

INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN - Amended

WEC Temporary Ash Disposal Area

Public Power Generation Agency and
City of Hastings Utilities

Hastings, Nebraska

December 30, 2025



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Inflow Design Flood Control System Plan

40 CFR §257.82(c)

WEC Temporary Ash Disposal Area

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1. Introduction and Purpose

On April 17, 2015 the U.S. Environmental Protection Agency (EPA) issued the final rule for the regulation and management of coal combustion residuals (CCR) under Subtitle D of the Resource Conservation and Recovery Act (RCRA) [40 CFR Part 257, Subpart D]. The rule – effective on October 19, 2015 – and as amended, applies to the WEC Ash Disposal Area which is considered an existing CCR surface impoundment.

CCR Rule 40 CFR §257.82 requires that owners or operators of a CCR surface impoundment must design, construct, operate, and maintain an inflow design flood control system per the requirements below:

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 requirement 3 below);
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 requirement 3 below);
3. The existing WEC Temporary Ash Disposal Area is not fully incised and thereby considered a low hazard potential CCR surface impoundment. Thus, the WEC Temporary Ash Disposal Area and surrounding areas that drain to the impoundment must be modelled using the 100-year, 24-hour storm event.

The requirements also include review and update every five years of the initial Inflow Design Flood Control System Plan which evaluates the inflow design flood control system for active CCR surface impoundments. This amended Inflow Design Flood Control System Plan presented herein addresses the specific requirements of 40 CFR §257.82(c)(1).

2. Facility Description

The Whelan Energy Center located near Hastings, Nebraska, has two coal fired electric generating units. WEC Units 1 and 2 have current net capacity ratings of 76 megawatts and 220 megawatts, respectively. Figure 1 provides the location of WEC relative to City of Hastings, Nebraska (see figures in Attachment 1). The City of Hastings Utilities Department, Hastings, Nebraska (Hastings) is the owner and operator of WEC Unit 1 (WEC1) and the operating agent of WEC Unit 2 (WEC2) for Public Power Generation Agency (PPGA). The WEC Temporary Ash Disposal Area, located at WEC, is permitted under the Nebraska Department of Water, Energy, and Environment (DWEE) [formerly the Nebraska Department of Environment and Energy (NDEE) and formerly the Nebraska Department of Environmental Quality (NDEQ)] Title 132 – Integrated Solid Waste Management Regulations. Original Title 132 permitting efforts began in 1999 pursuant to then NDEQ requirements. The federal CCR rule – effective on October 19, 2015 – and as subsequently amended, applies to the WEC Temporary Ash Disposal Area.

The WEC Temporary Ash Disposal Area is currently categorized as an existing CCR surface impoundment of approximately 23.2 acres in size that historically received CCR for disposal/storage and is permitted with the State of Nebraska (Permit No. NE0204129, Facility ID 58048). During 2023, approximately 6 acres of the northeast quadrant was retrofitted with a composite liner, complying with the federal CCR rule and NDEE Title 132 regulations, for a landfill cell and leachate pond. Retrofit activities included CCR removal and liner construction (August 9, 2023, to December 21, 2023), Construction Quality Assurance (CQA)



documentation report submittal to NDEE (January 24, 2024), NDEE reviews, and NDEE approval letter of the CQA documentation report (June 18, 2024). With this retrofit, the permitted WEC Temporary Ash Disposal Area has both a lined CCR landfill area and older unlined areas of the CCR surface impoundment. The CCR landfill consists of an approximate 4-acre cell with composite liner and a 1.5-acre lined leachate pond, plus surrounding berms. The remaining area of existing CCR surface impoundment is approximately 17.2 acres.

The WEC Temporary Ash Disposal Area historically received CCR in sluiced and dry form for storage prior to removal for beneficial uses. CCR sluicing and disposal at this site began in 1981, the same year that WEC1 began commercial operation. The disposal area was constructed as an ash pond to provide storage for ash, sluice water, and other process waters with option to recycle water back to the WEC. Due to ash pond size and evaporation, recycling water back to the plant did not occur. Over time, other process waters such as cooling tower blowdown was redirected away from the WEC Temporary Ash Disposal Area. With start-up of WEC2, commercial operations on May 1, 2011, scrubber ash was sluiced to the East Area and fly ash was periodically sluiced to the West Area. Sluicing of scrubber ash ended in 2013 after a pug mill was installed to load trucks with moistened scrubber ash for hauling and placement within the East Area of the WEC Temporary Ash Disposal Area. Since retrofit liner construction was completed in 2023 and approved by DWEE, CCR generation of scrubber ash, bottom ash, and if needed fly ash, is hauled to the landfill cell for temporary stockpiling and storage prior to removal for beneficial use off-site. Since August 2024, bottom ash is hauled to the new concrete lined bottom ash bunker for stockpiling prior to removal for beneficial use. Figure 2 in Attachment 1 shows the locations of the plant, supporting facilities, WEC Temporary Ash Disposal Area, bottom ash bunker, and groundwater monitoring wells.

2.1. Site Location

The legal description of the Whelan Energy Center site is as follows: “The North Half of Section 14, Township 7 North, Range 9 West in Adams County, Nebraska, containing 320 acres more or less.” The Site is approximately 2 miles east of Hastings, Nebraska, on Highway 6.

The site includes the WEC generating station, electric substation, WEC Temporary Ash Disposal Area, bottom ash bunker, farming operations, and a train car repair facility. The current disposal area footprint of the permitted WEC Temporary Ash Disposal Area is approximately 23.2 acres located along the west property boundary.

2.2. Site Description

The regional and site-specific topography is generally level. On the WEC site, moderately sloping elevations vary up to about 15 feet. The unlined portion of the WEC Temporary Ash Disposal Area has a base elevation within in-situ lean clay material of Peoria loess with permeability of approximately 10^{-4} to 10^{-8} cm/sec (HDR 2006). Three sides of the WEC Temporary Ash Disposal Area are incised. The only embankment that extends above the natural ground is the south embankment.

The south embankment has a top perimeter road design elevation of 1898 feet above mean sea level (MSL) (1927 NGVD), sloping at approximate 4:1 horizontal to vertical to natural ground elevation of 1890 feet MSL. Immediately south and bordering the south embankment is the Leachate Retention Pond and Surge Pond as shown on Figure 2 in Attachment 1.

3. Hydrologic and Hydraulic Analysis

The WEC Temporary Ash Disposal Area has had hydrologic and hydraulic analysis for the ash sluice flows from both WEC1 and WEC2 and sizing of outlet structures for the 25-year, 24-hour storm event as historically required by DWEE. These calculations are contained in Appendix M of the Title 132 Permit Renewal Application (HDR 2021). The CCR Rule requires a CCR surface impoundment with low hazard potential to model the potential impacts of stormwater during a 100-year, 24-hour storm event.

The hydraulic analysis completed in year 2020 for the initial Inflow Design Flood Control System Plan included preparation of a surface water model using Hydraflow for Autodesk Civil 3D to determine whether the existing areas of the WEC Temporary Ash Disposal Area and/or the outfalls are enough to manage inflow from the 100-year, 24-hour storm event. The modeling (Attachment 2) was completed by HDR based on the best available information provided by Hastings and contained within the Title 132 Permit Renewal Application. A review of updated data inputs shows the completed modeling represents a scenario more conservative than the current conditions.

3.1. CCR Surface Impoundment Description

The legal description of the Whelan Energy Center site is as follows: “The North Half of Section 14, Township 7 North, Range 9 West in Adams County, Nebraska, containing 320 acres more or less.” The Site is approximately 2 miles east of Hastings, Nebraska, on Highway 6. The site includes the WEC generating station, electric substation, WEC Temporary Ash Disposal Area, bottom ash bunker, farming operations, and a train car repair facility.

The current disposal area footprint of the WEC Temporary Ash Disposal Area is approximately 23.2 acres located along the west property boundary. Previously sluiced pond ash and dry scrubber ash, along with bottom ash, were separated in the WEC Temporary Ash Disposal Area by an interior management berm created from pond ash. This created a West Area and East Area, respectively, as shown in Figure 2 (Attachment 1). Although the dry and previously sluiced CCR waste streams are separated within the WEC Temporary Ash Disposal Area, the entire area is permitted with DWEE as a fossil fuel combustion ash disposal area and treated as one CCR unit.

The recent retrofit to composite lined landfill cell and leachate pond within the East Area further keeps new CCR generation and stormwater run-off contained. Only the West Area had operated as a CCR surface impoundment. WEC1 recently terminated sluicing of fly ash in early November 2025. Thus, addition of liquids and impounded liquids in the WEC Temporary Ash Disposal Area have been significantly reduced.

3.2. Existing Inflow/Outflow Design Flood Controls

WEC1 no longer sluices CCR into the West Area of the existing WEC Temporary Ash Disposal Area. Currently the only liquids continuing discharge into the north side of the West Area is WEC2 bottom ash submerged chain conveyor (SCC) forwarding tank overflow and WEC1 service water during bottom ash hopper flushing at total approximate flows of 24,000 gallons per day, as provided by Hastings. These flows may have de minimis ash from contact and volume is significantly less than the prior WEC1 CCR flows of approximately 400,000 gallons per day. The ash marketer continues to manage the routing of CCR, water flows and excavation of pond ash within the permitted limits of the disposal area.

In 2007, riser/spillway structures and the Leachate Retention Pond were constructed to transfer water from the WEC Temporary Ash Disposal Area. These structures were required by then NDEQ (now DWEE) in order to maintain the depth of leachate within the disposal area at a depth of approximately 12 to 14 inches or less under normal operations during a 25-year, 24-hour storm event. Ash sluice was directed to flow southward for settlement of ash sediment while the free liquids generally flow along the surface. The free liquids then either drained by gravity to a clear area surrounding the risers or pumped directly into the Leachate Retention Pond with a portable pump and piping. Spillway invert elevations are shown on Figure 3 in Attachment 1.

With further operational changes within the plant and ash management, the riser/spillway structures have not been regularly used for several years.

- East Area risers and spillways – Discontinued use in 2013 when pug mill installed on scrubber ash silo for loading direct into dump trucks, hauled and placed within the East Area of the WEC Temporary Ash Disposal Area.
- West Area risers and spillways – Discontinued use in 2015 when operations began using a pump, float and flexible pipe to pump free liquids to the Leachate Retention Pond. Operations began periodically pumping water into the West Area risers and spillways area as needed to avoid piping across road and monitor water levels in Leachate Retention Pond to maintain capacity.

Pumping water from the West Area into the riser/spillway area or directly into the Leachate Retention Pond has been periodic since 2016 due to significant reductions in water use for WEC1 ash sluice pipe flushing and pond evaporation. Water in the Leachate Retention Pond either evaporates or is used for CCR dust control within the permitted boundaries of the WEC Temporary Ash Disposal Area. Although the Leachate Retention Pond is seasonally dry, surface water modeling described in Section 3.3 used the normal pool depths. The inlets and outlets for the West Area of the WEC Temporary Ash Disposal Area are further described below.

3.2.1. Inlets

The West Area of the WEC Temporary Ash Disposal Area had received ash sluice via two (2) force mains with approximate invert elevations of 1897.2 to 1898.1 feet MSL. WEC1 fly ash and bottom ash sluice daily flow was approximately 400,000 gallons per day or 0.62 cubic feet per second (cfs) when the WEC1 was operational. WEC1 has not sluiced bottom ash since spring 2024. WEC1 no longer sluices fly ash as of early November 2025. WEC2 has not sluiced fly ash for many years.

WEC2 bottom ash SCC forwarding tank overflow and WEC1 service water during bottom ash hopper flushing are periodically pumped to the West Area of the WEC Temporary Ash Disposal Area. These flows add up to approximately 24,000 gallons per day or 0.037 cfs when WEC1 and WEC2 are operational. Planned plant work during 2026 includes recirculating and diverting these flows from discharge.

Some surface water run-on occurs from the north side into the WEC Temporary Ash Disposal Area. The north drainage area is estimated to be approximately 4.7 acres as shown on the drainage maps in Attachment 2. During a 100-year storm event the peak runoff flow into the West Area is 46.8 cfs.

3.2.2. Outlets

The outlets from the WEC Temporary Ash Disposal Area had been the CMP outlet risers and spillways located on the south end. The outlet risers are slotted from design elevation 1888.67 feet to 1889.00 feet MSL with an overflow rim elevation at 1891.00 feet MSL. Actual bottom elevations of slots are shown on Figure 3. The bottom of each riser is fitted with 36-inch diameter CMP spillway with invert design elevation of 1886.0 feet. Each spillway is about 120 horizontal feet at an installed slope of approximately 4.5 percent. The spillways convey water through the south embankment into the Leachate Retention Pond. Discharge invert elevations range from 1883.00 feet to 1883.52 feet MSL as shown in Figure 3.

3.2.3. Leachate Retention Pond

The Leachate Retention Pond has a riser feeding a pump station located on the east side of the pond. The Leachate Retention Pond was constructed within the native clay soils with a 12" compacted sub-base. It is approximately 5.2 acres, with a storage volume between elevation 1887 feet MSL and base elevation 1880 feet MSL of approximately 41,400 cubic yards. During a 25-year, 24-hour storm event, elevation 1887 was set as the maximum liquid elevation in the leachate retention pond so that liquids do not back up into the WEC Temporary Ash Disposal Area. The top of orifice elevation is set at 1884.40 feet MSL.

3.2.4. Surge Pond

The Surge Pond area was approximately 18 acres for storage of general site stormwater runoff and the runoff from the property north of U.S. Highway 6. With the recent completion of a new rail line across the southern border, the Surge Pond is now approximately 16 acres. The culvert through the rail line berm has an inlet invert elevation of 1891.8 feet MSL. The area south of the new rail line (Southwest Area) is approximately 1.5 acres. The existing weir structure (Outfall 001) at the south boundary of the WEC site has an invert elevation of 1890.4 feet MSL. A protective bermed area and headwall allows stormwater to accumulate to approximate elevation 1892.50 feet MSL before discharging through this outfall. Water levels greater than the new culvert invert elevation are anticipated to equalize across the Surge Pond and Southwest Area. With an average base elevation of 1890.0 feet MSL, the Surge Pond has a capacity up to 64,500 cubic yards or 40 acre-feet and the Southwest Area has capacity for approximately 6,100 cubic yards or 4 acre-feet.

3.3. Hydrologic and Hydraulic Model and Results

The surface water hydraulic model was prepared using Hydraflow to model the previous runoff and containment within the WEC Temporary Ash Disposal Area and the runoff structures. Model's input data is provided below with comparison to the updated inputs.

3.3.1. Drainage Areas

To accurately model the CCR surface impoundment, the model must include inflow from plant flows entering the system for treatment and stormwater entering the system via direct precipitation and stormwater runoff. Table 1 shows the drainage areas contributing to the WEC Temporary Ash Disposal Area during the 100-year, 24-hour storm event which are also shown in on a figure in Attachment 2.

Table 1. Inflow and Drainage Areas

Pond or Drainage Area Name	Source/Area	Peak Flow During 100-year, 24-hour Storm Event
North Run-on Area	4.7 Acres	46.8 CFS
WEC1 Ash Sluice	10-inch Force Main	0 CFS (previously 0.62 CFS)
WEC2 Fly Ash Sluice	10-inch Force Main	0 CFS
WEC2 Bottom Ash SCC Forwarding Tank Overflow & WEC1 Service Water during Bottom Ash Hopper Flushing	3-inch Force Main 10-inch Force Main (previously used for Ash Sluice)	0.037 CFS (previously 0 CFS)
WEC Temporary Ash Disposal Area		
West Area	11.3 Acres	102.36 CFS
East Area*	6.5 Acres (previously 11.9 Acres)	Approx. 59 CFS (previously 107.8 CFS)
East Run-on Area	0.7 Acres (previously 2.3 Acres)	Approx. 7 CFS (previously 23.44 CFS)

* Current East Area excludes the CCR Landfill cell and Leachate Pond but conservatively includes the back slopes of perimeter berms contributing to East Area drainage.

Total peak flow into the West Area was 149.78 cfs and now estimated to be 149.20 cfs which includes the North Run-on Area, current process flows and West Area precipitation. There is no longer any WEC1 or WEC2 ash sluice into the West Area. During the 100-year 24-hour storm event, the total volume increase into the West Area was previously modeled to be 439,406 cubic feet or 10.1 acre-feet. With the recent reduction in process flows, the updated volume during the 100-year, 24-hour storm event into the West Area is estimated to be approximately 389,000 cubic feet or 8.9 acre-feet.

3.3.2. Rainfall Data

Rainfall events for Hastings, Nebraska area were available from the National Oceanic and Atmospheric Administration (NOAA) Precipitation Frequency Data Server. Rainfall for the 100-year 24-hour storm event continues to be 6.70 inches.

3.3.3. Weighted Curve Number

The weighted curve number (CN) is determined according to a hydrologic soil group and ground cover for a delineated drainage basin. Most drainage areas were identified as water surfaces with compacted soil surfaces (i.e. impervious coverage), while some north areas contributing to runoff are considered vegetated soil. A CN number of 100 was conservatively used for all areas.

3.3.4. Time of Concentration

Time of concentration (Tc) is defined as the time required for run-on or run-off to travel from the most hydrologically distant point of a sub-catchment to the point of collection. It is determined by summing the travel time for consecutive flow segments along the sub-catchment's hydraulic path. For the West Area of the WEC Temporary Ash Disposal Area, the Tc is 5.0 minutes for the north runoff and 7.6 minutes for the West Area itself. Within the East Area of the WEC Temporary Ash Disposal Area, the Tc was estimated at 2.5 minutes for the east runoff and 7.1 minutes for the East Area itself.

3.3.5. Model Inputs

The hydraulic evaluation was completed based on the best available information provided by Hastings at the time of this report. North runon areas are due to access road improvements and new culverts along the north side of the WEC Temporary Ash Disposal Area. Existing pond elevations and inlet/outlet structures information were taken from previous design and permit reports. Spillway invert elevations and pipe slopes were obtained from survey information on permit drawings shown in Figure 3 (Attachment 1). Table 2 summarizes the structure information.

Table 2. Inflow/Outflow Structure Information

Pond	Structure & Type	Elevation (feet) (NGVD27)
WEC Temporary Ash Disposal Area: West Area	Top Embankment	1898.0
	Base of Disposal Area	1888.0
	Assumed Normal Pool Elevation (no outlets)	1892.0
	Assumed Pool Elevation (clear area w/ risers)	1892.5
	Inlets:	
	10-inch diameter pipe from WEC1 10-inch diameter pipe from WEC2 3-inch diameter pipe from WEC2 - North runon (assumed) - Precipitation	1897.2 1898.1 1898 (assumed) 1897.0
	Outlets:	
WEC Temporary Ash Disposal Area: East Area	- Two (2) 48-inch diameter Risers, - Orifice Openings - Riser Pipe Rim Elevation - Two (2) 36-inch diameter CMP - Evaporation	1888.59 to 1888.92 1888.66 to 1888.99 1890.97 1891.03 1886.0
	Top Embankment	1898.0
	Base of Disposal Area	1888.0
	Assumed Normal Pool Elevation	1888.0*
	Inlets: Precipitation	
	Outlets:	
	- Two (2) 48-inch diameter Risers, - Orifice Openings - Riser Pipe Rim Elevation - Two (2) 36-inch diameter CMP - Evaporation	1888.67 to 1889.00 1888.71 to 1889.04 1891.02 1891.00 1886.0

*No ash sluicing in East Area. Ash sluicing in West Area terminated in November 2025.



Pond	Structure & Type	Elevation (feet) (NGVD27)
Leachate Retention Pond	Top Embankment	1894.0
	Base of Leachate Retention Pond	1880.0
	Normal Pool Elevation	1884.3
	Maximum Pool Elevation	1893.0
	Inlets: Four (4) 36-inch diameter CMP (from west to east)	1883.27, 1883.00 1883.30, 1883.52
	Outlets: - One (1) 24-inch diameter CMP - One (1) 36-inch diameter Riser - Orifice Openings - Riser Pipe Rim Elevation - Evaporation	1880.63 1884 to 1884.40 1885.29

3.4. Evaluation of Existing Inflow/Outflow Design Controls

Hydraflow for Autodesk Civil 3D was used to evaluate the initial inflow, outflow and peak elevations observed for the 100-year, 24-hour storm event for the CCR surface impoundment. Table 3 summarizes the storage area and peak elevations within the WEC Temporary Ash Disposal Area.

Table 3. Areas and Elevations During 100-year, 24-hour Storm Event

WEC Temporary Ash Disposal Area CCR Surface Impoundment	Area Required for 4-ft Depth (acres)	Peak Elevation* (ft)	Peak Inflow** (cfs)	Remaining Freeboard (ft)
West Area – Pond Ash	2.2 (previously 2.5)	1896.0	149.20 (previously 149.78)	2.0
East Area – Scrubber Ash	Approx. 1.0 (previously 1.9)	1892.0	66 (previously 131.24)	6.0

* Peak elevation above normal pool elevation listed in Table 2.

** Peak inflow obtained from Table 1.

With excavation, stockpiling and removal of pond ash for beneficial use, the actual area available for peak inflow may be greater than that shown in Table 3. For example, available storage of five acres within the West Area would result in only a two-foot rise or peak elevation of 1894.0 feet MSL.

Based on the original modeling results and review of new data inputs, at no time during a 100-year, 24-hour storm event will water elevations rise above the top of slope/berms of the WEC Temporary Ash Disposal Area. Following the storm event, water will be discharged to the Leachate Retention Pond. Water in the Leachate Retention Pond evaporates or is used for dust control on the WEC Temporary Ash Disposal Area; it is not discharged to the Surge Pond.



3.5. Improvements to Existing Inflow/Outflow Design Controls

Based on the available information and model results contained in Attachment 2, the existing inflow design flood control systems in place for the WEC Temporary Ash Disposal Area meet the requirements of 40 CFR §257.82 and will adequately manage and contain the flow into the WEC Temporary Ash Disposal Area during the 100-year, 24-hour storm event without overtopping. At such a time that the disposal area no longer has the storage area required, the existing outlets should be hydraulically reconnected and utilized, and clear areas reshaped.

4. Certification

Based on the information in City of Hastings facility records, topographic survey data and information available in the DWEE Title 132 permit application, the initial Inflow Design Flood Control System Plan was reviewed and updated in accordance with the requirements of the USEPA 40 CFR Part 257-Criteria for Classification of Solid Waste Disposal Facilities and Practices; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, April 17, 2015 (CCR Rule). I certify to the best of my knowledge, information and belief that this amended Inflow Design Flood Control System Plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and requirements of CCR Rule §257.82. I am a duly licensed Professional Engineer under the laws of the State of Nebraska.

Print Name:	Lori J. Calub
Signature:	
Date:	December 30, 2025
License #:	E-9881



My license renewal date is December 31, 2027.

5. References

- Federal Register, 2015. 40 CFR Parts 257 and 261 Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities. Vol. 80, No. 74, Pages 21302 – 21501. April 17, 2015.
- Hastings, 2020 and 2025. Data on process flows, water surface elevations and storage volumes.
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- HDR, Inc., 2006. Supplemental Hydrogeologic Characterization for Whelan Energy Center Fossil Fuel Combustion Ash Temporary Ash Disposal Area. Prepared for Hastings Utilities. Original December 2001.



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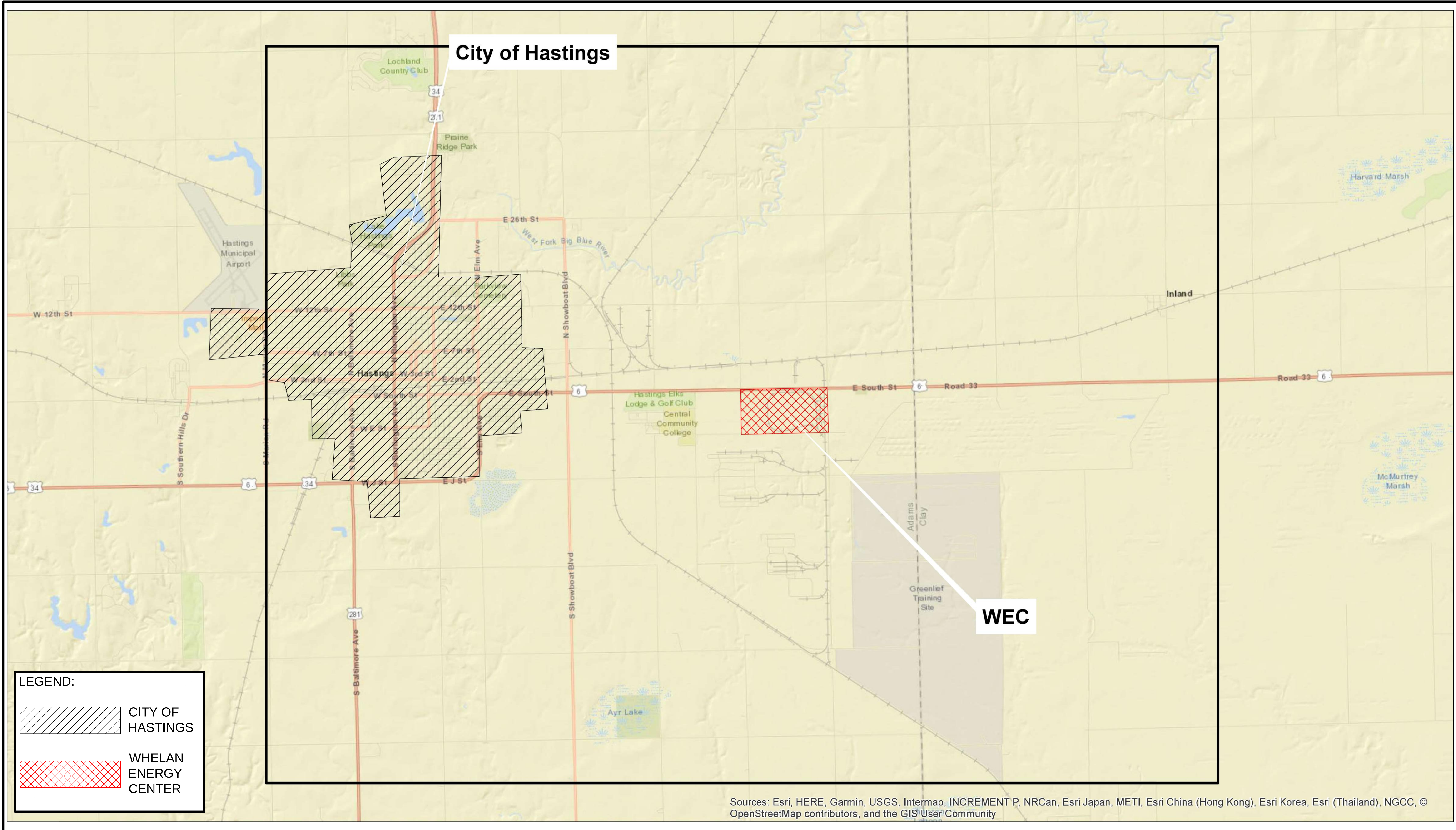
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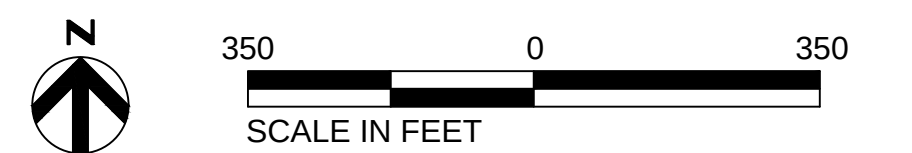
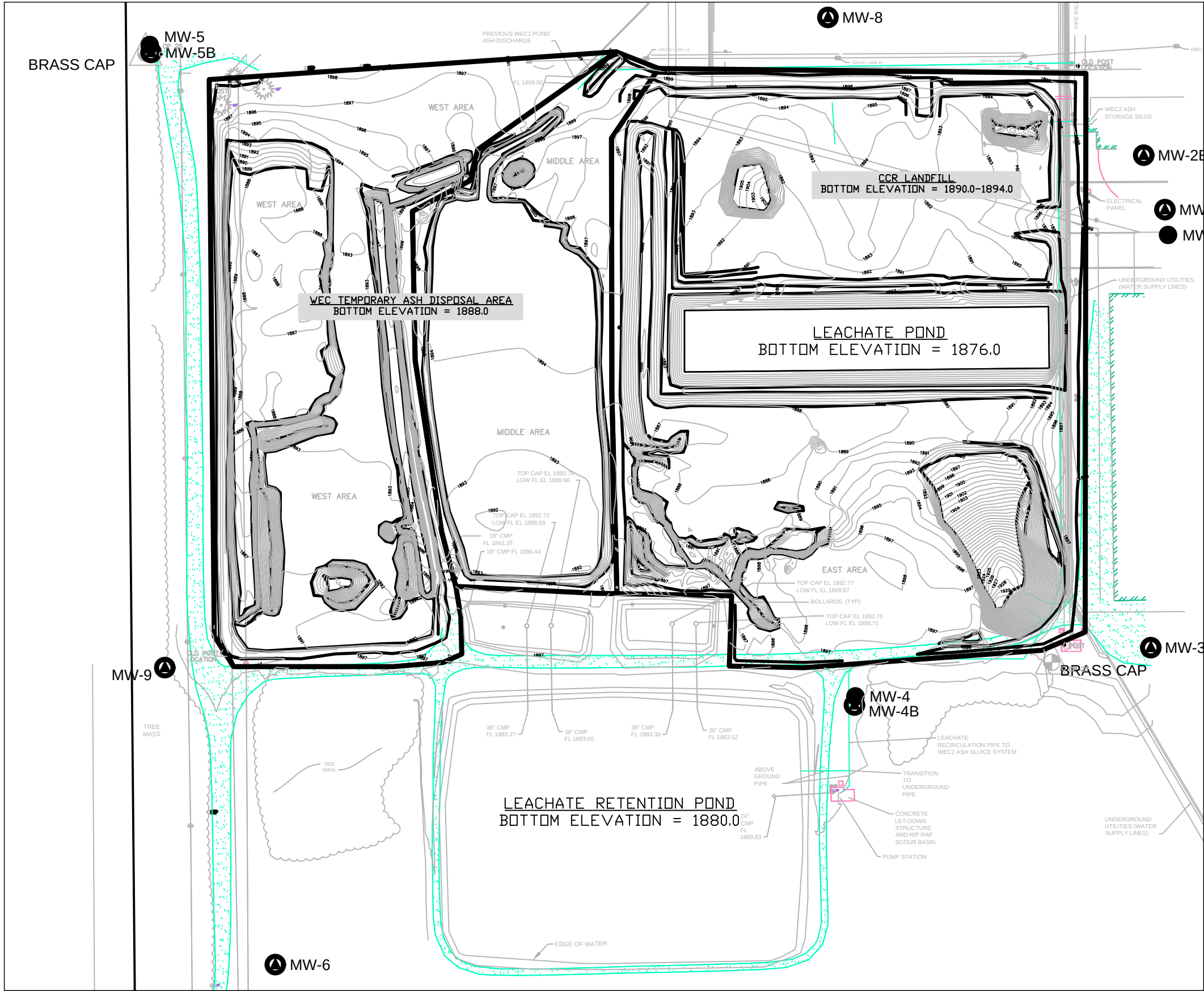
HDR, Inc. 2024. Construction Quality Assurance Report for WEC2 Ash Pond Liner Project. Whelan Energy Center. Prepared for Public Power Generation Agency. January 24, 2024.

NDEE, 2024. NDEE Approval CQA Report for Construction WEC2 Ash Pond Liner Project. June 18, 2024.

Attachment 1: Figures

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SURVEY CONTROL				
POINT ID	NORTHING	EASTING	ELEVATION	DESCRIPTION
CP-25	276397.53	2107987.07	1896.51	BRASS CAP
CP-26	276471.31	2109560.83	1900.94	BRASS CAP
CP-27	275522.21	2109289.93	1894.46	BRASS CAP

LEGEND			
	PROPERTY BOUNDARY		POWER POLE
	ASH DISPOSAL BOUNDARY		LIGHT POLE
	SURVEY CONTROL POINT		GUY WIRE
	CONIFEROUS TREE		WATER VALVE
	TREE DRIP LINE		FIRE HYDRANT
	STORM SEWER LINE		MONITORING WELL
	SANITARY SEWER LINE		CCR MONITORING NETWORK WELL
	OVERHEAD ELECTRIC		STEEL POST
	DISCHARGE PIPE		BOLLARD
	GRAVEL		STORM DRAIN MANHOLE
			GATE INLET

NOTES:
1. TOPOGRAPHIC SURVEY OF ASH DISPOSAL AREA AND LEACHATE DETENTION POND BY GRUMMERT PROFESSIONAL SERVICES PERFORMED ON 03/20/2025. TOPOGRAPHIC SURVEY OF LEACHATE RETENTION POND AND DRAINAGE STRUCTURES BY KRUEGER LAND SURVEYING PERFORMED ON 01/15/2021.
2. RISER ELEVATIONS PROVIDED BY HASTINGS UTILITIES.

SOURCE: 2021 TITLE 132 PERMIT RENEWAL.



GERALD T. WHELAN ENERGY CENTER
PUBLIC POWER GENERATION AGENCY

ASH DISPOSAL AREA PLAN

Attachment 2: Hydraulic Analyses

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Objective: Demonstrate disposal areas can manage a 100-yr 24-hr storm event
References: Site data, historic calculations
Hydraflow, Mannings
Assumptions: 25-yr 24 hr storm event is 5.11-inches on site. (NOAA Atlas 14 Vol 8 Version 2)
100-yr 24 hr storm event is 6.70-inches on site. (NOAA Atlas 14 Vol 8 Version 2)

UPDATED 12/17/2025 & 12/23/2025

Calculations: *Drainage Areas*

n for smooth surfaces 0.011 0.015

	Sheet Flow (ft)*	Channel Flow (ft)*	Acres	Peak flow (cfs)	Total Volume (cf in 24-hrs)	
North Runon	50	1500	4.7	46.8	117,881	No change 2025
WEC1 Ash Sluice**	na	na	10-in forcemain	0	0	WEC1 Ash Sluice terminated November 2025
WEC2 Fly Ash Sluice	na	na	10-in forcemain	0	0	
WEC1 & WEC2 Bottom Ash Overflow/ Flushing	na	na	10-in forcemain & 3-in forcemain	0.04	3,208	Miscellaneous contact water
West Disposal Area	300	600	11.3	102.36	267,957	No change 2025
Totals for west disposal area				149.20	389,046	
East Runon***	90	0	0.7	7	15,700	Reduced area of runon
East Disposal Area***	200	450	6.5	59	154,400	Reduced East Area due to CCR landfill retrofit
Totals for east disposal area				66	170,100	

*Slopes subject to change with operations. Generally low slope. Modeled with 0.5%.

**Had been 400,000 GPD

***Peak flow and Total Volume estimated based on prior hydraulic model results and ratio of reduced acres to original acres.

Current Conditions - No discharge

Under current conditions, there is estimated to be no discharge during the 100-yr 24-hr storm event. Operations change over time on site. In order to maintain no discharge for each area, the 100-YR 24-hr volume must be held within the disposal area with 1-ft of freeboard.

Current elevation of ponded water is estimated at elev. 1893 by the site:

	Req. Storage (cf)	Area Req. if 4-ft deep (SF)	(ACRES)	
West Disposal Area	389,046	97,262	2.2	11% less storage area required than in 2020
East Disposal Area	170,100	42,525	1.0	49% less storage area required than in 2020

Future Conditions - Discharge to Leachate Retention Pond

In the event the disposal area operations displace stormwater storage volume, the discharge structures will be utilized. Assumptions are as follows:

1. Starting pool elevation is 1892.5 (limited storage before riser discharge)
2. Storage is limited to 5,000-sf, 3:1 side slopes, and maximum elevation is 1898 (approx. inlet clear area)
3. Outflow culverts are modeled as 'dual barrel' to estimate peak storage.

Total flow to the Leachate Retention Pond= 559,146 cf for 24-hrs

Leachate Retention Ppond storage*= 1,568,160 cf

*Elevation 1884 to 1893, est. available for storage. Leachate Retention Pond is 5.2 acres.

Conclusion: **Conclusion in 2025 same as before:**

In the 100-yr storm event, the stormwater is contained within the disposal areas without overtopping. At such time that a disposal area no longer has the storage required, the discharge culverts will be hydraulically connected and utilized, and spillways reshaped. The discharge culverts are estimated to control the design storm without exceeding the berm elevation.

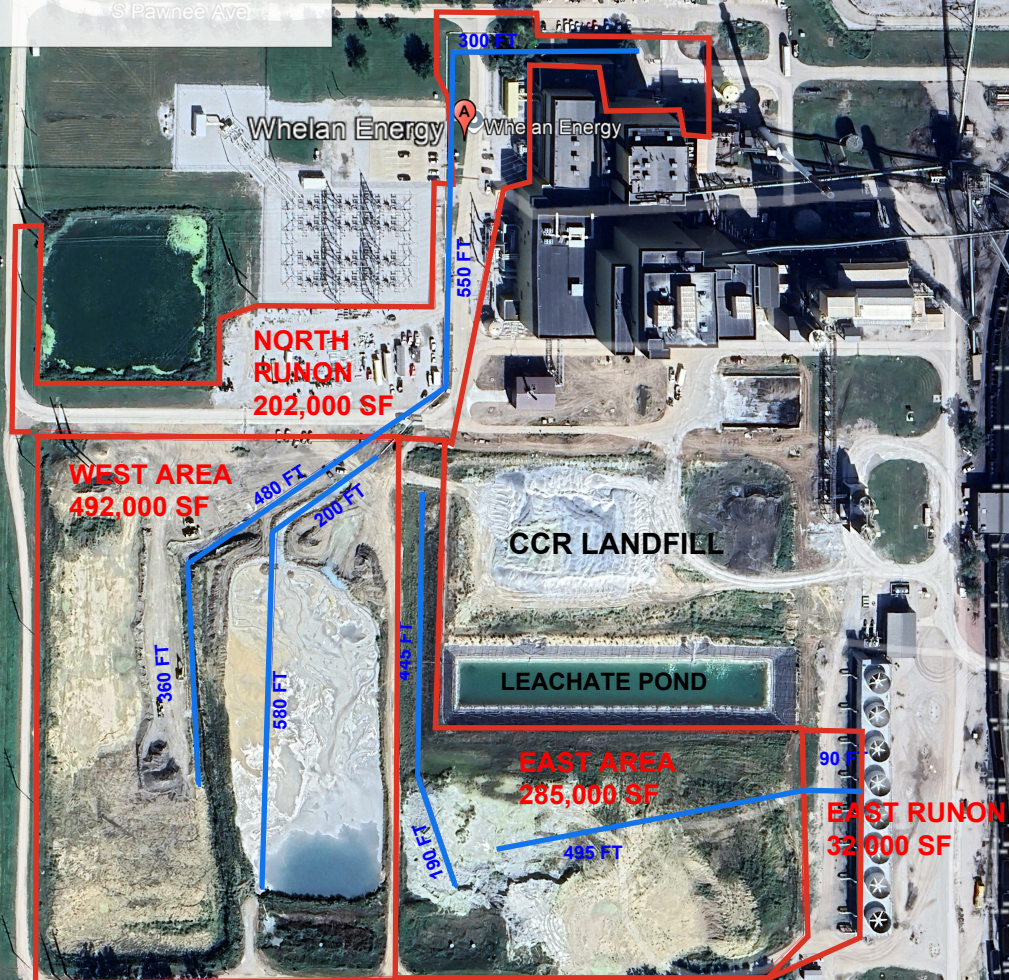
WEC DRAINAGE AREAS

September 2025

3 Pawnee Ave

Legend

 Whelan Energy



Google Earth

Image © 2025 Airbus

1000 ft



INITIAL HYDRAULIC CALCULATIONS 2020



Project: WEC
Subject: Stormwater
Task: Hydraulic Calculations

Computed by: K. Kinley Date: 11/19/2020
Checked by: L. Calub Date: 11/23/2020

Page: 1 of 1

Objective: Demonstrate disposal areas can manage a 100-yr 24-hr storm event

References: Site data, historic calculations

Hydraflow, Mannings

Assumptions: 25-yr 24 hr storm event is 5.11-inches on site. (NOAA Atlas 14 Vol 8 Version 2)

100-yr 24 hr storm event is 6.70-inches on site. (NOAA Atlas 14 Vol 8 Version 2)

Calculations: *Drainage Areas*

n for smooth surfaces 0.011 0.015

	Sheet Flow (ft)*	Channel Flow (ft)*	Acres	Peak flow (cfs)	Total Volume (cf in 24-hrs)
North Runon	50	1500	4.7	46.8	117,881
WEC1 Ash Sluice**	na	na	10-in forcemain	0.62	53,568
WEC2 Fly Ash Sluice	na	na	10-in forcemain	0	0
West Disposal Area	300	600	11.3	102.36	267,957
Totals for west disposal area				149.78	439,406
East Runon	100	0	2.3	23.44	52,442
East Disposal Area	300	400	11.9	107.8	282,184
Totals for east disposal area				131.24	334,626

*slopes subject to change with operations. Generally low slope. Modeled with 0.5%.

**400,000 GPD

Current Conditions - No discharge

Under current conditions, there is estimated to be no discharge during the 100-yr 24-hr storm event. Operations change over time on site. In order to maintain no discharge for each area, the 100-YR 24-hr volume must be held within the disposal area with 1-ft of freeboard.

Current elevation of ponded water is estimated at elev. 1893 by the site:

	Req. Storage (cf)	Area Req. if 4-ft deep (SF)
West Disposal Area	439,406	109,852
East Disposal Area	334,626	83,657

Future Conditions - Discharge to Leachate Pond

In the event the disposal area operations displace stormwater storage volume, the discharge structures will be utilized. Assumptions are as follows:

1. Starting pool elevation is 1892.5 (limited storage before riser discharge)
2. Storage is limited to 5,000-sf, 3:1 side slopes, and maximum elevation is 1898 (approx. inlet clear area)
3. Outflow culverts are modeled as 'dual barrel' to estimate peak storage.

Total flow to the leachate pond= 774,032 cf for 24-hrs

Leachate pond storage*= 1,568,160 cf

*Elevation 1884 to 1893, est. available for storage. Leachate Pond is 5.2 acres.

Conclusion:

In the 100-yr storm event, the stormwater is contained within the disposal areas without overtopping. At such time that a disposal area no longer has the storage required, the discharge culverts will be hydraulically connected and utilized, and spillways reshaped. The discharge culverts are estimated to control the design storm without exceeding the berm elevation.





NOAA Atlas 14, Volume 8, Version 2
Location name: Hastings, Nebraska, USA*
Latitude: 40.5791°, Longitude: -98.314°
Elevation: 1898.24 ft**
 * source: ESRI Maps
 ** source: USGS



12.17.2025 Checked
 NOAA website at
hdsc.nws.noaa.gov/pfds
 for Hastings, Nebraska. No
 change to precipitation
 frequency for 24-hr, 25-
 year and 100-year storm.

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffrey Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aeriels](#)

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	0.364 (0.290-0.466)	0.431 (0.342-0.551)	0.542 (0.429-0.695)	0.637 (0.501-0.818)	0.771 (0.588-1.01)	0.877 (0.654-1.15)	0.986 (0.711-1.31)	1.10 (0.760-1.48)	1.25 (0.834-1.71)	1.37 (0.890-1.88)
10-min	0.533 (0.424-0.683)	0.631 (0.501-0.807)	0.794 (0.628-1.02)	0.932 (0.734-1.20)	1.13 (0.861-1.48)	1.28 (0.957-1.69)	1.44 (1.04-1.92)	1.61 (1.11-2.17)	1.83 (1.22-2.50)	2.01 (1.30-2.75)
15-min	0.650 (0.517-0.832)	0.769 (0.611-0.985)	0.968 (0.766-1.24)	1.14 (0.895-1.46)	1.38 (1.05-1.80)	1.57 (1.17-2.06)	1.76 (1.27-2.34)	1.96 (1.36-2.64)	2.24 (1.49-3.05)	2.45 (1.59-3.36)
30-min	0.934 (0.743-1.20)	1.11 (0.880-1.42)	1.40 (1.11-1.79)	1.65 (1.30-2.11)	1.99 (1.52-2.60)	2.26 (1.69-2.98)	2.54 (1.83-3.38)	2.83 (1.96-3.81)	3.22 (2.14-4.39)	3.52 (2.28-4.82)
60-min	1.21 (0.958-1.54)	1.43 (1.13-1.83)	1.81 (1.43-2.32)	2.14 (1.68-2.75)	2.63 (2.01-3.45)	3.02 (2.26-3.99)	3.44 (2.48-4.59)	3.87 (2.69-5.24)	4.49 (2.99-6.14)	4.97 (3.23-6.82)
2-hr	1.48 (1.19-1.87)	1.74 (1.40-2.20)	2.21 (1.77-2.80)	2.63 (2.10-3.34)	3.26 (2.53-4.25)	3.78 (2.86-4.94)	4.33 (3.17-5.73)	4.92 (3.46-6.59)	5.75 (3.89-7.81)	6.42 (4.22-8.72)
3-hr	1.62 (1.31-2.04)	1.91 (1.54-2.40)	2.43 (1.96-3.05)	2.91 (2.33-3.66)	3.63 (2.85-4.72)	4.24 (3.24-5.53)	4.90 (3.61-6.46)	5.61 (3.98-7.49)	6.63 (4.52-8.96)	7.46 (4.94-10.1)
6-hr	1.88 (1.54-2.33)	2.21 (1.80-2.73)	2.80 (2.28-3.48)	3.36 (2.72-4.18)	4.21 (3.34-5.43)	4.94 (3.82-6.37)	5.73 (4.28-7.48)	6.59 (4.73-8.72)	7.83 (5.41-10.5)	8.83 (5.92-11.8)
12-hr	2.12 (1.76-2.60)	2.52 (2.08-3.08)	3.21 (2.65-3.94)	3.83 (3.14-4.70)	4.74 (3.79-6.00)	5.50 (4.28-6.97)	6.29 (4.74-8.09)	7.14 (5.18-9.31)	8.34 (5.82-11.0)	9.29 (6.30-12.3)
24-hr	2.45 (2.05-2.96)	2.85 (2.38-3.44)	3.56 (2.96-4.30)	4.18 (3.46-5.07)	5.11 (4.13-6.38)	5.88 (4.64-7.37)	6.70 (5.11-8.50)	7.57 (5.55-9.75)	8.80 (6.22-11.5)	9.78 (6.72-12.8)
2-day	2.80 (2.37-3.33)	3.21 (2.71-3.82)	3.93 (3.31-4.68)	4.57 (3.82-5.46)	5.52 (4.51-6.79)	6.30 (5.02-7.79)	7.13 (5.50-8.94)	8.01 (5.95-10.2)	9.26 (6.63-12.0)	10.3 (7.14-13.3)
3-day	3.02 (2.57-3.56)	3.46 (2.94-4.08)	4.22 (3.57-4.99)	4.89 (4.12-5.80)	5.87 (4.82-7.15)	6.67 (5.35-8.17)	7.51 (5.83-9.34)	8.40 (6.28-10.6)	9.63 (6.95-12.4)	10.6 (7.45-13.7)
4-day	3.21 (2.74-3.77)	3.68 (3.14-4.32)	4.48 (3.82-5.27)	5.18 (4.39-6.11)	6.19 (5.10-7.49)	7.00 (5.64-8.53)	7.85 (6.13-9.70)	8.74 (6.56-11.0)	9.97 (7.22-12.7)	10.9 (7.72-14.1)
7-day	3.78 (3.26-4.38)	4.31 (3.71-5.00)	5.19 (4.46-6.04)	5.95 (5.09-6.94)	7.02 (5.83-8.38)	7.88 (6.40-9.47)	8.75 (6.89-10.7)	9.65 (7.32-12.0)	10.9 (7.96-13.8)	11.8 (8.45-15.1)
10-day	4.31 (3.74-4.97)	4.89 (4.24-5.64)	5.86 (5.06-6.77)	6.67 (5.73-7.73)	7.81 (6.52-9.24)	8.70 (7.11-10.4)	9.61 (7.61-11.7)	10.5 (8.04-13.0)	11.8 (8.69-14.8)	12.8 (9.17-16.2)
20-day	5.87 (5.15-6.66)	6.62 (5.81-7.53)	7.85 (6.86-8.94)	8.86 (7.71-10.1)	10.2 (8.62-11.9)	11.3 (9.32-13.2)	12.3 (9.87-14.7)	13.4 (10.3-16.2)	14.7 (11.0-18.3)	15.7 (11.5-19.8)
30-day	7.17 (6.34-8.08)	8.09 (7.15-9.13)	9.57 (8.43-10.8)	10.8 (9.43-12.2)	12.4 (10.5-14.2)	13.5 (11.2-15.7)	14.7 (11.8-17.4)	15.8 (12.3-19.1)	17.3 (12.9-21.2)	18.3 (13.4-22.9)
45-day	8.82 (7.85-9.86)	9.98 (8.88-11.2)	11.8 (10.5-13.2)	13.2 (11.7-14.9)	15.1 (12.9-17.2)	16.5 (13.8-19.0)	17.8 (14.4-20.8)	19.0 (14.8-22.7)	20.5 (15.5-25.0)	21.5 (16.0-26.7)
60-day	10.2 (9.16-11.4)	11.6 (10.4-12.9)	13.7 (12.2-15.3)	15.4 (13.6-17.2)	17.5 (15.0-19.8)	19.0 (16.0-21.7)	20.4 (16.6-23.7)	21.7 (17.0-25.8)	23.3 (17.6-28.2)	24.3 (18.1-30.0)

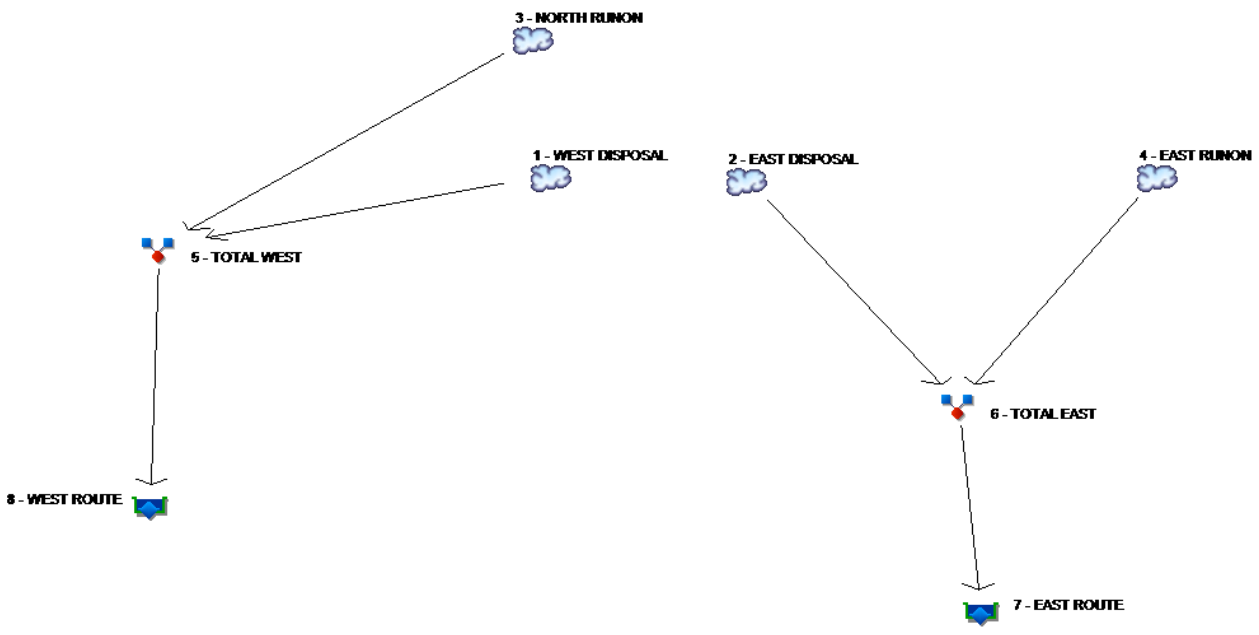
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average 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.

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PF graphical

Watershed Model Schematic

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



Hydrograph Summary Report

INITIAL HYDRAULIC MODELING 2020

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 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	102.36	1	718	267,957	-----	-----	-----	WEST DISPOSAL
2	SCS Runoff	107.80	1	718	282,184	-----	-----	-----	EAST DISPOSAL
3	SCS Runoff	46.80	1	717	117,881	-----	-----	-----	NORTH RUNON
4	SCS Runoff	23.44	1	715	52,442	-----	-----	-----	EAST RUNON
5	Combine	148.48	1	718	385,838	1, 3,	-----	-----	TOTAL WEST
6	Combine	125.92	1	717	334,627	2, 4,	-----	-----	TOTAL EAST
7	Reservoir	93.54	1	721	320,978	6	1893.85	70,669	EAST ROUTE
8	Reservoir	110.92	1	721	376,722	5	1893.91	74,115	WEST ROUTE
STORMWATER.gpw					Return Period: 100 Year			Friday, 11 / 20 / 2020	

Hydrograph Report

INITIAL HYDRAULIC MODELING 2020

3

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

No change to WEST DISPOSAL

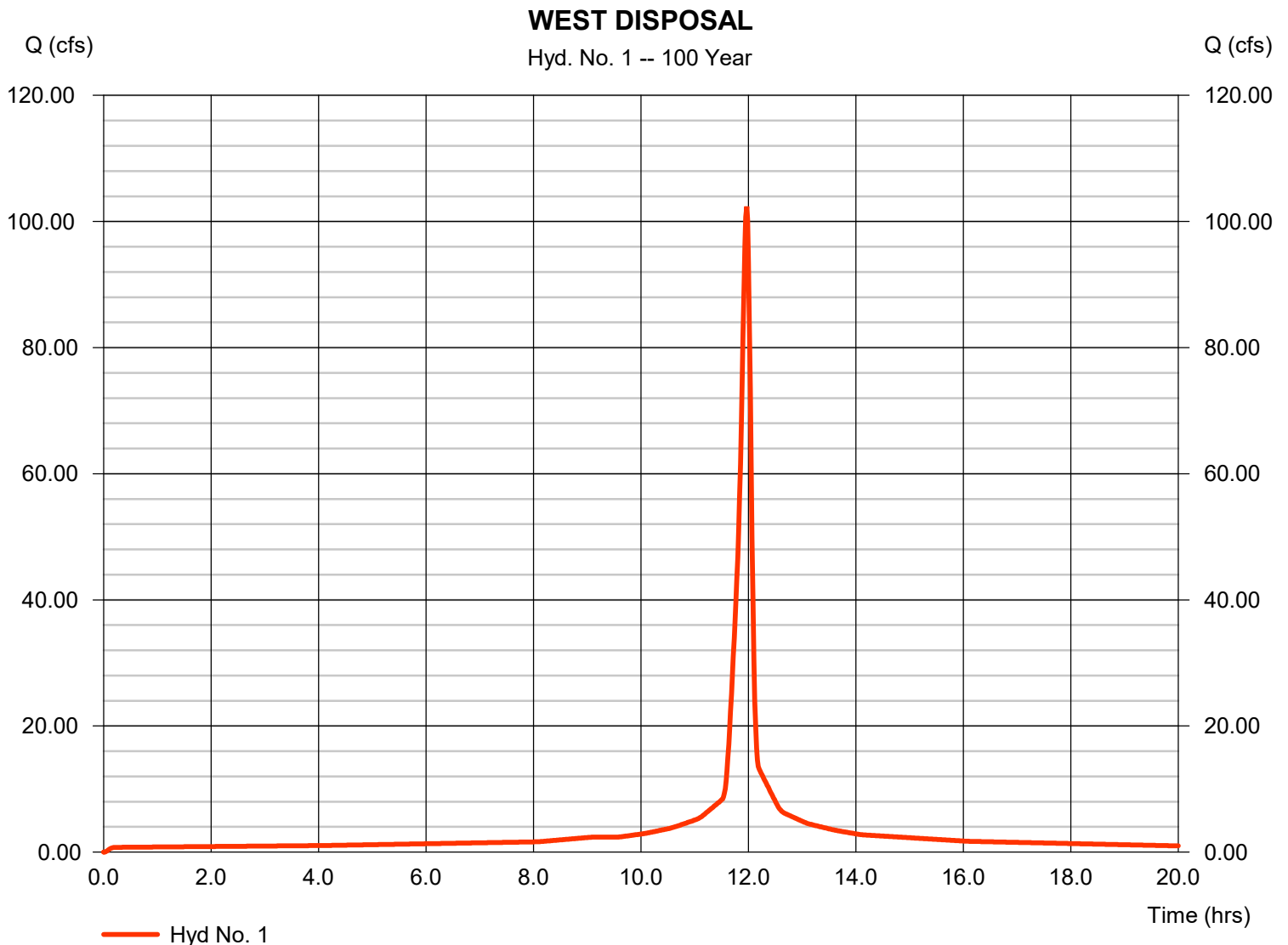
Friday, 11 / 20 / 2020

Hyd. No. 1

WEST DISPOSAL

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 1 min
Drainage area = 11.300 ac
Basin Slope = 0.5 %
Tc method = TR55
Total precip. = 6.70 in
Storm duration = 24 hrs

Peak discharge = 102.36 cfs
Time to peak = 11.97 hrs
Hyd. volume = 267,957 cuft
Curve number = 100
Hydraulic length = 900 ft
Time of conc. (Tc) = 7.60 min
Distribution = Type II
Shape factor = 484



Hyd. No. 2

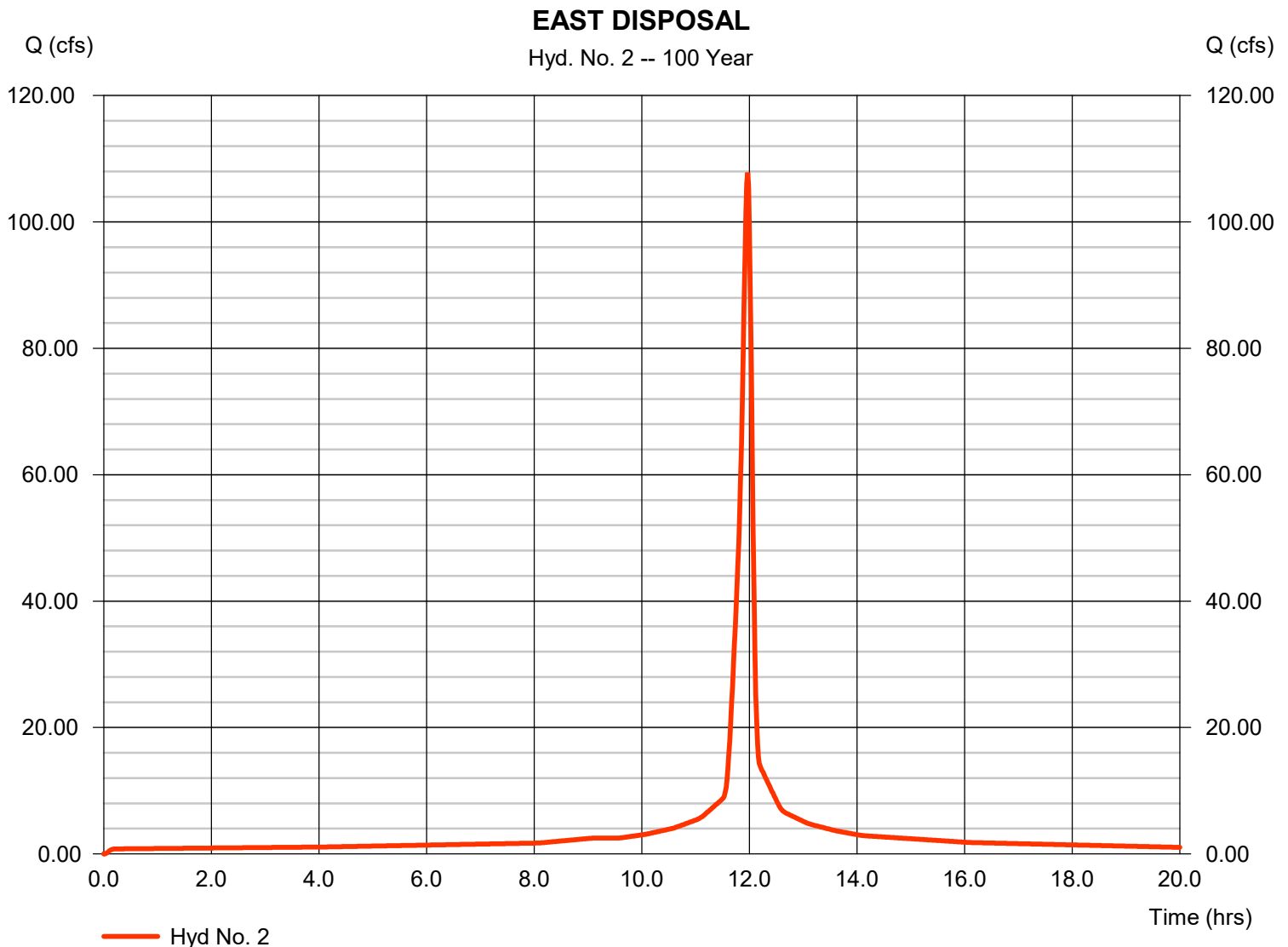
EAST DISPOSAL

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = ~~11.900 ac~~
 Basin Slope = 0.0 %
 Tc method = TR55
 Total precip. = 6.70 in
 Storm duration = 24 hrs

Peak discharge = 107.80 cfs
 Time to peak = 11.97 hrs
 Hyd. volume = 282,184 cuft
 Curve number = 100
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 7.10 min
 Distribution = Type II
 Shape factor = 484

2025 EAST DISPOSAL Drainage Area = 6.5 ac

Hydraulic volume for current conditions will be less due to reduced drainage area.



Hydrograph Report

INITIAL HYDRAULIC MODELING 2020

5

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

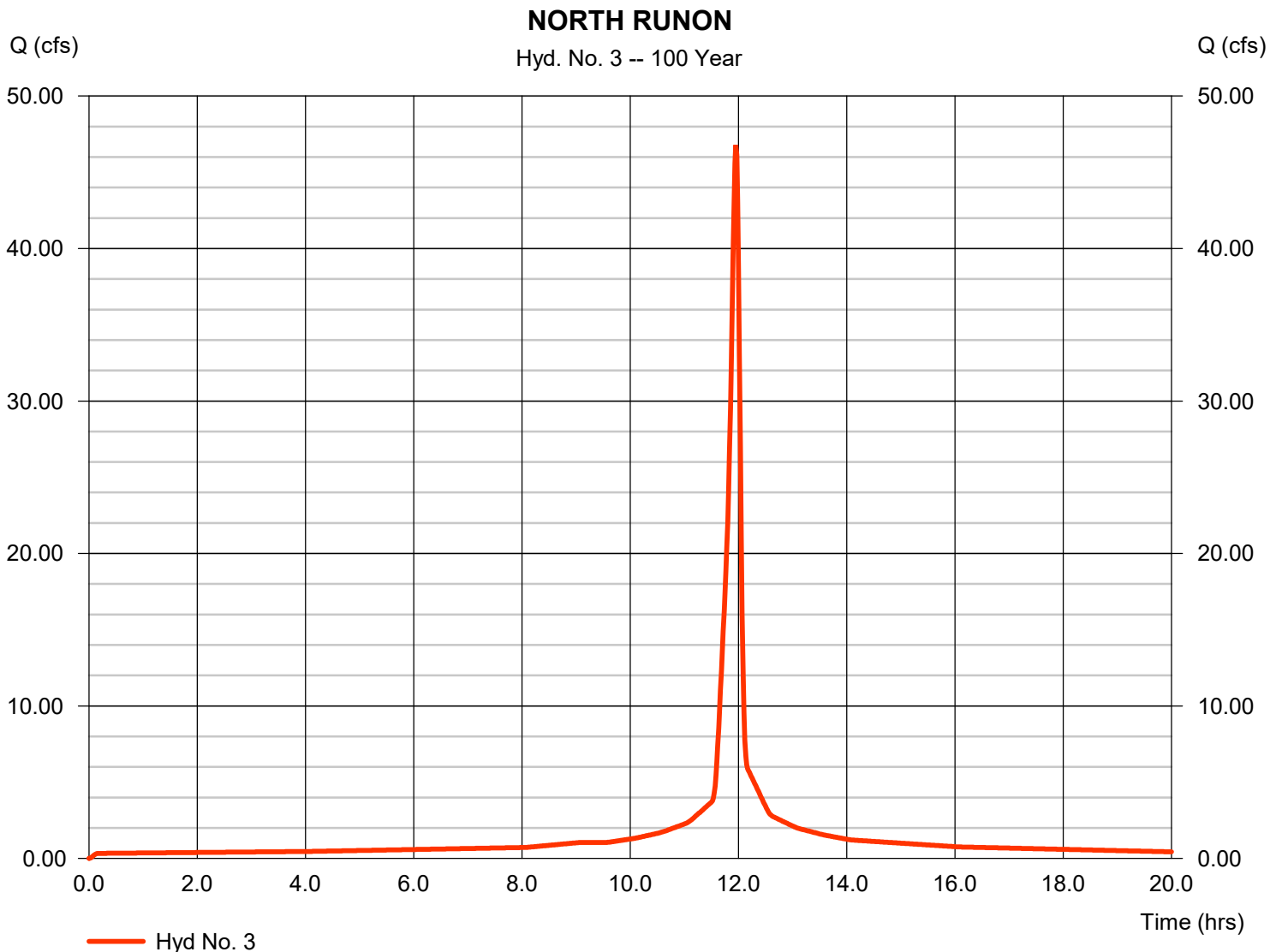
No change to NORTH RUNON Friday, 11 / 20 / 2020

Hyd. No. 3

NORTH RUNON

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 1 min
Drainage area = 4.700 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 6.70 in
Storm duration = 24 hrs

Peak discharge = 46.80 cfs
Time to peak = 11.95 hrs
Hyd. volume = 117,881 cuft
Curve number = 100
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.02 min
Distribution = Type II
Shape factor = 484



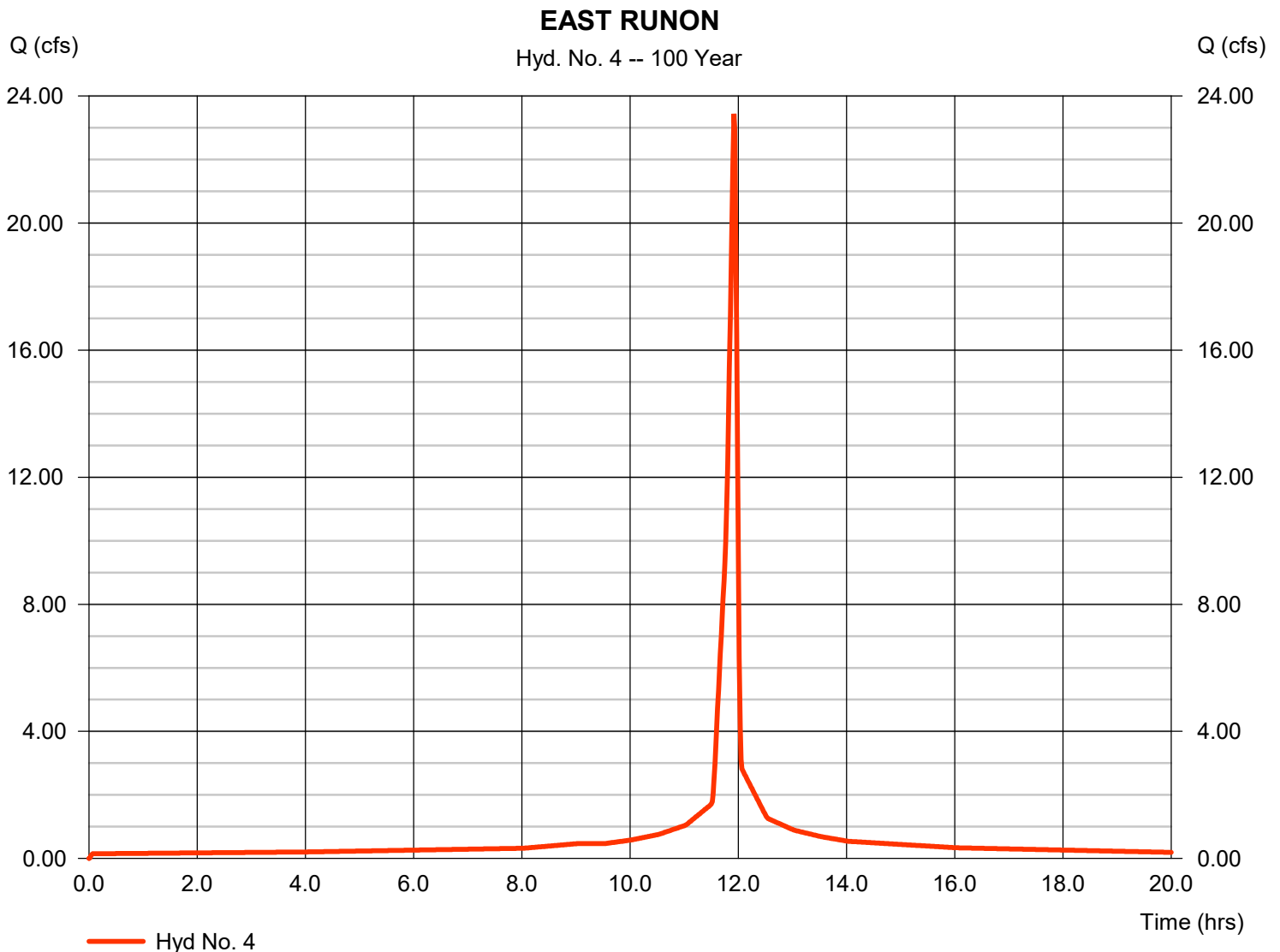
Hyd. No. 4

EAST RUNON

Hydrograph type	= SCS Runoff	Peak discharge	= 23.44 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.92 hrs
Time interval	= 1 min	Hyd. volume	= 52,442 cuft
Drainage area	= 2.300 ac	Curve number	= 100
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 2.50 min
Total precip.	= 6.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

2025 EAST RUNON Drainage Area = 0.7 ac

Hydraulic volume for current conditions will be less due to reduced drainage area.



Hydrograph Report

INITIAL HYDRAULIC MODELING 2020

7

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

Friday, 11 / 20 / 2020

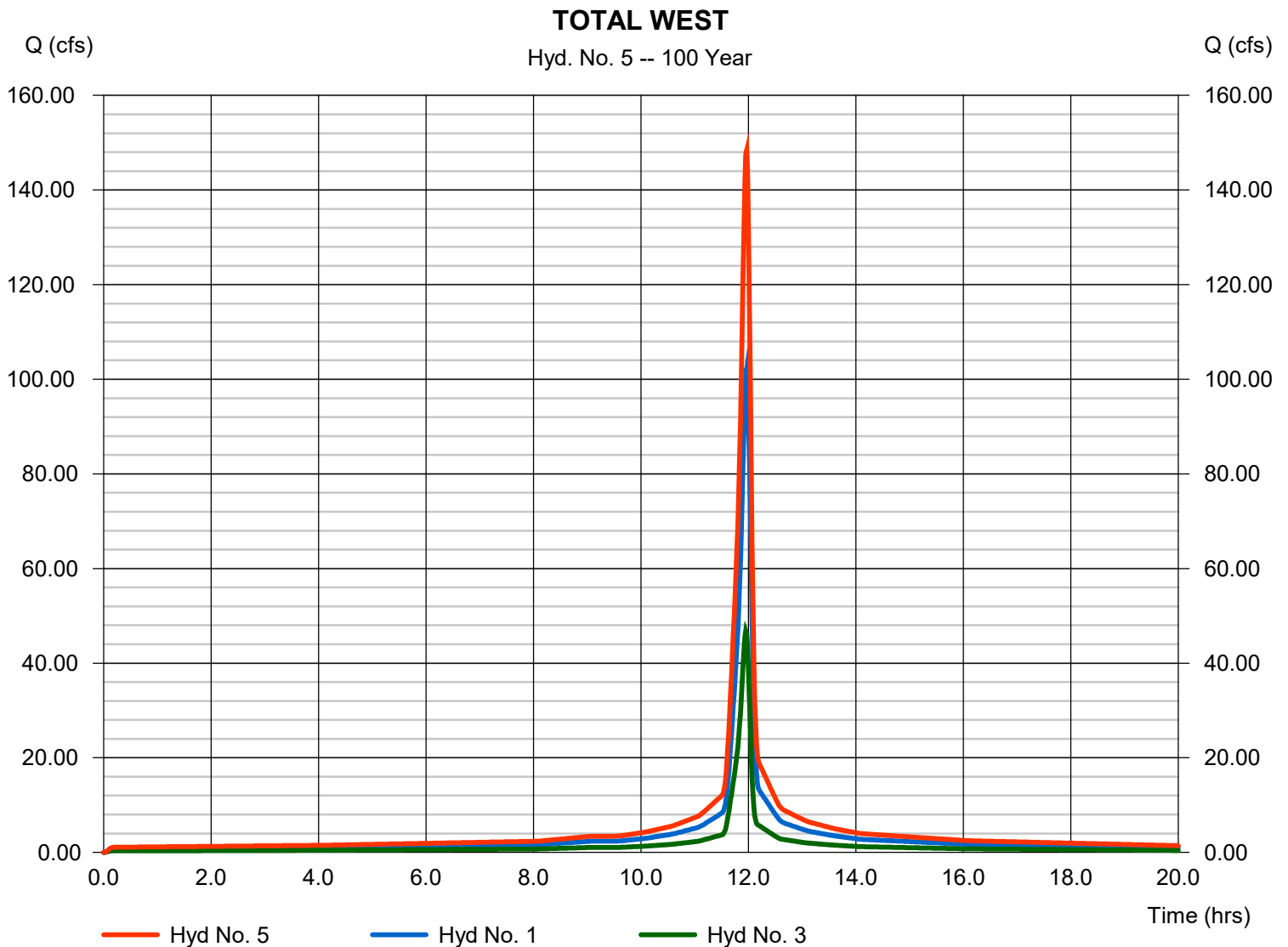
Hyd. No. 5

TOTAL WEST

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 1 min
Inflow hyds. = 1, 3

Peak discharge = 148.48 cfs
Time to peak = 11.97 hrs
Hyd. volume = 385,838 cuft
Contrib. drain. area = 16.000 ac

+0.62-CFS BASE FLOW (WEC1 Ash Sluice) = 149.1-CFS



Hydrograph Report

INITIAL HYDRAULIC MODELING 2020

8

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

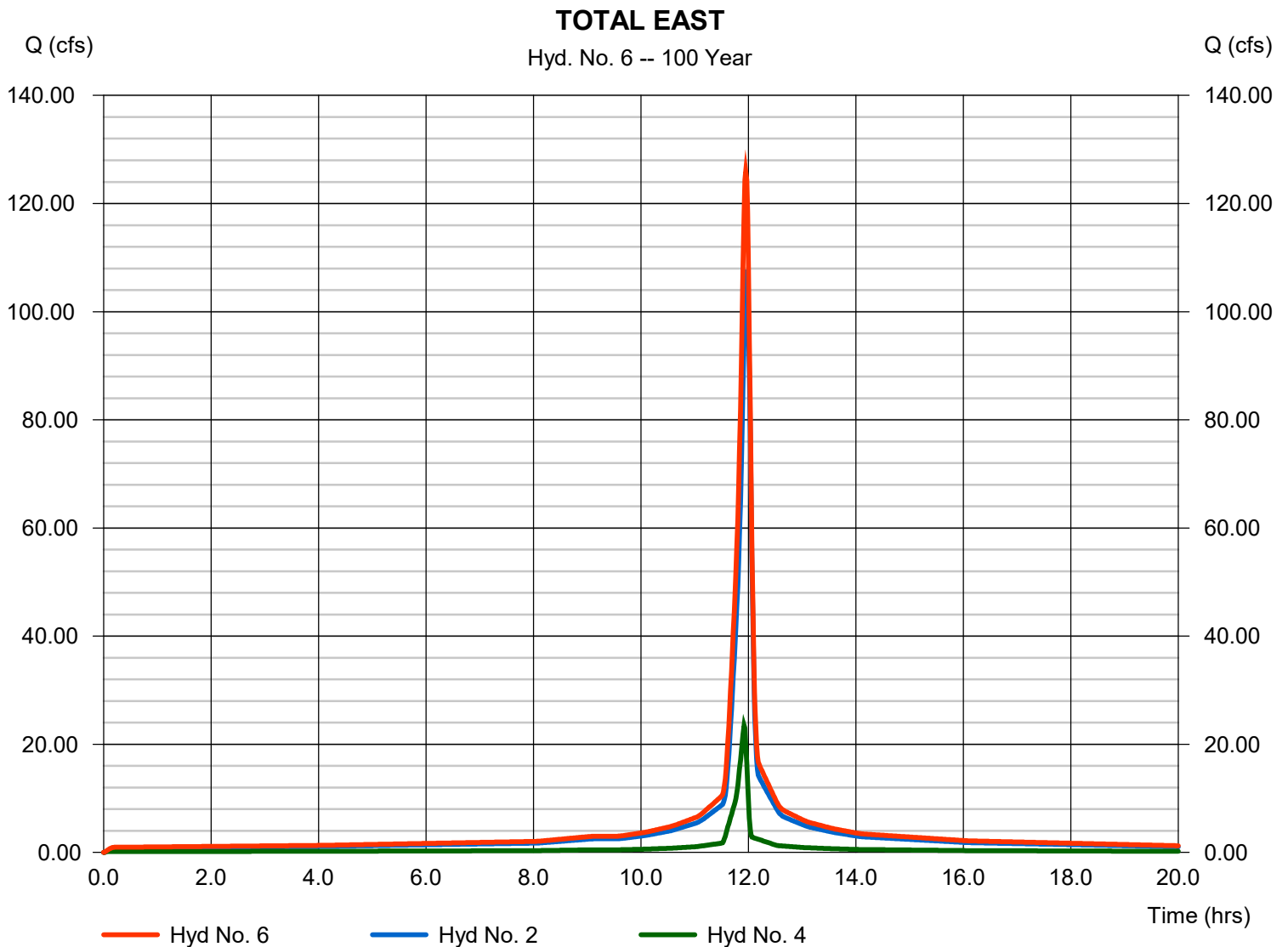
Friday, 11 / 20 / 2020

Hyd. No. 6

TOTAL EAST

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 1 min
Inflow hyds. = 2, 4

Peak discharge = 125.92 cfs
Time to peak = 11.95 hrs
Hyd. volume = 334,627 cuft
Contrib. drain. area = 14.200 ac



Hydrograph Report

INITIAL HYDRAULIC MODELING 2020

9

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

Friday, 11 / 20 / 2020

Hyd. No. 7

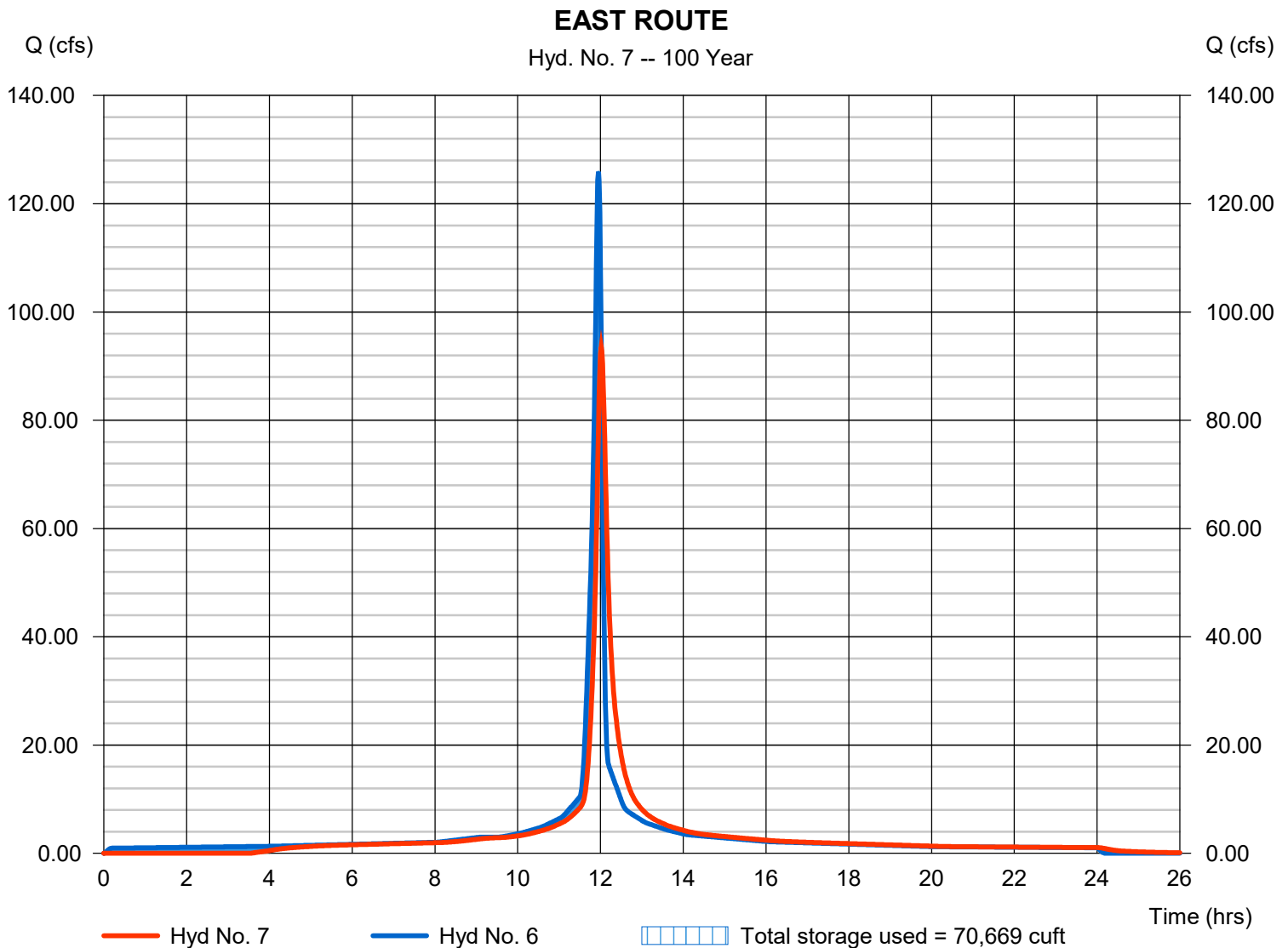
2X36" OUTLETS WITH 48" RISERS

EAST ROUTE

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 1 min
Inflow hyd. No. = 6 - TOTAL EAST
Reservoir name = EAST OUTLET

Peak discharge = 93.54 cfs
Time to peak = 12.02 hrs
Hyd. volume = 320,978 cuft
Max. Elevation = 1893.85 ft
Max. Storage = 70,669 cuft

Storage Indication method used.



Pond Report

INITIAL HYDRAULIC MODELING 2020 10

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

Friday, 11 / 20 / 2020

Pond No. 1 - EAST OUTLET

2X36" OUTLETS WITH 48" RISERS

Pond Data

Trapezoid -Bottom L x W = 100.0 x 50.0 ft, Side slope = 3.00:1, Bottom elev. = 1892.50 ft, Depth = 5.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1892.50	5,000	0	0
0.55	1893.05	5,506	2,888	2,888
1.10	1893.60	6,034	3,172	6,060
1.65	1894.15	6,583	3,469	9,529
2.20	1894.70	7,154	3,777	13,306
2.75	1895.25	7,747	4,097	17,403
3.30	1895.80	8,362	4,429	21,832
3.85	1896.35	8,999	4,773	26,605
4.40	1896.90	9,657	5,129	31,734
4.95	1897.45	10,337	5,497	37,232
5.50	1898.00	11,039	5,877	43,109

CLEAR AREA ONLY

INPUT APPROX.
INVERT ELEV.
AND LENGTHS
TO MODEL
DUAL CULVERT
OUTFLOW

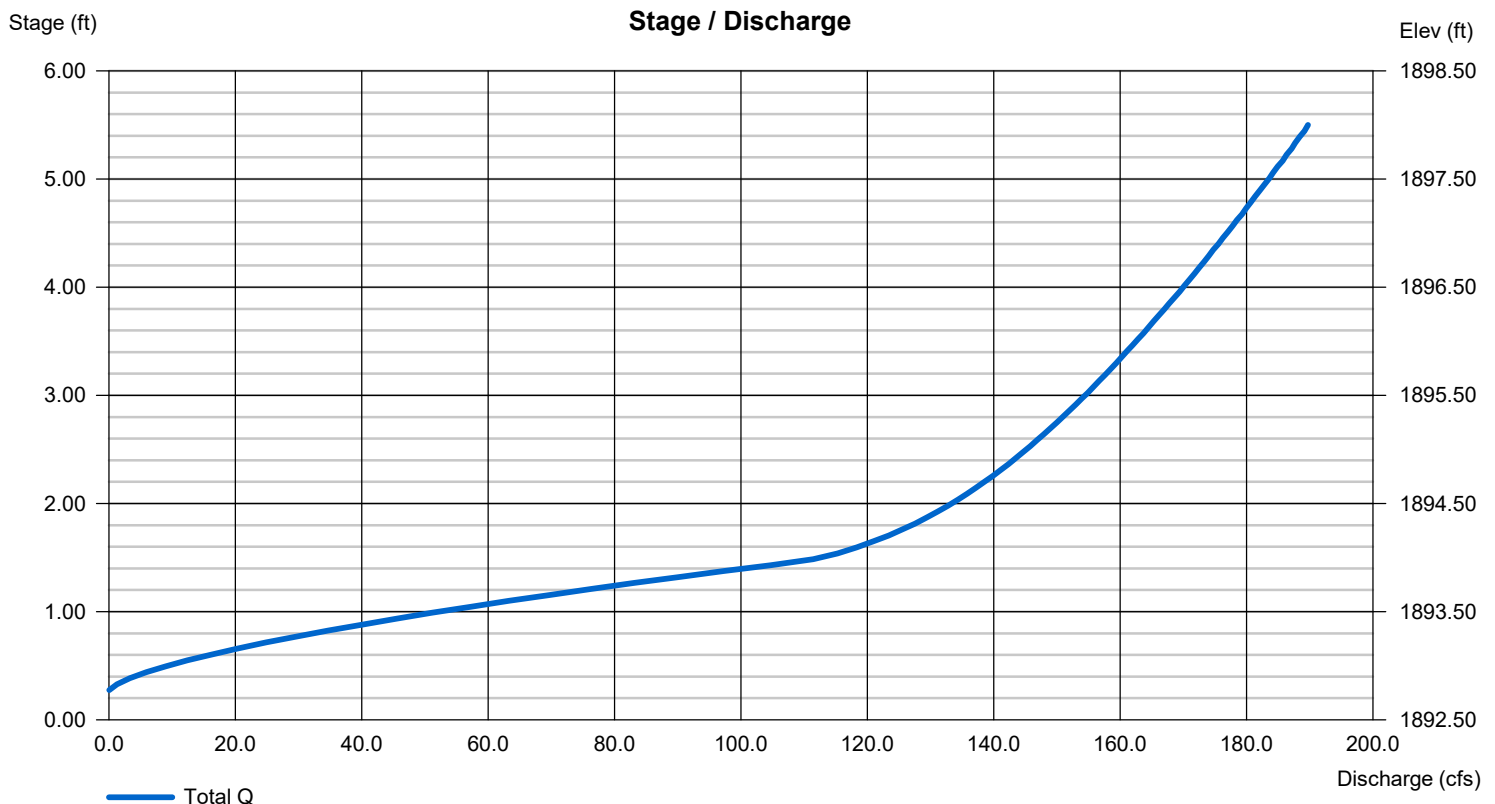
Culvert / Orifice Structures

	[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	= 2	0	0	0
Invert El. (ft)	= 1888.67	0.00	0.00	0.00
Length (ft)	= 125.00	0.00	0.00	0.00
Slope (%)	= 4.20	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)	= 25.14	0.00	0.00	0.00
Crest El. (ft)	= 1892.77	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
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

INITIAL HYDRAULIC MODELING 2020

11

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

Friday, 11 / 20 / 2020

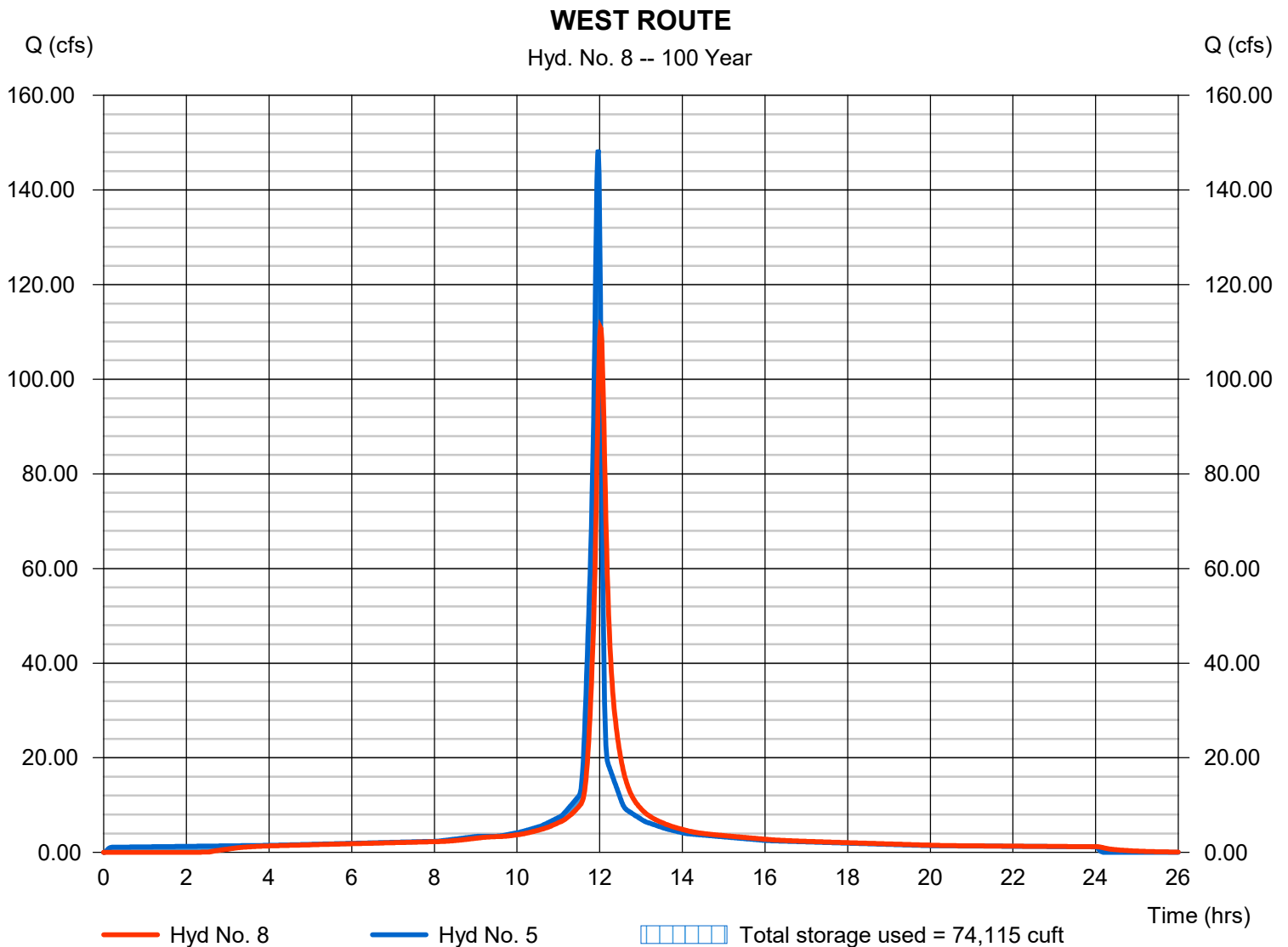
Hyd. No. 8

2X36" OUTLETS WITH 48" RISERS

WEST ROUTE

Hydrograph type	= Reservoir	Peak discharge	= 110.92 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.02 hrs
Time interval	= 1 min	Hyd. volume	= 376,722 cuft
Inflow hyd. No.	= 5 - TOTAL WEST	Max. Elevation	= 1893.91 ft
Reservoir name	= WEST OUTLET	Max. Storage	= 74,115 cuft

Storage Indication method used.



Pond No. 2 - WEST OUTLET

2X36" OUTLETS WITH 48" RISERS

Pond Data

Trapezoid -Bottom L x W = 100.0 x 50.0 ft, Side slope = 3.00:1, Bottom elev. = 1892.50 ft, Depth = 5.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1892.50	5,000	0	0
0.55	1893.05	5,506	2,888	2,888
1.10	1893.60	6,034	3,172	6,060
1.65	1894.15	6,583	3,469	9,529
2.20	1894.70	7,154	3,777	13,306
2.75	1895.25	7,747	4,097	17,403
3.30	1895.80	8,362	4,429	21,832
3.85	1896.35	8,999	4,773	26,605
4.40	1896.90	9,657	5,129	31,734
4.95	1897.45	10,337	5,497	37,232
5.50	1898.00	11,039	5,877	43,109

CLEAR AREA ONLY

INPUT APPROX.
INVERT ELEV.
AND LENGTHS
TO MODEL
DUAL CULVERT
OUTFLOW

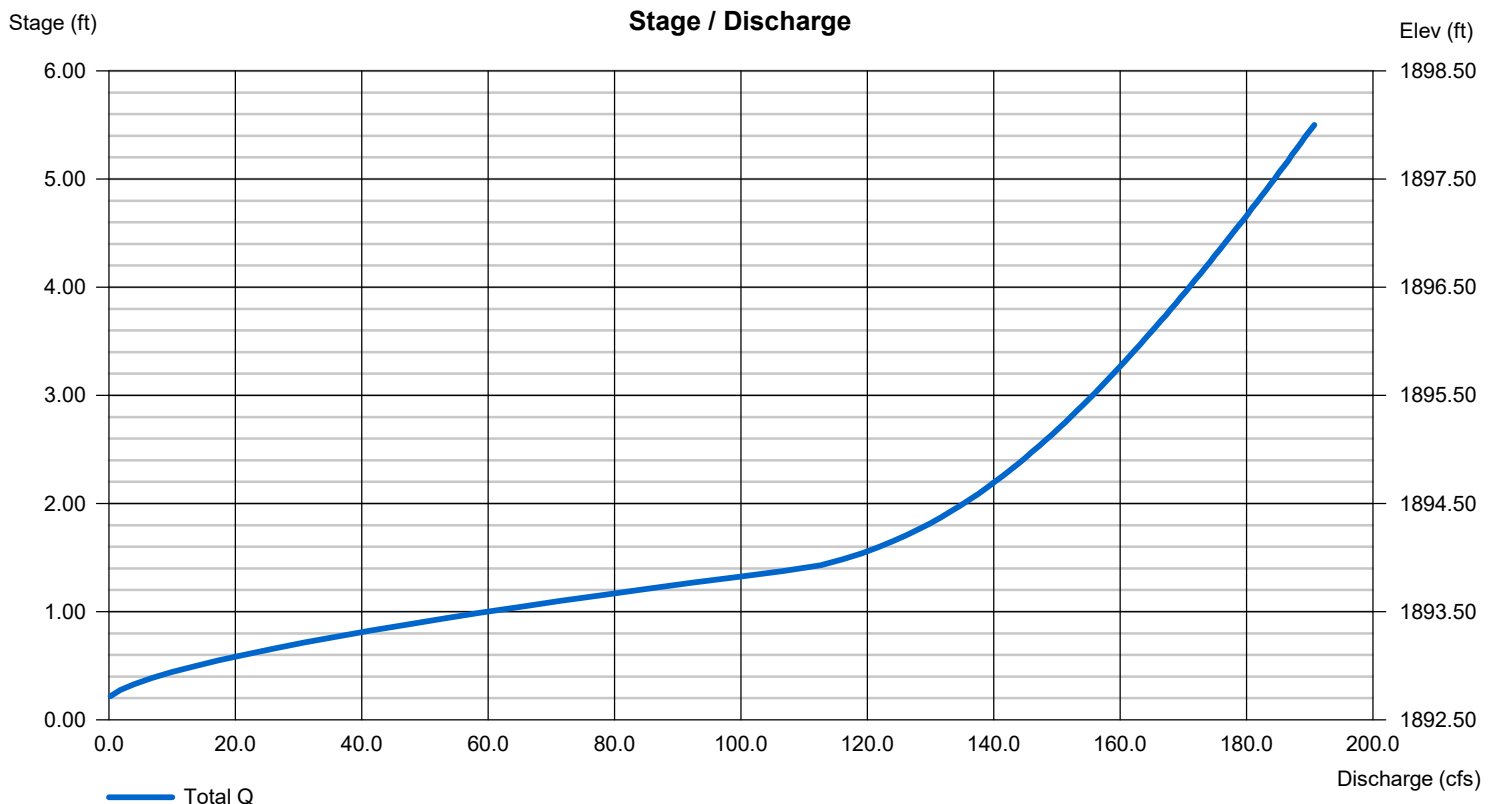
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	Inactive	0.00	0.00
Span (in)	= 36.00	36.00	0.00	0.00
No. Barrels	= 2	1	0	0
Invert El. (ft)	= 1888.60	1888.60	0.00	0.00
Length (ft)	= 125.00	125.00	0.00	0.00
Slope (%)	= 4.48	4.48	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)	= 25.14	0.00	0.00	0.00
Crest El. (ft)	= 1892.70	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

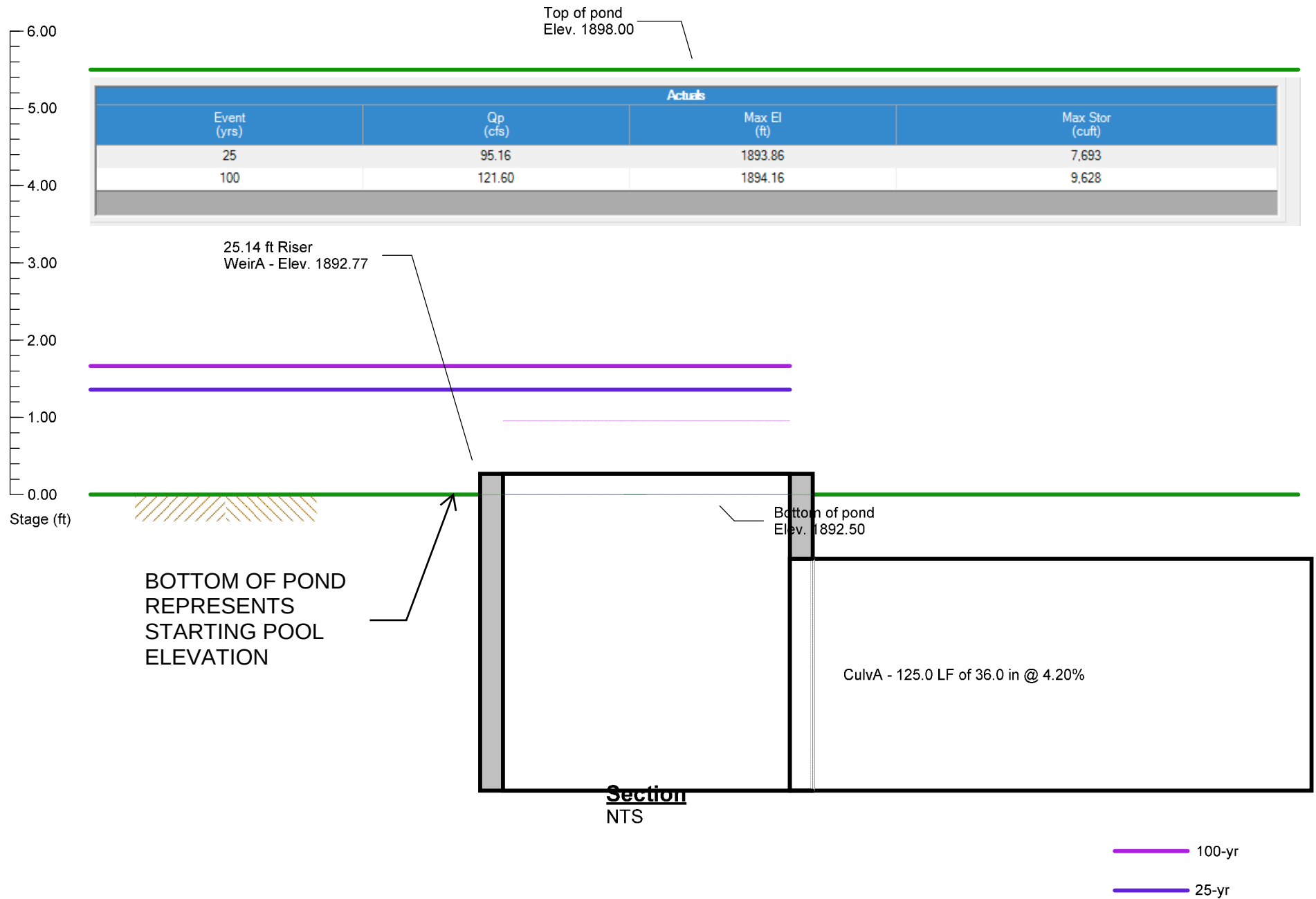
Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Pond No. 1 - EAST OUTLET

INITIAL HYDRAULIC MODELING 2020

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

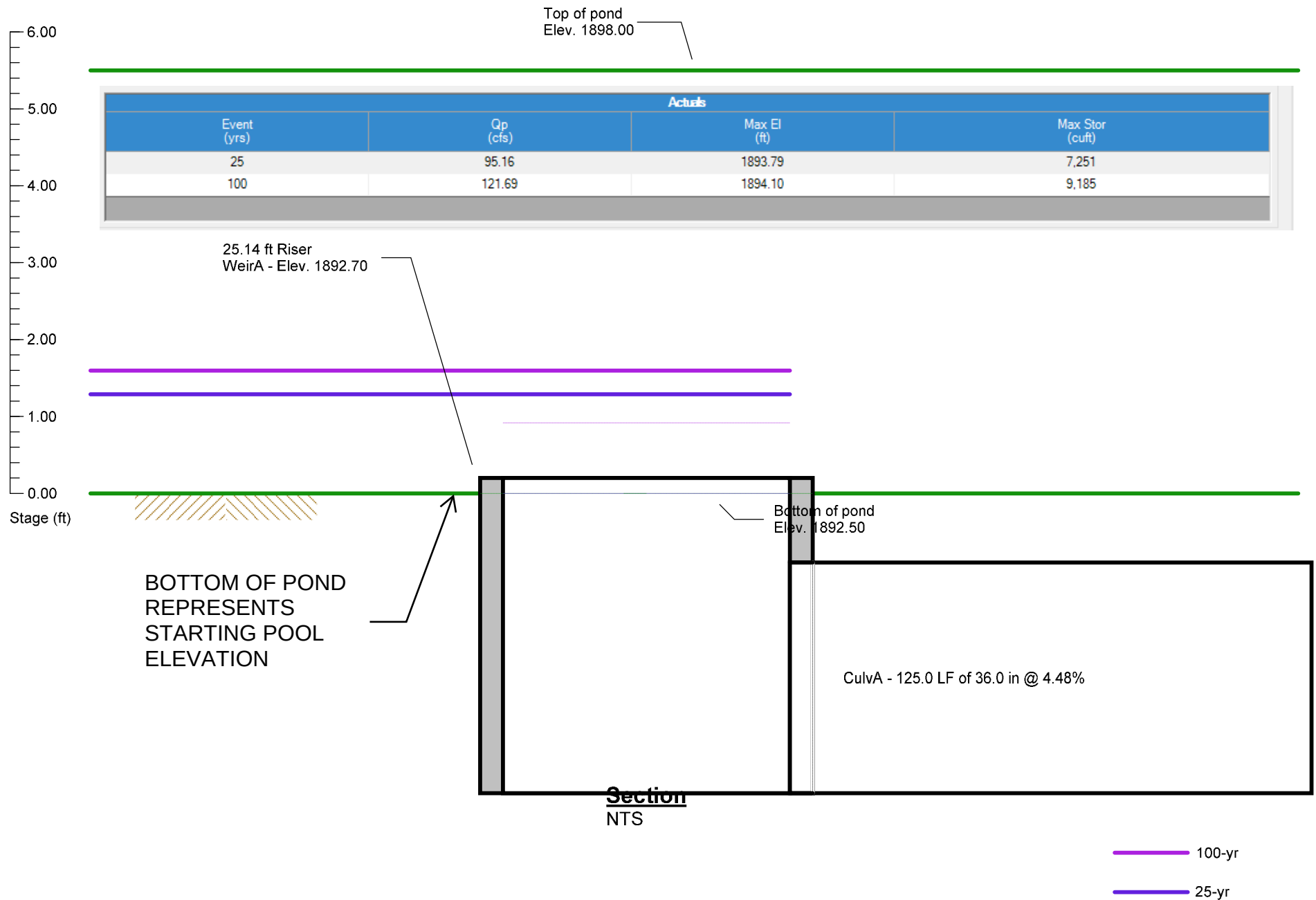


Inflow hydrograph = 6. Combine - TOTAL EAST

Pond No. 2 - WEST OUTLET

INITIAL HYDRAULIC MODELING 2020

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



Inflow hydrograph = 6. Combine - TOTAL EAST

Culvert Report

INITIAL HYDRAULIC MODELING 2020

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

Friday, Nov 20 2020

Circular Culvert

Invert Elev Dn (ft) = 1883.00
 Pipe Length (ft) = 125.00
 Slope (%) = 4.00
 Invert Elev Up (ft) = 1888.00
 Rise (in) = 36.0
 Shape = Circular
 Span (in) = 36.0
 No. Barrels = 1
 n-Value = 0.019
 Culvert Type = Circular Corrugate Metal Pipe
 Culvert Entrance = Headwall
 Coeff. K,M,c,Y,k = 0.0078, 2, 0.0379, 0.69, 0.5

Max. flow for
 1-culvert = 90-cfs.
 Max. flow for system
 is ~150-cfs.
 2 culverts are
 required.

Calculations

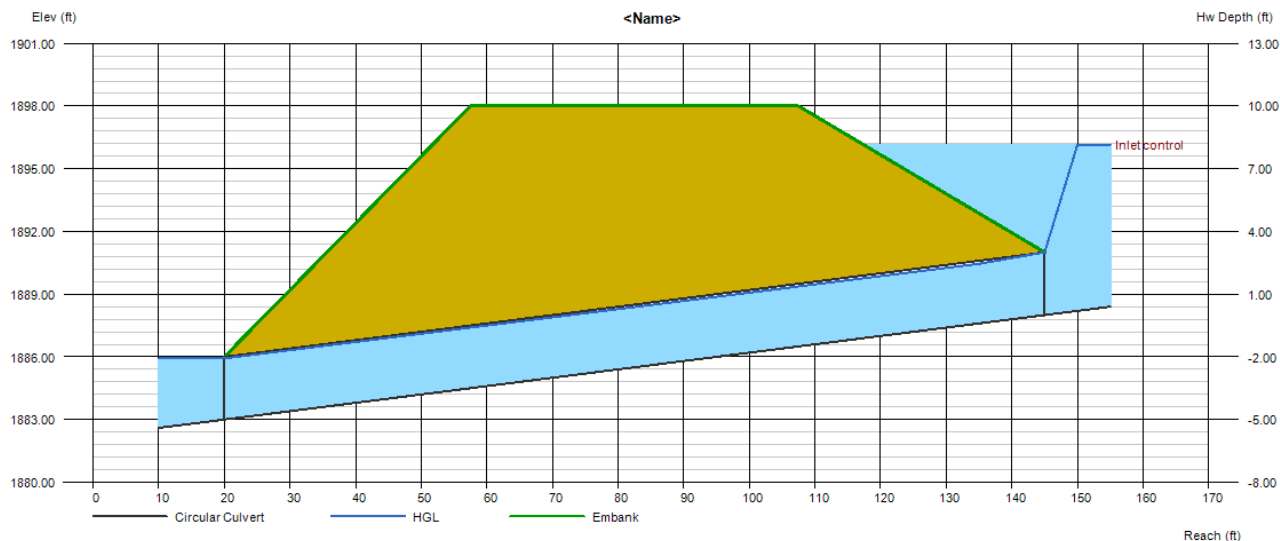
Qmin (cfs) = 0.00
 Qmax (cfs) = 110.00
 Tailwater Elev (ft) = (dc+D)/2

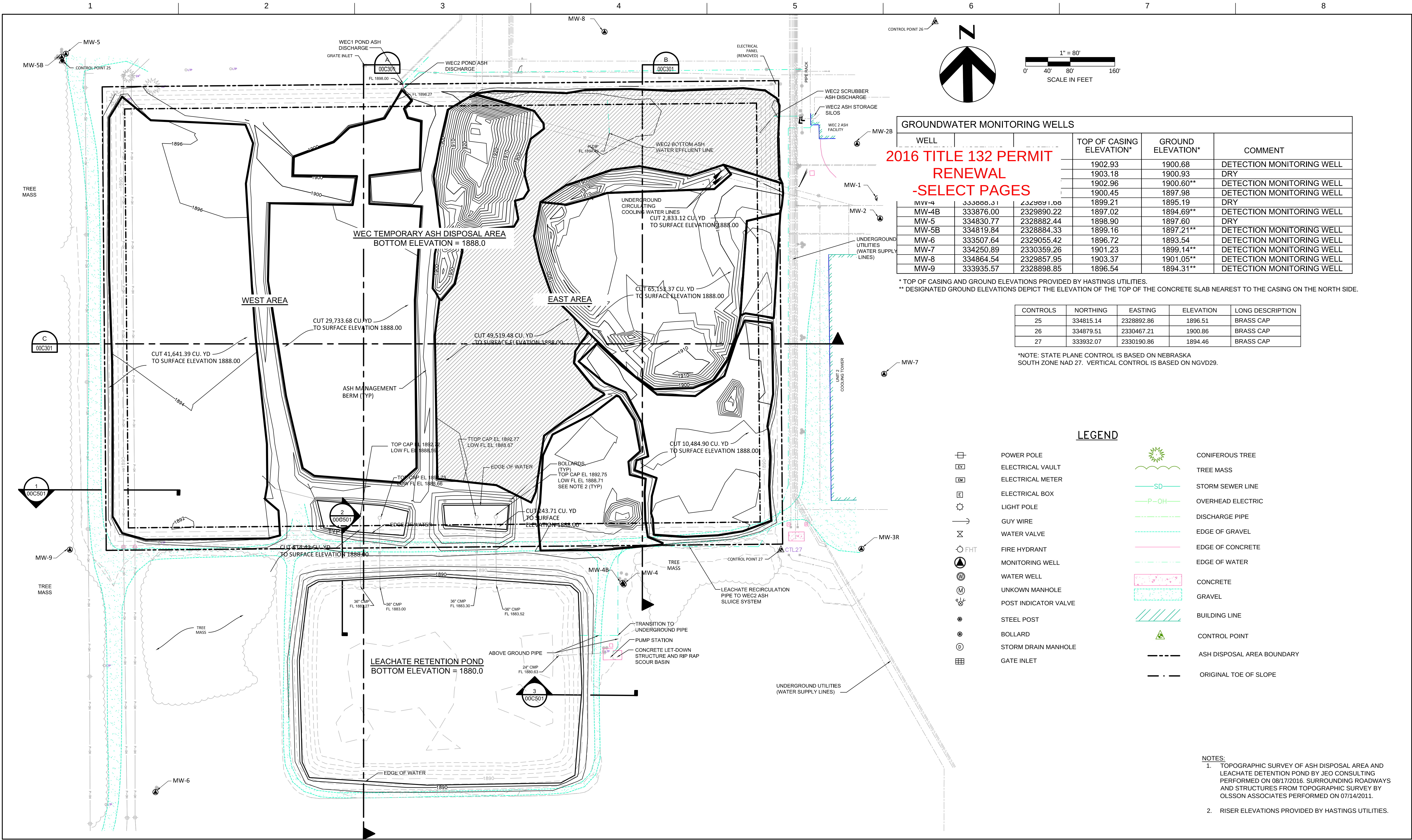
Highlighted

Qtotat (cfs) = 90.00
 Qpipe (cfs) = 90.00
 Qovertop (cfs) = 0.00
 Veloc Dn (ft/s) = 12.82
 Veloc Up (ft/s) = 12.99
 HGL Dn (ft) = 1885.92
 HGL Up (ft) = 1890.85
 Hw Elev (ft) = 1896.15
 Hw/D (ft) = 2.72
 Flow Regime = Inlet Control

Embankment

Top Elevation (ft) = 1898.00
 Top Width (ft) = 50.00
 Crest Width (ft) = 50.00





GROUNDWATER MONITORING WELLS				
WELL		TOP OF CASING ELEVATION*	GROUND ELEVATION*	COMMENT
2016 TITLE 132 PERMIT RENEWAL -SELECT PAGES				
		1902.93	1900.68	DETECTION MONITORING WELL
		1903.18	1900.93	DRY
		1902.96	1900.60**	DETECTION MONITORING WELL
		1900.45	1897.98	DETECTION MONITORING WELL
		1899.21	1895.19	DRY
MW-4	333876.00	2329890.22	1897.02	1894.69** DETECTION MONITORING WELL
MW-5	334830.77	2328882.44	1898.90	1897.60 DRY
MW-5B	334819.84	2328884.33	1899.16	1897.21** DETECTION MONITORING WELL
MW-6	333507.64	2329055.42	1896.72	1893.54 DETECTION MONITORING WELL
MW-7	334250.89	2330359.26	1901.23	1899.14** DETECTION MONITORING WELL
MW-8	334864.54	2329857.95	1903.37	1901.05** DETECTION MONITORING WELL
MW-9	333935.57	2328898.85	1896.54	1894.31** DETECTION MONITORING WELL

* TOP OF CASING AND GROUND ELEVATIONS PROVIDED BY HASTINGS UTILITIES.
** DESIGNATED GROUND ELEVATIONS DEPICT THE ELEVATION OF THE TOP OF THE CONCRETE SLAB NEAREST TO THE CASING ON THE NORTH SIDE.

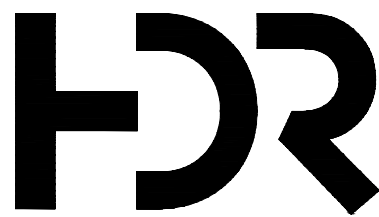
CONTROLS	NORTHING	EASTING	ELEVATION	LONG DESCRIPTION
25	334815.14	2328892.86	1896.51	BRASS CAP
26	334879.51	2330467.21	1900.86	BRASS CAP
27	333932.07	2330190.86	1894.46	BRASS CAP

*NOTE: STATE PLANE CONTROL IS BASED ON NEBRASKA SOUTH ZONE NAD 27. VERTICAL CONTROL IS BASED ON NGVD29.

LEGEND

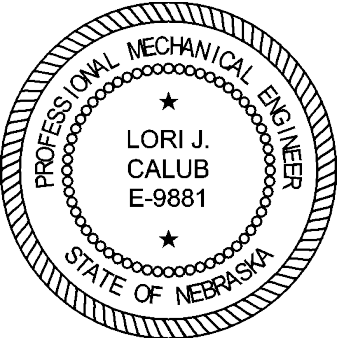
- POWER POLE
- ELECTRICAL VAULT
- ELECTRICAL METER
- ELECTRICAL BOX
- LIGHT POLE
- GUY WIRE
- WATER VALVE
- FIRE HYDRANT
- MONITORING WELL
- WATER WELL
- UNKNOWN MANHOLE
- POST INDICATOR VALVE
- STEEL POST
- BOLLARD
- STORM DRAIN MANHOLE
- GATE INLET
- CONIFEROUS TREE
- TREE MASS
- STORM SEWER LINE
- OVERHEAD ELECTRIC
- DISCHARGE PIPE
- EDGE OF GRAVEL
- EDGE OF CONCRETE
- EDGE OF WATER
- CONCRETE
- GRAVEL
- BUILDING LINE
- CONTROL POINT
- ASH DISPOSAL AREA BOUNDARY
- ORIGINAL TOE OF SLOPE

- NOTES:
- TOPOGRAPHIC SURVEY OF ASH DISPOSAL AREA AND LEACHATE DETENTION POND BY JEO CONSULTING PERFORMED ON 08/17/2016. SURROUNDING ROADWAYS AND STRUCTURES FROM TOPOGRAPHIC SURVEY BY OLSSON ASSOCIATES PERFORMED ON 07/14/2011.
 - RISER ELEVATIONS PROVIDED BY HASTINGS UTILITIES.



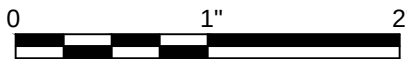
ISSUE	DATE	DESCRIPTION
1	11/3/2016	RESPONSE TO NDEQ COMMENTS
0	10/6/2016	NDEQ TITLE 132 PERMIT RENEWAL

PROJECT MANAGER	L. CALUB
PROJECT NUMBER	000000010040278



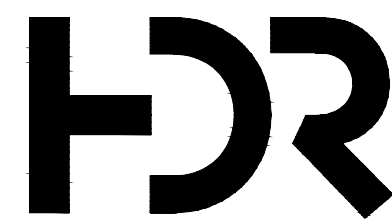
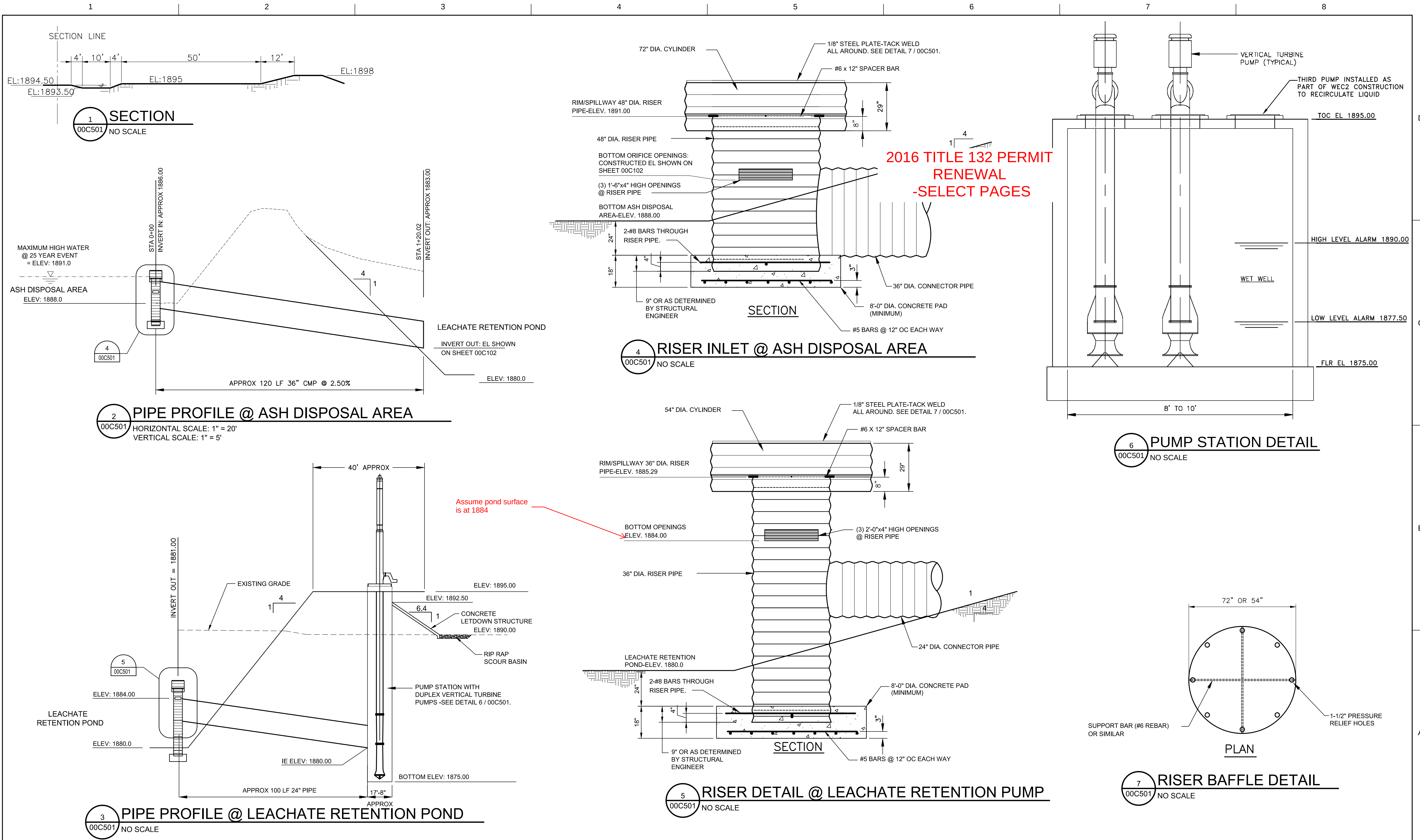
GERALD T. WHELAN ENERGY CENTER
WEC TEMPORARY ASH DISPOSAL AREA

ASH DISPOSAL AREA PLAN



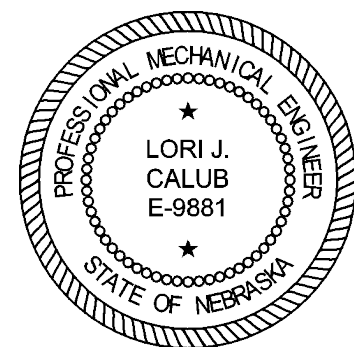
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SCALE	-

SHEET	00C102
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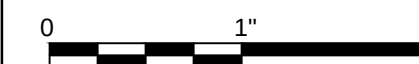
ISSUE	DATE	DESCRIPTION
1	11/3/2016	RESPONSE TO NDEQ COMMENTS
0	10/6/2016	NDEQ TITLE 132 PERMIT RENEWAL

PROJECT MANAGER	L. CALUB
PROJECT NUMBER	000000010040278



GERALD T. WHELAN ENERGY CENTER
WEC TEMPORARY ASH DISPOSAL AREA

LEACHATE MANAGEMENT DETAILS



FILENAME | 00C501.DWG
SCALE | AS SHOWN

SHEET
00C501

ORIGINAL SELECT PAGES -
FROM TITLE 132 PERMIT RENEWAL

APPENDIX M
SITE DRAINAGE CALCULATIONS

HDR ONE COMPANY | Many Solutions

Project	Hastings Utilities, Whelan Energy Center Ash Storage Area	Computed	DJM	Date	10/26/2006
Subject	Site Drainage Calculations	Checked	LJC	Date	11/7/2006
Task	Hydrology and Hydraulics	Sheet	2	Of	18

A. SIZE LEACHATE RETENTION POND

1) Total Volume Quantities (process flows peak day flow on 24 hrs basis and include safety factor of 1.5)

Daily Durations (t)=	24 hrs	or	1440 min		
No. Discharge Days =	1 day	or	1440 min		
Factor of Safety (FS)=	1.5				
1cf =	7.48 gallons				
1 acre =	43,560 sf				
V =	FS*Q*t	ac-ft			
a) Ash Sluice Water - Unit 1	Qsw =	600 gpm	Vsw=	3.98 ac-ft/day	
a) Ash Sluice Water - Unit 2	Qfa =	831 gpm	Vfa=	5.51 ac-ft/day	
c) Cooling Tower (1&2)	Qct =	0 gpm	Vct=	0.00 ac-ft/day	
d) Scrubber Ash Sluicing - Unit 2	Qb =	534 gpm	Vb=	3.54 ac-ft/day	
	Vt =	1965 gpm	Vt =	13.03 ac-ft/day	

2) Size Leachate Retention Pond to completely retain 25yr, 24 hr rainfall and process flows

Total Rainfall =	4.9 in	NOAA	
Evaporation =	0.15 in/day	Regional evaporation for Hastings (56 in/yr)	
Vap =	10 ac-ft	Ash pond runoff = (total rainfall-evaporation)*(area of East & West Ash Ponds)	
Vlr =	1.7 ac-ft	Leachate retention pond runoff =	
Side Slopes	4H:1V	(total rainfall-evaporation)*(Top of Berm Area of Water Depth with +)	

Leachate Retention Pond Design

	Water Depth ft	Floor W1 ft	L1 ft	A1 sf	Top of Berm W2 ft	L2 ft	A2 sf	Vrequired ac-ft	Vavailable ac-ft	Vavailable CF
	4	300	425	127,500	332	457	151,724	24.41	12.82	558,448
x	4.4	300	425	127,500	335	460	154,259	24.43	14.23	619,870
	5	300	425	127,500	364	489	177,996	24.65	17.53	763,740
	6	300	425	127,500	372	497	184,884	24.71	21.51	937,152
xx	7	300	425	127,500	380	505	191,900	24.77	25.66	1,117,900
	8	300	425	127,500	388	513	199,044	24.84	29.99	1,306,176
	9	300	425	127,500	396	521	206,316	24.90	34.49	1,502,172

1-indicates pond bottom dimensions and areas

2-indicates top of berm dimensions and areas

Vrequired = Vt + Vap + Vlr

x = pond dimensions to hold process water only.

xx = pond dimensions to hold process water and storm water.

Estimates are similar
for leachate pond
storage available

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Project	Hastings Utilities, Whelan Energy Center Ash Storage Area	Computed	DJM	Date	10/26/2006
Subject	Site Drainage Calculations	Checked	LJC	Date	11/7/2006
Task	Hydrology and Hydraulics	Sheet	3	Of	18

B. SIZE CONNECTOR PIPES (25-YEAR STORM): ASH PONDSRational Method; $Q = CiA$ 1) C = Runoff Coefficient = 1.002) T_c = Time of ConcentrationSince $T_c \sim 0$ for runoff at each Ash Pond, use $T_c = 5$ min.3) Rainfall Intensity: $i = 8.2$ in/hour for 25 year storm event, $T_c = 5$ min

Reference 1

4) Ash Pond (east)	W=640ft	H=860 ft	Ae=	550,400 SF	12.64 acres
Ash Pond (west)	W=640ft	H=860 ft	Aw=	550,400 SF	12.64 acres

5) Calculate Runoff for $T_c = 5$ min

	Q (cfs)	C	i(in/hr)	A (acres)
Ae	104	1	8.2	12.64
Aw	104	1	8.2	12.64

6) Maximum Daily Flows during normal operating conditions

a) Ash Sluice Water - Unit 1	Qsw =	600 gpm	1.3 cfs
b) Ash Sluice Water - Unit 2	Qfa =	831 gpm	1.9 cfs
c) Cooling Tower (1&2)	Qct =	0 gpm	0.0 cfs
d) Scrubber Ash Sluicing - Unit 2	Qb =	534 gpm	1.2 cfs
	Qt =	1965 gpm	4.4 cfs

7) Determine Number of Connector Pipes to Each Pond Considering 5-minute Duration Storm

Max Q (from west pond) = $Q_w + Q_{sw} + Q_{fa} =$ 107 cfsAssume number of pipes, $n =$ 2 $Q_n = Q/n =$ 53.40 cfsVerify Q_n Provided $Q_n = 1.48 \cdot A \cdot R^{.67} \cdot S^{.5/n}$ A = Pipe Area

slope(S) = 0.025

mannings $n =$ 0.024

diameter = 36 in

 Q_n provided = 57.28 cfs OK

8) Size Ash Pond Spillway

Head on Pipe Spillway (H) = Spillway crest elevation - design high water level of leachate retention pond
 Spillway crest elevation = 1891.00 feet, from drawings
 Design high water level of leachate retention pond = 1885.29 feet, from drawings
 $H =$ 5.71 feet

Table 2-8, ref. 4

For $H =$ 5.71 Spillway capacity = 68.80 cfs > 53.40 cfs, OK

9) Spillway Capacity Considering Pipe length

Pipe length = 120 lf

Pipe diameter = 36 in

Table 2-8, ref. 4 Correct flow for Length of 120 lf
 Correction factor from table = 0.86

So, corrected discharge capacity = 68.80 x 0.86 = 59.17 cfs
 59.17 cfs > 53.40 cfs, OK

Q is higher for 100-yr storm

Revised estimate is 400k GPD, 0.62-cfs

Installed slope is higher

Spillway to be reshaped with culvert connection

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Project	Hastings Utilities, Whelan Energy Center Ash Storage Area	Computed	DJM	Date	10/26/2006
Subject	Site Drainage Calculations	Checked	LJC	Date	11/7/2006
Task	Hydrology and Hydraulics	Sheet	4	Of	18

10) Determine Riser Size

Required Q = 53.40 cfs

Riser size = 48 in

From Figure 2-13, ref. 4: Max. head above the orifice crest when passing required Q = 1.2 ft

Elevation of orifice crest = 1888.67 ft, from drawings

Elevation of spillway crest = 1891.00 ft, from drawings

2.33 ft >

1.2 ft, OK

1.6-ft - OK

11) Area of Orifices Required

Assume height (h) above crest of orifice =

2 inches = 0.17 ft

Qorifice = $C_d \cdot A \cdot (2gh)^{0.5}$ Q = Discharge = $1/2 \cdot Q_t \cdot FS/n$ =

Cd = Orifice Coefficient = 0.70

h = Height = 0.17 ft

g = Gravity = 32.20 ft/sec²

A = Orifice Area = 0.72 sf

Assume 3 openings, A = 0.24 sf

1.64 cfs per outlet pipe

Meets base flow from sluice

Assume orifice height = 4 inches = 0.33 ft

Orifice length = 0.72 ft

Use 3 openings 4 inch high by 1.50 ft long

12) Rise of Water in Ash Pond From 25-year 24-hour storm

From sheet 2, total rainfall from a 25-year 24-hour storm event =

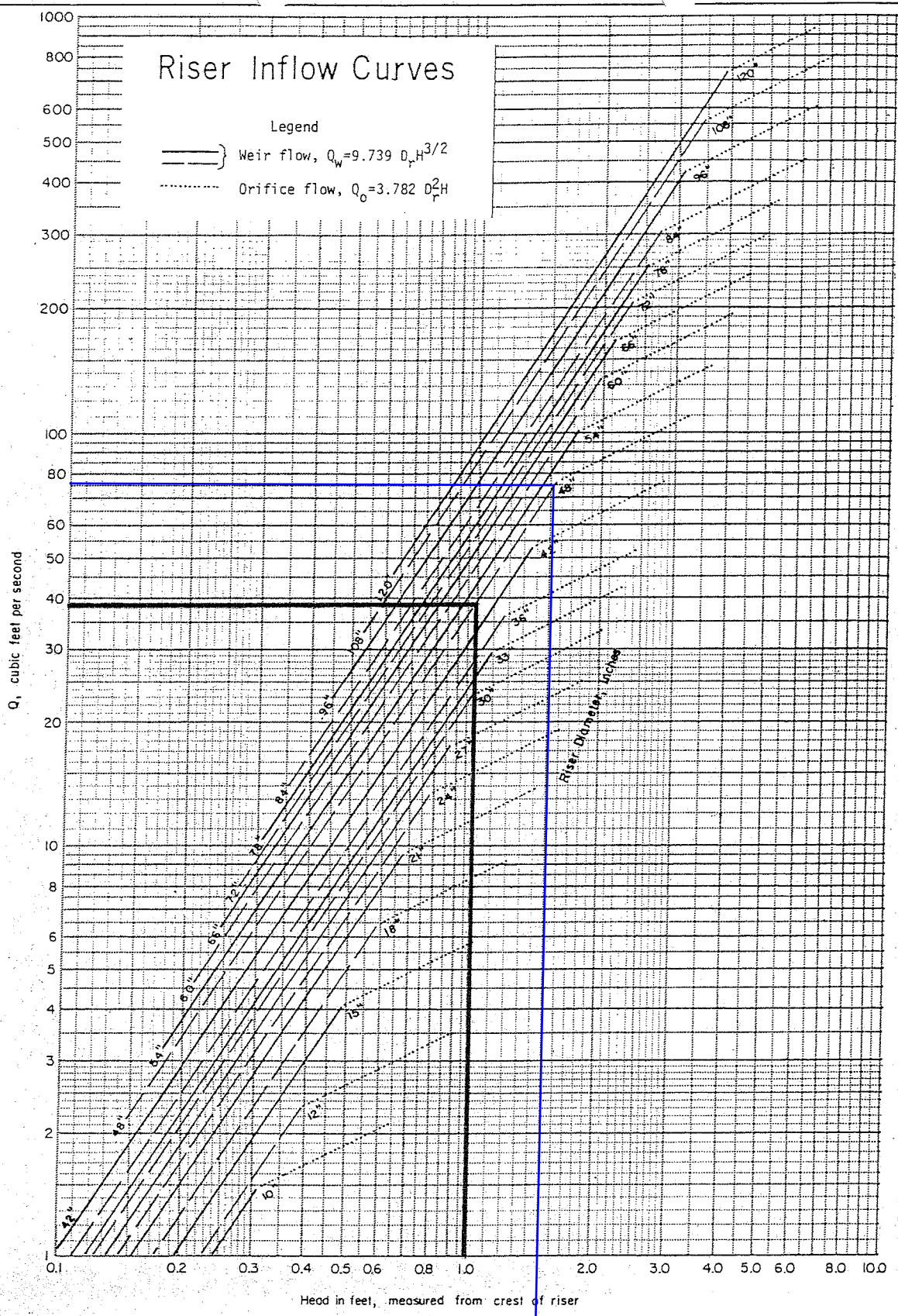
4.9 in =

0.41 ft

See hydraflow output for clear areas.

11 *H*

Ref. 4



Source: Soil Conservation Service

Riser Inflow Curves Sediment Basin

Date
JAN 1993

Figure
2-13