Kidder Compressor Station
DRAINAGE AREA: 76.98

Total Site Area: 76.98 acres
Protected Site Area: 51.19 acres
Managed Area: 25.79 acres
Total Impervious Area: 8.80 acres

2 Inch Runoff - Multiply Total Impervious Area by 2 inch

Cover Type	Area (ac)	Runoff Capture Volume (cubic ft)
Roof	0.00	0
Pavement	8.80	63924
Other Impervious	0.00	0
TOTAL:	8.80	63924

1 Inch Rainfall -

Cover Type	Area (square ft)	Area (ac)	Runoff (in)	Runoff Volumes (cubic ft)
Impervious/Gravel	383,543	8.80	0.79	25,279
Meadow	740,000	16.99	0.11	7,041
Woods	-	0.00	0.05	-
TOTAL:	1,123,543	25.79		32,320

1. Total Runoff Capture Volume (cu ft) = Total Impervious Area (sq ft x 2 inch x 1/12

2. PRV (cu ft) = Total Impervious Area (sq ft) x 1 inch x 1/12

3. EDV (cu ft) = Total Area (sq ft) x 1 inch x 1/12

Water quality volume requirements for land areas with existing cover consisting of meadow, brush, wood-grass combination, or woods proposed for conversion to any other non-equivalent type of pervious cover shall be sized for one-half (1/2) the volume required for impervious surfaces as mentioned in this worksheet and calculated in items 1 through 3 above

Worksheet 8. Structural BMP Volume Credits

PROJECT: PennEast Pipeline - Kidder Compressor Station
SUB-BASIN: Lehigh

Required Control Volume (cubic ft) - *from Worksheet 7:* 63,924
Non-structural Volume Credit (cubic ft) - *from Worksheet 3:* - 0

Structural Volume Reqmt (cubic ft) 63,924
(Required Control Volume minus Non-structural Credit)

Proposed BMP*		Area (square ft)	Storage Volume (cubic ft)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin	49092	97774
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden / Bioretention		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other			

Total Structural Volume (cubic ft): 97774

Structural Volume Requirement (cubic ft): #REF!

DIFFERENCE #REF!

Worksheet 10. Water Quality Compliance for Nitrate

Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 Primary BMPs for nitrate are provided across the site or 4 secondary BMPs for nitrate are provided across the site (or 1 primary and 2 secondary).

PRIMARY BMPs FOR NITRATE:

	YES	NO
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers		X
NS BMP 5.5.4 - Cluster Uses at Each Site		X
NS BMP 5.6.1 - Minimize Total Disturbed Area	X	
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas		X
NS BMP 5.9.1 - Street Sweeping / Vacuuming		X
Structural BMP 6.7.1 - Riparian Buffer Restoration		X
Structural BMP 6.7.2 - Landscape Restoration	X	

SECONDARY BMPs FOR NITRATE:

	YES	NO
NS BMP 5.4.1 - Protect Sensitive / Special Value Features		X
NS BMP 5.4.3 - Protect / Utilize Natural Drainage Features		X
NS BMP 5.6.2 - Minimize Soil Compaction		X
Structural BMP 6.4.5 - Rain Garden / Bioretention		X
Structural BMP 6.4.8 - Vegetated Swale	X	
Structural BMP 6.4.9 - Vegetated Filter Strip		X
Structural BMP 6.6.1 - Constructed Wetland		X
Structural BMP 6.7.1 - Riparian Buffer Restoration		X
Structural BMP 6.7.2 - Landscape Restoration	X	
Structural BMP 6.7.3 - Soils Amendment / Restoration	X	

D. Soil 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

Carbon County, Pennsylvania

PennEast: Kidder Compressor Station

June 22, 2017

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 alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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.

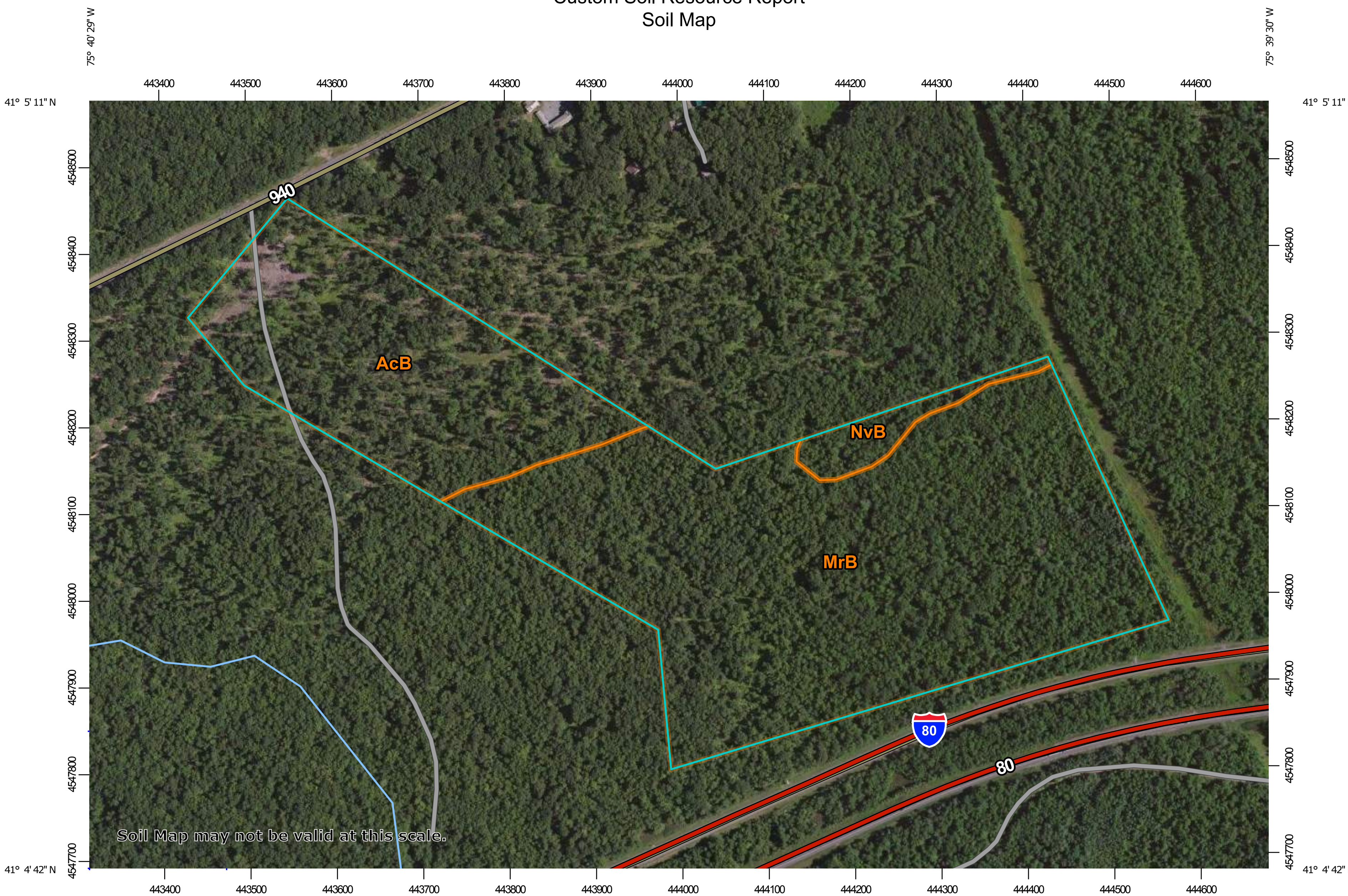
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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.

Soil Map



Map Scale: 1:6,240 if printed on A landscape (11" x 8.5") sheet.

N

0 50 100 200 300 Meters

0 300 600 1200 1800 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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 1:20,000.

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: Carbon County, Pennsylvania
Survey Area Data: Version 14, Sep 19, 2016

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

Date(s) aerial images were photographed: Mar 20, 2011—Jul 5, 2011

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

Carbon County, Pennsylvania (PA025)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AcB	Albrights very stony loam, 0 to 8 percent slopes	21.4	29.4%
MrB	Morris channery silt loam, 0 to 8 percent slopes, extremely stony	49.2	67.5%
NvB	Norwich soils, 0 to 8 percent slopes, extremely stony	2.2	3.1%
Totals for Area of Interest		**72.9**	**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.

Carbon County, Pennsylvania

AcB—Albrights very stony loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: l356
Elevation: 800 to 1,500 feet
Mean annual precipitation: 36 to 46 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 140 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Albrights and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Albrights

Setting

Landform: Ridges
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave, convex
Parent material: Colluvium derived from acid, red sandstone, siltstone, and shale

Typical profile

H1 - 0 to 9 inches: very stony loam
H2 - 9 to 30 inches: channery loam
H3 - 30 to 60 inches: gravelly loam

Properties and qualities

Slope: 0 to 8 percent
Percent of area covered with surface fragments: 1.6 percent
Depth to restrictive feature: 18 to 32 inches to fragipan
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 16 to 28 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Shelmadine

Percent of map unit: 20 percent
Landform: Depressions

Hydric soil rating: Yes

MrB—Morris channery silt loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2vxct
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Morris, Extremely Stony

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till from reddish sandstone, siltstone, and shale

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 5 inches: channery silt loam
Bw - 5 to 12 inches: channery silt loam
Eg - 12 to 16 inches: channery silt loam
Bx - 16 to 60 inches: channery silt loam
C - 60 to 72 inches: channery loam

Properties and qualities

Slope: 0 to 8 percent
Percent of area covered with surface fragments: 7.0 percent
Depth to restrictive feature: 10 to 22 inches to fragipan
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D

Hydric soil rating: No

Minor Components

Norwich, extremely stony

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Wellsboro, extremely stony

Percent of map unit: 5 percent
Landform: Hills, mountains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope, head slope
Down-slope shape: Convex, concave
Across-slope shape: Convex, linear
Hydric soil rating: No

NvB—Norwich soils, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2vcjx
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Norwich, extremely stony, very poorly drained, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Norwich, Extremely Stony, Very Poorly Drained

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy till dominated by reddish sandstone, siltstone and shale fragments

Typical profile

A - 0 to 6 inches: mucky silt loam
Eg - 6 to 10 inches: channery silt loam

Bg - 10 to 16 inches: channery silt loam
Bgx - 16 to 46 inches: channery silt loam
C - 46 to 72 inches: channery silt loam

Properties and qualities

Slope: 0 to 8 percent
Percent of area covered with surface fragments: 7.0 percent
Depth to restrictive feature: 10 to 24 inches to fragipan
Natural drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: Yes

Minor Components

Norwich, extremely stony

Percent of map unit: 10 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Morris, extremely stony

Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group ((PennEast: Kidder Compressor Station))

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

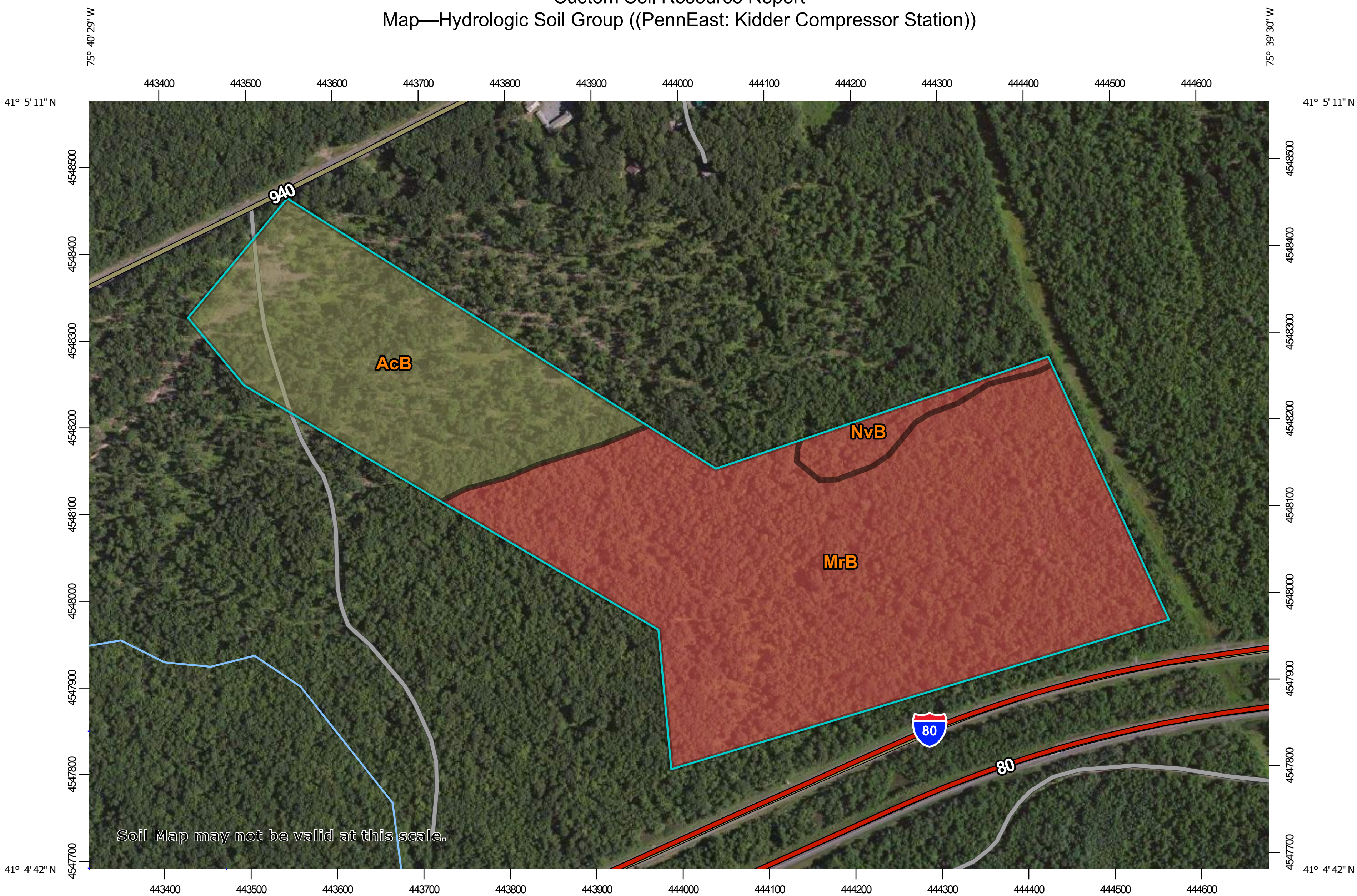
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Map—Hydrologic Soil Group ((PennEast: Kidder Compressor Station))



Map Scale: 1:6,240 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 50, 100, 200, 300

Feet: 0, 300, 600, 1200, 1800

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 18N WGS84

MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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 1:20,000.

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: Carbon County, Pennsylvania
Survey Area Data: Version 14, Sep 19, 2016

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

Date(s) aerial images were photographed: Mar 20, 2011—Jul 5, 2011

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.

Table—Hydrologic Soil Group ((PennEast: Kidder Compressor Station))

Hydrologic Soil Group— Summary by Map Unit — Carbon County, Pennsylvania (PA025)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
AcB	Albrights very stony loam, 0 to 8 percent slopes	C/D	21.4	29.4%
MrB	Morris channery silt loam, 0 to 8 percent slopes, extremely stony	D	49.2	67.5%
NvB	Norwich soils, 0 to 8 percent slopes, extremely stony	D	2.2	3.1%
Totals for Area of Interest			**72.9**	**100.0%**

Rating Options—Hydrologic Soil Group ((PennEast: Kidder Compressor Station))

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties ((PennEast: Kidder Compressor Station))

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–Carbon County, Pennsylvania

Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
AcB—Albrights very stony loam, 0 to 8 percent slopes														
Albrights	80	C/D	0-9	Very stony loam	ML, SM	A-4	6-16- 26	0-10- 20	70-85-100	60-73-95	55-73-90	40-60-80	22-31-39	6-9 -13
			9-30	Silty clay loam, gravelly silt loam, channery clay loam, channery loam	CL, ML, SC, SM	A-4, A-6	0- 0- 0	0- 8- 15	80-90-100	65-80-95	60-75-90	40-63-85	25-33-40	3-9 -15
			30-60	Channery clay loam, gravelly silty clay loam, silt loam, gravelly loam	CL, ML, SC, SC-SM	A-2, A-4, A-6	0- 0- 0	0- 8- 15	65-83-100	45-70-95	40-65-90	25-53-80	20-30-40	3-9 -15

Engineering Properties–Carbon County, Pennsylvania														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
MrB—Morris channery silt loam, 0 to 8 percent slopes, extremely stony														
Morris, extremely stony	90	D	0-1	Moderately decomposed plant material	PT	A-8	0-15- 20	—	—	—	—	—	—	—
			1-5	Channery silt loam, silt loam, channery loam, very channery silt loam, very channery loam	GM, OL, OH	A-4, A-7-5, A-5	0- 1- 3	9-17- 33	58-81-89	58-80-89	49-76-89	37-62-77	29-49 -77	3-8 -16
			5-12	Flaggy silt loam, very channery silt loam, very channery loam, channery silt loam, channery loam, silt loam, loam	GM, CL	A-4, A-6	0- 1- 3	10-19-37	65-84-92	64-84-91	52-78-91	39-62-78	19-29 -38	3-10-15
			12-16	Very channery silt loam, channery silt loam, channery loam, silt loam, loam, very channery loam, flaggy silt loam	GM, CL	A-4, A-6	0- 1- 3	10-19-37	65-84-92	64-84-91	52-77-91	38-60-76	18-26 -36	3-9 -15

Engineering Properties–Carbon County, Pennsylvania														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
			16-60	Very channery loam, channery sandy loam, very channery sandy loam, channery clay loam, very flaggy silt loam, channery silt loam, very channery silt loam, very flaggy loam, channery loam	GM, CL	A-6, A-4	0- 4- 18	10-16-42	58-84-88	57-84-88	47-78-88	36-62-76	18-26-39	3-10-20
			60-72	Very channery sandy loam, channery silt loam, very flaggy loam, very channery loam, channery loam, channery sandy loam, very flaggy silt loam, very channery silt loam	CL, GM	A-2-4, A-6, A-4	0- 4- 18	11-19-43	56-78-88	55-78-88	43-68-88	30-51-73	18-25-38	3-9 -19

Engineering Properties–Carbon County, Pennsylvania															
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				L-R-H	L-R-H	L-R-H	L-R-H	L-R-H	L-R-H	L-R-H	L-R-H
NvB—Norwich soils, 0 to 8 percent slopes, extremely stony														
Norwich, extremely stony, very poorly drained	85	D	0-6	Channery silt loam, channery loam, mucky silt loam	GM, OH	A-7-5, A-4	0- 1- 6	0- 9- 27	52-85-100	50-84-100	40-78-100	32-69-95	32-64-78	2-15-17
			6-10	Loam, channery loam, channery silt loam, silt loam	GM, CL, MH	A-6, A-4, A-7-5	0- 1- 14	0-12- 25	63-80-100	62-80-100	50-72-100	40-63-93	17-36-53	2-13-18
			10-16	Channery silt loam, channery loam, silt loam, loam	ML, CL, GM	A-6, A-4, A-7-6	0- 1- 14	0-12- 25	63-80-100	62-80-100	50-72-100	40-63-93	17-32-47	2-13-18
			16-46	Channery loam, channery silt loam, channery sandy loam, very channery silt loam, very channery loam, very channery sandy loam, gravelly silt loam, very gravelly loam	CL, GM	A-2-4, A-6	0- 2- 24	0-13- 33	58-79-88	56-78-87	44-72-87	35-63-83	16-31-37	2-15-18
			46-72	Channery loam, very channery silt loam, very channery loam, channery silt loam, channery sandy loam, very channery sandy loam, gravelly silt loam, very gravelly loam	GM, CL	A-6, A-2-4	0- 4- 24	0-15- 33	57-76-88	56-75-88	43-68-88	33-60-81	16-30-38	2-13-19

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

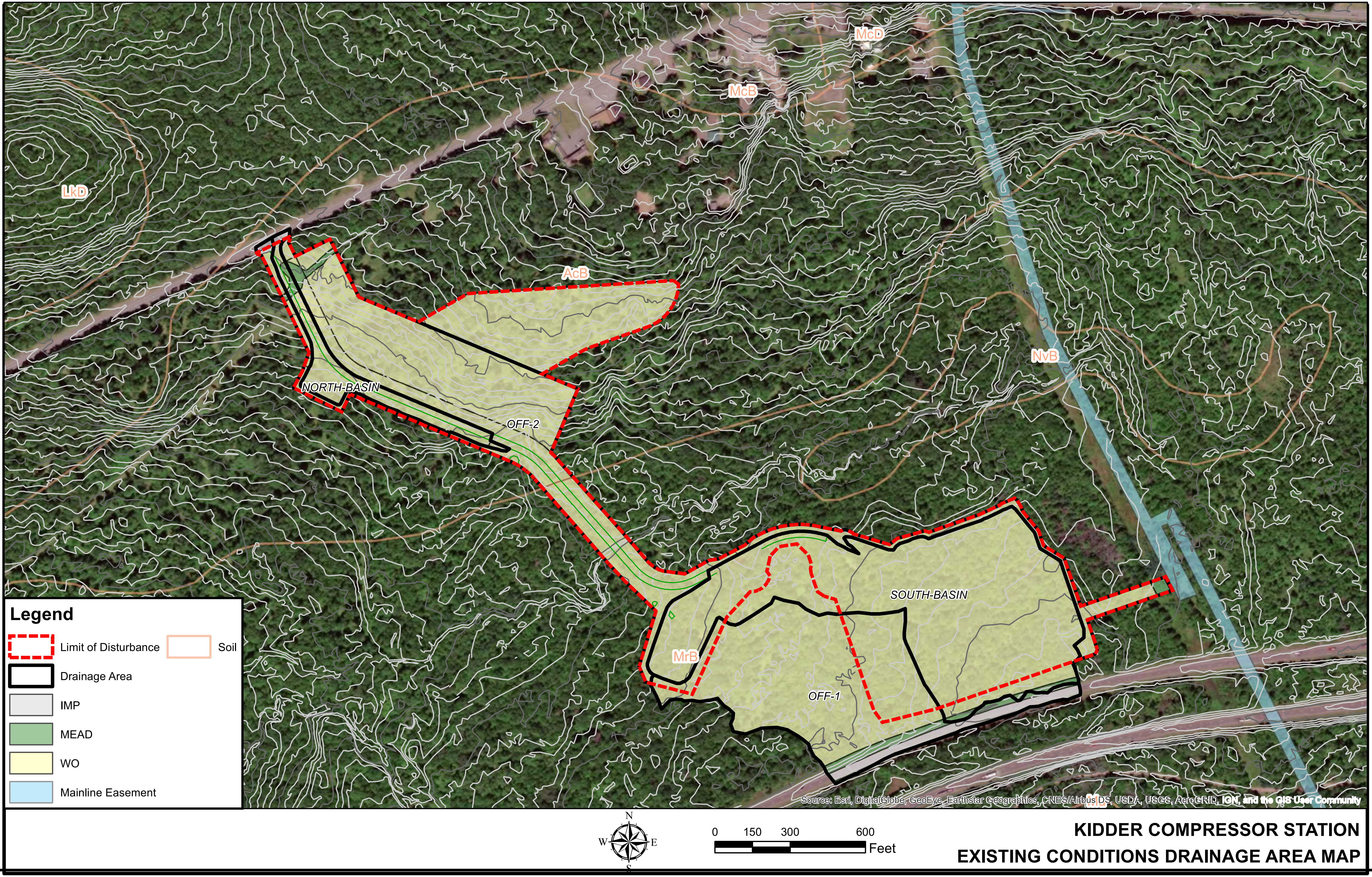
United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

E. Existing Conditions Drainage Area Map

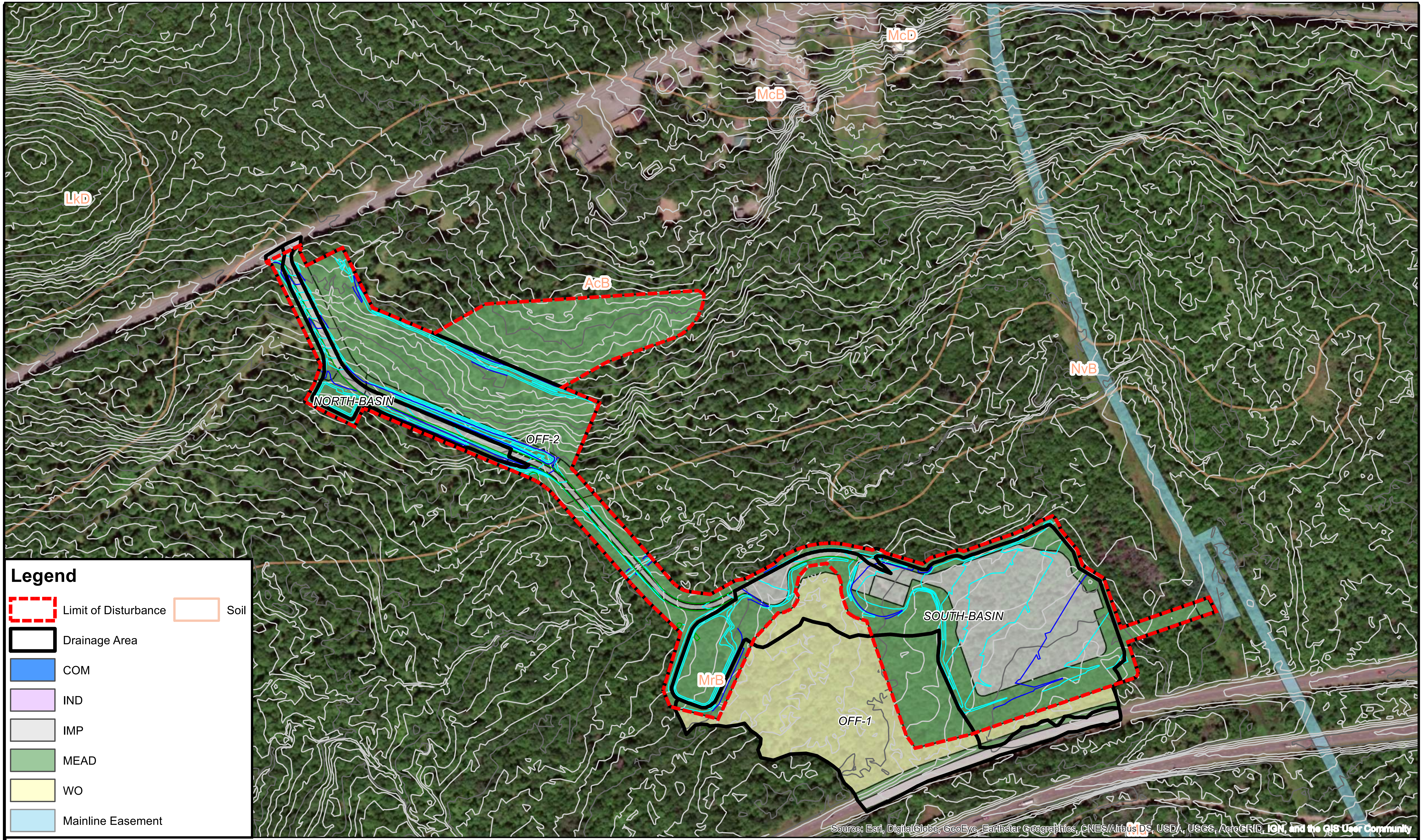


KIDDER COMPRESSOR STATION

EXISTING CONDITIONS DRAINAGE AREA MAP

Map Document: (P:\353754 PennEast\Stormwater\Kidder Compressor\GIS\Projects\EX_DA_Map.mxd) 14/12/2018 19:43:03 ZHI76919

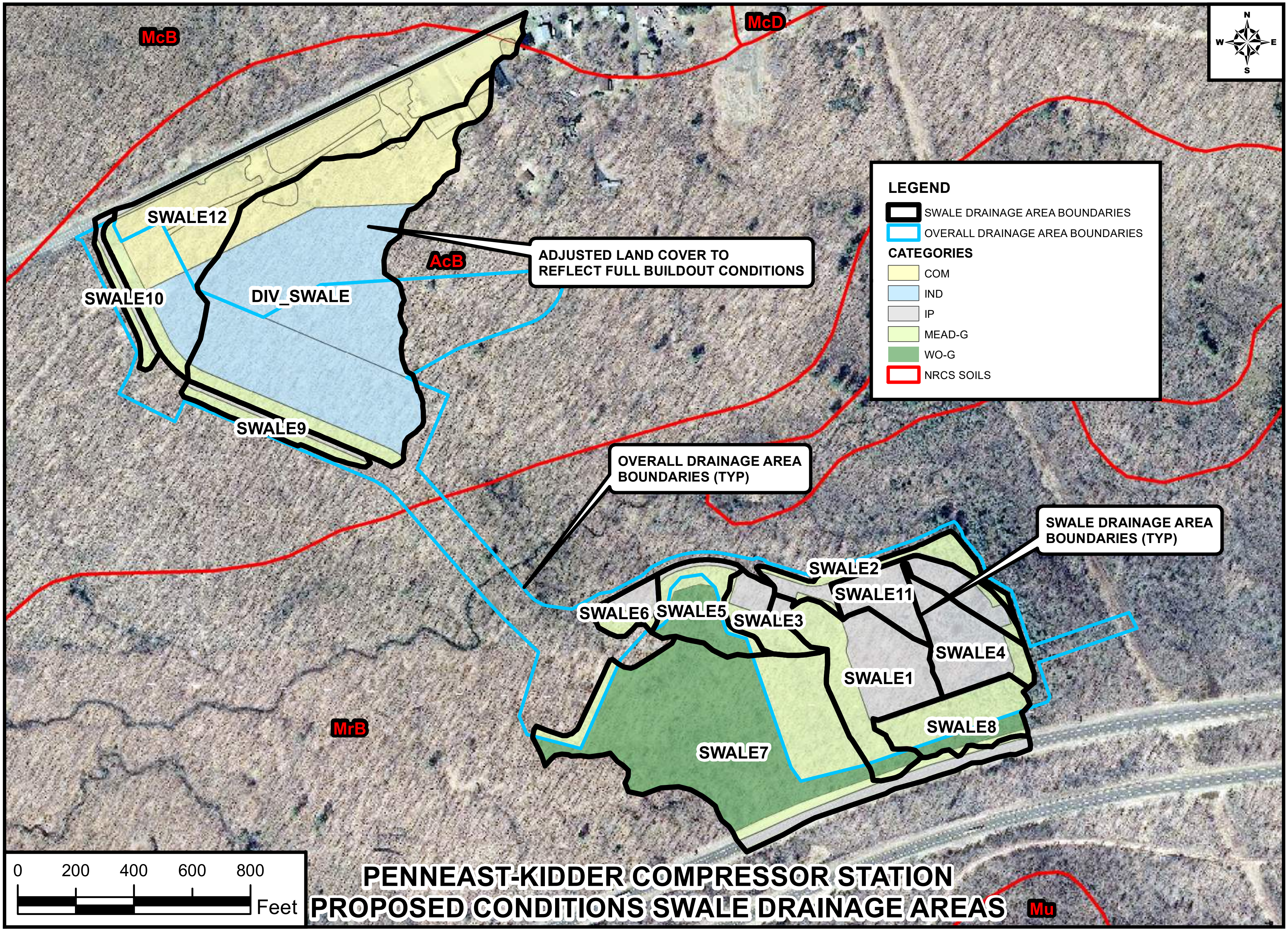
F. Proposed Conditions Drainage Area Map



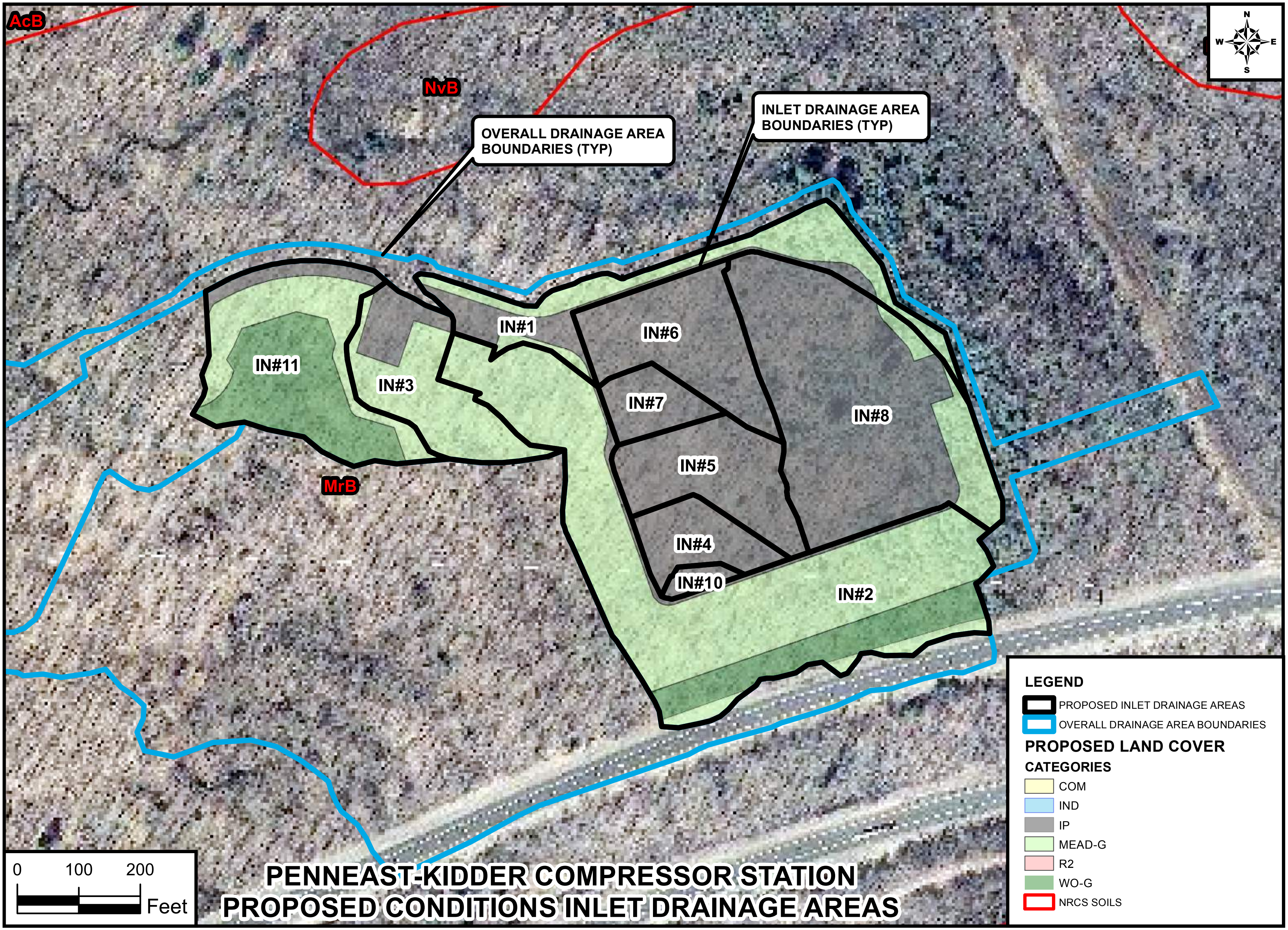
KIDDER COMPRESSOR STATION

PROPOSED CONDITIONS DRAINAGE AREA MAP

Map Document: (P:\353754 PennEast\Stormwater\Kidder Compressor\GIS\Projects\PR_DA_Map.mxd) 16/10/2019 16:03:58 ZHI76919



PENNEAST-KIDDER COMPRESSOR STATION
PROPOSED CONDITIONS SWALE DRAINAGE AREAS



PENNEAST-KIDDER COMPRESSOR STATION
PROPOSED CONDITIONS INLET DRAINAGE AREAS

G. Infiltration Memo

Kidder Compressor Station

PennEast Pipeline Project

Date: February 21, 2017

Confidential

1001 Corporate Drive
Suite 100
Canonsburg, PA 15317
724-514-5576

One Meridian Blvd.
Suite 2C01
Wyomissing, PA 19610
610-373-7999

Kidder Compressor Station Infiltration Test Report

PennEast Pipeline Project

Date: February 21, 2017

Confidential

Issue and revision record

Revision	Date	Originator	Checkout	Approver	Descriptor
A	01-11-2016	E. Vigliorolo	T. Rajah	V. Shah	Interim Report
B	01-27-2016	E. Vigliorolo	T. Rajah	V. Shah	Interim Report
0	09-09-2016	E. Vigliorolo	T. Rajah	V. Shah	Issued for FERC Filing
C	11-14-2016	B. Cortes	G. Obamije	T. Rajah	Interim Report
D	02-20-2017	B. Cortes	G. Obamije	T. Rajah	Interim Report

Information class: **Confidential**

Contents

Figures

Table

Executive Summary

The purpose of this investigation was to use the information obtained in the subsurface investigation to support the design recommendation for the construction of two (2) retention basins for the proposed Kidder Compressor Station located in White Haven, Carbon County, Pennsylvania.

The subsurface investigation consisted of eight (8) excavated test pits, with two (2) infiltration tests performed within each test pit, conducted in the months of December 2015, January 2016, and October 2016, utilizing a double ring infiltrometer.

The first basin is designated as the North Basin, located near the entrance to the Station access road, and the second basin is designated as the South Basin, located near the main entrance to the Compressor Station.

The infiltration rates observed in combination with the encountered soil types provided design values between 0.3 and 0.5 inches per hour (in/hr) for the proposed North Basin, and 0.3 and 1.0 inches per hour for the South Basin. The following summary table provides the test pit schedule and the infiltration test results obtained from our investigation.

Summary Table: Test Pit Schedule and Infiltration Test Result

Retention Basin Location	Test Pit No.	Existing Grade El. (feet)	Test Pit Total Depth (feet)	Infiltration Test El. (feet)	Infiltration Test Depth (feet)	Infiltration Test Results (Average) (in/hr)	Required Safety Factor	Recommended Design Infiltration Rate (in/hr)
North Basin	KTP-1	1735.9	3.0	1735.0	1.0	0.9	3.0	0.3
	KTP-2	1736.3	3.3	1735.0	1.3	1.6	3.0	0.5
South Basin	KTP-3	1737.5	6.5	1733.0	4.5	1.3	3.0	0.4
	KTP-4	1739.0	8.0	1733.0	6.0	1.0	3.0	0.3
	KTP-5	1736.2	5.2	1733.0	3.2	3.1	3.0	1.0
	KTP-6	1736.1	7.1	1733.0	5.1	1.4	3.0	0.5
	KTP-7	1736.8	5.8	1733.0	3.8	1.3	3.0	0.4
	KTP-8	1738.7	7.7	1733.0	5.7	1.5	3.0	0.5

1 Introduction

As requested by the PennEast Pipeline Company, LLC. (PennEast), Mott MacDonald conducted a subsurface investigation for the proposed Kidder Compressor Station for a 120-mile, 36-inch diameter high pressure natural gas pipeline that spans from Luzerne County, Pennsylvania to Mercer County, New Jersey.

This report provides geotechnical subsurface investigation data and results of the infiltration tests for the proposed natural gas meter Station located in White Haven, Carbon County, Pennsylvania. The Site Vicinity Map and the Site Location Map are provided below as Figure 1.1 and Figure 1.2, respectively.

The subsurface data from the representative test borings (K2-11, K2-13, K2-14, and K2-15), drilled in the general vicinity of the two retention basins, was used for this report. The boring and test pit location plan is provided in Appendix A.

Figure 1.1: Site Vicinity Map

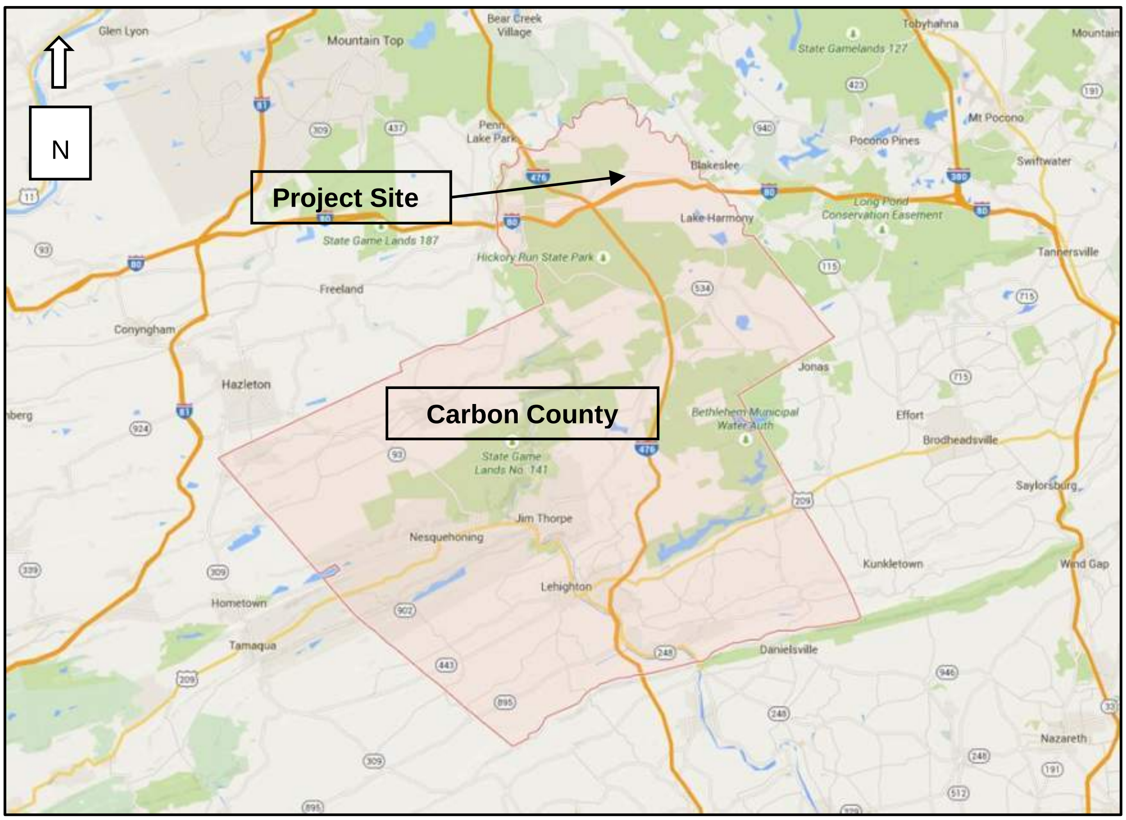
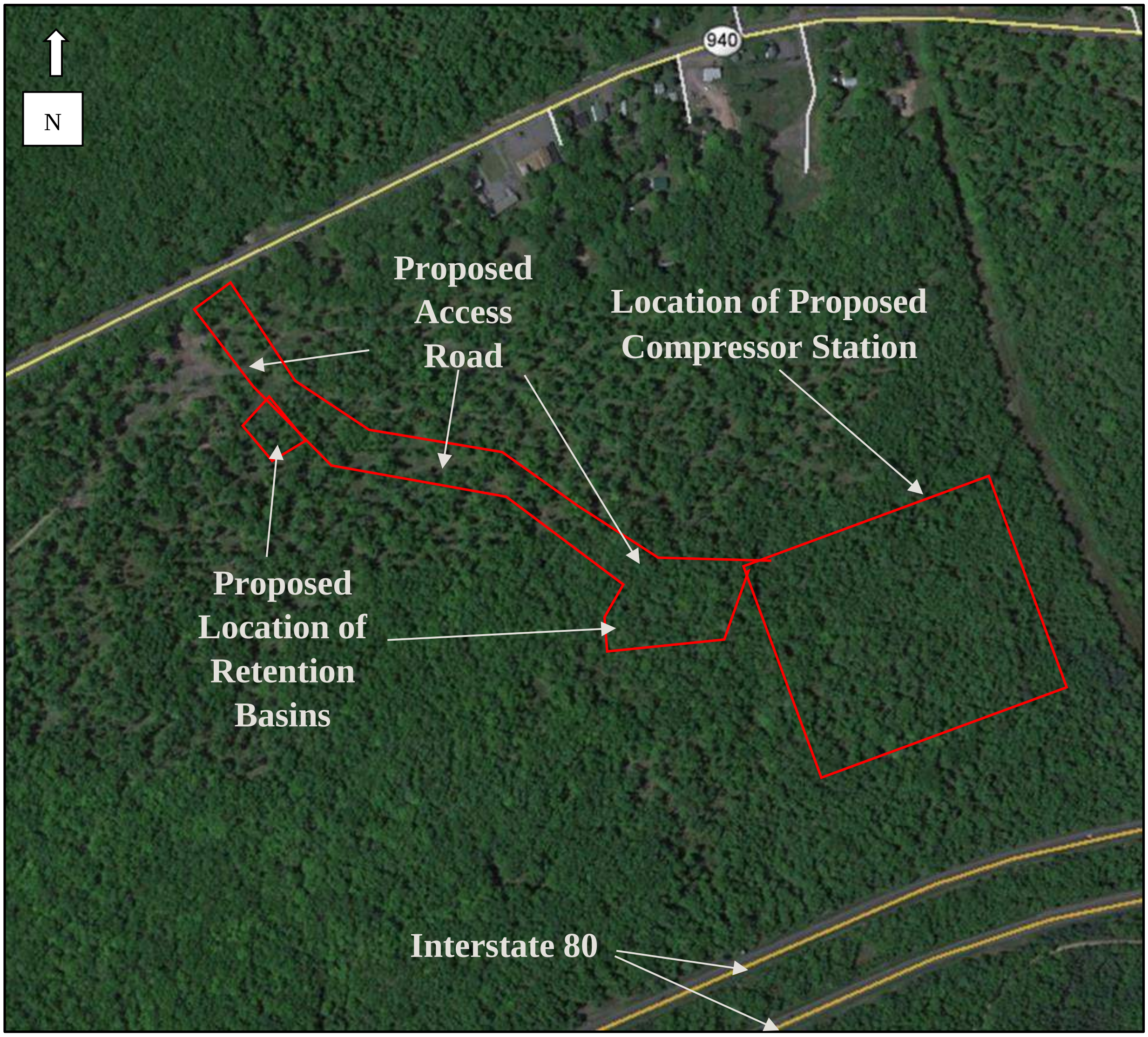


Figure 1.2: Site Location Map



2 Local Geology

2.1 Surficial Geology

Based on the Natural Resources Conservation Service (NRCS) Web Soil Survey, the surficial geology within the area of interest consists heavily of the Morris very stony silt loam. The Morris very stony silt loam is generally mapped as 38 percent sand, 46 percent silt, and 16 percent clay.

The Morris very stony silt loam has 0 to 8 percent slopes, is somewhat poorly drained, has a very high runoff class, and has a very low to moderately high rate of water transmission.

Mapped wetlands and existing streams surround the proposed Compressor Station site.

2.2 Rock Geology

The Kidder Compressor Station lies within the Spechty Kopf Formation, according to the Pennsylvania Department of Conservations and Natural Resources (PADCNR). The Spechty Kopf Formation is Mississippian and Devonian age, light to olive gray, fine to medium grained, crossbedded sandstone, siltstone, and polymictic diamicite, and pebbly mudstone with a maximum thickness of 575 feet thick. The formation is arranged in crude fining-upward cycles locally. Based on the United States Geological Survey (USGS) mapping, there are no known faults within the vicinity of the proposed Compressor Station site.

Although the proposed Compressor Station site falls within the approximate outlines of the Spechty Kopf Formation, it is possible that other formations or rock types could occur near the proposed Compressor Station, due to the approximate nature of USGS maps.

2.3 Karst Features and Abandoned Mines

No Karst features or abandoned mines have been mapped by PADCNR in the vicinity of the proposed Compressor Station.

Refer to the Geologic section in Appendix B.

3 Subsurface Exploration Program

3.1 Geotechnical Test Borings

The geotechnical subsurface exploration program consisting of 15 borings, K2-1 through K2-15, were performed for the Kidder Compressor Station. Selected borings from the investigation were used to determine the subsurface condition near the retention basins. Borings K2-11, K2-13, K2-14, and K2-15 were drilled in the general vicinity of the proposed basins. The boring logs and core photographs are provided in Appendix C. The following major stratigraphic stratum per assigned area, encountered during this investigation, are presented in the approximate order found, from existing ground surface to the boring termination depth:

3.1.1 North Basin Borings (K2-13 & K2-14)

Topsoil: Was encountered in both borings, and the thicknesses ranged between 2 and 8 inches.

Glacial Till: Was encountered beneath the topsoil in both borings. This stratum consisted of reddish brown to brown silt, clay, gravel, occasional cobbles and boulders. The silt and clay layers were described as very soft to hard in terms of consistency, and the gravel layers were described as dense to very dense in terms of relative density. The thickness of this stratum ranged between 20 and 24 feet. Boring K2-14 was terminated in this stratum at 24 feet Below Ground Surface (BGS).

Sandstone Bedrock: Was encountered beneath the glacial till stratum in boring K2-13. The Sandstone was generally described as gray, coarse to fine grained, highly weathered to fresh, and strong rock. The rock core recovery values were 40 and 60%, and the Rock Quality Designation (RQD) values were 0 and 45% for the 10 feet of rock coring performed. Boring K2-13 was terminated in this stratum at 30 feet BGS.

An observation well was not installed in borings K2-13 and K2-14 to determine the groundwater depth at the North Basin. Based on the soil moisture content and drilling observations, groundwater readings were estimated to be approximately 6 to 12 feet BGS.

3.1.2 South Basin Borings (K2-11 & K2-15)

Topsoil: Was encountered in both borings, and was approximately 2 inches thick.

Glacial Till: Was encountered beneath the topsoil in both borings. This stratum consisted of reddish brown silt and gravel with occasional cobbles and boulders. The silt layers were described as medium stiff to hard in terms of consistency, and the gravel layers were described as dense to very dense in terms of relative density. The thickness of this stratum ranged between 24 and 34 feet.

Siltstone Bedrock: Was encountered beneath the glacial till stratum in boring K2-11. The Siltstone was generally described as brownish red, fine grained, highly weathered, and weak rock. The rock core recovery of the 5-foot run was 100%, and the RQD was 0%. Boring K2-11 was terminated in this stratum at 29 feet BGS.

Sandstone Bedrock: Was encountered beneath the glacial till stratum in boring K2-15. The Sandstone was generally described as gray, medium to fine grained, highly weathered, and weak rock. The rock core recovery was 100%, and the RQD was 7%.

Conglomerate Bedrock: Was encountered beneath the sandstone stratum in boring K2-15. The conglomerate was generally described as gray, coarse to fine grained, highly weathered, weak rock. The rock core recovery was 100%, and the RQD ranged between 0 and 25%.

An observation well was not installed in borings K2-11 and K2-15 to accurately determine the groundwater depth at the North Basin. Based on the soil moisture content and drilling observations, groundwater readings were estimated to be approximately 6 to 12 feet BGS. The generalized soil profiles listed above are a simplified representation of prevalent soils encountered during the subsurface investigation. The completed boring logs should be referred to for the location specific data.

3.2 Test Pits and Double-Ring Infiltrometer Tests

Two stormwater retention basins are proposed at the site. The first is designated as the North Basin, located near the entrance to the Station access road, and the second is designated as the South Basin, located near the main entrance to the Compressor Station. Two infiltration tests were conducted in each excavated test pit using a double-ring infiltrometer, for both the North and South basin locations. The test pits and infiltration tests were conducted in accordance with Pennsylvania Stormwater Best Management Practices Manual (PABMP).

A total of eight (8) test pits were excavated by Craig Test Boring Co. Inc. of Mays Landing, New Jersey in December 2015, January 2016, and October 2016, using a backhoe excavator, to depths ranging between 3 and 8 feet below existing grade. The test pits were used to visually classify the soil conditions horizontally and vertically. The excavated test pit schedule is provided in Table 1 below.

Table 1: Test Pit Schedule

Retention Basin Location	Test Pit No.	Existing Grade El. (feet)	Test Pit Total Depth (feet)
North Basin	KTP-1	1735.9	3.0
	KTP-2	1736.3	3.3
South Basin	KTP-3	1737.5	6.5
	KTP-4	1739.0	8.0
	KTP-5	1736.2	5.2
	KTP-6	1736.1	7.1
	KTP-7	1736.8	5.8
	KTP-8	1738.7	7.7

The double ring infiltrometer was placed on level ground, and driven to a minimum 2 inches into the ground. Both the outer and the inner ring were filled with a minimum of 4 inches of water, starting with the outer ring first and then the inner ring. Once the infiltrometer was full, readings of the water level drops were taken periodically. The time interval between readings were determined based on the following:

> If water level drop is 2-inches or more, 10-minute measurement intervals was used.
> If water level drop is less than 2 inches, 30-minute measurement intervals were used.

During the test, a constant 4-inch head was maintained, and the drop of water level was recorded every 30 minutes unless higher infiltration rates were observed. After each reading, both rings were refilled to the pre-determined water level mark. Water level measurement and time at the determined interval were recorded until a minimum of eight readings are completed or until a stabilized rate of drop is obtained, whichever occurred first. A stabilized rate of drop is defined as the difference of 0.25 inch or less of drop between the highest and lowest reading of four consecutive readings. The drop that occurs in the center ring during the final period or the average stabilized rate, expressed as inches per hour, represents the infiltration rate for that test location. Upon completion of the infiltration testing, the test locations were excavated an additional 2 feet to further observe the subsurface conditions below the test depth.

The following describes the results of the infiltration testing and visual observations of the excavated test pits performed at the North and South basins.

3.2.1 North Basin Test Pit

KTP-1

Test Pit KTP-1 was excavated 1-foot below existing grade to conduct two infiltration tests on December 8, 2015. The first test yielded an infiltration rate of 0.25 inches per hour (in/hr), and the second test yielded an infiltration rate of 1.50 in/hr. It is recommended that the average infiltration rate of 0.88 in/hr be considered at this location.

The general description of the soil profile observed within the excavated test pits are provided below:

- **0 to 6 inches:** Topsoil.
- **6 to 12 inches:** Moist, dark brown silty clay, coarse to fine gravel, and varying amounts of cobbles, and boulders.
- **12 to 36 inches:** Moist, reddish brown silty clay, coarse to fine gravel, and varying amounts of cobbles, and boulders.

KTP-2

Test Pit KTP-2 was excavated 1.3 feet below existing grade to conduct two infiltration tests on October 14, 2016. The first test yielded to an infiltration rate of 1.50 in/hr, and the second test yielded an infiltration rate of 1.75 in/hr. It is recommended that the average infiltration rate of 1.60 in/hr be considered at this location.

The general description of the soil profile observed within the excavated test pits are provided below:

- **0 to 6 inches:** Topsoil.
- **6 to 39 inches:** Moist, brown silt, some coarse to fine gravel, trace coarse to fine sand, and varying amounts of cobbles.
- **39 inches:** Refusal observed to be top of bedrock.

3.2.2 South Basin Test Pit

KTP-3

Test pit KTP-3 was excavated approximately 4.5 feet below existing grade to conduct two infiltration tests on October 10, 2016. The first test yielded an infiltration rate of 1.75 in/hr, and the second test yielded an infiltration rate of 0.75 in/hr. It is recommended that the average infiltration rate of 1.25 in/hr be considered at this location.

The general description of the soil profile observed within the excavated test pits are provided below:

- **0 to 4 inches:** Topsoil.
- **4 to 54 inches:** Dry, reddish brown sandy silt, little coarse to fine gravel, and varying amounts of cobbles.
- **54 to 78 inches:** Dry, reddish brown weathered rock, some silt.

KTP-4

Test pit KTP-4 was excavated to a depth of 6 feet below existing grade to conduct two infiltration tests on October 11, 2016. The first test yielded an infiltration rate of 0.50 in/hr, and the second test yielded an infiltration rate of 1.50 in/hr. It is recommended that the average infiltration rate of 1.00 in/hr be considered at this location.

The general description of the soil profile observed within the excavated test pits are provided below:

> **0 to 4 inches:** Topsoil.
> **4 to 34 inches:** Dry, reddish brown sandy silt, little coarse to fine gravel, and varying amounts of cobbles and boulders.
> **34 to 72 inches:** Dry, brown sandy silt, little coarse to fine gravel, with varying amount of cobbles and boulders.
> **72 to 96 inches:** Moist, brown weathered rock, some silt, little coarse to fine gravel, trace coarse to fine sand.

KTP-5

Test pit KTP-5 was excavated approximately 3.2 feet below existing grade to conduct two infiltration tests on October 7, 2016. The first test yielded an infiltration rate of 4.50 in/hr, and the second test yielded an infiltration rate of 1.75 in/hr. It is recommended that the lowest rate of 3.12 in/hr be considered at this location.

The general description of the soil profile observed within the excavated test pits are provided below:

> **0 to 12 inches:** Topsoil.
> **12 to 39 inches:** Dry, reddish brown silt, little coarse to fine gravel, with varying amounts of cobbles.
> **39 to 63 inches:** Moist, reddish brown silt, little coarse to fine gravel, trace coarse to fine sand, and varying amounts of cobbles.

KTP-6

Test pit KTP-6 was excavated approximately 5.1 feet below existing grade to conduct two infiltration tests on October 12, 2016. The first test yielded an infiltration rate of 0.25 in/hr, and the second test yielded an infiltration rate of 2.50 in/hr. It is recommended that the average infiltration rate of 1.40 in/hr be considered at this location.

The general description of the soil profile observed within the excavated test pits are provided below:

> **0 to 18 inches:** Topsoil and varying amounts of cobbles and boulders.
> **18 to 42 inches:** Moist, brown clayey silt, little weathered rock fragments, little coarse to fine sand. Mottling was observed between 3.00 and 3.50 feet below existing grade.
> **42 to 85 inches:** Moist, reddish brown weathered rock fragments, some silt, little coarse to fine sand.

KTP-7

Test pit KTP-7 was excavated 4 feet below existing grade to conduct two infiltration tests on January 8, 2016. The first test yielded an infiltration rate of 1.50 in/hr, and the second test yielded an infiltration rate of 1.00 in/hr. It is recommended that the average infiltration rate of 1.25 in/hr be considered at this location.

The general description of the soil profile observed within the excavated test pits are provided below:

> **0 to 4 inches:** Topsoil.
> **4 to 72 inches:** Moist, reddish brown clay, coarse to fine gravel, some silt, and varying amounts of cobbles and boulders.

KTP-8

Test pit KTP-8 was excavated approximately 5.7 feet below existing grade to conduct two infiltration tests on October 13, 2016. The first test yielded an infiltration rate of 1.50 in/hr, and the second test yielded an infiltration rate of 1.50 in/hr. It is recommended that the average infiltration rate of 1.50 in/hr be considered at this location.

The general description of the soil profile observed within the excavated test pits are provided below:

> **0 to 10 inches:** Topsoil.
> **10 to 24 inches:** Moist, brown silt, some coarse to fine sand, little coarse to fine gravel, trace weathered rock fragments.
> **24 to 92 inches:** Moist, reddish brown weathered rock, some silt, little clay.

The test pit logs and infiltration field logs are provided in Appendix D.

3.3 Groundwater Conditions

Groundwater was not encountered while excavating test pits KTP-1 through KTP-8. However, mottling was observed in lone test pit KTP-6. Because mottling was not observed in seven of the eight test pits, which include nearby test pits KTP-7 and KTP-8, which were approximately 90 feet away from KTP-6, it is our assumption that the mottled soils observed within test pit KTP-6 are localized anomalies attributed to perched water conditions.

3.4 Design Infiltration Rates

Based on the Pennsylvania Stormwater Best Management Practices, and the soils encountered during our investigation, the following table provides the recommended design infiltration rates for both the North and South Basins.

Table 2: Infiltration Test Result

Retention Basin Location	Test Pit No.	Existing Grade El. (feet)	Test Pit Total Depth (feet)	Infiltration Test El. (feet)	Infiltration Test Depth (feet)	Infiltration Test Results (Average) (in/hr)	Required Safety Factor	Recommended Design Infiltration Rate (in/hr)
North Basin	KTP-1	1735.9	3.0	1735.0	1.0	0.9	3.0	0.3
	KTP-2	1736.3	3.3	1735.0	1.3	1.6	3.0	0.5
South Basin	KTP-3	1737.5	6.5	1733.0	4.5	1.3	3.0	0.4
	KTP-4	1739.0	8.0	1733.0	6.0	1.0	3.0	0.3
	KTP-5	1736.2	5.2	1733.0	3.2	3.1	3.0	1.0
	KTP-6	1736.1	7.1	1733.0	5.1	1.4	3.0	0.5
	KTP-7	1736.8	5.8	1733.0	3.8	1.3	3.0	0.4
	KTP-8	1738.7	7.7	1733.0	5.7	1.5	3.0	0.5

4 Special Construction Considerations

4.1 Corrosion of Concrete

"Risk of corrosion" pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens concrete. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the concrete in installations that are entirely within one kind of soil or within one soil layer.

Based on NRCS Web Soil Survey, the existing soils have a moderate risk of corrosion for concrete buried in the ground. Concrete structures and pipes placed in the proposed infiltration basin may be susceptible to corrosion based on this assessment.

4.2 Corrosion of Steel

"Risk of corrosion" pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel in installations that are entirely within one kind of soil or within one soil layer.

Based on NRCS Web Soil Survey, the existing soils have a moderate to high risk of corrosion for steel buried in the ground. Steel pipes or exposed steel members may be subjected to corrosion if installed within the proposed site.

4.3 Backfill

Recommendations for backfilling are provided the geotechnical recommendation report.

4.4 Temporary Excavation Support

Recommendations for temporary excavation support are provided in the geotechnical recommendation report.

4.5 Dewatering

Recommendations for dewatering are provided in the geotechnical recommendation report.

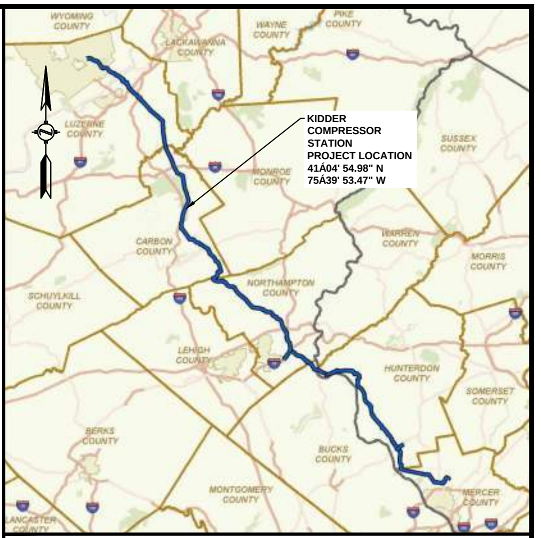
5 Limitations

The results presented in this report is based on the subsurface investigations performed in December 2015, January and October 2016. If further investigation reveals significant differences in the subsurface conditions, or if retention basin elevations or locations are revised, Mott MacDonald should be given the opportunity to review and modify our recommendations, if appropriate.

Appendices

A. Boring and Test Pit Location Plan

THIS PAGE HAS BEEN REMOVED FROM PUBLIC RECORDS BECAUSE IT CONTAINS CRITICAL ENERGY INFRASTRUCTURE INFORMATION UNDER 18 CFR § 388.113(c)(1)(2016), TO BE TREATED AS CONFIDENTIAL IN ACCORDANCE WITH KIDDER CODE § 180-92B(2).



LOCATION MAP

SCALE: 1" = 15 MILES

LEGENDS

PROPOSED

- PAD/ROAD AREA - PROPOSED FUTURE CONSTRUCTION (NOT INCLUDED WITH GP-8 APPLICATION)
- CS12 — STANDARD CONSTRUCTION COMPOST FILTER SOCK; SEE DETAIL
- TEMPORARY ACCESS ROAD THROUGH WETLANDS
- EXISTING UNIMPROVED DIRT ACCESS PATH
- ACCESS PATH
- K2-1 — GEOTECHNICAL BORING LOCATION (EARTH DISTURBANCE = 1 SQ. FT.)
- KTP-1 — INFILTRATION TESTING LOCATION (EARTH DISTURBANCE = 50 SQ. FT.)
- NS-1 — NOISE SURVEY MONITORING LOCATION (NO EARTH DISTURBANCE)
- CP-1 — CATHODIC PROTECTION STUDY LOCATION (NO EARTH DISTURBANCE)
- K2-MW-1 — MONITORING WELL

EXISTING

- PROPERTY LINE
- STREAM (PUBLIC)
- STREAM (DELINEATED)
- 1260' — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- BOUNDARY OF 1' INTERVAL CONTOURS
- APPROXIMATE 100 YEAR FLOODWAY
- EXISTING BUCKEYE PIPELINE
- WETLAND (DELINEATED)
- EXISTING FENCE
- PE-LU-001.000 — LINE LIST NUMBER
- WATERBODY (DELINEATED)
- WATERBODY (PUBLIC)
- EXISTING FOREIGN PERMANENT EASEMENT

NOTES:

1. EXISTING CONTOURS SHOWN WERE SURVEYED BY HMM DURING 2015 AND 2016. ADDITIONAL EXISTING CONTOURS WERE PROVIDED BY PICTOMETRY, 2015 AND SUPPLEMENTED FROM PASDA.
2. EXISTING UTILITIES SHOWN WERE SURVEYED FROM HMM AND DIGITIZED FROM IMAGERY. ALL LOCATIONS ARE APPROXIMATE AND SHALL BE FIELD VERIFIED BY CONTRACTOR.

REFERENCE DRAWINGS

DWG. NO.	TITLE
000-03-01-054	SITE INVESTIGATION SHEET
000-03-30-001 -- 006	TYPICAL STORMWATER DETAILS

REVISIONS

NO.	REVISIONS	DATE	DRAWN	CK	APPR
A	ISSUED FOR PERMIT	03/2016	HMM	HMM	HMM

PROJECT ENGINEER STAMP

APPROVALS

DRAWN BY	DATE
HMM	04/2016
CHECKED BY	DATE
HMM	04/2016
ENG. APPROVAL	DATE
P.M. APPROVAL	DATE

811 Know what's below. Call before you dig.

CLIENT APPROVAL

DATE

PREPARED FOR

PennEast PIPELINE

PREPARED BY

Hatch Mott MacDonald

PENNEAST PIPELINE

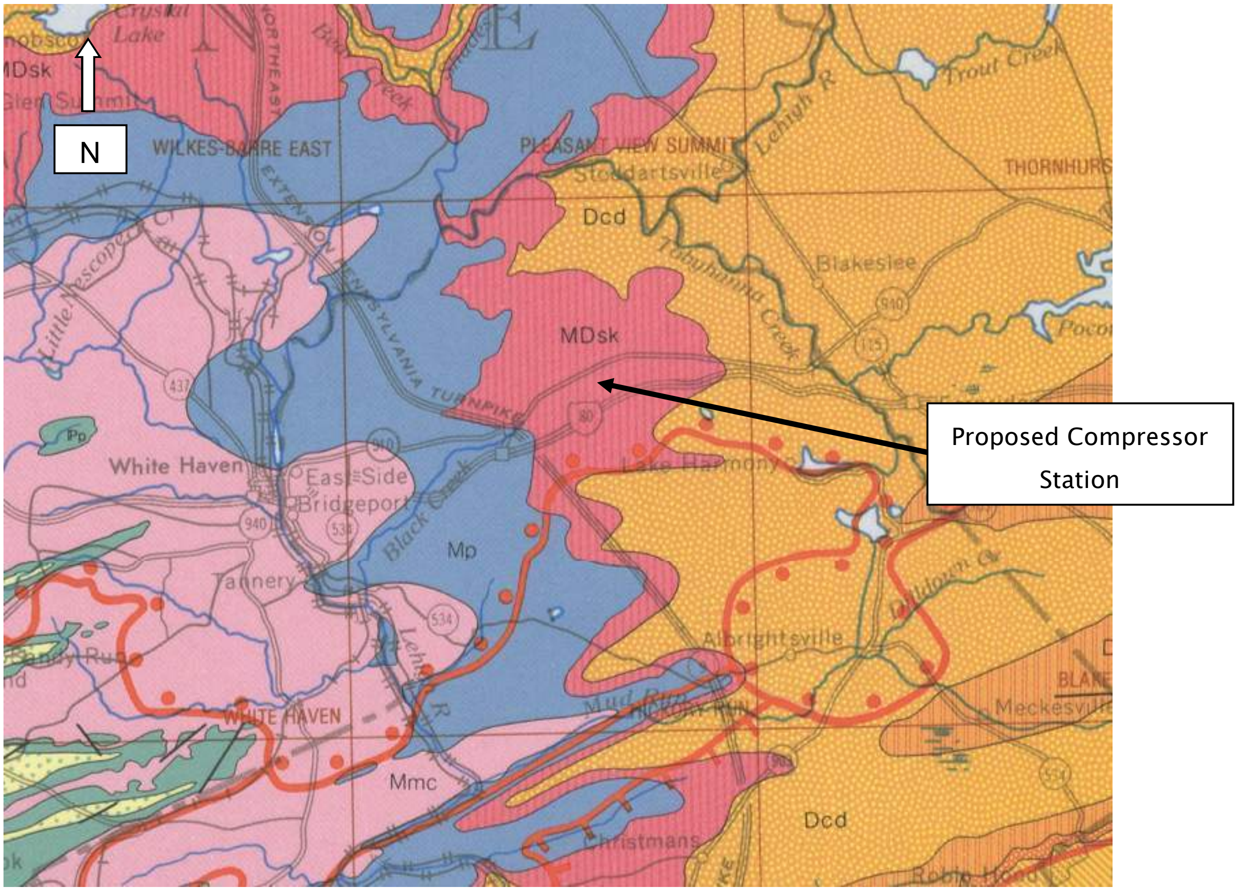
KIDDER COMPRESSOR STATION
EROSION AND SEDIMENT CONTROL PLAN
SITE INVESTIGATION

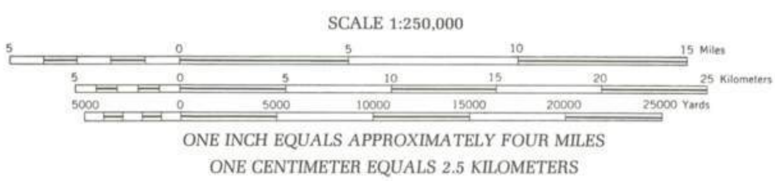
CARBON COUNTY, PENNSYLVANIA

SCALE	DRAWING NO.	REVISION
1" = 150'	023A-03-00-001	A

B. Geologic Section

Figure 1: Bedrock Geology





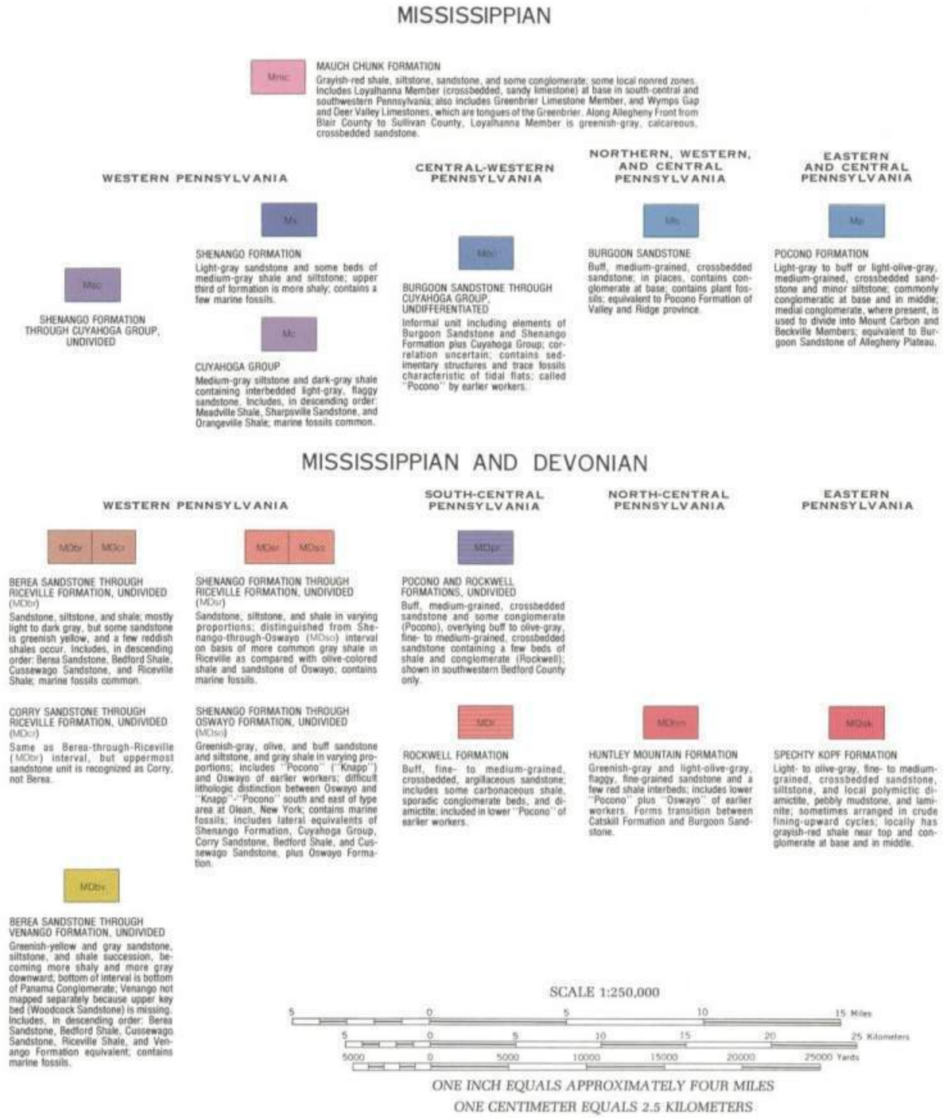
Notes:

1. The proposed compressor station falls within the Spechty Koft Formation (MDsk).
2. Geologic Imaging taken from:
   a. Berg, T.M., Edmunds, W.E., Geyer, A.R., and others, compilers, 1980, Geologic map of Pennsylvania (2nd ed.): Pennsylvania Geological Survey, 4th ser., Map 1, 3 sheets, scale 1:250,000.

Geological Map of Pennsylvania: Bedrock Formation Legend

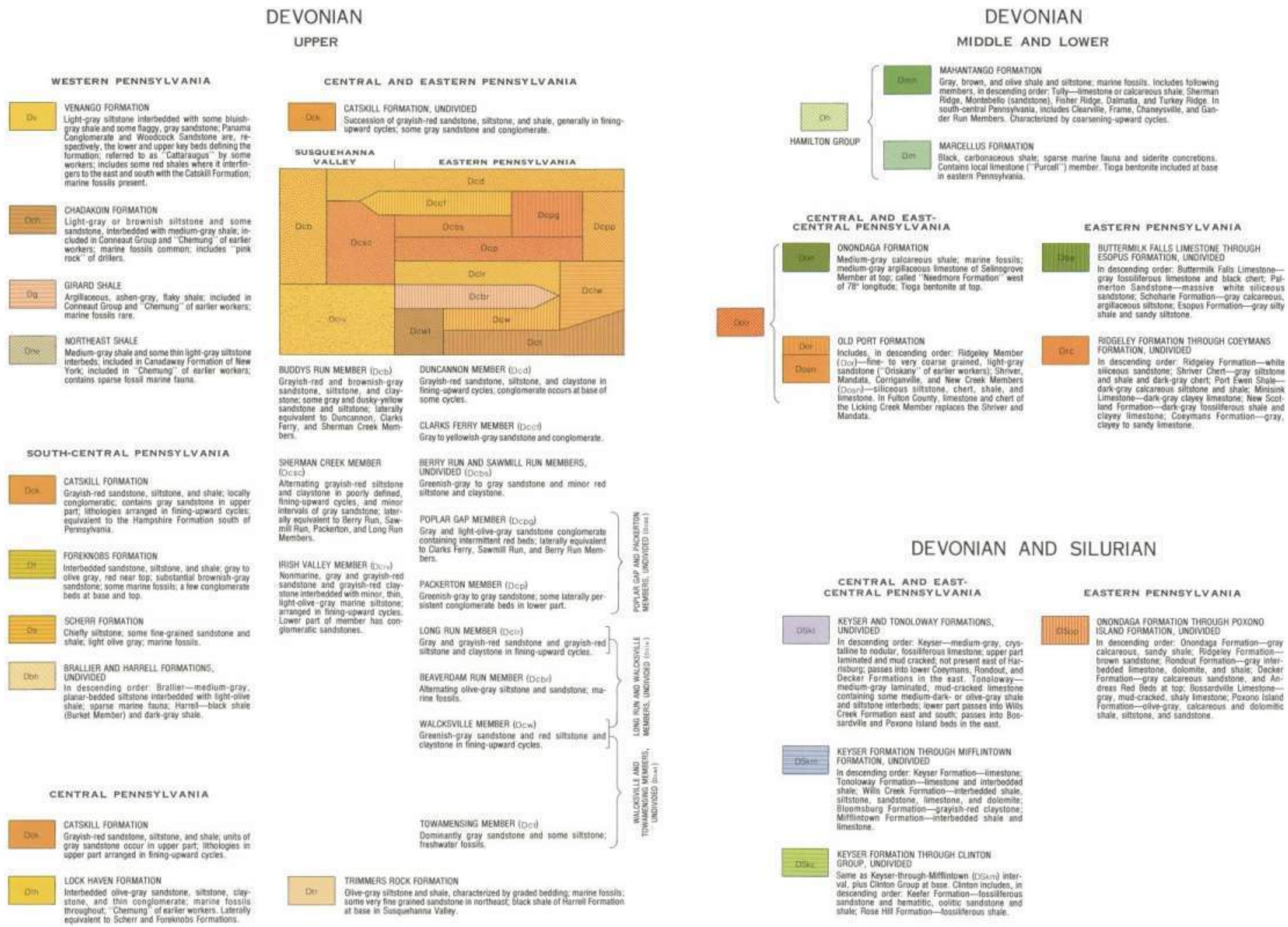
1. Note: Geologic Legend taken from:
    a. Berg, T.M., Edmunds, W.E., Geyer, A.R., and others, compilers, 1980, Geologic map of Pennsylvania (2nd ed.): Pennsylvania Geological Survey, 4th ser., Map 1, 3 sheets, scale 1:250,000.

Geological Map of Pennsylvania: Bedrock Formation Legend



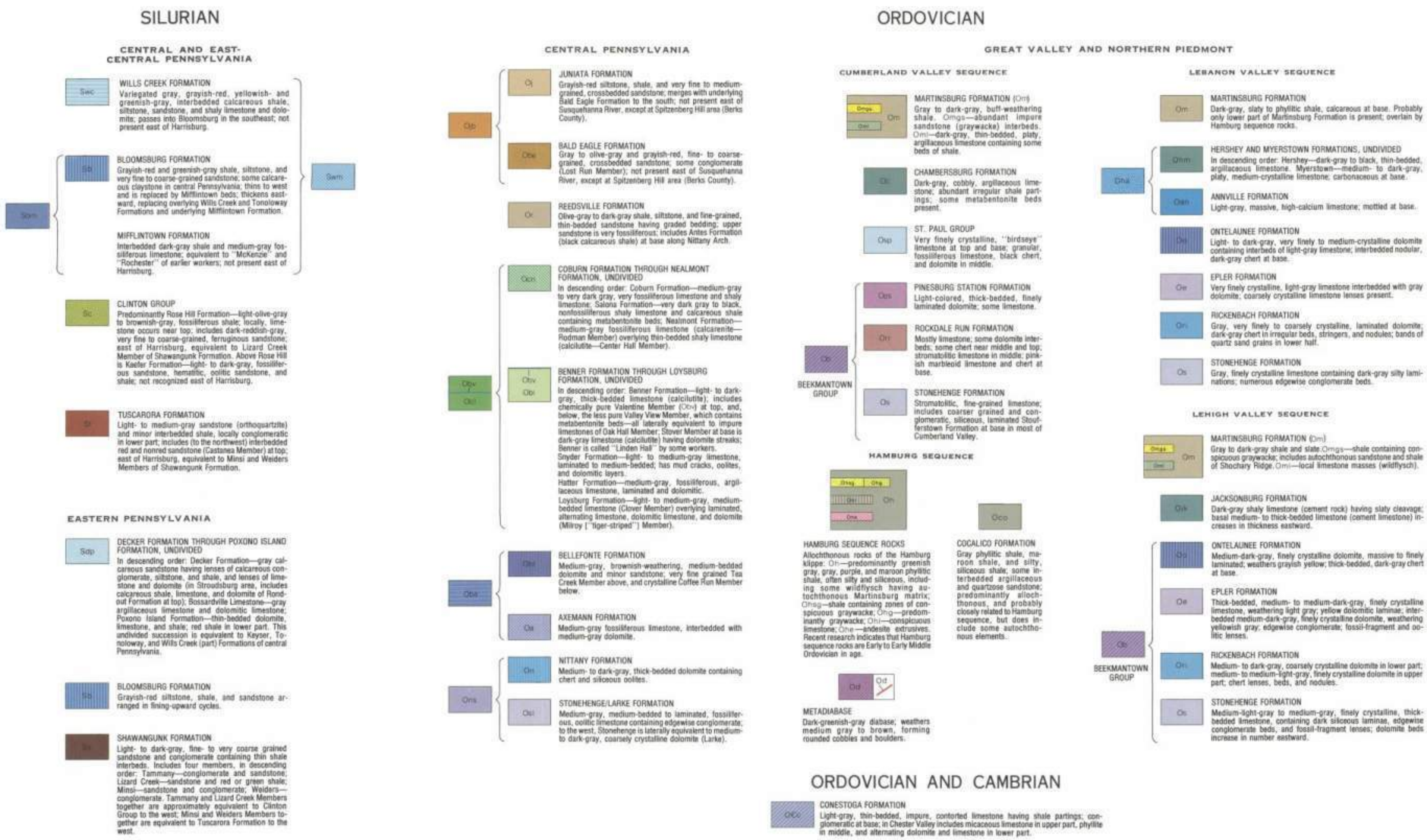
1. Note: Geologic Legend taken from:
    a. Berg, T.M., Edmunds, W.E., Geyer, A.R., and others, compilers, 1980, Geologic map of Pennsylvania (2nd ed.): Pennsylvania Geological Survey, 4th ser., Map 1, 3 sheets, scale 1:250,000.

Geological Map of Pennsylvania: Bedrock Formation Legend



1. Note: Geologic Legend taken from:
   a. Berg, T.M., Edmunds, W.E., Geyer, A.R., and others, compilers, 1980, Geologic map of Pennsylvania (2nd ed.): Pennsylvania Geological Survey, 4th ser., Map 1, 3 sheets, scale 1:250,000.

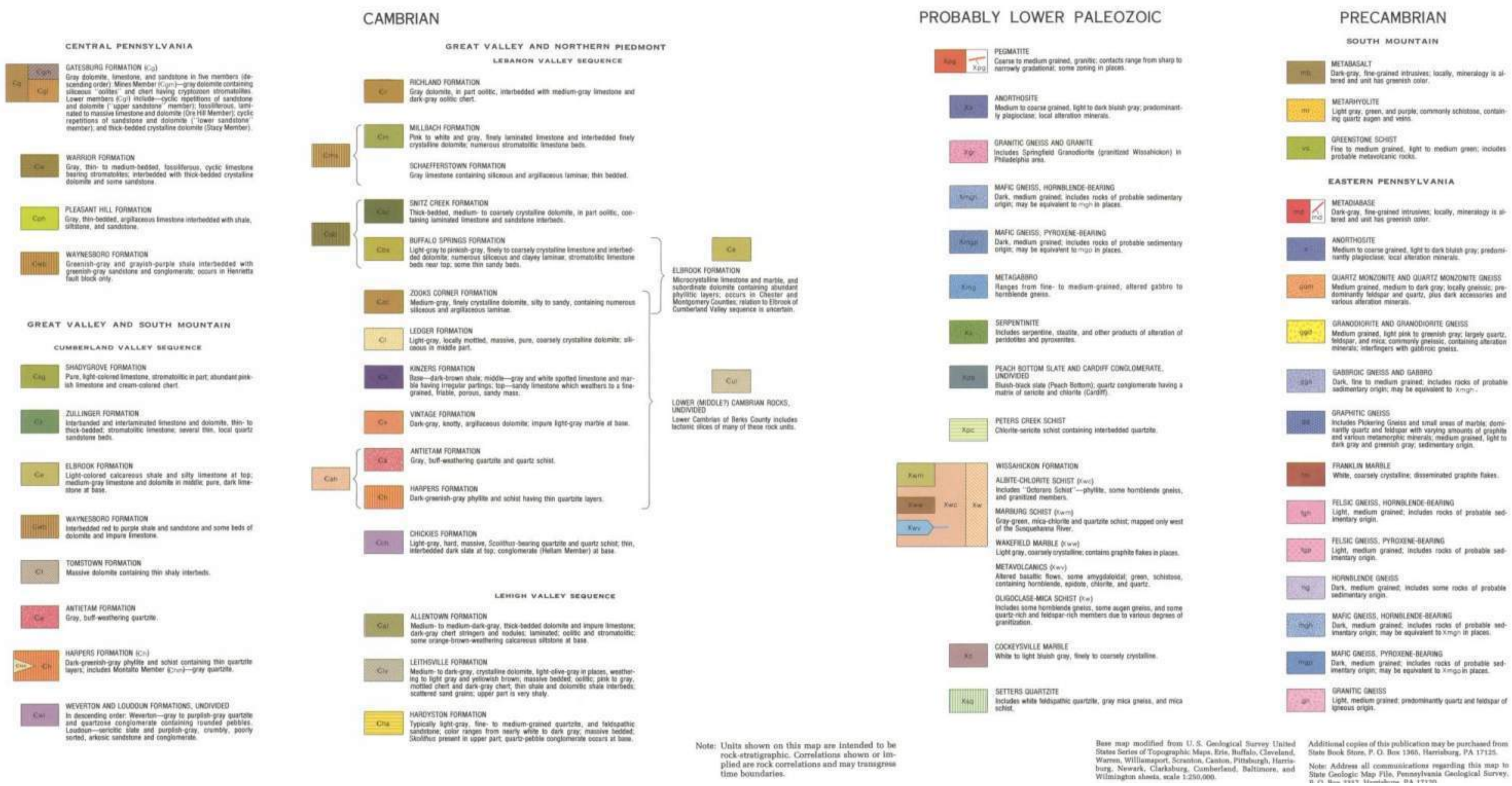
Geological Map of Pennsylvania: Bedrock Formation Legend



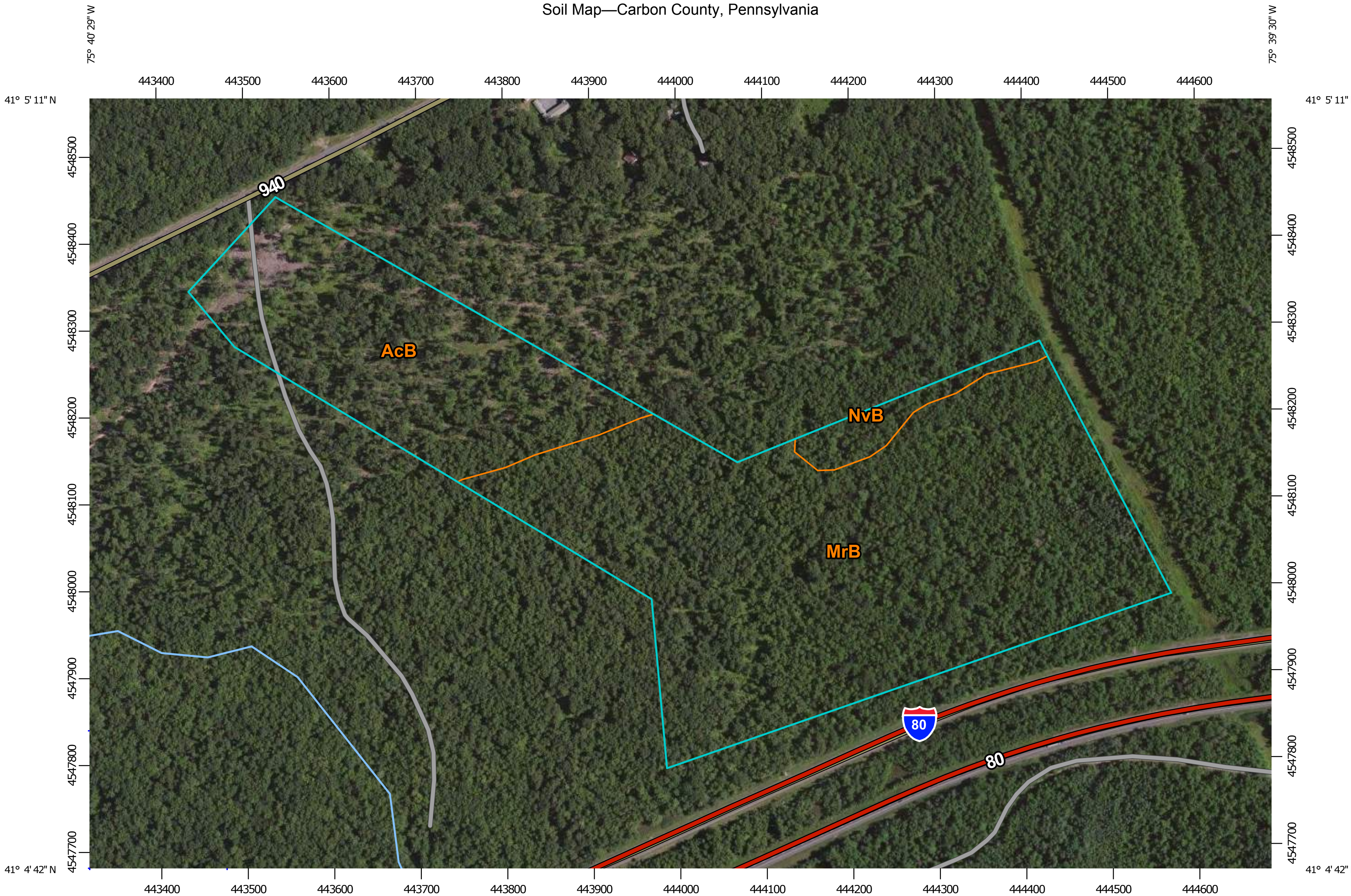
1. Note: Geologic Legend taken from:
   a. Berg, T.M., Edmunds, W.E., Geyer, A.R., and others, compilers, 1980, Geologic map of Pennsylvania (2nd ed.): Pennsylvania Geological Survey, 4th ser., Map 1, 3 sheets, scale 1:250,000.

MOTT MACDONALD

Geological Map of Pennsylvania: Bedrock Formation Legend



1. Note: Geologic Legend taken from:
   a. Berg, T.M., Edmunds, W.E., Geyer, A.R., and others, compilers, 1980, Geologic map of Pennsylvania (2nd ed.): Pennsylvania Geological Survey, 4th ser., Map 1, 3 sheets, scale 1:250,000.



Map Scale: 1:6,250 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Carbon County, Pennsylvania
Survey Area Data: Version 13, Nov 16, 2015

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

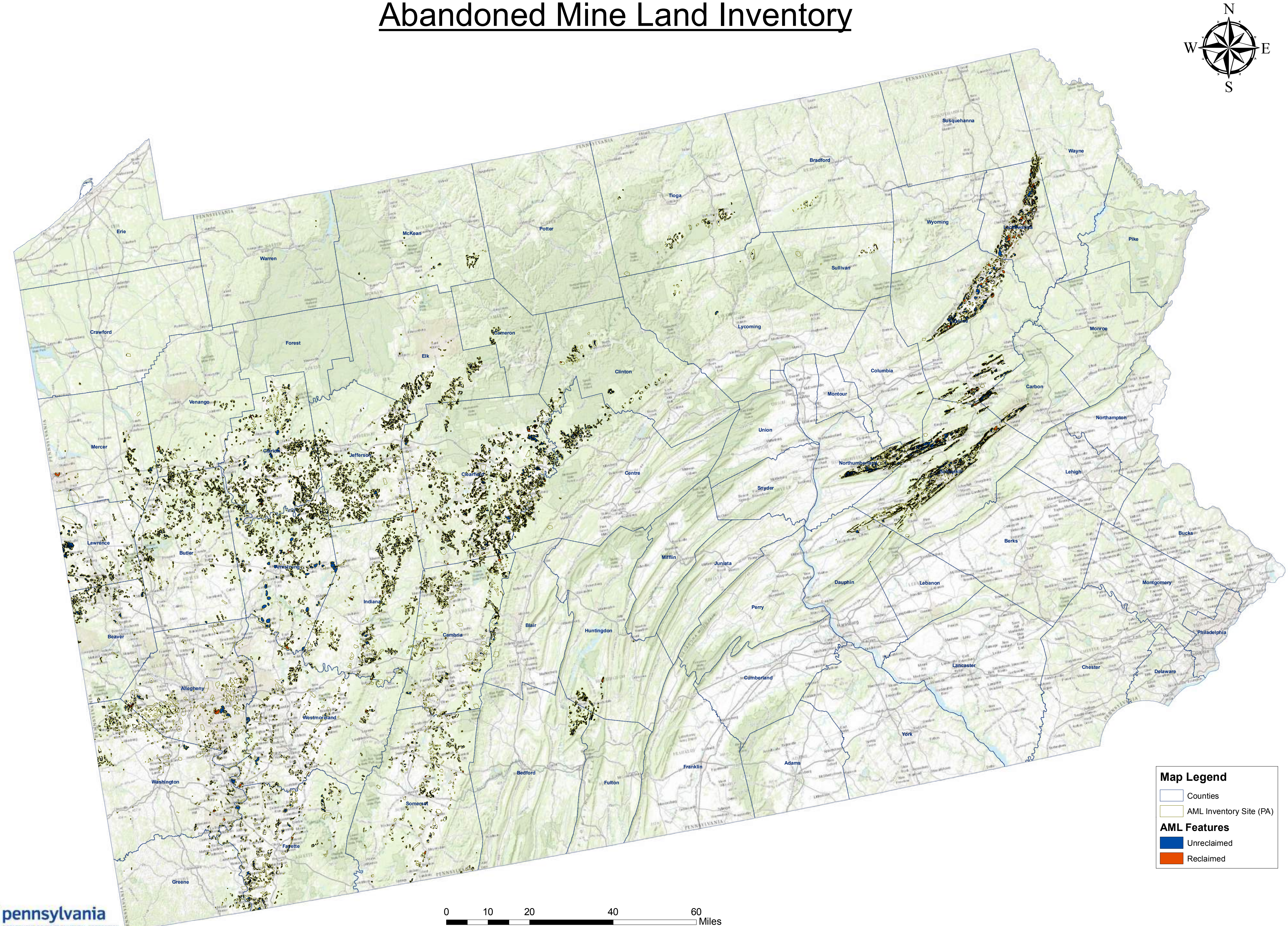
Date(s) aerial images were photographed: Mar 20, 2011—Jul 5, 2011

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

Carbon County, Pennsylvania (PA025)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AcB	Albrights very stony loam, 0 to 8 percent slopes	19.2	27.8%
MrB	Morris channery silt loam, 0 to 8 percent slopes, extremely stony	47.6	68.9%
NvB	Norwich soils, 0 to 8 percent slopes, extremely stony	2.3	3.3%
Totals for Area of Interest		**69.1**	**100.0%**

Pennsylvania
Abandoned Mine Land Inventory



Map Legend

- Counties
- AML Inventory Site (PA)

AML Features

- Unreclaimed
- Reclaimed

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

0 10 20 40 60 Miles

Please refer to one of the individual County maps
for the Disrtict Offices contact information

Map Prepared By: Katelyn I. Smith
Date: 1/09/2014
Data Source: Bureau of Abandoned Mine Reclamation
Projection: North_America_Albers_Equal_Area_Conic

For Information only
Priority 1 (P1): An AML problem concerning the protection of public health, safety, and property from extreme danger of adverse effects of mining practices or adjacent land and water reclamation.
Priority 2 (P2): An AML problem concerning the protection of public health and safety from adverse effects of mining practices or adjacent land and water reclamation.
Priority 3 (P3): An AML problem concerning the restoration of land and water resources and the environment previously degraded by adverse effects of mining practices.

C. Boring Logs and Core Photos

MOTT MACDONALD

SOIL BORING LOG

Project:	PennEast Pipeline Project	**Project No.:**	353754
Location:	Kidder Compressor Station	**Project Mgr:**	Vatsal Shah
Client:	PennEast Pipeline	**Field Eng. Staff:**	Bernard Cortes
Drilling Co.:	Craig Test Boring Co., Inc.	**Date/Time Started:**	October 15, 2016 at 9:30 am
Driller/Helper:	Paul Mullins /Nick Beehler	**Date/Time Finished:**	October 15, 2016 at 1:30 pm

Elevation: 1741.5 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** Kidder **Coord.:** **N:** 41.08181 **E:** -75.666199
Horizontal Datum: NAD 1983

Item	Casing	Sampler	Core Barrel
Type	HW	SS	NQ2
Length (ft)	5	2	5
Inside Dia. (in.)	4	1.375	2.0
Hammer Wt. (lb.)	140	140	-
Hammer Fall (in.)	30	30	-

Rig Make & Model: CME-750X
☐ Truck ☐ Tripod ☐ Cat-Head
☑ ATV ☐ Geoprobe ☑ Winch
☐ Track ☐ Air Track ☑ Roller Bit
☐ Skid ☐ ______ ☐ Cutting Head

Hammer Type: ☐ Safety ☐ Doughnut ☑ Automatic ☐ ______

Drilling Fluid: ☐ Bentonite ☐ Polymer ☑ Water ☐ None

Drill Rod Size: **Casing Advance** Mud Rotary

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Group Symbol	Visual - Manual Identification & Description (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
0.2	S-1 0.0'- 2.0'	11	1 2 3 5		ML	Top (2") TOPSOIL Medium stiff, Reddish brown SILT, moist (ML)	-	-	-	-	P.P.= N/A T.V.= N/A
1740											
	S-2 2.0'- 4.0'	22	6 9 18 25		ML	Very stiff, Reddish brown SILT, some coarse to fine Gravel, trace fine Sand, dry (ML)	-	-	-	-	P.P.= N/A T.V.= N/A
4.0	S-3 4.0'- 6.0'					Rock encountered with Roller Bit to 6 feet	-	-	-	-	
5											
6.0	S-4 6.0'- 8.0'					Cored to 16 feet BGS. See Rock Coring Log.	-	-	-	-	
	S-5 8.0'- 10.0'						-	-	-	-	
10	S-6 10.0'- 12.0'						-	-	-	-	
1730											
	S-7 12.0'- 14.0'						-	-	-	-	
15	S-8 14.0'- 16.0'						-	-	-	-	
16.0	S-9 16.0'- 18.0'	14	5 4 13 29		ML	Very stiff, Reddish brown Clayey SILT, some coarse to fine Gravel, wet (ML)	-	H	L	-	P.P.= N/A T.V.= N/A
18.0	S-10 18.0'- 20.0'	9	26 20 55/6"		GM	Very dense, Reddish brown coarse to fine GRAVEL, little Silt, wet (GM)	-	-	-	-	

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet to: Bot. of Casing	Bottom of Hole	Water

Sample Type
O Open End Rod
T Thin-Wall Tube
U Undisturbed Sample
S Split Spoon Sample
G Geoprobe

Notes:
PP = Pocket Penetrometer
TV = Torvane

Boring No.: **K2-11**

Field Test Legend: Dilatancy: N - None S - Slow R - Rapid; Plasticity: NP - Non-Plastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High VH - Very High

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

MOTT MACDONALD

SOIL BORING LOG
(continued)

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	Visual - Manual Identification & Description (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Dilatancy	Toughness	Plasticity	Dry Strength	Remarks*
1720	S-11 20.0'-22.0'	17	12 17 23 24		GM	Dense, Reddish brown coarse to fine GRAVEL, little Silt, wet (GM)	-	-	-	-	
	S-12 22.0'-24.0'	4	50/4"		GM	Very dense, Reddish brown coarse to fine Gravel, some Silt, wet (GM)	-	-	-	-	
24.0											
25	S-13 24.0'-24.0'		50/0'			Split Spoon Refusal Top of Rock at 24 feet BGS. See Rock Coring Log from 24 feet BGS.	-	-	-	-	
30											
1710											
35											
40											
1700											
45											

NOTES:

PROJECT NO.: **353754**

BORING NO.: **K2-11**

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

MOTT MACDONALD

CORE BORING LOG

BORING NO.: **K2-11**

Project:	PennEast Pipeline Project	**Project No.:**	353754
Location:	Kidder Compressor Station	**Project Mgr:**	Vatsal Shah
Client:	PennEast Pipeline	**Field Eng. Staff:**	Bernard Cortes
Drilling Co.:	Craig Test Boring Co., Inc.	**Date/Time Started:**	October 15, 2016 at 9:30 am
Driller/Helper:	Paul Mullins /Nick Beehler	**Date/Time Finished:**	October 15, 2016 at 1:30 pm

Elevation: 1741.5 ft. **Vertical Datum:** NAVD 1988

Boring Location: Kidder

Coord.: N: 41.08181 **E:** -75.666199

Horizontal Datum: NAD 1983

Rig Make & Model: CME-750X

Drilling Method: Wireline

Item	Casing	Core Barrel	Core Bit
Type	HW	NQ2	Imp. Diamond
Length (ft)	5	5	3.25
Inside Dia. (in.)	4	2.0	2.0

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec (in. / %)	RQD (in / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations) SEE TEST BORING LOG FOR OVERBURDEN DETAILS	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	1.50	6.0							SANDSTONE, Brownish red, coarse to fine grained, highly weathered, weak, extremely close spaced discontinuities 6' - 11' Highly Fractured zone								
	1.50																
	1.50		R-1	20 33%	0 0%	R2	H										
	1.50																
10	1.50	11.0							11.0								
1730	1.00	11.0							DECOMPOSED SANDSTONE								
	1.00																
	1.00		R-2	6 10%	0 0%	-	-										
	1.00																
15	1.00	16.0							16.0								
20									See Soil Boring Log for SPT Sampling at 16 feet BGS.								
1720									24.0								
	1.75	24.0							SILTSTONE, Brownish red, coarse to fine grained, highly weathered, weak, extremely close to close spaced discontinuities 24' - 29' Highly Fractured zone								
25	1.50																

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet to: Bot. of Casing	Bottom of Hole	Water
		-			

Notes:

Depth/ Elev. (ft)	Avg Core Rate (min/ft)	Depth (ft)	Run/ (Box) No.	Rec. (in. / %)	RQD (in. / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations)	Depth (ft.)	Discontinuities (See Legend for Rock Description System) Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	1.50		R-4	60 100%	0 0%	-	-										
	1.50																
	1.50	29.0							29.0								
30									End of Boring at 29 feet BGS. Borehole backfilled with soil cuttings and bentonite hole plug.								
1710																	
35																	
40																	
1700																	
45																	
50																	

NOTES:

Figure K2-11.1
K2-11 Box 1 Runs 1-3 Dry

Figure K2-11.2
K2-11 Box 1 Runs 1-3 Wet

MOTT MACDONALD	PennEast Pipeline Project Rock Core Photographs	BORING NO.: K2-11

MOTT MACDONALD

SOIL BORING LOG

BORING NO.: **K2-13**

Project:	PennEast Pipeline Project	**Project No.:**	353754
Location:	Kidder Compressor Station	**Project Mgr:**	Vatsal Shah
Client:	PennEast Pipeline	**Field Eng. Staff:**	Bernard Cortes
Drilling Co.:	Craig Test Boring Co., Inc.	**Date/Time Started:**	October 3, 2016 at 9:30 am
Driller/Helper:	Paul Mullins /Nick Beehler	**Date/Time Finished:**	October 3, 2016 at 10:15 am

Elevation: 1743.9 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** Future Road Location **Coord.: N:** 41.08347 **E:** -75.67033

Horizontal Datum: NAD 1983

Item	Casing	Sampler	Core Barrel
Type	HW	SS	NQ2
Length (ft)	5	2	5
Inside Dia. (in.)	4	1.375	2.0
Hammer Wt. (lb.)	140	140	-
Hammer Fall (in.)	30	30	-

Rig Make & Model: CME-750X

Rig			Hammer Type	Drilling Fluid
☐ Truck	☐ Tripod	☐ Cat-Head	☐ Safety	☐ Bentonite
☑ ATV	☐ Geoprobe	☑ Winch	☐ Doughnut	☐ Polymer
☐ Track	☐ Air Track	☑ Roller Bit	☑ Automatic	☑ Water
☐ Skid	☐ ______	☑ Cutting Head	☐ ______	☐ None

Drill Rod Size:

Casing Advance: Mud Rotary

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Group Symbol	Visual - Manual Identification & Description (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
	S-1 0.0'- 2.0'	1	2 2 4 4			TOPSOIL	-	-	-	-	Only TOPSOIL recovered.
						0.8					
						2.0					
	S-2 2.0'- 4.0'		9 10 14 15		ML	Very stiff, Reddish brown SILT, some weathered rock fragments, moist (ML)	-	-	-	-	Installed 4" casing to 4 feet BGS.
1740						4.0					
5	S-3 4.0'- 6.0'	15	9 13 19 29		GM	Dense, Reddish brown coarse to fine GRAVEL, some Silt, wet (GM)	-	-	-	-	
	S-4 6.0'- 8.0'	21	15 29 35 20		GM	Very dense, Reddish brown coarse to fine GRAVEL, some Silt, little Clay, trace medium to fine Sand, wet (GM)	-	-	-	-	Possible groundwater at 6 feet BGS.
	S-5 8.0'- 10.0'	17	19 15 12 13		GM	Dense, Reddish brown coarse to fine GRAVEL, some Silt, little Clay, trace medium to fine Sand, wet (GM)	-	-	-	-	
10						10.0					
	S-6 10.0'- 12.0'	10	6 50/4"		CL	Hard, Reddish brown Silty CLAY, some coarse to fine Gravel, wet (CL)	-	-	-	-	
						12.0					
	S-7 12.0'- 14.0'	19	26 39 37 32		ML	Hard, Reddish brown SILT, some Clay, some coarse to fine Gravel, wet (ML)	-	-	-	-	
1730						14.0					
15	S-8 14.0'- 16.0'	0	50/0"			No Recovery	-	-	-	-	
	S-9 16.0'- 18.0'	0	50/0"			No Recovery	-	-	-	-	Loss of water.
						18.0					
	S-10 18.0'- 20.0'					Top of Rock at 20 feet BGS. See Rock Coring Log.	-	-	-	-	Advancing to roller bit refusal. Started Coring at 20 feet BGS.

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet to: Bot. of Casing	Bottom of Hole	Water

Sample Type

- **O** Open End Rod
- **T** Thin-Wall Tube
- **U** Undisturbed Sample
- **S** Split Spoon Sample
- **G** Geoprobe

Notes:

PP = Pocket Penetrometer
TV = Torvane

Boring No.: **K2-13**

Field Test Legend: Dilatancy: N - None S - Slow R - Rapid Plasticity: NP - Non-Plastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High Dry Strength: N - None L - Low M - Medium H - High VH - Very High

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

MOTT MACDONALD

CORE BORING LOG

BORING NO.: **K2-13**

Project:	PennEast Pipeline Project	**Project No.:**	353754
Location:	Kidder Compressor Station	**Project Mgr:**	Vatsal Shah
Client:	PennEast Pipeline	**Field Eng. Staff:**	Bernard Cortes
Drilling Co.:	Craig Test Boring Co., Inc.	**Date/Time Started:**	October 3, 2016 at 9:30 am
Driller/Helper:	Paul Mullins /Nick Beehler	**Date/Time Finished:**	October 3, 2016 at 10:15 am

Elevation: 1743.9 ft. **Vertical Datum:** NAVD 1988

Item	Casing	Core Barrel	Core Bit
Type	HW	NQ2	Imp. Diamond
Length (ft)	5	5	3.25
Inside Dia. (in.)	4	2.0	2.0

Boring Location: Future Road Location

Coord.: N: 41.08347 **E:** -75.67033

Horizontal Datum: NAD 1983

Rig Make & Model: CME-750X

Drilling Method: Wireline

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec (in. / %)	RQD (in / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations) SEE TEST BORING LOG FOR OVERBURDEN DETAILS	Depth (ft.)	Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	1.75	20.0							SANDSTONE, Gray, coarse to fine grained, fresh, strong, extremely close to close spaced discontinuities								No Return. Soft Zone at 23.75 feet BGS (2"- 3").
										20.80	J	35	P,R	FR	O	N	
	2.25									21.80	J	35	P,R	FR	O	N	
	2.00		R-1	36 60%	27 45%	R4	FR			22.40	J	35	P,R	FR	O	N	
	2.00																
1720	2.00	25.0															
25	.500	25.0							SANDSTONE, Gray, coarse to fine grained, highly weathered, strong, extremely close spaced discontinuities								Soft Zone at 25 - 26 feet BGS.
	.500																
	.500		R-2	24 40%	0 0%	R4	H										
	.500																
	.500	30.0							30.0								
30									End of Boring at 30 feet BGS. Borehole backfilled with soil cuttings and bentonite hole plug.								
1710																	
35																	

Discontinuities (See Legend for Rock Description System)

Water Level Data

Date	Time	Elapsed Time (hr)	Bot. of Casing	Bottom of Hole	Water
		-			

Notes:

Boring No.: **K2-13**

Figure K2-13.1
K2-13 Box 1 Runs 1-2 Dry

Figure K2-13.2
K2-13 Box 1 Runs 1-2 Wet

MOTT MACDONALD	**PennEast Pipeline Project** **Rock Core Photographs**	**BORING NO.:** K2-13

MOTT MACDONALD	SOIL BORING LOG	BORING NO.: **K2-14**
		Page **1** of **2**

Project:	PennEast Pipeline Project	**Project No.:**	353754
Location:	Kidder Compressor Station	**Project Mgr:**	Vatsal Shah
Client:	PennEast Pipeline	**Field Eng. Staff:**	Bernard Cortes
Drilling Co.:	Craig Test Boring Co., Inc.	**Date/Time Started:**	September 28, 2016 at 10:00 am
Driller/Helper:	Paul Mullins /Nick Beehler	**Date/Time Finished:**	September 28, 2016 at 1:00 pm

Elevation: 1746.1 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** Near Site Entrance **Coord.:** **N:** 41.084361 **E:** -75.67239

Horizontal Datum: NAD 1983

Item	**Casing**	**Sampler**	**Core Barrel**
Type	HW	SS	NQ2
Length (ft)	5	2	5
Inside Dia. (in.)	4	1.375	2.0
Hammer Wt. (lb.)	140	140	-
Hammer Fall (in.)	30	30	-

Rig Make & Model: CME-750X

			Hammer Type	**Drilling Fluid**
☐ Truck	☐ Tripod	☐ Cat-Head	☐ Safety	☐ Bentonite
☑ ATV	☐ Geoprobe	☑ Winch	☐ Doughnut	☐ Polymer
☐ Track	☐ Air Track	☑ Roller Bit	☑ Automatic	☑ Water
☐ Skid	☐ ______	☐ Cutting Head	☐ ______	☐ None

Drill Rod Size:

Casing Advance: Mud Rotary

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Group Symbol	Visual - Manual Identification & Description (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
	S-1 0.0'- 2.0'	9	1 2 1 2		CL	0.2 Top (2") TOPSOIL Very soft, Brown CLAY, trace fine Sand, roots, moist (CL)	-	L	L	-	P.P.= 1.5 tsf T.V.= 3.0 tsf
	S-2A 2.0'- 3.0'	12	9 10		CL	Top (12") Very stiff, Brown CLAY, trace fine Sand, moist (CL)	-	L	L	-	P.P.= 1.5 tsf T.V.= 1.5 tsf
	S-2B 3.0'- 4.0'	12	15 20		ML	3.0 Bottom (12") Very stiff, Reddish brown SILT, some coarse to fine Gravel, dry (ML)	-	-	-	-	
5	S-3 4.0'- 6.0'	14	17 8 12 15		ML	Very stiff, Reddish brown, Clayey SILT, some coarse to fine Gravel, wet (ML)	-	L	L	-	Installed 4" casing to 4 feet BGS. Possible groundwater at 4 feet BGS.
1740	S-4 6.0'- 8.0'	24	14 12 18 16		ML	Very stiff, Reddish brown Clayey SILT, some coarse to fine Gravel, moist (ML)	-	L	L	-	P.P.= N/A T.V.= N/A
	S-5 8.0'- 10.0'	14	10 40 31 21		GM	8.0 Very dense, Reddish brown, coarse to fine GRAVEL, some Silt, little Clay, wet (GM)	-	-	-	-	Installed 4" casing to 10 feet BGS.
10	S-6 10.0'- 12.0'	9	8 10 26 41		GM	Dense, Reddish brown coarse to fine GRAVEL, some Silt, little Clay, wet (GM)	-	-	-	-	
	S-7 12.0'- 14.0'	10	18 8 9 8		ML	12.0 Stiff, Reddish brown Clayey SILT, some coarse to fine Gravel, wet (ML)	-	L	L	-	P.P.= N/A T.V.= N/A
15	S-8 14.0'- 16.0'	9	10 4 6 7		ML	Stiff, Reddish brown Clayey SILT, some coarse to fine Gravel, wet (ML)	-	L	L	-	P.P.= N/A T.V.= N/A
1730	S-9 16.0'- 18.0'	15	6 4 7 5		ML	Stiff, Reddish brown Clayey SILT, some coarse to fine Gravel, wet (ML)	-	L	L	-	P.P.= N/A T.V.= N/A
	S-10 18.0'- 20.0'	10	10 28 50/3"		GM	18.0 Very dense, Reddish brown coarse GRAVEL, little Silt, wet (GM) 20.0	-	-	-	-	Installed 4" casing to 20 feet BGS. P.P.= N/A T.V.= N/A Cobble fragments present.

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet to: Bot. of Casing	Bottom of Hole	Water

Sample Type

- **O** Open End Rod
- **T** Thin-Wall Tube
- **U** Undisturbed Sample
- **S** Split Spoon Sample
- **G** Geoprobe

Notes:
PP = Pocket Penetrometer
TV = Torvane

Boring No.: **K2-14**

Field Test Legend: Dilatancy: N - None S - Slow R - Rapid; Toughness: L - Low M - Medium H - High; Plasticity: NP - Non-Plastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High VH - Very High

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

MOTT MACDONALD

SOIL BORING LOG

(continued)

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	Visual - Manual Identification & Description (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Dilatancy	Toughness	Plasticity	Dry Strength	Remarks*
	S-11 20.0'-22.0'	14	24 23 50/4"		GW	Very dense, Reddish brown coarse to fine GRAVEL, some coarse to fine Sand, little Silt, cobble fragments present, moist (GW) 22.0	-	-	-	-	
	S-12 22.0'-24.0'	0	50/0"			No Recovery 24.0	-	-	-	-	Installed 4" casing to 22 feet BGS.
25 / 1720						Top of Rock at 24 feet. End of Boring at 24 feet BGS. Borehole backfilled with soil cuttings and bentonite hole plug.					
30											
35 / 1710											
40											
45 / 1700											

NOTES:

PROJECT NO.: **353754**

BORING NO.: **K2-14**

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

SOIL BORING LOG

MOTT MACDONALD

BORING NO.: **K2-15**

Project:	PennEast Pipeline Project	**Project No.:**	353754
Location:	Kidder Compressor Station	**Project Mgr:**	Vatsal Shah
Client:	PennEast Pipeline	**Field Eng. Staff:**	Bernard Cortes
Drilling Co.:	Craig Test Boring Co., Inc.	**Date/Time Started:**	October 5, 2016 at 7:30 am
Driller/Helper:	Paul Mullins /Nick Beehler	**Date/Time Finished:**	October 15, 2016 at 8:30 am

Elevation: 1732.8 ft. **Vertical Datum:** NAVD 1988 **Boring Location:** South Side of Creek **Coord.: N:** 41.081861 **E:** -75.667614 **Horizontal Datum:** NAD 1983

Item	Casing	Sampler	Core Barrel
Type	HW	SS	NQ2
Length (ft)	5	2	5
Inside Dia. (in.)	4	1.375	2.0
Hammer Wt. (lb.)	140	140	-
Hammer Fall (in.)	30	30	-

Rig Make & Model: CME-750X

☐ Truck ☐ Tripod ☐ Cat-Head
☑ ATV ☐ Geoprobe ☑ Winch
☐ Track ☐ Air Track ☑ Roller Bit
☐ Skid ☐ ______ ☐ Cutting Head

Hammer Type: ☐ Safety ☐ Doughnut ☑ Automatic ☐ ______

Drilling Fluid: ☐ Bentonite ☐ Polymer ☑ Water ☐ None

Drill Rod Size:

Casing Advance: Mud Rotary

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Group Symbol	Visual - Manual Identification & Description (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Dilatancy	Toughness	Plasticity	Dry Strength	Remarks
	S-1 0.0'- 2.0'	15	1 1 4 5		ML	0.2 Top (2") TOPSOIL Medium stiff, Reddish brown SILT, trace coarse to fine Sand, moist (ML)	-	-	-	-	P.P.= 1.5 tsf T.V.= 0.5 tsf
1730	S-2 2.0'- 4.0'	24	11 11 11 13		ML	Very stiff, Reddish brown SILT, trace coarse to fine Sand, dry (ML)	-	-	-	-	
5	S-3 4.0'- 6.0'	16	12 12 13 13		ML	Very stiff, Reddish brown Sandy SILT, little coarse to fine Gravel, wet (ML)	-	-	-	-	Installed 4" casing to 4 feet BGS.
	S-4 6.0'- 8.0'	17	14 13 15 23		ML	Very stiff, Reddish brown Sandy SILT, some coarse to fine Gravel, wet (ML)	-	-	-	-	Possible groundwater at 6 feet BGS.
	S-5 8.0'- 10.0'	24	19 13 26 50		ML	Hard, Reddish brown Sandy SILT, little coarse to fine Gravel, wet (ML)	-	-	-	-	
10	S-6 10.0'- 12.0'	14	4 3 21 29		ML	Very stiff, Reddish brown SILT, some coarse to fine Gravel, moist (ML) 12.0	-	-	-	-	
1720	S-7 12.0'- 14.0'	7	36 29 19 50/3"		GW-GM	Dense, Reddish brown Sandy coarse to fine GRAVEL, some Silt, wet (GW-GM) 14.0	-	-	-	-	
15	S-8 14.0'- 16.0'	17	12 8 15 24		ML	Very stiff, Reddish brown SILT, some coarse to fine Gravel, moist (ML) 16.0	-	-	-	-	
	S-9 16.0'- 18.0'	19	16 19 35 35		GM	Very dense, Reddish brown coarse to fine GRAVEL, some Silt, wet (GM) 18.0	-	-	-	-	
	S-10 18.0'- 20.0'	14	10 12 12 18		SM	Medium dense, Reddish brown Silty coarse to fine SAND, some coarse to fine Gravel, wet (GM) 20.0	-	-	-	-	

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet to: Bot. of Casing	Bottom of Hole	Water

Sample Type
- **O** Open End Rod
- **T** Thin-Wall Tube
- **U** Undisturbed Sample
- **S** Split Spoon Sample
- **G** Geoprobe

Notes:
PP = Pocket Penetrometer
TV = Torvane

Boring No.: **K2-15**

Field Test Legend: Dilatancy: N - None S - Slow R - Rapid; Toughness: L - Low M - Medium H - High; Plasticity: NP - Non-Plastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High VH - Very High

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

Depth/ Elev. (ft)	Sample No. / Interval (ft)	Rec. (in)	Sample Blows per 6"	Stratum Graphic	USCS Symbol Group	Visual - Manual Identification & Description (Density/consistency, color, Group Name, constituents, particle size, structure, moisture, optional descriptions, geologic interpretation, Symbol)	Dilatancy	Toughness	Plasticity	Dry Strength	Remarks*
	S-11 20.0'- 22.0'	11	14 21 13 12		GM	Dense, Reddish brown coarse to fine GRAVEL, some Silt, little coarse to fine Sand, wet (GM)	-	-	-	-	
1710	S-12 22.0'- 24.0'	1	12 11 11 13		GM	Medium dense, Reddish brown coarse to fine GRAVEL, little Silt, little coarse to fine Sand (GM)	-	-	-	-	
						24.0					
25	S-13 24.0'- 26.0'	16	8 7 12 17		ML	Very stiff, Reddish brown Sandy SILT, some coarse to fine Gravel, wet (ML)	-	-	-	-	
						26.0					
	S-14 26.0'- 28.0'	24	8 11 10 26		GM	Medium dense, Reddish brown coarse to fine GRAVEL, some Silt, little coarse to fine Sand, wet (GM)	-	-	-	-	
	S-15 28.0'- 30.0'	16	12 16 35 29		GM	Very dense, Reddish brown coarse to fine GRAVEL, some Silt, little coarse to fine Sand, wet (GM)	-	-	-	-	
30	S-16 30.0'- 32.0'	6	50/6"		GM	Very dense, Reddish brown coarse to fine GRAVEL, little Silt, wet (GM)	-	-	-	-	
						32.0					
1700	S-17 32.0'- 34.0'	0	50/0"			No Recovery	-	-	-	-	
						34.0					
35	34.0'-'					Top of Rock at 34 feet BGS. See Rock Coring Log.	-	-	-	-	
40											
1690											
45											

NOTES:

PROJECT NO.: **353754**

BORING NO.: **K2-15**

NOTES: 1.) "ppd" denotes soil sample average diametral pocket penetrometer reading. 2.) "ppa" denotes soil sample average axial pocket penetrometer reading.
3.) Maximum Particle Size is determined by direct observation within limitations of sampler size. 4.) Soil identifications and field tests based on visual-manual methods per ASTM D2488.

MOTT MACDONALD

CORE BORING LOG

BORING NO.: **K2-15**

Project:	PennEast Pipeline Project	**Project No.:**	353754
Location:	Kidder Compressor Station	**Project Mgr:**	Vatsal Shah
Client:	PennEast Pipeline	**Field Eng. Staff:**	Bernard Cortes
Drilling Co.:	Craig Test Boring Co., Inc.	**Date/Time Started:**	October 5, 2016 at 7:30 am
Driller/Helper:	Paul Mullins /Nick Beehler	**Date/Time Finished:**	October 15, 2016 at 8:30 am

Elevation: 1732.8 ft.		**Vertical Datum:** NAVD 1988		**Boring Location:** South Side of Creek	**Coord.: N:** 41.081861 **E:** -75.667614
Item	**Casing**	**Core Barrel**	**Core Bit**		
Type	HW	NQ2	Imp. Diamond	**Horizontal Datum:** NAD 1983	**Drilling Method:** Wireline
Length (ft)	5	5	3.25	**Rig Make & Model:** CME-750X	
Inside Dia. (in.)	4	2.0	2.0		

Depth/ Elev. (ft)	Avg Core Rate (min /ft)	Depth (ft)	Run/ (Box) No.	Rec (in. / %)	RQD (in / %)	Rock Core Hard.	Rock Core Weath	Stratum Graphic	Visual Identification, Description and Remarks (Rock type, colour, texture, weathering, field strength, discontinuity spacing, optional additional geological observations) SEE TEST BORING LOG FOR OVERBURDEN DETAILS	Depth (ft.)	Discontinuities Type	Dip	Rgh	Wea	Aper	Infill	Remarks
	1.80	35.0							DECOMPOSED ROCK, medium to fine grained, highly weathered, weak, extremely close to close discontinuities 35' - 40' Highly Fractured and Decomposed zone								
	1.80																
	1.80		R-1	41 68%	0 0%	R2	H										
	1.80																
	1.80	40.0							40.0								
40	2.00	40.0							SANDSTONE, Gray, medium to fine grained, highly weathered, weak, extremely close to close discontinuities 40' - 45' Highly Fractured zone								
	2.00																
1690	2.00		R-2	60 100%	4 7%	R2	H										
	2.00																
	2.00	45.0							45.0								
45	2.50	45.0							CONGLOMERATE, Gray, coarse to fine grained, highly weathered, weak, extremely close to close discontinuities 45' - 50' Highly Fractured zone								
	2.50																
	2.50		R-3	60 100%	0 0%	R2	H										
	2.50																
	2.50	50.0															
50	3.00	50.0							CONGLOMERATE, Gray, coarse to fine grained, moderately weathered, extremely close to close discontinuities 50' - 53' Highly Fractured zone 53.4' - 53.7' Highly Fractured zone								
	3.00																
1680	3.00		R-4	60 100%	15 25%	R3	M										
	3.00																
	3.00	55.0							55.0	54.30	J	40	P,R	FR	O	N	

(See Legend for Rock Description System)

Water Level Data

Date	Time	Elapsed Time (hr)	Depth in feet to: Bot. of Casing	Bottom of Hole	Water
		-			

Notes:

Figure K2-15.1
K2-15 Box 1 Runs 1-4 Dry

Figure K2-15.2
K2-15 Box 1 Runs 1-4 Wet

D. Test Pit Logs and Field Documents

Hatch Mott MacDonald

Sheet 1 of 2

Test Pit/Percolation Test Form

Geotechnical Investigation:

Project Name:	**PennEast Pipeline**	Date:	12/8/15
Job Number:	**353754**	Site Location :	KIDDER
Contractor:	CRAIG	Weather/Temp:	CLOUDY 32°
Test Pit ID :	KTP 1	Report by:	B. CORTES
Test Pit Depth :	1 ft	Percolation Test Method :	DOUBLE RING INFILTROMETER

Test Pit Soil Description:

Depth Range (inches)		Description of Soil/Rock Layers
0	6	TOPSOIL
0	12	DARK BROWN CLAY AND SILT, C-F GRAVEL, COBBLES, BOULDERS,
		ROOTS, MOIST
12	24	REDDISH BROWN CLAY AND SILT, C-F GRAVEL, COBBLES, BOULDERS,
		MOIST

Percolation Test: KTP 1

TEST 1

Time (min.)	30	30	30	30					
Test Depth (feet)	**Reading No. 1**	**Reading No. 2**	**Reading No. 3**	**Reading No. 4**	**Reading No. 5**	**Reading No. 6**	**Reading No. 7**	**Reading No. 8**	**Perc. Rate (Min/ in)**
1 ft	1/8"	1/8"	1/8"	1/8"					240

1/4 in/hr

TEST 2

Time (min.)	30	30	30	30					
Test Depth (feet)	**Reading No. 1**	**Reading No. 2**	**Reading No. 3**	**Reading No. 4**	**Reading No. 5**	**Reading No. 6**	**Reading No. 7**	**Reading No. 8**	**Perc. Rate (Min/ in)**
1 ft	3/4"	3/4"	3/4"	3/4"					40

1.5 in/hr

MOTT MACDONALD M M

TEST PIT LOG

SITE LOCATION	Kidder	**TEST PIT NUMBER**	**KTP- 1**
PROJECT NUMBER	353754	**MM REPRESENTATIVE**	B. Cortes
GENERAL LOCATION	Carbon County, PA	**CONTRACTOR**	Craig Test Boring Co. Inc.
TIME OPENED	11:30am	**TIME CLOSED**	3:00pm
GROUNDWATER	Not encountered and no evidence of seasonal high groundwater (mottling)	**GROUND SURFACE ELEVATION (ft.)**	1736
TESTING DEPTH ELEVATION (ft.)	1735	**FINAL EXCAVATION DEPTH ELEVATION (ft.)**	1733
BEDROCK DEPTH ELEVATION (ft.)	Not Encountered	**DATE**	12/8/2015

0-6": Topsoil

12-36": Reddish brown clay and silt, coarse to fine gravel with varying amounts of cobbles and boulder.

6-12": Dark brown CLAY and SILT, some coarse to fine Gravel, Cobbles, Boulders, roots, moist

Note: All classifications and descriptions in this log are solely based on visual field observations. All test pits indicate no groundwater encountered, previously two indicated groundwater and the basin was refined based on these results.

MOTT MACDONALD M M

Test Pit/Percolation Test Form

Geotechnical Investigation:

- Project Name: PENNEAST
- Date: 10/14/16
- Job Number: 353734
- Site Location : KIDDER
- Contractor: CTB
- Weather/Temp:
- Test Pit ID : KTP 2
- Report by: B. CORTES
- Test Pit Depth : 1.3'
- Percolation Test Method : DOUBLE RING

Test Pit Soil Description:

Depth Range (inches)		Description of Soil/Rock Layers
0	6	DARK BROWN TOPSOIL, SOME ROOTS, LITTLE
		COBBLES, TRACE BOULDERS, MOIST
6	3.9'	BROWN SILT, SOME C-F GRAVEL, LITTLE
		COBBLE, TRACE F SAND, TRACE ROOTS, MOIST
3.9' →		TOP OF ROCK

Percolation Test:

Time (min.)	30	30	30	30	30	30			
Test Depth (feet)	**Reading No. 1**	**Reading No. 2**	**Reading No. 3**	**Reading No. 4**	**Reading No. 5**	**Reading No. 6**	**Reading No. 7**	**Reading No. 8**	**Perc. Rate (in/hr)**
1.3'	1 1/2"	1 3/8"	1"	3/4"	3/4"	3/4"	—	—	1.5

Time (min.)	30	30	30	30	30	30			
Test Depth (feet)	**Reading No. 1**	**Reading No. 2**	**Reading No. 3**	**Reading No. 4**	**Reading No. 5**	**Reading No. 6**	**Reading No. 7**	**Reading No. 8**	**Perc. Rate (in/hr)**
1.3'	1 1/2"	1"	3/4"	3/4"	7/8"	7/8"	—	—	1.75

MOTT
MACDONALD

TEST PIT LOG

SITE LOCATION	Kidder	**TEST PIT NUMBER**	**KTP- 2**
PROJECT NUMBER	353754	**MM REPRESENTATIVE**	B. Cortes
GENERAL LOCATION	Carbon County, PA	**CONTRACTOR**	Craig Test Boring Co. Inc.
TIME OPENED	7:30am	**TIME CLOSED**	12:30pm
GROUNDWATER	Not encountered and no evidence of seasonal high groundwater (mottling)	**GROUND SURFACE ELEVATION (ft.)**	1736.3
TESTING DEPTH ELEVATION (ft.)	1735	**FINAL EXCAVATION DEPTH ELEVATION (ft.)**	1733.1
BEDROCK DEPTH ELEVATION (ft.)	1733.1	**DATE**	10/14/2016

6-37”: Reddish brown SILT, some coarse to fine Gravel, little Cobbles, trace fine sand, trace roots, moist

39”: Bedrock encountered, (not depicted)

0-6”: Topsoil, some roots, little Cobbles, trace Boulders, moist

Note: All classifications and descriptions in this log are solely based on visual field observations. All test pits indicate no groundwater encountered, previously two indicated groundwater and the basin was refined based on these results.

MOTT MACDONALD

Test Pit/Percolation Test Form

Geotechnical Investigation:

- Project Name: PENNEAST
- Date: 10/10/16
- Job Number: 353754
- Site Location: KIDDER
- Contractor: CTB
- Weather/Temp: CLEAR 50°
- Test Pit ID: KTP 3
- Report by: B. CORTI
- Test Pit Depth: 4.5
- Percolation Test Method: DOUBLE RING INFILTROMETER

Test Pit Soil Description:

Depth Range (inches)		Description of Soil/Rock Layers
0	4	DARK BROWN TOPSOIL, SOME ROOTS, MOIST
4	54	REDDISH BROWN, SANDY SILT, SOME COBBLES, LITTLE
		C-F GRAVEL, DRY
54	78	REDDISH BROWN WEATHERED ROCK FRAGMENTS, SOME SILT,
		DRY

Percolation Test:

TEST #1

	PRESOAK	PRESOAK							
Time (min.)	30	30	30	30	30	30			
Test Depth (feet)	Reading No. 1	Reading No. 2	Reading No. 3	Reading No. 4	Reading No. 5	Reading No. 6	Reading No. 7	Reading No. 8	Perc. Rate (in/hr)
4.5	1 3/4	1 3/4	1 1/8"	1"	7/8"	7/8"	—	—	1.75"

	PRE-SOAK	PRE-SOAK							
Time (min.)	30	30	30	30	30	30			
Test Depth (feet)	Reading No. 1	Reading No. 2	Reading No. 3	Reading No. 4	Reading No. 5	Reading No. 6	Reading No. 7	Reading No. 8	Perc. Rate (in/hr)
4.5	1 3/4	1/4"	1/2"	1/4	3/8"	3/8"	—	—	0.75"

MOTT MACDONALD M M

TEST PIT LOG

SITE LOCATION	Kidder	**TEST PIT NUMBER**	**KTP- 3**
PROJECT NUMBER	353754	**MM REPRESENTATIVE**	B. Cortes
GENERAL LOCATION	Carbon County, PA	**CONTRACTOR**	Craig Test Boring Co. Inc.
TIME OPENED	8:00am	**TIME CLOSED**	1:00pm
GROUNDWATER	Not encountered and no evidence of seasonal high groundwater (mottling)	**GROUND SURFACE ELEVATION (ft.)**	1737.5
TESTING DEPTH ELEVATION (ft.)	1733	**FINAL EXCAVATION DEPTH ELEVATION (ft.)**	1731
BEDROCK DEPTH ELEVATION (ft.)	Not Encountered	**DATE**	10/10/2016

54 - 78": Reddish brown WEATHERED ROCK fragments, some Silt, dry

4-54": Reddish brown Sandy SILT, little coarse to fine Gravel, dry

0-6": Topsoil, some roots, moist

Note: All classifications and descriptions in this log are solely based on visual field observations. All test pits indicate no groundwater encountered, previously two indicated groundwater and the basin was refined based on these results.

MOTT MACDONALD M M

Sheet 1 of 2

Test Pit/Percolation Test Form

Geotechnical Investigation:

- Project Name: PENNEAST
- Date: 10/11/16
- Job Number: 353754
- Site Location: KIDDER
- Contractor: GTR
- Weather/Temp: CLEAR 48°
- Test Pit ID: KTP-4
- Report by: B. CARTES
- Test Pit Depth: 6.0
- Percolation Test Method: DOUBLE RING

Test Pit Soil Description:

Depth Range (inches)		Description of Soil/Rock Layers
0"	4"	DARK BROWN TOPSOIL, SOME ROOTS, MOIST
4"	34"	REDDISH BROWN SANDY SILT, SOME COBBLES, LITTLE C-F GRAVEL,
		TRACE BOULDERS, DRY
34"	72	BROWN SANDY SILT, SOME COBBLES, LITTLE BOULDERS, LITTLE C-F GRAVEL, DRY
72"	96	BROWN WEATHERED ROCK FRAGMENTS, SOME SILT, LITTLE
		C-F GRAVEL, TRACE C-F SAND, MOIST

Percolation Test:

PRE-SOAK PRE-SOAK

Time (min.)	30	30	30	30	30	30			
Test Depth (feet)	**Reading No. 1**	**Reading No. 2**	**Reading No. 3**	**Reading No. 4**	**Reading No. 5**	**Reading No. 6**	**Reading No. 7**	**Reading No. 8**	**Perc. Rate (in/hr)**
6.0	7/8	1/2	1/2"	1/4"	1/4"	1/4"	—	—	1/2"

PRE-SOAK PRE-SOAK

Time (min.)	30"	30	30	30	30	30	30		
Test Depth (feet)	**Reading No. 1**	**Reading No. 2**	**Reading No. 3**	**Reading No. 4**	**Reading No. 5**	**Reading No. 6**	**Reading No. 7**	**Reading No. 8**	**Perc. Rate (in/hr)**
6.0	2 1/4	3/8	1 3/8"	7/8"	7/8"	3/4"	3/4"	—	1.5"

MOTT MACDONALD M M

TEST PIT LOG

SITE LOCATION	Kidder	**TEST PIT NUMBER**	**KTP- 4**
PROJECT NUMBER	353754	**MM REPRESENTATIVE**	B. Cortes
GENERAL LOCATION	Carbon County, PA	**CONTRACTOR**	Craig Test Boring Co. Inc.
TIME OPENED	1:00pm on 10/10/2016	**TIME CLOSED**	12:00pm on 10/11/2016
GROUNDWATER	Not encountered and no evidence of seasonal high groundwater (mottling)	**GROUND SURFACE ELEVATION (ft.)**	1739
TESTING DEPTH ELEVATION (ft.)	1733	**FINAL EXCAVATION DEPTH ELEVATION (ft.)**	1731
BEDROCK DEPTH ELEVATION (ft.)	Not Encountered	**DATE**	10/11/2016

0-4": Topsoil, some roots, moist

4 - 34": Reddish brown Sandy SILT, some Cobbles, little coarse to fine Gravel, trace Boulders, dry

34 - 72": Brown Sandy SILT, some Cobbles, little Boulders, little coarse to fine Gravel, dry

72 - 96": Brown WEATHERED ROCK fragments, some Silt, little coarse to fine Gravel (not depicted)

Note: All classifications and descriptions in this log are solely based on visual field observations. All test pits indicate no groundwater encountered, previously two indicated groundwater and the basin was refined based on these results.

MOTT MACDONALD

Sheet 1 of 2

Test Pit/~~Percolation~~ INFILTRATION Test Form

Geotechnical Investigation:

- Project Name: PENNEAST
- Date: 10/7/16
- Job Number: 353754
- Site Location: KIDDER
- Contractor: CTB
- Weather/Temp: CLEAR
- Test Pit ID: KTP 5
- Report by: B. CORTES
- Test Pit Depth: 3.2'
- Percolation Test Method: DOUBLE RING

Test Pit Soil Description:

Depth Range (inches)		Description of Soil/Rock Layers
0	12	DARK BROWN TOPSOIL SOME ROOTS
12	39	REDDISH BROWN SILT, SOME COBBLES, LITTLE BOULDERS
		(POSSIBLE TILL), TRACE ROOTS, TRACE C-F SAND, MOIST
39	63	REDDISH BROWN SILT, SOME COBBLES, LITTLE C-F GRAVEL TRACE C-F SAND, MOIST

INFILTRATION ~~Percolation~~ Test:

TEST 1

	PRE-SOAK	PRE-SOAK							
Time (min.)	30	30	10	10	10	10			
Test Depth (feet)	**Reading No. 1**	**Reading No. 2**	**Reading No. 3**	**Reading No. 4**	**Reading No. 5**	**Reading No. 6**	**Reading No. 7**	**Reading No. 8**	**INFIL. ~~Perc.~~ Rate (in/hr)**
3.2	>2	>2	3/4"	3/4"	3/4"	3/4"			4.5

TEST 2

Time (min.)	PRE-SOAK 30	PRE-SOAK 30	30	30	30	30			
Test Depth (feet)	**Reading No. 1**	**Reading No. 2**	**Reading No. 3**	**Reading No. 4**	**Reading No. 5**	**Reading No. 6**	**Reading No. 7**	**Reading No. 8**	**INFIL. ~~Perc.~~ Rate (in/hr)**
3.2	1.5	1 1/4"	1 1/8"	1"	7/8"	7/8"			1.75

MOTT MACDONALD M M

TEST PIT LOG

SITE LOCATION	Kidder	**TEST PIT NUMBER**	**KTP- 5**
PROJECT NUMBER	353754	**MM REPRESENTATIVE**	B. Cortes
GENERAL LOCATION	Carbon County, PA	**CONTRACTOR**	Craig Test Boring Co. Inc.
TIME OPENED	8:30am	**TIME CLOSED**	1:00pm
GROUNDWATER	Not encountered and no evidence of seasonal high groundwater (mottling)	**GROUND SURFACE ELEVATION (ft.)**	1736.2
TESTING DEPTH ELEVATION (ft.)	1733.0	**FINAL EXCAVATION DEPTH ELEVATION (ft.)**	1731
BEDROCK DEPTH ELEVATION (ft.)	Not Encountered	**DATE**	10/7/2016

0-12”: Topsoil, some roots, moist

12 - 39”: Reddish brown SILT, some Cobbles, little Boulders, trace roots, trace coarse to fine Sand, moist

39 – 63”: Reddish brown SILT, some Cobbles, little coarse to fine Gravel, trace coarse to fine Sand, moist

Note: All classifications and descriptions in this log are solely based on visual field observations. All test pits indicate no groundwater encountered, previously two indicated groundwater and the basin was refined based on these results.

MOTT MACDONALD M M

Test Pit/Percolation Test Form

Geotechnical Investigation:

- Project Name: PENNEAST
- Date: 10/12/16
- Job Number: 353754
- Site Location: KIDDER
- Contractor: CTB
- Weather/Temp: PARTLY CLOUDY 44°
- Test Pit ID: LTP 6
- Report by: B. CORTES
- Test Pit Depth: 5.1'
- Percolation Test Method: DOUBLE RING

Test Pit Soil Description:

Depth Range (inches)		Description of Soil/Rock Layers
0	18	DARK BROWN TOPSOIL, SOME COBBLES, LITTLE BOULDERS
		(POSSIBLE FILL) (LITTLE ROOTS), MOIST
18	42	BROWN CLAYEY SILT, LITTLE WEATHERED ROCK FRAGMENTS,
		LITTLE C-F SAND, TRACE ROOTS, (MOTTLING 36"-42")
42	85	REDDISH BROWN WEATHERED ROCK FRAGMENTS,
		SOME SILT, LITTLE C-F SAND, MOIST

Percolation Test:

Time (min.)	Pre 30	Pre 30	30	30	30	30	30	30	
Test Depth (feet)	**Reading No. 1**	**Reading No. 2**	**Reading No. 3**	**Reading No. 4**	**Reading No. 5**	**Reading No. 6**	**Reading No. 7**	**Reading No. 8**	**Perc. Rate (in/hr)**
5.1	>2"	1 5/8"	1 5/8"	1 5/8"	1/8"	5/8	1/2"	3/4"	1/4"

Time (min.)	Pre 30	Pre 30	30	30	30	30	—	—	
Test Depth (feet)	**Reading No. 1**	**Reading No. 2**	**Reading No. 3**	**Reading No. 4**	**Reading No. 5**	**Reading No. 6**	**Reading No. 7**	**Reading No. 8**	**Perc. Rate (in/hr)**
5.1	>2"	>2"	1 3/8"	1 3/8"	1 1/2"	1 1/4"	—	—	2.5

MOTT MACDONALD

TEST PIT LOG

SITE LOCATION	Kidder	**TEST PIT NUMBER**	**KTP- 6**
PROJECT NUMBER	353754	**MM REPRESENTATIVE**	B. Cortes
GENERAL LOCATION	Carbon County, PA	**CONTRACTOR**	Craig Test Boring Co. Inc.
TIME OPENED	8:30am on 10/7/2016	**TIME CLOSED**	1:30pm
GROUNDWATER	Not Encountered; mottling 36" – 42" BGS	**GROUND SURFACE ELEVATION (ft.)**	1738.1
TESTING DEPTH ELEVATION (ft.)	1733	**FINAL EXCAVATION DEPTH ELEVATION (ft.)**	1731
BEDROCK DEPTH ELEVATION (ft.)	Not Encountered	**DATE**	10/12/2016

0-18": Topsoil, some Cobbles, little Boulders, little roots, moist

42 – 85": Reddish brown WEATHERED ROCK fragments, some Silt, little coarse to fine Sand, moist

18 - 42": Brown clayey SILT, little weathered rock fragments, little coarse to fine Sand, trace roots, (mottling 36" -42")

Note: All classifications and descriptions in this log are solely based on visual field observations. All test pits indicate no groundwater encountered, previously two indicated groundwater and the basin was refined based on these results.

Hatch Mott MacDonald

Sheet 1 of 1

Test Pit/Percolation Test Form

Geotechnical Investigation:

- Project Name: PennEast Pipeline
- Date: 1/7/2016 - 1/8/2016
- Job Number: 353754
- Site Location: KIDDER
- Contractor: CRAIG
- Weather/Temp: CLOUDY
- Test Pit ID: KTP 7
- Report by: B. CORTES
- Test Pit Depth: 4 FEET
- Percolation Test Method: DOUBLE-RING INFILTROMETER

Test Pit Soil Description:

Depth Range (inches)		Description of Soil/Rock Layers
6	4	TOPSOIL
4	72	REDDISH BROWN SILTY CLAY, SOME GRAVEL, LITTLE C-F SAND
		COBBLES, BOULDERS, MOIST

Percolation Test:

TEST 1

Time (min.)	30	30	30	30	30				
Test Depth (feet)	**Reading No. 1**	**Reading No. 2**	**Reading No. 3**	**Reading No. 4**	**Reading No. 5**	**Reading No. 6**	**Reading No. 7**	**Reading No. 8**	**Perc. Rate (Min/ in)**
4	1 1/4	3/4	3/4	3/4	3/4	–	–	–	1.5 in/hr

TEST 2

Time (min.)	30	30	30	30	30				
Test Depth (feet)	**Reading No. 1**	**Reading No. 2**	**Reading No. 3**	**Reading No. 4**	**Reading No. 5**	**Reading No. 6**	**Reading No. 7**	**Reading No. 8**	**Perc. Rate (Min/ in)**
4	1 1/4"	3/4"	1/2"	3/4"	1/2"	—	—	—	1 in/hr

MOTT MACDONALD

TEST PIT LOG

SITE LOCATION	Kidder	**TEST PIT NUMBER**	**KTP- 7**
PROJECT NUMBER	353754	**MM REPRESENTATIVE**	B. Cortes
GENERAL LOCATION	Carbon , PA	**CONTRACTOR**	Craig Test Boring Co. Inc.
TIME OPENED	3:00pm on 1/7/2016	**TIME CLOSED**	3:30pm on 1/8/2016
GROUNDWATER	Not encountered and no evidence of seasonal high groundwater (mottling)	**GROUND SURFACE ELEVATION (ft.)**	1736.8
TESTING DEPTH ELEVATION (ft.)	1732.8	**FINAL EXCAVATION DEPTH ELEVATION (ft.)**	1730.8
BEDROCK DEPTH ELEVATION (ft.)	Not Encountered	**DATE**	1/7/2016

4-72": Reddish brown Silty CLAY, some coarse to fine Gravel, little coarse to fine Sand, Cobbles, Boulders, moist

0-4": Topsoil

Note: All classifications and descriptions in this log are solely based on visual field observations. All test pits indicate no groundwater encountered, previously two indicated groundwater and the basin was refined based on these results.

MOTT MACDONALD M M

Sheet 1 of 2

Test Pit/~~Percolation~~ INFILTRATION Test Form

Geotechnical Investigation:

- Project Name: PENNEAST
- Date: 10/13/16
- Job Number: 353754
- Site Location: KIDDER
- Contractor: CTB
- Weather/Temp: 52° CLEAR
- Test Pit ID: ITP 8
- Report by: B CORTES
- Test Pit Depth: 5.7'
- ~~Percolation~~ Test Method: DOUBLE RING

Test Pit Soil Description:

Depth Range (inches)		Description of Soil/Rock Layers
0	10"	DARK BROWN TOPSOIL, SOME ROOTS, MOIST
10"	24"	BROWN SILT, SOME C-F SAND, LITTLE C-F GRAVEL, TRACE
		WEATHERED ROCK FRAGMENTS, MOIST
24"	92"	REDDISH BROWN WEATHERED ROCK FRAGMENTS, SOME SILT, LITTLE
		CLAY, MOIST

Percolation Test:

Time (min.)	30	30	10	10	10	10	10	10	
Test Depth (feet)	**Reading No. 1**	**Reading No. 2**	**Reading No. 3**	**Reading No. 4**	**Reading No. 5**	**Reading No. 6**	**Reading No. 7**	**Reading No. 8**	**Perc. Rate (in/hr)**
5.7'	>2	>2	1 3/8	1 1/4"	1 1/8	7/8	3/4	3/4	1.5

Time (min.)	30	30	30	30	30	30	—	—	
Test Depth (feet)	**Reading No. 1**	**Reading No. 2**	**Reading No. 3**	**Reading No. 4**	**Reading No. 5**	**Reading No. 6**	**Reading No. 7**	**Reading No. 8**	**Perc. Rate (in/hr)**
5.7'	>2	1 1/4"	1"	3/4"	3/4"	7/8"	—	—	1.5

MOTT MACDONALD

TEST PIT LOG

SITE LOCATION	Kidder	**TEST PIT NUMBER**	**KTP- 8**
PROJECT NUMBER	353754	**MM REPRESENTATIVE**	B. Cortes
GENERAL LOCATION	Carbon , PA	**CONTRACTOR**	Craig Test Boring Co. Inc.
TIME OPENED	7:00am	**TIME CLOSED**	12:00pm
GROUNDWATER	Not encountered and no evidence of seasonal high groundwater (mottling)	**GROUND SURFACE ELEVATION (ft.)**	1738.7
TESTING DEPTH ELEVATION (ft.)	1733	**FINAL EXCAVATION DEPTH ELEVATION (ft.)**	1731
BEDROCK DEPTH ELEVATION (ft.)	Not Encountered	**DATE**	10/13/2016

0-10”: Topsoil, some roots, moist

10-24”: Brown SILT, some coarse to fine Sand, little coarse to fine Gravel, trace weathered rock fragments, moist

24-92.4”: Reddish brown WEATHERED ROCK fragments, some Silt, little Clay, moist

Note: All classifications and descriptions in this log are solely based on visual field observations. All test pits indicate no groundwater encountered, previously two indicated groundwater and the basin was refined based on these results.

TABLE E.1 LIMITATIONS OF PENNSYLVANIA SOILS PERTAINING TO EARTHMOVING PROJECTS (Absence of an X does not mean "No Potential Limitation")
NOTE: THIS IS NOT NECESSARILY AN ALL-INCLUSIVE LIST.

SITE	SOIL NAME	CUTBANKS CAVE	CORROSIVE TO CONCRETE\STEEL	DROUGHTY	EASLY ERODIBLE	FLOODING	DEPTH TO SATURATED ZONE/ SEASONAL HIGH WATER TABLE	HYDRIC/ HYDRIC INCLUSIONS	LOW STRENGTH/ LANDSLIDE PRONE	SLOW PERCOLATION	PIPING	POOR SOURCE OF TOPSOIL	FROST ACTION	SHRINK-SWELL	POTENTIAL SINKHOLE	PONDING	WETNESS
Kidder Compressor Station	AcB	X	C/S	X	X		X	X	X	X	X	X	X				X
	MrB	X	C/S	X	X		X	X	X	X		X	X				X

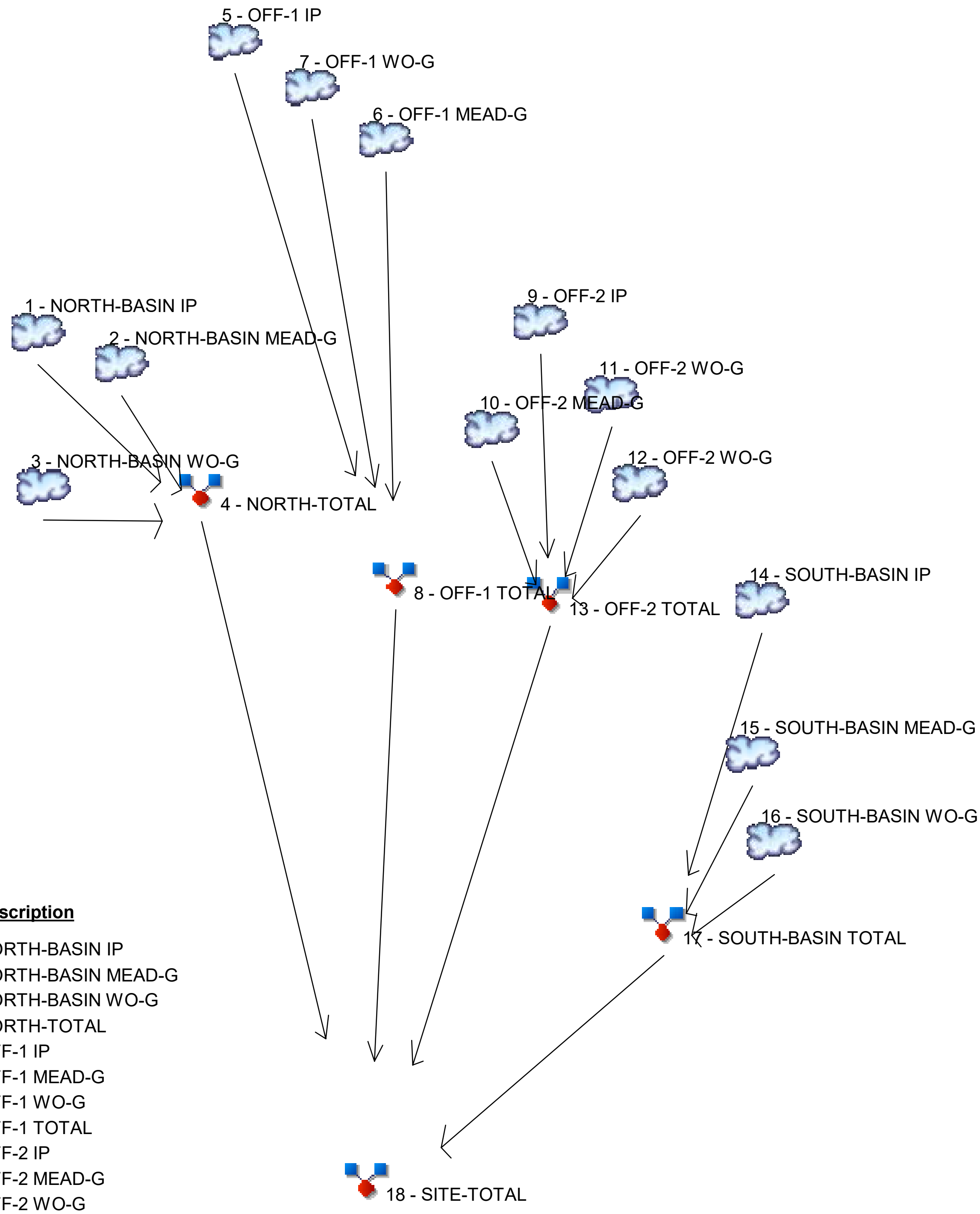
H. Model Input and Output Report

EXISTING CONDITIONS

Hydraflow Table of Contents

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020



Legend

Hyd.	Origin	Description
1	SCS Runoff	NORTH-BASIN IP
2	SCS Runoff	NORTH-BASIN MEAD-G
3	SCS Runoff	NORTH-BASIN WO-G
4	Combine	NORTH-TOTAL
5	SCS Runoff	OFF-1 IP
6	SCS Runoff	OFF-1 MEAD-G
7	SCS Runoff	OFF-1 WO-G
8	Combine	OFF-1 TOTAL
9	SCS Runoff	OFF-2 IP
10	SCS Runoff	OFF-2 MEAD-G
11	SCS Runoff	OFF-2 WO-G
12	SCS Runoff	OFF-2 WO-G
13	Combine	OFF-2 TOTAL
14	SCS Runoff	SOUTH-BASIN IP
15	SCS Runoff	SOUTH-BASIN MEAD-G
16	SCS Runoff	SOUTH-BASIN WO-G
17	Combine	SOUTH-BASIN TOTAL
18	Combine	SITE-TOTAL

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	------	0.138	0.167	-------	0.208	0.245	0.303	0.358	0.423	NORTH-BASIN IP
2	SCS Runoff	------	0.172	0.235	-------	0.332	0.421	0.565	0.700	0.862	NORTH-BASIN MEAD-G
3	SCS Runoff	------	2.559	3.685	-------	5.433	7.075	9.838	12.48	15.67	NORTH-BASIN WO-G
4	Combine	1, 2, 3	2.863	4.079	-------	5.961	7.741	10.71	13.54	16.96	NORTH-TOTAL
5	SCS Runoff	------	3.211	3.875	-------	4.837	5.684	7.039	8.306	9.820	OFF-1 IP
6	SCS Runoff	------	1.222	1.667	-------	2.360	2.988	4.010	4.971	6.122	OFF-1 MEAD-G
7	SCS Runoff	------	14.25	20.52	-------	30.26	39.41	54.80	69.51	87.29	OFF-1 WO-G
8	Combine	5, 6, 7	18.54	25.89	-------	37.32	48.08	65.84	82.79	103.23	OFF-1 TOTAL
9	SCS Runoff	------	0.089	0.107	-------	0.133	0.157	0.194	0.229	0.271	OFF-2 IP
10	SCS Runoff	------	0.576	0.786	-------	1.113	1.410	1.891	2.345	2.887	OFF-2 MEAD-G
11	SCS Runoff	------	18.53	26.69	-------	39.35	51.24	71.25	90.38	113.50	OFF-2 WO-G
12	SCS Runoff	------	7.068	10.18	-------	15.01	19.55	27.18	34.48	43.29	OFF-2 WO-G
13	Combine	9, 10, 11, 12	26.26	37.75	-------	55.59	72.35	100.51	127.43	159.95	OFF-2 TOTAL
14	SCS Runoff	------	0.011	0.013	-------	0.016	0.019	0.023	0.028	0.033	SOUTH-BASIN IP
15	SCS Runoff	------	0.344	0.470	-------	0.665	0.842	1.130	1.401	1.725	SOUTH-BASIN MEAD-G
16	SCS Runoff	------	22.96	33.07	-------	48.77	63.50	88.31	112.02	140.67	SOUTH-BASIN WO-G
17	Combine	14, 15, 16	23.32	33.56	-------	49.44	64.37	89.46	113.45	142.43	SOUTH-BASIN TOTAL
18	Combine	4, 8, 13, 17	70.98	101.28	-------	148.20	192.53	266.52	337.20	422.56	SITE-TOTAL

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	0.138	2	716	320	------	------	------	NORTH-BASIN IP
2	SCS Runoff	0.172	2	718	345	------	------	------	NORTH-BASIN MEAD-G
3	SCS Runoff	2.559	2	718	5,135	------	------	------	NORTH-BASIN WO-G
4	Combine	2.863	2	718	5,800	1, 2, 3	------	------	NORTH-TOTAL
5	SCS Runoff	3.211	2	716	7,430	------	------	------	OFF-1 IP
6	SCS Runoff	1.222	2	718	2,449	------	------	------	OFF-1 MEAD-G
7	SCS Runoff	14.25	2	718	28,600	------	------	------	OFF-1 WO-G
8	Combine	18.54	2	718	38,479	5, 6, 7	------	------	OFF-1 TOTAL
9	SCS Runoff	0.089	2	716	205	------	------	------	OFF-2 IP
10	SCS Runoff	0.576	2	718	1,155	------	------	------	OFF-2 MEAD-G
11	SCS Runoff	18.53	2	718	37,187	------	------	------	OFF-2 WO-G
12	SCS Runoff	7.068	2	718	14,186	------	------	------	OFF-2 WO-G
13	Combine	26.26	2	718	52,733	9, 10, 11, 12	------	------	OFF-2 TOTAL
14	SCS Runoff	0.011	2	716	25	------	------	------	SOUTH-BASIN IP
15	SCS Runoff	0.344	2	718	690	------	------	------	SOUTH-BASIN MEAD-G
16	SCS Runoff	22.96	2	718	46,091	------	------	------	SOUTH-BASIN WO-G
17	Combine	23.32	2	718	46,805	14, 15, 16	------	------	SOUTH-BASIN TOTAL
18	Combine	70.98	2	718	143,817	4, 8, 13, 17	------	------	SITE-TOTAL

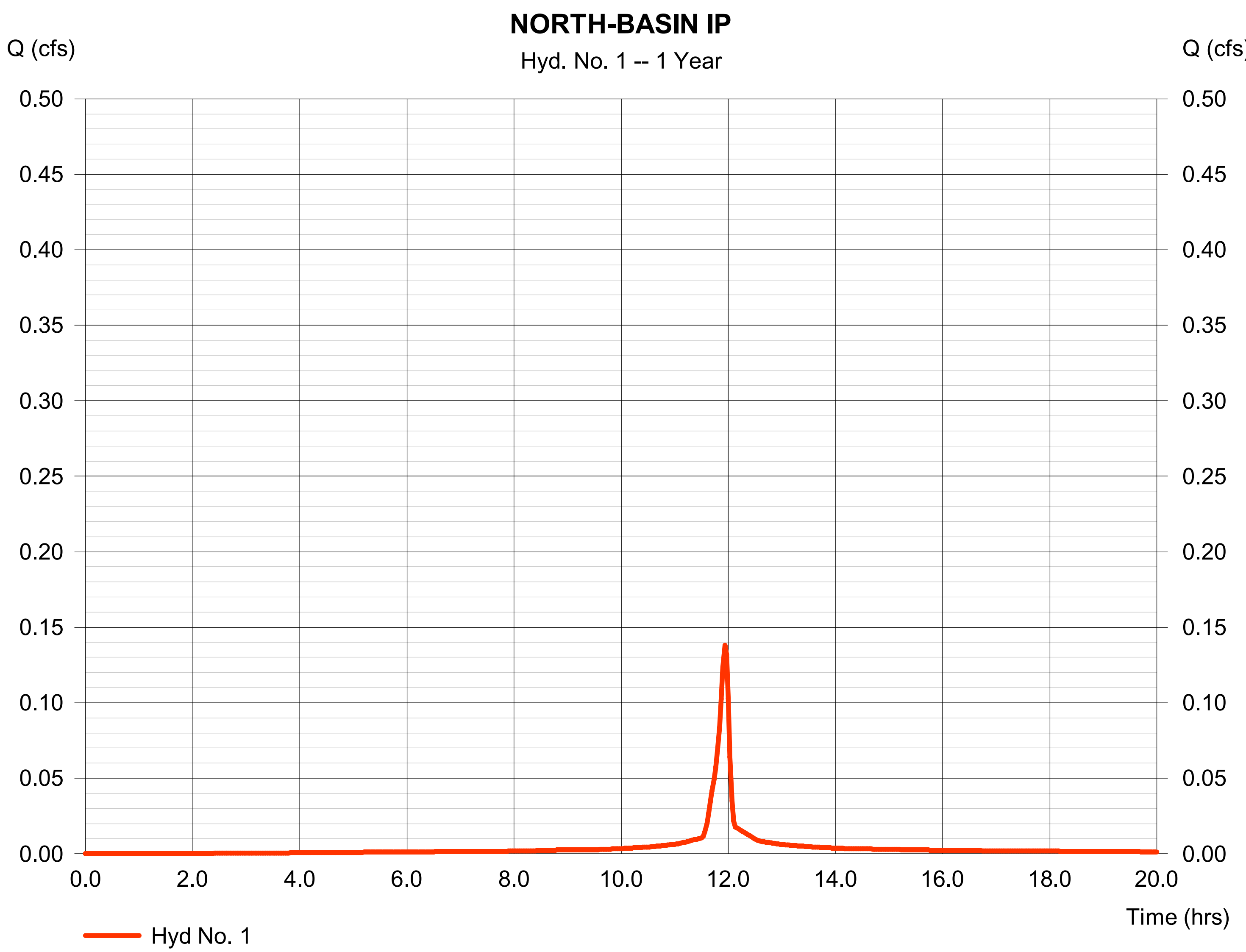
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 1

NORTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.138 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 320 cuft
Drainage area	= 0.039 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



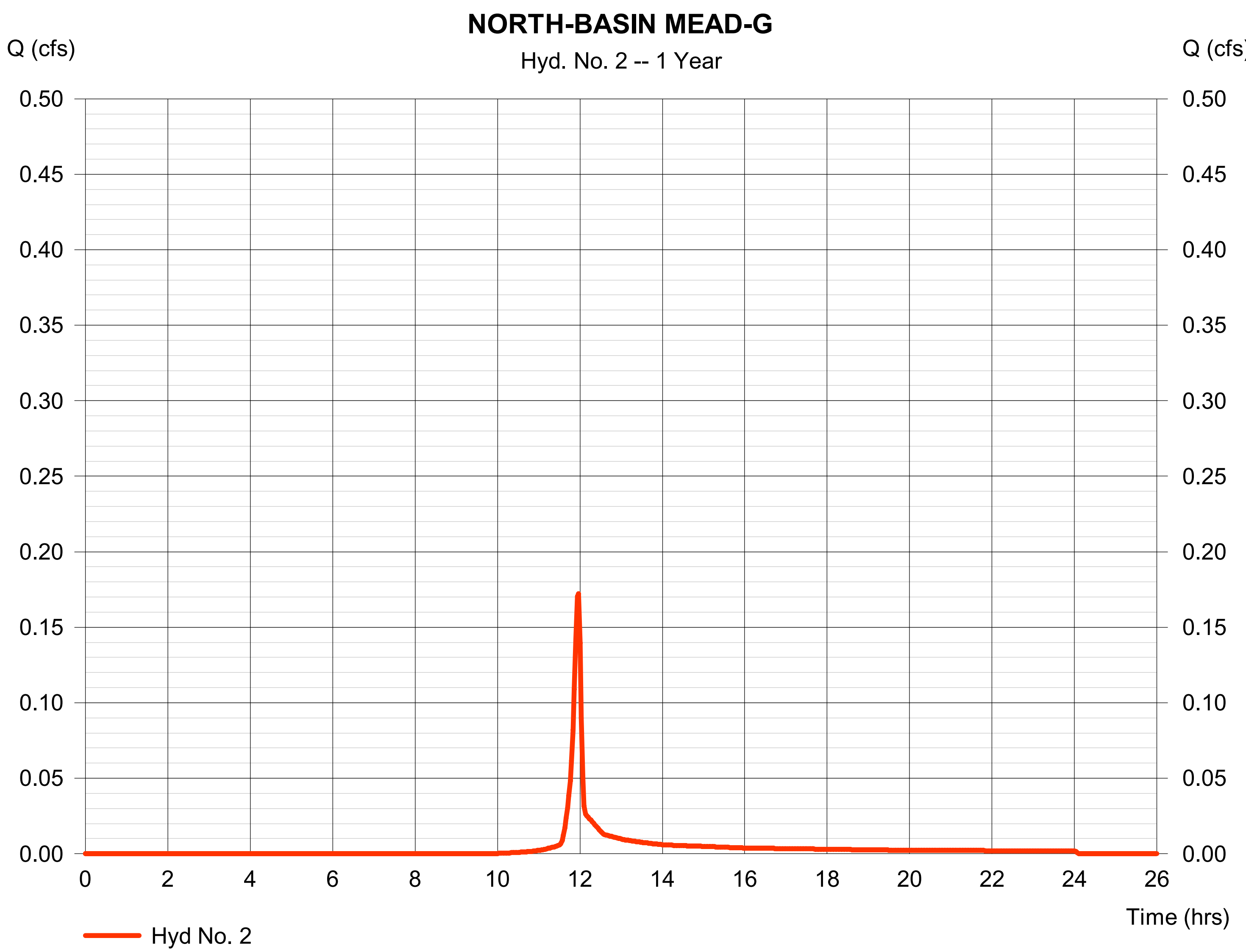
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 2

NORTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.172 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 345 cuft
Drainage area	= 0.092 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



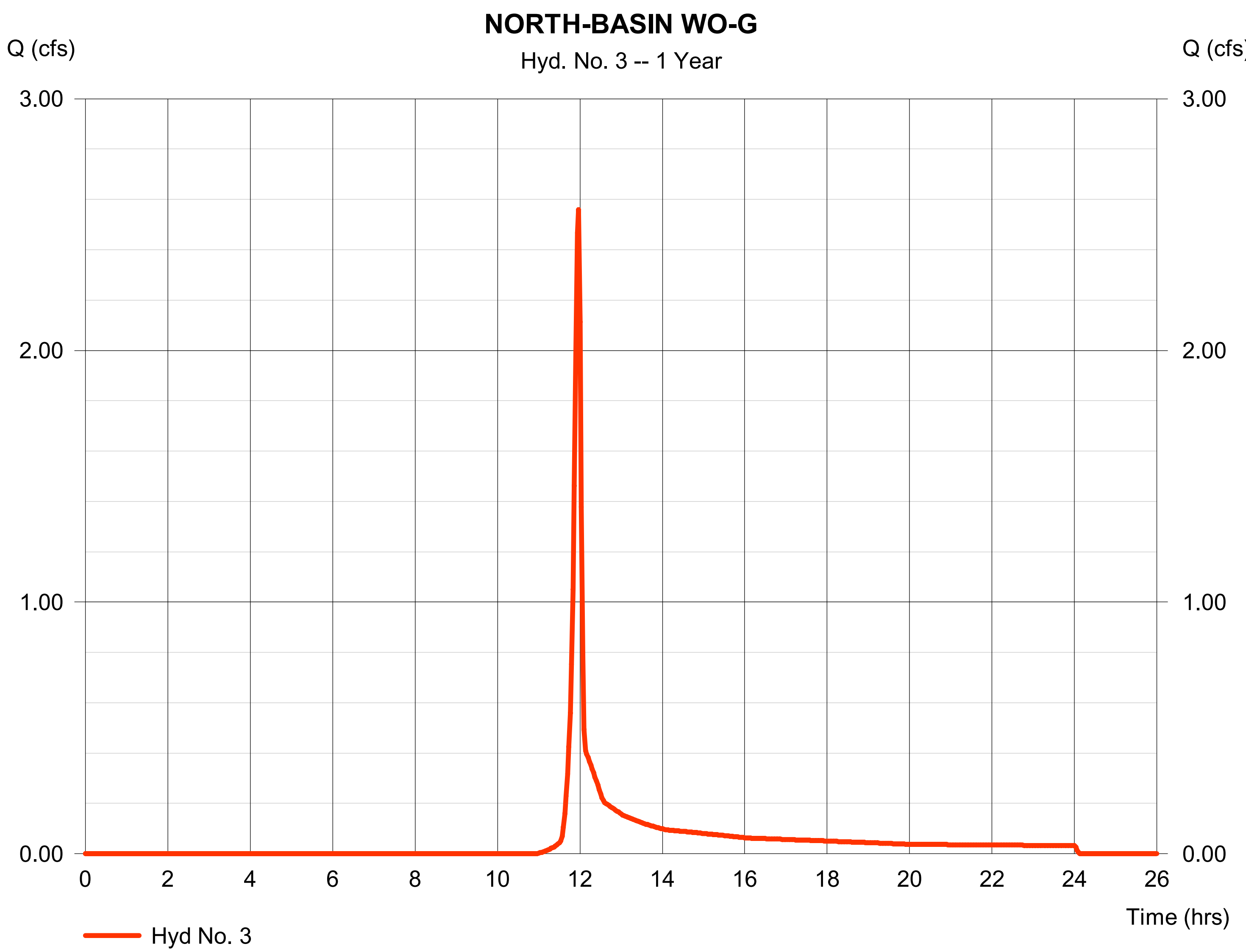
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 3

NORTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 2.559 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 5,135 cuft
Drainage area	= 1.819 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



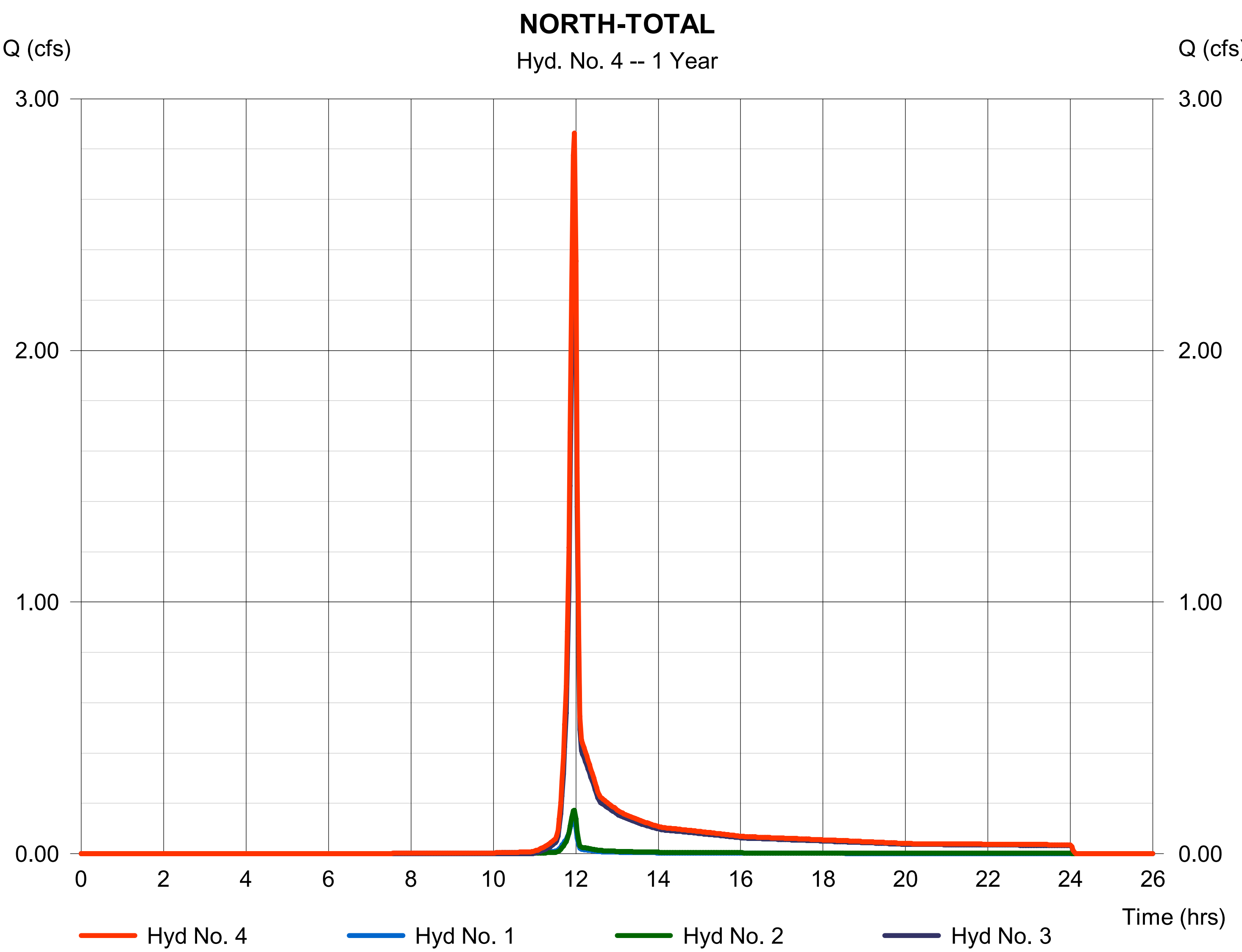
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 4

NORTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 2.863 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 5,800 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 1.950 ac



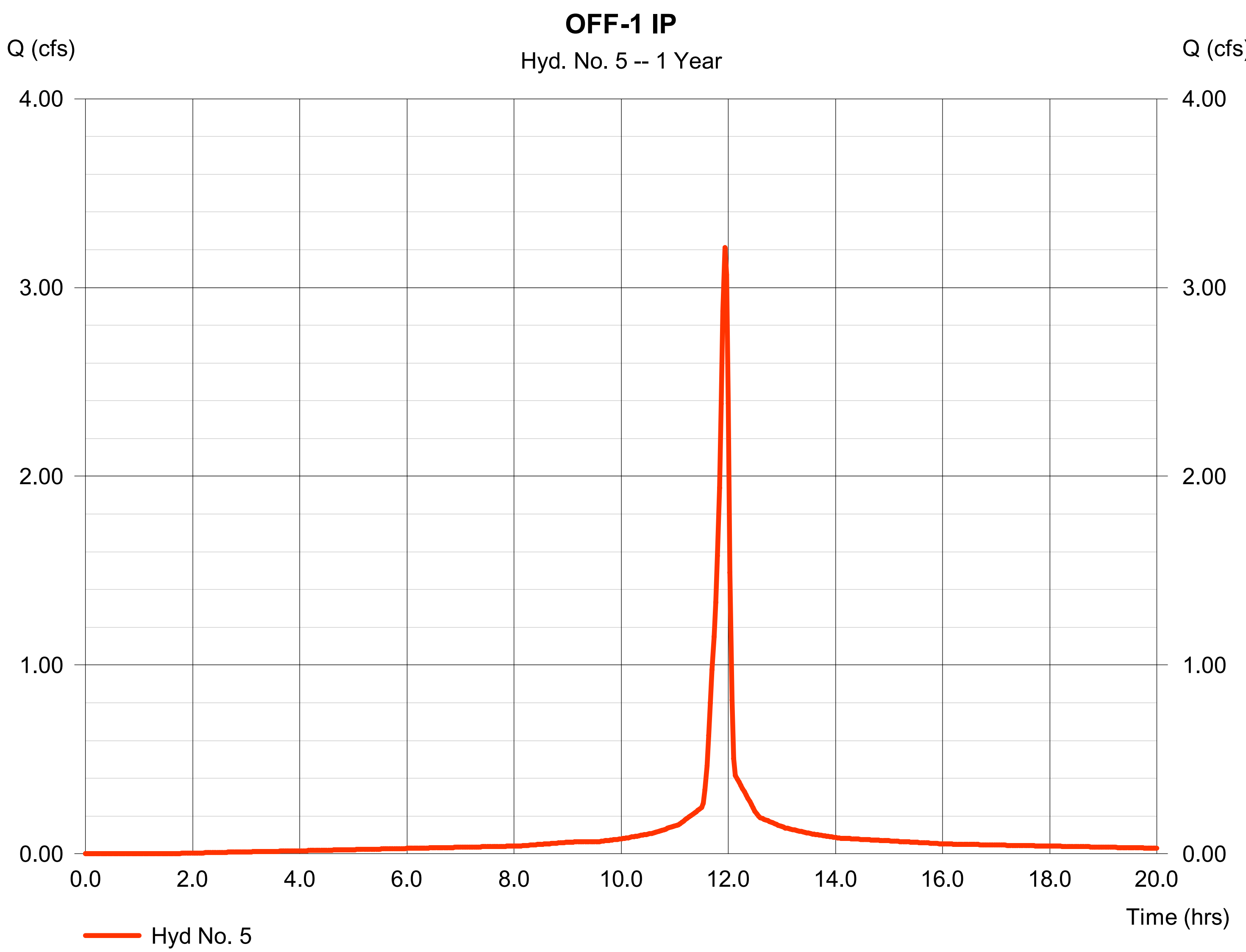
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 5

OFF-1 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 3.211 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 7,430 cuft
Drainage area	= 0.906 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



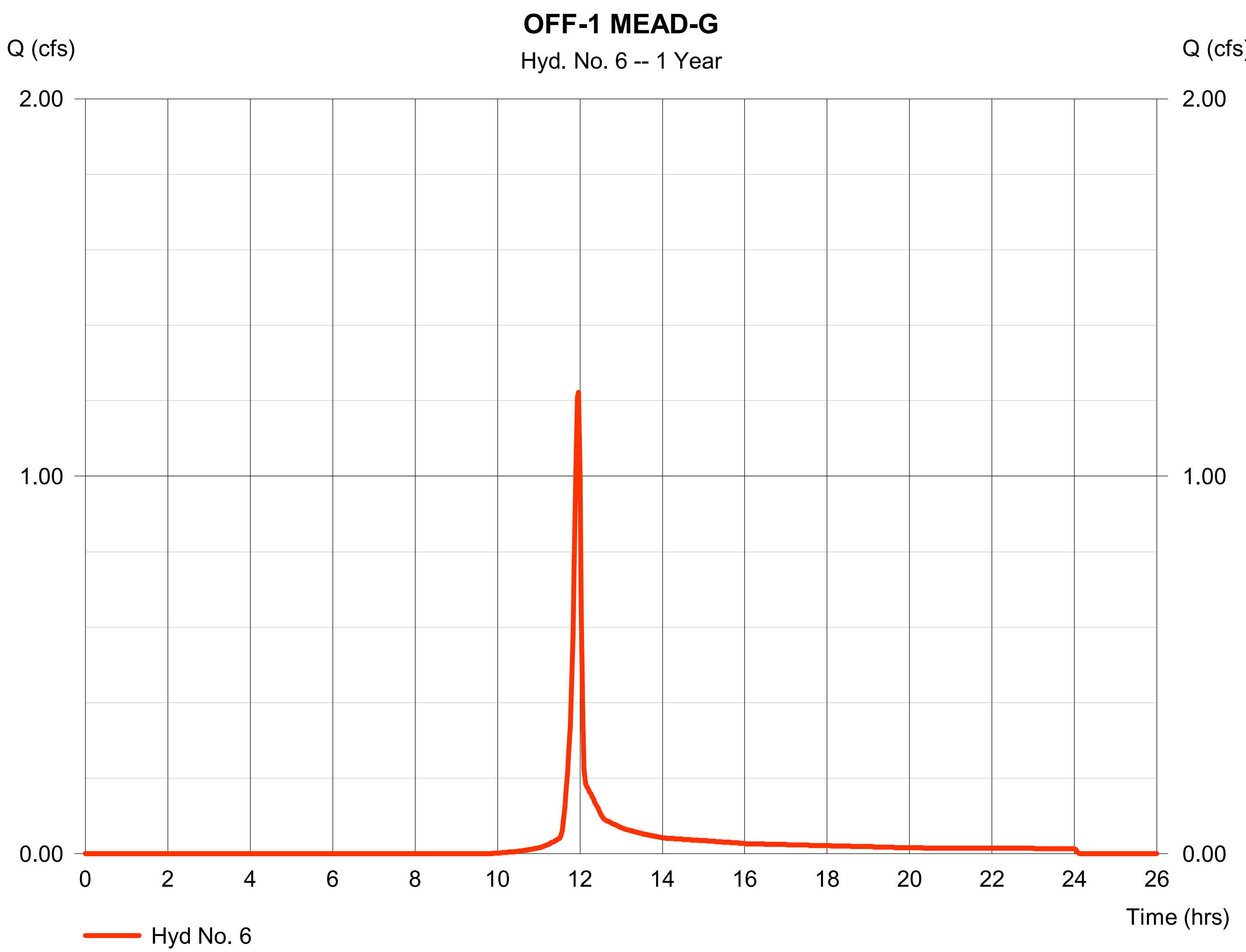
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 6

OFF-1 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 1.222 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 2,449 cuft
Drainage area	= 0.653 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



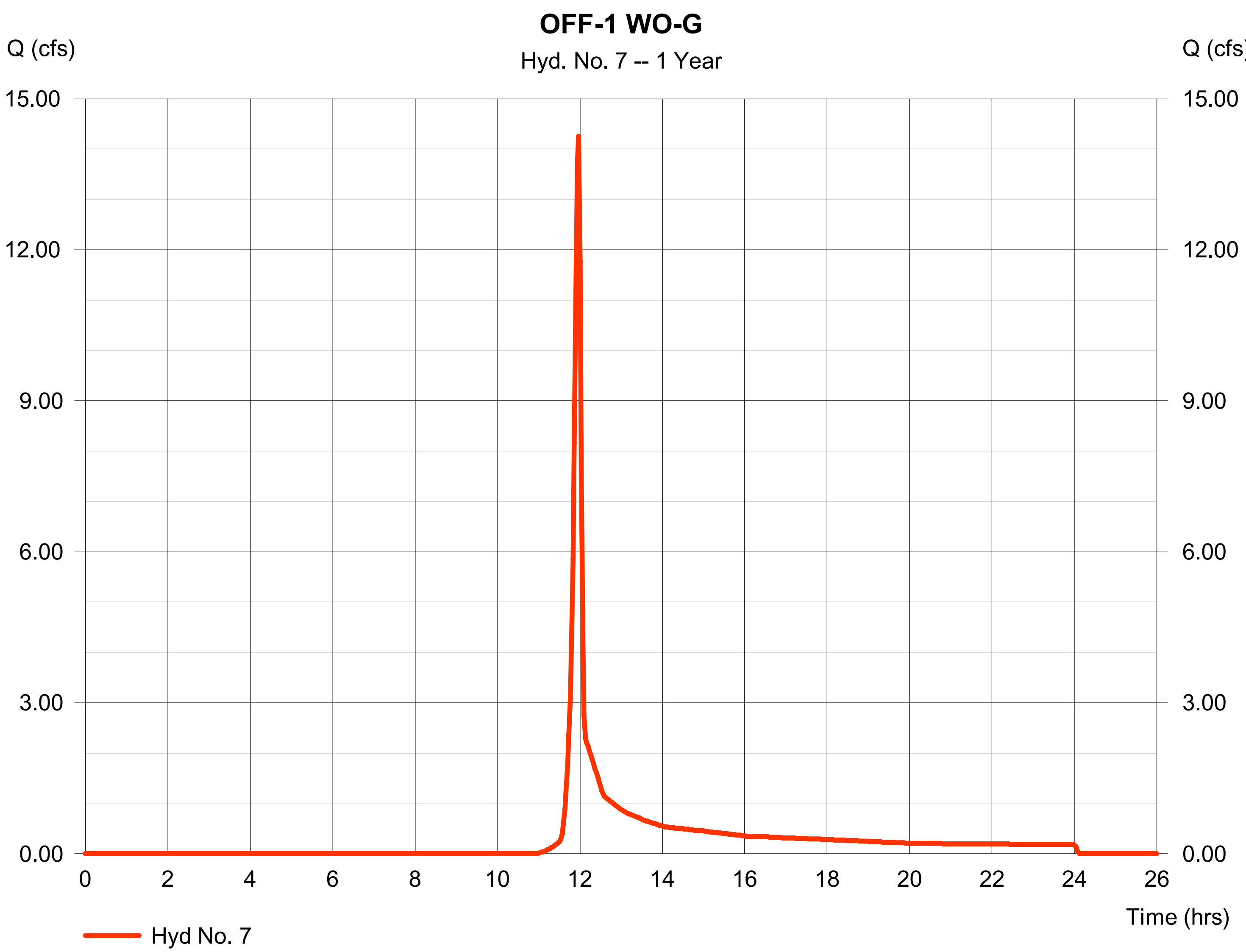
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 7

OFF-1 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 14.25 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 28,600 cuft
Drainage area	= 10.131 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

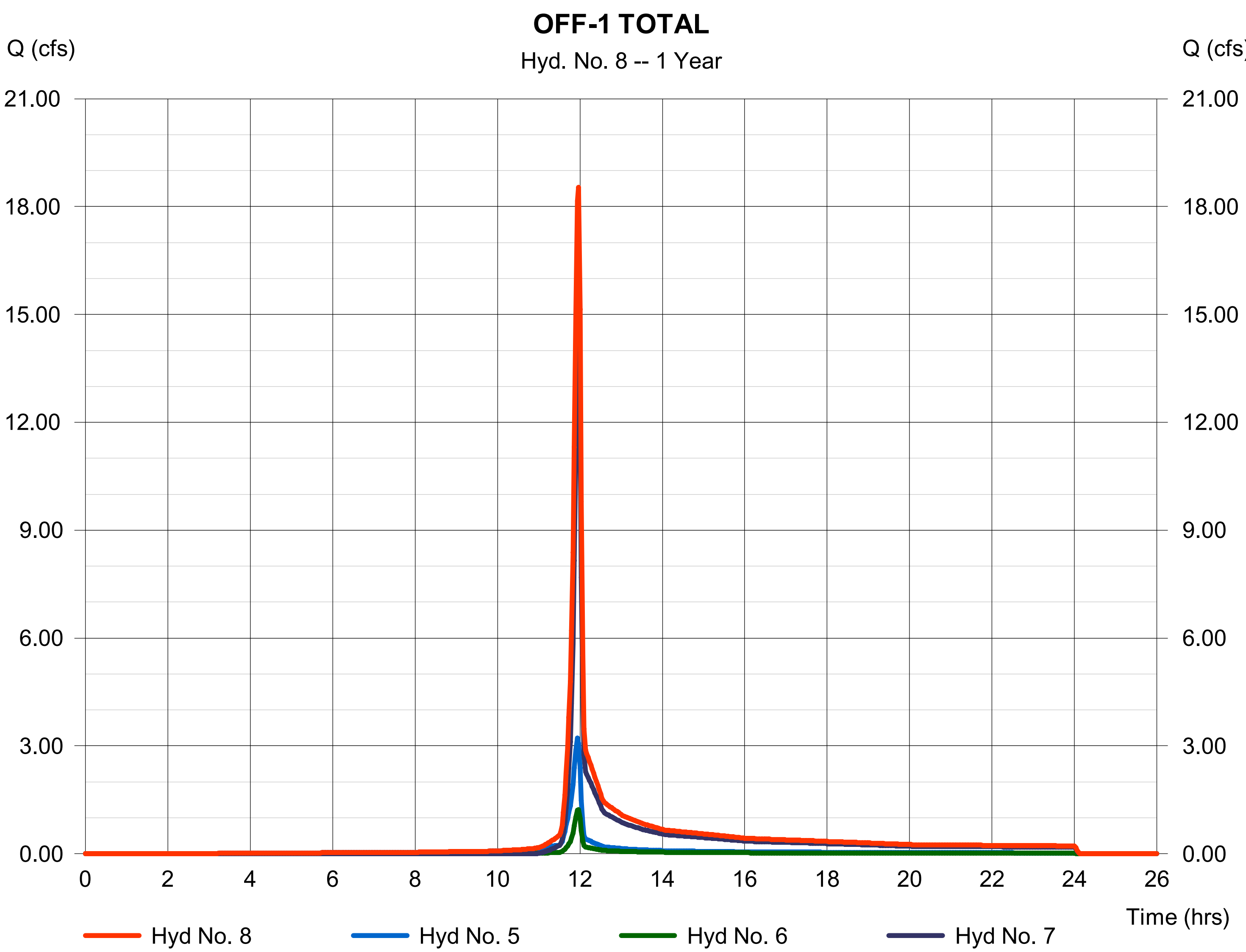


Hydrograph Report

Hyd. No. 8

OFF-1 TOTAL

Hydrograph type	= Combine	Peak discharge	= 18.54 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 38,479 cuft
Inflow hyds.	= 5, 6, 7	Contrib. drain. area	= 11.690 ac

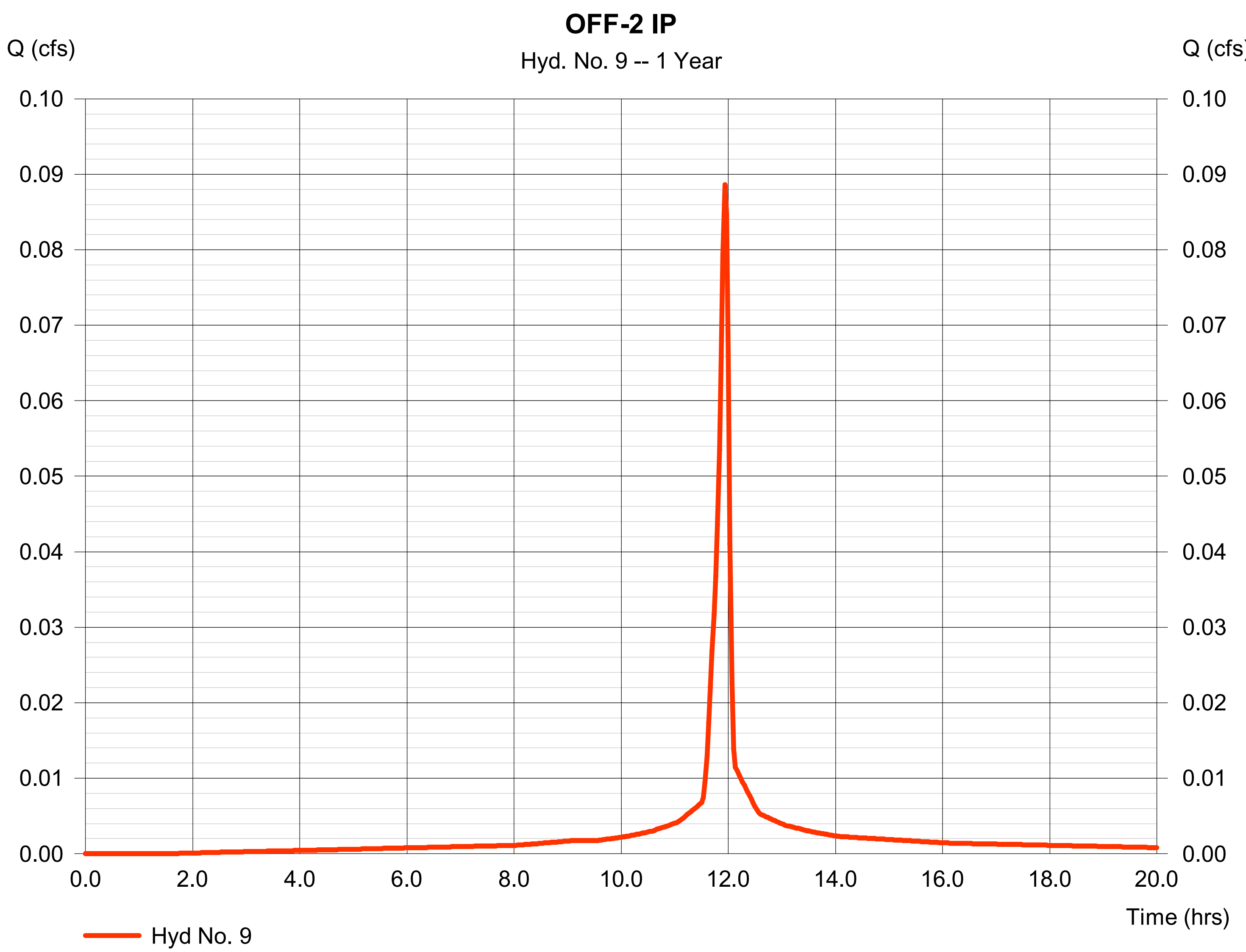


Hydrograph Report

Hyd. No. 9

OFF-2 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.089 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 205 cuft
Drainage area	= 0.025 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

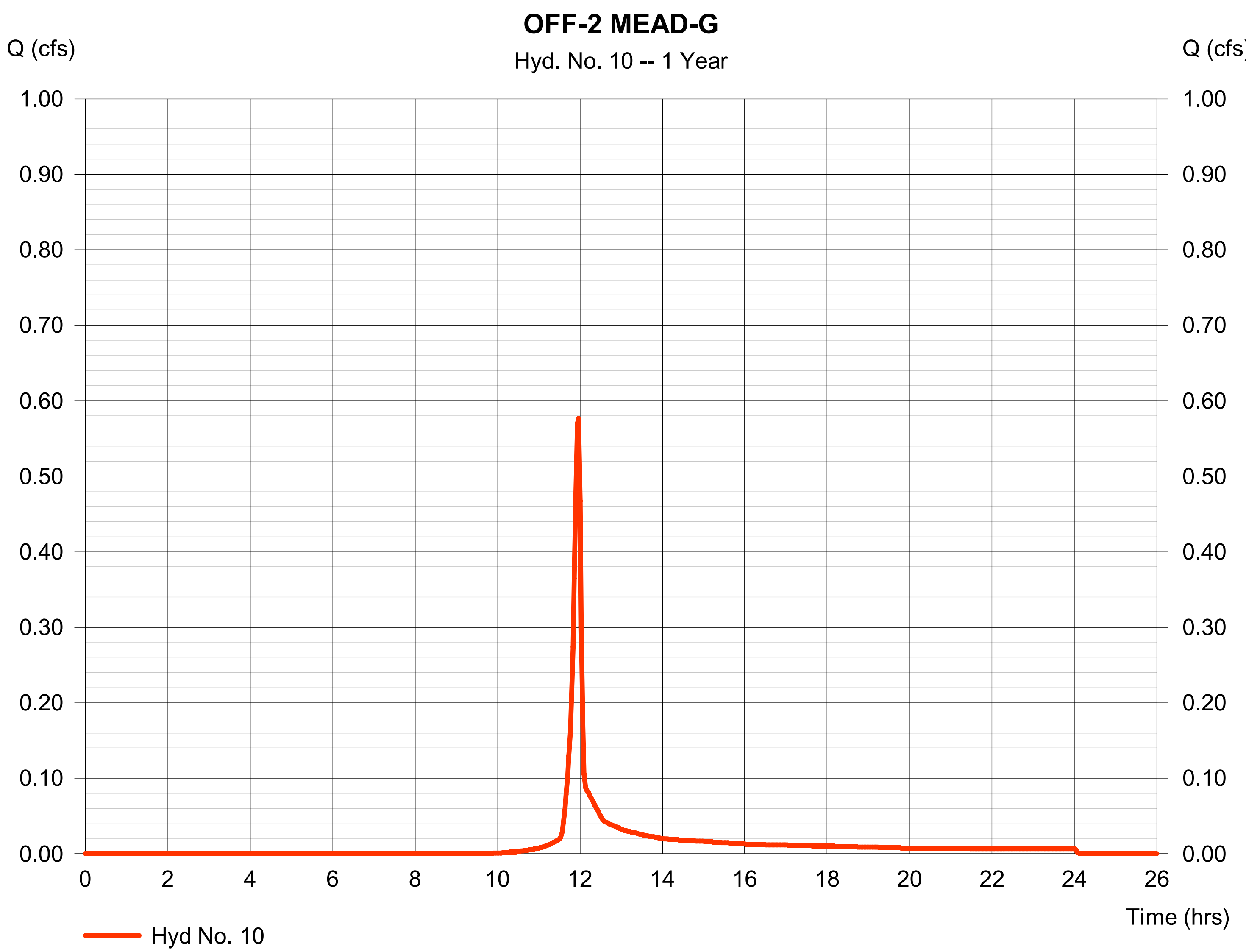


Hydrograph Report

Hyd. No. 10

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.576 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 1,155 cuft
Drainage area	= 0.308 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



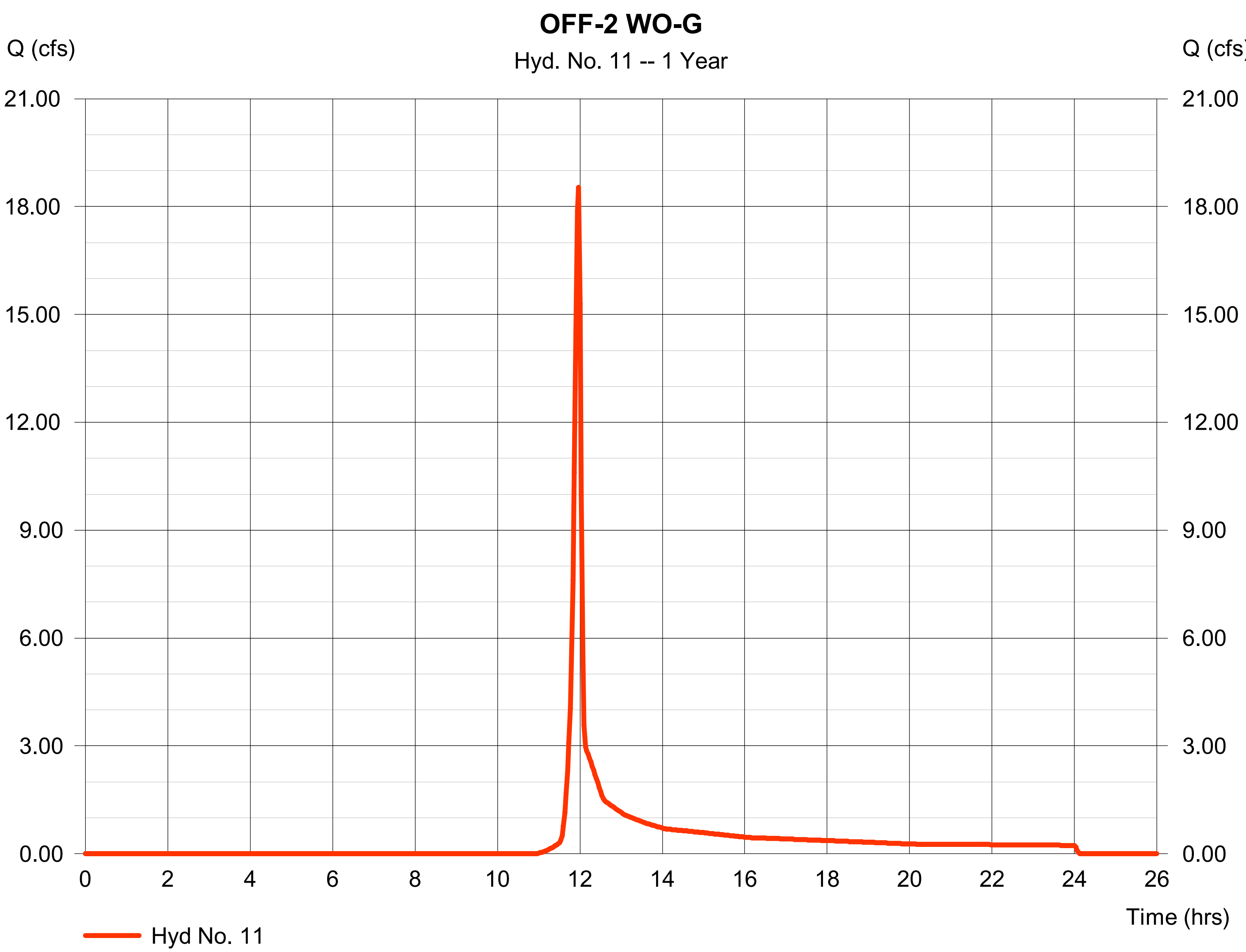
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 11

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 18.53 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 37,187 cuft
Drainage area	= 13.173 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

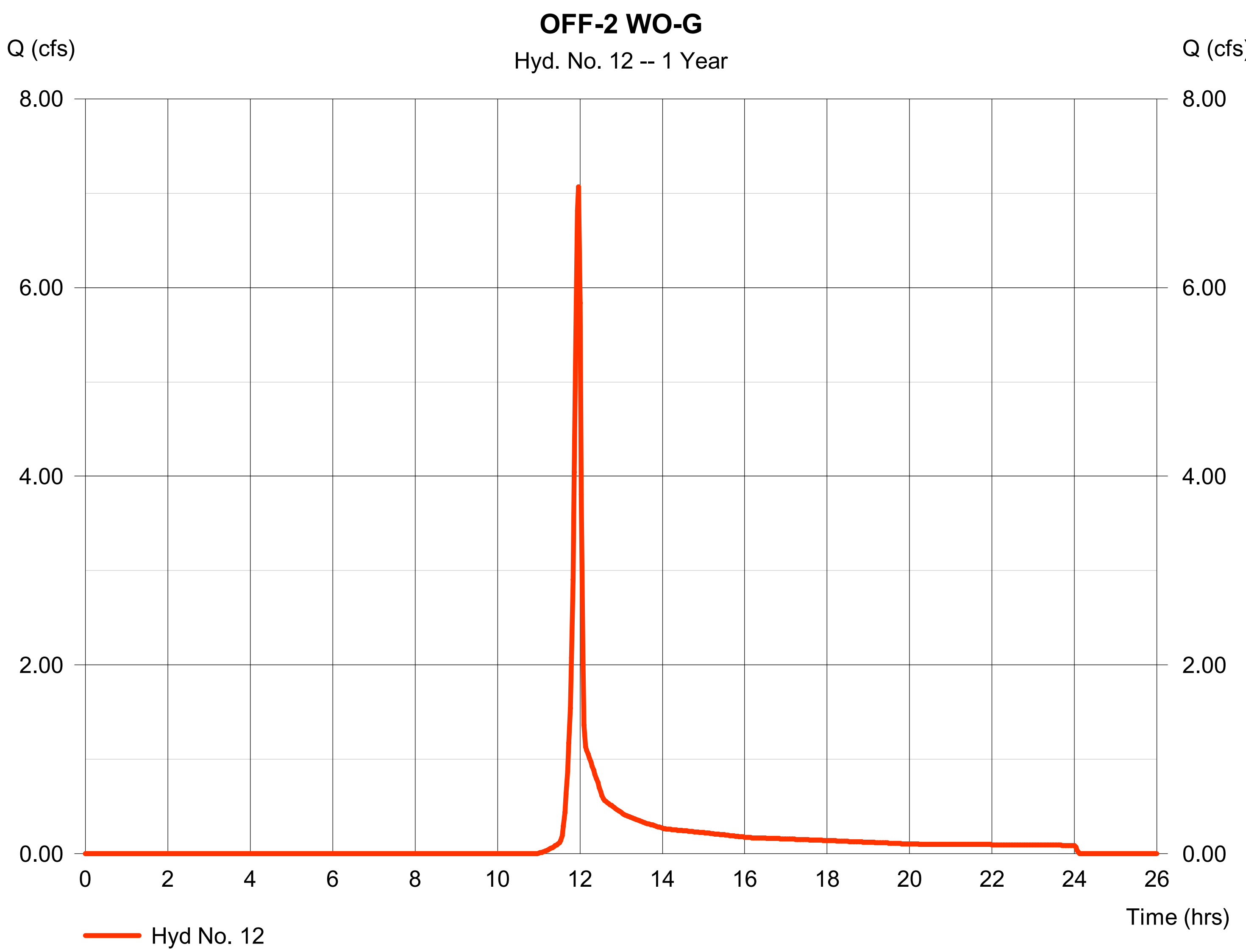


Hydrograph Report

Hyd. No. 12

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 7.068 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 14,186 cuft
Drainage area	= 5.025 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



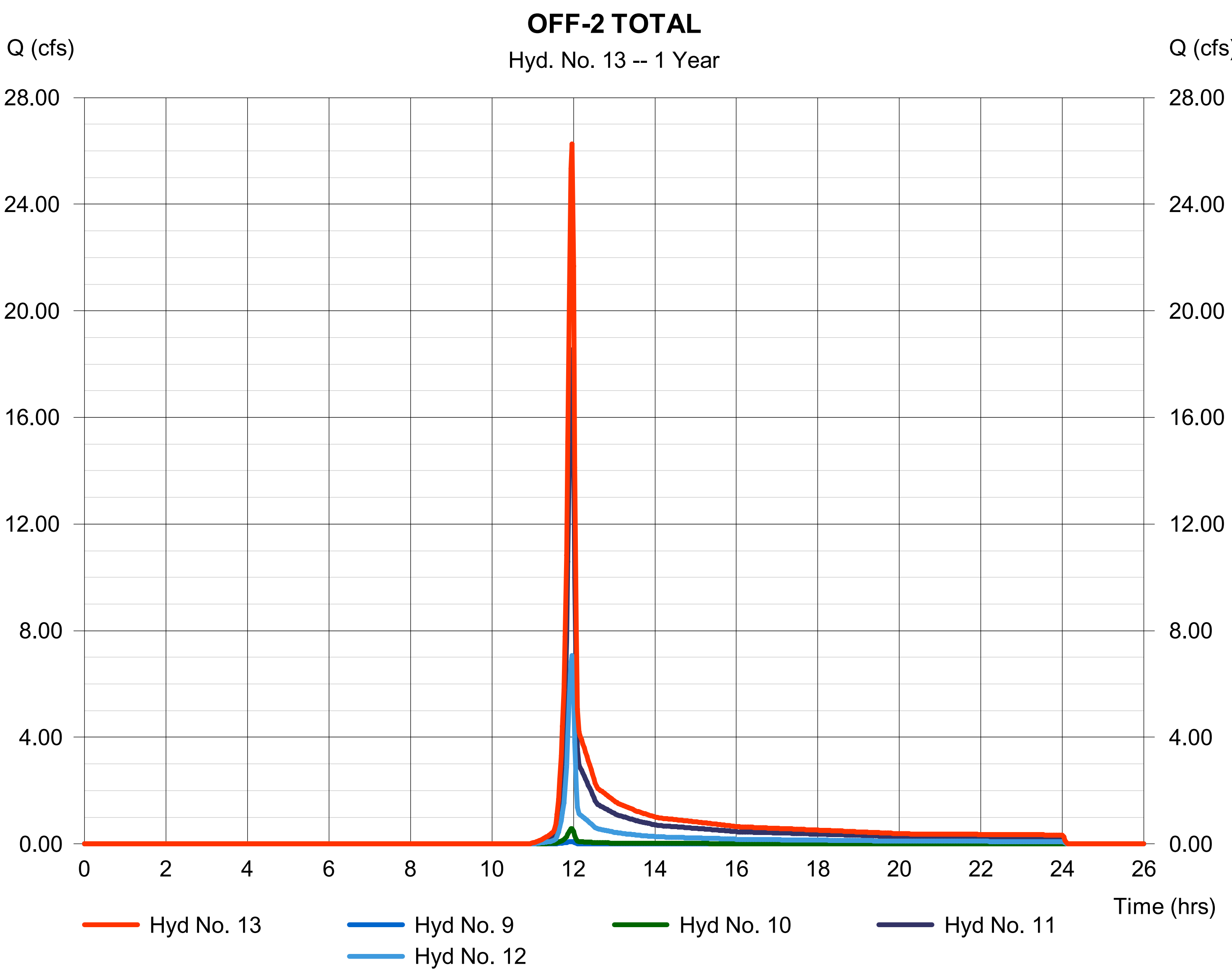
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 13

OFF-2 TOTAL

Hydrograph type	= Combine	Peak discharge	= 26.26 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 52,733 cuft
Inflow hyds.	= 9, 10, 11, 12	Contrib. drain. area	= 18.531 ac



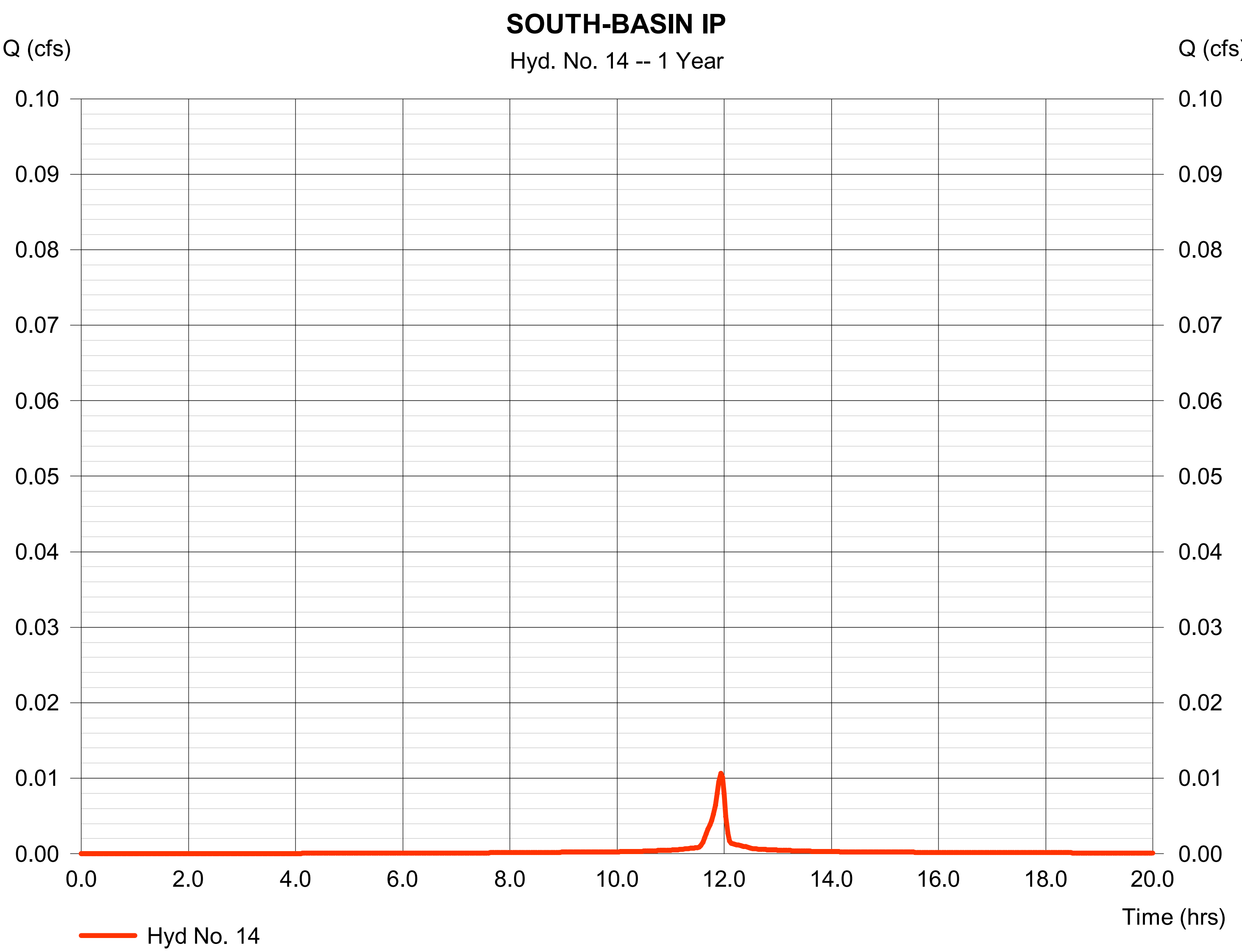
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 14

SOUTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.011 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 25 cuft
Drainage area	= 0.003 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



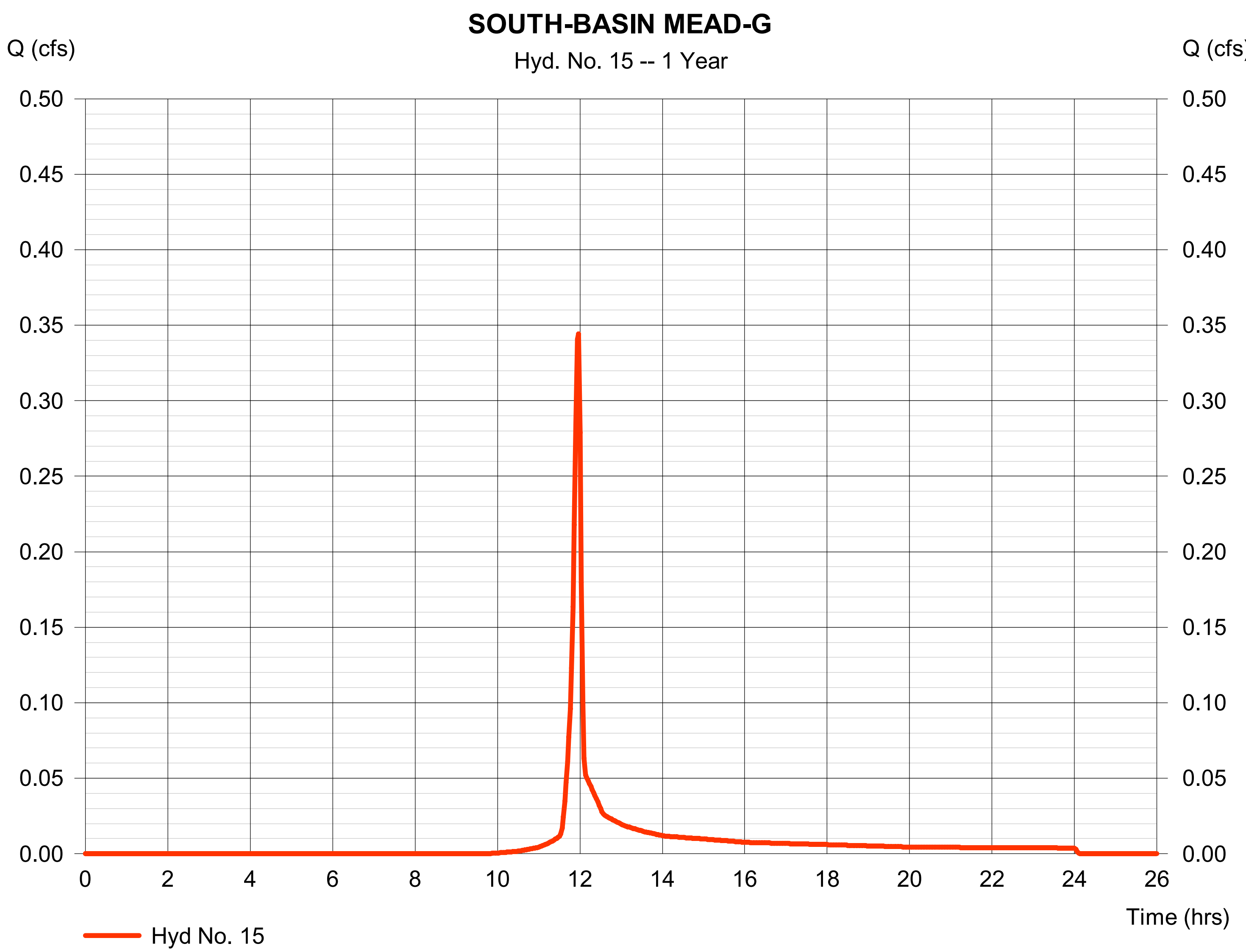
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 15

SOUTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.344 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 690 cuft
Drainage area	= 0.184 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



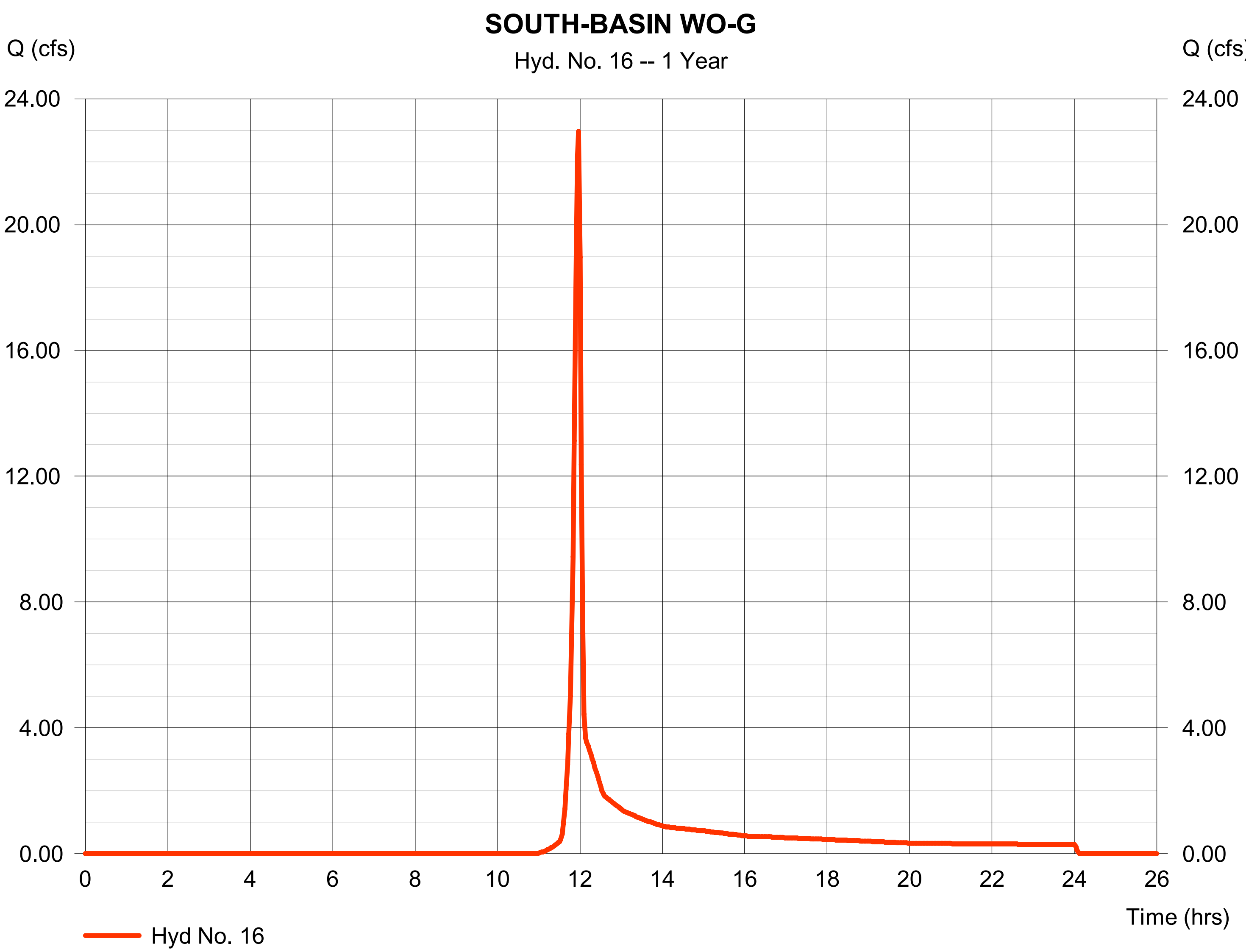
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 16

SOUTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 22.96 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 46,091 cuft
Drainage area	= 16.327 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



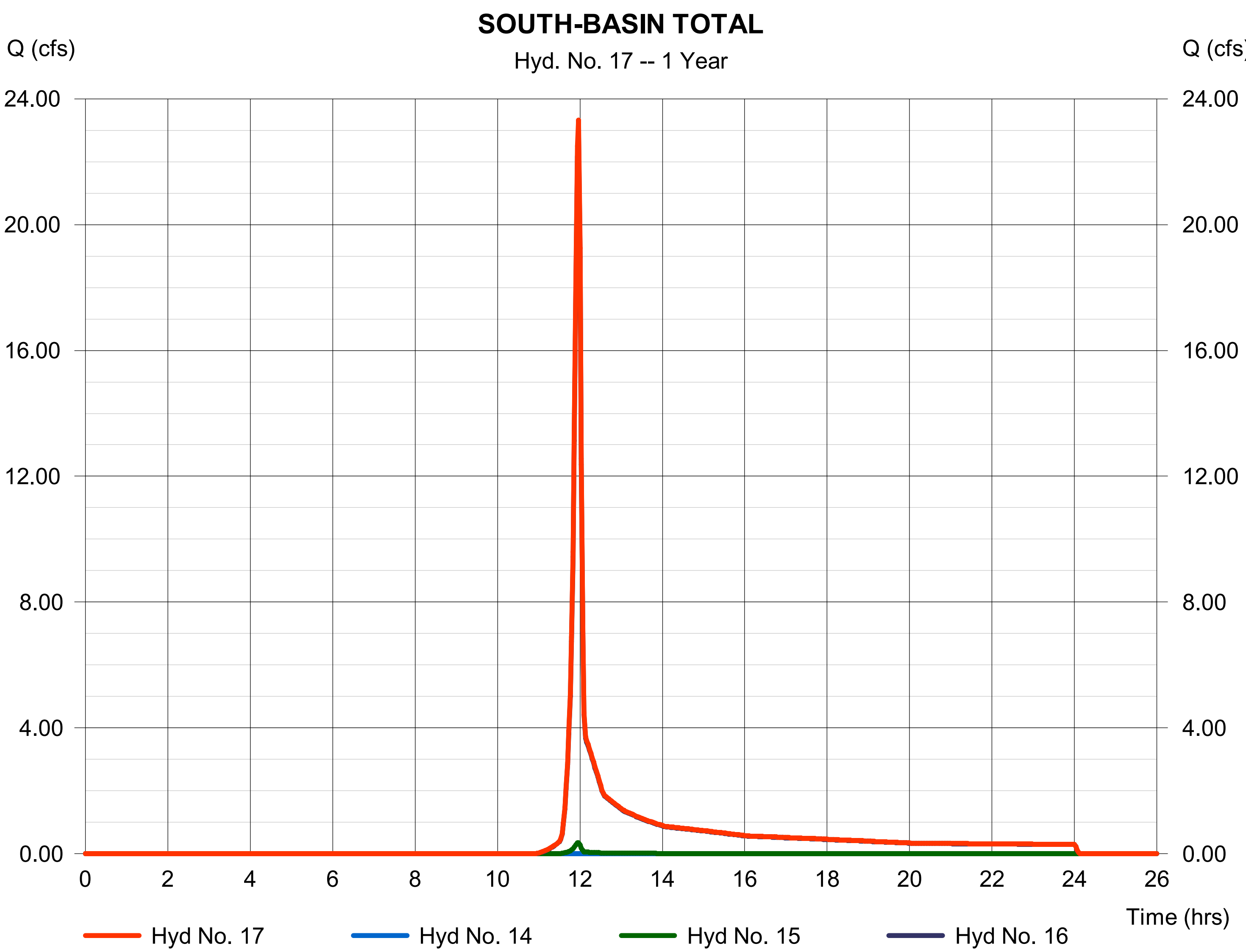
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 17

SOUTH-BASIN TOTAL

Hydrograph type	= Combine	Peak discharge	= 23.32 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 46,805 cuft
Inflow hyds.	= 14, 15, 16	Contrib. drain. area	= 16.514 ac



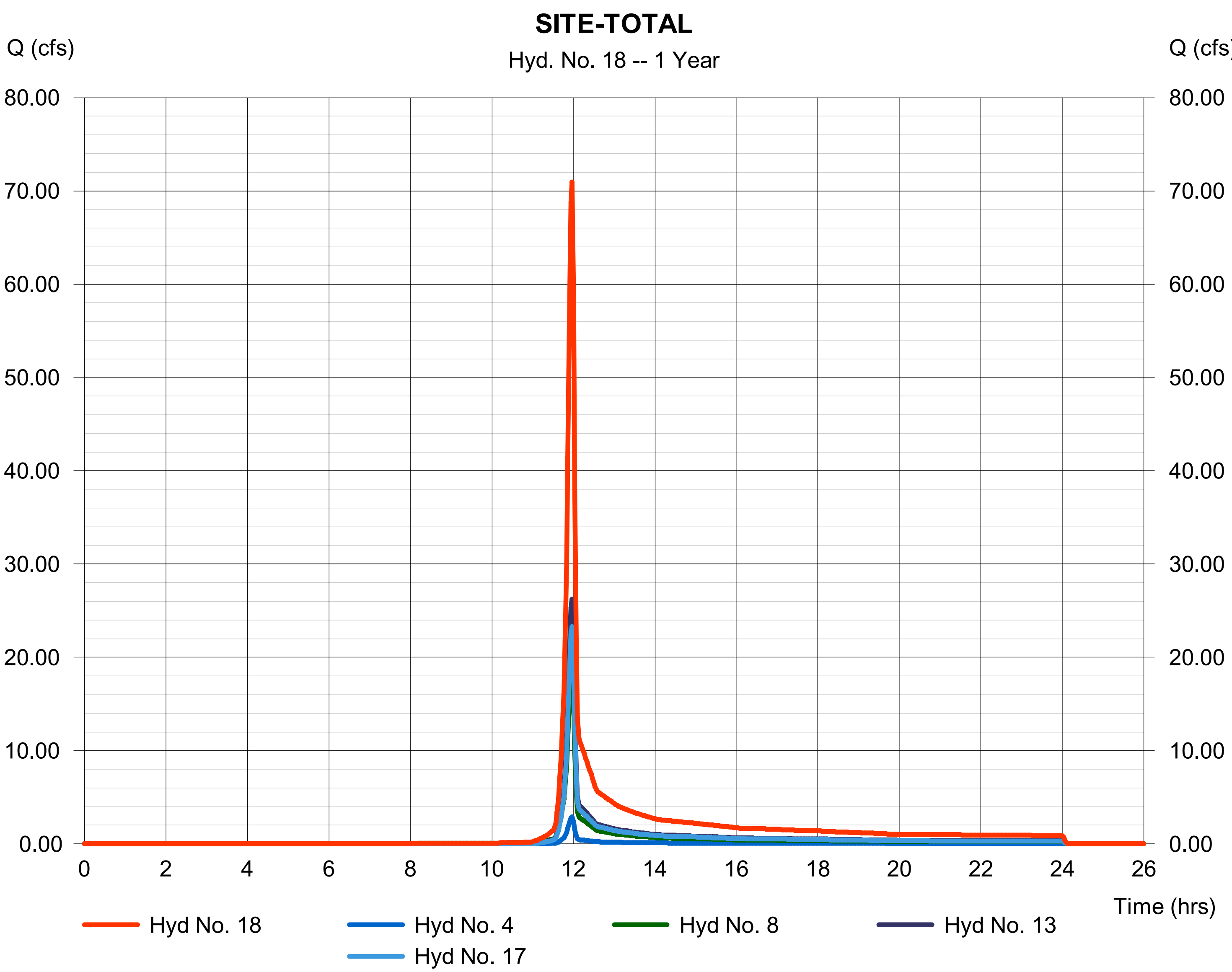
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 18

SITE-TOTAL

Hydrograph type	= Combine	Peak discharge	= 70.98 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 143,817 cuft
Inflow hyds.	= 4, 8, 13, 17	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	0.167	2	716	390	------	------	------	NORTH-BASIN IP
2	SCS Runoff	0.235	2	716	474	------	------	------	NORTH-BASIN MEAD-G
3	SCS Runoff	3.685	2	718	7,369	------	------	------	NORTH-BASIN WO-G
4	Combine	4.079	2	718	8,233	1, 2, 3	------	------	NORTH-TOTAL
5	SCS Runoff	3.875	2	716	9,057	------	------	------	OFF-1 IP
6	SCS Runoff	1.667	2	716	3,365	------	------	------	OFF-1 MEAD-G
7	SCS Runoff	20.52	2	718	41,042	------	------	------	OFF-1 WO-G
8	Combine	25.89	2	718	53,464	5, 6, 7	------	------	OFF-1 TOTAL
9	SCS Runoff	0.107	2	716	250	------	------	------	OFF-2 IP
10	SCS Runoff	0.786	2	716	1,587	------	------	------	OFF-2 MEAD-G
11	SCS Runoff	26.69	2	718	53,366	------	------	------	OFF-2 WO-G
12	SCS Runoff	10.18	2	718	20,357	------	------	------	OFF-2 WO-G
13	Combine	37.75	2	718	75,559	9, 10, 11, 12	------	------	OFF-2 TOTAL
14	SCS Runoff	0.013	2	716	30	------	------	------	SOUTH-BASIN IP
15	SCS Runoff	0.470	2	716	948	------	------	------	SOUTH-BASIN MEAD-G
16	SCS Runoff	33.07	2	718	66,143	------	------	------	SOUTH-BASIN WO-G
17	Combine	33.56	2	718	67,121	14, 15, 16	------	------	SOUTH-BASIN TOTAL
18	Combine	101.28	2	718	204,377	4, 8, 13, 17	------	------	SITE-TOTAL

EX-SWM.gpw	Return Period: 2 Year	Tuesday, 10 / 15 / 2019

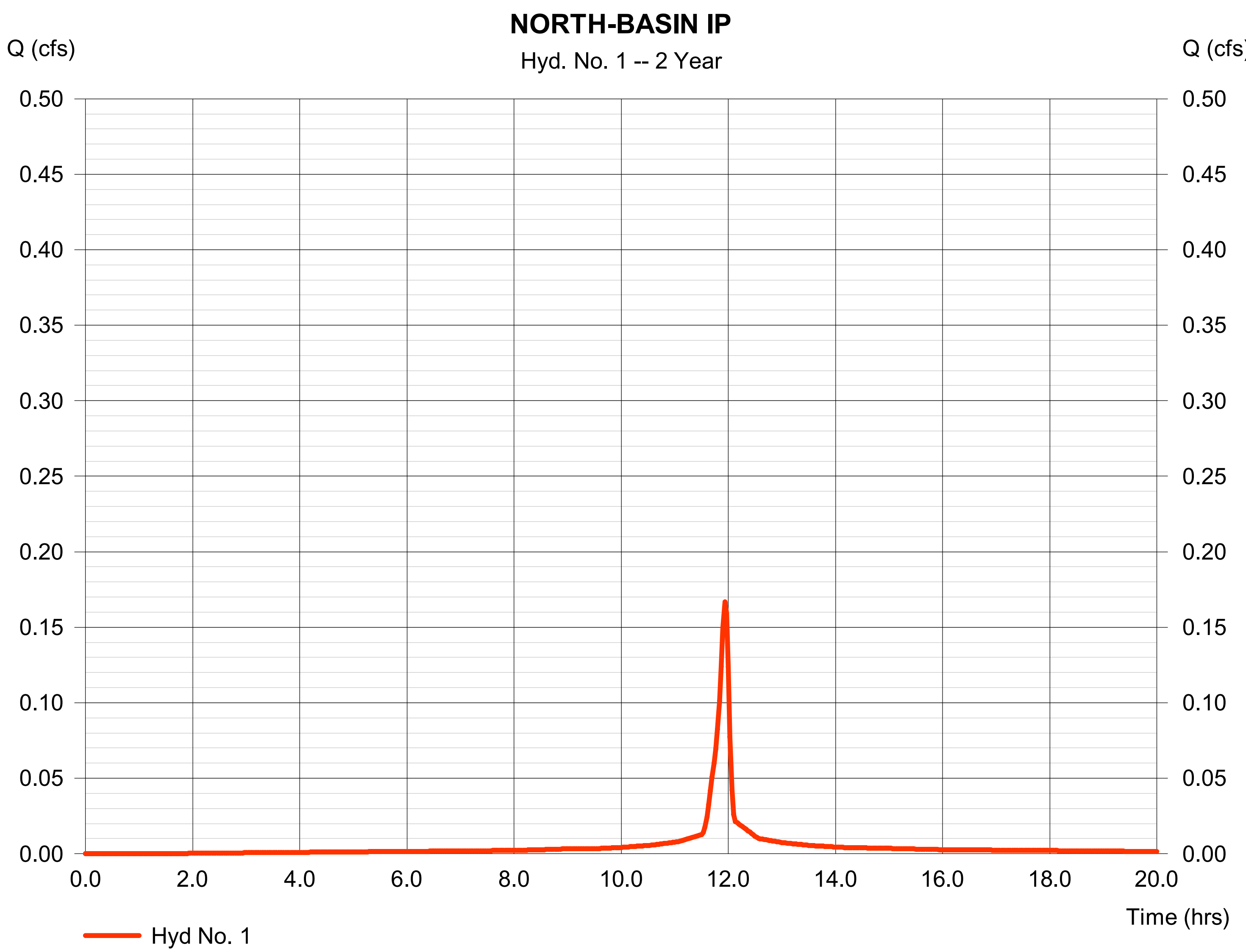
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 1

NORTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.167 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 390 cuft
Drainage area	= 0.039 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



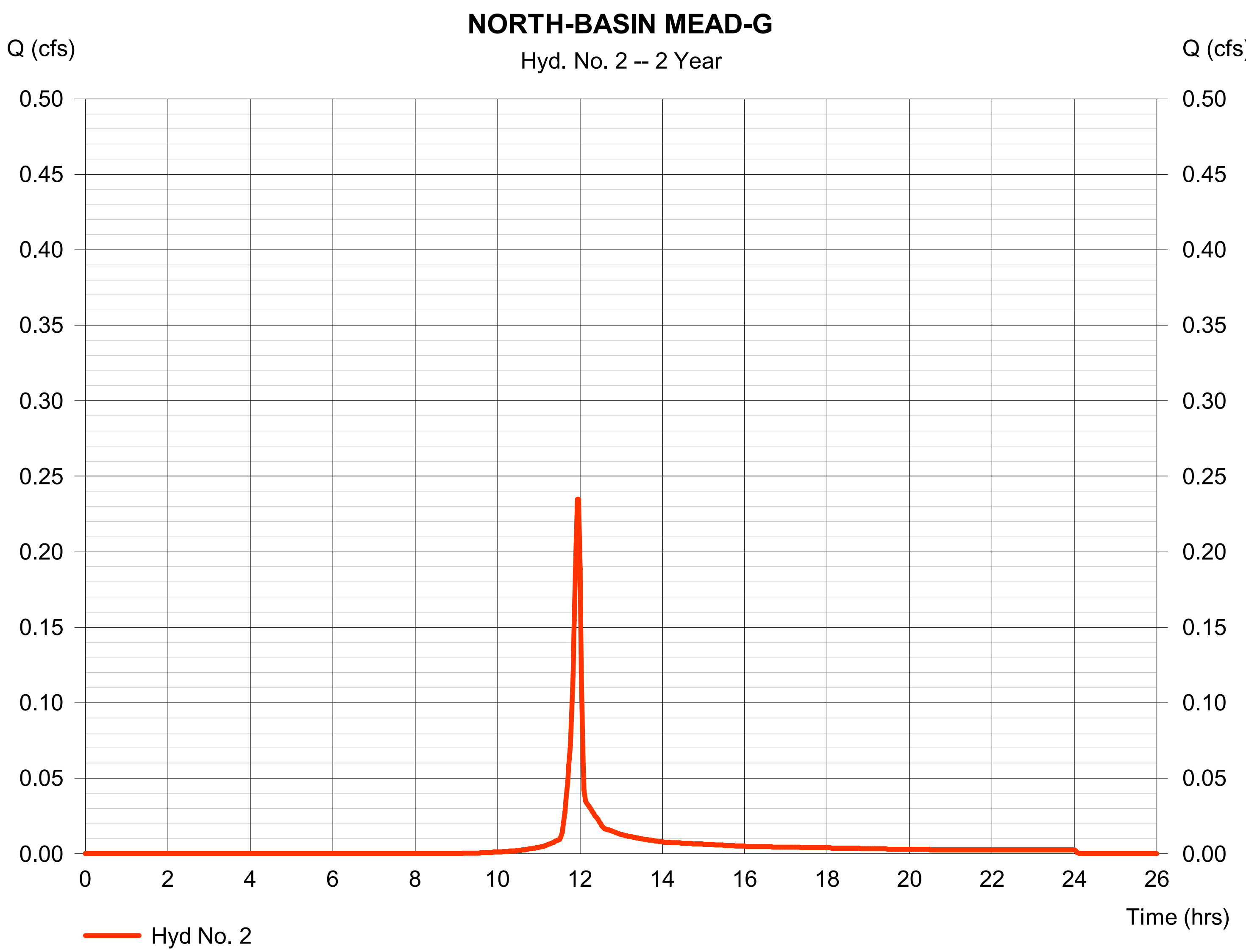
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 2

NORTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.235 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 474 cuft
Drainage area	= 0.092 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



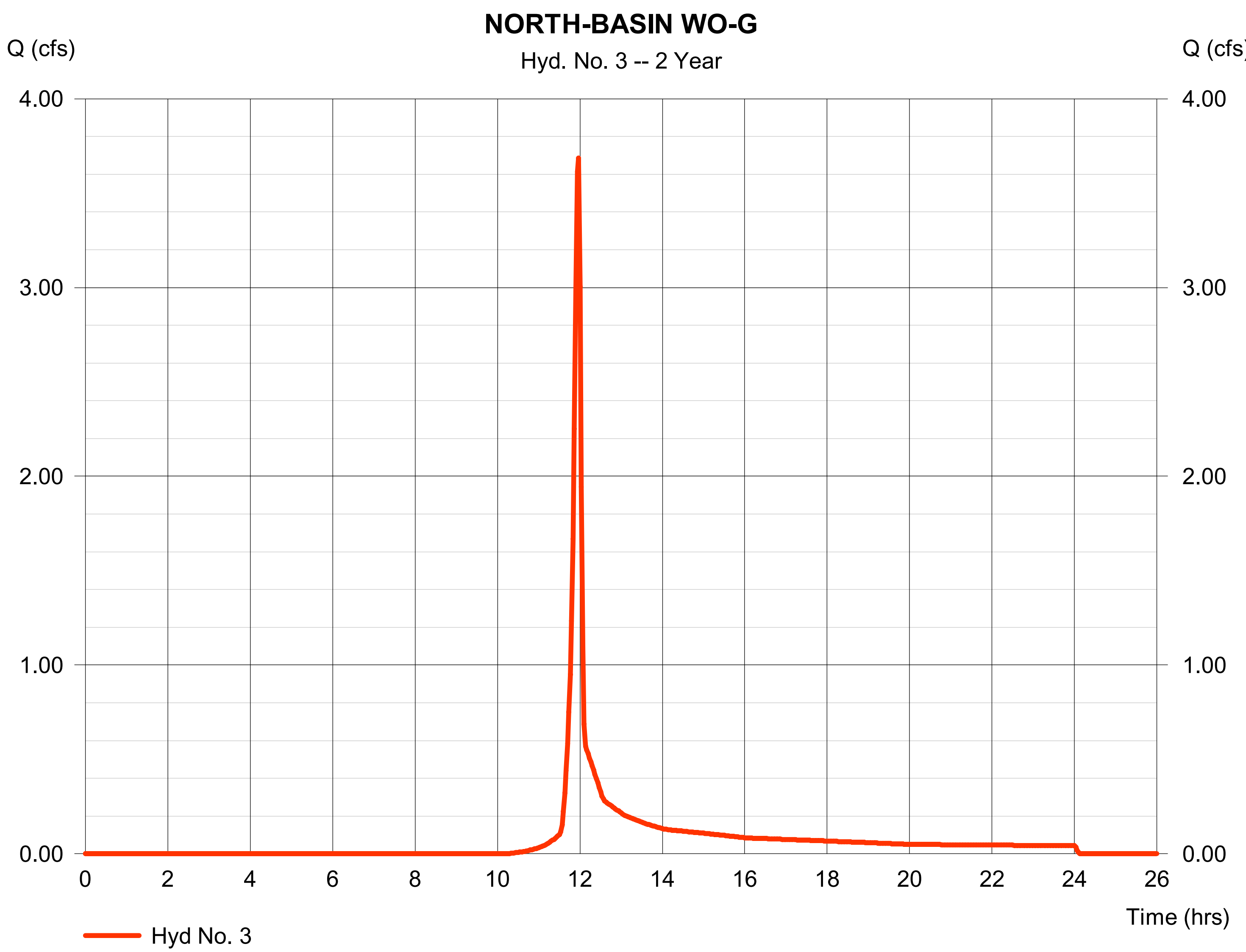
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 3

NORTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 3.685 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 7,369 cuft
Drainage area	= 1.819 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



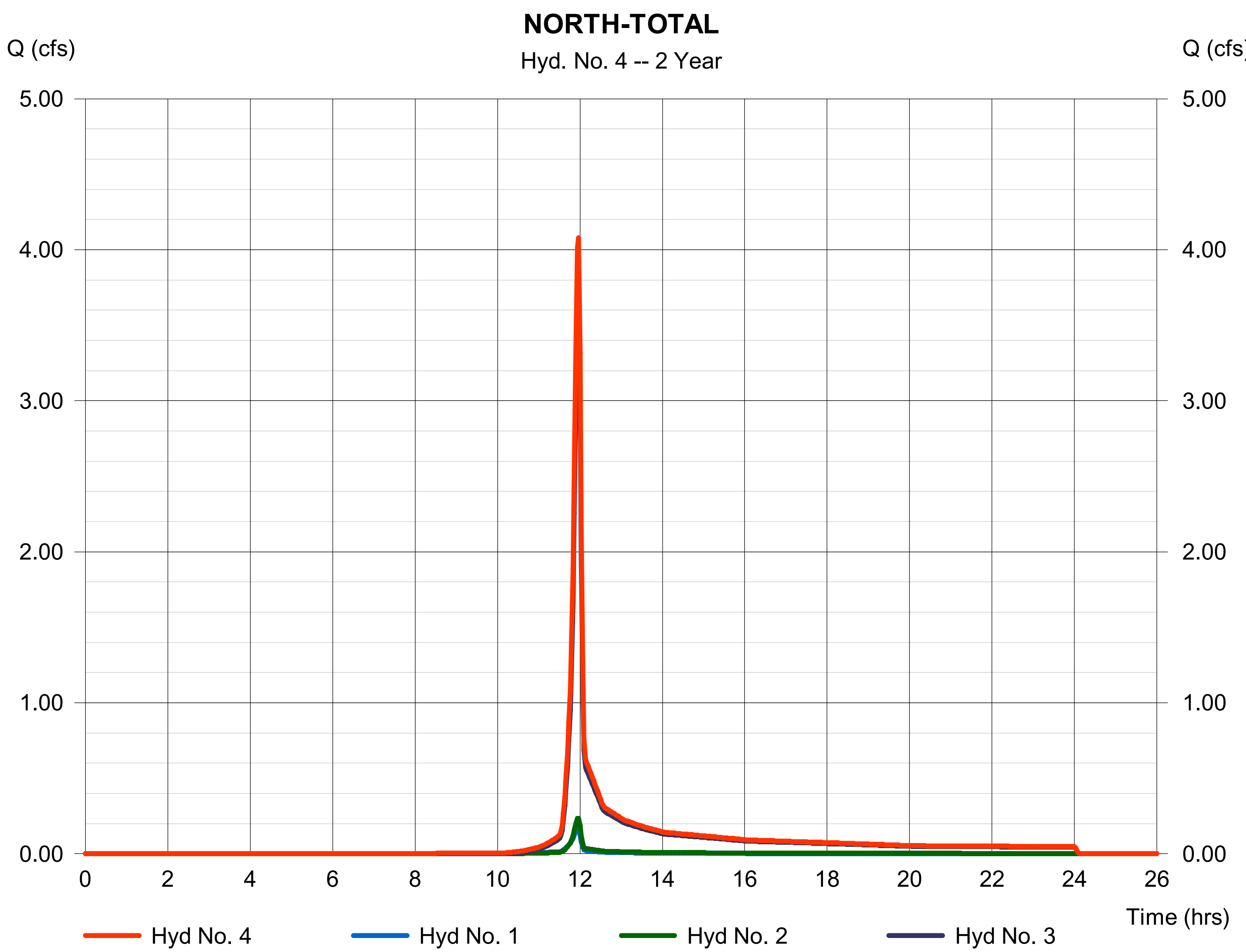
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 4

NORTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 4.079 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 8,233 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 1.950 ac



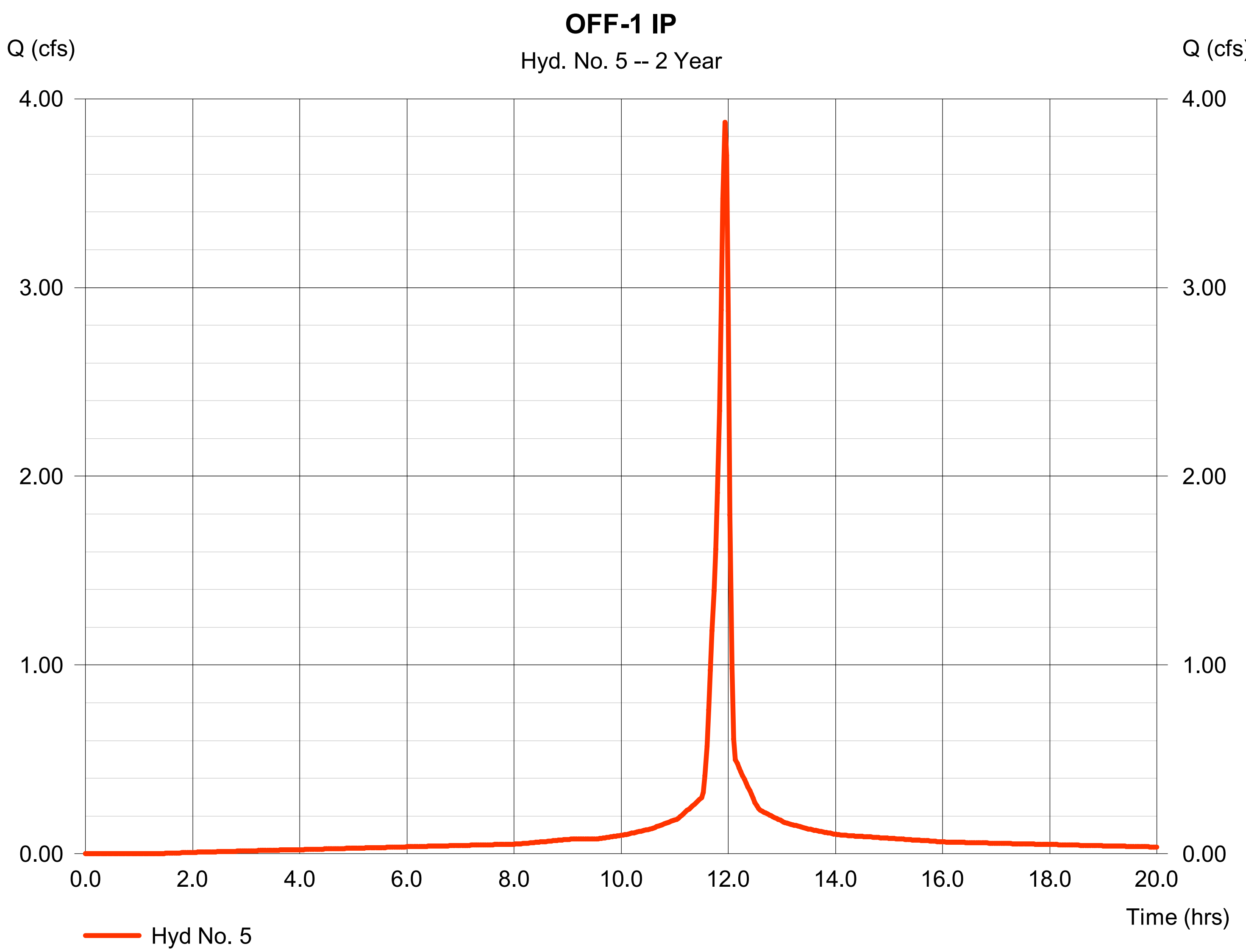
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 5

OFF-1 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 3.875 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 9,057 cuft
Drainage area	= 0.906 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



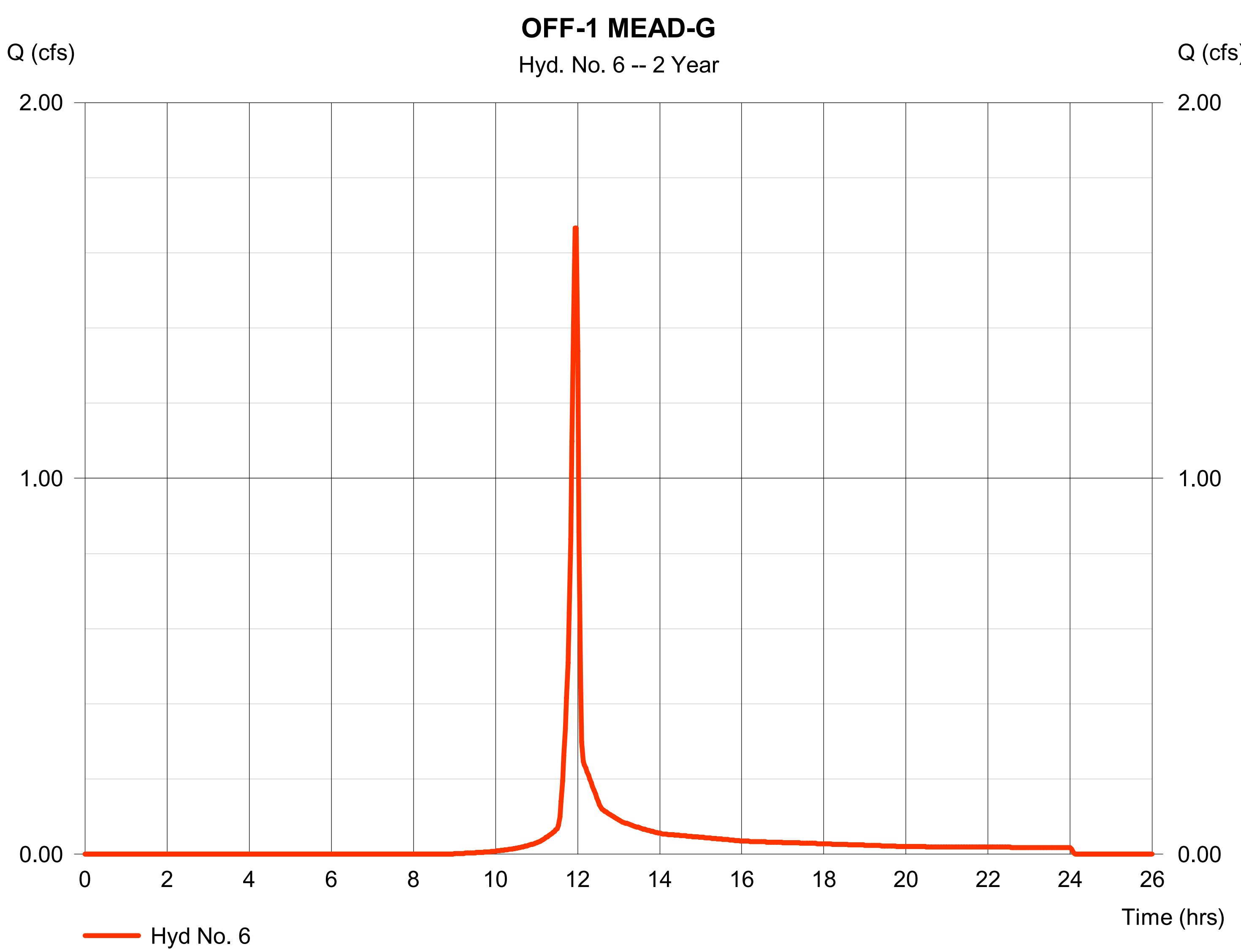
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 6

OFF-1 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 1.667 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 3,365 cuft
Drainage area	= 0.653 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



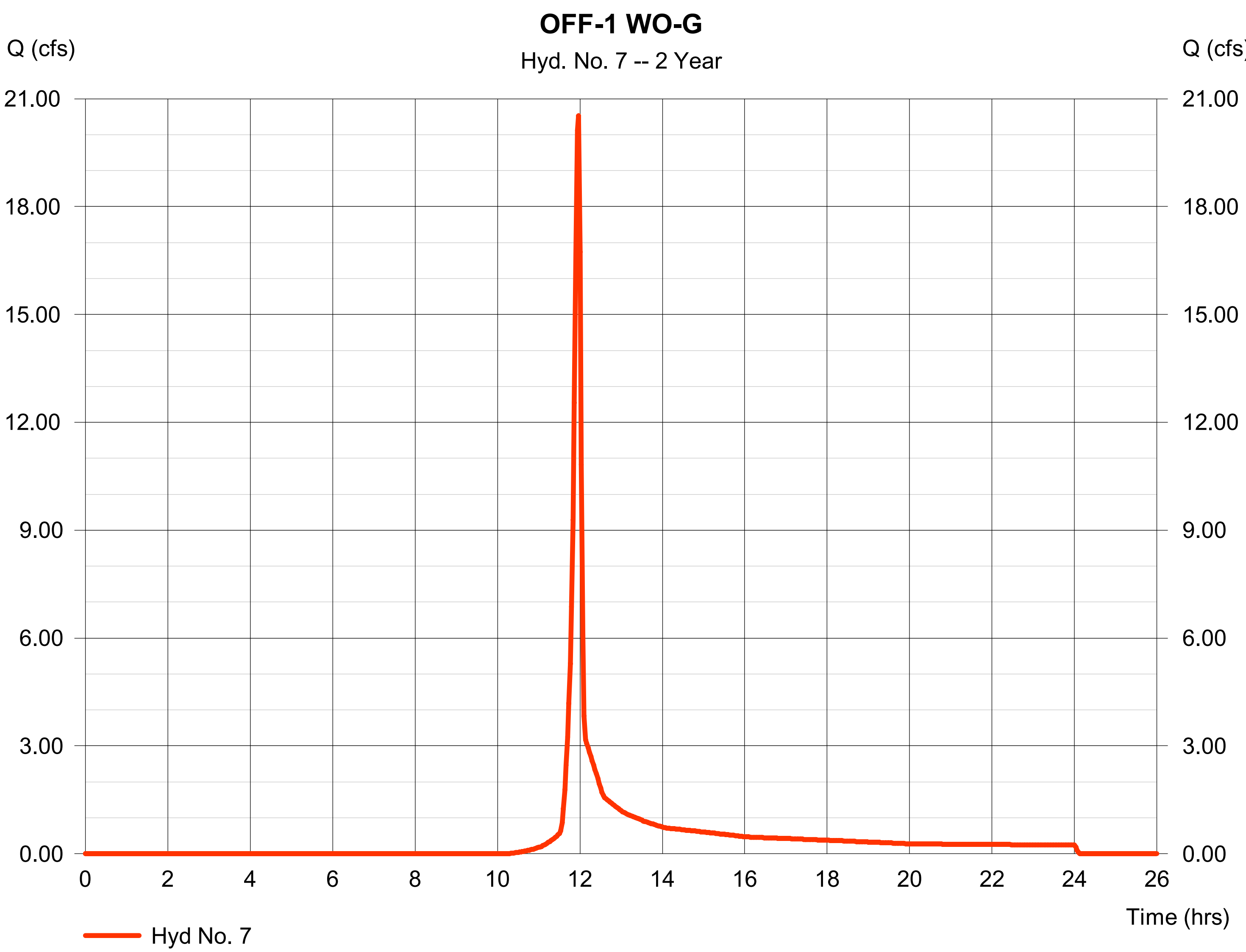
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 7

OFF-1 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 20.52 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 41,042 cuft
Drainage area	= 10.131 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



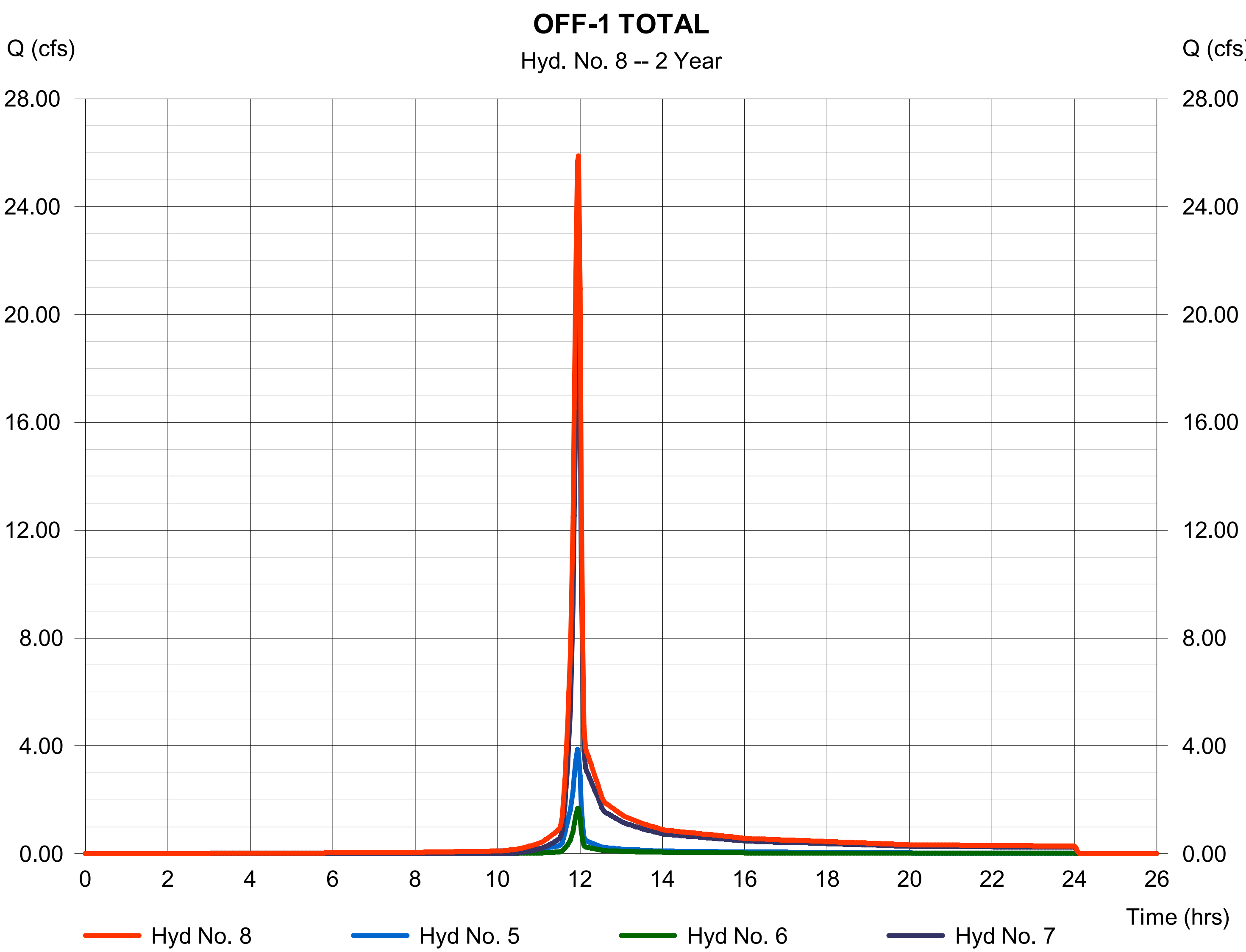
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 8

OFF-1 TOTAL

Hydrograph type	= Combine	Peak discharge	= 25.89 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 53,464 cuft
Inflow hyds.	= 5, 6, 7	Contrib. drain. area	= 11.690 ac



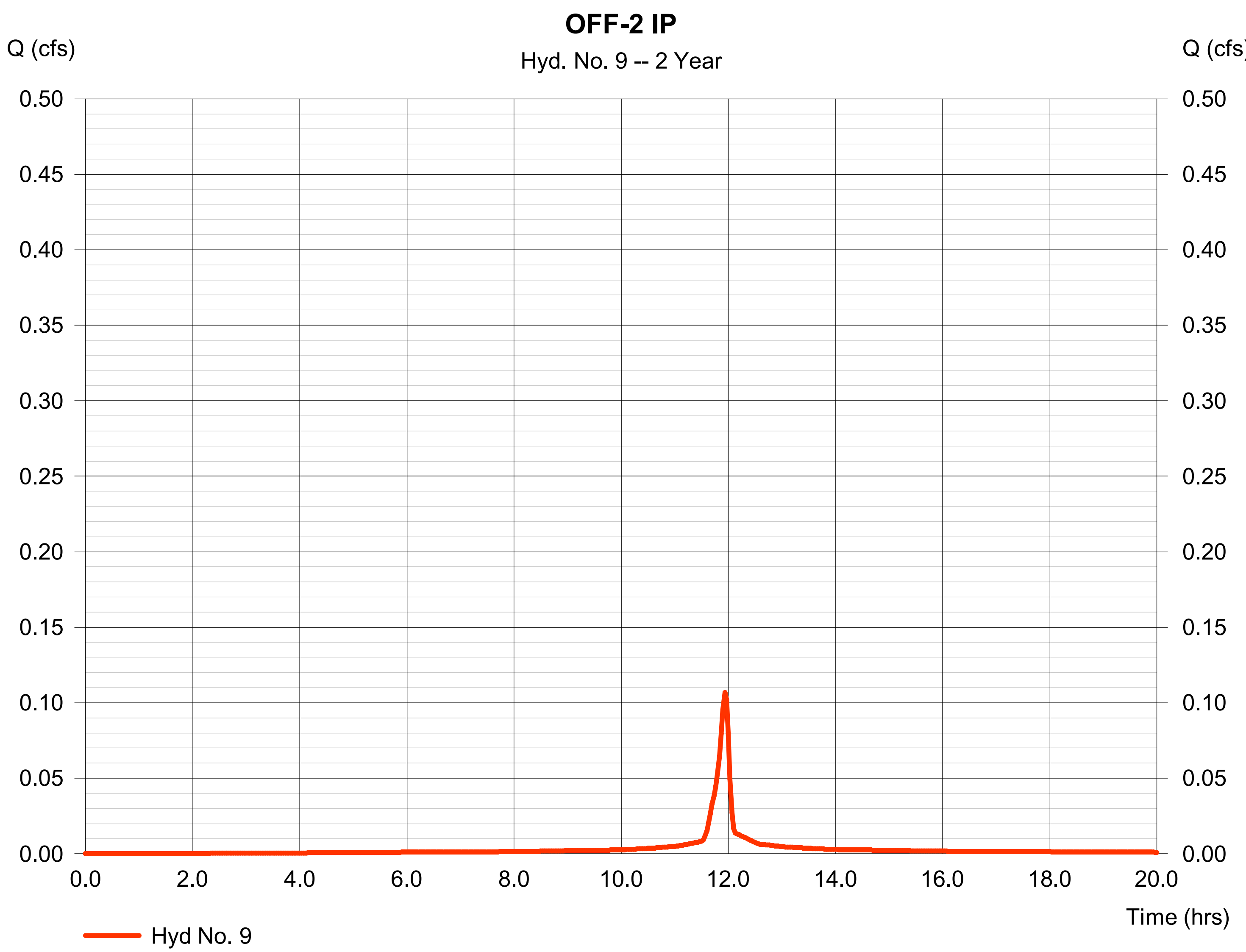
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 9

OFF-2 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.107 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 250 cuft
Drainage area	= 0.025 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



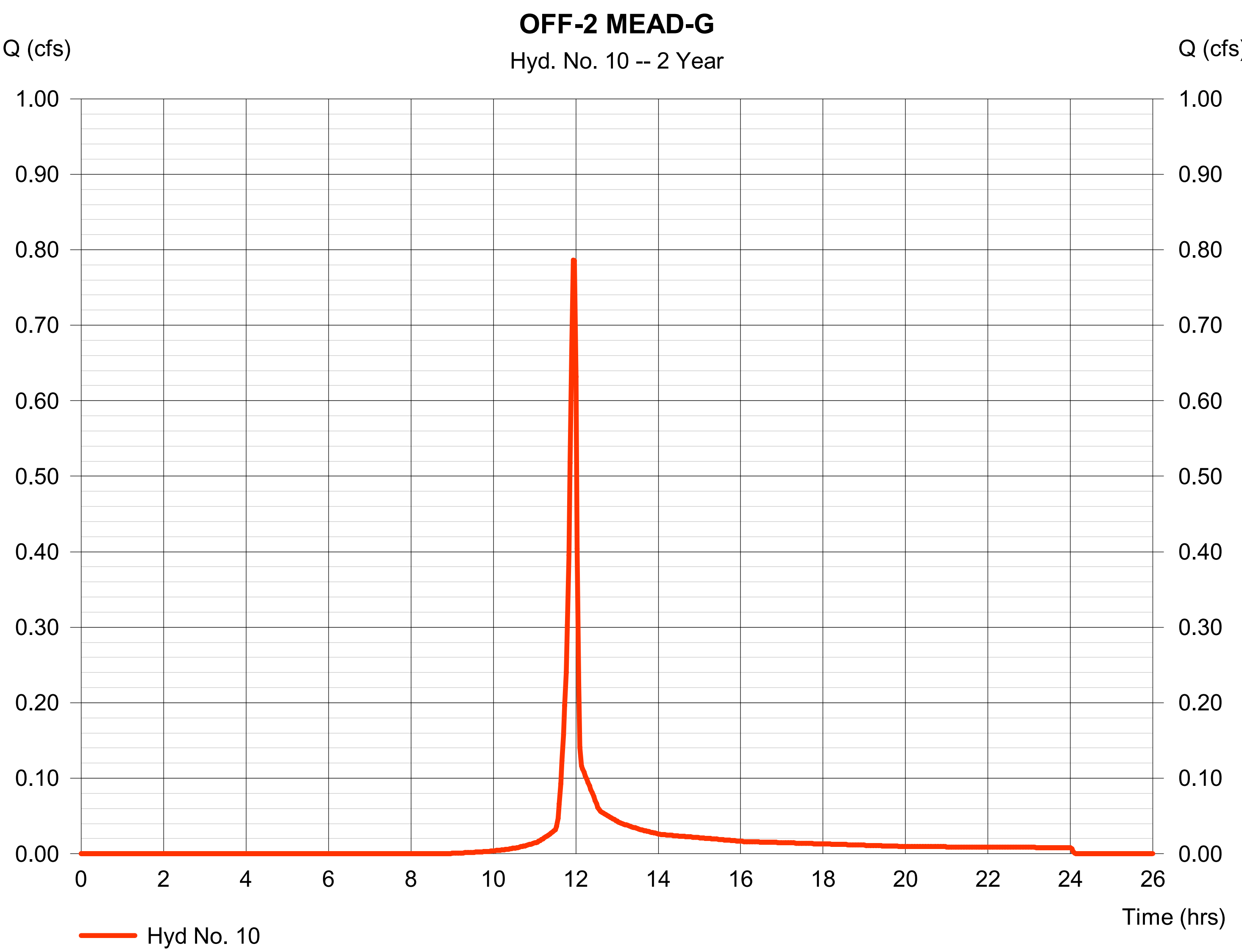
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 10

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.786 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,587 cuft
Drainage area	= 0.308 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



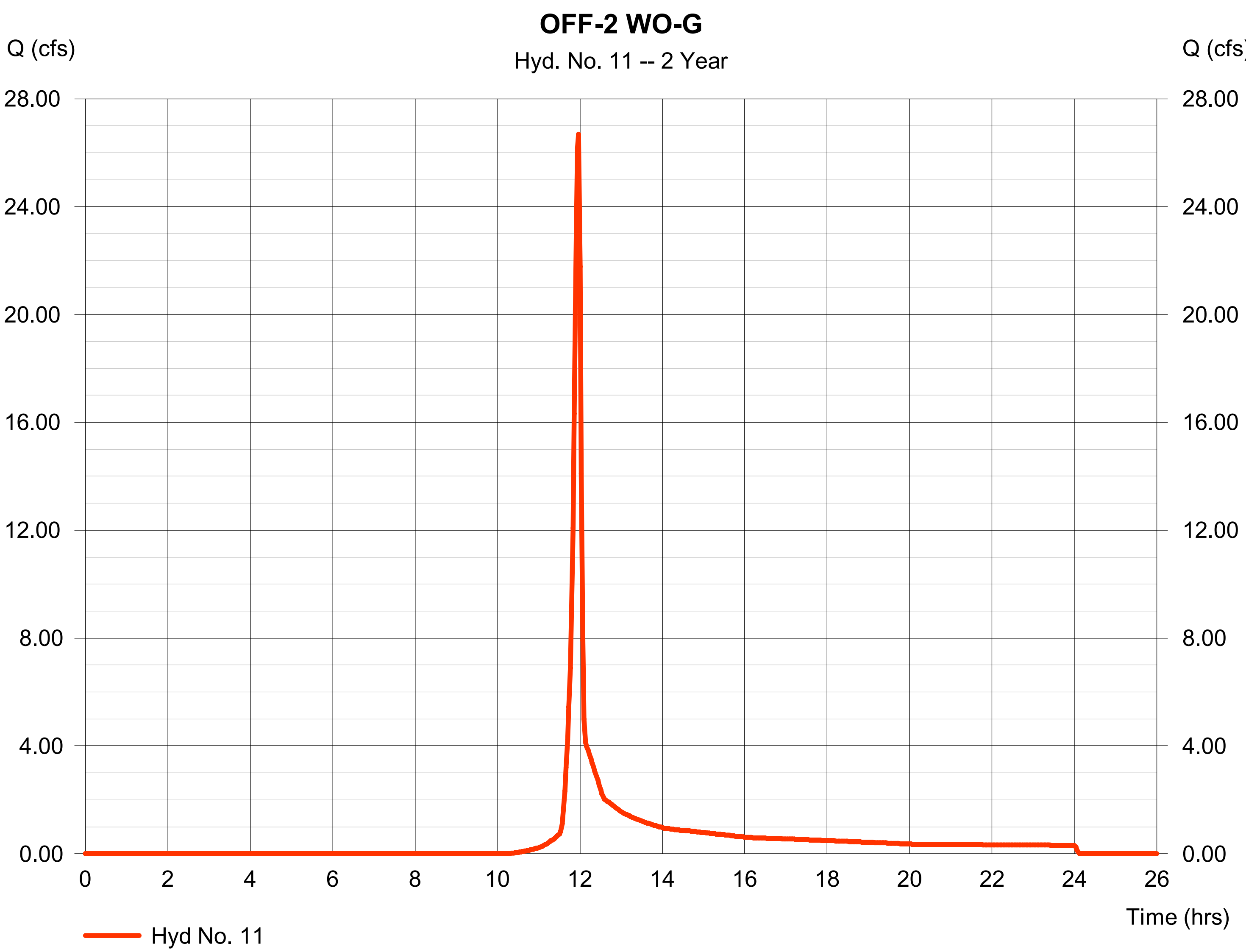
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 11

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 26.69 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 53,366 cuft
Drainage area	= 13.173 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



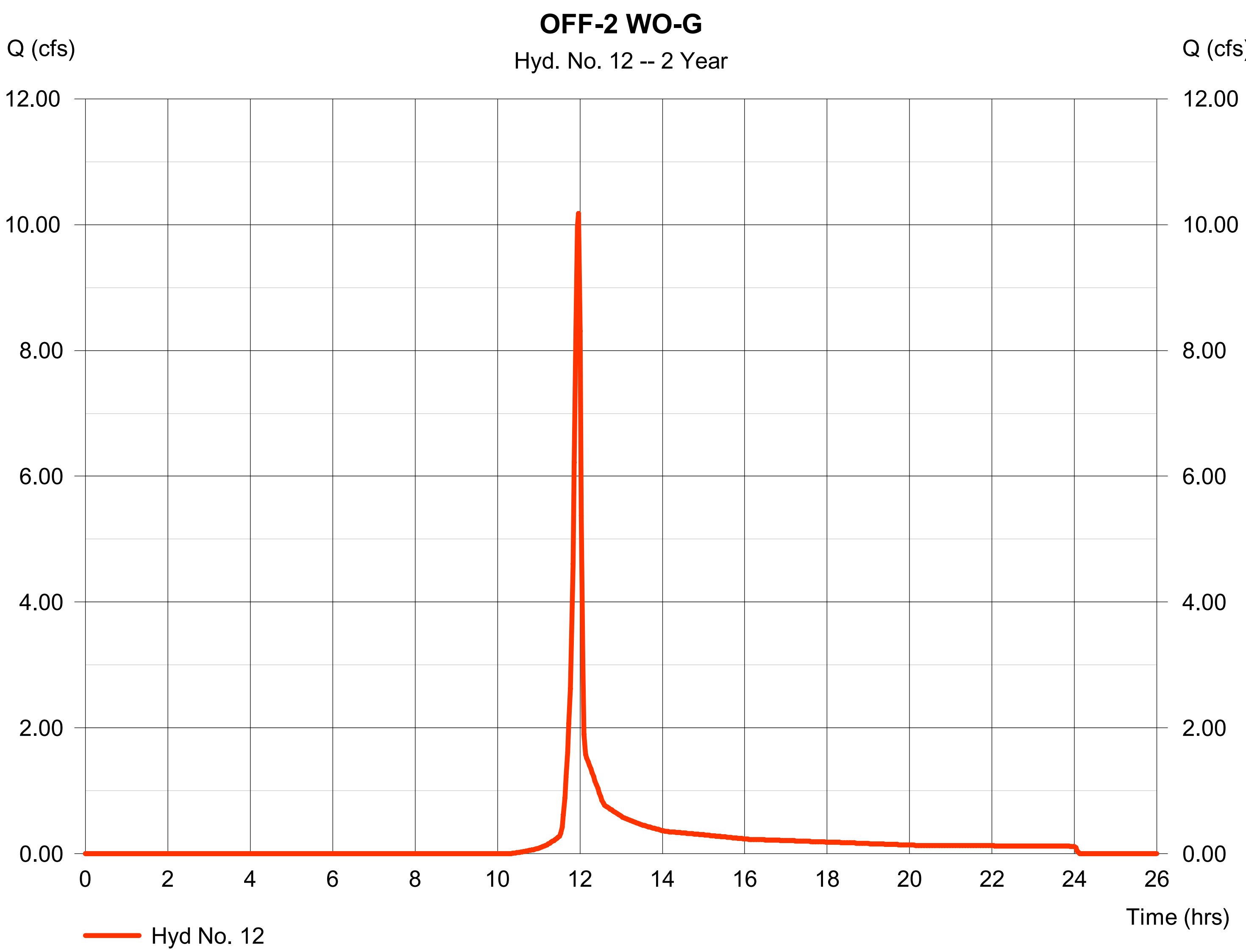
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 12

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 10.18 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 20,357 cuft
Drainage area	= 5.025 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



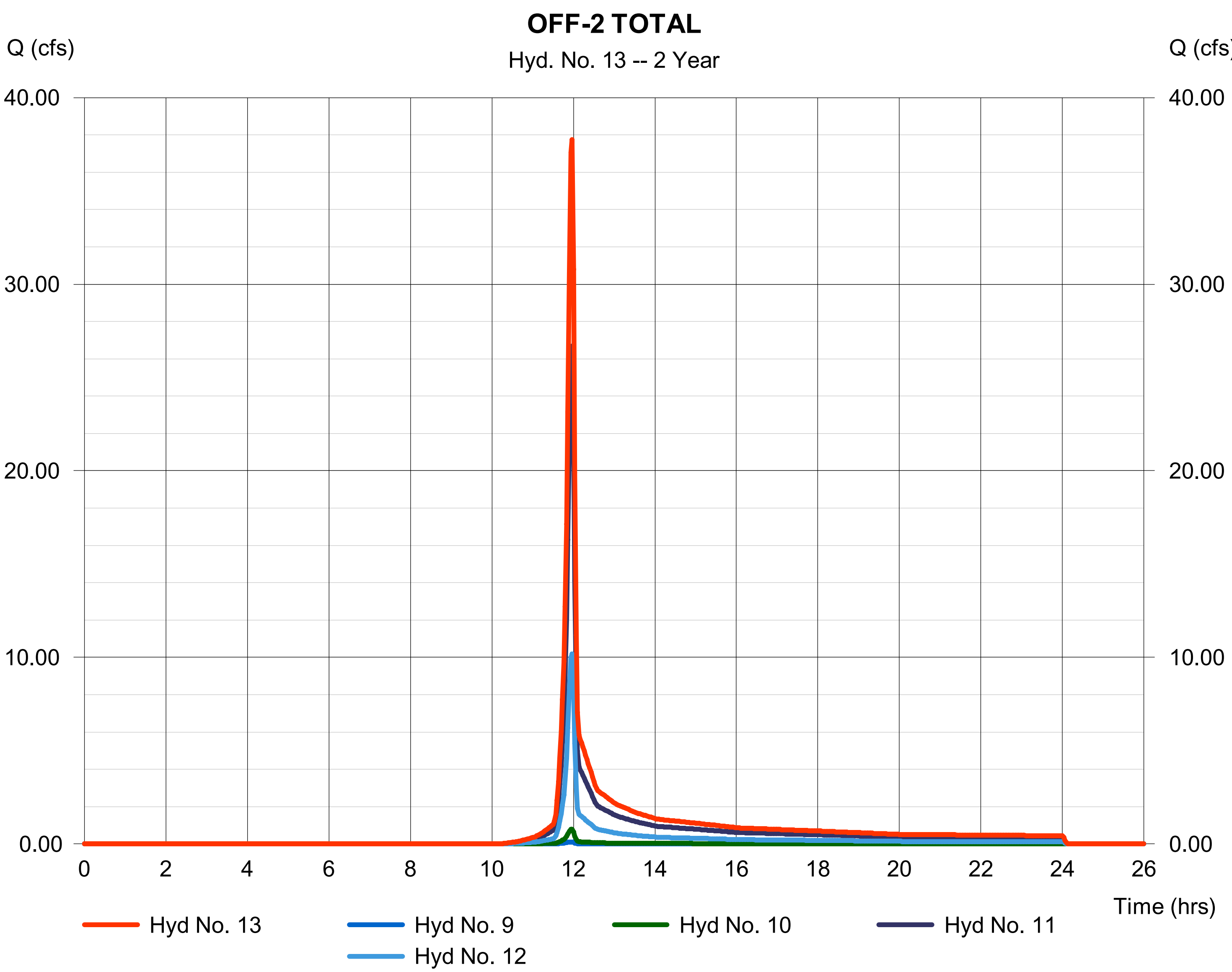
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 13

OFF-2 TOTAL

Hydrograph type	= Combine	Peak discharge	= 37.75 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 75,559 cuft
Inflow hyds.	= 9, 10, 11, 12	Contrib. drain. area	= 18.531 ac

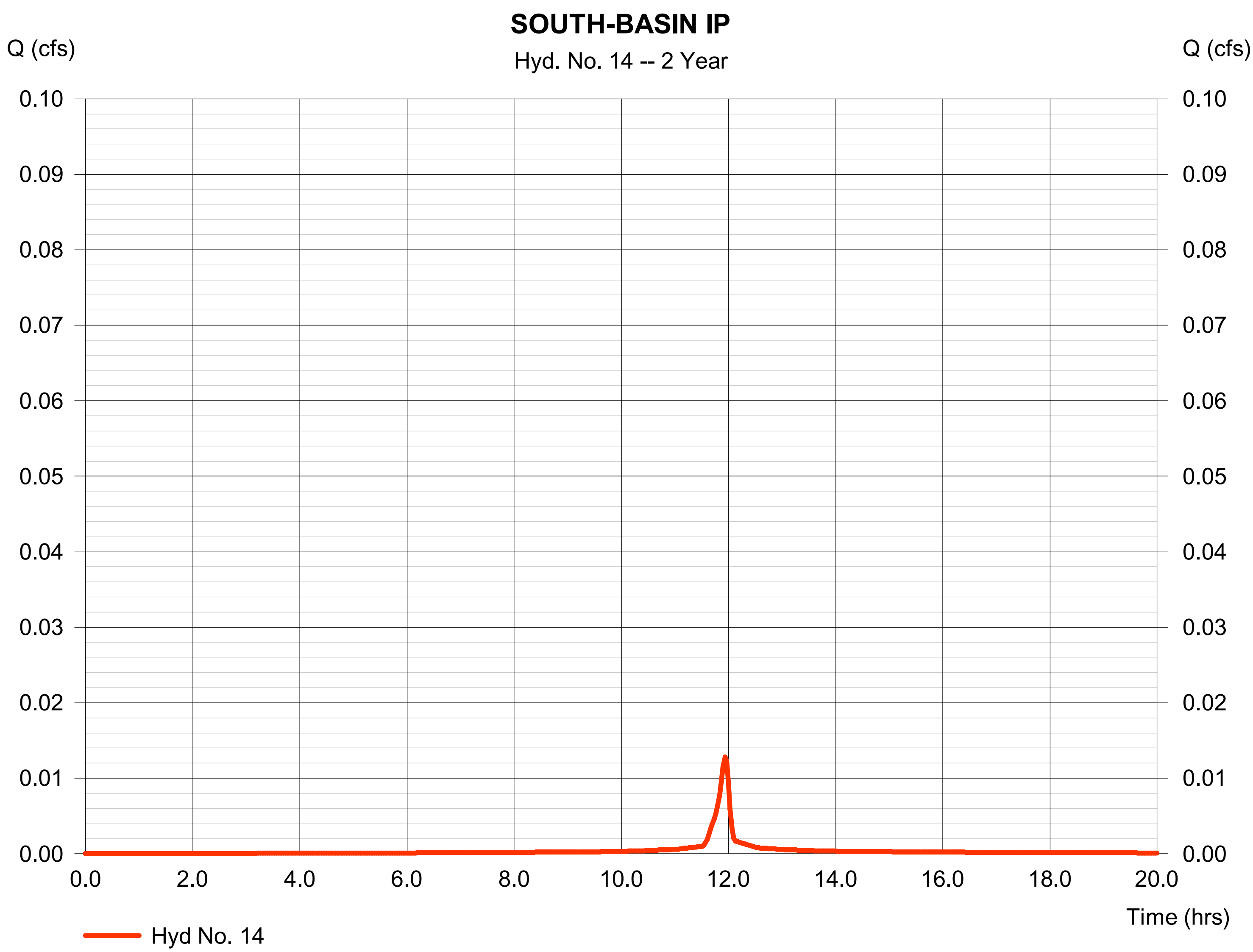


Hydrograph Report

Hyd. No. 14

SOUTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.013 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 30 cuft
Drainage area	= 0.003 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



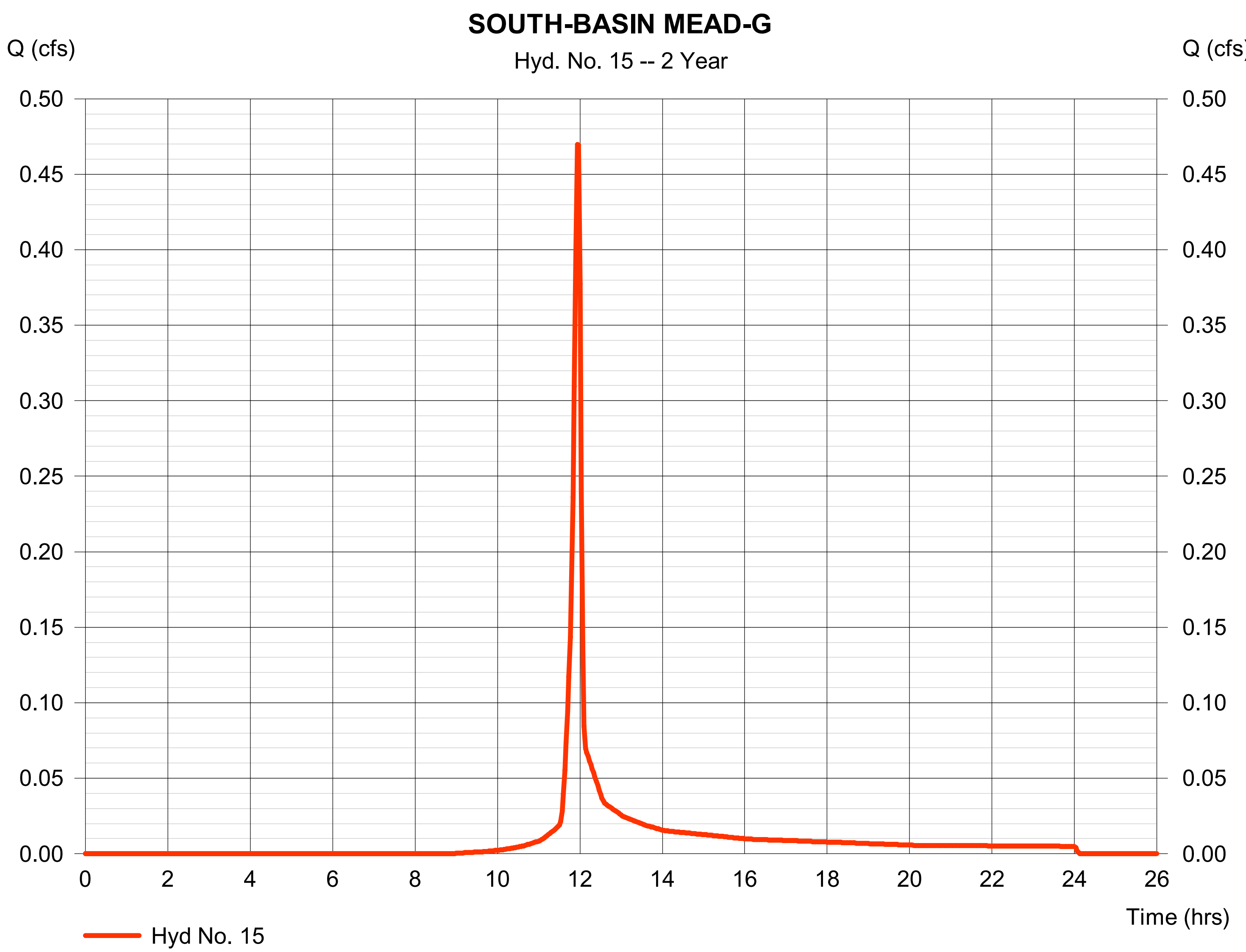
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 15

SOUTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.470 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 948 cuft
Drainage area	= 0.184 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



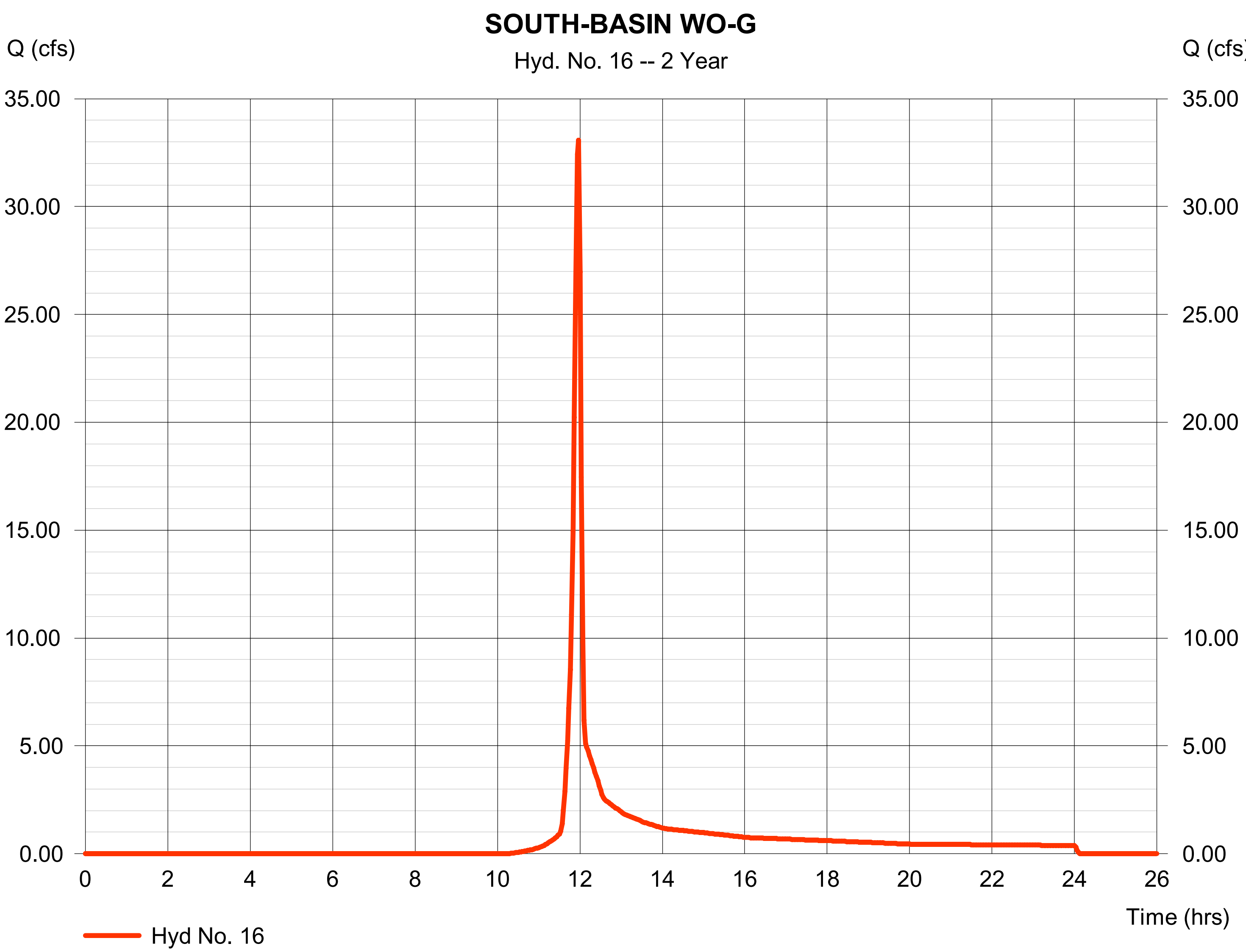
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 16

SOUTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 33.07 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 66,143 cuft
Drainage area	= 16.327 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



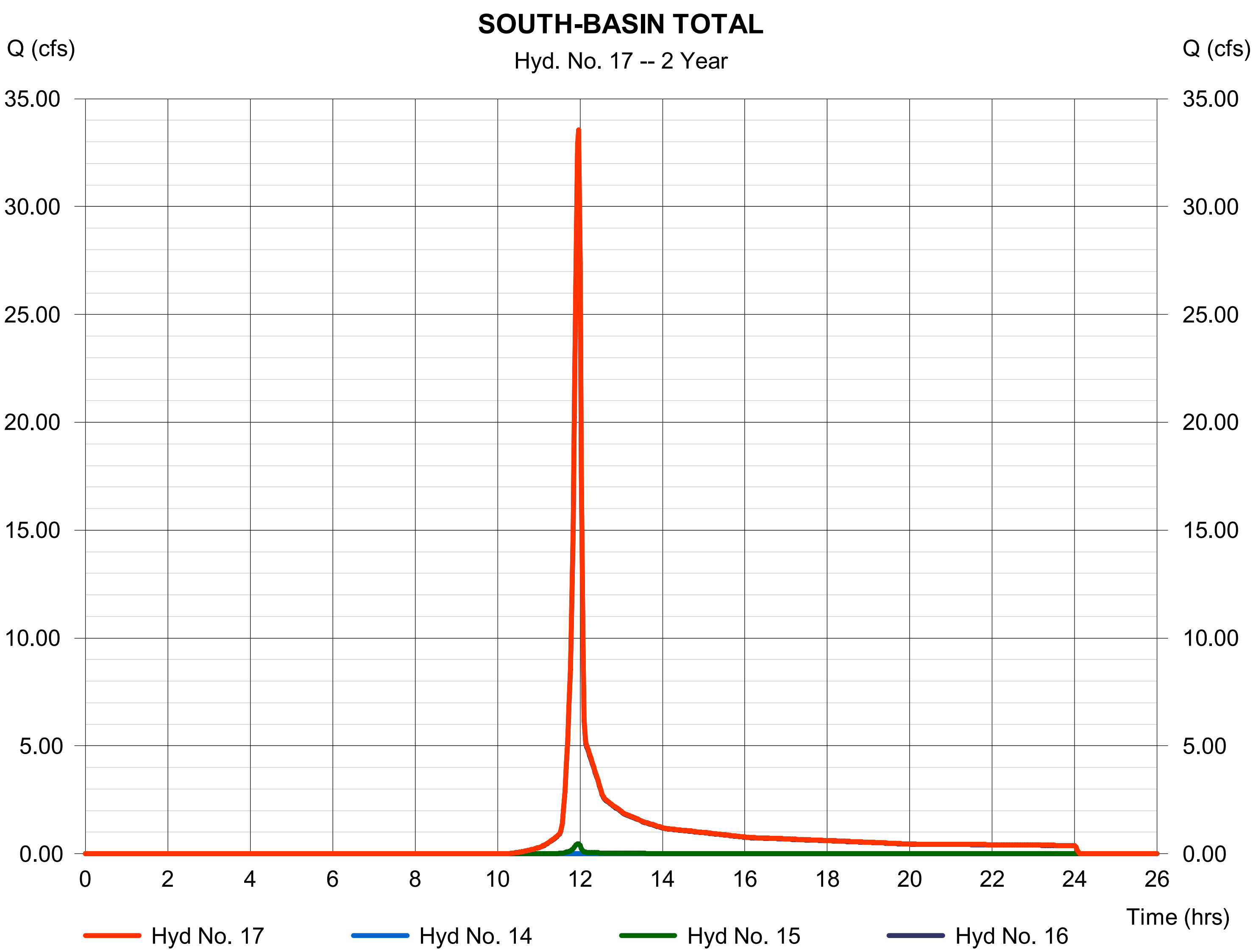
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 17

SOUTH-BASIN TOTAL

Hydrograph type	= Combine	Peak discharge	= 33.56 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 67,121 cuft
Inflow hyds.	= 14, 15, 16	Contrib. drain. area	= 16.514 ac



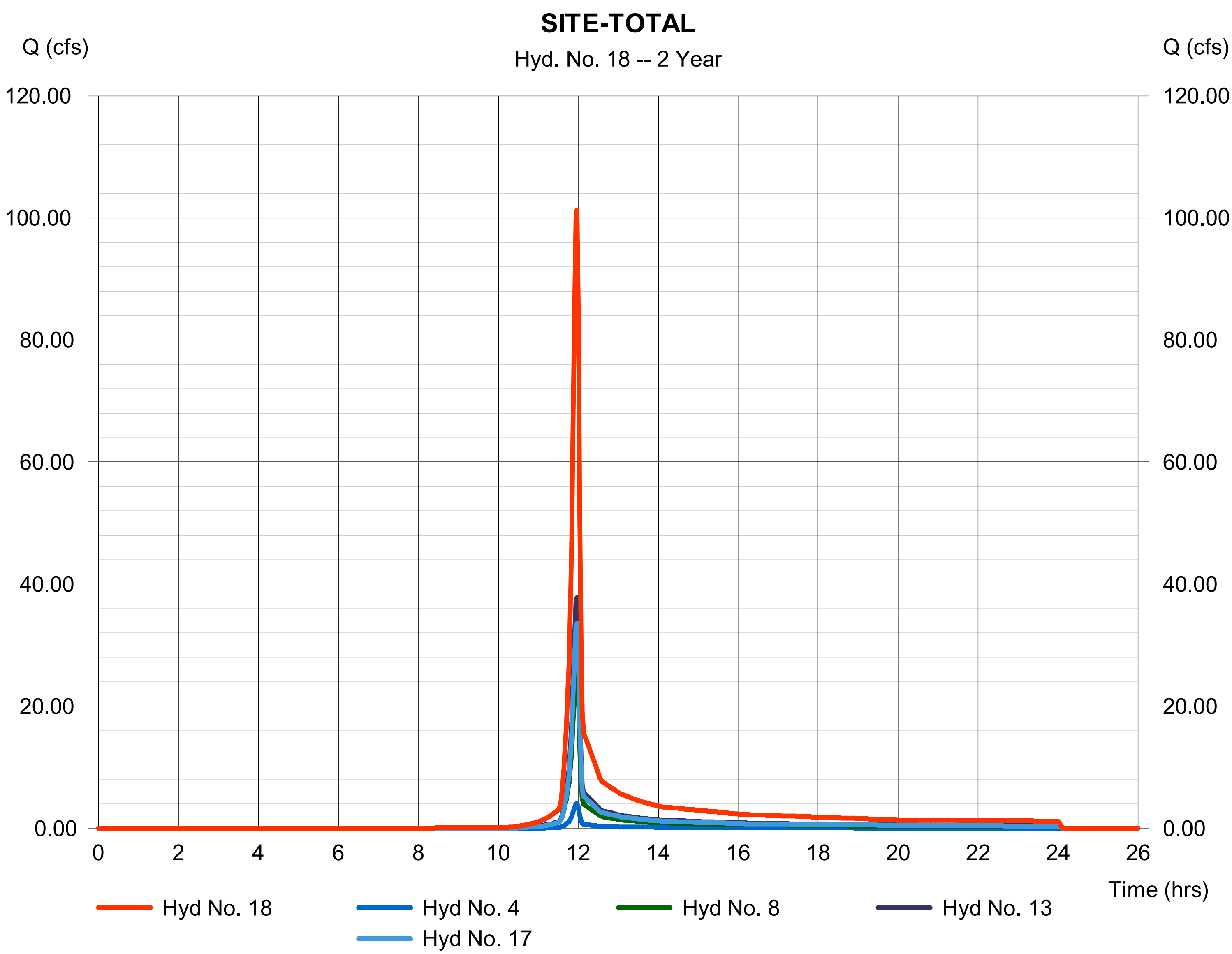
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 18

SITE-TOTAL

Hydrograph type	= Combine	Peak discharge	= 101.28 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 204,377 cuft
Inflow hyds.	= 4, 8, 13, 17	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	0.208	2	716	492	------	------	------	NORTH-BASIN IP
2	SCS Runoff	0.332	2	716	674	------	------	------	NORTH-BASIN MEAD-G
3	SCS Runoff	5.433	2	718	10,927	------	------	------	NORTH-BASIN WO-G
4	Combine	5.961	2	718	12,092	1, 2, 3	------	------	NORTH-TOTAL
5	SCS Runoff	4.837	2	716	11,424	------	------	------	OFF-1 IP
6	SCS Runoff	2.360	2	716	4,782	------	------	------	OFF-1 MEAD-G
7	SCS Runoff	30.26	2	718	60,859	------	------	------	OFF-1 WO-G
8	Combine	37.32	2	716	77,064	5, 6, 7	------	------	OFF-1 TOTAL
9	SCS Runoff	0.133	2	716	315	------	------	------	OFF-2 IP
10	SCS Runoff	1.113	2	716	2,255	------	------	------	OFF-2 MEAD-G
11	SCS Runoff	39.35	2	718	79,132	------	------	------	OFF-2 WO-G
12	SCS Runoff	15.01	2	718	30,186	------	------	------	OFF-2 WO-G
13	Combine	55.59	2	718	111,889	9, 10, 11, 12	------	------	OFF-2 TOTAL
14	SCS Runoff	0.016	2	716	38	------	------	------	SOUTH-BASIN IP
15	SCS Runoff	0.665	2	716	1,347	------	------	------	SOUTH-BASIN MEAD-G
16	SCS Runoff	48.77	2	718	98,079	------	------	------	SOUTH-BASIN WO-G
17	Combine	49.44	2	718	99,464	14, 15, 16	------	------	SOUTH-BASIN TOTAL
18	Combine	148.20	2	718	300,510	4, 8, 13, 17	------	------	SITE-TOTAL

EX-SWM.gpw	Return Period: 5 Year	Tuesday, 10 / 15 / 2019

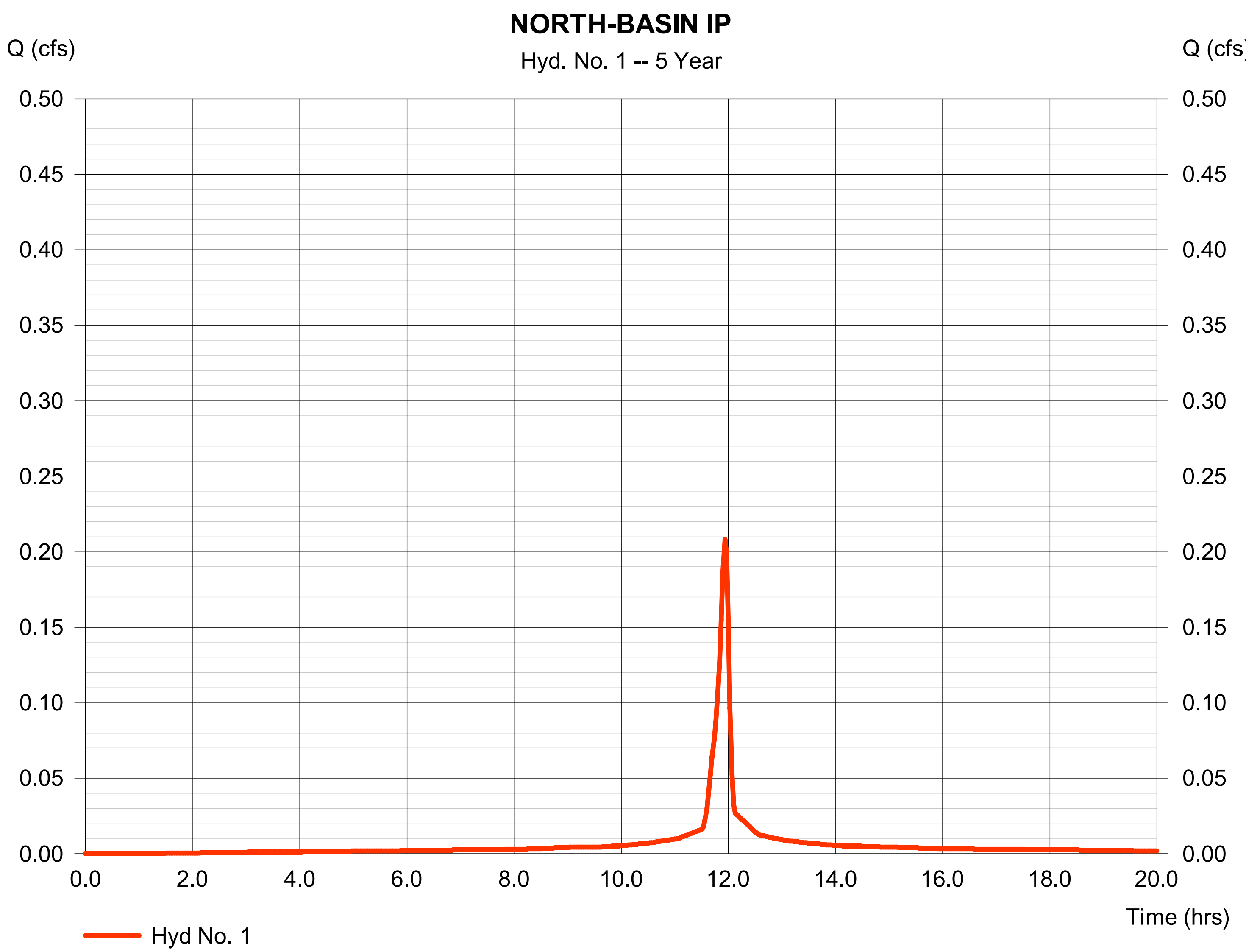
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 1

NORTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.208 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 492 cuft
Drainage area	= 0.039 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



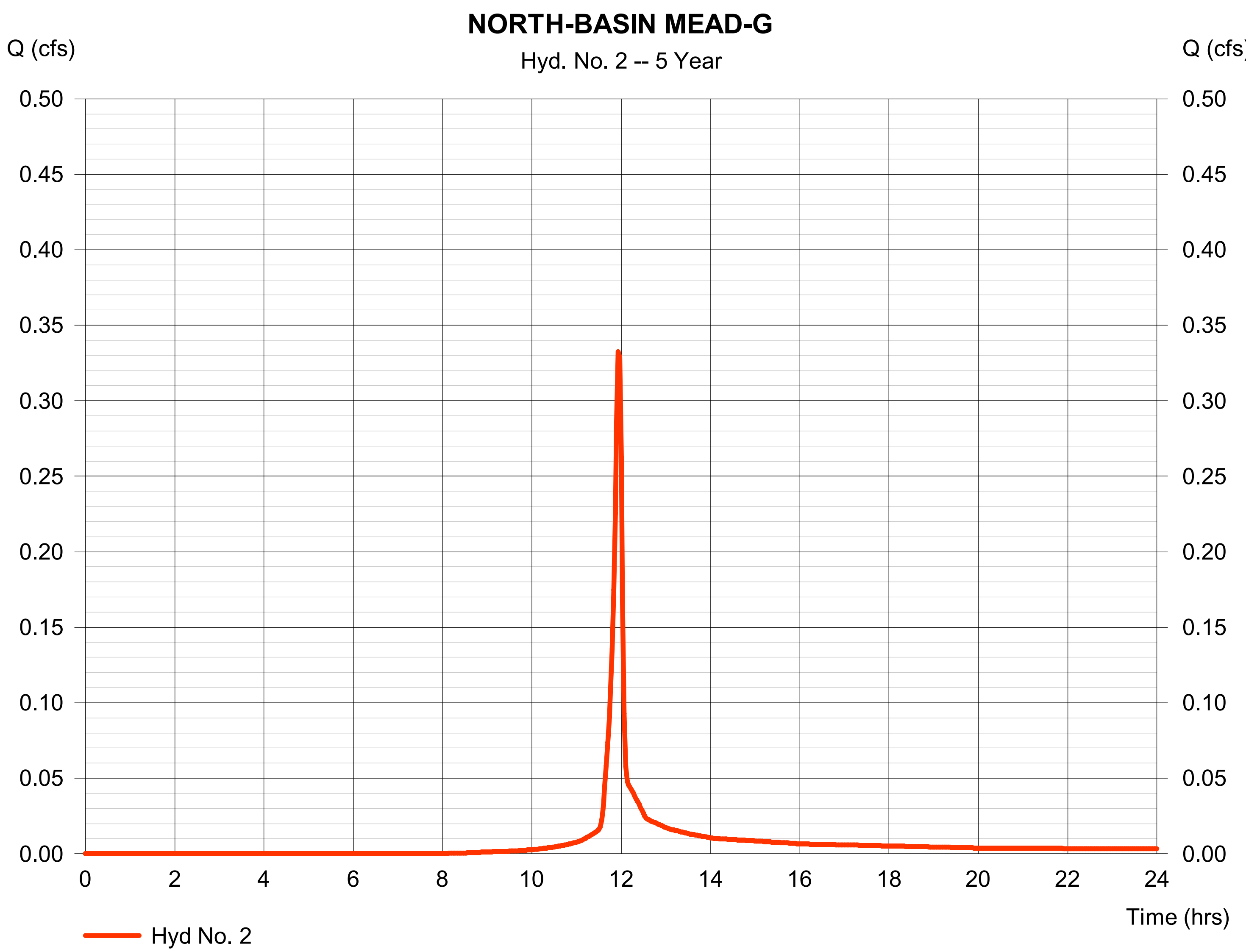
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 2

NORTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.332 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 674 cuft
Drainage area	= 0.092 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



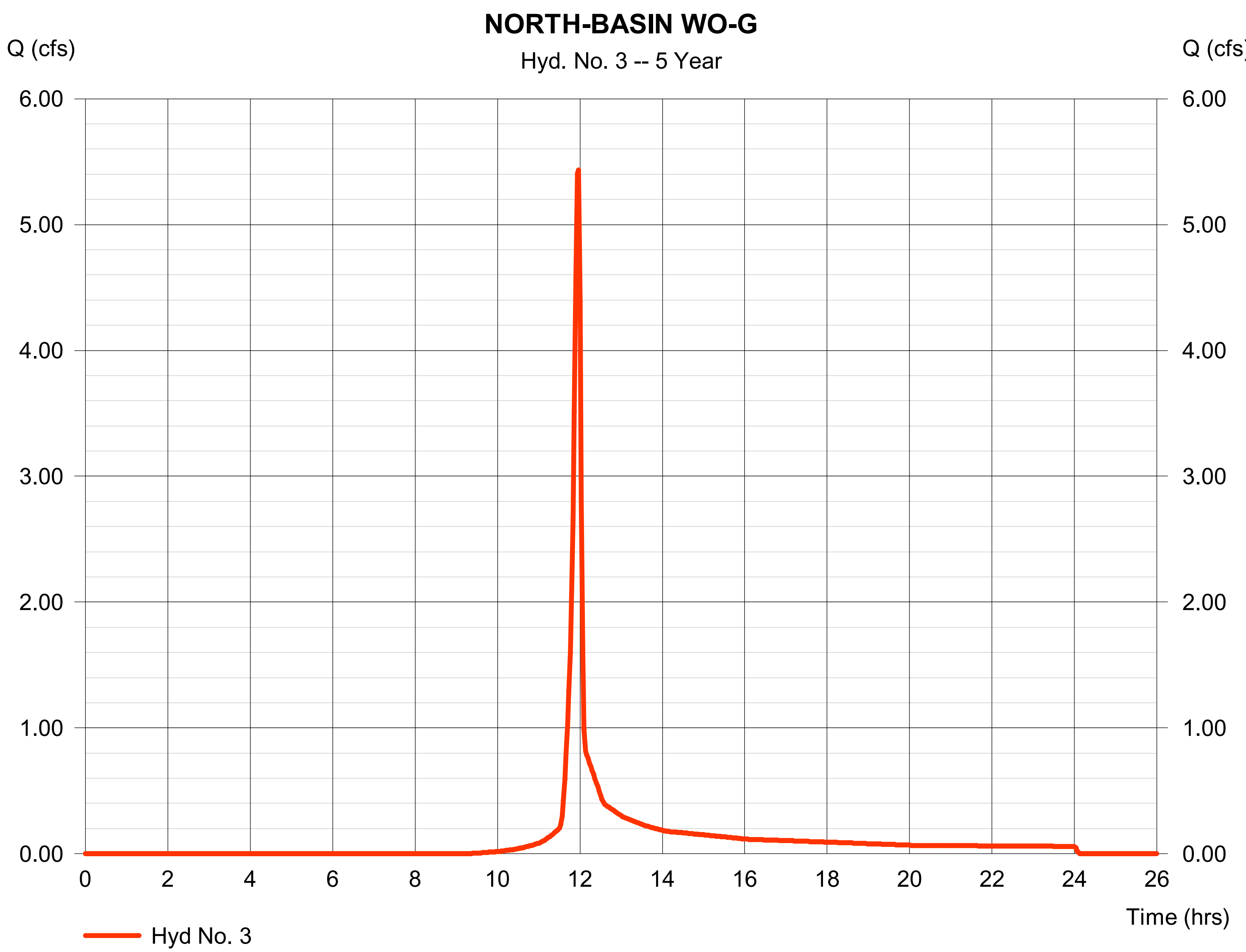
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Tuesday, 10 / 15 / 2019

Hyd. No. 3

NORTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 5.433 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 10,927 cuft
Drainage area	= 1.819 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



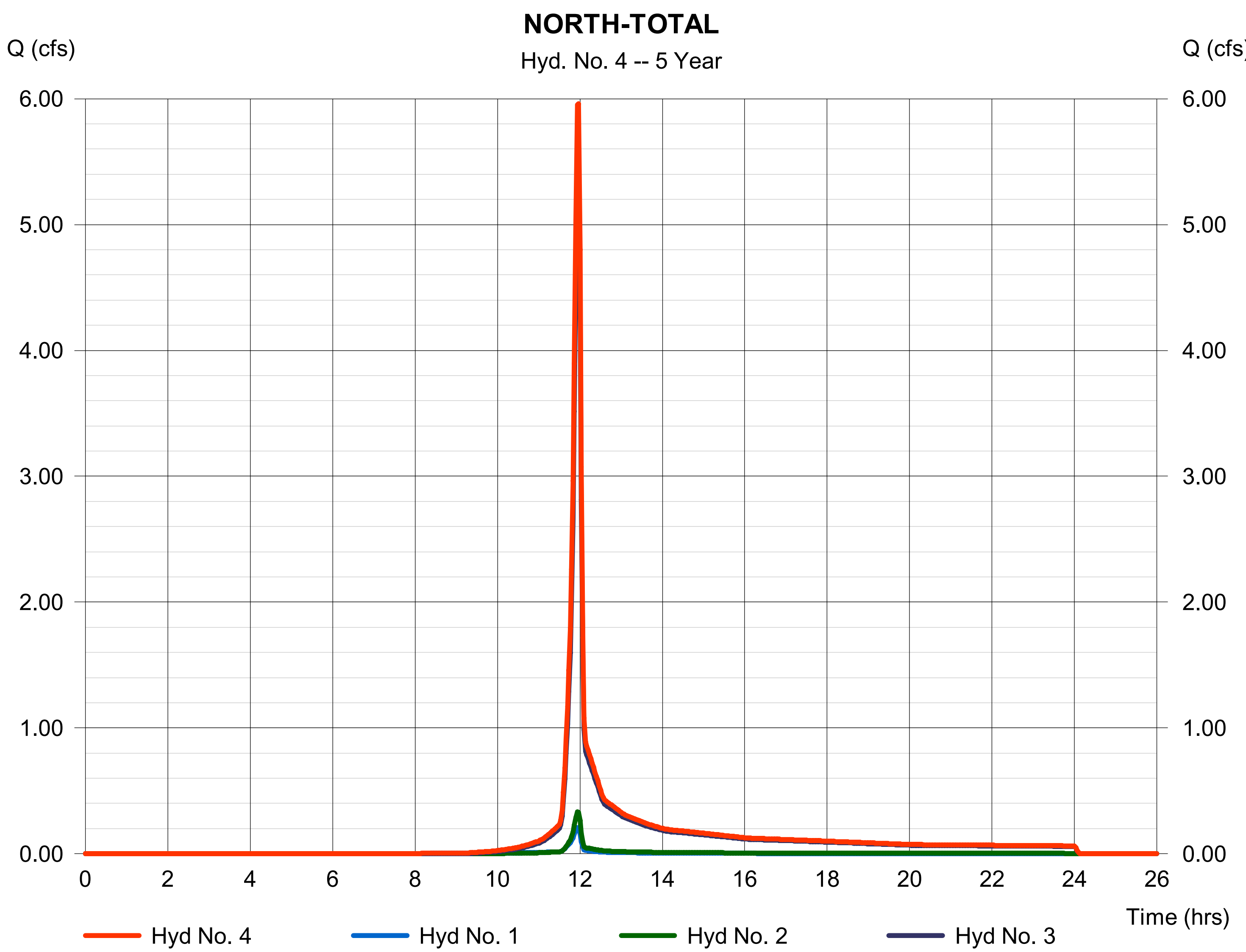
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 4

NORTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 5.961 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 12,092 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 1.950 ac



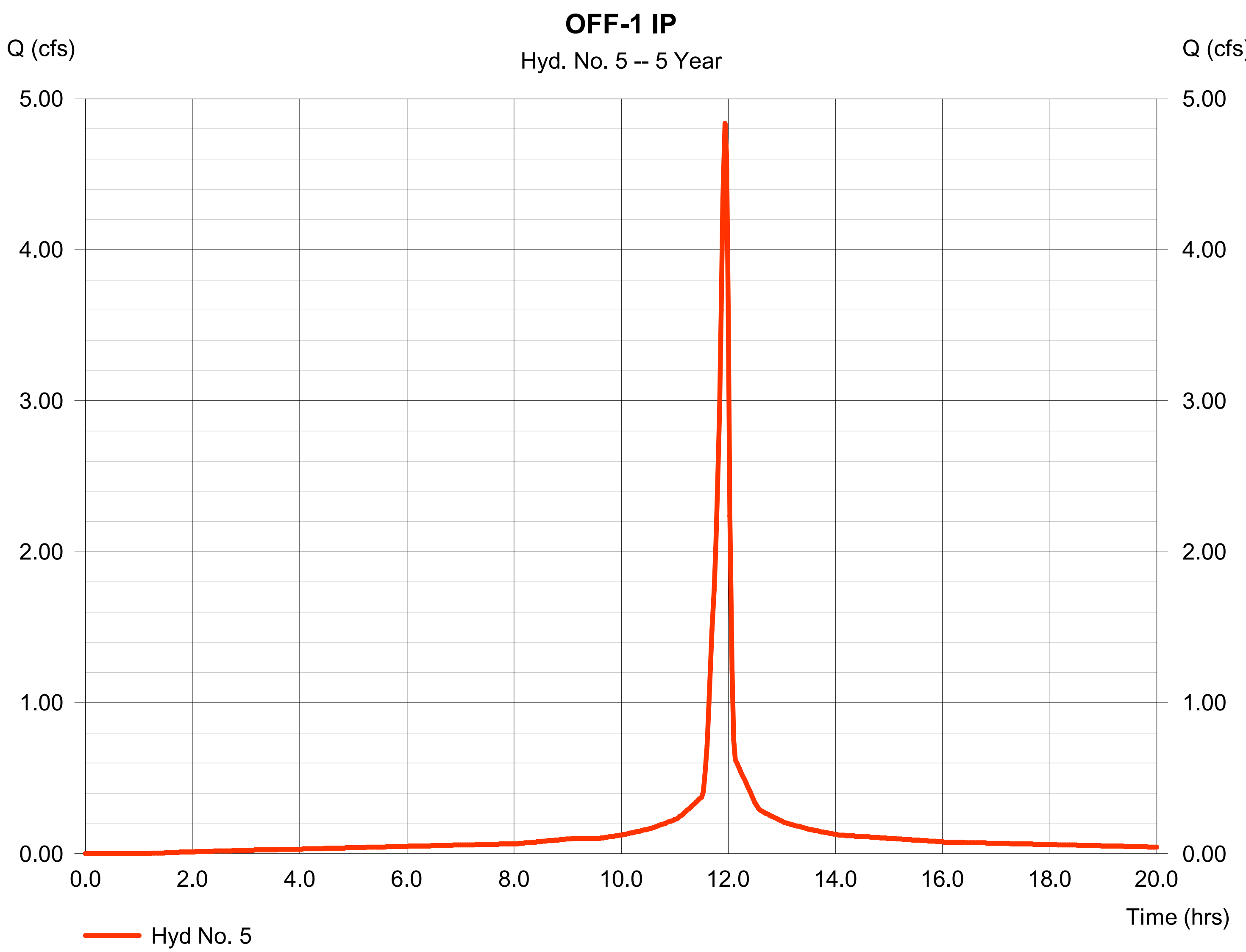
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 5

OFF-1 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 4.837 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 11,424 cuft
Drainage area	= 0.906 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



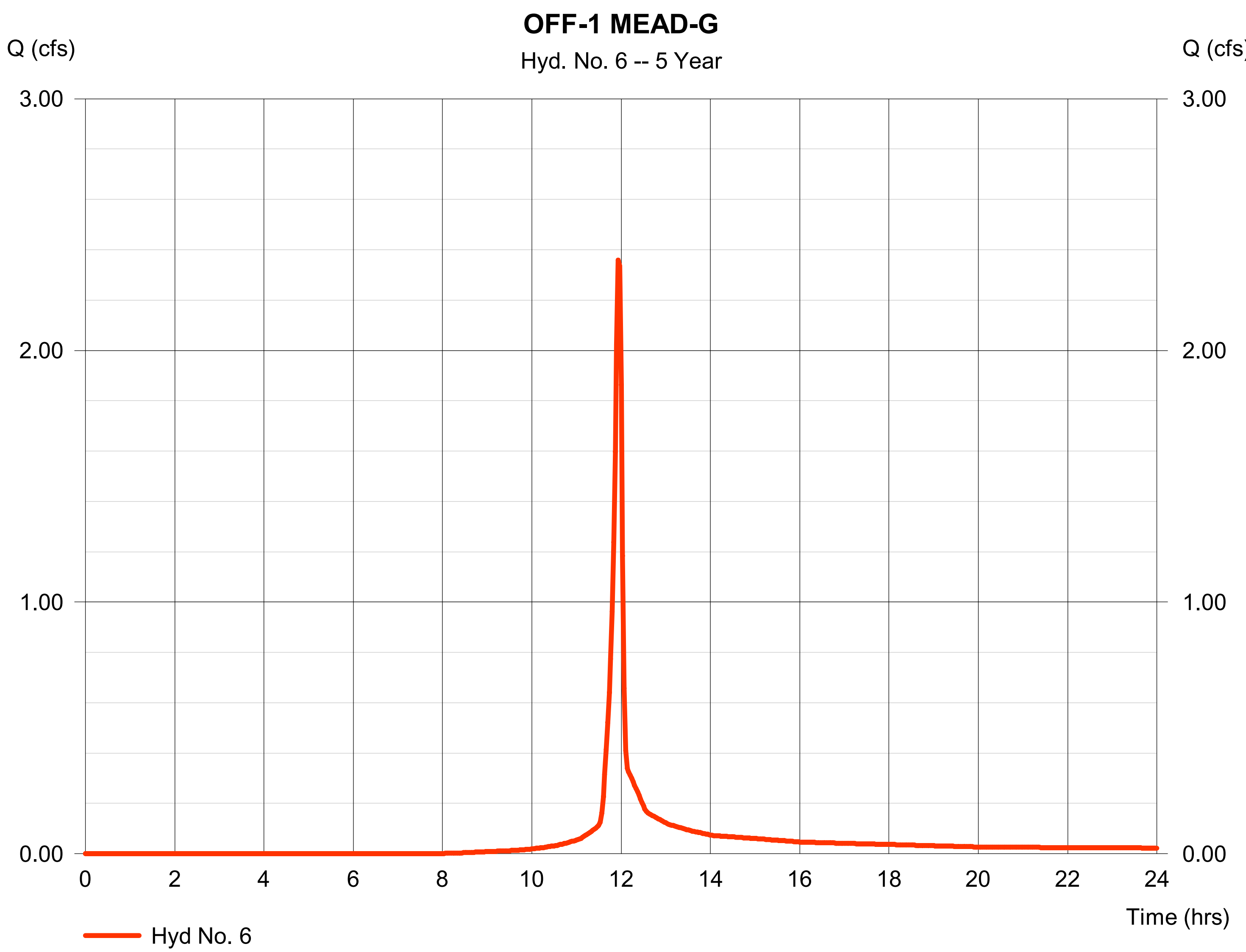
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 6

OFF-1 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 2.360 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 4,782 cuft
Drainage area	= 0.653 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



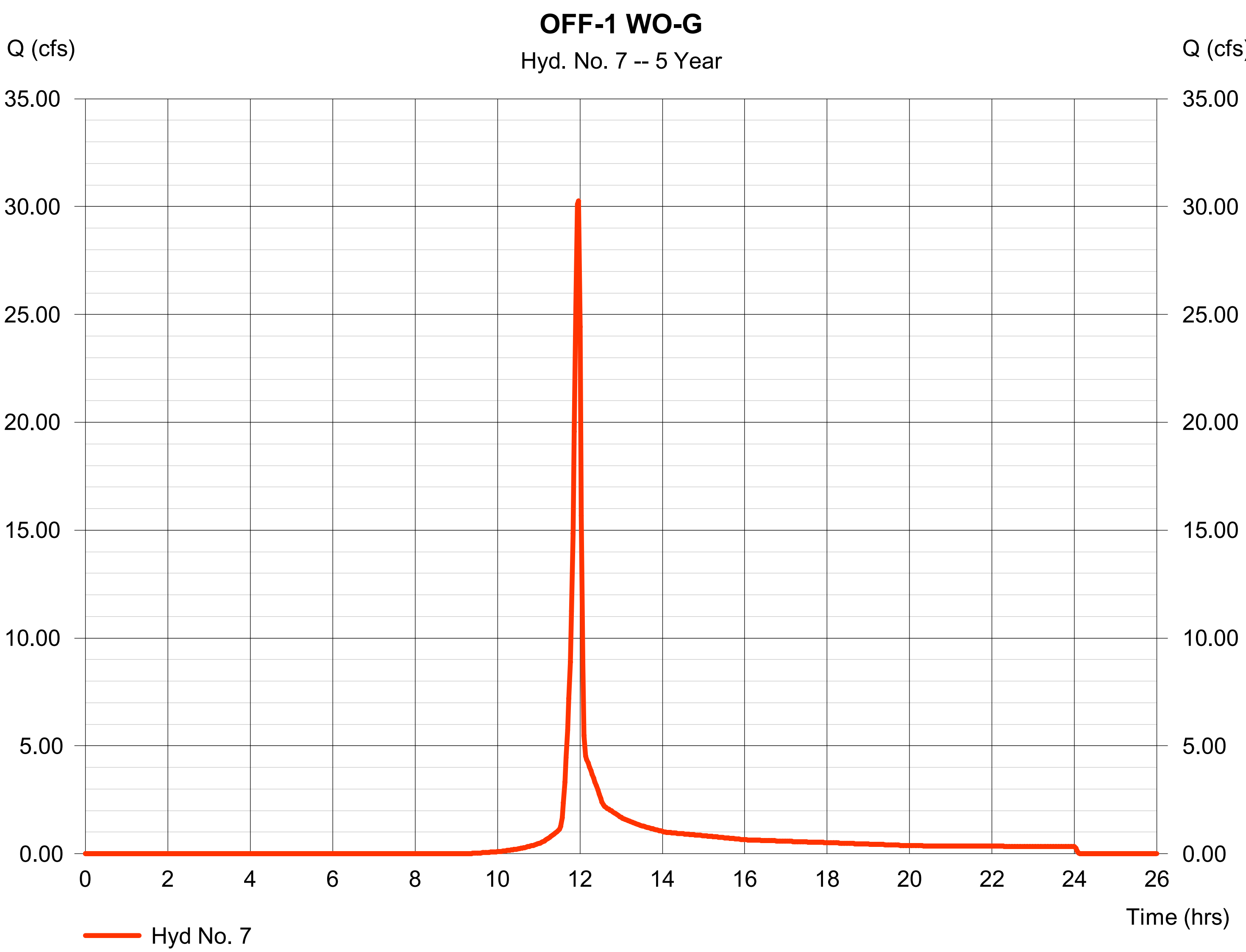
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 7

OFF-1 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 30.26 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 60,859 cuft
Drainage area	= 10.131 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



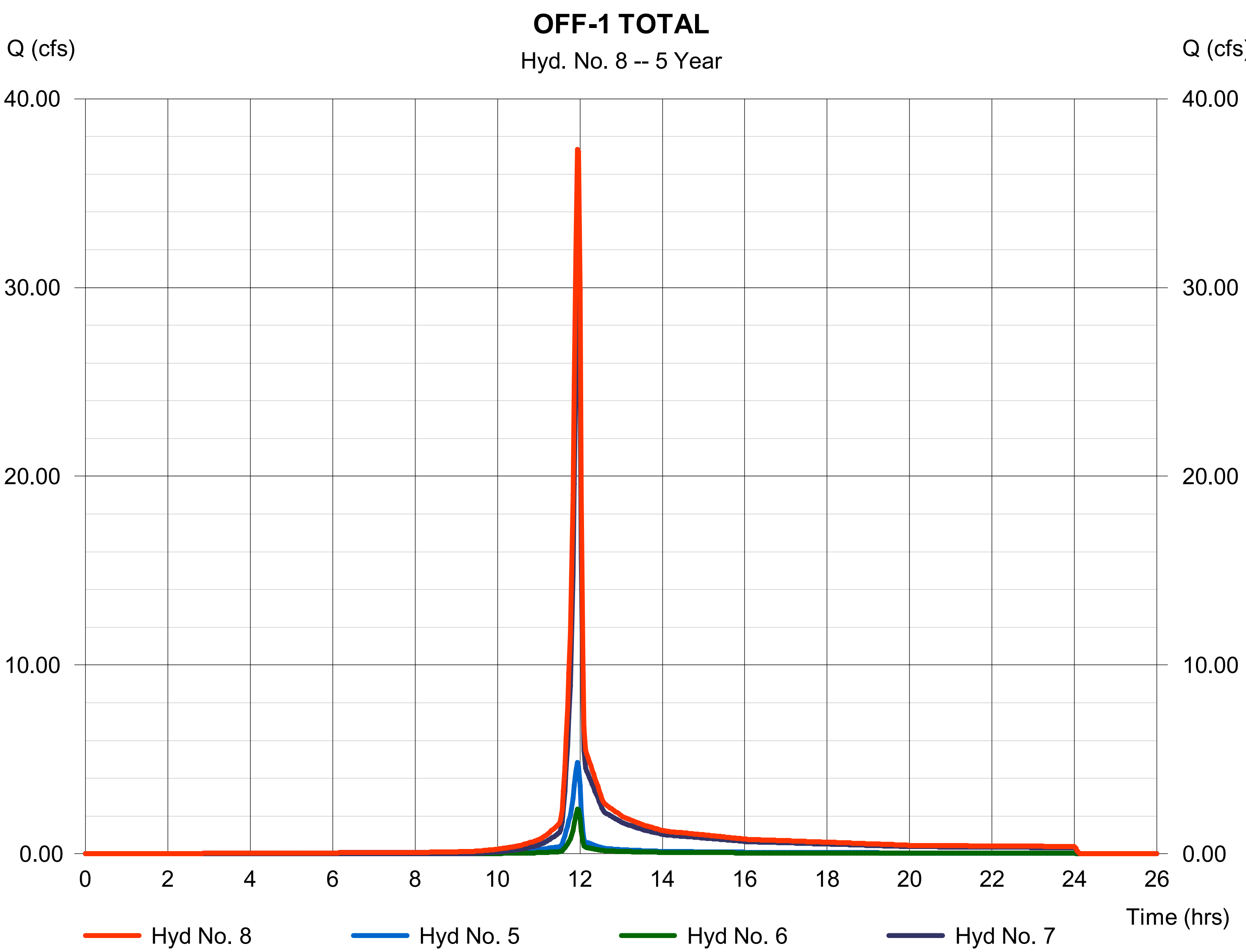
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 8

OFF-1 TOTAL

Hydrograph type	= Combine	Peak discharge	= 37.32 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 77,064 cuft
Inflow hyds.	= 5, 6, 7	Contrib. drain. area	= 11.690 ac



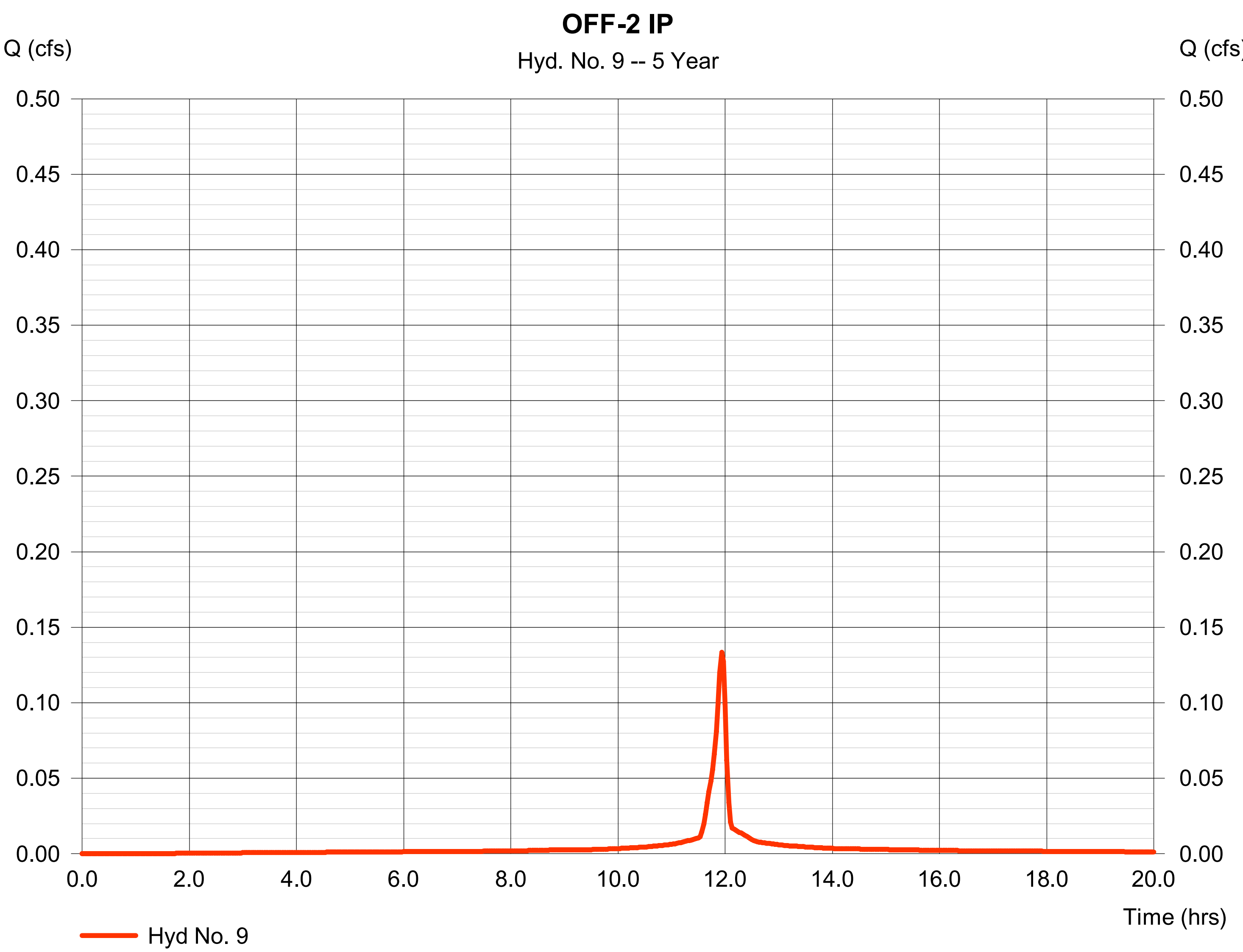
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 9

OFF-2 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.133 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 315 cuft
Drainage area	= 0.025 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



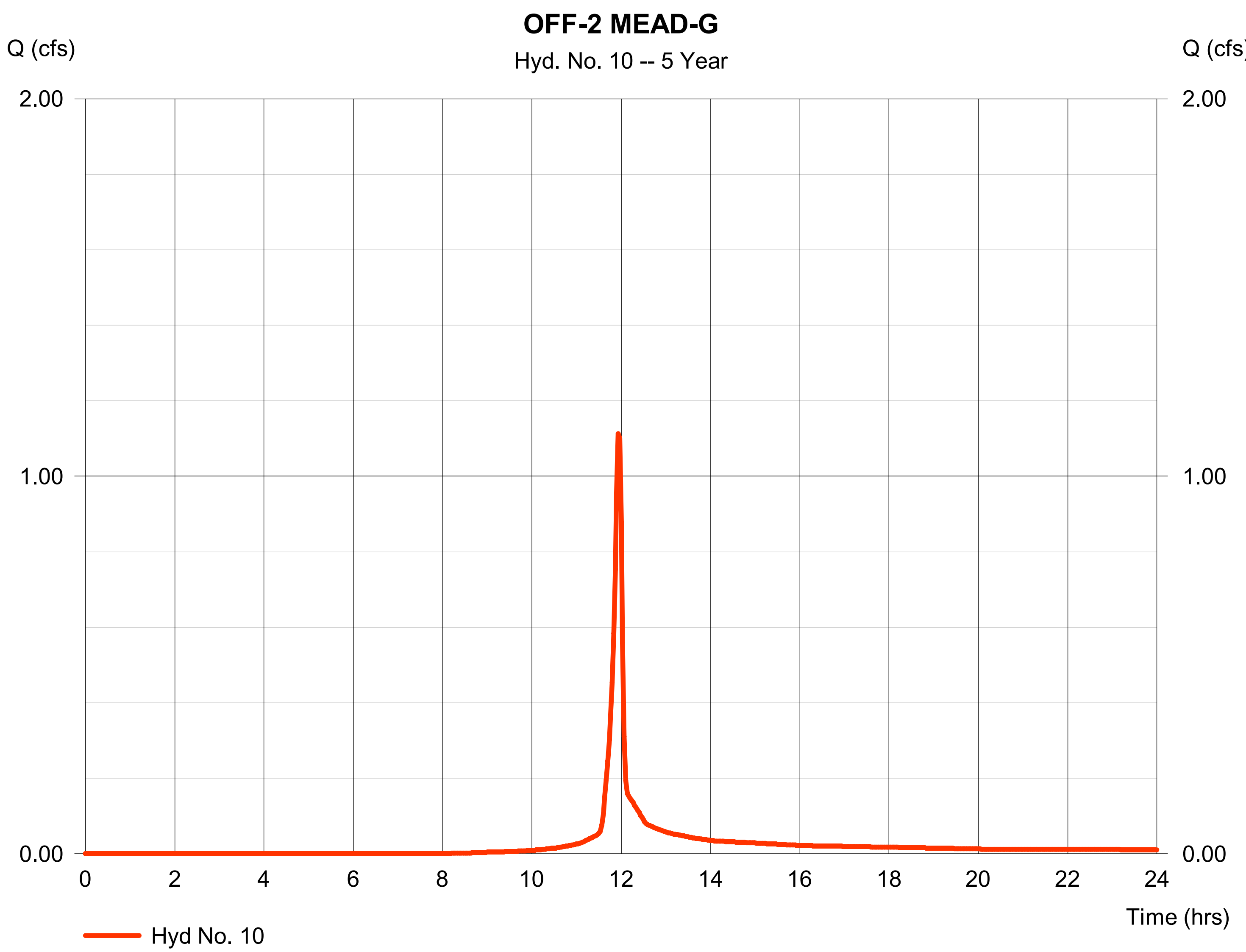
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 10

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 1.113 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,255 cuft
Drainage area	= 0.308 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



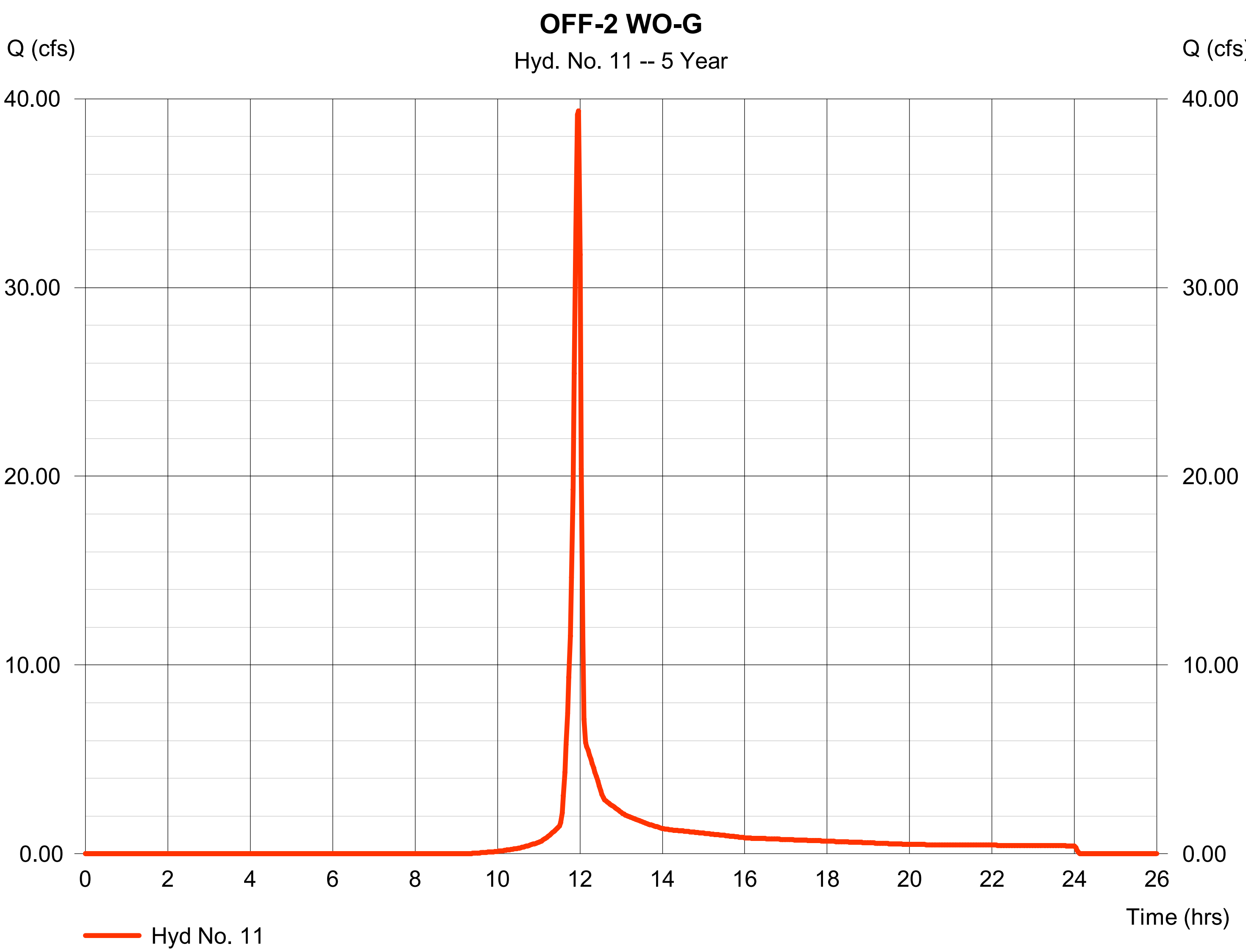
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 11

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 39.35 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 79,132 cuft
Drainage area	= 13.173 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



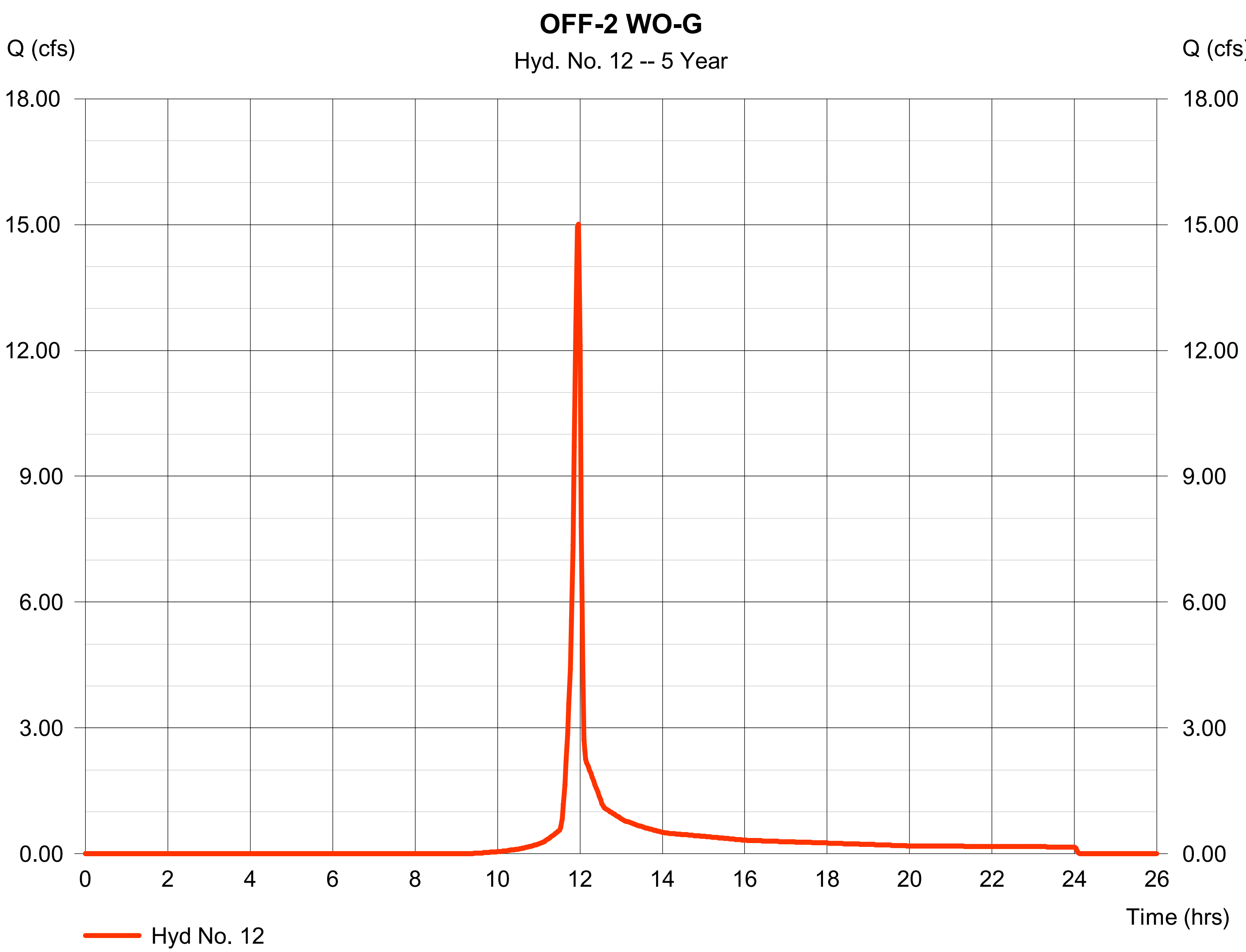
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 12

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 15.01 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 30,186 cuft
Drainage area	= 5.025 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



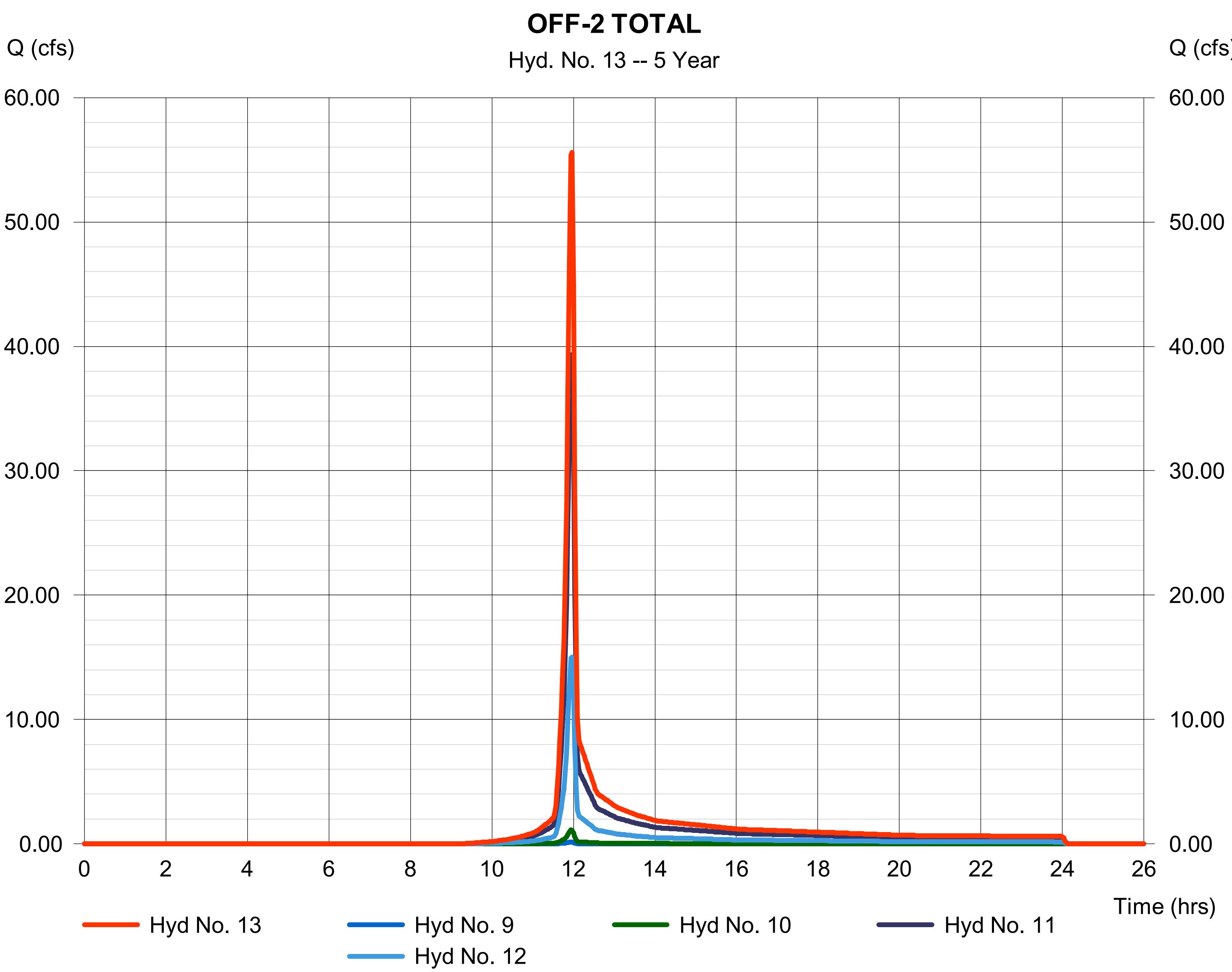
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 13

OFF-2 TOTAL

Hydrograph type	= Combine	Peak discharge	= 55.59 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 111,889 cuft
Inflow hyds.	= 9, 10, 11, 12	Contrib. drain. area	= 18.531 ac



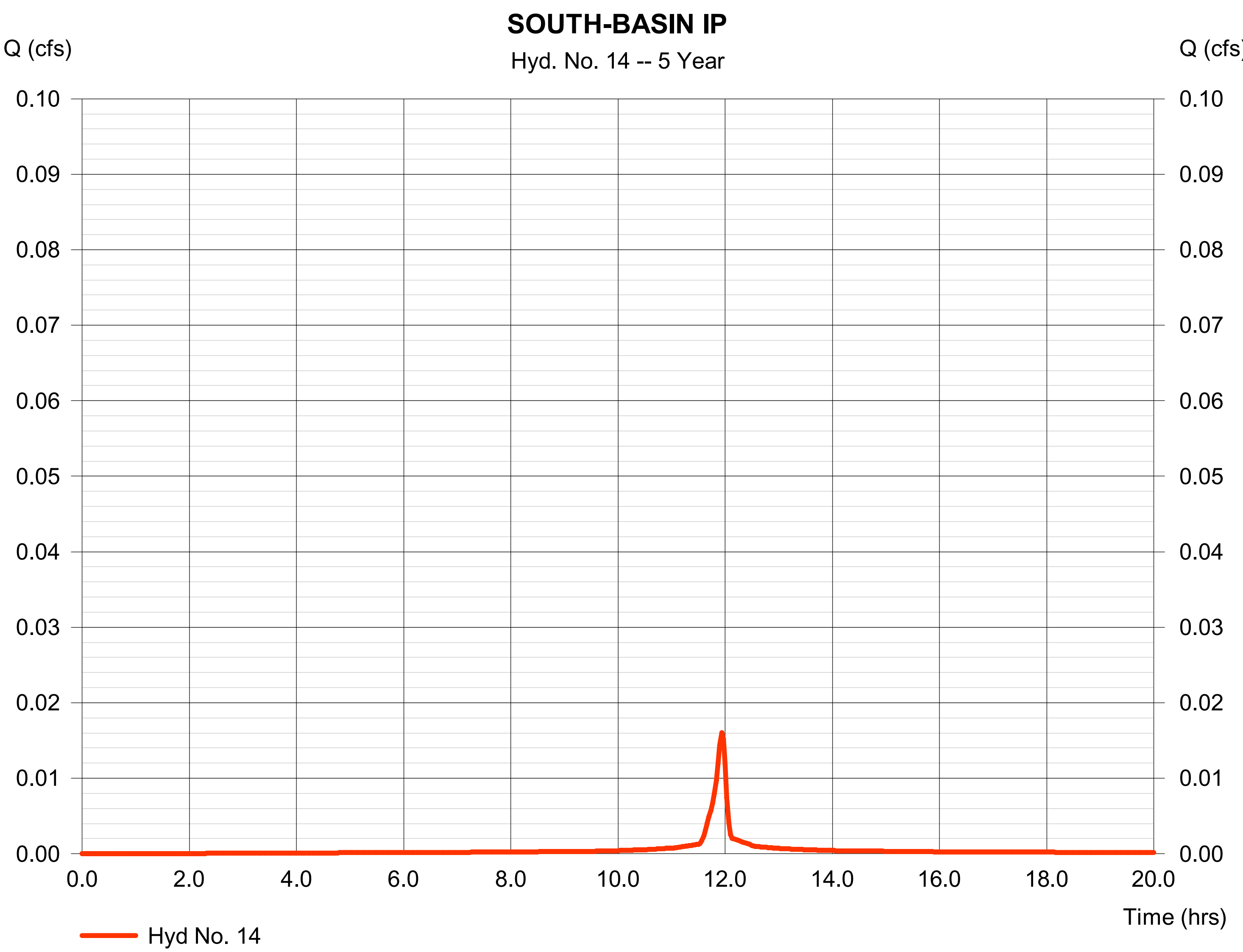
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 14

SOUTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.016 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 38 cuft
Drainage area	= 0.003 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



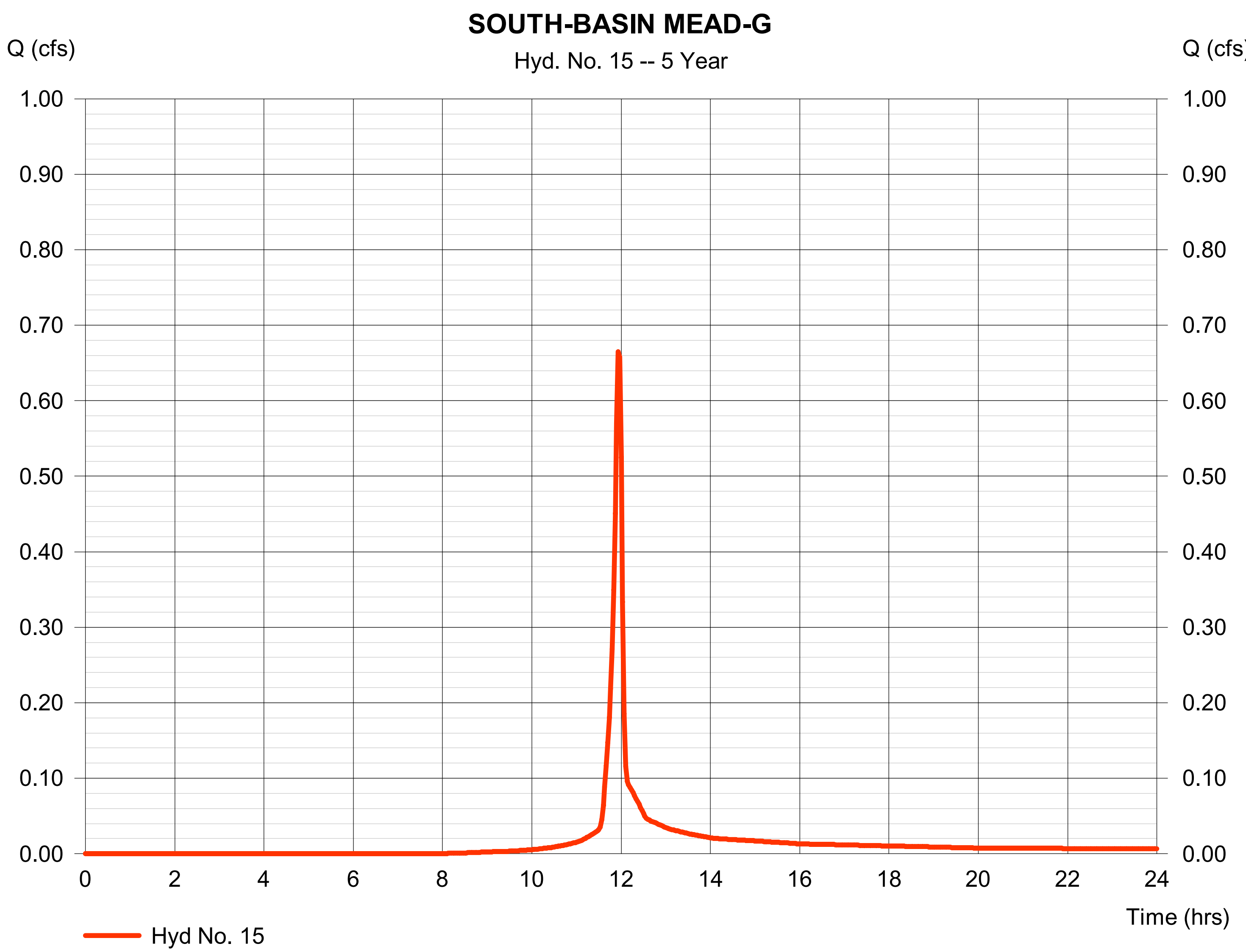
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 15

SOUTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.665 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,347 cuft
Drainage area	= 0.184 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



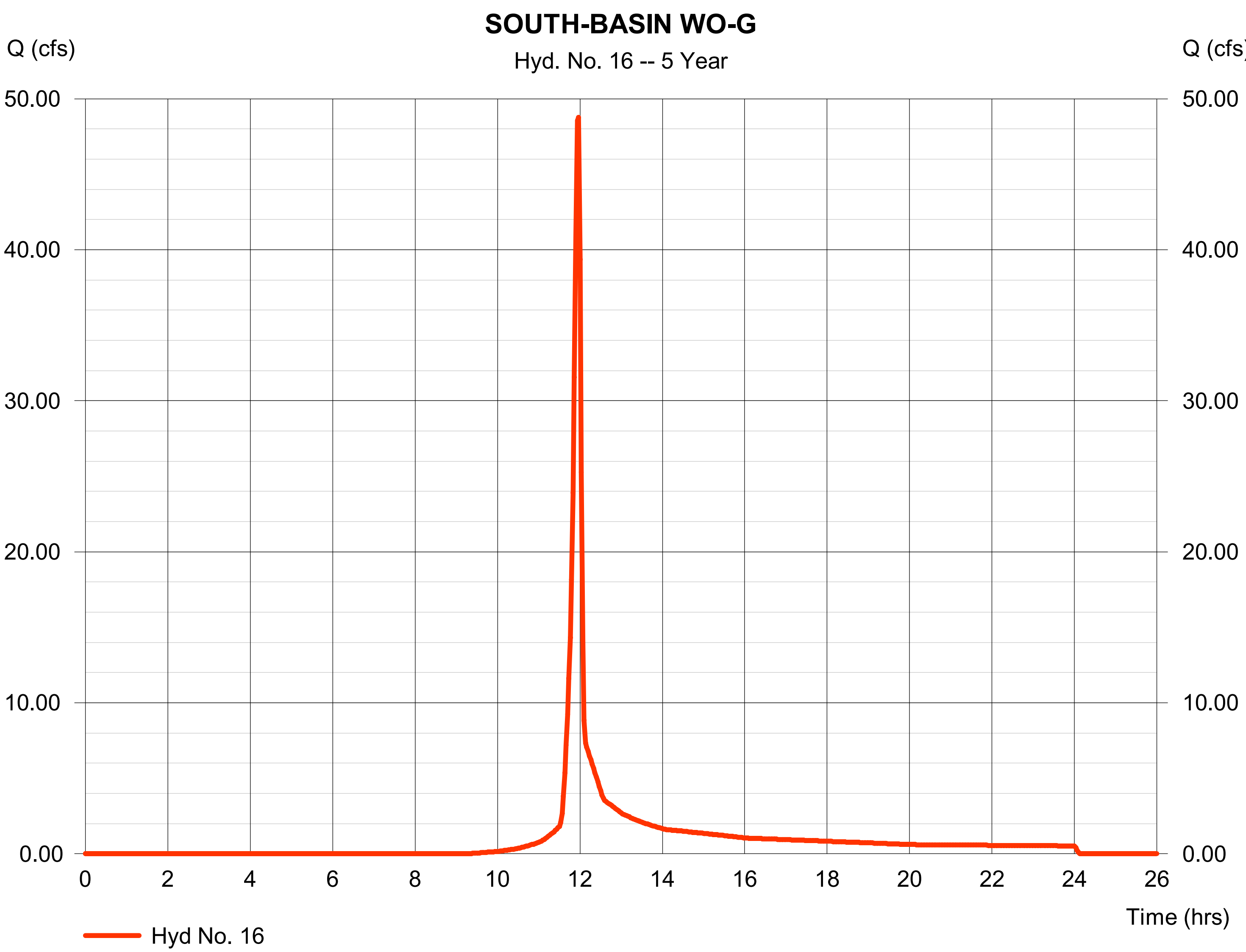
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 16

SOUTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 48.77 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 98,079 cuft
Drainage area	= 16.327 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



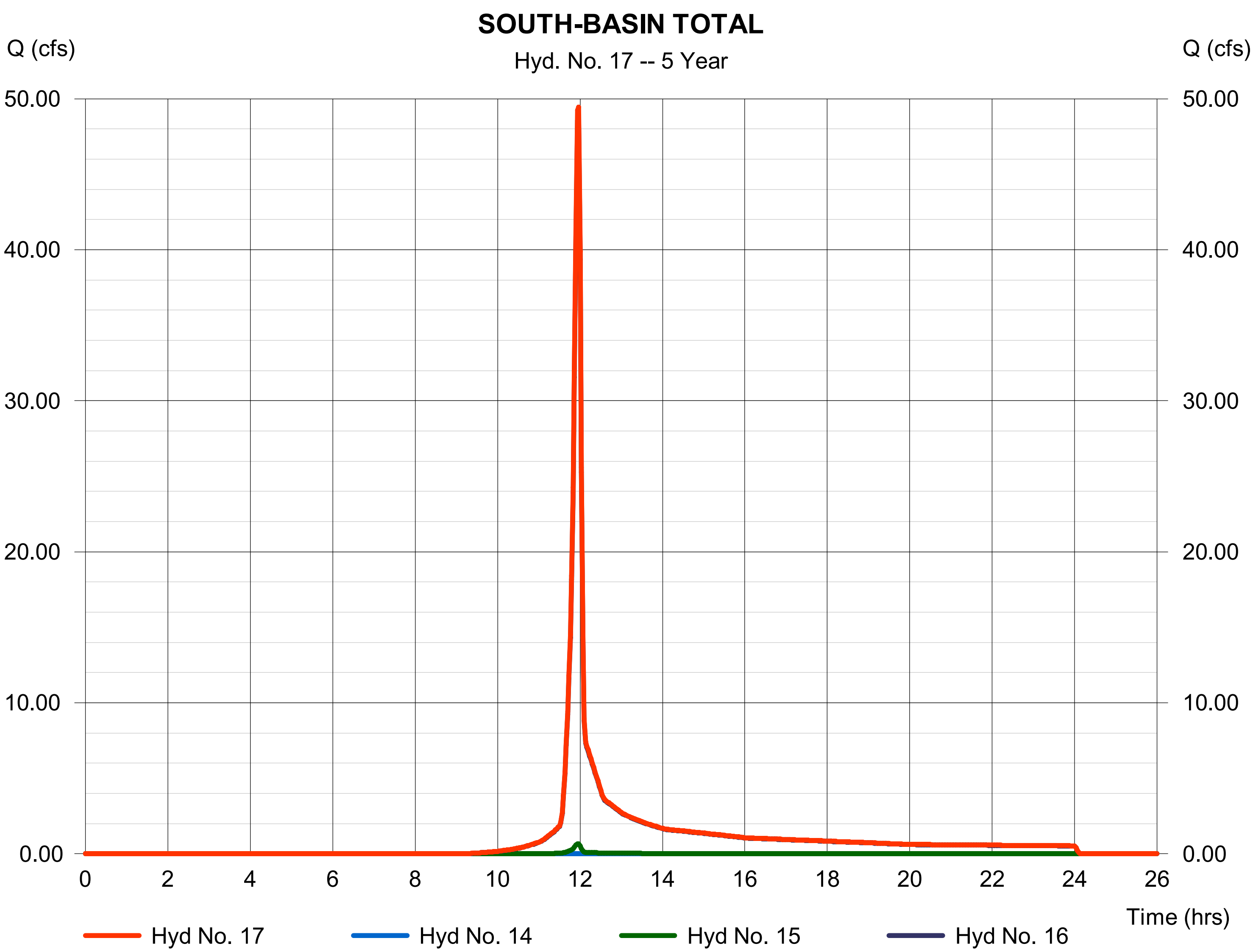
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 17

SOUTH-BASIN TOTAL

Hydrograph type	= Combine	Peak discharge	= 49.44 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 99,464 cuft
Inflow hyds.	= 14, 15, 16	Contrib. drain. area	= 16.514 ac



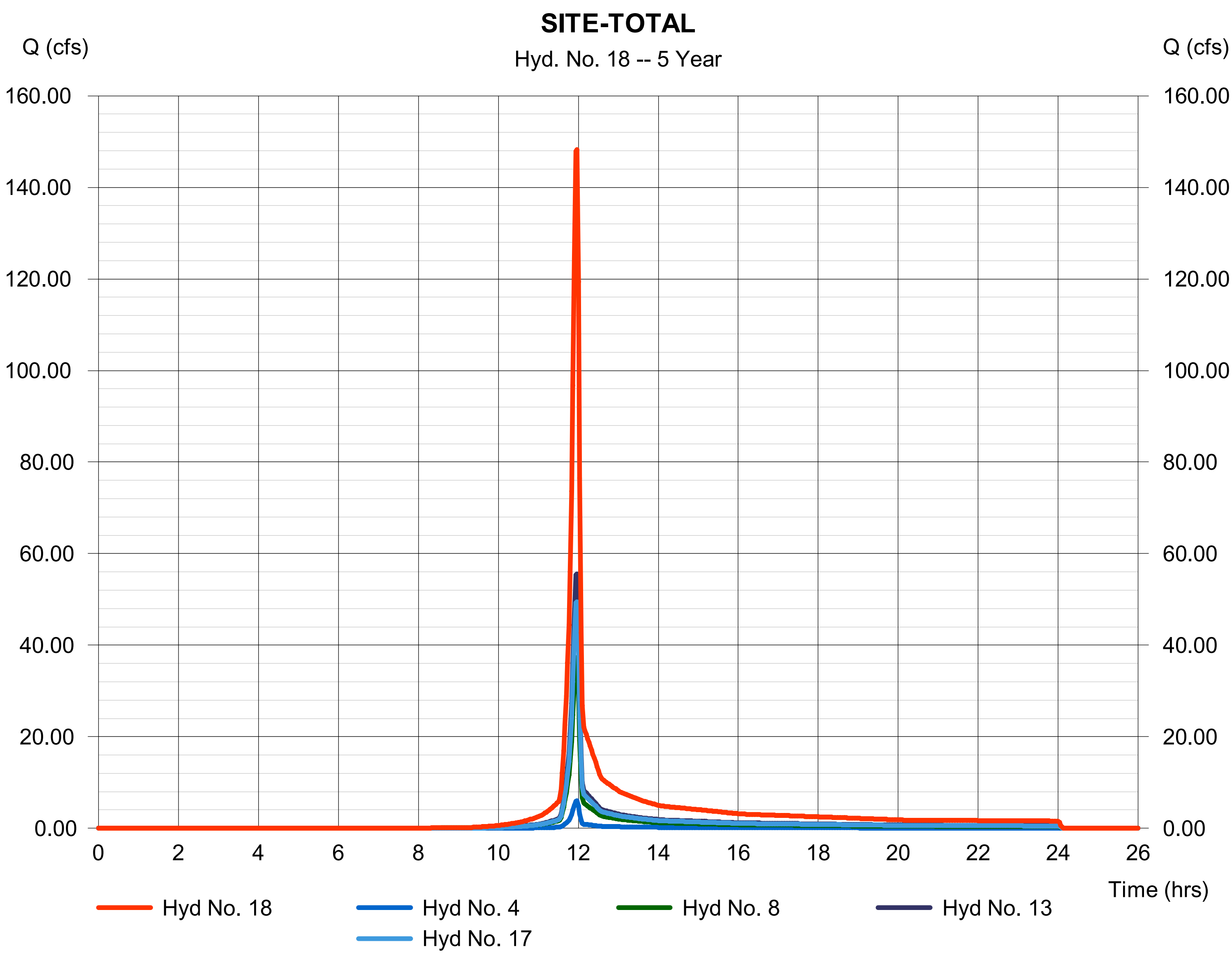
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 18

SITE-TOTAL

Hydrograph type	= Combine	Peak discharge	= 148.20 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 300,510 cuft
Inflow hyds.	= 4, 8, 13, 17	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	0.245	2	716	582	------	------	------	NORTH-BASIN IP
2	SCS Runoff	0.421	2	716	858	------	------	------	NORTH-BASIN MEAD-G
3	SCS Runoff	7.075	2	716	14,290	------	------	------	NORTH-BASIN WO-G
4	Combine	7.741	2	716	15,730	1, 2, 3	------	------	NORTH-TOTAL
5	SCS Runoff	5.684	2	716	13,516	------	------	------	OFF-1 IP
6	SCS Runoff	2.988	2	716	6,092	------	------	------	OFF-1 MEAD-G
7	SCS Runoff	39.41	2	716	79,588	------	------	------	OFF-1 WO-G
8	Combine	48.08	2	716	99,197	5, 6, 7	------	------	OFF-1 TOTAL
9	SCS Runoff	0.157	2	716	373	------	------	------	OFF-2 IP
10	SCS Runoff	1.410	2	716	2,874	------	------	------	OFF-2 MEAD-G
11	SCS Runoff	51.24	2	716	103,486	------	------	------	OFF-2 WO-G
12	SCS Runoff	19.55	2	716	39,476	------	------	------	OFF-2 WO-G
13	Combine	72.35	2	716	146,209	9, 10, 11, 12	------	------	OFF-2 TOTAL
14	SCS Runoff	0.019	2	716	45	------	------	------	SOUTH-BASIN IP
15	SCS Runoff	0.842	2	716	1,717	------	------	------	SOUTH-BASIN MEAD-G
16	SCS Runoff	63.50	2	716	128,264	------	------	------	SOUTH-BASIN WO-G
17	Combine	64.37	2	716	130,025	14, 15, 16	------	------	SOUTH-BASIN TOTAL
18	Combine	192.53	2	716	391,161	4, 8, 13, 17	------	------	SITE-TOTAL

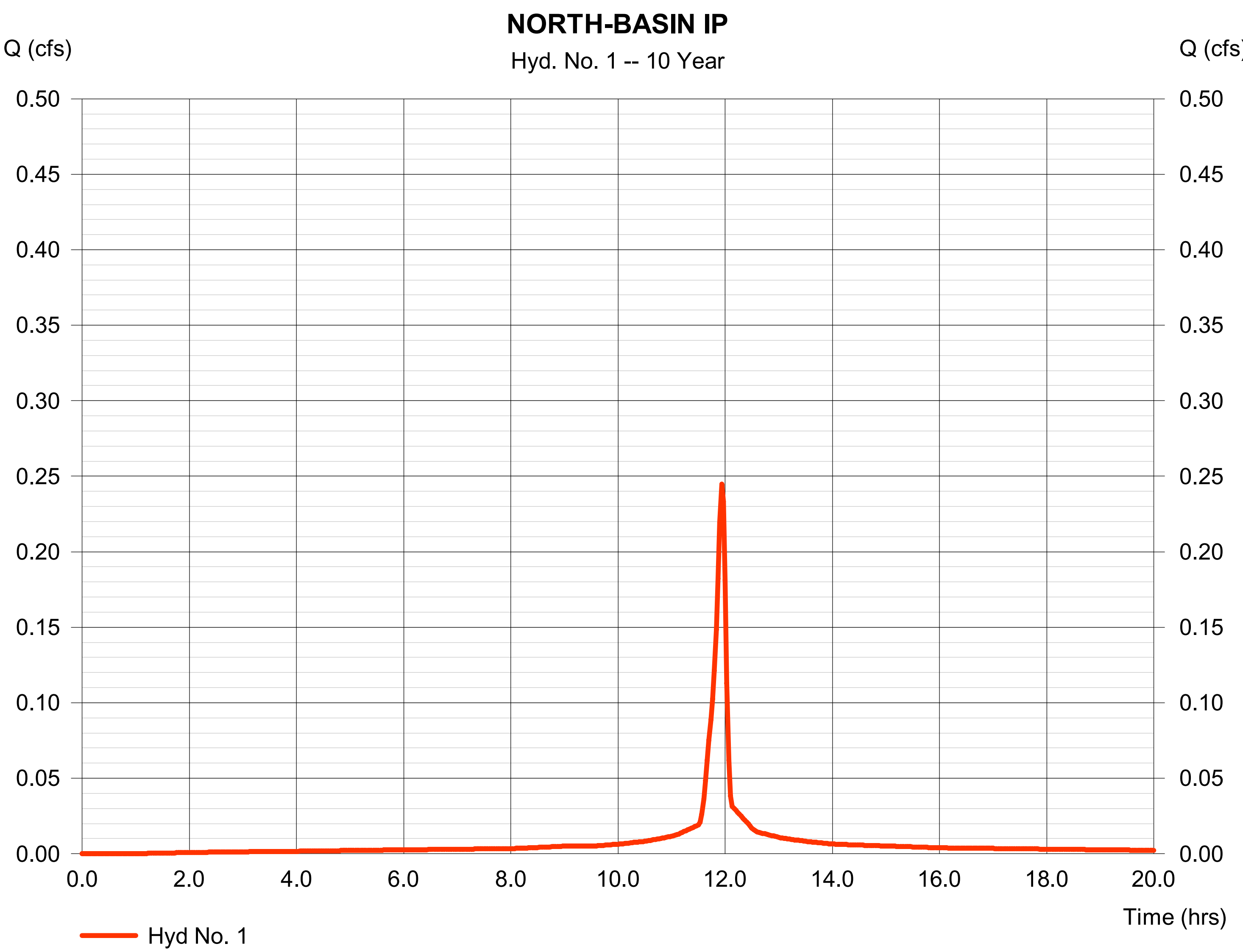
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 1

NORTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.245 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 582 cuft
Drainage area	= 0.039 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



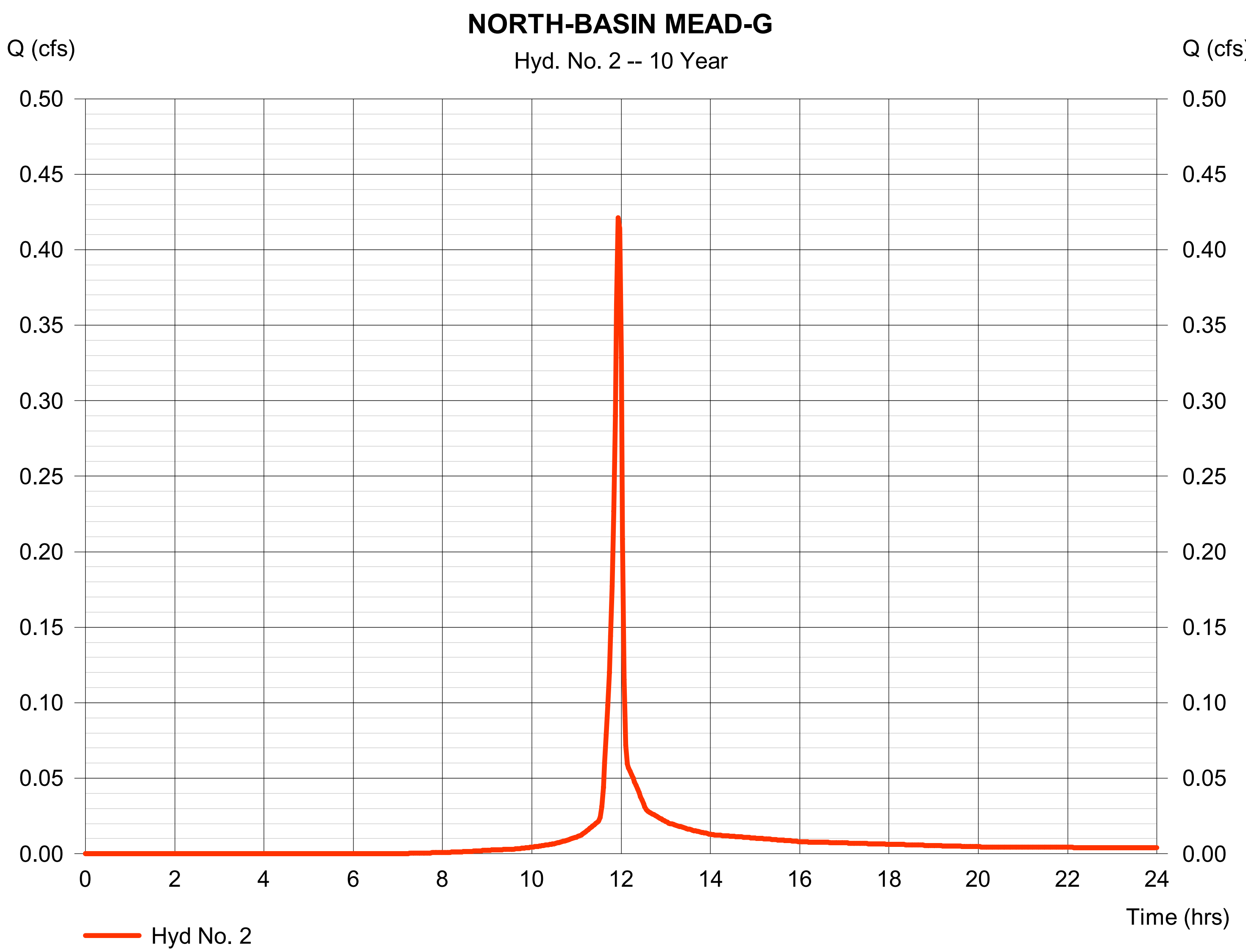
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 2

NORTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.421 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 858 cuft
Drainage area	= 0.092 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



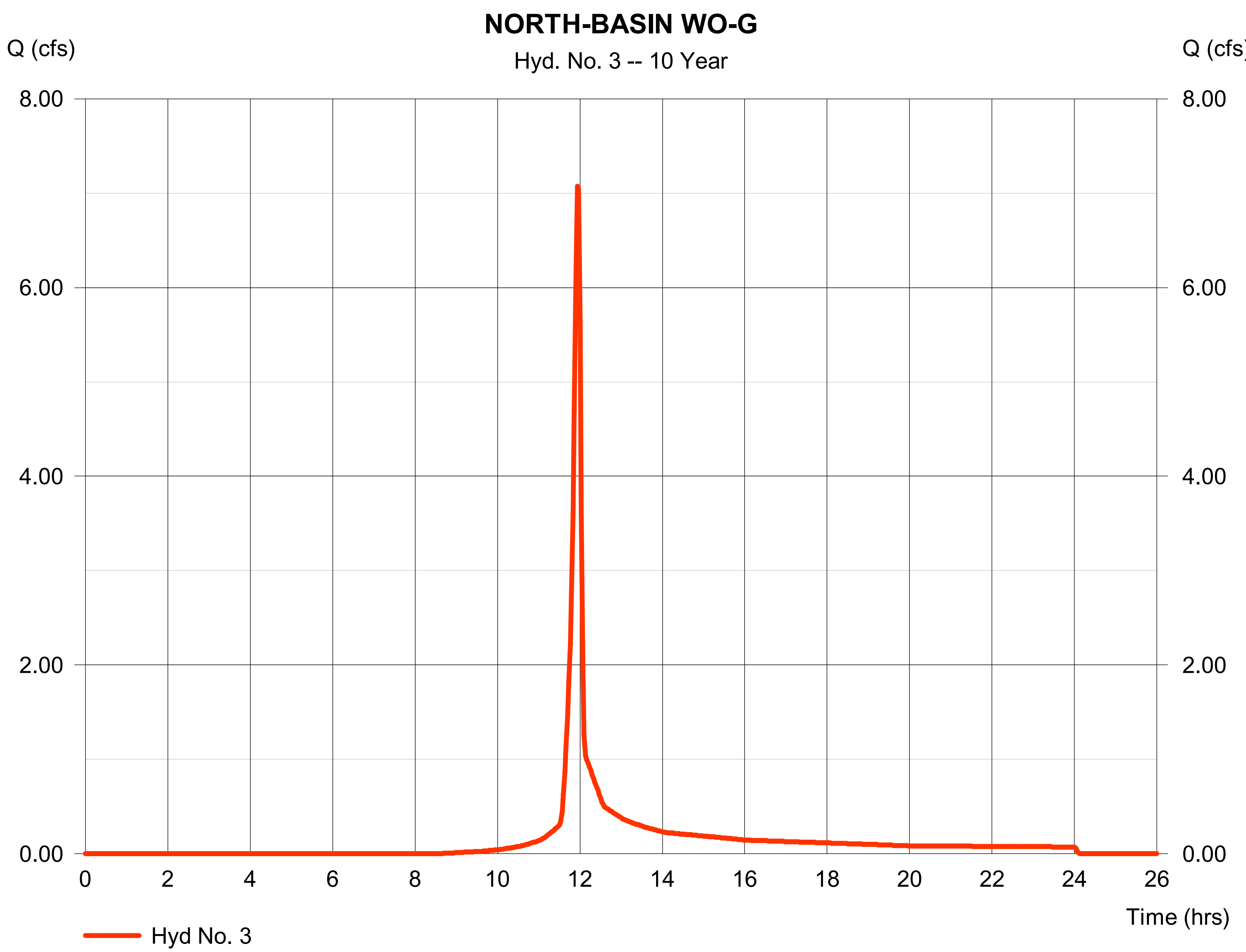
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 3

NORTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 7.075 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 14,290 cuft
Drainage area	= 1.819 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



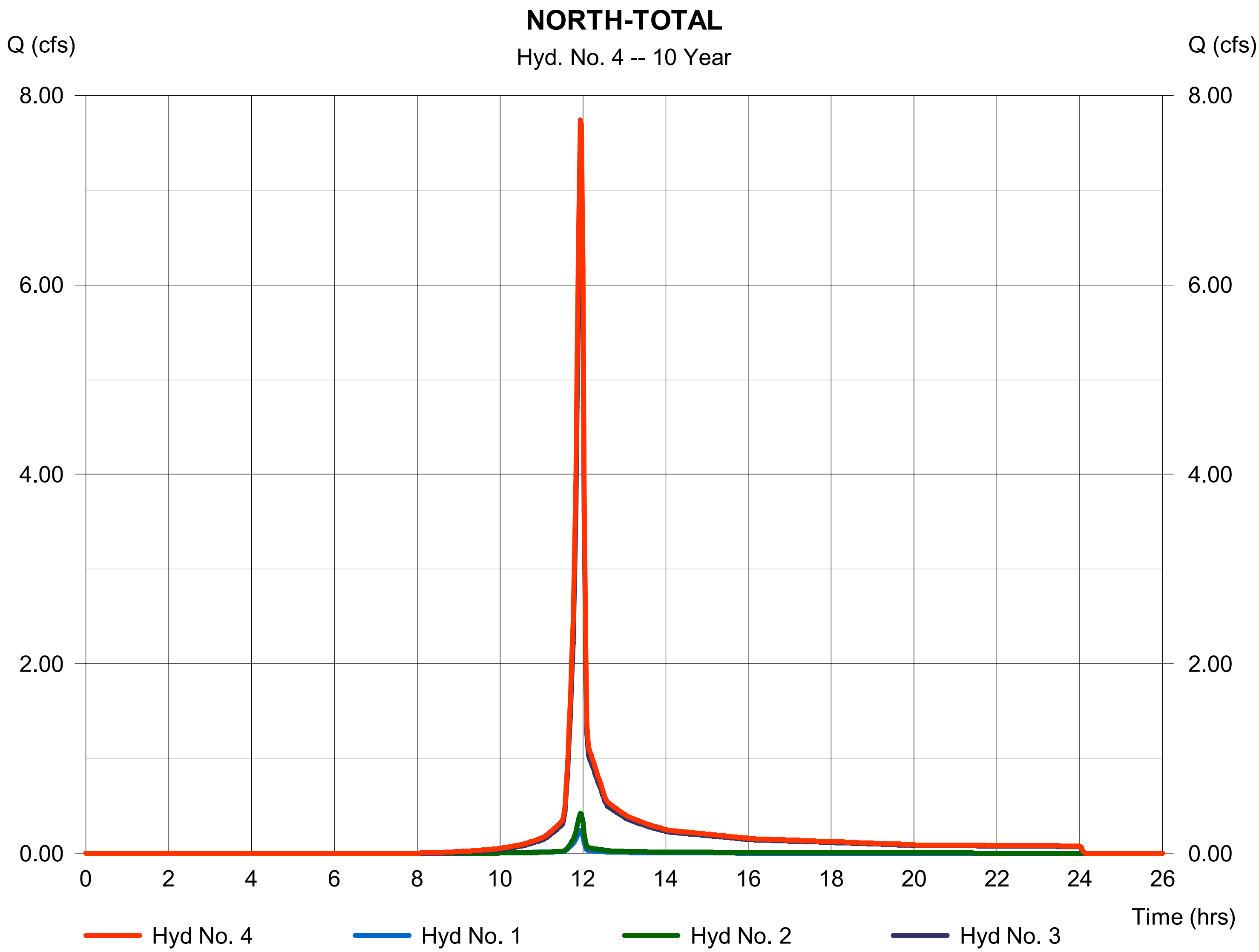
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 4

NORTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 7.741 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 15,730 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 1.950 ac



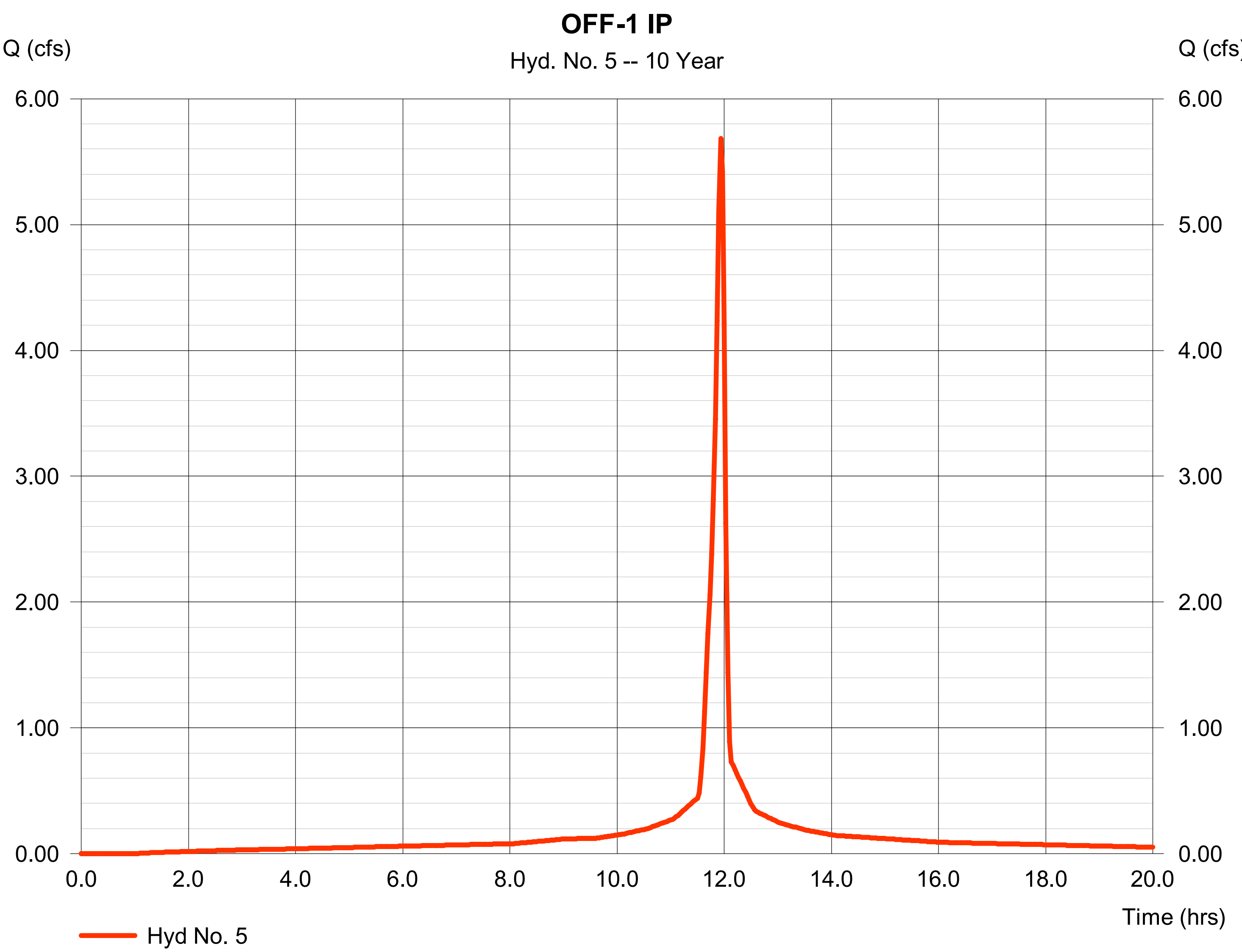
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 5

OFF-1 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 5.684 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 13,516 cuft
Drainage area	= 0.906 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



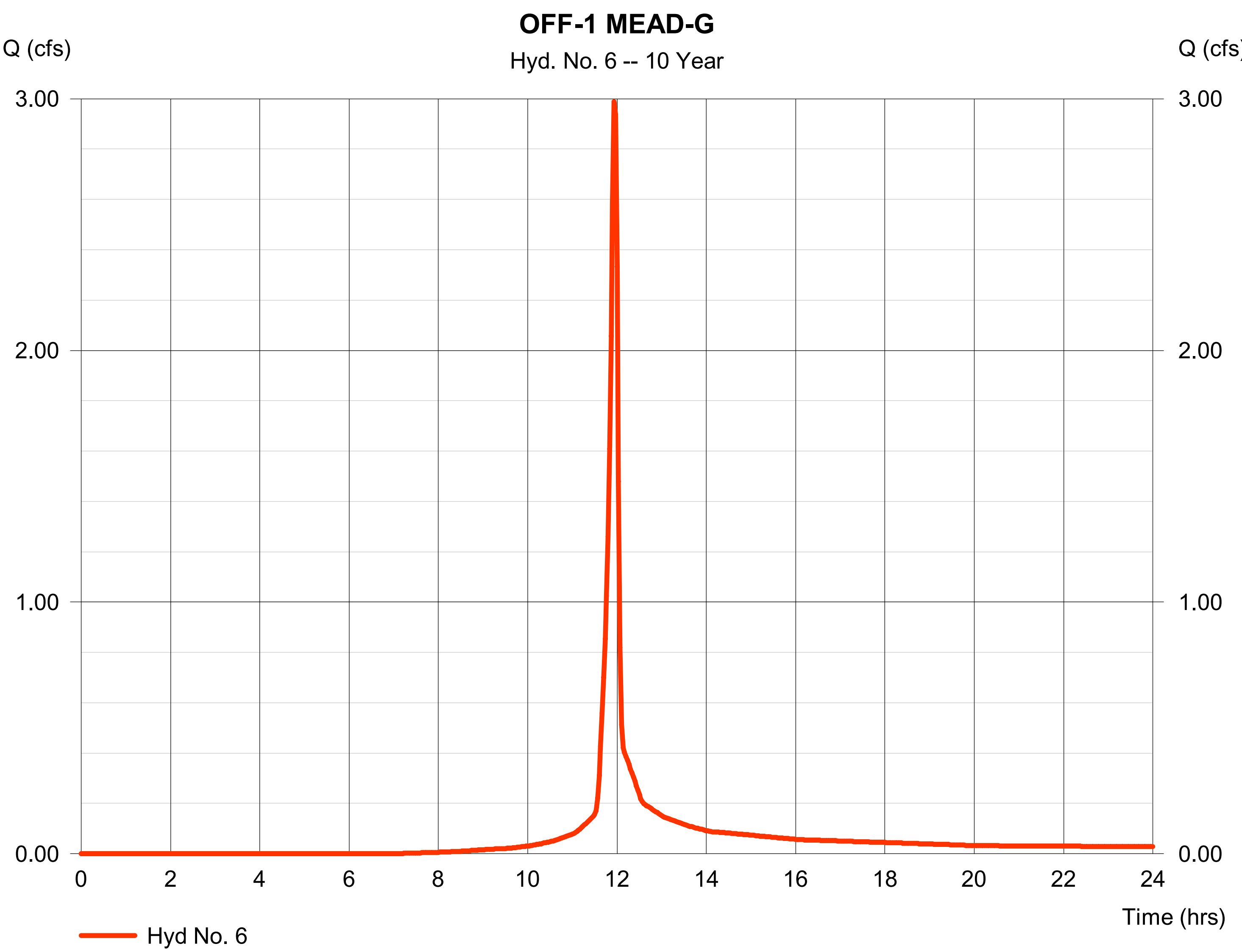
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 6

OFF-1 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 2.988 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 6,092 cuft
Drainage area	= 0.653 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



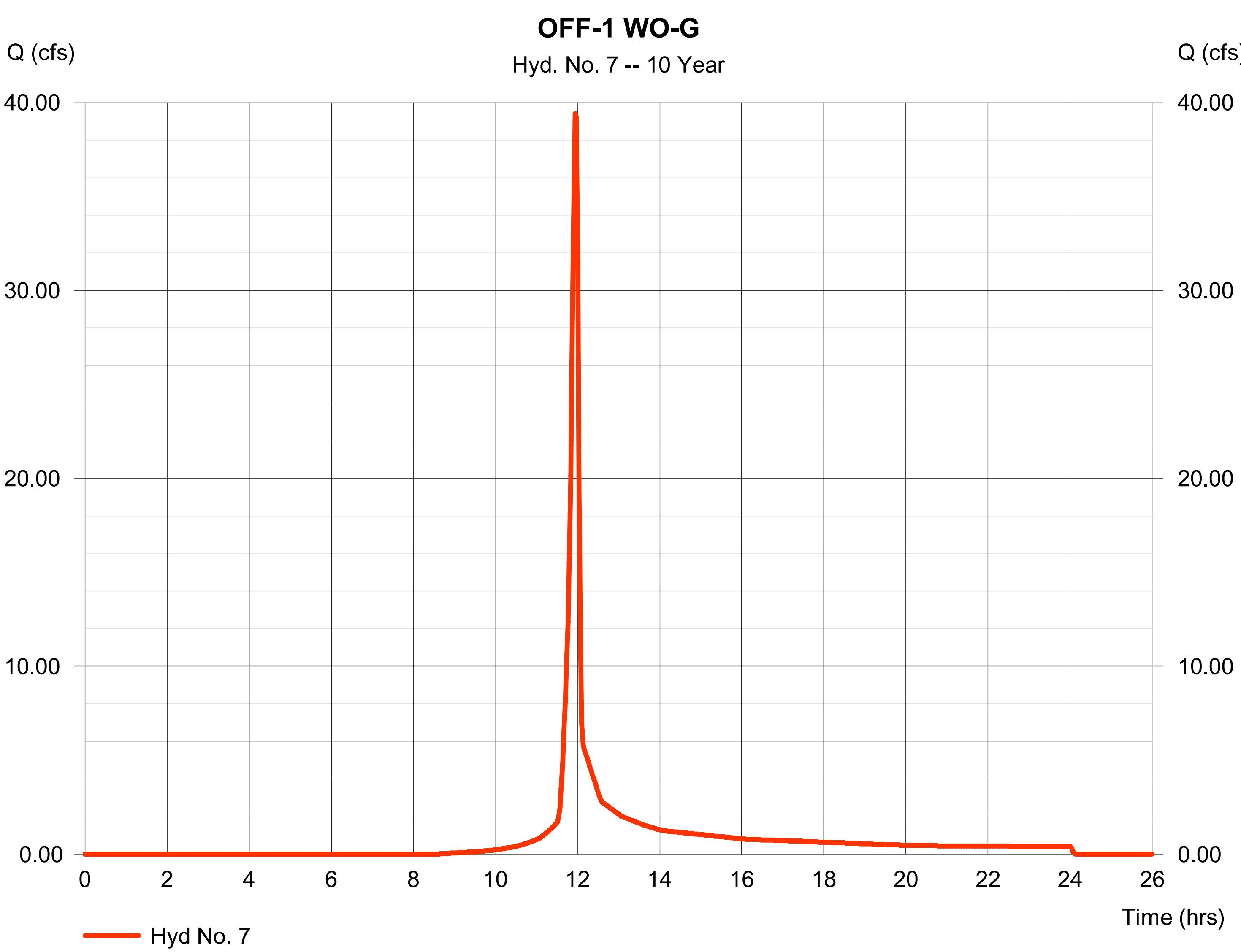
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 7

OFF-1 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 39.41 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 79,588 cuft
Drainage area	= 10.131 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



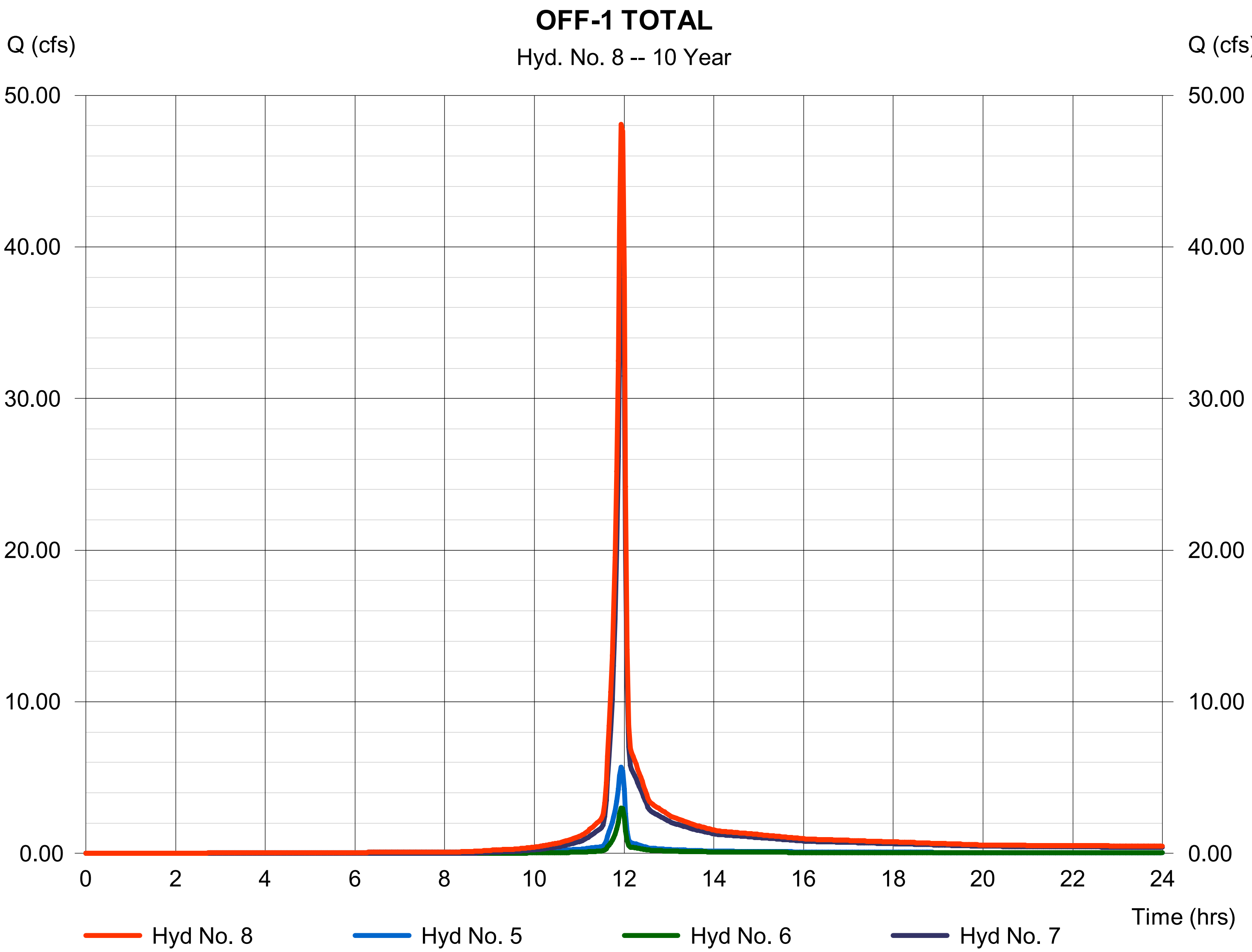
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 8

OFF-1 TOTAL

Hydrograph type	= Combine	Peak discharge	= 48.08 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 99,197 cuft
Inflow hyds.	= 5, 6, 7	Contrib. drain. area	= 11.690 ac



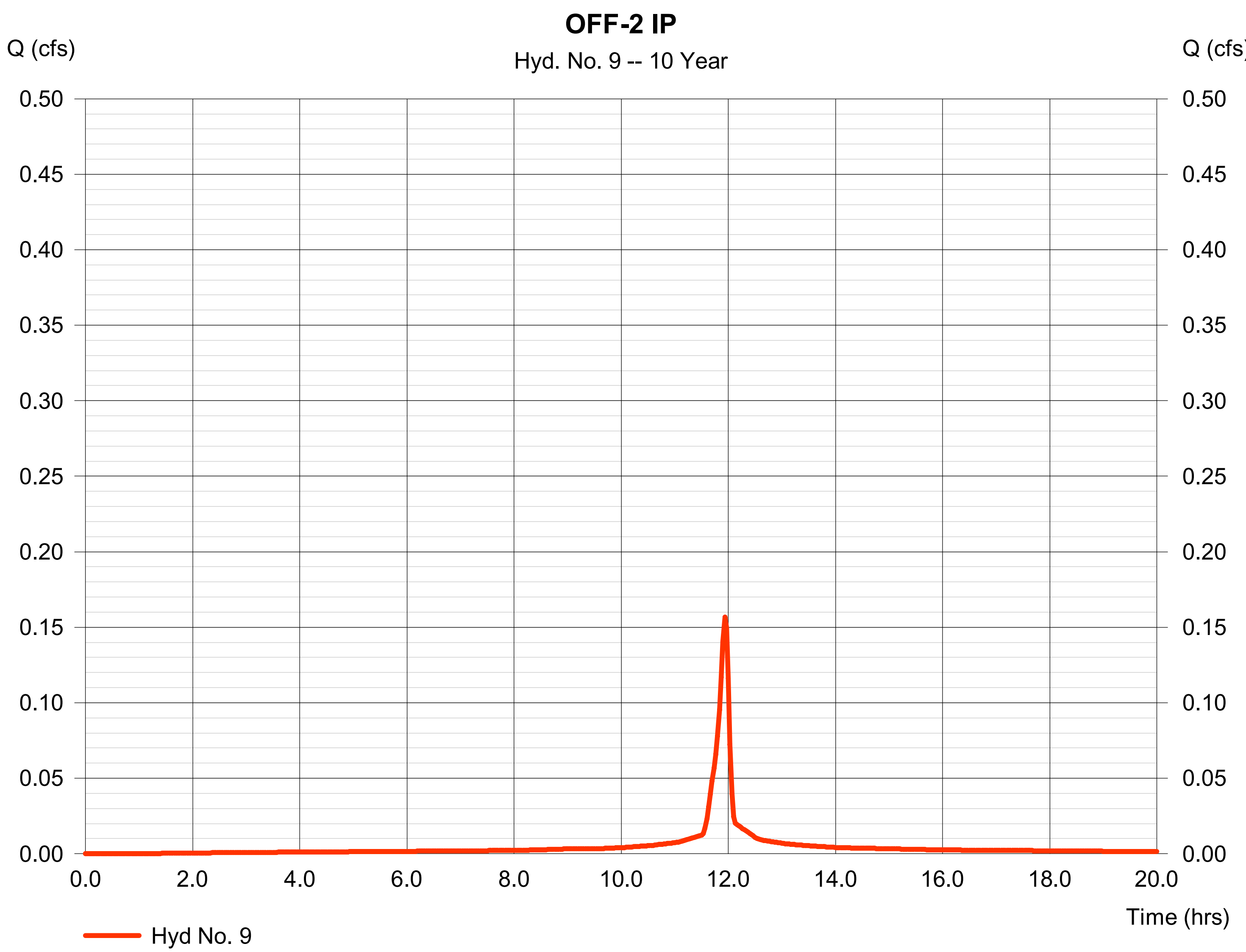
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 9

OFF-2 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.157 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 373 cuft
Drainage area	= 0.025 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



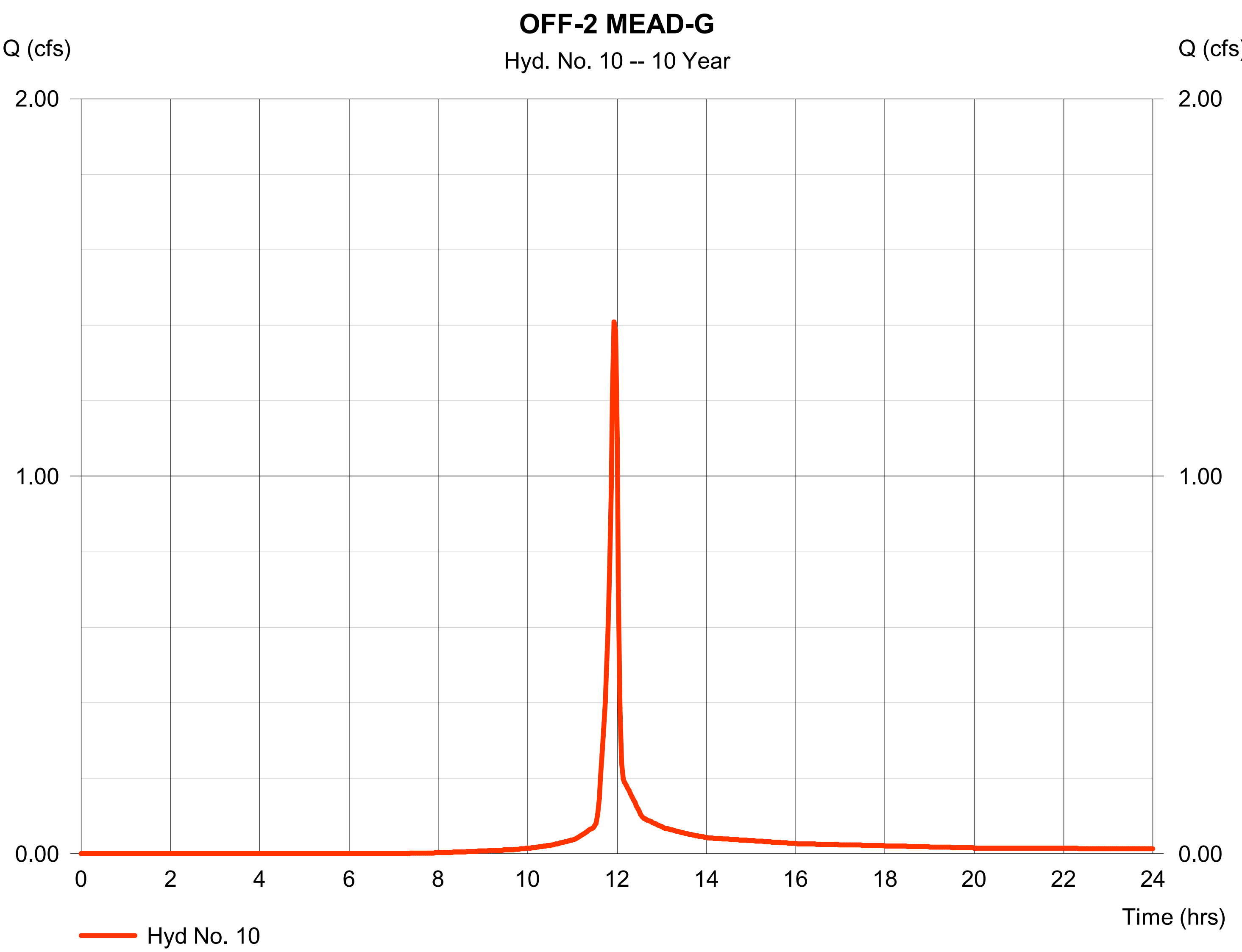
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Tuesday, 10 / 15 / 2019

Hyd. No. 10

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 1.410 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,874 cuft
Drainage area	= 0.308 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



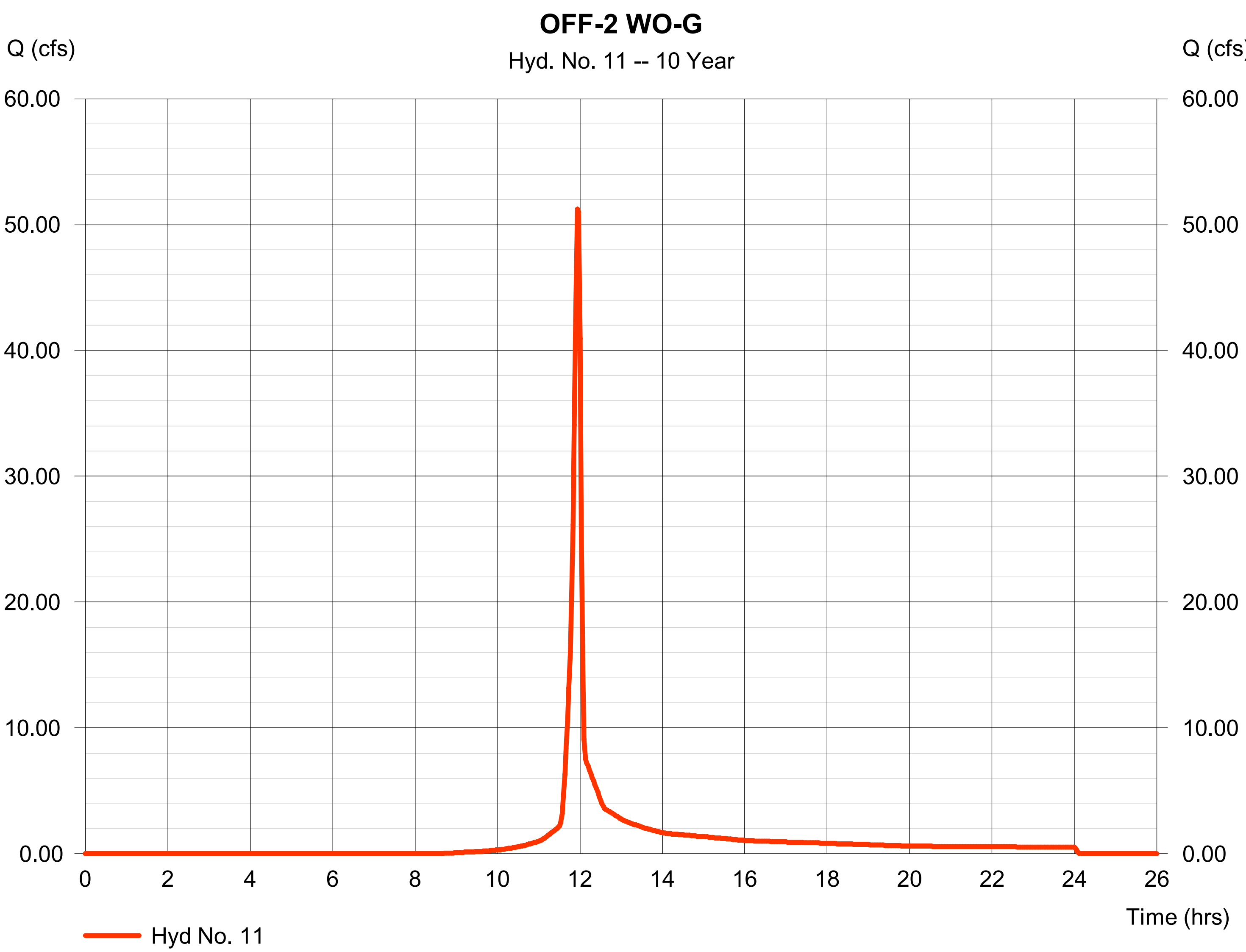
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 11

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 51.24 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 103,486 cuft
Drainage area	= 13.173 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



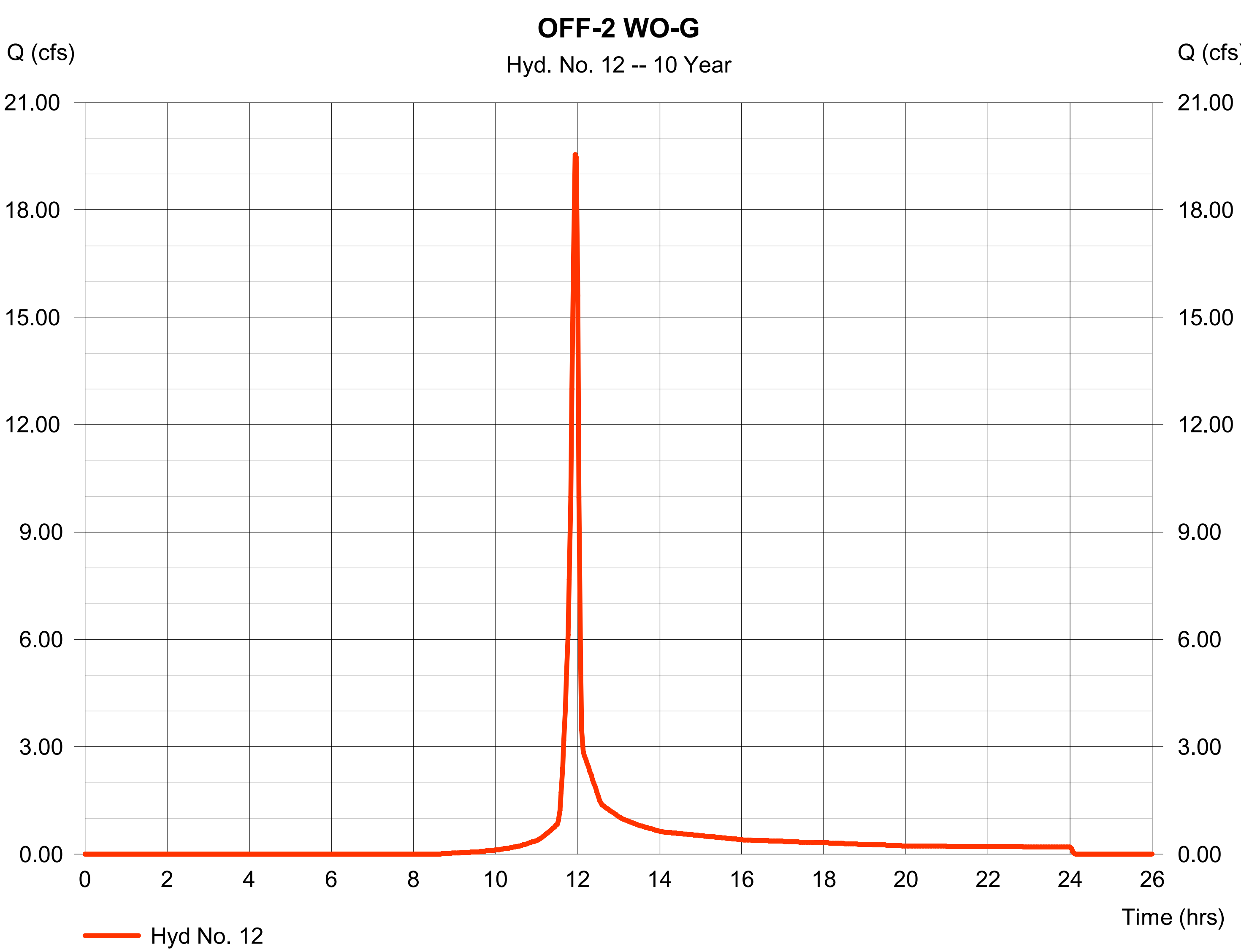
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 12

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 19.55 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 39,476 cuft
Drainage area	= 5.025 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



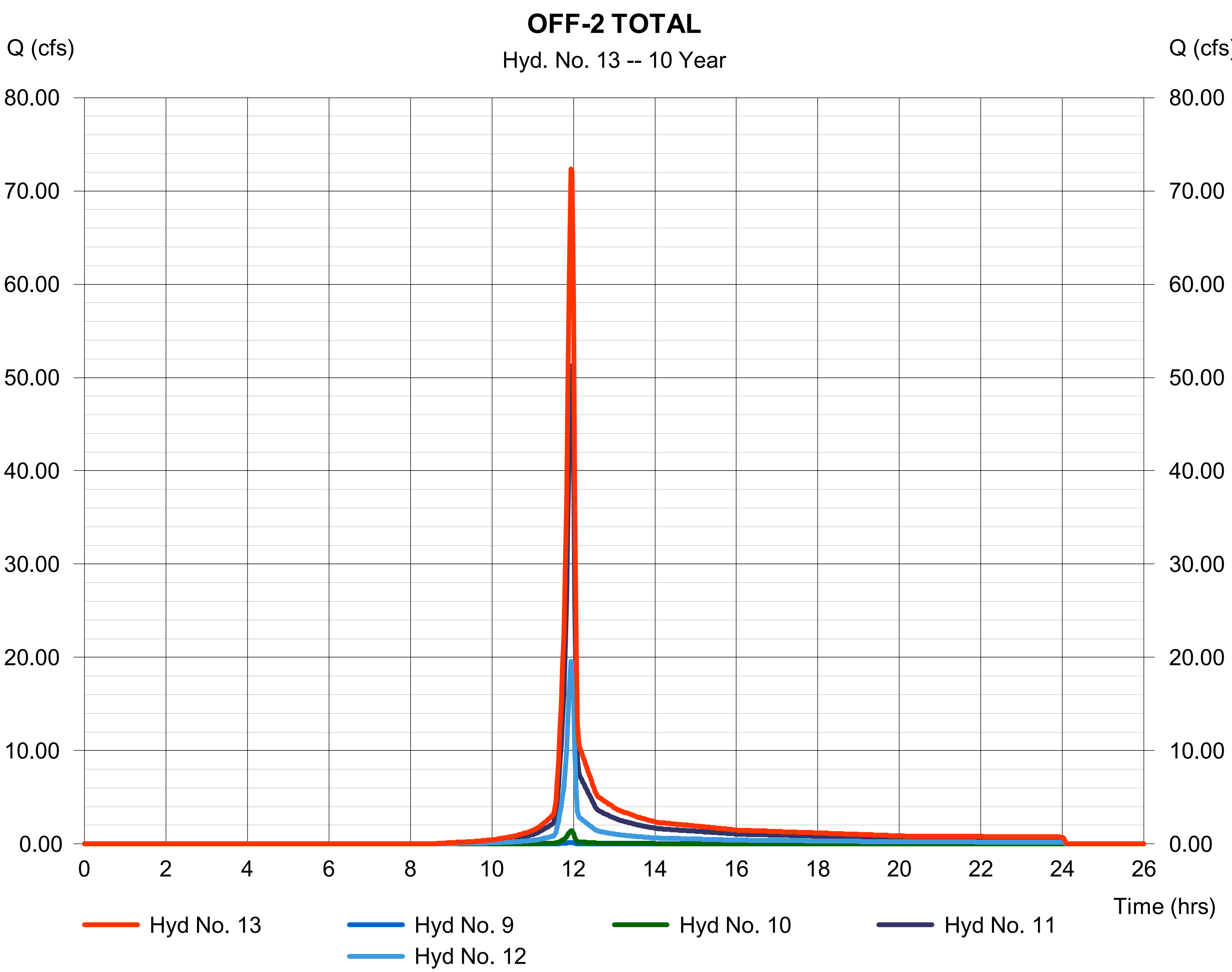
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Tuesday, 10 / 15 / 2019

Hyd. No. 13

OFF-2 TOTAL

Hydrograph type	= Combine	Peak discharge	= 72.35 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 146,209 cuft
Inflow hyds.	= 9, 10, 11, 12	Contrib. drain. area	= 18.531 ac



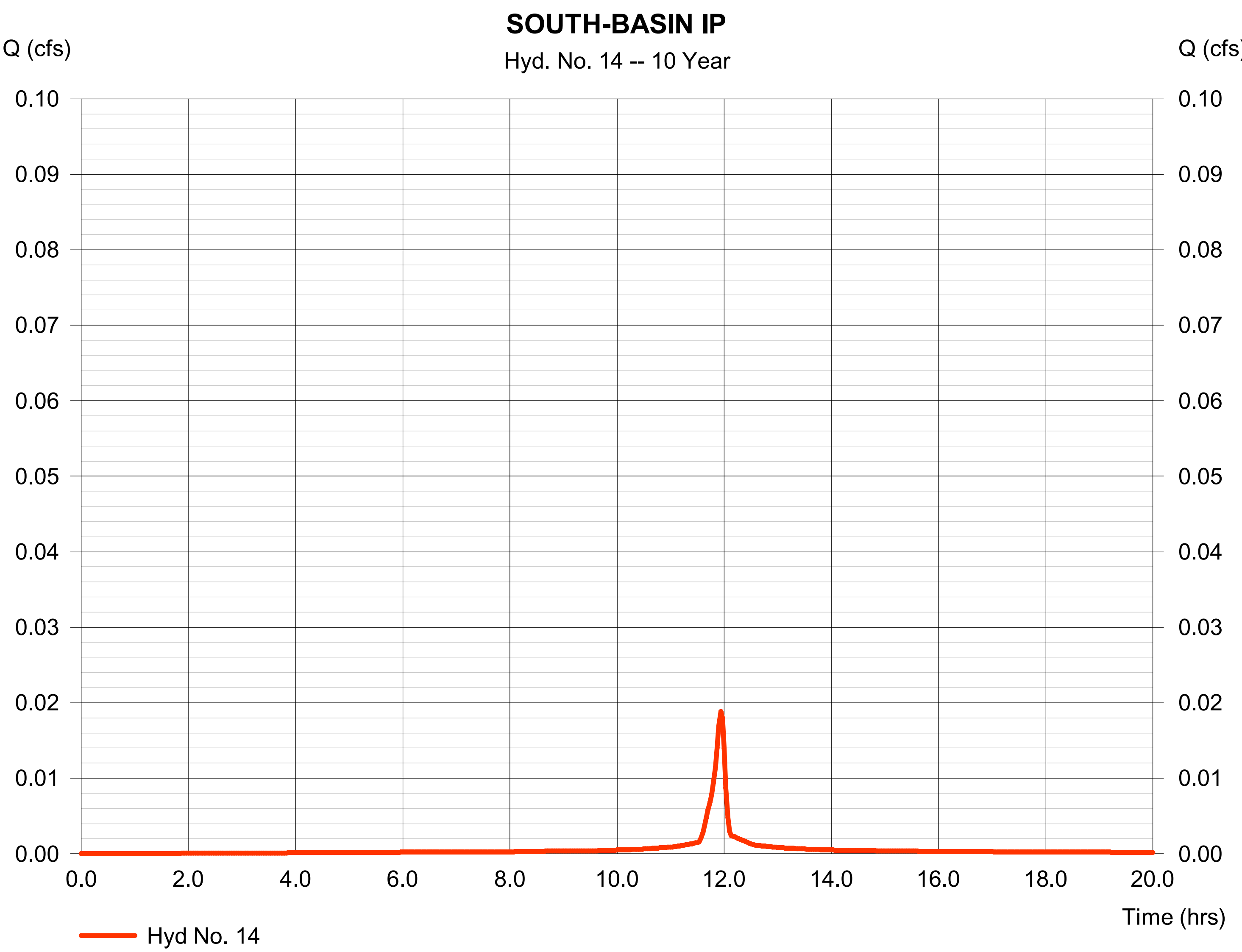
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 14

SOUTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.019 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 45 cuft
Drainage area	= 0.003 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



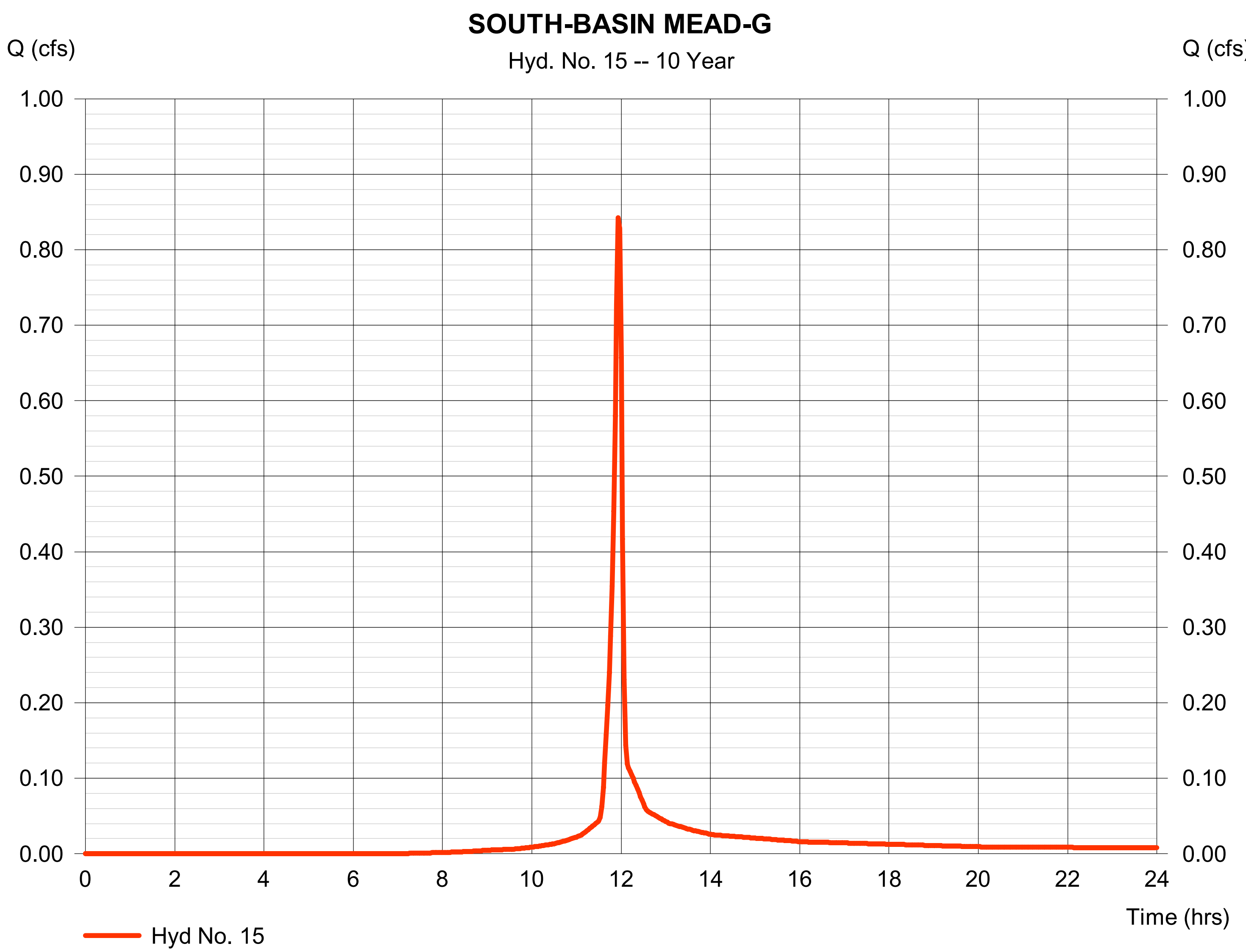
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 15

SOUTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.842 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,717 cuft
Drainage area	= 0.184 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



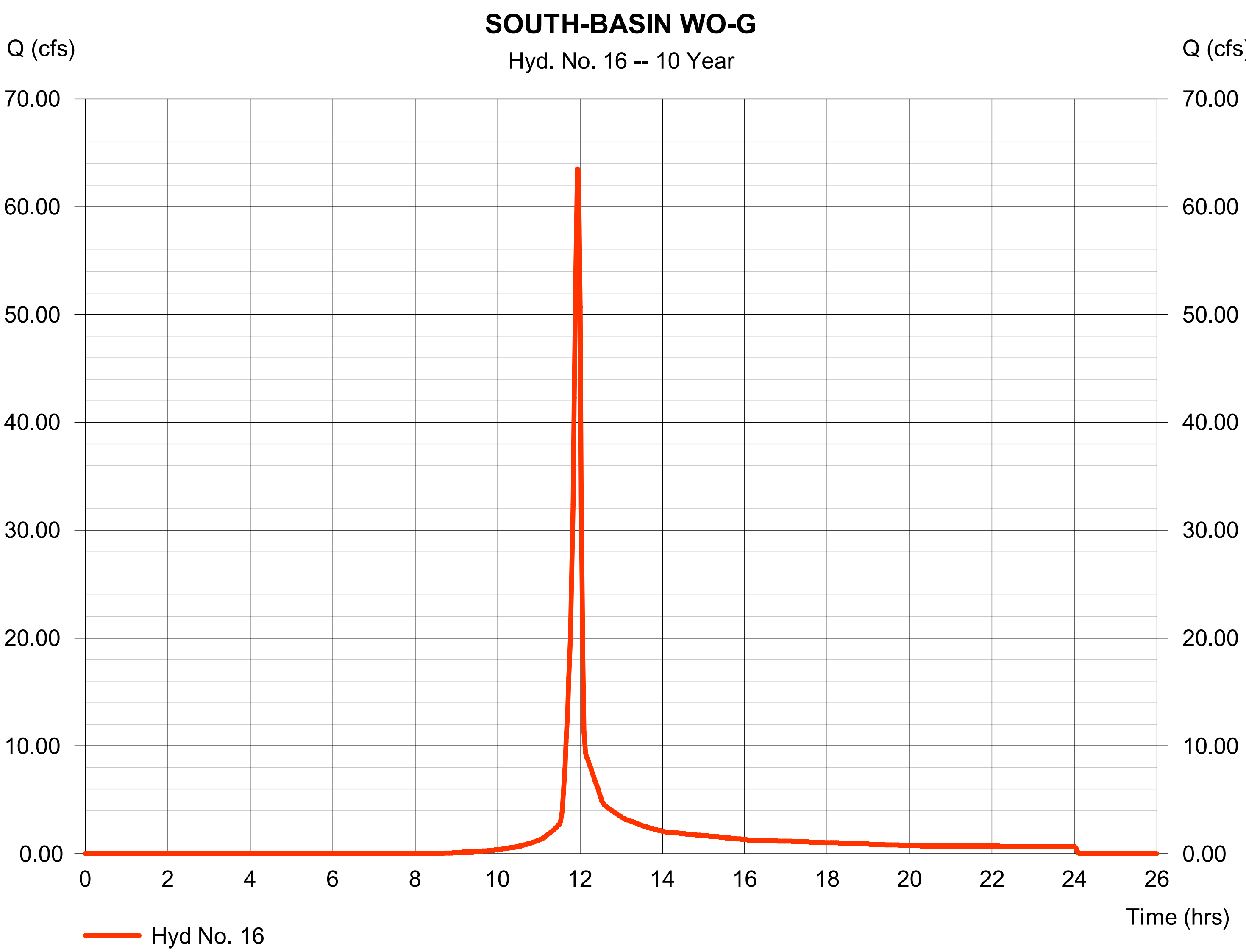
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 16

SOUTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 63.50 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 128,264 cuft
Drainage area	= 16.327 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



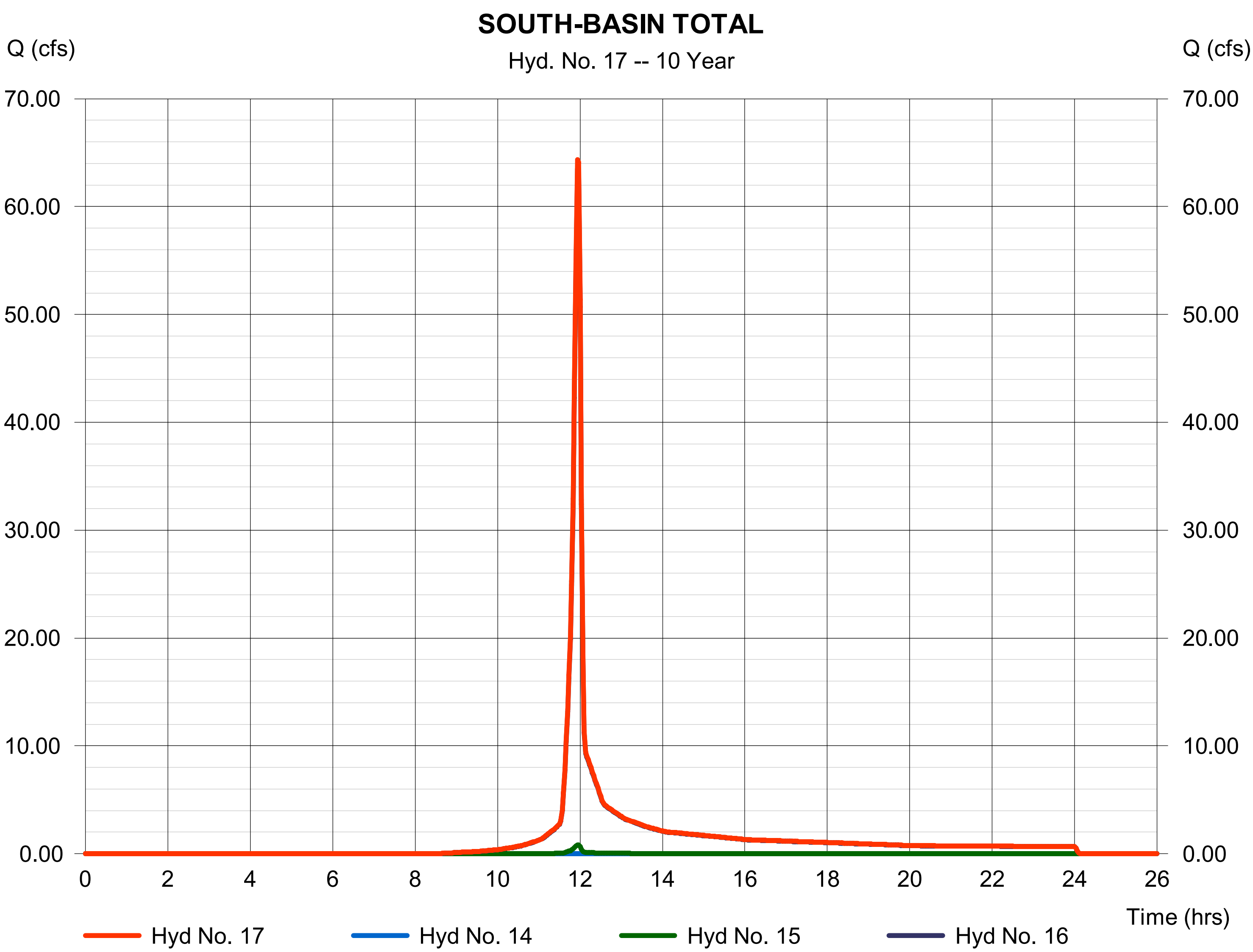
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 17

SOUTH-BASIN TOTAL

Hydrograph type	= Combine	Peak discharge	= 64.37 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 130,025 cuft
Inflow hyds.	= 14, 15, 16	Contrib. drain. area	= 16.514 ac



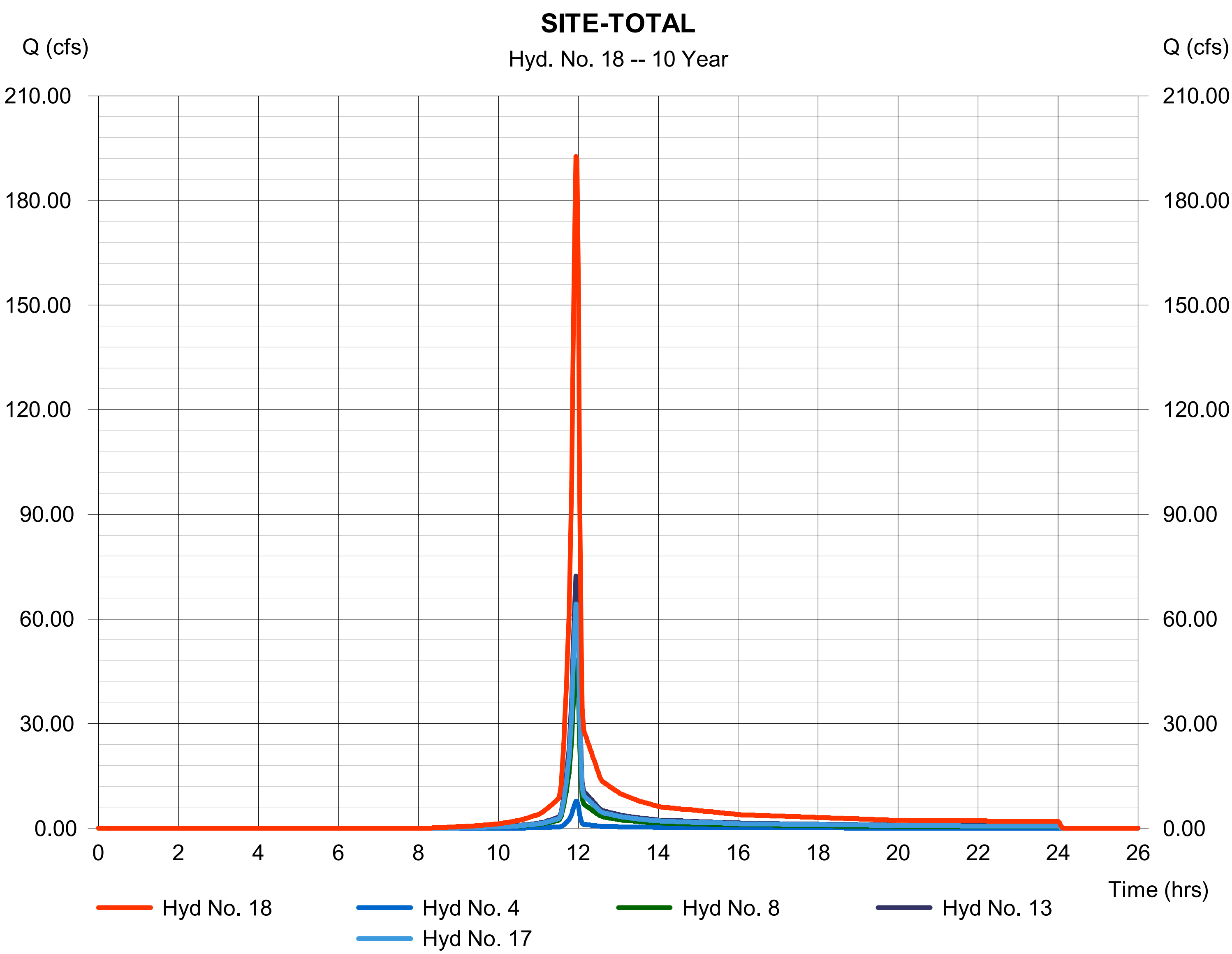
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 18

SITE-TOTAL

Hydrograph type	= Combine	Peak discharge	= 192.53 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 391,161 cuft
Inflow hyds.	= 4, 8, 13, 17	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	0.303	2	716	726	------	------	------	NORTH-BASIN IP
2	SCS Runoff	0.565	2	716	1,165	------	------	------	NORTH-BASIN MEAD-G
3	SCS Runoff	9.838	2	716	19,977	------	------	------	NORTH-BASIN WO-G
4	Combine	10.71	2	716	21,868	1, 2, 3	------	------	NORTH-TOTAL
5	SCS Runoff	7.039	2	716	16,872	------	------	------	OFF-1 IP
6	SCS Runoff	4.010	2	716	8,270	------	------	------	OFF-1 MEAD-G
7	SCS Runoff	54.80	2	716	111,263	------	------	------	OFF-1 WO-G
8	Combine	65.84	2	716	136,404	5, 6, 7	------	------	OFF-1 TOTAL
9	SCS Runoff	0.194	2	716	466	------	------	------	OFF-2 IP
10	SCS Runoff	1.891	2	716	3,900	------	------	------	OFF-2 MEAD-G
11	SCS Runoff	71.25	2	716	144,671	------	------	------	OFF-2 WO-G
12	SCS Runoff	27.18	2	716	55,187	------	------	------	OFF-2 WO-G
13	Combine	100.51	2	716	204,224	9, 10, 11, 12	------	------	OFF-2 TOTAL
14	SCS Runoff	0.023	2	716	56	------	------	------	SOUTH-BASIN IP
15	SCS Runoff	1.130	2	716	2,330	------	------	------	SOUTH-BASIN MEAD-G
16	SCS Runoff	88.31	2	716	179,310	------	------	------	SOUTH-BASIN WO-G
17	Combine	89.46	2	716	181,696	14, 15, 16	------	------	SOUTH-BASIN TOTAL
18	Combine	266.52	2	716	544,192	4, 8, 13, 17	------	------	SITE-TOTAL

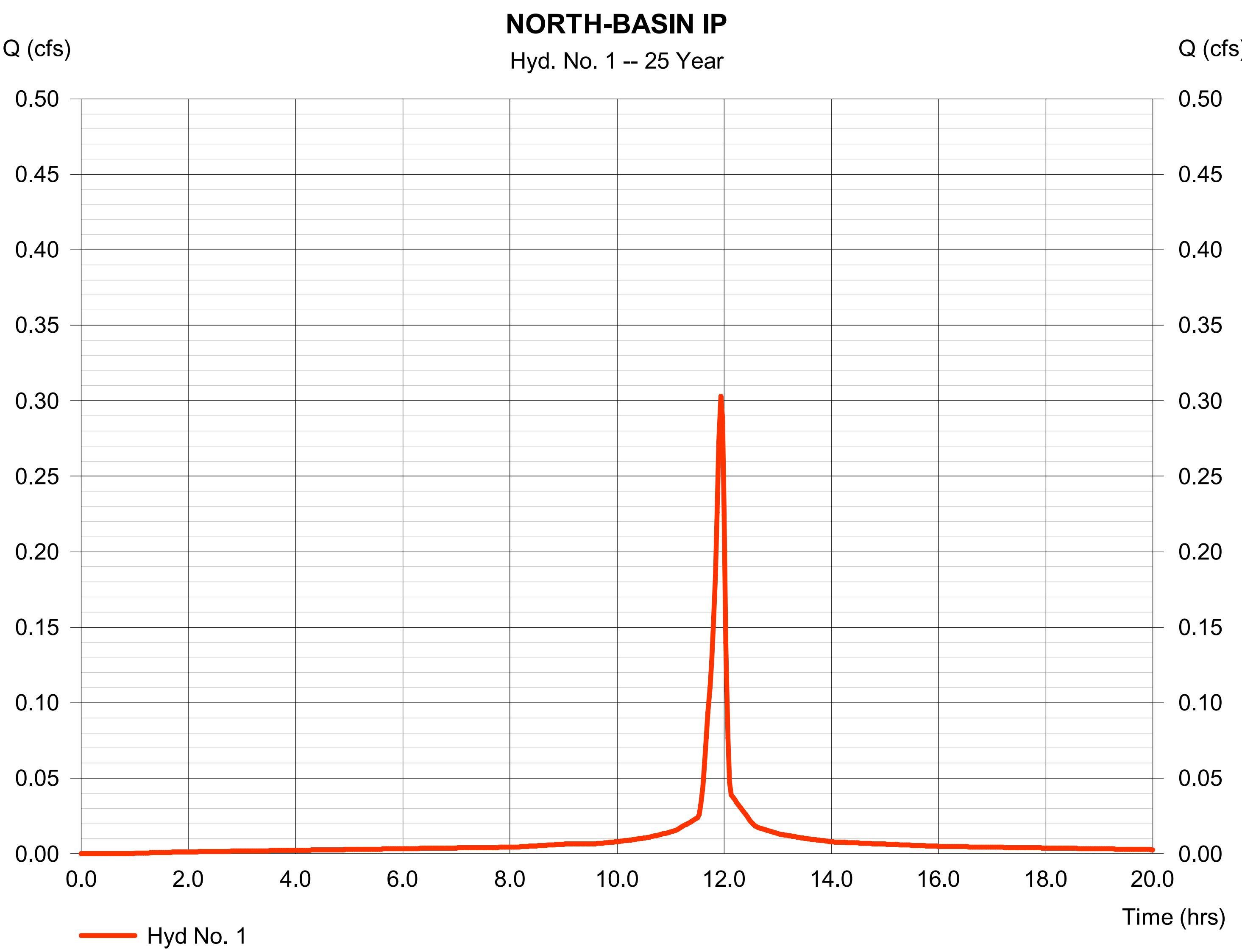
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 1

NORTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.303 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 726 cuft
Drainage area	= 0.039 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



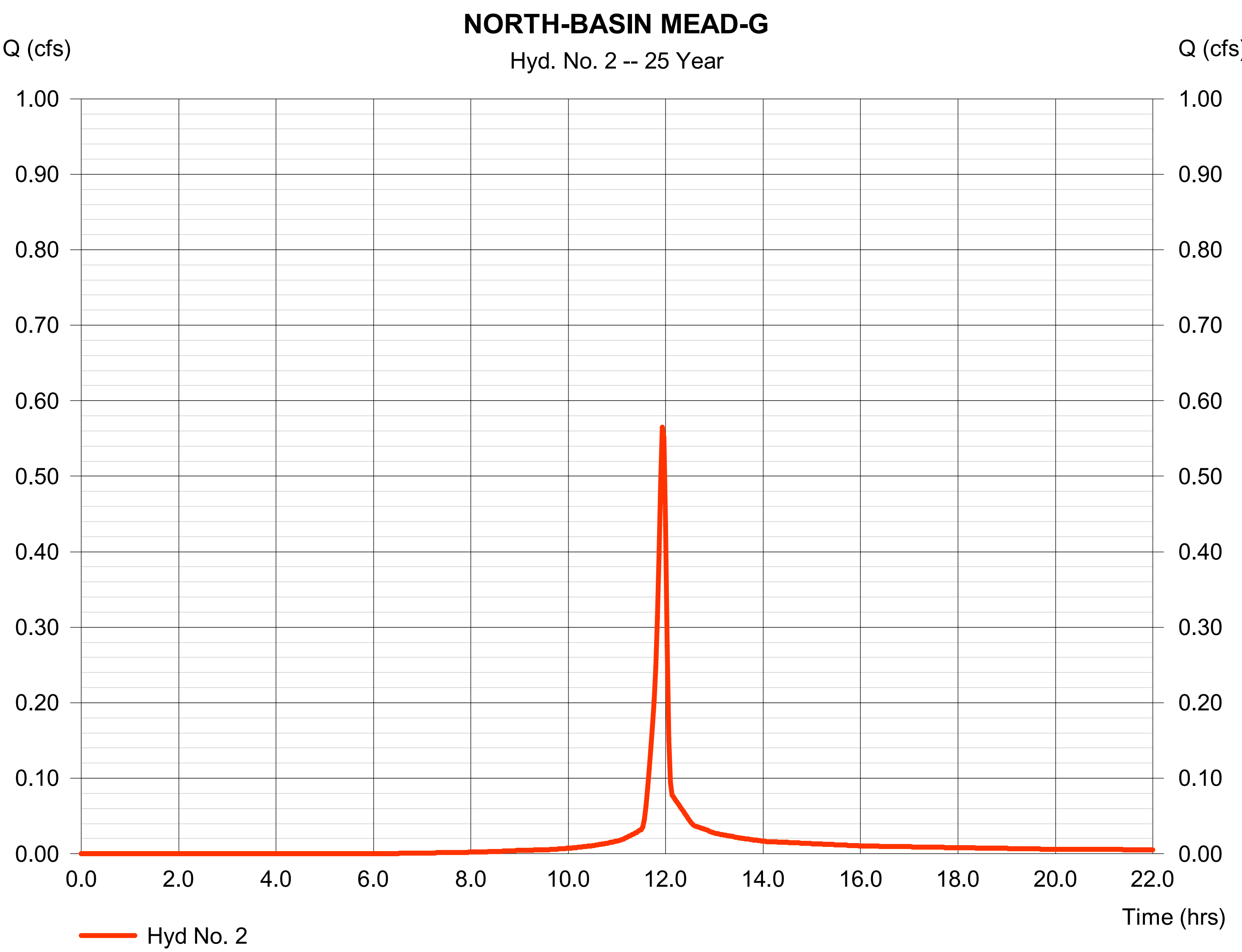
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 2

NORTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.565 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,165 cuft
Drainage area	= 0.092 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



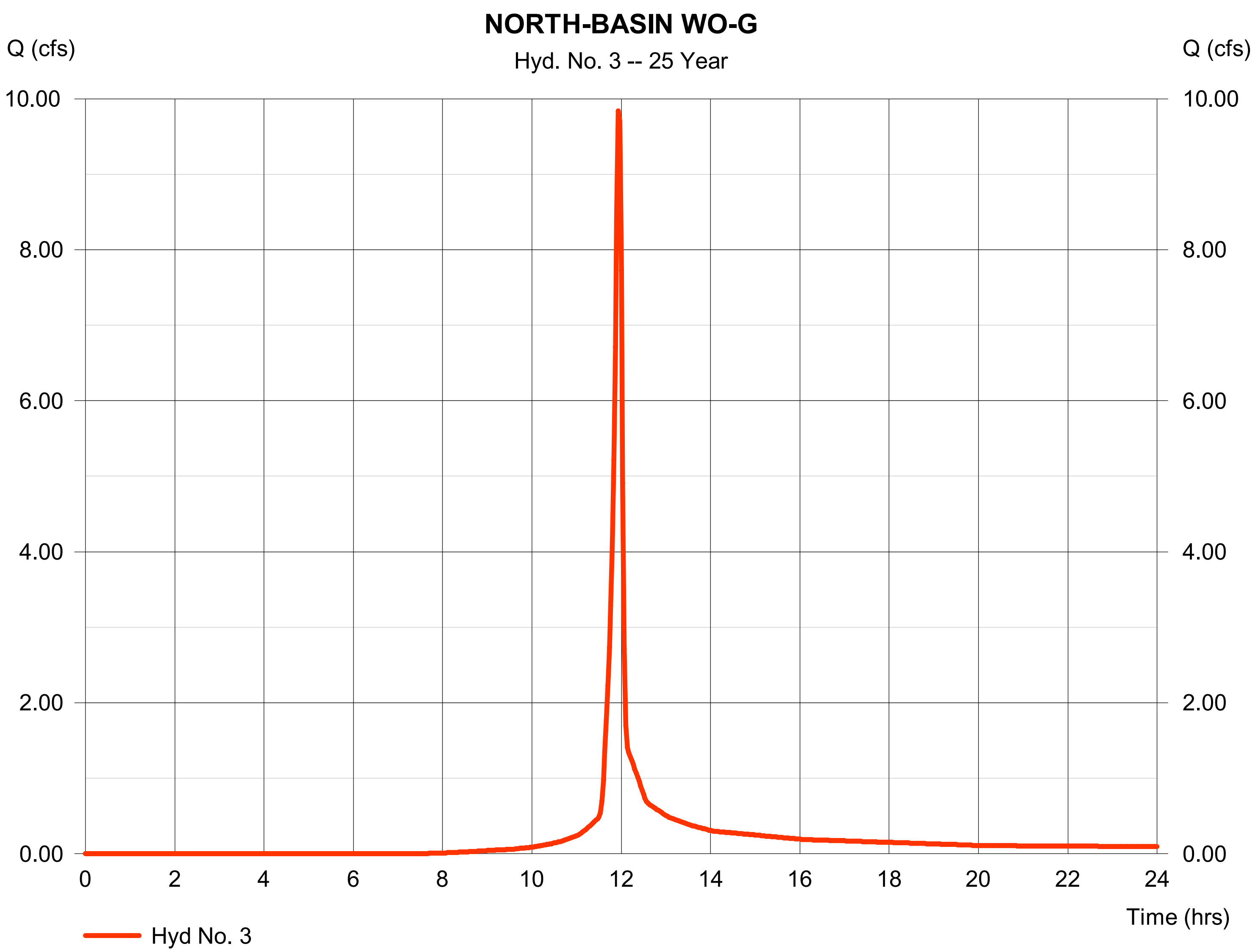
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 3

NORTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 9.838 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 19,977 cuft
Drainage area	= 1.819 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



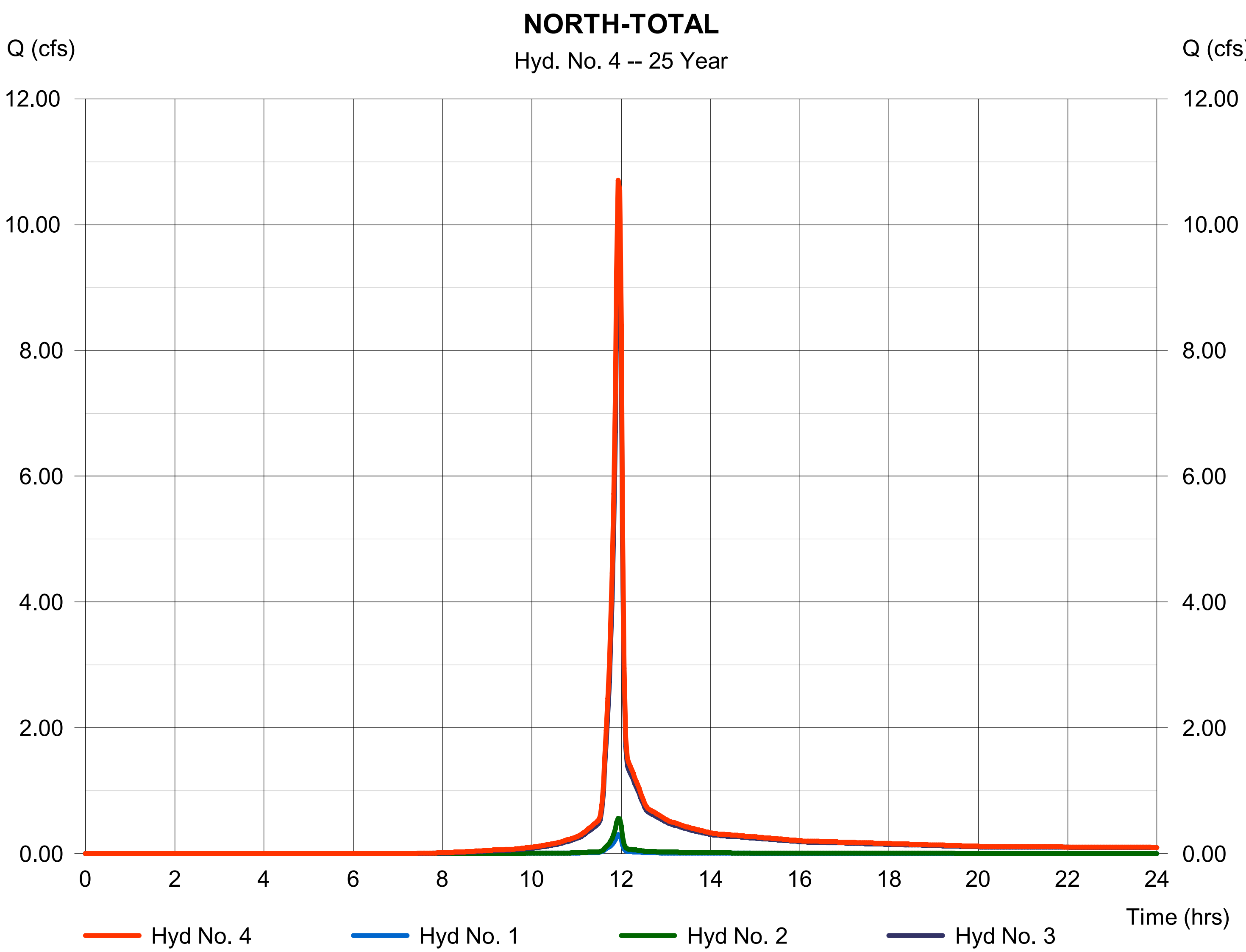
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 4

NORTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 10.71 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 21,868 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 1.950 ac



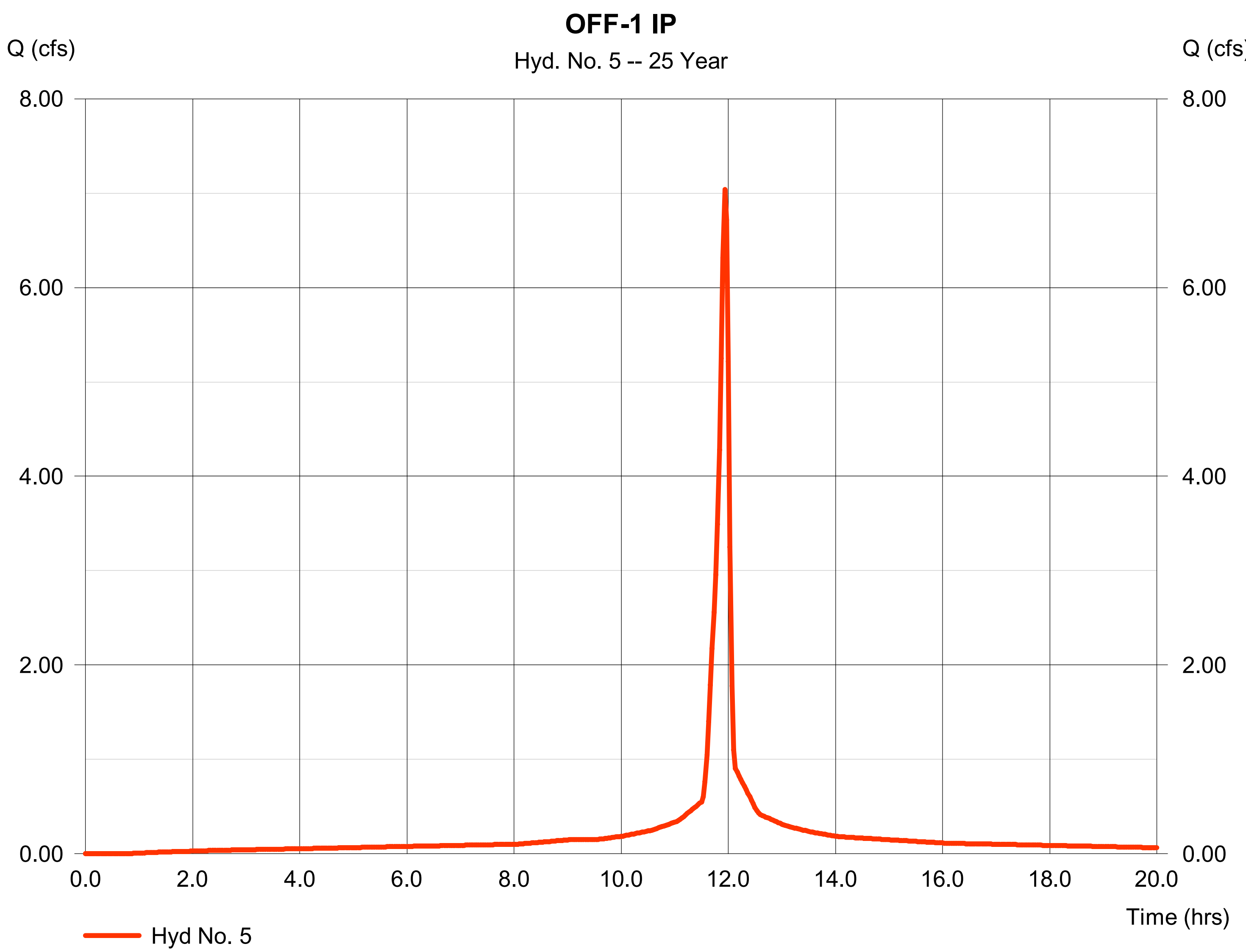
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 5

OFF-1 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 7.039 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 16,872 cuft
Drainage area	= 0.906 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



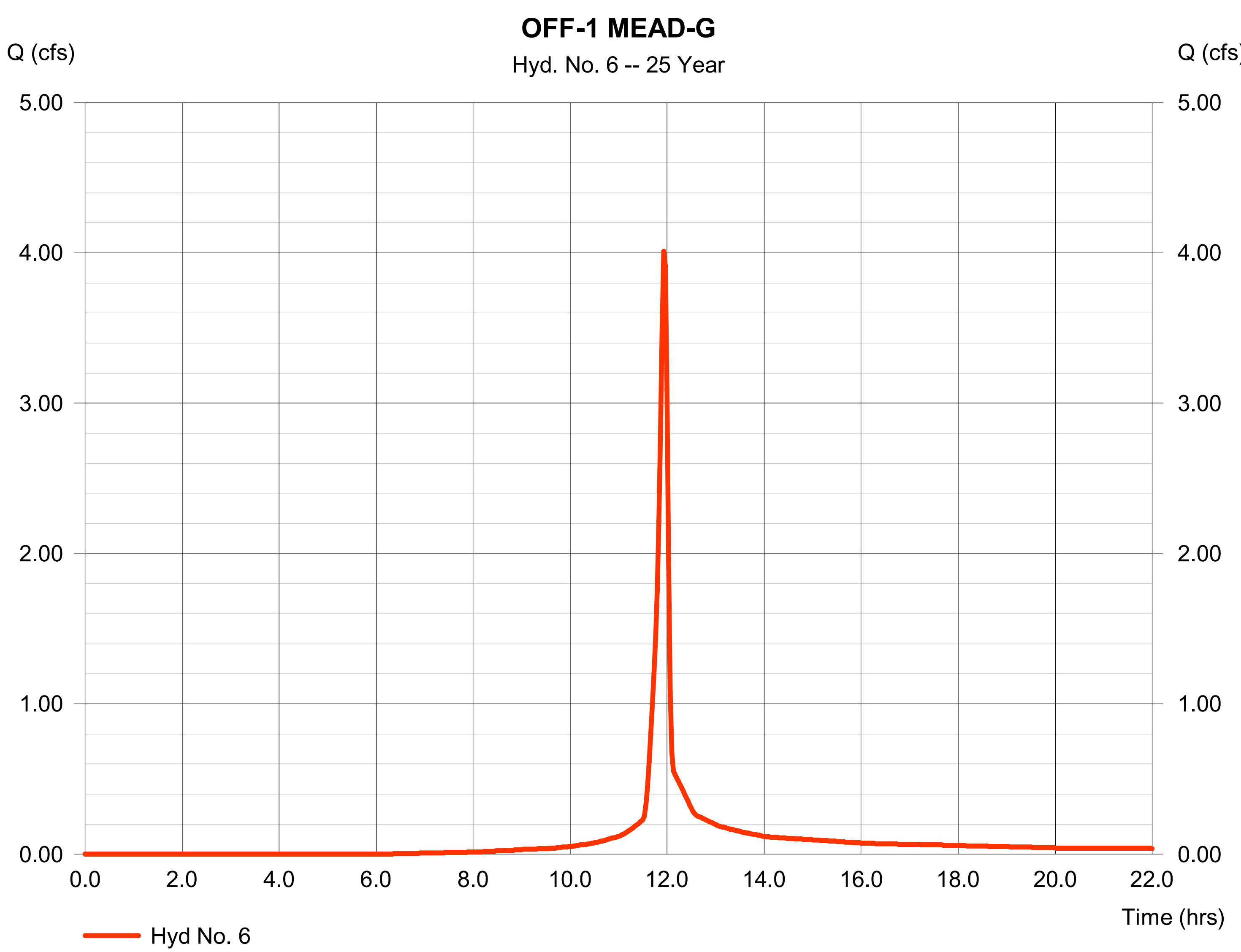
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 6

OFF-1 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 4.010 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 8,270 cuft
Drainage area	= 0.653 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



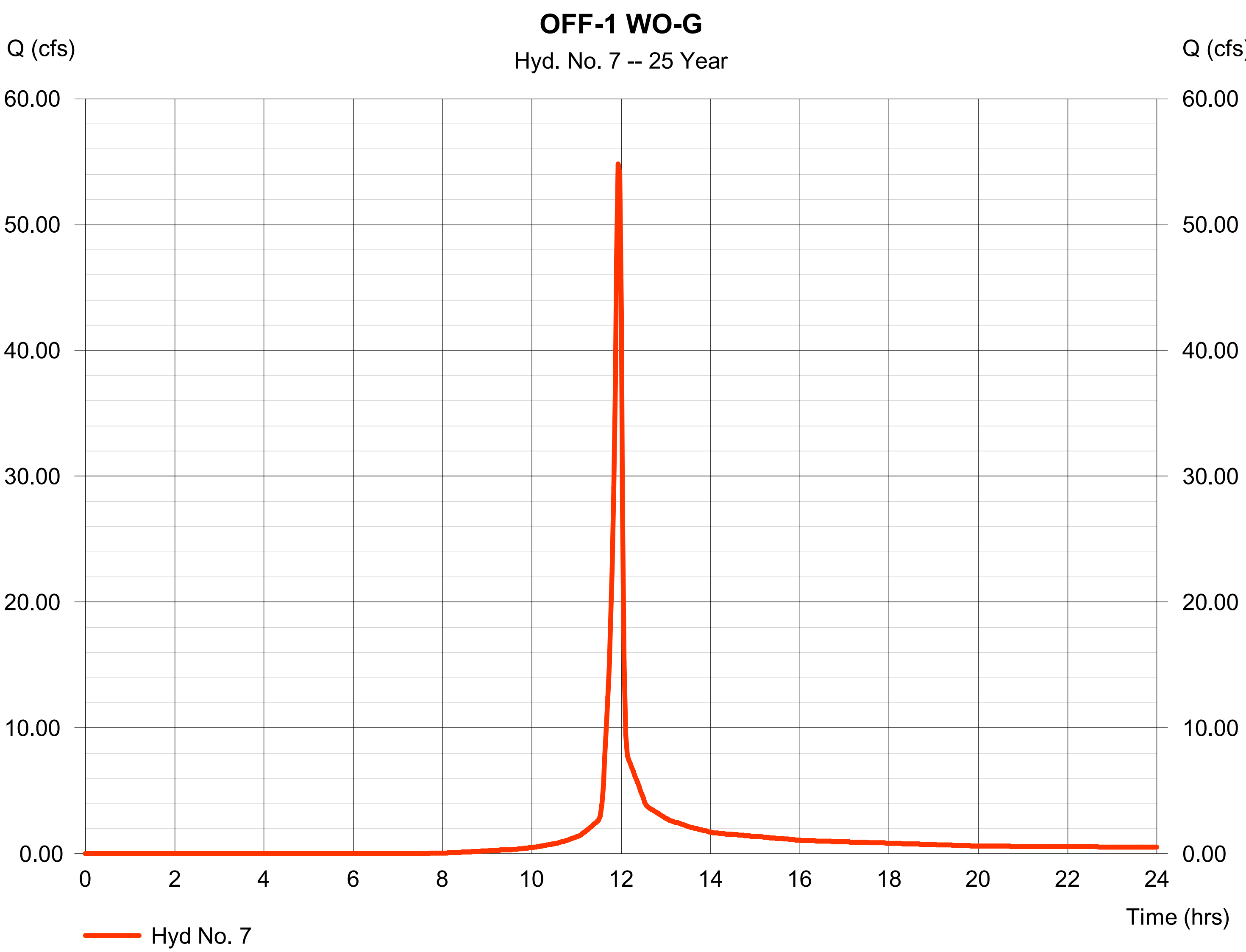
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 7

OFF-1 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 54.80 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 111,263 cuft
Drainage area	= 10.131 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



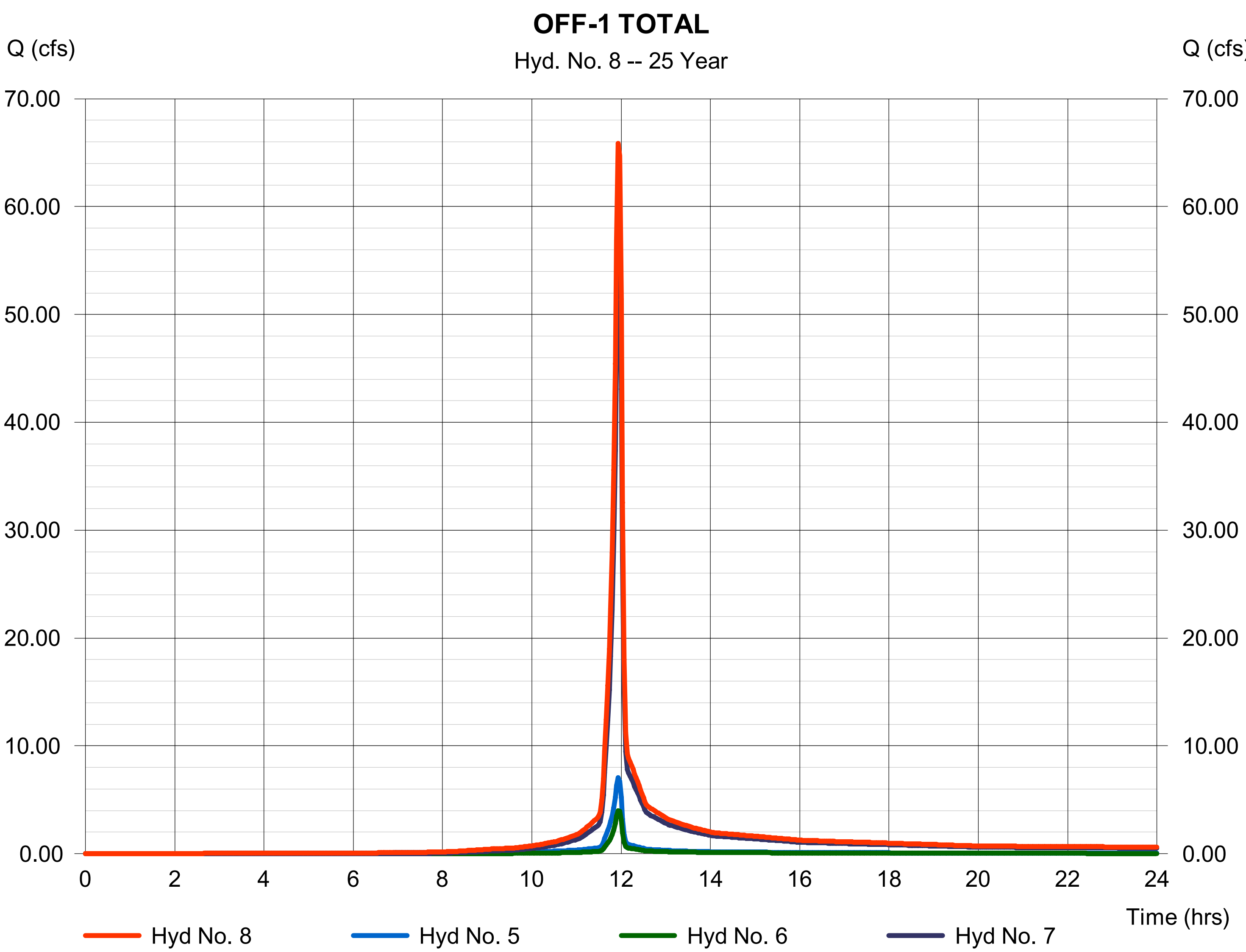
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 8

OFF-1 TOTAL

Hydrograph type	= Combine	Peak discharge	= 65.84 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 136,404 cuft
Inflow hyds.	= 5, 6, 7	Contrib. drain. area	= 11.690 ac



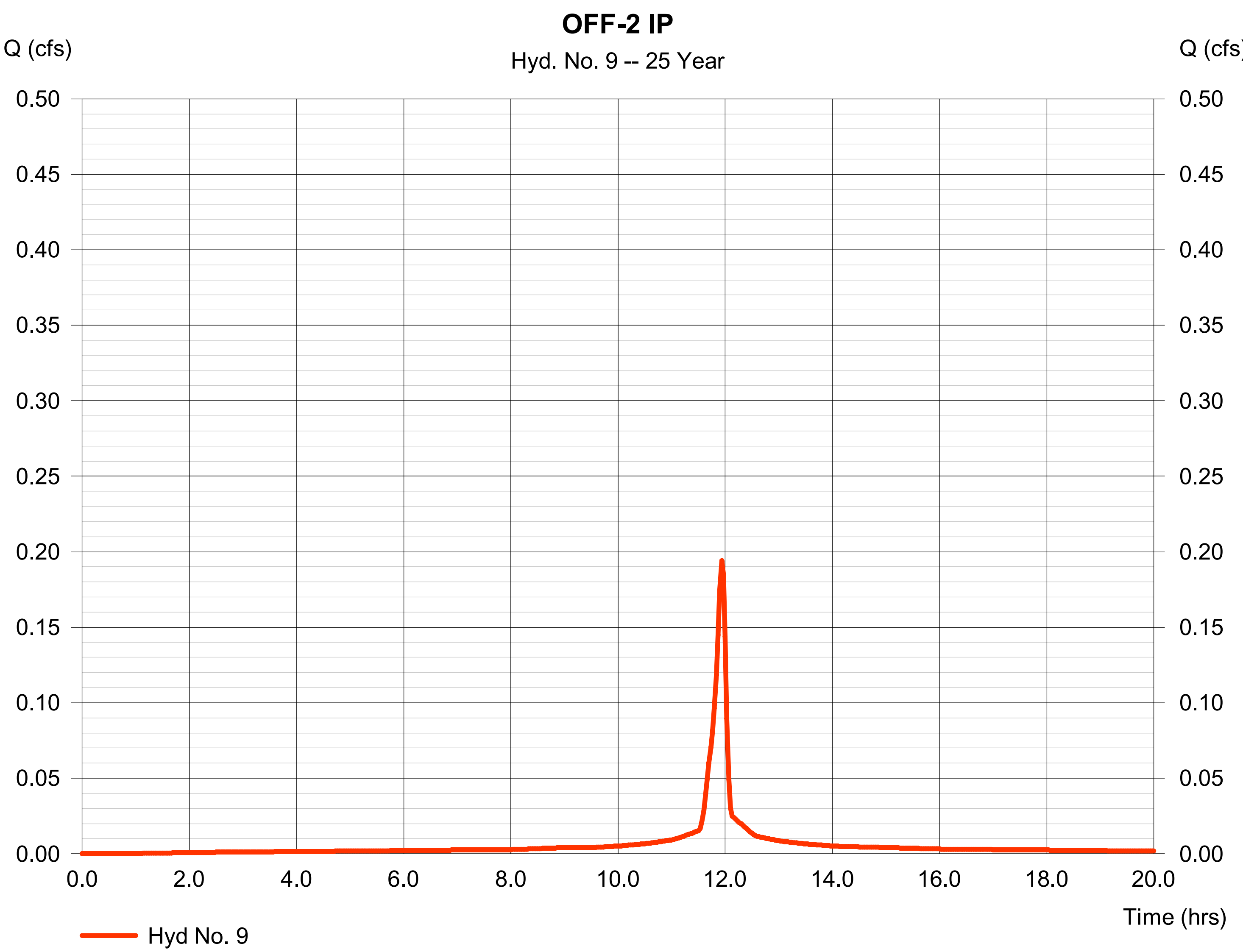
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Tuesday, 10 / 15 / 2019

Hyd. No. 9

OFF-2 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.194 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 466 cuft
Drainage area	= 0.025 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



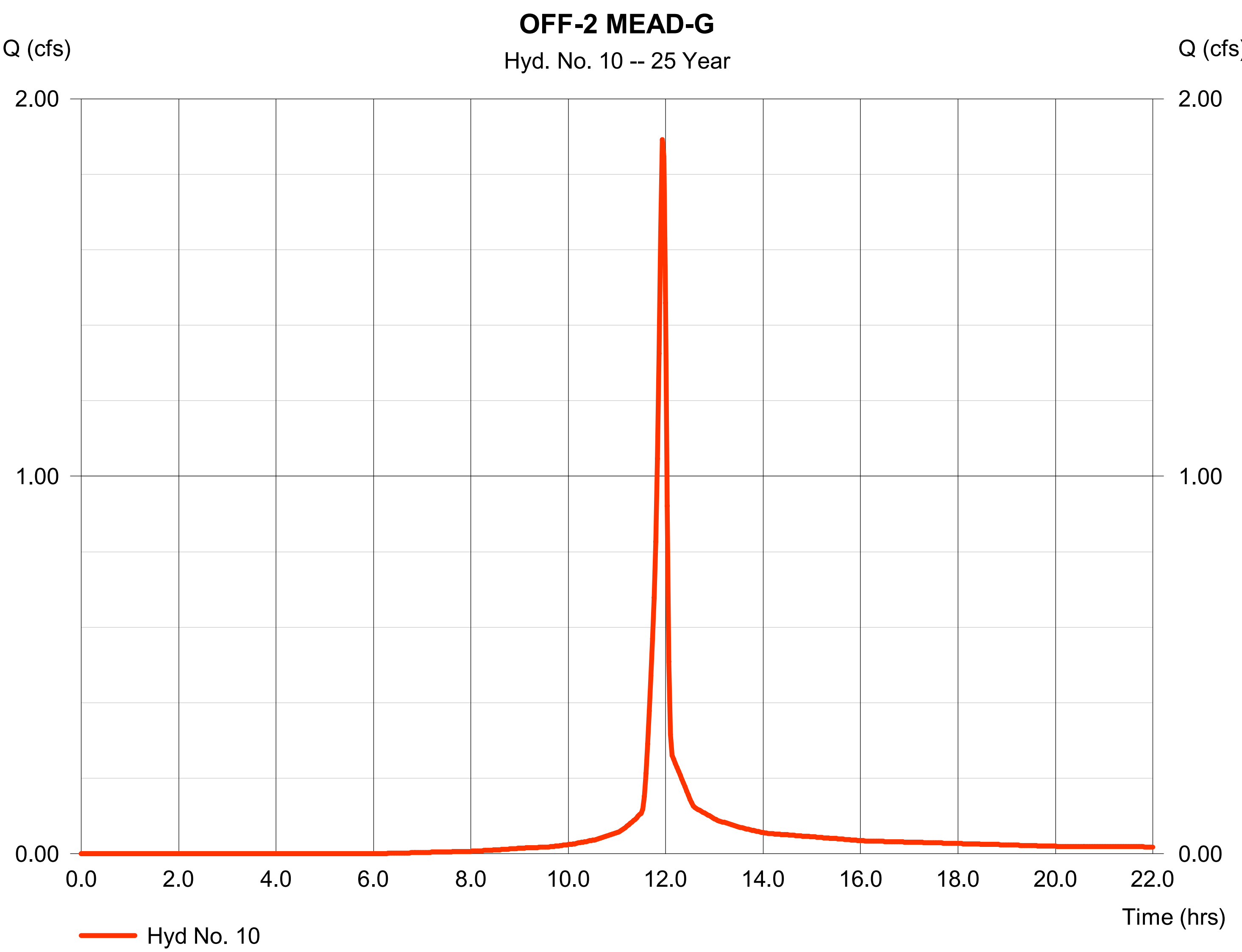
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 10

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 1.891 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 3,900 cuft
Drainage area	= 0.308 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



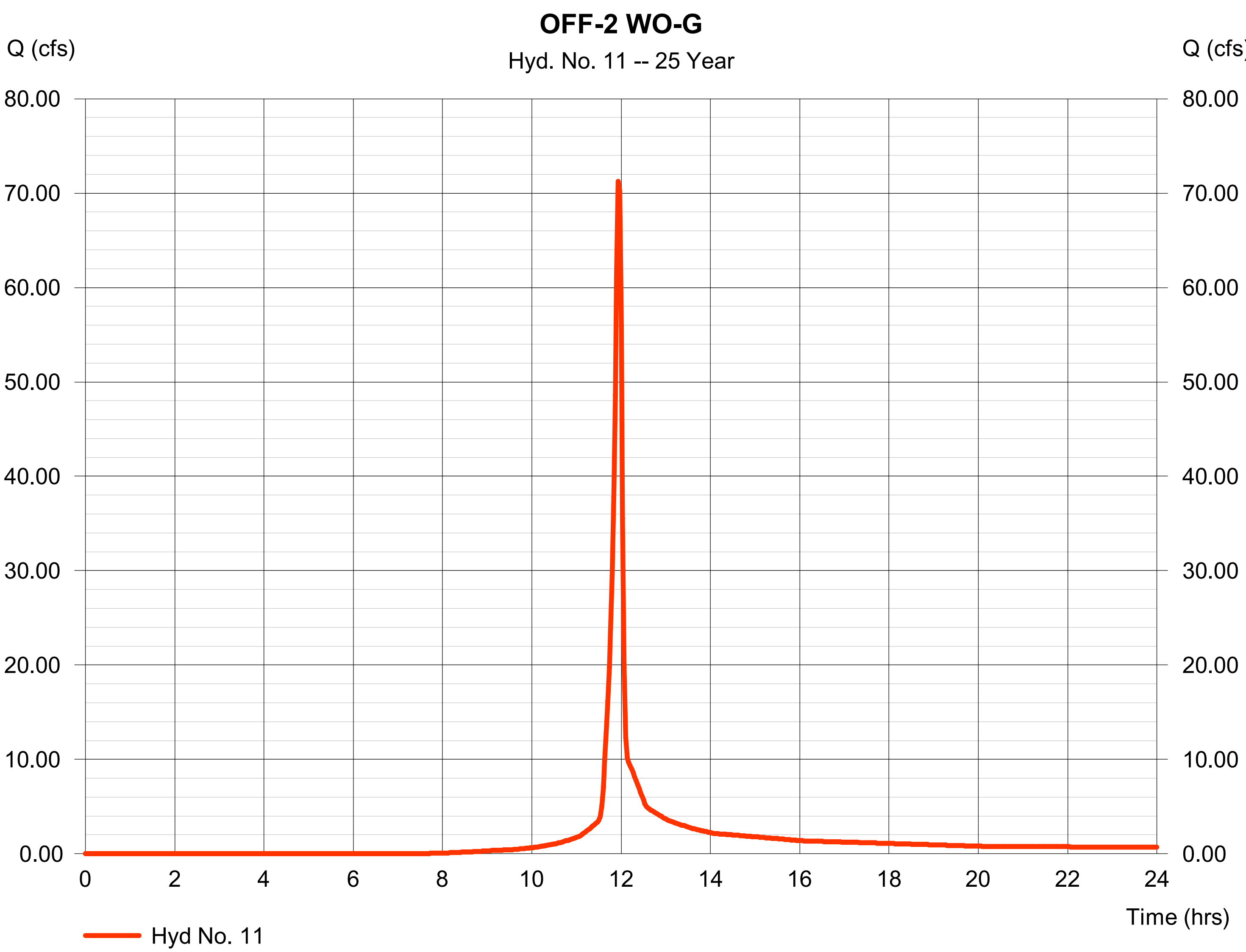
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 11

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 71.25 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 144,671 cuft
Drainage area	= 13.173 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



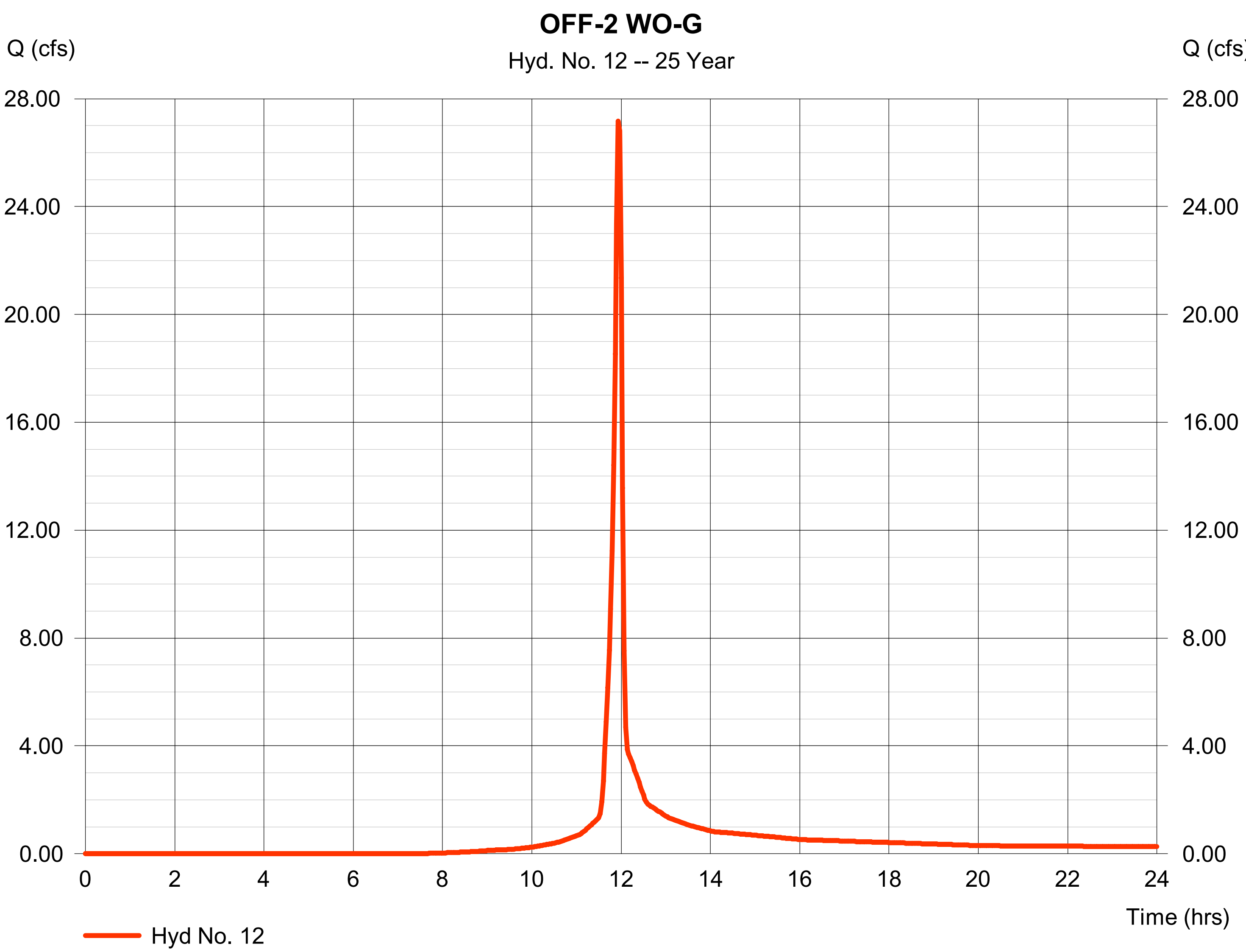
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 12

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 27.18 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 55,187 cuft
Drainage area	= 5.025 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



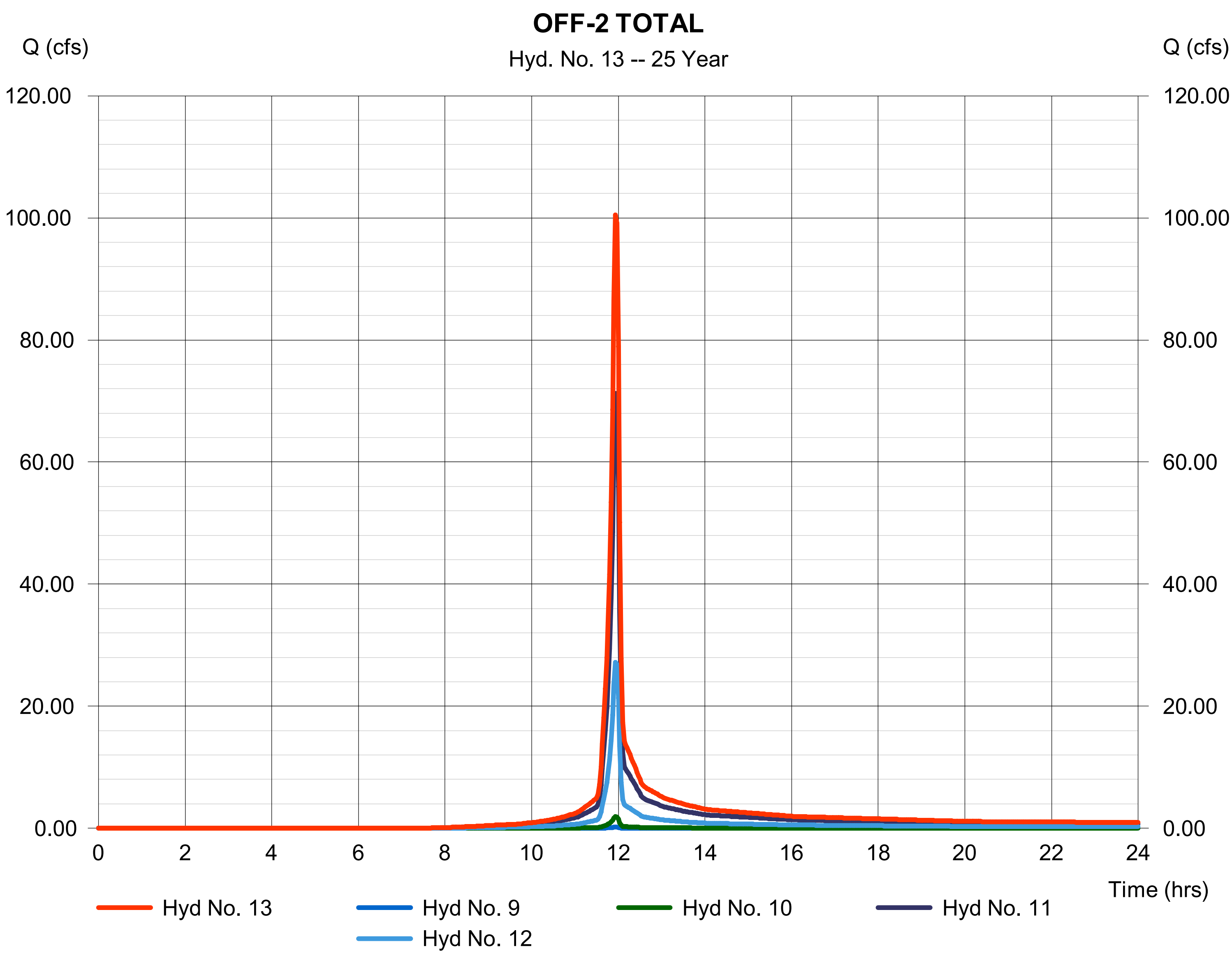
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Tuesday, 10 / 15 / 2019

Hyd. No. 13

OFF-2 TOTAL

Hydrograph type	= Combine	Peak discharge	= 100.51 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 204,224 cuft
Inflow hyds.	= 9, 10, 11, 12	Contrib. drain. area	= 18.531 ac



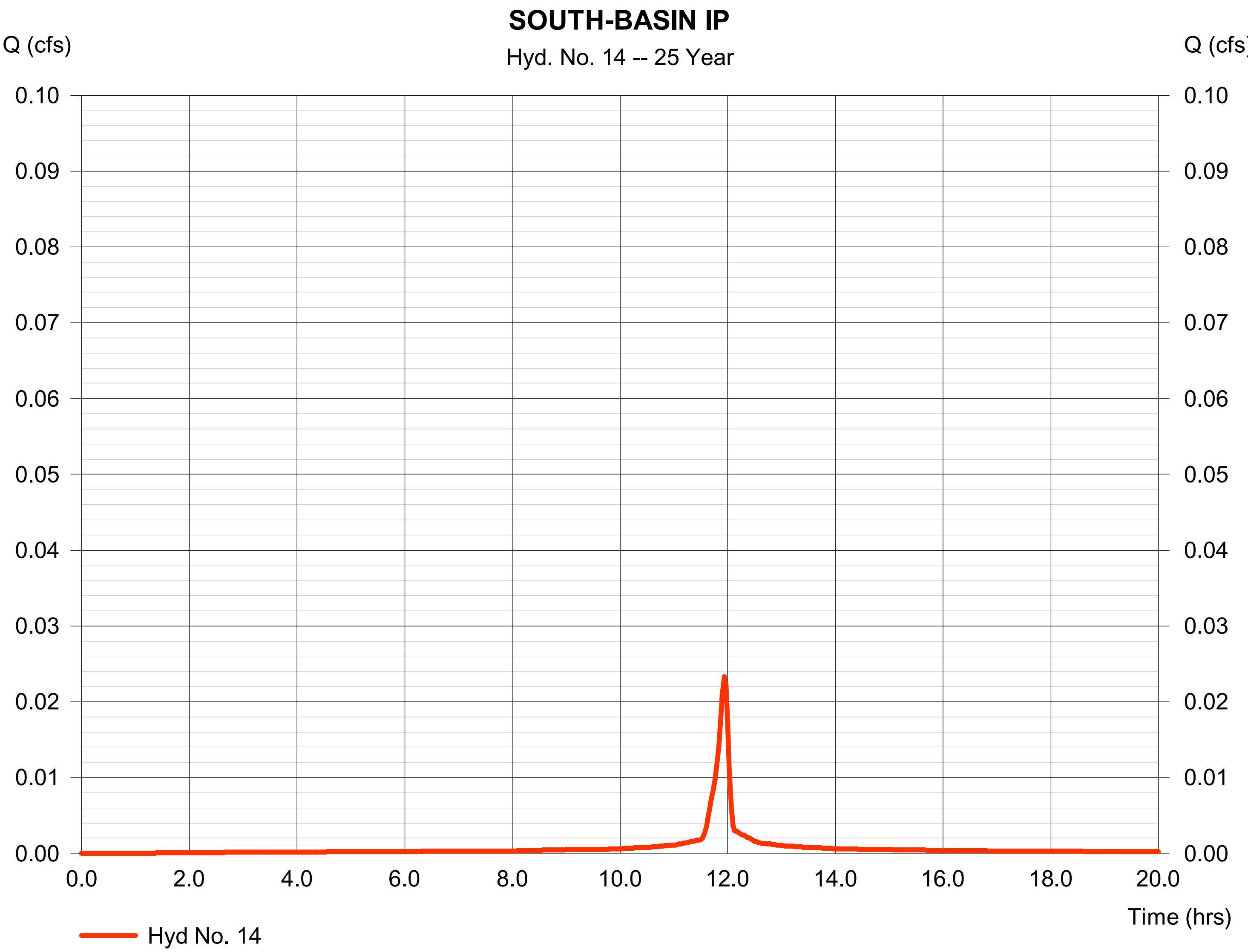
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 14

SOUTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.023 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 56 cuft
Drainage area	= 0.003 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



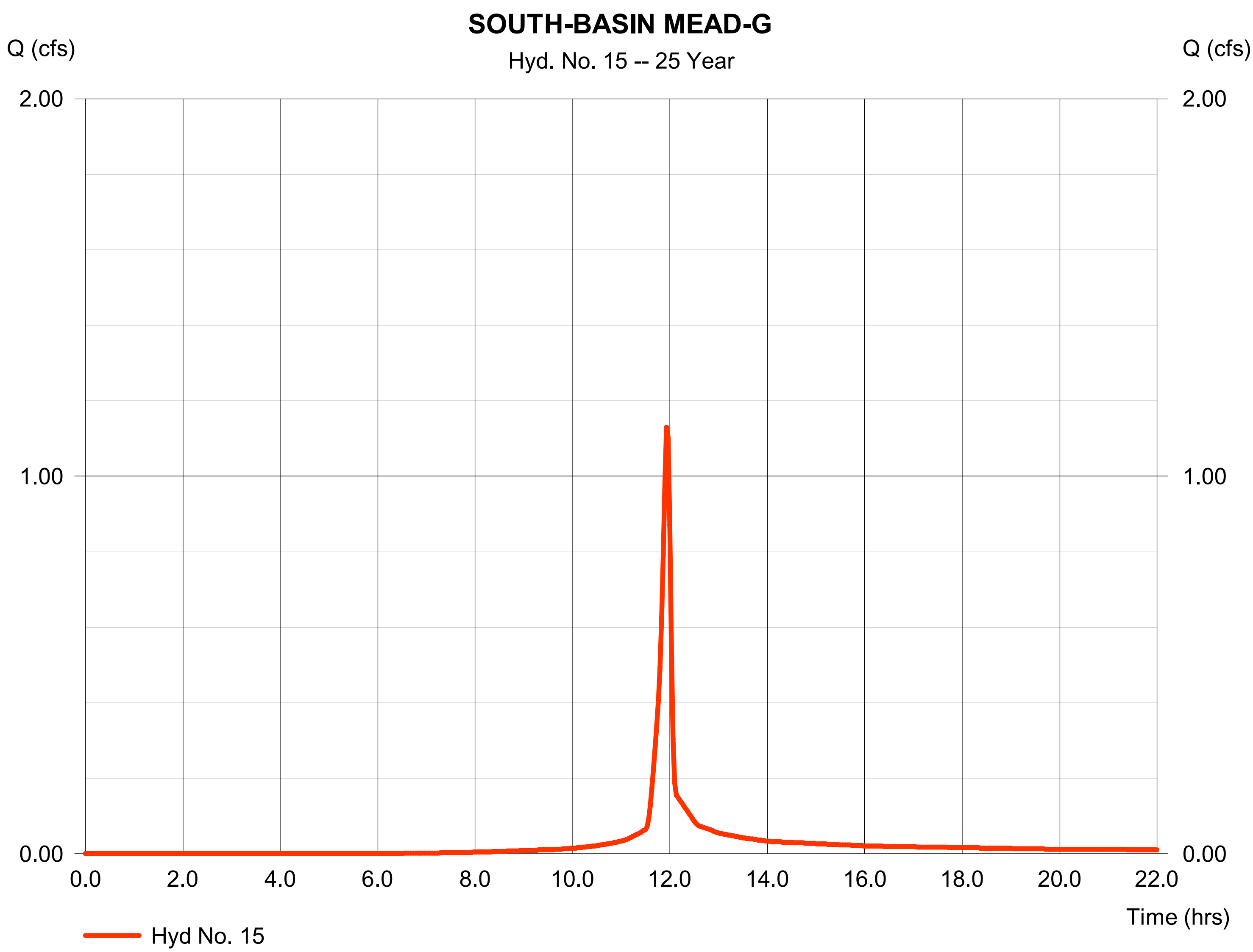
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 15

SOUTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 1.130 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,330 cuft
Drainage area	= 0.184 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



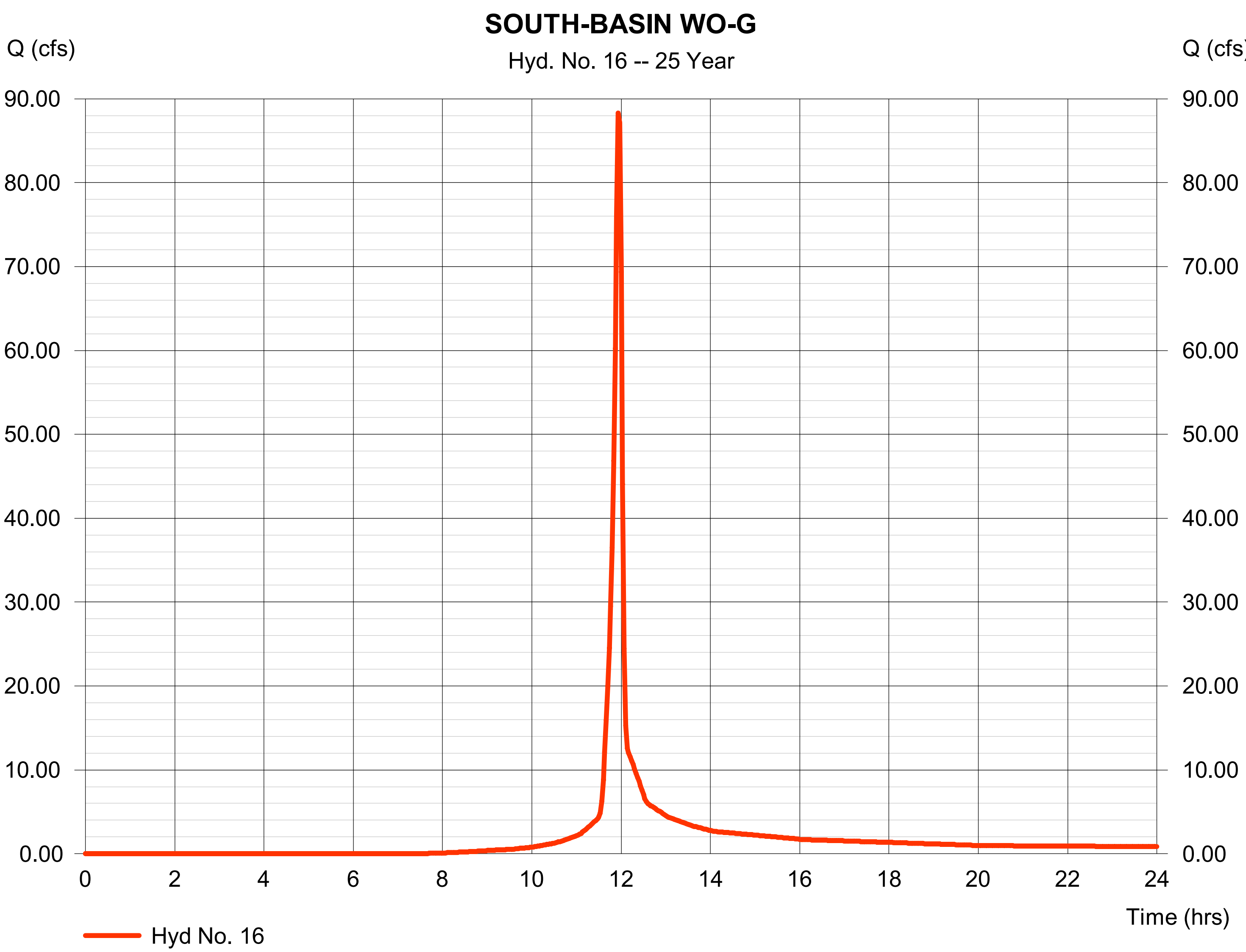
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Tuesday, 10 / 15 / 2019

Hyd. No. 16

SOUTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 88.31 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 179,310 cuft
Drainage area	= 16.327 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



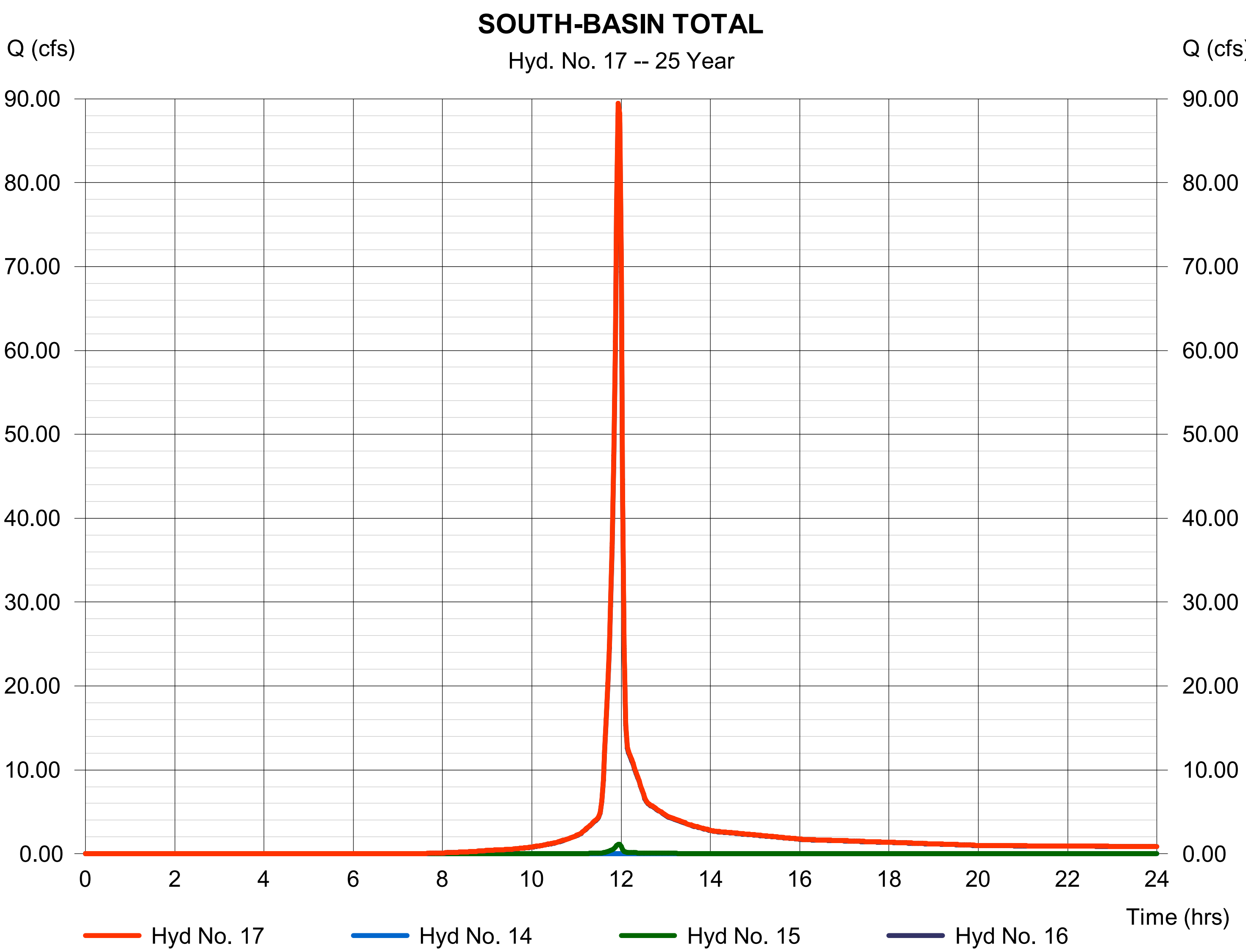
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 17

SOUTH-BASIN TOTAL

Hydrograph type	= Combine	Peak discharge	= 89.46 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 181,696 cuft
Inflow hyds.	= 14, 15, 16	Contrib. drain. area	= 16.514 ac



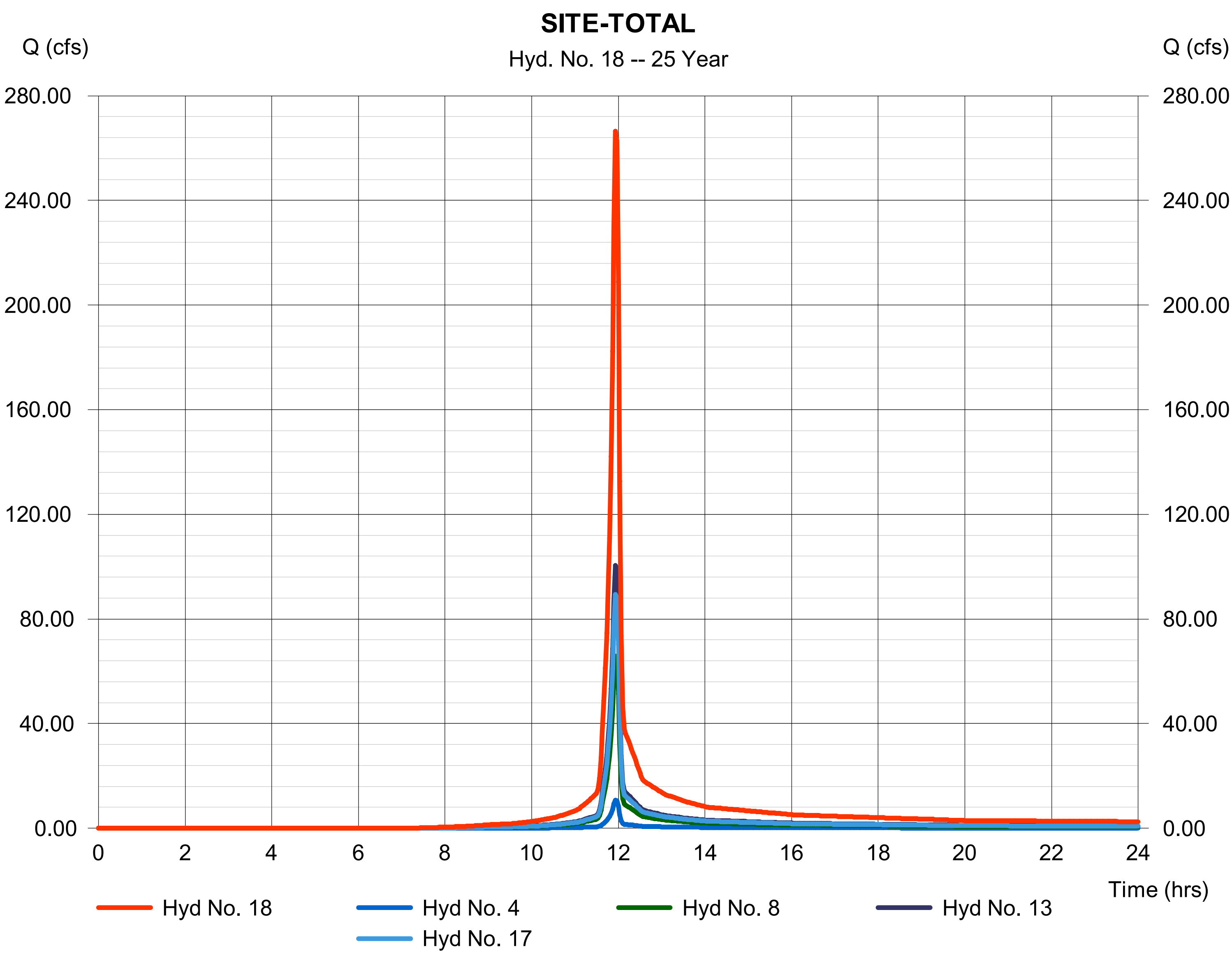
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 18

SITE-TOTAL

Hydrograph type	= Combine	Peak discharge	= 266.52 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 544,192 cuft
Inflow hyds.	= 4, 8, 13, 17	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	0.358	2	716	862	------	------	------	NORTH-BASIN IP
2	SCS Runoff	0.700	2	716	1,460	------	------	------	NORTH-BASIN MEAD-G
3	SCS Runoff	12.48	2	716	25,528	------	------	------	NORTH-BASIN WO-G
4	Combine	13.54	2	716	27,850	1, 2, 3	------	------	NORTH-TOTAL
5	SCS Runoff	8.306	2	716	20,014	------	------	------	OFF-1 IP
6	SCS Runoff	4.971	2	716	10,364	------	------	------	OFF-1 MEAD-G
7	SCS Runoff	69.51	2	716	142,181	------	------	------	OFF-1 WO-G
8	Combine	82.79	2	716	172,559	5, 6, 7	------	------	OFF-1 TOTAL
9	SCS Runoff	0.229	2	716	552	------	------	------	OFF-2 IP
10	SCS Runoff	2.345	2	716	4,888	------	------	------	OFF-2 MEAD-G
11	SCS Runoff	90.38	2	716	184,874	------	------	------	OFF-2 WO-G
12	SCS Runoff	34.48	2	716	70,522	------	------	------	OFF-2 WO-G
13	Combine	127.43	2	716	260,837	9, 10, 11, 12	------	------	OFF-2 TOTAL
14	SCS Runoff	0.028	2	716	66	------	------	------	SOUTH-BASIN IP
15	SCS Runoff	1.401	2	716	2,920	------	------	------	SOUTH-BASIN MEAD-G
16	SCS Runoff	112.02	2	716	229,138	------	------	------	SOUTH-BASIN WO-G
17	Combine	113.45	2	716	232,125	14, 15, 16	------	------	SOUTH-BASIN TOTAL
18	Combine	337.20	2	716	693,370	4, 8, 13, 17	------	------	SITE-TOTAL

EX-SWM.gpw	Return Period: 50 Year	Tuesday, 10 / 15 / 2019

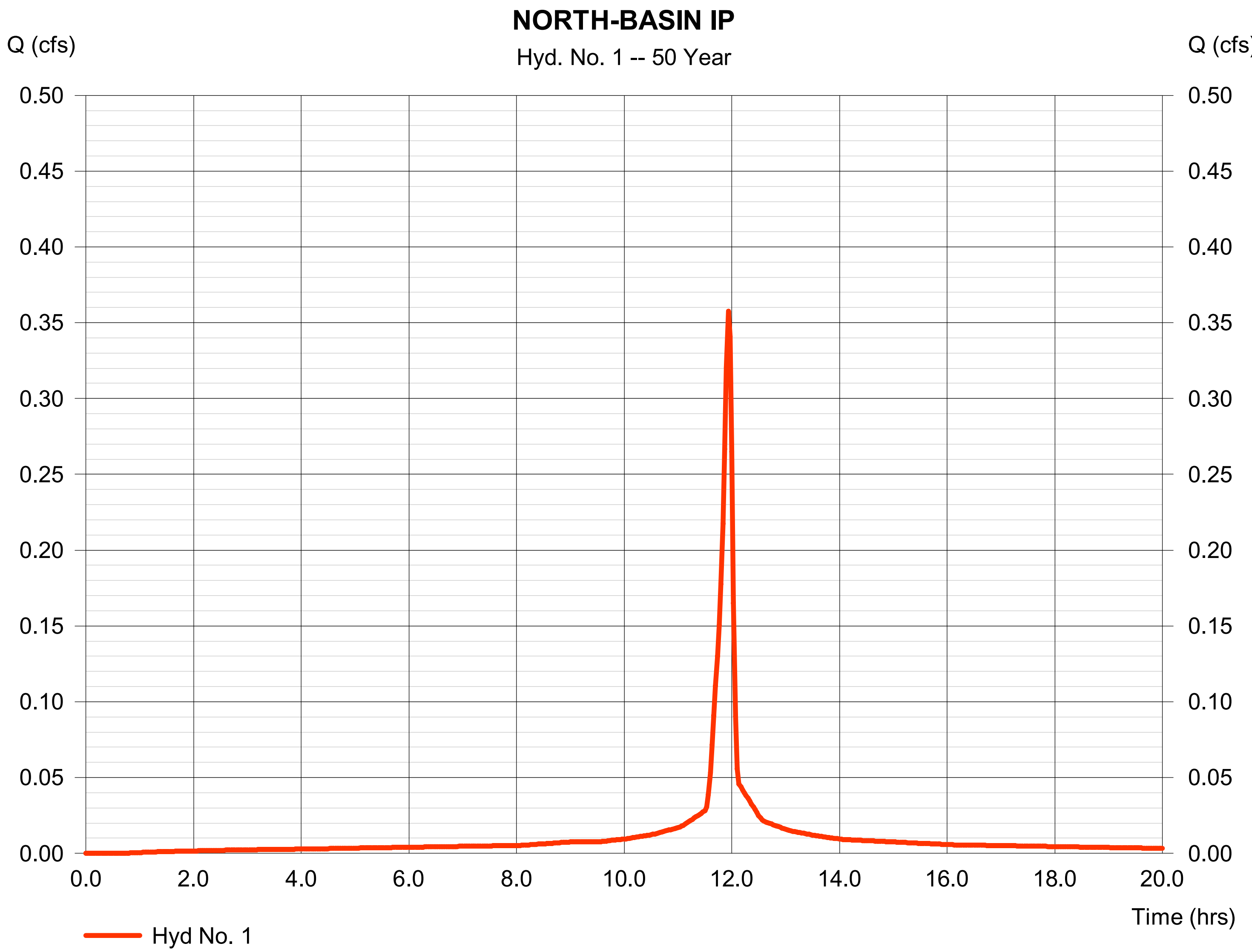
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 1

NORTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.358 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 862 cuft
Drainage area	= 0.039 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



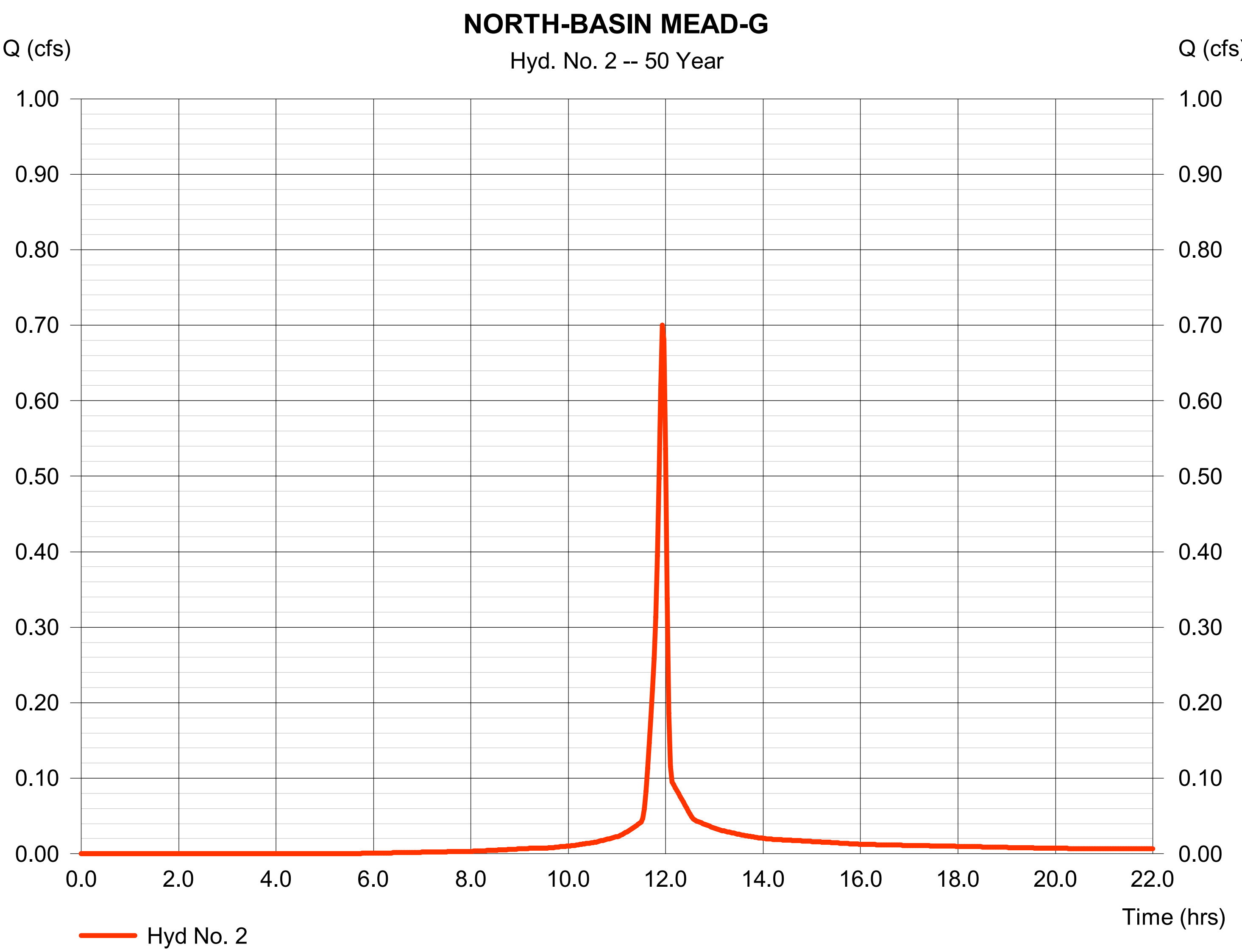
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 2

NORTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.700 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,460 cuft
Drainage area	= 0.092 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



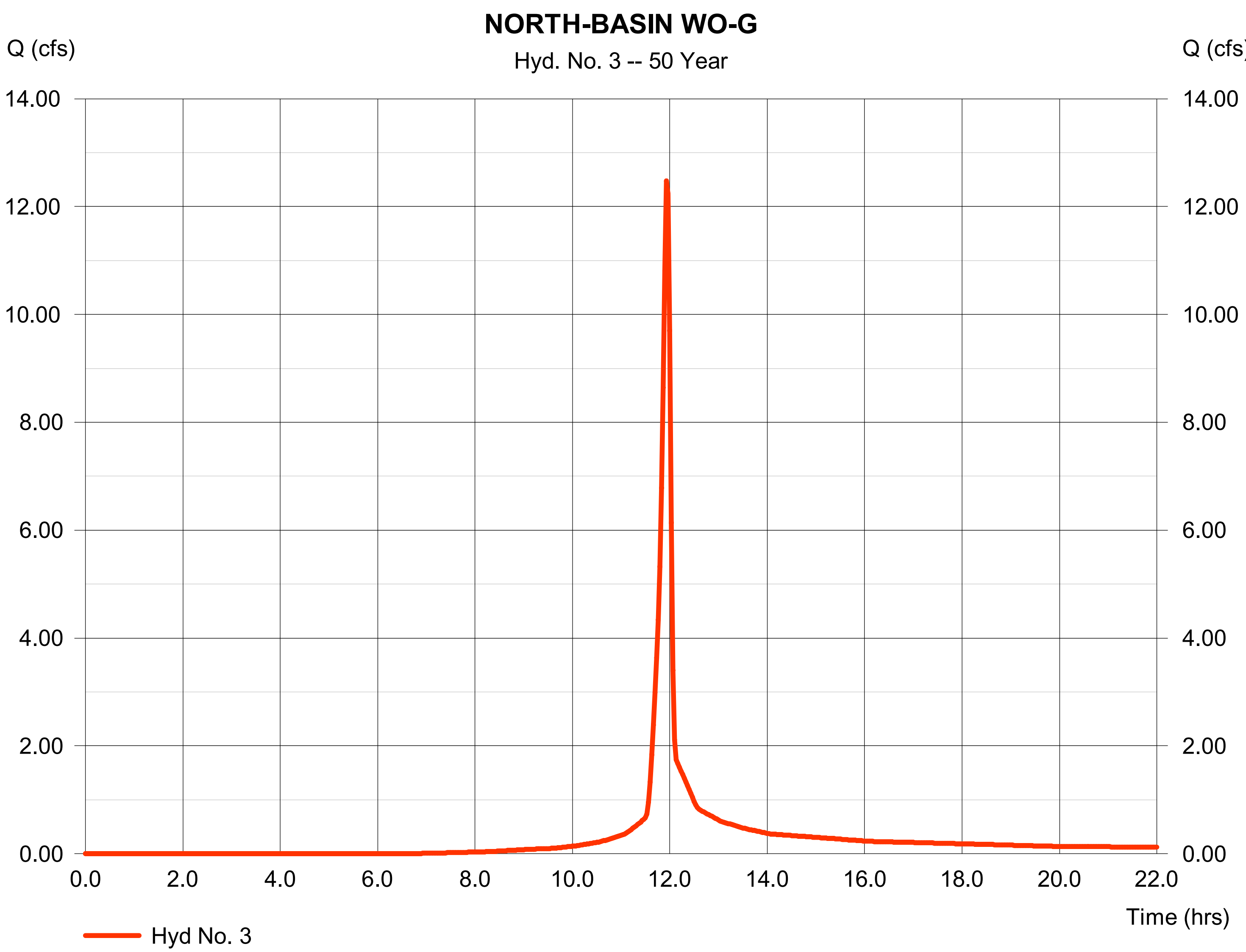
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 3

NORTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 12.48 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 25,528 cuft
Drainage area	= 1.819 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



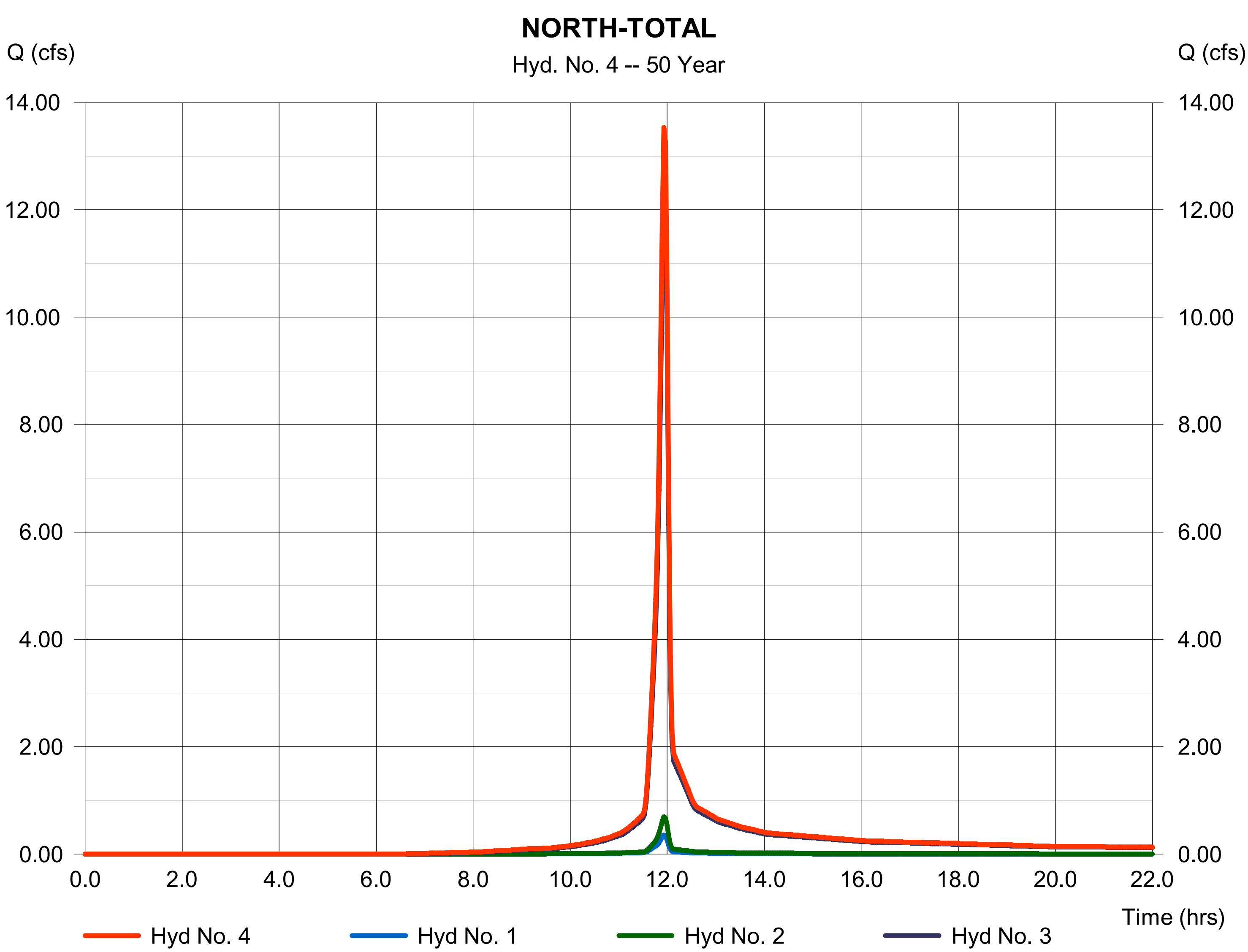
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 4

NORTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 13.54 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 27,850 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 1.950 ac



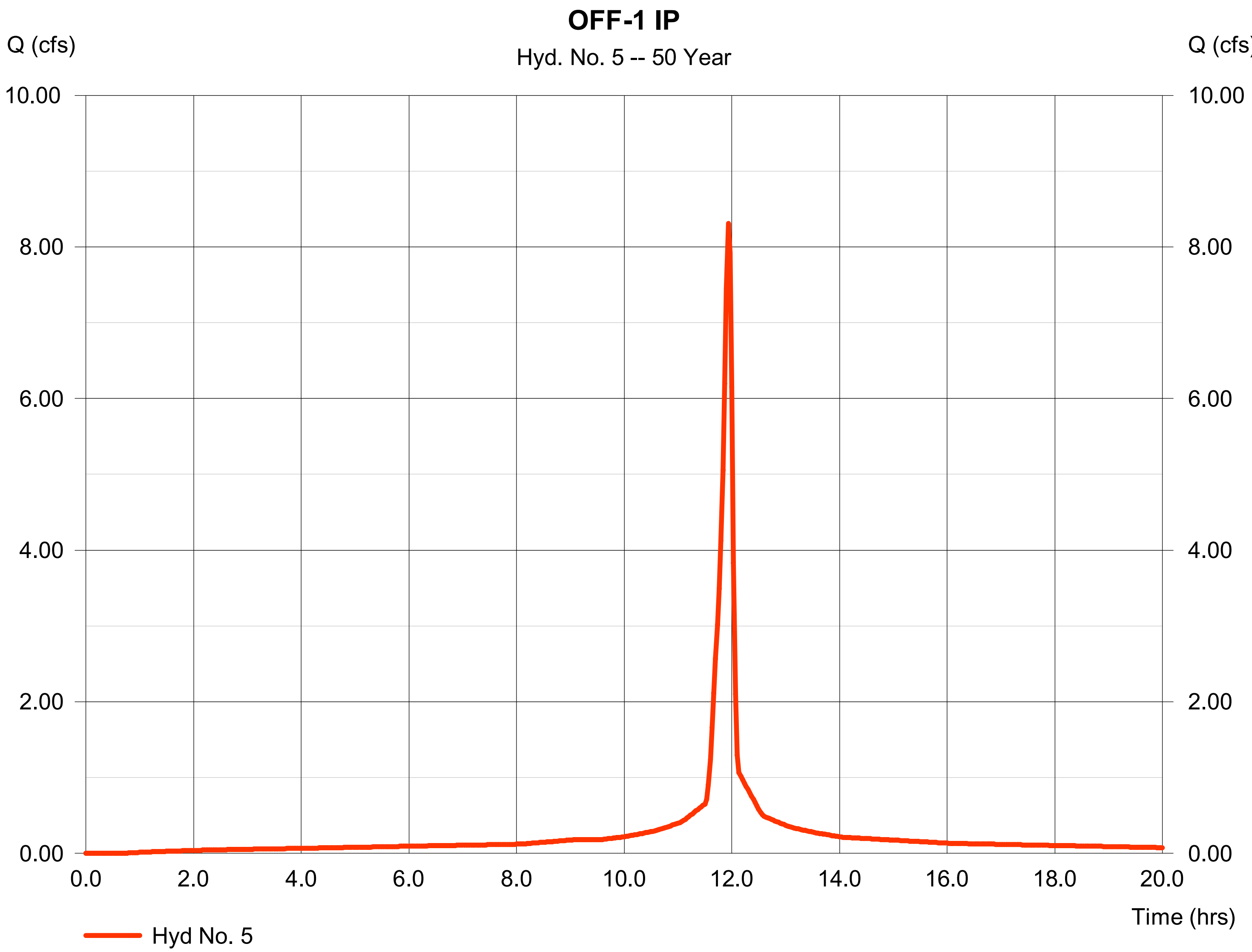
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 5

OFF-1 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 8.306 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 20,014 cuft
Drainage area	= 0.906 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

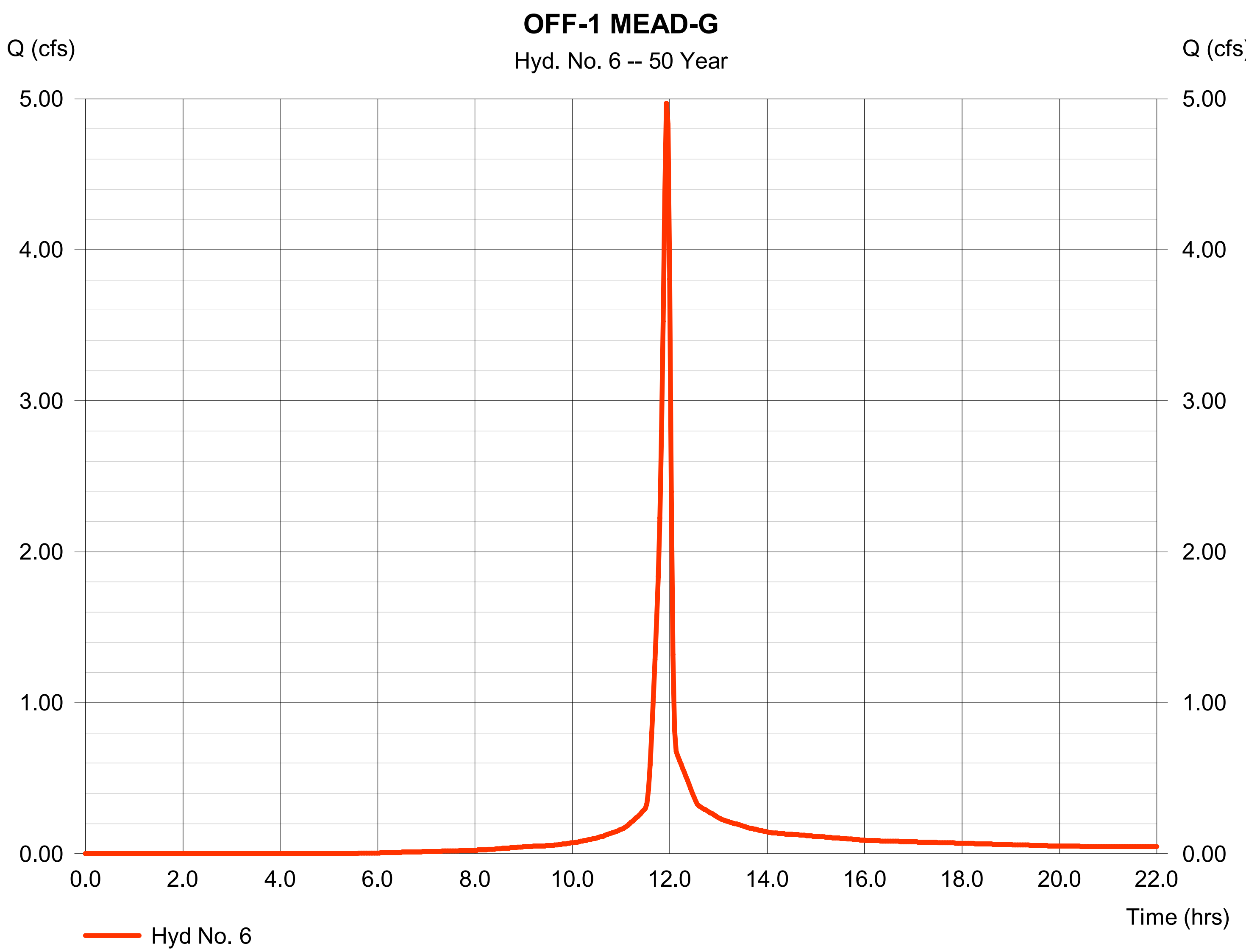


Hydrograph Report

Hyd. No. 6

OFF-1 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 4.971 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 10,364 cuft
Drainage area	= 0.653 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



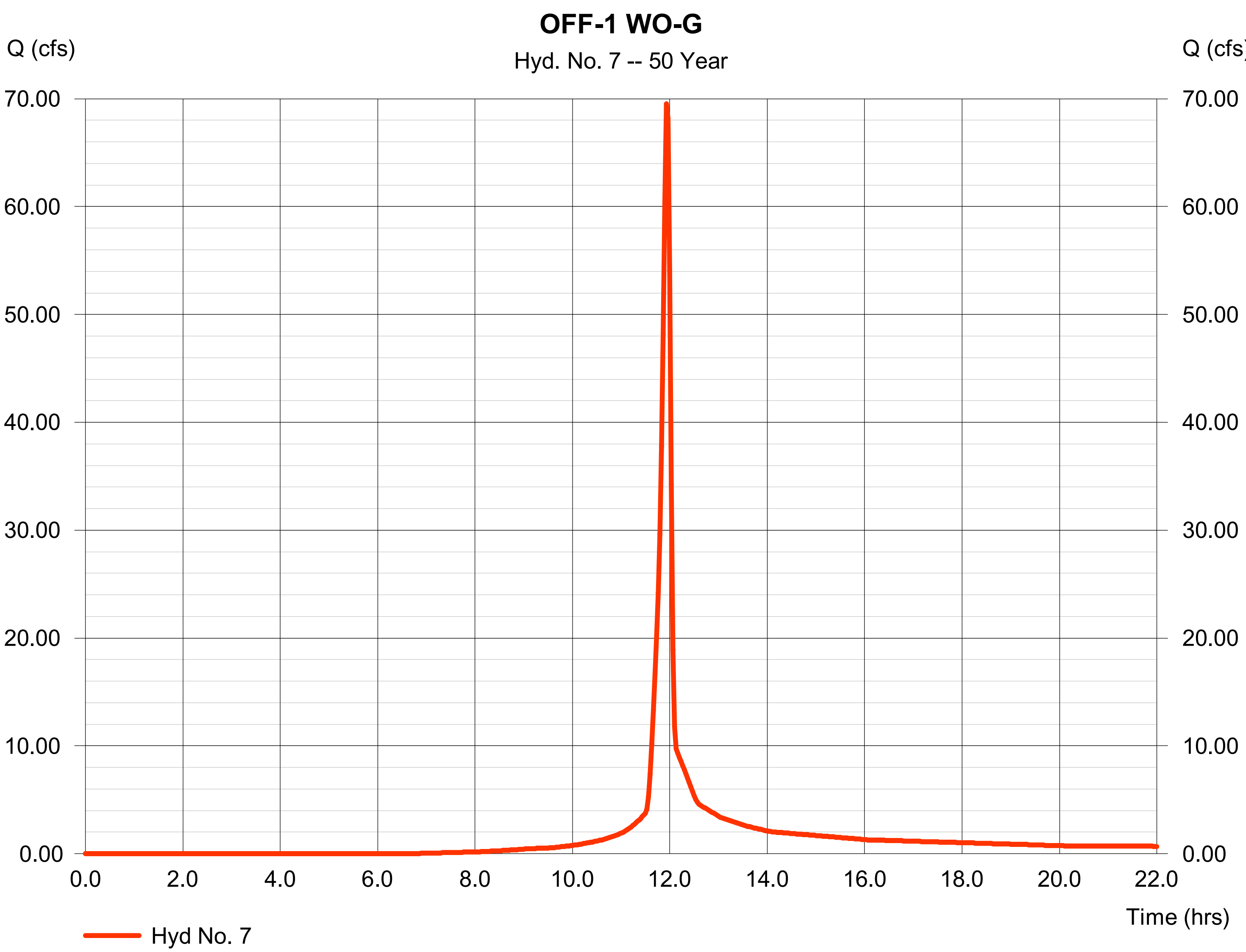
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 7

OFF-1 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 69.51 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 142,181 cuft
Drainage area	= 10.131 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



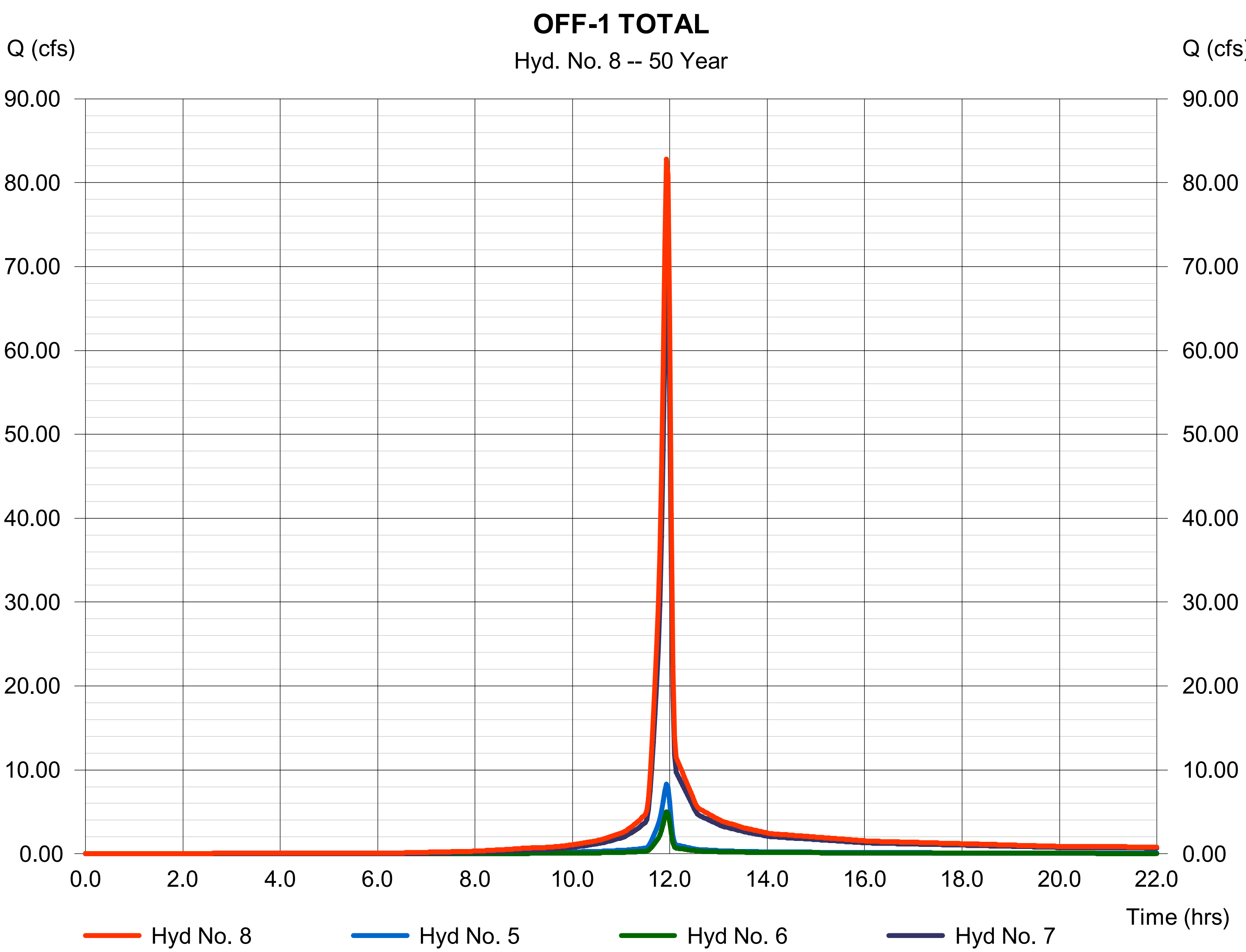
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 8

OFF-1 TOTAL

Hydrograph type	= Combine	Peak discharge	= 82.79 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 172,559 cuft
Inflow hyds.	= 5, 6, 7	Contrib. drain. area	= 11.690 ac



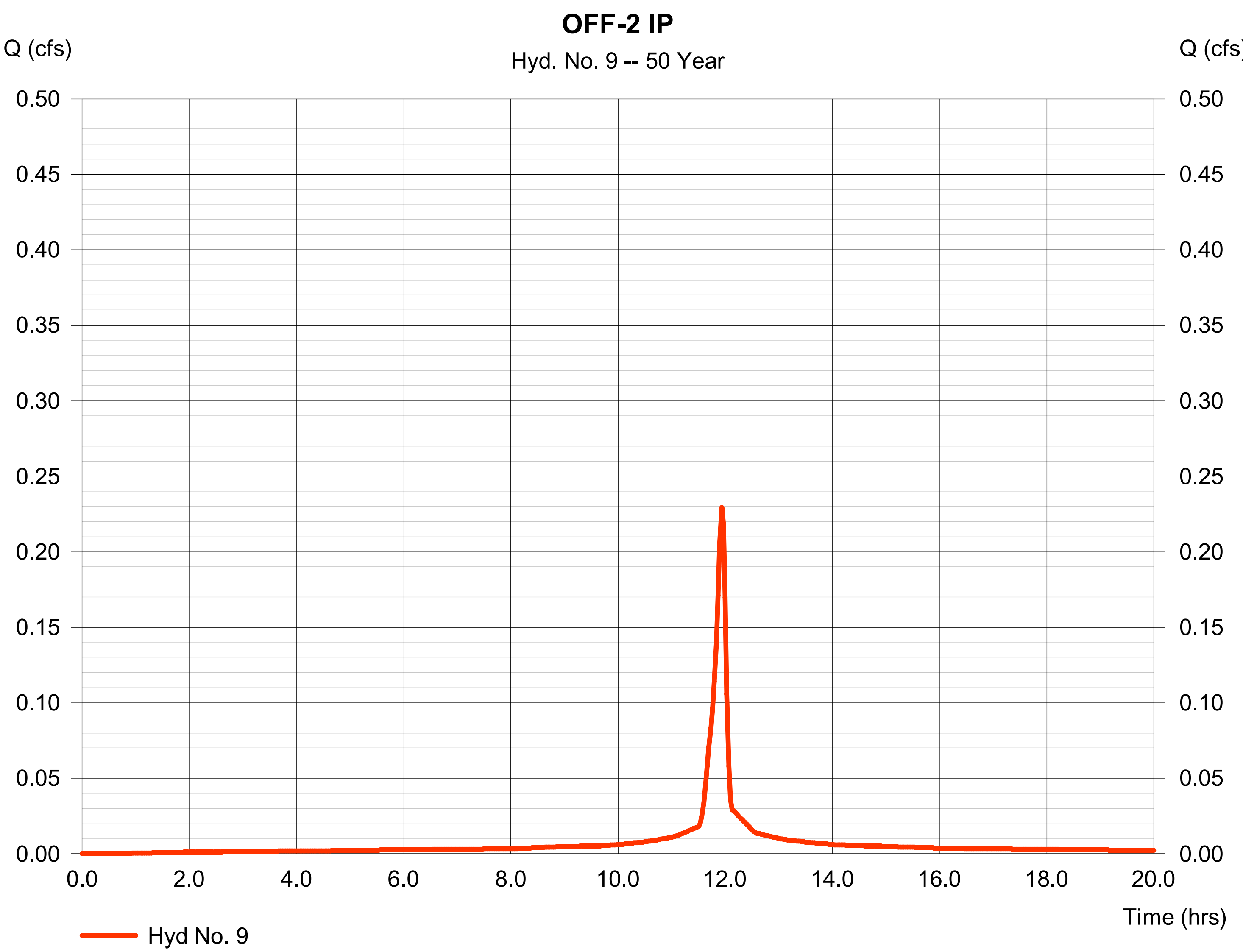
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 9

OFF-2 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.229 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 552 cuft
Drainage area	= 0.025 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



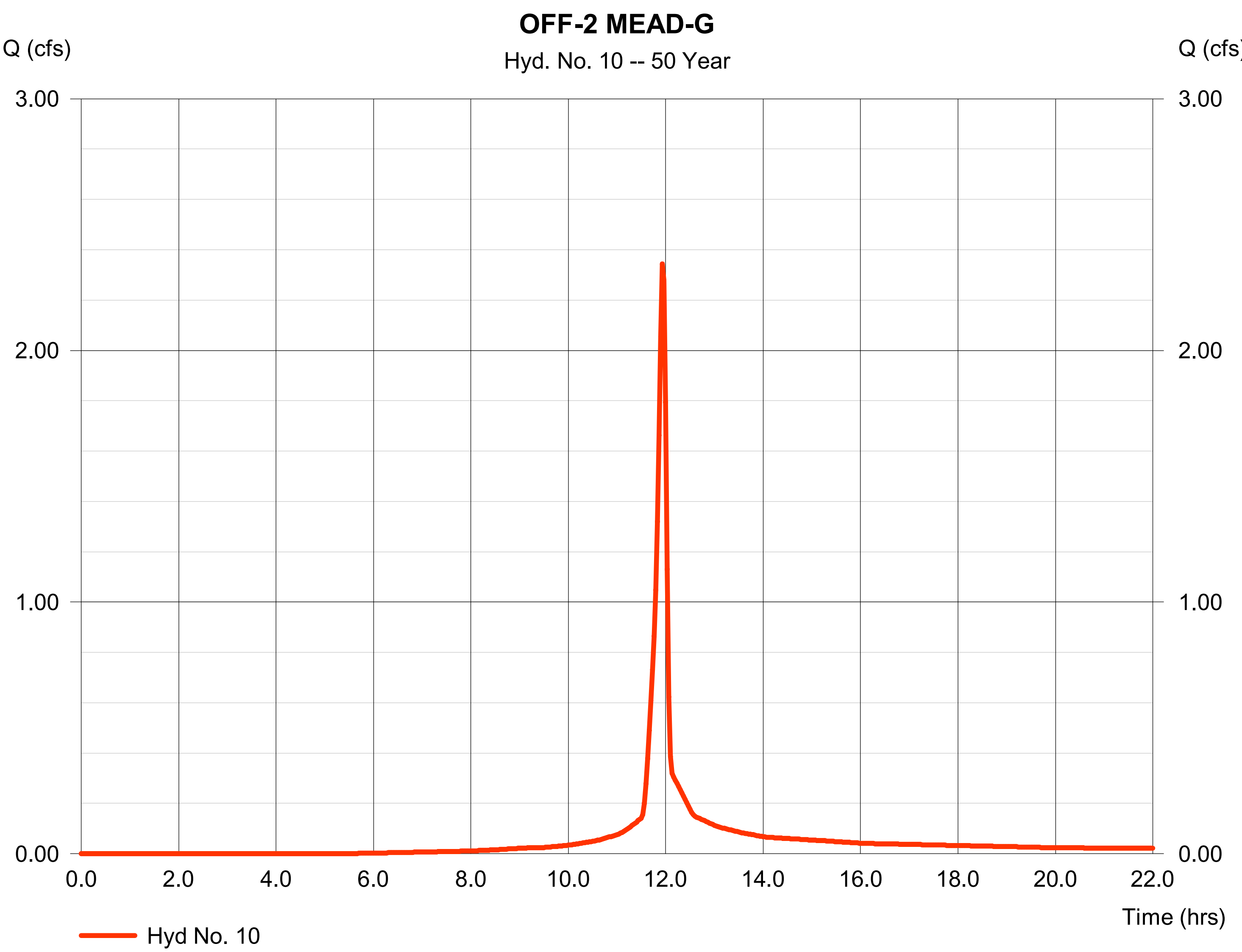
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 10

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 2.345 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 4,888 cuft
Drainage area	= 0.308 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



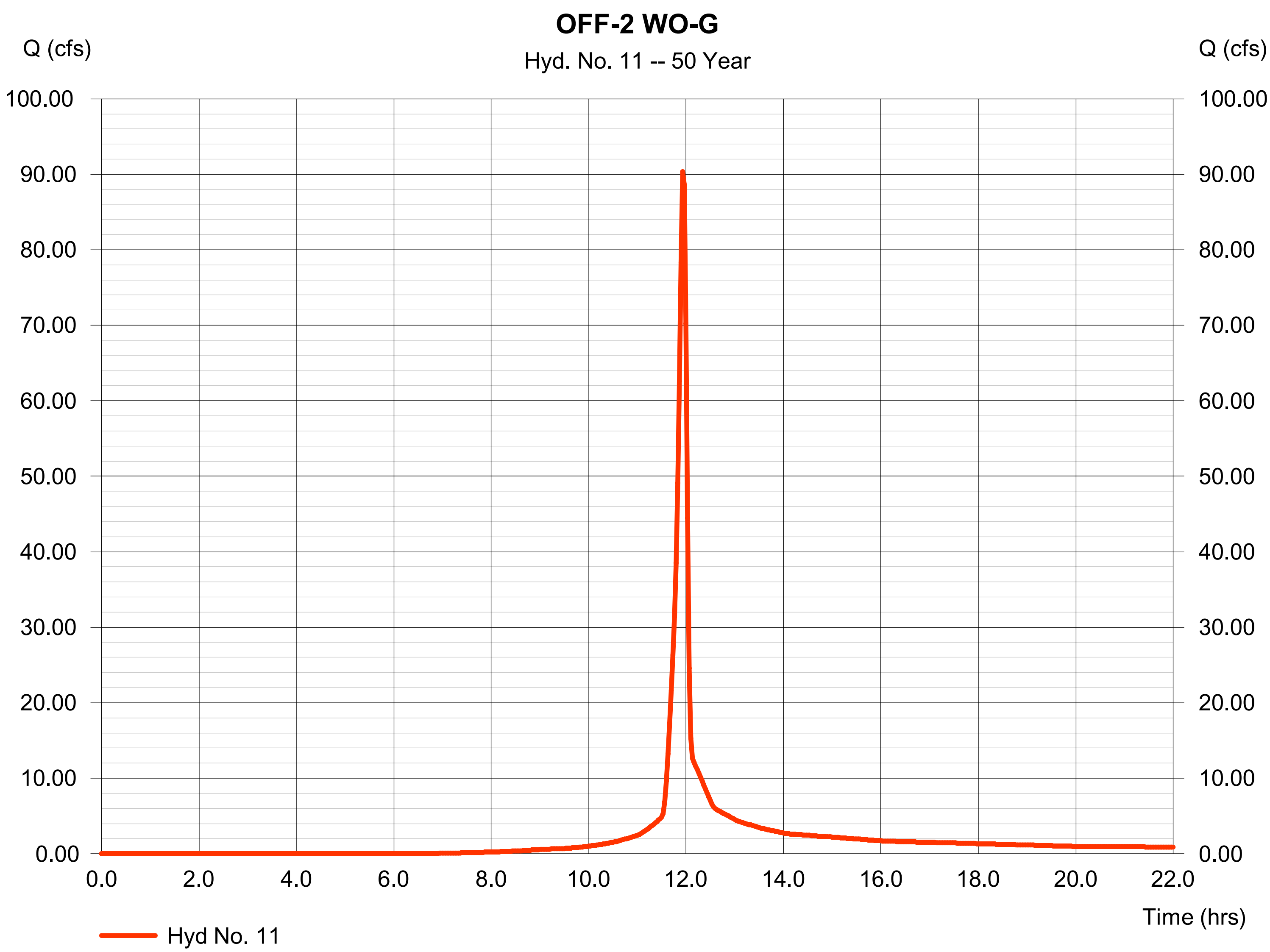
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 11

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 90.38 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 184,874 cuft
Drainage area	= 13.173 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



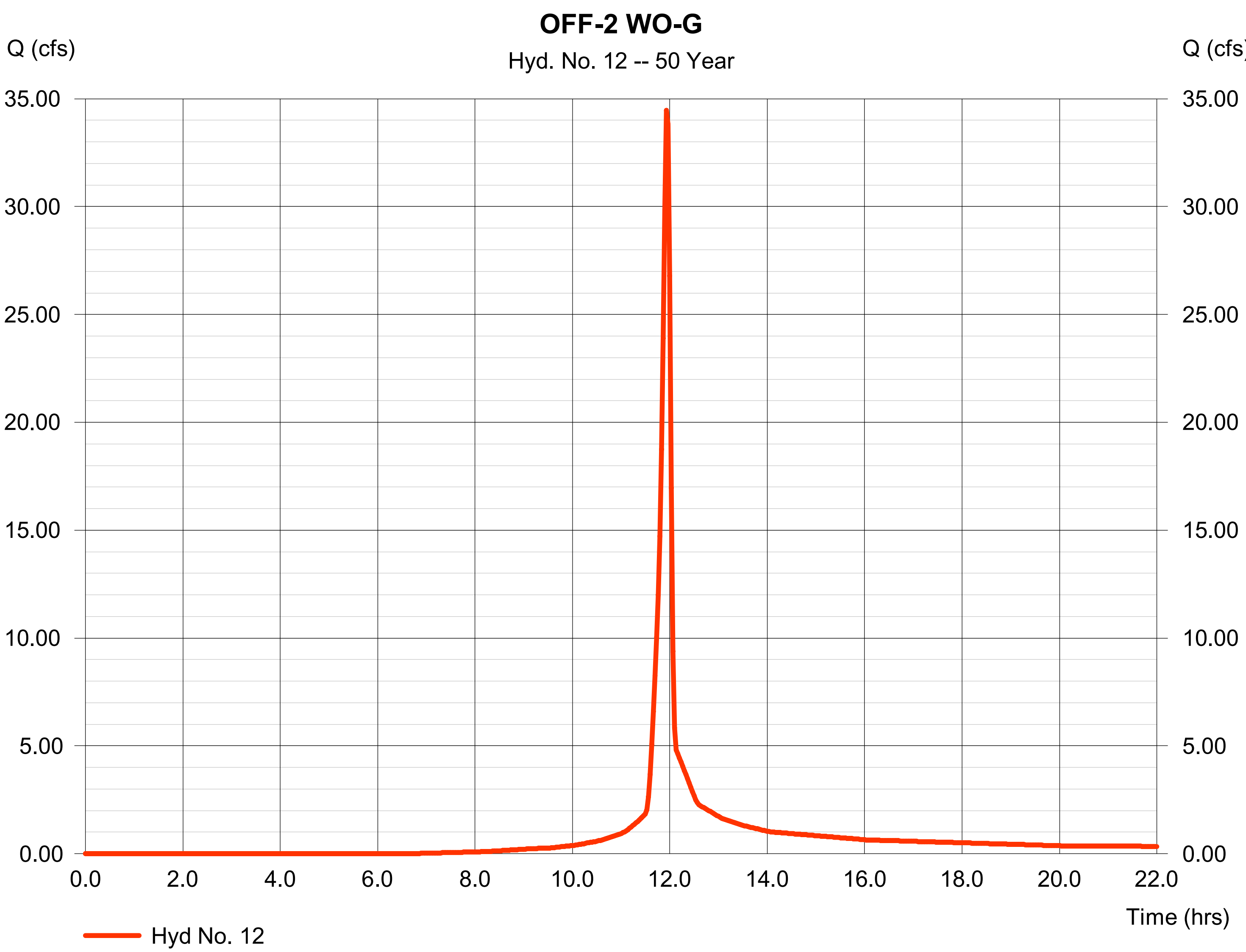
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 12

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 34.48 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 70,522 cuft
Drainage area	= 5.025 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



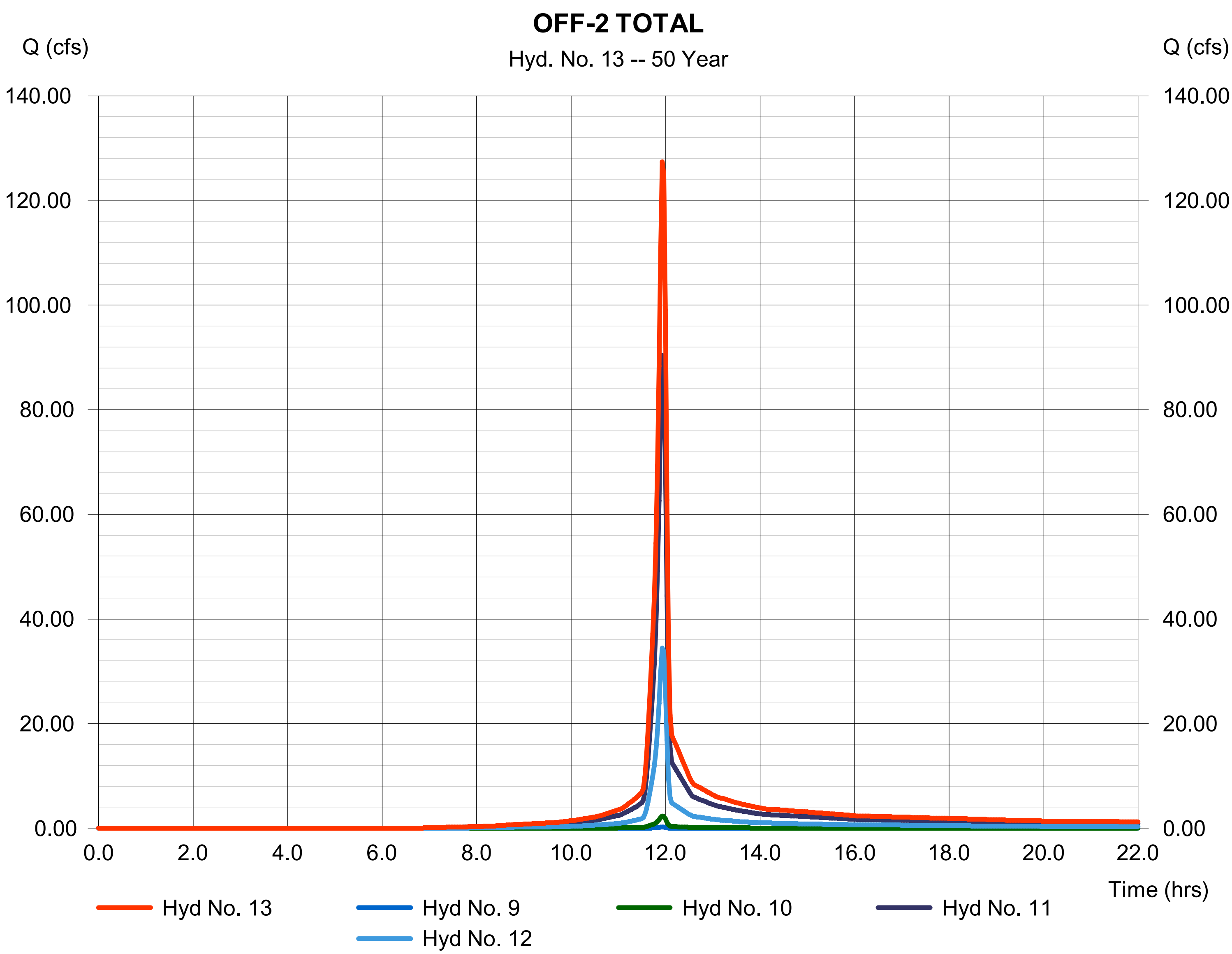
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 13

OFF-2 TOTAL

Hydrograph type	= Combine	Peak discharge	= 127.43 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 260,837 cuft
Inflow hyds.	= 9, 10, 11, 12	Contrib. drain. area	= 18.531 ac



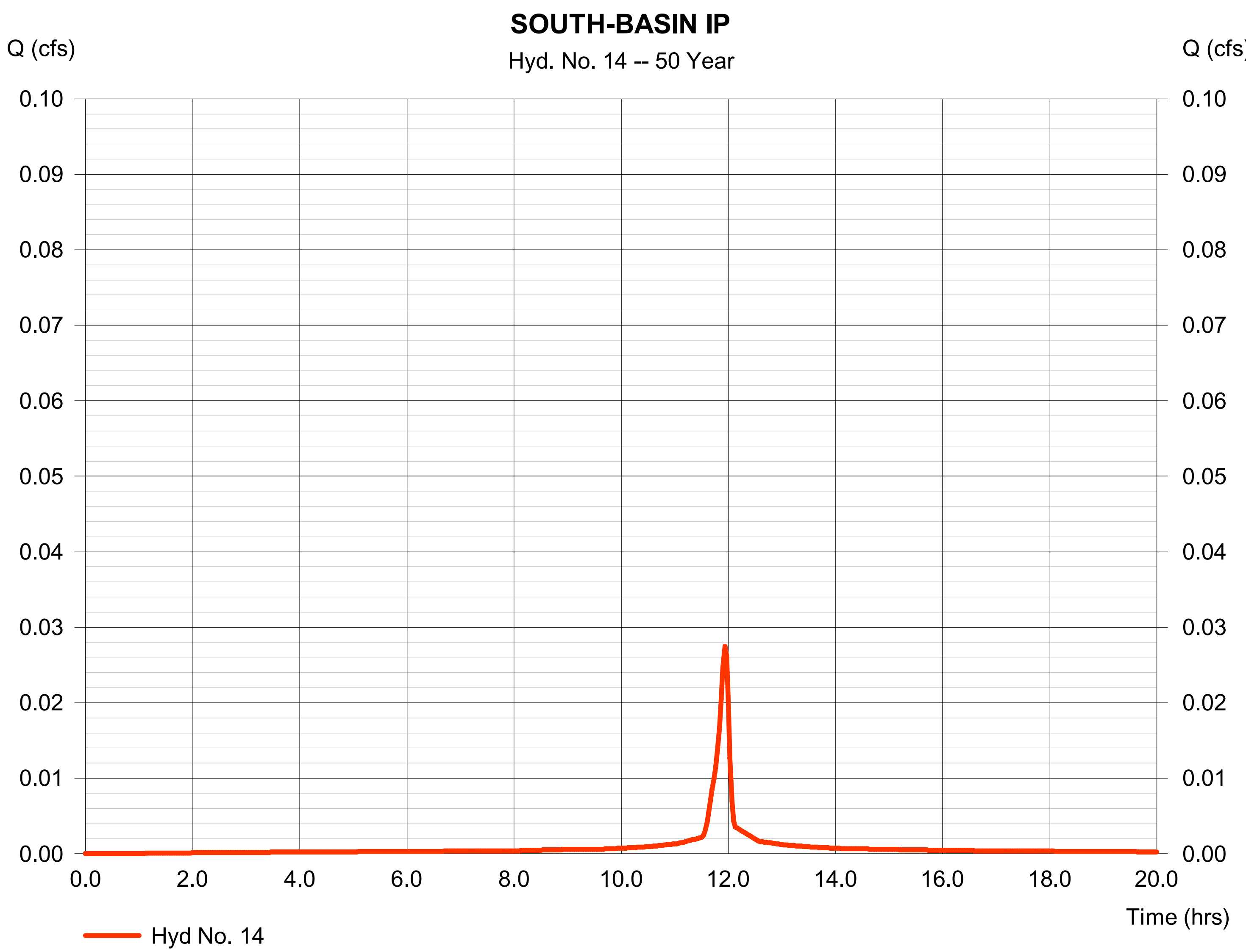
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 14

SOUTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.028 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 66 cuft
Drainage area	= 0.003 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



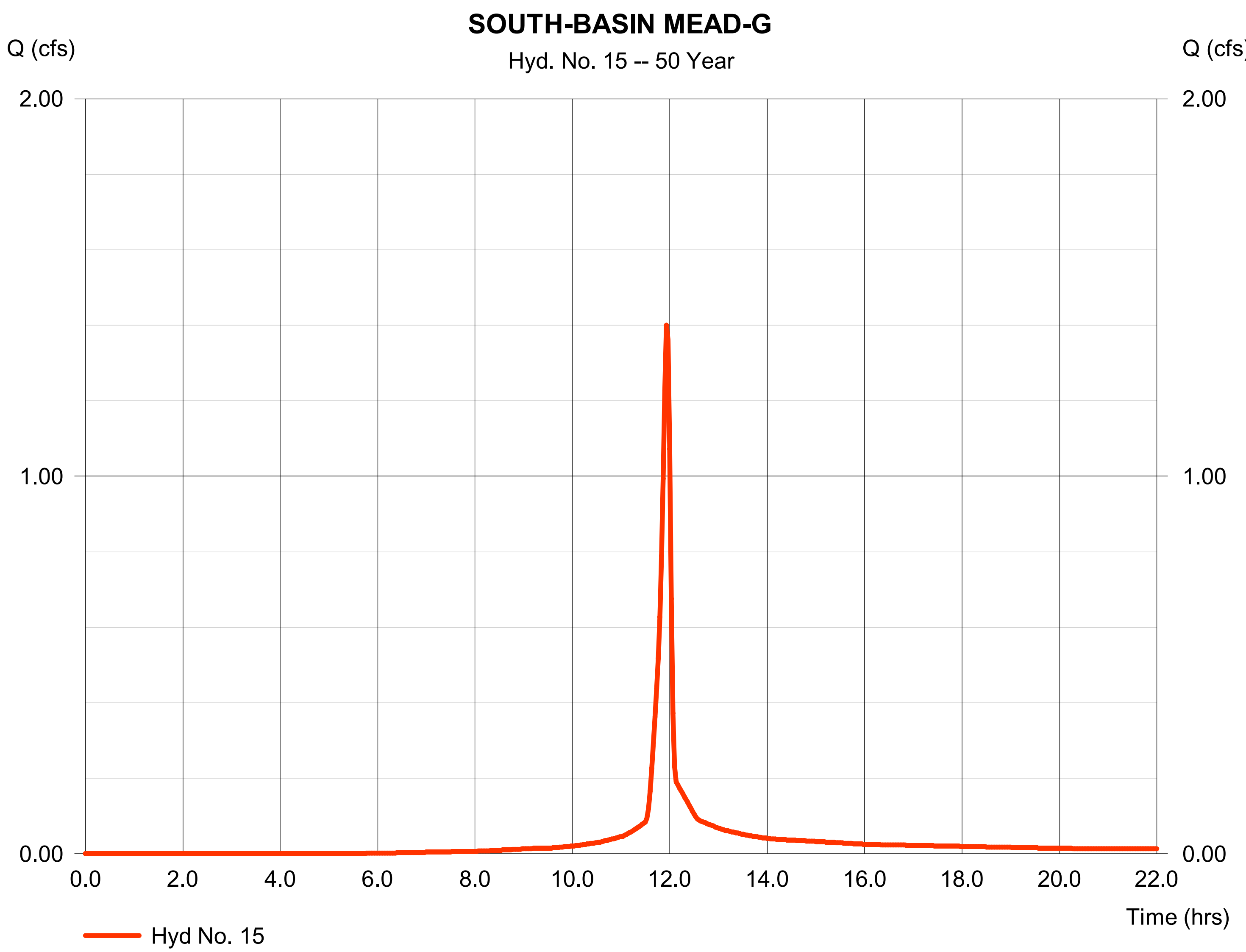
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 15

SOUTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 1.401 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,920 cuft
Drainage area	= 0.184 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



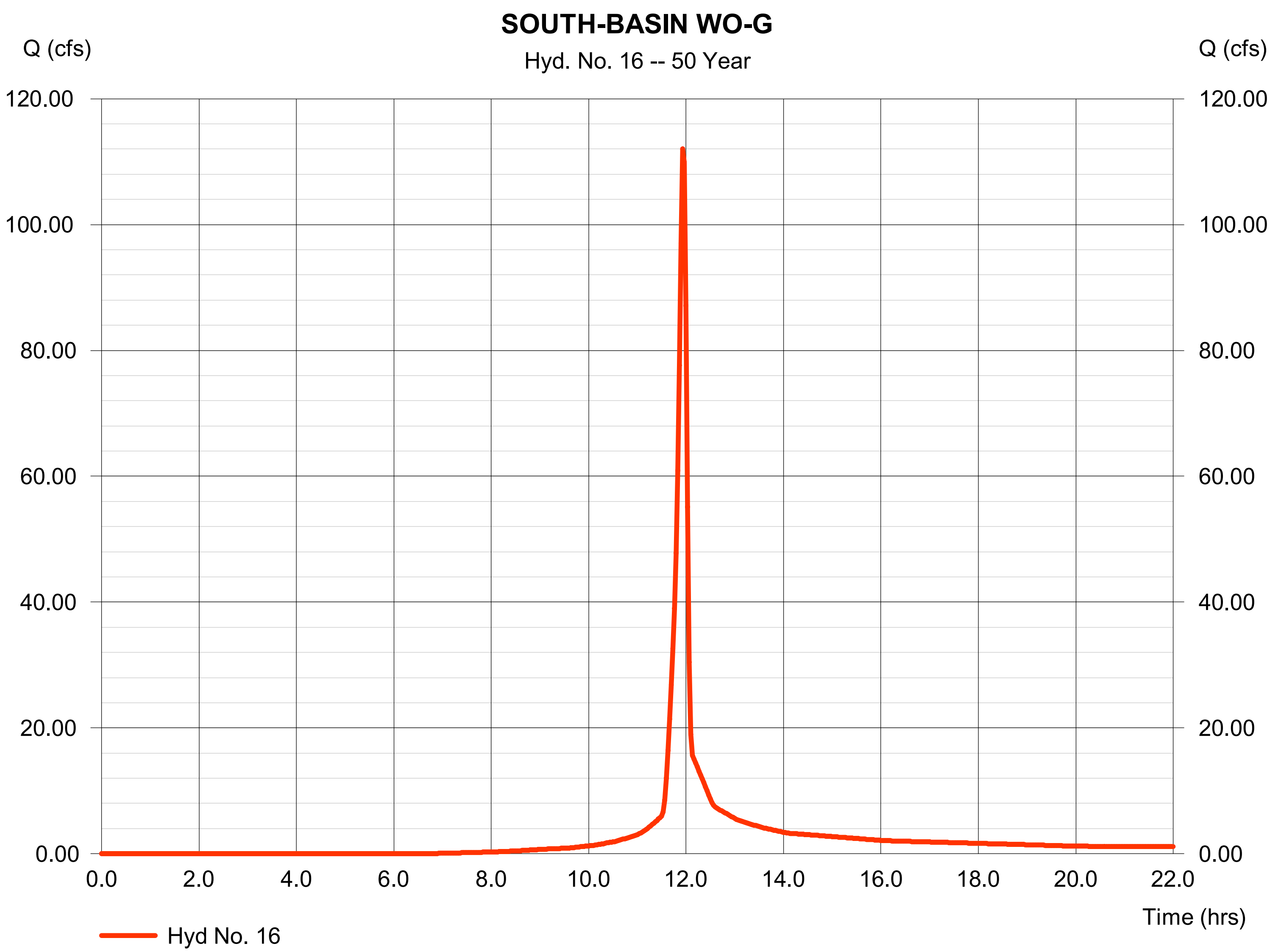
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 16

SOUTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 112.02 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 229,138 cuft
Drainage area	= 16.327 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



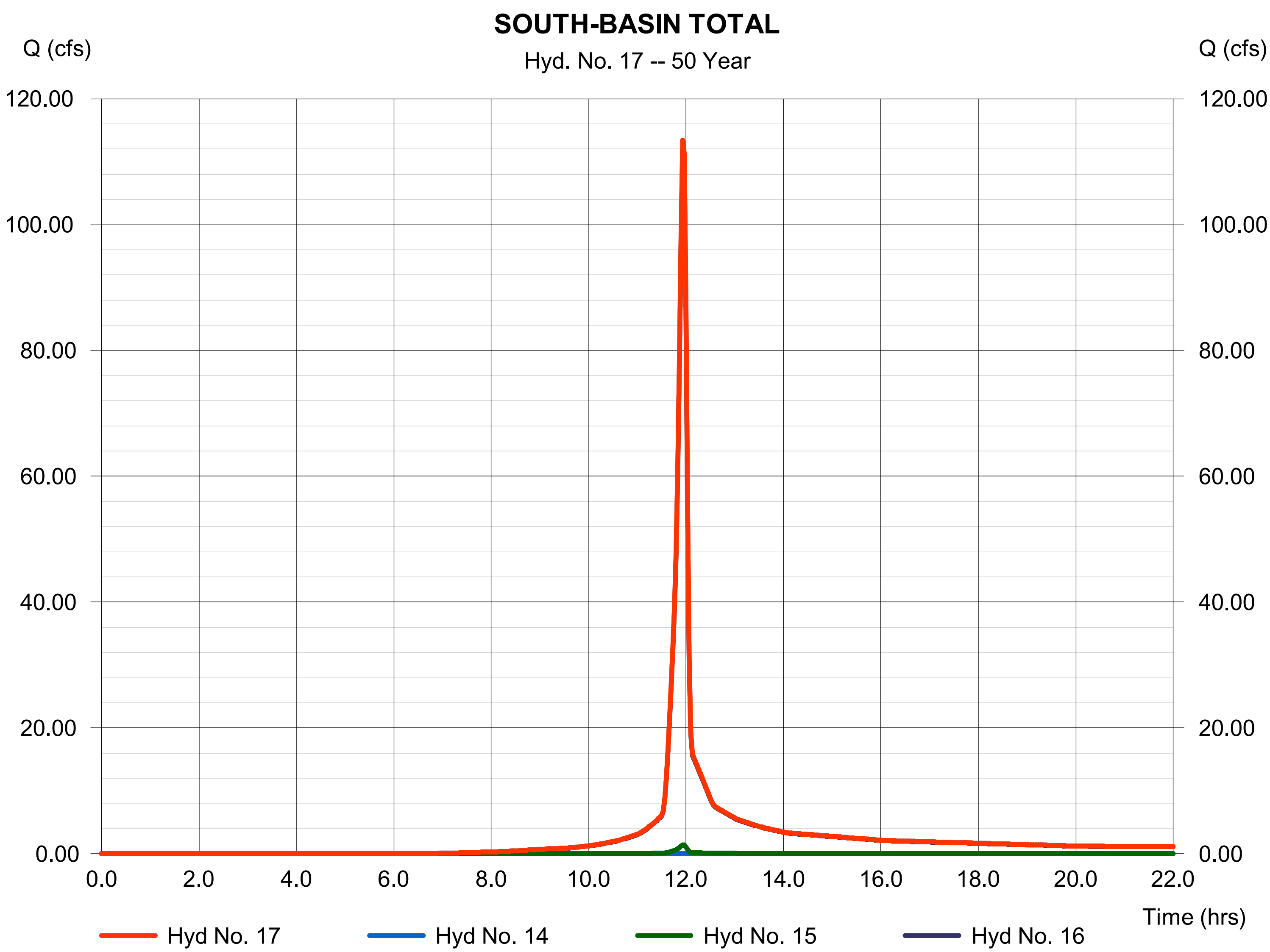
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 17

SOUTH-BASIN TOTAL

Hydrograph type	= Combine	Peak discharge	= 113.45 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 232,125 cuft
Inflow hyds.	= 14, 15, 16	Contrib. drain. area	= 16.514 ac



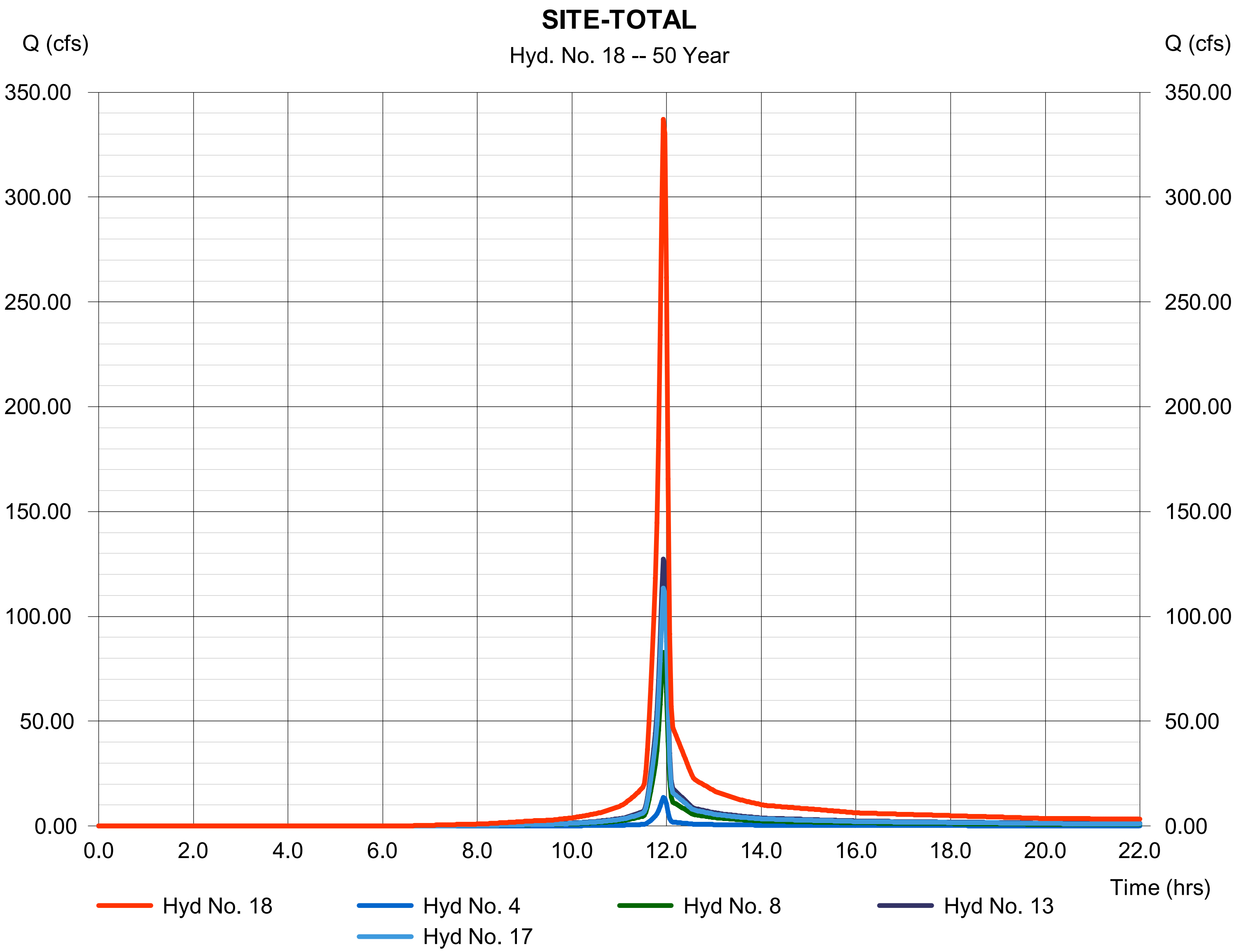
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 18

SITE-TOTAL

Hydrograph type	= Combine	Peak discharge	= 337.20 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 693,370 cuft
Inflow hyds.	= 4, 8, 13, 17	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	0.423	2	716	1,023	------	------	------	NORTH-BASIN IP
2	SCS Runoff	0.862	2	716	1,820	------	------	------	NORTH-BASIN MEAD-G
3	SCS Runoff	15.67	2	716	32,366	------	------	------	NORTH-BASIN WO-G
4	Combine	16.96	2	716	35,209	1, 2, 3	------	------	NORTH-TOTAL
5	SCS Runoff	9.820	2	716	23,772	------	------	------	OFF-1 IP
6	SCS Runoff	6.122	2	716	12,916	------	------	------	OFF-1 MEAD-G
7	SCS Runoff	87.29	2	716	180,263	------	------	------	OFF-1 WO-G
8	Combine	103.23	2	716	216,952	5, 6, 7	------	------	OFF-1 TOTAL
9	SCS Runoff	0.271	2	716	656	------	------	------	OFF-2 IP
10	SCS Runoff	2.887	2	716	6,092	------	------	------	OFF-2 MEAD-G
11	SCS Runoff	113.50	2	716	234,391	------	------	------	OFF-2 WO-G
12	SCS Runoff	43.29	2	716	89,411	------	------	------	OFF-2 WO-G
13	Combine	159.95	2	716	330,550	9, 10, 11, 12	------	------	OFF-2 TOTAL
14	SCS Runoff	0.033	2	716	79	------	------	------	SOUTH-BASIN IP
15	SCS Runoff	1.725	2	716	3,640	------	------	------	SOUTH-BASIN MEAD-G
16	SCS Runoff	140.67	2	716	290,510	------	------	------	SOUTH-BASIN WO-G
17	Combine	142.43	2	716	294,229	14, 15, 16	------	------	SOUTH-BASIN TOTAL
18	Combine	422.56	2	716	876,939	4, 8, 13, 17	------	------	SITE-TOTAL

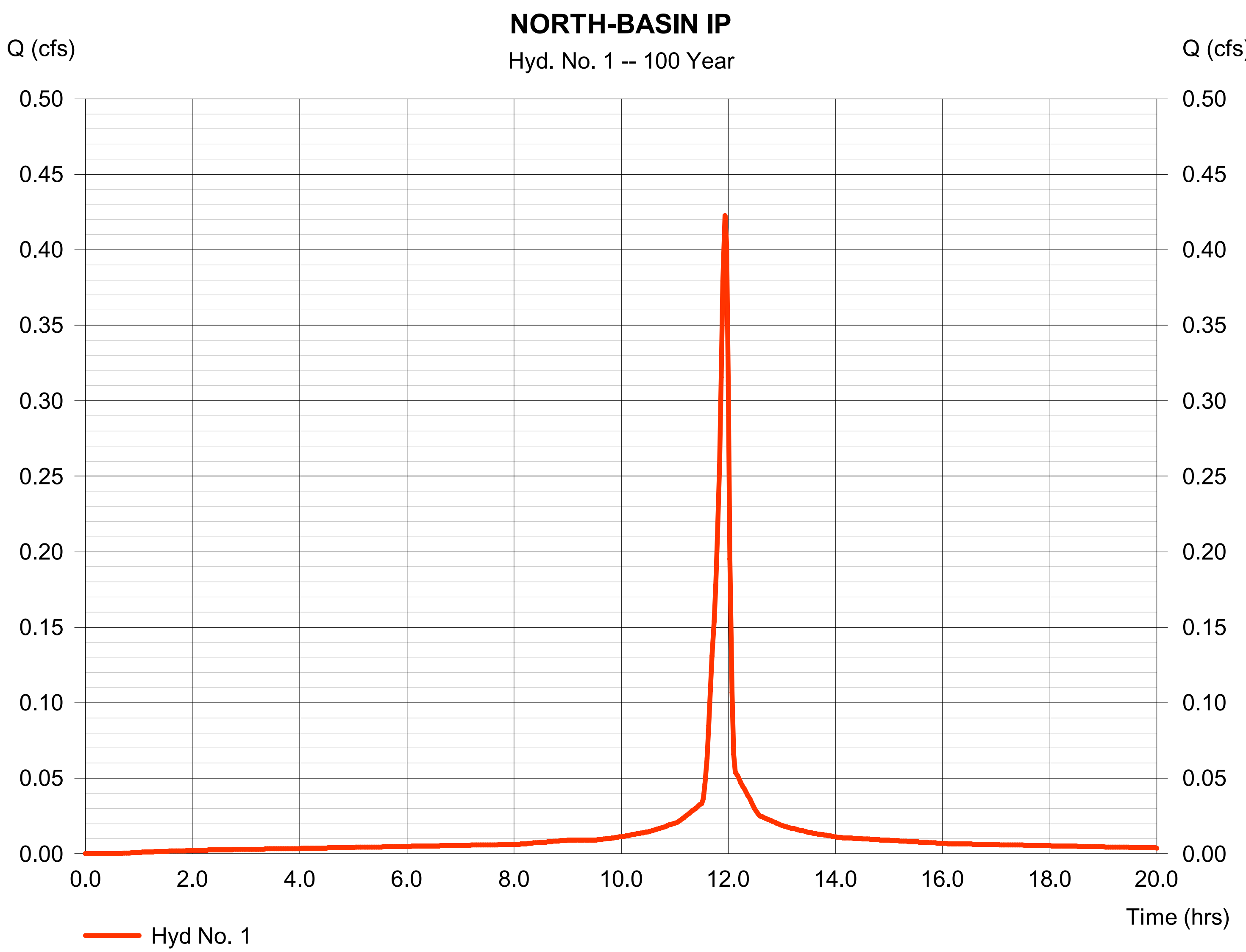
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 1

NORTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.423 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,023 cuft
Drainage area	= 0.039 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



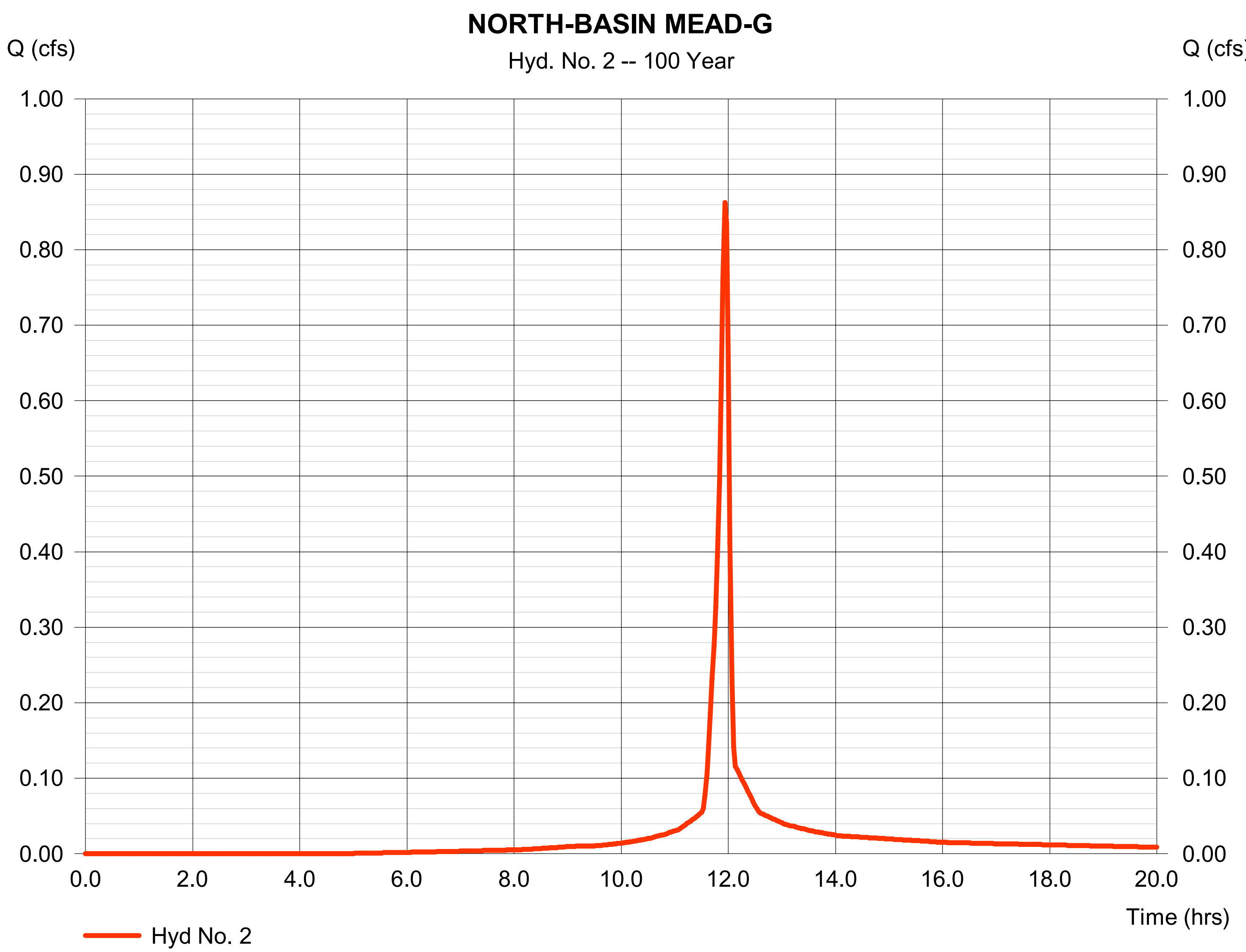
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 2

NORTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.862 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,820 cuft
Drainage area	= 0.092 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



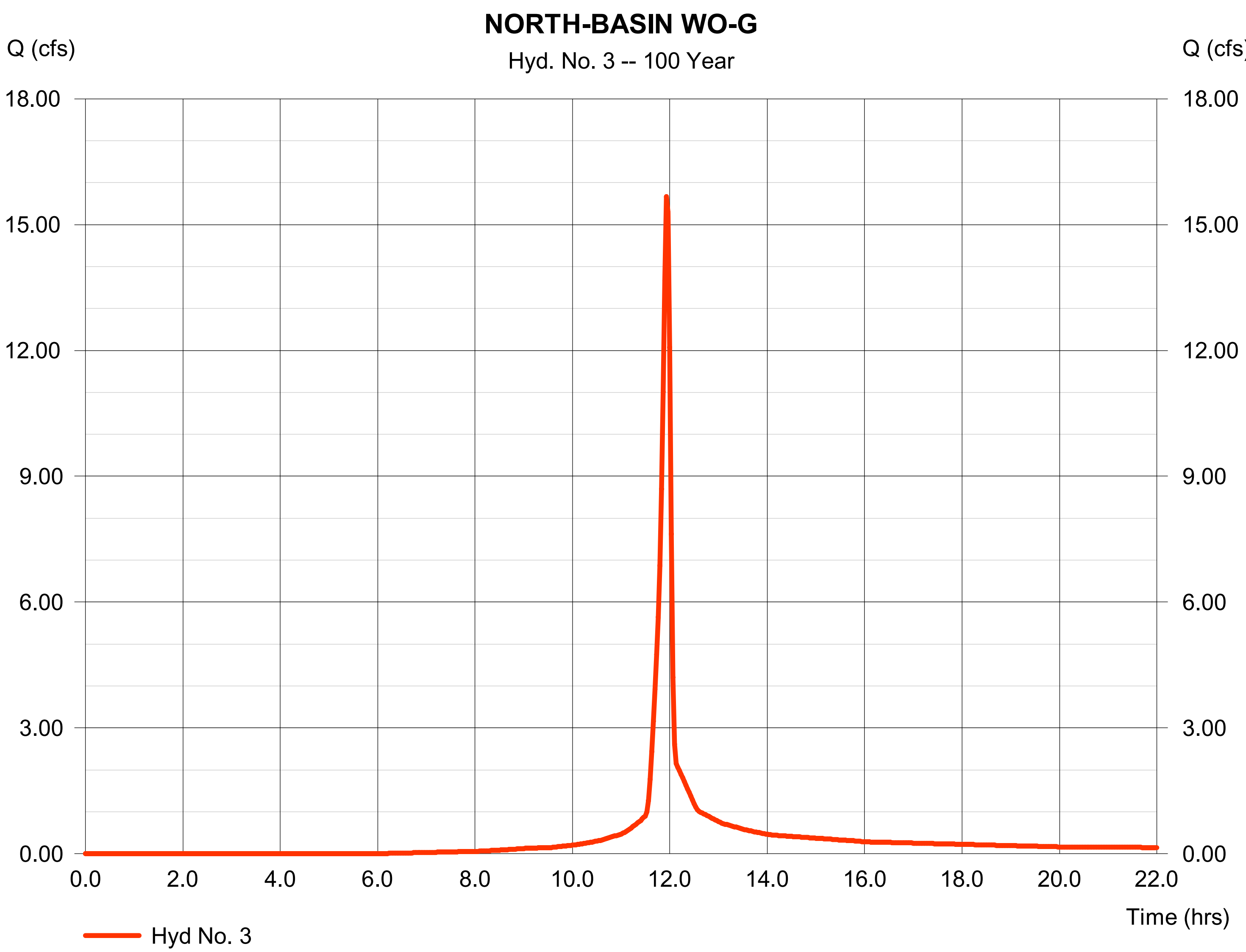
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 3

NORTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 15.67 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 32,366 cuft
Drainage area	= 1.819 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



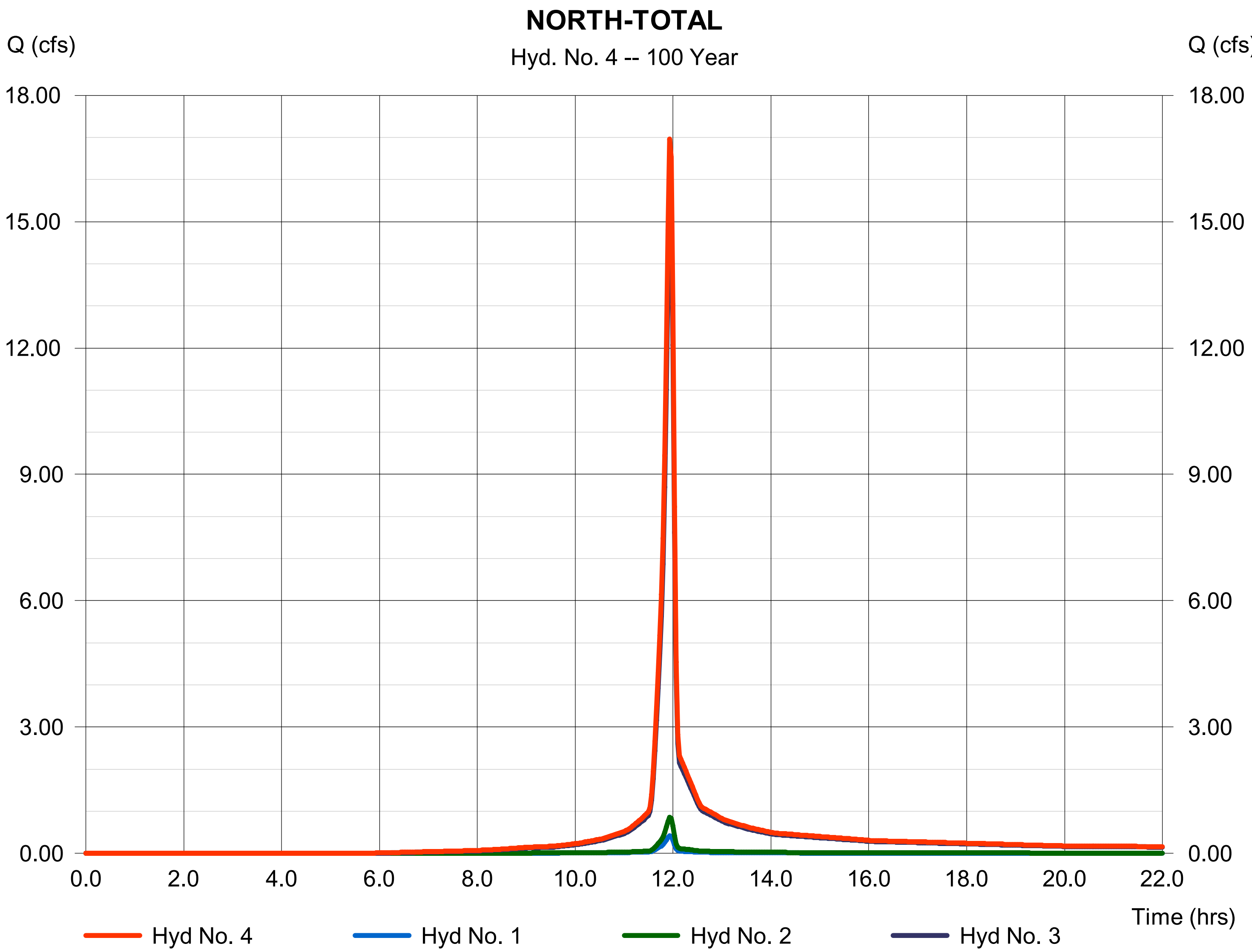
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 4

NORTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 16.96 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 35,209 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 1.950 ac



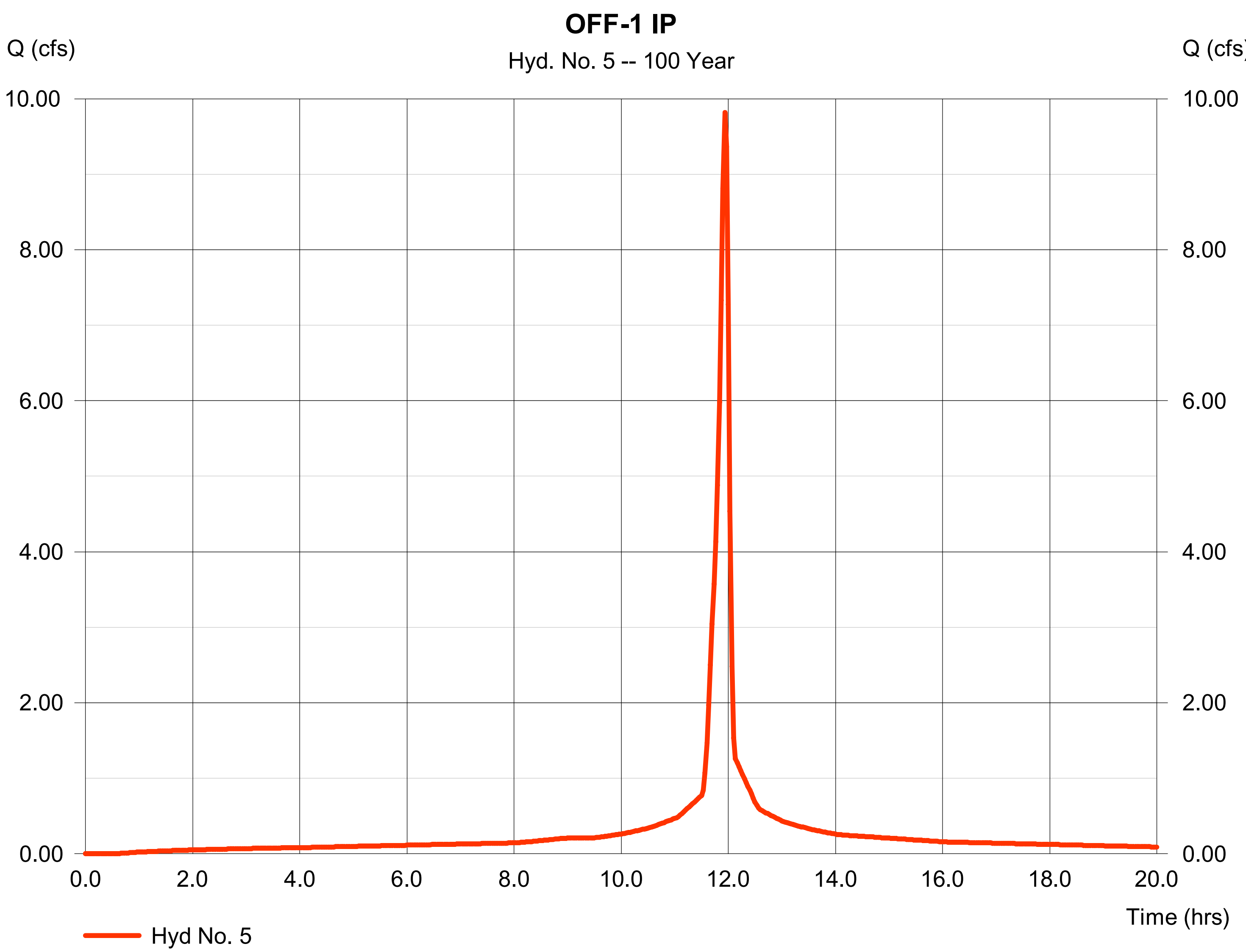
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 5

OFF-1 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 9.820 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 23,772 cuft
Drainage area	= 0.906 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



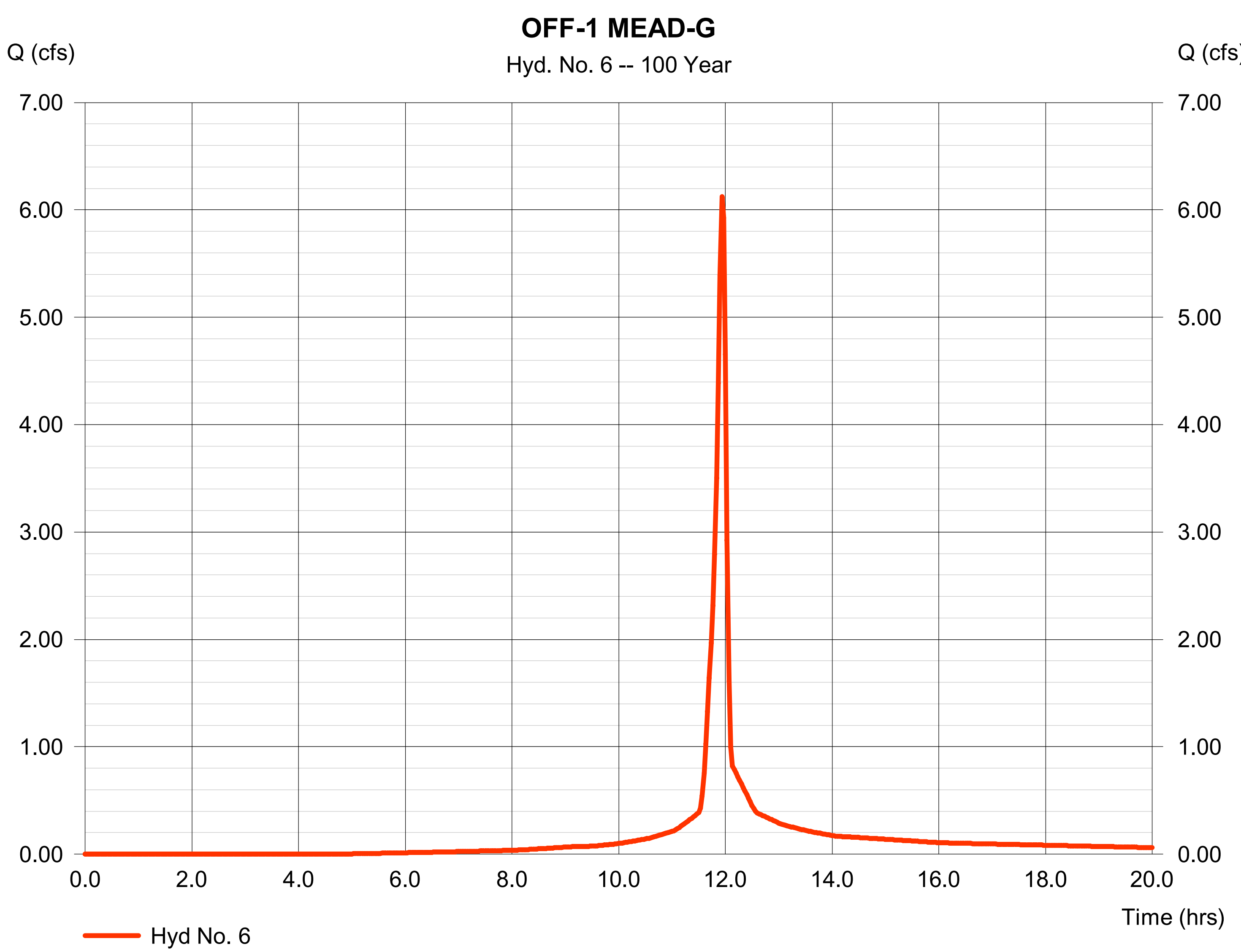
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 6

OFF-1 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 6.122 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 12,916 cuft
Drainage area	= 0.653 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



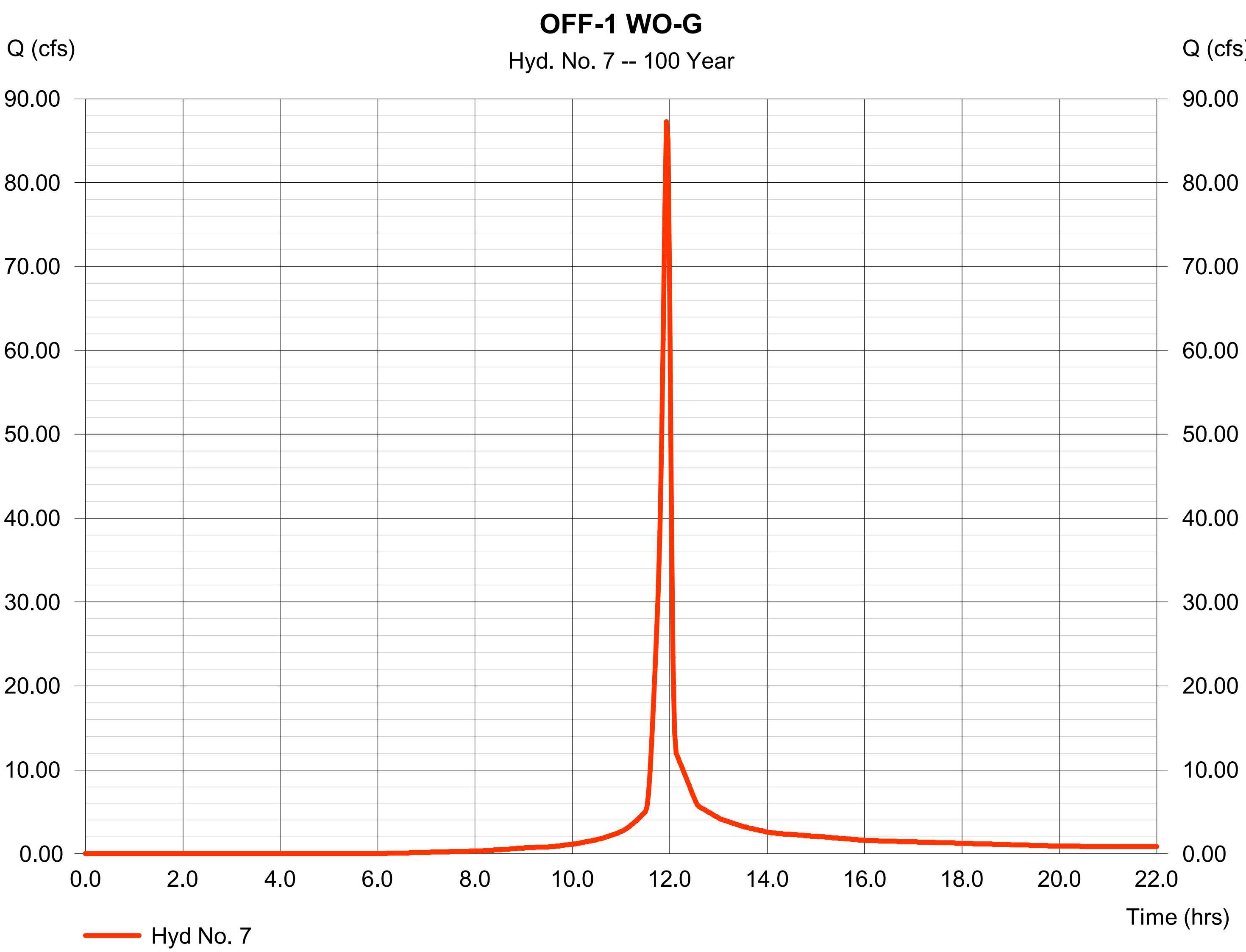
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 7

OFF-1 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 87.29 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 180,263 cuft
Drainage area	= 10.131 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



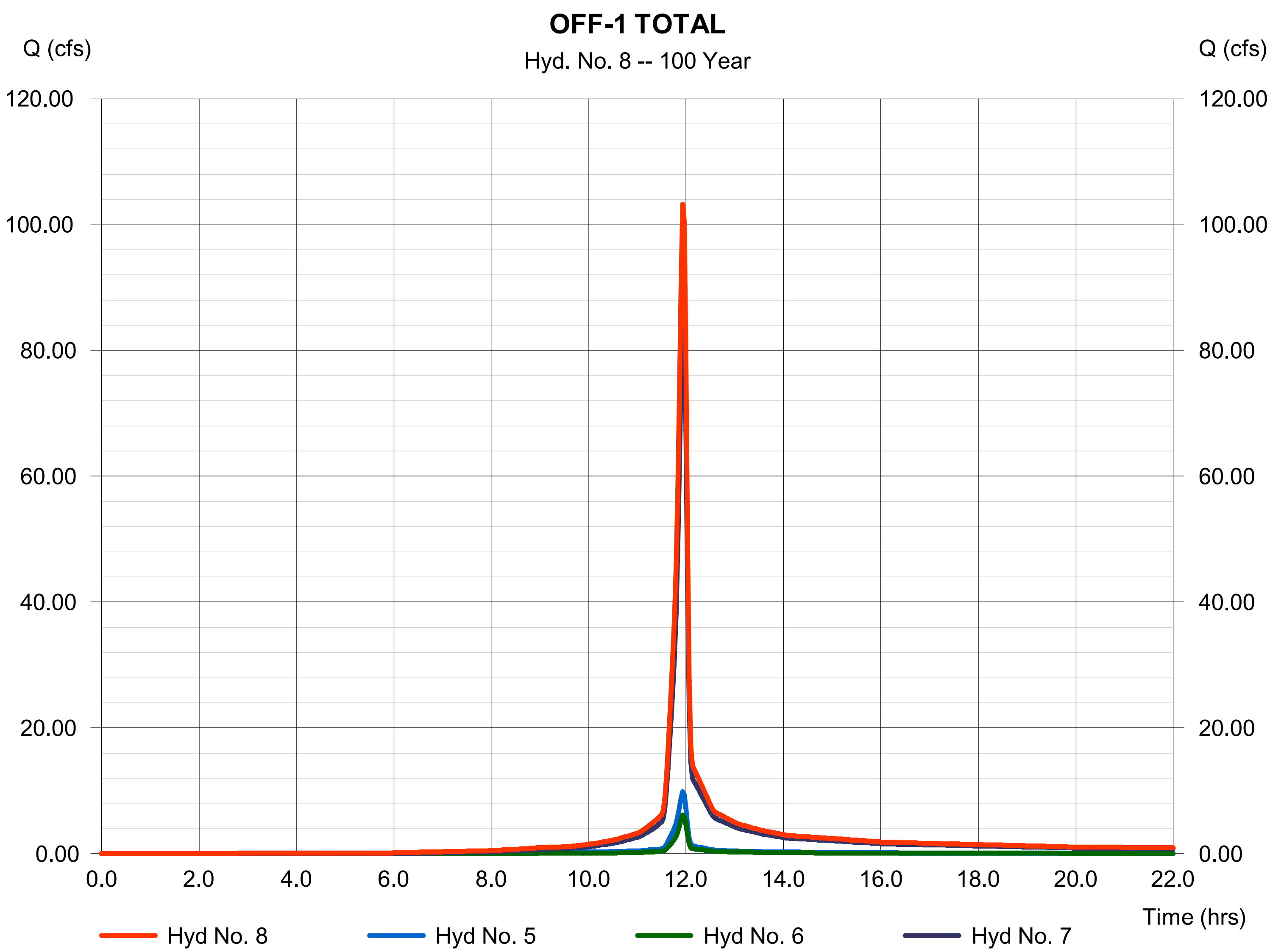
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 8

OFF-1 TOTAL

Hydrograph type	= Combine	Peak discharge	= 103.23 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 216,952 cuft
Inflow hyds.	= 5, 6, 7	Contrib. drain. area	= 11.690 ac



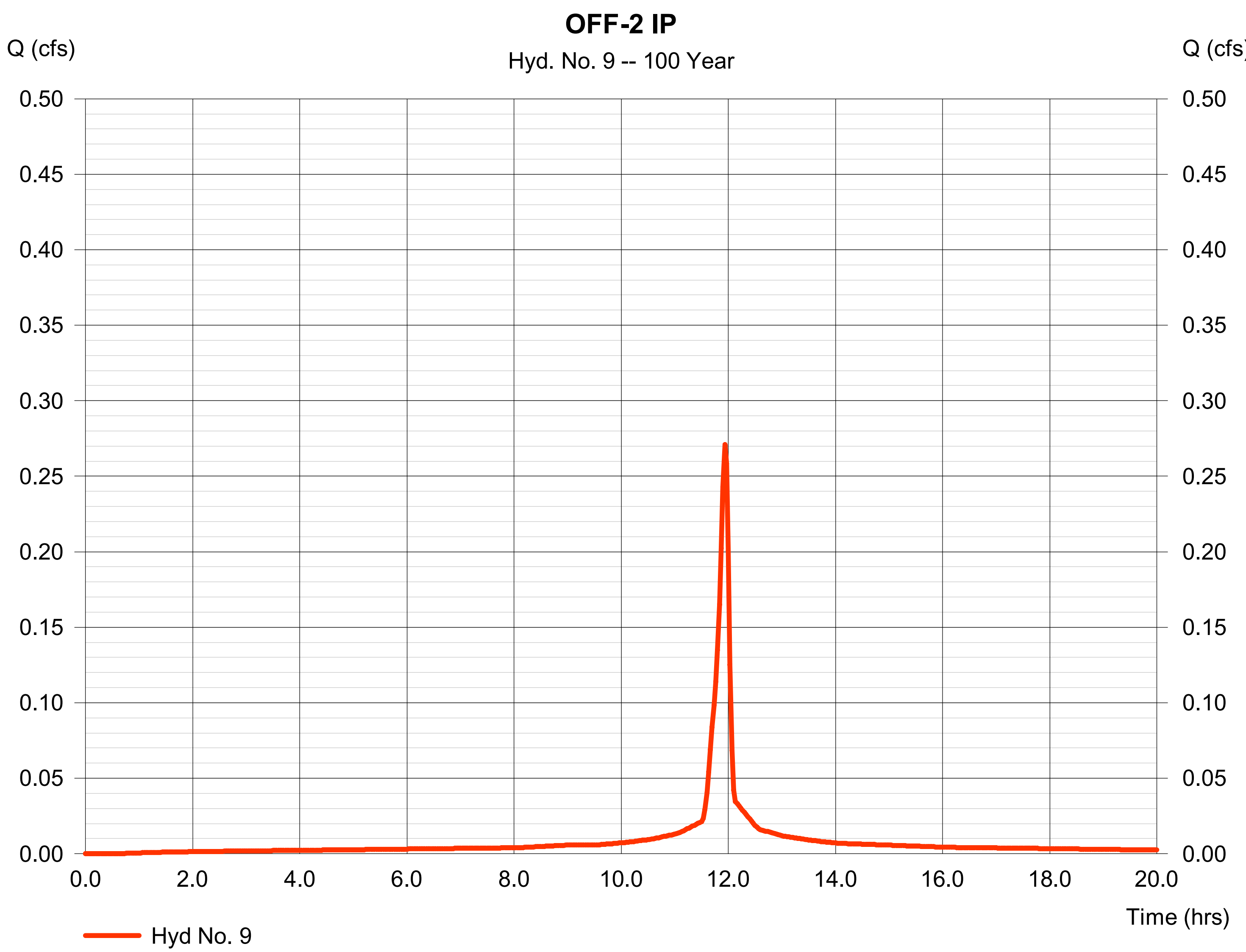
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 9

OFF-2 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.271 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 656 cuft
Drainage area	= 0.025 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



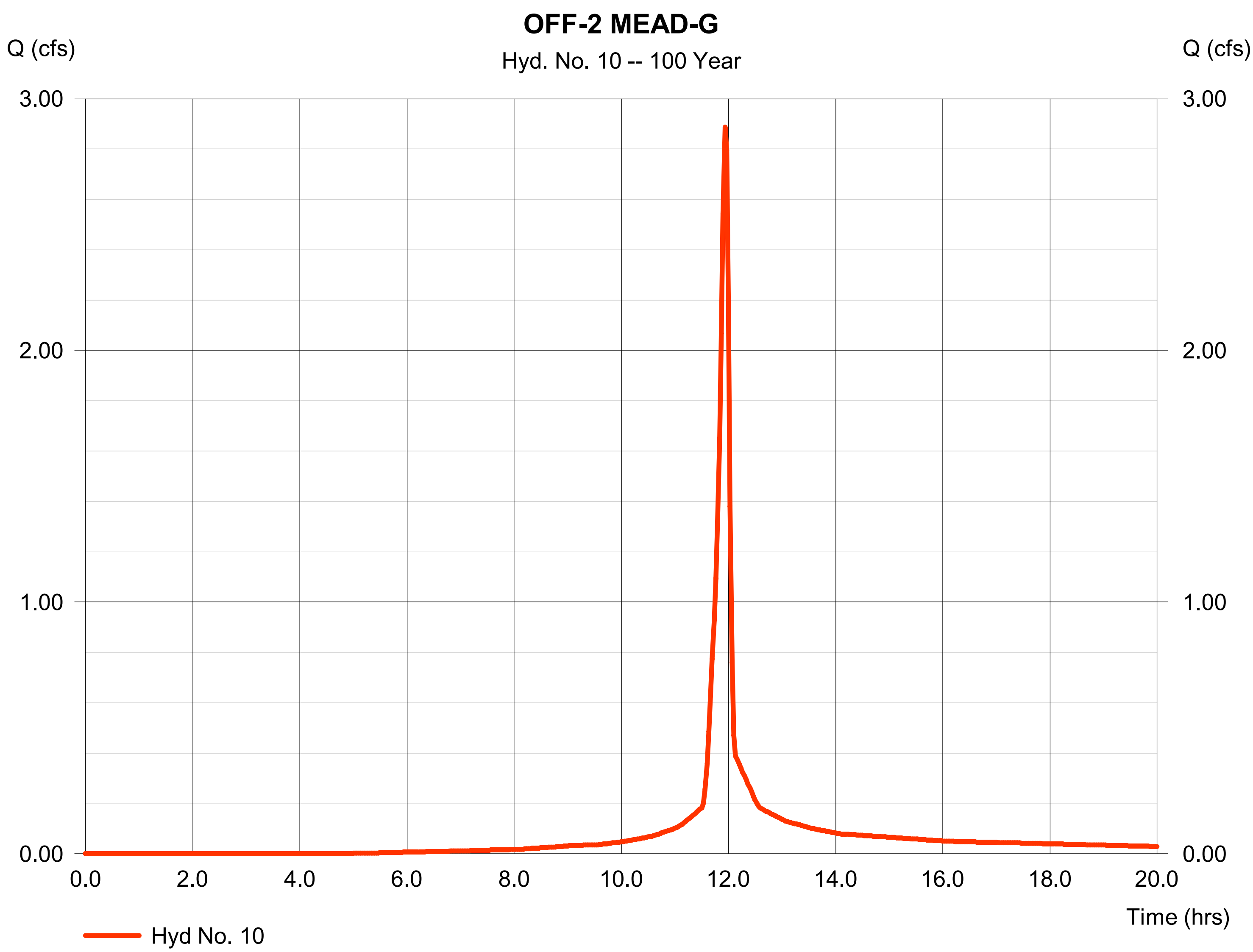
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Tuesday, 10 / 15 / 2019

Hyd. No. 10

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 2.887 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 6,092 cuft
Drainage area	= 0.308 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



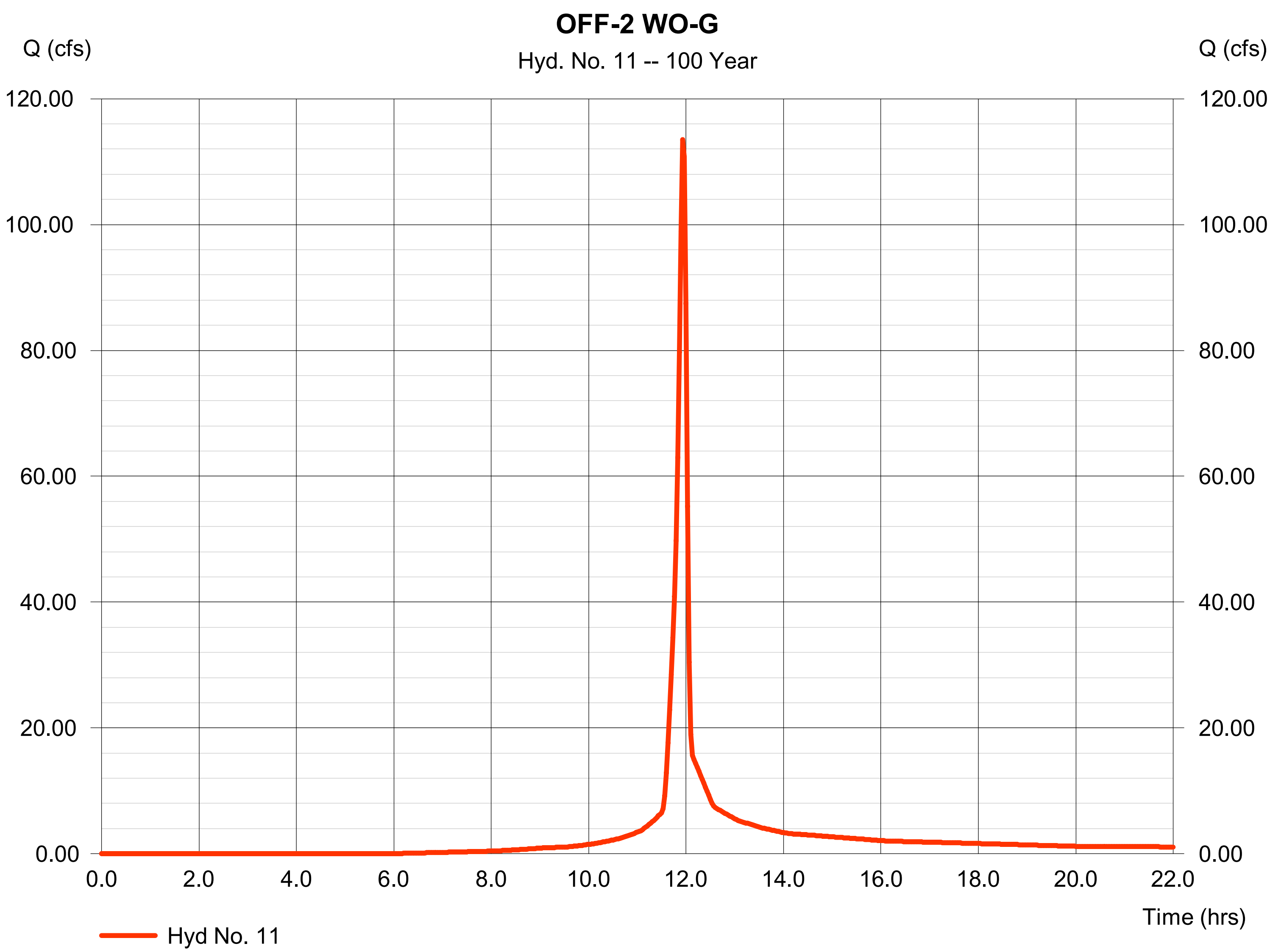
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 11

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 113.50 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 234,391 cuft
Drainage area	= 13.173 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



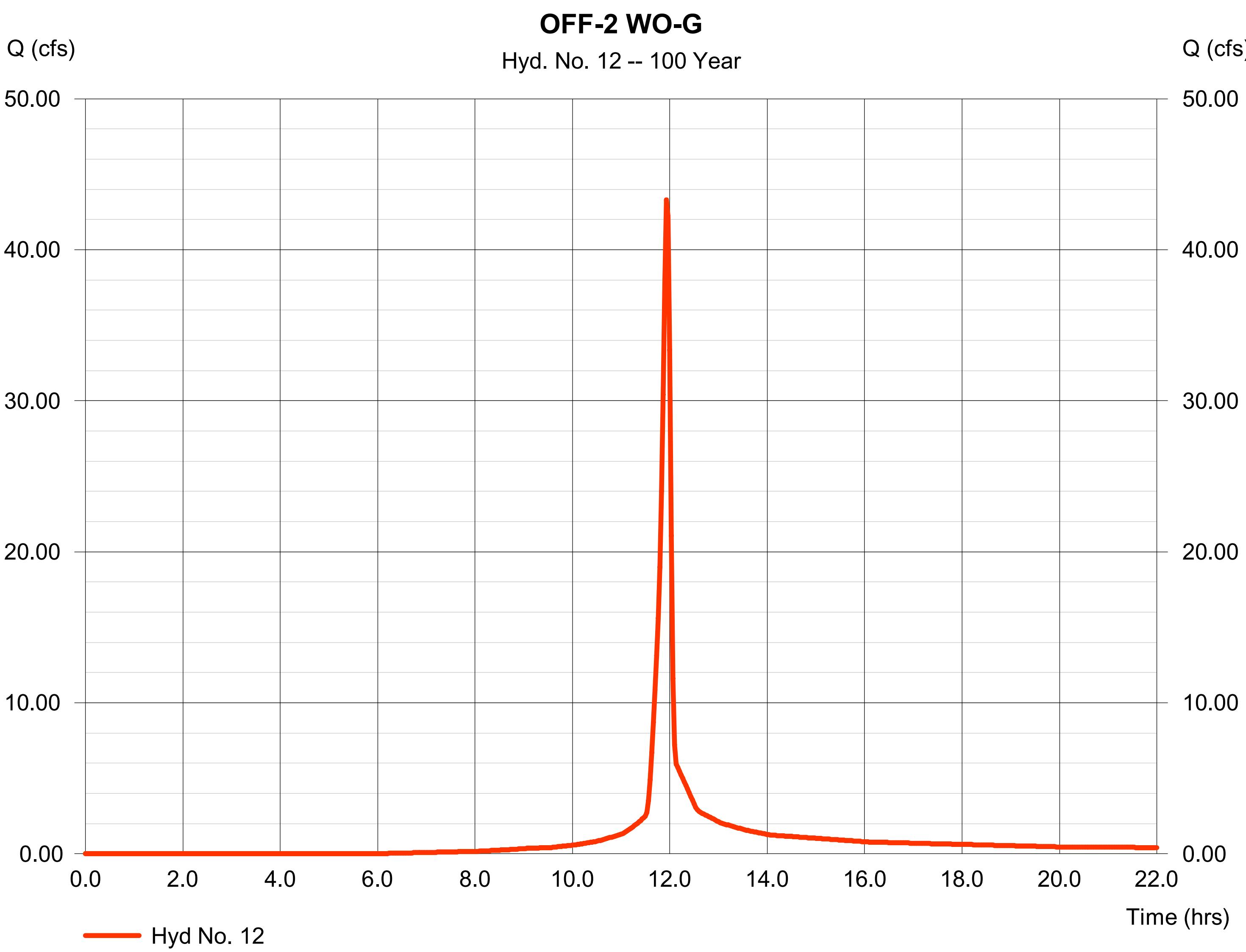
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 12

OFF-2 WO-G

Hydrograph type	=	SCS Runoff	Peak discharge	=	43.29 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	89,411 cuft
Drainage area	=	5.025 ac	Curve number	=	77
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.95 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



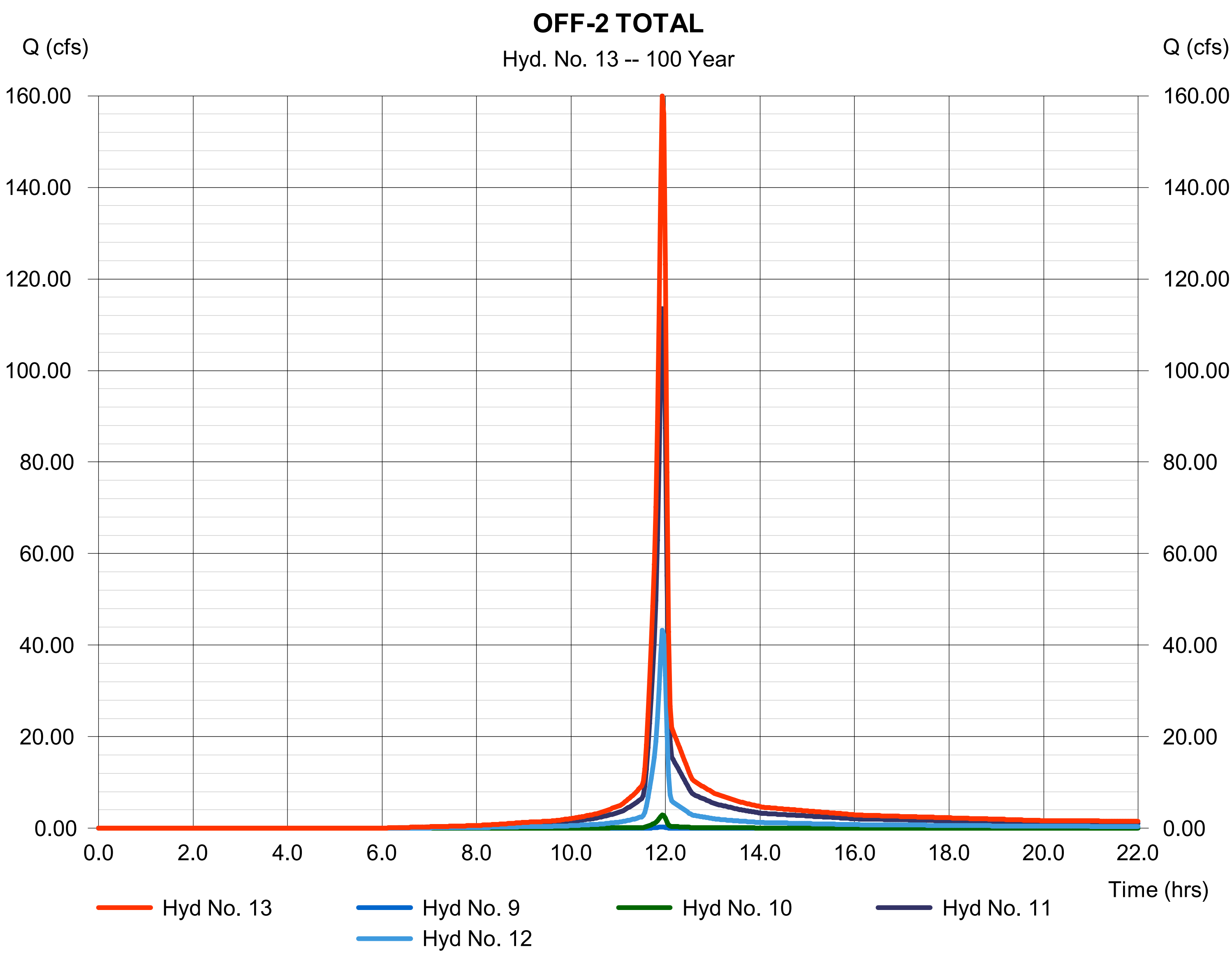
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 13

OFF-2 TOTAL

Hydrograph type	= Combine	Peak discharge	= 159.95 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 330,550 cuft
Inflow hyds.	= 9, 10, 11, 12	Contrib. drain. area	= 18.531 ac



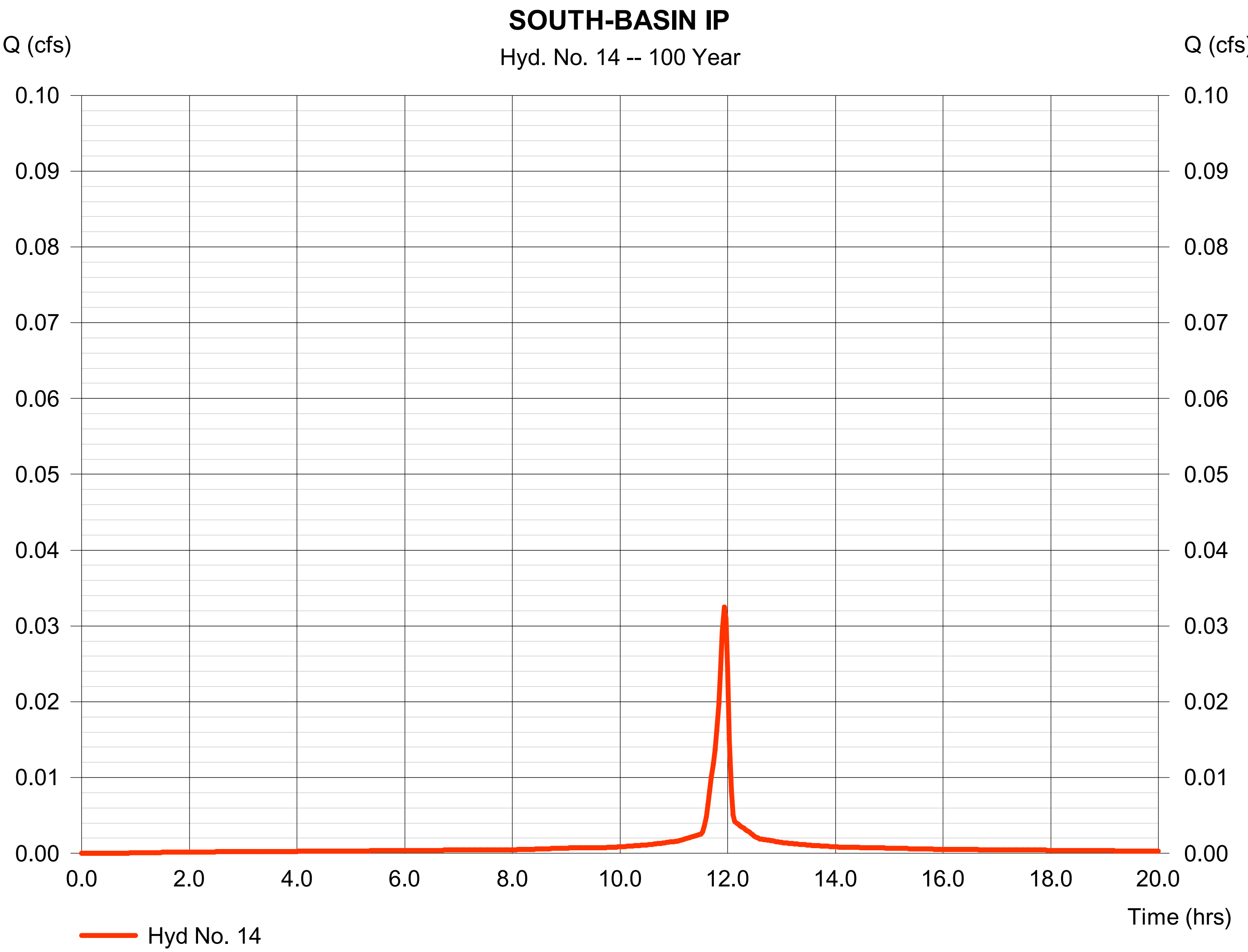
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 14

SOUTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 0.033 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 79 cuft
Drainage area	= 0.003 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



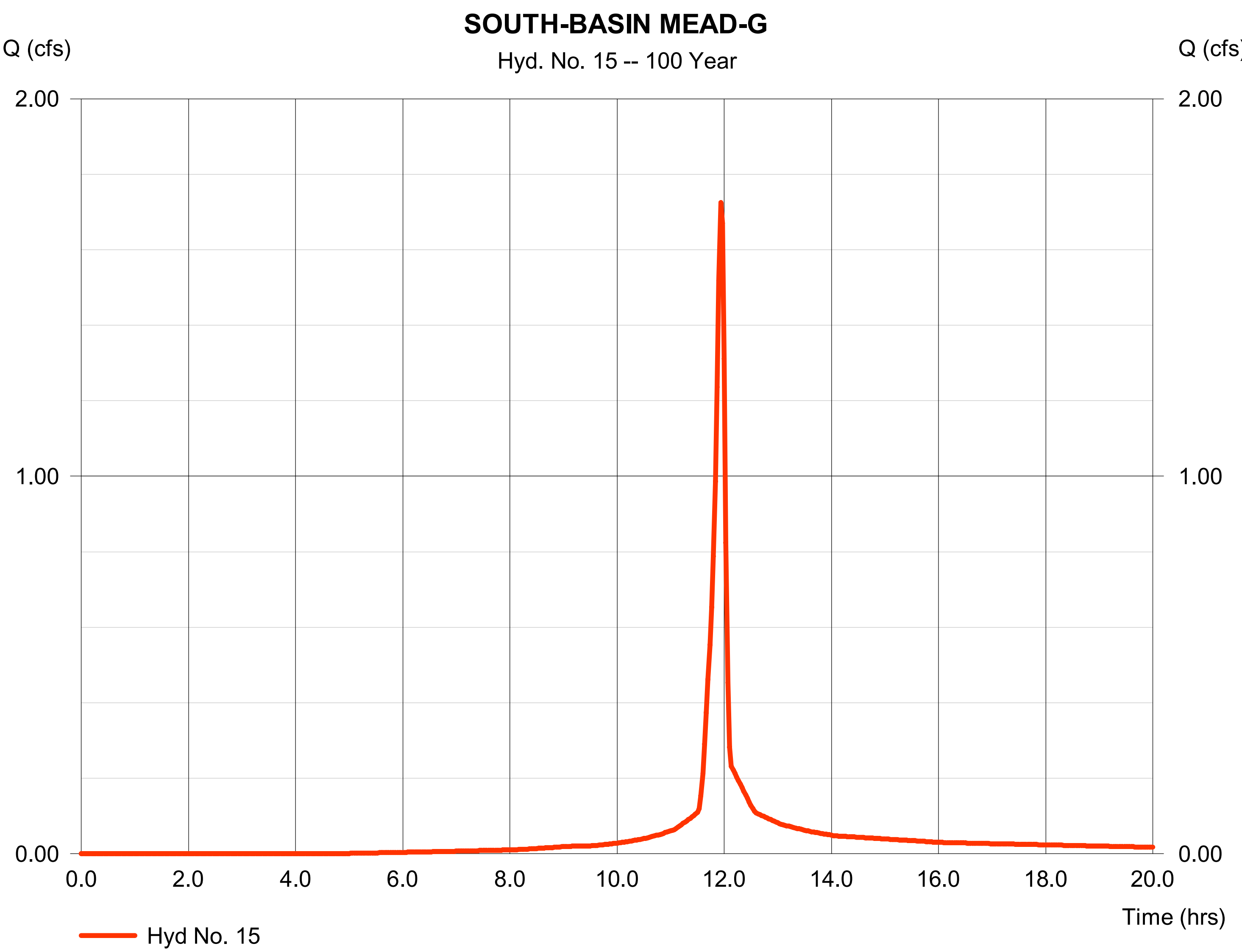
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 15

SOUTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 1.725 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 3,640 cuft
Drainage area	= 0.184 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



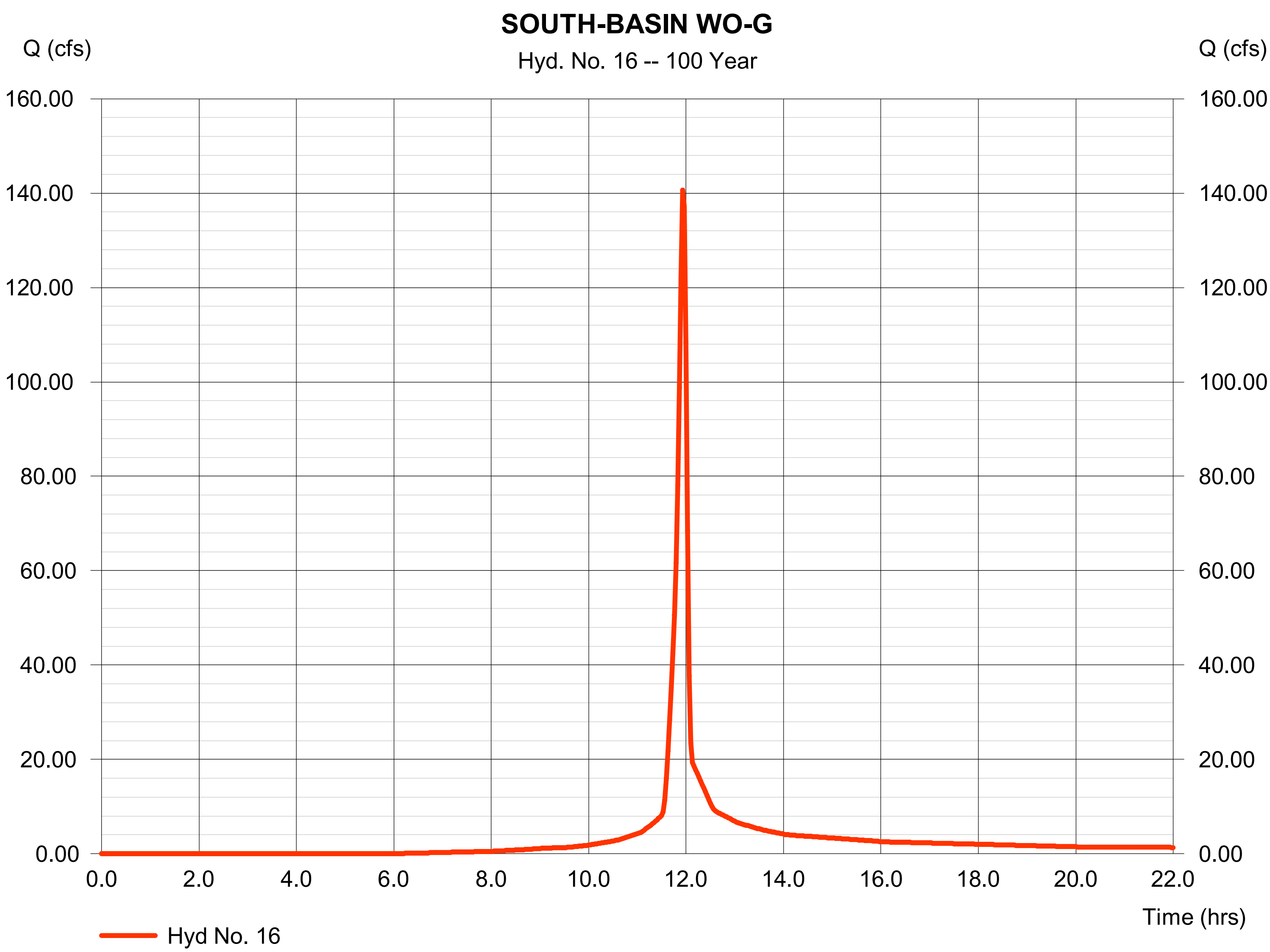
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 16

SOUTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 140.67 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 290,510 cuft
Drainage area	= 16.327 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



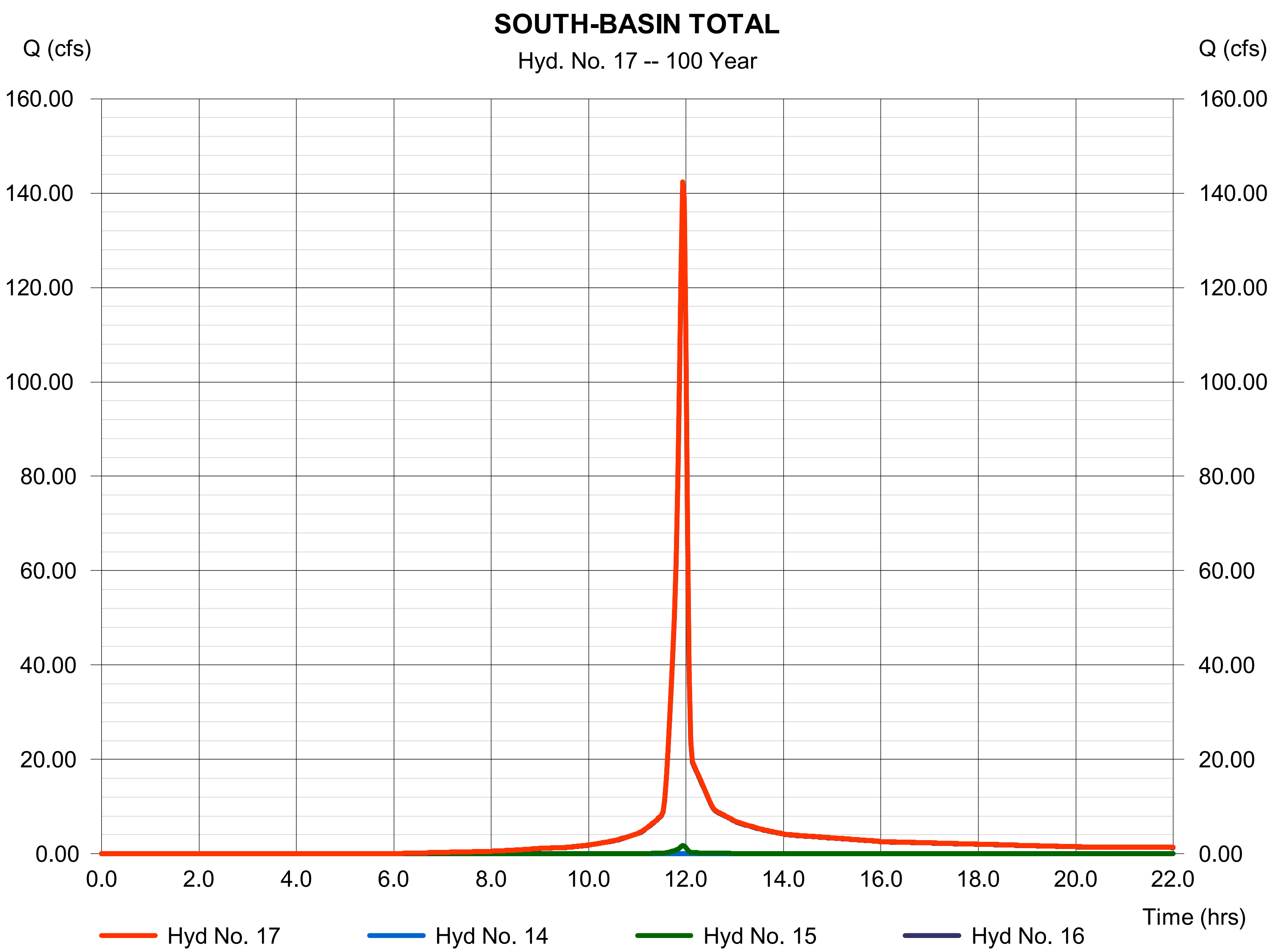
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Tuesday, 10 / 15 / 2019

Hyd. No. 17

SOUTH-BASIN TOTAL

Hydrograph type	= Combine	Peak discharge	= 142.43 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 294,229 cuft
Inflow hyds.	= 14, 15, 16	Contrib. drain. area	= 16.514 ac



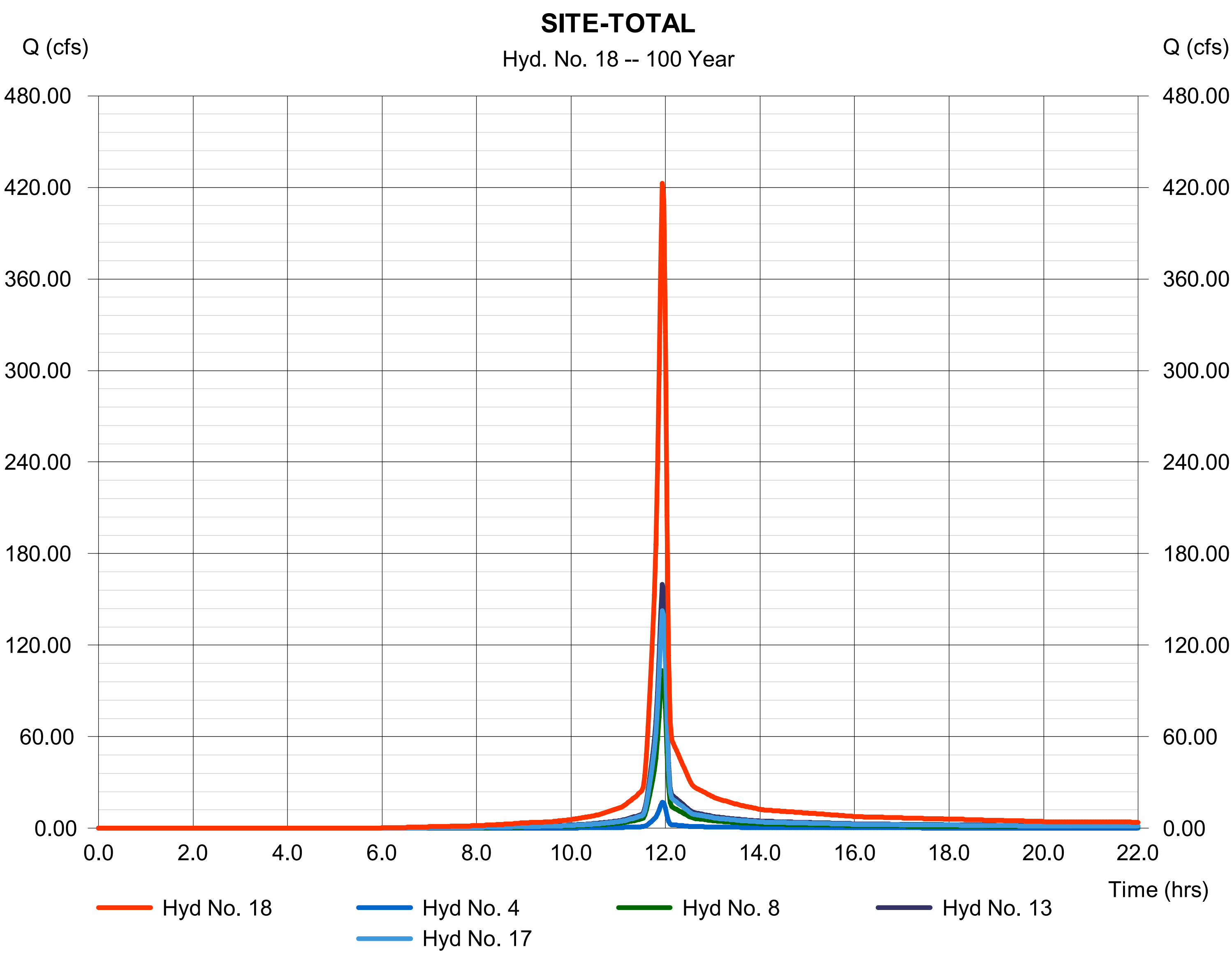
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 18

SITE-TOTAL

Hydrograph type	= Combine	Peak discharge	= 422.56 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 876,939 cuft
Inflow hyds.	= 4, 8, 13, 17	Contrib. drain. area	= 0.000 ac



Hydraflow Rainfall Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	36.9738	16.1000	0.7641	--------
2	94.4784	24.8001	0.9391	--------
3	0.0000	0.0000	0.0000	--------
5	176.2795	30.1001	1.0248	--------
10	317.8354	35.8000	1.1154	--------
25	309.7854	36.4000	1.0685	--------
50	1324.7950	53.7998	1.3207	--------
100	68.0213	20.7000	0.7186	--------

File name: Irvington.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	3.60	3.06	2.67	2.39	2.16	1.98	1.83	1.70	1.60	1.50	1.42	1.35
2	3.90	3.37	2.97	2.66	2.41	2.20	2.03	1.88	1.75	1.64	1.55	1.46
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	4.60	4.01	3.56	3.19	2.90	2.65	2.44	2.26	2.11	1.97	1.86	1.75
10	5.08	4.46	3.98	3.58	3.25	2.98	2.75	2.54	2.37	2.22	2.08	1.96
25	5.80	5.13	4.60	4.17	3.81	3.50	3.24	3.01	2.82	2.64	2.49	2.35
50	6.10	5.48	4.96	4.52	4.14	3.82	3.54	3.29	3.07	2.88	2.71	2.55
100	6.60	5.81	5.21	4.74	4.36	4.05	3.79	3.56	3.36	3.19	3.04	2.90

Tc = time in minutes. Values may exceed 60.

Precip. file name: P:\353754 PennEast\Stormwater\Site 2 - Springville\SW Model\Site2.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.64	3.17	0.00	3.94	4.62	5.71	6.73	7.95
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

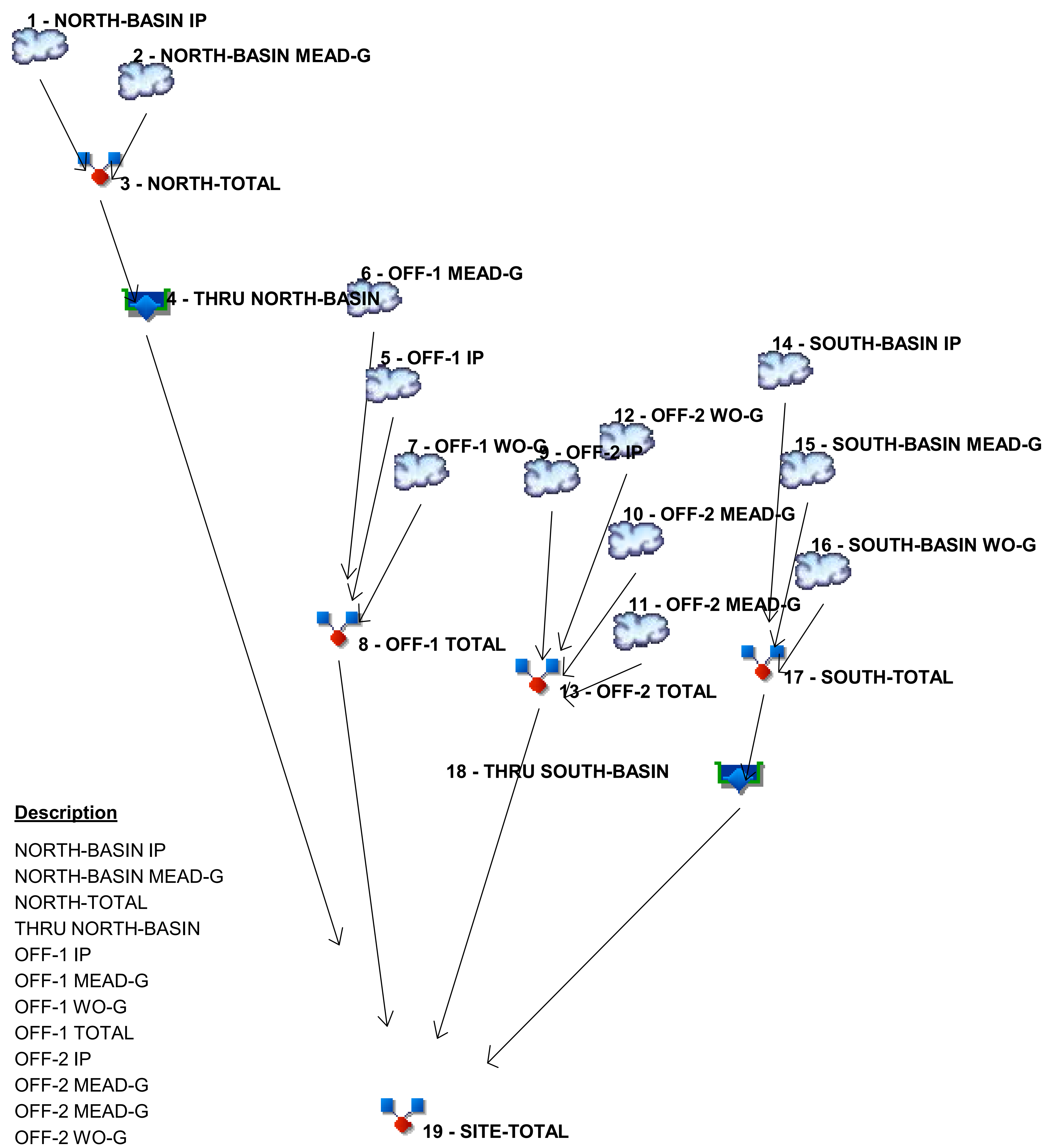
PROPOSED CONDITIONS

50 - Year

100 - Year

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020



Legend

Hyd.	Origin	Description
1	SCS Runoff	NORTH-BASIN IP
2	SCS Runoff	NORTH-BASIN MEAD-G
3	Combine	NORTH-TOTAL
4	Reservoir	THRU NORTH-BASIN
5	SCS Runoff	OFF-1 IP
6	SCS Runoff	OFF-1 MEAD-G
7	SCS Runoff	OFF-1 WO-G
8	Combine	OFF-1 TOTAL
9	SCS Runoff	OFF-2 IP
10	SCS Runoff	OFF-2 MEAD-G
11	SCS Runoff	OFF-2 MEAD-G
12	SCS Runoff	OFF-2 WO-G
13	Combine	OFF-2 TOTAL
14	SCS Runoff	SOUTH-BASIN IP
15	SCS Runoff	SOUTH-BASIN MEAD-G
16	SCS Runoff	SOUTH-BASIN WO-G
17	Combine	SOUTH-TOTAL
18	Reservoir	THRU SOUTH-BASIN
19	Combine	SITE-TOTAL

Project: PR-SWM.gpw

Tuesday, 10 / 15 / 2019

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	------	2.630	3.174	-------	3.961	4.655	5.765	6.802	8.042	NORTH-BASIN IP
2	SCS Runoff	------	2.260	3.083	-------	4.366	5.528	7.418	9.197	11.32	NORTH-BASIN MEAD-G
3	Combine	1, 2	4.867	6.257	-------	8.327	10.18	13.18	16.00	19.37	NORTH-TOTAL
4	Reservoir	3	1.926	2.697	-------	3.814	4.351	4.662	5.431	6.362	THRU NORTH-BASIN
5	SCS Runoff	------	3.211	3.875	-------	4.837	5.684	7.039	8.306	9.820	OFF-1 IP
6	SCS Runoff	------	6.118	8.345	-------	11.82	14.96	20.08	24.90	30.66	OFF-1 MEAD-G
7	SCS Runoff	------	10.57	15.22	-------	22.44	29.23	40.64	51.55	64.74	OFF-1 WO-G
8	Combine	5, 6, 7	19.75	27.26	-------	39.00	49.87	67.76	84.75	105.21	OFF-1 TOTAL
9	SCS Runoff	------	3.442	4.153	-------	5.184	6.091	7.544	8.902	10.52	OFF-2 IP
10	SCS Runoff	------	23.45	31.99	-------	45.30	57.36	76.96	95.42	117.49	OFF-2 MEAD-G
11	SCS Runoff	------	9.402	12.82	-------	18.16	23.00	30.86	38.26	47.11	OFF-2 MEAD-G
12	SCS Runoff	------	0.001	0.002	-------	0.003	0.004	0.005	0.007	0.009	OFF-2 WO-G
13	Combine	9, 10, 11, 12	50.19	68.13	-------	95.78	120.81	161.47	199.74	245.52	OFF-2 TOTAL
14	SCS Runoff	------	24.37	29.41	-------	36.71	43.14	53.42	63.04	74.53	SOUTH-BASIN IP
15	SCS Runoff	------	14.54	19.83	-------	28.08	35.55	47.71	59.15	72.83	SOUTH-BASIN MEAD-G
16	SCS Runoff	------	2.629	3.786	-------	5.583	7.270	10.11	12.82	16.10	SOUTH-BASIN WO-G
17	Combine	14, 15, 16	41.29	52.95	-------	70.34	85.96	111.24	135.01	163.46	SOUTH-TOTAL
18	Reservoir	17	14.02	19.58	-------	28.88	40.88	56.82	65.43	73.89	THRU SOUTH-BASIN
19	Combine	4, 8, 13, 18	58.92	81.33	-------	115.15	147.75	203.87	249.15	300.88	SITE-TOTAL

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	2.630	2	716	6,085	------	------	------	NORTH-BASIN IP
2	SCS Runoff	2.260	2	718	4,530	------	------	------	NORTH-BASIN MEAD-G
3	Combine	4.867	2	716	10,616	1, 2	------	------	NORTH-TOTAL
4	Reservoir	1.926	2	722	10,612	3	1736.33	11,993	THRU NORTH-BASIN
5	SCS Runoff	3.211	2	716	7,430	------	------	------	OFF-1 IP
6	SCS Runoff	6.118	2	718	12,263	------	------	------	OFF-1 MEAD-G
7	SCS Runoff	10.57	2	718	21,212	------	------	------	OFF-1 WO-G
8	Combine	19.75	2	718	40,905	5, 6, 7	------	------	OFF-1 TOTAL
9	SCS Runoff	3.442	2	716	7,964	------	------	------	OFF-2 IP
10	SCS Runoff	23.45	2	718	47,000	------	------	------	OFF-2 MEAD-G
11	SCS Runoff	9.402	2	718	18,844	------	------	------	OFF-2 MEAD-G
12	SCS Runoff	0.001	2	718	3	------	------	------	OFF-2 WO-G
13	Combine	50.19	2	718	101,966	9, 10, 11, 12	------	------	OFF-2 TOTAL
14	SCS Runoff	24.37	2	716	56,393	------	------	------	SOUTH-BASIN IP
15	SCS Runoff	14.54	2	718	29,134	------	------	------	SOUTH-BASIN MEAD-G
16	SCS Runoff	2.629	2	718	5,276	------	------	------	SOUTH-BASIN WO-G
17	Combine	41.29	2	716	90,803	14, 15, 16	------	------	SOUTH-TOTAL
18	Reservoir	14.02	2	724	90,796	17	1735.68	121,654	THRU SOUTH-BASIN
19	Combine	58.92	2	718	197,280	4, 8, 13, 18	------	------	SITE-TOTAL

PR-SWM.gpw	Return Period: 1 Year	Tuesday, 10 / 15 / 2019

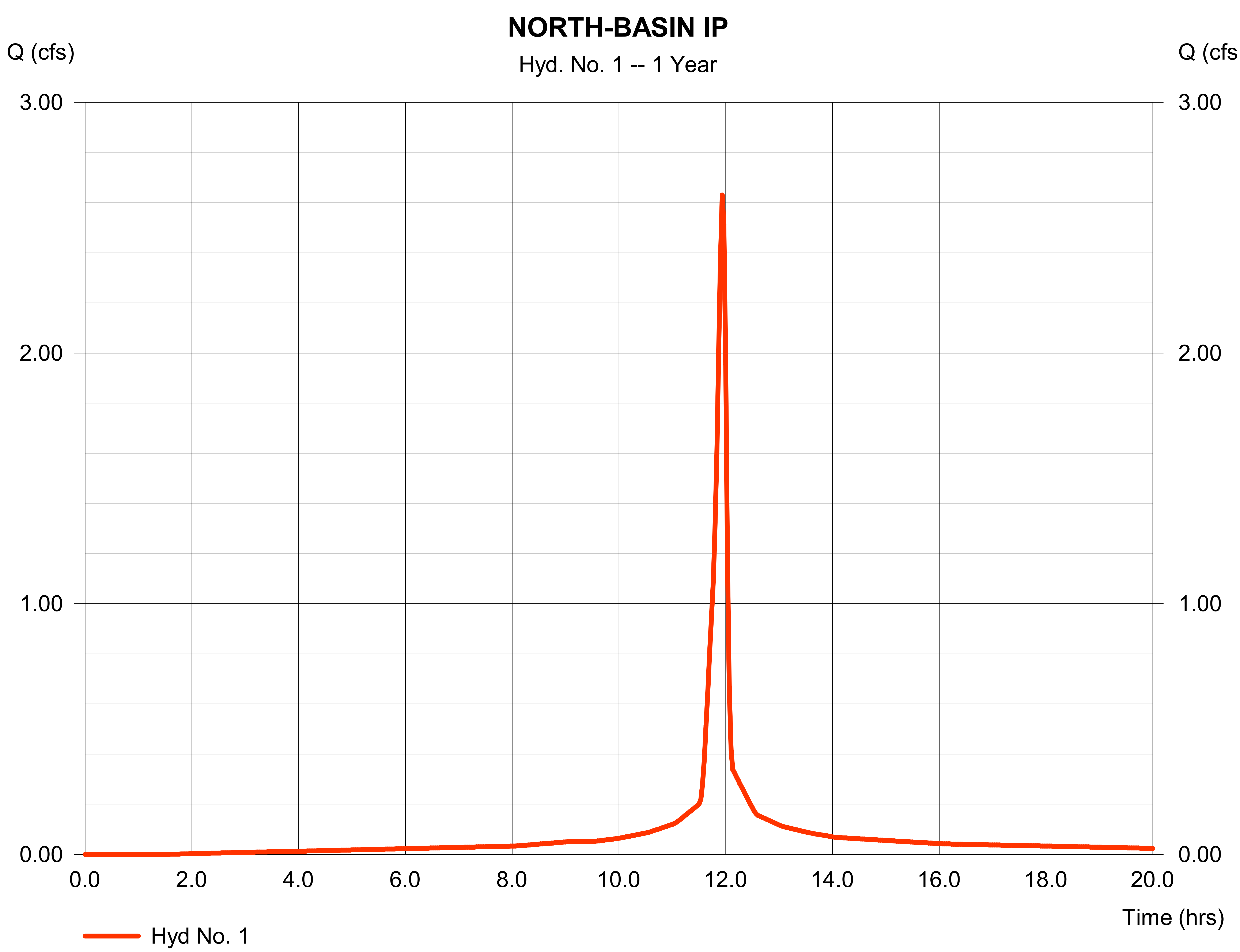
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 1

NORTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 2.630 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 6,085 cuft
Drainage area	= 0.742 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



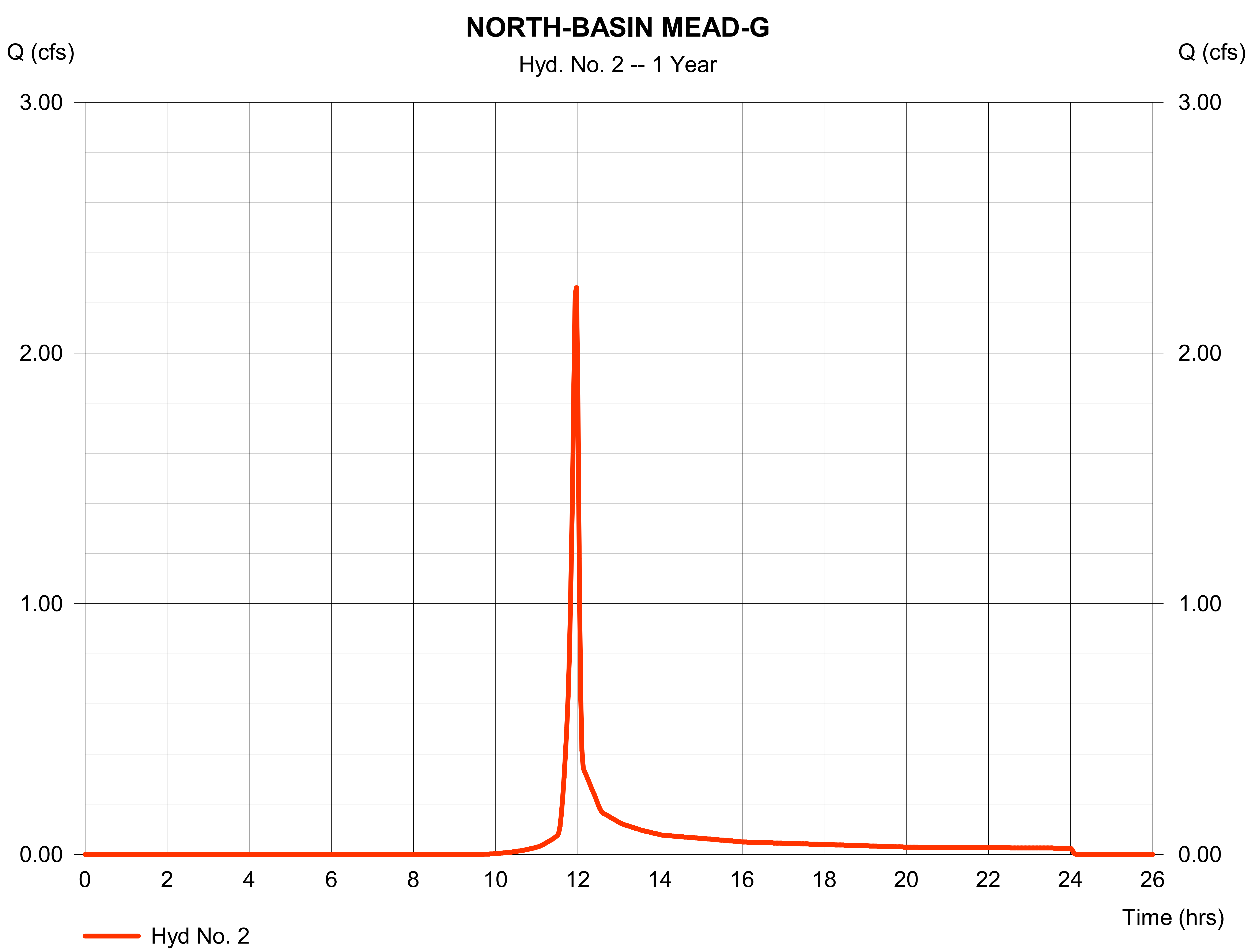
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 2

NORTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 2.260 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 4,530 cuft
Drainage area	= 1.208 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



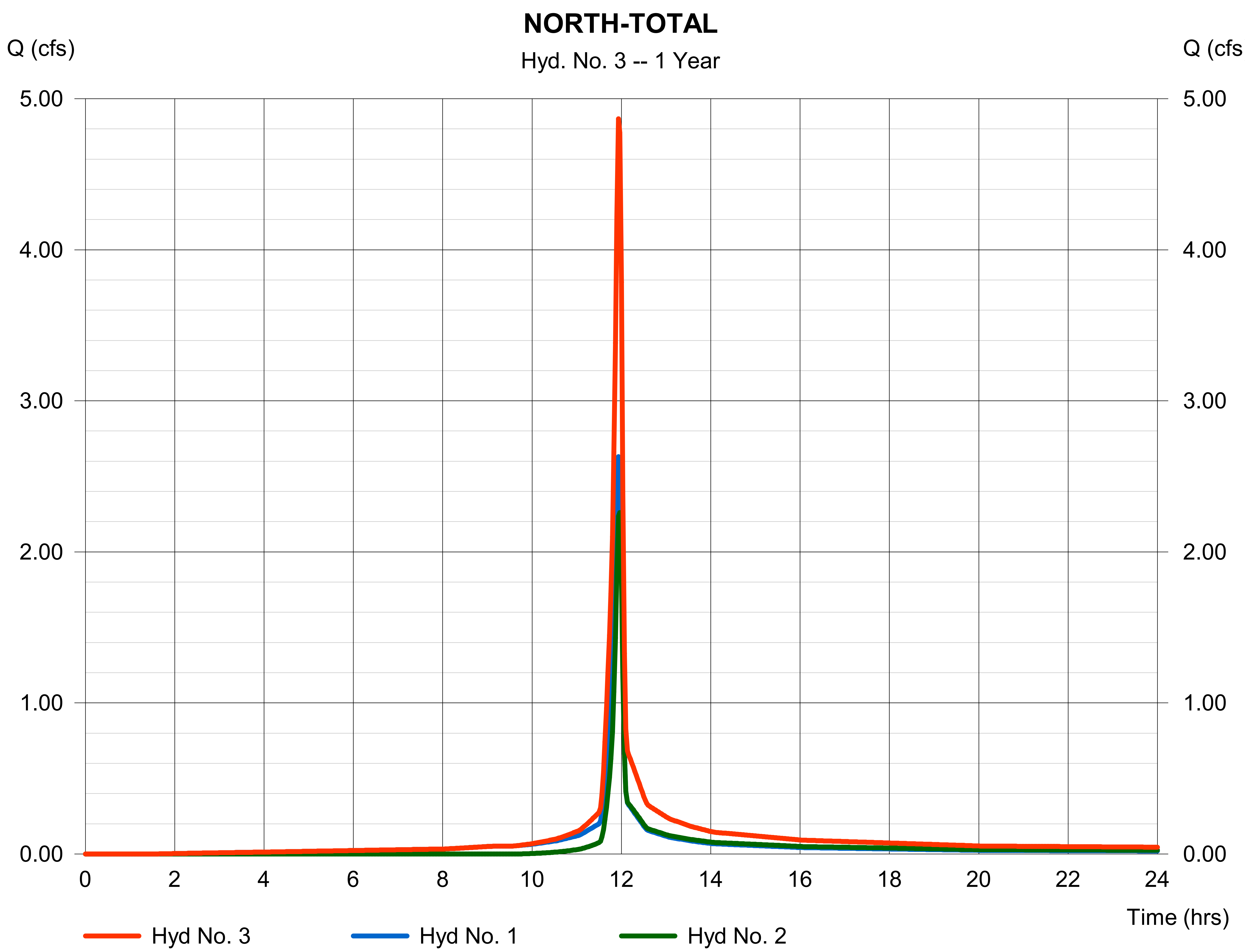
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 3

NORTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 4.867 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 10,616 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 1.950 ac



Hydrograph Report

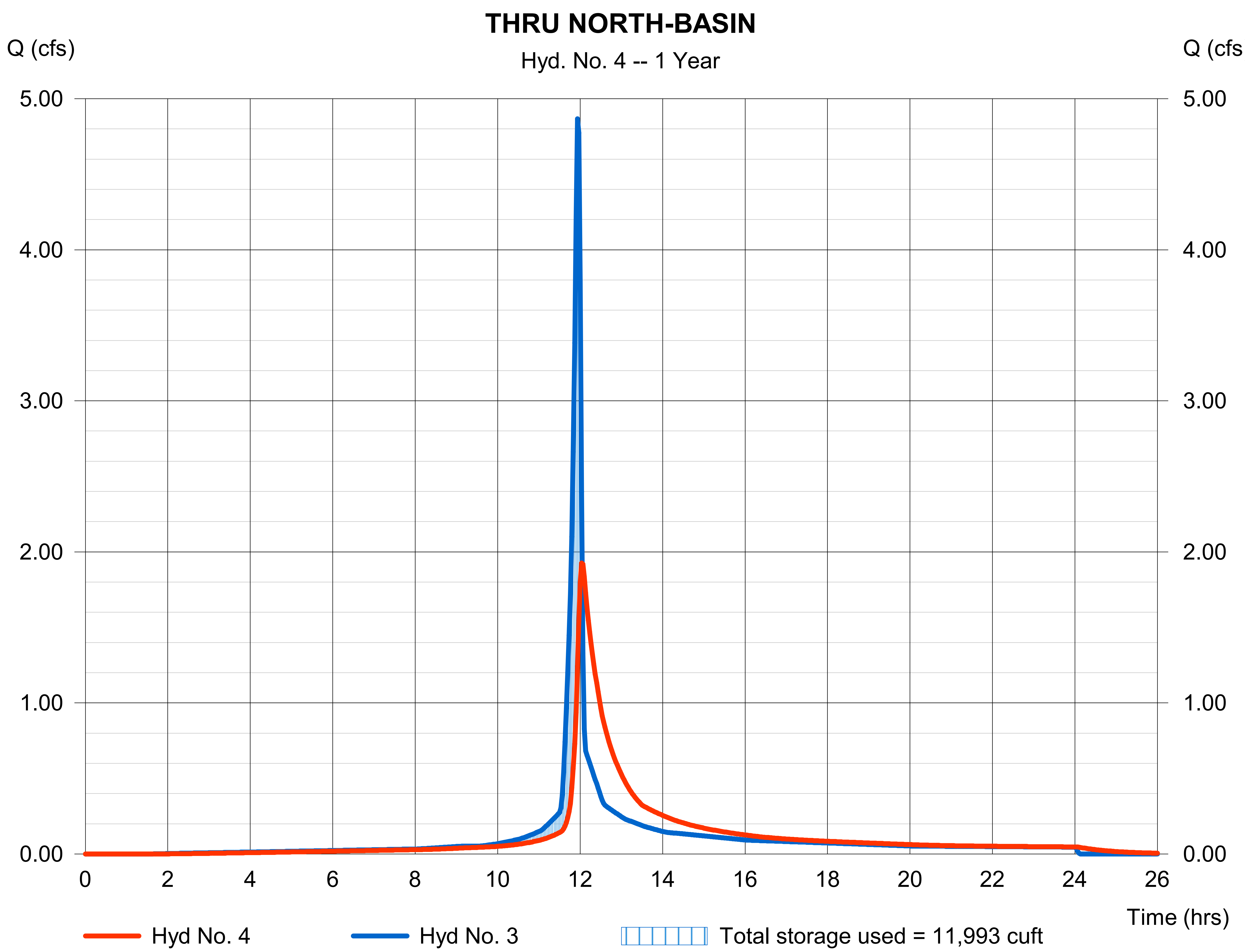
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 4

THRU NORTH-BASIN

Hydrograph type	= Reservoir	Peak discharge	= 1.926 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 10,612 cuft
Inflow hyd. No.	= 3 - NORTH-TOTAL	Max. Elevation	= 1736.33 ft
Reservoir name	= NORTH-BASIN	Max. Storage	= 11,993 cuft

Storage Indication method used. Wet pond routing start elevation = 1736.00 ft.



Pond Report

Pond No. 1 - NORTH-BASIN

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 1735.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1735.00	7,920	0	0
1.00	1736.00	9,286	8,603	8,603
2.00	1737.00	11,423	10,354	18,957
3.00	1738.00	15,777	13,600	32,557
4.00	1739.00	21,068	18,423	50,980

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	6.00	6.00	Inactive
Span (in)	= 18.00	18.00	14.00	0.00
No. Barrels	= 1	2	1	0
Invert El. (ft)	= 1735.00	1736.00	1736.75	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	25.00	Inactive	Inactive
Crest El. (ft)	= 1737.50	1738.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage 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	1735.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.10	860	1735.10	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.20	1,721	1735.20	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.30	2,581	1735.30	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.40	3,441	1735.40	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.50	4,301	1735.50	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.60	5,162	1735.60	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.70	6,022	1735.70	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.80	6,882	1735.80	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.90	7,743	1735.90	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.00	8,603	1736.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.10	9,638	1736.10	0.33 ic	0.32 ic	0.00	---	0.00	0.00	---	---	---	---	0.323
1.20	10,674	1736.20	0.93 ic	0.91 ic	0.00	---	0.00	0.00	---	---	---	---	0.913
1.30	11,709	1736.30	1.68 oc	1.68 ic	0.00	---	0.00	0.00	---	---	---	---	1.678
1.40	12,745	1736.40	2.60 oc	2.58 ic	0.00	---	0.00	0.00	---	---	---	---	2.583
1.50	13,780	1736.50	3.63 oc	3.61 ic	0.00	---	0.00	0.00	---	---	---	---	3.610
1.60	14,816	1736.60	4.27 oc	4.27 ic	0.00	---	0.00	0.00	---	---	---	---	4.272
1.70	15,851	1736.70	4.45 oc	4.45 ic	0.00	---	0.00	0.00	---	---	---	---	4.450
1.80	16,886	1736.80	4.61 oc	4.56 ic	0.04 ic	---	0.00	0.00	---	---	---	---	4.607
1.90	17,922	1736.90	4.71 oc	4.48 ic	0.23 ic	---	0.00	0.00	---	---	---	---	4.709
2.00	18,957	1737.00	5.21 oc	4.71 ic	0.50 ic	---	0.00	0.00	---	---	---	---	5.208
2.10	20,317	1737.10	5.72 oc	4.89 ic	0.82 ic	---	0.00	0.00	---	---	---	---	5.717
2.20	21,677	1737.20	6.23 oc	5.03 ic	1.20 ic	---	0.00	0.00	---	---	---	---	6.232
2.30	23,037	1737.30	6.71 oc	5.17 ic	1.54 ic	---	0.00	0.00	---	---	---	---	6.707
2.40	24,397	1737.40	7.11 oc	5.33 ic	1.78 ic	---	0.00	0.00	---	---	---	---	7.111
2.50	25,757	1737.50	7.49 oc	5.50 ic	1.99 ic	---	0.00	0.00	---	---	---	---	7.486
2.60	27,117	1737.60	8.57 oc	4.96 ic	1.93 ic	---	1.68	0.00	---	---	---	---	8.571
2.70	28,477	1737.70	9.95 oc	3.73 ic	1.45 ic	---	4.76	0.00	---	---	---	---	9.946
2.80	29,837	1737.80	10.87 oc	2.67 ic	1.04 ic	---	7.17 s	0.00	---	---	---	---	10.87
2.90	31,197	1737.90	11.44 oc	2.11 ic	0.82 ic	---	8.50 s	0.00	---	---	---	---	11.44
3.00	32,557	1738.00	11.90 oc	1.74 ic	0.68 ic	---	9.48 s	0.00	---	---	---	---	11.89
3.10	34,399	1738.10	12.30 oc	1.47 ic	0.57 ic	---	10.26 s	2.63	---	---	---	---	14.93
3.20	36,242	1738.20	12.67 oc	1.27 ic	0.49 ic	---	10.91 s	7.44	---	---	---	---	20.11
3.30	38,084	1738.30	13.02 oc	1.11 ic	0.43 ic	---	11.47 s	13.67	---	---	---	---	26.69
3.40	39,926	1738.40	13.35 oc	0.99 ic	0.39 ic	---	11.97 s	21.05	---	---	---	---	34.40
3.50	41,768	1738.50	13.67 oc	0.89 ic	0.35 ic	---	12.43 s	29.42	---	---	---	---	43.09
3.60	43,611	1738.60	13.98 oc	0.81 ic	0.32 ic	---	12.85 s	38.68	---	---	---	---	52.65
3.70	45,453	1738.70	14.28 oc	0.74 ic	0.29 ic	---	13.22 s	48.74	---	---	---	---	62.99

Continues on next page...

NORTH-BASIN

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
3.80	47,295	1738.80	14.58 oc	0.68 ic	0.27 ic	---	13.59 s	59.55	---	---	---	---	74.09
3.90	49,137	1738.90	14.87 oc	0.64 ic	0.25 ic	---	13.93 s	71.05	---	---	---	---	85.87
4.00	50,980	1739.00	15.15 oc	0.59 ic	0.23 ic	---	14.24 s	83.25	---	---	---	---	98.31

...End

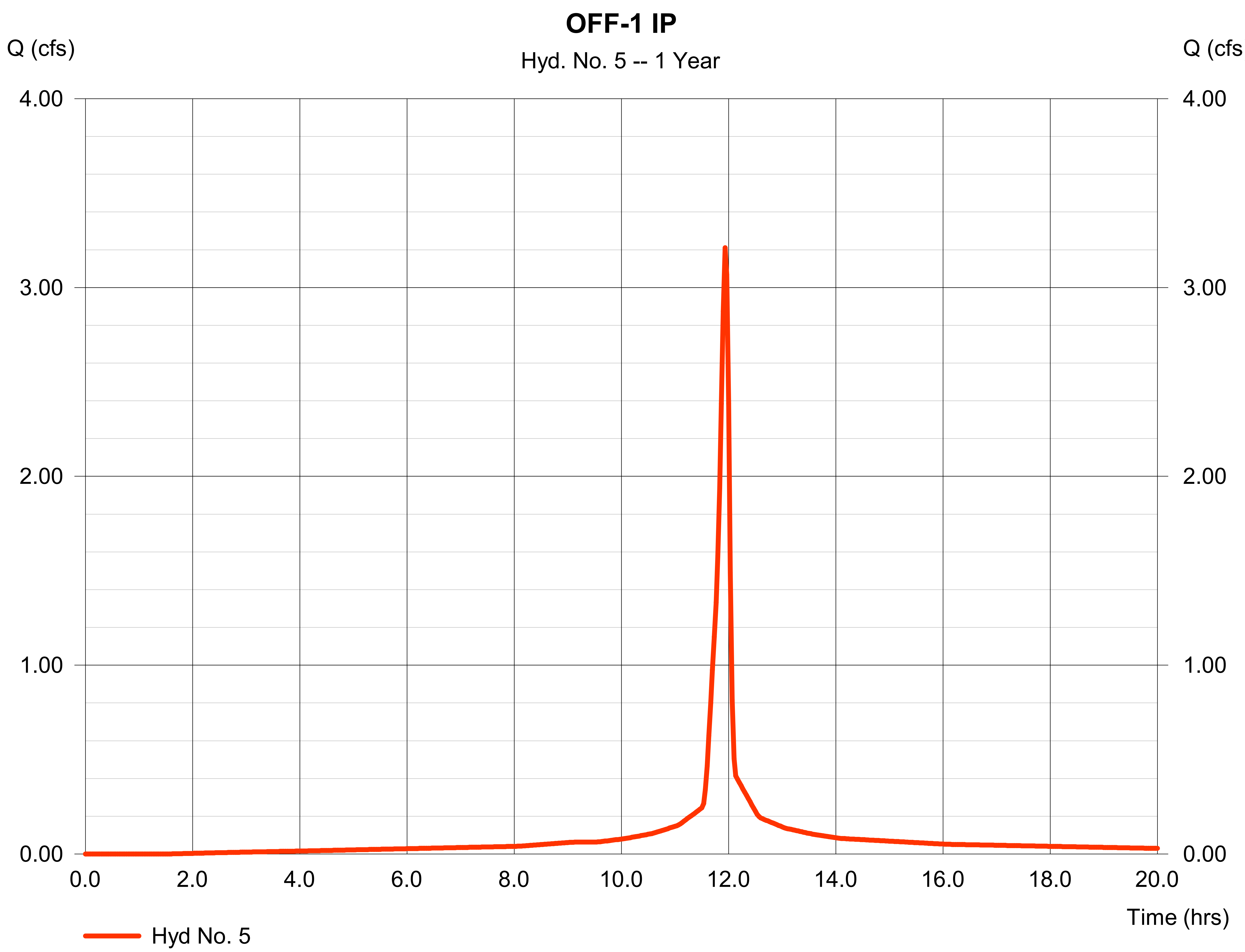
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 5

OFF-1 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 3.211 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 7,430 cuft
Drainage area	= 0.906 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



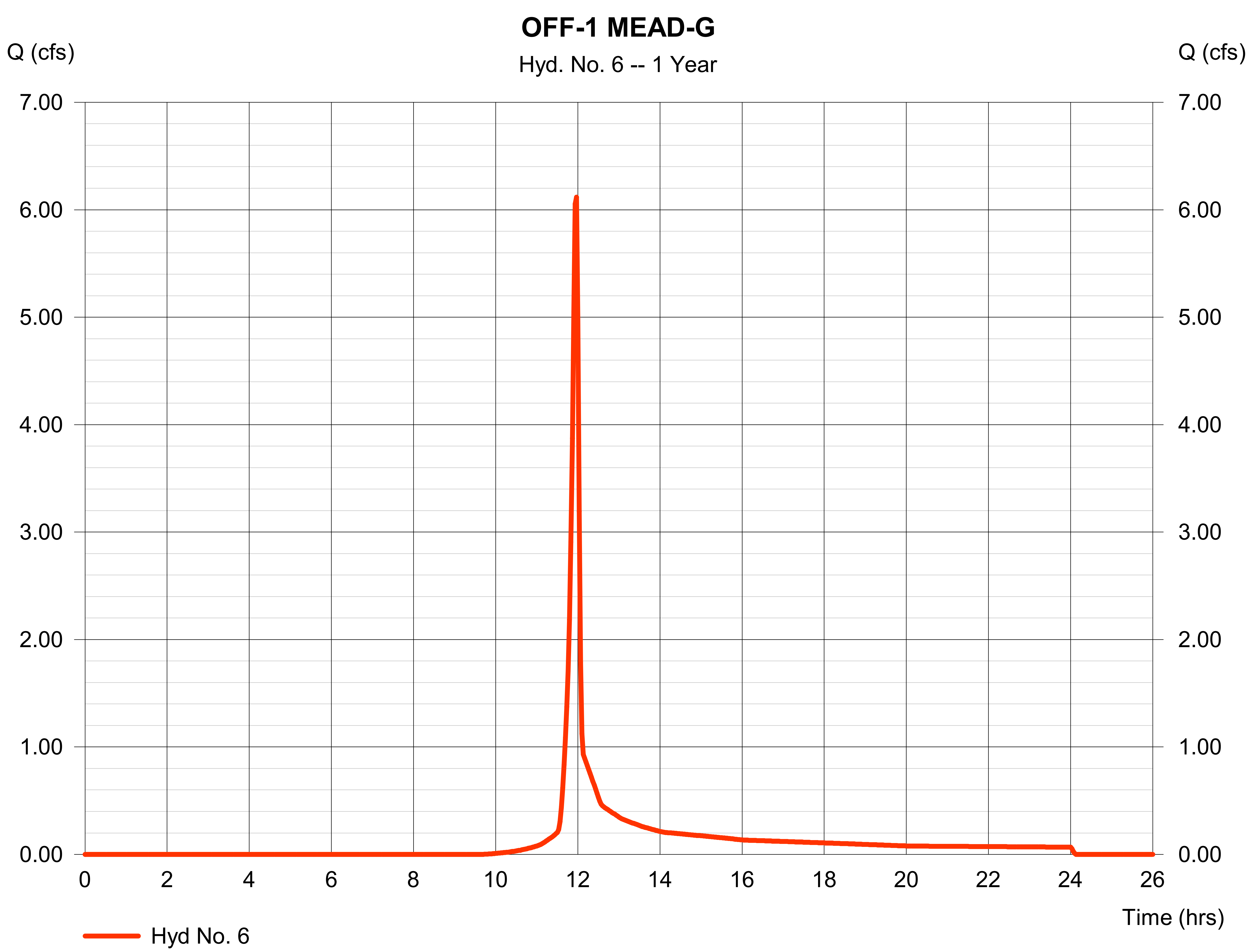
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 6

OFF-1 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 6.118 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 12,263 cuft
Drainage area	= 3.270 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



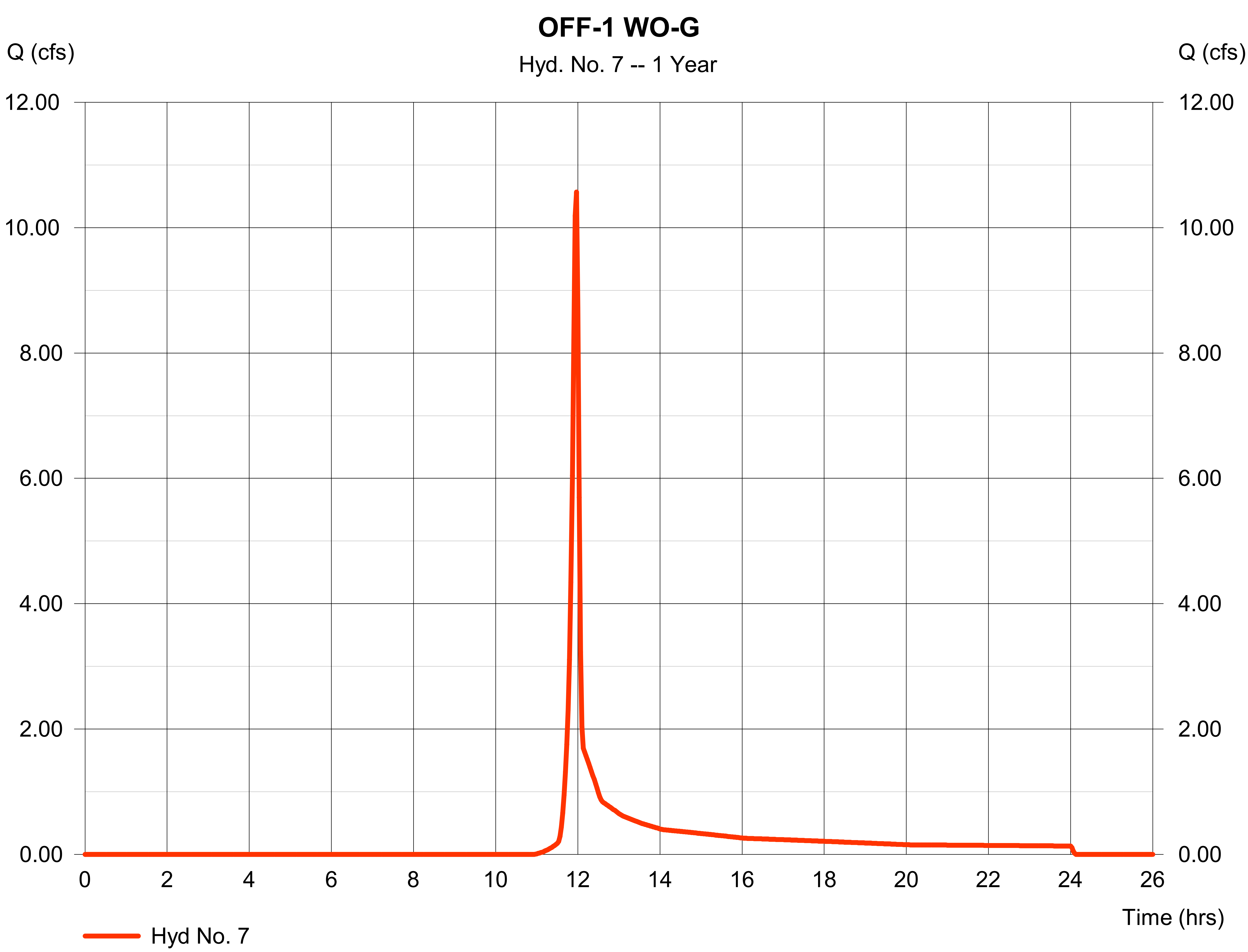
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 7

OFF-1 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 10.57 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 21,212 cuft
Drainage area	= 7.514 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



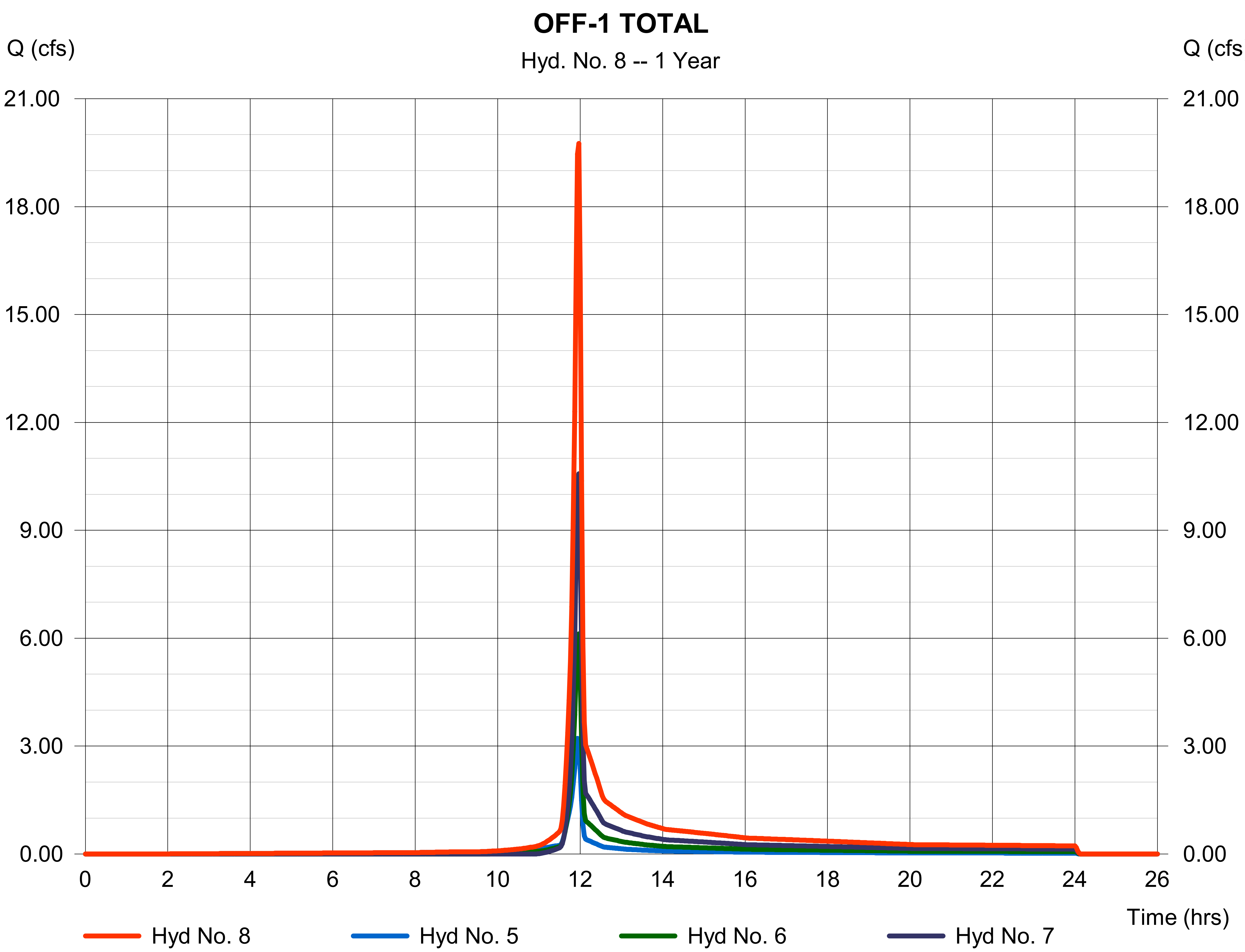
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 8

OFF-1 TOTAL

Hydrograph type	= Combine	Peak discharge	= 19.75 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 40,905 cuft
Inflow hyds.	= 5, 6, 7	Contrib. drain. area	= 11.690 ac



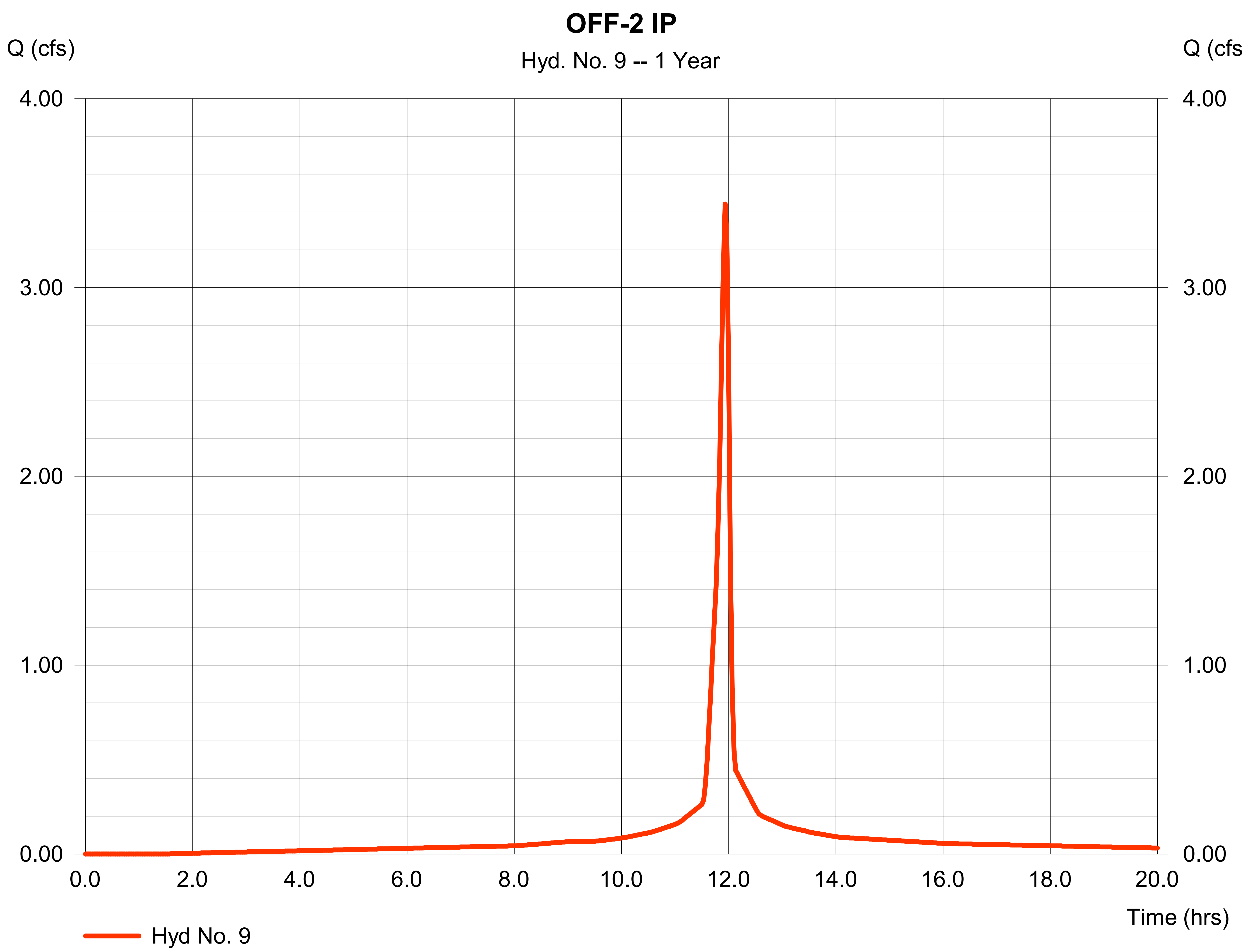
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 9

OFF-2 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 3.442 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 7,964 cuft
Drainage area	= 0.971 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

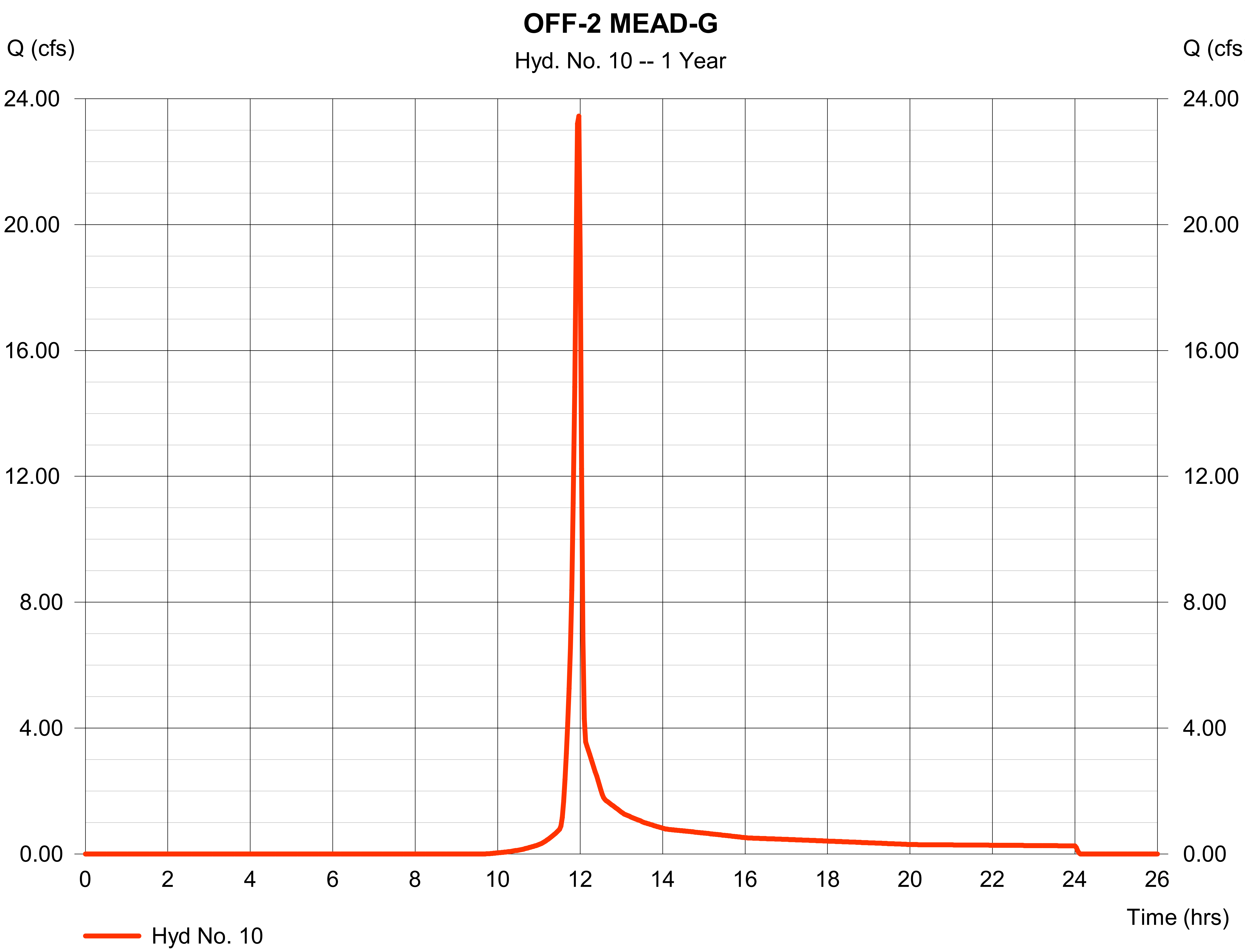


Hydrograph Report

Hyd. No. 10

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 23.45 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 47,000 cuft
Drainage area	= 12.533 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



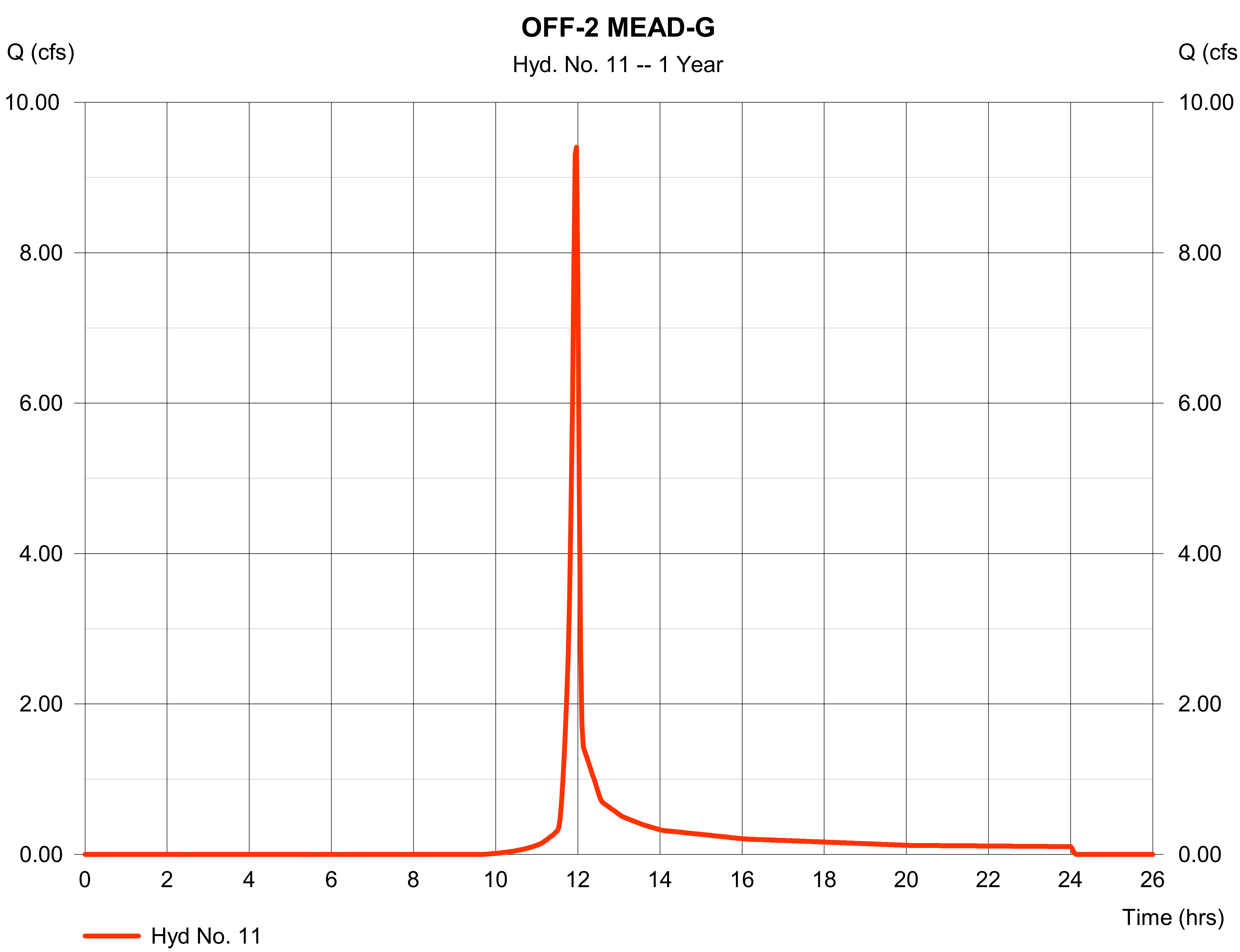
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 11

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 9.402 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 18,844 cuft
Drainage area	= 5.025 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



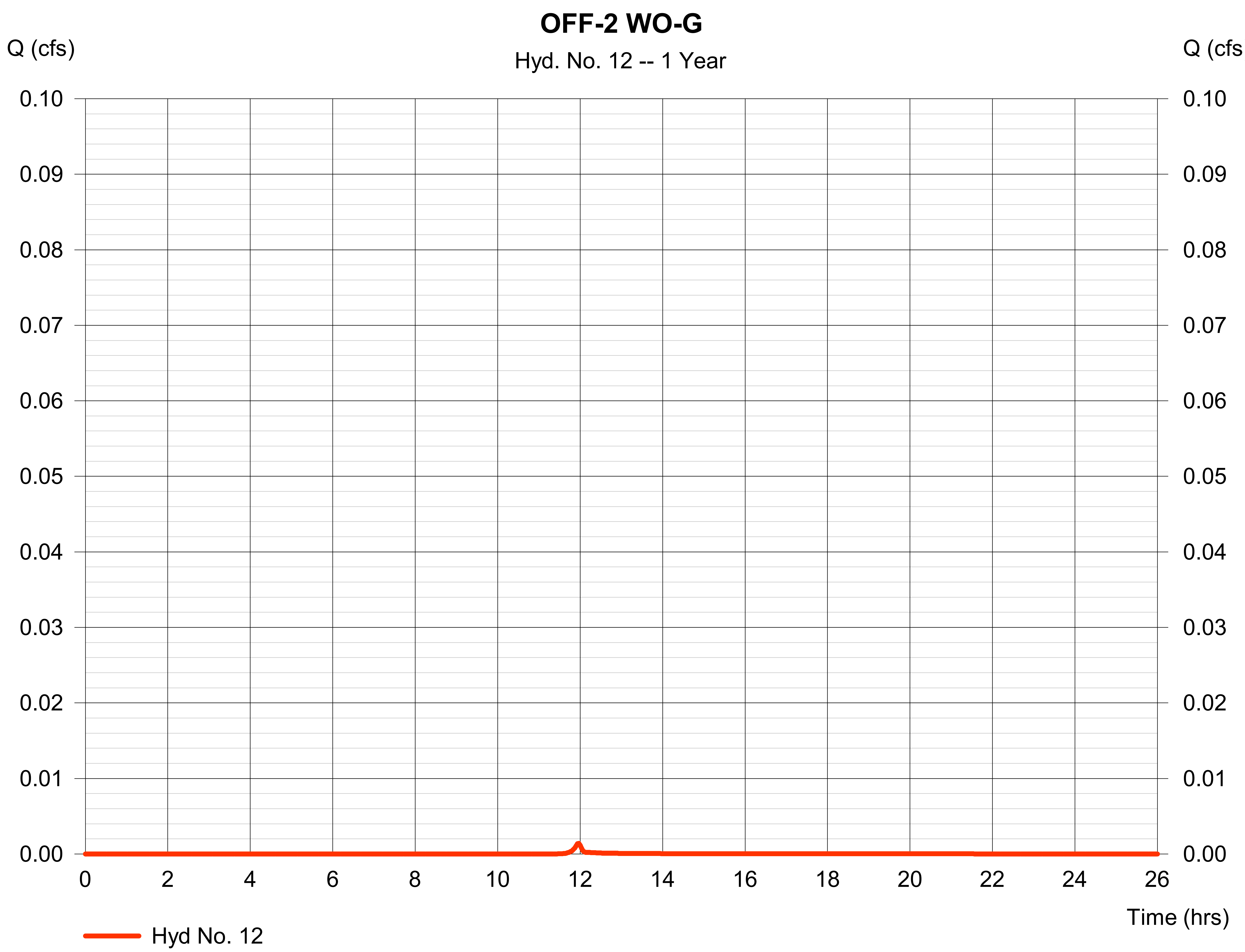
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 12

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.001 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 3 cuft
Drainage area	= 0.001 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

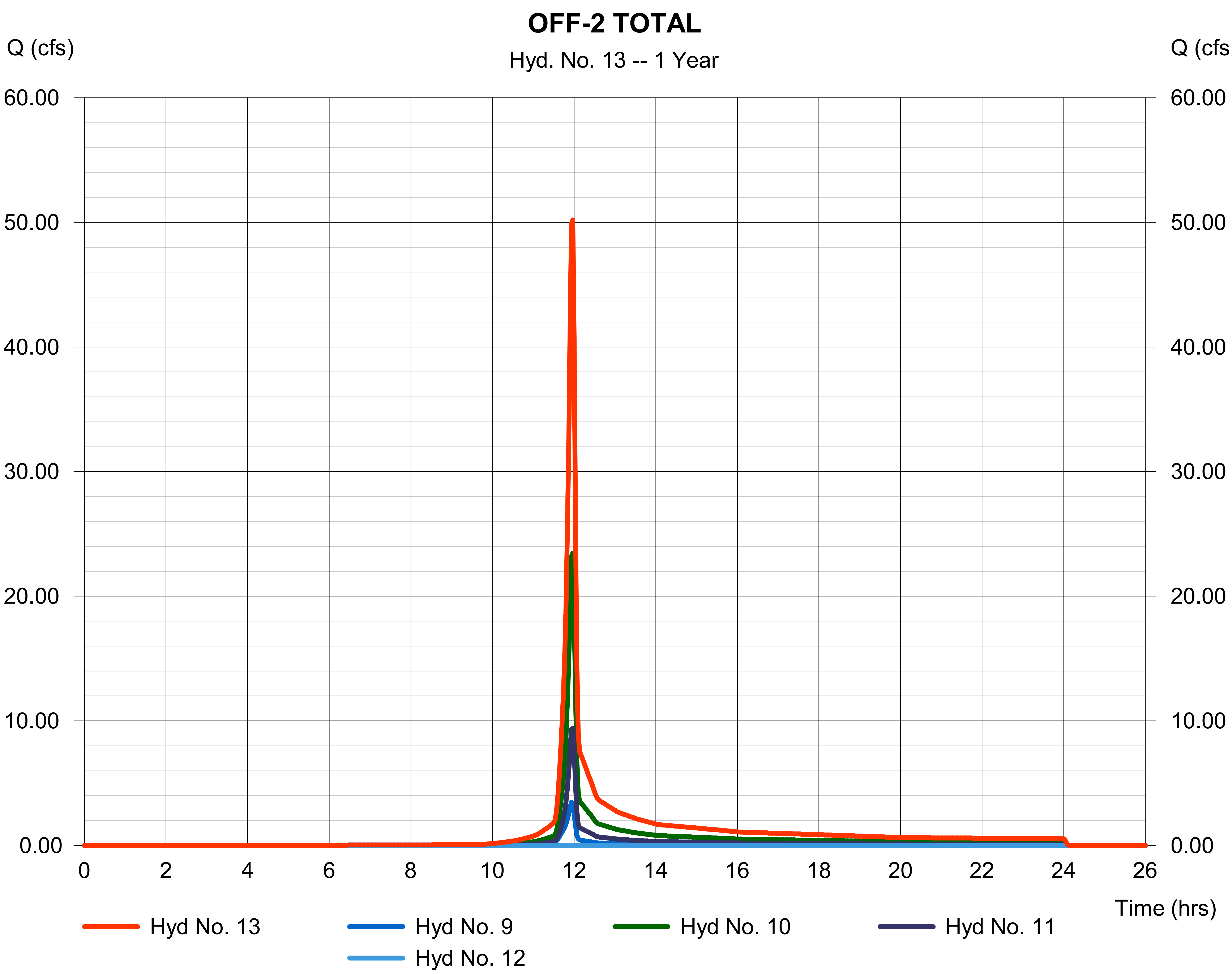


Hydrograph Report

Hyd. No. 13

OFF-2 TOTAL

Hydrograph type	= Combine	Peak discharge	= 50.19 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 101,966 cuft
Inflow hyds.	= 9, 10, 11, 12	Contrib. drain. area	= 18.530 ac



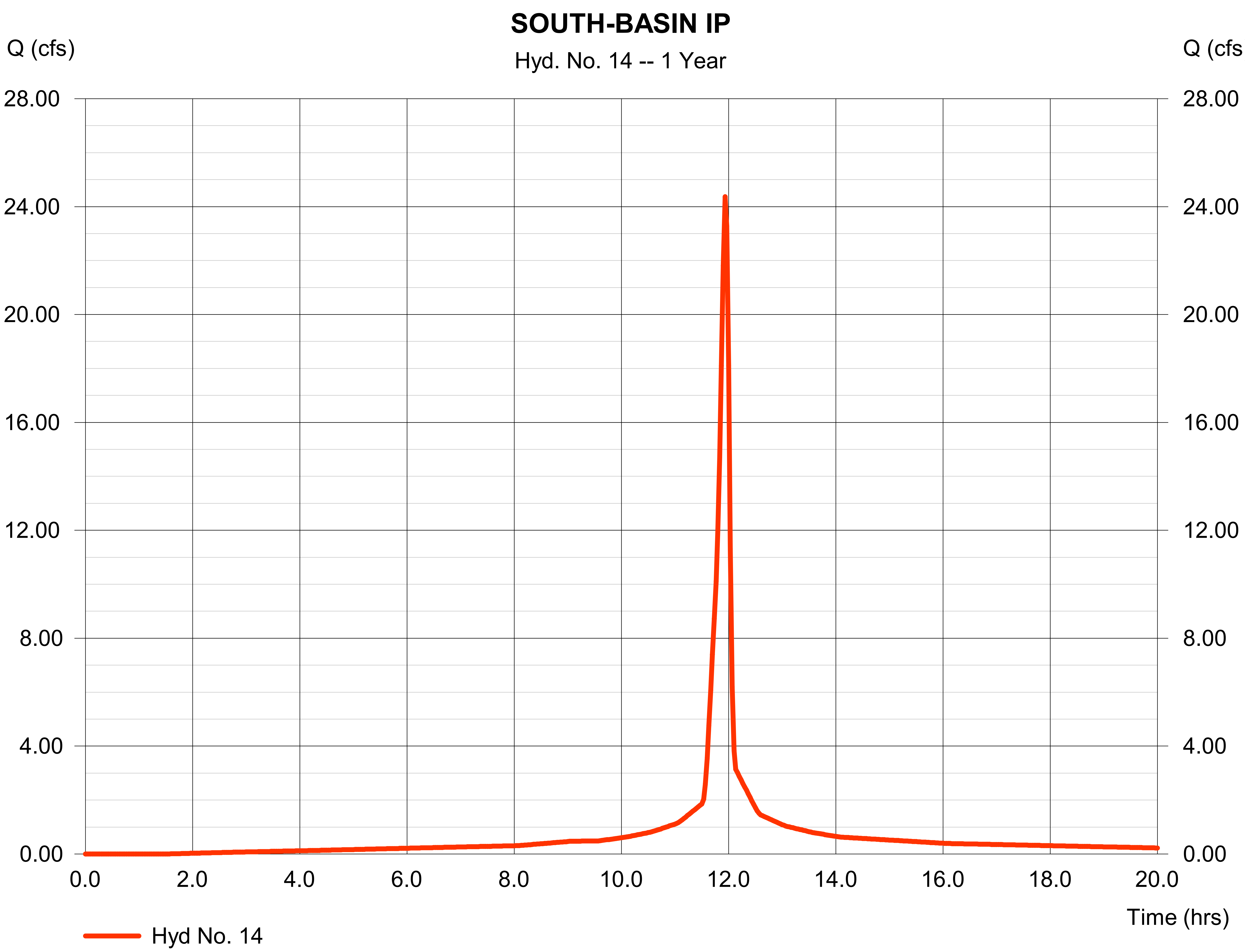
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 14

SOUTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 24.37 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 56,393 cuft
Drainage area	= 6.876 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



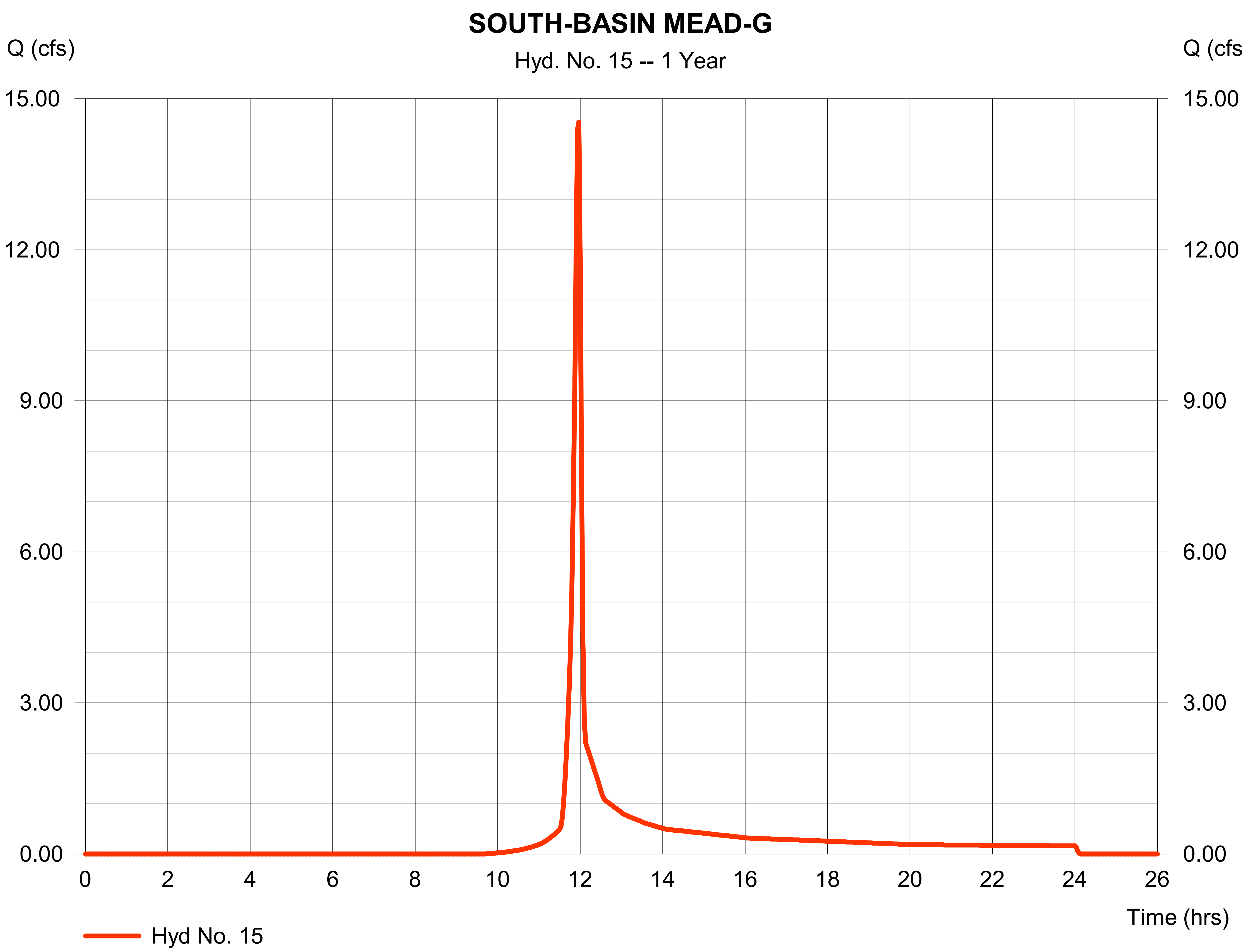
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 15

SOUTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 14.54 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 29,134 cuft
Drainage area	= 7.769 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



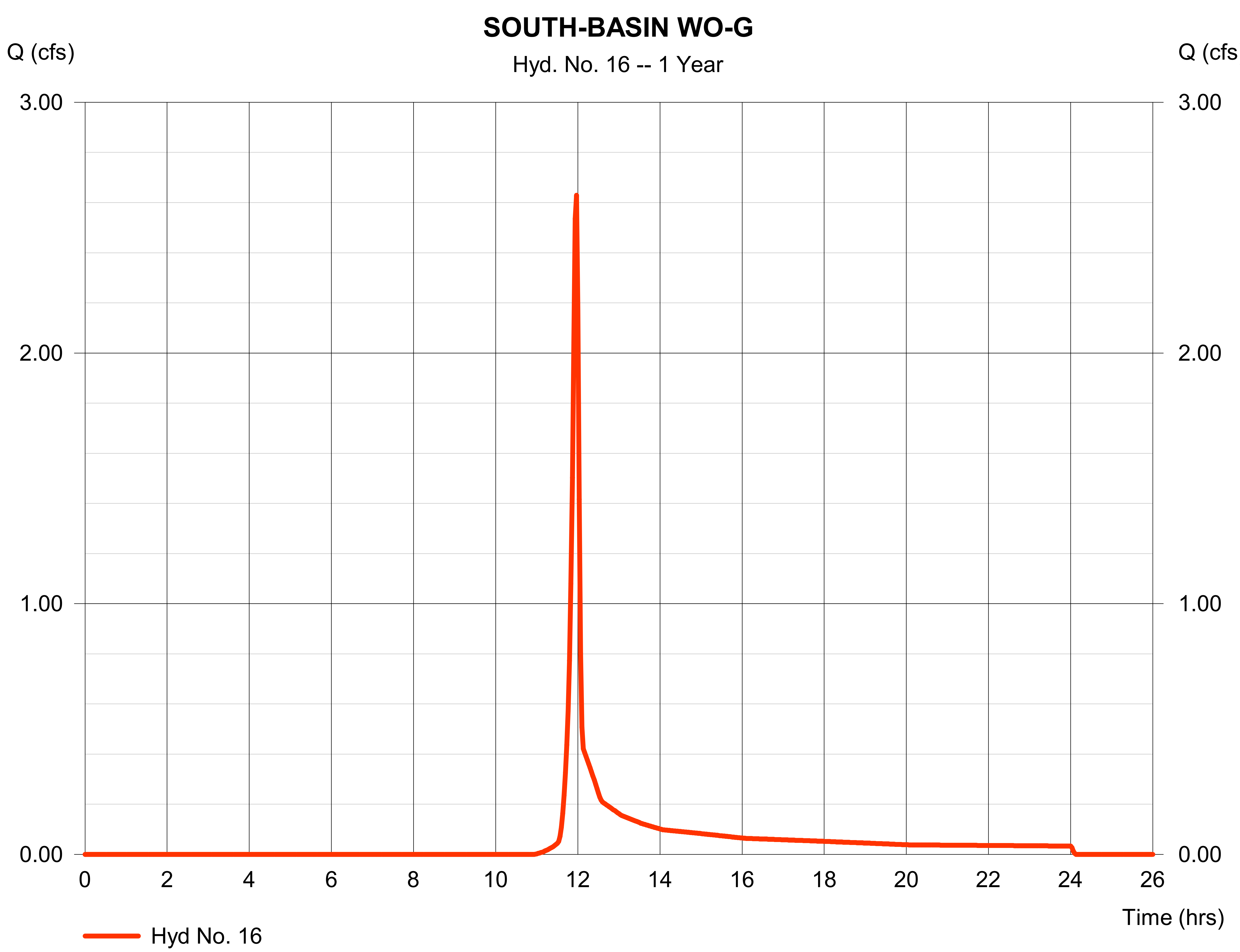
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 16

SOUTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 2.629 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 5,276 cuft
Drainage area	= 1.869 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



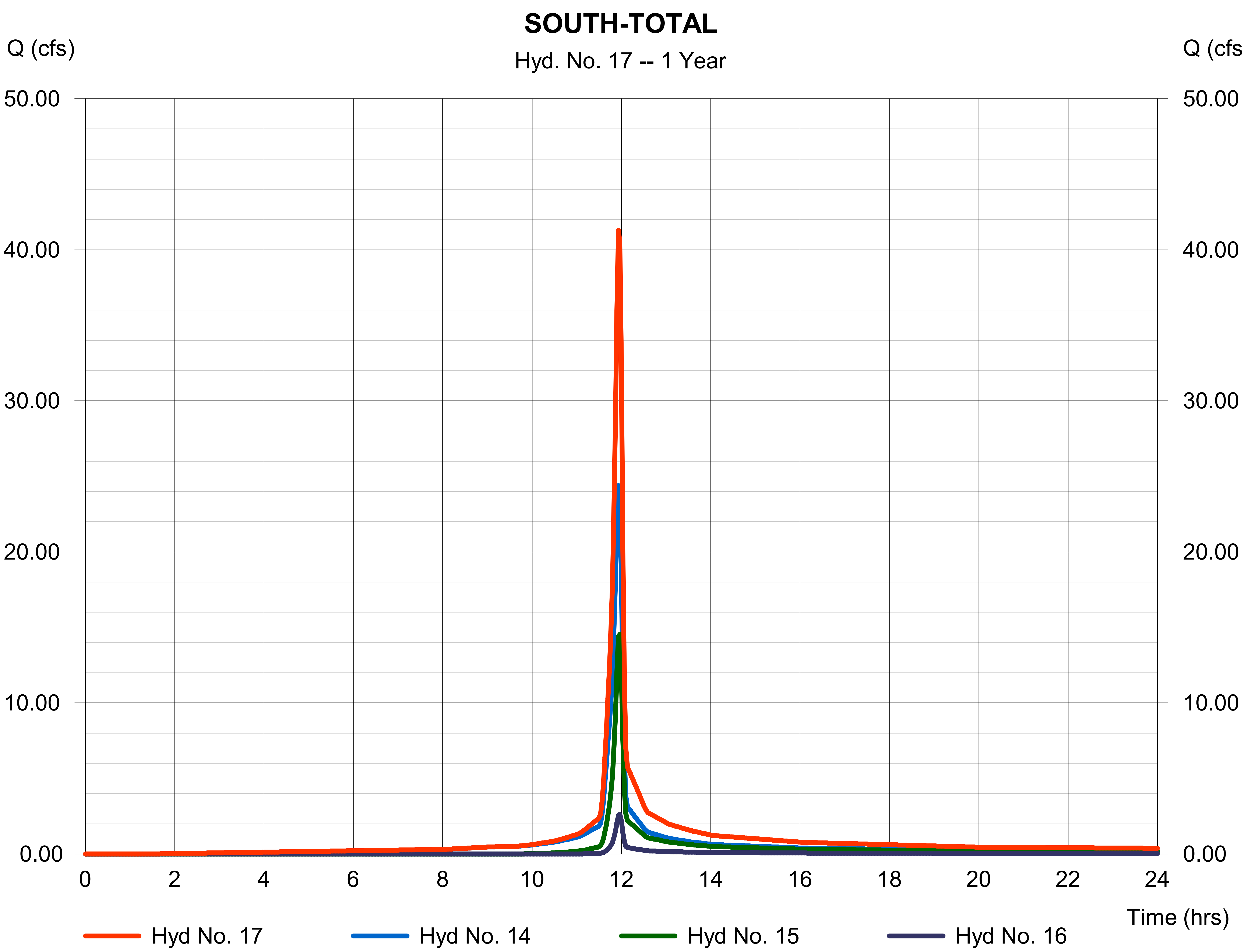
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 17

SOUTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 41.29 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 90,803 cuft
Inflow hyds.	= 14, 15, 16	Contrib. drain. area	= 16.514 ac



Hydrograph Report

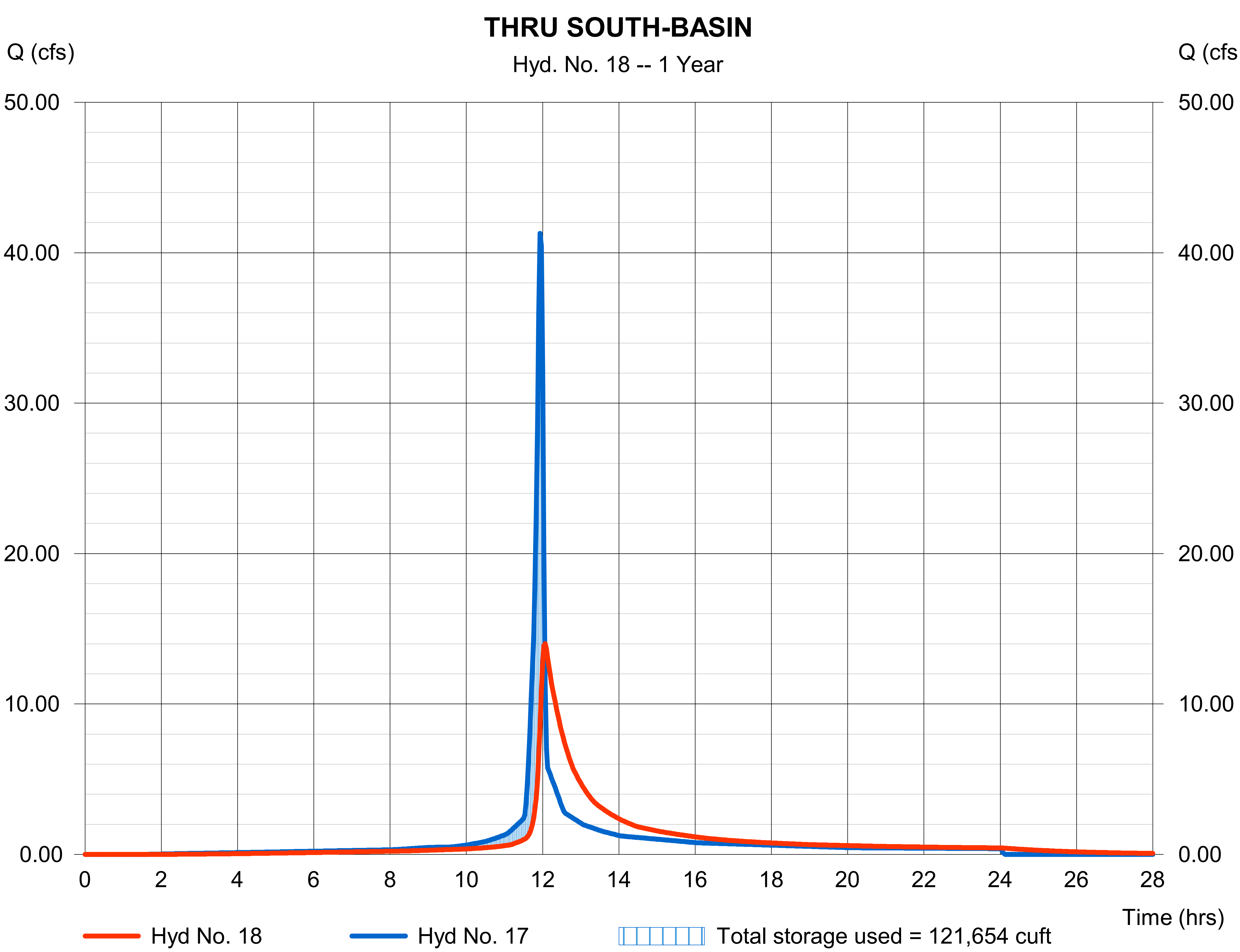
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 18

THRU SOUTH-BASIN

Hydrograph type	= Reservoir	Peak discharge	= 14.02 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 90,796 cuft
Inflow hyd. No.	= 17 - SOUTH-TOTAL	Max. Elevation	= 1735.68 ft
Reservoir name	= SOUTH-BASIN	Max. Storage	= 121,654 cuft

Storage Indication method used. Wet pond routing start elevation = 1735.00 ft.



Pond Report

Pond No. 2 - SOUTH-BASIN

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 1733.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1733.00	41,165	0	0
1.00	1734.00	44,172	42,668	42,668
2.00	1735.00	47,200	45,686	88,354
3.00	1736.00	50,837	49,018	137,372
4.00	1737.00	54,781	52,809	190,182
5.00	1738.00	58,898	56,840	247,021

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	18.00	6.00	Inactive
Span (in)	= 24.00	36.00	16.00	0.00
No. Barrels	= 3	2	2	0
Invert El. (ft)	= 1733.00	1735.00	1735.25	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	25.00	Inactive	Inactive
Crest El. (ft)	= 1736.00	1737.25	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage 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	1733.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.10	4,267	1733.10	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.20	8,534	1733.20	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.30	12,801	1733.30	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.40	17,067	1733.40	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.50	21,334	1733.50	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.60	25,601	1733.60	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.70	29,868	1733.70	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.80	34,135	1733.80	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.90	38,402	1733.90	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.00	42,668	1734.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.10	47,237	1734.10	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.20	51,806	1734.20	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.30	56,374	1734.30	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.40	60,943	1734.40	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.50	65,511	1734.50	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.60	70,080	1734.60	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.70	74,648	1734.70	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.80	79,217	1734.80	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.90	83,786	1734.90	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
2.00	88,354	1735.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
2.10	93,256	1735.10	0.67 ic	0.65 ic	0.00	---	0.00	0.00	---	---	---	---	0.646
2.20	98,158	1735.20	1.92 ic	1.83 ic	0.00	---	0.00	0.00	---	---	---	---	1.826
2.30	103,060	1735.30	3.59 ic	3.36 ic	0.10 ic	---	0.00	0.00	---	---	---	---	3.459
2.40	107,961	1735.40	5.82 oc	5.17 ic	0.53 ic	---	0.00	0.00	---	---	---	---	5.696
2.50	112,863	1735.50	8.55 oc	7.22 ic	1.13 ic	---	0.00	0.00	---	---	---	---	8.357
2.60	117,765	1735.60	11.58 oc	9.49 ic	1.88 ic	---	0.00	0.00	---	---	---	---	11.37
2.70	122,667	1735.70	14.70 oc	11.96 ic	2.74 ic	---	0.00	0.00	---	---	---	---	14.70
2.80	127,569	1735.80	18.25 oc	14.62 ic	3.52 ic	---	0.00	0.00	---	---	---	---	18.14
2.90	132,471	1735.90	21.55 oc	17.44 ic	4.06 ic	---	0.00	0.00	---	---	---	---	21.50
3.00	137,372	1736.00	25.04 oc	20.43 ic	4.54 ic	---	0.00	0.00	---	---	---	---	24.97
3.10	142,653	1736.10	30.23 oc	23.57 ic	4.97 ic	---	1.68	0.00	---	---	---	---	30.22
3.20	147,934	1736.20	36.99 oc	26.85 ic	5.37 ic	---	4.76	0.00	---	---	---	---	36.99
3.30	153,215	1736.30	44.78 oc	30.28 ic	5.74 ic	---	8.76	0.00	---	---	---	---	44.78
3.40	158,496	1736.40	51.65 oc	32.93 ic	5.23 ic	---	13.48	0.00	---	---	---	---	51.64
3.50	163,777	1736.50	56.44 oc	32.75 ic	4.85 ic	---	18.84	0.00	---	---	---	---	56.44
3.60	169,058	1736.60	60.03 oc	31.15 ic	4.61 ic	---	24.26 s	0.00	---	---	---	---	60.02

Continues on next page...

SOUTH-BASIN

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
3.70	174,339	1736.70	63.15 oc	29.85 ic	4.42 ic	---	28.87 s	0.00	---	---	---	---	63.14
3.80	179,620	1736.80	66.02 oc	28.65 ic	4.24 ic	---	33.13 s	0.00	---	---	---	---	66.02
3.90	184,901	1736.90	68.71 oc	27.51 ic	4.08 ic	---	37.12 s	0.00	---	---	---	---	68.71
4.00	190,182	1737.00	71.24 oc	26.44 ic	3.92 ic	---	40.88 s	0.00	---	---	---	---	71.23
4.10	195,866	1737.10	73.63 oc	25.42 ic	3.77 ic	---	44.43 s	0.00	---	---	---	---	73.62
4.20	201,550	1737.20	75.89 oc	24.47 ic	3.62 ic	---	47.79 s	0.00	---	---	---	---	75.88
4.30	207,234	1737.30	78.05 oc	23.56 ic	3.49 ic	---	50.99 s	0.93	---	---	---	---	78.98
4.40	212,917	1737.40	80.12 oc	22.72 ic	3.37 ic	---	54.03 s	4.84	---	---	---	---	84.96
4.50	218,601	1737.50	81.76 ic	21.81 ic	3.23 ic	---	56.71 s	10.41	---	---	---	---	92.16
4.60	224,285	1737.60	83.25 ic	20.94 ic	3.10 ic	---	59.20 s	17.24	---	---	---	---	100.48
4.70	229,969	1737.70	84.70 ic	20.13 ic	2.98 ic	---	61.58 s	25.13	---	---	---	---	109.82
4.80	235,653	1737.80	86.09 ic	19.38 ic	2.87 ic	---	63.83 s	33.96	---	---	---	---	120.04
4.90	241,337	1737.90	87.45 ic	18.67 ic	2.77 ic	---	65.99 s	43.63	---	---	---	---	131.06
5.00	247,021	1738.00	88.77 ic	18.02 ic	2.67 ic	---	68.06 s	54.07	---	---	---	---	142.82

...End

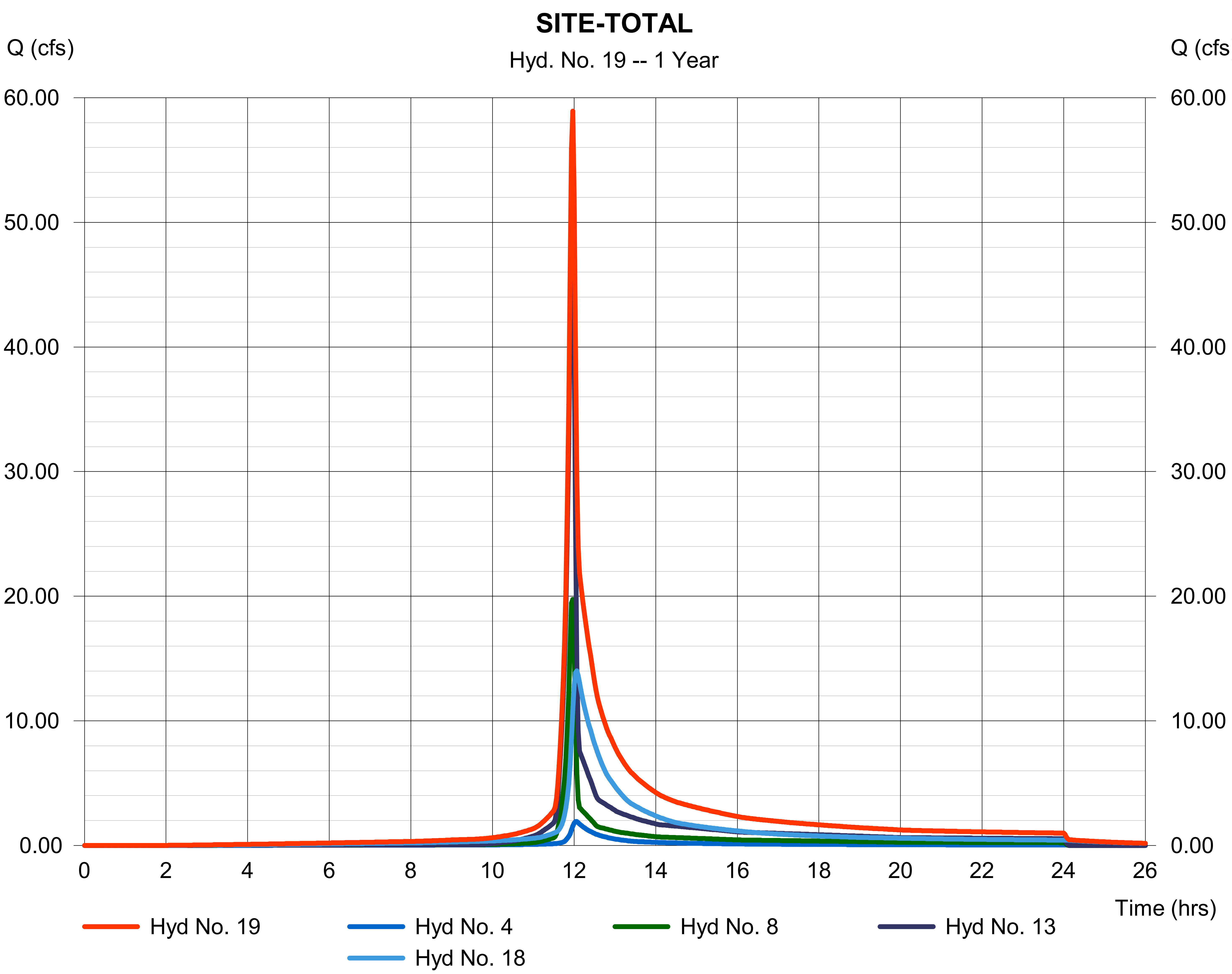
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 19

SITE-TOTAL

Hydrograph type	= Combine	Peak discharge	= 58.92 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 197,280 cuft
Inflow hyds.	= 4, 8, 13, 18	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	3.174	2	716	7,418	------	------	------	NORTH-BASIN IP
2	SCS Runoff	3.083	2	716	6,224	------	------	------	NORTH-BASIN MEAD-G
3	Combine	6.257	2	716	13,642	1, 2	------	------	NORTH-TOTAL
4	Reservoir	2.697	2	722	13,639	3	1736.41	12,860	THRU NORTH-BASIN
5	SCS Runoff	3.875	2	716	9,057	------	------	------	OFF-1 IP
6	SCS Runoff	8.345	2	716	16,848	------	------	------	OFF-1 MEAD-G
7	SCS Runoff	15.22	2	718	30,440	------	------	------	OFF-1 WO-G
8	Combine	27.26	2	718	56,346	5, 6, 7	------	------	OFF-1 TOTAL
9	SCS Runoff	4.153	2	716	9,707	------	------	------	OFF-2 IP
10	SCS Runoff	31.99	2	716	64,575	------	------	------	OFF-2 MEAD-G
11	SCS Runoff	12.82	2	716	25,891	------	------	------	OFF-2 MEAD-G
12	SCS Runoff	0.002	2	718	4	------	------	------	OFF-2 WO-G
13	Combine	68.13	2	716	138,862	9, 10, 11, 12	------	------	OFF-2 TOTAL
14	SCS Runoff	29.41	2	716	68,739	------	------	------	SOUTH-BASIN IP
15	SCS Runoff	19.83	2	716	40,029	------	------	------	SOUTH-BASIN MEAD-G
16	SCS Runoff	3.786	2	718	7,572	------	------	------	SOUTH-BASIN WO-G
17	Combine	52.95	2	716	116,340	14, 15, 16	------	------	SOUTH-TOTAL
18	Reservoir	19.58	2	724	116,333	17	1735.85	129,670	THRU SOUTH-BASIN
19	Combine	81.33	2	718	260,603	4, 8, 13, 18	------	------	SITE-TOTAL

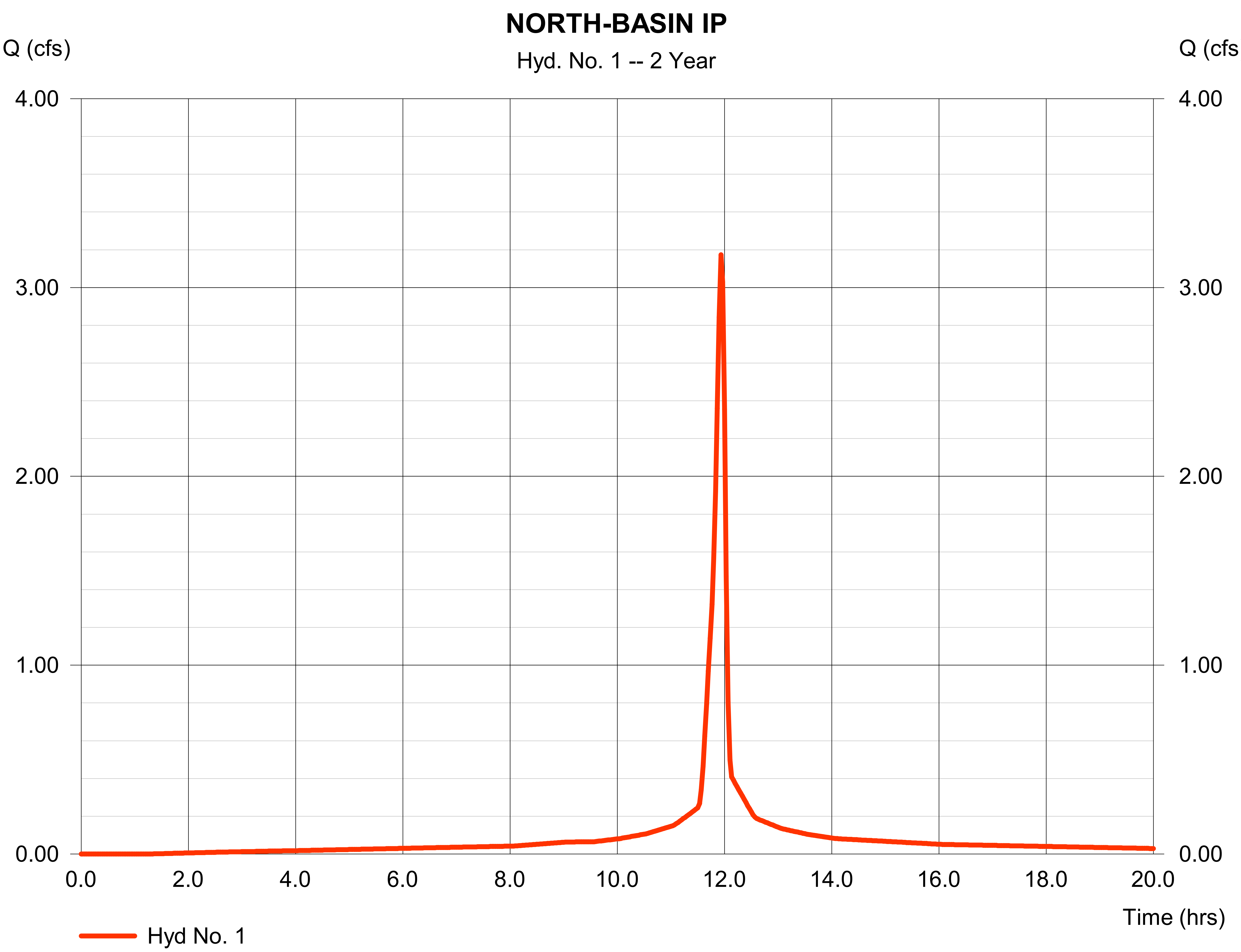
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 1

NORTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 3.174 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 7,418 cuft
Drainage area	= 0.742 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

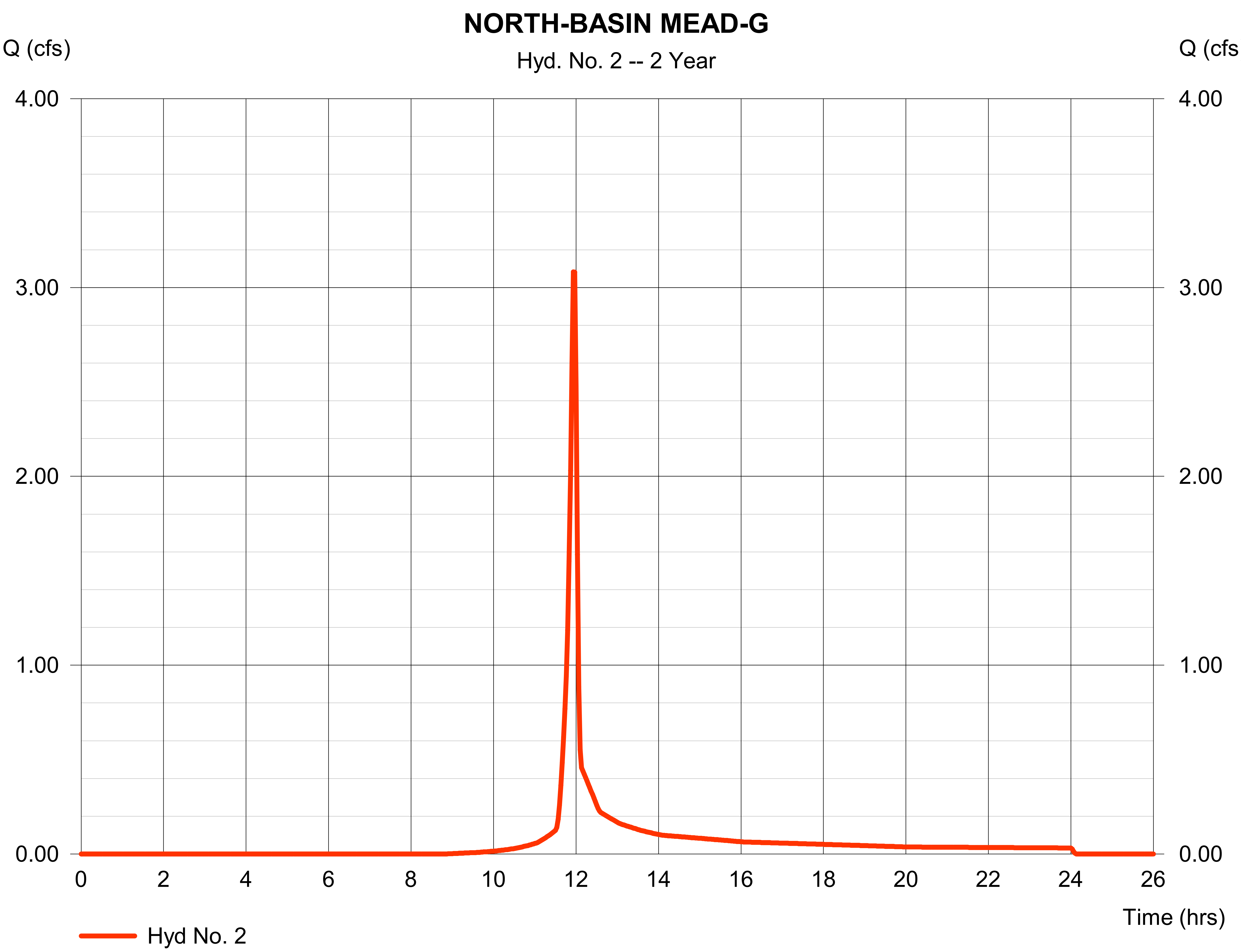


Hydrograph Report

Hyd. No. 2

NORTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 3.083 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 6,224 cuft
Drainage area	= 1.208 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



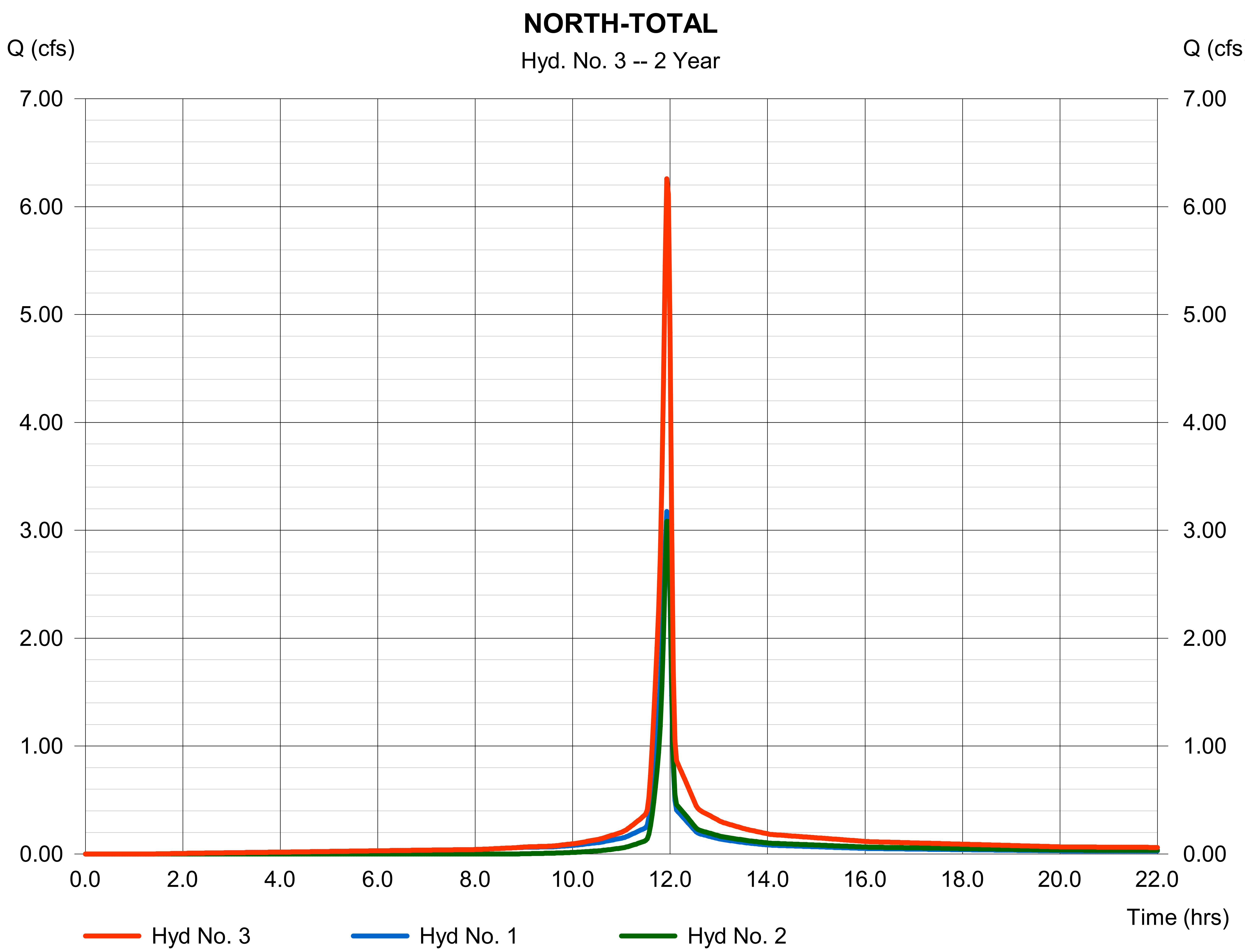
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 3

NORTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 6.257 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 13,642 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 1.950 ac



Hydrograph Report

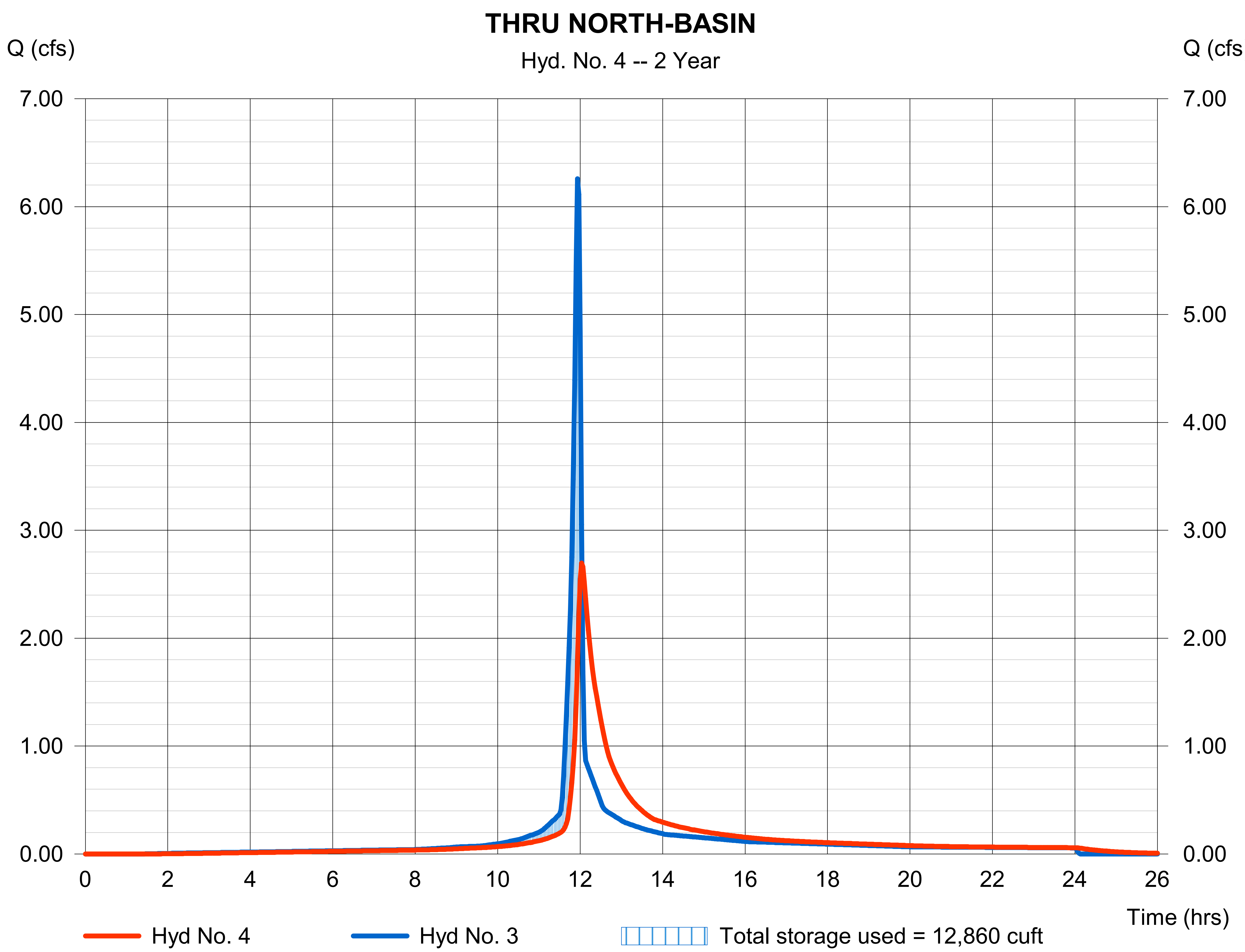
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 4

THRU NORTH-BASIN

Hydrograph type	= Reservoir	Peak discharge	= 2.697 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 13,639 cuft
Inflow hyd. No.	= 3 - NORTH-TOTAL	Max. Elevation	= 1736.41 ft
Reservoir name	= NORTH-BASIN	Max. Storage	= 12,860 cuft

Storage Indication method used. Wet pond routing start elevation = 1736.00 ft.



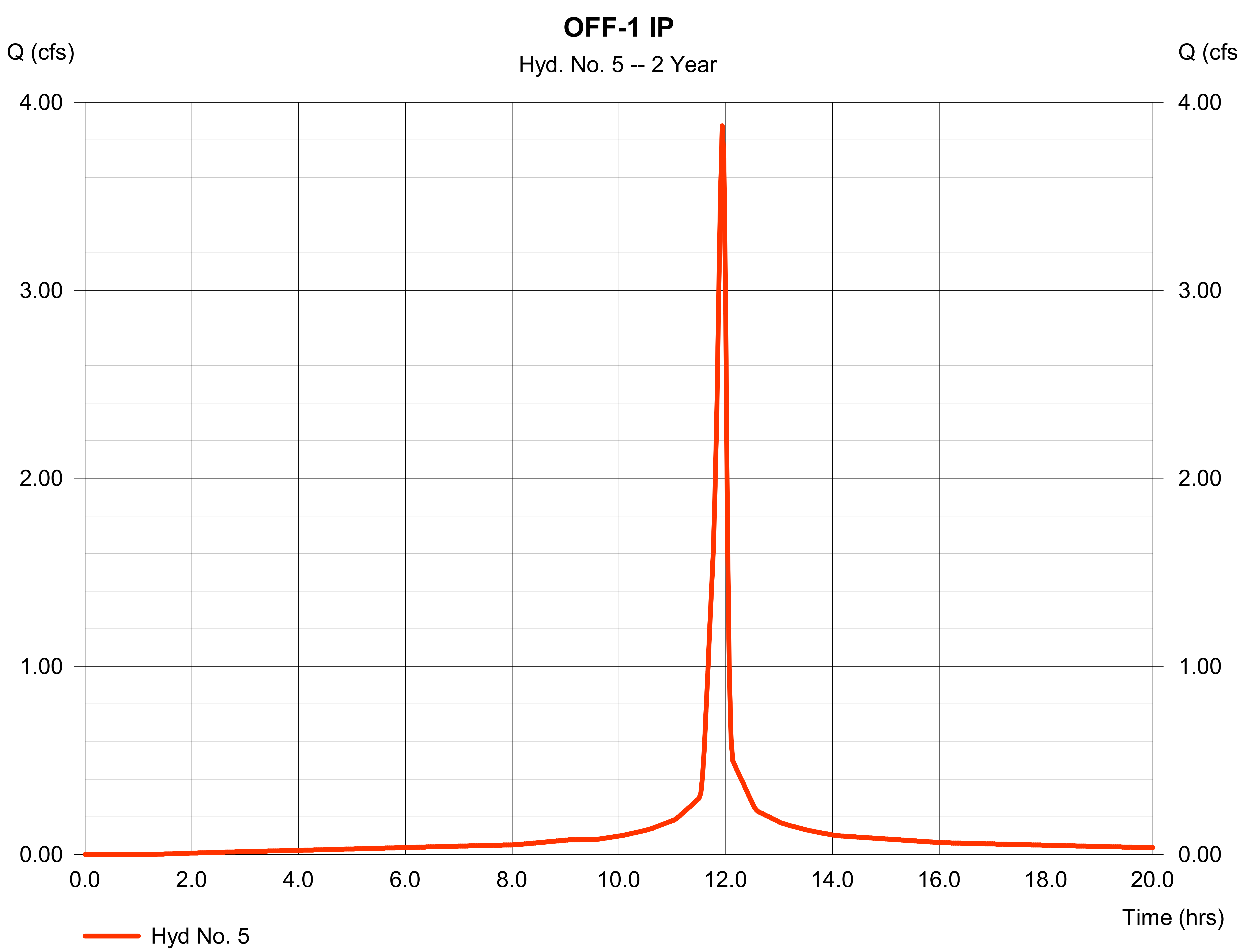
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 5

OFF-1 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 3.875 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 9,057 cuft
Drainage area	= 0.906 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



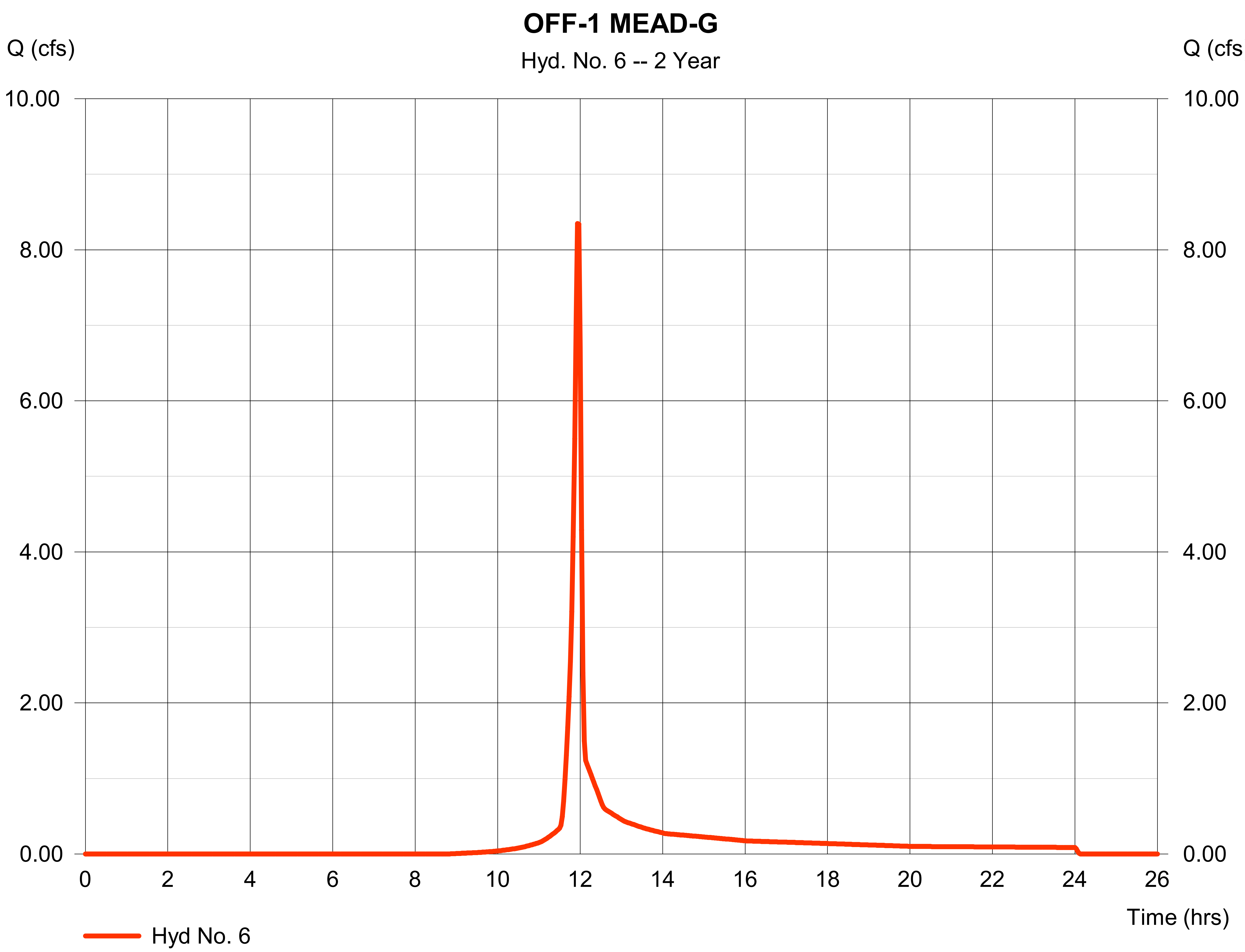
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 6

OFF-1 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 8.345 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 16,848 cuft
Drainage area	= 3.270 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



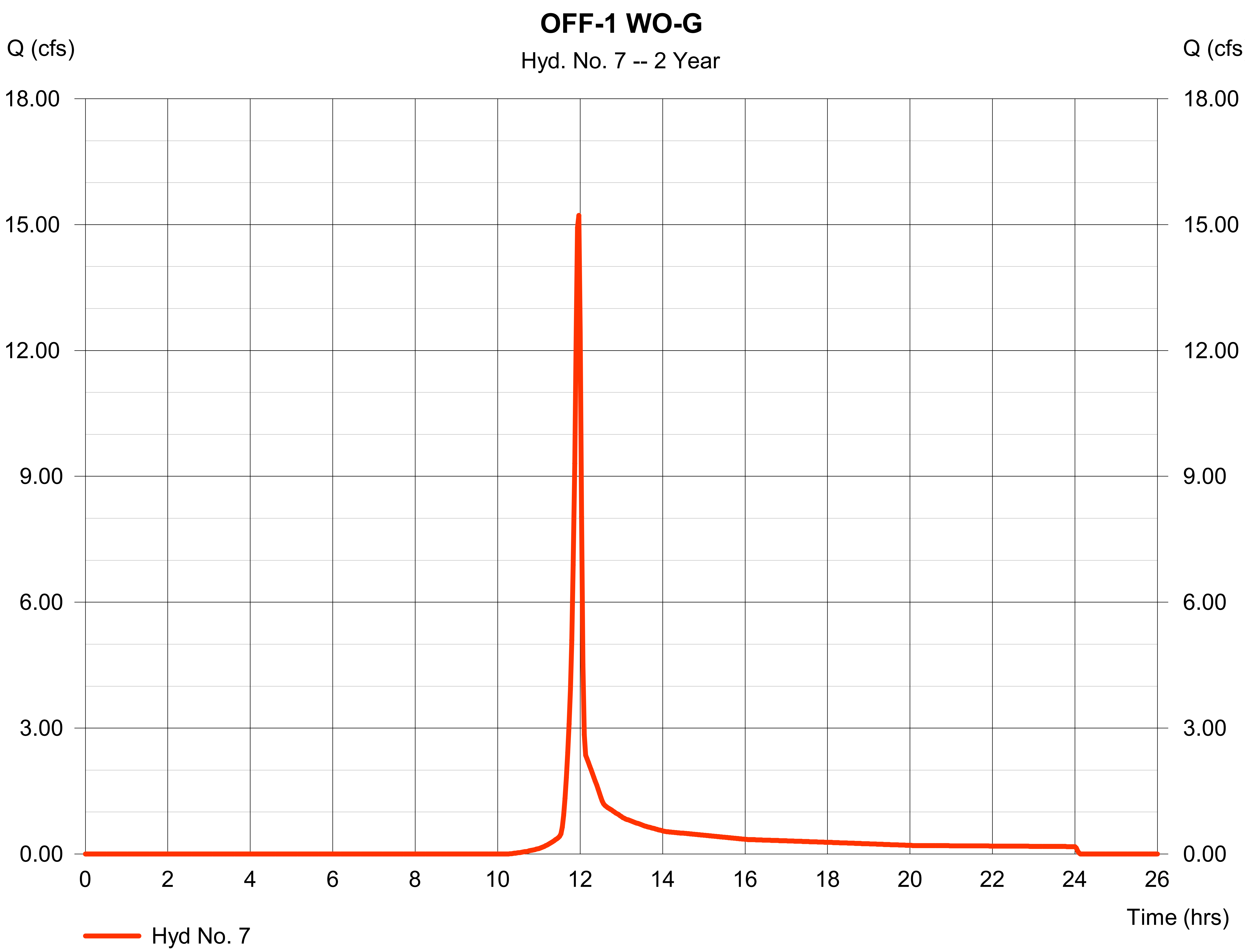
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 7

OFF-1 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 15.22 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 30,440 cuft
Drainage area	= 7.514 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



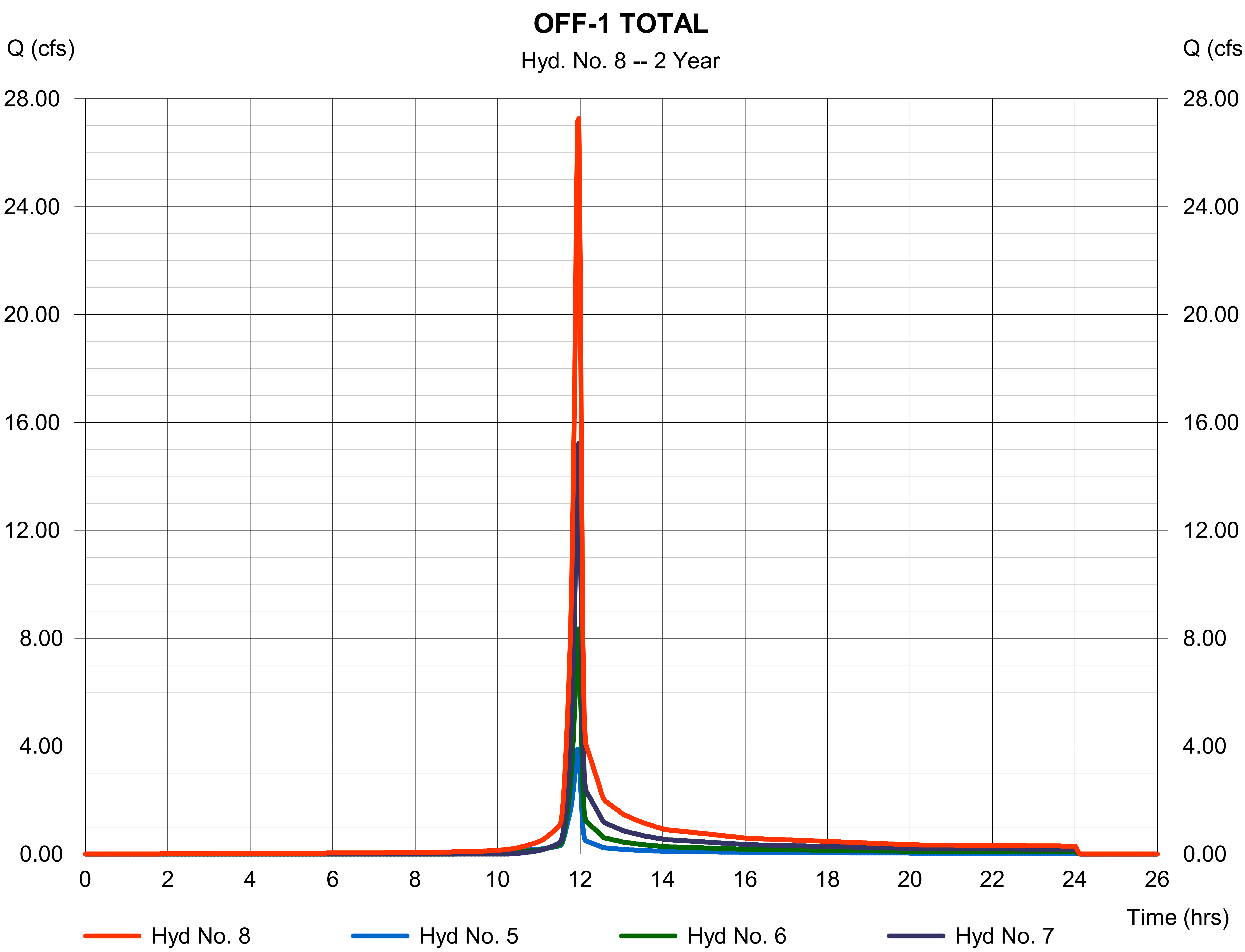
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 8

OFF-1 TOTAL

Hydrograph type	= Combine	Peak discharge	= 27.26 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 56,346 cuft
Inflow hyds.	= 5, 6, 7	Contrib. drain. area	= 11.690 ac



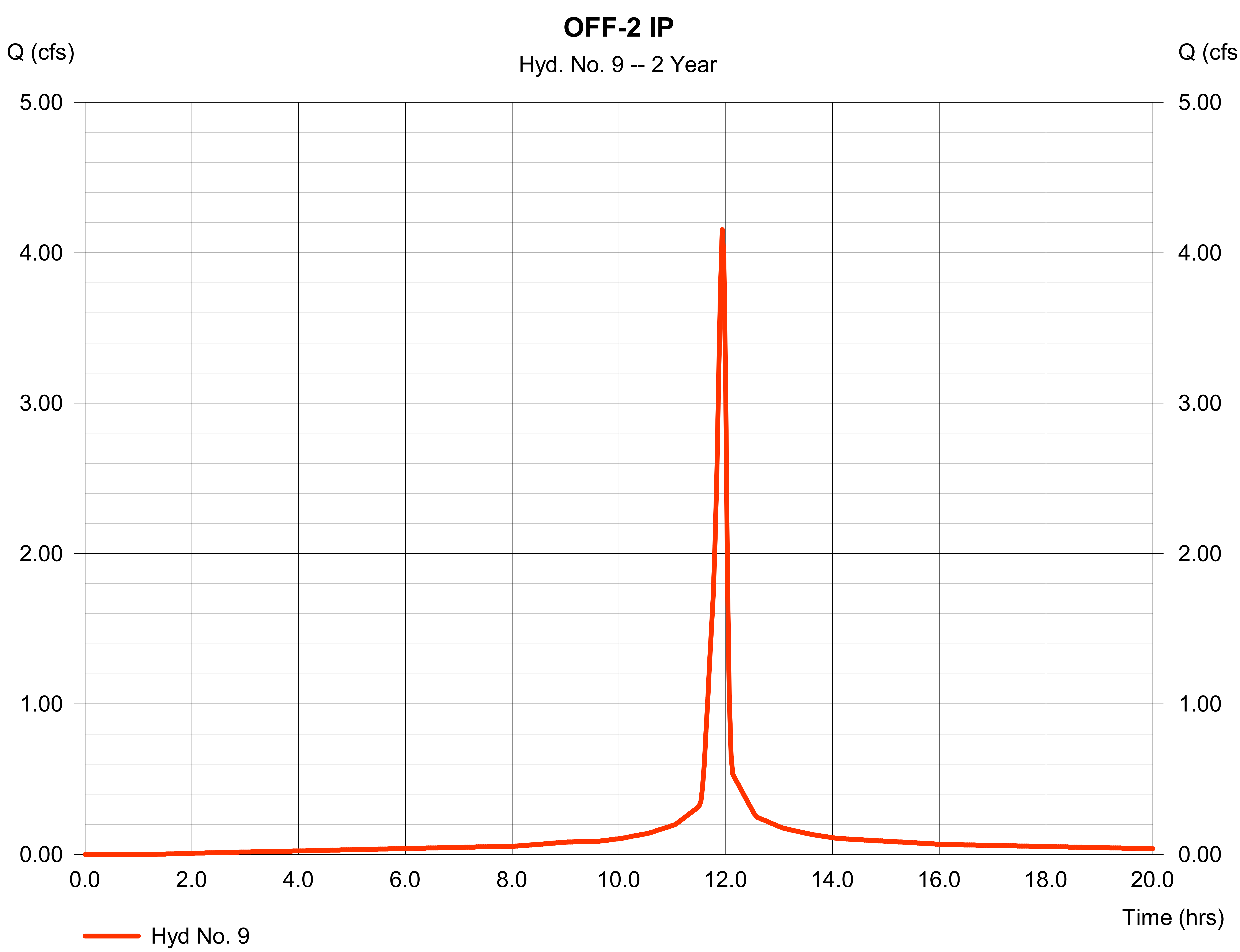
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 9

OFF-2 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 4.153 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 9,707 cuft
Drainage area	= 0.971 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



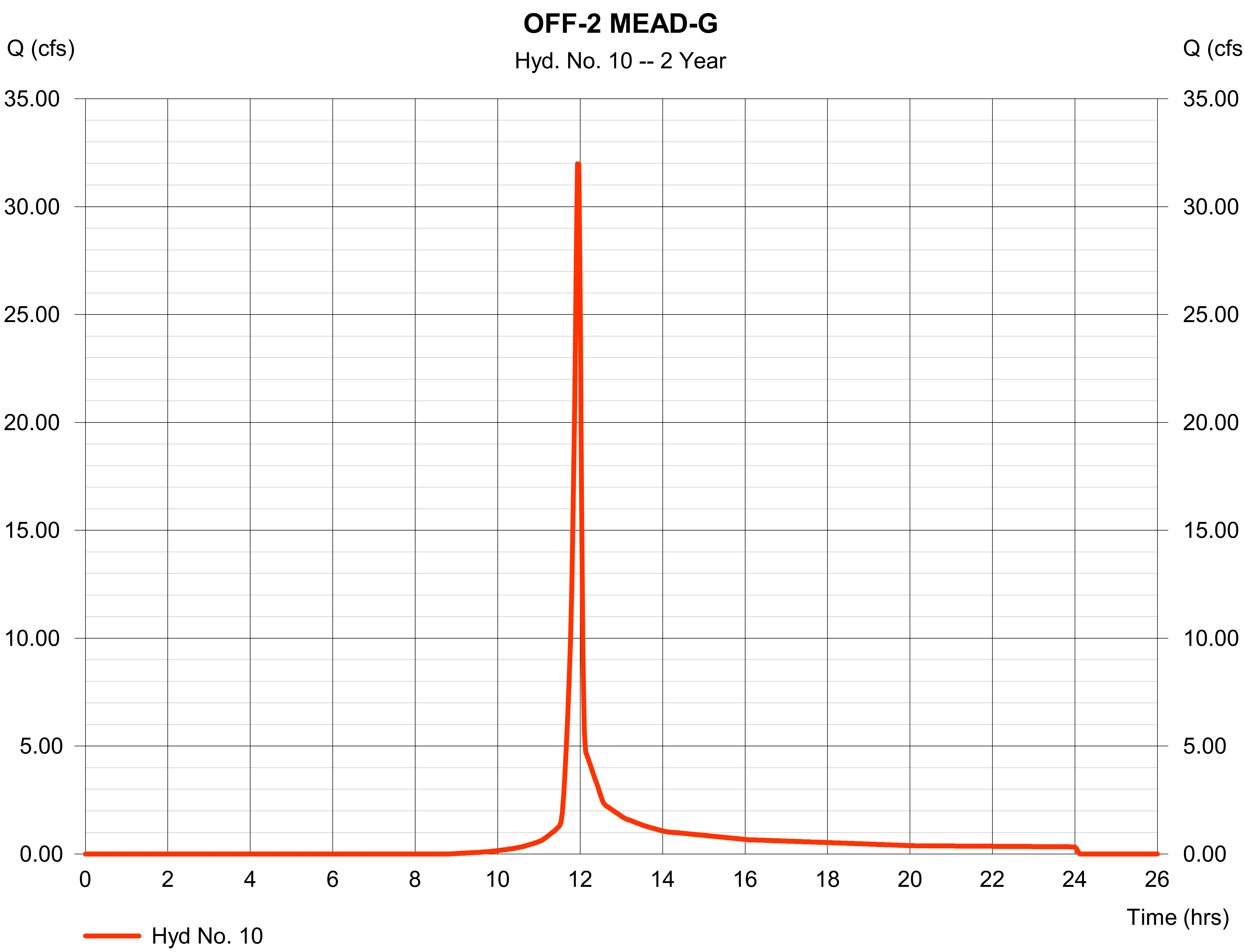
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 10

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 31.99 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 64,575 cuft
Drainage area	= 12.533 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



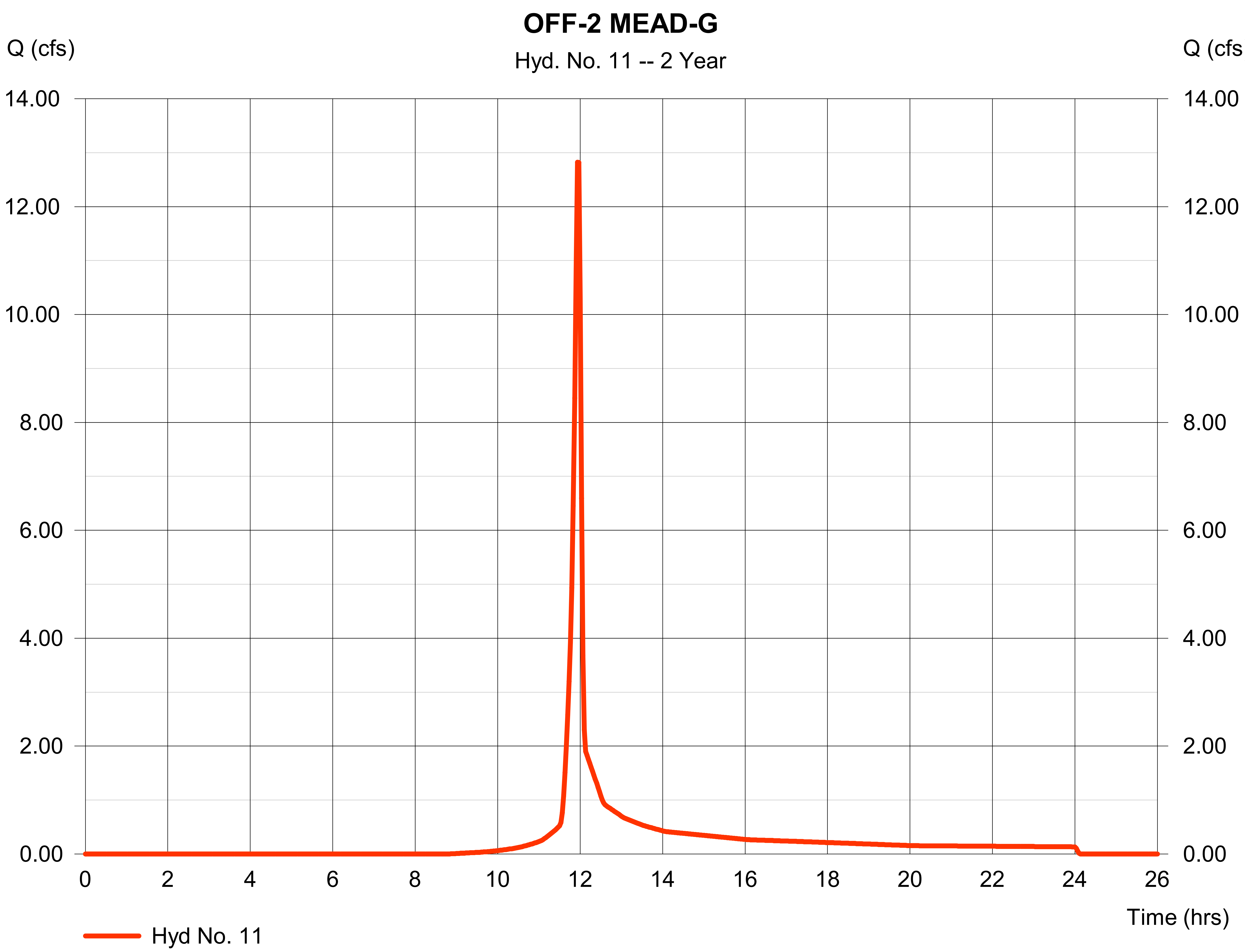
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 11

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 12.82 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 25,891 cuft
Drainage area	= 5.025 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



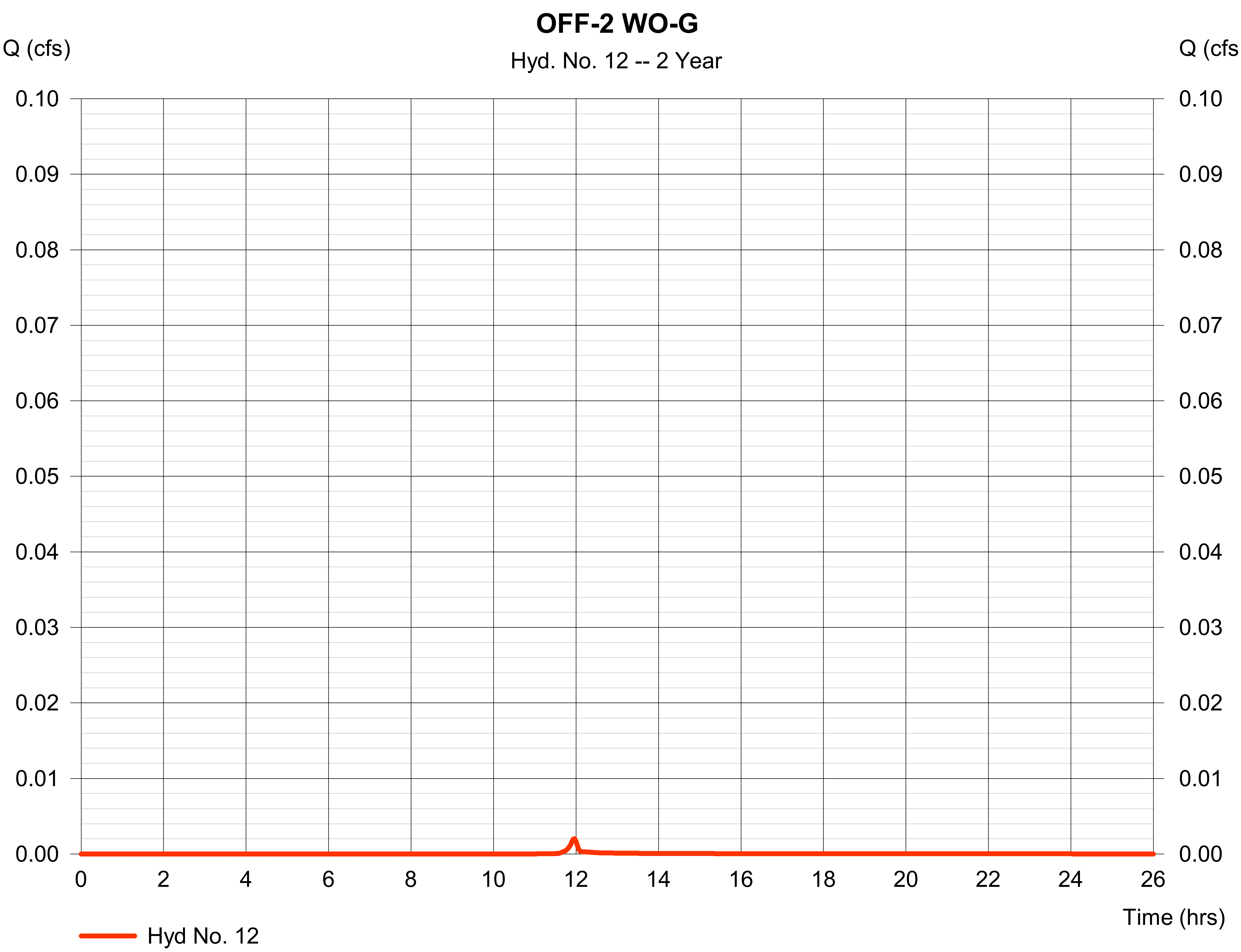
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 12

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.002 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 4 cuft
Drainage area	= 0.001 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



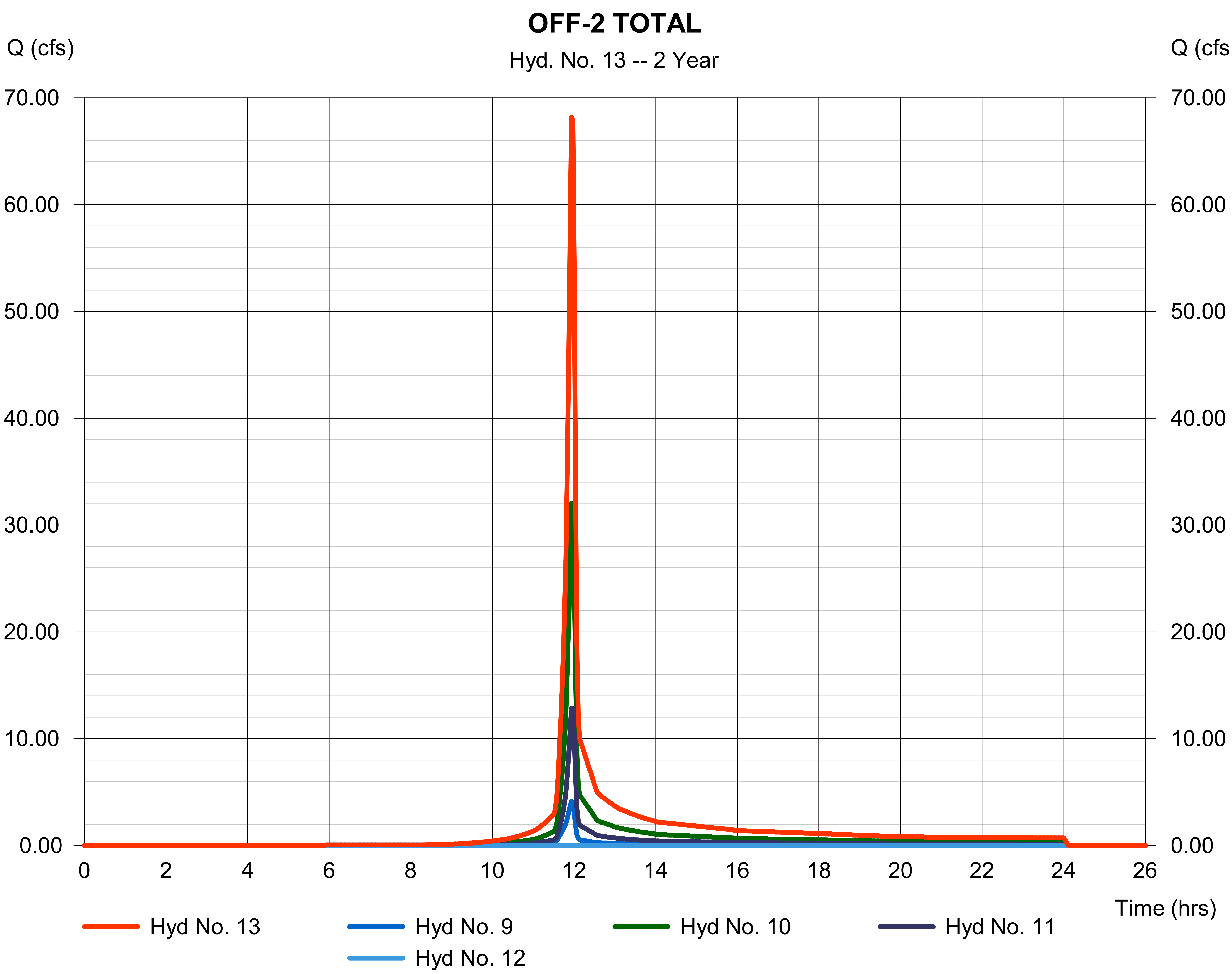
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 13

OFF-2 TOTAL

Hydrograph type	= Combine	Peak discharge	= 68.13 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 138,862 cuft
Inflow hyds.	= 9, 10, 11, 12	Contrib. drain. area	= 18.530 ac



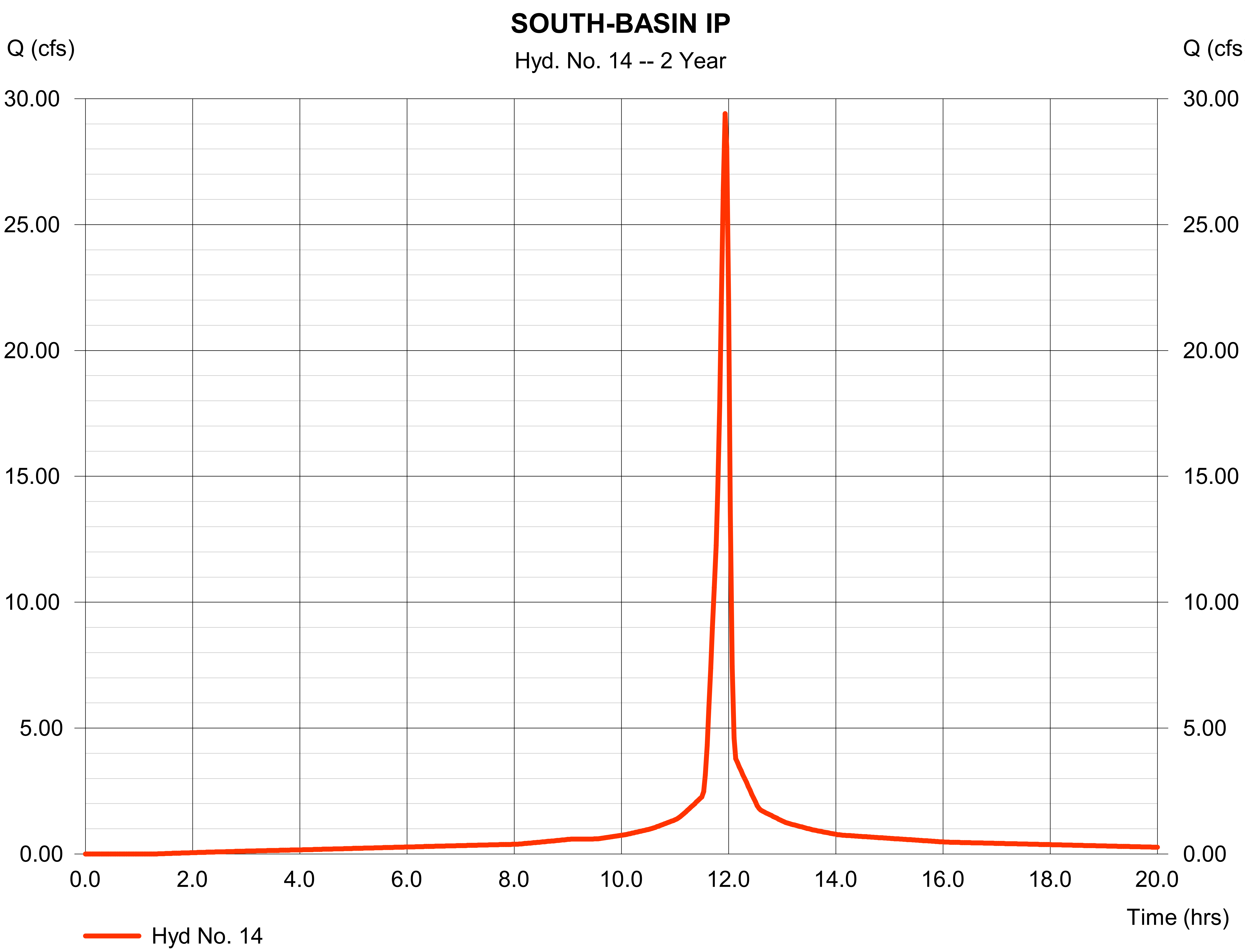
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 14

SOUTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 29.41 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 68,739 cuft
Drainage area	= 6.876 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



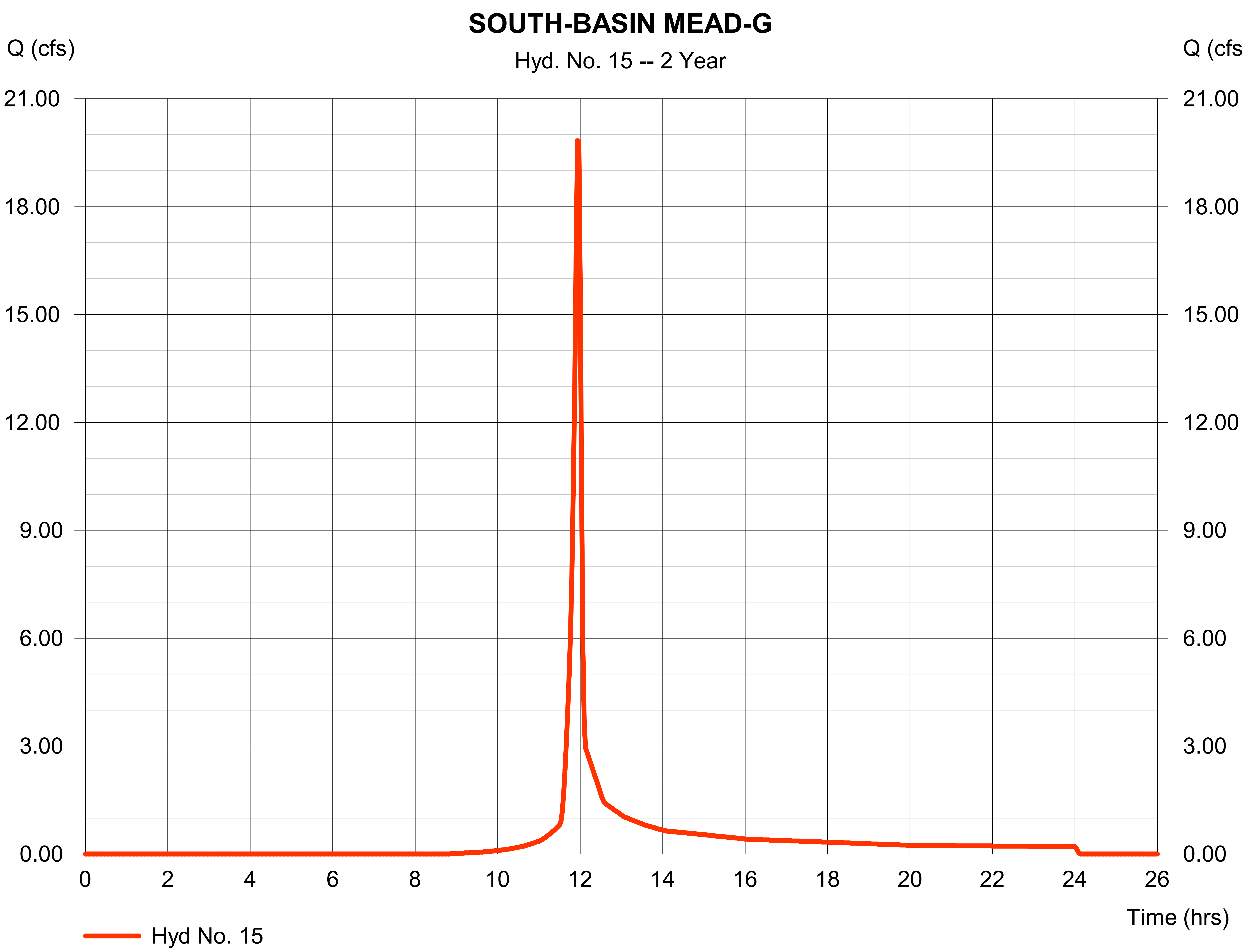
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 15

SOUTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 19.83 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 40,029 cuft
Drainage area	= 7.769 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



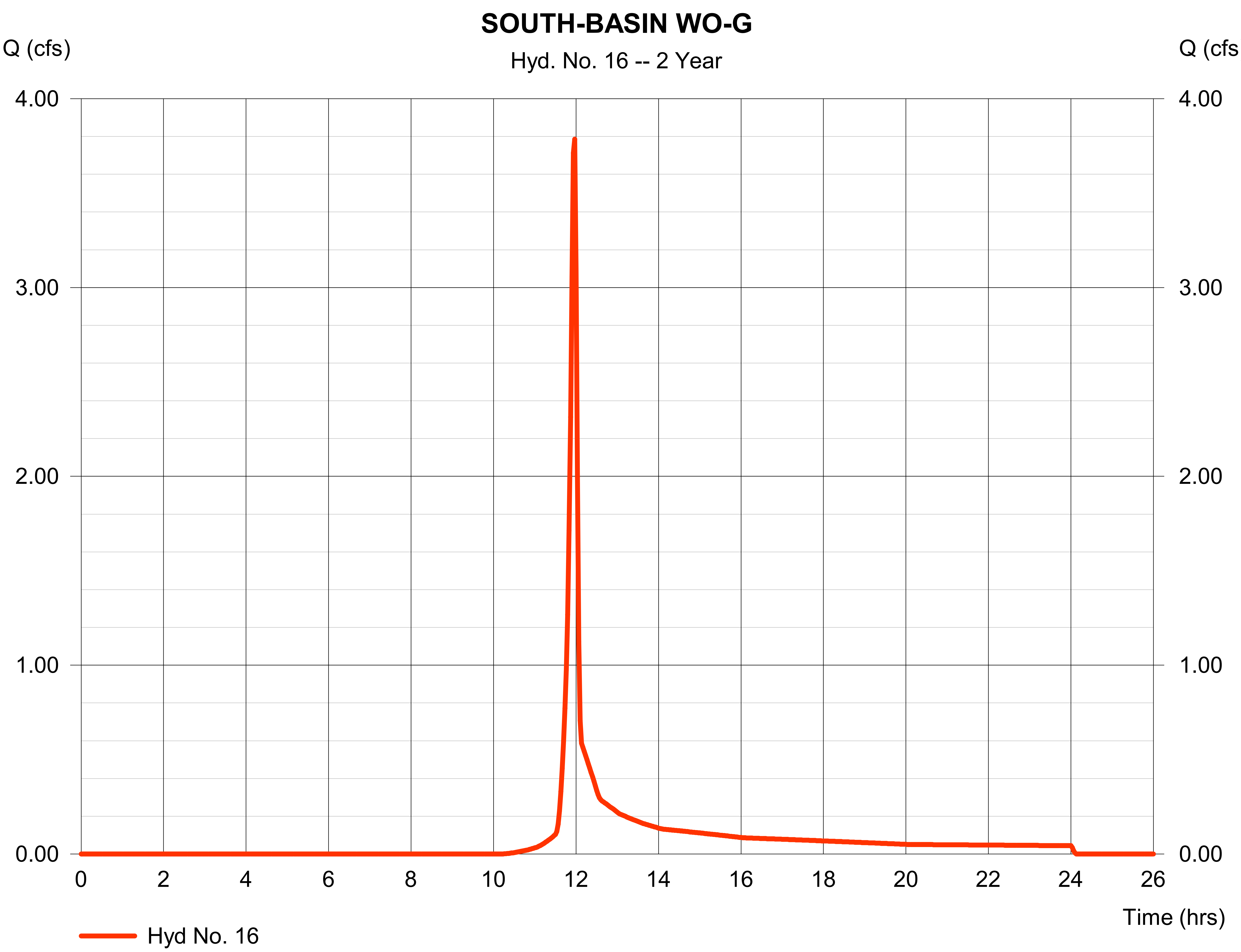
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 16

SOUTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 3.786 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 7,572 cuft
Drainage area	= 1.869 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



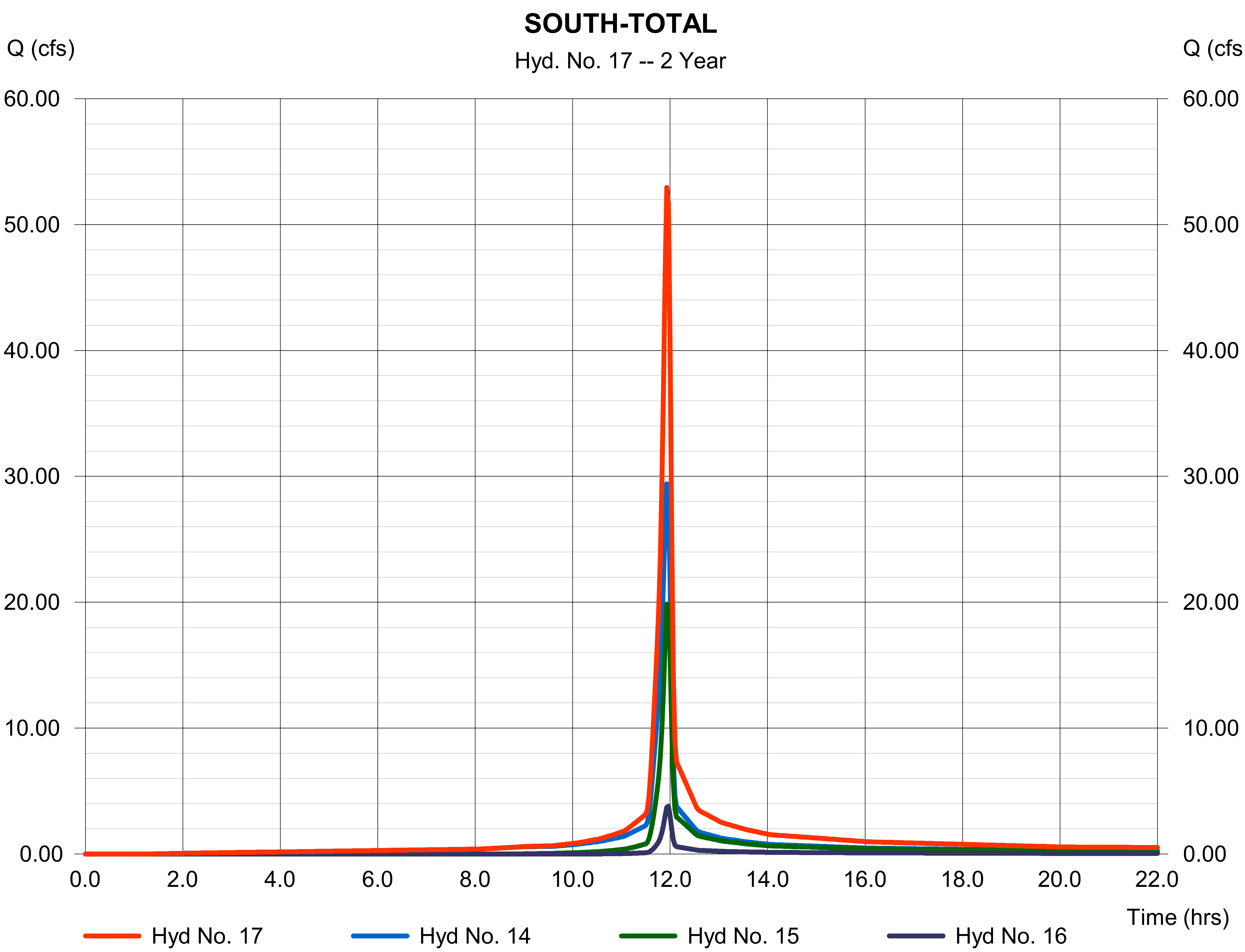
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 17

SOUTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 52.95 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 116,340 cuft
Inflow hyds.	= 14, 15, 16	Contrib. drain. area	= 16.514 ac



Hydrograph Report

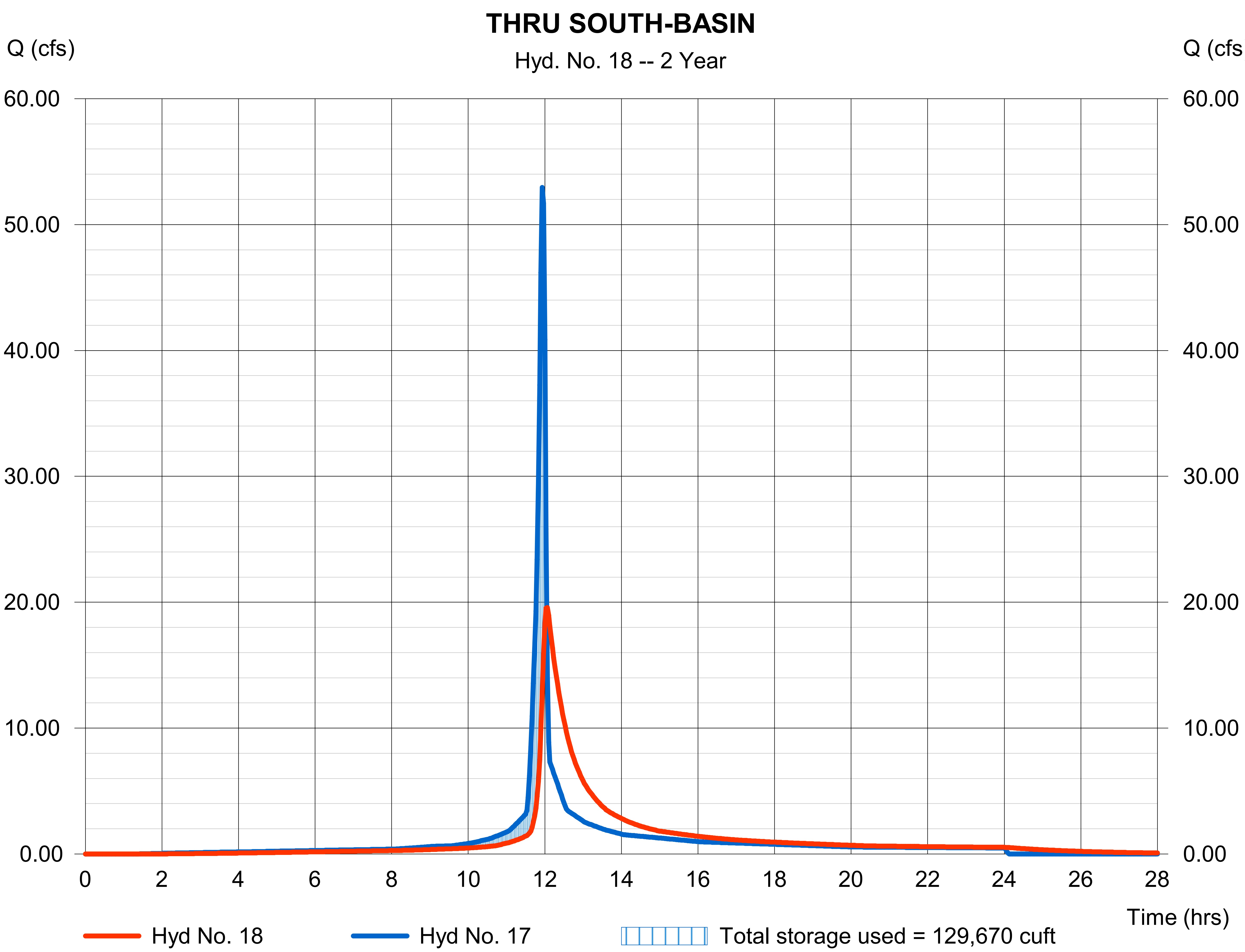
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 18

THRU SOUTH-BASIN

Hydrograph type	= Reservoir	Peak discharge	= 19.58 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 116,333 cuft
Inflow hyd. No.	= 17 - SOUTH-TOTAL	Max. Elevation	= 1735.85 ft
Reservoir name	= SOUTH-BASIN	Max. Storage	= 129,670 cuft

Storage Indication method used. Wet pond routing start elevation = 1735.00 ft.



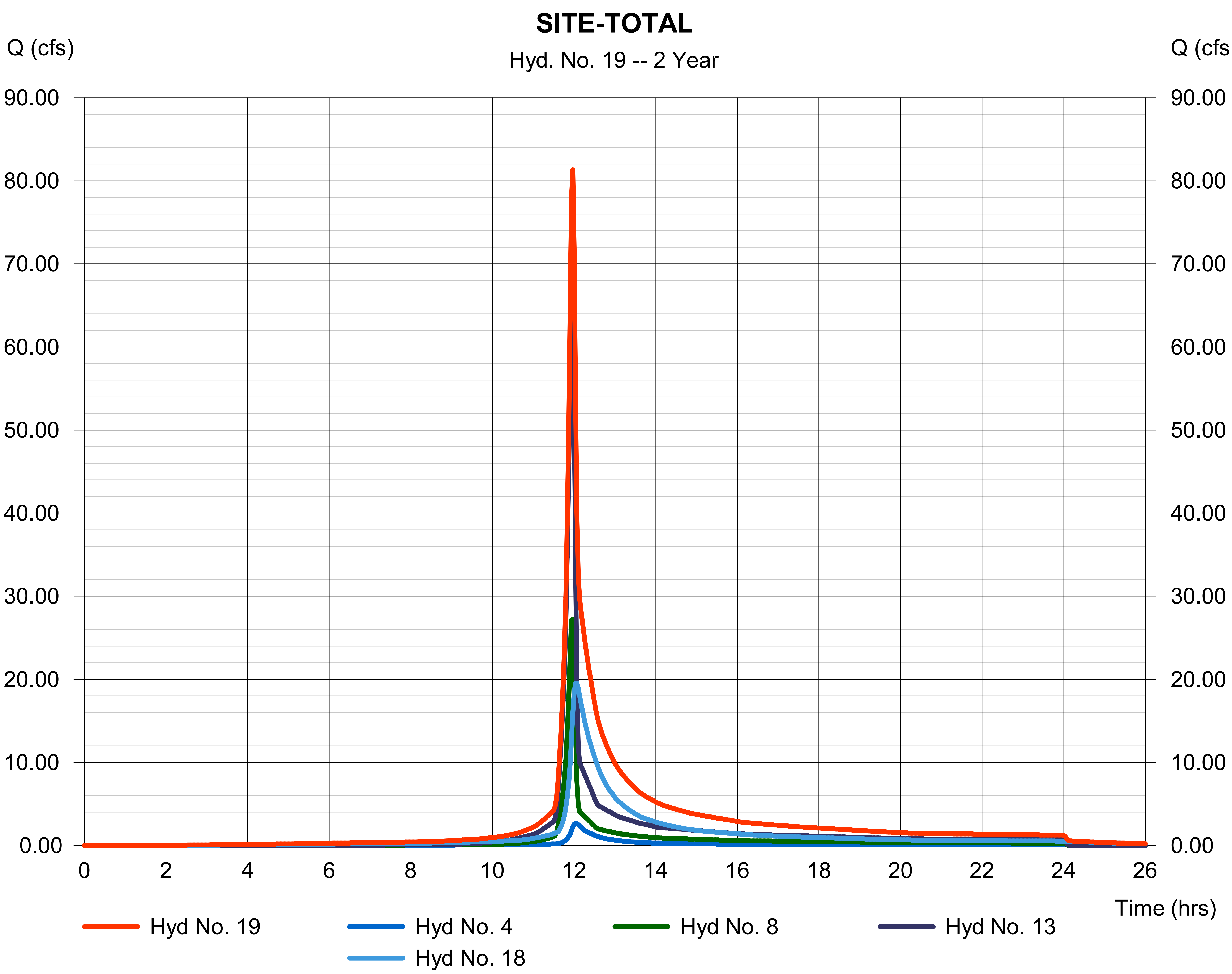
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 19

SITE-TOTAL

Hydrograph type	= Combine	Peak discharge	= 81.33 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 260,603 cuft
Inflow hyds.	= 4, 8, 13, 18	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	3.961	2	716	9,356	------	------	------	NORTH-BASIN IP
2	SCS Runoff	4.366	2	716	8,846	------	------	------	NORTH-BASIN MEAD-G
3	Combine	8.327	2	716	18,202	1, 2	------	------	NORTH-TOTAL
4	Reservoir	3.814	2	722	18,199	3	1736.53	14,099	THRU NORTH-BASIN
5	SCS Runoff	4.837	2	716	11,424	------	------	------	OFF-1 IP
6	SCS Runoff	11.82	2	716	23,946	------	------	------	OFF-1 MEAD-G
7	SCS Runoff	22.44	2	718	45,138	------	------	------	OFF-1 WO-G
8	Combine	39.00	2	716	80,508	5, 6, 7	------	------	OFF-1 TOTAL
9	SCS Runoff	5.184	2	716	12,244	------	------	------	OFF-2 IP
10	SCS Runoff	45.30	2	716	91,777	------	------	------	OFF-2 MEAD-G
11	SCS Runoff	18.16	2	716	36,797	------	------	------	OFF-2 MEAD-G
12	SCS Runoff	0.003	2	718	6	------	------	------	OFF-2 WO-G
13	Combine	95.78	2	716	195,804	9, 10, 11, 12	------	------	OFF-2 TOTAL
14	SCS Runoff	36.71	2	716	86,702	------	------	------	SOUTH-BASIN IP
15	SCS Runoff	28.08	2	716	56,891	------	------	------	SOUTH-BASIN MEAD-G
16	SCS Runoff	5.583	2	718	11,227	------	------	------	SOUTH-BASIN WO-G
17	Combine	70.34	2	716	154,821	14, 15, 16	------	------	SOUTH-TOTAL
18	Reservoir	28.88	2	722	154,813	17	1736.08	141,302	THRU SOUTH-BASIN
19	Combine	115.15	2	718	357,546	4, 8, 13, 18	------	------	SITE-TOTAL

PR-SWM.gpw	Return Period: 5 Year	Tuesday, 10 / 15 / 2019

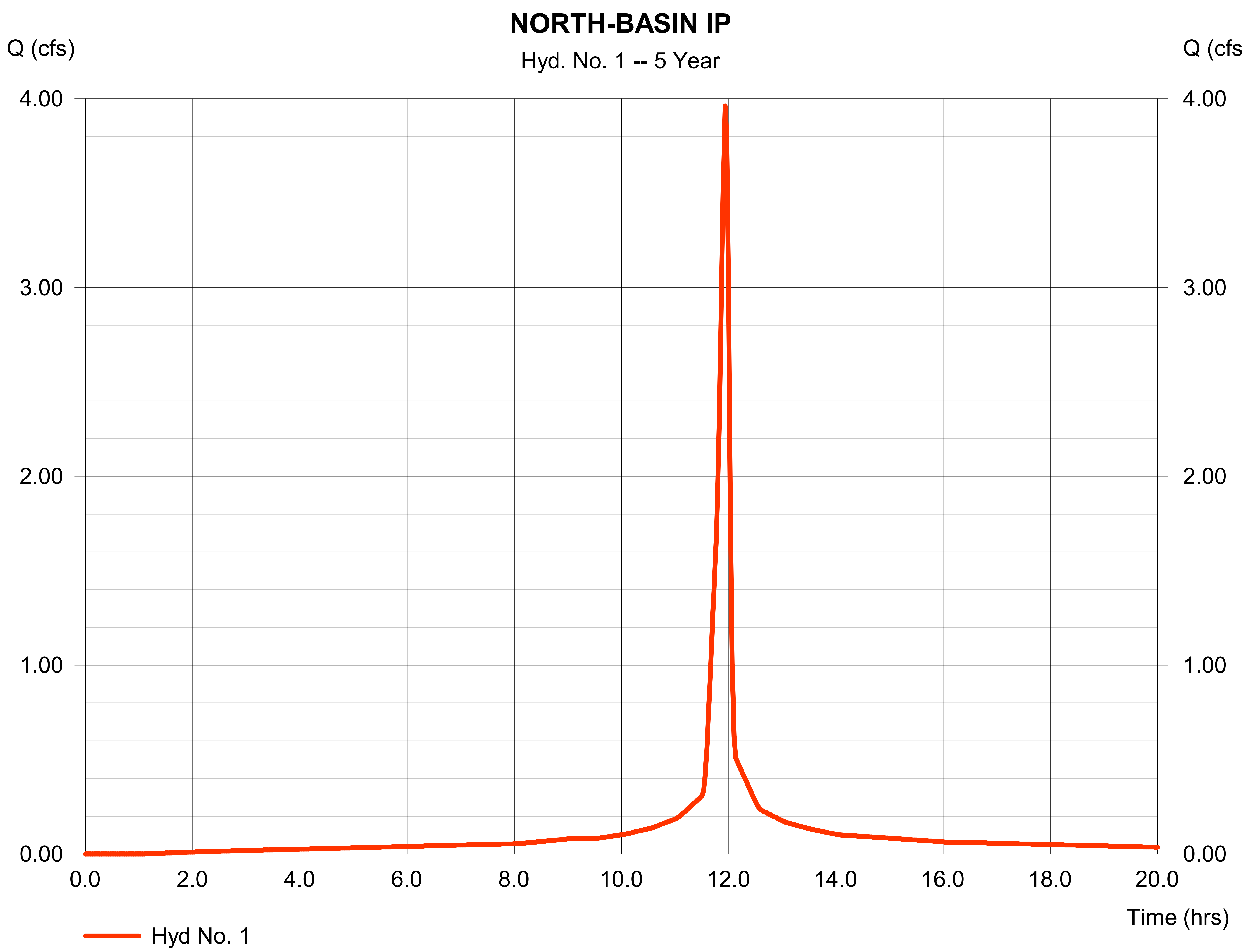
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 1

NORTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 3.961 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 9,356 cuft
Drainage area	= 0.742 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



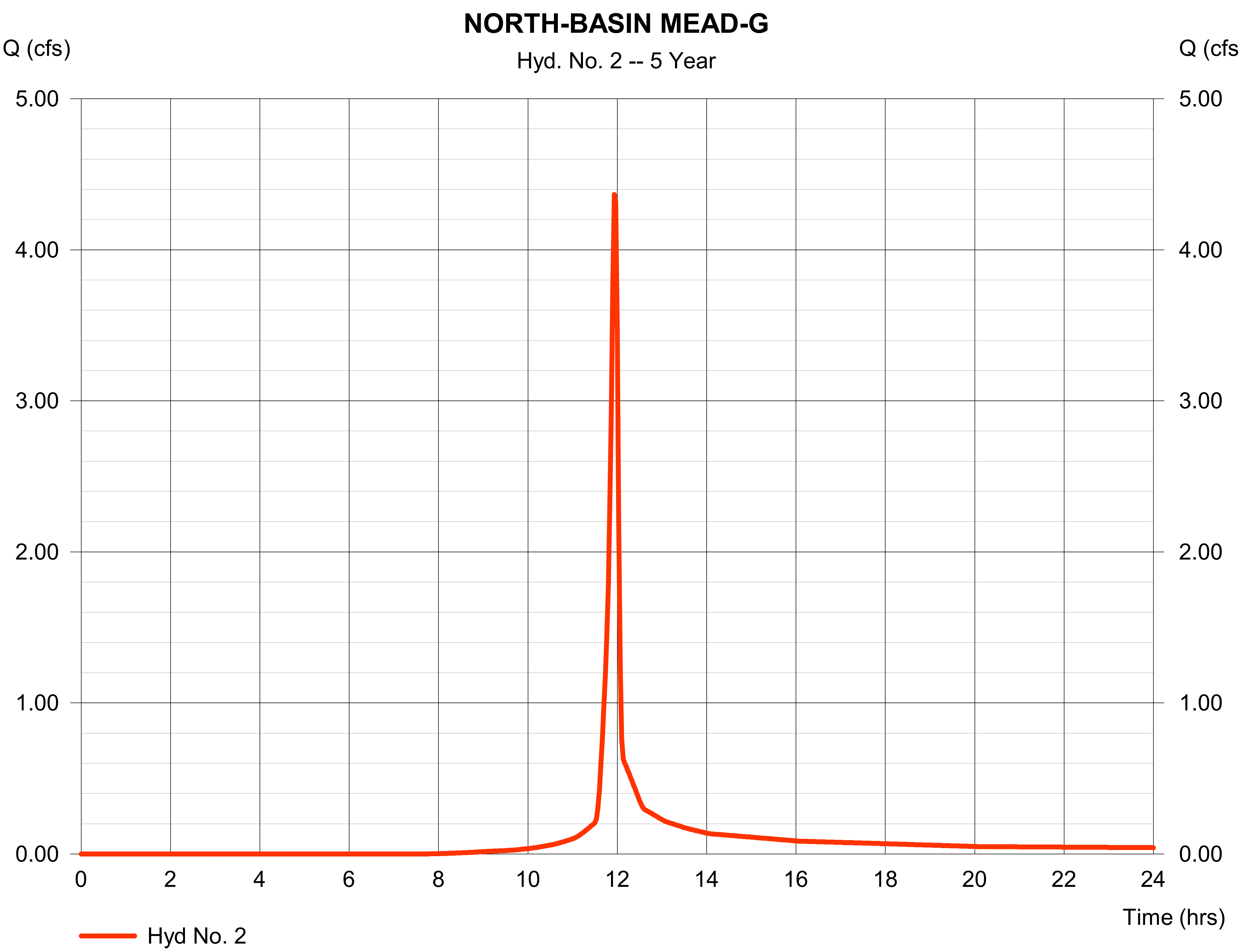
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 2

NORTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 4.366 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 8,846 cuft
Drainage area	= 1.208 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



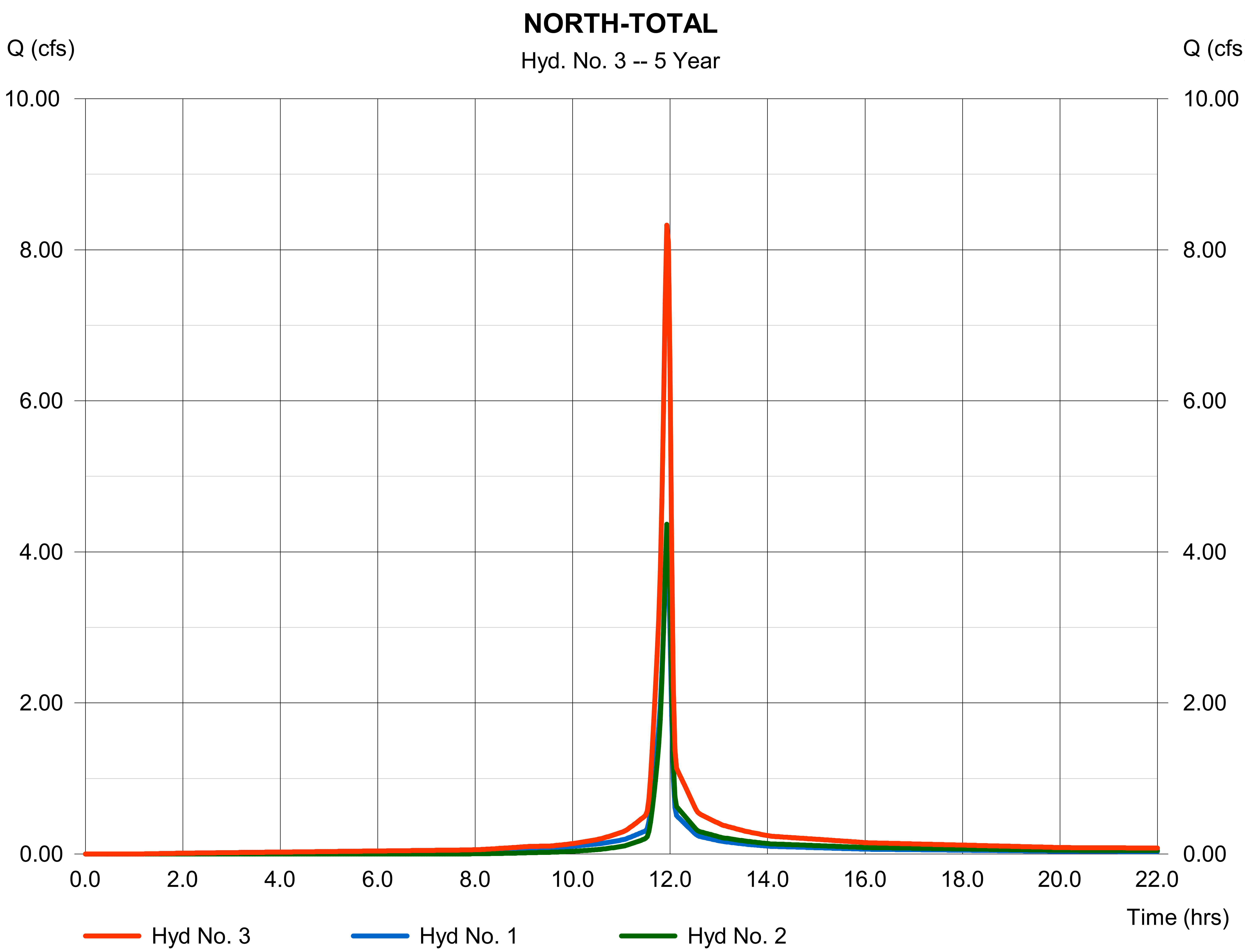
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 3

NORTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 8.327 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 18,202 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 1.950 ac



Hydrograph Report

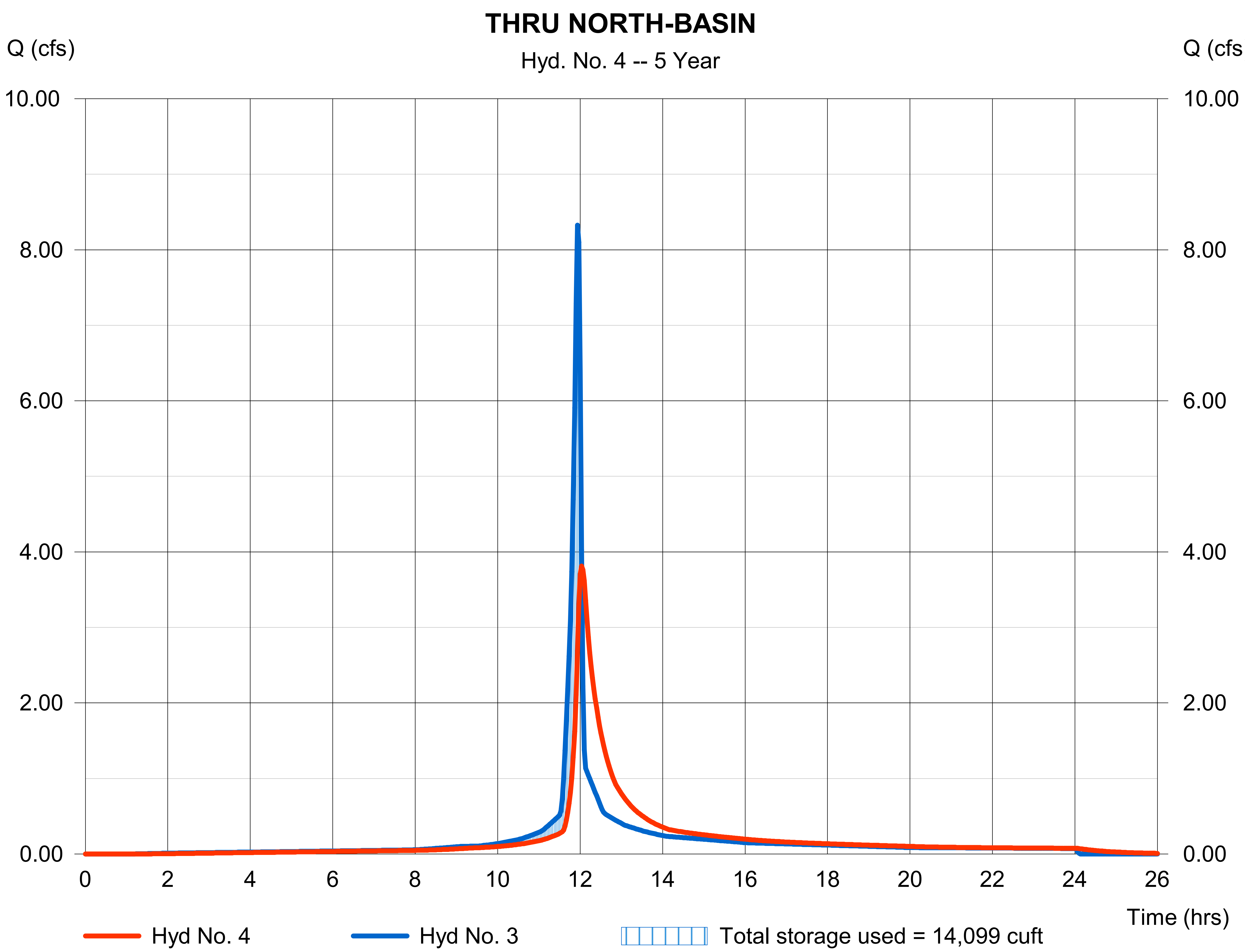
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 4

THRU NORTH-BASIN

Hydrograph type	= Reservoir	Peak discharge	= 3.814 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 18,199 cuft
Inflow hyd. No.	= 3 - NORTH-TOTAL	Max. Elevation	= 1736.53 ft
Reservoir name	= NORTH-BASIN	Max. Storage	= 14,099 cuft

Storage Indication method used. Wet pond routing start elevation = 1736.00 ft.



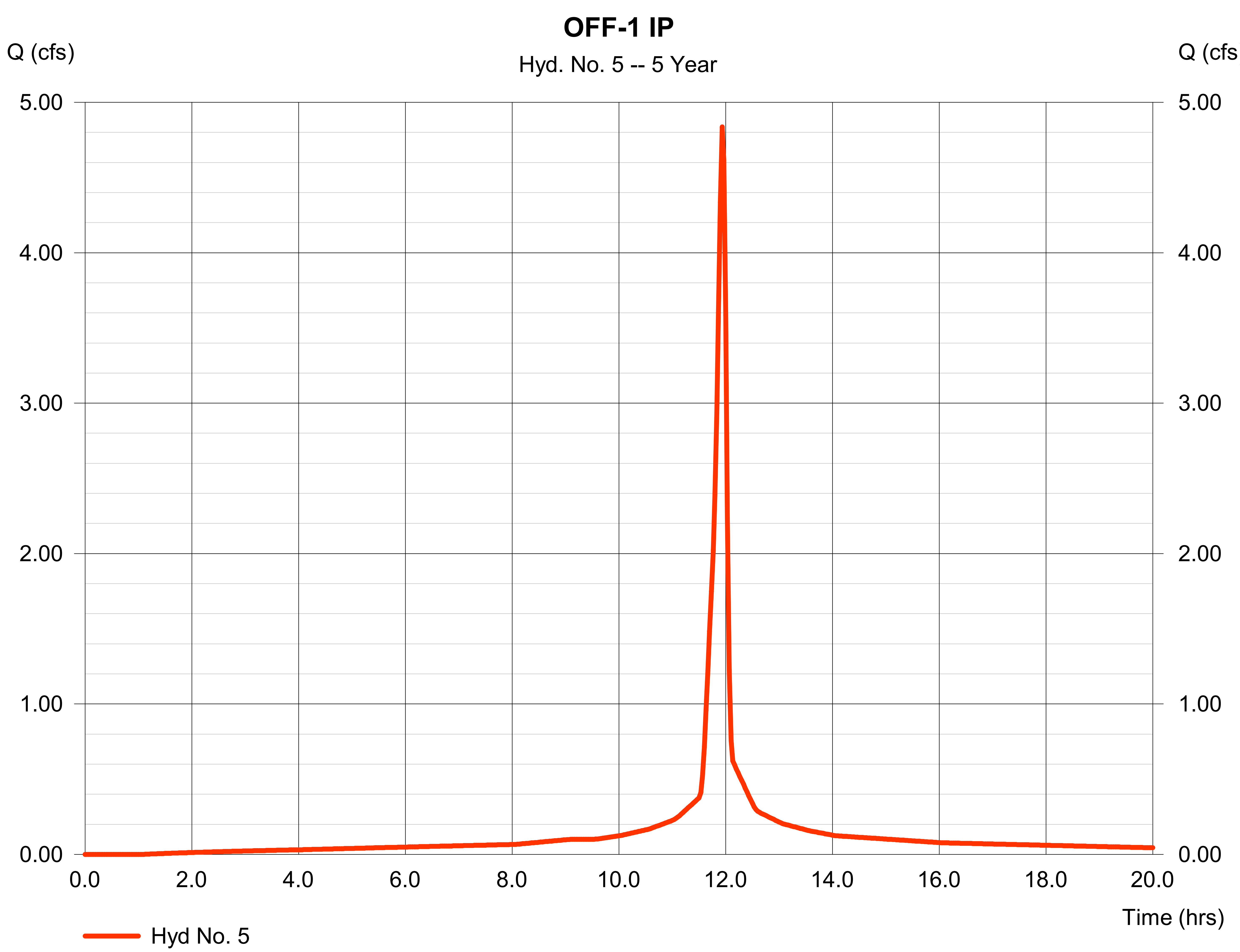
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 5

OFF-1 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 4.837 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 11,424 cuft
Drainage area	= 0.906 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



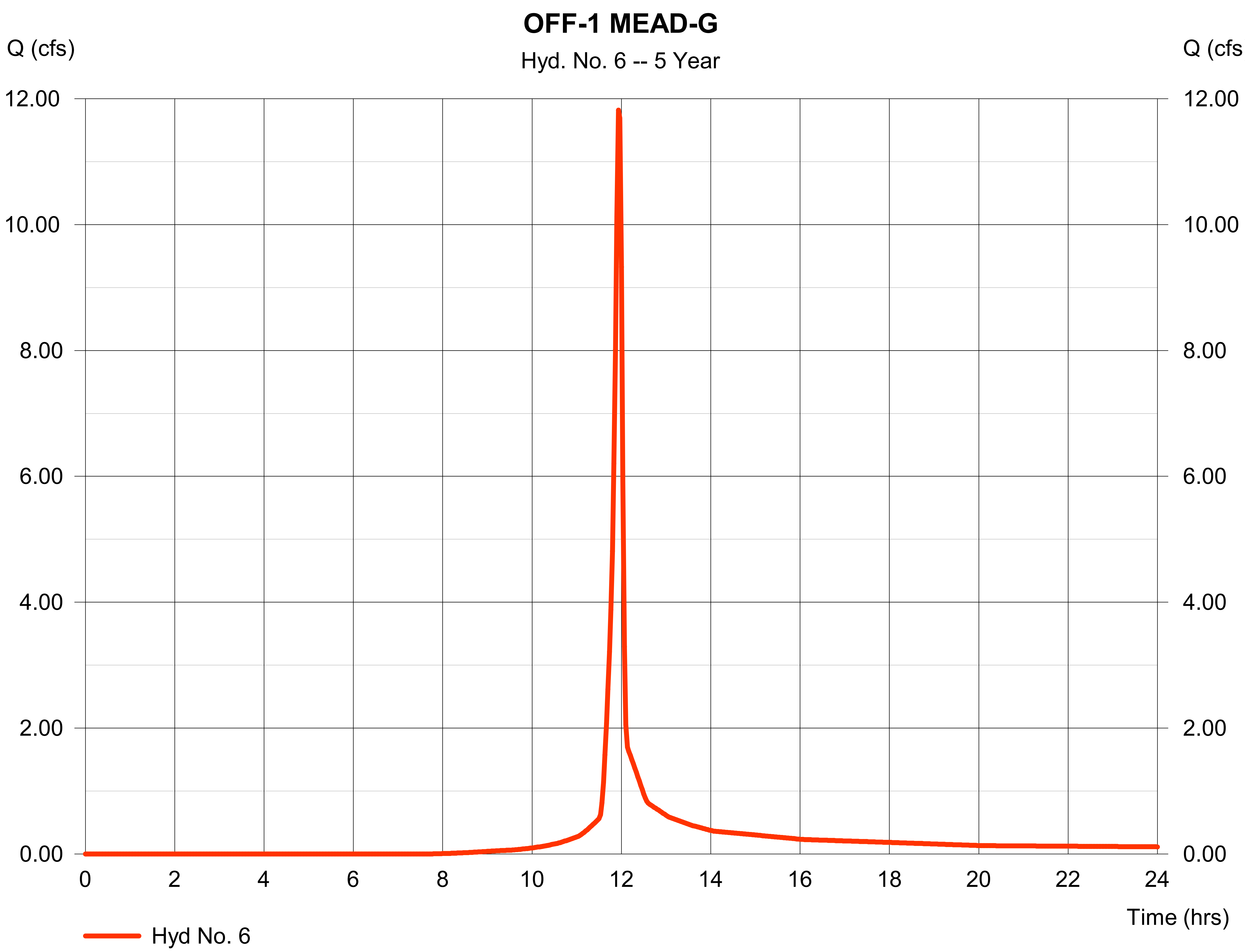
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 6

OFF-1 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 11.82 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 23,946 cuft
Drainage area	= 3.270 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



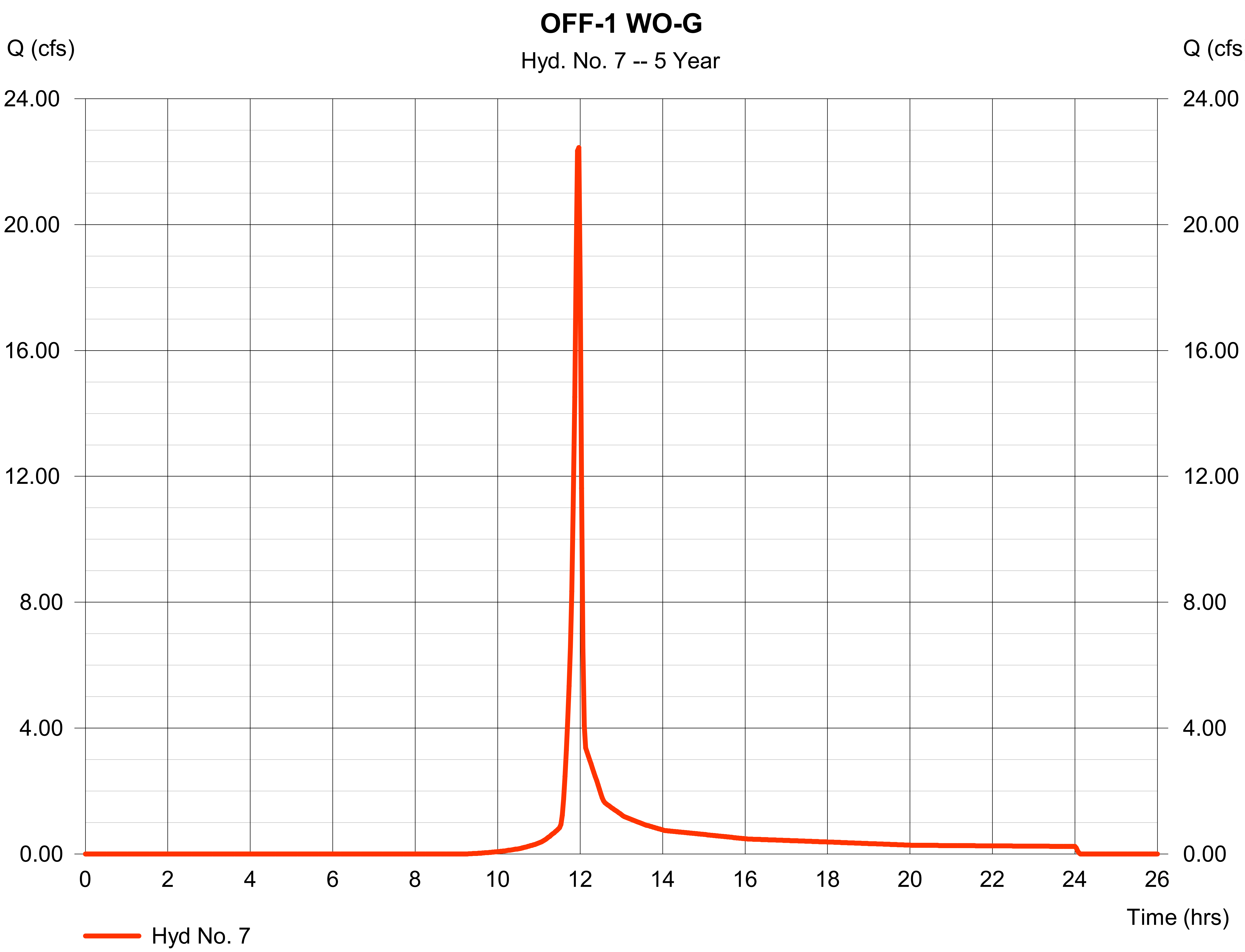
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 7

OFF-1 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 22.44 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 45,138 cuft
Drainage area	= 7.514 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



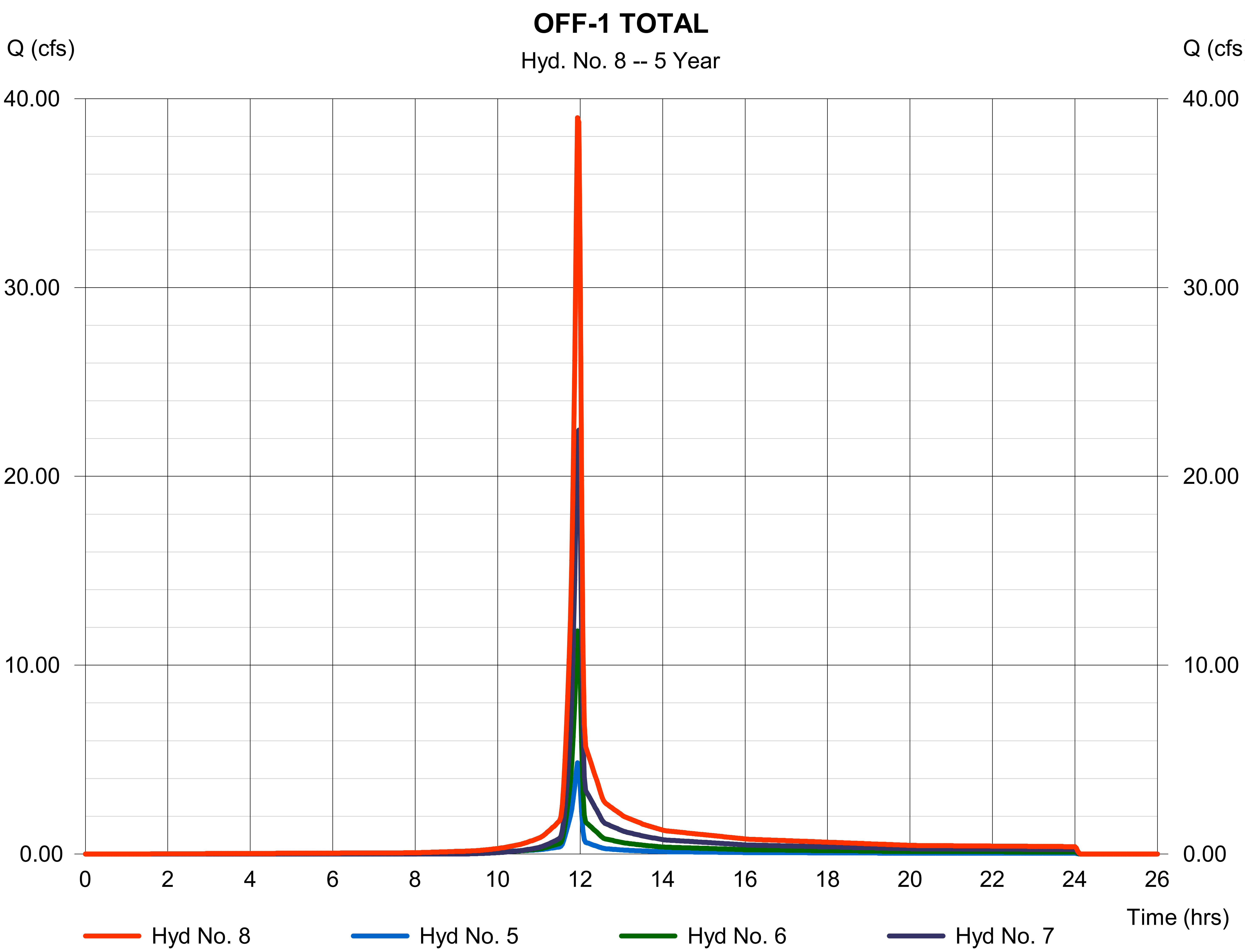
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 8

OFF-1 TOTAL

Hydrograph type	= Combine	Peak discharge	= 39.00 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 80,508 cuft
Inflow hyds.	= 5, 6, 7	Contrib. drain. area	= 11.690 ac



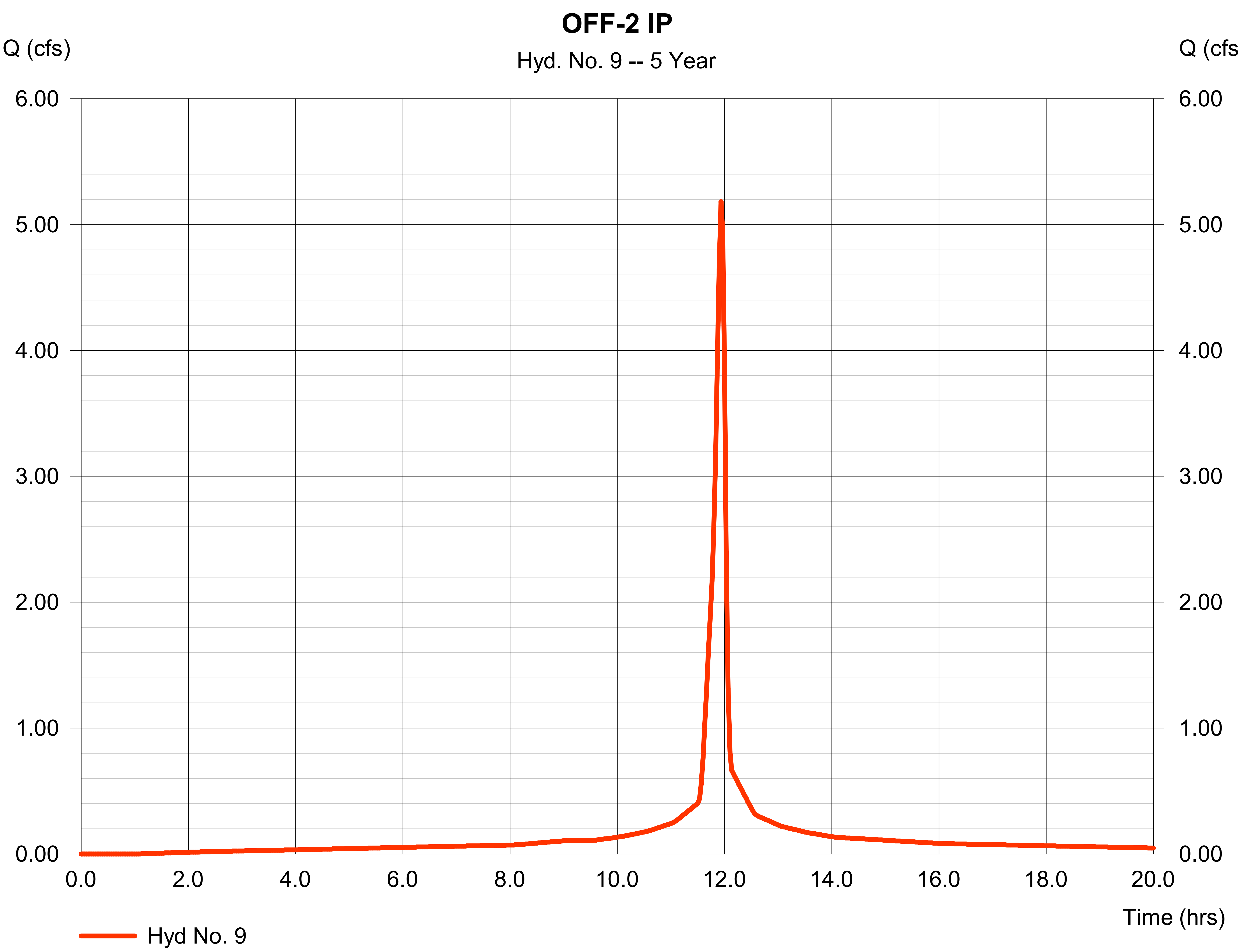
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 9

OFF-2 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 5.184 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 12,244 cuft
Drainage area	= 0.971 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



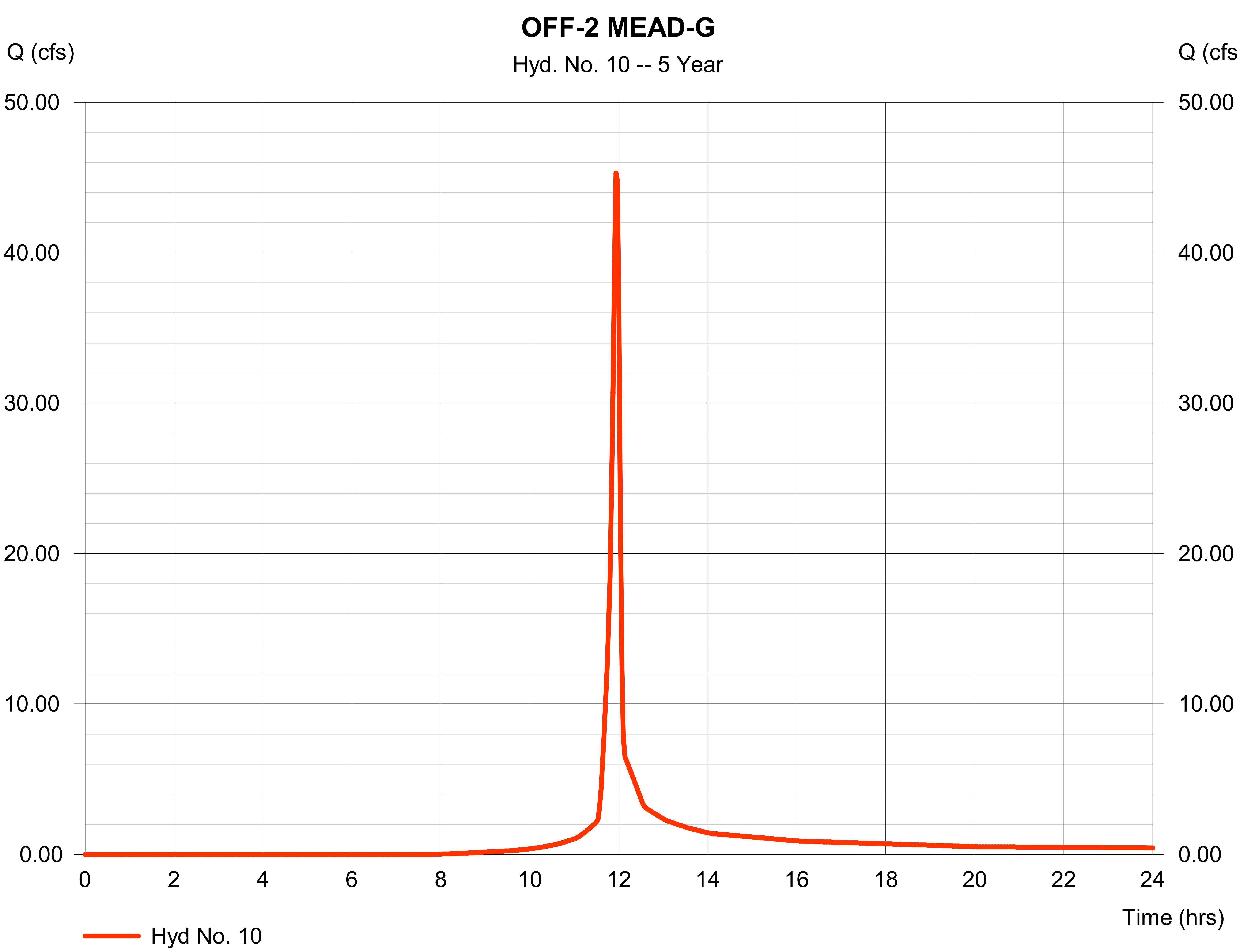
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 10

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 45.30 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 91,777 cuft
Drainage area	= 12.533 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



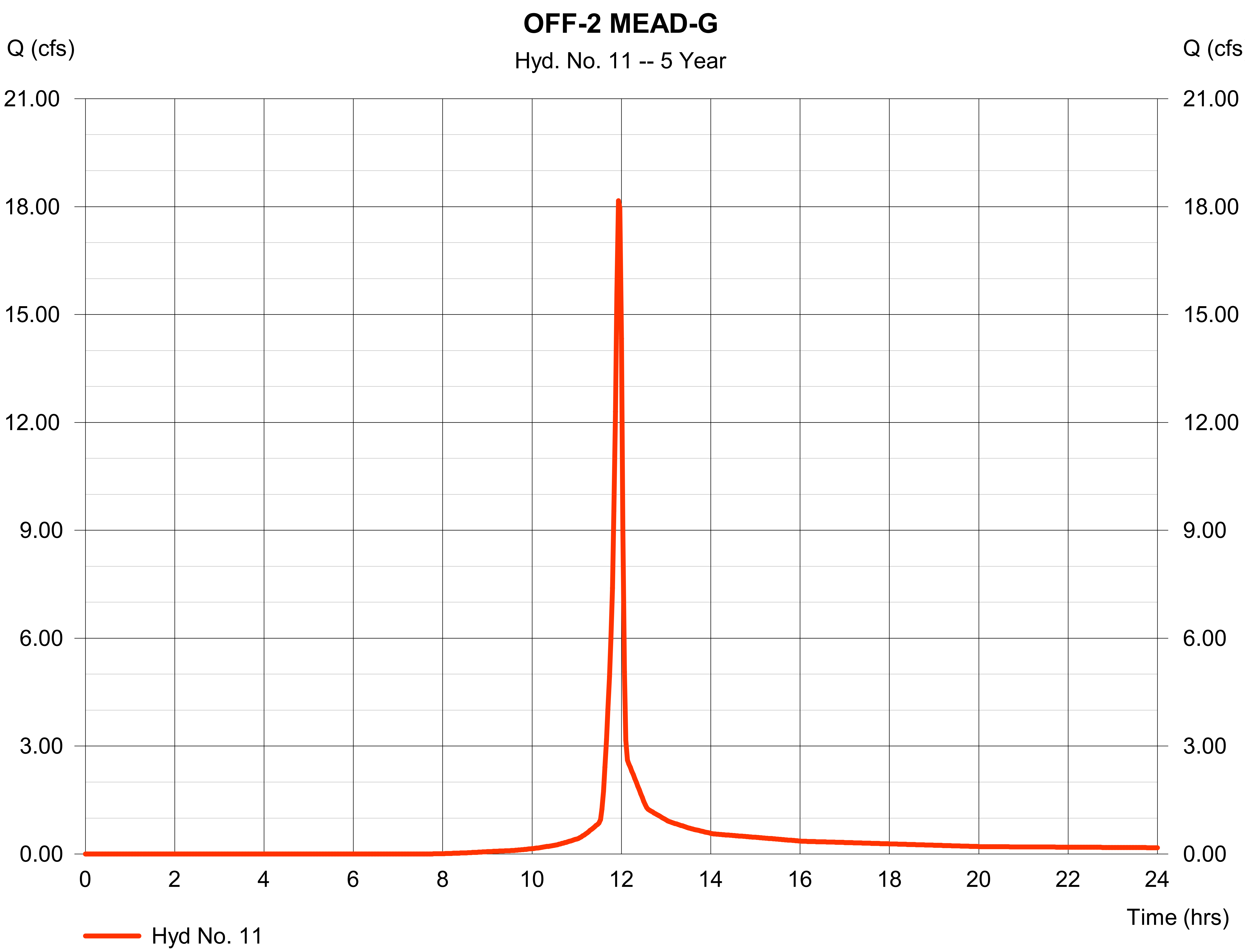
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 11

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 18.16 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 36,797 cuft
Drainage area	= 5.025 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



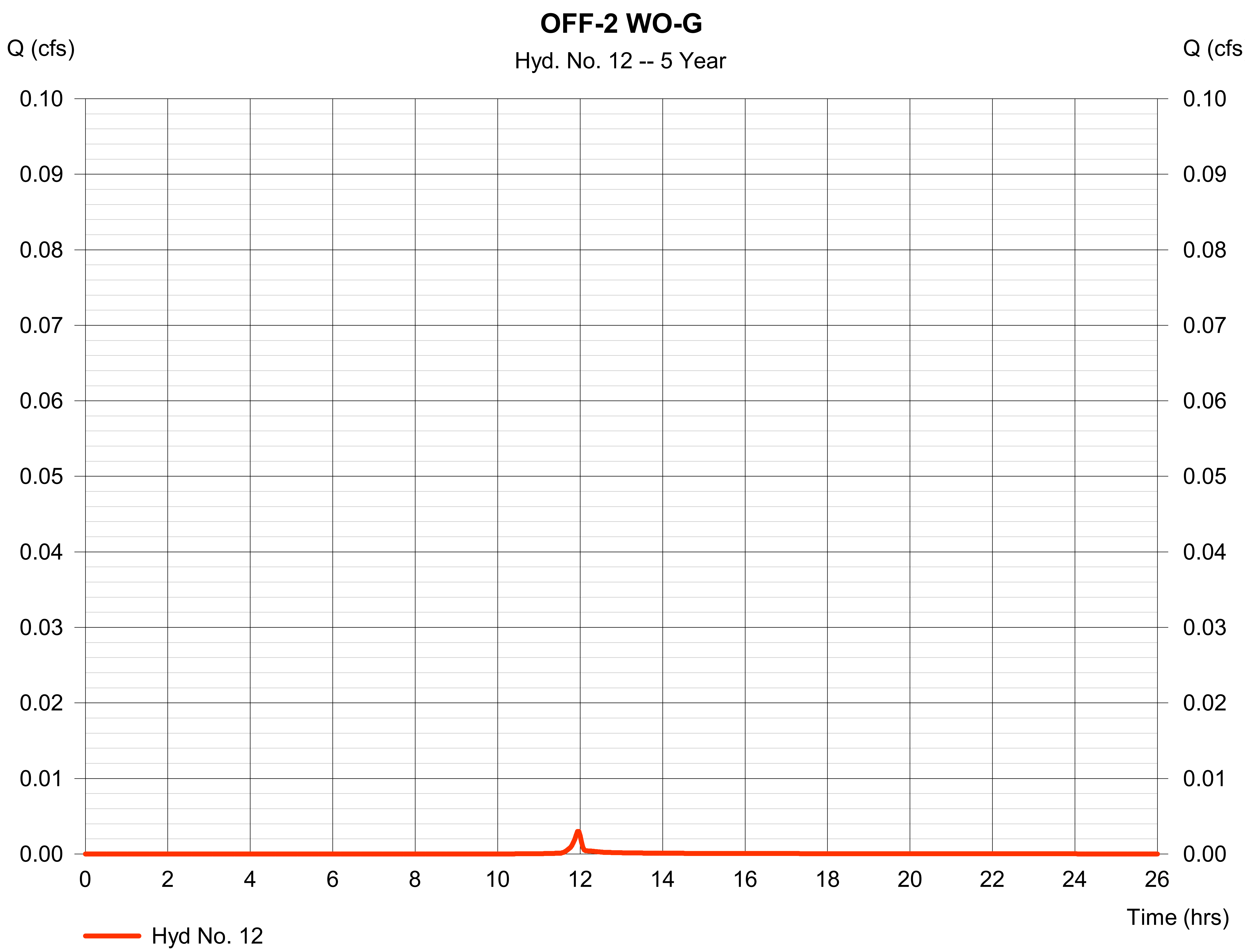
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 12

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.003 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 6 cuft
Drainage area	= 0.001 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



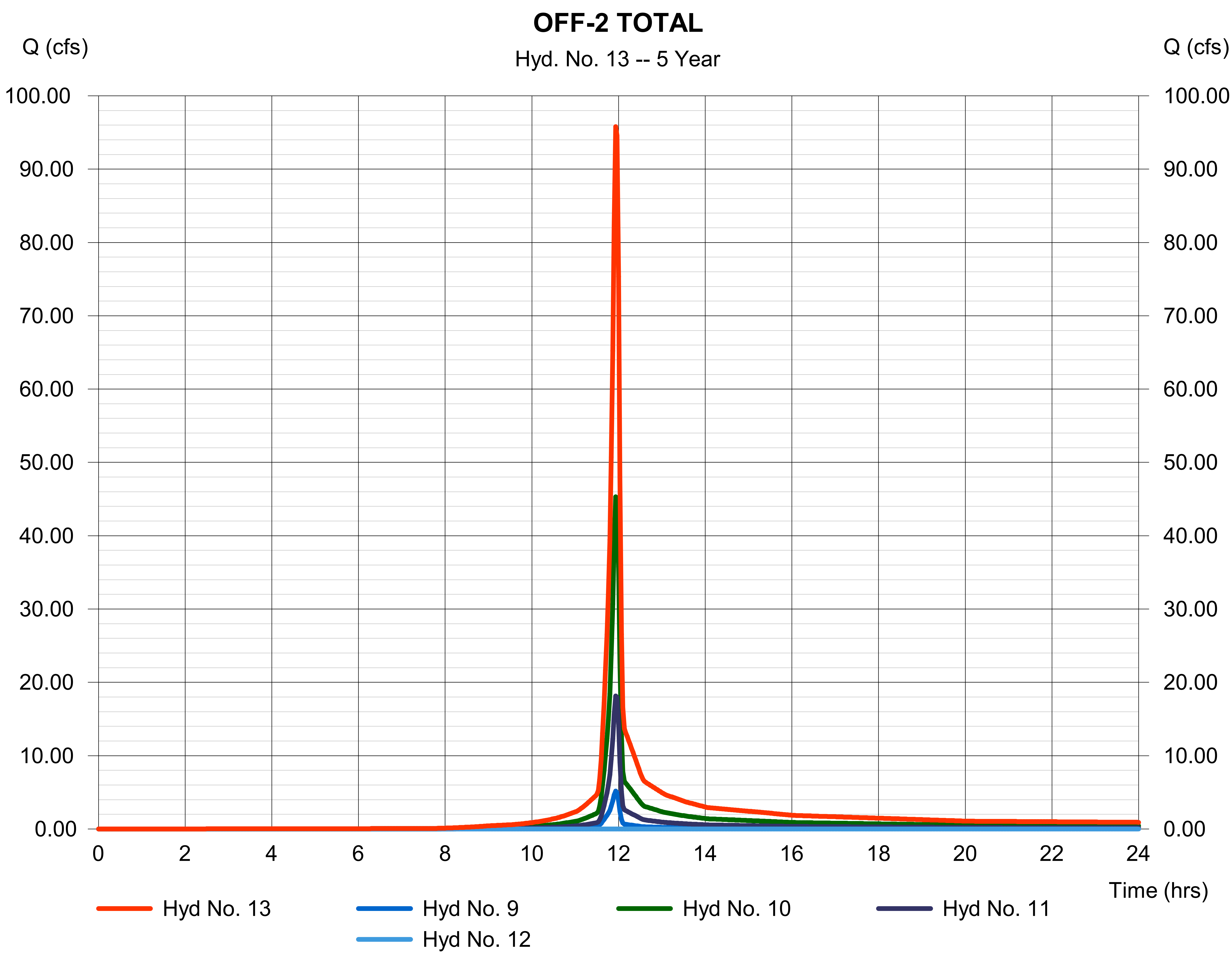
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 13

OFF-2 TOTAL

Hydrograph type	= Combine	Peak discharge	= 95.78 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 195,804 cuft
Inflow hyds.	= 9, 10, 11, 12	Contrib. drain. area	= 18.530 ac



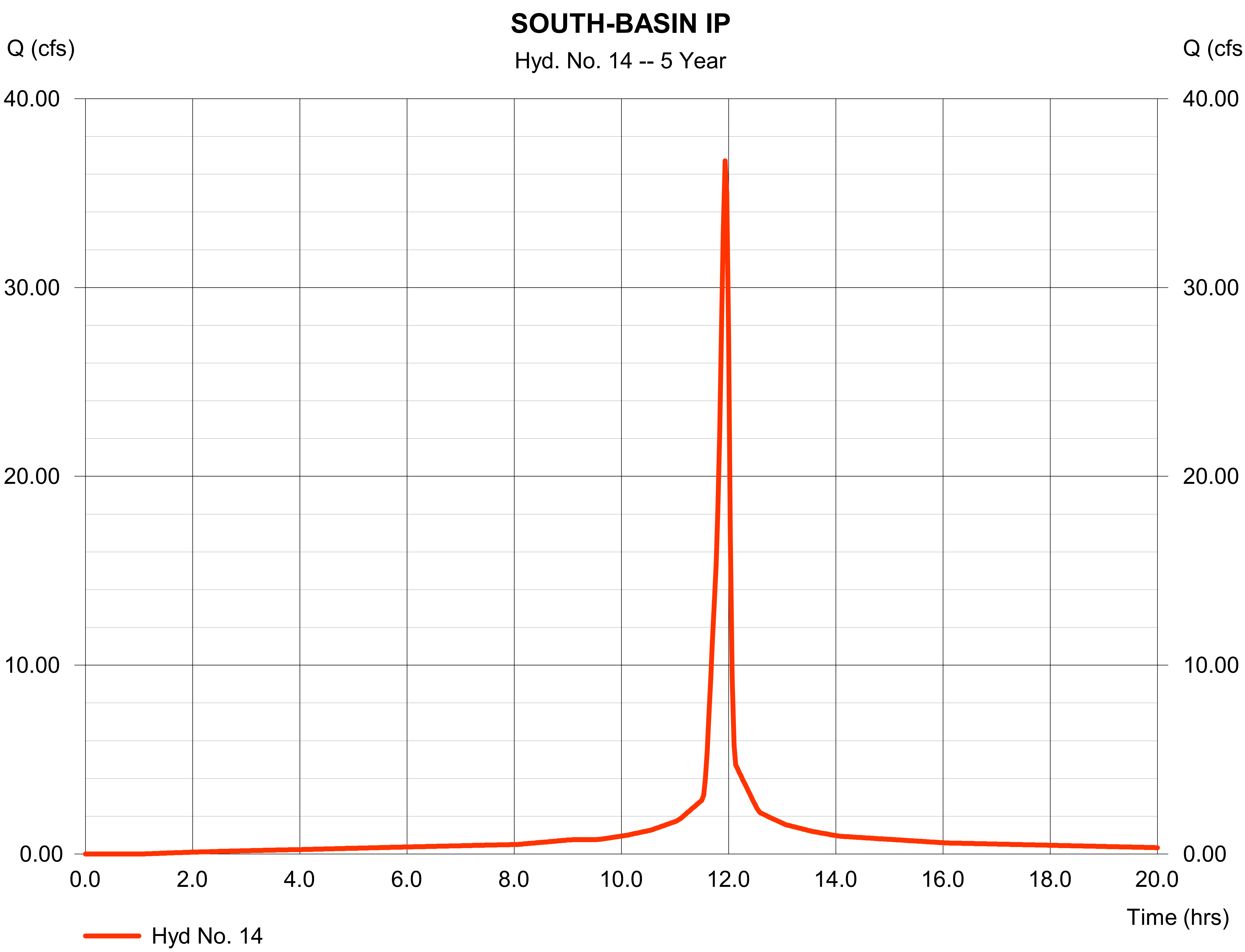
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 14

SOUTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 36.71 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 86,702 cuft
Drainage area	= 6.876 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



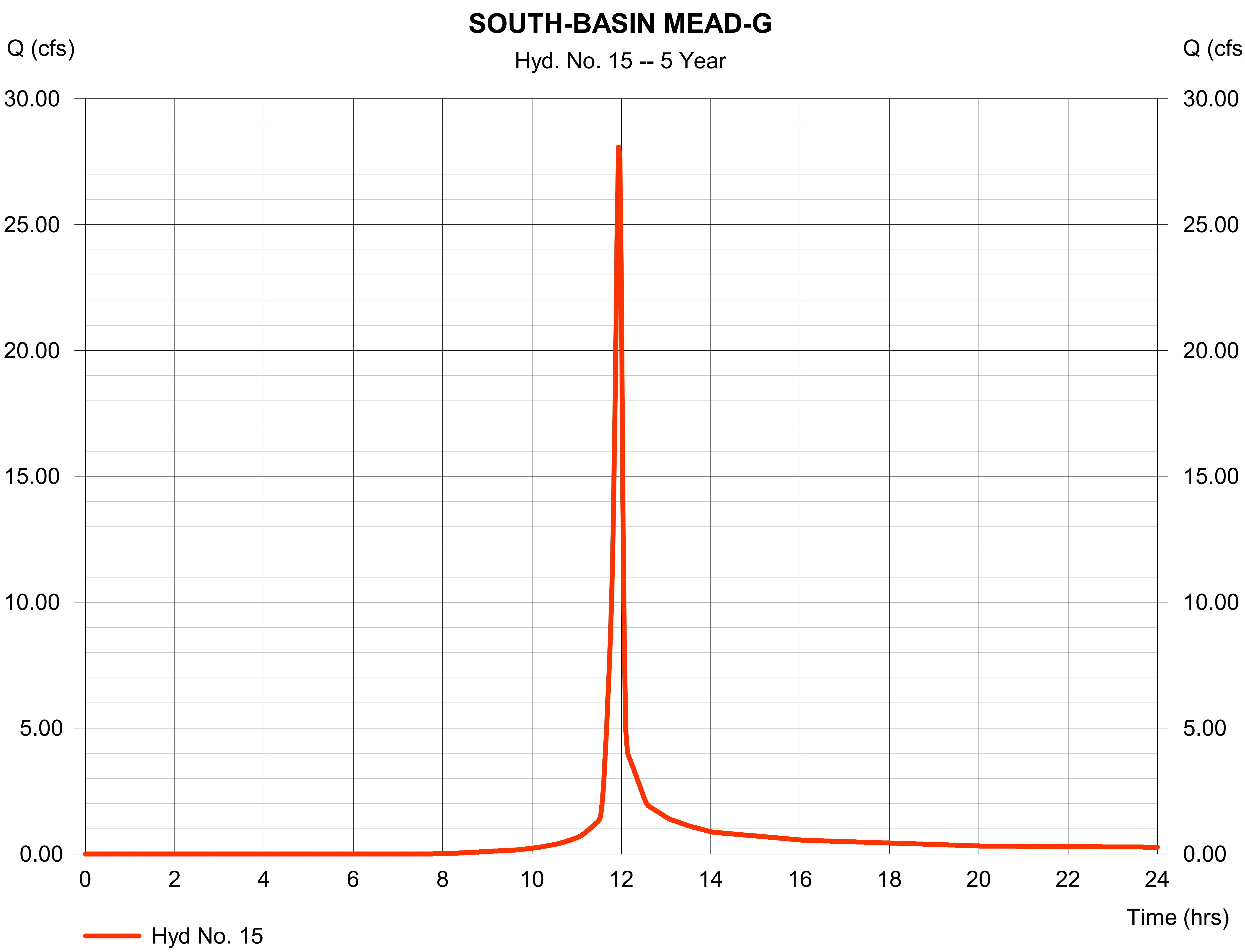
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 15

SOUTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 28.08 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 56,891 cuft
Drainage area	= 7.769 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



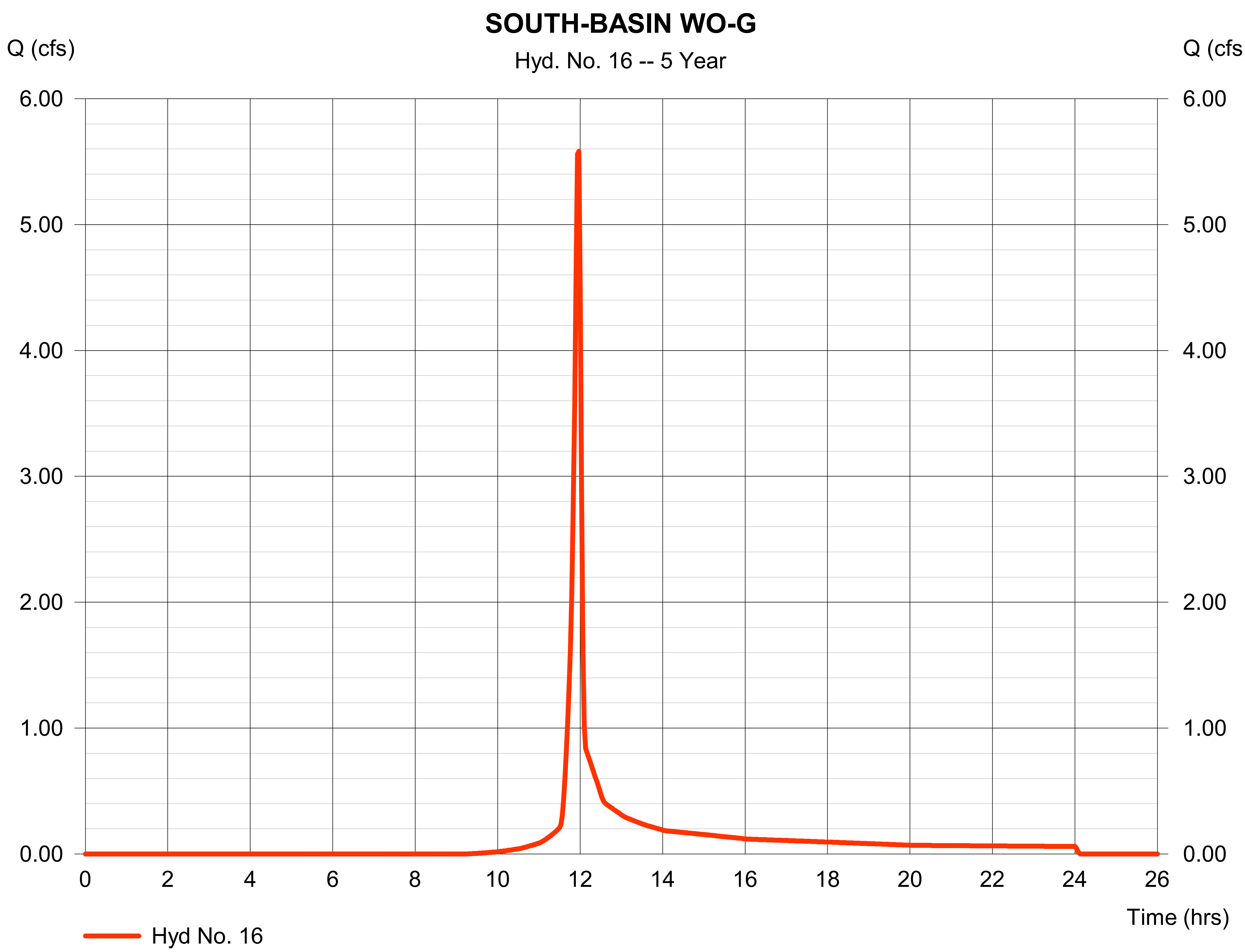
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 16

SOUTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 5.583 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 11,227 cuft
Drainage area	= 1.869 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.94 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



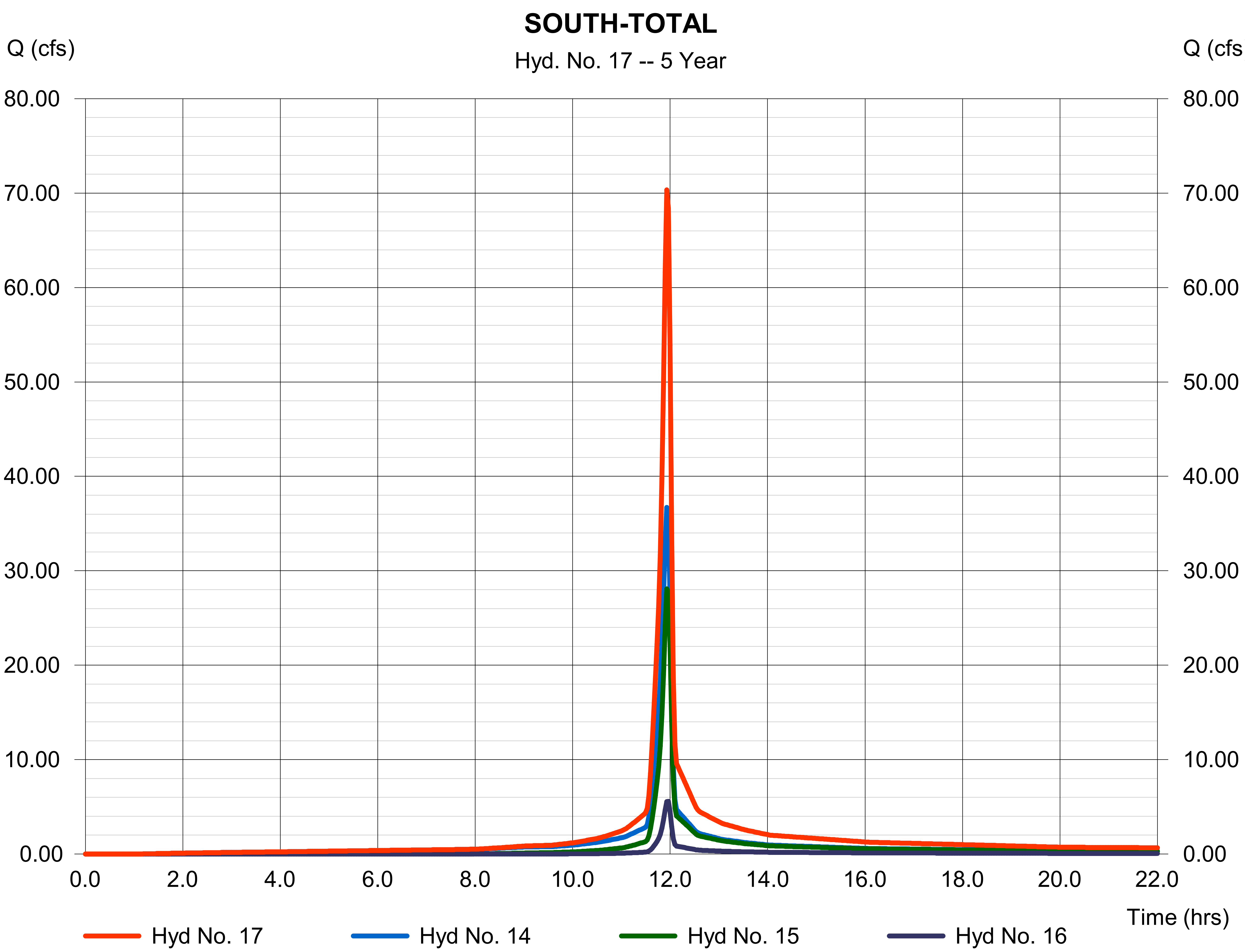
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 17

SOUTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 70.34 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 154,821 cuft
Inflow hyds.	= 14, 15, 16	Contrib. drain. area	= 16.514 ac



Hydrograph Report

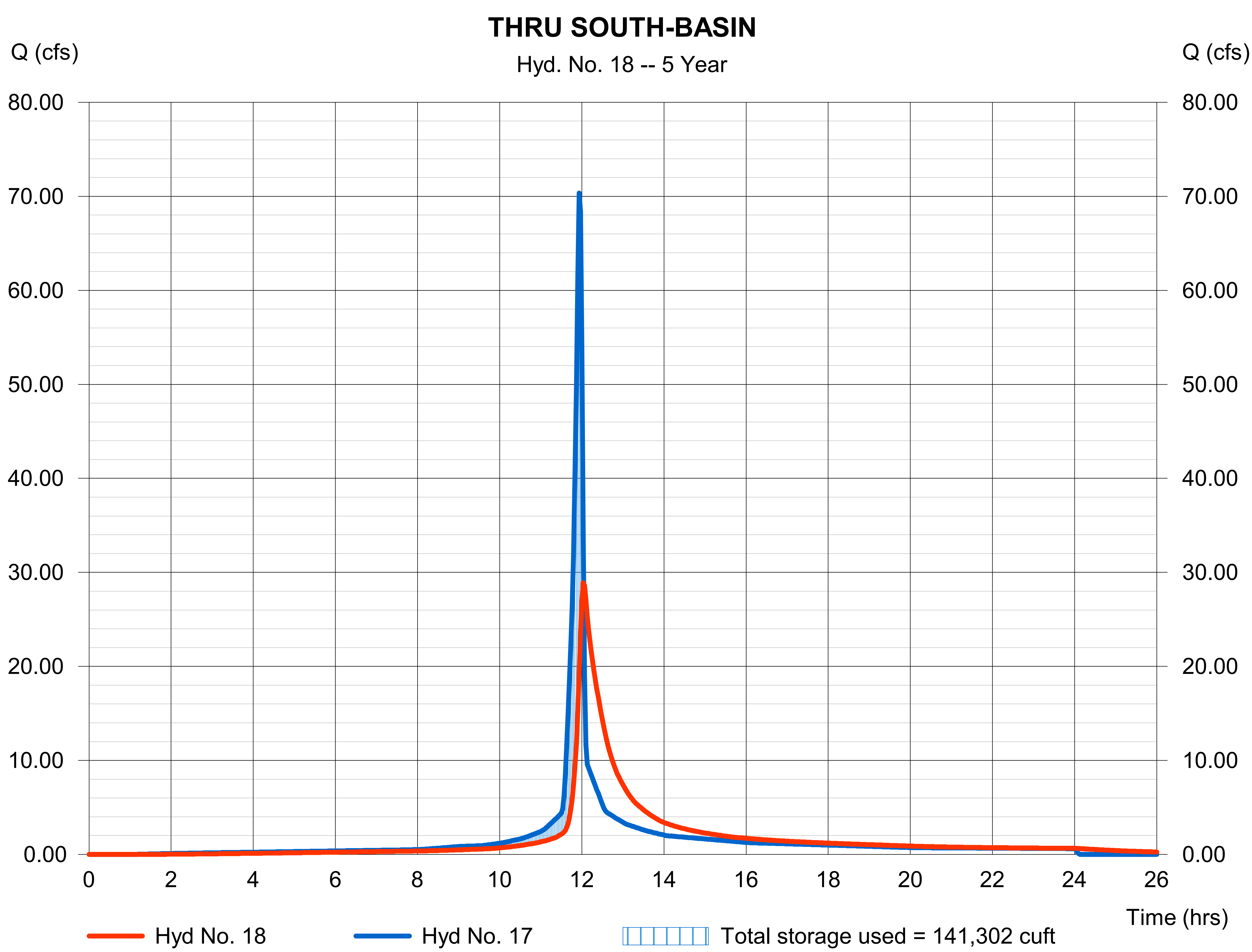
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 18

THRU SOUTH-BASIN

Hydrograph type	= Reservoir	Peak discharge	= 28.88 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 154,813 cuft
Inflow hyd. No.	= 17 - SOUTH-TOTAL	Max. Elevation	= 1736.08 ft
Reservoir name	= SOUTH-BASIN	Max. Storage	= 141,302 cuft

Storage Indication method used. Wet pond routing start elevation = 1735.00 ft.



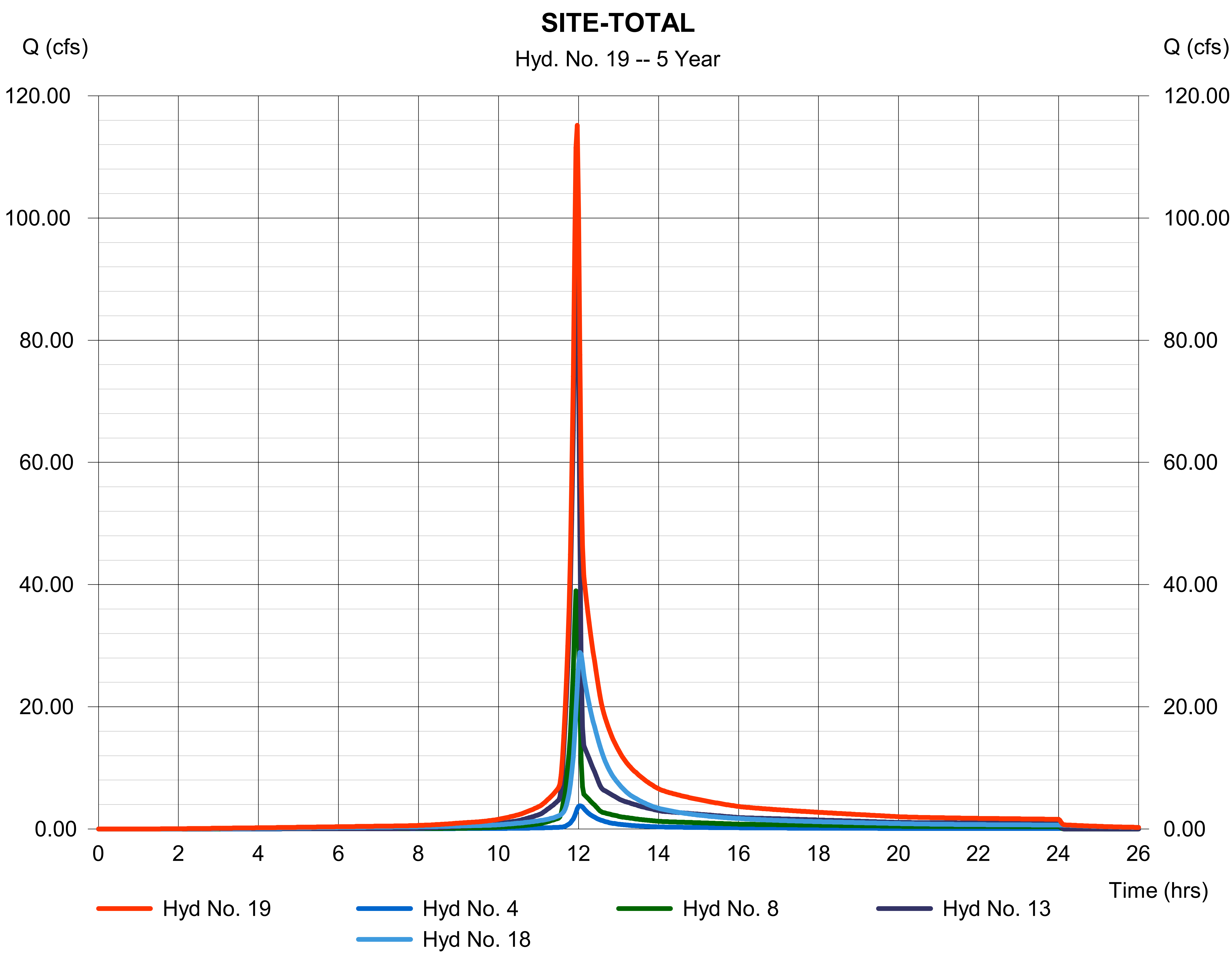
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 19

SITE-TOTAL

Hydrograph type	= Combine	Peak discharge	= 115.15 cfs
Storm frequency	= 5 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 357,546 cuft
Inflow hyds.	= 4, 8, 13, 18	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	4.655	2	716	11,070	------	------	------	NORTH-BASIN IP
2	SCS Runoff	5.528	2	716	11,271	------	------	------	NORTH-BASIN MEAD-G
3	Combine	10.18	2	716	22,340	1, 2	------	------	NORTH-TOTAL
4	Reservoir	4.351	2	722	22,337	3	1736.65	15,278	THRU NORTH-BASIN
5	SCS Runoff	5.684	2	716	13,516	------	------	------	OFF-1 IP
6	SCS Runoff	14.96	2	716	30,509	------	------	------	OFF-1 MEAD-G
7	SCS Runoff	29.23	2	716	59,029	------	------	------	OFF-1 WO-G
8	Combine	49.87	2	716	103,055	5, 6, 7	------	------	OFF-1 TOTAL
9	SCS Runoff	6.091	2	716	14,486	------	------	------	OFF-2 IP
10	SCS Runoff	57.36	2	716	116,932	------	------	------	OFF-2 MEAD-G
11	SCS Runoff	23.00	2	716	46,883	------	------	------	OFF-2 MEAD-G
12	SCS Runoff	0.004	2	716	8	------	------	------	OFF-2 WO-G
13	Combine	120.81	2	716	248,358	9, 10, 11, 12	------	------	OFF-2 TOTAL
14	SCS Runoff	43.14	2	716	102,581	------	------	------	SOUTH-BASIN IP
15	SCS Runoff	35.55	2	716	72,484	------	------	------	SOUTH-BASIN MEAD-G
16	SCS Runoff	7.270	2	716	14,683	------	------	------	SOUTH-BASIN WO-G
17	Combine	85.96	2	716	189,747	14, 15, 16	------	------	SOUTH-TOTAL
18	Reservoir	40.88	2	722	189,740	17	1736.25	150,574	THRU SOUTH-BASIN
19	Combine	147.75	2	718	446,557	4, 8, 13, 18	------	------	SITE-TOTAL

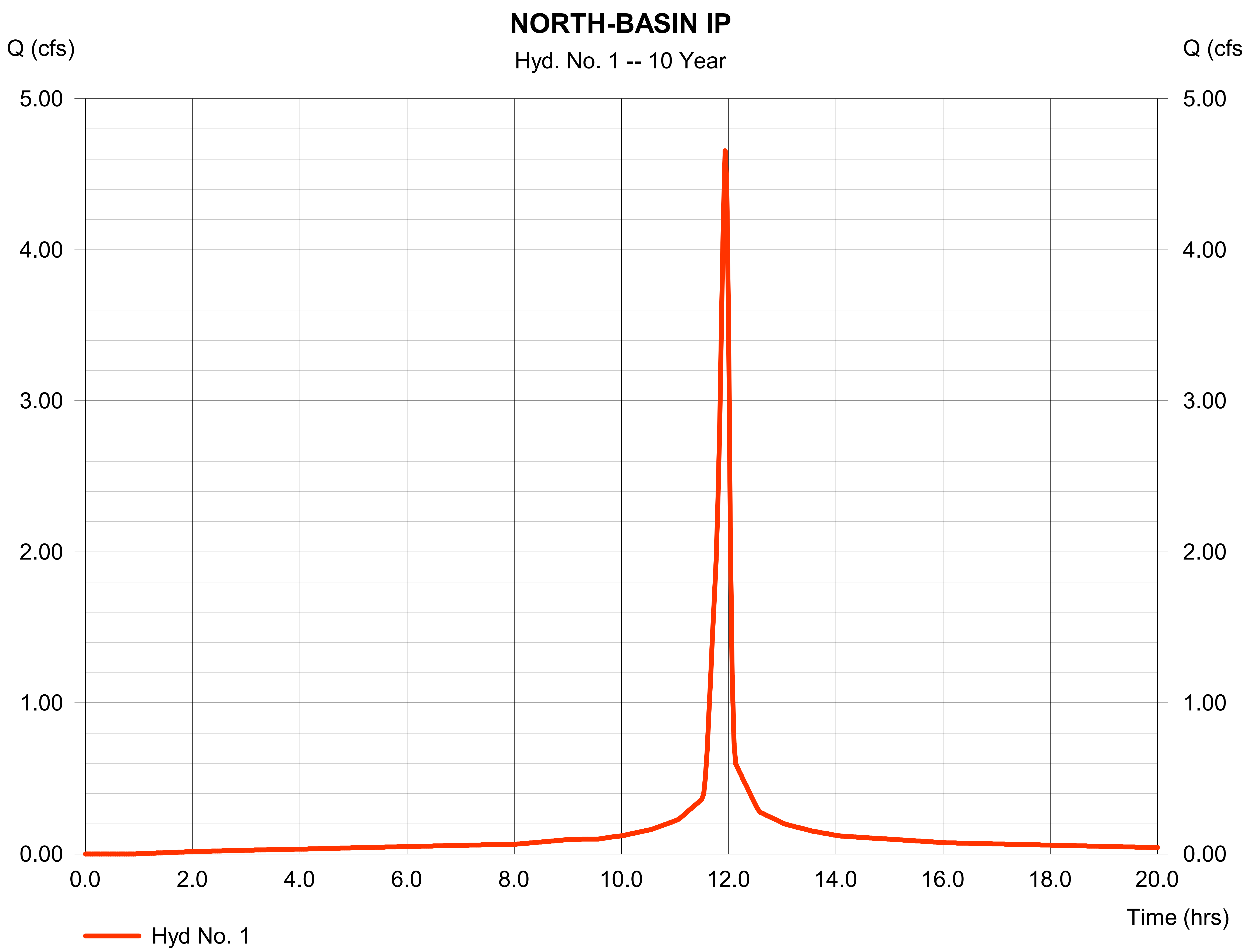
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 1

NORTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 4.655 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 11,070 cuft
Drainage area	= 0.742 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



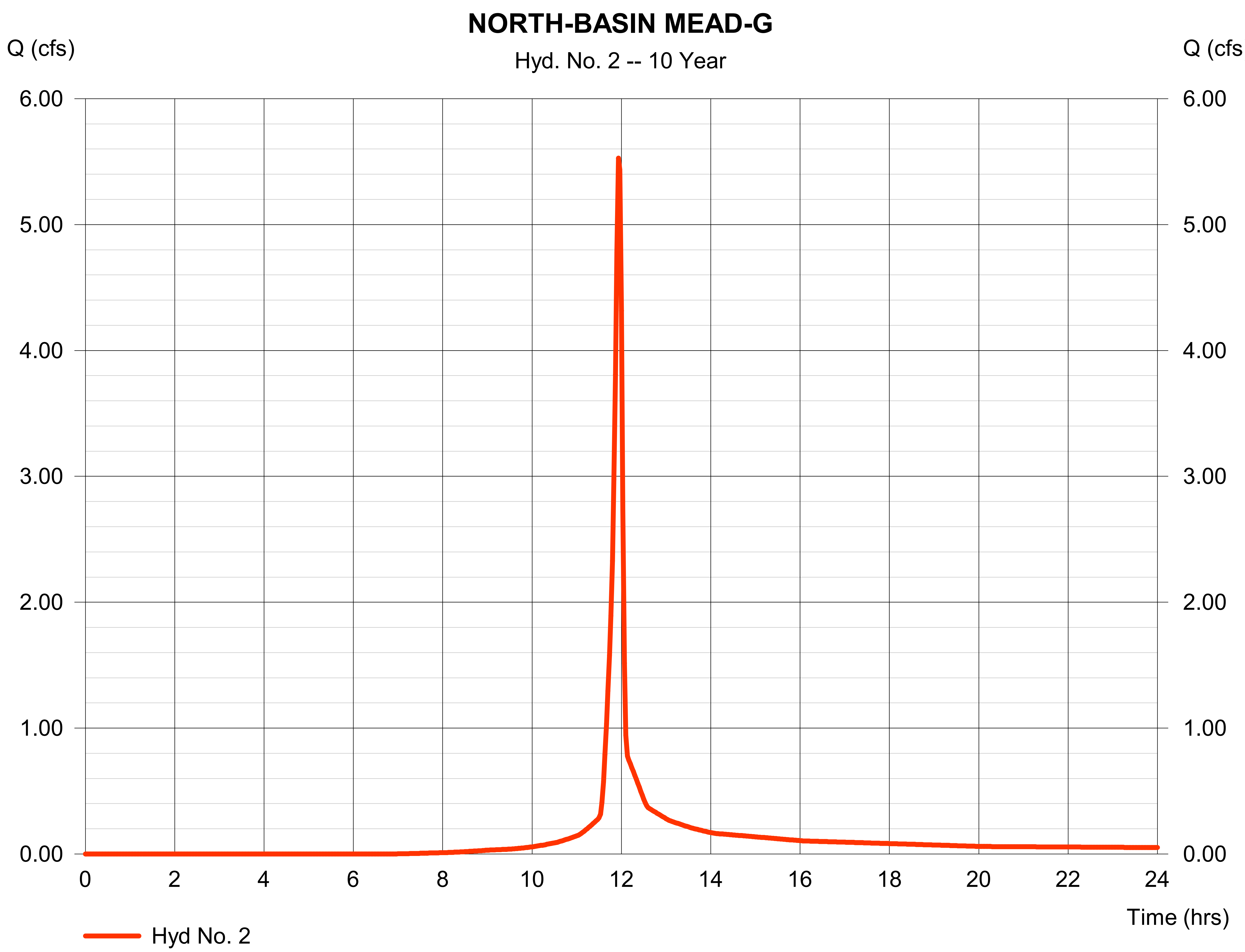
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 2

NORTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 5.528 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 11,271 cuft
Drainage area	= 1.208 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



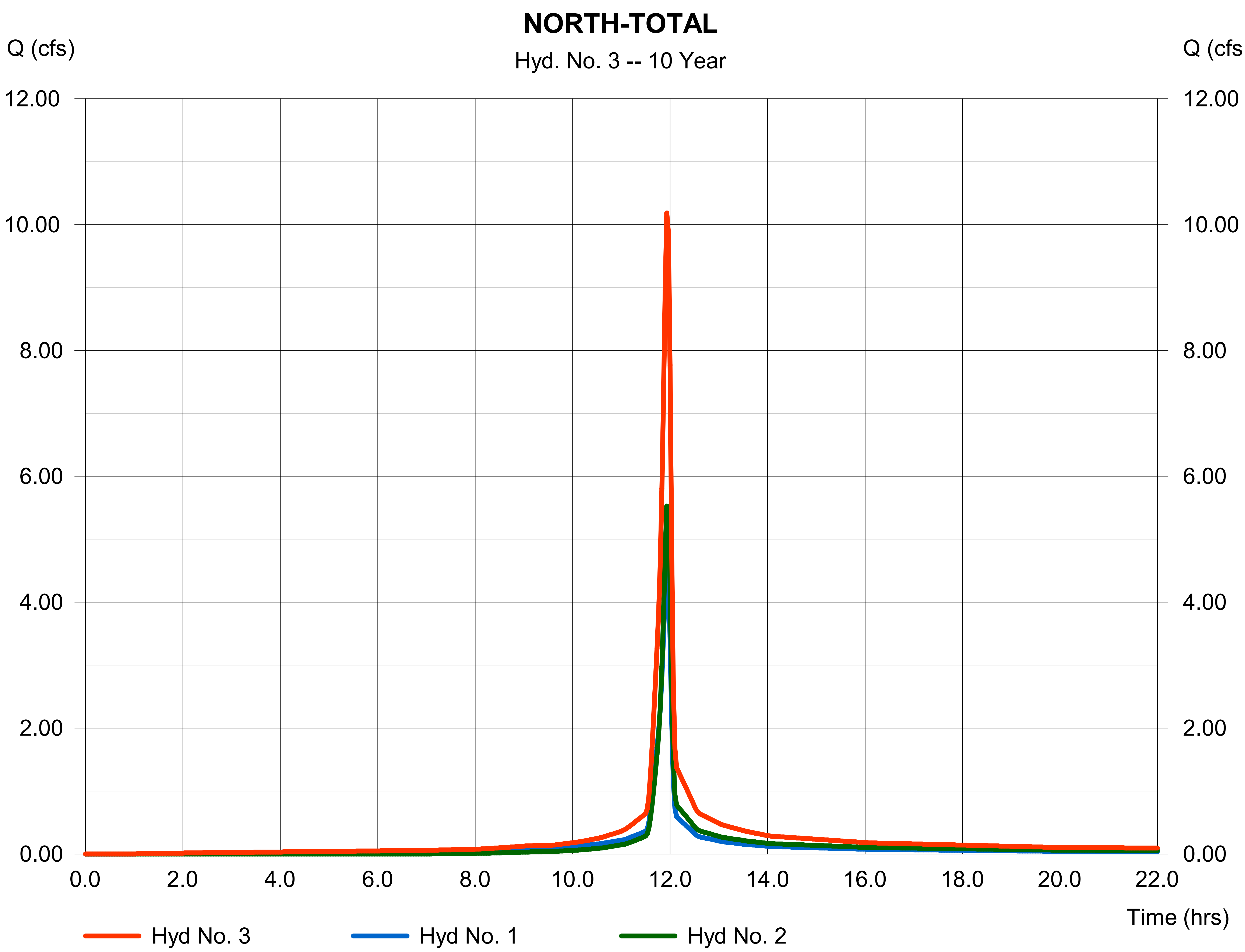
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 3

NORTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 10.18 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 22,340 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 1.950 ac



Hydrograph Report

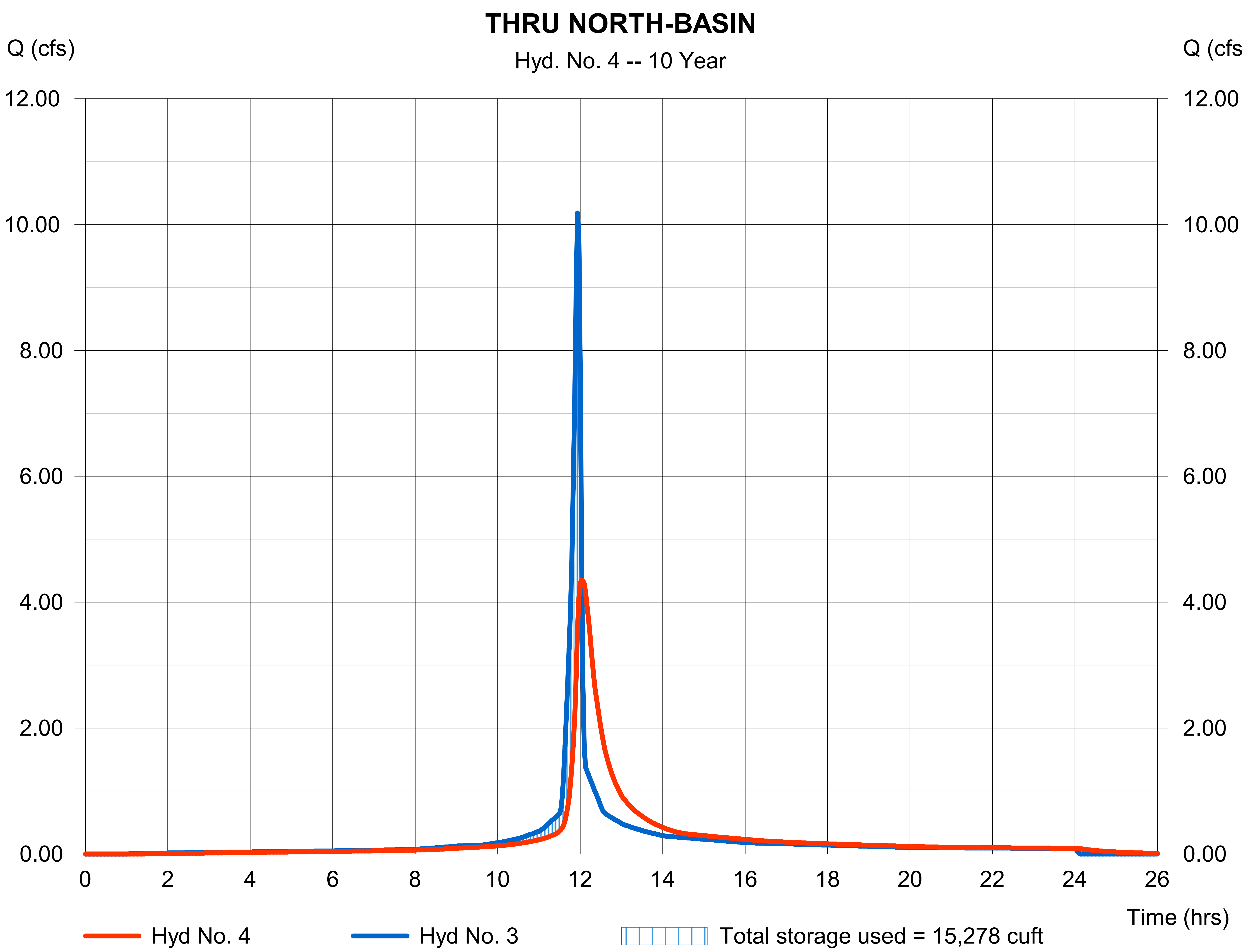
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 4

THRU NORTH-BASIN

Hydrograph type	= Reservoir	Peak discharge	= 4.351 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 22,337 cuft
Inflow hyd. No.	= 3 - NORTH-TOTAL	Max. Elevation	= 1736.65 ft
Reservoir name	= NORTH-BASIN	Max. Storage	= 15,278 cuft

Storage Indication method used. Wet pond routing start elevation = 1736.00 ft.



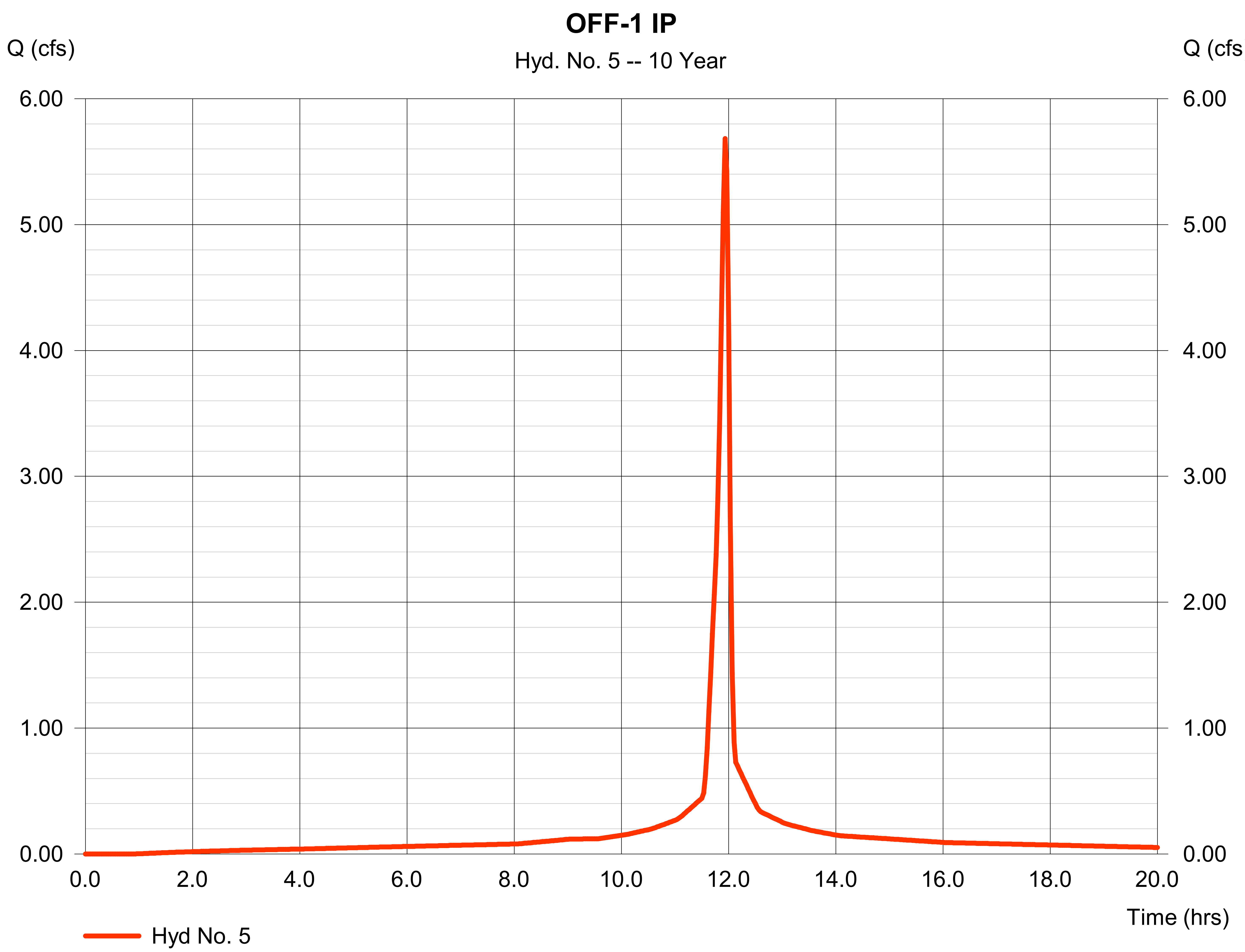
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 5

OFF-1 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 5.684 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 13,516 cuft
Drainage area	= 0.906 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



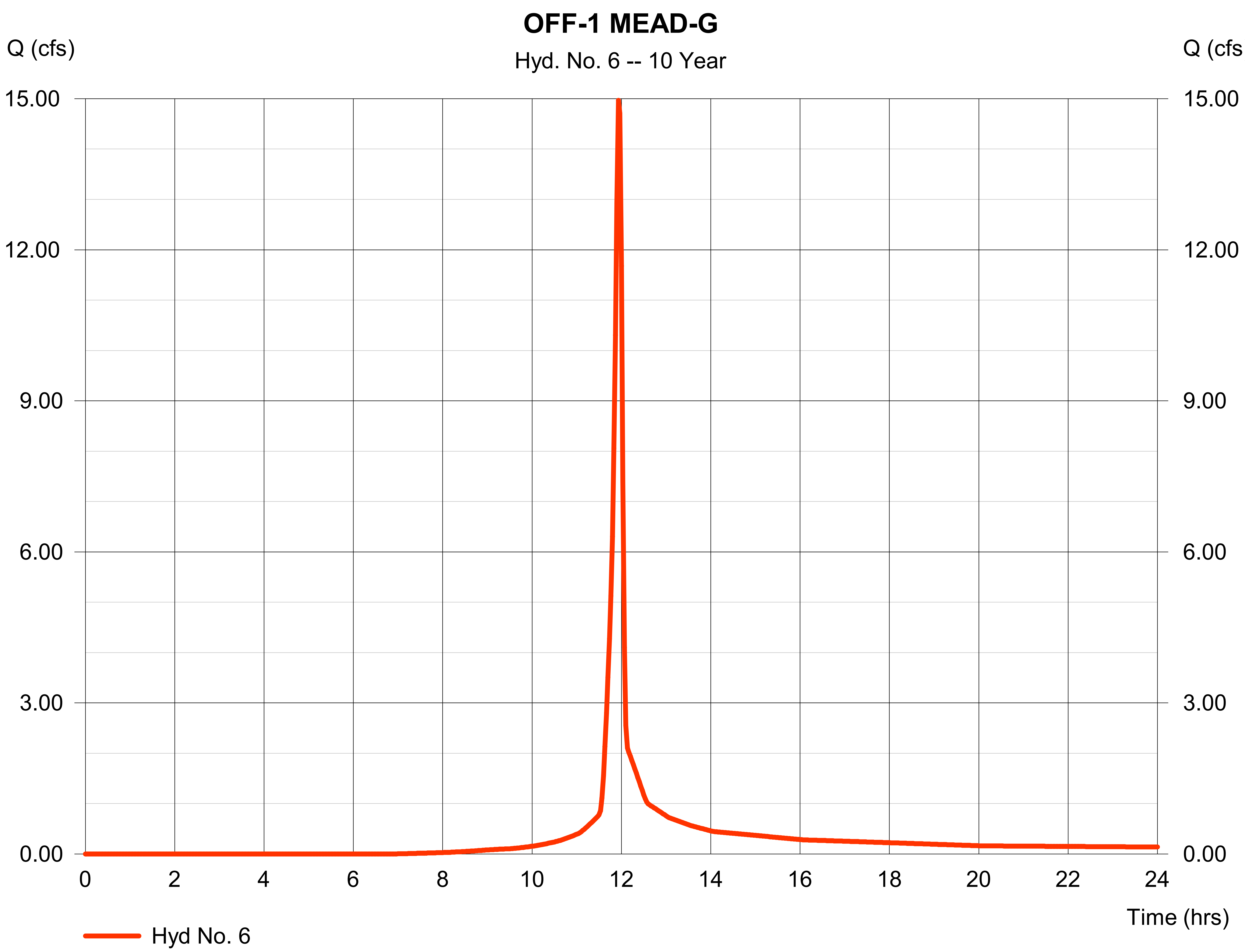
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 6

OFF-1 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 14.96 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 30,509 cuft
Drainage area	= 3.270 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



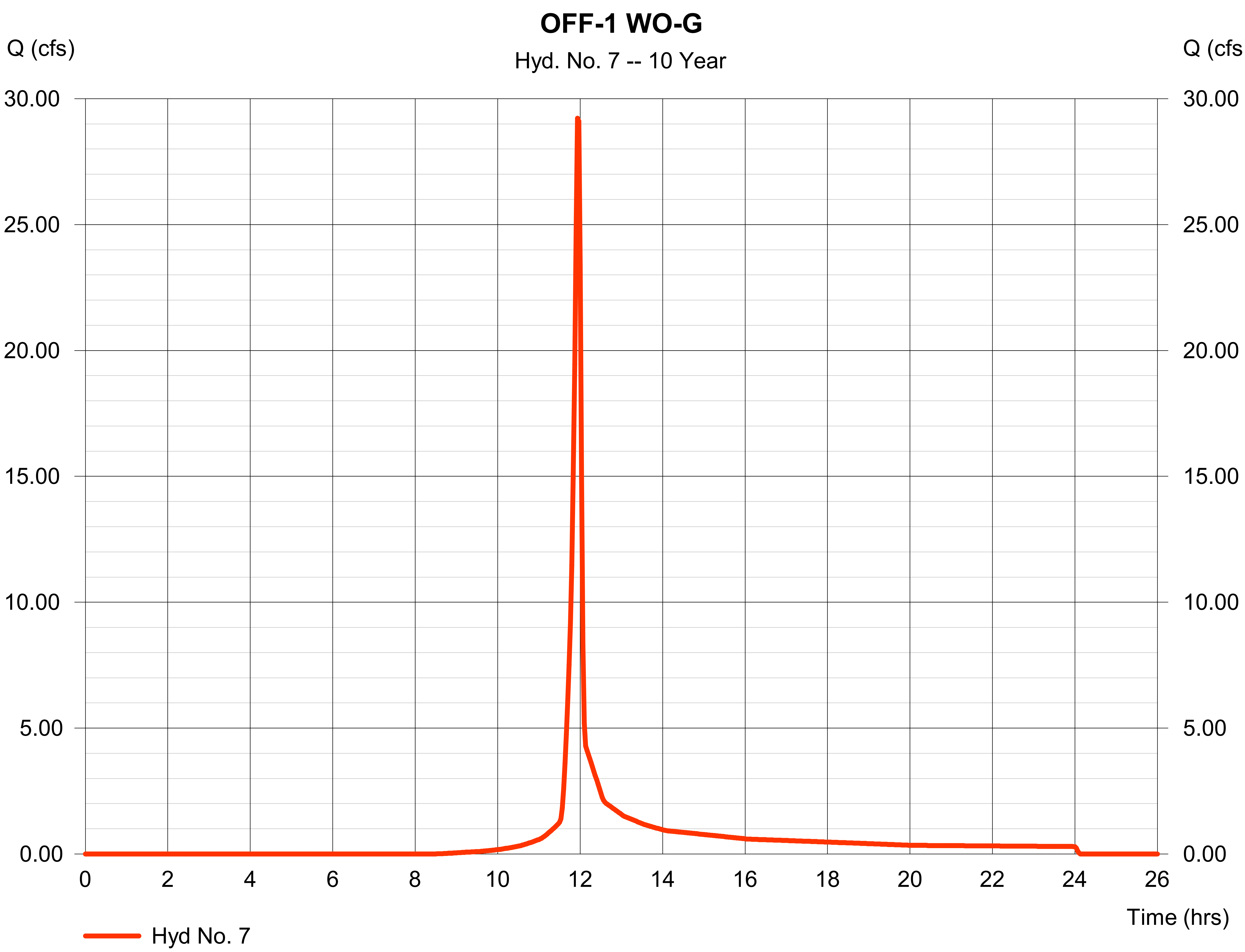
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 7

OFF-1 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 29.23 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 59,029 cuft
Drainage area	= 7.514 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



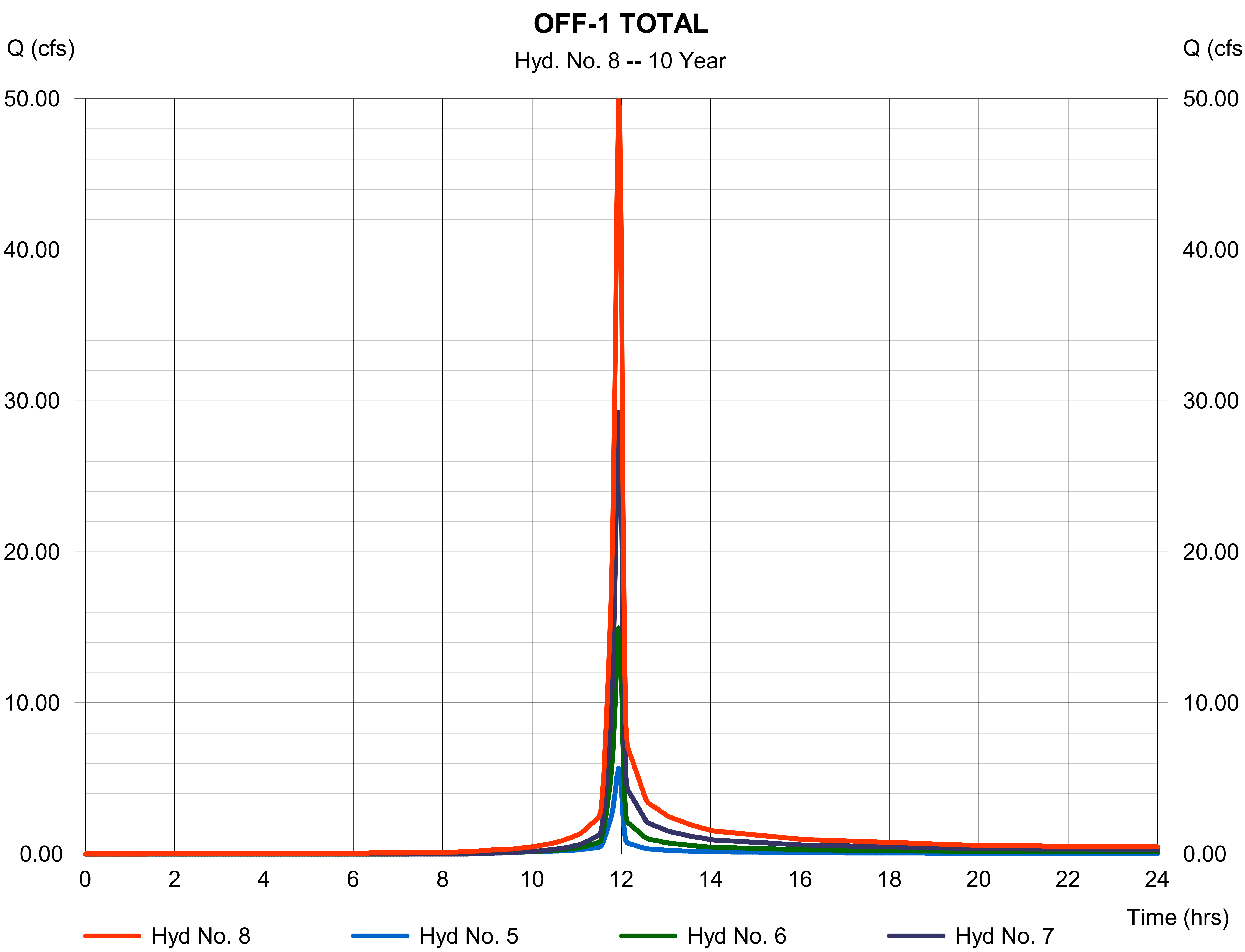
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 8

OFF-1 TOTAL

Hydrograph type	= Combine	Peak discharge	= 49.87 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 103,055 cuft
Inflow hyds.	= 5, 6, 7	Contrib. drain. area	= 11.690 ac



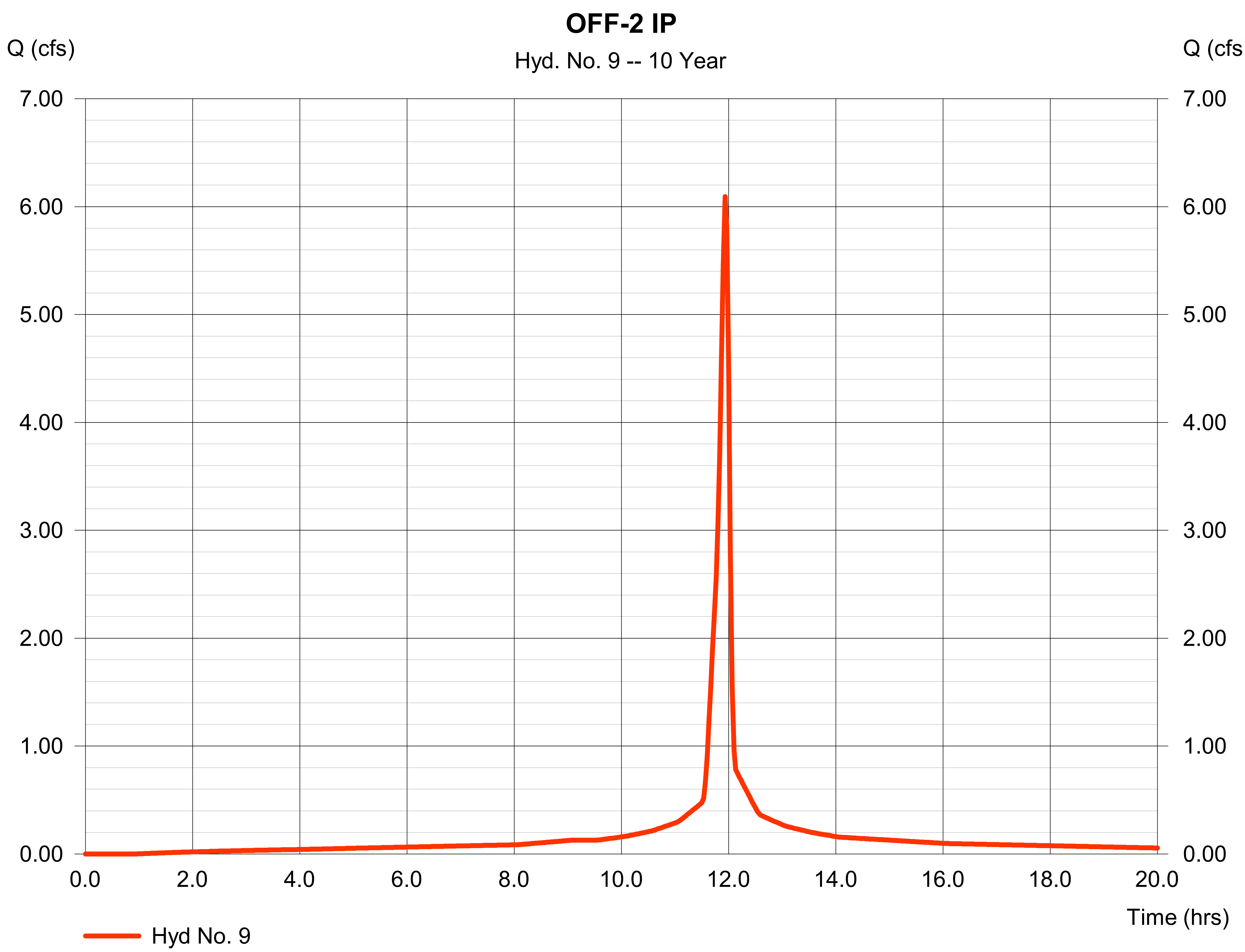
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 9

OFF-2 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 6.091 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 14,486 cuft
Drainage area	= 0.971 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



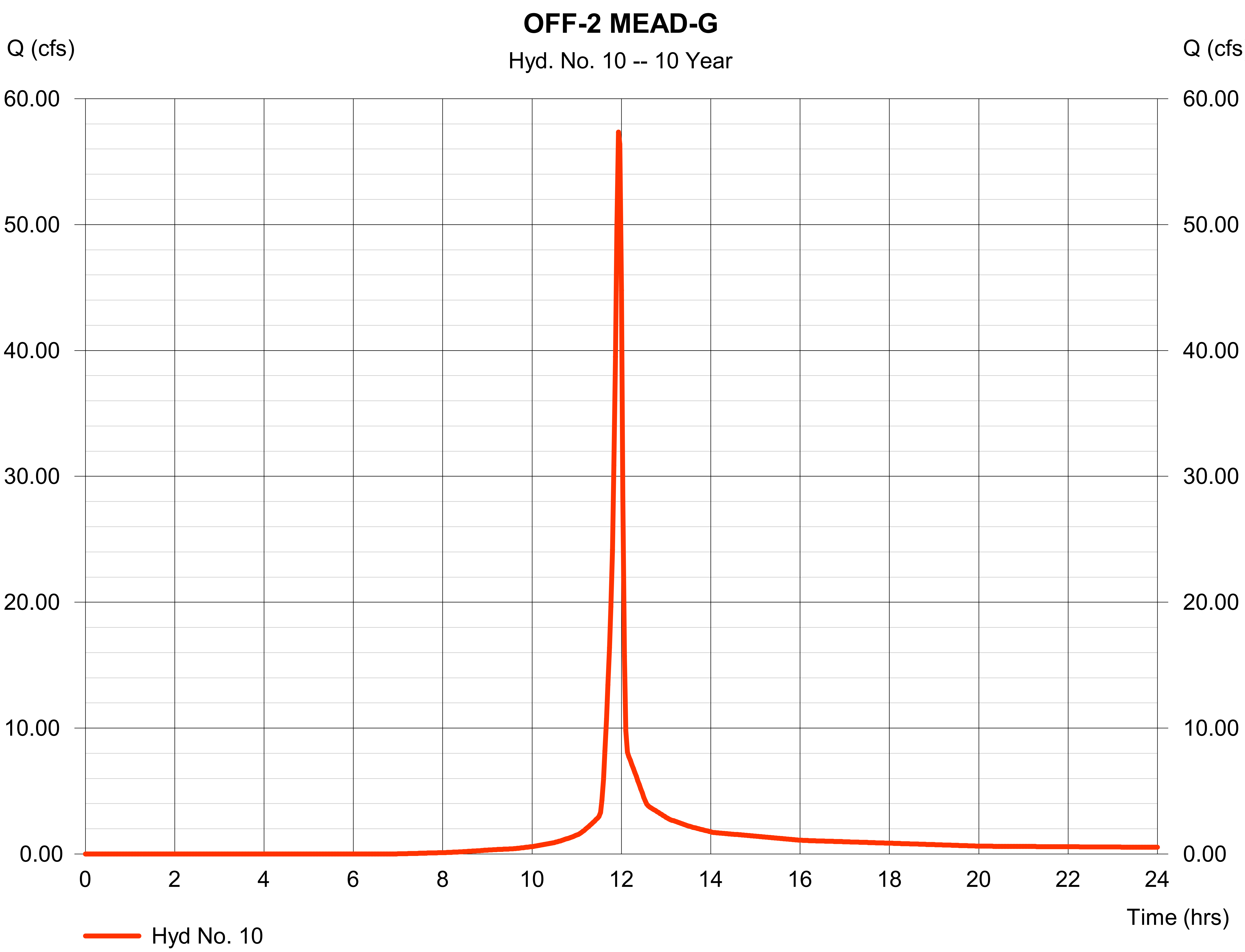
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 10

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 57.36 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 116,932 cuft
Drainage area	= 12.533 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



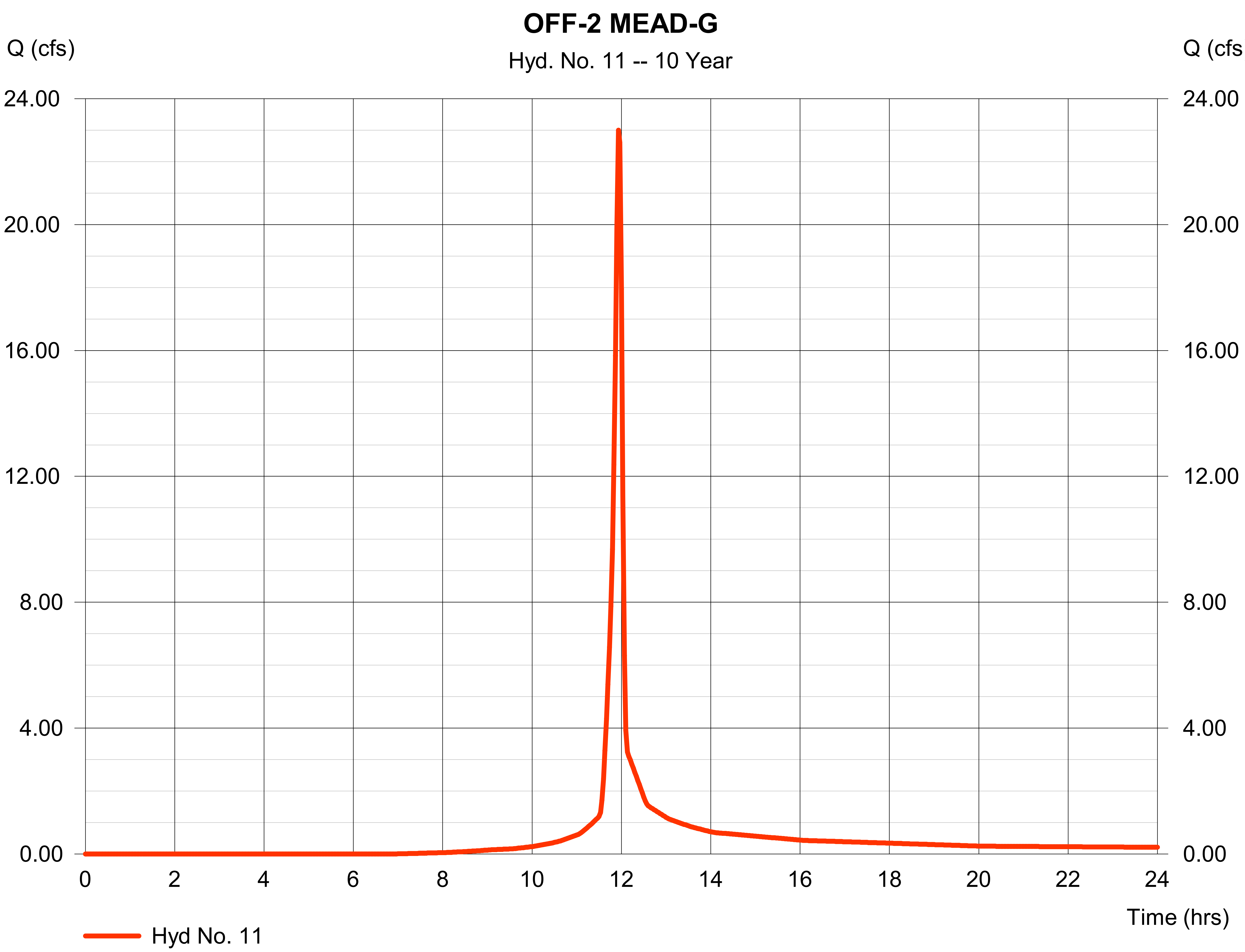
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 11

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 23.00 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 46,883 cuft
Drainage area	= 5.025 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



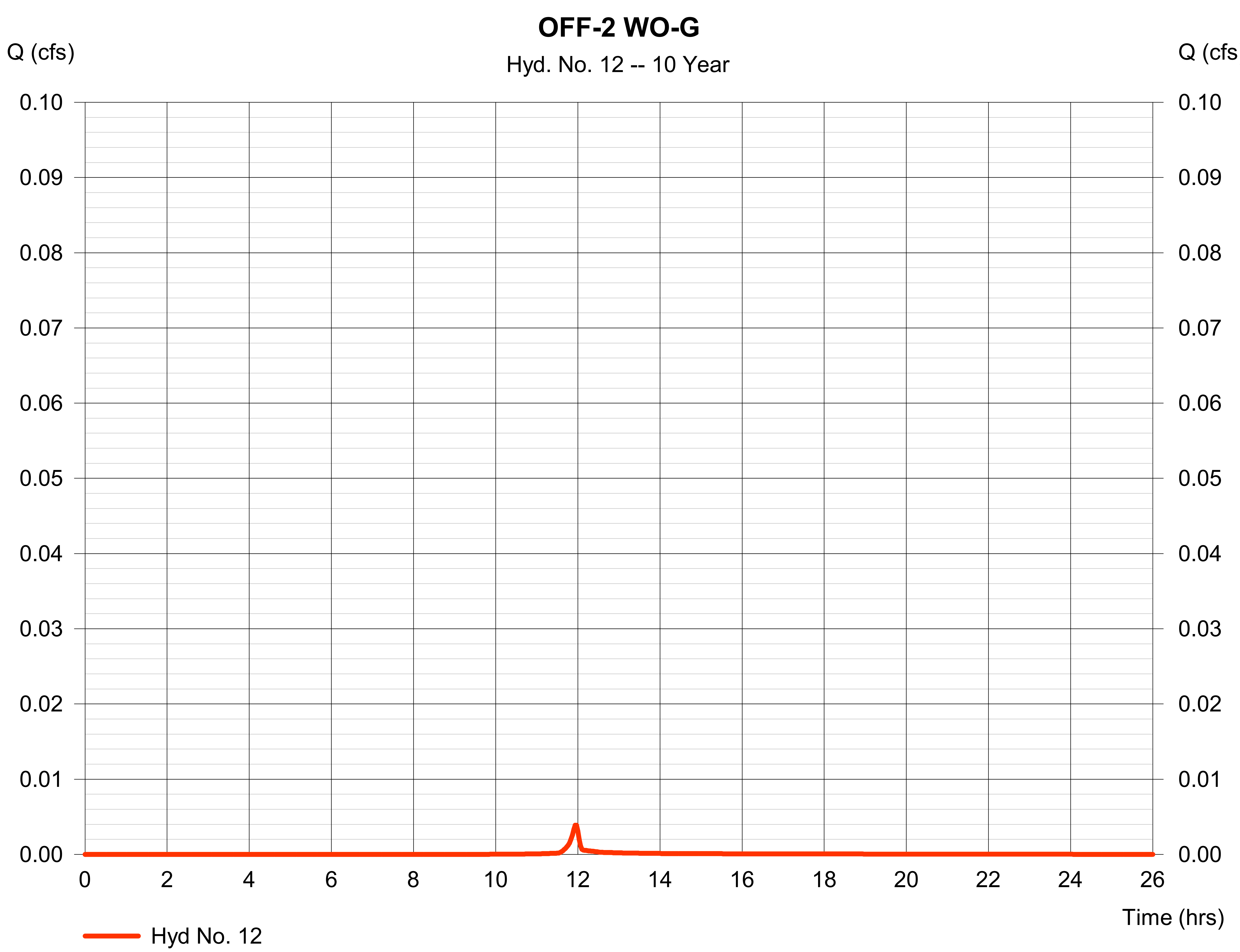
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Tuesday, 10 / 15 / 2019

Hyd. No. 12

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.004 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 8 cuft
Drainage area	= 0.001 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



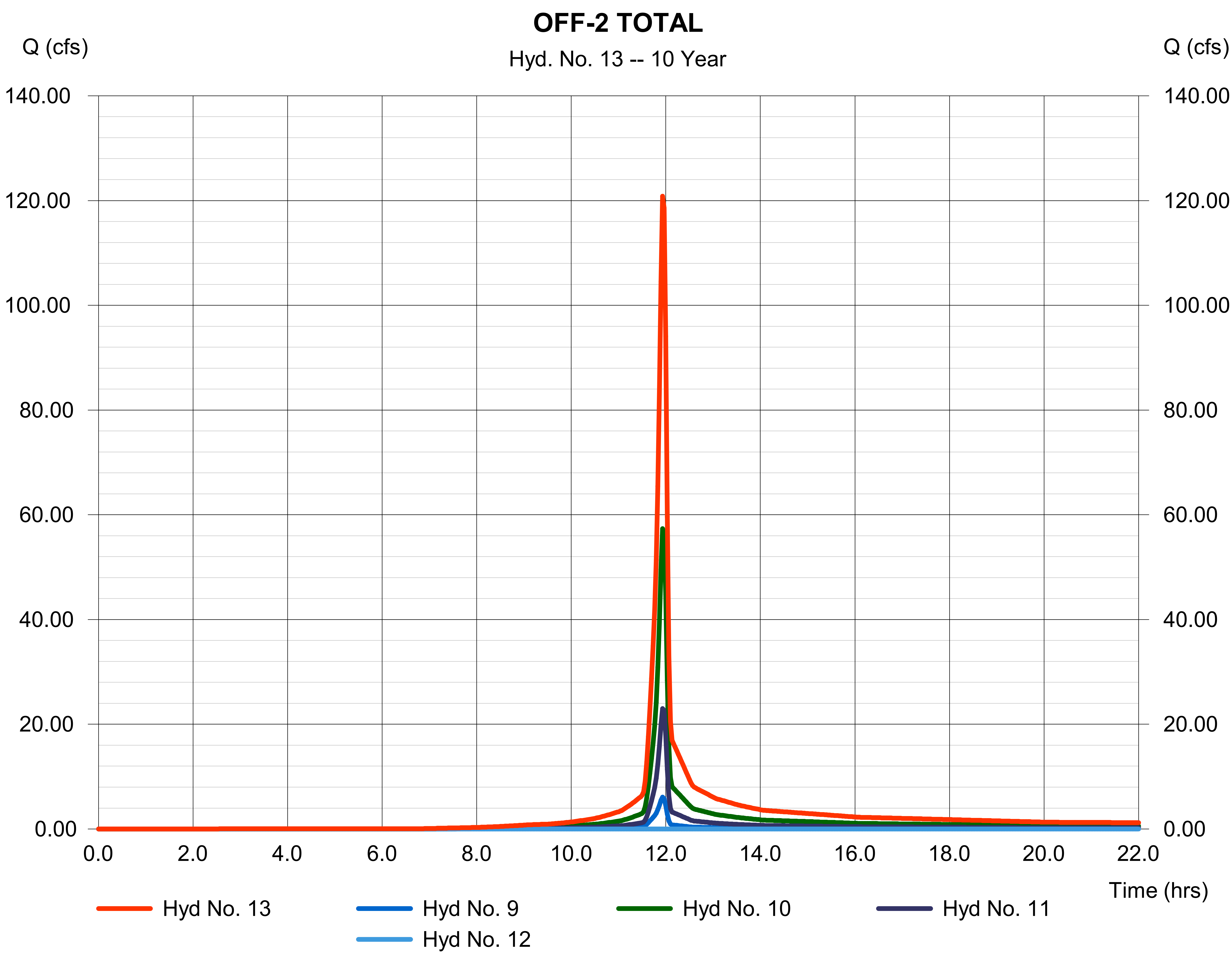
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 13

OFF-2 TOTAL

Hydrograph type	= Combine	Peak discharge	= 120.81 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 248,358 cuft
Inflow hyds.	= 9, 10, 11, 12	Contrib. drain. area	= 18.530 ac



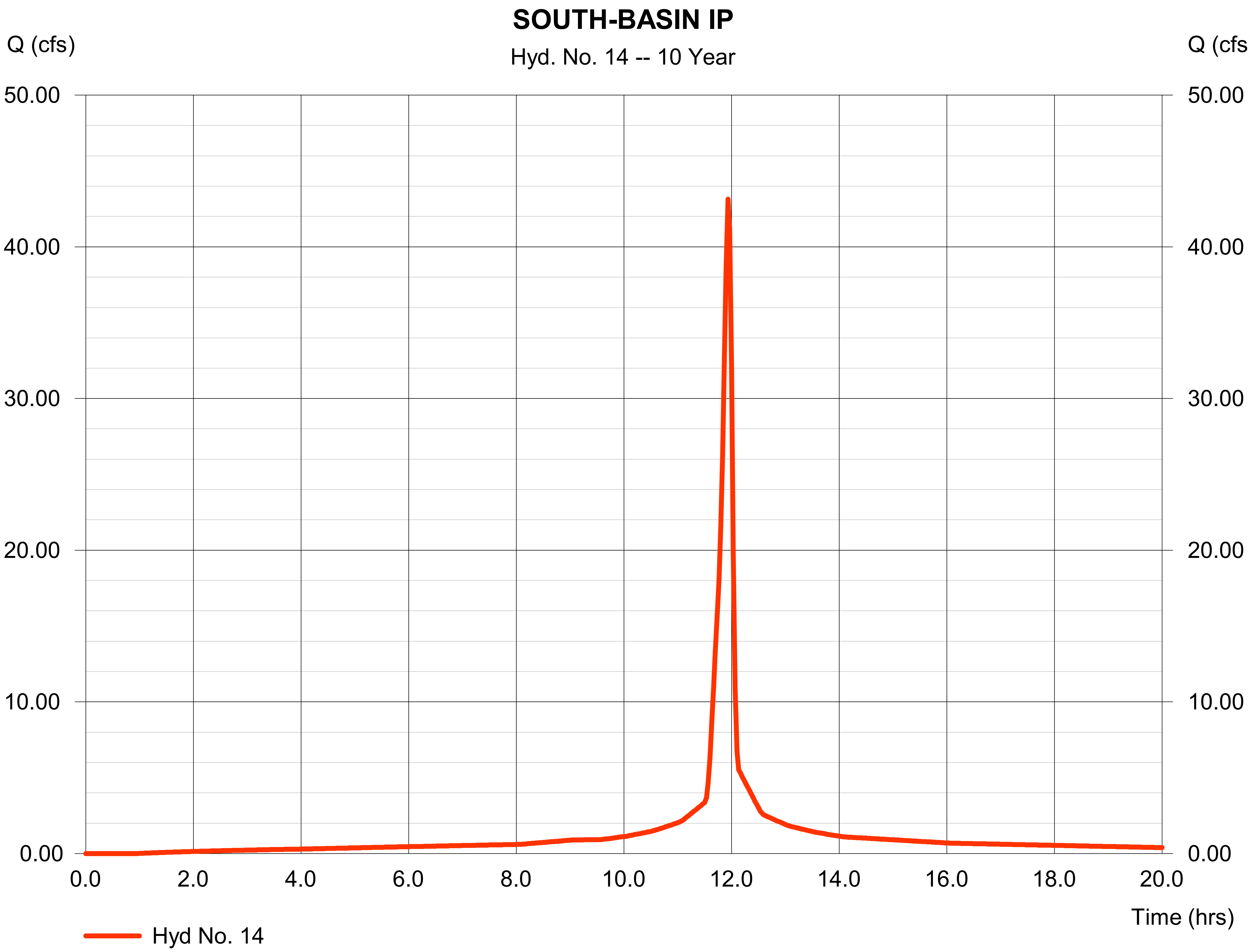
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 14

SOUTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 43.14 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 102,581 cuft
Drainage area	= 6.876 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



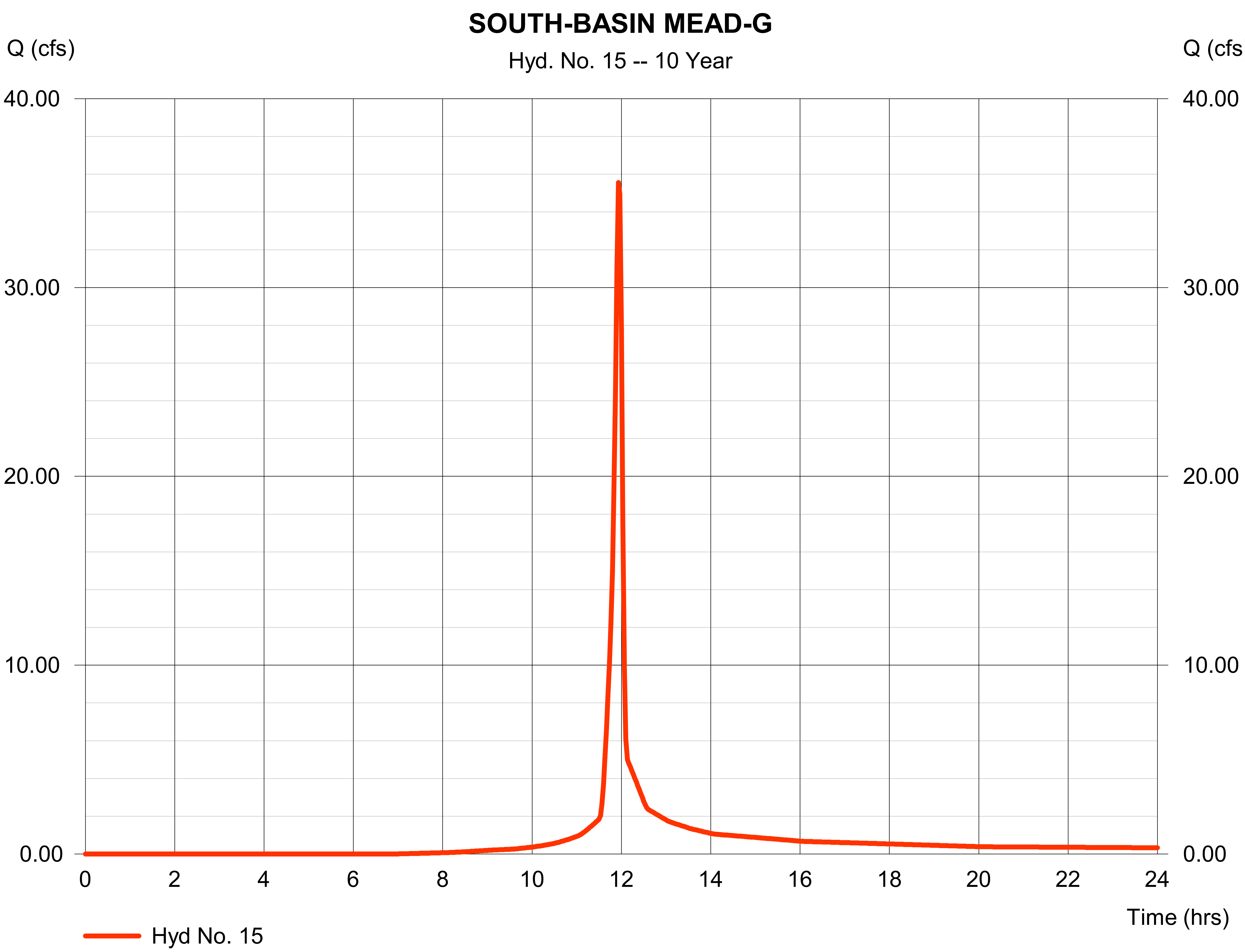
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 15

SOUTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 35.55 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 72,484 cuft
Drainage area	= 7.769 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



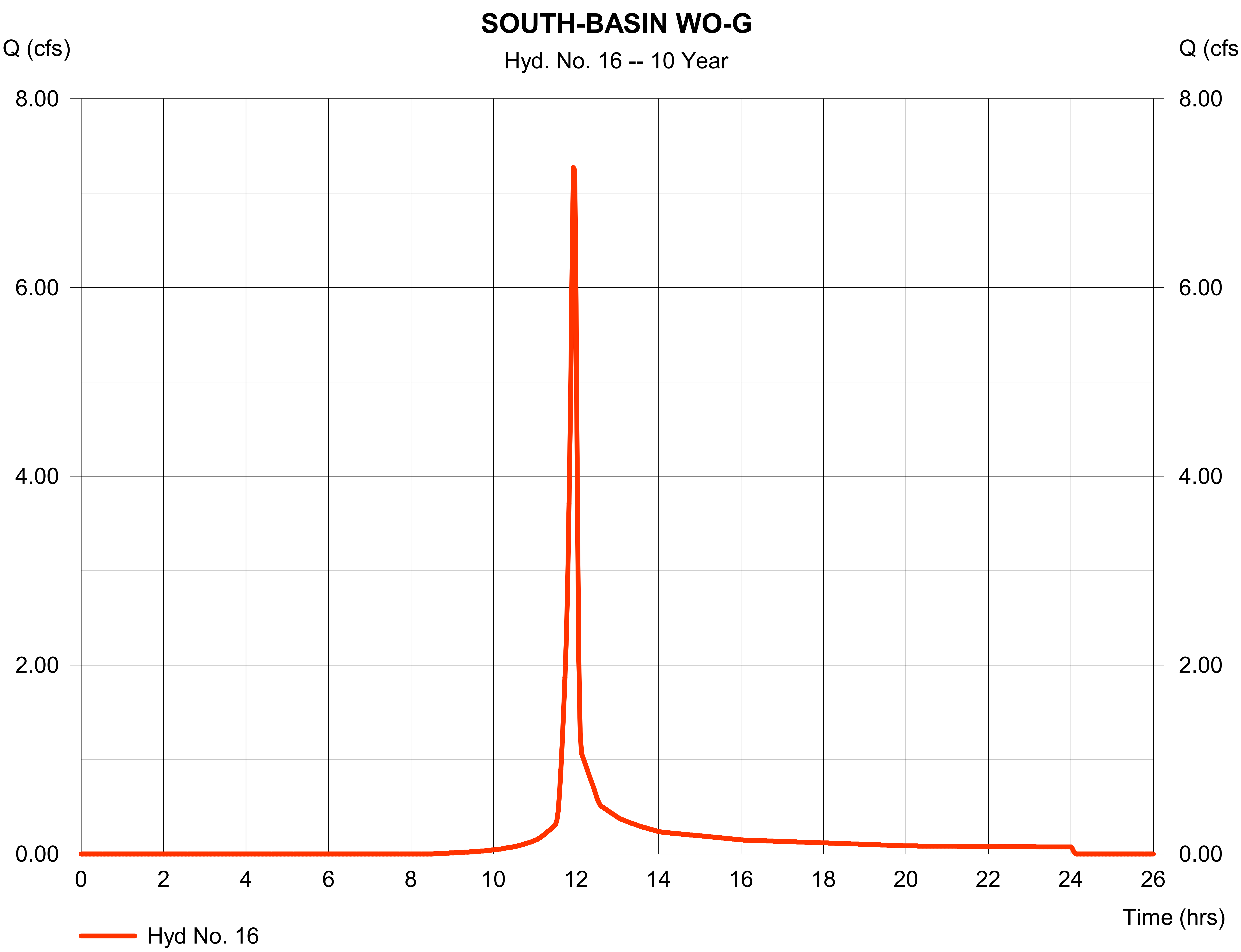
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 16

SOUTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 7.270 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 14,683 cuft
Drainage area	= 1.869 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.62 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



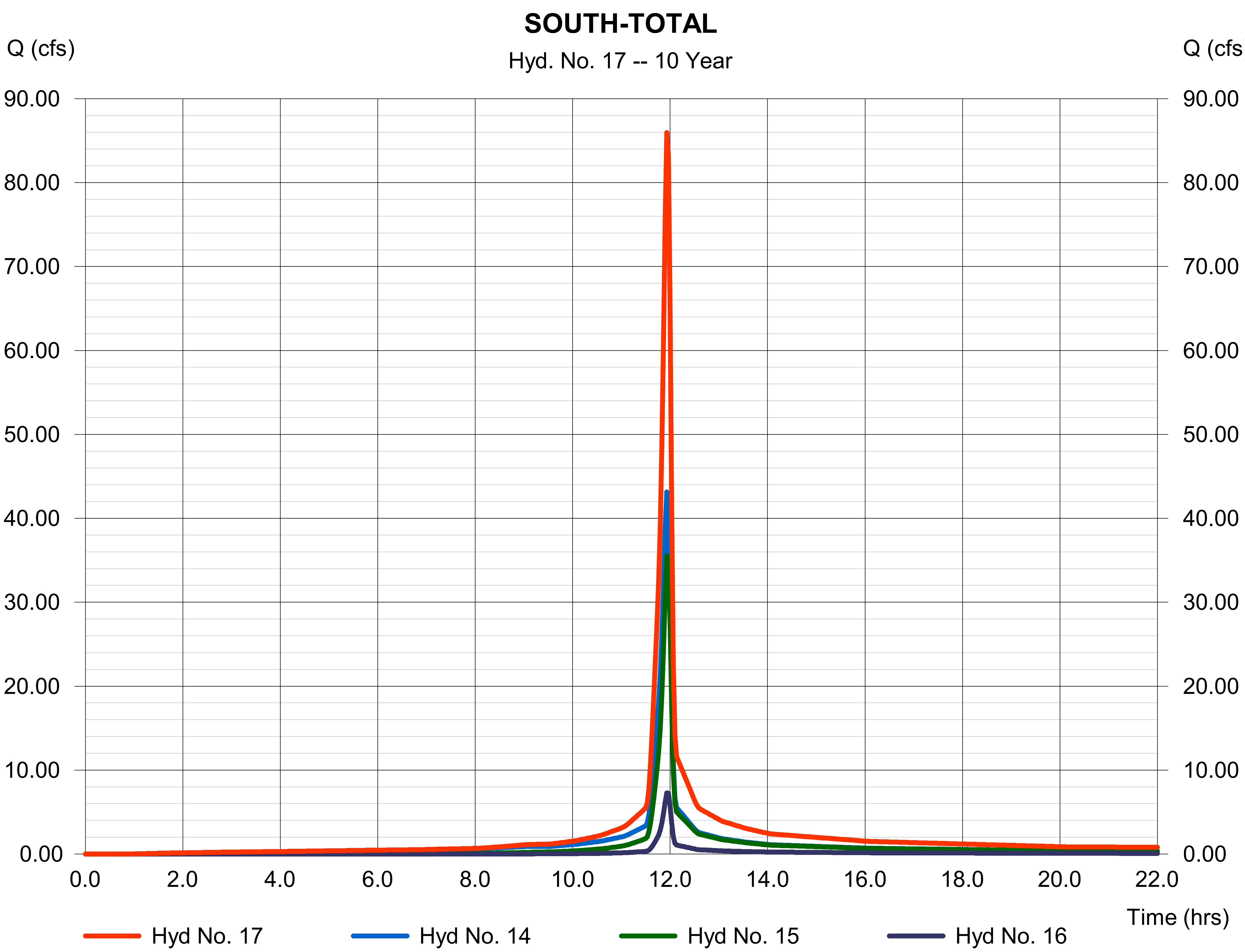
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 17

SOUTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 85.96 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 189,747 cuft
Inflow hyds.	= 14, 15, 16	Contrib. drain. area	= 16.514 ac



Hydrograph Report

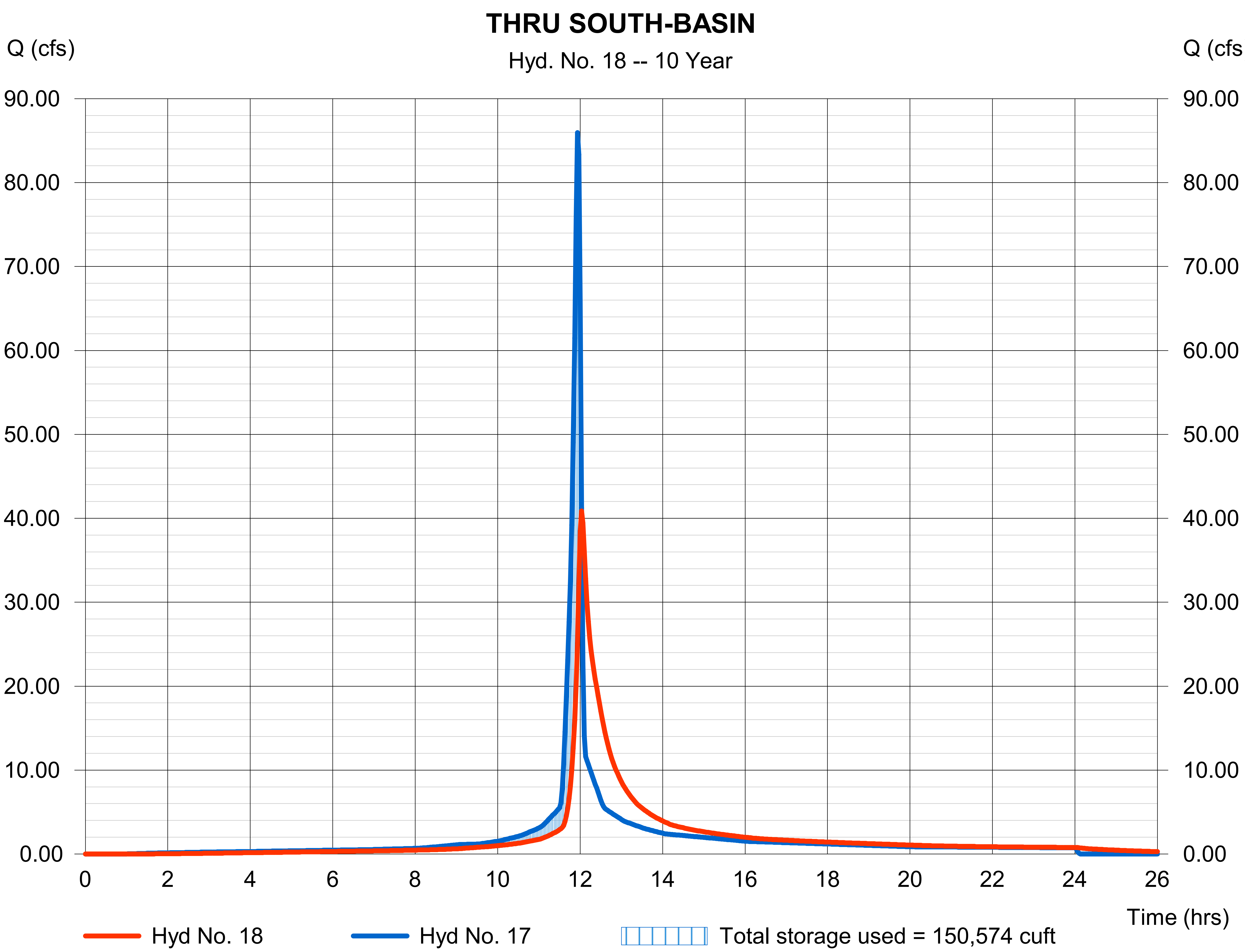
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Tuesday, 10 / 15 / 2019

Hyd. No. 18

THRU SOUTH-BASIN

Hydrograph type	= Reservoir	Peak discharge	= 40.88 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 189,740 cuft
Inflow hyd. No.	= 17 - SOUTH-TOTAL	Max. Elevation	= 1736.25 ft
Reservoir name	= SOUTH-BASIN	Max. Storage	= 150,574 cuft

Storage Indication method used. Wet pond routing start elevation = 1735.00 ft.



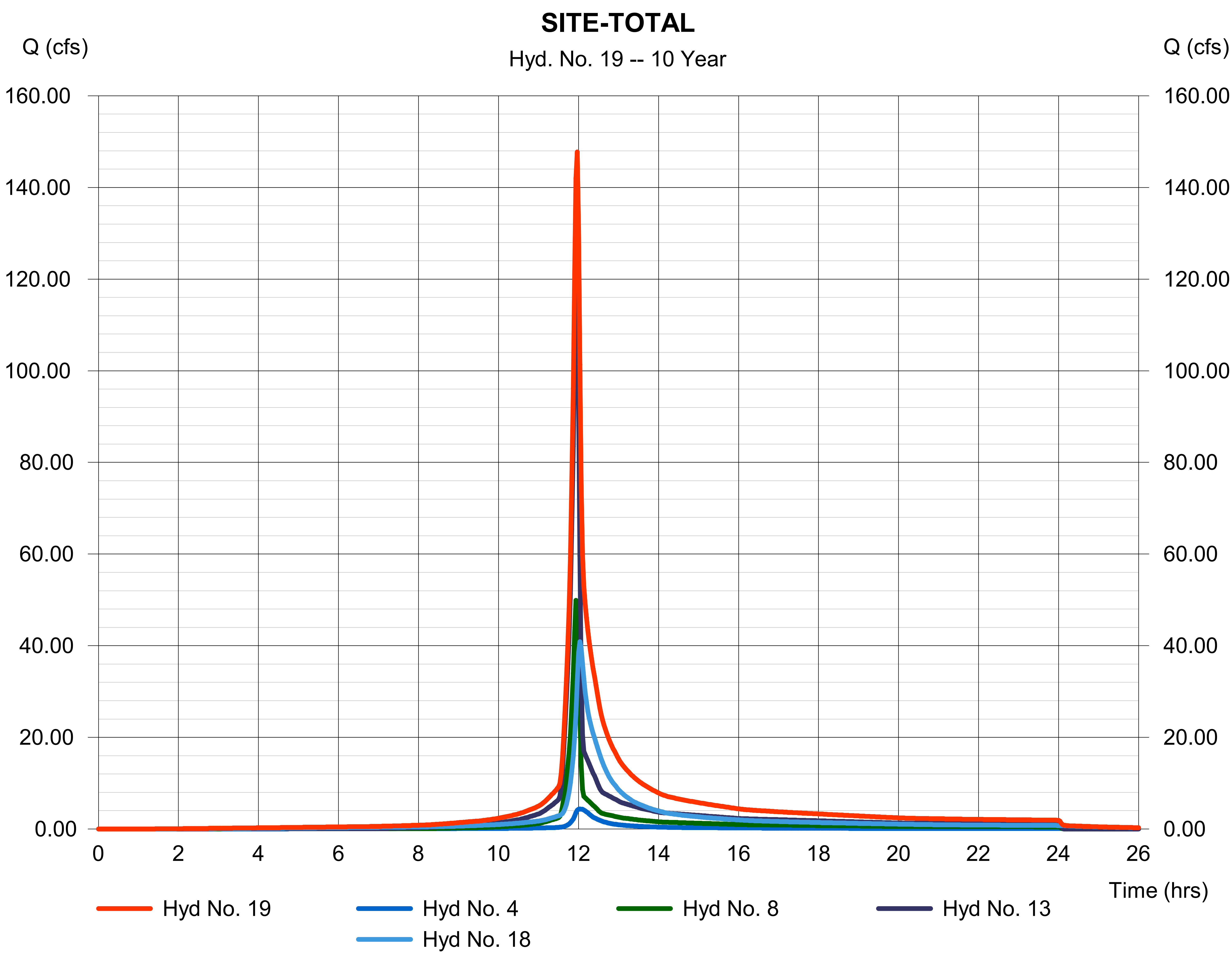
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 19

SITE-TOTAL

Hydrograph type	= Combine	Peak discharge	= 147.75 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 446,557 cuft
Inflow hyds.	= 4, 8, 13, 18	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	5.765	2	716	13,818	------	------	------	NORTH-BASIN IP
2	SCS Runoff	7.418	2	716	15,298	------	------	------	NORTH-BASIN MEAD-G
3	Combine	13.18	2	716	29,116	1, 2	------	------	NORTH-TOTAL
4	Reservoir	4.662	2	724	29,113	3	1736.86	17,448	THRU NORTH-BASIN
5	SCS Runoff	7.039	2	716	16,872	------	------	------	OFF-1 IP
6	SCS Runoff	20.08	2	716	41,411	------	------	------	OFF-1 MEAD-G
7	SCS Runoff	40.64	2	716	82,522	------	------	------	OFF-1 WO-G
8	Combine	67.76	2	716	140,805	5, 6, 7	------	------	OFF-1 TOTAL
9	SCS Runoff	7.544	2	716	18,083	------	------	------	OFF-2 IP
10	SCS Runoff	76.96	2	716	158,716	------	------	------	OFF-2 MEAD-G
11	SCS Runoff	30.86	2	716	63,636	------	------	------	OFF-2 MEAD-G
12	SCS Runoff	0.005	2	716	11	------	------	------	OFF-2 WO-G
13	Combine	161.47	2	716	335,526	9, 10, 11, 12	------	------	OFF-2 TOTAL
14	SCS Runoff	53.42	2	716	128,049	------	------	------	SOUTH-BASIN IP
15	SCS Runoff	47.71	2	716	98,386	------	------	------	SOUTH-BASIN MEAD-G
16	SCS Runoff	10.11	2	716	20,526	------	------	------	SOUTH-BASIN WO-G
17	Combine	111.24	2	716	246,960	14, 15, 16	------	------	SOUTH-TOTAL
18	Reservoir	56.82	2	722	246,953	17	1736.52	164,341	THRU SOUTH-BASIN
19	Combine	203.87	2	718	593,680	4, 8, 13, 18	------	------	SITE-TOTAL

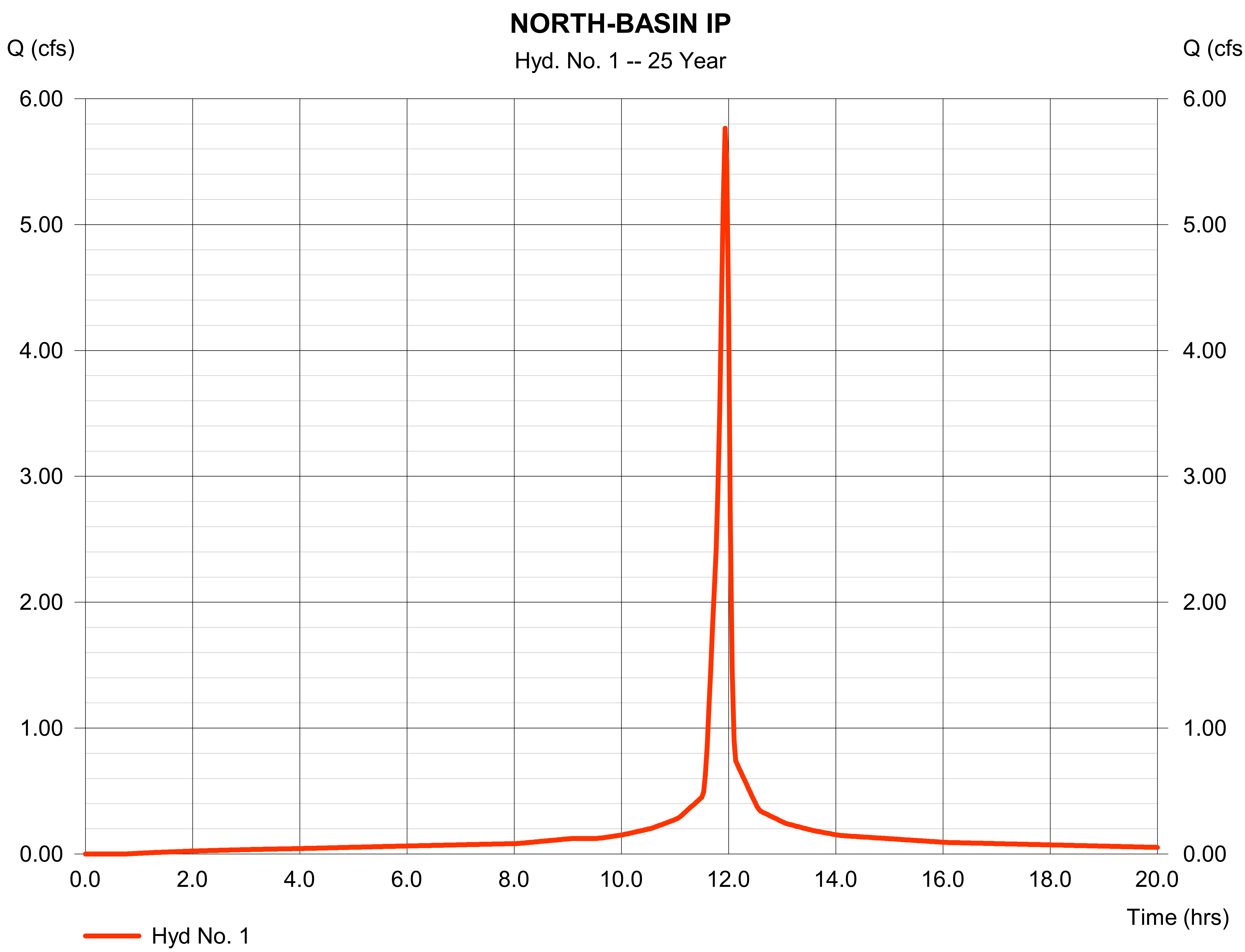
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 1

NORTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 5.765 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 13,818 cuft
Drainage area	= 0.742 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



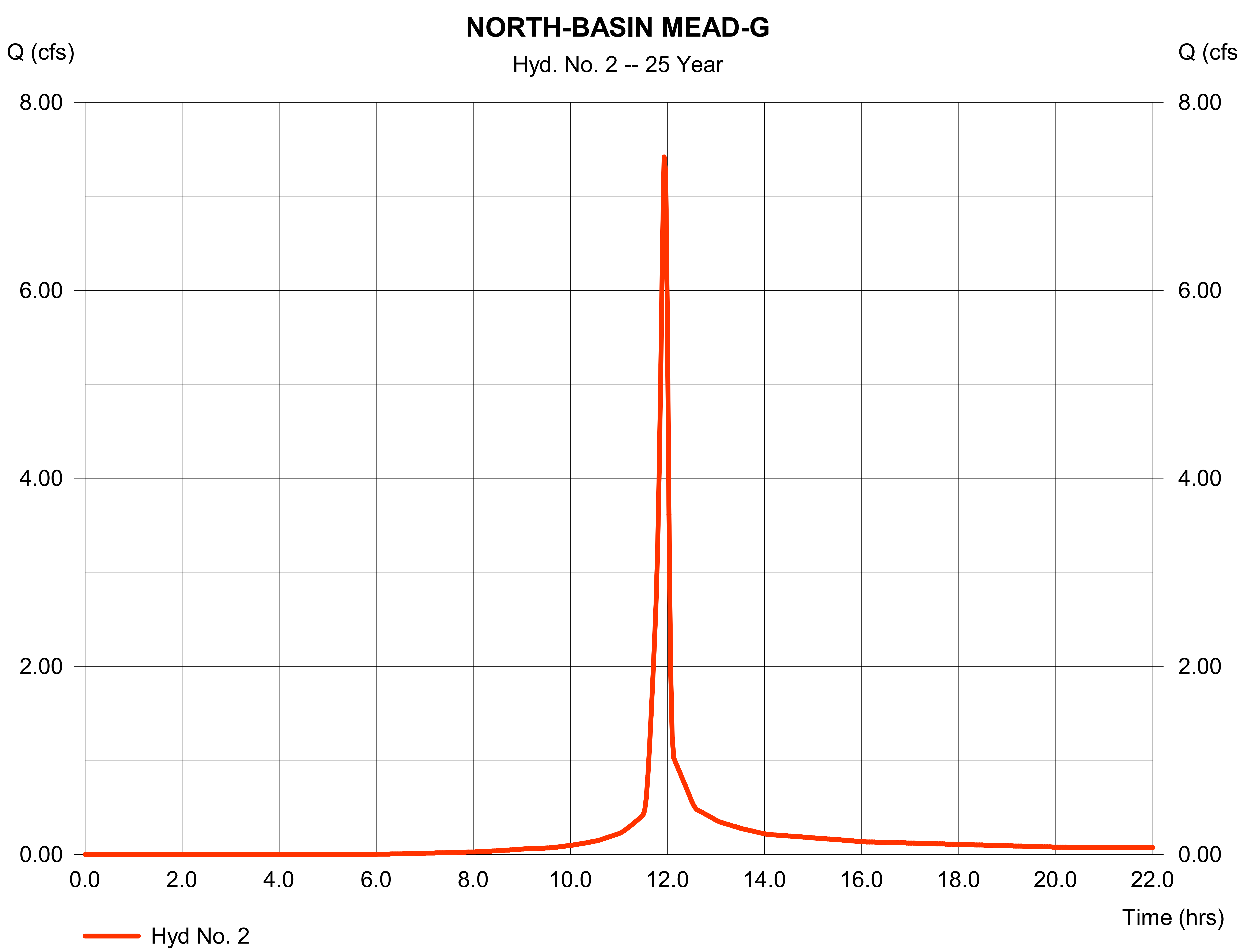
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Tuesday, 10 / 15 / 2019

Hyd. No. 2

NORTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 7.418 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 15,298 cuft
Drainage area	= 1.208 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



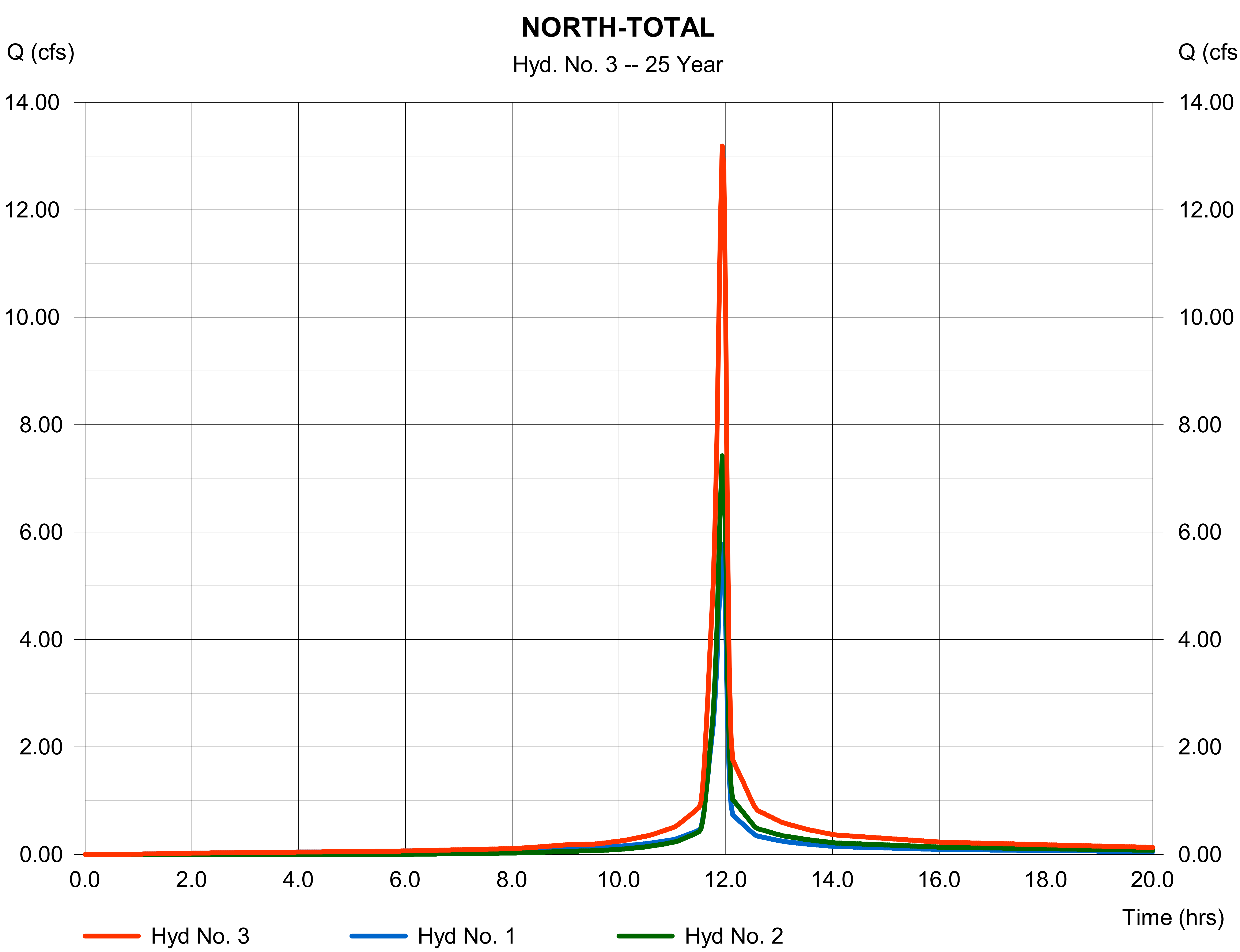
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 3

NORTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 13.18 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 29,116 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 1.950 ac



Hydrograph Report

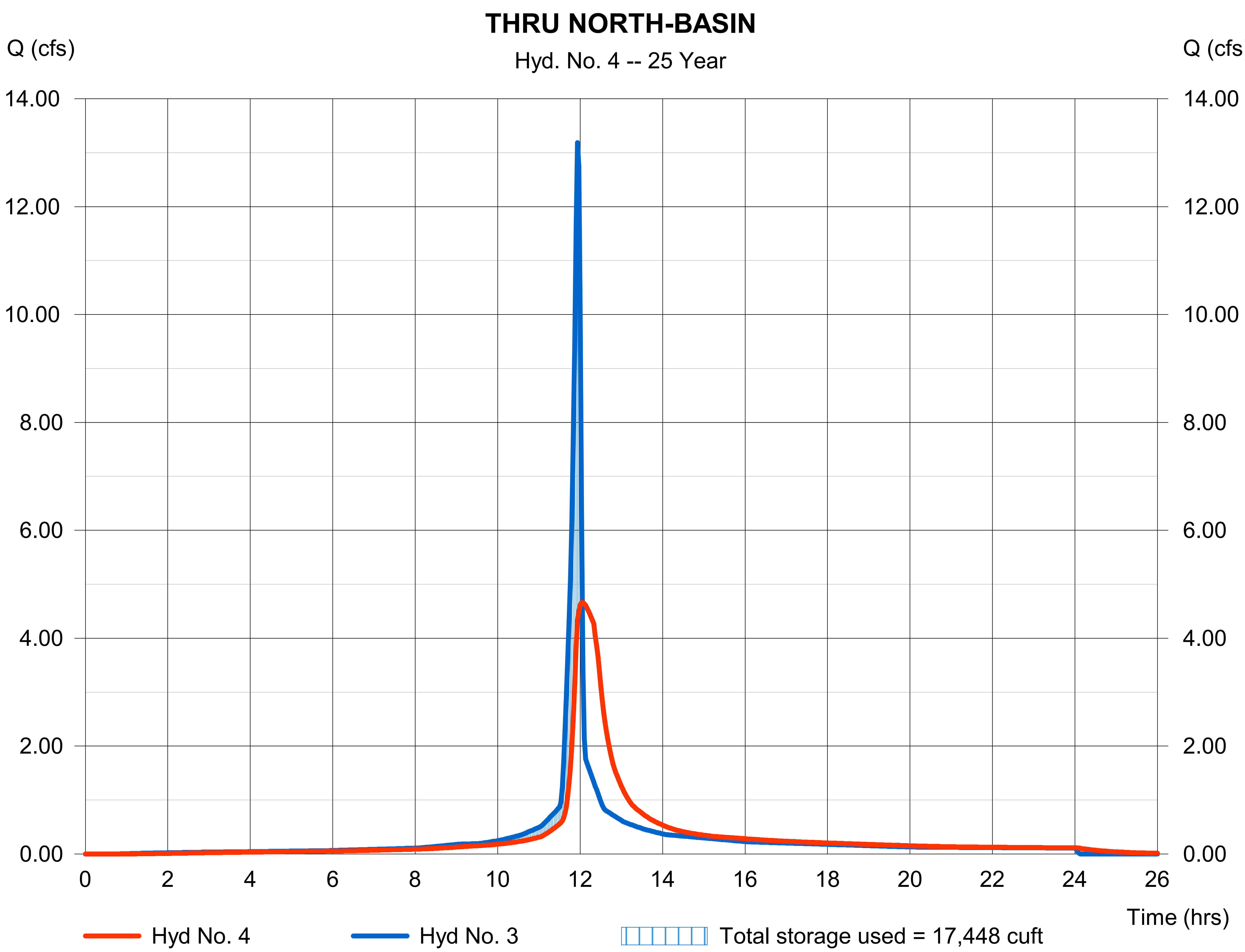
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 4

THRU NORTH-BASIN

Hydrograph type	= Reservoir	Peak discharge	= 4.662 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 29,113 cuft
Inflow hyd. No.	= 3 - NORTH-TOTAL	Max. Elevation	= 1736.86 ft
Reservoir name	= NORTH-BASIN	Max. Storage	= 17,448 cuft

Storage Indication method used. Wet pond routing start elevation = 1736.00 ft.



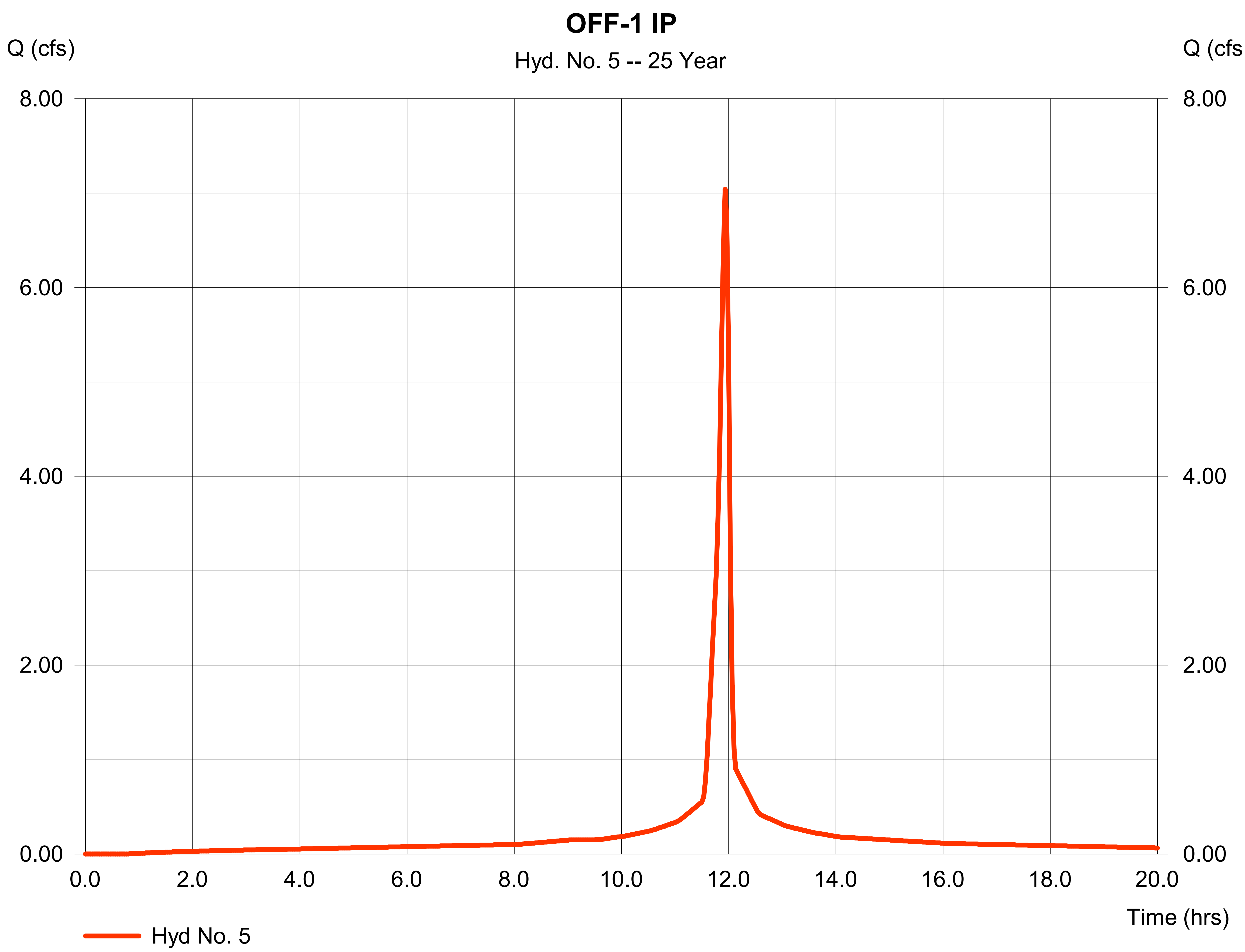
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Tuesday, 10 / 15 / 2019

Hyd. No. 5

OFF-1 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 7.039 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 16,872 cuft
Drainage area	= 0.906 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



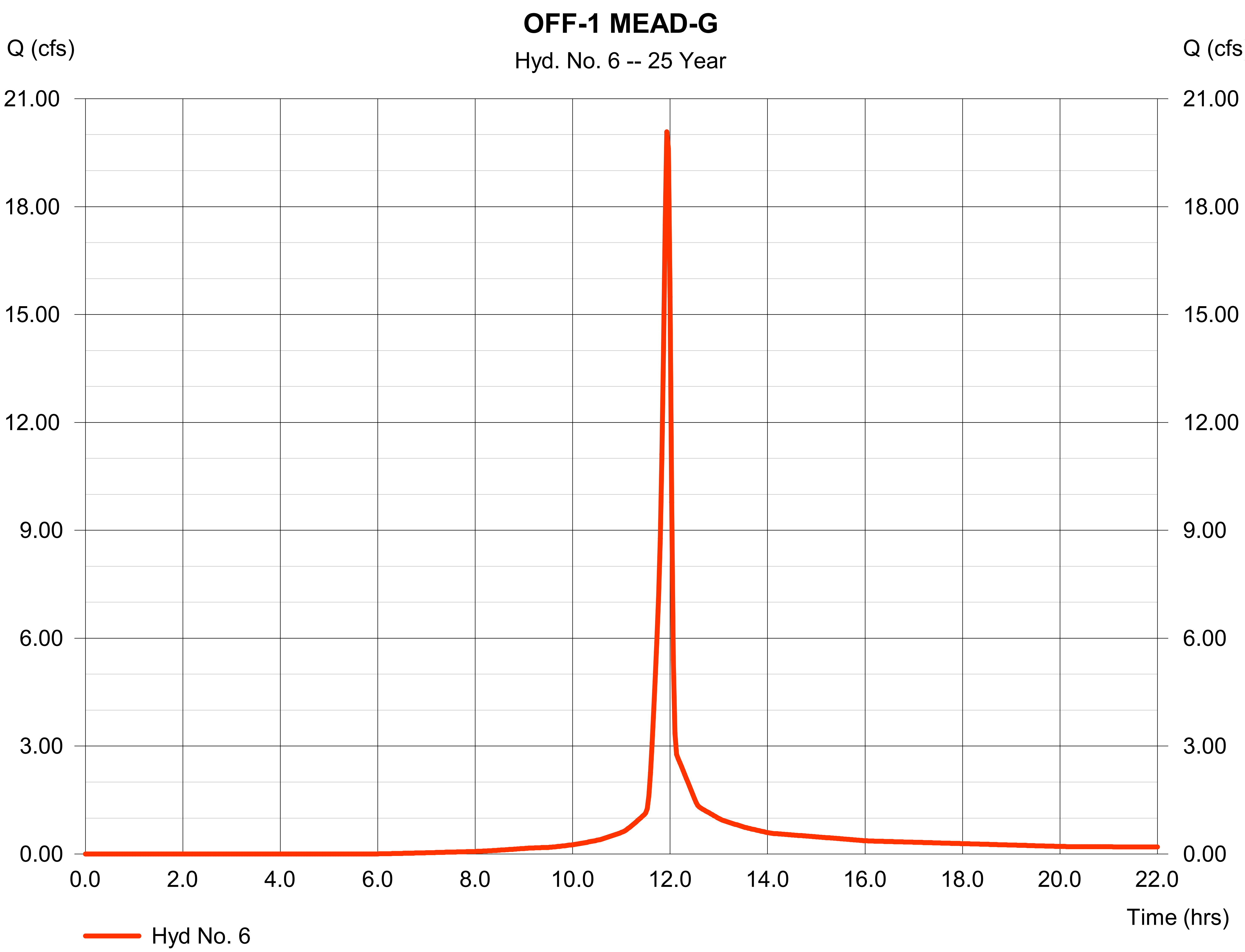
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 6

OFF-1 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 20.08 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 41,411 cuft
Drainage area	= 3.270 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



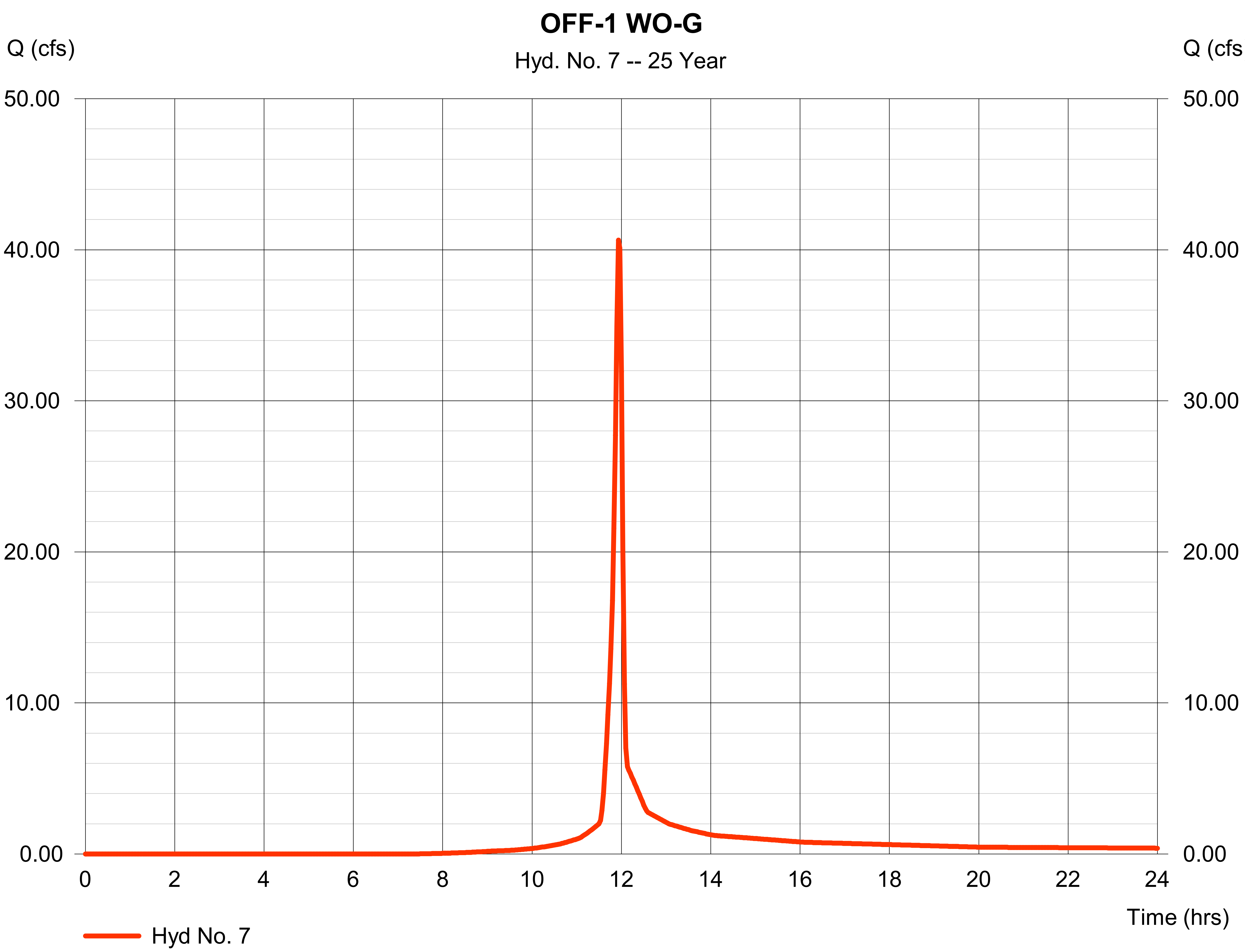
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 7

OFF-1 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 40.64 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 82,522 cuft
Drainage area	= 7.514 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



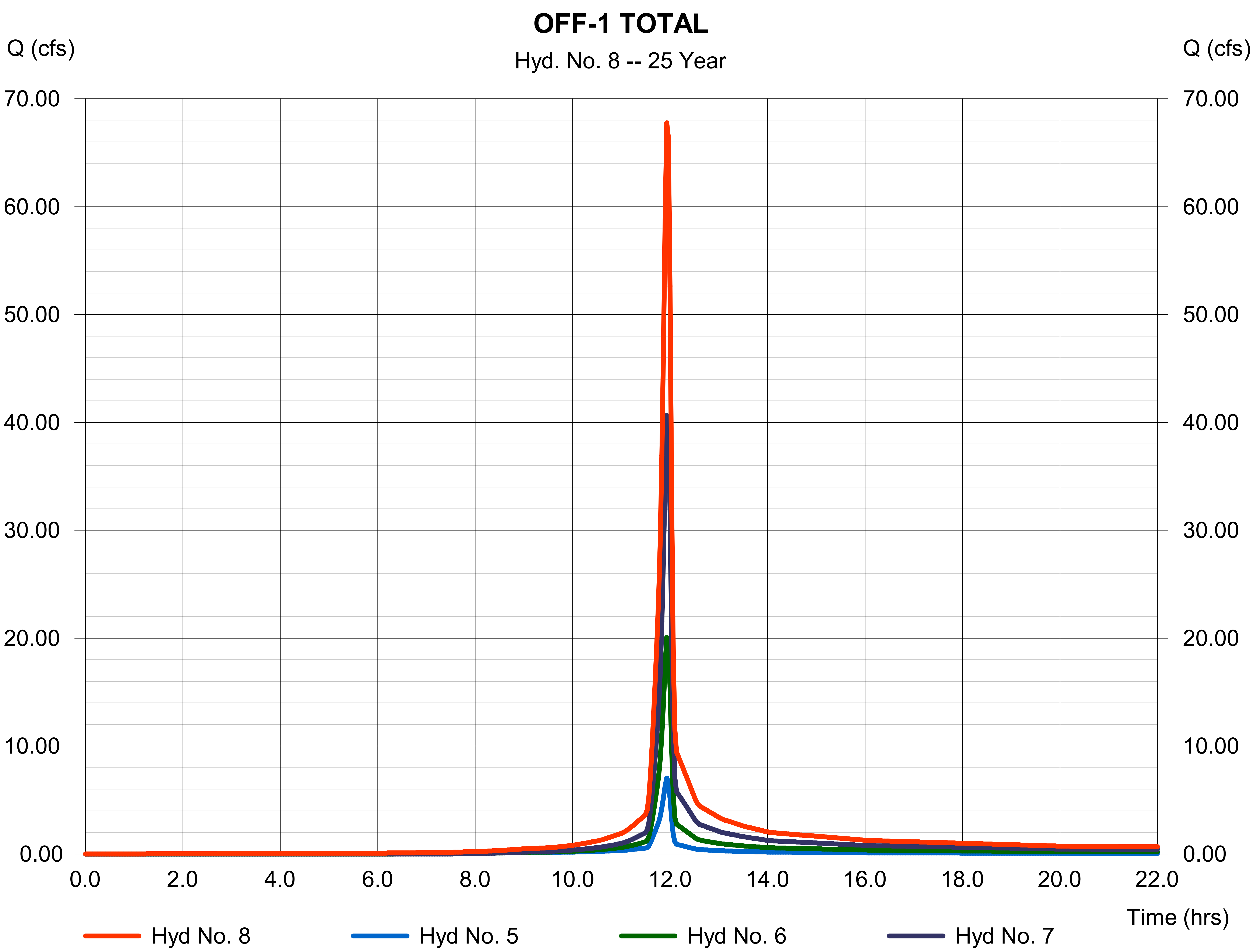
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 8

OFF-1 TOTAL

Hydrograph type	= Combine	Peak discharge	= 67.76 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 140,805 cuft
Inflow hyds.	= 5, 6, 7	Contrib. drain. area	= 11.690 ac



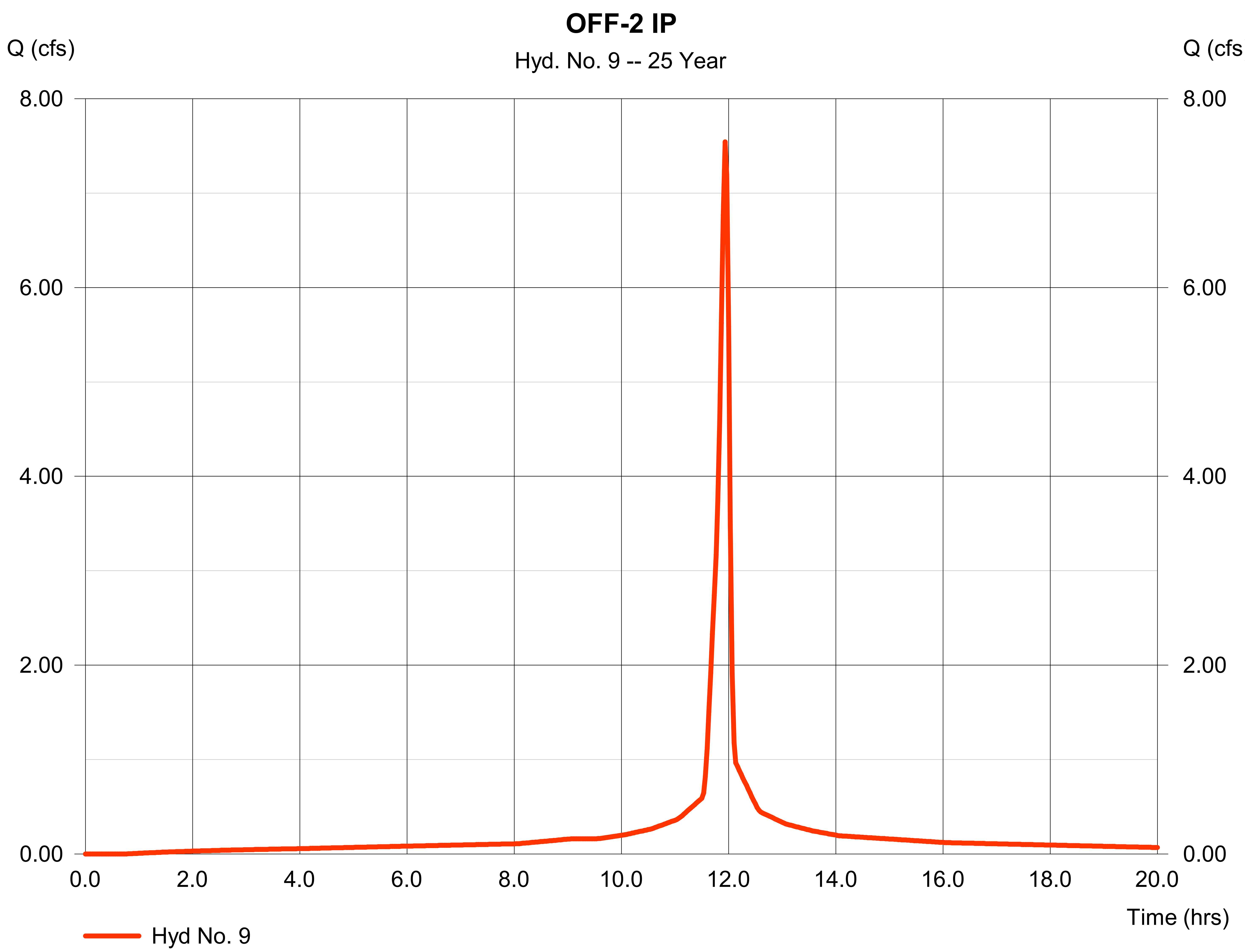
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Tuesday, 10 / 15 / 2019

Hyd. No. 9

OFF-2 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 7.544 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 18,083 cuft
Drainage area	= 0.971 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



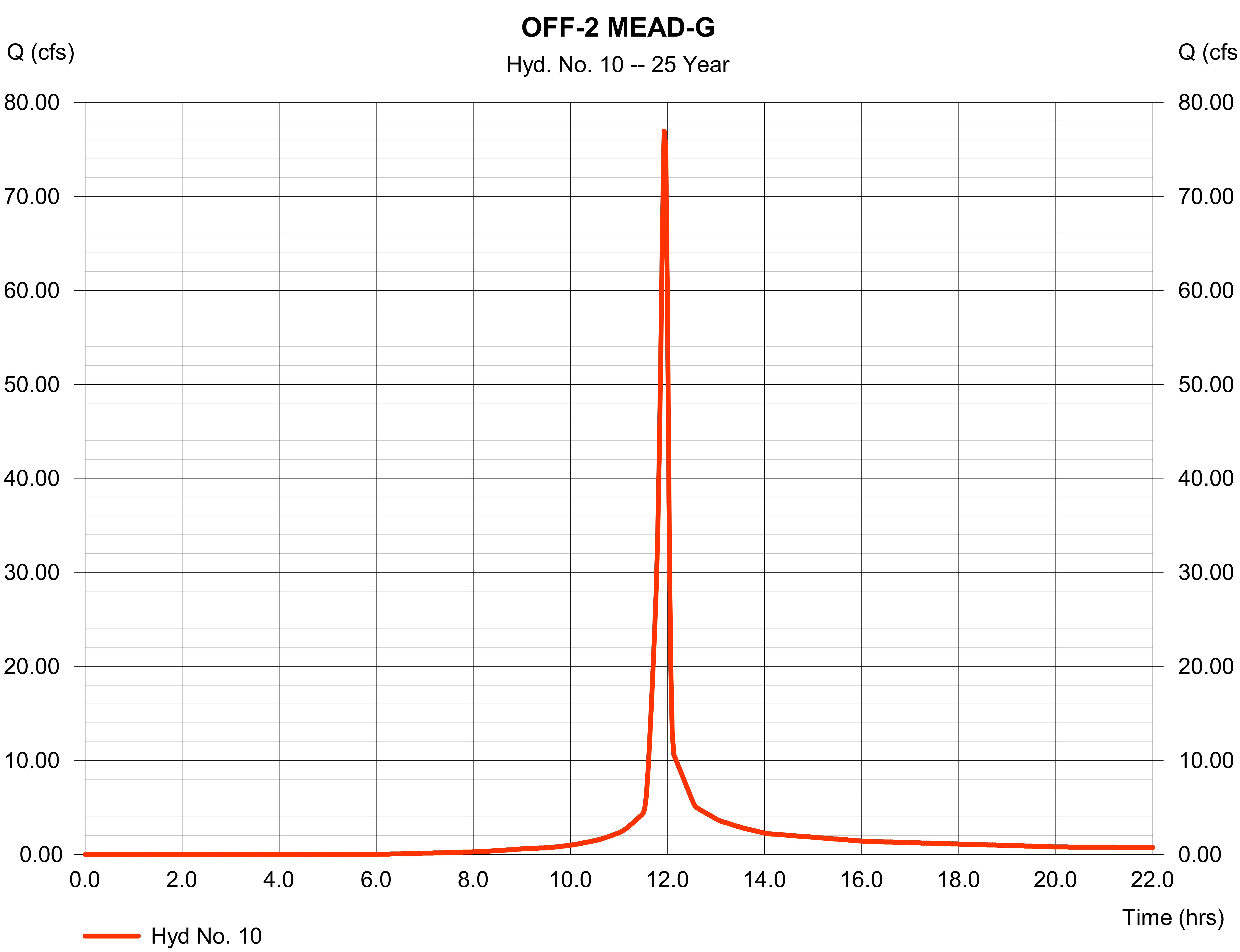
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 10

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 76.96 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 158,716 cuft
Drainage area	= 12.533 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



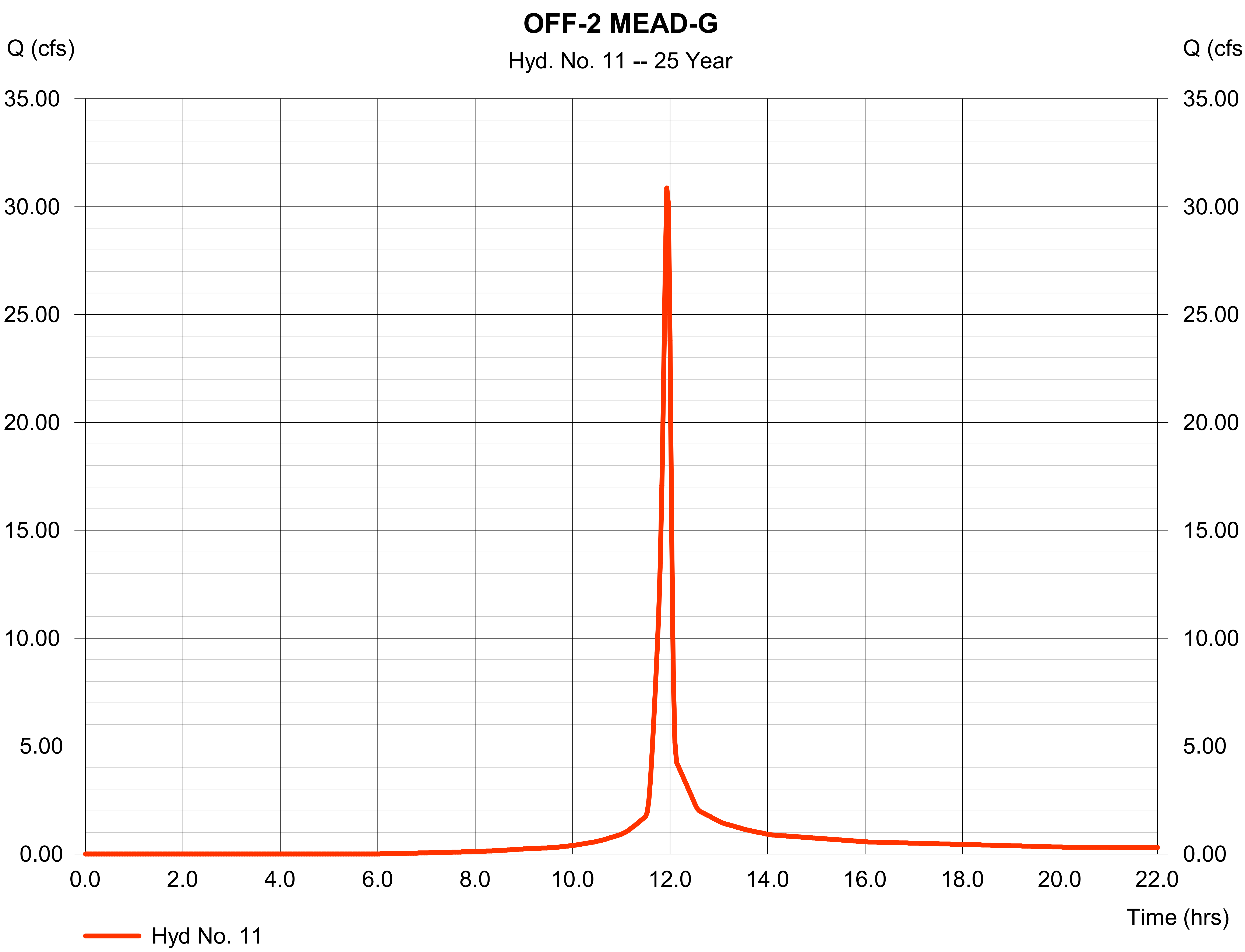
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 11

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 30.86 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 63,636 cuft
Drainage area	= 5.025 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



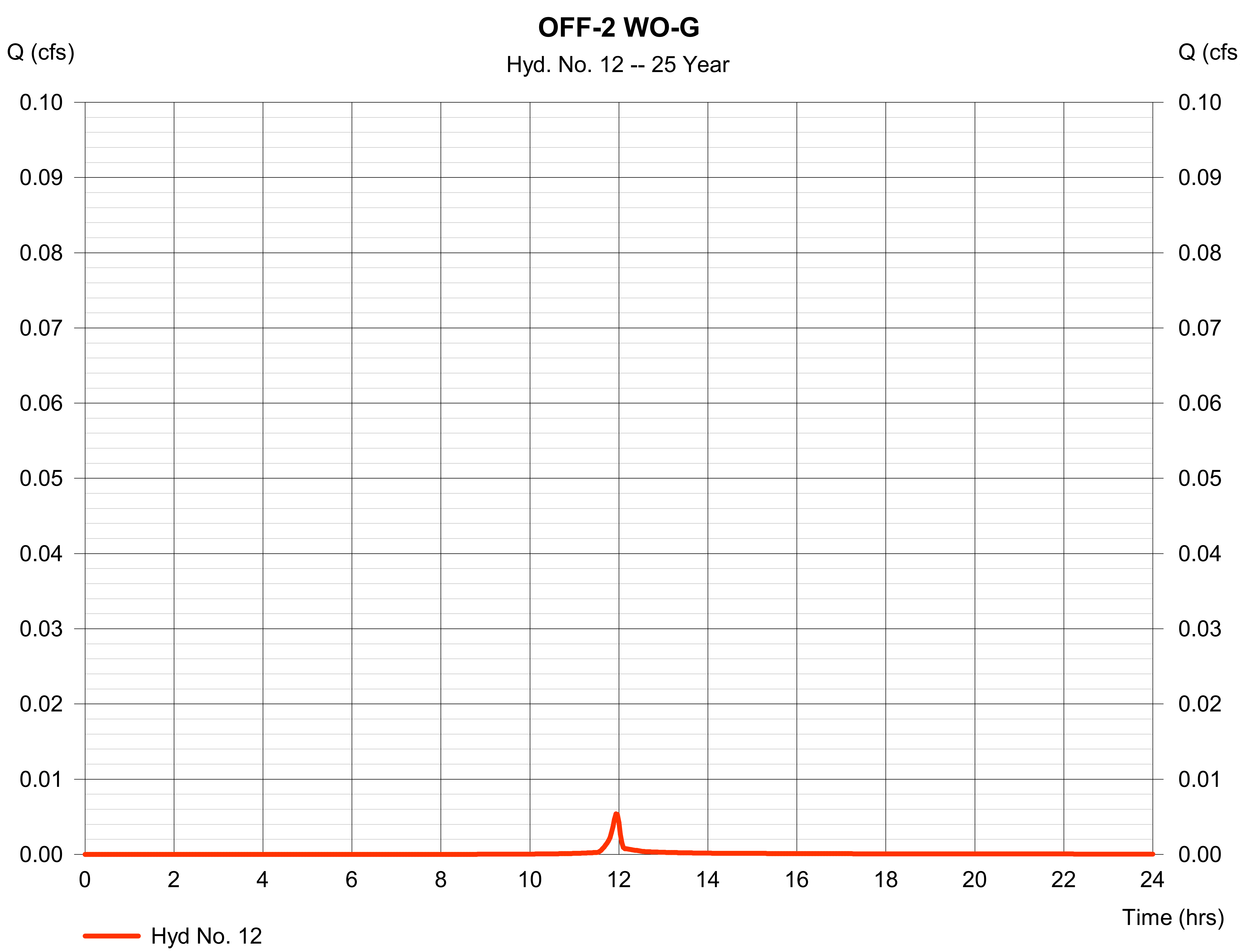
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 12

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.005 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 11 cuft
Drainage area	= 0.001 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



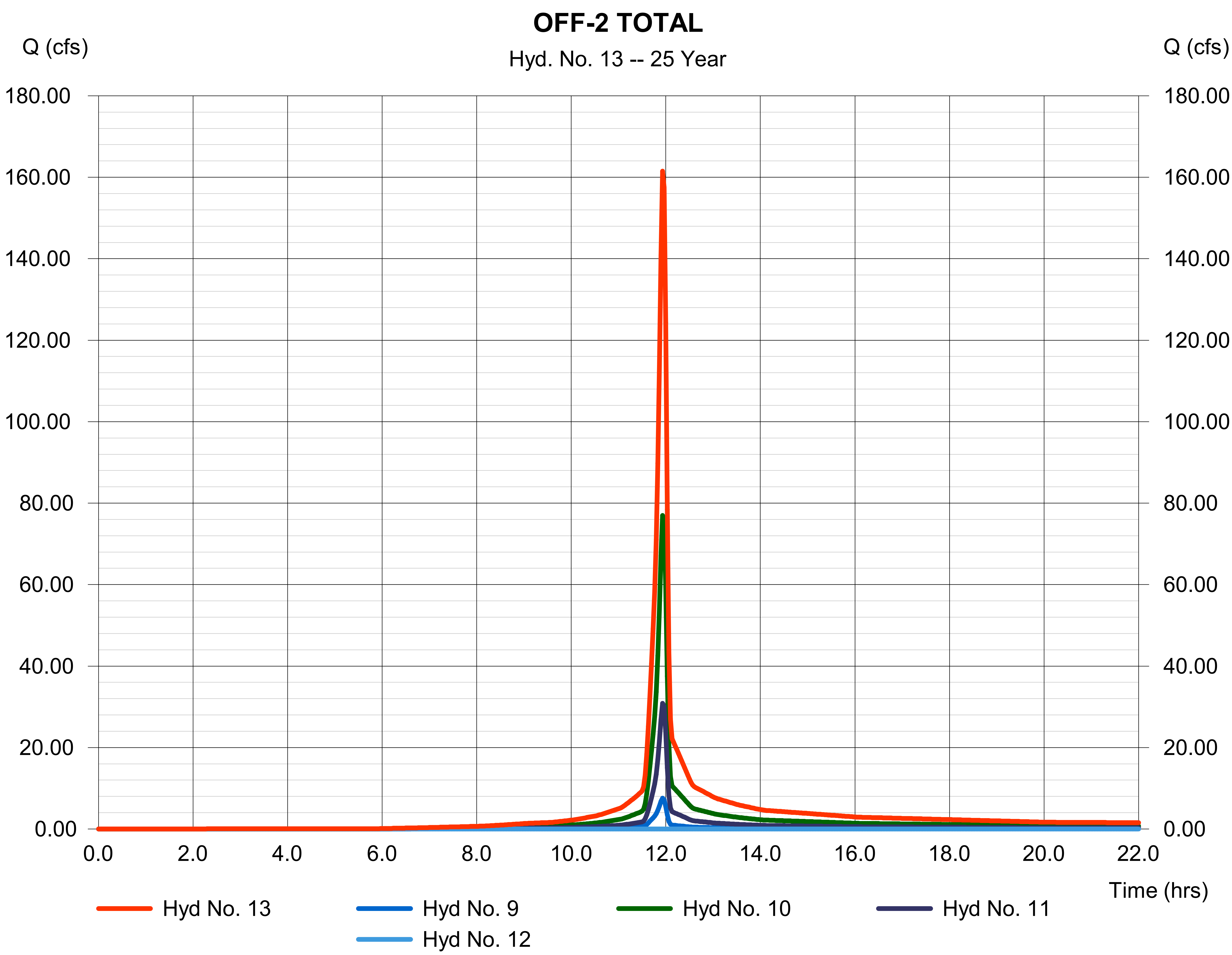
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 13

OFF-2 TOTAL

Hydrograph type	= Combine	Peak discharge	= 161.47 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 335,526 cuft
Inflow hyds.	= 9, 10, 11, 12	Contrib. drain. area	= 18.530 ac



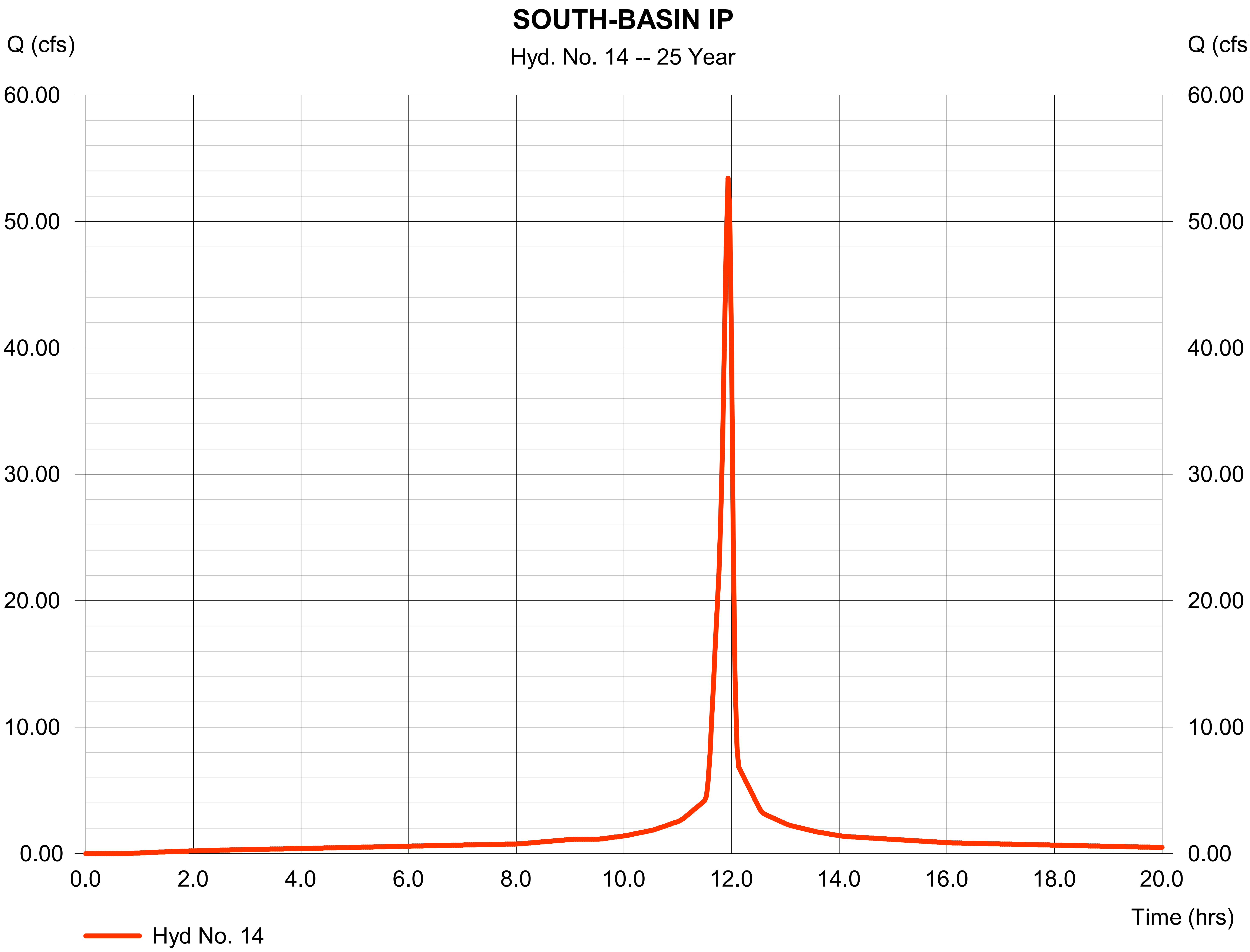
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 14

SOUTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 53.42 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 128,049 cuft
Drainage area	= 6.876 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



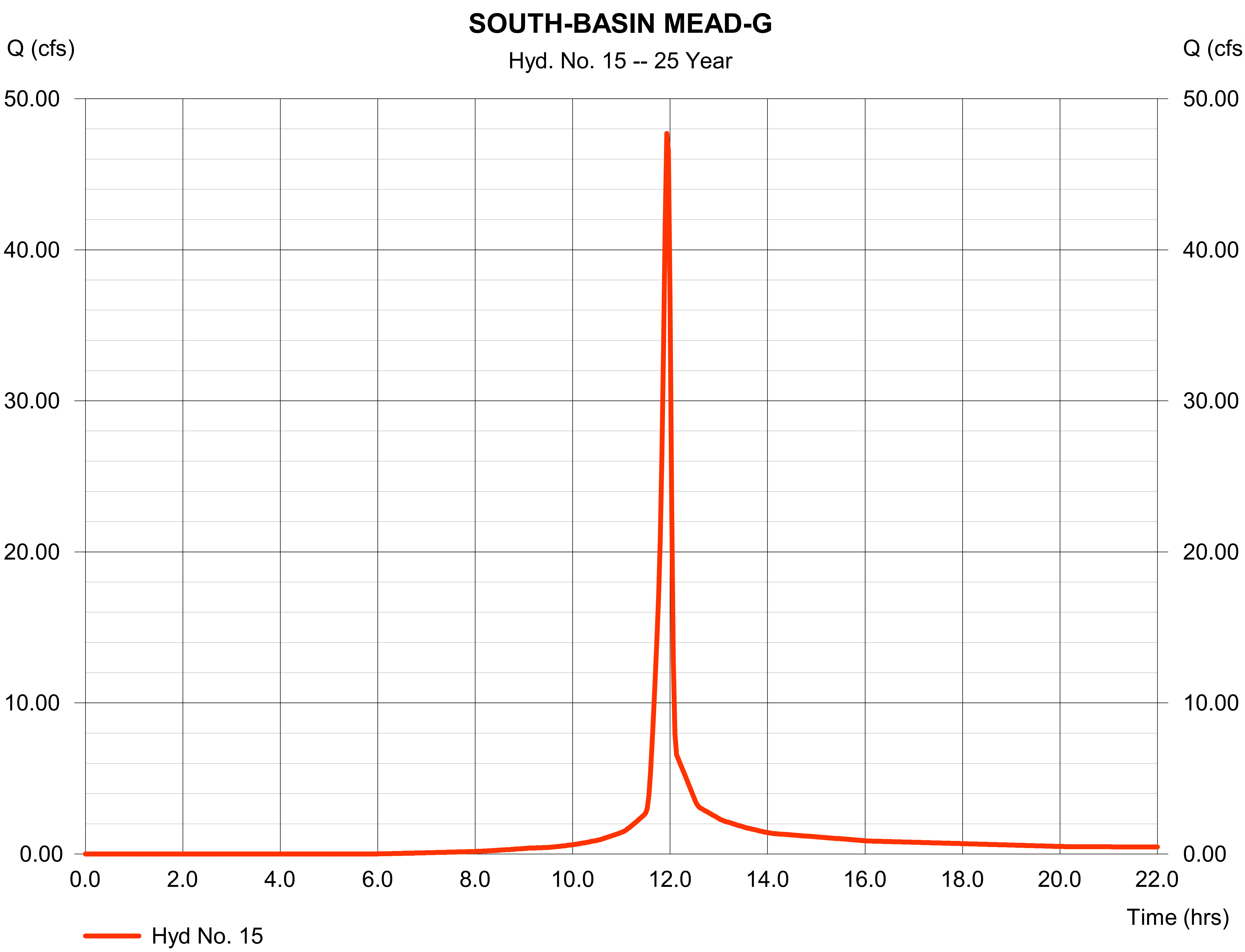
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 15

SOUTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 47.71 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 98,386 cuft
Drainage area	= 7.769 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



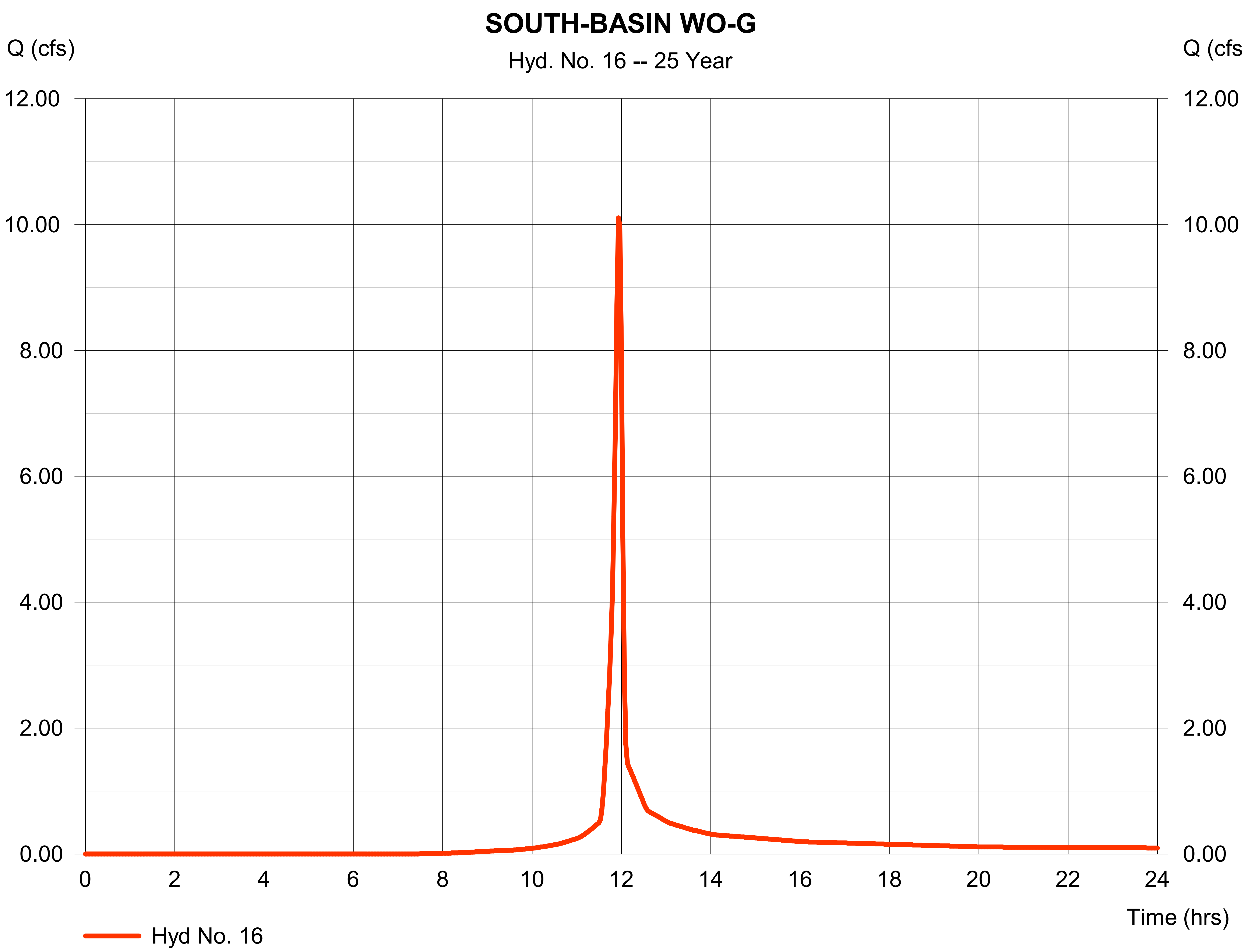
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 16

SOUTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 10.11 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 20,526 cuft
Drainage area	= 1.869 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



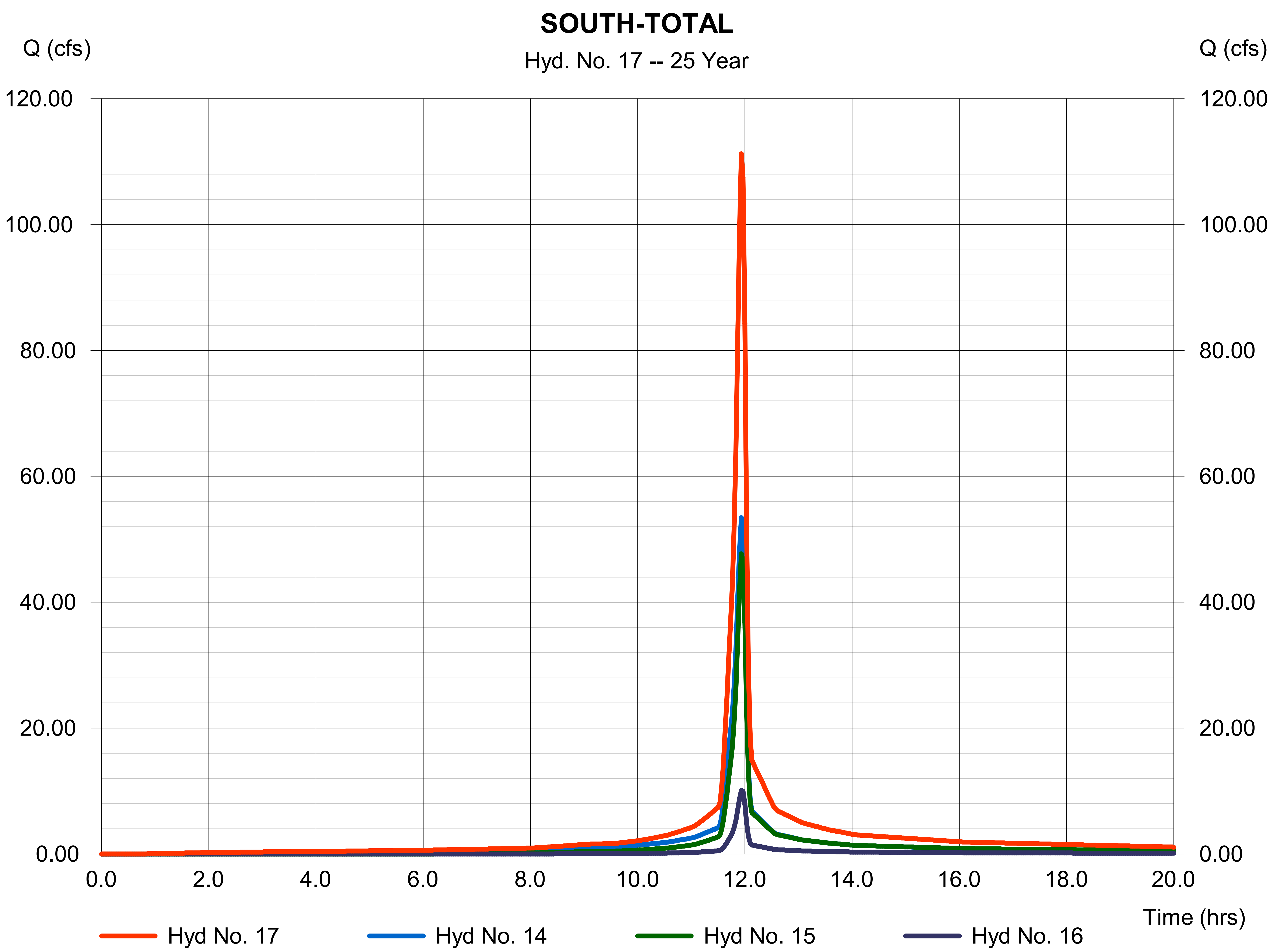
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 17

SOUTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 111.24 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 246,960 cuft
Inflow hyds.	= 14, 15, 16	Contrib. drain. area	= 16.514 ac



Hydrograph Report

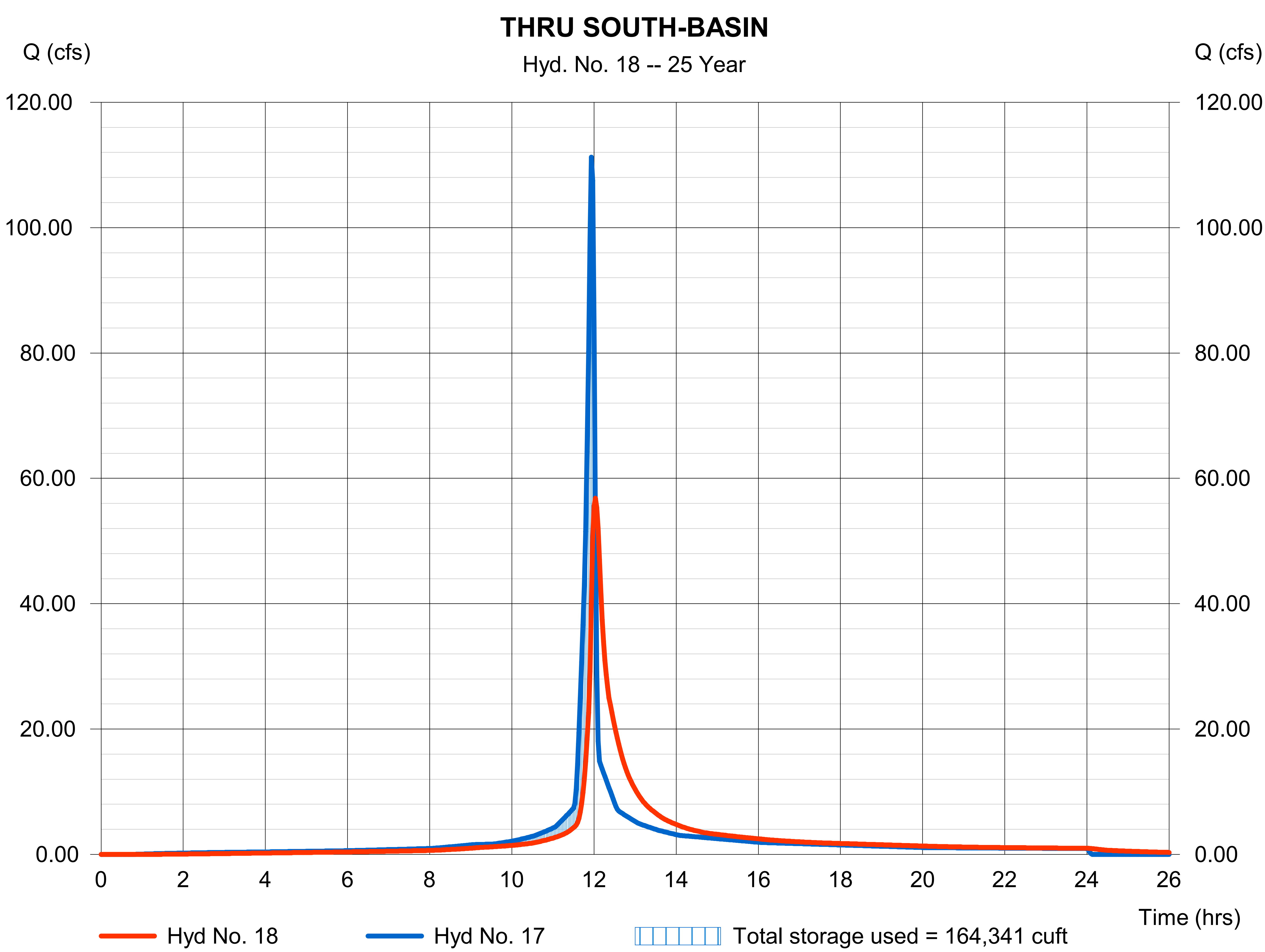
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 18

THRU SOUTH-BASIN

Hydrograph type	= Reservoir	Peak discharge	= 56.82 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 246,953 cuft
Inflow hyd. No.	= 17 - SOUTH-TOTAL	Max. Elevation	= 1736.52 ft
Reservoir name	= SOUTH-BASIN	Max. Storage	= 164,341 cuft

Storage Indication method used. Wet pond routing start elevation = 1735.00 ft.



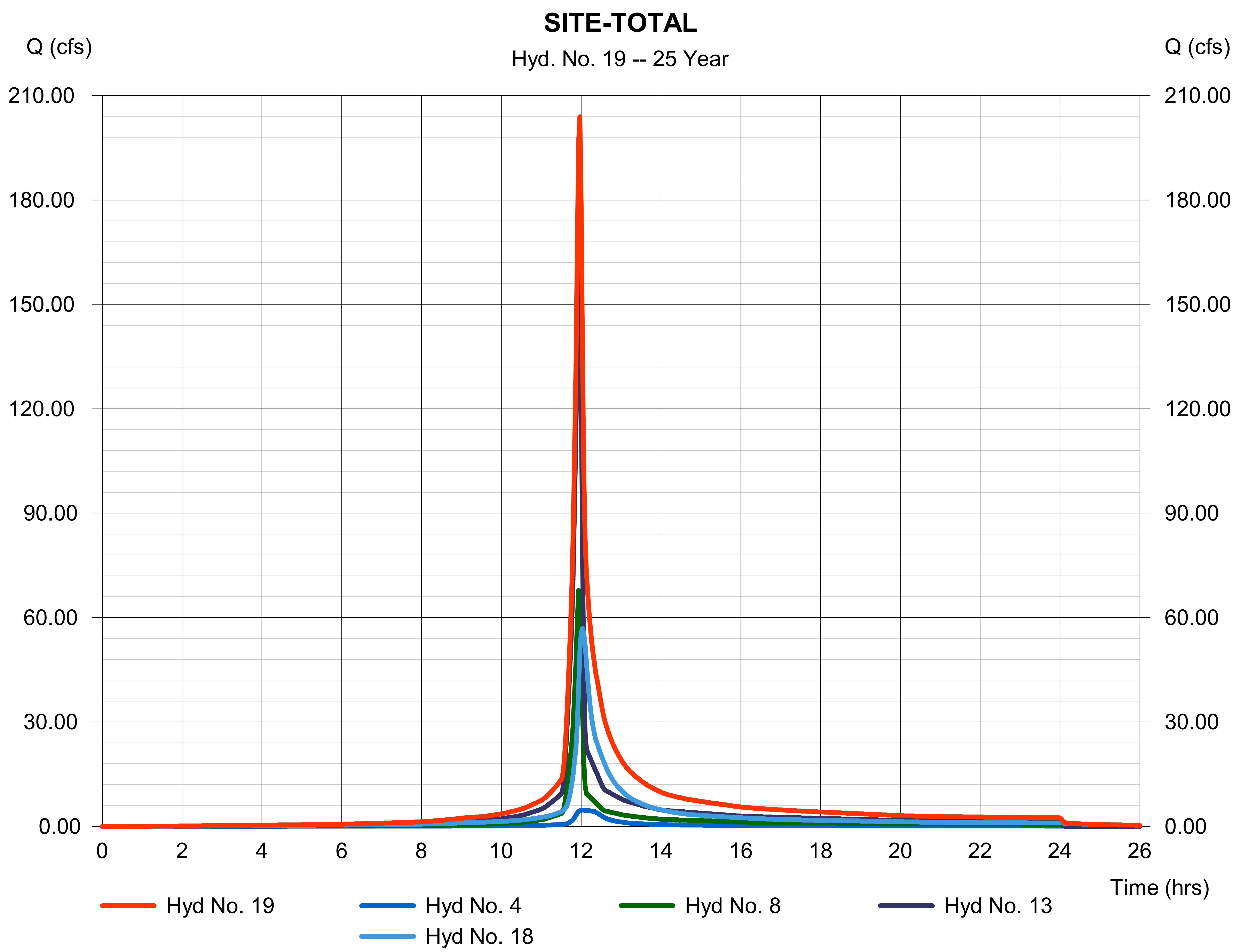
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 19

SITE-TOTAL

Hydrograph type	= Combine	Peak discharge	= 203.87 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 593,680 cuft
Inflow hyds.	= 4, 8, 13, 18	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	6.802	2	716	16,391	------	------	------	NORTH-BASIN IP
2	SCS Runoff	9.197	2	716	19,172	------	------	------	NORTH-BASIN MEAD-G
3	Combine	16.00	2	716	35,563	1, 2	------	------	NORTH-TOTAL
4	Reservoir	5.431	2	724	35,560	3	1737.05	19,552	THRU NORTH-BASIN
5	SCS Runoff	8.306	2	716	20,014	------	------	------	OFF-1 IP
6	SCS Runoff	24.90	2	716	51,898	------	------	------	OFF-1 MEAD-G
7	SCS Runoff	51.55	2	716	105,454	------	------	------	OFF-1 WO-G
8	Combine	84.75	2	716	177,366	5, 6, 7	------	------	OFF-1 TOTAL
9	SCS Runoff	8.902	2	716	21,450	------	------	------	OFF-2 IP
10	SCS Runoff	95.42	2	716	198,912	------	------	------	OFF-2 MEAD-G
11	SCS Runoff	38.26	2	716	79,752	------	------	------	OFF-2 MEAD-G
12	SCS Runoff	0.007	2	716	14	------	------	------	OFF-2 WO-G
13	Combine	199.74	2	716	419,288	9, 10, 11, 12	------	------	OFF-2 TOTAL
14	SCS Runoff	63.04	2	716	151,892	------	------	------	SOUTH-BASIN IP
15	SCS Runoff	59.15	2	716	123,302	------	------	------	SOUTH-BASIN MEAD-G
16	SCS Runoff	12.82	2	716	26,230	------	------	------	SOUTH-BASIN WO-G
17	Combine	135.01	2	716	301,424	14, 15, 16	------	------	SOUTH-TOTAL
18	Reservoir	65.43	2	722	301,417	17	1736.78	178,532	THRU SOUTH-BASIN
19	Combine	249.15	2	718	734,718	4, 8, 13, 18	------	------	SITE-TOTAL

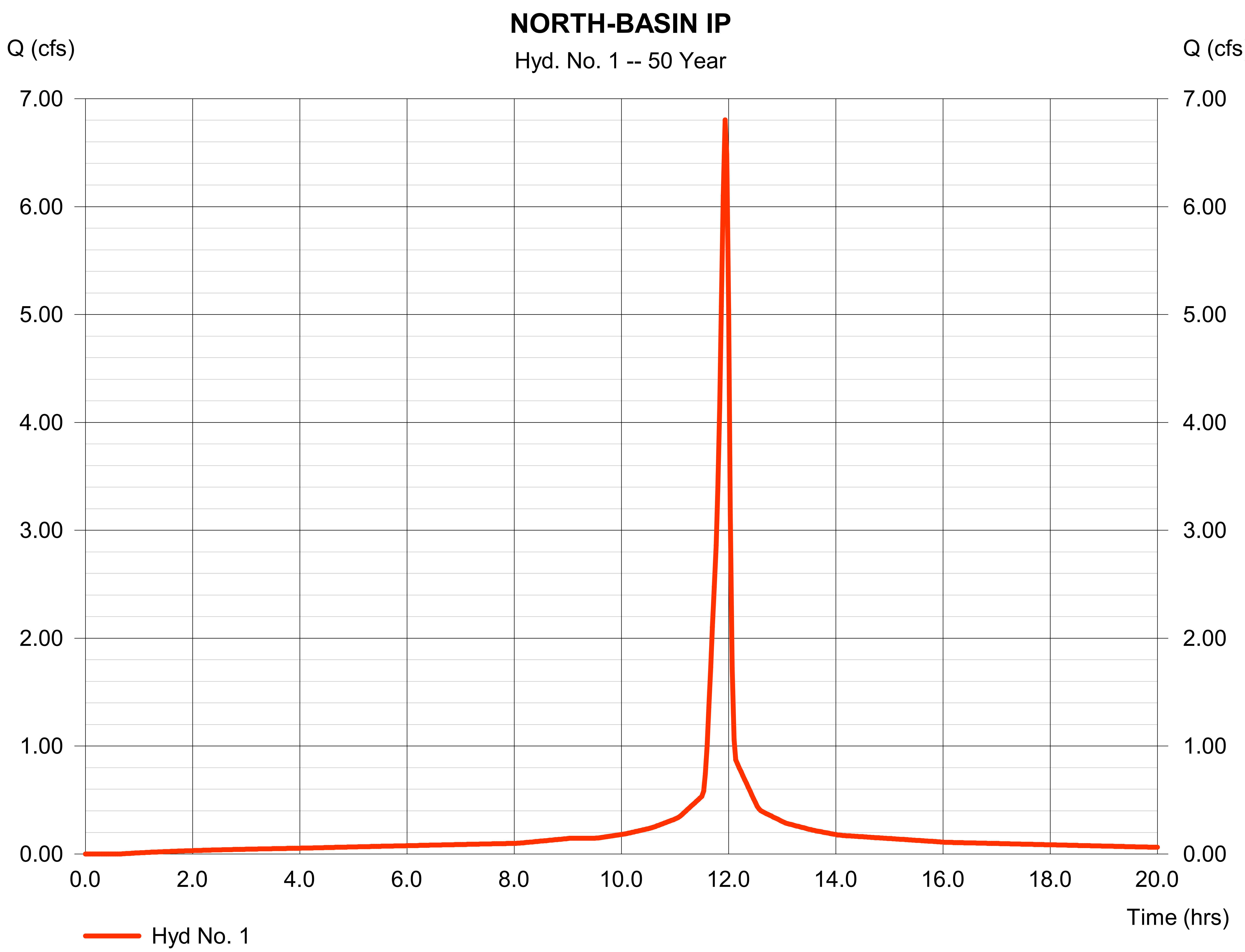
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 1

NORTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 6.802 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 16,391 cuft
Drainage area	= 0.742 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



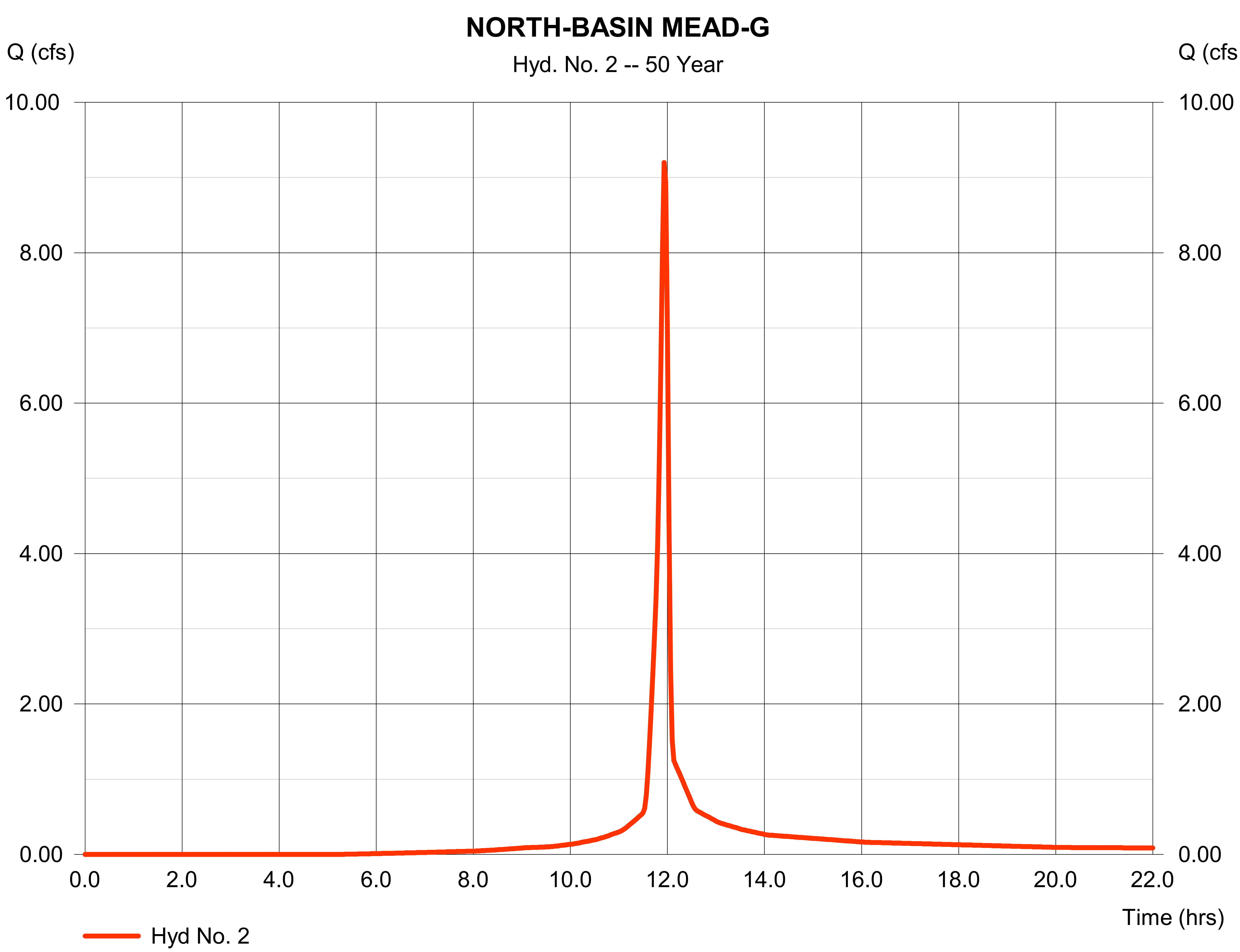
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 2

NORTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 9.197 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 19,172 cuft
Drainage area	= 1.208 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



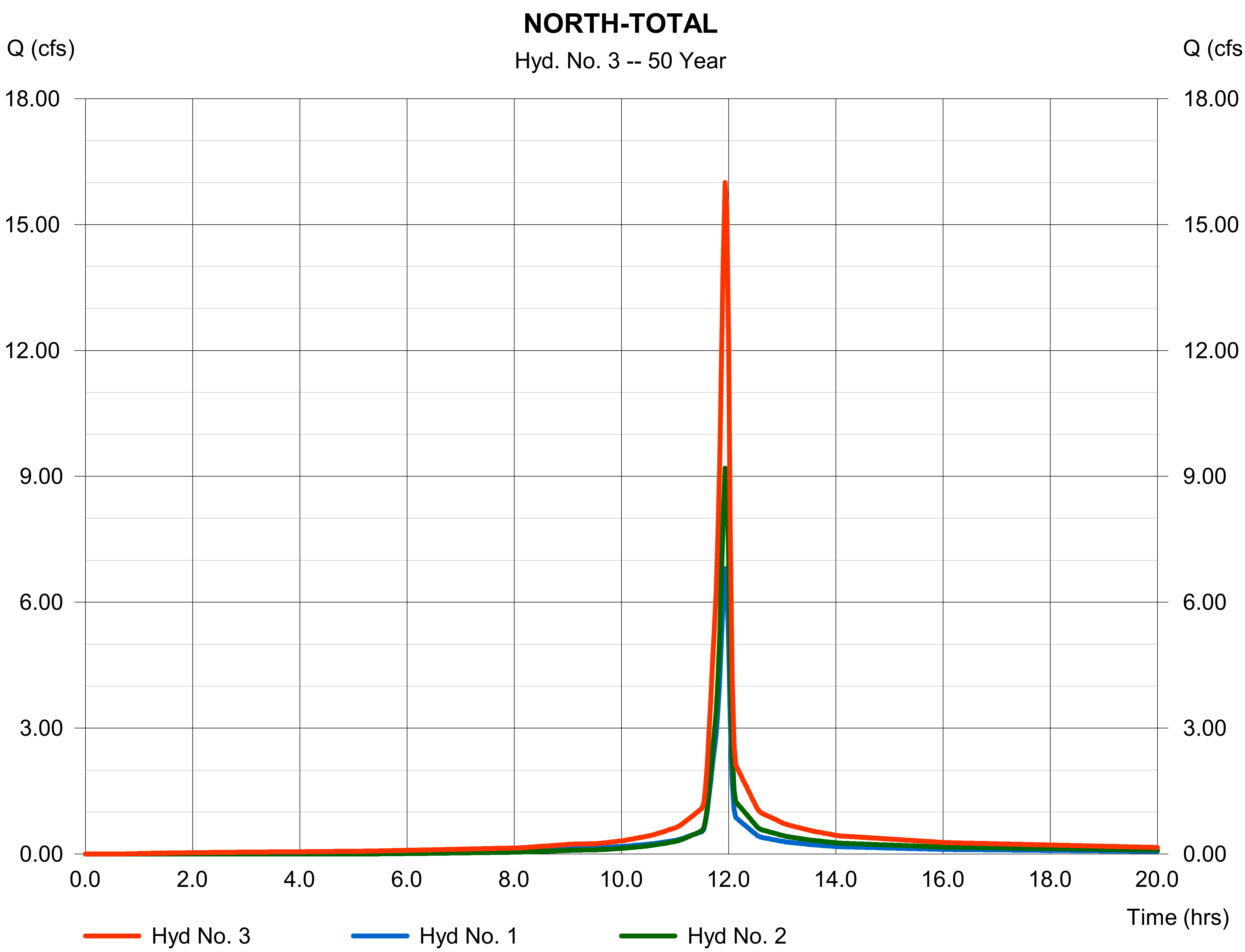
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 3

NORTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 16.00 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 35,563 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 1.950 ac



Hydrograph Report

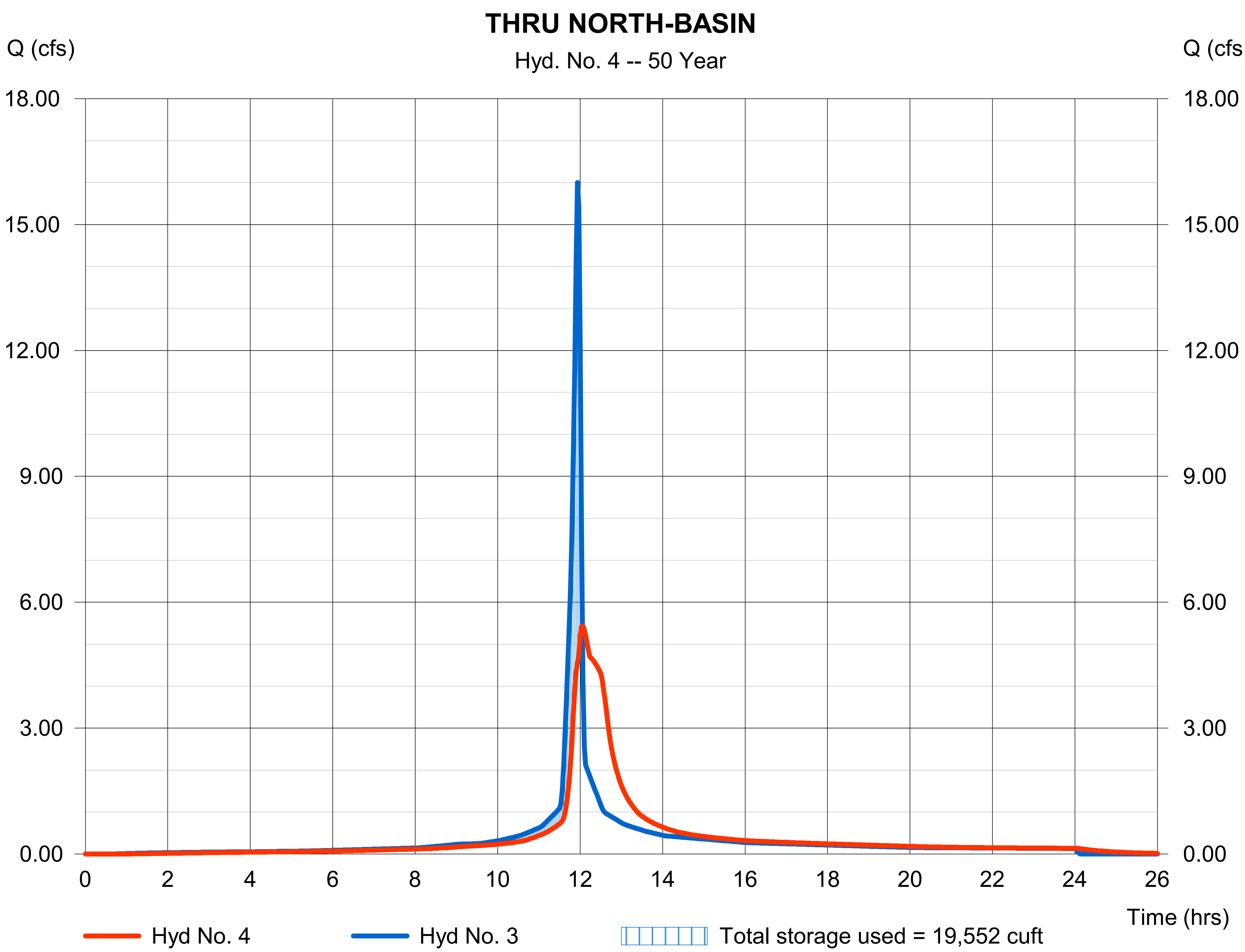
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 4

THRU NORTH-BASIN

Hydrograph type	= Reservoir	Peak discharge	= 5.431 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 35,560 cuft
Inflow hyd. No.	= 3 - NORTH-TOTAL	Max. Elevation	= 1737.05 ft
Reservoir name	= NORTH-BASIN	Max. Storage	= 19,552 cuft

Storage Indication method used. Wet pond routing start elevation = 1736.00 ft.



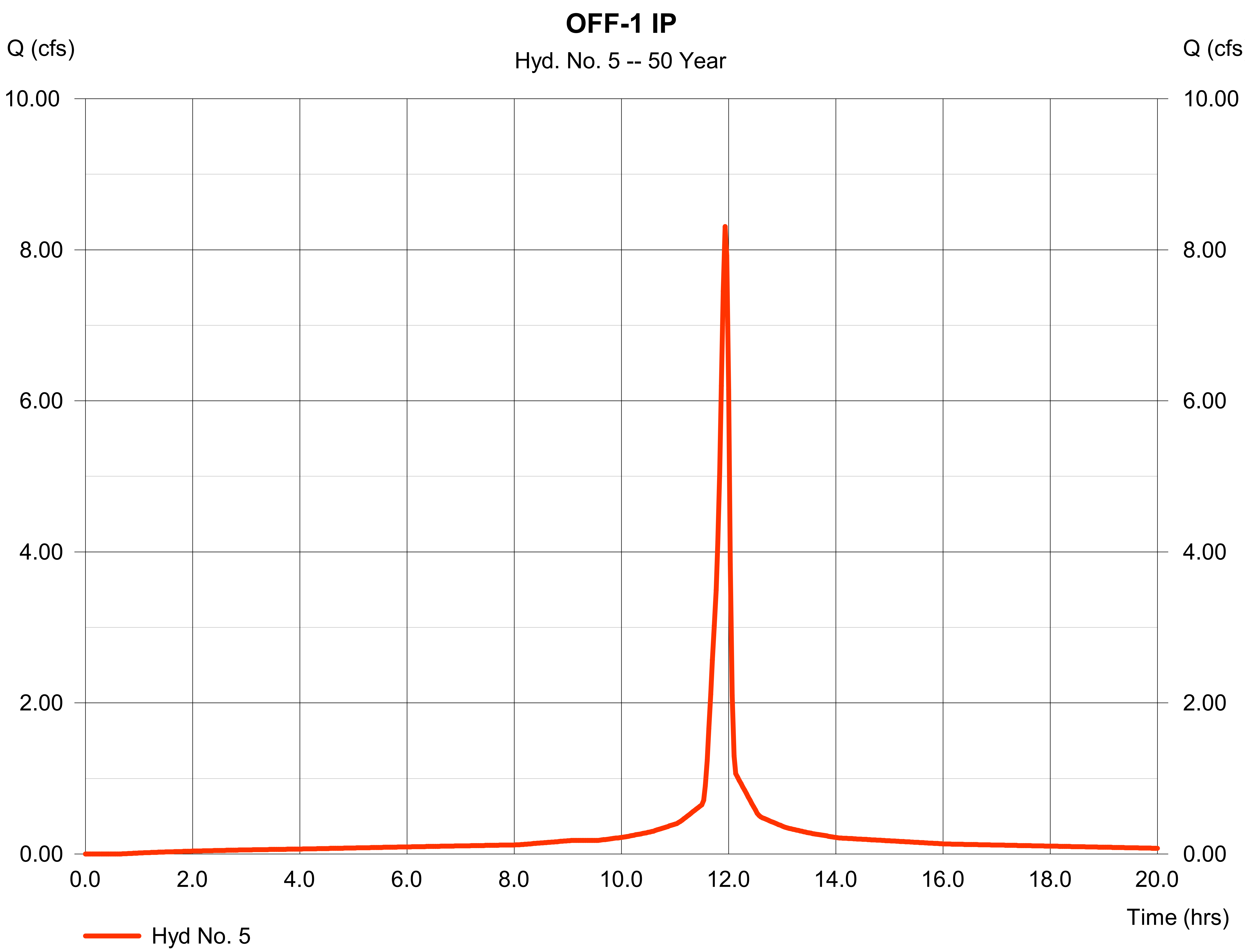
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 5

OFF-1 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 8.306 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 20,014 cuft
Drainage area	= 0.906 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

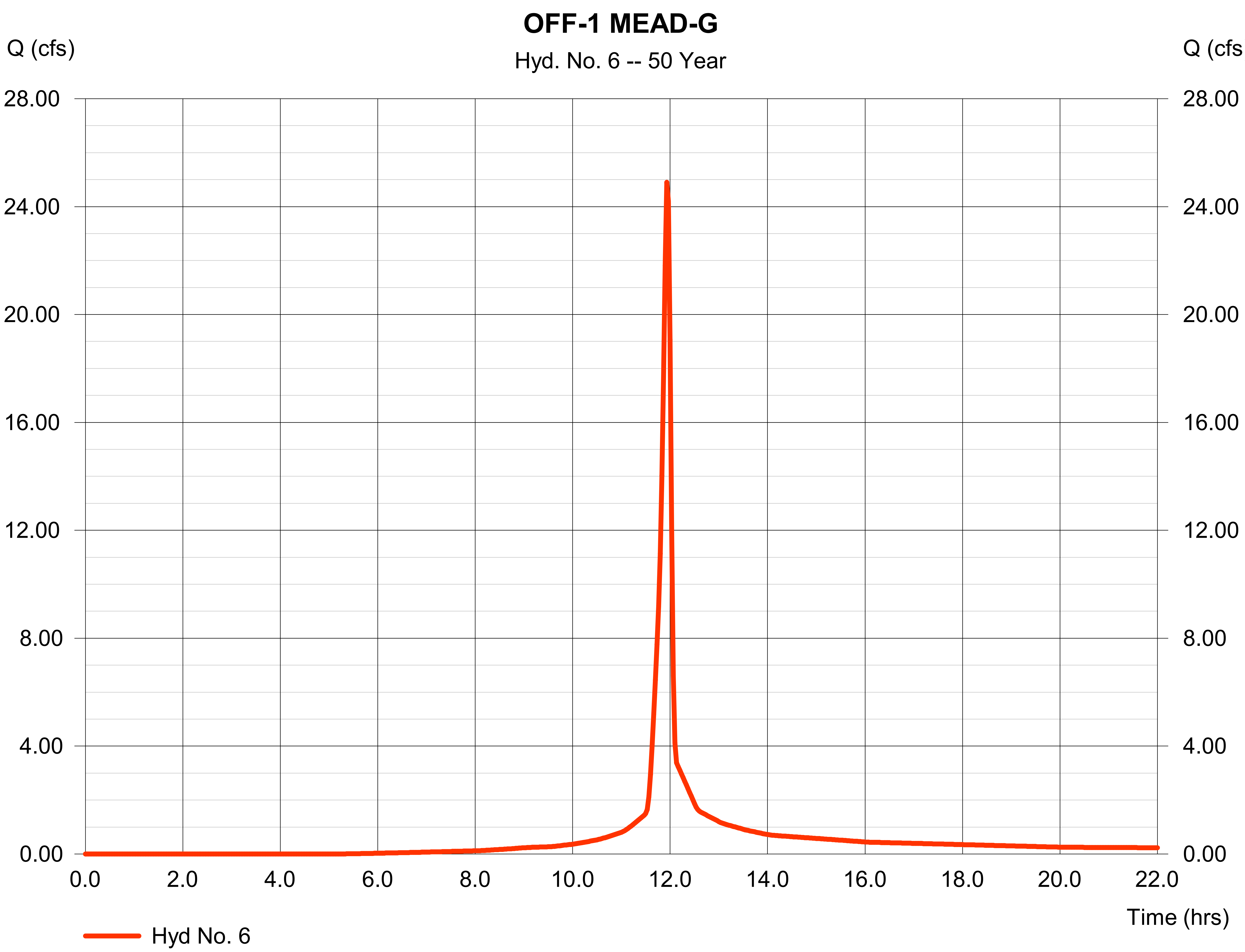


Hydrograph Report

Hyd. No. 6

OFF-1 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 24.90 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 51,898 cuft
Drainage area	= 3.270 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



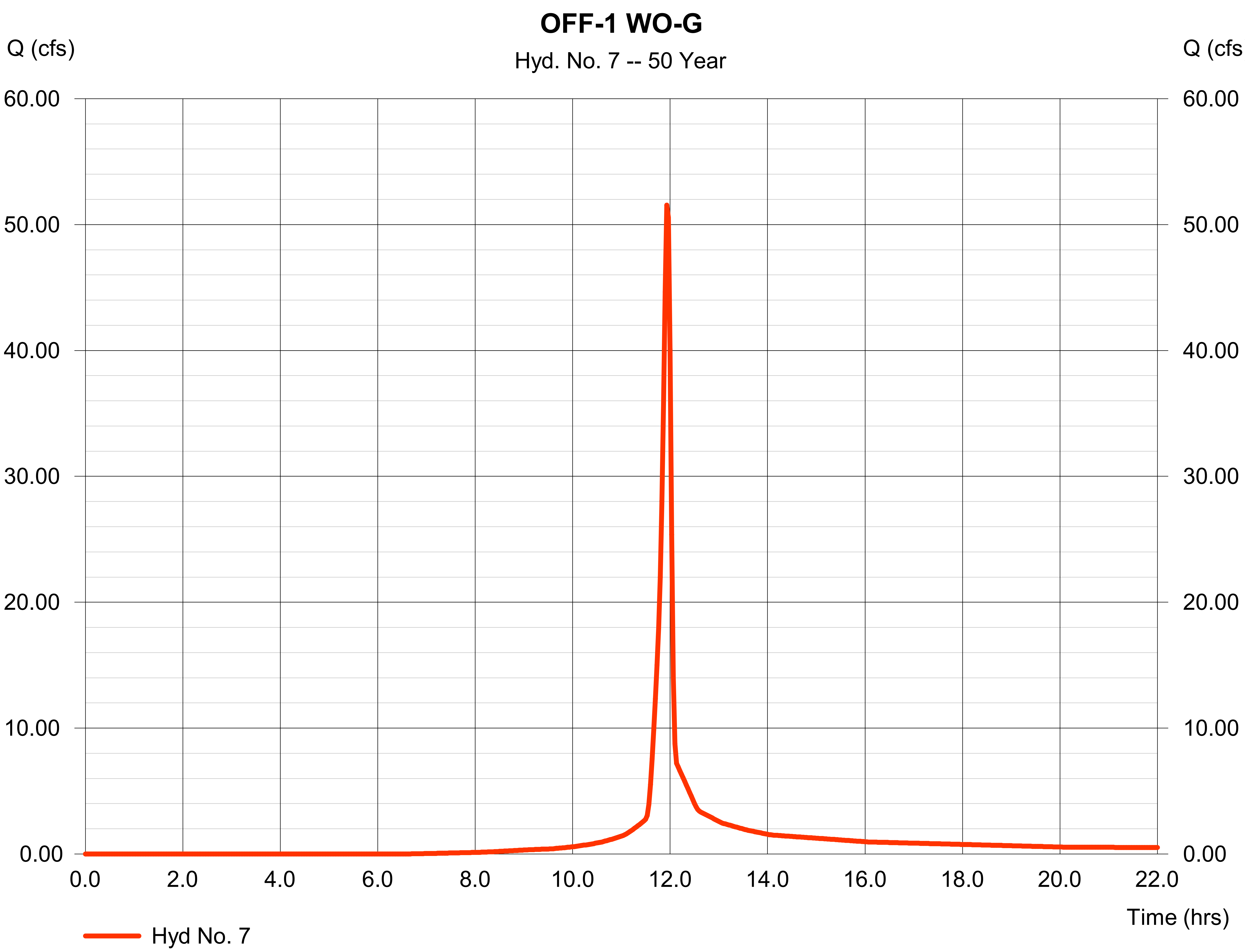
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 7

OFF-1 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 51.55 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 105,454 cuft
Drainage area	= 7.514 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



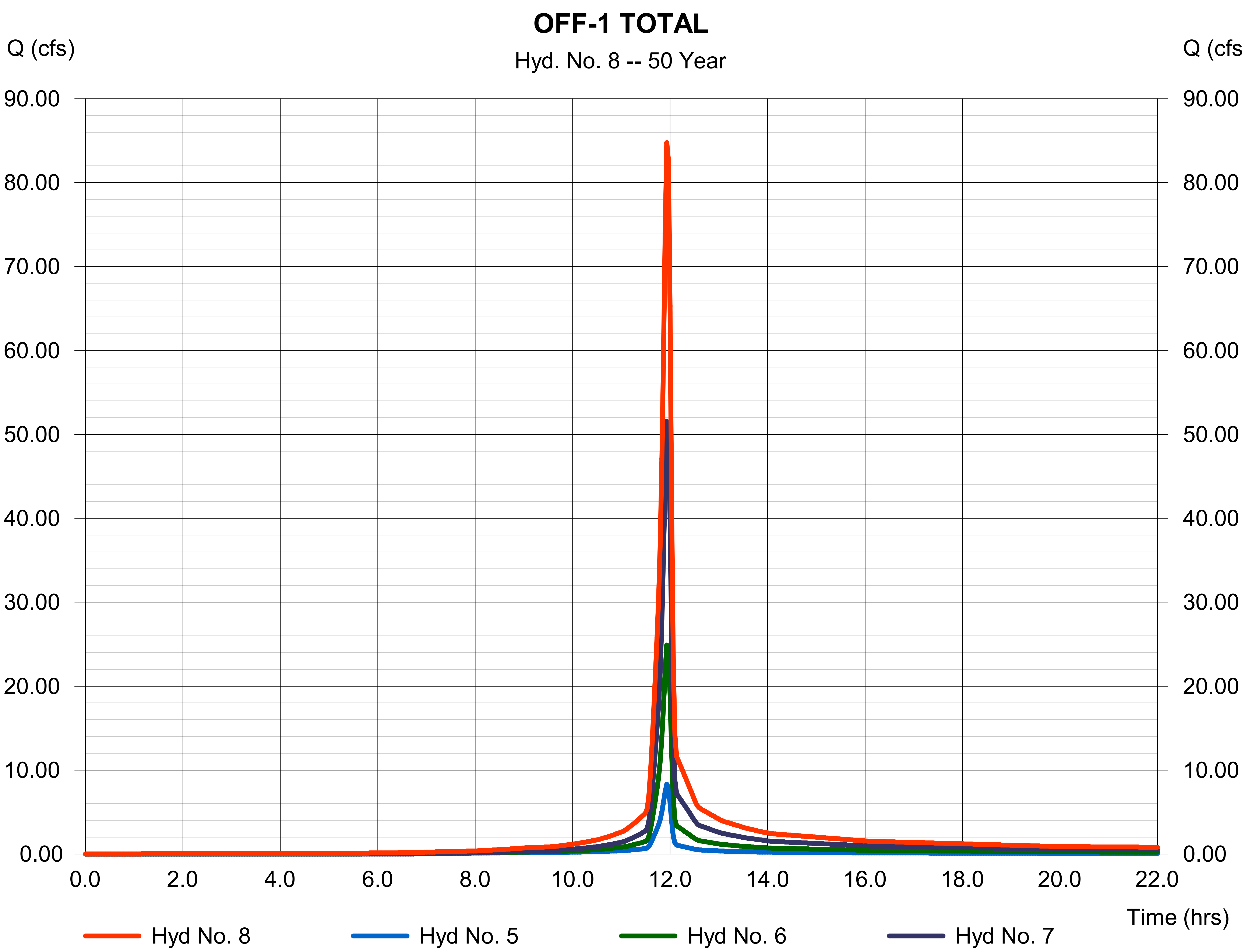
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 8

OFF-1 TOTAL

Hydrograph type	= Combine	Peak discharge	= 84.75 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 177,366 cuft
Inflow hyds.	= 5, 6, 7	Contrib. drain. area	= 11.690 ac



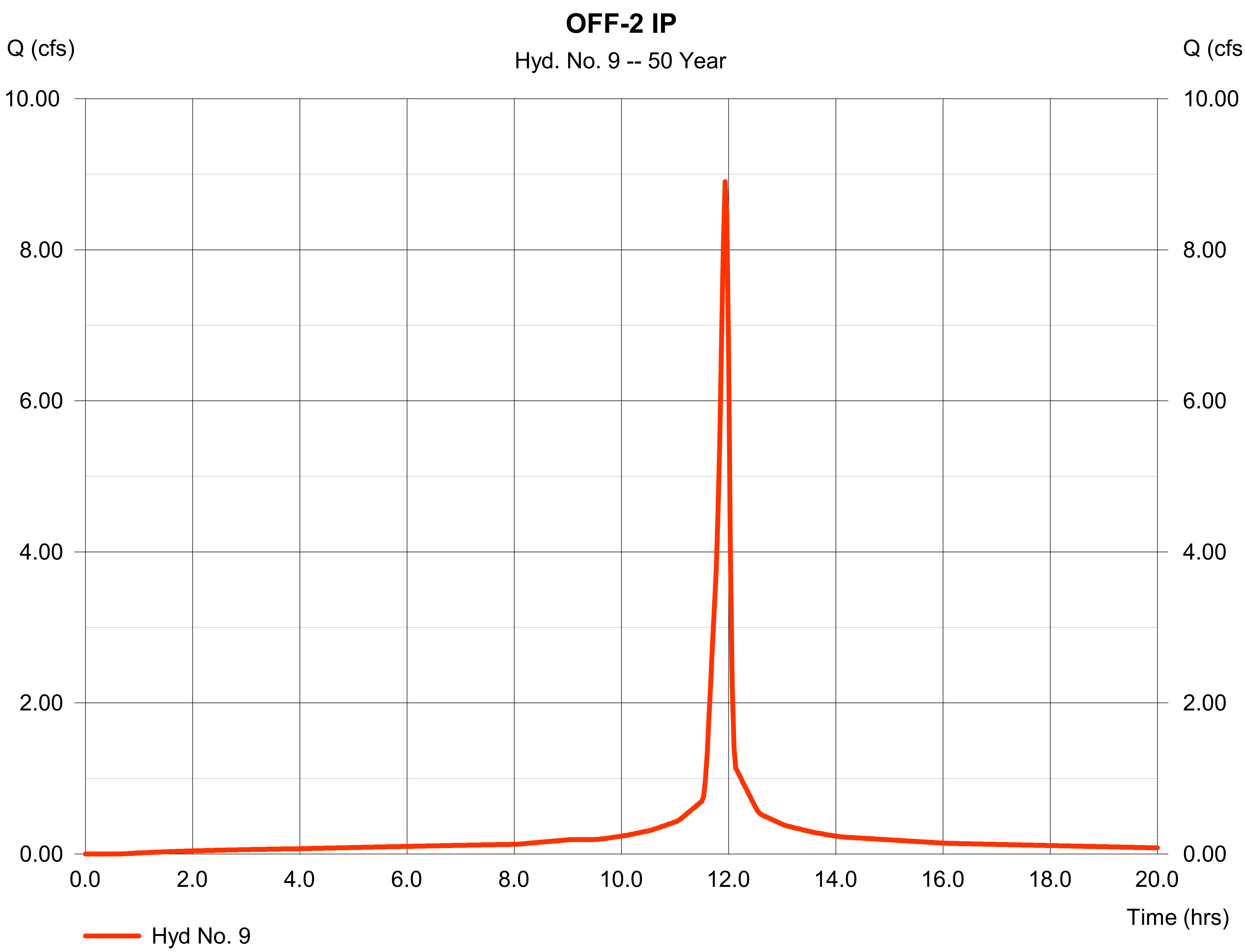
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 9

OFF-2 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 8.902 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 21,450 cuft
Drainage area	= 0.971 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



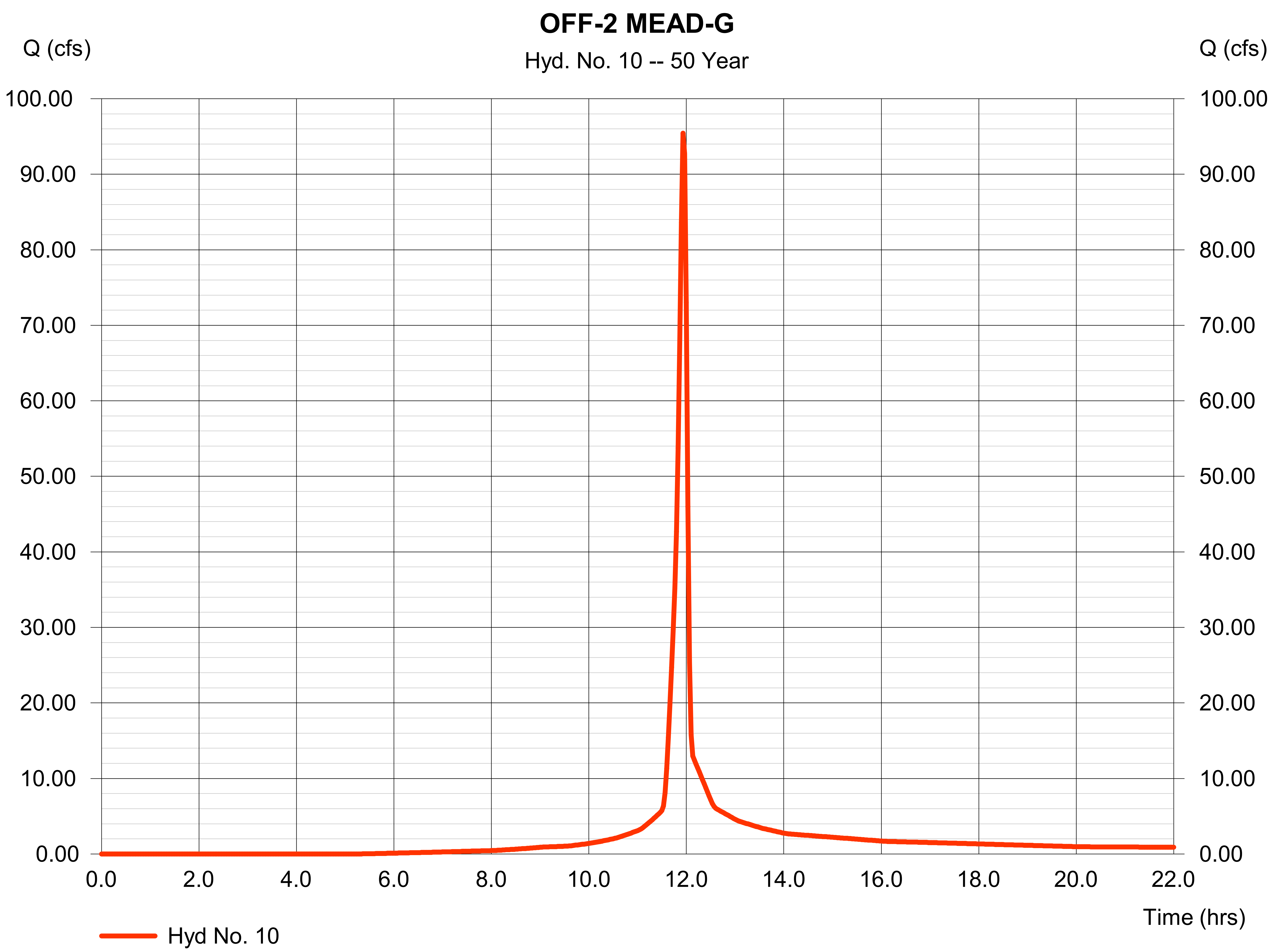
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 10

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 95.42 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 198,912 cuft
Drainage area	= 12.533 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



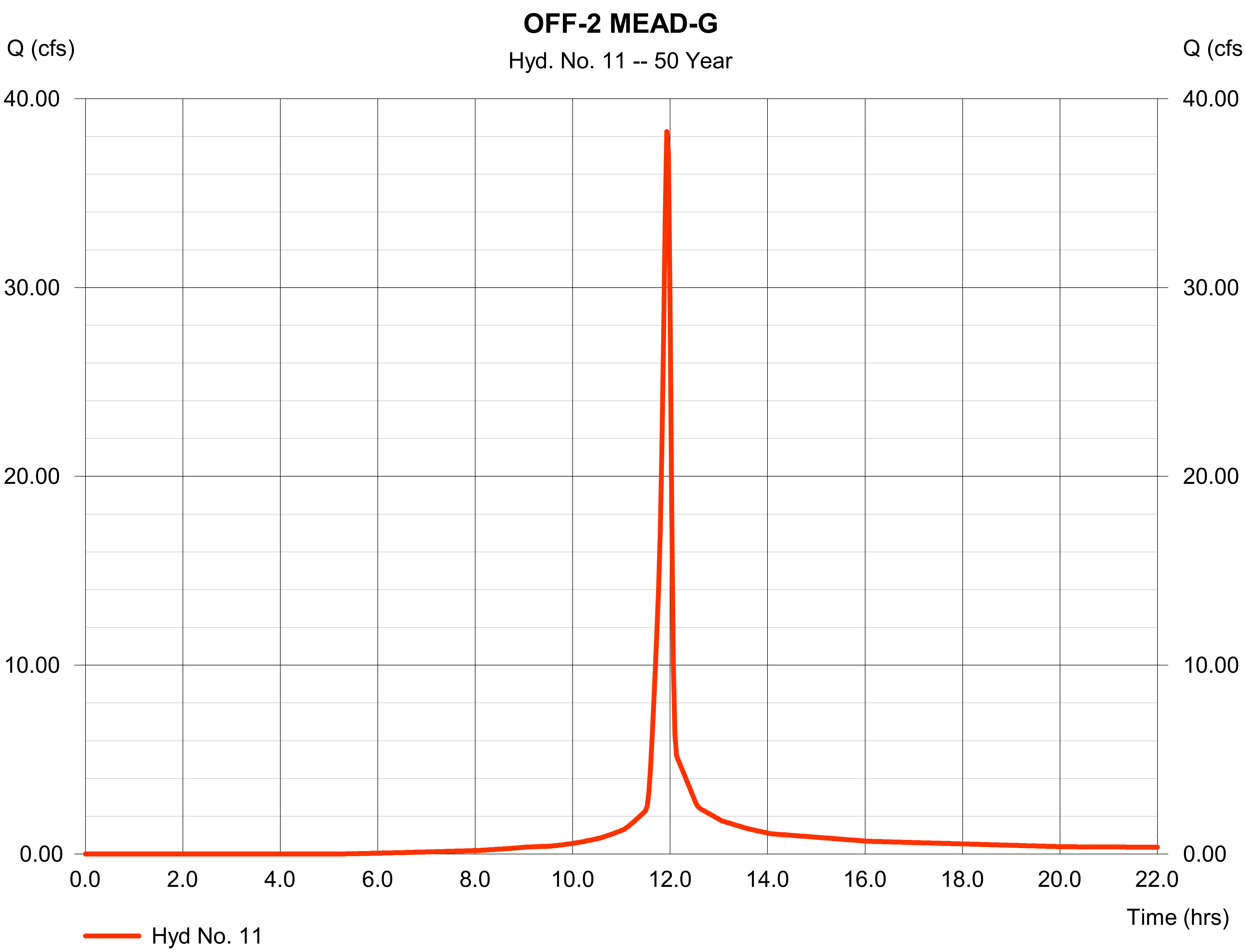
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 11

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 38.26 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 79,752 cuft
Drainage area	= 5.025 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



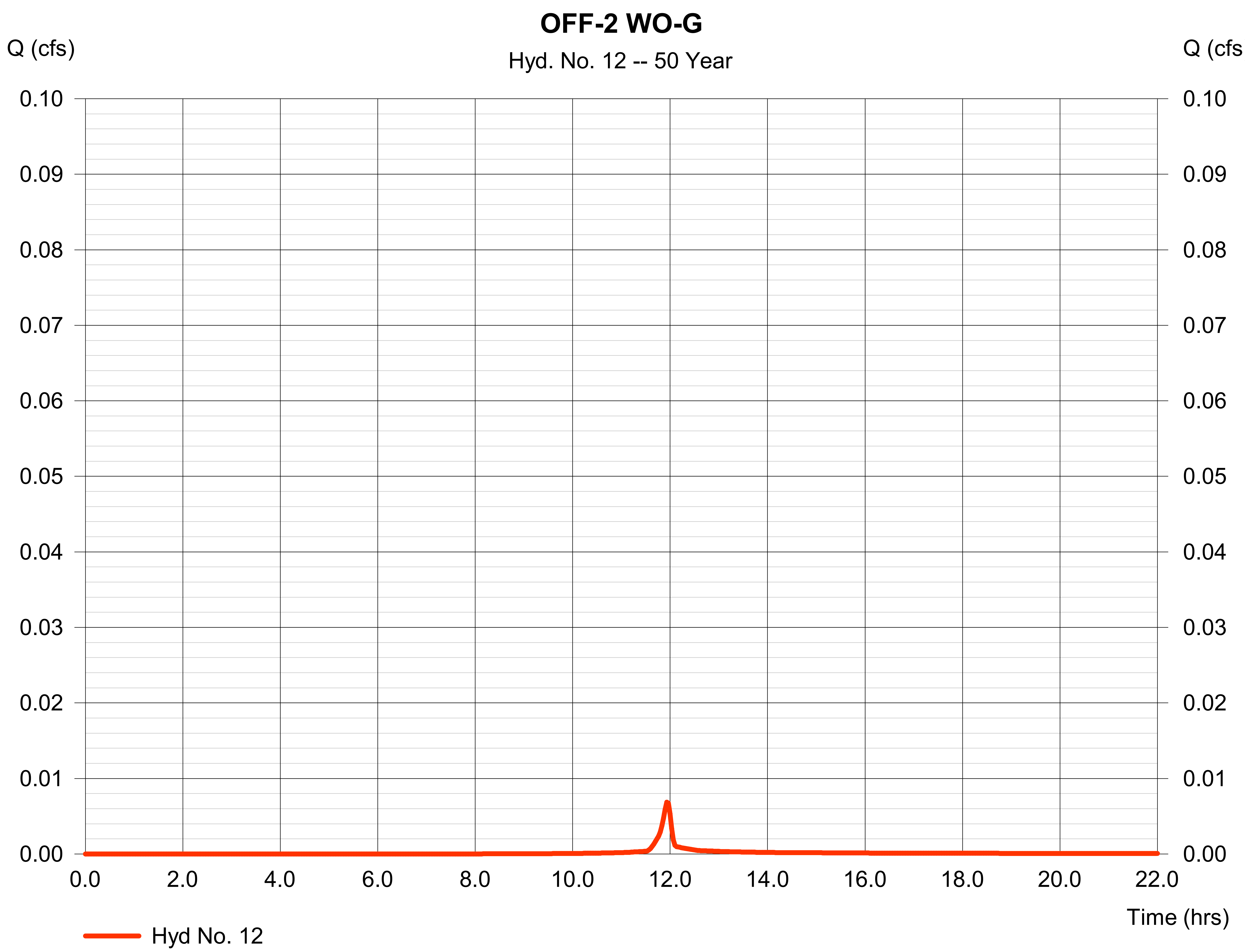
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 12

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.007 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 14 cuft
Drainage area	= 0.001 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



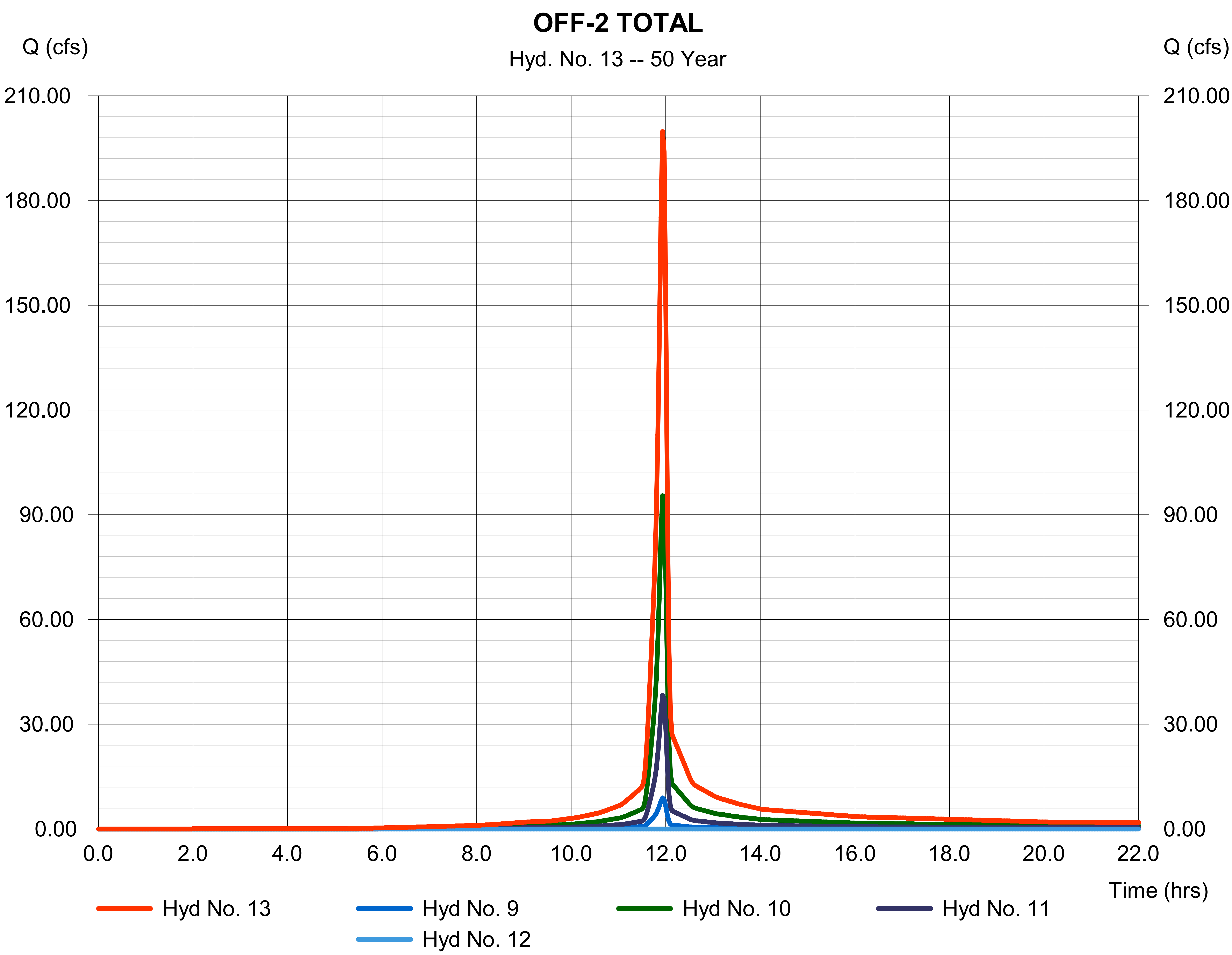
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 13

OFF-2 TOTAL

Hydrograph type	= Combine	Peak discharge	= 199.74 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 419,288 cuft
Inflow hyds.	= 9, 10, 11, 12	Contrib. drain. area	= 18.530 ac



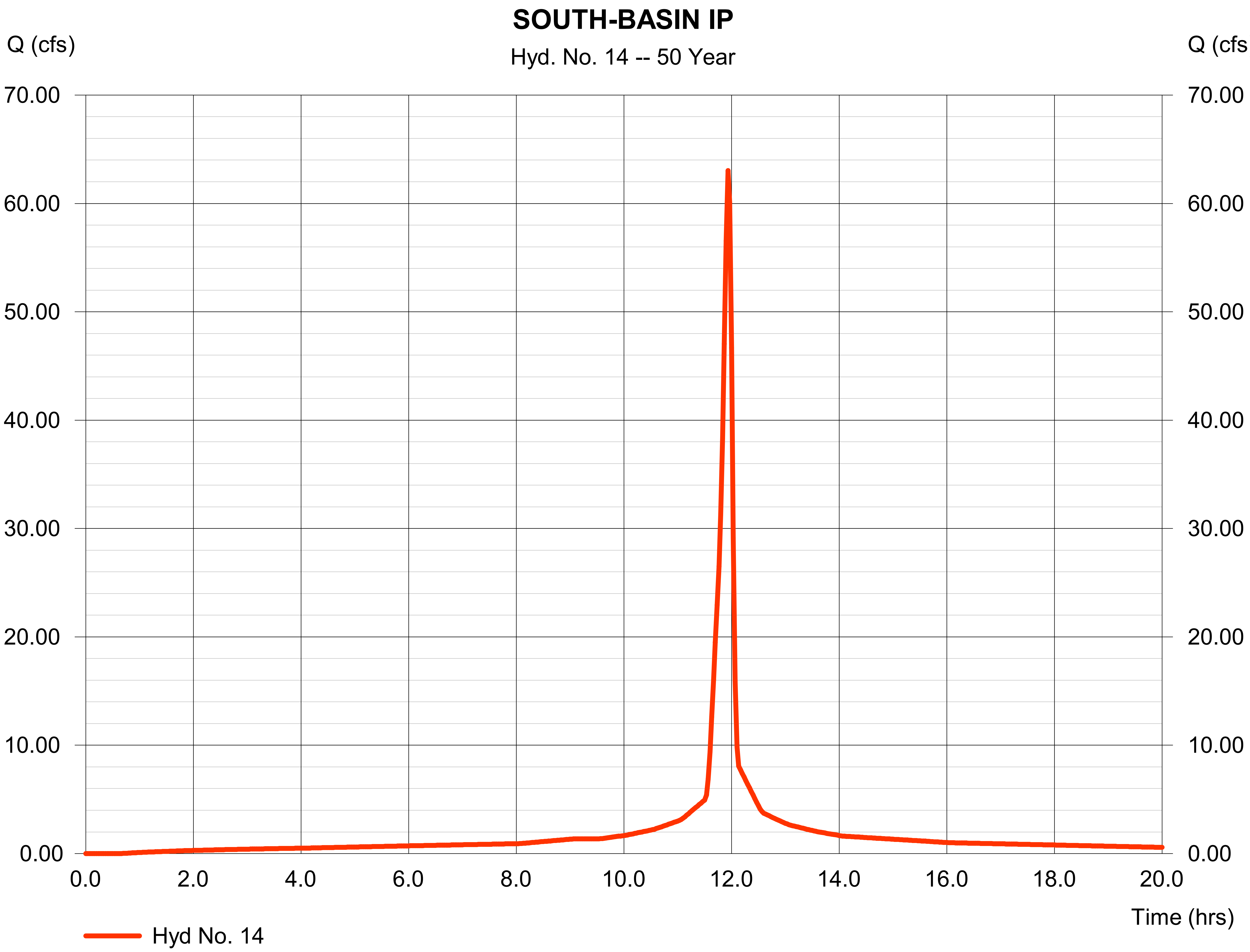
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 14

SOUTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 63.04 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 151,892 cuft
Drainage area	= 6.876 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



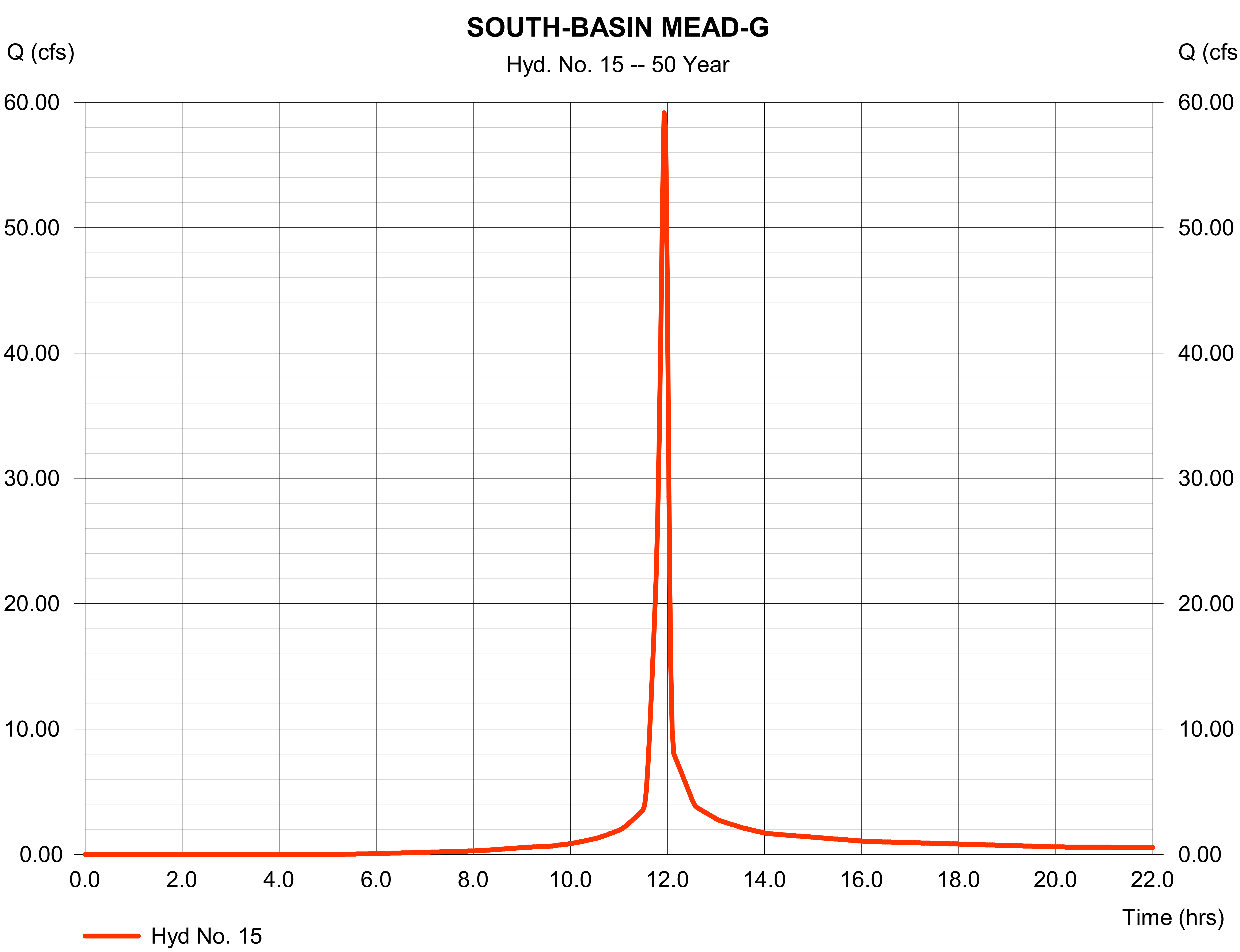
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Tuesday, 10 / 15 / 2019

Hyd. No. 15

SOUTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 59.15 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 123,302 cuft
Drainage area	= 7.769 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



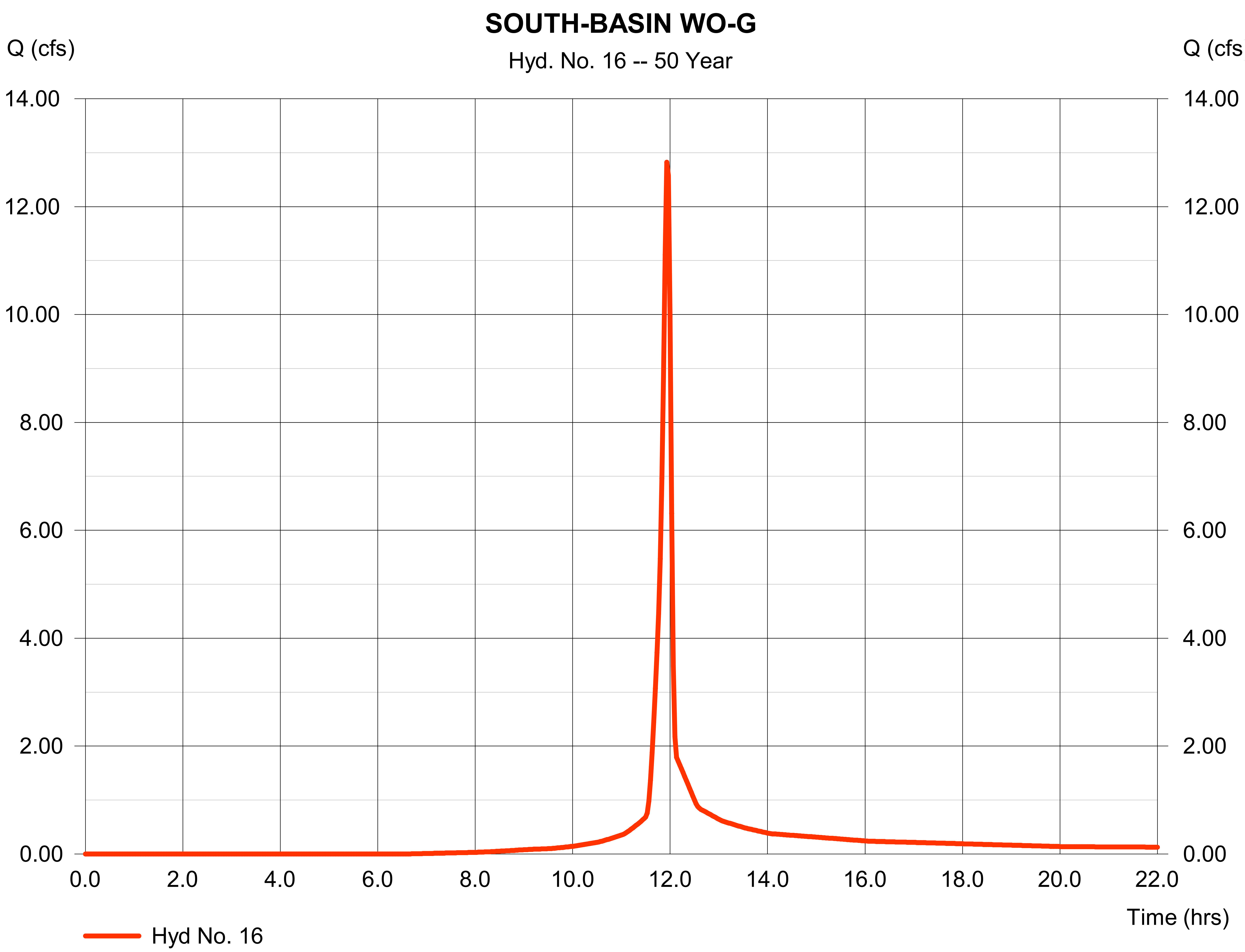
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 16

SOUTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 12.82 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 26,230 cuft
Drainage area	= 1.869 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



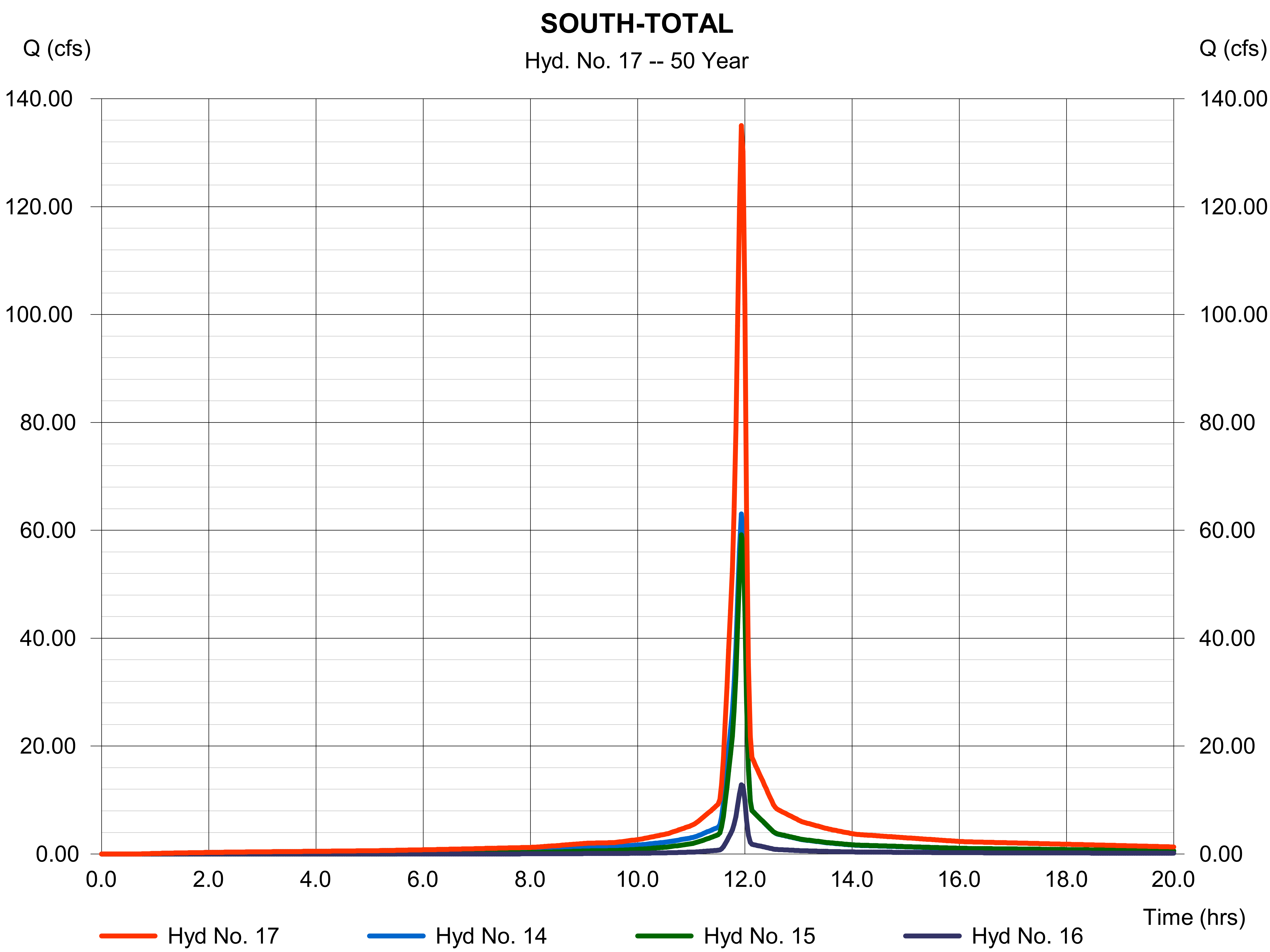
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 17

SOUTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 135.01 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 301,424 cuft
Inflow hyds.	= 14, 15, 16	Contrib. drain. area	= 16.514 ac



Hydrograph Report

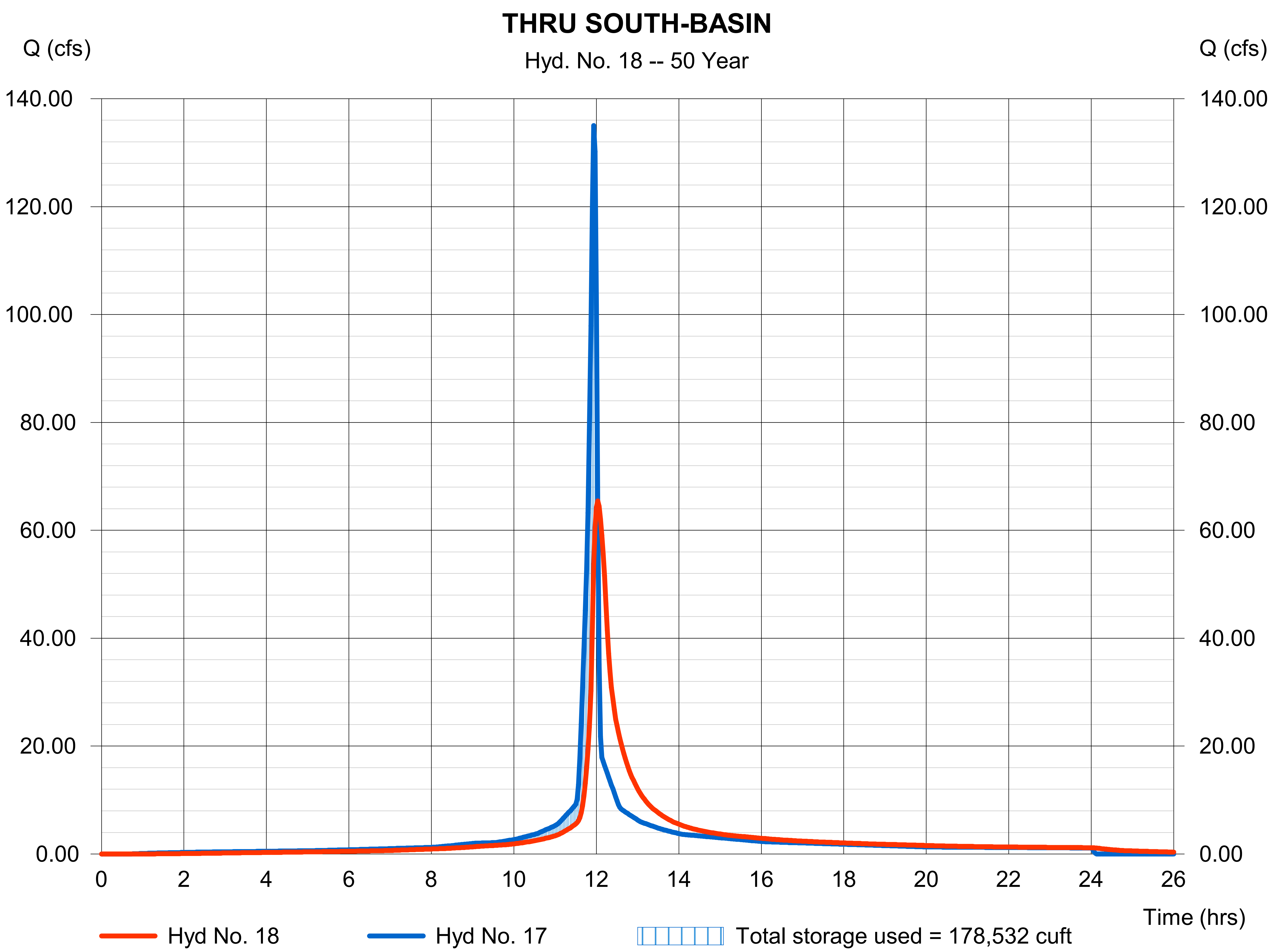
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 18

THRU SOUTH-BASIN

Hydrograph type	= Reservoir	Peak discharge	= 65.43 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 301,417 cuft
Inflow hyd. No.	= 17 - SOUTH-TOTAL	Max. Elevation	= 1736.78 ft
Reservoir name	= SOUTH-BASIN	Max. Storage	= 178,532 cuft

Storage Indication method used. Wet pond routing start elevation = 1735.00 ft.



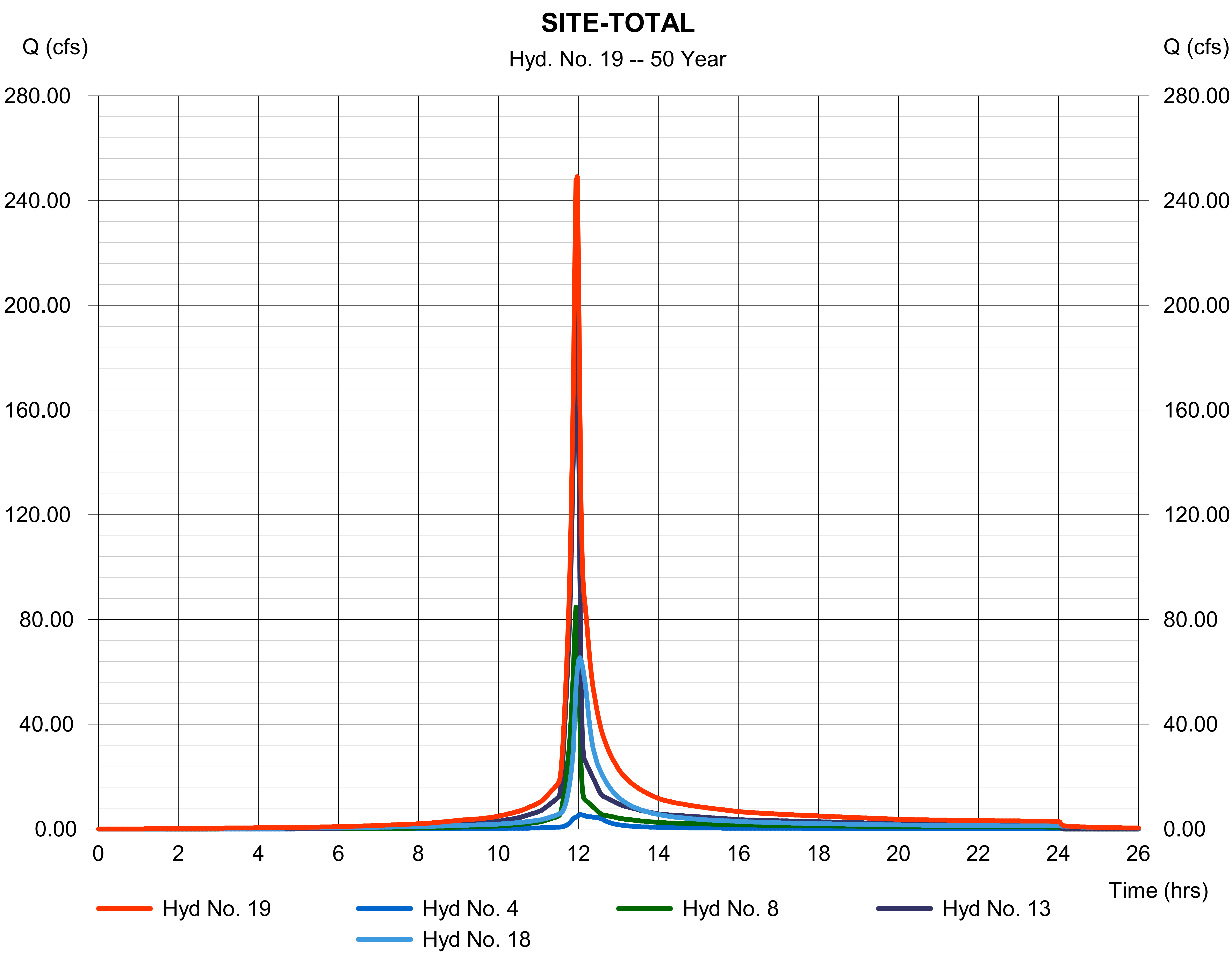
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 19

SITE-TOTAL

Hydrograph type	= Combine	Peak discharge	= 249.15 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 734,718 cuft
Inflow hyds.	= 4, 8, 13, 18	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	8.042	2	716	19,469	------	------	------	NORTH-BASIN IP
2	SCS Runoff	11.32	2	716	23,894	------	------	------	NORTH-BASIN MEAD-G
3	Combine	19.37	2	716	43,363	1, 2	------	------	NORTH-TOTAL
4	Reservoir	6.362	2	724	43,360	3	1737.23	22,049	THRU NORTH-BASIN
5	SCS Runoff	9.820	2	716	23,772	------	------	------	OFF-1 IP
6	SCS Runoff	30.66	2	716	64,681	------	------	------	OFF-1 MEAD-G
7	SCS Runoff	64.74	2	716	133,699	------	------	------	OFF-1 WO-G
8	Combine	105.21	2	716	222,151	5, 6, 7	------	------	OFF-1 TOTAL
9	SCS Runoff	10.52	2	716	25,478	------	------	------	OFF-2 IP
10	SCS Runoff	117.49	2	716	247,903	------	------	------	OFF-2 MEAD-G
11	SCS Runoff	47.11	2	716	99,394	------	------	------	OFF-2 MEAD-G
12	SCS Runoff	0.009	2	716	18	------	------	------	OFF-2 WO-G
13	Combine	245.52	2	716	521,301	9, 10, 11, 12	------	------	OFF-2 TOTAL
14	SCS Runoff	74.53	2	716	180,418	------	------	------	SOUTH-BASIN IP
15	SCS Runoff	72.83	2	716	153,671	------	------	------	SOUTH-BASIN MEAD-G
16	SCS Runoff	16.10	2	716	33,256	------	------	------	SOUTH-BASIN WO-G
17	Combine	163.46	2	716	367,345	14, 15, 16	------	------	SOUTH-TOTAL
18	Reservoir	73.89	2	722	367,337	17	1737.11	196,548	THRU SOUTH-BASIN
19	Combine	300.88	2	716	906,247	4, 8, 13, 18	------	------	SITE-TOTAL

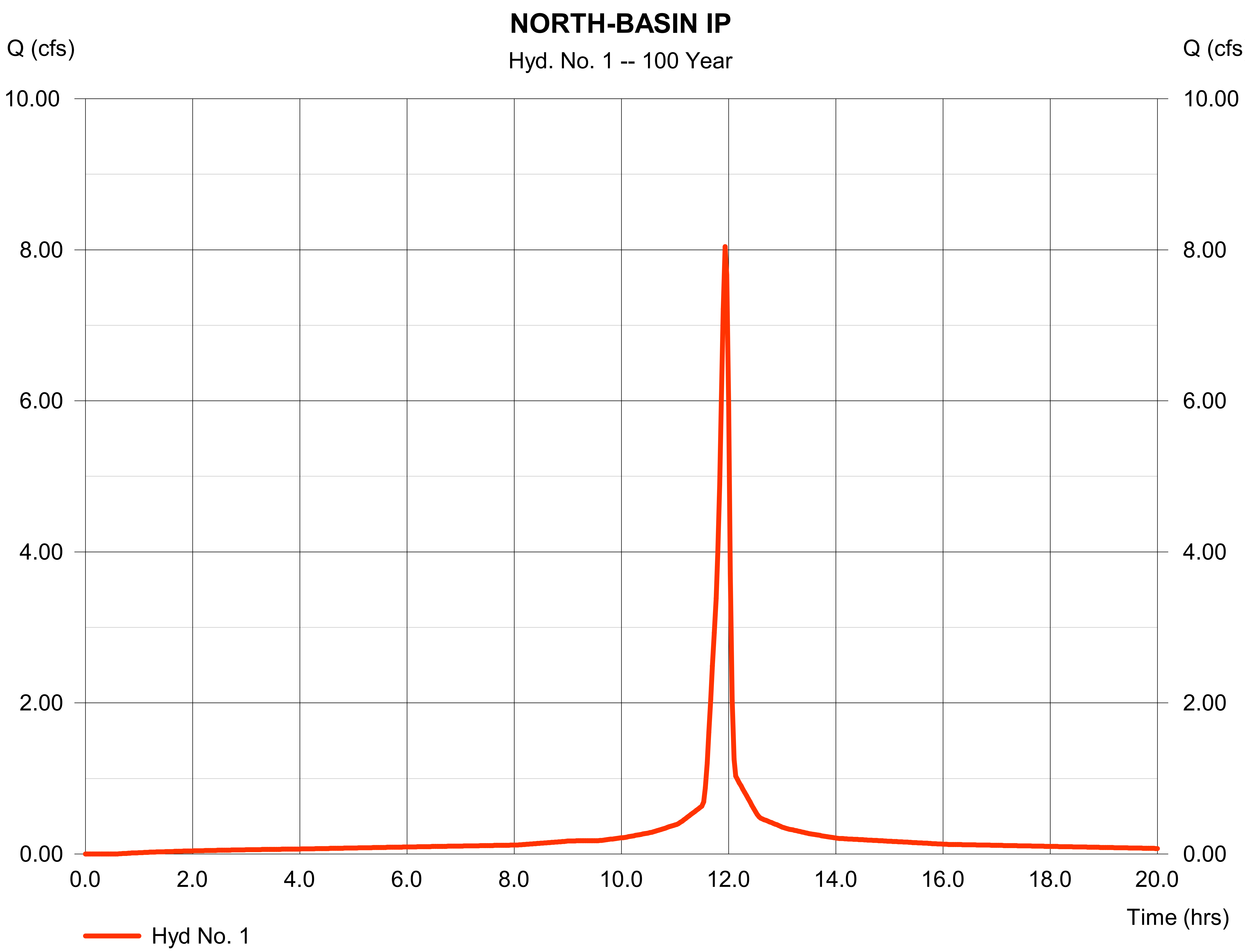
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 | Tuesday, 10 / 15 / 2019

Hyd. No. 1

NORTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 8.042 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 19,469 cuft
Drainage area	= 0.742 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



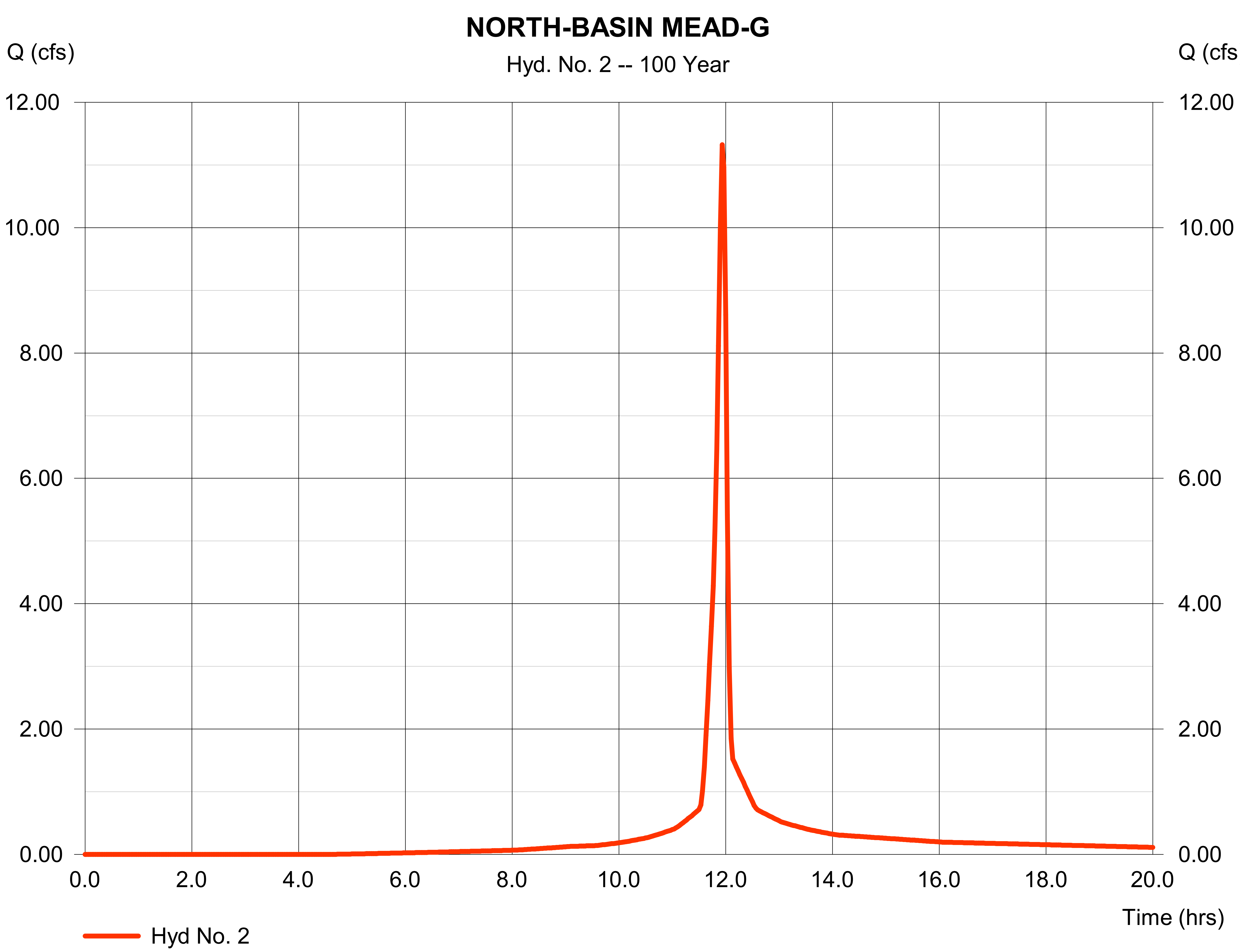
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 2

NORTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 11.32 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 23,894 cuft
Drainage area	= 1.208 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



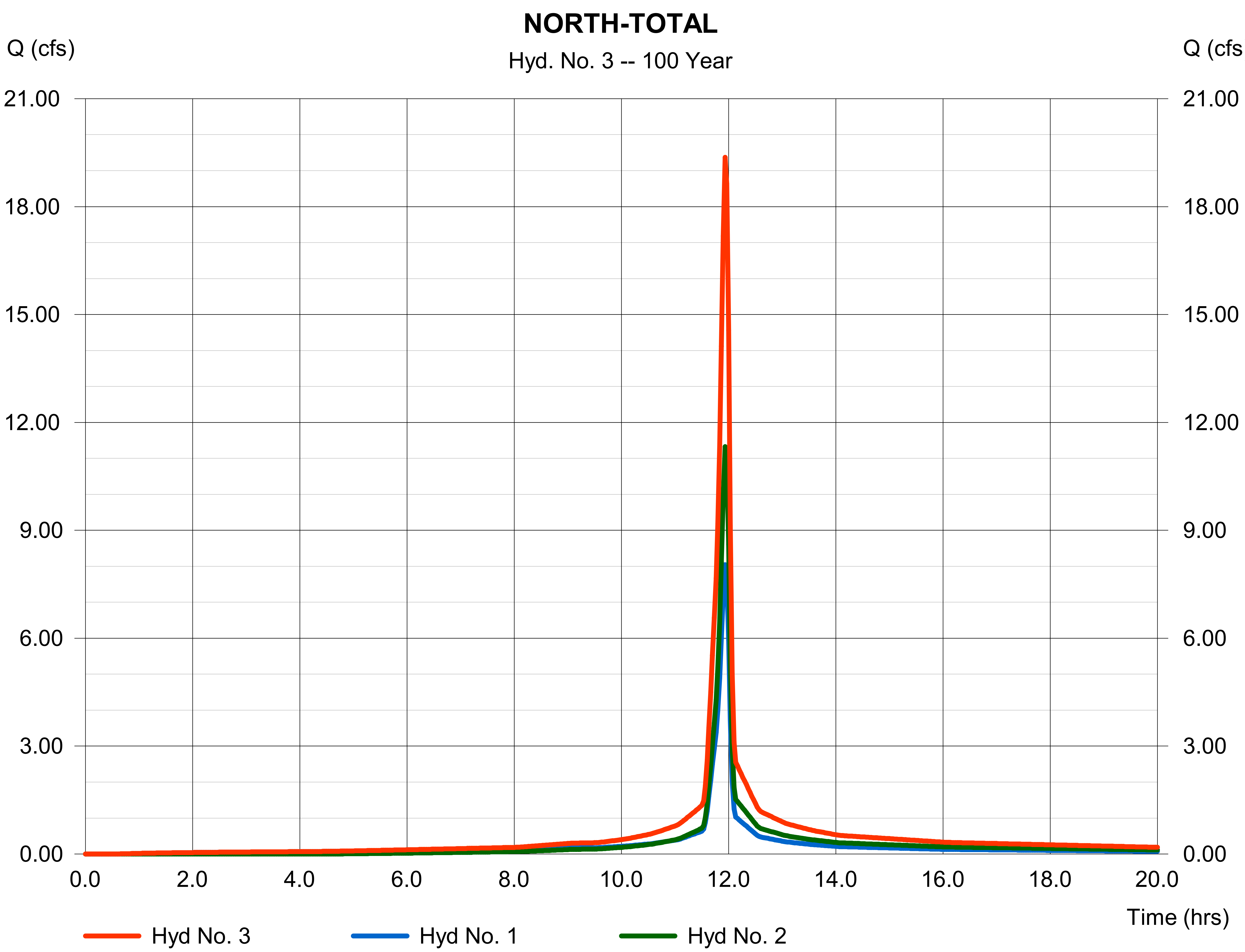
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 3

NORTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 19.37 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 43,363 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 1.950 ac



Hydrograph Report

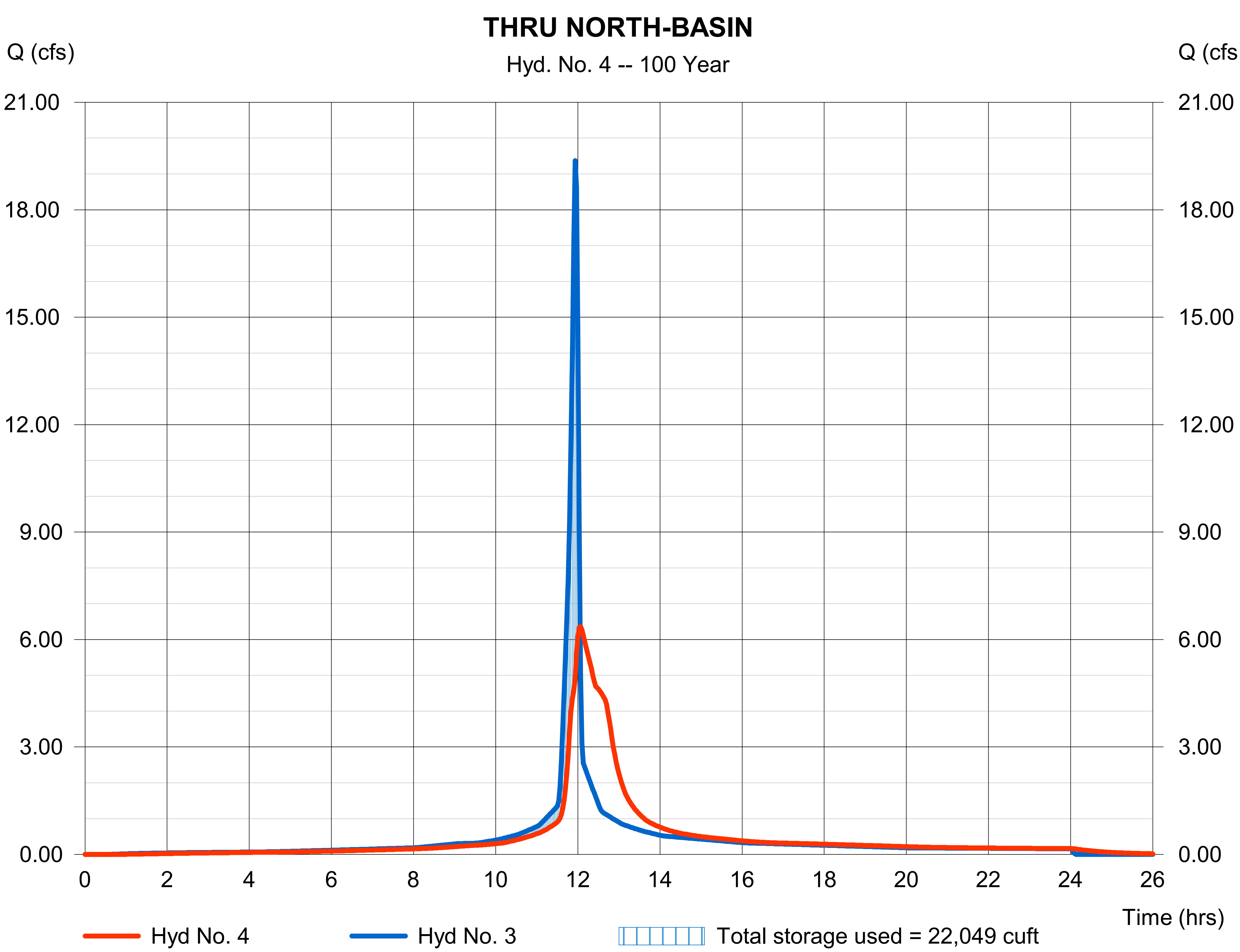
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 4

THRU NORTH-BASIN

Hydrograph type	= Reservoir	Peak discharge	= 6.362 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 43,360 cuft
Inflow hyd. No.	= 3 - NORTH-TOTAL	Max. Elevation	= 1737.23 ft
Reservoir name	= NORTH-BASIN	Max. Storage	= 22,049 cuft

Storage Indication method used. Wet pond routing start elevation = 1736.00 ft.



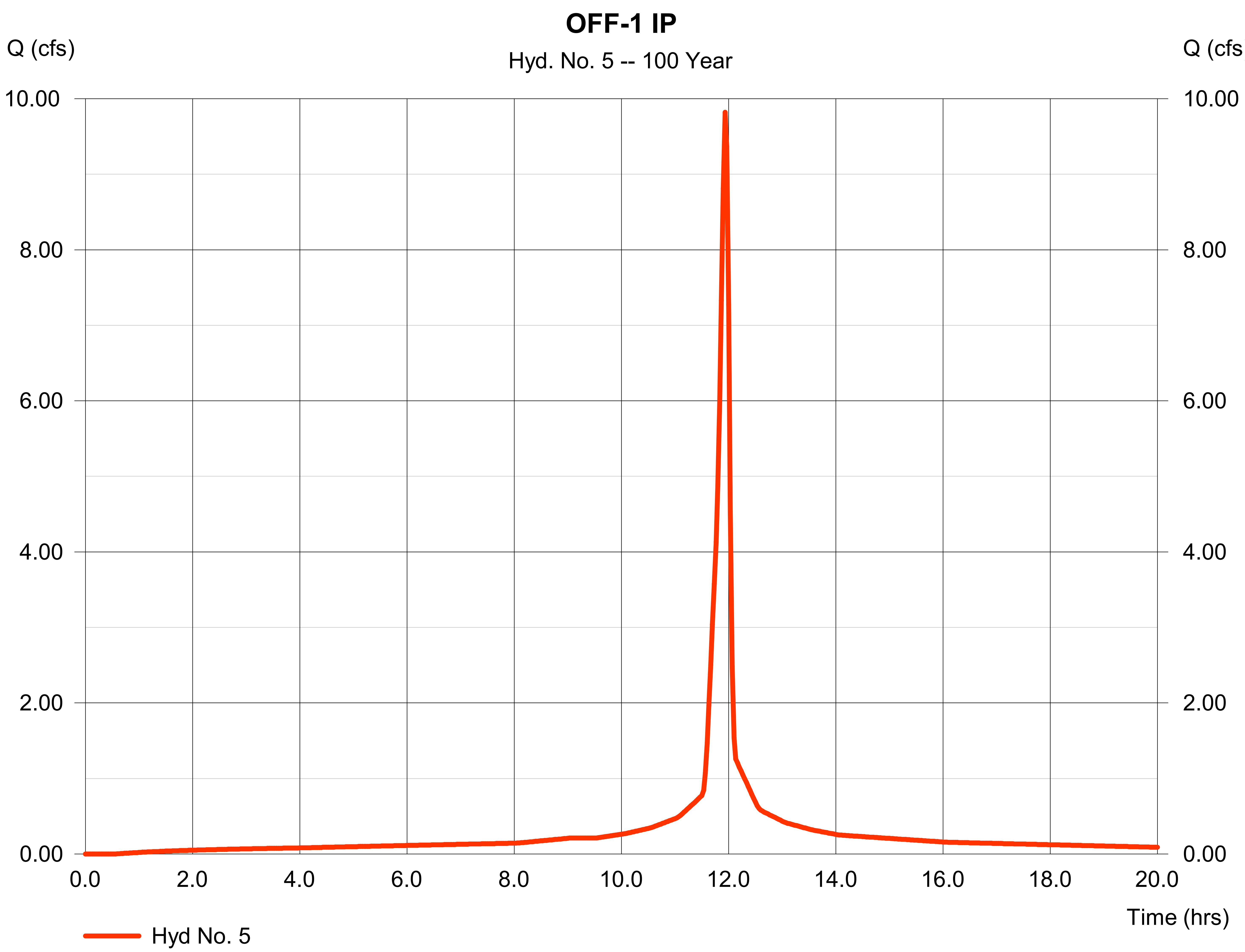
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 5

OFF-1 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 9.820 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 23,772 cuft
Drainage area	= 0.906 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



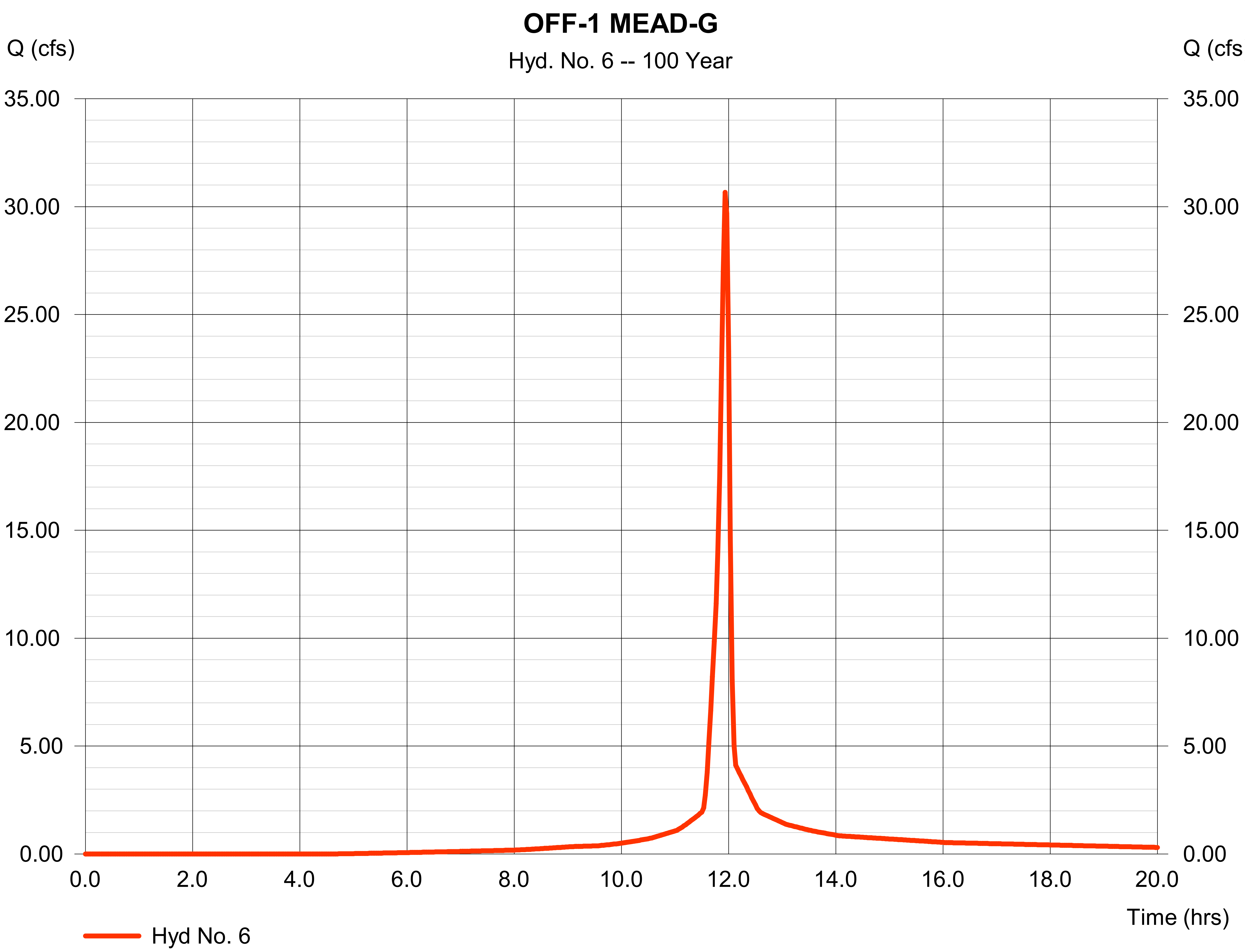
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 6

OFF-1 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 30.66 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 64,681 cuft
Drainage area	= 3.270 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



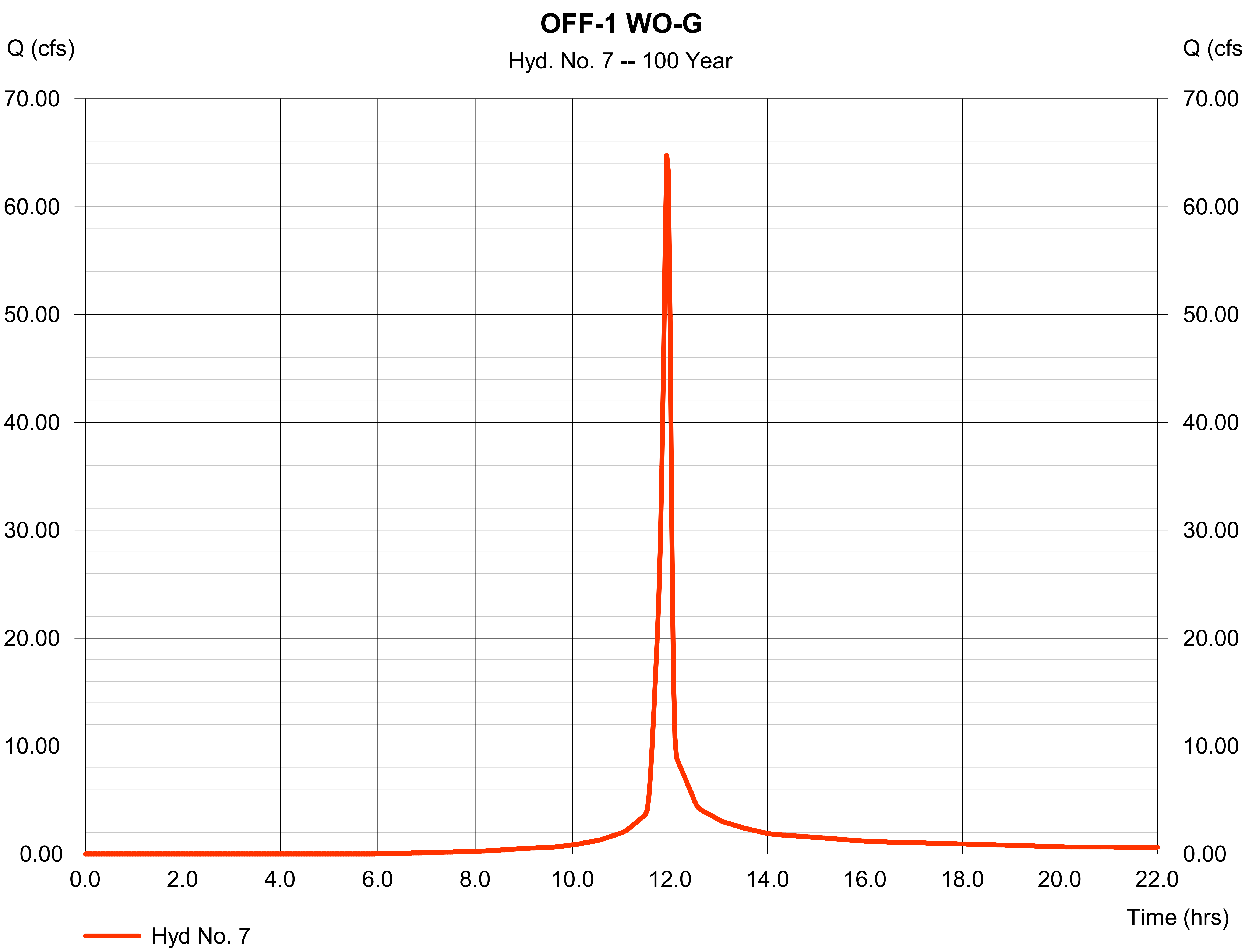
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 7

OFF-1 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 64.74 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 133,699 cuft
Drainage area	= 7.514 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



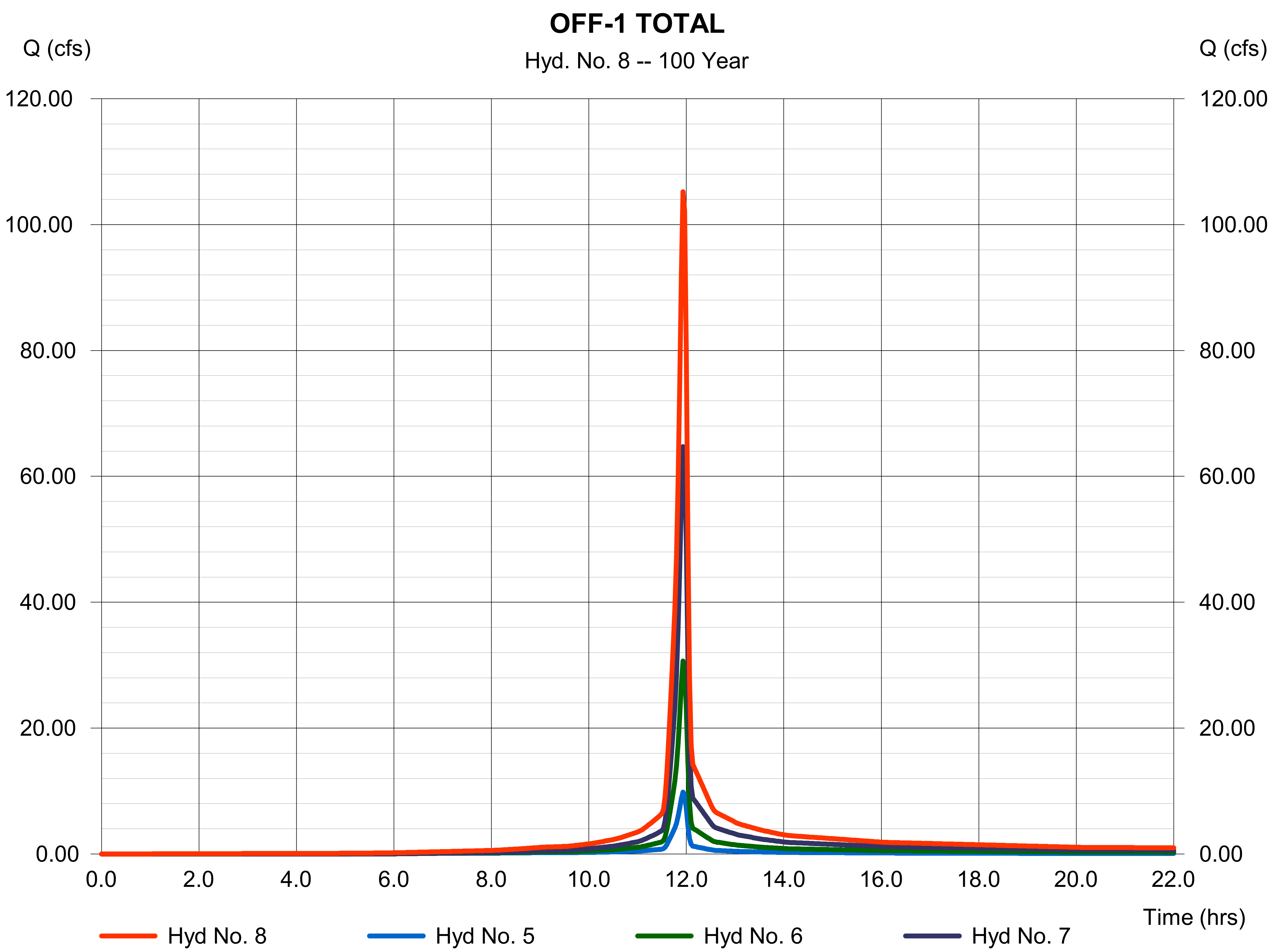
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 8

OFF-1 TOTAL

Hydrograph type	= Combine	Peak discharge	= 105.21 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 222,151 cuft
Inflow hyds.	= 5, 6, 7	Contrib. drain. area	= 11.690 ac



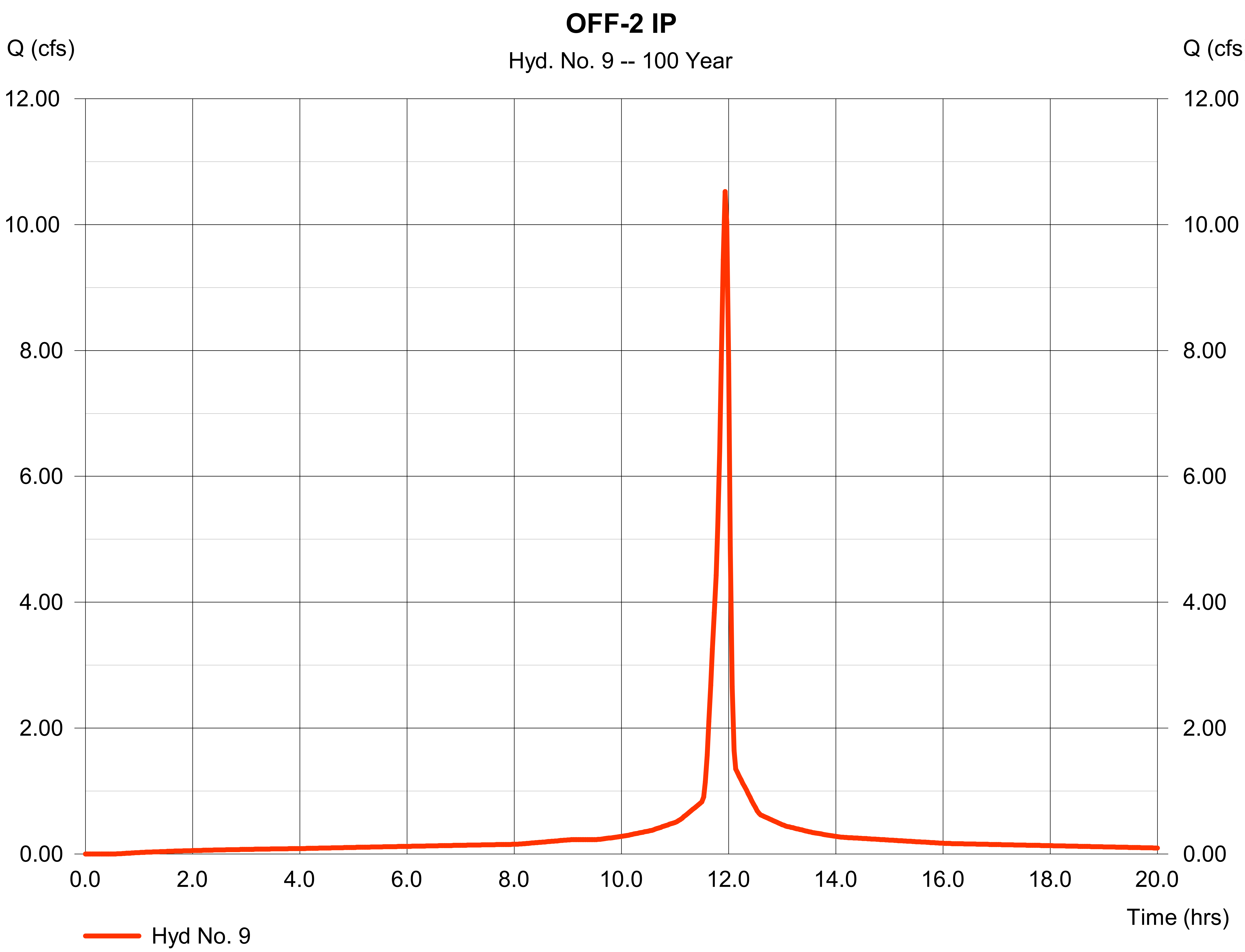
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 9

OFF-2 IP

Hydrograph type	= SCS Runoff	Peak discharge	= 10.52 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 25,478 cuft
Drainage area	= 0.971 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



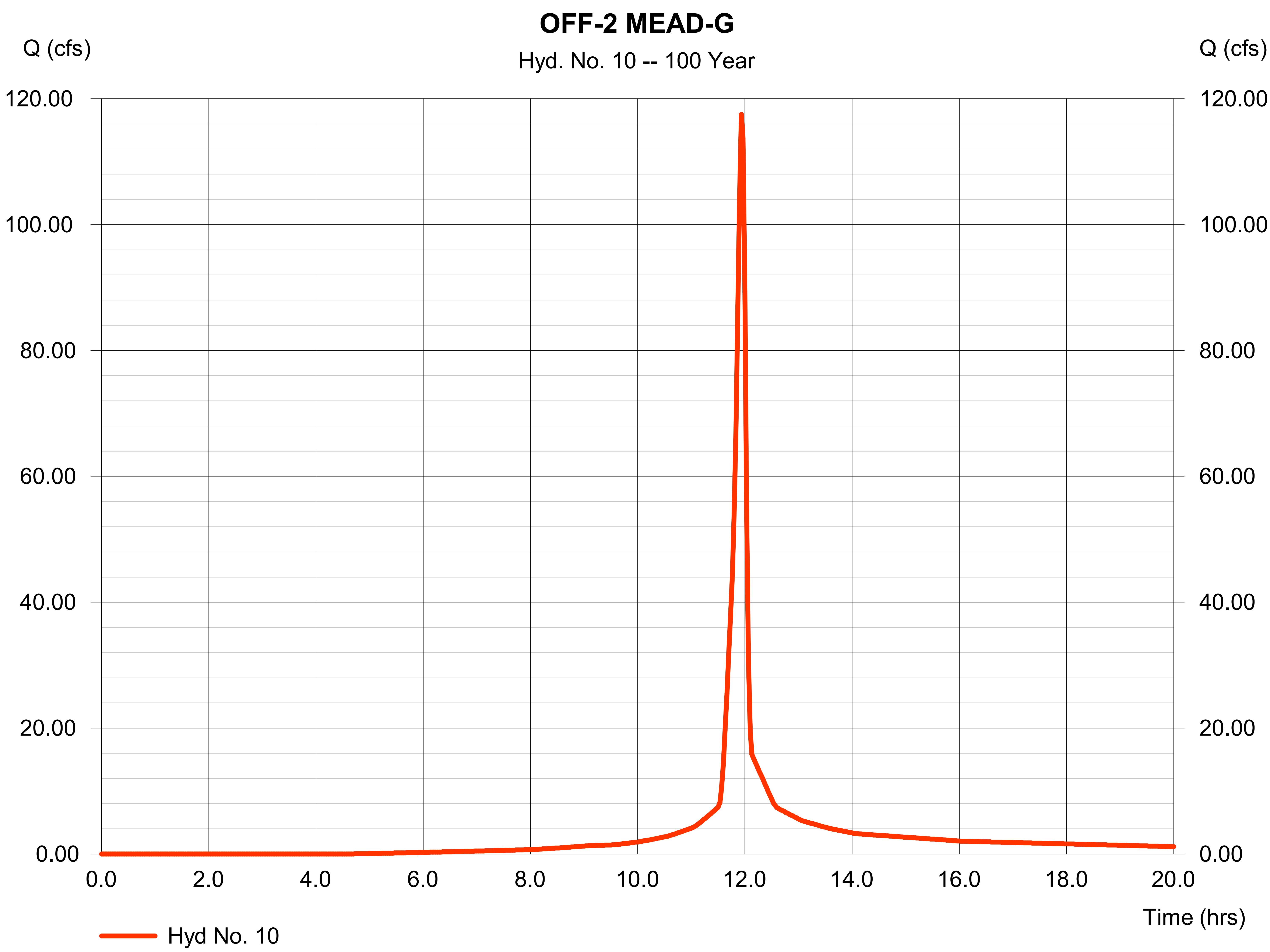
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 10

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 117.49 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 247,903 cuft
Drainage area	= 12.533 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



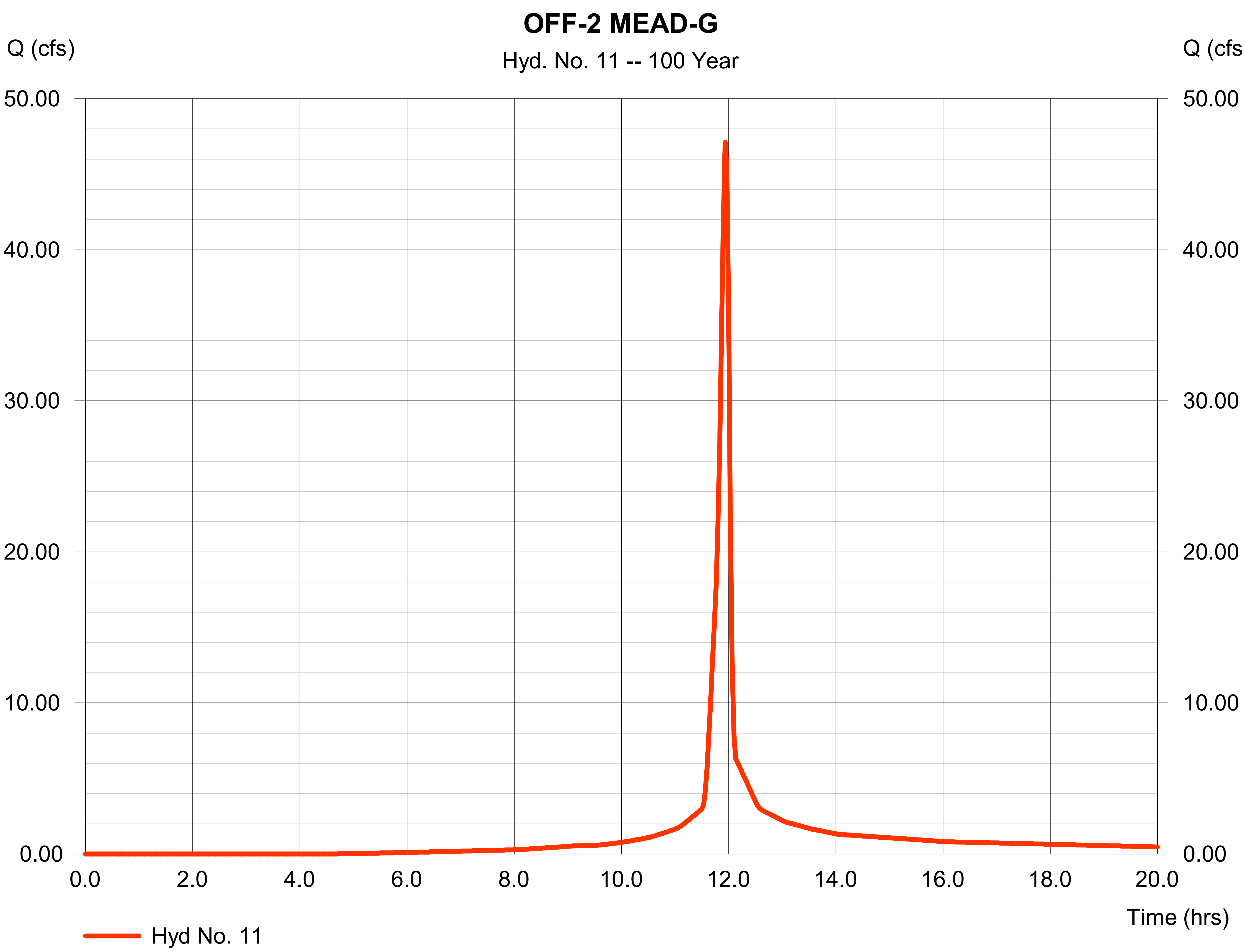
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 11

OFF-2 MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 47.11 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 99,394 cuft
Drainage area	= 5.025 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



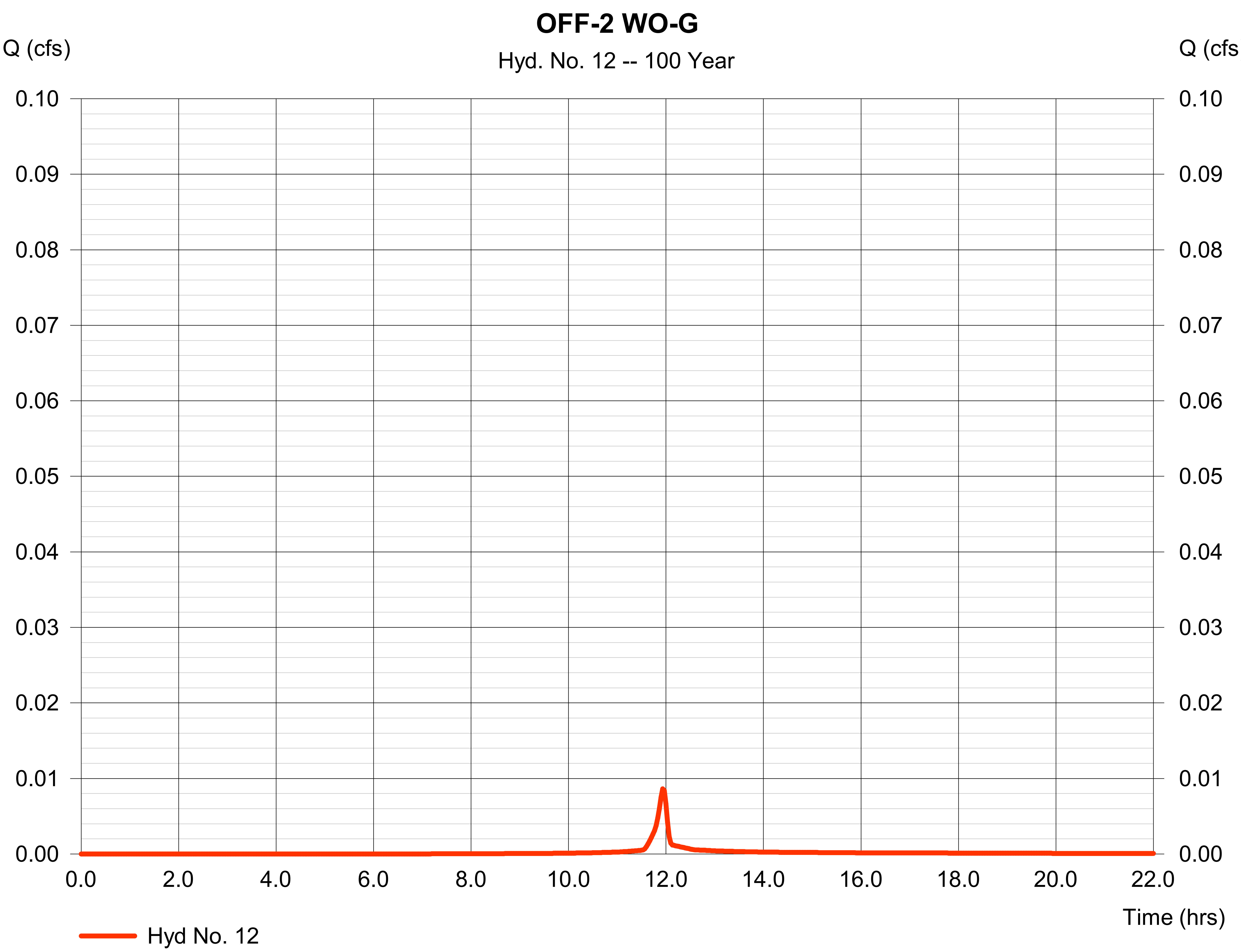
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 12

OFF-2 WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 0.009 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 18 cuft
Drainage area	= 0.001 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



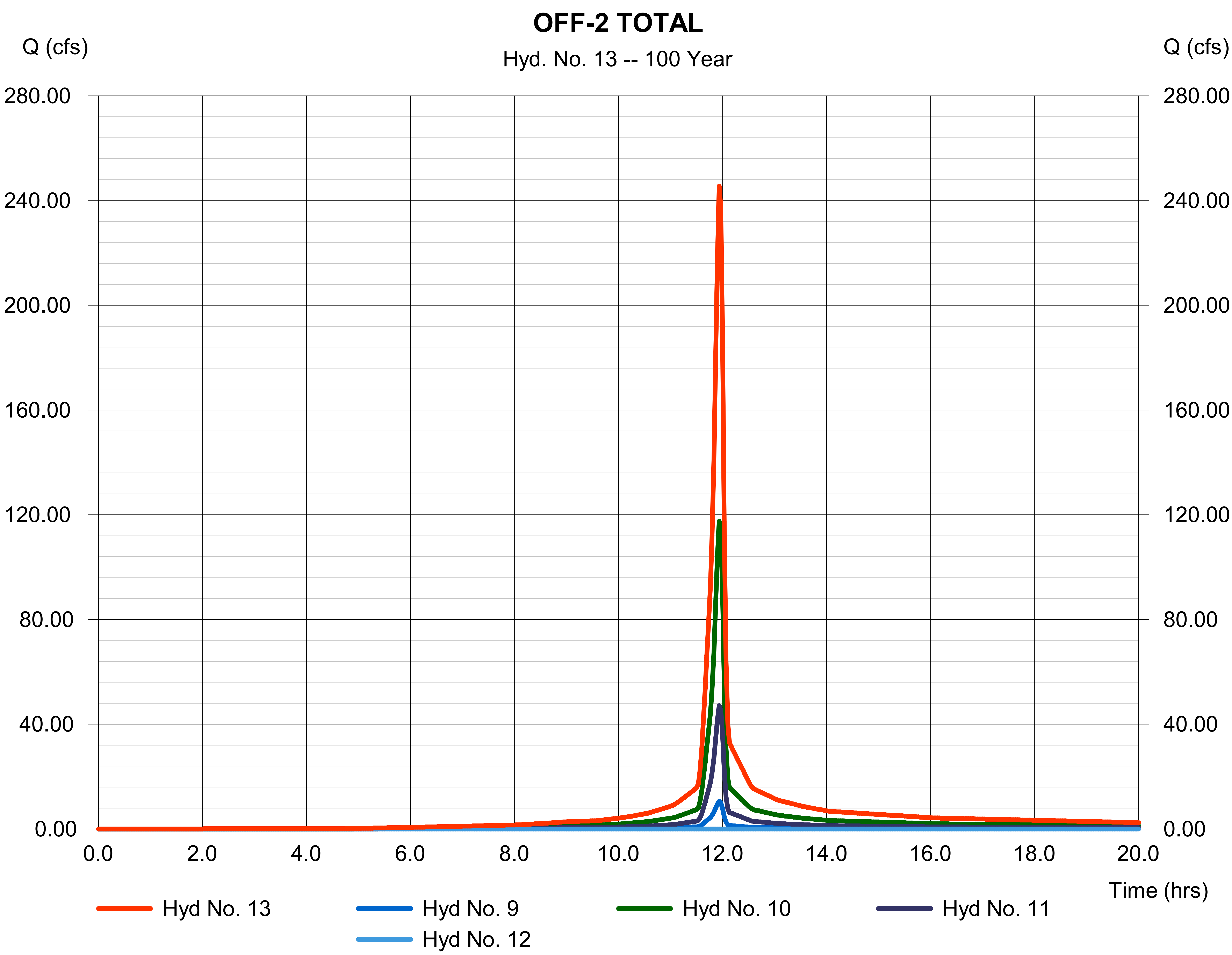
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 13

OFF-2 TOTAL

Hydrograph type	= Combine	Peak discharge	= 245.52 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 521,301 cuft
Inflow hyds.	= 9, 10, 11, 12	Contrib. drain. area	= 18.530 ac



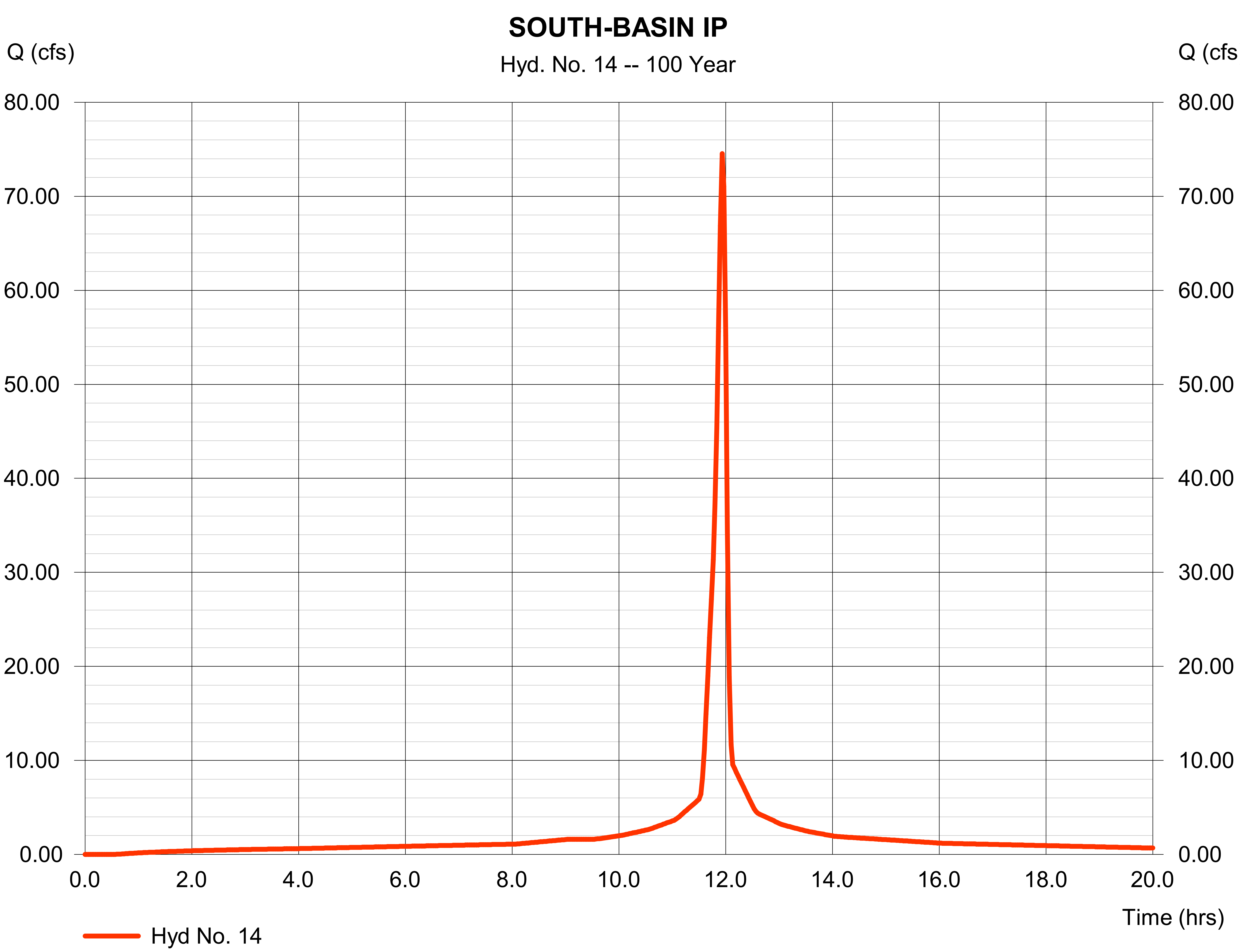
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 14

SOUTH-BASIN IP

Hydrograph type	= SCS Runoff	Peak discharge	= 74.53 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 180,418 cuft
Drainage area	= 6.876 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



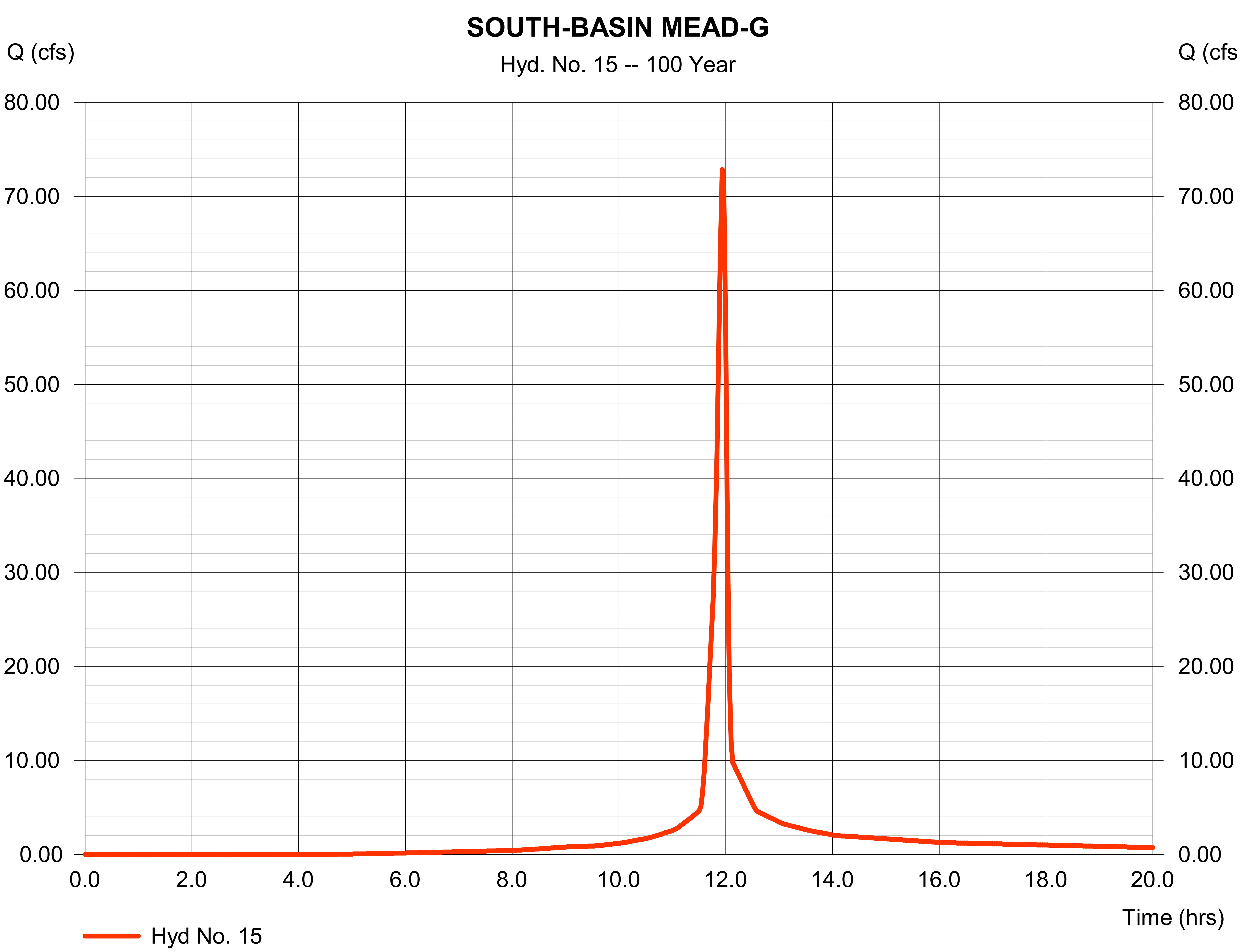
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 15

SOUTH-BASIN MEAD-G

Hydrograph type	= SCS Runoff	Peak discharge	= 72.83 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 153,671 cuft
Drainage area	= 7.769 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



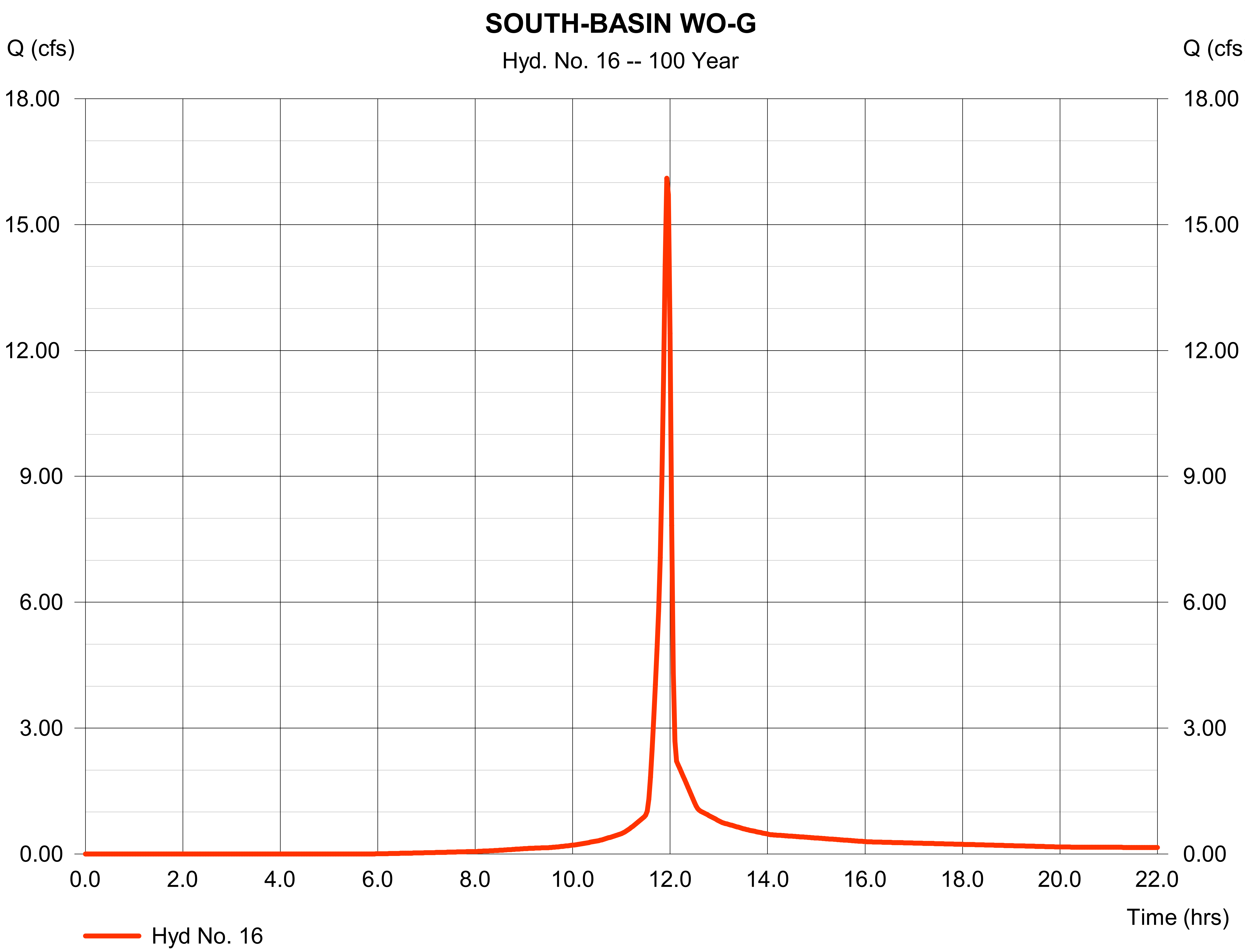
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 16

SOUTH-BASIN WO-G

Hydrograph type	= SCS Runoff	Peak discharge	= 16.10 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 33,256 cuft
Drainage area	= 1.869 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



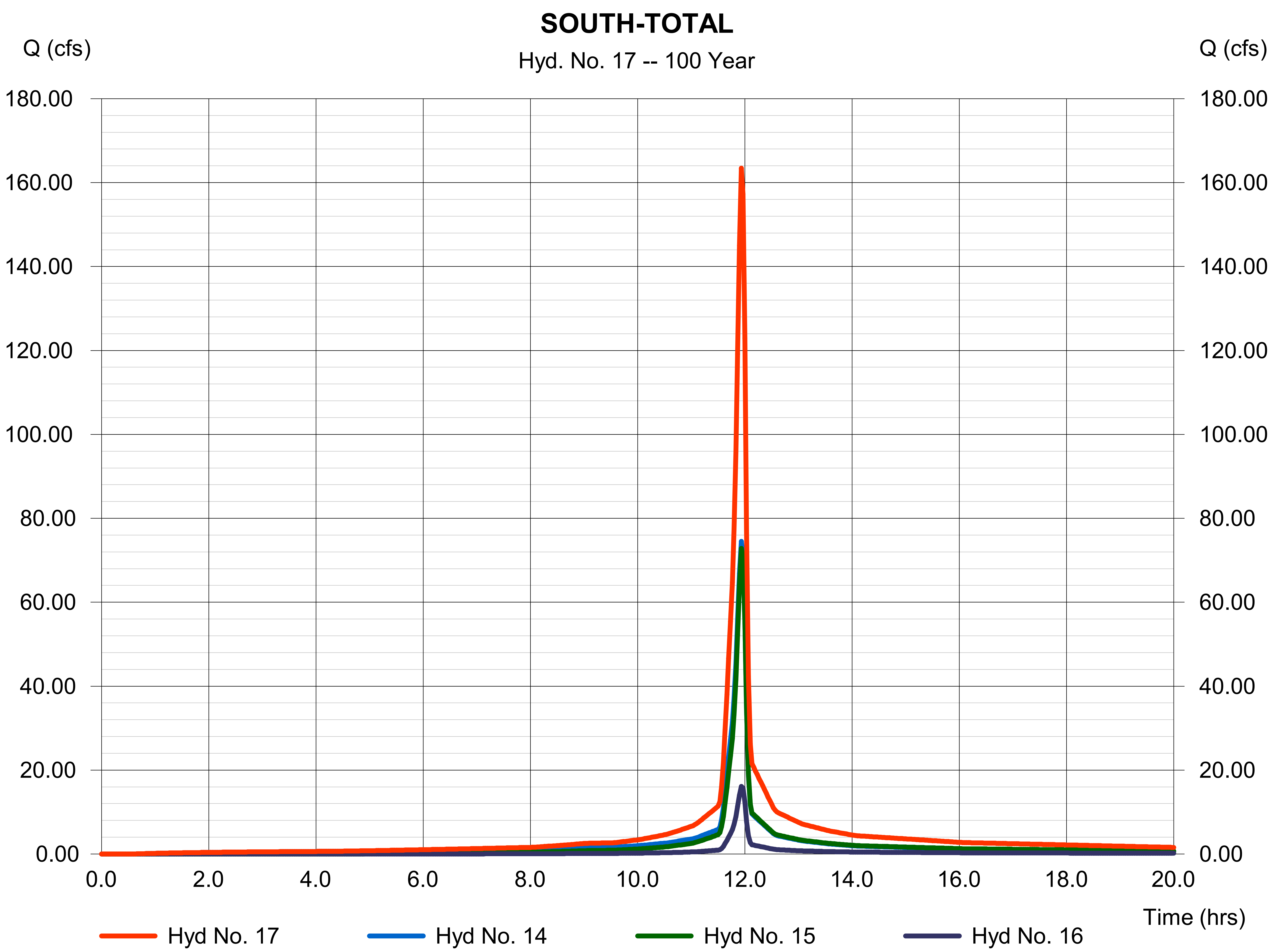
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 17

SOUTH-TOTAL

Hydrograph type	= Combine	Peak discharge	= 163.46 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 367,345 cuft
Inflow hyds.	= 14, 15, 16	Contrib. drain. area	= 16.514 ac



Hydrograph Report

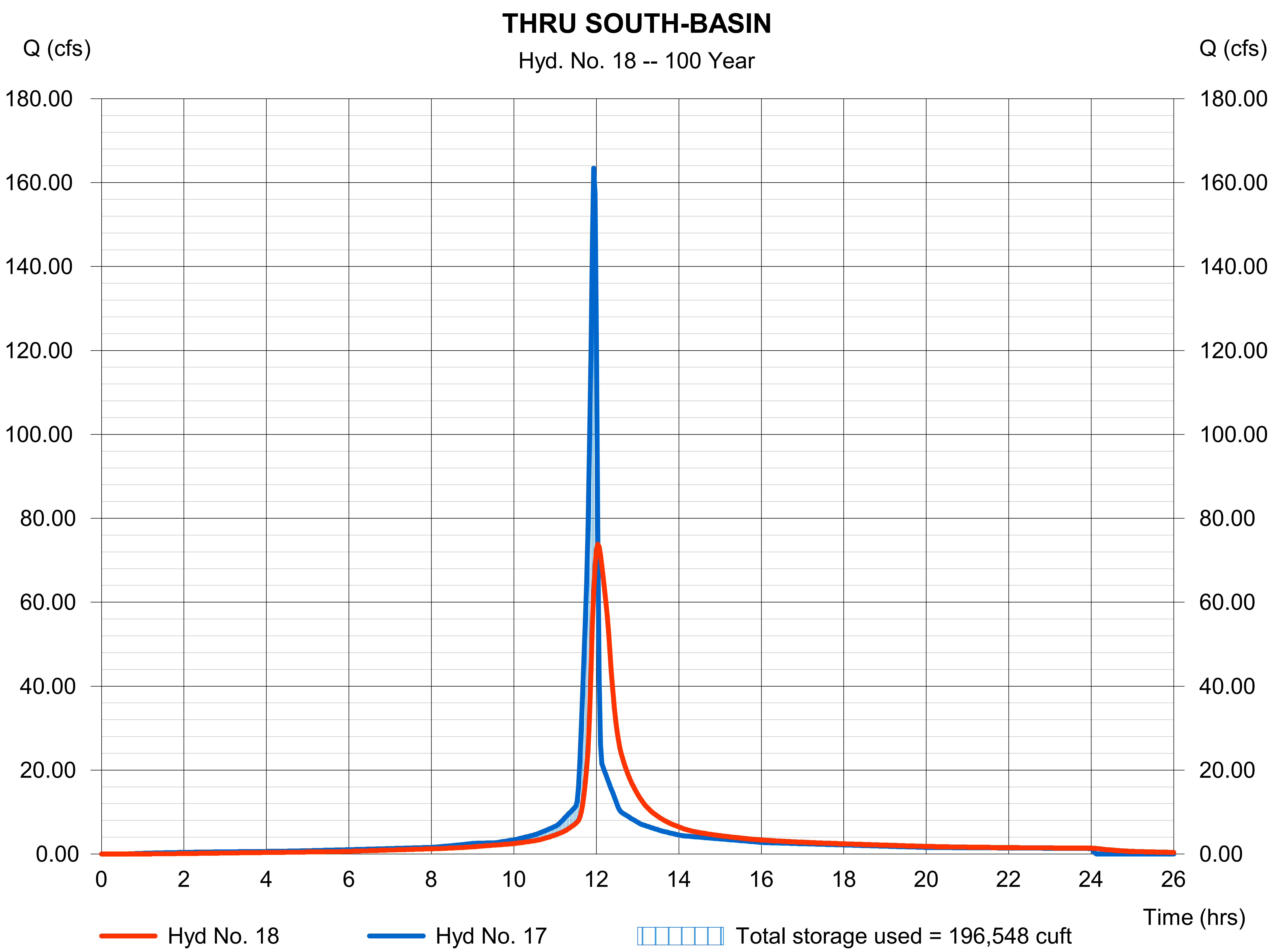
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Hyd. No. 18

THRU SOUTH-BASIN

Hydrograph type	= Reservoir	Peak discharge	= 73.89 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 367,337 cuft
Inflow hyd. No.	= 17 - SOUTH-TOTAL	Max. Elevation	= 1737.11 ft
Reservoir name	= SOUTH-BASIN	Max. Storage	= 196,548 cuft

Storage Indication method used. Wet pond routing start elevation = 1735.00 ft.



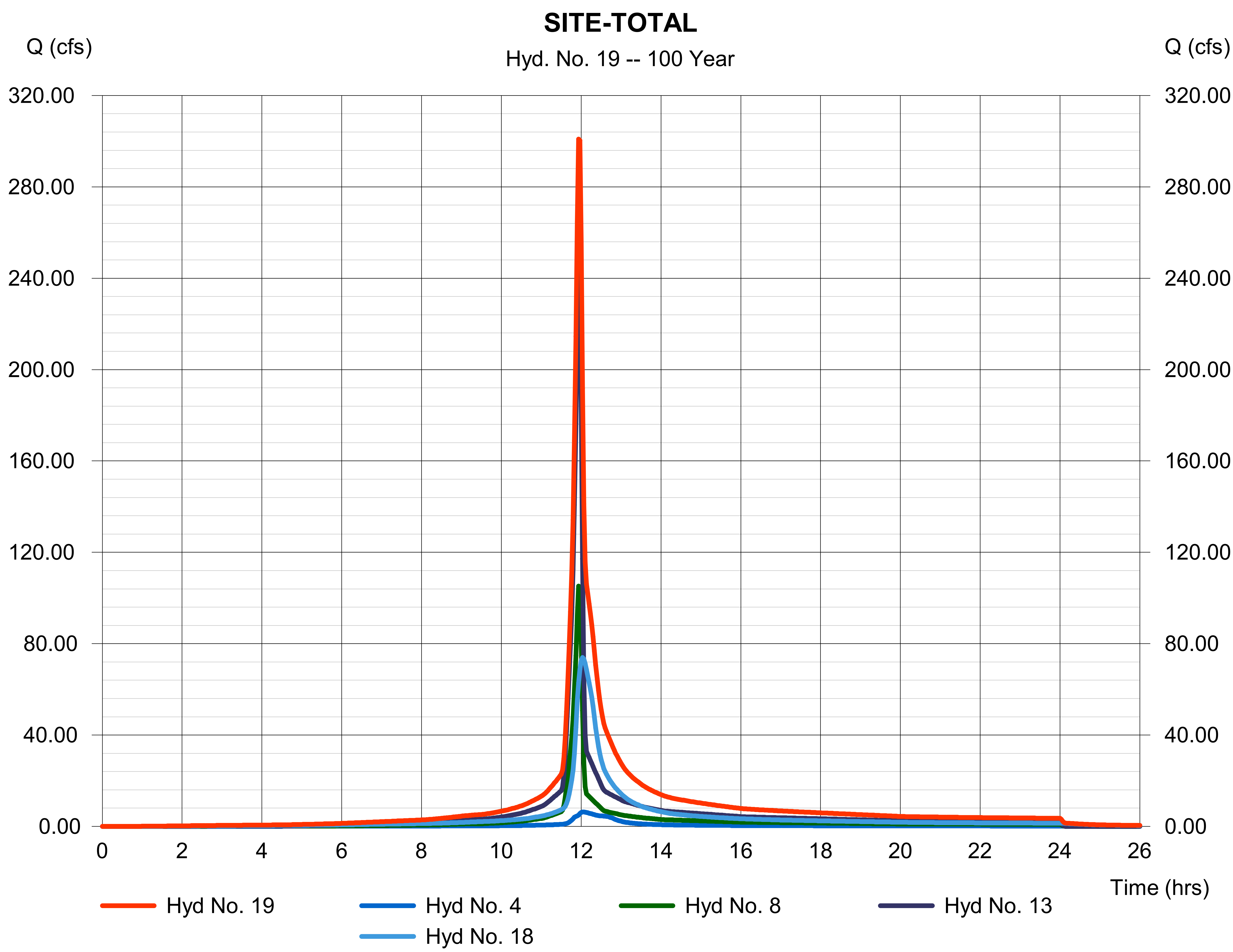
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 — Tuesday, 10 / 15 / 2019

Hyd. No. 19

SITE-TOTAL

Hydrograph type	= Combine	Peak discharge	= 300.88 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 906,247 cuft
Inflow hyds.	= 4, 8, 13, 18	Contrib. drain. area	= 0.000 ac



Hydraflow Rainfall Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Tuesday, 10 / 15 / 2019

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	36.9738	16.1000	0.7641	--------
2	94.4784	24.8001	0.9391	--------
3	0.0000	0.0000	0.0000	--------
5	176.2795	30.1001	1.0248	--------
10	317.8354	35.8000	1.1154	--------
25	309.7854	36.4000	1.0685	--------
50	1324.7950	53.7998	1.3207	--------
100	68.0213	20.7000	0.7186	--------

File name: Irvington.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	3.60	3.06	2.67	2.39	2.16	1.98	1.83	1.70	1.60	1.50	1.42	1.35
2	3.90	3.37	2.97	2.66	2.41	2.20	2.03	1.88	1.75	1.64	1.55	1.46
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	4.60	4.01	3.56	3.19	2.90	2.65	2.44	2.26	2.11	1.97	1.86	1.75
10	5.08	4.46	3.98	3.58	3.25	2.98	2.75	2.54	2.37	2.22	2.08	1.96
25	5.80	5.13	4.60	4.17	3.81	3.50	3.24	3.01	2.82	2.64	2.49	2.35
50	6.10	5.48	4.96	4.52	4.14	3.82	3.54	3.29	3.07	2.88	2.71	2.55
100	6.60	5.81	5.21	4.74	4.36	4.05	3.79	3.56	3.36	3.19	3.04	2.90

Tc = time in minutes. Values may exceed 60.

Precip. file name: P:\353754 PennEast\Stormwater\Site 2 - Springville\SW Model\Site2.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.64	3.17	0.00	3.94	4.62	5.71	6.73	7.95
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

I. PCSM Drawings (Attached)

J. Offsite Stormwater Discharge Plan (Attached)