PRELIMINARY DRAINAGE REPORT

FOR

DITTMER COMMERCIAL

Iris Ave. & 29th St.
Crete, Nebraska

Prepared By:

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State of Nebraska Certificate of Authorization # CA0008

E & A Project Number: P2022.289.001

August 15, 2024

Table of Contents

1. Executive Summary

Dittmer Commercial is a new commercial development encompassing approximately 9 acres within the City of Crete municipal limits. The approximate location is 29th Street and Iris Avenue (reference Appendix A - Site Vicinity Map). The preliminary plat, construction drawings and final plat were submitted to the City of Crete for review and approval.

The preliminary and final plat include a portion of the overall property. At this time, only the commercial development is moving forward.

Sanitary service for the commercial portion of the development is proposed to gravity sewer to the northwest. The City of Crete has expressed limiting development on this branch main to ensure that adequate capacity is maintained in the sanitary sewer trunk for future growth along Highway 33. The remainder of the property will be sewered by a sanitary sewer lift station to be installed by the City of Crete in conjunction with future platting.

This site is adjacent to a tributary of Walnut Creek. According to the FEMA Flood Insurance Rate Maps, Panel 31109C0390F, there is no floodplain within the developing property. A wetland delineation was not completed but from aerial imagery the tributary is likely under the jurisdiction of the U.S. Army Corps of Engineers. Development improvements are proposed immediately adjacent to the channel; so, wetland disturbance is not anticipated as part of this development.

The commercial development will be graded to drain to the south into a proposed extended dry detention basin. The pond will utilize a multi-stage outlet structure to attenuate the post-development runoff rates to below the pre-development flow rates. The proposed pond design also accounts for managing runoff from 10 acres adjacent to the commercial development which is programed for future residential development. Pond design has been sized with the future buildout taken into account. The City of Crete has no post-development water quality standards at this time.

This report presents a hydrology study of existing conditions and the proposed development with incorporated Best Management Practices (BMPs) for storm water management.

2. Pre-Developed Site

2.1.1 Existing Usage of Land

The existing site consists of mostly grass and woods along the unnamed stream.

2.1.2 Wetlands and Preservation of Natural Areas

The Supreme Court decision in Sackett v. EPA (2023) changed the U.S. Army Corps of Engineers jurisdiction. However, it is likely that the channel and adjacent banks are jurisdictional based on aerial imagery.

Construction activity is not planned within potential jurisdictional areas. If conflict is unavoidable, proper permitting will be obtained prior to disturbance. For additional information please reference Appendix H, National Wetland Viewer.

2.1.3 Site Soil Information

Soil classification for stormwater runoff calculations is referenced from the USDA National Cooperative Soil Survey. The user selected site is comprised of the following soils: Burchard Clay Loam, Malmo Silty Clay Loam, Pawnee Clay Loam, and Wymore Silty Clay Loam. The survey also classified the project area's only hydrologic soil Type as Type D. For additional information on soil type please reference Appendix B, Soil Information.

2.1.4 Existing Topography

Existing site topography was provided by Catlett Surveying. Catlett Surveying has been working on this property for many years based on an assumed local coordinate system. This approach limits the ability to correlate field survey with publicly available GIS data for a comprehensive look at the drainage areas. However, field survey data was supplemented with 2022 LiDAR data obtained from United States Geological Survey (USGS) to establish the general drainage boundaries beyond the limits of the Catlett Surveying's data.

2.1.5 Pre-Development Site Hydrology

The majority of the site flows south/southwest and discharges directly to the unnamed stream. A twin 3' x 5' concrete box culvert takes the water across Iris Avenue to the west. Minimal perimeter areas of the site drain to the north onto 29th Street and eventually into the existing storm sewer system. The following assumptions were made in the calculation of pre-development runoff.

Table 1.0 – Referenced NOAA Atlas 14 Rainfall for Crete, Nebraska

24-Hour Design Rainfall	
Storm Event	**Rainfall (inches)**
2-Year	2.98
10-Year	4.40
100-Year	7.31

Table 2.0 – SCS Curve Numbers for Pre-Development Runoff

SCS Method Curve Numbers (CN)	
Land Classification	**CN**
	C
Woods & Grass - Good	79
Pavement - Impervious	98

The following table summarizes the calculated pre-development runoff. For a visual representation of areas please reference Appendix C, Pre-Development Drainage Map. For details on calculated flows, reference Appendix F, PCSMP HydroCAD Software Model Report.

Table 3.0 – Pre-Development Runoff per Area Summary

Pre-Development Area (ID)	Area (acres)	CN	Time of Concentration (min)	2-YR Peak Flow (cfs)	10-YR Peak Flow (cfs)	100-YR Peak Flow (cfs)
EX-A	17.791	80	14.1	30.21	58.13	116.97

3. Post Developed Site

3.1.1 Proposed Usage of Land

The proposed usage will be seven commercial lots. The first phase of development includes an approximately 4,000 square foot building with parking and perimeter drive access. The second phase includes five 5,000 square foot buildings and one 6,000 square foot building to the east of the first building. Approximately 8 acres of the total 19 acres is anticipated to be developed.

3.1.2 Post-Development Site Hydrology

The commercial development will consist of buildings, private roadways, and parking lots. A conceptual layout was used for analysis and buildings are assumed to have gable roofs. Table 2.2a from the TR-55 was used to approximate the curve numbers for the proposed post-development conditions.

Basin A includes private and public stormwater runoff collected from the roofs, parking lots, and drives through a series of area and curb inlets. The stormwater runoff is conveyed to the southeast corner of the drive from 29th Street, and in the southwest corner of the parking lots. South of the proposed development is a basin with a swale from the southwest lots and a culvert from the southeast corner feeding into it. The basin then outlets to the unnamed stream.

The following assumptions were made in the pipe sizing calculations. See Appendix F, Preliminary Pipe Sizing Calculations for the sub-basin map and calculations.

Table 4.0 – Summary of Assumptions for Pipe Sizing Calculations

Pipe Sizing Calculations		
Time of Concentration, Minimum (min.)	**Storm Event (Yr)**	**Rainfall Intensity (in/hr)**
8	10	6.55
	100	9.96

Table 5.0 – Rational Method C-Values for Post Development Runoff

Rational Method C-Values	
Land Classification	**C**
Urban District - Industrial	0.80
Unimproved – Flat	0.10
Unimproved Average	0.25
Suburban	0.40

The following tables summarize the calculated Post Development runoff and assumptions made for calculations. For a visual representation of areas please see Appendix D, Post-Development Drainage Map. For details on calculated flows, reference Appendix F, HydroCAD Software Model Report.

Table 6.0 – SCS Curve Numbers for Post Development Runoff

Land Classification	**CN**
	D
Pavement – Impervious	98
1/8 Acre Lot	92
1/4 Acre Lot	87
>75% Grass Cover - Good	80
Woods & Grass - Good	79

Table 7.0 – Post Development Runoff per Area Summary

Post-Development Area (ID)	Area (acres)	CN	Time of Concentration (min)	2-Year Peak Flow (cfs)	10-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)
A1	14.21	89	10.9	40.12	66.37	118.03
A2	4.96	79	8.0	12.26	21.80	41.08

The following table compares the pre-development and post-development runoff rates.

Table 8.0 – Hydrologic Summary for Pre- & Post-Development Conditions

	Peak Runoff Rate (CFS)		
Pre-Development*	2-Year	10-Year	100-Year
EX-A – Generated [1S]	30.21	58.13	116.97
Post-Development*			
A1 – Generated [1S]	40.12	66.37	118.03
A1 – Attenuated (Pond A1) [1P]	18.68	45.56	83.39
A2 – Generated [2S]	12.26	21.80	41.08
Impact Point A – Generated [1L]	22.48	58.02	112.90

*Sub-basin ID – Flow Method (Desc.) [HydroCAD ID]

3.1.3 Culverts

Iris Avenue is a rural section roadway. A proposed private street connection to Iris Avenue will include a culvert pipe to convey ditch drainage under the intersection. Culvert C1 analyzed the headwater during the minor and major events adjacent to Iris Avenue. The contributing area to this culvert has been delineated to include roughly the western half of the Walmart parking lot and 29th Street. For details on calculated flows, reference Appendix G, HY-8 Culvert Analysis.

Table 9.0 – Culvert Summary of Area and Runoff

Culvert	Size	Storm Event	Top of Roadway Elevation (ft.)	Peak Flow (cfs)	HW Elevation (ft.)
C1	24" RCP	10-Year	1400.00	16.30	1398.75
		100-Year		30.70	1400.19

3.1.4 Basin Design

There is one basin designed for the proposed commercial development. Pond A1 will receive the majority of runoff from the commercial development, and a portion of the runoff from the future residential to the east. Full buildout of these units was used when calculating flows and water surface elevations. For more information, reference Appendix F, HydroCAD software model report.

Table 10.0 – Pond Multi Stage Outlet Structures

Pond Multi Stage Outlet Structure Information										
	Outlet Pipe		Low Flow		Weir		Rim		Spillway	
Pond ID	Size (in.)	Elev. (ft)	Size (in.)	Elev. (ft)	Size (in.) W x H	Elev. (ft)	Size (in.)	Elev. (ft)	Length (ft)	Elev. (ft)
A1	36	1386.00	3.0	1386.50	20” x 27”	1390.30	36 x 36	1393.00	14	1394.00

Table 11.0 – Pond Water Surface Elevation (Ft.)

Pond ID	2-Year	10-Year	100-Year	Spillway Elev.	Top of Pond
A1	1391.39	1392.29	1393.48	1394.00	1395.00

4. Post Construction Stormwater Management Plan (PCSMP)

4.1 Jurisdiction and Requirements

The City of Crete has no post-development storm water treatment requirements.

5. References

1. Agriculture, U. S. (n.d.). *Web Soil Survey*. Retrieved from Natural Resources Conservation Service: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

2. County, L. (n.d.). *Lancaster-Lincoln Geographic Information Systems*. Retrieved from: https://opendata.lincoln.ne.gov/datasets

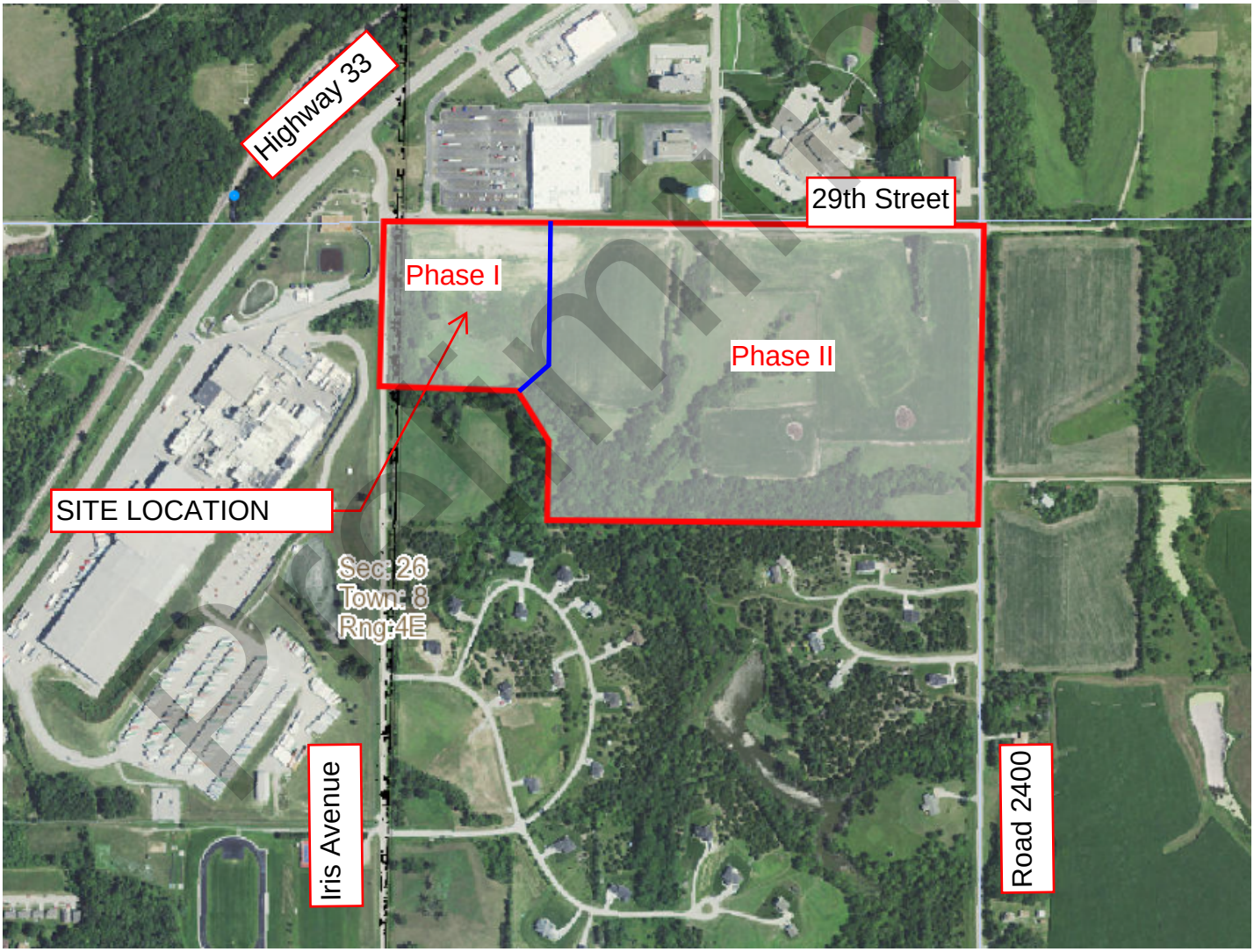
3. Division, L. o. (2004 - 2014). *City of Lincoln Flood and Water Quality Protection Manual .* Lincoln, NE: City of Lincoln. Retrieved from https://lincoln.ne.gov/city/ltu/watershed/dcm/

6. Appendices

APPENDIX A: SITE VICINITY MAP

Dittmer Commercial Addition Site Map

29th Street & Iris Avenue, Crete Nebraska



APPENDIX B: SOIL INFORMATION

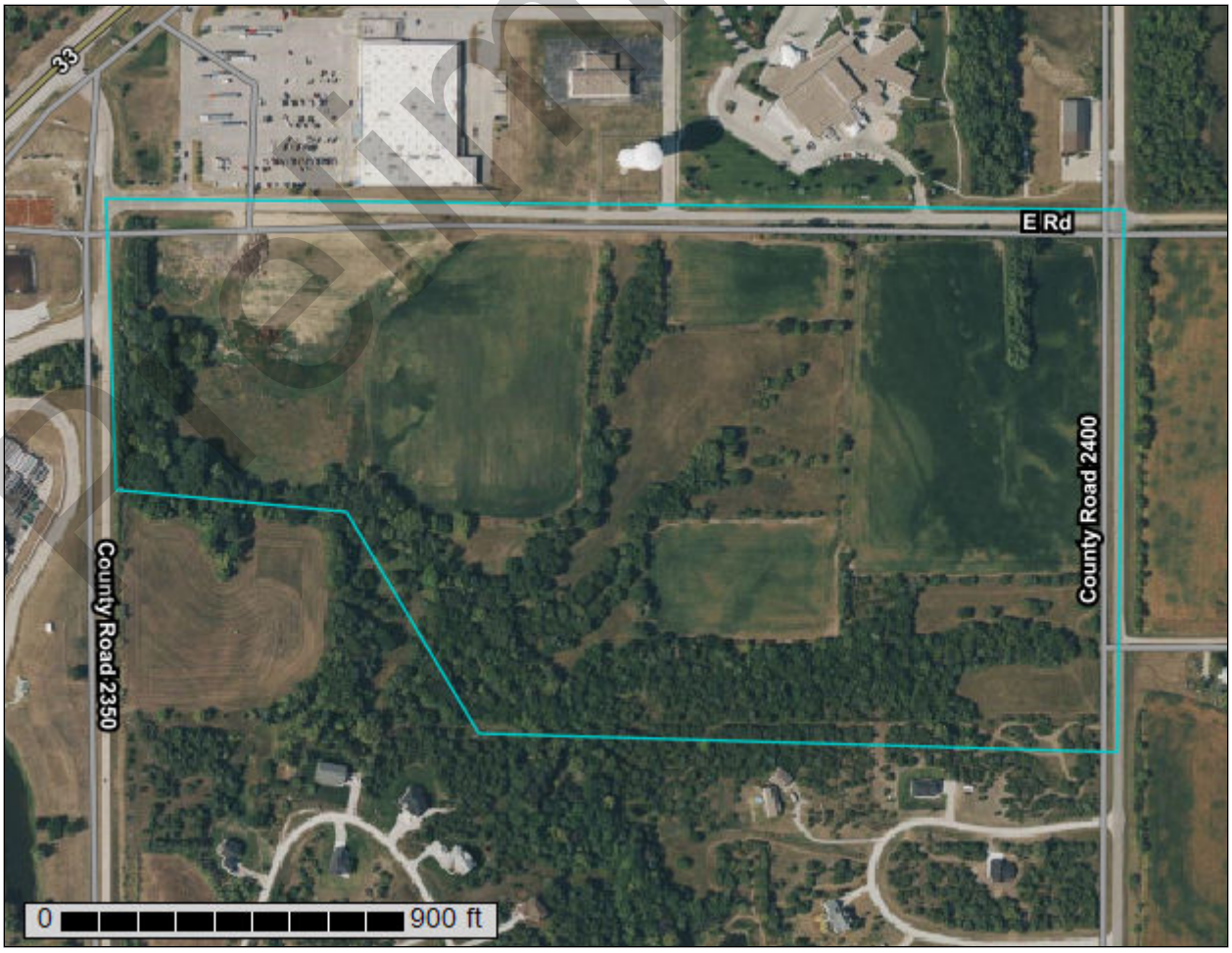
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Saline County, Nebraska



May 8, 2024

Custom Soil Resource Report
Soil Map

Map Scale: 1:4,480 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Saline County, Nebraska
Survey Area Data: Version 23, Sep 6, 2023

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

Date(s) aerial images were photographed: Aug 21, 2021—Aug 28, 2021

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
7219	Burchard clay loam, 11 to 17 percent slopes, eroded	22.7	30.4%
7228	Burchard clay loam, 6 to 11 percent slopes, eroded	24.8	33.2%
7348	Malmo silty clay loam, 3 to 6 percent slopes, eroded	2.4	3.2%
7501	Pawnee clay loam, 4 to 8 percent slopes, eroded	5.6	7.5%
7683	Wymore silty clay loam, 3 to 6 percent slopes	18.2	24.3%
7684	Wymore silty clay loam, 3 to 6 percent slopes, eroded	1.0	1.3%
Totals for Area of Interest		**74.7**	**100.0%**

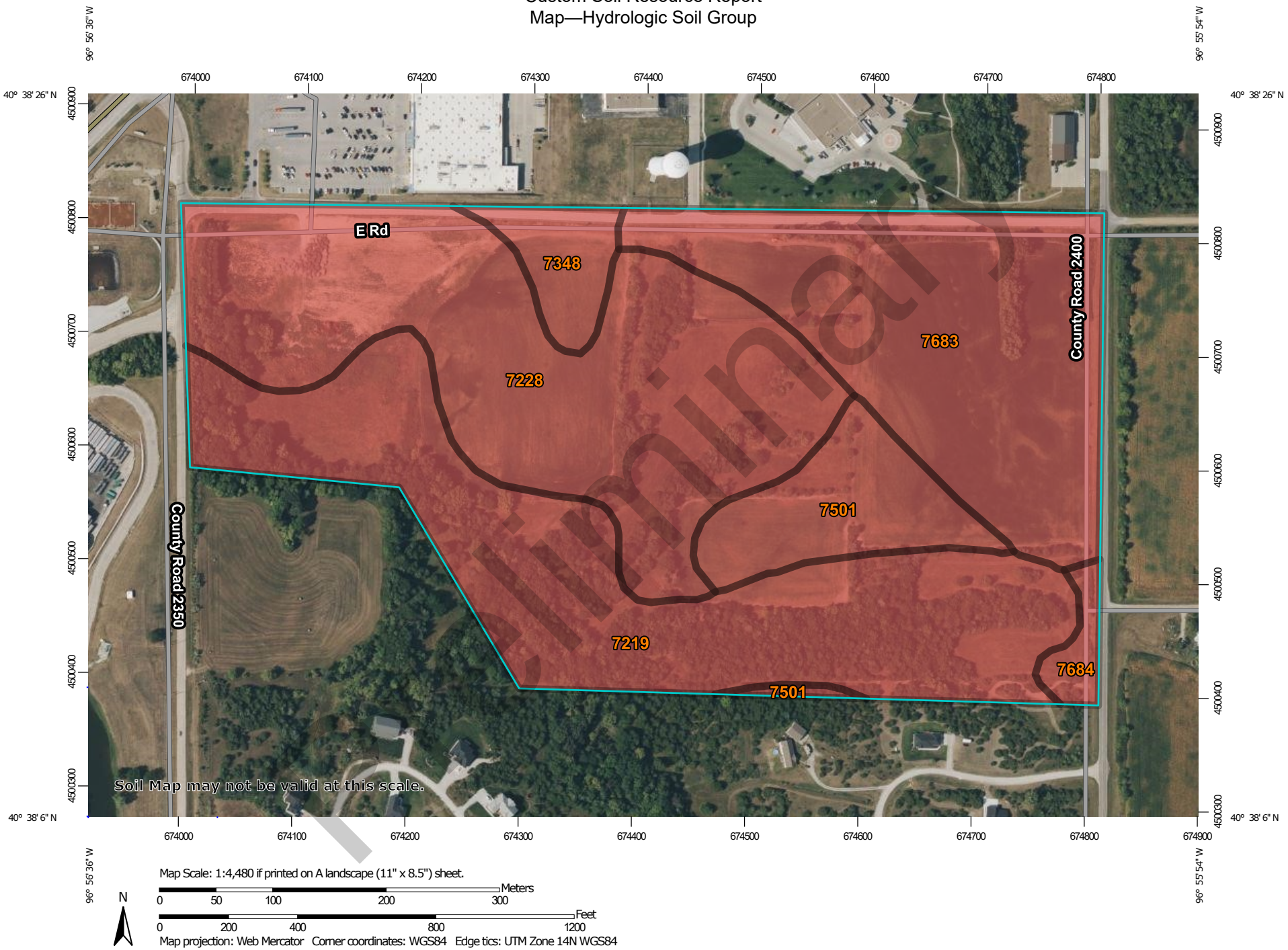
Map Unit Descriptions

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

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

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

Custom Soil Resource Report
Map—Hydrologic Soil Group



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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Survey Area Data: Version 23, Sep 6, 2023

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

Date(s) aerial images were photographed: Aug 21, 2021—Aug 28, 2021

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
7219	Burchard clay loam, 11 to 17 percent slopes, eroded	D	22.7	30.4%
7228	Burchard clay loam, 6 to 11 percent slopes, eroded	D	24.8	33.2%
7348	Malmo silty clay loam, 3 to 6 percent slopes, eroded	D	2.4	3.2%
7501	Pawnee clay loam, 4 to 8 percent slopes, eroded	D	5.6	7.5%
7683	Wymore silty clay loam, 3 to 6 percent slopes	D	18.2	24.3%
7684	Wymore silty clay loam, 3 to 6 percent slopes, eroded	D	1.0	1.3%
Totals for Area of Interest			**74.7**	**100.0%**

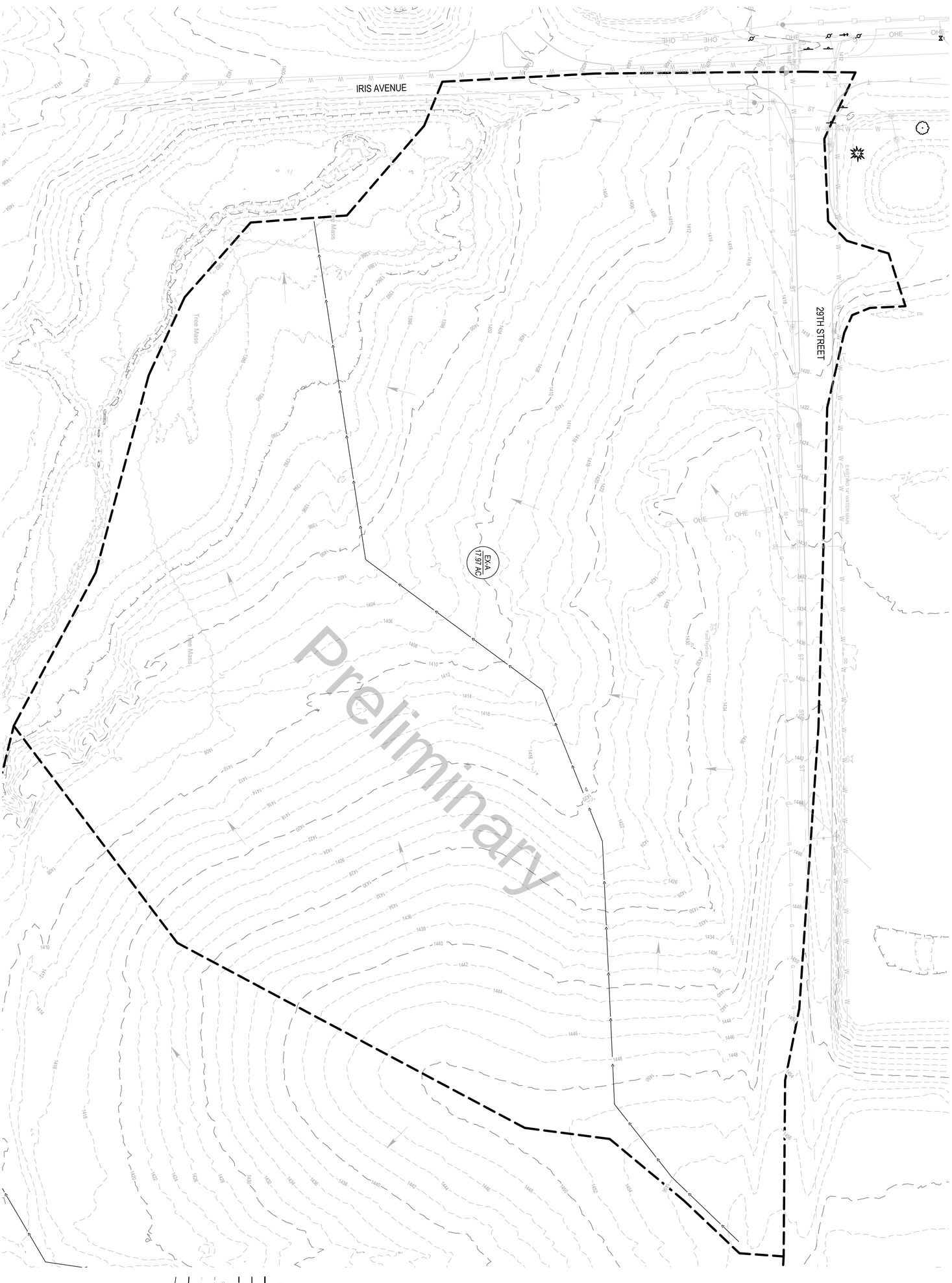
Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX C: PRE-DEVELOPMENT DRAINAGE MAP



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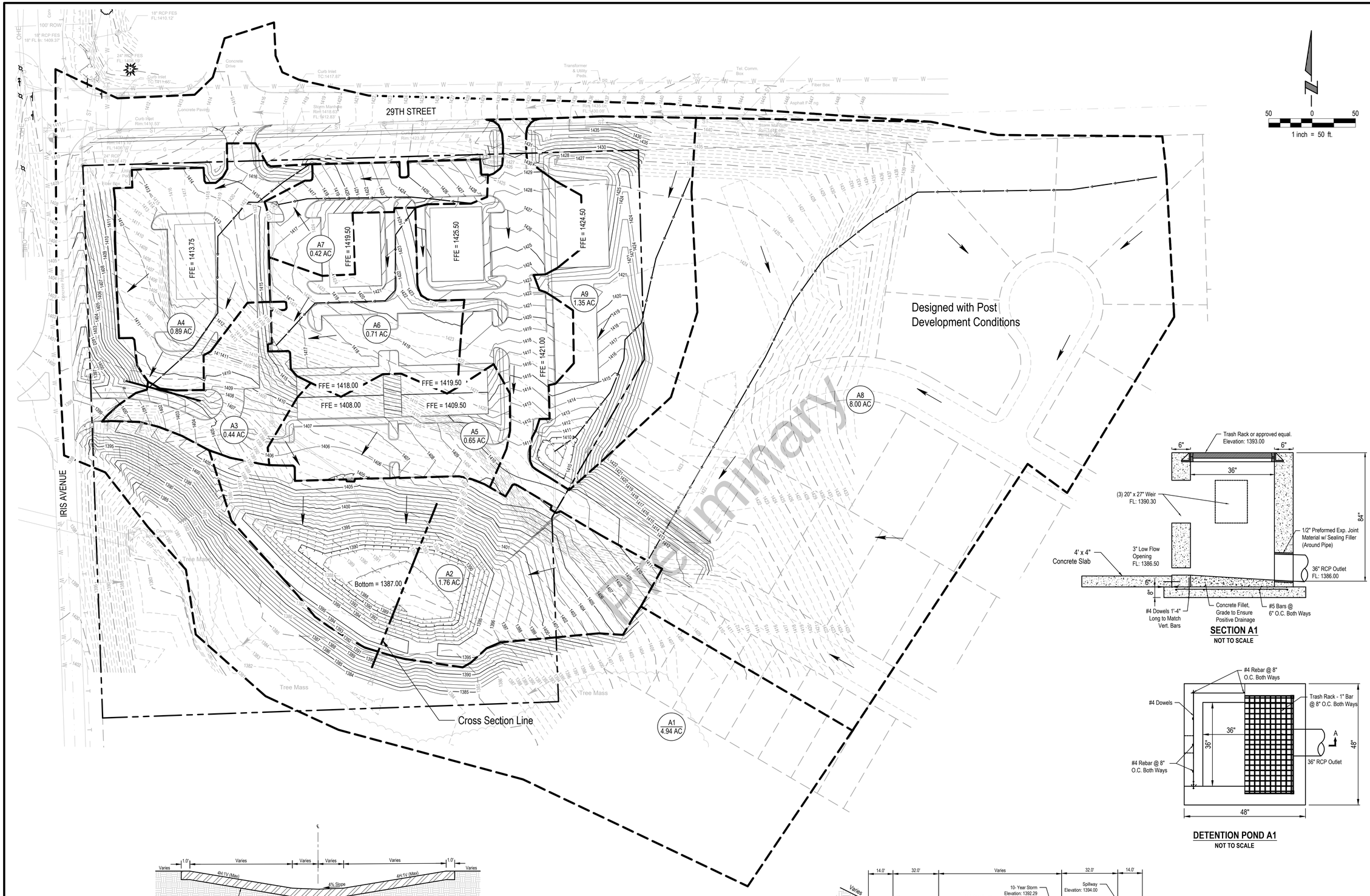
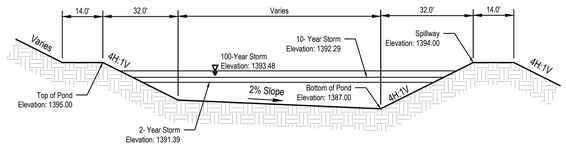
APPENDIX D: POST DEVELOPMENT DRAINAGE MAP



SECTION A1
NOT TO SCALE

DETENTION POND A1
NOT TO SCALE

WATER QUALITY GRASS SWALE CROSS SECTION
NOT TO SCALE



DETENTION POND A1 CROSS SECTION
NOT TO SCALE

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DITTMER COMMERCIAL
ADDITION
DRAINAGE REPORT
CRETE, NEBRASKA

POST DRAINAGE EXHIBIT

PRELIMINARY
NOT FOR
CONSTRUCTION

Revision	Description	Date
1		

Prog No: 2022.289.001
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Sheet: 2 of 3

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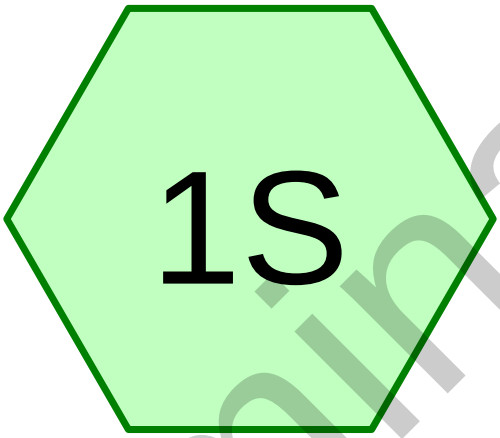
APPENDIX E:

HYDROCAD SOFTWARE MODEL REPORT



EX-A

Subcat Reach Pond Link

Routing Diagram for Pre-000
Prepared by E&A Consulting Group, Printed 8/15/2024

Project Notes

Rainfall events imported from "Temporary Basins.hcp"

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type II 24-hr		Default	24.00	1	3.04	2
2	10-Year	Type II 24-hr		Default	24.00	1	4.48	2
3	100-Year	Type II 24-hr		Default	24.00	1	7.33	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.957	98	Paved parking, HSG C (1S)
17.014	79	Woods/grass comb., Good, HSG D (1S)
17.971	**80**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.957	HSG C	1S
17.014	HSG D	1S
0.000	Other	
17.971		**TOTAL AREA**

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: EX-A Runoff Area=17.971 ac 5.33% Impervious Runoff Depth>1.17"
Flow Length=1,265' Tc=14.1 min CN=80 Runoff=30.21 cfs 1.745 af

Total Runoff Area = 17.971 ac Runoff Volume = 1.745 af Average Runoff Depth = 1.17"
94.67% Pervious = 17.014 ac 5.33% Impervious = 0.957 ac

Summary for Subcatchment 1S: EX-A

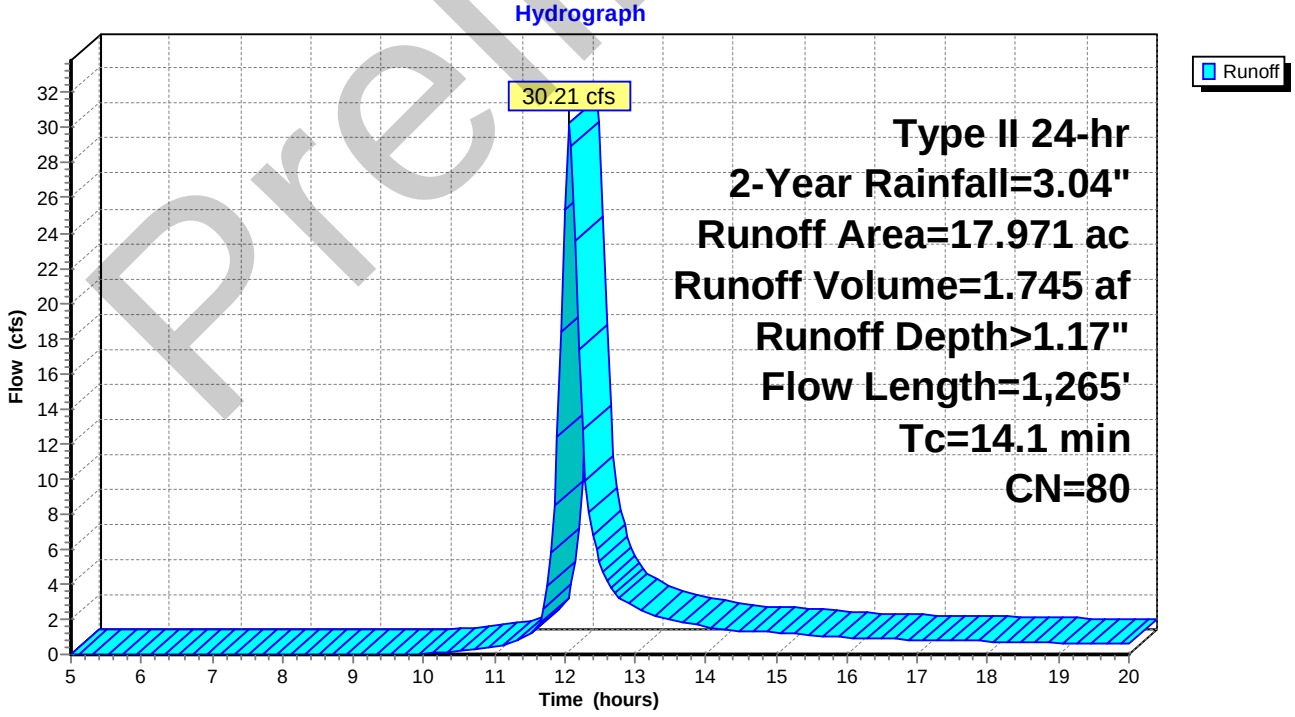
Runoff = 30.21 cfs @ 12.07 hrs, Volume= 1.745 af, Depth> 1.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.04"

Area (ac)	CN	Description
17.014	79	Woods/grass comb., Good, HSG D
0.957	98	Paved parking, HSG C
17.971	80	Weighted Average
17.014		94.67% Pervious Area
0.957		5.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	100	0.0257	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.04"
0.5	100	0.0434	3.35		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.9	285	0.1076	5.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.6	780	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.1	1,265	Total			

Subcatchment 1S: EX-A



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: EX-A Runoff Area=17.971 ac 5.33% Impervious Runoff Depth>2.25"
Flow Length=1,265' Tc=14.1 min CN=80 Runoff=58.13 cfs 3.374 af

Total Runoff Area = 17.971 ac Runoff Volume = 3.374 af Average Runoff Depth = 2.25"
94.67% Pervious = 17.014 ac 5.33% Impervious = 0.957 ac

Summary for Subcatchment 1S: EX-A

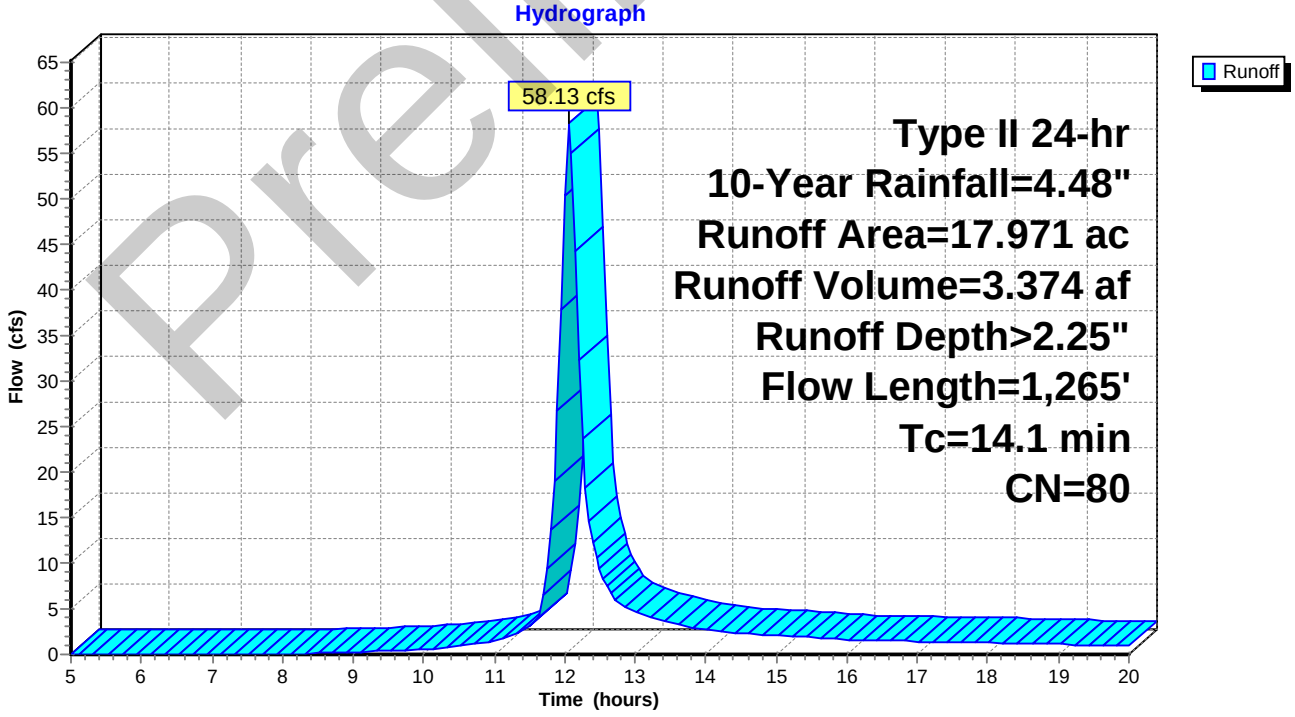
Runoff = 58.13 cfs @ 12.06 hrs, Volume= 3.374 af, Depth> 2.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.48"

Area (ac)	CN	Description
17.014	79	Woods/grass comb., Good, HSG D
0.957	98	Paved parking, HSG C
17.971	80	Weighted Average
17.014		94.67% Pervious Area
0.957		5.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	100	0.0257	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.04"
0.5	100	0.0434	3.35		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.9	285	0.1076	5.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.6	780	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.1	1,265	Total			

Subcatchment 1S: EX-A



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: EX-A Runoff Area=17.971 ac 5.33% Impervious Runoff Depth>4.66"
Flow Length=1,265' Tc=14.1 min CN=80 Runoff=116.97 cfs 6.974 af

Total Runoff Area = 17.971 ac Runoff Volume = 6.974 af Average Runoff Depth = 4.66"
94.67% Pervious = 17.014 ac 5.33% Impervious = 0.957 ac

Summary for Subcatchment 1S: EX-A

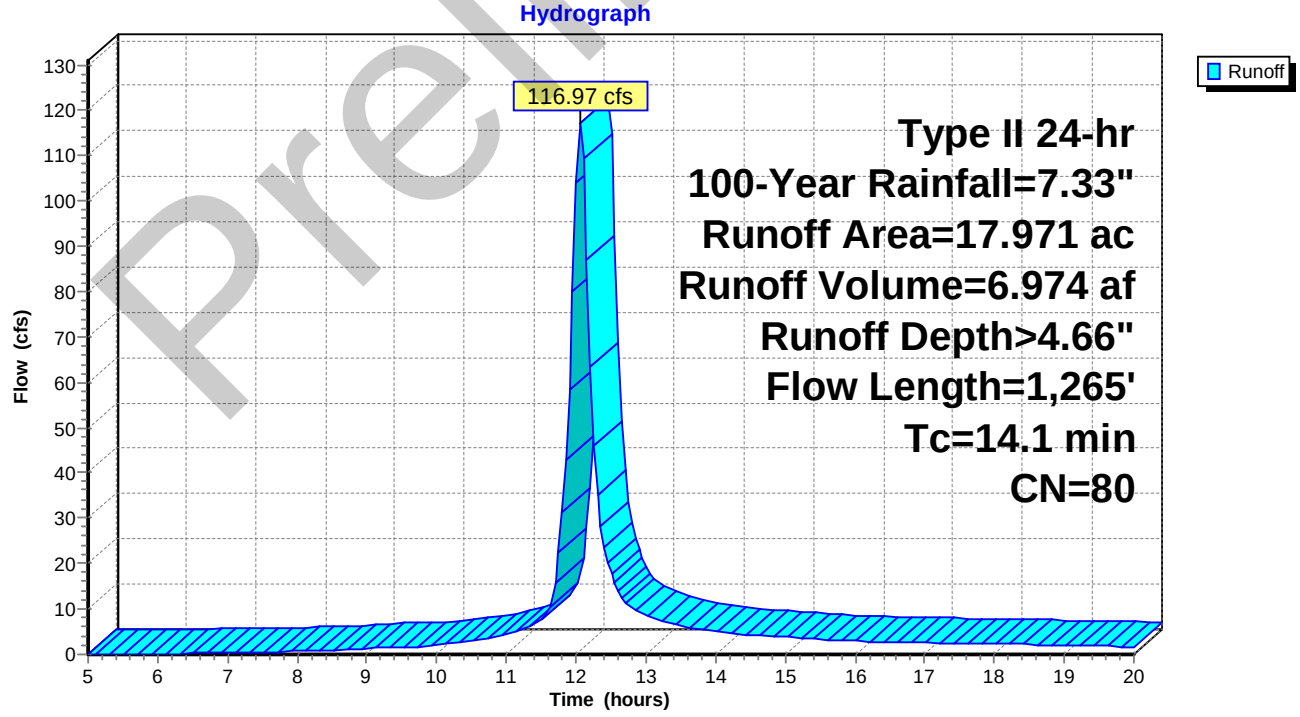
Runoff = 116.97 cfs @ 12.06 hrs, Volume= 6.974 af, Depth> 4.66"

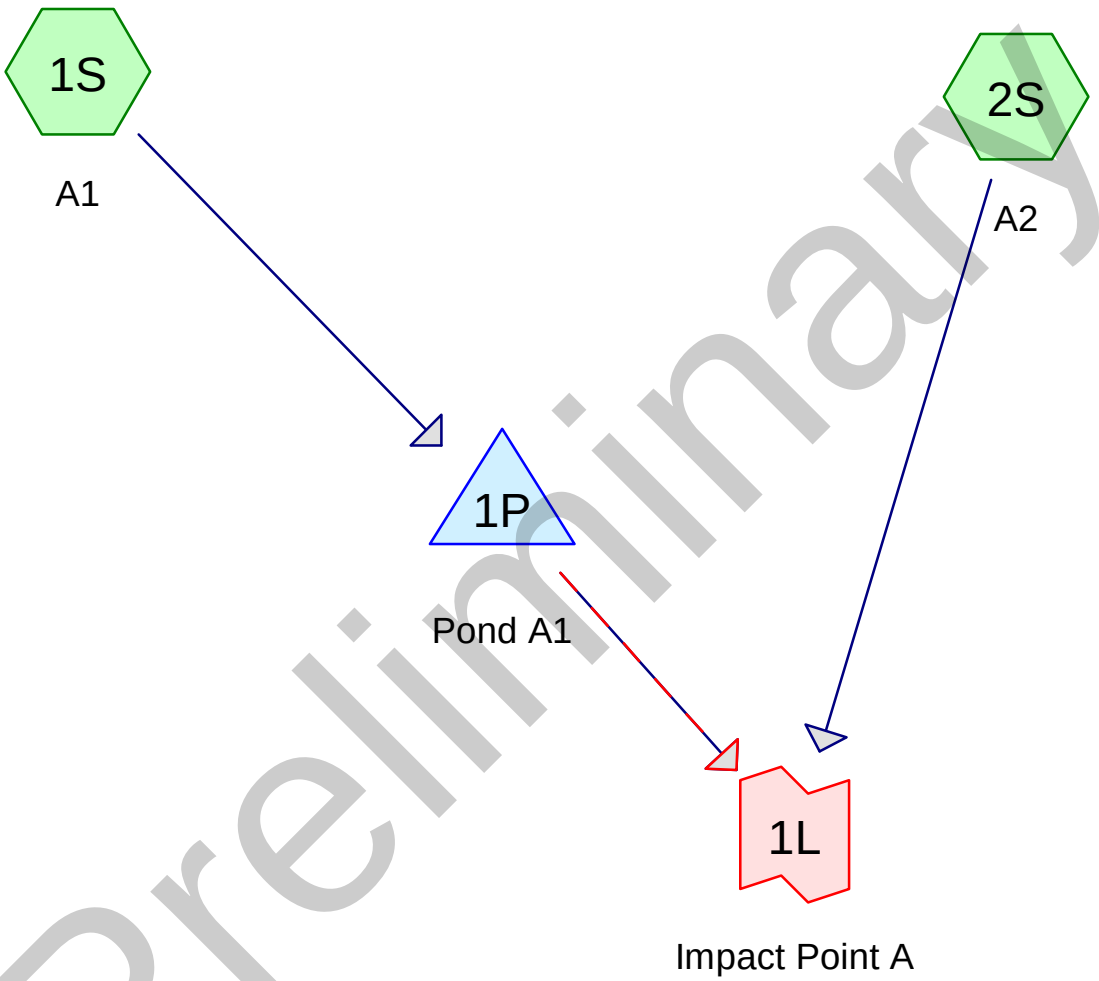
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.33"

Area (ac)	CN	Description
17.014	79	Woods/grass comb., Good, HSG D
0.957	98	Paved parking, HSG C
17.971	80	Weighted Average
17.014		94.67% Pervious Area
0.957		5.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	100	0.0257	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.04"
0.5	100	0.0434	3.35		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.9	285	0.1076	5.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.6	780	0.0500	3.60		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.1	1,265	Total			

Subcatchment 1S: EX-A





Subcat Reach Pond Link

Routing Diagram for Post-000
Prepared by E&A Consulting Group, Printed 8/15/2024

Project Notes

Rainfall events imported from "Pre-000.hcp"

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type II 24-hr		Default	24.00	1	3.04	2
2	10-Year	Type II 24-hr		Default	24.00	1	4.48	2
3	100-Year	Type II 24-hr		Default	24.00	1	7.33	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.389	87	1/4 acre lots, 38% imp, HSG D (1S)
1.261	92	1/8 acre lots, 65% imp, HSG D (1S, 2S)
6.557	80	>75% Grass cover, Good, HSG D (1S, 2S)
0.828	98	Paved parking, HSG C (2S)
5.295	98	Paved parking, HSG D (1S)
1.840	79	Woods/grass comb., Good, HSG D (2S)
19.170	**88**	**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	1P	1,386.00	1,382.00	180.0	0.0222	0.011	0.0	36.0	0.0	

Time span=5.00-60.00 hrs, dt=0.05 hrs, 1101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: A1 Runoff Area=14.330 ac 49.19% Impervious Runoff Depth=1.94"
Tc=10.9 min CN=89 Runoff=40.12 cfs 2.312 af

Subcatchment 2S: A2 Runoff Area=4.840 ac 24.40% Impervious Runoff Depth=1.55"
Tc=8.0 min CN=84 Runoff=12.26 cfs 0.625 af

Pond 1P: Pond A1 Peak Elev=1,391.39' Storage=39,217 cf Inflow=40.12 cfs 2.312 af
Primary=18.68 cfs 2.312 af Secondary=0.00 cfs 0.000 af Outflow=18.68 cfs 2.312 af

Link 1L: Impact Point A Inflow=22.48 cfs 2.937 af
Primary=22.48 cfs 2.937 af

Total Runoff Area = 19.170 ac Runoff Volume = 2.937 af Average Runoff Depth = 1.84"
57.07% Pervious = 10.940 ac 42.93% Impervious = 8.230 ac

Summary for Subcatchment 1S: A1

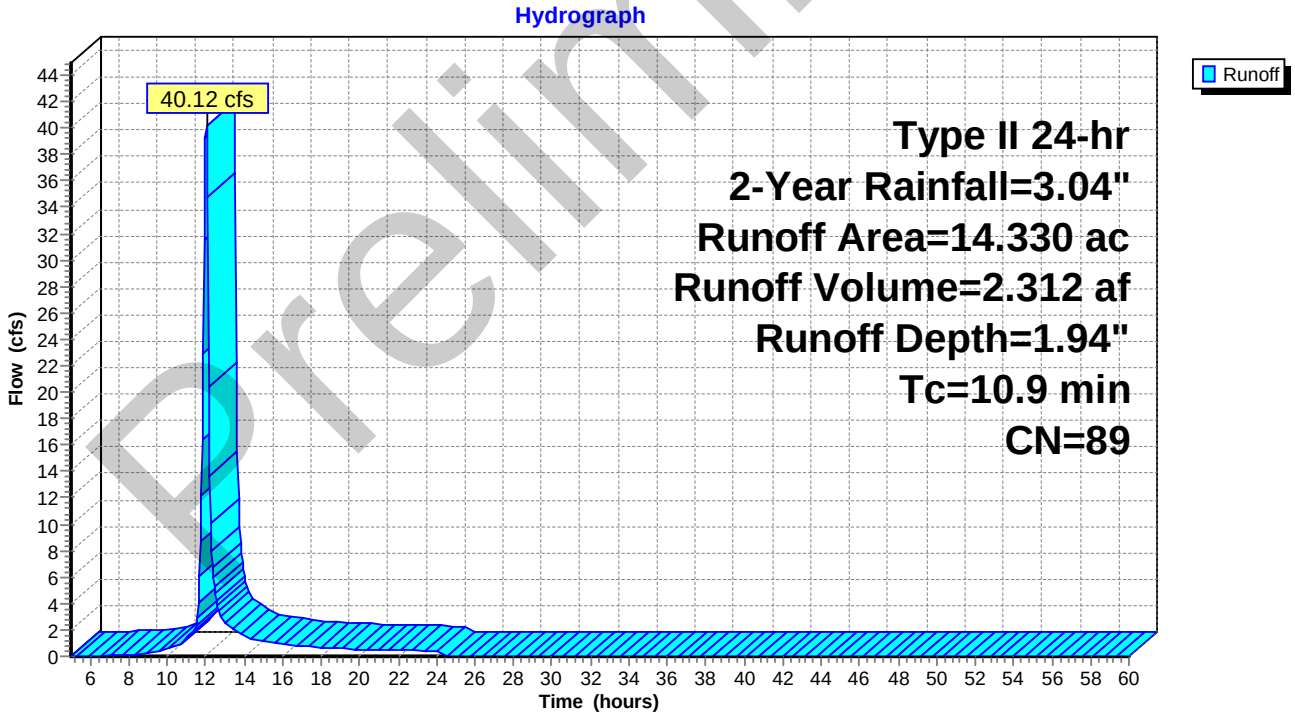
Runoff = 40.12 cfs @ 12.02 hrs, Volume= 2.312 af, Depth= 1.94"
Routed to Pond 1P : Pond A1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.04"

Area (ac)	CN	Description
5.295	98	Paved parking, HSG D
0.718	92	1/8 acre lots, 65% imp, HSG D
3.389	87	1/4 acre lots, 38% imp, HSG D
4.928	80	>75% Grass cover, Good, HSG D
14.330	89	Weighted Average
7.280		50.81% Pervious Area
7.050		49.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9					**Direct Entry,**

Subcatchment 1S: A1



Summary for Subcatchment 2S: A2

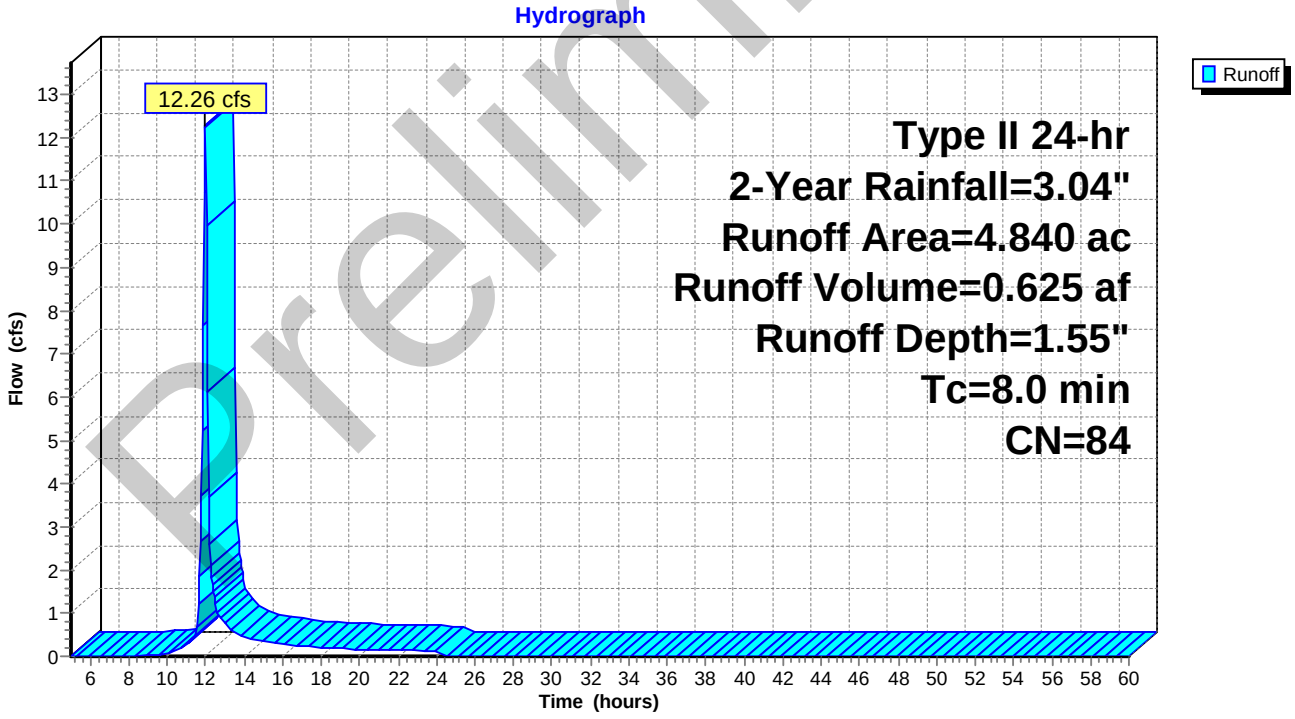
Runoff = 12.26 cfs @ 12.00 hrs, Volume= 0.625 af, Depth= 1.55"
Routed to Link 1L : Impact Point A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.04"

Area (ac)	CN	Description
0.828	98	Paved parking, HSG C
0.543	92	1/8 acre lots, 65% imp, HSG D
1.629	80	>75% Grass cover, Good, HSG D
1.840	79	Woods/grass comb., Good, HSG D
4.840	84	Weighted Average
3.659		75.60% Pervious Area
1.181		24.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0					**Direct Entry,**

Subcatchment 2S: A2



Summary for Pond 1P: Pond A1

WQCV- 24626
Opening- 2.66 to 3.2 inches

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 14.330 ac, 49.19% Impervious, Inflow Depth = 1.94" for 2-Year event
Inflow = 40.12 cfs @ 12.02 hrs, Volume= 2.312 af
Outflow = 18.68 cfs @ 12.17 hrs, Volume= 2.312 af, Atten= 53%, Lag= 8.7 min
Primary = 18.68 cfs @ 12.17 hrs, Volume= 2.312 af
Routed to Link 1L : Impact Point A
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Routed to Link 1L : Impact Point A

Routing by Stor-Ind method, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 1,391.39' @ 12.17 hrs Surf.Area= 15,210 sf Storage= 39,217 cf

Plug-Flow detention time= 314.1 min calculated for 2.312 af (100% of inflow)
Center-of-Mass det. time= 314.1 min (1,128.7 - 814.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,387.00'	175,416 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

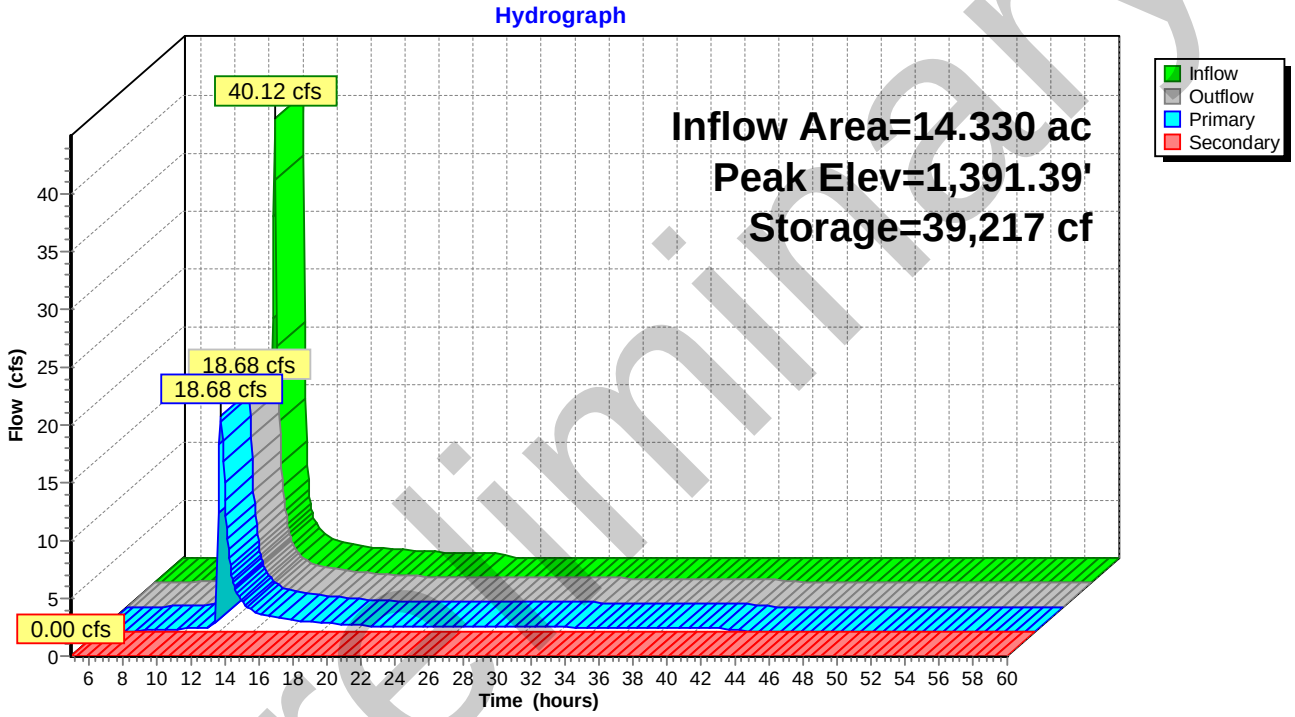
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,387.00	40	0	0
1,388.00	4,725	2,383	2,383
1,389.00	9,749	7,237	9,620
1,390.00	11,912	10,831	20,450
1,391.00	14,257	13,085	33,535
1,392.00	16,727	15,492	49,027
1,393.00	19,358	18,043	67,069
1,394.00	22,151	20,755	87,824
1,395.00	26,517	24,334	112,158
1,396.00	100,000	63,259	175,416

Device	Routing	Invert	Outlet Devices
#1	Primary	1,386.00'	**36.0" Round Culvert** L= 180.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,386.00' / 1,382.00' S= 0.0222 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	1,386.50'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,390.30'	**20.0" W x 27.0" H Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	1,393.00'	**36.0" x 36.0" Horiz. Orifice/Grate** C= 0.600 in 48.0" x 48.0" Grate (56% open area) Limited to weir flow at low heads
#5	Secondary	1,394.00'	**14.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=18.35 cfs @ 12.17 hrs HW=1,391.37' (Free Discharge)
└─**1=Culvert** (Passes 18.35 cfs of 66.98 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.52 cfs @ 10.49 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 17.83 cfs @ 3.32 fps)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=1,387.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Pond A1

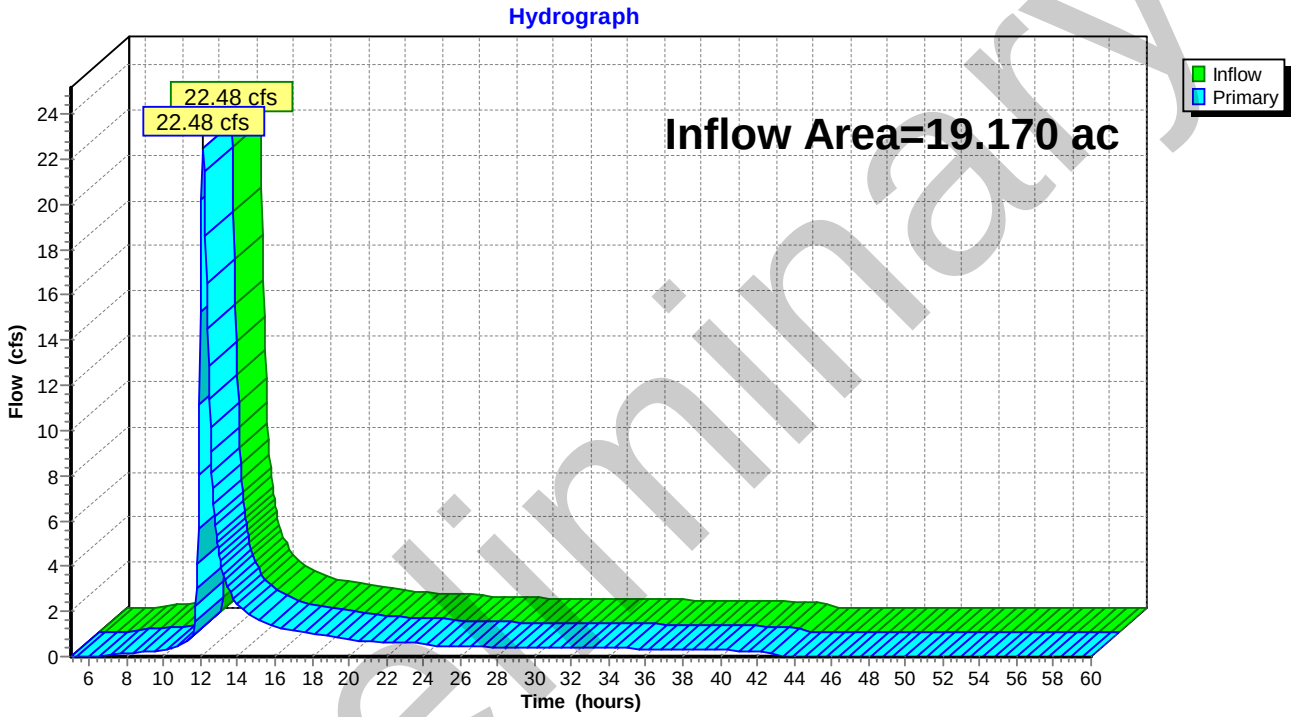


Summary for Link 1L: Impact Point A

Inflow Area = 19.170 ac, 42.93% Impervious, Inflow Depth = 1.84" for 2-Year event
Inflow = 22.48 cfs @ 12.12 hrs, Volume= 2.937 af
Primary = 22.48 cfs @ 12.12 hrs, Volume= 2.937 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs

Link 1L: Impact Point A



Time span=5.00-60.00 hrs, dt=0.05 hrs, 1101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: A1 Runoff Area=14.330 ac 49.19% Impervious Runoff Depth>3.28"
Tc=10.9 min CN=89 Runoff=66.37 cfs 3.912 af

Subcatchment 2S: A2 Runoff Area=4.840 ac 24.40% Impervious Runoff Depth=2.80"
Tc=8.0 min CN=84 Runoff=21.80 cfs 1.129 af

Pond 1P: Pond A1 Peak Elev=1,392.29' Storage=53,958 cf Inflow=66.37 cfs 3.912 af
Primary=45.56 cfs 3.912 af Secondary=0.00 cfs 0.000 af Outflow=45.56 cfs 3.912 af

Link 1L: Impact Point A Inflow=58.02 cfs 5.041 af
Primary=58.02 cfs 5.041 af

Total Runoff Area = 19.170 ac Runoff Volume = 5.041 af Average Runoff Depth = 3.16"
57.07% Pervious = 10.940 ac 42.93% Impervious = 8.230 ac

Summary for Subcatchment 1S: A1

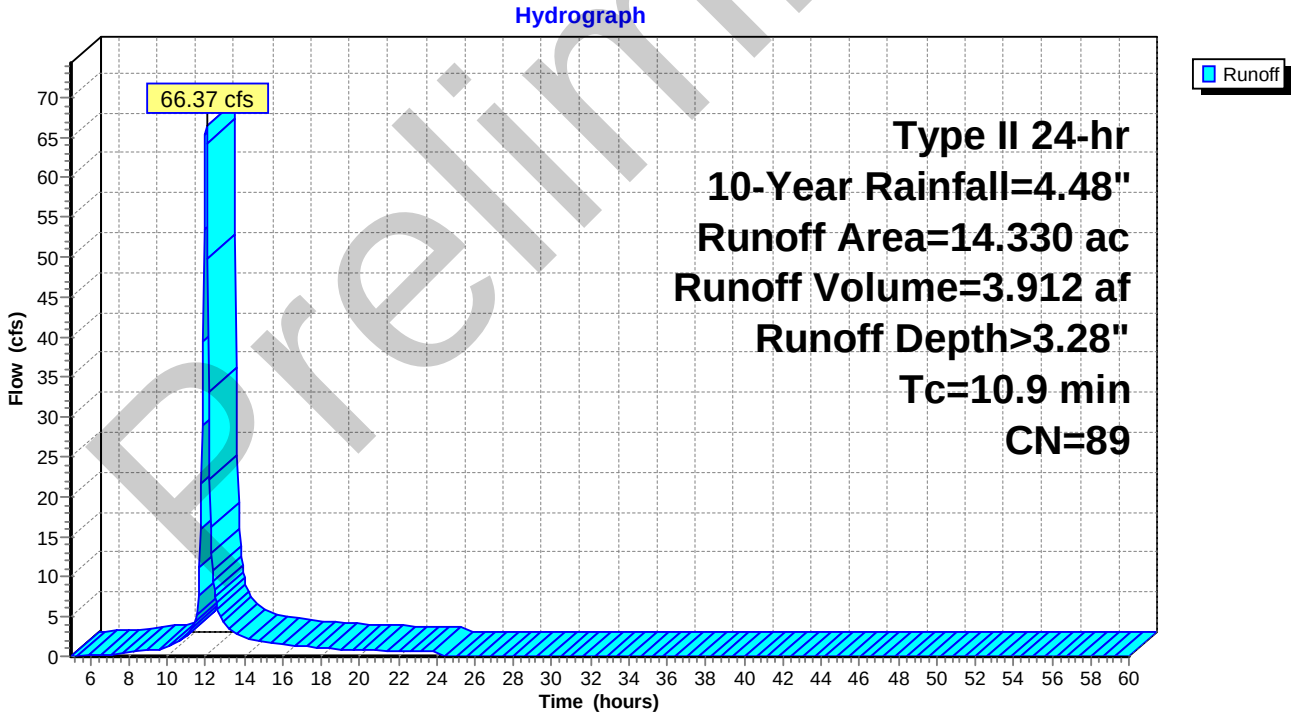
Runoff = 66.37 cfs @ 12.02 hrs, Volume= 3.912 af, Depth> 3.28"
Routed to Pond 1P : Pond A1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.48"

Area (ac)	CN	Description
5.295	98	Paved parking, HSG D
0.718	92	1/8 acre lots, 65% imp, HSG D
3.389	87	1/4 acre lots, 38% imp, HSG D
4.928	80	>75% Grass cover, Good, HSG D
14.330	89	Weighted Average
7.280		50.81% Pervious Area
7.050		49.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9					**Direct Entry,**

Subcatchment 1S: A1



Summary for Subcatchment 2S: A2

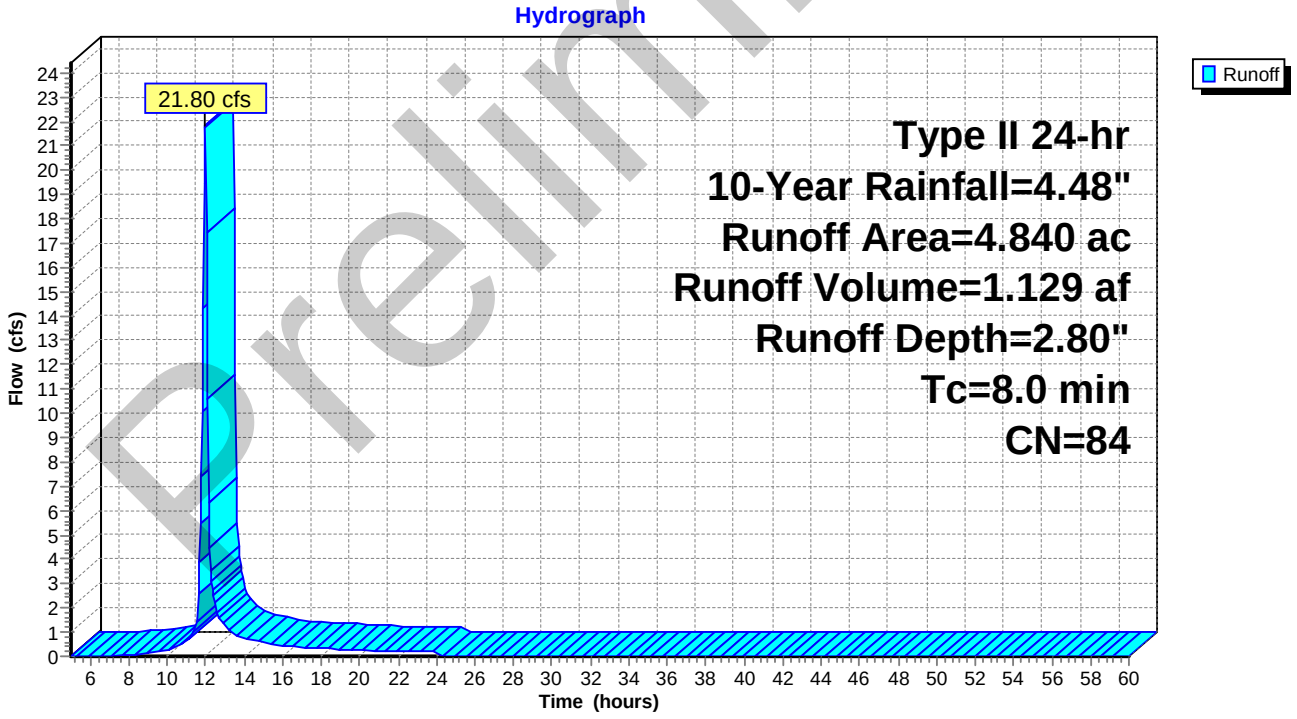
Runoff = 21.80 cfs @ 11.99 hrs, Volume= 1.129 af, Depth= 2.80"
Routed to Link 1L : Impact Point A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.48"

Area (ac)	CN	Description
0.828	98	Paved parking, HSG C
0.543	92	1/8 acre lots, 65% imp, HSG D
1.629	80	>75% Grass cover, Good, HSG D
1.840	79	Woods/grass comb., Good, HSG D
4.840	84	Weighted Average
3.659		75.60% Pervious Area
1.181		24.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0					**Direct Entry,**

Subcatchment 2S: A2



Summary for Pond 1P: Pond A1

WQCV- 24626
Opening- 2.66 to 3.2 inches

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 14.330 ac, 49.19% Impervious, Inflow Depth > 3.28" for 10-Year event
Inflow = 66.37 cfs @ 12.02 hrs, Volume= 3.912 af
Outflow = 45.56 cfs @ 12.12 hrs, Volume= 3.912 af, Atten= 31%, Lag= 5.7 min
Primary = 45.56 cfs @ 12.12 hrs, Volume= 3.912 af
Routed to Link 1L : Impact Point A
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Routed to Link 1L : Impact Point A

Routing by Stor-Ind method, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 1,392.29' @ 12.12 hrs Surf.Area= 17,486 sf Storage= 53,958 cf

Plug-Flow detention time= 201.1 min calculated for 3.912 af (100% of inflow)
Center-of-Mass det. time= 201.1 min (1,000.8 - 799.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,387.00'	175,416 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

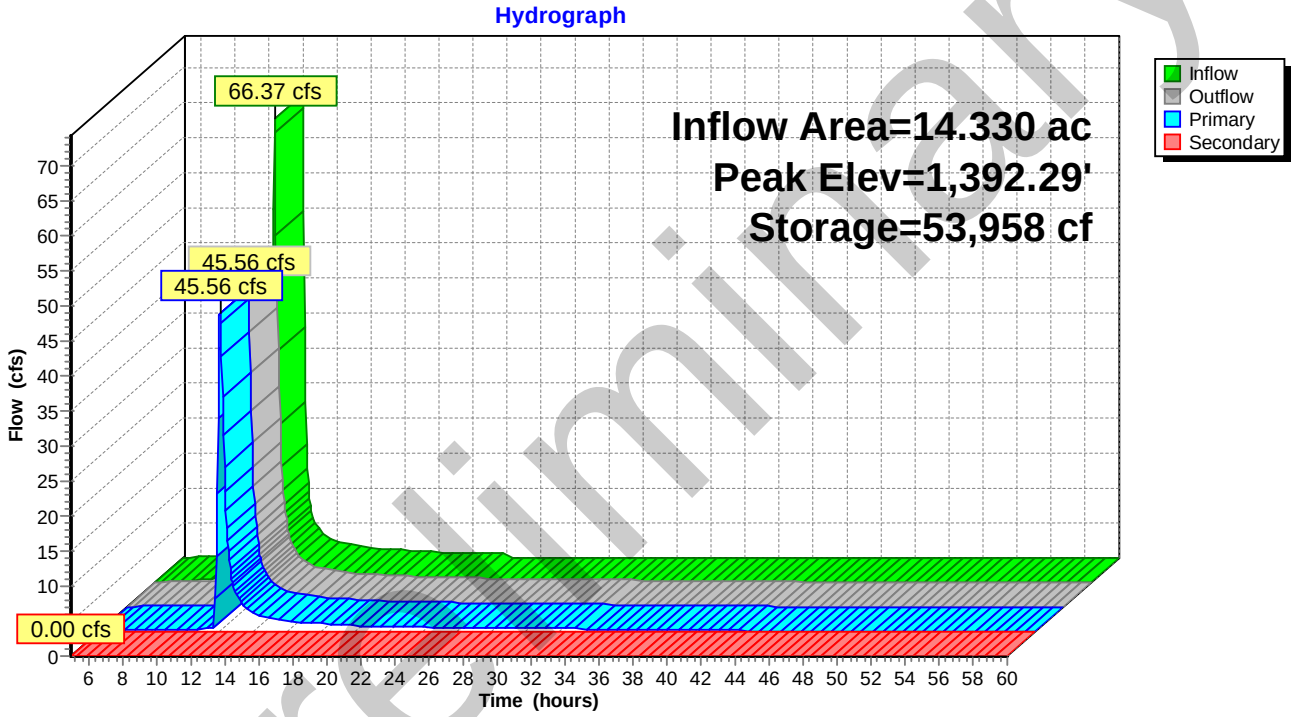
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,387.00	40	0	0
1,388.00	4,725	2,383	2,383
1,389.00	9,749	7,237	9,620
1,390.00	11,912	10,831	20,450
1,391.00	14,257	13,085	33,535
1,392.00	16,727	15,492	49,027
1,393.00	19,358	18,043	67,069
1,394.00	22,151	20,755	87,824
1,395.00	26,517	24,334	112,158
1,396.00	100,000	63,259	175,416

Device	Routing	Invert	Outlet Devices
#1	Primary	1,386.00'	**36.0" Round Culvert** L= 180.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,386.00' / 1,382.00' S= 0.0222 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	1,386.50'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,390.30'	**20.0" W x 27.0" H Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	1,393.00'	**36.0" x 36.0" Horiz. Orifice/Grate** C= 0.600 in 48.0" x 48.0" Grate (56% open area) Limited to weir flow at low heads
#5	Secondary	1,394.00'	**14.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=44.90 cfs @ 12.12 hrs HW=1,392.27' (Free Discharge)
└─**1=Culvert** (Passes 44.90 cfs of 74.33 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.56 cfs @ 11.44 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 44.34 cfs @ 4.50 fps)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=1,387.01' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Pond A1

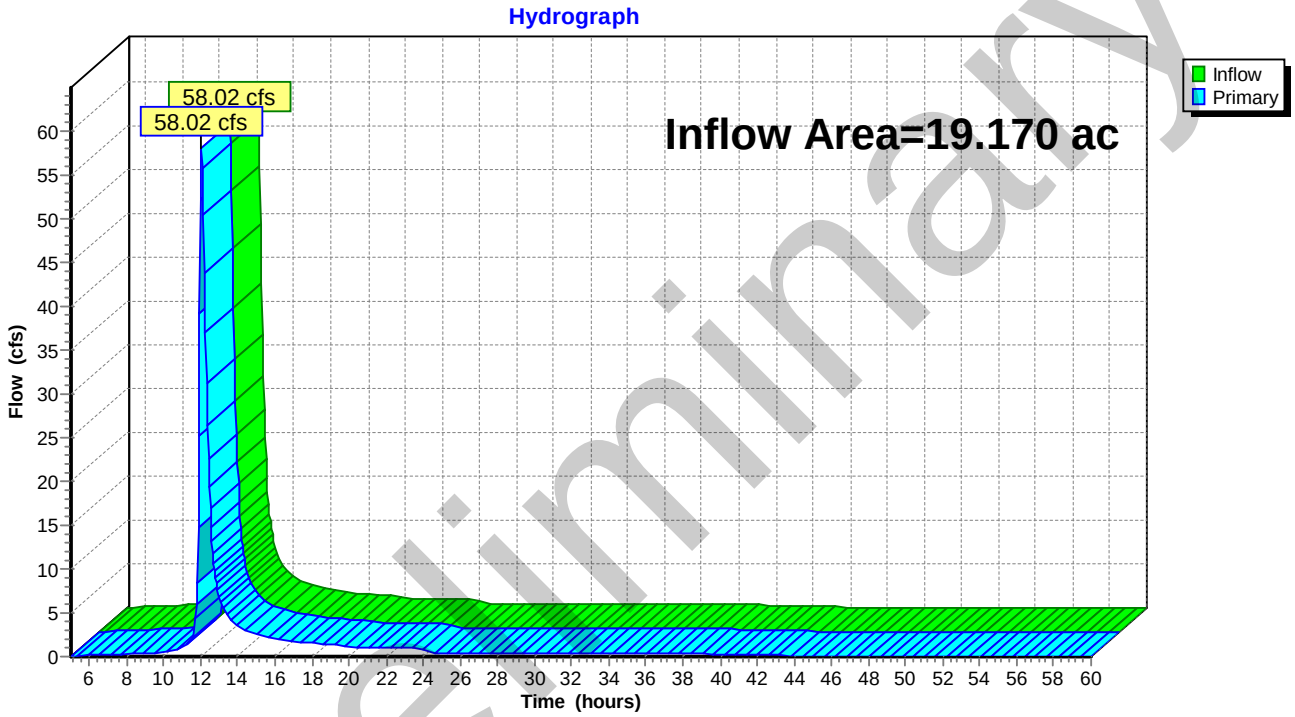


Summary for Link 1L: Impact Point A

Inflow Area = 19.170 ac, 42.93% Impervious, Inflow Depth > 3.16" for 10-Year event
Inflow = 58.02 cfs @ 12.06 hrs, Volume= 5.041 af
Primary = 58.02 cfs @ 12.06 hrs, Volume= 5.041 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs

Link 1L: Impact Point A



Time span=5.00-60.00 hrs, dt=0.05 hrs, 1101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: A1 Runoff Area=14.330 ac 49.19% Impervious Runoff Depth>6.00"
Tc=10.9 min CN=89 Runoff=118.03 cfs 7.170 af

Subcatchment 2S: A2 Runoff Area=4.840 ac 24.40% Impervious Runoff Depth>5.45"
Tc=8.0 min CN=84 Runoff=41.08 cfs 2.199 af

Pond 1P: Pond A1 Peak Elev=1,393.48' Storage=76,706 cf Inflow=118.03 cfs 7.170 af
Primary=83.39 cfs 7.170 af Secondary=0.00 cfs 0.000 af Outflow=83.39 cfs 7.170 af

Link 1L: Impact Point A Inflow=112.90 cfs 9.369 af
Primary=112.90 cfs 9.369 af

Total Runoff Area = 19.170 ac Runoff Volume = 9.369 af Average Runoff Depth = 5.87"
57.07% Pervious = 10.940 ac 42.93% Impervious = 8.230 ac

Summary for Subcatchment 1S: A1

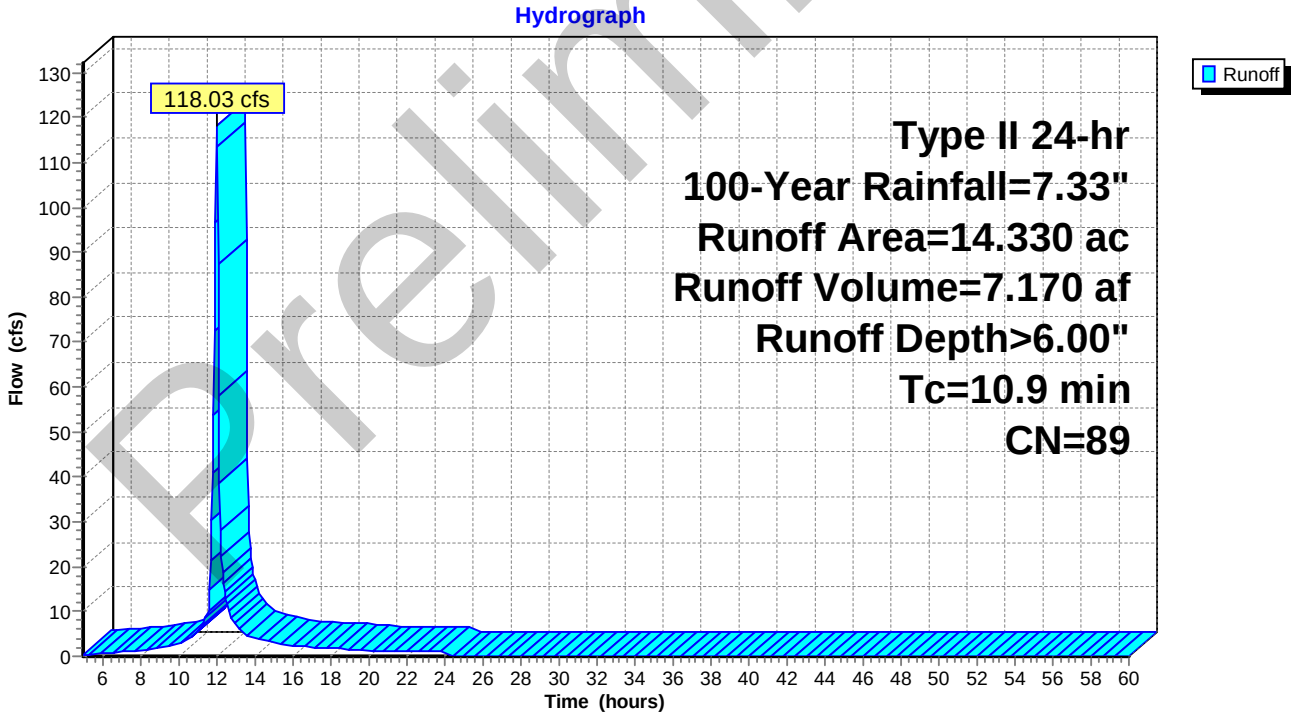
Runoff = 118.03 cfs @ 12.02 hrs, Volume= 7.170 af, Depth> 6.00"
Routed to Pond 1P : Pond A1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.33"

Area (ac)	CN	Description
5.295	98	Paved parking, HSG D
0.718	92	1/8 acre lots, 65% imp, HSG D
3.389	87	1/4 acre lots, 38% imp, HSG D
4.928	80	>75% Grass cover, Good, HSG D
14.330	89	Weighted Average
7.280		50.81% Pervious Area
7.050		49.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9					**Direct Entry,**

Subcatchment 1S: A1



Summary for Subcatchment 2S: A2

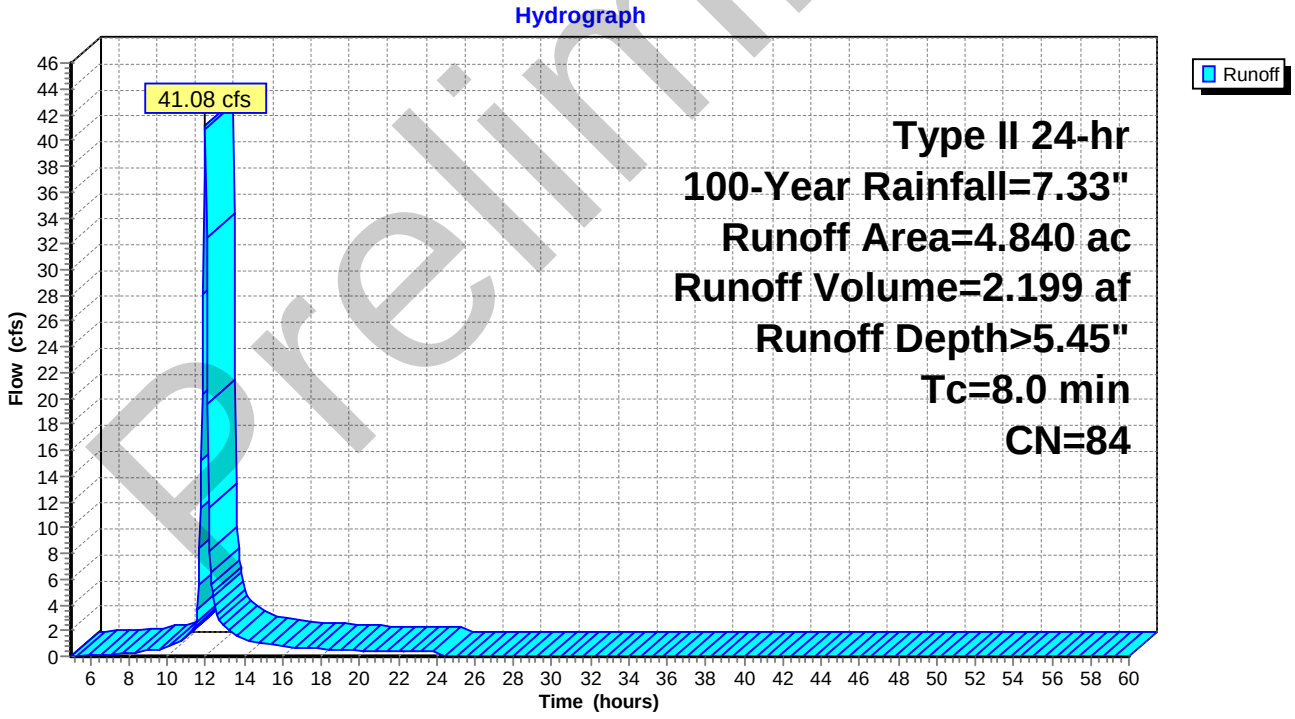
Runoff = 41.08 cfs @ 11.99 hrs, Volume= 2.199 af, Depth> 5.45"
Routed to Link 1L : Impact Point A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=7.33"

Area (ac)	CN	Description
0.828	98	Paved parking, HSG C
0.543	92	1/8 acre lots, 65% imp, HSG D
1.629	80	>75% Grass cover, Good, HSG D
1.840	79	Woods/grass comb., Good, HSG D
4.840	84	Weighted Average
3.659		75.60% Pervious Area
1.181		24.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0					**Direct Entry,**

Subcatchment 2S: A2



Summary for Pond 1P: Pond A1

WQCV- 24626
Opening- 2.66 to 3.2 inches

[82] Warning: Early inflow requires earlier time span
[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 14.330 ac, 49.19% Impervious, Inflow Depth > 6.00" for 100-Year event
Inflow = 118.03 cfs @ 12.02 hrs, Volume= 7.170 af
Outflow = 83.39 cfs @ 12.12 hrs, Volume= 7.170 af, Atten= 29%, Lag= 5.8 min
Primary = 83.39 cfs @ 12.12 hrs, Volume= 7.170 af
Routed to Link 1L : Impact Point A
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Routed to Link 1L : Impact Point A

Routing by Stor-Ind method, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 1,393.48' @ 12.11 hrs Surf.Area= 20,702 sf Storage= 76,706 cf

Plug-Flow detention time= 125.4 min calculated for 7.163 af (100% of inflow)
Center-of-Mass det. time= 126.2 min (911.4 - 785.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,387.00'	175,416 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,387.00	40	0	0
1,388.00	4,725	2,383	2,383
1,389.00	9,749	7,237	9,620
1,390.00	11,912	10,831	20,450
1,391.00	14,257	13,085	33,535
1,392.00	16,727	15,492	49,027
1,393.00	19,358	18,043	67,069
1,394.00	22,151	20,755	87,824
1,395.00	26,517	24,334	112,158
1,396.00	100,000	63,259	175,416

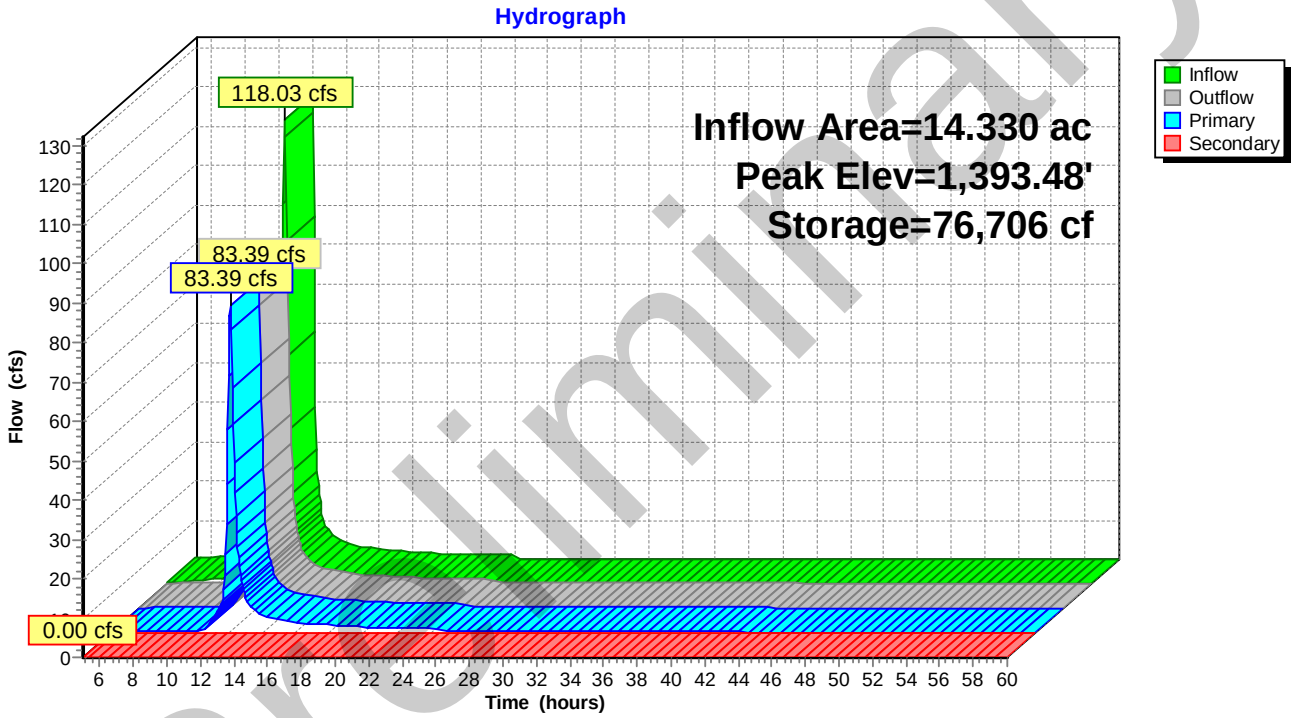
Device	Routing	Invert	Outlet Devices
#1	Primary	1,386.00'	**36.0" Round Culvert** L= 180.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,386.00' / 1,382.00' S= 0.0222 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	1,386.50'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,390.30'	**20.0" W x 27.0" H Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads
#4	Device 1	1,393.00'	**36.0" x 36.0" Horiz. Orifice/Grate** C= 0.600 in 48.0" x 48.0" Grate (56% open area) Limited to weir flow at low heads
#5	Secondary	1,394.00'	**14.0' long x 14.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60

Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=83.02 cfs @ 12.12 hrs HW=1,393.45' (Free Discharge)
└─**1=Culvert** (Inlet Controls 83.02 cfs @ 11.75 fps)
  ├─**2=Orifice/Grate** (Passes < 0.62 cfs potential flow)
  ├─**3=Orifice/Grate** (Passes < 76.04 cfs potential flow)
  └─**4=Orifice/Grate** (Passes < 11.86 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=1,387.09' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Pond A1



APPENDIX F:

PRELIMINARY PIPE SIZING CALCULATIONS

E & A CONSULTING GROUP, INC.

Engineer's Preliminary Pipe Sizing Calculations
Dittmer Commercial
Crete, NE

Project No: 2022.289.001
8/15/2024

Proposed Preliminary Pipe Sizing Calculations

Minor Storm System Conveyance Analysis														Major Storm System Conveyance Analysis						
Minor Storm Average Return Frequency 10 Years														Major Storm Average Return Frequency 100 Years						
Location (Parcel)	Area, A	Coeffici-ent, C	A*C	Sum, A*C	Time of Concen-tration, Tc	Intensity, I	Runoff, Qr	Pipe Slope, Sp	Pipe Length, L	Pipe Diameter D	Pipe Capacity Qp	Pipe Velocity Vp	Time in Section Tp	Intensity I100	Flow, Q100	Overflow Route Slope	Street Width	Street Capacity	Overflow + Pipe Capacity	Comments
	acre				min	in/hr	cfs	ft/ft	ft	in	cfs	f/s	min	in/hr	cfs	ft/ft	ft	cfs	cfs	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(23)	(24)
Basin A1																				
A9	1.35	0.33	0.45	0.45	12.2	5.82	2.6	0.0200	65	12	5.0	6.4	0.17	10.96	4.94	0.025	6		5.0	Sump Condition - Swale
A8-9	8.00	0.51	4.10	4.55	12.4	5.78	26.3	0.0800	105	18	29.7	16.8	0.10	10.89	49.52	0.15	27		29.7	Sump Condition - Private Roadway
A7	0.42	0.92	0.38	0.38	8.0	7.00	2.7	0.0100	165	12	3.6	4.5	0.61	13.20	5.07	0.02	27		3.6	Sump Condition - Parking Lot
A6-7	0.71	0.89	0.63	1.02	8.6	6.79	6.9	0.0300	215	15	11.2	9.1	0.39	12.81	13.06	0.2	27		11.2	Sump Condition - Parking Lot
A5-7	0.65	0.91	0.59	1.61	9.0	6.67	10.7	0.0800	50	15	18.3	14.9	0.06	12.57	20.24	0.25	45		18.3	Sump Condition - Private Roadway
A4	0.89	0.87	0.78	0.78	8.0	7.00	5.4	0.0270	50	12	5.9	7.5	0.11	13.20	10.26	0.25	30		5.9	Sump Condition - Parking Lot
A3-4	0.44	0.76	0.33	1.11	8.1	6.96	7.7	0.0050	220	24	16.0	5.1	0.72	13.13	14.60	0.025	27		16.0	On Grade - Private Roadway
Culvert on Iris Ave	8.78	0.36	3.12	3.12	15.2	5.23	16.3													Culvert under Big Mac Drive

CURB INLET DESIGN COMPUTATIONS

HEC 12 METHOD

Date: 45519.0
Calculated by: Jordan Jurgens

Project Dittmer Commercial
Project No. 2022.289.001

LOCATION		DISCHARGE (Design Storm = 10 Year)													INLET CAPTURE					REMARKS
Inlet Id.	Drainage Basin Id.	Area (A) acres	Runoff Coefficent (C)	Time of Concentration (Tc) minutes	Intensity (I) in/hr	Direct Runoff cfs	Previous By-Pass cfs	Cross Over cfs	Total Gutter Flow (Q) cfs	Paving Slope (S) ft/ft	Cross Slope (S_x) ft/ft	Depth (d) feet	Curb Height ft	Gutter Spread (T) ft	Inlet Type	Opening Length ft	Efficiency	Intercepted (Qi) cfs	By-Passed (Q-Qi) cfs	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
	A9	1.35	0.33	12	5.9	2.6			2.6						18" Grate Inlet	4				Sump Condition - Grass Area
	A8	8.00	0.51	12	5.8	23.8			23.8	0.000	0.030	5.63	0.50	187.8	NDOT Inlet	4	100%	23.8	0.0	Sump Condition - Private Roadway
	A7	0.42	0.92	8	7.0	2.7			2.7	0.000	0.030	0.26	0.50	8.6	NDOT Inlet	4	100%	2.7	0.0	Sump Condition - Parking Lot
	A6	0.71	0.89	9	6.9	4.3			4.3	0.000	0.024	0.35	0.50	14.8	NDOT Inlet	4	100%	4.3	0.0	Sump Condition - Parking Lot
	A5	0.65	0.91	9	6.7	4.0			4.0	0.000	0.030	0.33	0.50	11.2	NDOT Inlet	4	100%	4.0	0.0	Sump Condition - Private Roadway
	A4	0.89	0.87	8	7.1	5.5			5.5	0.000	0.060	0.41	0.50	6.9	NDOT Inlet	4	100%	5.5	0.0	Sump Condition - Parking Lot
C1	A3	0.44	0.76	8	7.0	2.4			2.4	0.025	0.030	0.19	0.50	6.5	NDOT Inlet	8	91%	2.2	0.2	On Grade - Private Roadway

Column 9, Cross Over: This column may utilized to account for additional flow received by the inlet that crossed over from the opposite side of the crown.

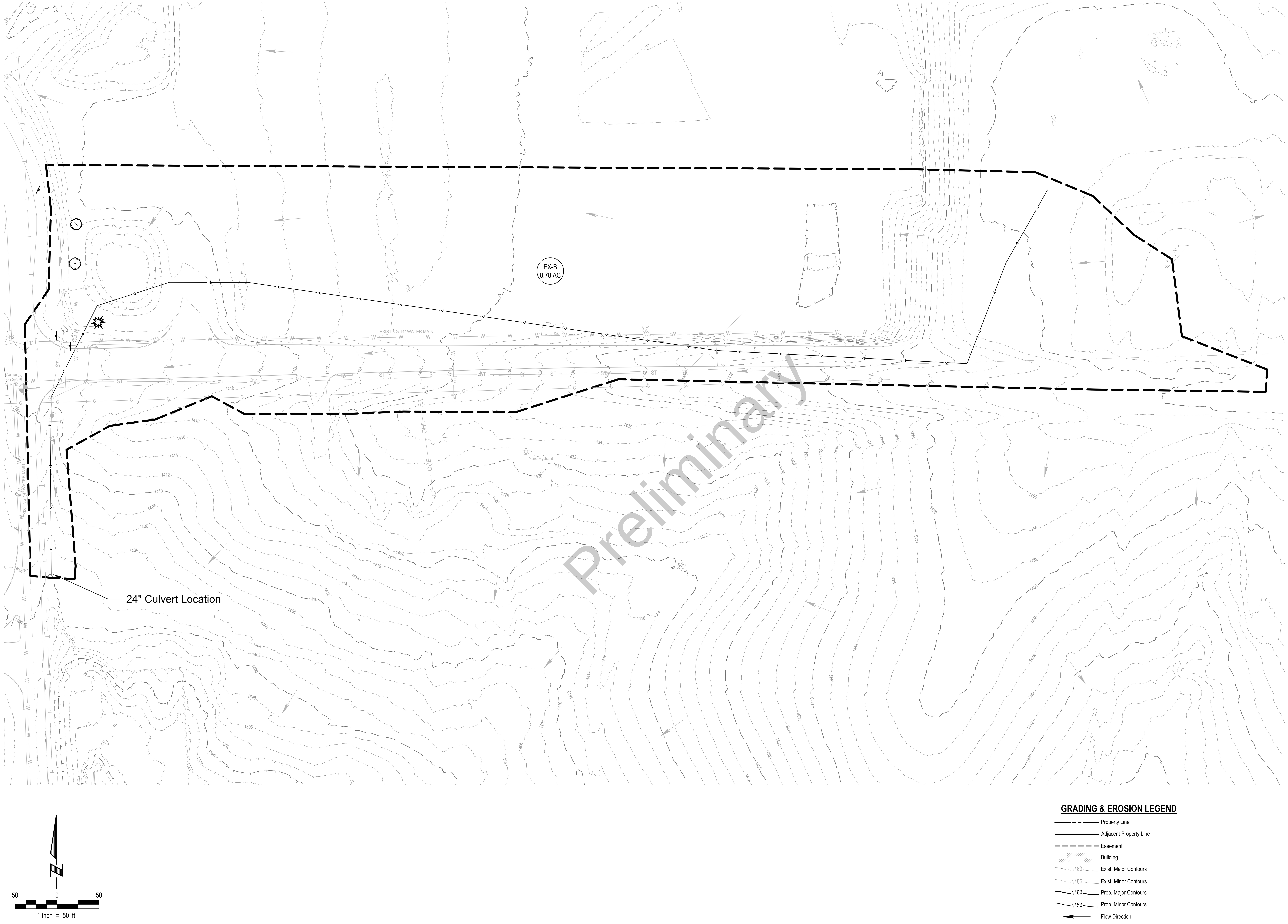
Column 13 - Depth (d) at Gutter Upstream of Inlet

Notes:

Sheet 1 of 1

APPENDIX G:

HY-8 CULVERT ANALYSIS



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Phone: 402.420.7217
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State of NE Certificate of Authorization #CA0008

E & A CONSULTING GROUP, INC.
Engineering Answers

DITTMER COMMERCIAL ADDITION
DRAINAGE REPORT

CRETE, NEBRASKA

CULVERT DRAINAGE EXHIBIT

Revision		
No.	Date	Description

Proj No:	2022.289.001
Date:	08/13/2024
Designed By:	RPO
Drawn By:	JLJ
Scale:	AS SHOWN
Sheet:	3 of 3

Jordan Jurgens 8/15/2024 10:57 AM K:\Projects\2022\289\p01\Engineering\CAD Files\Drainage Study\PRE-DRN-000.dwg

HY-8 Culvert Analysis Report

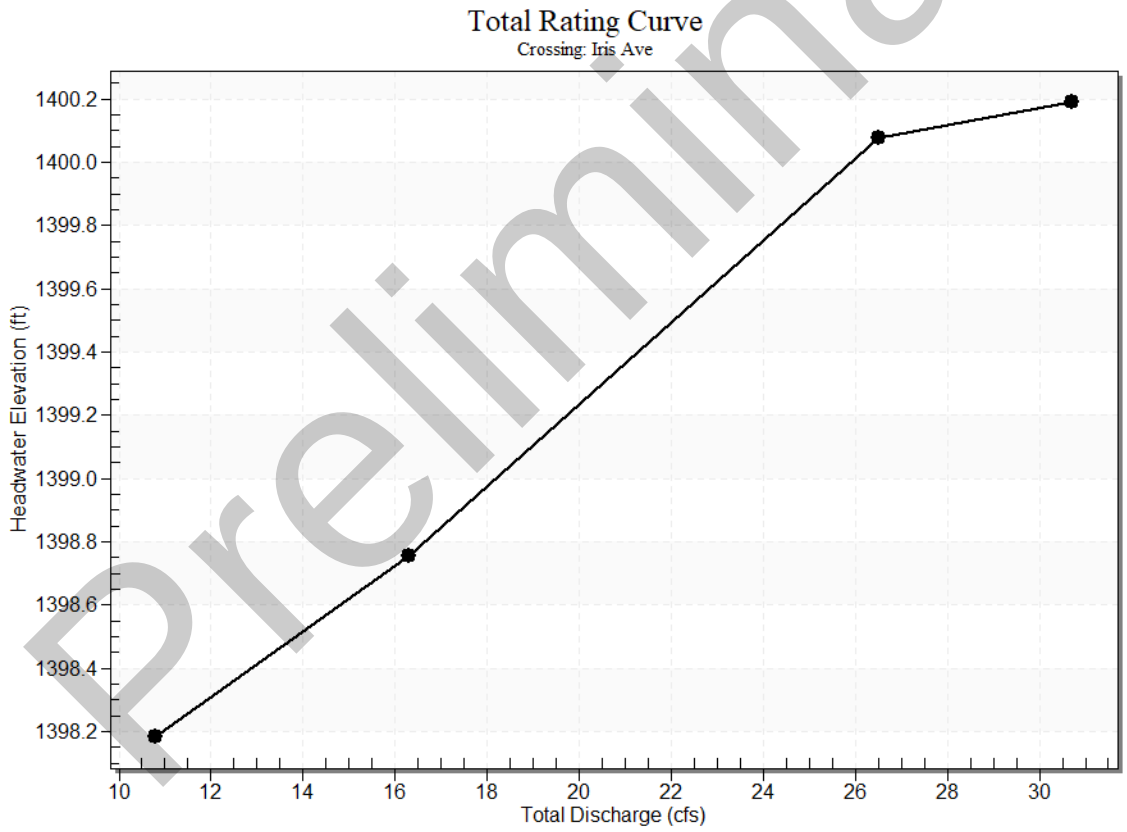
Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: Iris Ave

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1398.18	2 year	10.80	10.80	0.00	1
1398.75	10 year	16.30	16.30	0.00	1
1400.08	50 year	26.50	25.19	1.28	13
1400.19	100 year	30.70	25.79	4.89	6
1400.00	Overtopping	24.75	24.75	0.00	Overtopping

Rating Curve Plot for Crossing: Iris Ave



Culvert Data: Culvert 1

Table 1 - Culvert Summary Table: Culvert 1

Disc	Total	Culv	Head	Inle	Out	Fl	Nor	Crit	Ou	Tail	Outl	Tail

harge Names	Discharge (cfs)	ert Discharge (cfs)	water Elevation (ft)	t Control Depth (ft)	let Control Depth (ft)	ow Type	mal Depth (ft)	ical Depth (ft)	tlet Depth (ft)	water Depth (ft)	et Velocity (ft/s)	water Velocity (ft/s)
2 year	10.80 cfs	10.80 cfs	1398.18	1.68	0.0*	1-S2n	0.62	1.18	0.66	0.31	11.92	4.95
10 year	16.30 cfs	16.30 cfs	1398.75	2.25	0.0*	5-S2n	0.77	1.46	0.84	0.40	13.08	5.68
50 year	26.50 cfs	25.19 cfs	1400.08	3.58	0.864	5-S2n	0.98	1.77	1.09	0.53	14.35	6.66
100 year	30.70 cfs	25.79 cfs	1400.19	3.69	0.963	5-S2n	1.00	1.78	1.11	0.57	14.43	6.98

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

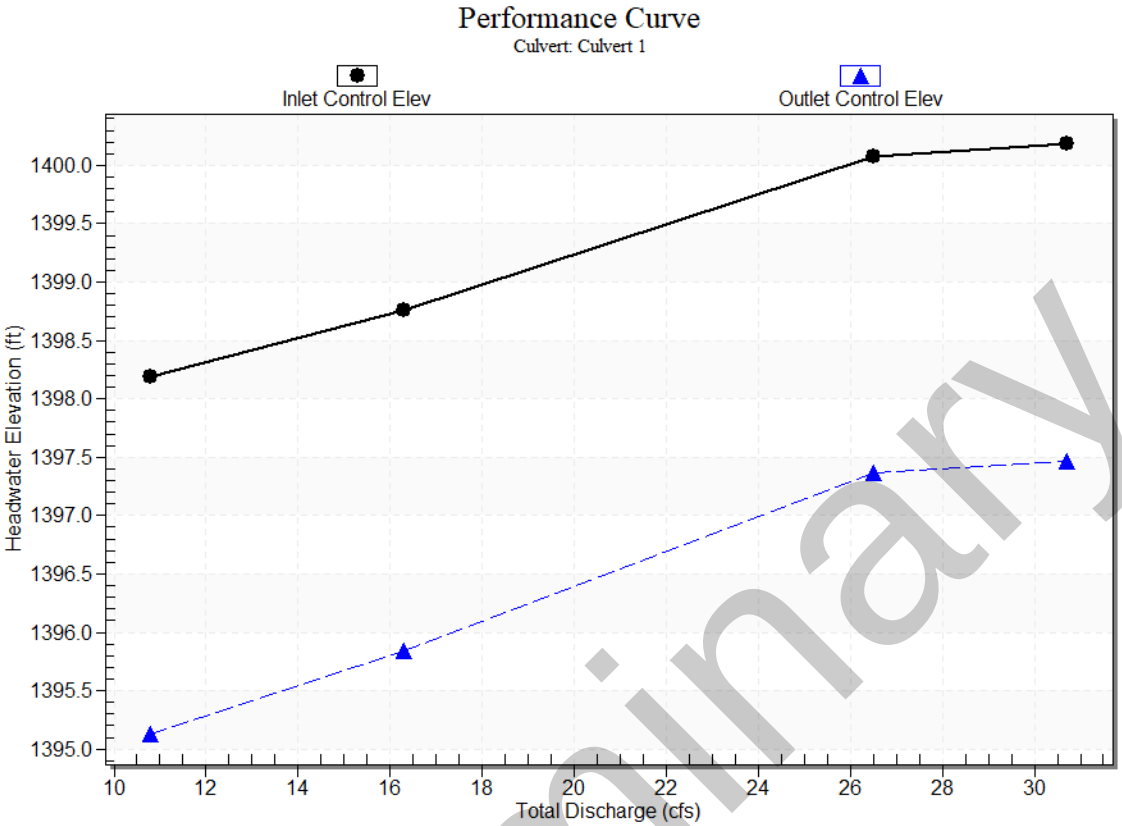
Inlet Elevation (invert): 1396.50 ft,

Outlet Elevation (invert): 1393.60 ft

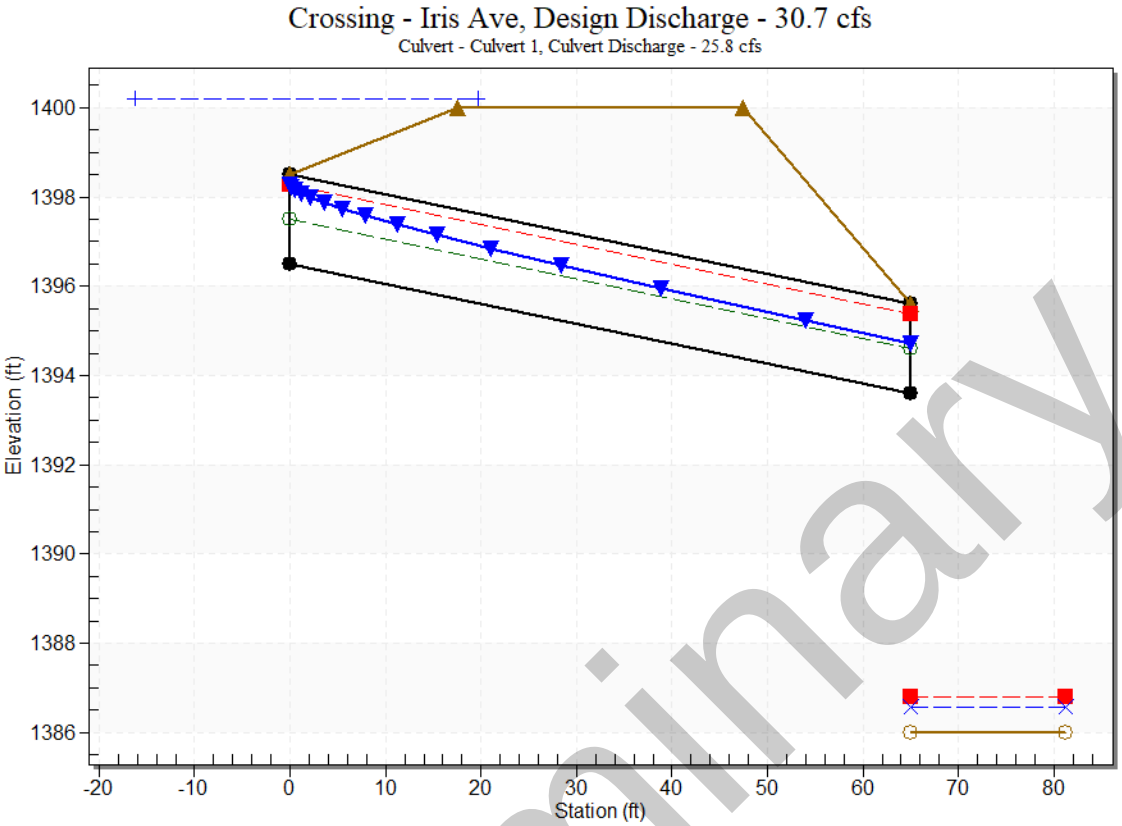
Culvert Length: 65.06 ft,

Culvert Slope: 0.0446

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 1396.50 ft

Outlet Station: 65.00 ft

Outlet Elevation: 1393.60 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Beveled Edge (1:1) (Ke=0.2)

Inlet Depression: None

Tailwater Data for Crossing: Iris Ave

Table 2 - Downstream Channel Rating Curve (Crossing: Iris Ave)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
10.80	1386.31	0.31	4.95	1.96	1.66
16.30	1386.40	0.40	5.68	2.49	1.71
26.50	1386.53	0.53	6.66	3.28	1.78
30.70	1386.57	0.57	6.98	3.56	1.80

Tailwater Channel Data - Iris Ave

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 6.00 ft

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.1000

Channel Manning's n: 0.0400

Channel Invert Elevation: 1386.00 ft

Roadway Data for Crossing: Iris Ave

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 30.00 ft

Crest Elevation: 1400.00 ft

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

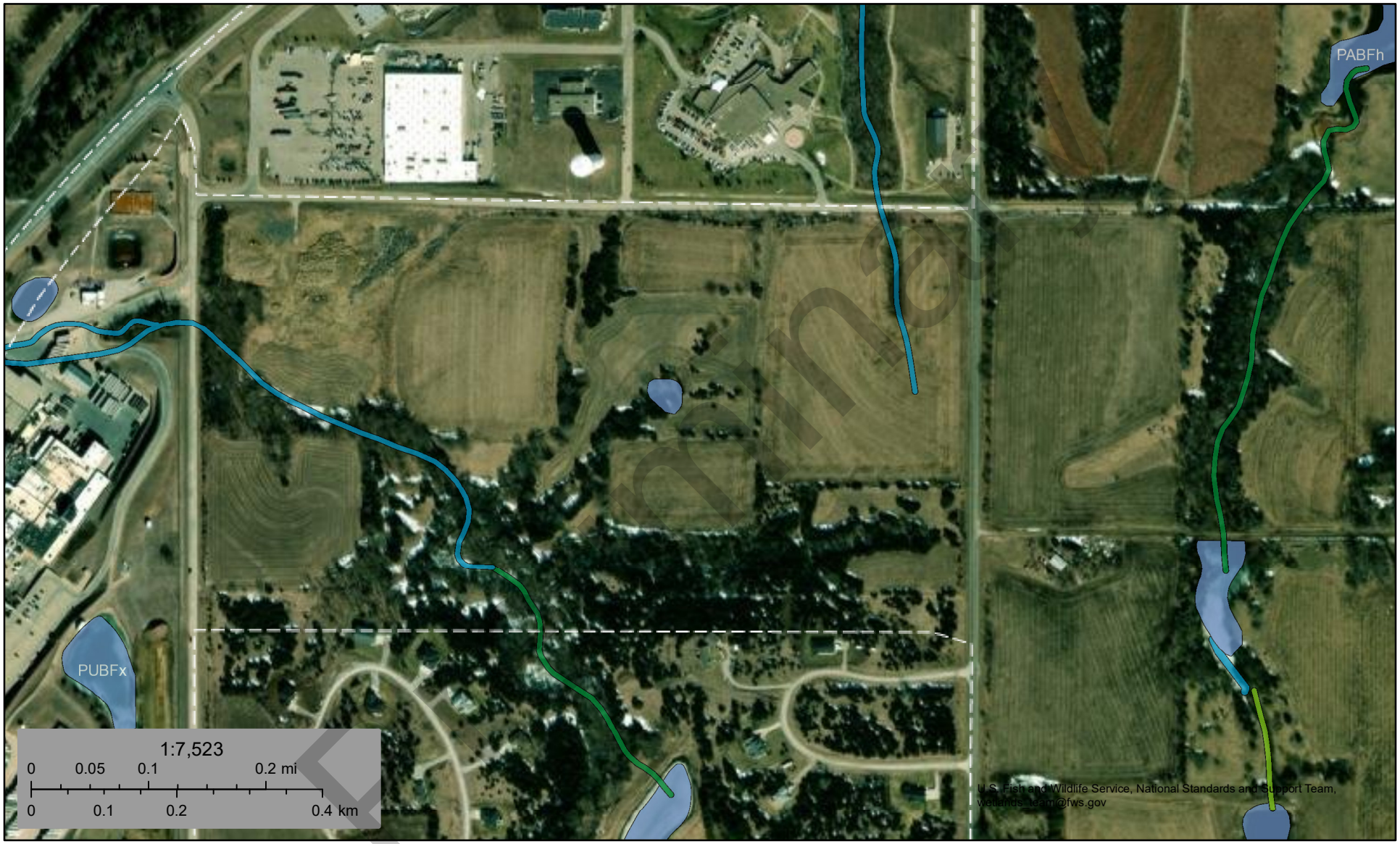
APPENDIX H:

NATIONAL WETLAND VIEWER MAP

U.S. Fish and Wildlife Service

National Wetlands Inventory

Dittmer Commercial Addition



August 15, 2024

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.