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GREDELL Engineering Resources, Inc.

Sikeston Board of Municipal Utilities
Sikeston Power Station
Bottom Ash Pond
Inflow Design Flood Control System Plan

Prepared for:

Sikeston Board of Municipal Utilities

Sikeston Power Station
1551 West Wakefield Avenue
Sikeston, MO 63801

October 17, 2016

Sikeston Board of Municipal Utilities
Sikeston Power Station
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Inflow Design Flood Control System Plan

October 17, 2016

Table of Contents

List of Appendices

PROFESSIONAL ENGINEER'S CERTIFICATION

40 CFR 257.82(c) Inflow Design Flood Control System Plan

I, John N. Browning, P.E., a professional engineer licensed in the State of Missouri, hereby certify in accordance with 40 CFR 257.82(c)(5) that the inflow design flood control system plan for the Sikeston Board of Municipal Utilities, Sikeston Power Station, Bottom Ash Pond meets the requirements of 40 CFR 257.82(c)(1) as found in federal regulation 40 CFR 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments and has been prepared using good engineering and environmental judgement and standard accepted practices.

Name: John N. Browning, P.E.

Signature:

Date: 10-17-2016

Registration Number: E-20769
State of Registration: Missouri

STATE OF MISSOURI
JOHN N. BROWNING
NUMBER
E-20769
REGISTERED PROFESSIONAL ENGINEER

1.0 INTRODUCTION

In accordance with the scope of services outlined in the Sikeston Board of Municipal Utilities (SBMU) Work Order No. 4 dated August 02, 2016, GREDELL Engineering Resources, Inc. (Gredell Engineering) developed an inflow design flood control system plan for the SBMU, Sikeston Power Station (SPS) Bottom Ash Pond, a coal combustion residual (CCR) surface impoundment. The purpose of this inflow design flood control system plan is document how the inflow design flood control system has been designed and constructed to meet the requirements of the Federal CCR Rule, section (§) 40 CFR 257.82. Excerpts from the Federal CCR Rule, §257.82(a)-(c), describing the hydrologic and hydraulic capacity requirements of CCR surface impoundments and the required contents of this inflow design flood control system plan are provided for reference below. §257.3-3 describing the surface water protection requirements is also provided for reference below.

1.1 §257.82(a) and (b) – Hydrologic and Hydraulic Capacity Requirements for CCR Surface Impoundments

Excerpts from §257.82(a) and (b), which regards the hydrologic and hydraulic capacity requirements for CCR surface impoundments completed by Gredell Engineering, are provided for reference below.

(a)(1) The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood specified in paragraph (a)(3) of this section.

(a)(2) The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood specified in paragraph (a)(3) of this section.

(a)(3)The inflow design flood is: for a high hazard potential CCR surface impoundment, the probable maximum flood; for a significant hazard potential CCR surface impoundment, the 1,000-year flood; for a low hazard potential CCR surface impoundment, the 100-year flood; and for an incised CCR surface impoundment, the 25-year flood.

(b) Discharge from the CCR unit must be handled in accordance with the surface water requirements under §257.3-3.

1.2 §257.82(c) – Inflow Design Flood Control System Plan

Excerpts from §257.82(c), which regards the inflow design flood control system plan requirements for CCR surface impoundments completed by Gredell Engineering, are provided for reference below.

(c)(1) The owner or operator must prepare initial and periodic inflow design flood control system plans for the CCR unit according the timeframes specified in paragraphs (c)(3) and (4) of this section. These plans must document how the inflow design flood control system has been designed and constructed to meet the requirements of this section. Each plan must be supported by appropriate engineering calculations. The owner or operator of the CCR unit has completed the inflow design flood control system plan when the plan has been placed in the facility's operating record as required by §257.105(g)(4).

(c)(5) The owner or operator must obtain a certification from a qualified professional engineer stating that the initial and periodic inflow design flood control system plan meets the requirements of this section.

1.3 §257.3-3 – Surface Water

Excerpts from §257.3-3, which is referenced in §257.82(b), are provided for reference below.

(a) For purposes of section 4004(a) of the Act, a facility shall not cause a discharge of pollutants into waters of the United States that is in violation of the requirements of the National Pollutant Discharge Elimination System (NPDES) under section 402 of the Clean Water Act, as amended.

(c) A facility or practice shall not cause non-point source pollution of waters of the United States that violates applicable legal requirements implementing an area wide or Statewide water quality management plan that has been approved by the Administrator under section 208 of the Clean Water Act, as amended.

2.0 POND DESCRIPTIONS

SPS is located east of the City of Sikeston, south of West Wakefield Avenue, and west of Route Bb in Scott County, Missouri. The Bottom Ash Pond at SPS resides to the southeast of SPS, and directly south of SPS's coal pile and inactive Fly Ash Pond. The Bottom Ash Pond occupies approximately 61 acres with a maximum and consistent berm elevation of 322 feet. Based on an aerial survey conducted by Surdex Corporation on May 6, 2012, the Bottom Ash Pond has an approximate remaining capacity of 333 acre-feet (ac-ft) (14,500,000 cubic feet [ft^3]).

SPS and the Bottom Ash Pond are located at a transition between agricultural and urban areas. The Bottom Ash Pond is surrounded by agricultural, commercial, and residential areas. Residential areas are located approximately 150 feet east/southeast of the Bottom Ash Pond. Commercial areas are located approximately 700 feet south of the Bottom Ash Pond. The remaining area around the Bottom Ash Pond is agricultural land. See Appendix A, Figure 1 – Aerial View for a depiction of the Bottom Ash Pond.

2.1 Bottom Ash Pond Influent and Discharge Systems

SPS discharges influent into the Bottom Ash Pond through three influent pipes located in the northeast corner of the Bottom Ash Pond. Influent consists of CCR and non-CCR wastewaters. Non-CCR wastewater sources include plant maintenance, boiler blowdown wastewaters and sump water from the concrete utility trench used for plant piping out to the Bottom Ash Pond. Non-CCR wastewaters discharge into the northwest corner of the Bottom Ash Pond through a 12-inch carbon fiber pipe and a 4-inch PVC pipe. Bottom ash handling wastewater is the only CCR wastewater influent into the Bottom Ash Pond. Bottom ash handling wastewater discharges into the northwest corner of the Bottom Ash Pond through an estimated 10-inch ductile iron pipe. Average daily and monthly maximum flow rates for each wastewater source are shown in Table 1 – Wastewater Sources.

Discharge from the Bottom Ash Pond is through a concrete structure with dimensions of 6 feet wide, 11 feet long, and 8.5 feet deep with a top elevation of 322.53 feet. The structure outlet contains a single, 10-inch carbon fiber pipe which discharges Bottom Ash Pond effluent into the Process Waste Pond. The discharge pipe inlet and outlet invert elevations are 314.53 feet and 304.97 feet respectively. A hand-operated valve, which is located near the toe of the Bottom Ash Pond's north berm, is used to control the discharge from the Bottom Ash Pond. The distance from the discharge structure to the control valve is approximately 80 feet and the slope of the discharge pipe is approximately 10.3%. From the control valve, the discharge pipe is routed to the Process Waste Pond over a distance of approximately 1,820 feet with a slope of approximately 0.07%. Average daily and monthly maximum flow rates from the Bottom Ash Pond are shown as influents into the Process Waste Pond in Table 1 – Wastewater Sources.

The existing Bottom Ash Pond overflow structure is constructed with a concrete inlet that has a 30-inch iron discharge pipe through the berm separating the Bottom Ash Pond from the inactive Fly Ash Pond. The discharge of the overflow structure is into the inactive Fly Ash Pond. The overflow structure is inoperable due to excess CCR deposits in the inactive Fly Ash Pond obstructing the discharge end of the 30-inch pipe. Influent and discharge structures are identified in Appendix A, Figure 2 – Bottom Ash Pond Hydraulic Structures. Schematic details of the Bottom Ash Pond outlet structure are provided in Appendix A, Figure 4 – Outlet Structure Details.

2.2 Settling Pond Influent and Discharge Systems

SPS discharges influent into the Settling Pond through an inlet located in the southeast corner of the Settling Pond. Influent consists of non-CCR wastewaters. Non-CCR wastewater sources include coal pile runoff and coal handling wash down wastewaters. Runoff from approximately 15.1 acres of the coal/limestone storage area is estimated to discharge into the Settling Pond Non-CCR wastewaters discharge into the Settling Pond through a structure series of four arched influent pipes. Average daily and monthly maximum flow rates for each wastewater source are shown in Table 1 – Wastewater Sources.

Discharge from the Settling Pond is through a principal spillway consisting of a 36-inch diameter corrugated metal. The Settling Pond effluent discharges into the Process Waste Pond. The principle discharge pipe inlet and outlet invert elevations are 304.8 feet and 304.55 feet respectively. The slope and length of the discharge pipe are approximately 0.6% and 41 feet. Average daily and monthly maximum flow rates from the Settling Pond are shown as influents into the Process Waste Pond in Table 1 – Wastewater Sources.

The existing Settling Pond emergency spillway is constructed as a 37-foot long concrete broad crested weir. The width of the weir is approximately 30 feet long. The inlet and outlet invert elevations are 306.40 feet and 306.32 feet respectively. The emergency spillway discharges into the Process Waste Pond. Influent and discharge structures are identified in Appendix A, Figure 3 – Process Waste Pond Hydraulic Structures.

2.3 Process Waste Pond Influent and Discharge Systems

SPS discharges influent into the Process Waste Pond through four influent pipes located along the southern bank and in the northeast corner of the Process Waste Pond. Influent consists of non-CCR wastewaters. Non-CCR wastewaters sources include coal/limestone pile runoff, demineralizer water, Bottom Ash Pond effluent, and Settling Pond Effluent. Bottom Ash Pond and Settling Pond effluents are not CCR wastewaters because the wastewaters include only de minimus quantities of CCR. The Process Waste Pond is approximately 9.6 acres.

Non-CCR wastewaters discharge into the Process Waste Pond through a 10-inch carbon fiber pipe (Bottom Ash Pond effluent) and a 3-inch carbon fiber pipe (demineralizer wastewater). Invert elevations of the 10-inch and 3-inch carbon pipe influents are 304.97 feet and 305.01 feet respectively.

Runoff from approximately 23.8 acres of the coal pile storage area discharges into the Process Waste Pond through a 24-inch corrugated metal pipe. The 24-inch corrugated metal pipe inlet and outlet invert elevations are 309.06 feet and 306.65 feet respectively. The minimum slope and length were determined to be approximately at 3.2 % and 75 feet.

Discharge from the Process Waste Pond is through a concrete stop log structure with dimensions of 5 feet wide, 18 feet long, and 8 feet deep. The concrete structure contains a 3 foot wide rectangular weir at an approximate elevation of 303.8 feet. The pond is discharged through a 24-inch corrugated metal pipe which discharges Process Waste Pond effluent to Richland Drainage Ditch #4 through Outfall 003 (Missouri State Operating Permit MO-0095575). The discharge pipe inlet and outlet invert elevations were estimated to be approximately 301.4 feet and 300.3 feet respectively. The discharge pipe was assumed to have a minimum slope of 0.5% and a length of approximately 230 feet. Average daily and monthly maximum flow rates from the Process Waste Pond are shown in Table 1 – Wastewater Sources. There is no emergency spillway for the Process Waste Pond. All influent and discharge structures are identified in Appendix A, Figure 3 – Process Waste Pond Hydraulic Structures. Schematic details of the Process Waste Pond outlet structure are provided in Appendix A, Figure 4 – Outlet Structure Details.

Table 1: Wastewater Sources

Discharging Water Body / Process	Receiving Water Body	Average Daily Flowrate (MGD)	Maximum Daily Flowrate (MGD)
Bottom Ash Handling	Bottom Ash Pond	1.36	1.36
Oil Separator	Bottom Ash Pond	0.06	0.06
Boiler Blowdown Tank	Bottom Ash Pond	0.05	0.07
Precipitation[2]	Bottom Ash Pond	0.08	0.85
Coal Handling Washdown	Settling Pond	0.05	0.10
Precipitation[2]	Settling Pond	0.04	0.42
Bottom Ash Pond	Process Waste Pond	1.22	2.13
Demineralizer	Process Waste Pond	0.02	0.02
Settling Pond	Process Waste Pond	0.09	0.52
Precipitation[2]	Process Waste Pond	0.01	0.16
Process Waste Pond	Richland Drainage Ditch #4	1.38	3.27

1. Wastewater Source flowrates were taken from the Process Flow Diagram dated 7-15-2013 that was prepared and provided by SPS.

2. Precipitation values provided by SPS were not used in the Hydraflow model. Precipitation values were calculated by Hydraflow utilizing the inflow design flood of a 1,000-yr flood event.

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3.0 INFLOW DESIGN FLOOD

§257.82 requires owners and operators of CCR surface impoundments to have hydrologic and hydraulic systems designed to adequately manage the flow from the peak discharge of the inflow design flood into and out of the CCR surface impoundment. The inflow design flood is determined by the hazard potential classification for the CCR surface impoundment. As previously stated, §257.82(a)(3) defines the inflow design flood for each hazard potential classification. The potential inflow design flood for CCR surface impoundments are as follows:

- High Hazard Potential – probably maximum flood
- Significant Hazard Potential – 1,000-year flood
- Low Hazard Potential – 100 year flood

3.1 Bottom Ash Pond Hazard Potential Classification

The hazard potential classification for the Bottom Ash Pond was determined by modeling a worst-case scenario breach of the Bottom Ash Pond Berms and its resulting flood waters impact on the surrounding land. A worst-case scenario breach of the Bottom Ash Pond berm at SPS was modeled using HydroCAD. The flooded areas from the modeled breach include agricultural (owned by the City of Sikeston) and residential (owned by various private entities) properties.

Flood waters from a breach in the Bottom Ash Pond berm under the worst-case scenario conditions would not be contained to property owned solely by the City of Sikeston. Additionally, environmental damage, economic loss, disruption of lifeline facilities, or other impact concerns are expected from a breach in the Bottom Ash Pond berm. However, there is no probable loss of human life due to the flood waters from the breach in the Bottom Ash Pond berm. Therefore, the Bottom Ash Pond at SPS was classified as: Significant Hazard Potential Classification.

3.2 Bottom Ash Pond Inflow Design Flood

As stated above, §257.82(a)(3) requires the inflow design flood for CCR surface impoundments with significant hazard potential classifications to be the 1,000-year flood. The 1,000-year flood is the volume of runoff generated by the 1,000-year rainfall event for a given location. The duration of the 1,000-year event was taken to be 24 hours. The 24 hour duration was used as it generated the maximum runoff volume. The 1,000-year, 24-hour rainfall event was modeled to determine if the existing hydrologic and hydraulic capacity of the Bottom Ash Pond and other hydraulic structures impacted by the discharge from the Bottom Ash Pond is adequate. From the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 8, Version 2, the 1,000-year, 24-hour depth of rainfall for Sikeston, Missouri is 12 inches.

4.0 INFLOW DESIGN FLOOD CONTROL SYSTEM

As previously stated above, §257.82(a)(1) and (2) pertaining to CCR surface impoundments states owners or operators of CCR surface impoundments must design, construct, operate, and maintain the inflow design flood control system to adequately manage flow into the CCR surface impoundment during and following the peak discharge of the inflow design flood, as well as adequately manage the flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood. Therefore, the inflow design flood control system for the Bottom Ash Pond includes the following hydraulic structures which were modeled using Hydraflow.

- Bottom Ash Pond
- Settling Pond
- Process Waste Pond

4.1 Bottom Ash Pond Inflow and Outflow

The Bottom Ash Pond was modeled using Hydraflow with two inputs, the 1,000-year storm event and Sikeston Power Station process wastewaters. Sikeston Power Station process wastewaters include Bottom Ash Handling and Maintenance and Operations. The maximum daily flow rates from Table 1 were used to develop a conservative model. It should be noted that due to the limitations of the modeling software, process wastewater flows were modeled using artificial drainage areas and runoff coefficients to yield the desired maximum daily flowrates reported in Table 1. The watershed for the Bottom Ash Pond is solely the area within the berms of the Bottom Ash Pond. The Bottom Ash Pond berms elevations are above the surrounding topography and therefore, do not receive additional stormwater runoff.

The peak discharge from the combined process wastewaters and the 1,000-year flood was determined to be 967 cubic feet per second (CFS). The average daily discharge rate was determined to be approximately 19.6 million gallons per day (MGD) with a total influent volume of approximately 2,622,500 ft^3 (19.6 MG). The initial water elevation in the Bottom Ash Pond was assumed to be 318.5 feet, the average water elevation as recorded in the weekly inspection reports for the Bottom Ash Pond. The maximum water elevation in the Bottom Ash Pond from the combined influents was determined to be 320.3 feet, 1.7 feet below the top of the Bottom Ash Pond berms (elevation 322 feet). The remaining capacity of the Bottom Ash Pond with an area of 61 acres and 1.7 feet of storage is approximately 4,517,200 ft^3. The peak discharge from the Bottom Ash Pond during the 1,000-year inflow design flood was determined to be 1.78 CFS. The average daily discharge rate was determined to be approximately 136,200 ft^3/day (1 MGD). Therefore, the Bottom Ash Pond hydrologic and hydraulic capacity can adequately manage flow during and following the peak discharge from the inflow design flood as required by §257.82(a)(1). See Appendix B, Hydraflow Report - 1,000-year Design Flood for a detailed report of the hydrologic and hydraulic model.

4.2 Settling Pond Inflow and Outflow

The Settling Pond was modeled using Hydraflow with three inputs, the 1,000-year storm event, Settling Pond discharge, coal pile runoff from the 1,000-year storm event, and the runoff from the Settling Pond. The maximum daily flow rates from Table 1 were used to develop a conservative model. As previously stated, process wastewater flows were modeled using artificial drainage areas and runoff coefficients to yield the desired maximum daily flowrates reported in Table 1. The watershed for the Settling Pond includes the Settling Pond itself and the coal yard directly east of the Settling Pond. The Settling Pond and the coal pile storage area are surrounded by berms with elevations greater than the surrounding topography, and therefore do not receive any additional stormwater runoff.

The peak discharge from the combined inputs to the Settling Pond was determined to be 155 CFS. The average daily discharge rate was determined to be approximately 4.1 MGD with a total influent volume of approximately 546,500 ft^3 (4.1 MG). The initial water elevation in the Settling Pond was assumed to be 304.6 feet, the normal operational elevation of the Settling Pond. The maximum water elevation in the Settling Pond from the resulting from the combined influents was determined to be 307.1 feet, 1.9 feet below the top of the Settling Pond berms (elevation 309 feet). The remaining capacity of the Settling Pond with an area of 2.4 acres and 1.9 feet of storage is approximately 198,600 ft^3. The peak discharge from the Settling Pond during the 1,000-year inflow design flood was determined to be 77.9 CFS. The average daily discharge from the Settling Pond was determined to be approximately 414,700 ft^3/day (3.1 MGD). Therefore, the Settling Pond hydrologic and hydraulic capacity can adequately manage flow during and following the peak discharge from the inflow design flood as required by §257.82(a)(1). See Appendix B, Hydraflow Report - 1,000-year Design Flood for a detailed report of the hydrologic and hydraulic model.

4.3 Process Waste Pond Inflow and Outflow

The Process Waste Pond was modeled using Hydraflow with five inputs, the 1,000-year storm event, Settling Pond discharge, Bottom Ash Pond discharge, coal pile runoff from the 1,000-year storm event, and demineralizer wastewater flows. The maximum daily flow rates from Table 1 were used to develop a conservative model. As previously stated, process wastewater flows were modeled using artificial drainage areas and runoff coefficients to yield the desired maximum daily flowrates reported in Table 1. The watershed for the Process Waste Pond includes the Process Waste Pond itself and the coal yard directly east of the Process Waste Pond. The Process Waste Pond and the coal pile storage area are surrounded by berms with elevations greater than the surrounding topography, and therefore do not receive any additional stormwater runoff.

The peak discharge from the combined inputs to the Process Waste Pond was determined to be 317.4 CFS. The average daily discharge rate was determined to be approximately 12.6 MGD with a total influent volume of approximately 1,888,200 ft^3 (14.1 MG). The initial water elevation in the Process Waste Pond was assumed to be 303.8 feet, the normal operational elevation of the Process Waste Pond. The maximum water elevation in the Process Waste Pond from the resulting from the combined influents was determined to be approximately 306.2 feet, or 2.8 feet below the top of the Process Waste Pond berms (approximate elevation 309 feet). The remaining capacity of the Process Waste Pond with an area of 9.7 acres and 2.8 feet of storage is approximately 1,183,100 ft^3 (8.8 MGD). The peak discharge from the Process Waste Pond during the 1,000-year inflow design flood was determined to be 21.9 CFS. The average daily discharge from the Process Waste Pond was determined to be approximately 841,900 ft^3/day (6.3 MGD). Therefore, the Process Waste Pond hydrologic and hydraulic capacity can adequately manage flow during and following the peak discharge from the inflow design flood as required by §257.82(a)(1). See Appendix B, Hydraflow Report - 1,000-year Design Flood for a detailed report of the hydrologic and hydraulic model.

4.4 Clean Water Act Surface Water Requirements

40 CFR 257.82 requires owners and operators of CCR surface impoundments to manage discharge during and following the inflow design flood in accordance with the surface water requirements of §257.3-3. As previously stated, §257.3-3 requires discharges from CCR surface impoundments into waters of the United States to be conducted in manner which does not violate NPDES requirements and which does not cause non-point source pollution of waters of the United States. Since the majority of the discharge is a direct result from the volume of stormwater runoff generated during a 1,000-year event, it is presumed that the amount of constituents present in the effluent will be in compliance with SPS's operating permit. SPS will continue monitoring, sampling, and record keeping operations as required by their operating permit during a 1,000-year event to maintain compliance with their operating permit and thereby satisfy the requirements of §257.3-3.

It is noted that the Process Waste Pond discharges through Outfall #003, which is regulated by Missouri State Operating Permit MO-0095575. Under the regulating statutes, Chapter 644.076(4) RS MO states that,

> "*The liabilities which shall be imposed pursuant to any provision of sections 644.006 to 644.141 upon persons violating the provisions of sections 644.006 to 644.141 or any standard, rule, limitation, or regulation adopted pursuant thereto shall not be imposed due to any violation caused by an act of God, war, strike, riot, or other catastrophe.*"

The 1,000-year flood is viewed as an "act of God." Even though it was determined that the berms would not be overtopped during the event, the provisions of 644.076(4) are presumed to be applicable.

5.0 RECOMMENDATIONS

The presumed normal operating conditions are: the Bottom Ash Pond operating at an elevation of 318.5 feet; the Settling Pond operating at an elevation of 304.6 feet; and the Process Waste Pond Operating at 303.8 feet. Under these conditions, it was determined that the CCR impoundment and non-CCR impoundments affected by its discharge, have sufficient hydrologic and hydraulic capacity to adequately manage flow during and following the peak discharge from the inflow design flood as required by §257.82(a)(1).

Furthermore, it was also determined that if the valve on the Bottom Ash Pond was closed during the 1,000-year flood event, the Bottom Ash Pond has capacity to store the entire 1,000-year flood event. With the valve completely closed during this event, the Bottom Ash Pond would not discharge flows and the maximum water surface elevation was determined to be approximately 320.4 feet, leaving approximately 1.6 feet of freeboard in the pond.

Additionally, if the Bottom Ash Pond is discharging and all but one of the stop logs were placed in the outlet structure of the Process Waste Pond resulting in an estimate water surface elevation of 306.7 feet, the Process Waste Pond has the hydrologic capacity to manage the 1,000-year flood event. With all the but one of the stop logs in place, the maximum water surface elevation was determined to be approximately 308.92 feet, leaving 0.08 feet of freeboard in the pond.

It is recommended that before or during an anticipated heavy rainfall event (up to a 1,000-year event), the stop logs in the Process Waste Pond be set at an elevation below 306.0 feet to maintain a minimum freeboard of 1+/- feet in the Process Waste Pond.

6.0 PERIODIC PLAN PROCEDURES

As per §257.82(c)(4), the owner or operator must prepare periodic inflow design flood control system plans every five years. The date of completing the initial plan is the basis for establishing the deadline to complete the first periodic plan. The deadline for completing a subsequent plan is based on the date for completing the previous plan. The first periodic plan must be completed on or prior to October 18 in the year 2021, which corresponds to the completion of the initial inflow design flood control plan on October 17, 2016.

7.0 PLAN AMENDMENTS

This Inflow Design Flood Control System Plan will be amended, as per §257.82(c)(2), whenever there is a change in conditions that would substantially affect the written plan in effect, such as modifications to hydraulic structures of the Bottom Ash Pond, additional influents or additional effluents.

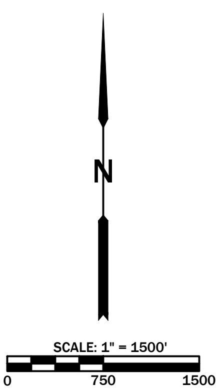
8.0 MISCELLANEOUS REQUIREMENTS

Section 257.82(d) states that SBMU must comply with:

- The recordkeeping requirements specified in 257.105(g);
- The notification requirements specified in 257.106(g); and,
- The Internet requirements specified in 257.107(g).

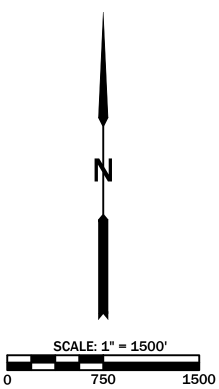
APPENDIX A

Figures



M:\Share\CADDFiles\SIKESTON\POND CLOSURE\INFLOW FLOOD PLAN.dwg, FIGURE 1 - AERIAL VIEW, 10/14/2016 2:22:03 PM

INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN BOTTOM ASH POND SIKESTON POWER STATION	GREDELL Engineering Resources, Inc. ENVIRONMENTAL ENGINEERING LAND - AIR - WATER 1505 East High Street, Jefferson City, Missouri Telephone: (573) 659-9078 Facsimile: (573) 659-9079 MO CORP. ENGINEERING LICENSE NO. E-2001001669-D			
FIGURE 1 - AERIAL VIEW	DATE 10/2016	SCALE AS NOTED	PROJECT NAME SIKESTON	REVISION
	DRAWN AJK	APPROVED TG	FILE NAME INFLOW DESIGN FLOOD CNTRL SYS PLAN	SHEET # 1 OF 1



M:\Share\CADDFiles\SIKESTON\POND CLOSURE\INFLOW FLOOD PLAN.dwg, FIGURE 2 - BOTTOM ASH POND HYDRAULIC STRUCTURES, 10/14/2016 2:22:04 PM

INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
BOTTOM ASH POND
SIKESTON POWER STATION

GREDELL Engineering Resources, Inc.

ENVIRONMENTAL ENGINEERING LAND - AIR - WATER

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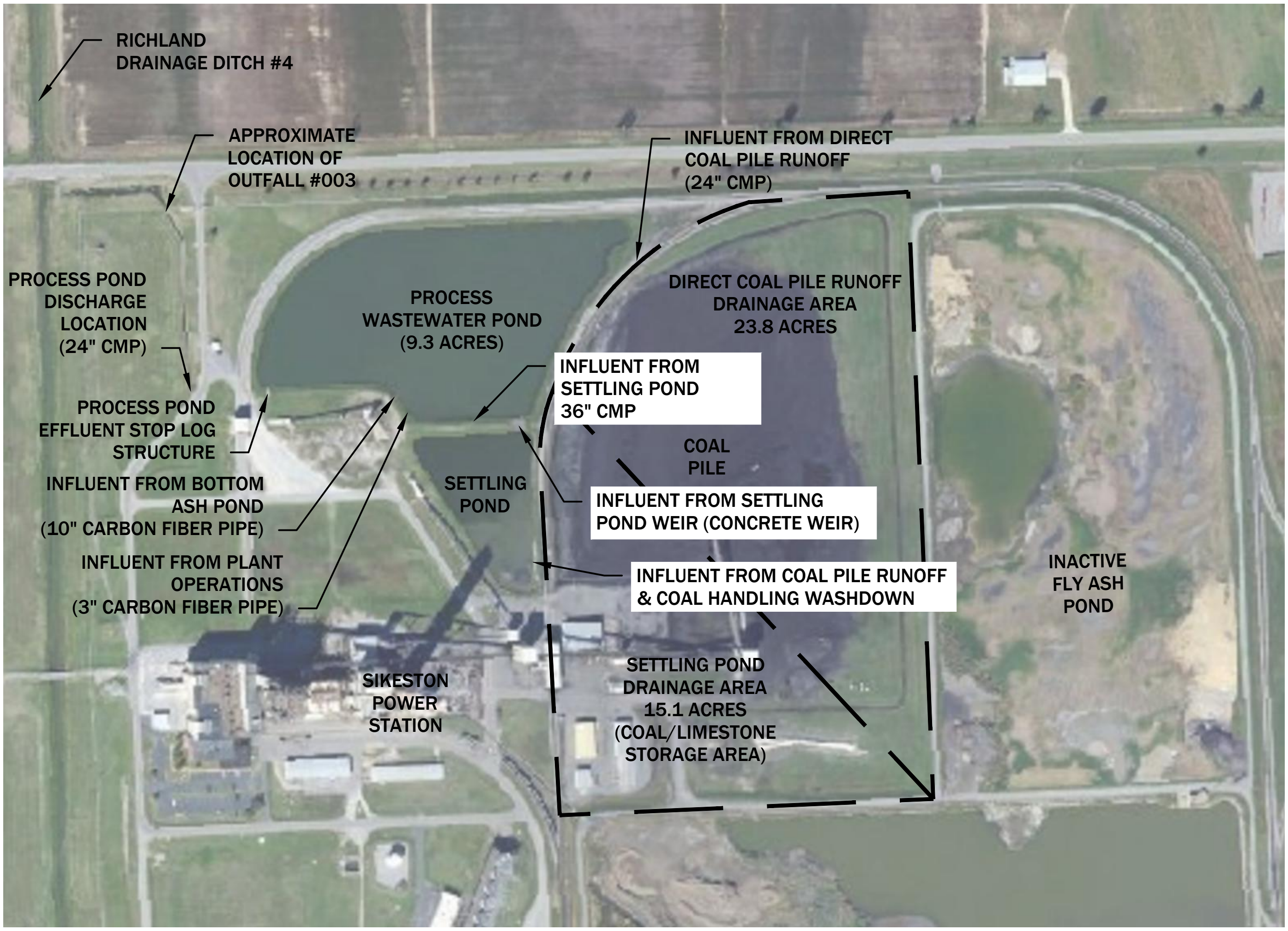
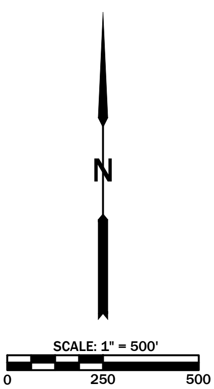
MO CORP. ENGINEERING LICENSE NO. E-2001001669-D

FIGURE 2 - BOTTOM ASH POND HYDRAULIC STRUCTURES

DATE	SCALE	PROJECT NAME	REVISION
10/2016	AS NOTED	SIKESTON	
DRAWN	APPROVED	FILE NAME	SHEET #
AJK	TG	INFLOW DESIGN FLOOD CNTRL SYS PLAN	1 OF 1





M:\Share\CADDFiles\SIKESTON\POND CLOSURE\INFLOW FLOOD PLAN.dwg, FIGURE 3 - PROCESS WASTE POND HYDRAULIC STRUCTURES, 10/14/2016 2:22:04 PM

INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
BOTTOM ASH POND
SIKESTON POWER STATION

FIGURE 3 - PROCESS WASTE POND HYDRAULIC STRUCTURES

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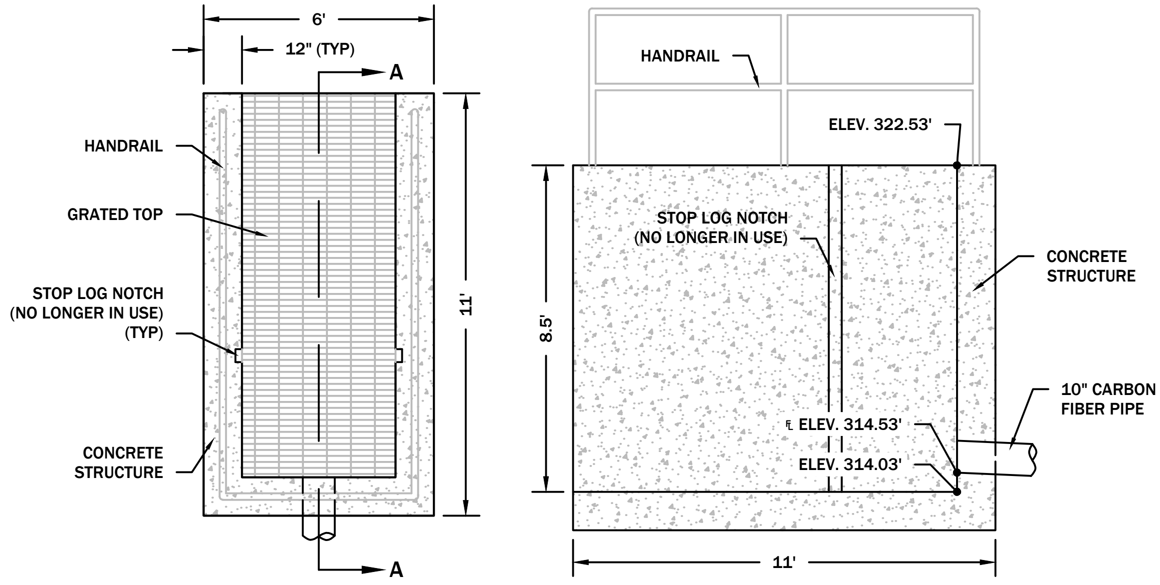
MO CORP. ENGINEERING LICENSE NO. E-2001001669-D

DATE	SCALE	PROJECT NAME	REVISION
10/2016	AS NOTED	SIKESTON	
DRAWN	APPROVED	FILE NAME	SHEET #
AJK	TG	INFLOW DESIGN FLOOD CNTRL SYS PLAN	1 OF 1

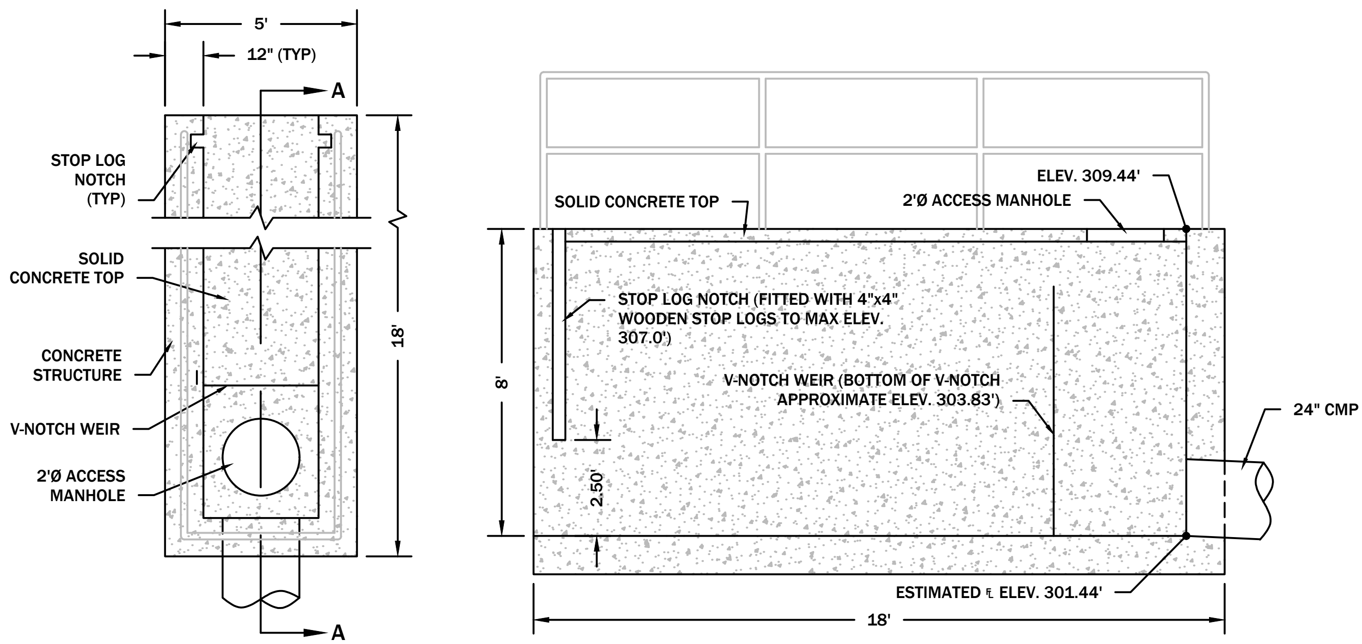


PLAN VIEW

SECTION A-A

BOTTOM ASH POND OUTLET STRUCTURE

SCALE: N.T.S.



PLAN VIEW

SECTION A-A

PROCESS WASTEWATER POND OUTLET STRUCTURE

SCALE: N.T.S.

NOTE:
NO CONSTRUCTION PLANS WERE AVAILABLE FOR THE PROCESS WASTEWATER POND OUTLET STRUCTURE. SCHEMATIC DRAWINGS BASED ON LIMITED SITE OBSERVATIONS & ENGINEERING JUDGEMENT AS MOST OF THE OUTLET WAS SUBMERGED AT THE TIME OF THE SITE VISIT.

INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN BOTTOM ASH POND SIKESTON POWER STATION

GREDELL Engineering Resources, Inc.
ENVIRONMENTAL ENGINEERING LAND - AIR - WATER
1505 East High Street Telephone: (573) 659-9078
Jefferson City, Missouri Facsimile: (573) 659-9079
MO CORP. ENGINEERING LICENSE NO. E-2001001669-D

FIGURE 4 - OUTLET STRUCTURE DETAILS

DATE	SCALE	PROJECT NAME	REVISION
10/2016	AS NOTED	SIKESTON	
DRAWN	APPROVED	FILE NAME	SHEET #
AJK	TG	INFLOW DESIGN FLOOD CNTRL SYS PLAN	1 OF 1

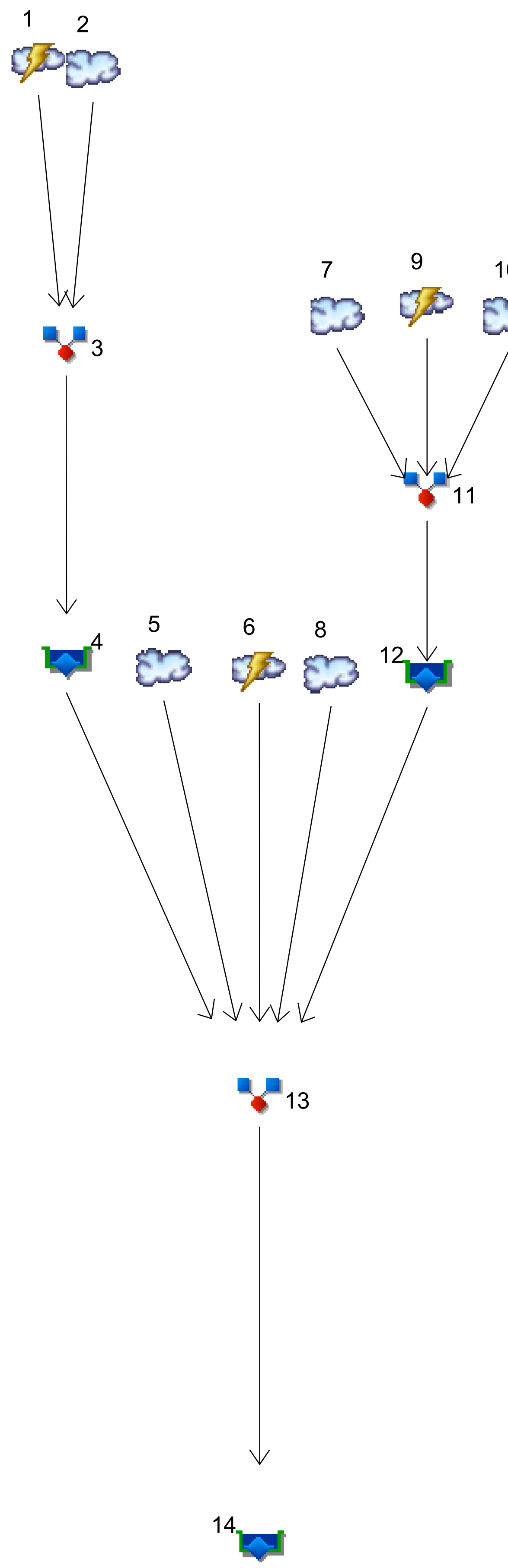
APPENDIX B

Hydroflow Report – 1,000 Year Design Flood

Hydraflow Table of Contents

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5



Legend

Hyd.	Origin	Description
1	Rational	Ash Handling, Oil Sep., and Boiler Tank Inflow
2	SCS Runoff	Bottom Ash Pond Runoff
3	Combine	Combined Bottom Ash Flows
4	Reservoir	Bottom Ash Pond
5	SCS Runoff	Process Pond Runoff
6	Rational	Demineralizer Inflow
7	SCS Runoff	Coal Pile Runoff Settling Pond
8	SCS Runoff	Coal Pile Runoff
9	Rational	Coal Handling Washdown Inflow
10	SCS Runoff	Settling Pond Runoff
11	Combine	Settling Pond Inflow
12	Reservoir	Settling Pong
13	Combine	Process Pond Inflow
14	Reservoir	Process Waste Pond

Project: M:\Share\My Documents\PROJECT - Active\SikestonMunUtil\CCR-2016\Tab 6 Inflow Design Flood Control\Inflow Design 10-17-16.gpw | Monday, 10 / 17 / 2016

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

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	Rational	4.606	1	720	198,973	------	------	------	Ash Handling, Oil Sep., and Boiler Tank Inflow
2	SCS Runoff	962.15	1	717	2,423,501	------	------	------	Bottom Ash Pond Runoff
3	Combine	966.74	1	717	2,622,473	1, 2	------	------	Combined Bottom Ash Flows
4	Reservoir	0.000	1	n/a	0	3	320.36	9,780,210	Bottom Ash Pond
5	SCS Runoff	172.59	1	717	430,476	------	------	------	Process Pond Runoff
6	Rational	0.062	1	720	2,686	------	------	------	Demineralizer Inflow
7	SCS Runoff	135.32	1	725	425,222	------	------	------	Coal Pile Runoff Settling Pond
8	SCS Runoff	194.80	1	727	664,231	------	------	------	Coal Pile Runoff
9	Rational	0.311	1	720	13,428	------	------	------	Coal Handling Washdown Inflow
10	SCS Runoff	42.80	1	717	107,811	------	------	------	Settling Pond Runoff
11	Combine	154.88	1	721	546,461	7, 9, 10	------	------	Settling Pond Inflow
12	Reservoir	77.91	1	736	518,347	11	307.13	850,464	Settling Pong
13	Combine	317.37	1	719	1,888,174	4, 5, 6, 8, 12	------	------	Process Pond Inflow
14	Reservoir	22.57	1	918	1,700,537	13	306.22	3,513,680	Process Waste Pond

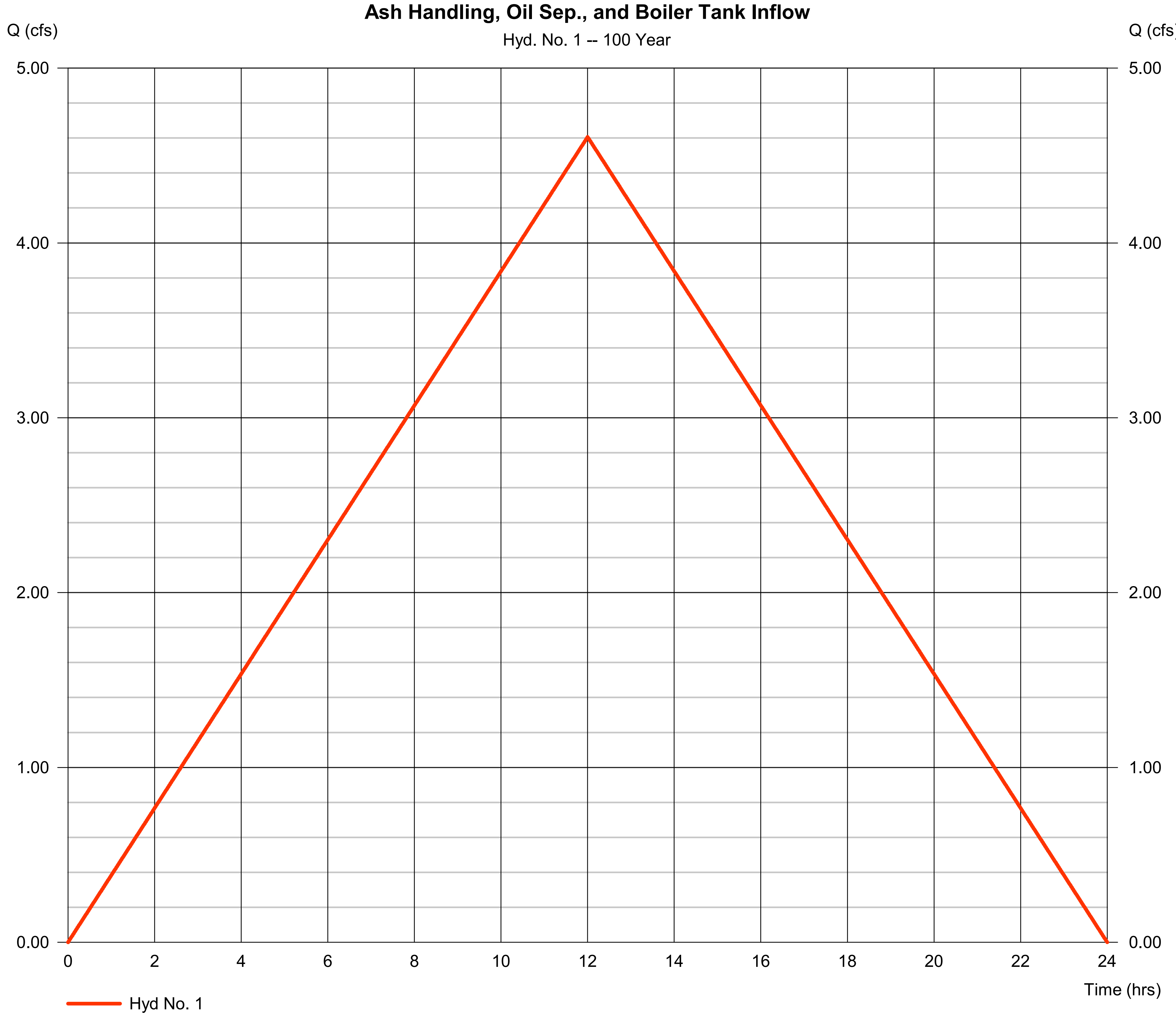
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Monday, 10 / 17 / 2016

Hyd. No. 1

Ash Handling, Oil Sep., and Boiler Tank Inflow

Hydrograph type	= Rational	Peak discharge	= 4.606 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 1 min	Hyd. volume	= 198,973 cuft
Drainage area	= 8.150 ac	Runoff coeff.	= 0.99
Intensity	= 0.571 in/hr	Tc by User	= 720.00 min
IDF Curve	= IDF.IDF	Asc/Rec limb fact	= 1/1



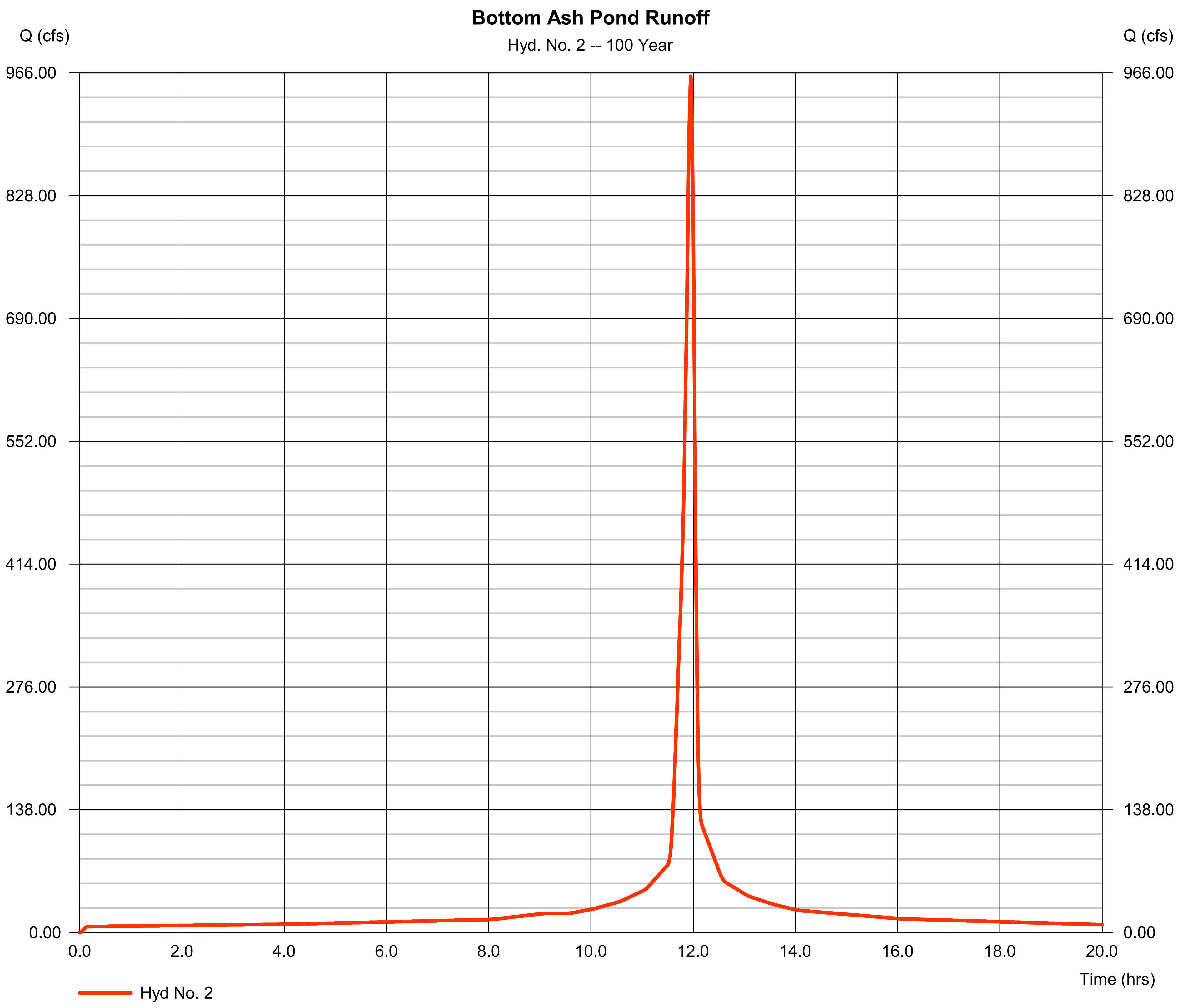
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 — Monday, 10 / 17 / 2016

Hyd. No. 2

Bottom Ash Pond Runoff

Hydrograph type	= SCS Runoff	Peak discharge	= 962.15 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.95 hrs
Time interval	= 1 min	Hyd. volume	= 2,423,501 cuft
Drainage area	= 53.950 ac	Curve number	= 100
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 12.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



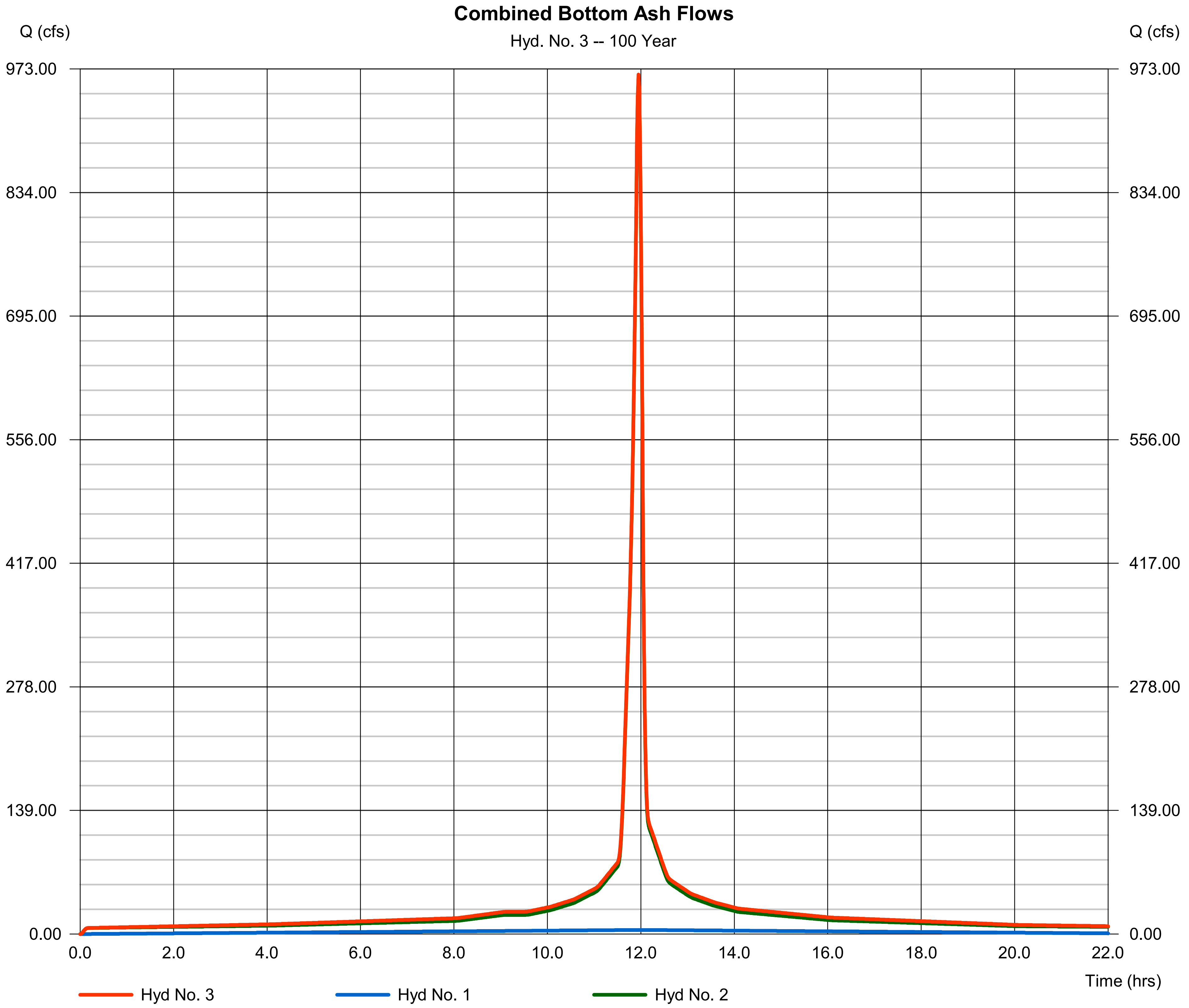
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Monday, 10 / 17 / 2016

Hyd. No. 3

Combined Bottom Ash Flows

Hydrograph type	= Combine	Peak discharge	= 966.74 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.95 hrs
Time interval	= 1 min	Hyd. volume	= 2,622,473 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 62.100 ac



Hydrograph Report

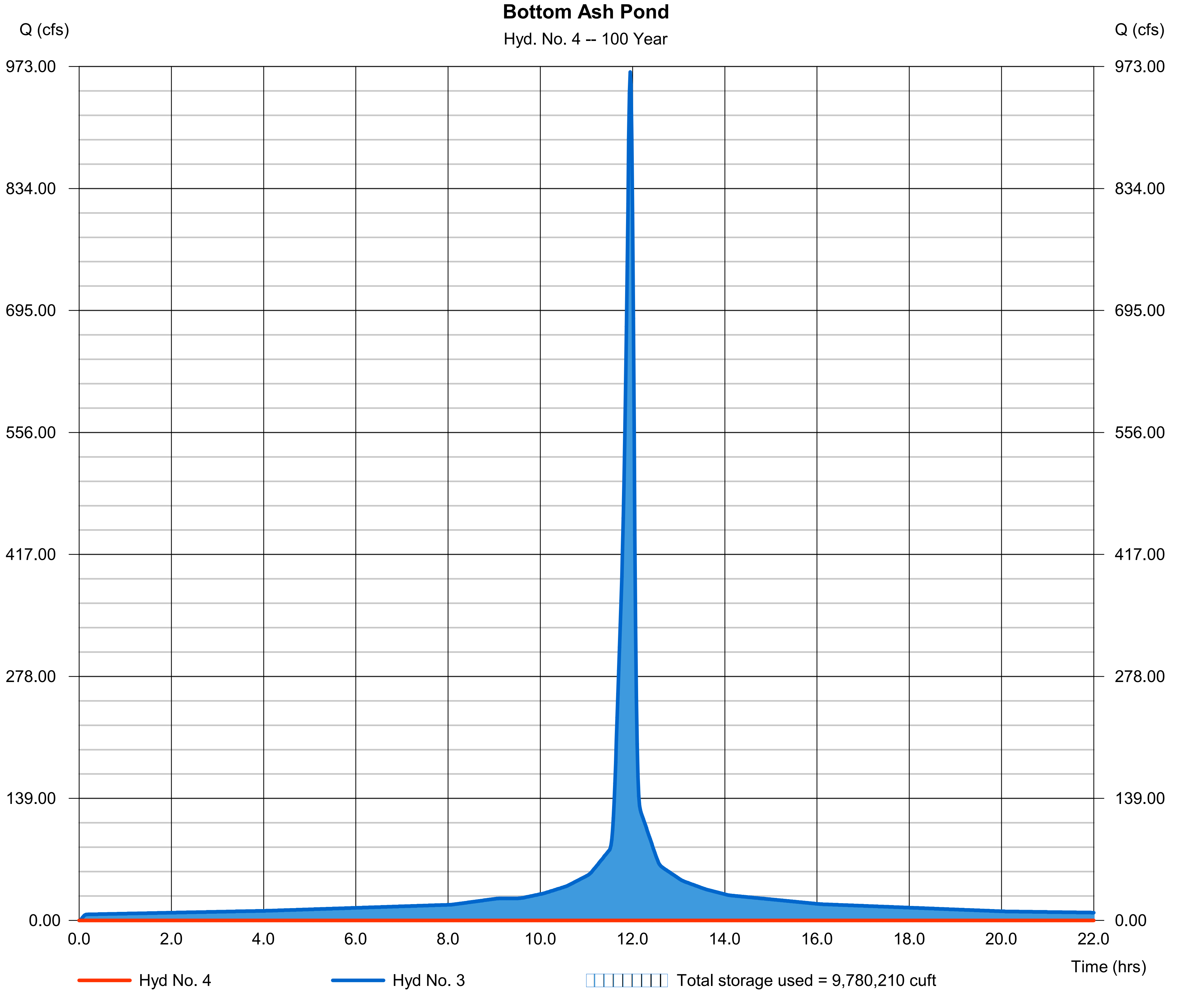
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Monday, 10 / 17 / 2016

Hyd. No. 4

Bottom Ash Pond

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= n/a
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Combined Bottom Ash Flows	Max. Elevation	= 320.36 ft
Reservoir name	= Bottom Ash Pond	Max. Storage	= 9,780,210 cuft

Storage Indication method used. Wet pond routing start elevation = 318.50 ft.



Pond Report

Pond No. 1 - Bottom Ash Pond

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 305.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	305.00	00	0	0
1.00	306.00	500,538	250,269	250,269
2.00	307.00	500,538	500,538	750,807
3.00	308.00	500,538	500,538	1,251,345
4.00	309.00	500,538	500,538	1,751,883
5.00	310.00	500,538	500,538	2,252,421
6.00	311.00	500,538	500,538	2,752,959
7.00	312.00	500,538	500,538	3,253,497
8.00	313.00	500,538	500,538	3,754,035
9.00	314.00	500,538	500,538	4,254,573
10.00	315.00	500,538	500,538	4,755,111
11.00	316.00	530,032	515,285	5,270,396
12.00	317.00	657,511	593,772	5,864,168
13.00	318.00	897,070	777,290	6,641,458
14.00	319.00	1,168,041	1,032,556	7,674,014
15.00	320.00	1,635,975	1,402,008	9,076,022
16.00	321.00	2,256,627	1,946,298	11,022,320
17.00	322.00	2,349,932	2,303,280	13,325,600

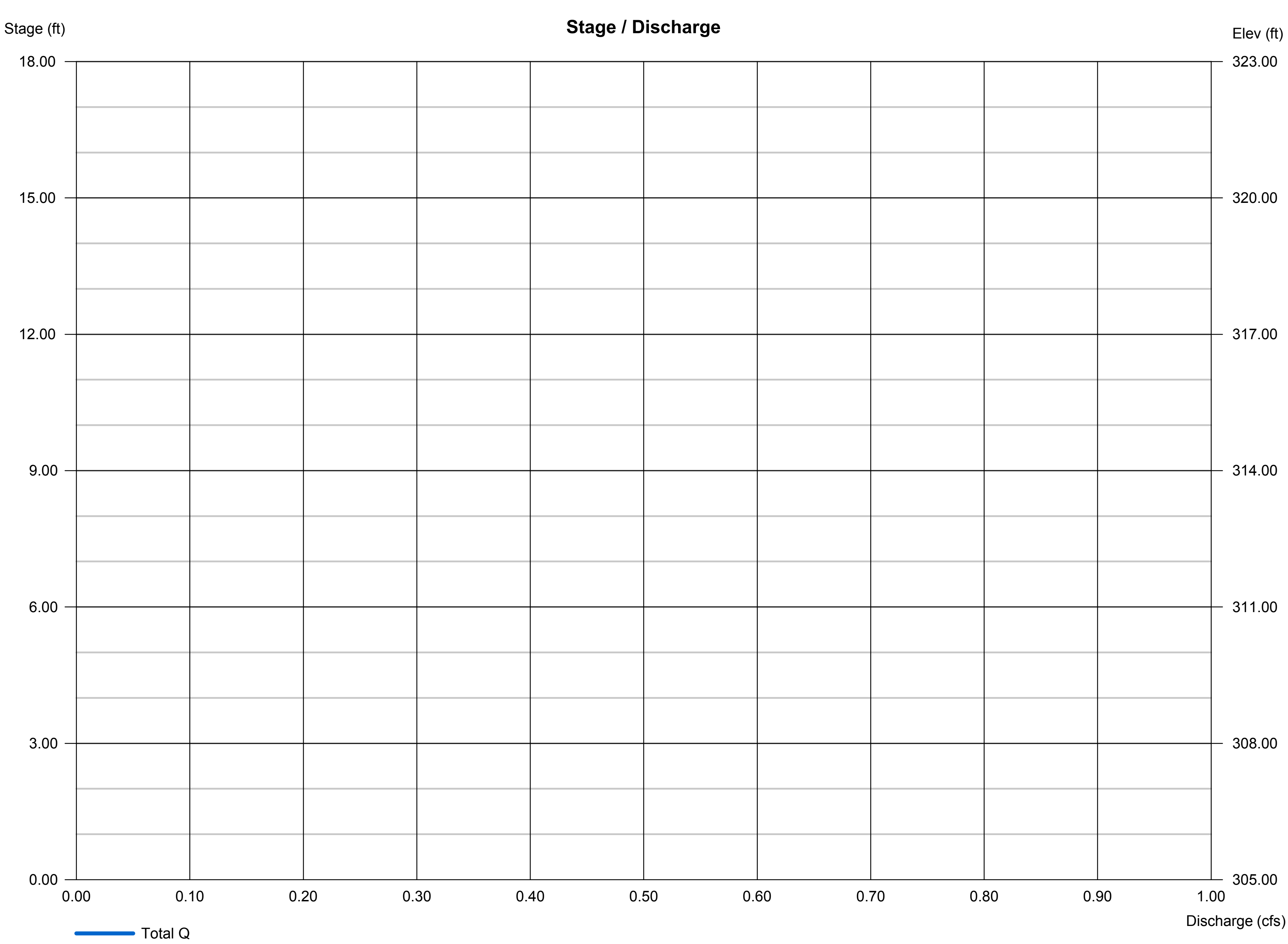
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 10.00	0.00	0.00	0.00
Span (in)	= 10.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 314.53	0.00	0.00	0.00
Length (ft)	= 1900.00	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	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 322.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 307.00			

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



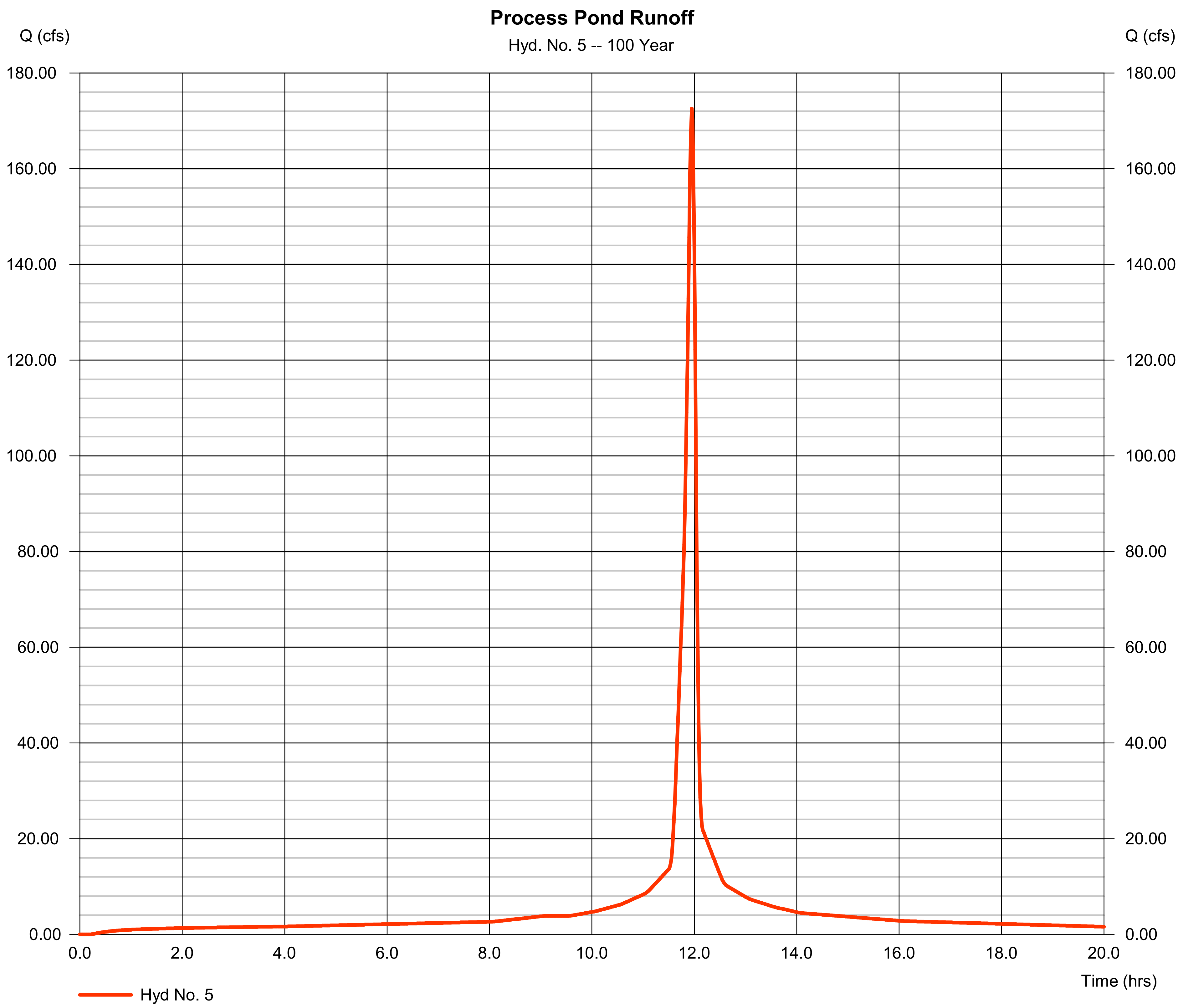
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 | Monday, 10 / 17 / 2016

Hyd. No. 5

Process Pond Runoff

Hydrograph type	= SCS Runoff	Peak discharge	= 172.59 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.95 hrs
Time interval	= 1 min	Hyd. volume	= 430,476 cuft
Drainage area	= 9.680 ac	Curve number	= 99
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 12.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

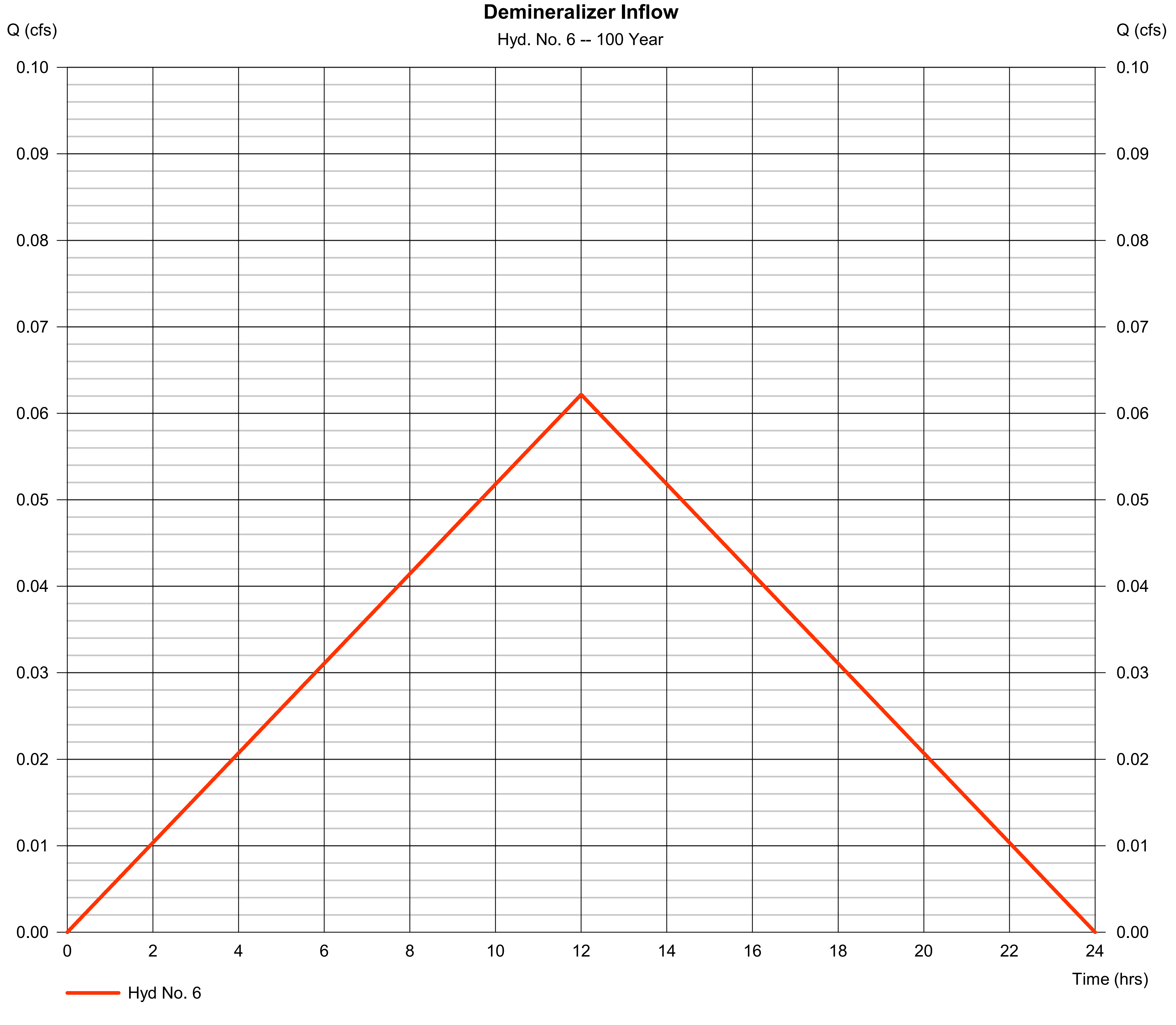


Hydrograph Report

Hyd. No. 6

Demineralizer Inflow

Hydrograph type	= Rational	Peak discharge	= 0.062 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 1 min	Hyd. volume	= 2,686 cuft
Drainage area	= 0.110 ac	Runoff coeff.	= 0.99
Intensity	= 0.571 in/hr	Tc by User	= 720.00 min
IDF Curve	= IDF.IDF	Asc/Rec limb fact	= 1/1



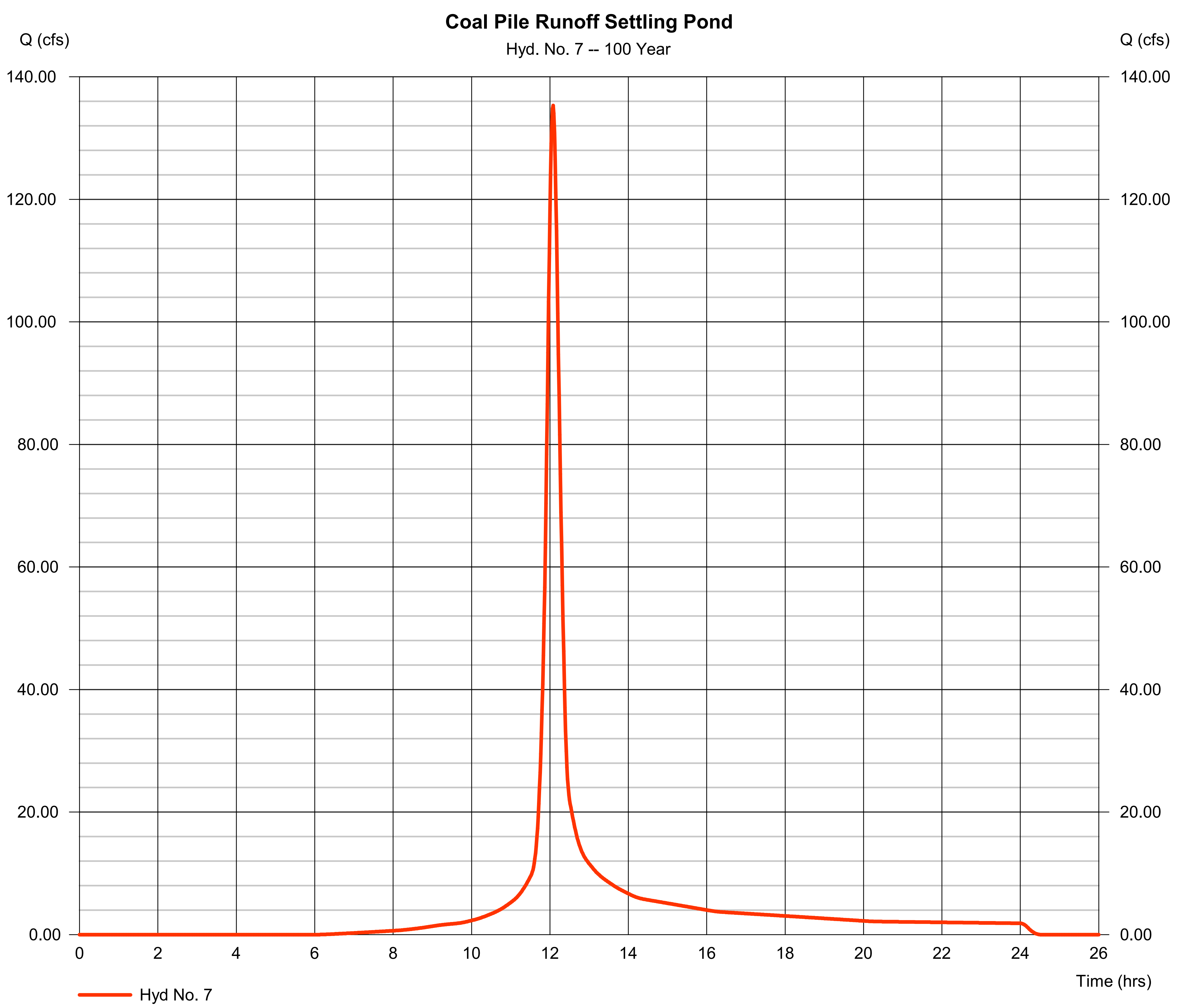
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 — Monday, 10 / 17 / 2016

Hyd. No. 7

Coal Pile Runoff Settling Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 135.32 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.08 hrs
Time interval	= 1 min	Hyd. volume	= 425,222 cuft
Drainage area	= 15.100 ac	Curve number	= 68
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 19.00 min
Total precip.	= 12.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

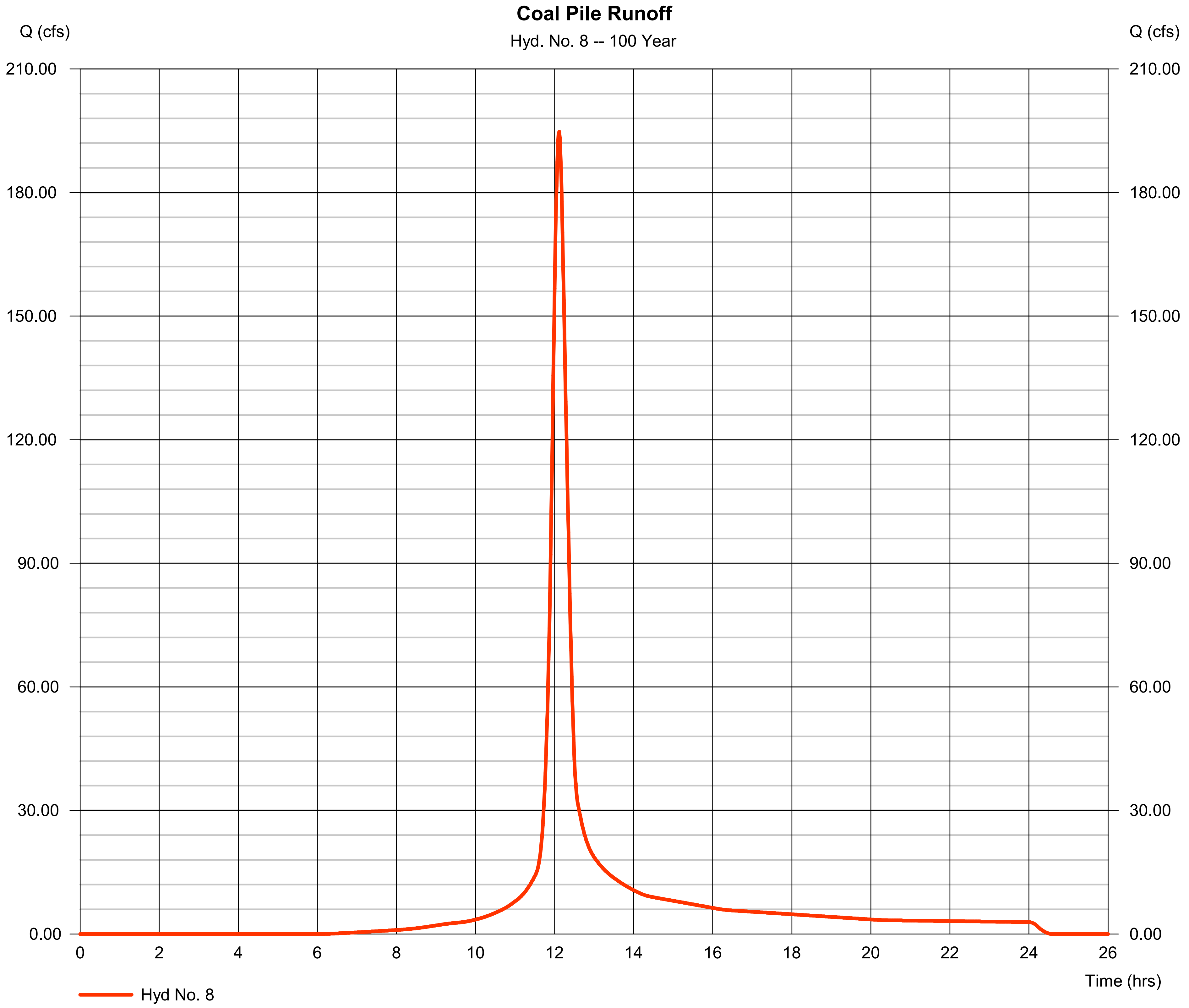


Hydrograph Report

Hyd. No. 8

Coal Pile Runoff

Hydrograph type	= SCS Runoff	Peak discharge	= 194.80 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.12 hrs
Time interval	= 1 min	Hyd. volume	= 664,231 cuft
Drainage area	= 23.800 ac	Curve number	= 68
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 23.00 min
Total precip.	= 12.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



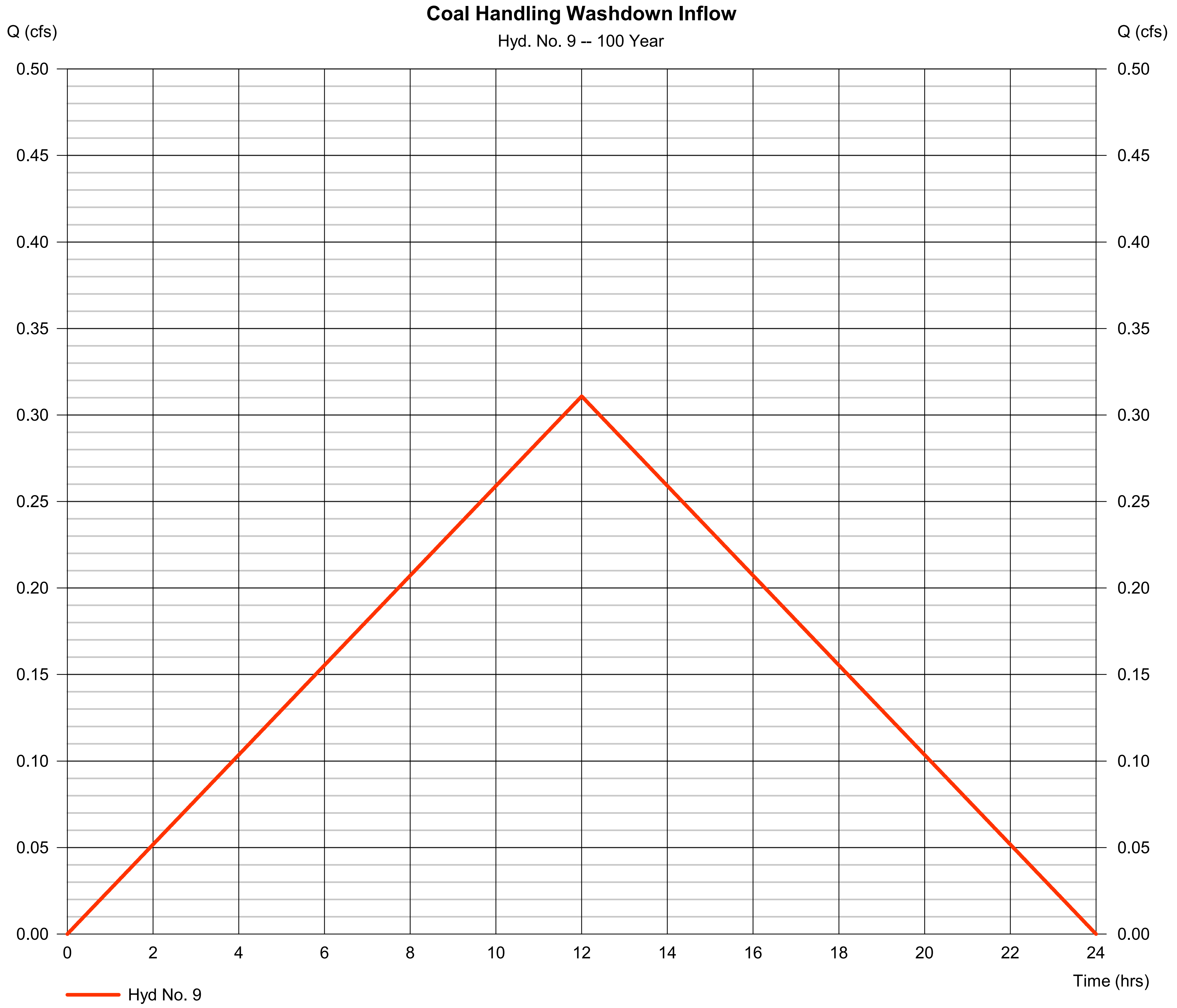
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Monday, 10 / 17 / 2016

Hyd. No. 9

Coal Handling Washdown Inflow

Hydrograph type	= Rational	Peak discharge	= 0.311 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 1 min	Hyd. volume	= 13,428 cuft
Drainage area	= 0.550 ac	Runoff coeff.	= 0.99
Intensity	= 0.571 in/hr	Tc by User	= 720.00 min
IDF Curve	= IDF.IDF	Asc/Rec limb fact	= 1/1



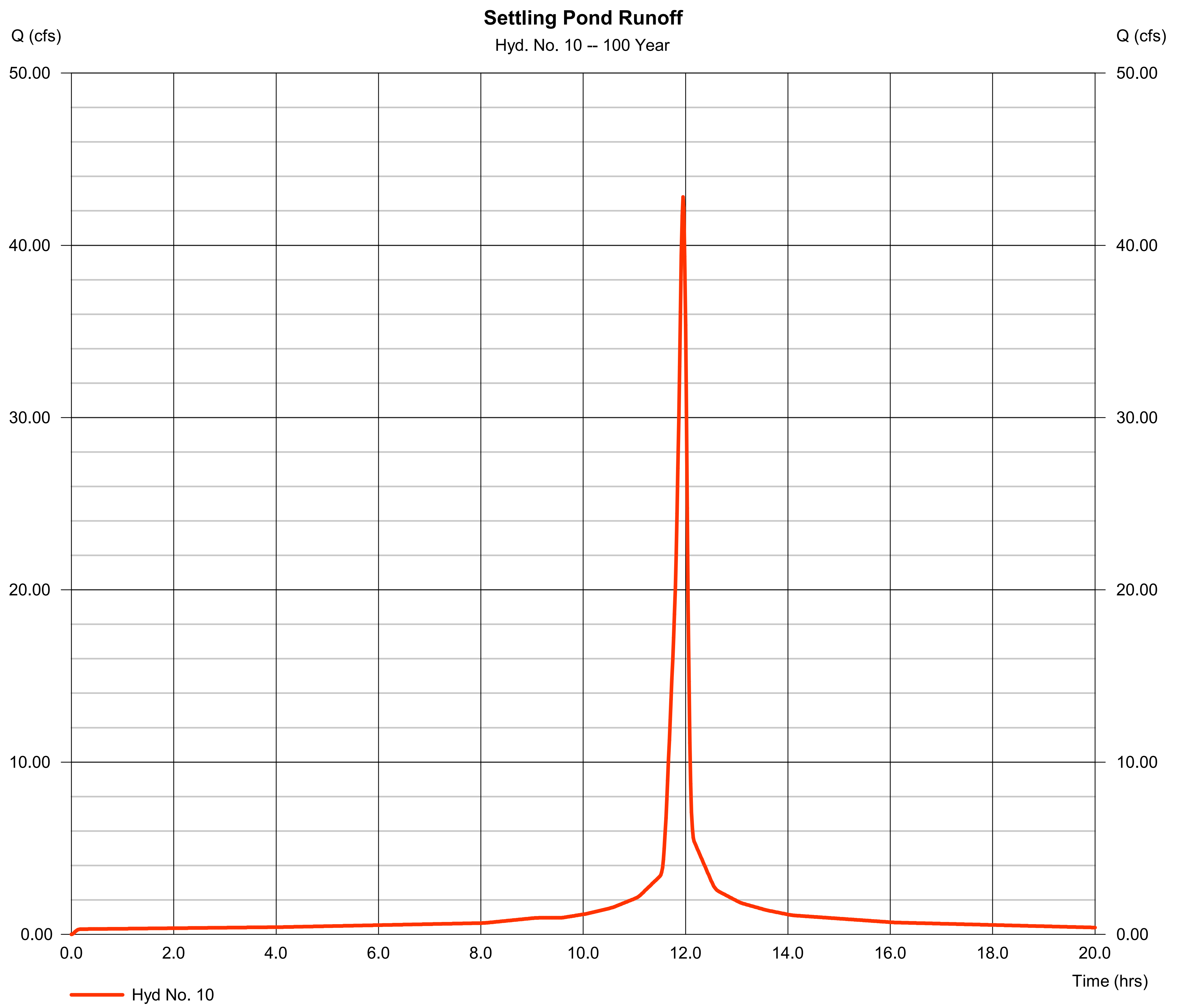
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Monday, 10 / 17 / 2016

Hyd. No. 10

Settling Pond Runoff

Hydrograph type	= SCS Runoff	Peak discharge	= 42.80 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.95 hrs
Time interval	= 1 min	Hyd. volume	= 107,811 cuft
Drainage area	= 2.400 ac	Curve number	= 100
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 12.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



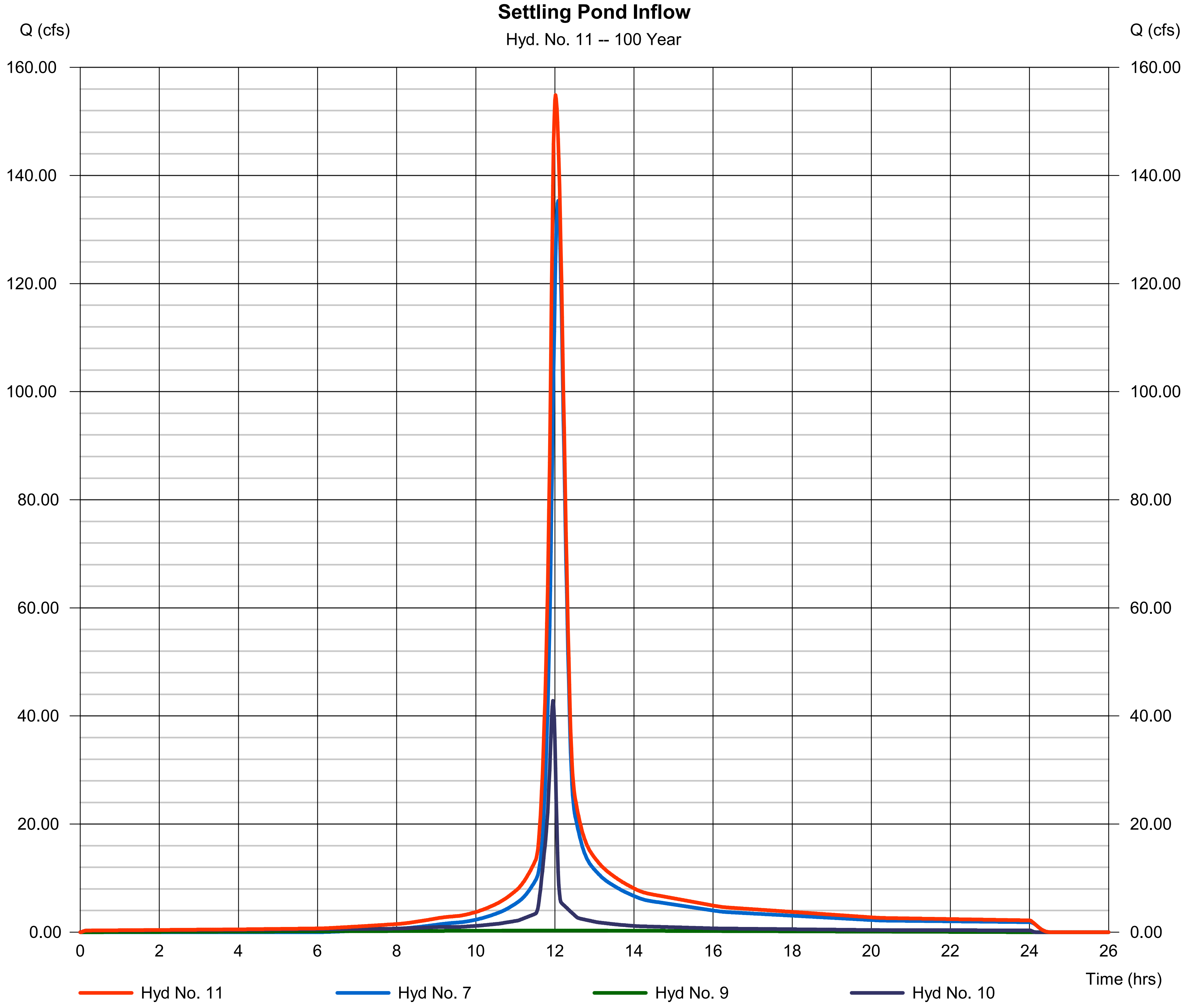
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Monday, 10 / 17 / 2016

Hyd. No. 11

Settling Pond Inflow

Hydrograph type	= Combine	Peak discharge	= 154.88 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.02 hrs
Time interval	= 1 min	Hyd. volume	= 546,461 cuft
Inflow hyds.	= 7, 9, 10	Contrib. drain. area	= 18.050 ac



Hydrograph Report

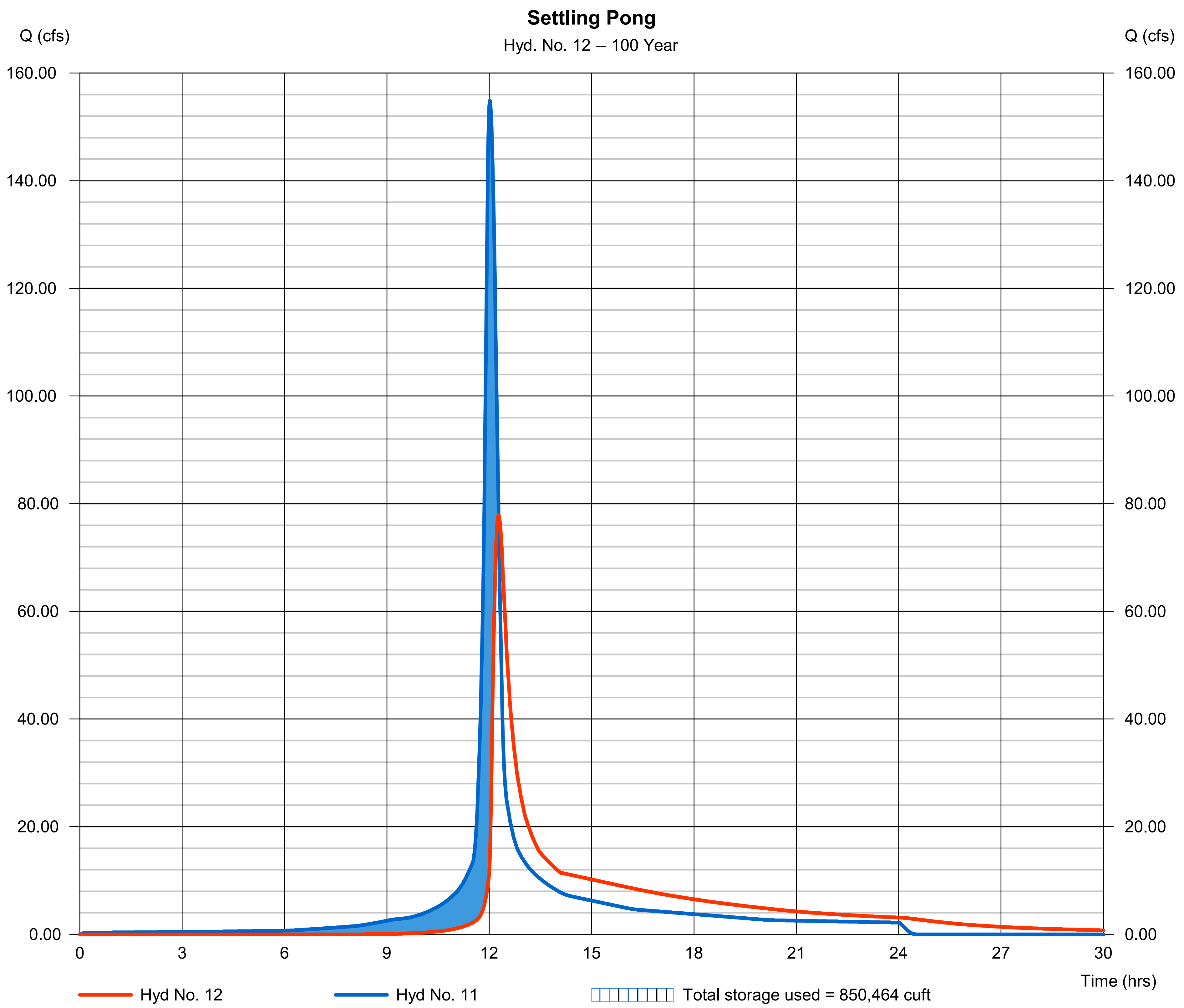
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Monday, 10 / 17 / 2016

Hyd. No. 12

Settling Pong

Hydrograph type	= Reservoir	Peak discharge	= 77.91 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 1 min	Hyd. volume	= 518,347 cuft
Inflow hyd. No.	= 11 - Settling Pond Inflow	Max. Elevation	= 307.13 ft
Reservoir name	= Settling Pond	Max. Storage	= 850,464 cuft

Storage Indication method used. Wet pond routing start elevation = 304.60 ft.



Pond Report

Pond No. 3 - Settling Pond

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 297.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	297.00	70,300	0	0
1.00	298.00	72,800	71,550	71,550
2.00	299.00	75,400	74,100	145,650
3.00	300.00	78,100	76,750	222,400
4.00	301.00	80,800	79,450	301,850
5.00	302.00	83,600	82,200	384,050
6.00	303.00	86,400	85,000	469,050
7.00	304.00	89,200	87,800	556,850
8.00	305.00	92,100	90,650	647,500
9.00	306.00	95,000	93,550	741,050
10.00	307.00	98,000	96,500	837,550
11.00	308.00	101,000	99,500	937,050
12.00	309.00	104,100	102,550	1,039,600

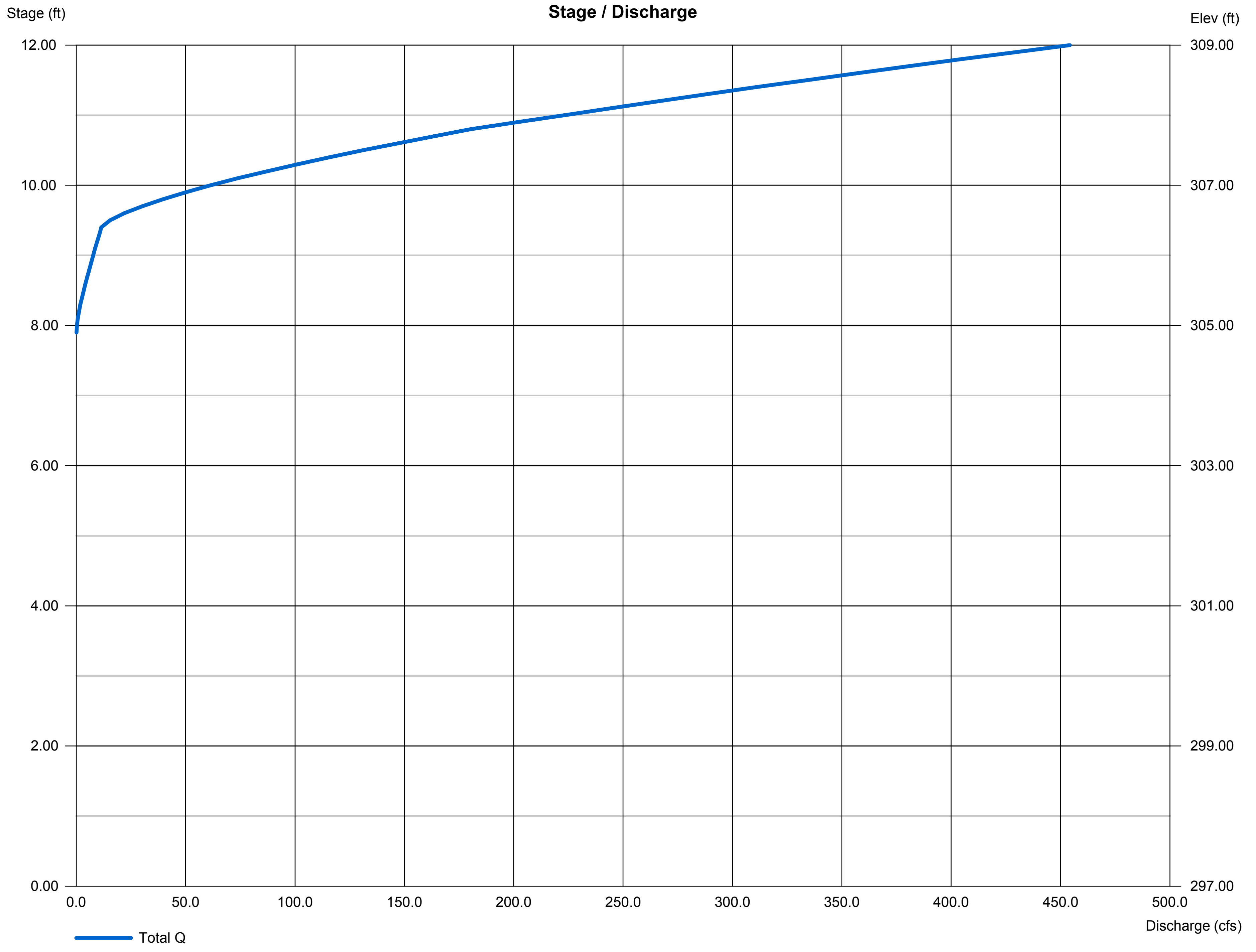
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	0.00	0.00	0.00
Span (in)	= 36.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 304.80	0.00	0.00	0.00
Length (ft)	= 41.00	0.00	0.00	0.00
Slope (%)	= 0.60	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 37.00	0.00	0.00	0.00
Crest El. (ft)	= 306.40	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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

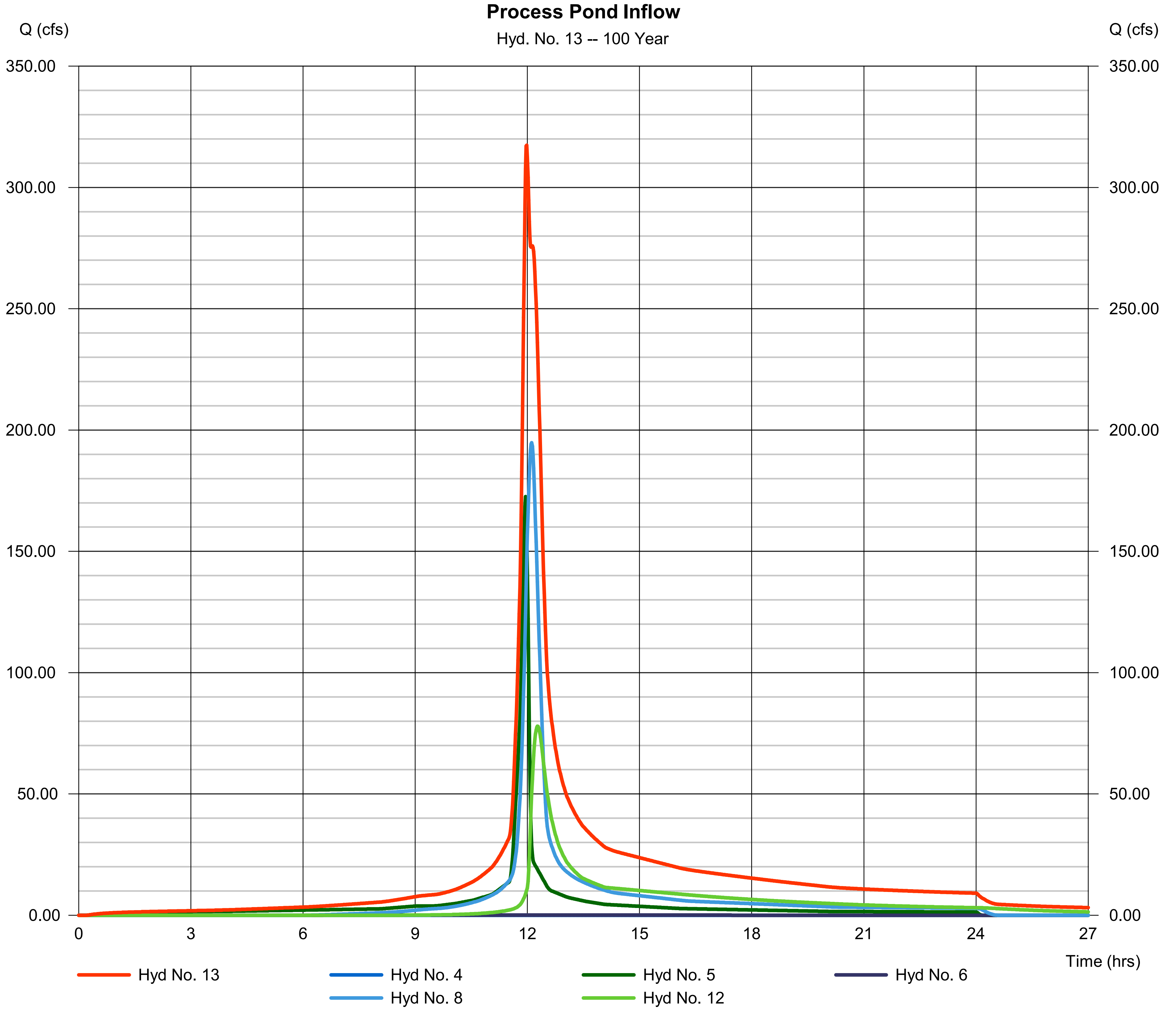


Hydrograph Report

Hyd. No. 13

Process Pond Inflow

Hydrograph type	= Combine	Peak discharge	= 317.37 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.98 hrs
Time interval	= 1 min	Hyd. volume	= 1,888,174 cuft
Inflow hyds.	= 4, 5, 6, 8, 12	Contrib. drain. area	= 33.590 ac



Hydrograph Report

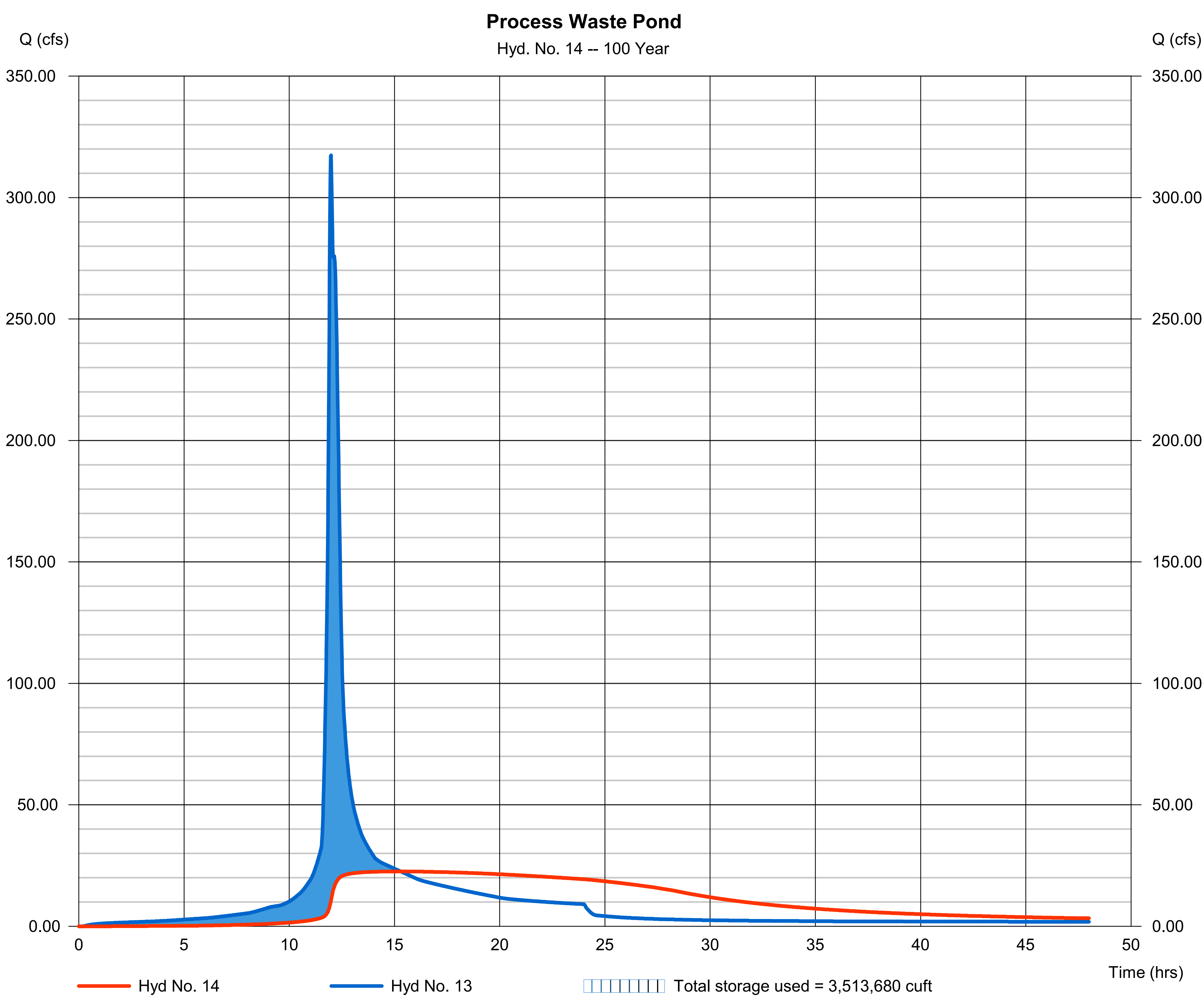
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 — Monday, 10 / 17 / 2016

Hyd. No. 14

Process Waste Pond

Hydrograph type	= Reservoir	Peak discharge	= 22.57 cfs
Storm frequency	= 100 yrs	Time to peak	= 15.30 hrs
Time interval	= 1 min	Hyd. volume	= 1,700,537 cuft
Inflow hyd. No.	= 13 - Process Pond Inflow	Max. Elevation	= 306.22 ft
Reservoir name	= Process Waste Pond	Max. Storage	= 3,513,680 cuft

Storage Indication method used. Wet pond routing start elevation = 303.80 ft.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5 Monday, 10 / 17 / 2016

Pond No. 2 - Process Waste Pond

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 297.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	297.00	356,500	0	0
1.00	298.00	361,700	359,100	359,100
2.00	299.00	367,000	364,350	723,450
3.00	300.00	372,400	369,700	1,093,150
4.00	301.00	377,700	375,050	1,468,200
5.00	302.00	383,100	380,400	1,848,600
6.00	303.00	388,600	385,850	2,234,450
7.00	304.00	394,000	391,300	2,625,750
8.00	305.00	399,500	396,750	3,022,500
9.00	306.00	405,000	402,250	3,424,750
10.00	307.00	410,500	407,750	3,832,500
11.00	308.00	416,100	413,300	4,245,800
12.00	309.00	421,700	418,900	4,664,700

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 301.44	0.00	0.00	0.00
Length (ft)	= 230.00	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	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.00	0.00	0.00	0.00
Crest El. (ft)	= 303.80	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 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).