PPS'n West Chester
9117 Cincinnati Columbus Road
Cincinnati, OH 45241
Butler County, Ohio

STORMWATER MANAGEMENT REPORT

PREPARED FOR

PDA, Inc.
3627 West Fork Road
Cincinnati, OH 45247



BY

ROBERTS
ENGINEERING
INCORPORATED

PROJECT NO. 1611
MAY 2017



602 Lila Avenue Milford, Ohio 45150 513-831-6868 Fax 513-831-6894

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EXISTING CONDITIONS

The 11.64 acre irregular shaped site contains a vacant 32,000± sf single story building, several small out-buildings, a house and several connected small parking lots. The site contains an east and west drainage area. (See attached drainage map for existing conditions) The southern portion of the roof, front parking lot, and portions of the northern parking lot drain to a detention basin in the eastern portion of drainage area (Area A - 1.75 ac). This basin outlets to the northeast. The stormwater runoff from the house located in the eastern portion of drainage area (Area B – 2.71 ac.) drains to the northeast and is not managed. The remainder of the site drains to the western drainage area (Area C – 7.61 ac.) unmanaged. The total impervious surface area of the property is approximately 1.56 ac.

PROPOSED IMPROVEMENTS

The initial development would include expanding the 32,000± sf building to approximately 40,450 sf and adding parking and drive aisles that would result in approximately 1.1 acres of additional impermeable surface. Future development could add 2.79 acres of impermeable surface.

STORMWATER MANAGEMENT APPROACH

The Butler County stormwater regulations govern this property.

Area A and B generally drain to the northeast to an area downstream that has documented stormwater runoff issues. Therefore, the grading of this site is to be developed so as not to exacerbate the downstream drainage issues.

The grading and stormwater runoff plan for the proposed improvements is to be developed to reduce the stormwater runoff in Area A draining to the existing detention basin from 1.75 ac to 1.11 ac. to include only that runoff from the area between the front of the building and the street. A portion of the roof and northern parking area that currently flows to the basin has been redirected to Area C. Likewise, the proposed improvements of about 0.55 ac. of Area B will be directed to Area C which is to contain a new storm sewer system to convey the runoff from the remainder of the site to a detention basin to be located adjacent to the north property line. This proposed basin is to be sized to accommodate full development of the site with a projected runoff coefficient of 0.7.

Since the amount of surface area, and therefore the volume of runoff draining from Area A to the existing basin, is to be reduced from 1.75 ac. (including R/W) to 1.11 ac. (including R/W), no management of this area is required. Likewise, the area and volume of runoff from Area B draining to northeast is to be reduced from 2.71 ac. to 2.16 ac. and therefore no management of stormwater runoff from this area is required.

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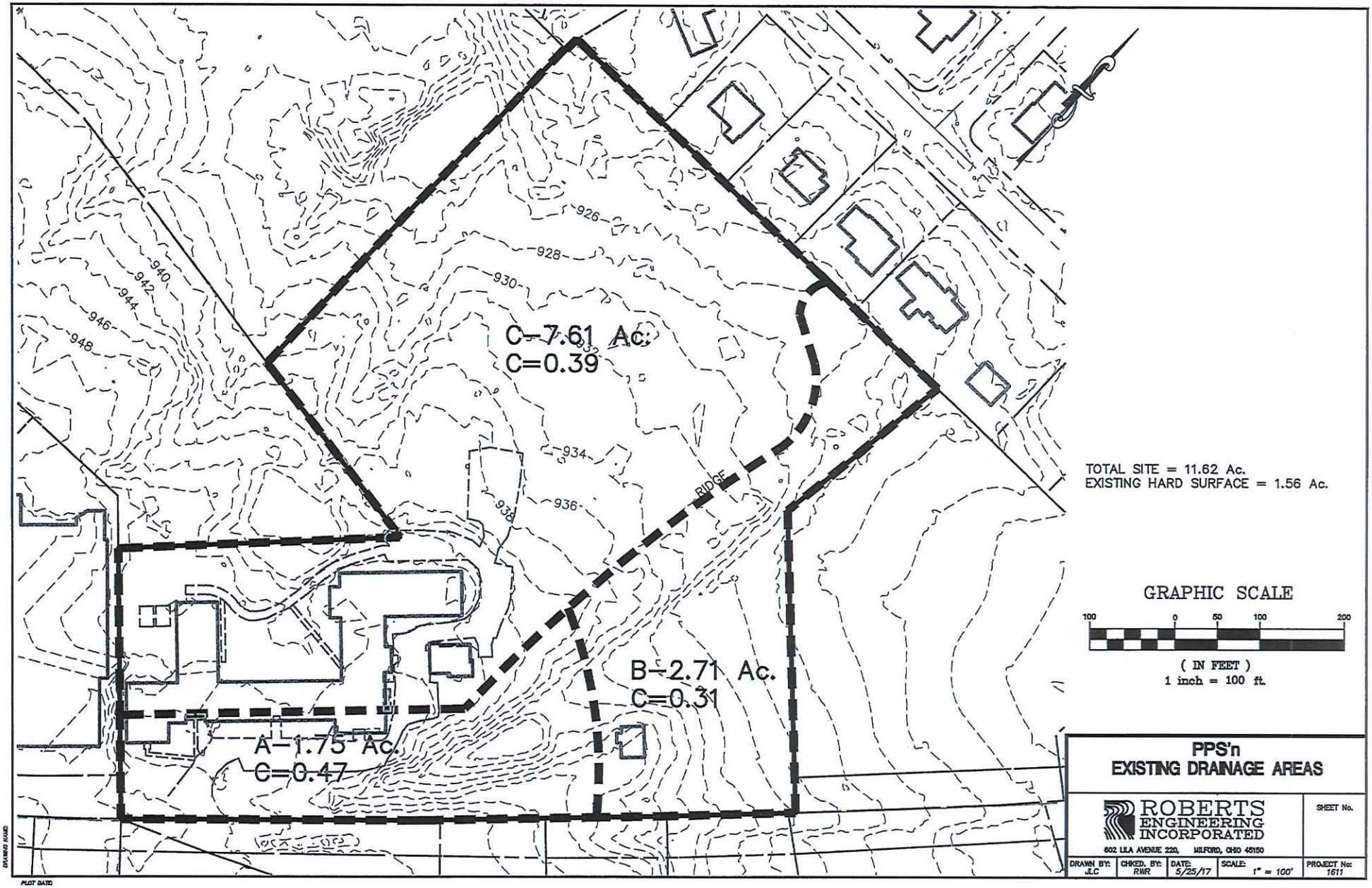
Calculations indicate that the current runoff from the 1 year rainfall in Area C that contains 7.61 ac. and has a calculated runoff coefficient of 0.39 with a time of concentration of 26 minutes is 5.94 cfs. The 1 year rainfall in the future developed Area C (FC) that is to contain 8.8 ac. with a projected runoff coefficient of 0.7 and a time of concentration of 13 minutes is 18.25 cfs. The following table summarizes the required storage and release rates for the proposed detention basin:

ALLOWABLE STORMWATER RUNOFF SUMMARY FOR FUTURE AREA B (All Q's in CFS)							
EVENT	Q_{EX}	Q_{POST}	Q_{ALLOW}		THROUGH BASIN		
					Q	VOL cf	ELEV.
1	5.94	18.25	5.94		3.41	11,935	924.44
2	7.32	21.77	5.94		4.11	14,109	924.65
5	8.64	25.22	5.94		4.66	16,301	924.82
10	10.3	29.09	5.94		5.24	18,798	925.00
25	12.19	32.95	5.94		5.85	21,319	925.16
50	14.00	38.5	12.19		8.78	24,477	925.34
100	15.10	40.6	14.00		10.18	25,492	925.41

Existing Area C Q1=5.94cfs Future Area C Q1 = 18.25cfs

(18.25/5.94 -1) x100 = 207% ∴ Critical Stm = 25yr

Req'd WQ Vol = 10,113cf - Provided = 11,359cf @ Elev. 923.5



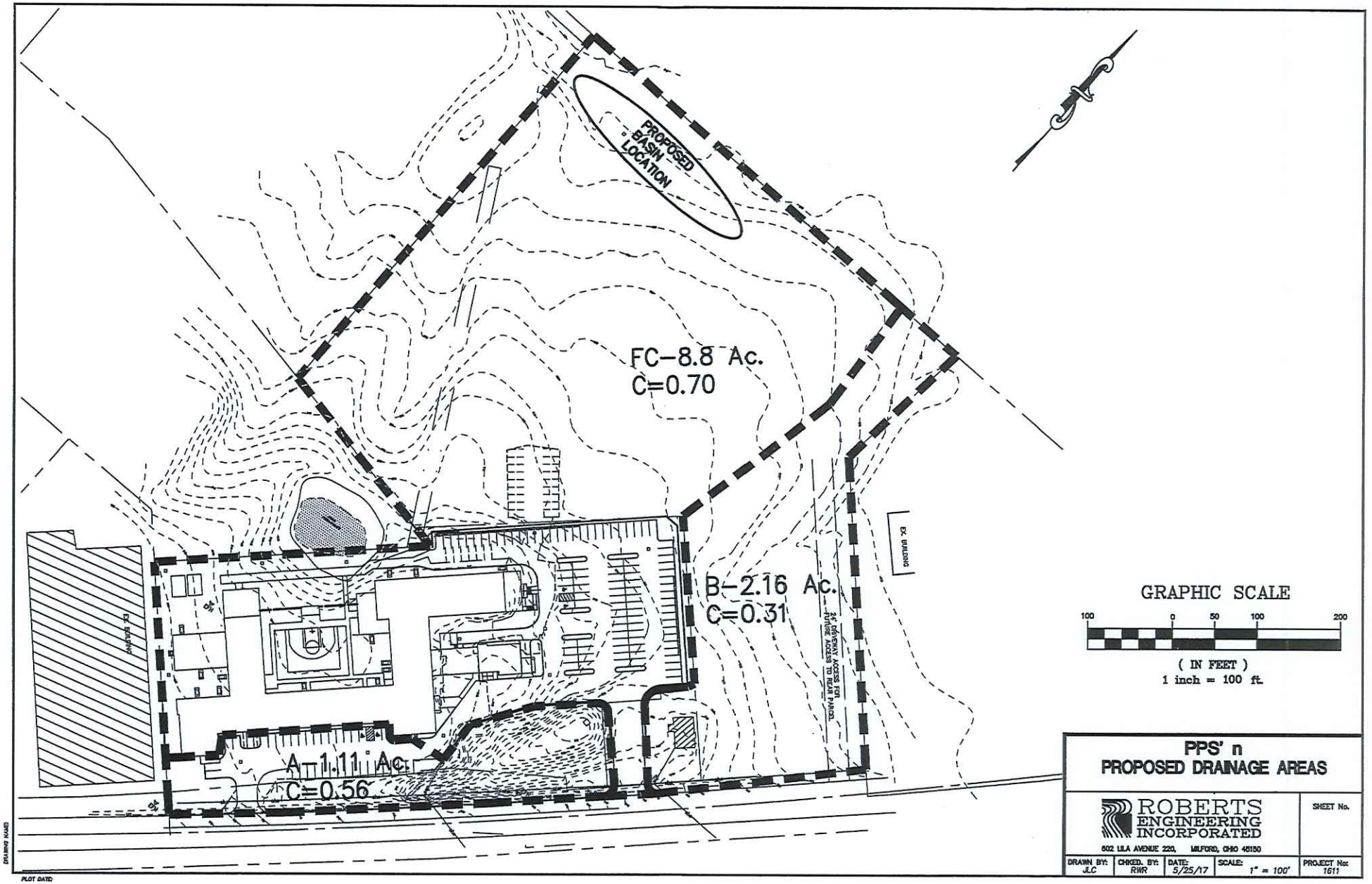
PPS'n
EXISTING DRAINAGE AREAS

ROBERTS ENGINEERING INCORPORATED
602 LILA AVENUE 220, MILFORD, OHIO 45150

SHEET No.

DRAWN BY:	CHKED. BY:	DATE:	SCALE:	PROJECT No:
JLC	RWR	5/25/17	1" = 100'	1611

DRAWING NAME:
PLOT DATE:



PPS' n
PROPOSED DRAINAGE AREAS

ROBERTS ENGINEERING INCORPORATED
502 LILA AVENUE 220, MILFORD, OHIO 45150

SHEET No.

DRAWN BY:	CHKED. BY:	DATE:	SCALE:	PROJECT No:
JLC	RWR	5/25/17	1" = 100'	1611

DRAWING NAME:
PLOT DATE:

Post-Construction Storm Water Quality Orifice Design

Spreadsheet Created by Chris Barnes, PE, CPESC, CPSWQ - Assistant City Engineer, City of Canton, OH

To be used for sizing of single water quality orifice in applicable structural post-construction Best Management Practices

PROJECT LOCATION: PPSn 9117 Cincinnati-Columbus Road

DATE: 5/19/2017

BY: REI

See Ohio EPA Construction General Permit & Post-Construction Q&A Document for details

WATER QUALITY VOLUME (WQv)

WQv = CPA/12

where WQv = Water Quality Volume (acre-ft)

Runoff Coefficient, C = value from table:

Industrial & Commercial	0.8
High Density Residential (>8 dwellings/acre)	0.5
Medium Density Residential (4 to 8 dwellings/acre)	0.4
Low Density Residential (<4 dwellings/acre)	0.3
Open Space and Recreational Areas	0.2

= 0.4221 (Use composite C as necessary)

Precipitation Depth, P = 0.75 inches

Drainage Area, A = 8.8 acres

WQv = 0.23 acre-ft

WQv = 10,113 ft^3

EXTENDED DETENTION VOLUME (EDv)

- dry basin required to provide 25% for sediment storage
∴ vol req = 12,074.83 cu. ft.

DESIGN PARAMETERS

BMP Type = Extended Dry Basin

Draw-down time for selected BMP = 48 hrs (see p.23 in Ohio EPA Permit No. OHC000003)

Per page 22 in Ohio EPA Permit No. OHC000003, "the outlet structure for the post-construction BMP must not discharge more than the first half of the WQv or extended detention volume (Edv) in less than one-third of the drain time."

EDv = 10,113 ft^3, as applicable for selected BMP

1/2 of WQv or EDv = 5,057 ft^3, as applicable for selected BMP

1/3 of draw-down time = 16.00 hrs

Maximum Volume Allowed to be discharged in 16.00 hrs = 3,371 cf

OHIO EPA METHOD 1 (for sizing Water Quality Orifice)

Average Discharge, Q_{avg} = 0.06 cfs (this is the average discharge corresponding to the draw-down time)

Maximum Discharge, Q_{max} = 0.12 cfs (this is the maximum discharge corresponding to the draw-down time)

Maximum Hydraulic Head, H_{max} = 1.50 ft (measured from orifice invert to WQv elevation)

Orifice Coefficient, C = 0.60

Orifice Area, A = $Q_{max}/[C(2gH_{max})^{0.5}]$

= 0.020 ft^2

Orifice Diameter, D = 1.91 in (This is a preliminary estimate only)

(Must route the EDv to ensure design parameters are met and adjust design accordingly...)

OHIO EPA METHOD 2 (for sizing Water Quality Orifice using same parameters above)

Average Discharge, Q_{avg} = 0.06 cfs (this is the average discharge corresponding to the draw-down time)

Maximum Hydraulic Head, H_{max} = 1.50 ft (measured from orifice invert to WQv elevation)

Average Hydraulic Head, H_{avg} = 0.75 ft

Orifice Coefficient, C = 0.60

Orifice Area, A = $Q_{avg}/[C(2gH_{avg})^{0.5}]$

= 0.014 ft^2

Orifice Diameter, D = 1.60 in

Volume discharged in 1/3 of draw-down time = 3,371 cf **Design parameters met. Orifice size OK.**

Manual Estimate of Water Quality Orifice Diameter

(Calculations based on EDv parameters provided above)

Orifice D = 1 in

Maximum Hydraulic Head, H_{max} = 1.50 ft (measured from orifice invert to WQv elevation)

Orifice Coefficient, C = 0.60

Average Discharge, Q_{avg} = 0.02 cfs (this is the average discharge corresponding to the draw-down time)

Draw-down time = 123.52 hrs

Volume discharged in 1/3 of draw-down time = 1,310 cf **Design parameters met. Orifice size OK.**

STAGE STORAGE TABLE						
ELEV	AREA (sq. ft.)	DEPTH (ft)	AVG END INC. VOL. (cu. ft.)	AVG END TOTAL VOL. (cu. ft.)	CONIC INC. VOL. (cu. ft.)	CONIC TOTAL VOL. (cu. ft.)
922.000	5,255.39	N/A	N/A	0.00	N/A	0.00
923.000	8,396.69	1.000	6826.04	6826.04	6764.99	6764.99
923.500	10,005.05	0.500	4600.44	11426.48	4594.57	WD 11359.55
924.000	11,638.53	0.500	5410.89	16837.37	5405.75	16765.30
925.000	14,980.90	1.000	13309.72	30147.09	13274.61	30039.91
926.000	18,423.80	1.000	16702.35	46849.44	16672.70	46712.61

top basin contour (no freeboard)

46,712.61
−11,359.55
35,353.06 cu ft det.

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

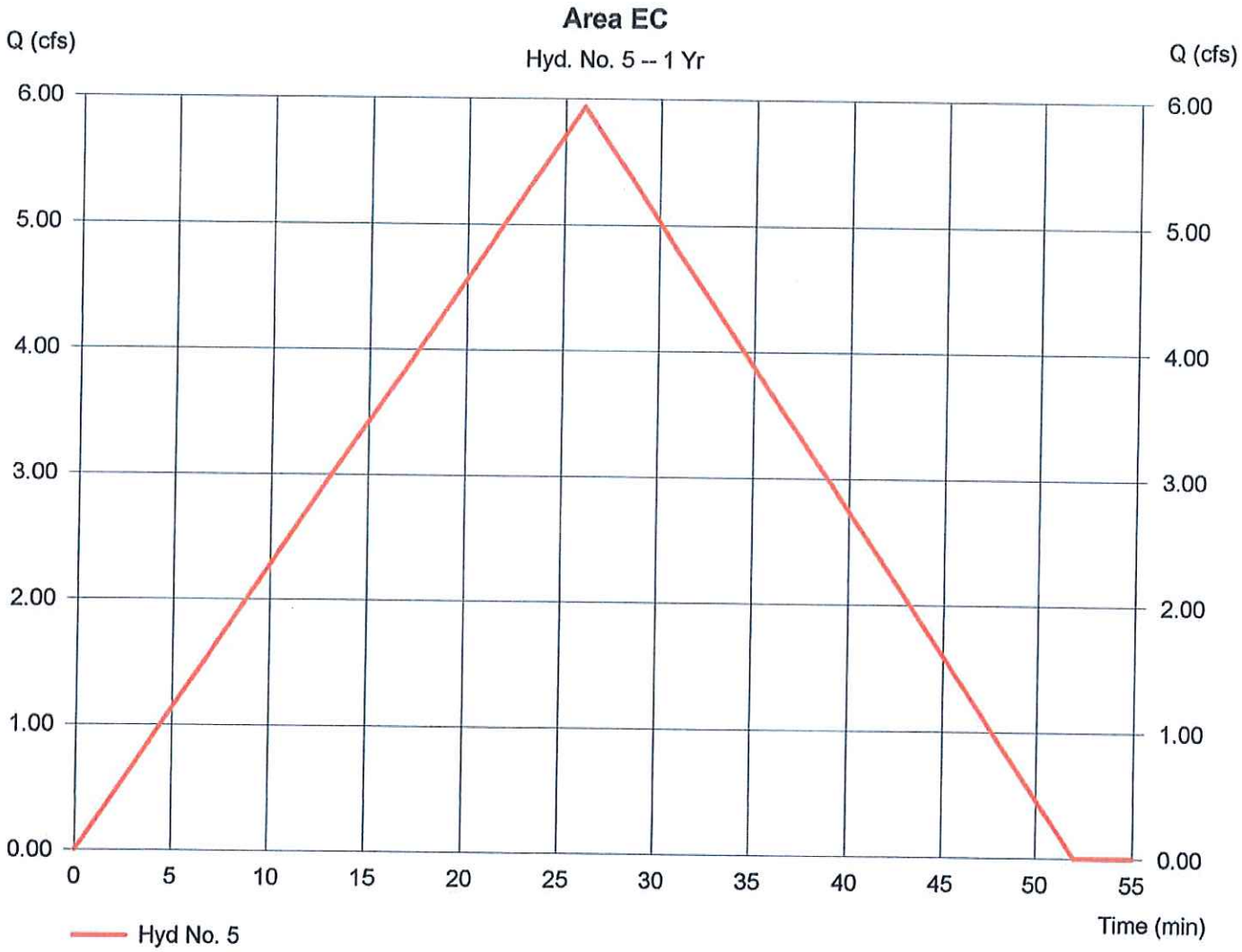
Thursday, May 25 2017, 3:9 PM

Hyd. No. 5

Area EC

Hydrograph type	= Rational	Peak discharge	= 5.94 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 7.610 ac	Runoff coeff.	= 0.39
Intensity	= 2.000 in/hr	Tc by User	= 26.00 min
IDF Curve	= Butler Co.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 9,260 cuft



Hydrograph Plot

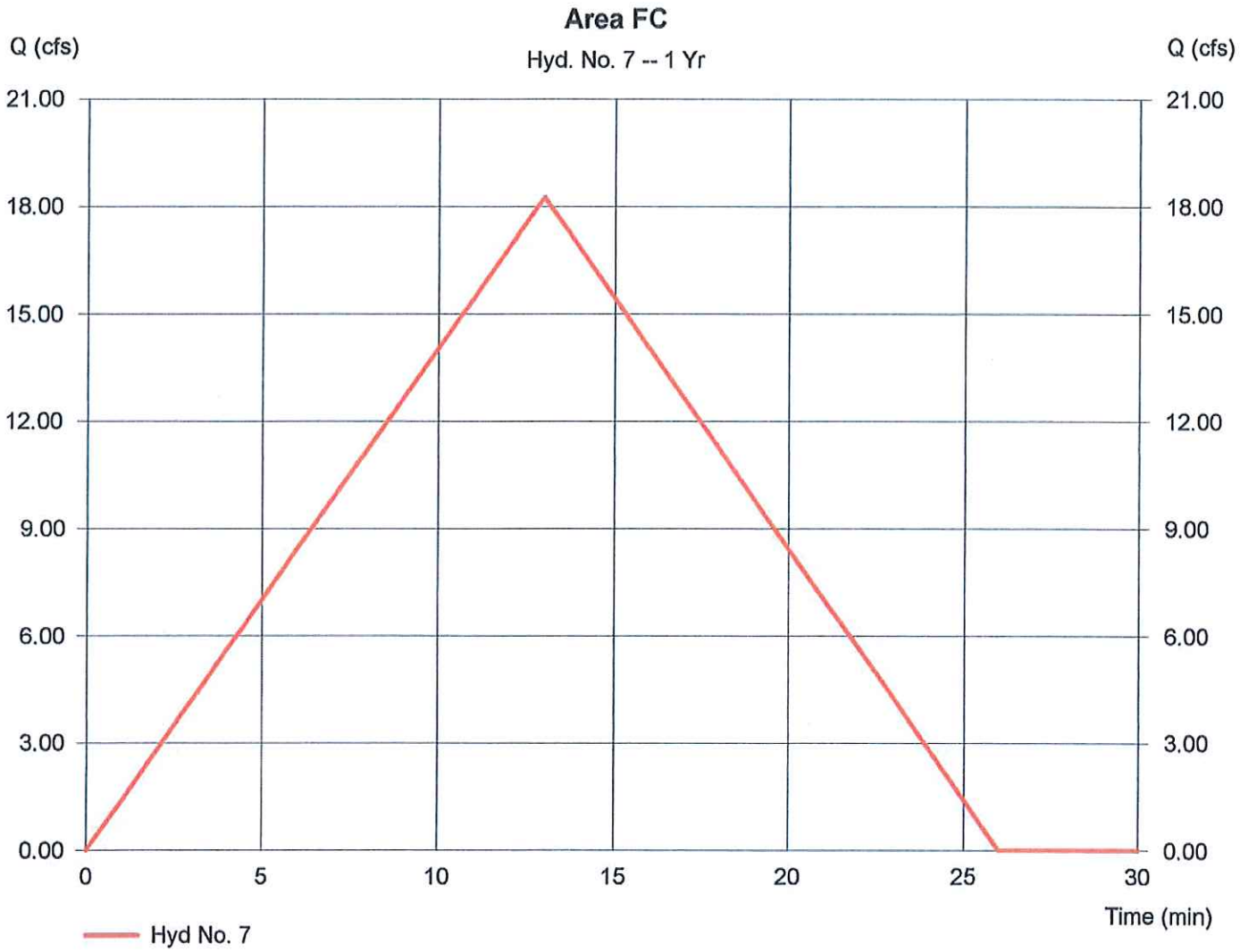
Hydraflow Hydrographs by Intelisolve | Thursday, May 25 2017, 3:14 PM

Hyd. No. 7

Area FC

Hydrograph type	= Rational	Peak discharge	= 18.25 cfs
Storm frequency	= 1 yrs	Time interval	= 1 min
Drainage area	= 8.800 ac	Runoff coeff.	= 0.7
Intensity	= 2.963 in/hr	Tc by User	= 13.00 min
IDF Curve	= Butler Co.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 14,236 cuft



Hydrograph Plot

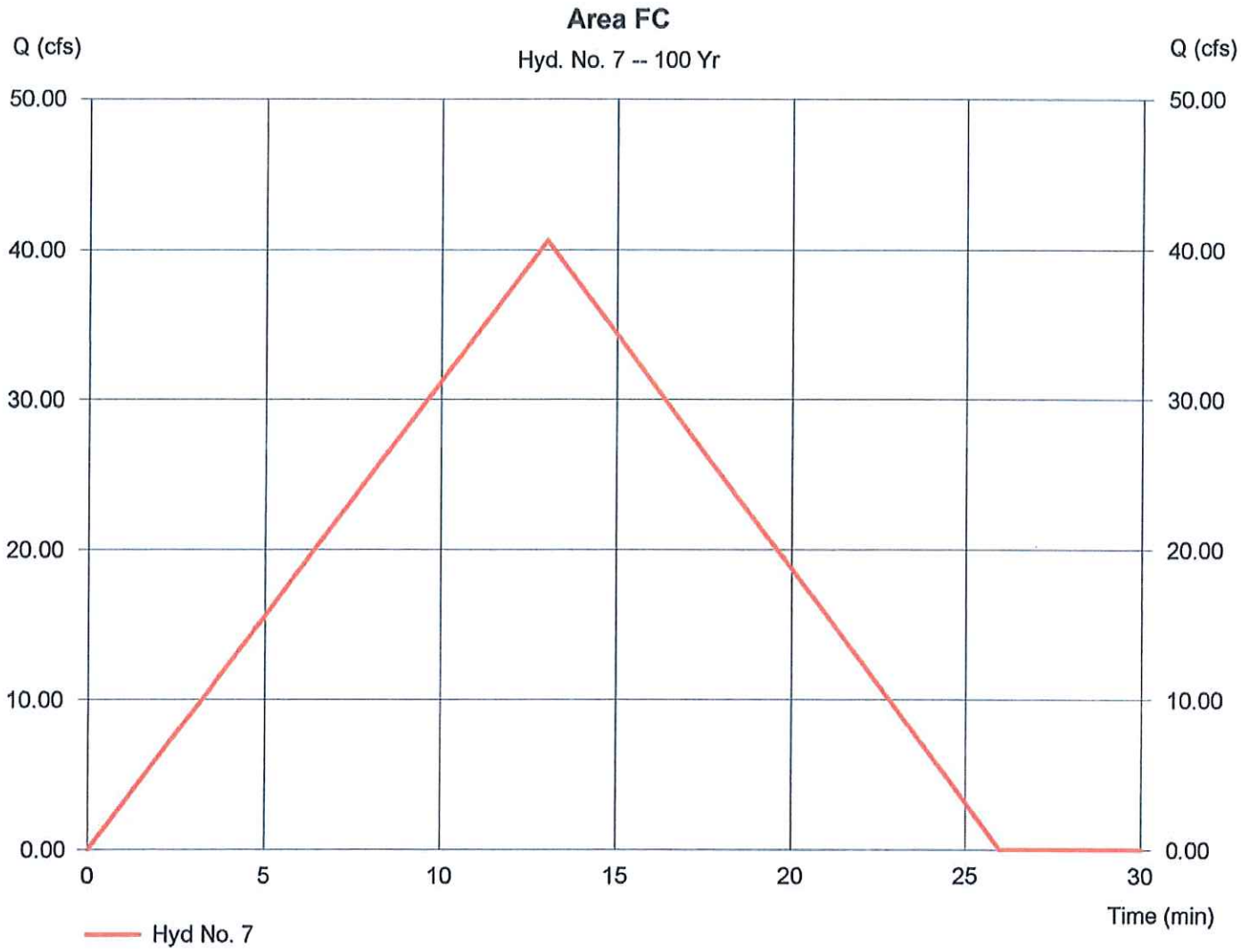
Hydraflow Hydrographs by Intelisolve | Monday, May 22 2017, 11:31 AM

Hyd. No. 7

Area FC

Hydrograph type	= Rational	Peak discharge	= 40.60 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 8.800 ac	Runoff coeff.	= 0.7
Intensity	= 6.591 in/hr	Tc by User	= 13.00 min
IDF Curve	= Butler Co.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 31,668 cuft



Hydrograph Plot

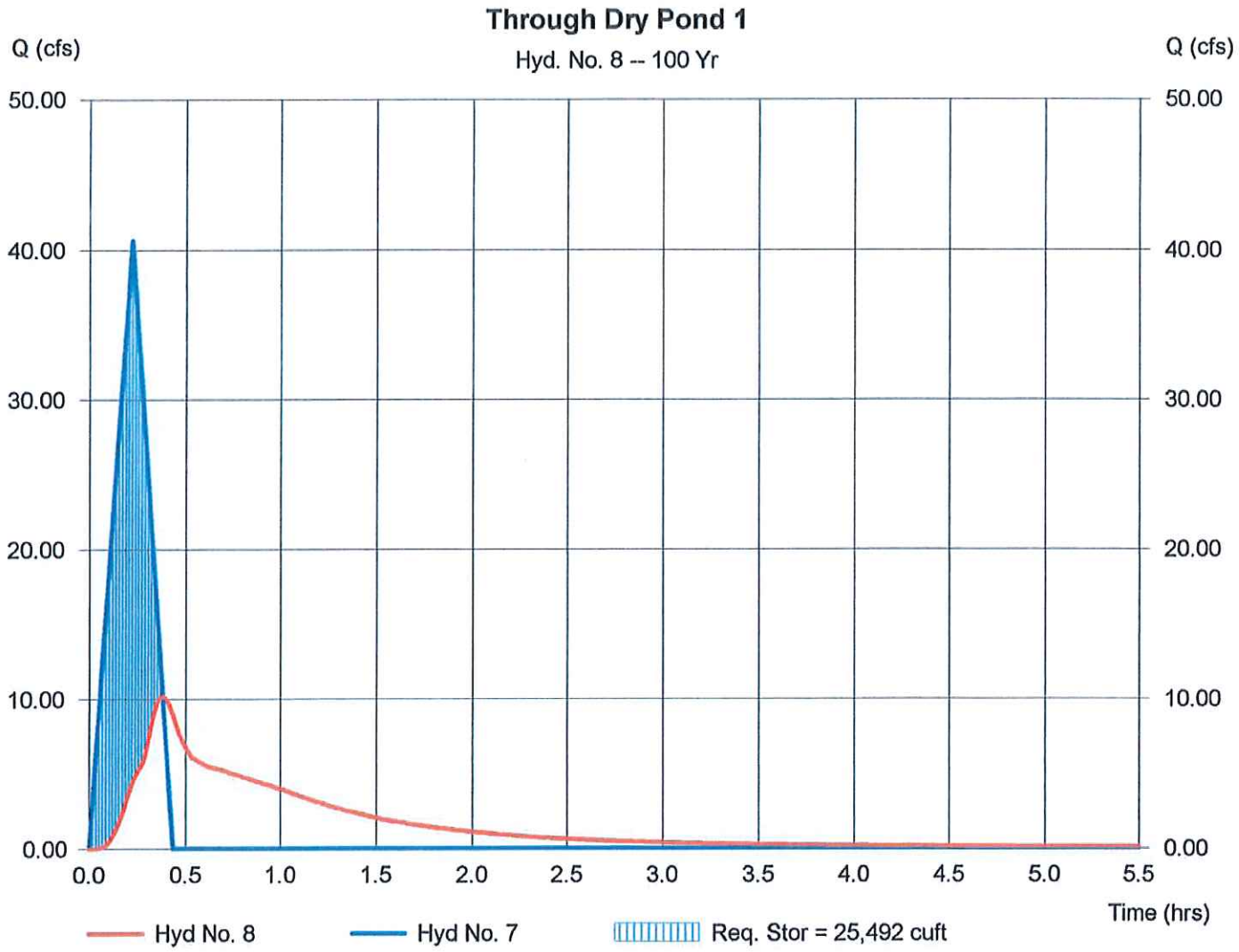
Hydraflow Hydrographs by Intelisolve | Friday, May 26 2017, 8:26 AM

Hyd. No. 8

Through Dry Pond 1

Hydrograph type	= Reservoir	Peak discharge	= 10.18 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 7	Max. Elevation	= 925.41 ft
Reservoir name	= Dry Pond 1	Max. Storage	= 25,492 cuft

Storage Indication method used. | Hydrograph Volume = 31,624 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve — Friday, May 26 2017, 8:17 AM

Pond No. 2 - Dry Pond 1

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	923.50	10,005	0	0
0.50	924.00	11,638	5,411	5,411
1.50	925.00	14,980	13,309	18,720
2.50	926.00	18,423	16,702	35,421

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 14.50	0.00	0.00	0.00
Span (in)	= 14.50	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 923.50	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 9.00	0.00	0.00	0.00
Crest El. (ft)	= 925.15	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

