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STORMWATER MANAGEMENT REPORT

For

Fairfield Logistics Center

Fairfield Township
Butler County, Ohio
Prepared: January 2018

Prepared by: Joe Haubert, PE
Reviewed by: David V. Wright, PE, LEED AP

JOB #: 170044.004

Table of Contents

Fairfield Township
Butler County, Ohio
STORMWATER MANAGEMENT PLAN

Introduction

The following report details the steps taken to provide storm water conveyance, detention, and water quality for the proposed development of a parcel of land east of Seward Road in Fairfield Township, Butler County, Ohio. The proposed construction will consist of a new industrial building, associated utilities, parking lot, and modification of existing stormwater management facilities.

Site Description

The existing site is an undeveloped field along the east side of Seward Road in Fairfield Township, Butler County, Ohio. Storm runoff from this site generally runs west to east and is detained by an existing dry detention basin located in the northeastern corner of the site. This basin was designed to detain runoff from 21.88 acres onsite and an additional 44.813 acres from offsite areas. The analysis of this existing basin can be found in the Miller Farm Detention Report by Nexus Engineering in November 2007. This basin will be modified into a wet detention basin to provide detention and water quality to the proposed development while continuing to detain and control runoff from all offsite locations. Runoff ultimately is routed to Mill Creek.

Hydrologic Methodologies

The stormwater detention calculations contained in this report were performed by using the SCS Unit Hydrograph hydrologic method in Bentley's PondPack, Version 10.1 software. Pre-developed and post-developed condition hydrographs were generated for storm frequencies of 1, 2, 5, 10, 25, 50, and 100 year 24-hour storm events using an SCS Type II distribution. Please refer to the drainage maps at the back of this report for a delineation of the drainage areas.

Fairfield Township and Butler County require projects to adhere to the stormwater management requirements provided in the Butler County Subdivision Regulations. These regulations stipulate a critical year storm method where the percent increase in runoff volume from the 1 year, 24-hour storm frequency determines the critical storm event. The post-developed peak rate of runoff must be controlled for storms of a frequency between one year and the critical storm so that the rate of runoff does not exceed the peak rate of runoff for a pre-developed, 24-hour, 1-year frequency storm. All storm events greater than the critical year must be controlled such the post-developed runoff rate does not exceed the pre-developed runoff rate for the previous storm event frequency

The 1-year pre-developed hydrologic volume for the site is 4.654 ac-ft. The 1-year post-developed hydrologic volume for the site is 6.414 ac-ft. The difference between the two volumes represents an increase in stormwater runoff of 37.82%, which corresponds to a 5-year critical storm.

Table 1 - Existing Hydrologic Conditions

Tributary Area Name	Area (ac)	CN	Tc (hr)	Q1 (cfs)	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q25 (cfs)	Q50 (cfs)	Q100 (cfs)
PREDEV	66.693	79.17	0.25	65.45	88.80	132.51	165.23	205.57	239.80	267.47

Table 2 - Proposed Hydrologic Conditions

Tributary Area Name	Area (ac)	CN	Tc (hr)	Q1 (cfs)	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q25 (cfs)	Q50 (cfs)	Q100 (cfs)
POSTDEV	68.973	84.28	0.25	92.92	119.85	168.74	204.48	247.85	284.22	313.40

Applicable Permits

The Ohio Environmental Protection Agency (OEPA) required projects to capture and treat stormwater from a storm event of 0.75" or less.

The required water quality volume is calculated by the following equation and provided in Appendix 1:

$$WQ_v = \frac{CPA}{12}$$

Where WQv= water quality volume, in acre feet
C = runoff coefficient, $0.858i^3-0.78i^2+0.774i+0.04$, where i = 0.49 (fraction of impervious area)
P = 0.75 inch precipitation depth
A = area draining into the BMP in acres

$$WQ_v = \frac{(0.33)(0.75)(24.16)}{12} = 0.50\ ac-ft$$

As required by the OEPA, a volume equivalent to 75% WQv must be provided in both the permanent pool and above the permanent pool. An additional 20% should also be provided in the permanent pool for sediment storage.

The required volume in the permanent pool for water quality: 0.75WQv + 0.2WQv = 0.4777 acre-feet.
The required volume above the permanent pool for water quality: 0.75WQv = 0.3771 acre-feet.

Water quality capture and treatment for this site will occur in the proposed retention basin.
A 12" diameter orifice, invert elevation=599.45, has been designed to provide the drawdown time required. The orifice provides a 100% drawdown time of 26.60 hours, which satisfies the minimum 24 hour drawdown time required by the OEPA. The water quality elevation in the basin is 599.75. The water quality volume provided in the permanent pool is 12.30 acre-feet and the water quality volume provided above the permanent pool is 0.607 acre-feet.

Stormwater Management Plan

Stormwater management for the watershed (POSTDEV) will be achieved through the wet detention basin.

The existing outlet structure on site will remain as the basin's outlet control. The structure has a 12" PVC reverse flow pipe with an invert on the structure at an elevation of 599.45. It has windows at 603.02 and it's top elevation is 604.57. The 12" PVC will be capped with a 5.5" orifice at 599.45 and a 2' x 1' windows at 599.75 will be added to the structure to provide adequate water quality volume and drawdown time. With these modifications, the structure will also adequately control all storm peak flows to the conditions of the critical storm.

Table 3 – Wet Basin Detention Summary from Pond Pack

Storm Event	Peak Water Surface Elevation (ft)	Detention Storage Volume (ac-ft)	Peak Flow (cfs)
1-yr	601.12	4.417	9.50
2-yr	601.57	5.431	11.03
5-yr	602.38	7.351	13.48
10-yr	602.96	8.818	15.05
25-yr	603.61	10.540	18.76
50-yr	604.11	11.926	22.94
100-yr	604.49	13.034	26.61

Results Summary

The detained area will adhere to the release rates specified in the Butler County Subdivision Regulations. A summary of the peak flows of pre to post conditions are present below for reference.

Table 4 – Peak Flows

Storm Event	PREDEV Peak Flows (cfs)	POSTDEV Peak Flows (cfs)	Allowable Release Rate (cfs)	POST-DEVELOPED RELEASE RATES (cfs) (ONSITE)
1-yr	65.45	92.92	65.45	9.50
2-yr	88.80	119.85	65.45	11.03
5-yr*	132.51	168.74	65.45	13.48
10-yr	165.23	204.48	132.51	15.05
25-yr	205.57	247.85	165.23	18.76
50-yr	239.80	284.22	205.57	22.94
100-yr	267.47	313.40	239.80	26.61

*denotes critical storm

Appendix A
Design Calculations

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STORM SEWER COMPUTATIONS

2/27/2018
i = MORPC manual

Project: Fairfiled Logistics Center
Project Number: 170044.004

Design Storm: 10 yr
Check Storm: 25 yr
Manning's n: 0.013

LOCATION			BASIN DATA									PIPE DATA							HGL CHECK							
Inlet	Station	Outlet	ΔA (ac)	ΣA (ac)	ΔT_c (min)	ΣT_c (min)	Design i (in/hr)	Coeff. C	ΔCA (ac)	ΣCA (ac)	Design Discharge (cfs)	Pipe Size (in)	Pipe Length (ft)	Pipe Slope (ft/ft)	US Invert (ft)	DS Invert (ft)	Mean Velocity (ft/sec)	Pipe Full Capacity (cfs)	Check i (in/hr)	Check Discharge (cfs)	Mean Velocity (ft/sec)	Friction Slope (ft/ft)	Head Loss (ft)	TW Elevation (ft)	HW Elevation (ft)	Grate Elevation (ft)
105		104	0.39	0.39	10	10	5.15	0.90	0.35	0.35	1.81	12	153	0.0100	612.17	610.64	4.55	3.57	5.75	2.02	4.55	0.0100	1.53	611.44	612.97	616.17
104		103	0.30	0.69	10	11	5.07	0.90	0.27	0.62	3.15	12	153	0.0100	610.64	609.11	4.55	3.57	5.67	3.52	4.55	0.0100	1.53	609.91	611.44	616.17
103		102	0.35	1.04	10	11	4.98	0.90	0.32	0.94	4.66	15	75	0.0101	608.86	608.10	5.30	6.50	5.59	5.24	5.30	0.0101	0.76	609.10	609.86	616.50
102		102A	0.19	1.23	10	11	4.95	0.90	0.17	1.11	5.48	18	104	0.0100	607.85	606.82	5.95	10.51	5.56	6.16	5.95	0.0100	1.03	608.02	609.05	616.70
102A		101	0.18	1.41	10	12	4.91	0.90	0.16	1.27	6.23	18	104	0.0100	606.82	605.78	5.97	10.56	5.52	7.01	5.97	0.0100	1.04	613.05	614.09	616.75
101		100	1.13	2.54	10	12	4.87	0.90	1.02	2.12	10.33	24	194	0.0076	605.33	603.85	6.31	19.82	5.48	11.65	6.31	0.0076	1.48	605.45	606.93	616.13
201		200	1.16	1.16	10	10	5.15	0.90	1.04	1.04	5.38	12	164	0.0400	612.25	605.69	9.10	7.15	5.75	6.00	9.10	0.0400	6.56	606.49	613.05	616.25
303		301	0.64	0.64	10	10	5.15	0.90	0.58	0.58	2.97	12	153	0.0100	612.25	610.72	4.55	3.58	5.75	3.31	4.55	0.0100	1.53	611.72	613.25	616.25
302		301	0.69	0.69	10	10	5.15	0.90	0.62	0.62	3.20	12	153	0.0100	612.25	610.72	4.55	3.58	5.75	3.57	4.55	0.0100	1.53	611.72	613.25	616.25
301		300	1.03	2.36	10	11	5.07	0.90	0.93	2.12	10.76	15	131	0.0400	610.72	605.47	10.55	12.95	5.67	12.04	10.55	0.0400	5.25	606.47	611.72	616.25
401		400	0.20	0.20	10	10	5.15	0.90	0.18	0.18	0.93	12	28	0.0599	611.66	609.96	11.13	8.74	5.75	1.04	11.13	0.0599	1.70	610.76	612.46	615.66
501		500	0.17	0.17	10	10	5.15	0.90	0.15	0.15	0.79	12	28	0.0600	611.67	609.99	11.14	8.75	5.75	0.88	11.14	0.0600	1.68	610.79	612.47	615.67
605		604	0.19	0.19	10	10	5.15	0.90	0.17	0.17	0.88	12	156	0.0070	608.19	607.10	3.80	2.99	5.75	0.98	3.80	0.0070	1.09	610.52	611.61	613.60
604		603	2.99	3.18	10	11	5.05	0.90	2.69	2.86	14.44	24	268	0.0037	607.10	606.10	4.41	13.86	5.65	16.18	5.15	0.0051	1.36	609.16	610.52	609.86
603		602	3.20	6.38	10	12	4.90	0.90	2.88	5.74	28.13	30	268	0.0037	606.10	605.11	5.09	25.00	5.52	31.67	6.45	0.0059	1.59	607.57	609.16	609.86
602		601	1.61	7.99	10	13	4.78	0.90	1.45	7.19	34.36	36	231	0.0037	605.11	604.26	5.74	40.55	5.40	38.85	5.74	0.0037	0.85	606.72	607.57	609.86
601		600	1.51	9.50	10	13	4.69	0.90	1.36	8.55	40.10	36	69	0.0038	604.26	604.00	5.81	41.07	5.32	45.47	6.43	0.0046	0.32	606.40	606.72	612.16

Designed:
Checked:

PROJECT	**Fairfield Logistics Center**		
JOB #	**170044**	**DESIGN**	**JMH**
DATE	**4/27/2018**	**CHECK**	**DVW**

WATER QUALITY VOLUME

= INPUT FIELDS

Method 2

WQv= C * P * A / 12

C = 0.56
P = 0.9 IN
A = 24.16 ACRES *

WQv = 1.01 AC FT

RUNOFF COEFFICIENT

C = Rv = 0.05 + 0.9i

WHERE: i = IMPERVIOUS RATIO

IMPERVIOUS RATIO, i = IMPERVIOUS AREA / TOTAL AREA

IMPERVIOUS AREA =	13.69
TOTAL AREA =	24.16
i =	0.566639

P = Precipitation Depth of 0.90 - inches

***AREA TO INCLUDE OFFSITE DRAINAGE**

THEREFORE, WQv =		**1.01**	**AC FT**
	OR,	44199.24	CF

BASIN STORAGE VOLUME

ELEV.	VOLUME	EDv *
599.45	0.0000	599.82
600	1.1230	

Bottom of Basin: 599.45

EXTENDED DETENTION VOLUME - WET BASINS

EDv = 0.75 * WQv

Wet EDv = 0.761 AC FT or, 33149 CF

EDv REQUIRED STORAGE AVAILABLE AT: 599.82

SIZE ORIFICE FOR EXTENDED DETENTION VOLUME DRAIN

Td = 48 HOURS FOR DRY
24 HOURS FOR WET

Q(avg) = EDv / Td Q(max) = 2 * Q(avg)

Q(avg) = 0.3837 CFS

Q(max) = 0.7673 CFS

WHERE:

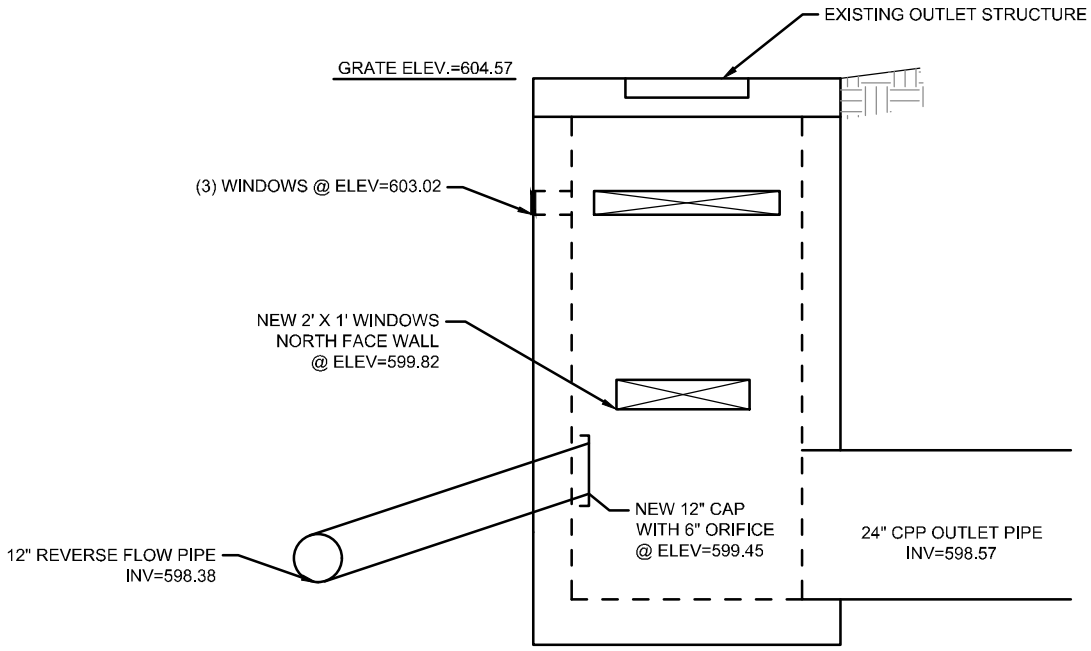
EDv = EXTENDED DETENTION VOLUME
*EDv = 0.75 * WQv FOR WET PONDS AND WETLANDS*
*EDv = 1.2 * WQv FOR DRY DETENTION BASINS*
Q_{avg} = *AVERAGE FLOW RATE THROUGH THE ORIFICE*
Q_{max} = *MAXIMUM FLOW RATE THROUGH THE ORIFICE*
T_d = *EDv DRAIN TIME (24 TO 48 HOURS)*
C = 0.6 ORIFICE COEFF.
g = 32.2 ft/ sec²
H_{max} = *MAXIMUM HYDRAULIC HEAD*
A = ORIFICE AREA (ft²)
D = ORIFICE DIAMETER (ft)

A = Q(max) / C * (2 * g * H(max))^0.5

H(max) = 0.37 FT

A = 0.2610 SQ FT AREA OF REQUIRED ORIFICE

D = 6.92 IN **Use a 6" orifice**



DETENTION OUTFALL STRUCTURE

N.T.S.

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PROJECT NO:	**170044.004**
DATE:	**2018-04-26**
SCALE:	**NOT TO SCALE**
SHEET NO.	**1 OF 1**

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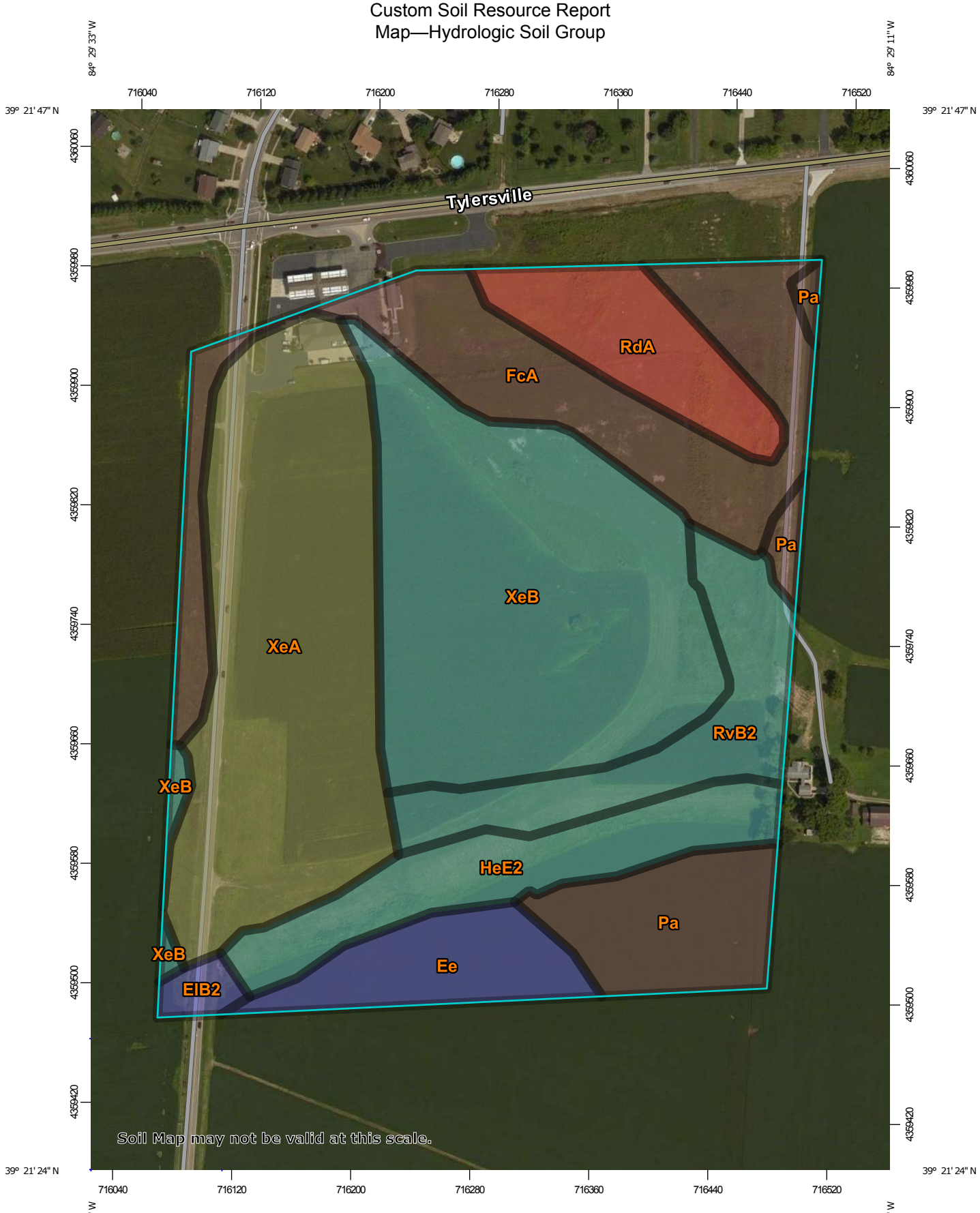
Appendix B
Hydrologic Soil Map



Map Scale: 1:3,460 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Butler County, Ohio
Survey Area Data: Version 16, Sep 26, 2017

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

Date(s) aerial images were photographed: Aug 26, 2014—Oct 26, 2014

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
Ee	Eel silt loam, 0 to 2 percent slopes, occasionally flooded	B	2.6	5.2%
ElB2	Eldean loam, 2 to 6 percent slopes, eroded	B	0.4	0.9%
FcA	Fincastle silt loam, Southern Ohio Till Plain, 0 to 2 percent slopes	B/D	7.6	15.2%
HeE2	Hennepin-Miamian silt loams, 18 to 25 percent slopes, moderately eroded	C	4.0	8.0%
Pa	Patton silty clay loam, 0 to 2 percent slopes	B/D	3.6	7.2%
RdA	Raub silt loam, 0 to 2 percent slopes	D	3.0	6.0%
RvB2	Russell-Miamian silt loams, 2 to 6 percent slopes, moderately eroded	C	3.9	7.8%
XeA	Xenia silt loam, Southern Ohio Till Plain, 0 to 2 percent slopes	C/D	11.8	23.9%
XeB	Xenia silt loam, Southern Ohio Till Plain, 2 to 6 percent slopes	C	12.8	25.7%
Totals for Area of Interest			**49.7**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix C
Drainage Maps

OFFSITE DRAINAGE AREA PER MILLER
FARM DETENTION REPORT
TOTAL OFFSITE AREA: 44.813 ACRES
AREA A: 27.522 ACRES, CN: 80
AREA B: 2.283 ACRES, CN: 72
AREA C: 3.254 ACRES, CN: 79
AREA D: 11.754 ACRES, CN: 79

PREDEVELOPED DRAINAGE AREA
(ON SITE AREA PART OF AREA D)
TOTAL AREA: 21.88 ACRES, CN: 79

RdA
FcA
XeA
XeB
RvB2
Pa
HeE2

BENCHMARK #1 =619.87
ARROW BOLT ON FH

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PREDEVELOPED DRAINAGE MAP

ISSUANCES

#	Description	Date
1	PERMIT ISSUE	01.26.2018
2	CONSTRUCTION ISSUE	04.03.2018

DRAWING INFORMATION

Scale:	as noted
Date:	12.22.2017
Checked By:	DVW
Drawn By:	JMH
Duke Realty Job #:	DUKEAJ-351
A/E Job #:	170044.004

DRAWING / SHEET TITLE

PREDEVELOPED
DRAINAGE MAP

SHEET NUMBER

1 OF 4

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OFFSITE DRAINAGE AREA PER MILLER FARM
DETENTION REPORT
TOTAL OFFSITE AREA: 44.813 ACRES
AREA A: 27.522 ACRES, CN: 80
AREA B: 2.283 ACRES, CN: 72
AREA C: 3.254 ACRES, CN: 79
AREA D: 11.754 ACRES, CN: 90 (FUTURE DEV)

POSTDEVELOPED DRAINAGE AREA
TOTAL AREA: 24.16 ACRES
PERVIOUS: 10.47 ACRES, CN: 79
IMPERVIOUS: 13.69 ACRES, CN: 98

RdA
FcA
XeA
XeB
RvB2
Pa
HeE2
16" PUBLIC WATERLINE EASEMENT
PROP 16" PUBLIC WATER EXTENSION
EX. 12" SAN
EX. 8" SAN
EX. 6" SAN
BENCHMARK #1 =619.80
ARROW BOLT ON FH

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HAMILTON, OHIO 45011

POSTDEVELOPED DRAINAGE MAP

ISSUANCES

#	Description	Date
1	PERMIT ISSUE	01.26.2018
2	CONSTRUCTION ISSUE	04.03.2018

DRAWING INFORMATION

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DRAWING / SHEET TITLE

POSTDEVELOPED
DRAINAGE MAP

SHEET NUMBER

2 OF 4

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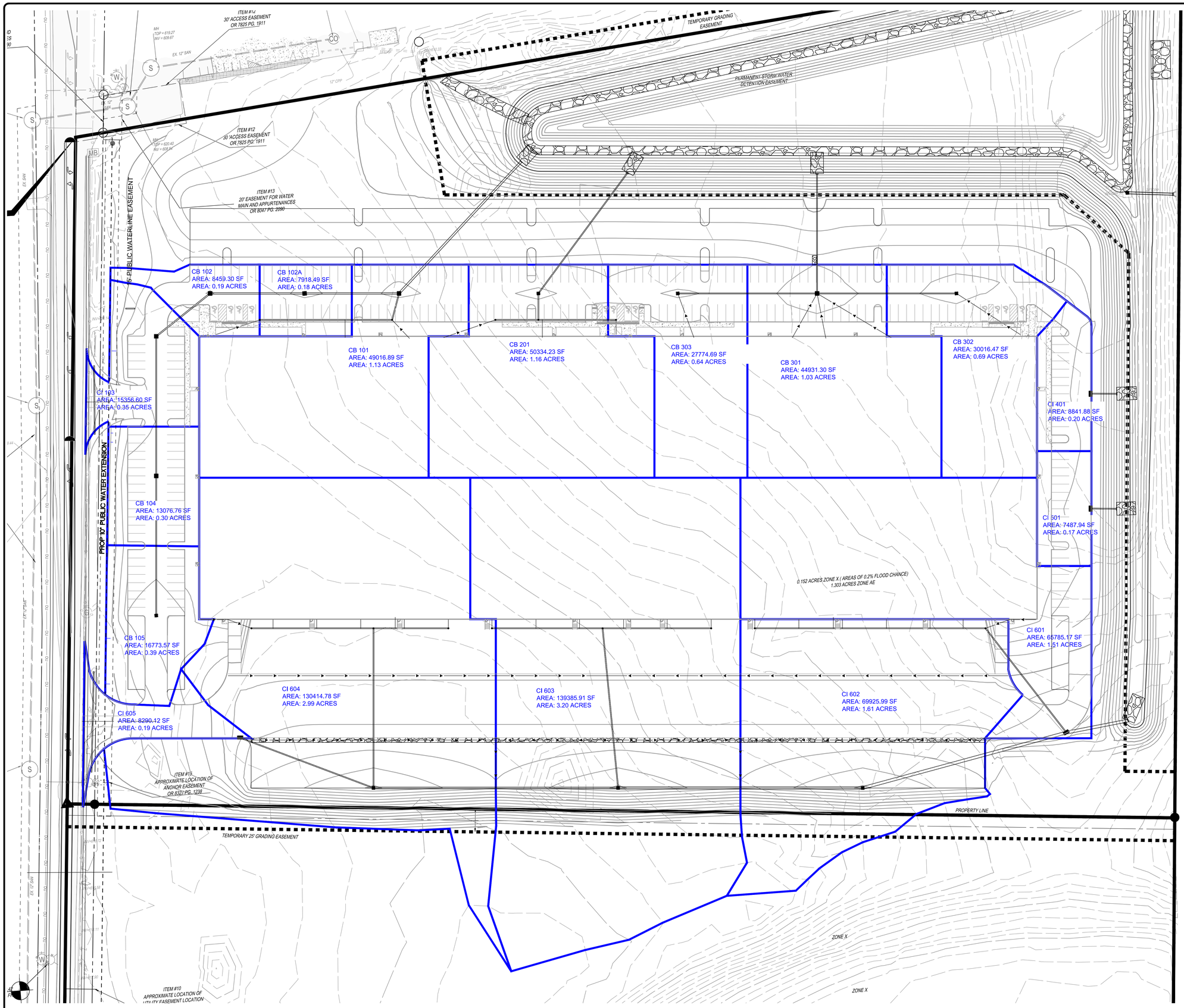

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7940 SEWARD ROAD
HAMILTON, OHIO 45011

LOCAL DRAINAGE MAP

ISSUANCES

#	Description	Date
1	PERMIT ISSUE	01.26.2018
2	CONSTRUCTION ISSUE	04.03.2018

DRAWING INFORMATION

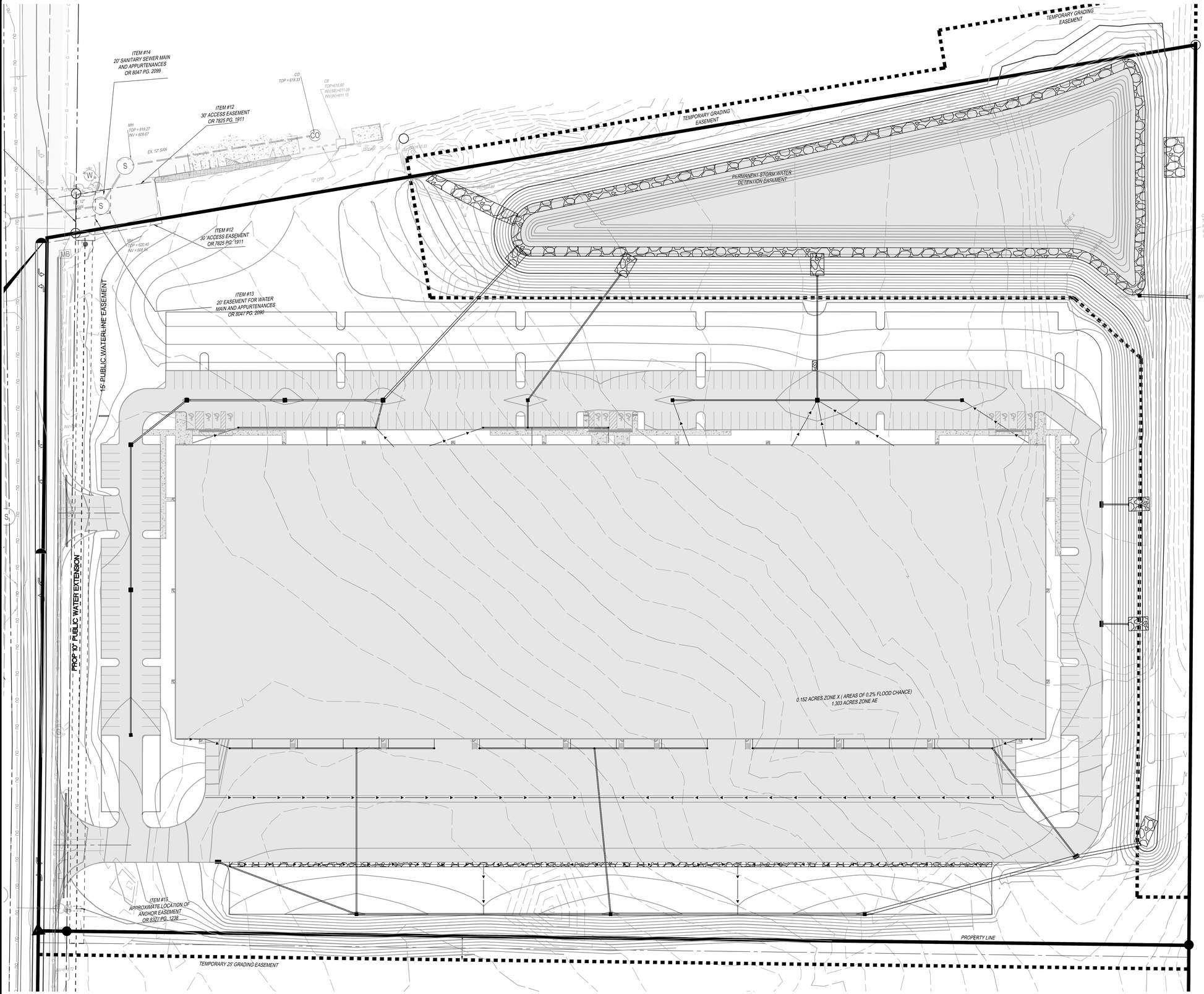
Scale:	as noted
Date:	12.22.2017
Checked By:	DVW
Drawn By:	JMH
Duke Realty Job #:	DUKEAJ-351
A/E Job #:	170044.004

DRAWING / SHEET TITLE

LOCAL DRAINAGE MAP

SHEET NUMBER

3 OF 4



LEGEND

IMPERVIOUS AREA

Duke REALTY

5181 Natorp Blvd, Suite 600
Cincinnati, OH 45040
513.234.3700 • 513.234.3745 (fx)

ARCHITECT

ATA BEILHARZ ARCHITECTS
1063 Central Avenue
Cincinnati, Ohio 45202
513.241.4422

THE KLEINGERS GROUP
CIVIL ENGINEERING | SURVEYING | LANDSCAPE ARCHITECTURE
www.kleingers.com
8300 Centre Park Dr., West Chester, OH 45069
513.779.7851

STATE OF OHIO
DAVID V. WRIGHT, III
E-68774
REGISTERED PROFESSIONAL ENGINEER

FAIRFILED LOGISTICS CENTER 7940

7940 SEWARD ROAD
HAMILTON, OHIO 45011

IMPERVIOUS AREA MAP

ISSUANCES

#	Description	Date
1	PERMIT ISSUE	01.26.2018
2	CONSTRUCTION ISSUE	04.03.2018

DRAWING INFORMATION

Scale:	as noted
Date:	12.22.2017
Checked By:	DVW
Drawn By:	JMH
Duke Realty Job #:	DUKEAJ-351
A/E Job #:	170044.004

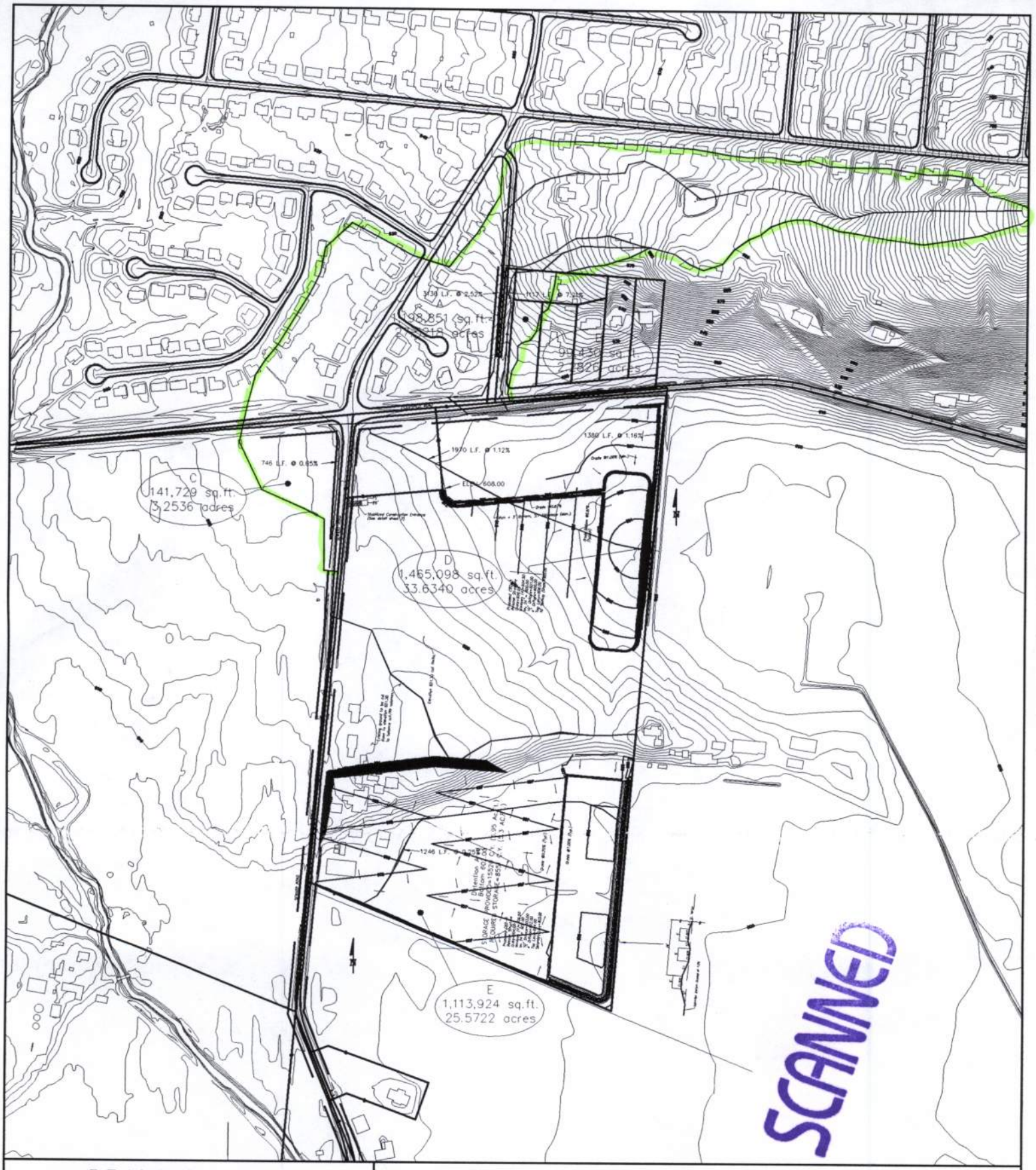
DRAWING / SHEET TITLE

IMPERVIOUS AREA MAP

SHEET NUMBER

4 OF 4

H:\2017\170044\Design\Storm\Drawings\170044STORM4.dwg, 4/27/2018 3:23:45 PM, jhamilton, 1:1



DRAINAGE MAP
MILLER FARM
TYLERSVILLE@SEWARD
FAIRFIELD TWP. OH
SCALE: 1"=500'

NEXUS ENGINEERING

NEXUS ENGINEERING
CIVIL ENGINEERS AND LAND SURVEYORS
8080 BECKETT CENTER DRIVE, SUITE 203
WEST CHESTER, OHIO 45069
PHONE: (513) 860-9130

Appendix D
Pond Pack Calculations

Table of Contents

Table of Contents (continued)

MASTER DESIGN STORM SUMMARY

Network Storm Collection: BUTLER

Return Event	Total Depth in	Rainfall Type	RNF ID
1	2.5000	Synthetic Curve	TypeII 24hr
2	2.9000	Synthetic Curve	TypeII 24hr
5	3.6000	Synthetic Curve	TypeII 24hr
10	4.1000	Synthetic Curve	TypeII 24hr
25	4.7000	Synthetic Curve	TypeII 24hr
50	5.2000	Synthetic Curve	TypeII 24hr
100	5.6000	Synthetic Curve	TypeII 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
01 PREDEV	AREA	1	4.654	--	12.0500	65.45		
01 PREDEV	AREA	2	6.202		12.0500	88.80		
01 PREDEV	AREA	5	9.138		12.0500	132.51		
01 PREDEV	AREA	10	11.366		12.0500	165.23		
01 PREDEV	AREA	25	14.146		12.0500	205.57		
01 PREDEV	AREA	50	16.532		12.0500	239.80		
01 PREDEV	AREA	100	18.478		12.0500	267.47		
02 EX POND IN	POND	1	4.654		12.0500	65.45		
02 EX POND IN	POND	2	6.202		12.0500	88.80		
02 EX POND IN	POND	5	9.138		12.0500	132.51		
02 EX POND IN	POND	10	11.366		12.0500	165.23		
02 EX POND IN	POND	25	14.146		12.0500	205.57		
02 EX POND IN	POND	50	16.532		12.0500	239.80		
02 EX POND IN	POND	100	18.478		12.0500	267.47		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
02 EX POND OUT	POND	1	4.615		13.7000	4.54	601.35	2.281
02 EX POND OUT	POND	2	6.163		13.7500	5.36	601.90	3.244
02 EX POND OUT	POND	5	9.098		14.1000	6.55	602.87	5.174
02 EX POND OUT	POND	10	11.326		13.8500	8.93	603.46	6.507
02 EX POND OUT	POND	25	14.107		13.4000	13.74	604.03	7.907
02 EX POND OUT	POND	50	16.493		13.1000	18.38	604.46	9.096
02 EX POND OUT	POND	100	18.439		12.9000	23.89	604.78	10.025
*03 PRE OUTFALL	JCT	1	4.615		13.7000	4.54		
*03 PRE OUTFALL	JCT	2	6.163		13.7500	5.36		
*03 PRE OUTFALL	JCT	5	9.098		14.1000	6.55		
*03 PRE OUTFALL	JCT	10	11.326		13.8500	8.93		
*03 PRE OUTFALL	JCT	25	14.107		13.4000	13.74		
*03 PRE OUTFALL	JCT	50	16.493		13.1000	18.38		
*03 PRE OUTFALL	JCT	100	18.439		12.9000	23.89		
04 POSTDEV	AREA	1	6.774		12.0500	98.35		
04 POSTDEV	AREA	2	8.648		12.0500	125.75		
04 POSTDEV	AREA	5	12.092		12.0500	175.20		
04 POSTDEV	AREA	10	14.642		12.0500	211.19		
04 POSTDEV	AREA	25	17.772		12.0500	254.76		
04 POSTDEV	AREA	50	20.424		12.0500	291.21		
04 POSTDEV	AREA	100	22.569		12.0500	320.41		
05 PR BASIN IN	POND	1	6.774		12.0500	98.35		
05 PR BASIN IN	POND	2	8.648		12.0500	125.75		
05 PR BASIN IN	POND	5	12.092		12.0500	175.20		
05 PR BASIN IN	POND	10	14.642		12.0500	211.19		
05 PR BASIN IN	POND	25	17.772		12.0500	254.76		
05 PR BASIN IN	POND	50	20.424		12.0500	291.21		
05 PR BASIN IN	POND	100	22.569		12.0500	320.41		

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max WSEL ft	Max Pond Storage ac-ft
05 PR BASIN OUT	POND	1	7.370	L	12.8000	10.01	601.23	3.777
05 PR BASIN OUT	POND	2	9.244	L	12.9000	11.57	601.69	4.821
05 PR BASIN OUT	POND	5	12.688	L	13.0000	14.01	602.51	6.780
05 PR BASIN OUT	POND	10	15.238	L	13.1000	15.72	603.09	8.265
05 PR BASIN OUT	POND	25	18.368	L	13.0000	19.86	603.73	9.978
05 PR BASIN OUT	POND	50	21.020	L	12.9500	24.23	604.22	11.369
05 PR BASIN OUT	POND	100	23.165	L	12.8500	28.09	604.61	12.485
*06 POST OUTFALL	JCT	1	7.370		12.8000	10.01		
*06 POST OUTFALL	JCT	2	9.245		12.9000	11.57		
*06 POST OUTFALL	JCT	5	12.688		13.0000	14.01		
*06 POST OUTFALL	JCT	10	15.238		13.1000	15.72		
*06 POST OUTFALL	JCT	25	18.368		13.0000	19.86		
*06 POST OUTFALL	JCT	50	21.021		12.9500	24.23		
*06 POST OUTFALL	JCT	100	23.165		12.8500	28.09		

Title... Project Date: 1/17/2018
Project Engineer: jhaubert
Project Title: Fairfield Logistics Center
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = BUTLER

Storm Tag Name = 1

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 1 yr
Total Rainfall Depth= 2.5000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 2

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 2 yr
Total Rainfall Depth= 2.9000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 5

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 5 yr
Total Rainfall Depth= 3.6000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 10

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 10 yr
Total Rainfall Depth= 4.1000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 25

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 25 yr
Total Rainfall Depth= 4.7000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Title... Project Date: 1/17/2018
Project Engineer: jhaubert
Project Title: Fairfield Logistics Center
Project Comments:

DESIGN STORMS SUMMARY

Design Storm File,ID = BUTLER

Storm Tag Name = 50

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 50 yr
Total Rainfall Depth= 5.2000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

Storm Tag Name = 100

Data Type, File, ID = Synthetic Storm TypeII 24hr
Storm Frequency = 100 yr
Total Rainfall Depth= 5.6000 in
Duration Multiplier = 1
Resulting Duration = 24.0000 hrs
Resulting Start Time= .0000 hrs Step= .1000 hrs End= 24.0000 hrs

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: User Defined

Segment #1 Time: .2500 hrs

==========
Total Tc: .2500 hrs
==========

Tc Equations used...

==== User Defined ====

Tc = Value entered by user

Where: Tc = Time of concentration

TIME OF CONCENTRATION CALCULATOR

Segment #1: Tc: User Defined

Segment #1 Time: .2500 hrs

Total Tc: .2500 hrs

Tc Equations used...

==== User Defined ====

Tc = Value entered by user

Where: Tc = Time of concentration

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
Miller Farm Area A	80	27.522			80.00
Miller Farm Area B	72	2.283			72.00
Miller Farm Area C	79	3.254			79.00
Miller Farm Area D (Site w/i)	79	33.634			79.00
COMPOSITE AREA & WEIGHTED CN --->		66.693			79.17 (79)

RUNOFF CURVE NUMBER DATA

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	Impervious Adjustment %UC	Adjusted CN
Miller Farm Area D (Offsite)	90	11.754			90.00
Miller Farm Area A	80	27.522			80.00
Miller Farm Area B	72	2.283			72.00
Miller Farm Area C	79	3.254			79.00
Miller Farm Area D (Pervious)	79	10.470			79.00
Miller Farm Area D (Impervious)	98	13.690			98.00
COMPOSITE AREA & WEIGHTED CN --->		68.973			84.81 (85)

Elevation (ft)	Planimeter (sq.in)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	Volume (ac-ft)	Volume Sum (ac-ft)
599.00	-----	0	0	.000	.000
600.00	-----	49792	49792	.381	.381
601.00	-----	67554	175343	1.342	1.723
602.00	-----	81337	223018	1.707	3.429
603.00	-----	94926	264133	2.021	5.451
604.00	-----	113098	311639	2.385	7.835
605.00	-----	139528	378245	2.894	10.730

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Elevation (ft)	Planimeter (sq.in)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	Volume (ac-ft)	Volume Sum (ac-ft)
599.45	-----	87277	0	.000	.000
600.00	-----	90587	266781	1.123	1.123
601.00	-----	95884	279669	2.140	3.263
602.00	-----	103411	298871	2.287	5.550
603.00	-----	112426	323661	2.477	8.027
604.00	-----	123070	353123	2.702	10.729
605.00	-----	133696	385039	2.946	13.675

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 599.00 ft
Increment = .25 ft
Max. Elev.= 605.00 ft

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Weir-Rectangular	W0	--->	C0	603.020	605.000
Inlet Box	R0	--->	C0	604.570	605.000
Orifice-Circular	O1	--->	C0	599.450	605.000
Culvert-Circular	C0	--->	TW	598.570	605.000
TW SETUP, DS Channel					

OUTLET STRUCTURE INPUT DATA

Structure ID = W0
Structure Type = Weir-Rectangular

# of Openings = 1
Crest Elev. = 603.02 ft
Weir Length = 2.00 ft
Weir Coeff. = 3.330000

Weir TW effects (Use adjustment equation)

Structure ID = R0
Structure Type = Inlet Box

# of Openings = 1
Invert Elev. = 604.57 ft
Orifice Area = 2.5000 sq.ft
Orifice Coeff. = .600
Weir Length = 6.50 ft
Weir Coeff. = 3.330
K, Reverse = 1.000
Mannings n = .0000
Kev,Charged Riser = .000
Weir Submergence = No

Structure ID = O1
Structure Type = Orifice-Circular

# of Openings = 1
Invert Elev. = 599.45 ft
Diameter = 1.0000 ft
Orifice Coeff. = .610

OUTLET STRUCTURE INPUT DATA

Structure ID = C0
Structure Type = Culvert-Circular

No. Barrels = 1
Barrel Diameter = 2.0000 ft
Upstream Invert = 598.57 ft
Dnstream Invert = 598.55 ft
Horiz. Length = 49.00 ft
Barrel Length = 49.00 ft
Barrel Slope = .00041 ft/ft

OUTLET CONTROL DATA...
Mannings n = .0150
Ke = .0000 (forward entrance loss)
Kb = .016523 (per ft of full flow)
Kr = .0000 (reverse entrance loss)
HW Convergence = .001 +/- ft

INLET CONTROL DATA...
Equation form = 2
Inlet Control K = .5340
Inlet Control M = .5550
Inlet Control c = .01960
Inlet Control Y = .9000
T1 ratio (HW/D) = 1.070
T2 ratio (HW/D) = 1.213
Slope Factor = -.500

Use unsubmerged inlet control Form 2 equ. below T1 elev.
Use submerged inlet control Form 2 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...
At T1 Elev = 600.71 ft ---> Flow = 15.55 cfs
At T2 Elev = 601.00 ft ---> Flow = 17.77 cfs

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations= 40
Min. TW tolerance = .01 ft
Max. TW tolerance = .01 ft
Min. HW tolerance = .01 ft
Max. HW tolerance = .01 ft
Min. Q tolerance = .00 cfs
Max. Q tolerance = .00 cfs

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 599.45 ft
Increment = .25 ft
Max. Elev.= 605.00 ft

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Orifice-Area	O2	--->	C0	599.820	605.000
Weir-Rectangular	W0	--->	C0	603.020	605.000
Inlet Box	R0	--->	C0	604.570	605.000
Orifice-Circular	O1	--->	C0	599.450	605.000
Culvert-Circular	C0	--->	TW	598.570	605.000
TW SETUP, DS Channel					

OUTLET STRUCTURE INPUT DATA

Structure ID = O2
Structure Type = Orifice-Area

# of Openings = 1
Invert Elev. = 599.82 ft
Area = 2.0000 sq.ft
Top of Orifice = .00 ft
Datum Elev. = 599.82 ft
Orifice Coeff. = .600

Structure ID = W0
Structure Type = Weir-Rectangular

# of Openings = 1
Crest Elev. = 603.02 ft
Weir Length = 2.00 ft
Weir Coeff. = 3.330000

Weir TW effects (Use adjustment equation)

OUTLET STRUCTURE INPUT DATA

Structure ID = R0
Structure Type = Inlet Box

# of Openings = 1
Invert Elev. = 604.57 ft
Orifice Area = 2.5000 sq.ft
Orifice Coeff. = .600
Weir Length = 6.50 ft
Weir Coeff. = 3.330
K, Reverse = 1.000
Mannings n = .0000
Kev,Charged Riser = .000
Weir Submergence = No

Structure ID = O1
Structure Type = Orifice-Circular

# of Openings = 1
Invert Elev. = 599.45 ft
Diameter = .5000 ft
Orifice Coeff. = .610

OUTLET STRUCTURE INPUT DATA

Structure ID = C0
Structure Type = Culvert-Circular

No. Barrels = 1
Barrel Diameter = 2.0000 ft
Upstream Invert = 598.57 ft
Dnstream Invert = 598.55 ft
Horiz. Length = 49.00 ft
Barrel Length = 49.00 ft
Barrel Slope = .00041 ft/ft

OUTLET CONTROL DATA...
Mannings n = .0150
Ke = .0000 (forward entrance loss)
Kb = .016523 (per ft of full flow)
Kr = .0000 (reverse entrance loss)
HW Convergence = .001 +/- ft

INLET CONTROL DATA...
Equation form = 2
Inlet Control K = .5340
Inlet Control M = .5550
Inlet Control c = .01960
Inlet Control Y = .9000
T1 ratio (HW/D) = 1.070
T2 ratio (HW/D) = 1.213
Slope Factor = -.500

Use unsubmerged inlet control Form 2 equ. below T1 elev.
Use submerged inlet control Form 2 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...
At T1 Elev = 600.71 ft ---> Flow = 15.55 cfs
At T2 Elev = 601.00 ft ---> Flow = 17.77 cfs

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations= 40
Min. TW tolerance = .01 ft
Max. TW tolerance = .01 ft
Min. HW tolerance = .01 ft
Max. HW tolerance = .01 ft
Min. Q tolerance = .00 cfs
Max. Q tolerance = .00 cfs

Index of Starting Page Numbers for ID Names