HAWTHORNE PARK DRAINAGE SUMMARY
2011

Prepared for:
TOWN OF PORTER, INDIANA

November 30, 2011

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HAWTHORNE PARK DRAINAGE SUMMARY - 2011
TOWN OF PORTER, INDIANA

I. INTRODUCTION

This summary is presented to the Town of Porter (OWNER) in response to a request from the OWNER to provide two scenarios, for the OWNER to present to the Porter Park Board, in support of their resolution on drainage in Hawthorne Park.

II. PROJECT DESCRIPTION AND DETAILS

The Hawthorne Park Drainage Analysis (PROJECT) includes providing existing conditions for two concepts to drain storm water from the north side of the Amtrak RR at Waverly Road, through Hawthorne Park and outfall in the low-lying area to the north of Ackerman Drive, in Hawthorne Park, all within the Town of Porter.

The two concepts analyzed were determined at a meeting held on September 20, 2011, between Porter Town Officials and HAAS. The drainage concepts are as follows:

a. Provide a drainage solution for a 10-year, 1-hour storm event to include the portion of Hawthorne Park south of Franklin Street. The boundaries for the watershed include the centerline of Waverly Road on the west, the centerline of Amtrak property to the south, the centerline Hageman Street to the east, and the centerline of Franklin Street on the north which is approximately 5.29 acres; and
b. Provide a drainage solution for an 10-year, 1-hour storm event to include the a portion of Hawthorne Park bounded by the centerline of Waverly Road on the east, the centerline of Franklin Street on the south, the centerline of the Hageman Street on the east, and the south edge of pavement on Ackerman Drive on the North, approximately 7.91 acres.

Hawthorne Park south of Franklin Street has existing drainage conveyance by overland flow south of Lincoln Street to a drainage structure on the southwest quadrant of Lincoln Street and Waverly Road.

The drainage structure outlet pipe is an 8 inch corrugated metal pipe culvert that discharge north into a drainage swale along the west right -of-way of Waverly Road. The drainage swale continues north on Waverly Road to the south side of the Franklin Street right-of-way.

Franklin Street, between Waverly Road and Hageman Avenue, drains midblock to an existing 12 inch corrugated metal pipe that extends north under Franklin Street into Hawthorne Park. The pipe culvert is about 380 feet west of Waverly in the south Franklin Street right-of-way.

Surface water from south of Franklin Street and Hawthorne Park, between Hageman Avenue and Waverly Road, drains to a existing 12 inch corrugated metal pipe that discharges north of Ackerman Drive into the wetland area adjacent to the Little Calumet River.

III. ENGINEERING SERVICES COMPLETED

Based on the Section II Project Description and Details, the following engineering services were completed for the Project:

Drainage Calculations:

1. The necessary calculations were performed to determine the properly sized culvert piping system under the midblock Franklin Street crossing.
2. The necessary calculations were performed to determine the properly sized culvert piping system under Ackerman Drive in Hawthorne Park.

IV. SUMMARY FINDINGS

The drainage calculations for the two concept plans are included in Appendix A, B and C of this summary. They show 2 year, 10 year, and 100 year peak flows for the drainage basins. Peak flows for the 10 year storm event were used to size the pipe systems.

Rainfall intensity data was taken from the Rainfall Frequency Atlas of the Midwest (Bulletin 71), 1992, co-produced by the Midwest Climate Center (NOAA) and the Illinois State Water Survey. This data corresponds with the Porter County Storm Water Control Ordinance #05-21.

Franklin Street midblock crossing requires two arch 11 inch x 18 inch (15 inch equivalent) pipes to carry 5.30 cfs of surface water for a 10-year storm event. The software used to determine the arch pipe models half circles which have equivalent hydraulics. The outfall culvert under Ackerman Drive requires a 24 inch diameter pipe to carry 10.88 cfs of surface water for a 10-year storm event. It should be noted that, although Franklin Street midblock requires two arch pipe culverts to be placed on existing ground within the Franklin Street right-of-way. Minimum coverage over the pipes will not be satisfied if the roadway is reconstructed to existing conditions and erosion of soils will be an issue downstream beyond the right-of-way.

VII. CLOSURE

Haas & Associates would like to thank the Director of Engineering and Development for the opportunity to present this Summary. We are ready to answer any questions and to discuss this Summary further, at your convenience.

APPENDICES

APPENDIX A DRAINAGE CALCULATIONS,
SOFTWARE BY:
HYDRAFLOW HYRDOGRAPHS FOR AUTOCAD

APPENDIX B CULVERT REPORTS – FRANKLIN STREET

APPENDIX C CULVERT REPORTS – ACKERMAN DRIVE

APPENDIX A

DRAINAGE CALCULATIONS

SOFTWARE BY:
HYDRAFLOW HYDROGRAPHS FOR AUTOCAD

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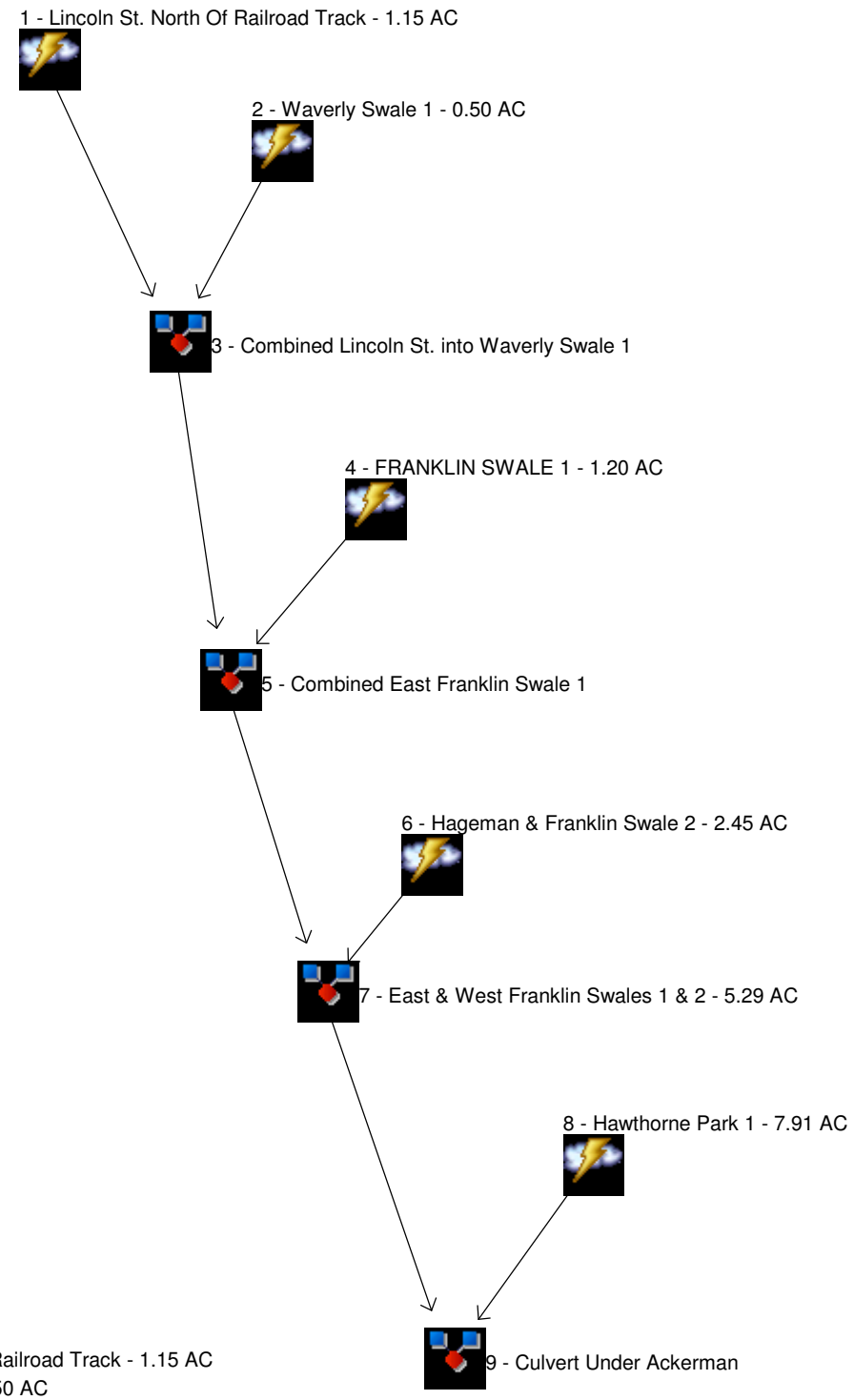
Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066



Legend

Hyd.	Origin	Description
1	Rational	Lincoln St. North Of Railroad Track - 1.15 AC
2	Rational	Waverly Swale 1 - 0.50 AC
3	Combine	Combined Lincoln St. into Waverly Swale 1
4	Rational	FRANKLIN SWALE 1 - 1.20 AC
5	Combine	Combined East Franklin Swale 1
6	Rational	Hageman & Franklin Swale 2 - 2.45 AC
7	Combine	East & West Franklin Swales 1 & 2 - 5.29 AC
8	Rational	Hawthorne Park 1 - 7.91 AC
9	Combine	Culvert Under Ackerman

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	Rational	------	-------	0.876	-------	-------	1.277	-------	-------	2.152	Lincoln St. North Of Railroad Track -
2	Rational	------	-------	0.437	-------	-------	0.637	-------	-------	1.072	Waverly Swale 1 - 0.50 AC
3	Combine	1, 2	-------	1.199	-------	-------	1.748	-------	-------	2.944	Combined Lincoln St. into Waverly S
4	Rational	------	-------	1.039	-------	-------	1.514	-------	-------	2.557	FRANKLIN SWALE 1 - 1.20 AC
5	Combine	3, 4	-------	1.916	-------	-------	2.793	-------	-------	4.710	Combined East Franklin Swale 1
6	Rational	------	-------	2.656	-------	-------	3.868	-------	-------	6.542	Hageman & Franklin Swale 2 - 2.45 A
7	Combine	5, 6	-------	3.626	-------	-------	5.283	-------	-------	8.926	East & West Franklin Swales 1 & 2 -
8	Rational	------	-------	4.007	-------	-------	5.834	-------	-------	9.868	Hawthorne Park 1 - 7.91 AC
9	Combine	7, 8	-------	7.470	-------	-------	10.88	-------	-------	18.40	Culvert Under Ackerman

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	Rational	0.876	1	29	1,523	------	------	------	Lincoln St. North Of Railroad Track -
2	Rational	0.437	1	23	603	------	------	------	Waverly Swale 1 - 0.50 AC
3	Combine	1.199	1	29	2,126	1, 2	------	------	Combined Lincoln St. into Waverly S
4	Rational	1.039	1	42	2,618	------	------	------	FRANKLIN SWALE 1 - 1.20 AC
5	Combine	1.916	1	29	4,745	3, 4	------	------	Combined East Franklin Swale 1
6	Rational	2.656	1	55	8,765	------	------	------	Hageman & Franklin Swale 2 - 2.45 A
7	Combine	3.626	1	42	13,509	5, 6	------	------	East & West Franklin Swales 1 & 2 -
8	Rational	4.007	1	55	13,222	------	------	------	Hawthorne Park 1 - 7.91 AC
9	Combine	7.470	1	55	26,731	7, 8	------	------	Culvert Under Ackerman

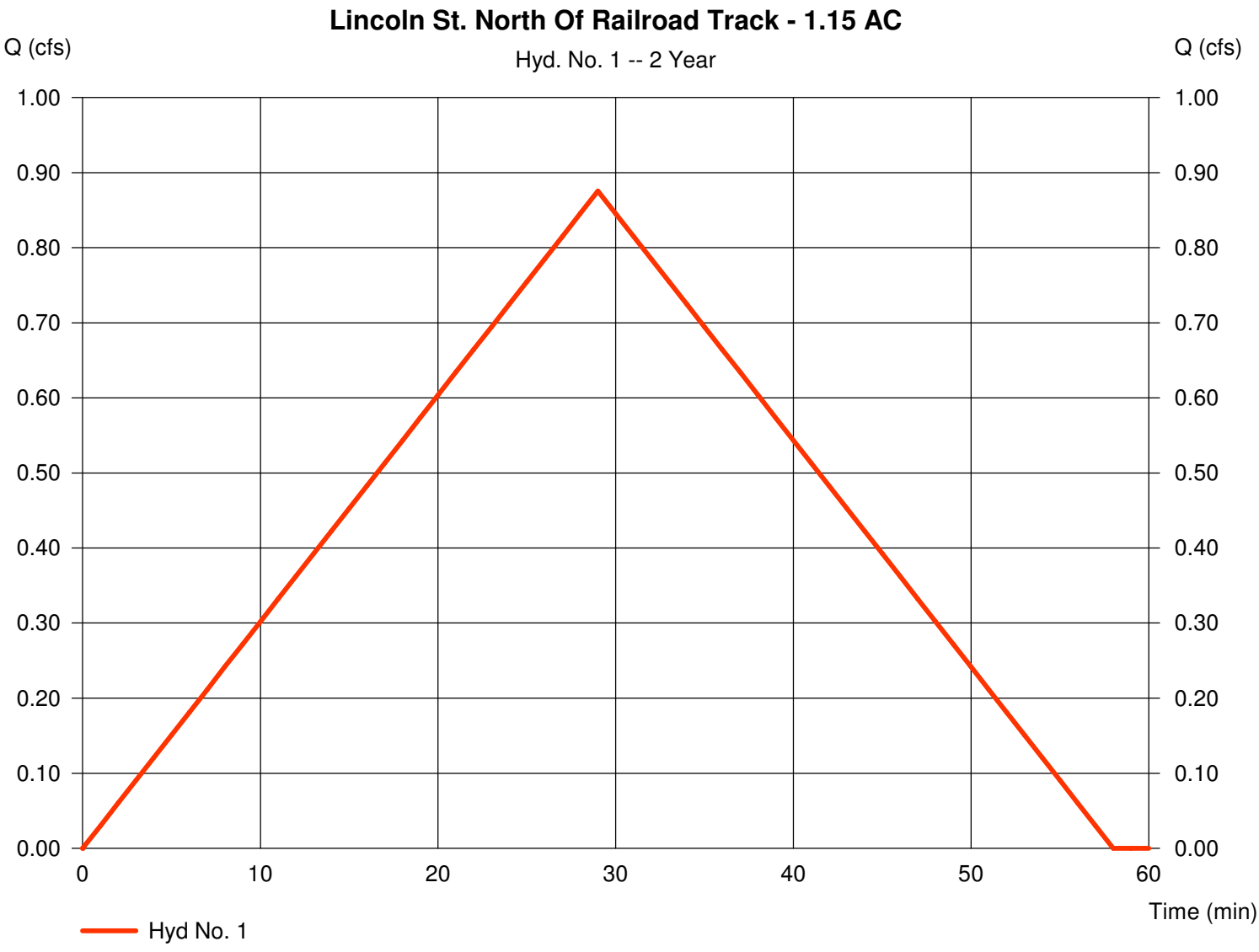
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 1

Lincoln St. North Of Railroad Track - 1.15 AC

Hydrograph type	=	Rational	Peak discharge	=	0.876 cfs
Storm frequency	=	2 yrs	Time to peak	=	29 min
Time interval	=	1 min	Hyd. volume	=	1,523 cuft
Drainage area	=	1.146 ac	Runoff coeff.	=	0.35
Intensity	=	2.182 in/hr	Tc by FAA	=	29.00 min
IDF Curve	=	1992_Bulletin 71_NW Indiana.IDF	Asc/Rec limb fact	=	1/1



FAA Formula Tc Worksheet

Tc = 1.8(1.1 - C) x Flow length^0.5 / Watercourse slope^0.33 Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No. 1

Lincoln St. North Of Railroad Track - 1.15 AC

Description

Flow length (ft)	=	439.00
Watercourse slope (%)	=	0.93
Runoff coefficient (C)	=	0.35
Time of Conc. (min)	**=**	**29**

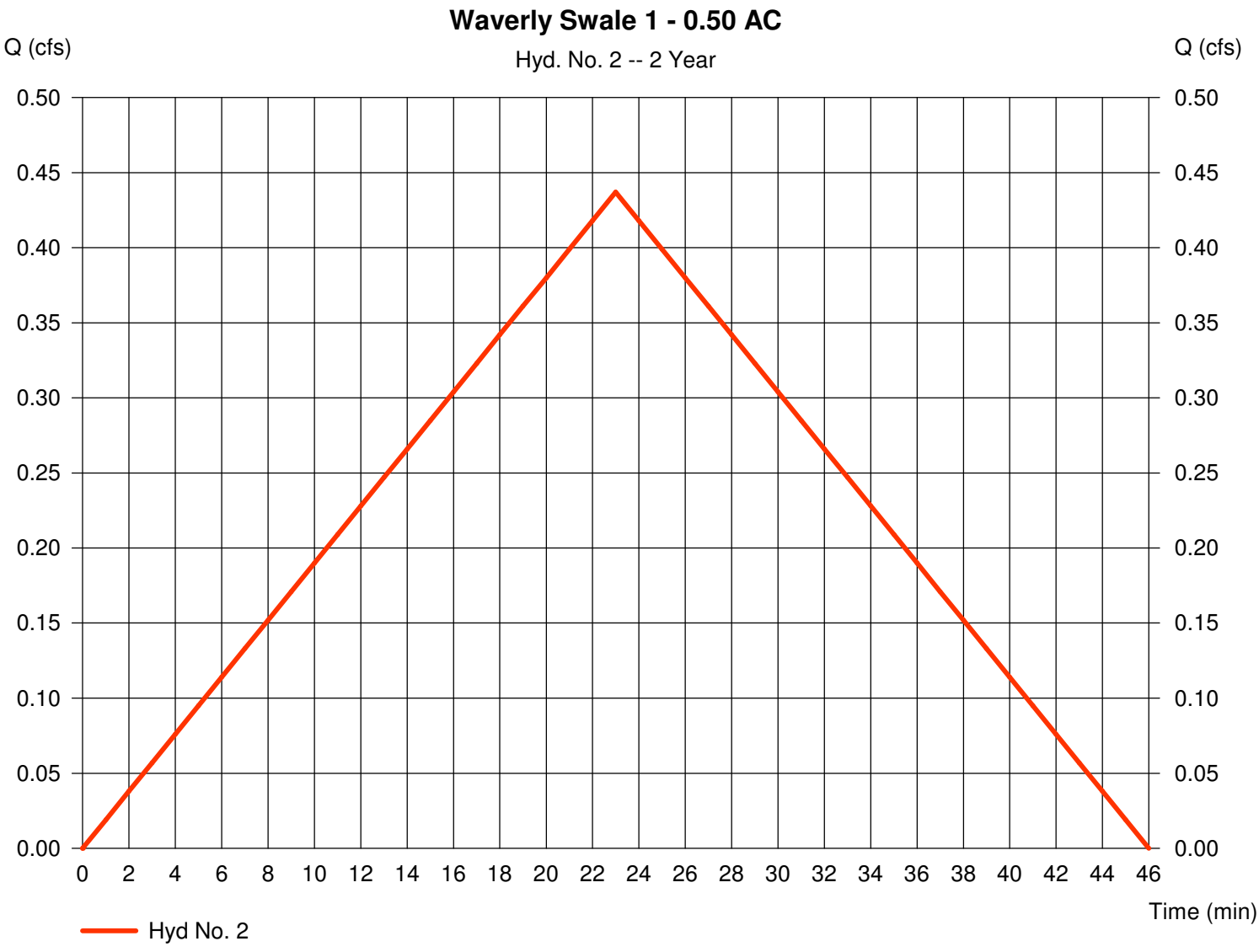
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 2

Waverly Swale 1 - 0.50 AC

Hydrograph type	=	Rational	Peak discharge	=	0.437 cfs
Storm frequency	=	2 yrs	Time to peak	=	23 min
Time interval	=	1 min	Hyd. volume	=	603 cuft
Drainage area	=	0.504 ac	Runoff coeff.	=	0.35
Intensity	=	2.476 in/hr	Tc by FAA	=	23.00 min
IDF Curve	=	1992_Bulletin 71_NW Indiana.IDF	Asc/Rec limb fact	=	1/1



FAA Formula Tc Worksheet

Tc = 1.8(1.1 - C) x Flow length^0.5 / Watercourse slope^0.33 Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No. 2

Waverly Swale 1 - 0.50 AC

Description

Flow length (ft)	=	371.59
Watercourse slope (%)	=	1.45
Runoff coefficient (C)	=	0.35
Time of Conc. (min)	**=**	**23**

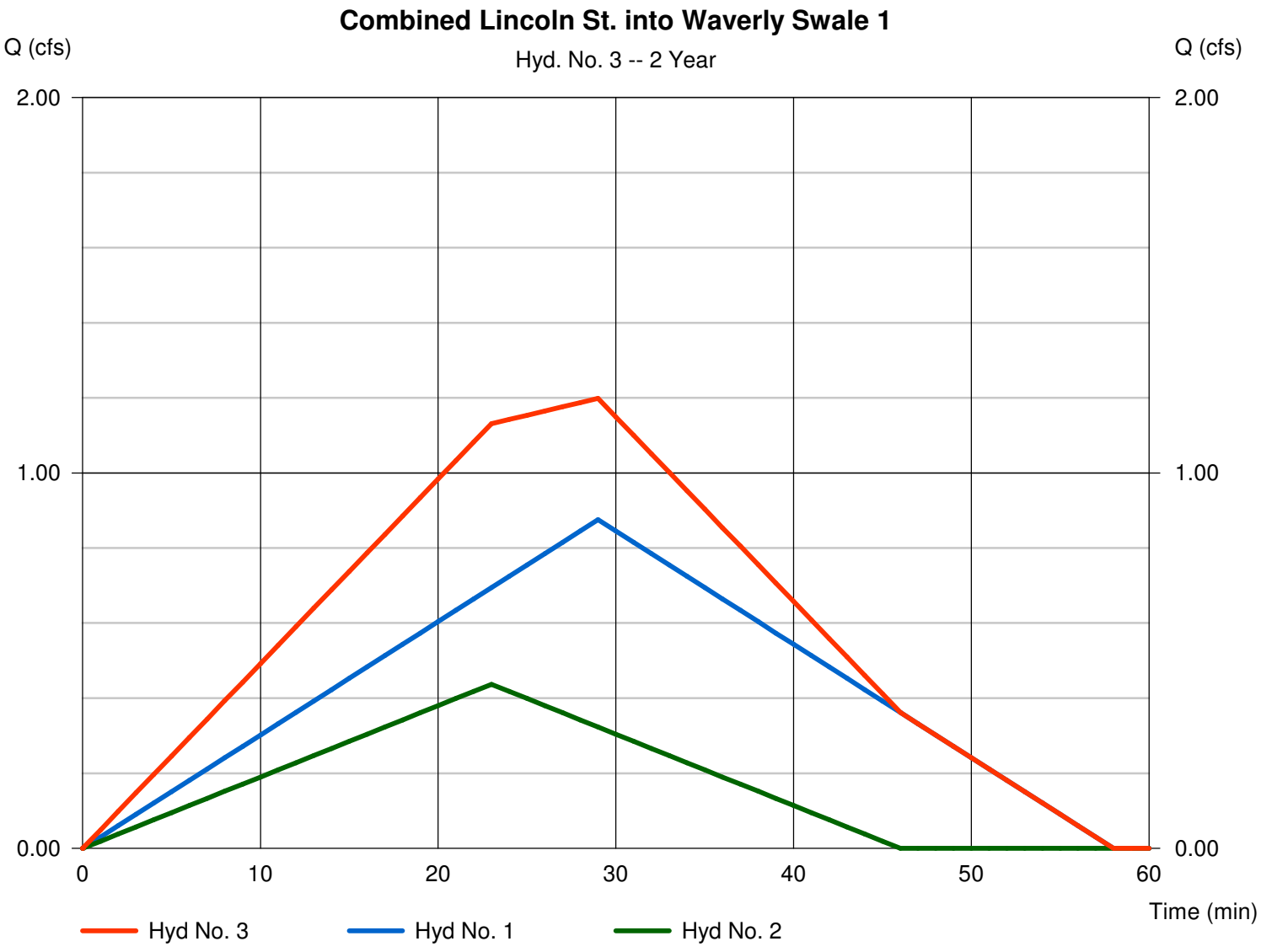
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 3

Combined Lincoln St. into Waverly Swale 1

Hydrograph type	= Combine	Peak discharge	= 1.199 cfs
Storm frequency	= 2 yrs	Time to peak	= 29 min
Time interval	= 1 min	Hyd. volume	= 2,126 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 1.651 ac



Hydrograph Report

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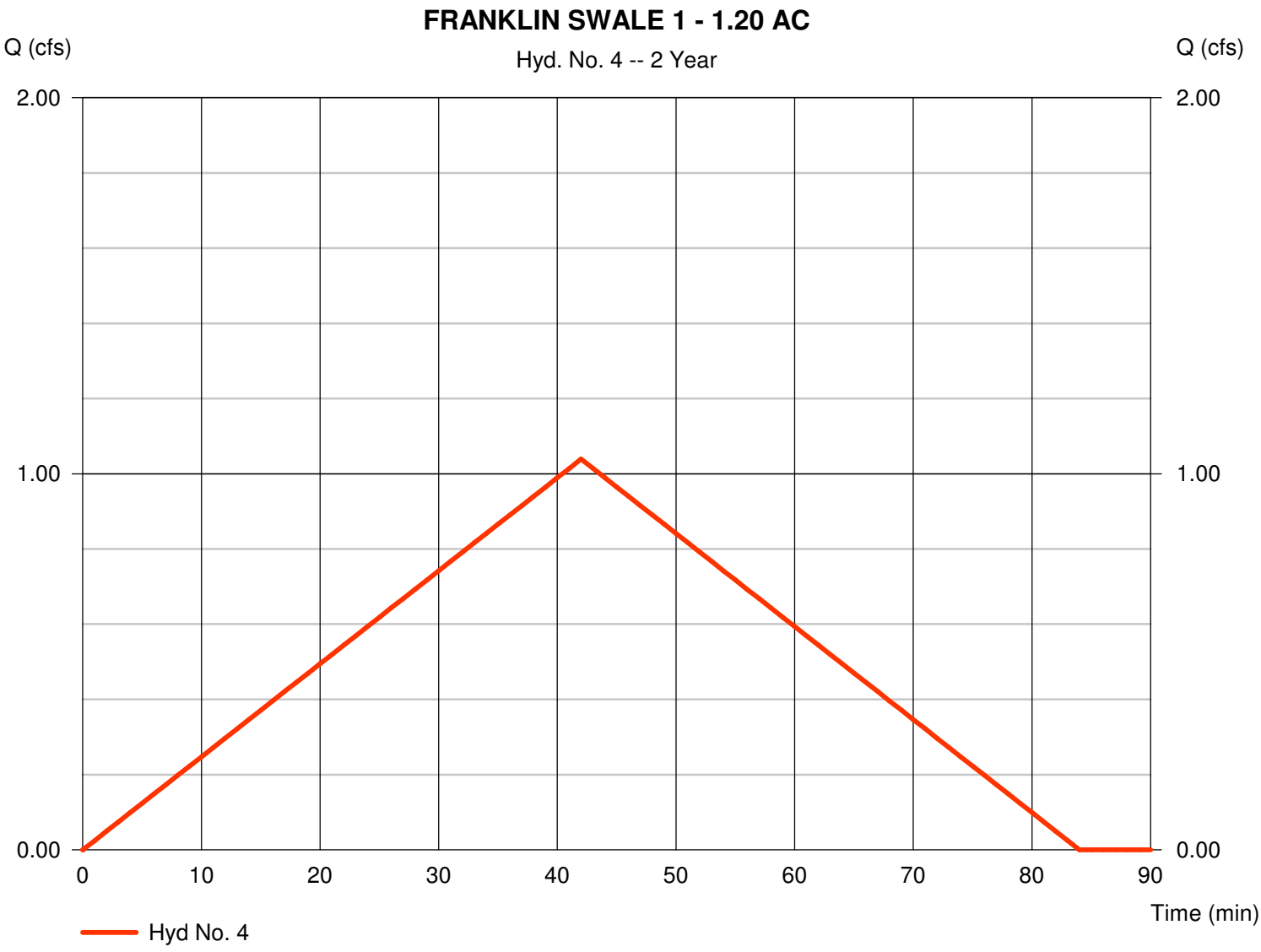
Hyd. No. 4

FRANKLIN SWALE 1 - 1.20 AC

Hydrograph type	=	Rational	Peak discharge	=	1.039 cfs
Storm frequency	=	2 yrs	Time to peak	=	42 min
Time interval	=	1 min	Hyd. volume	=	2,618 cuft
Drainage area	=	1.195 ac	Runoff coeff.	=	0.5
Intensity	=	1.739 in/hr	Tc by User	=	42.00 min
IDF Curve	=	1992_Bulletin 71_NW Indiana.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Report

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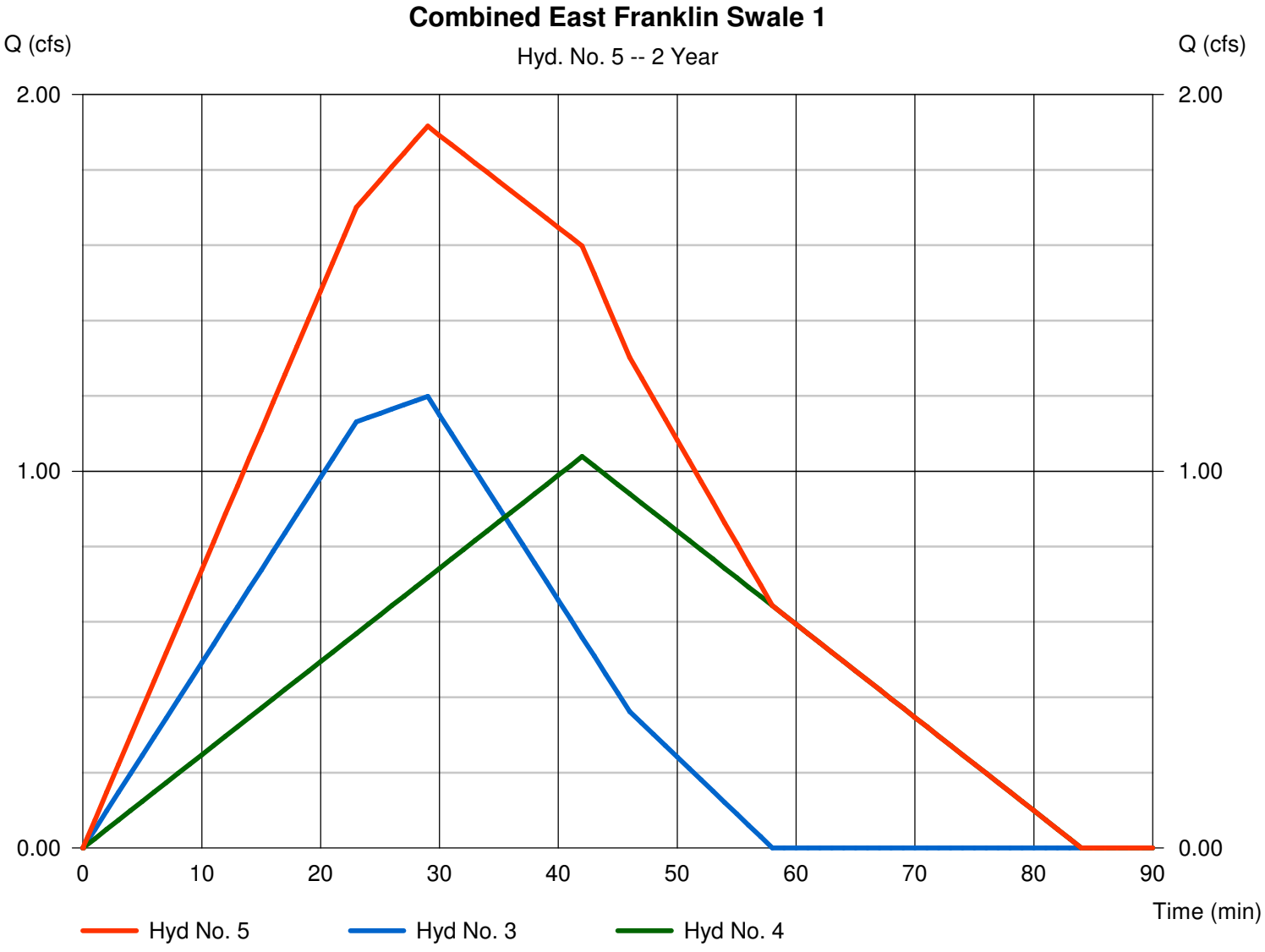
Hyd. No. 5

Combined East Franklin Swale 1

Hydrograph type	=	Combine	Peak discharge	=	1.916 cfs
Storm frequency	=	2 yrs	Time to peak	=	29 min
Time interval	=	1 min	Hyd. volume	=	4,745 cuft
Inflow hyds.	=	3, 4	Contrib. drain. area	=	1.195 ac



Hydrograph Report

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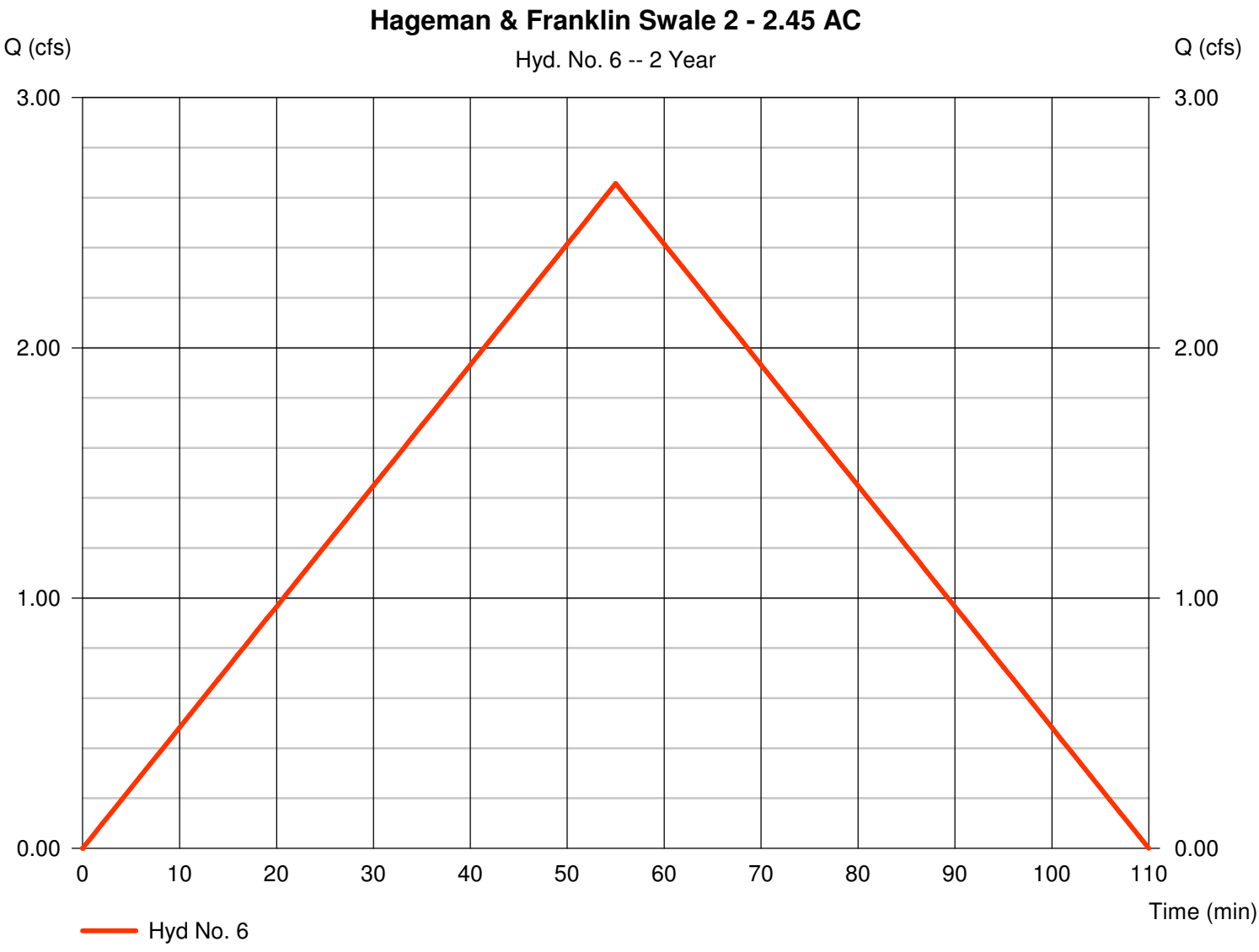
Hyd. No. 6

Hageman & Franklin Swale 2 - 2.45 AC

Hydrograph type	=	Rational	Peak discharge	=	2.656 cfs
Storm frequency	=	2 yrs	Time to peak	=	55 min
Time interval	=	1 min	Hyd. volume	=	8,765 cuft
Drainage area	=	2.447 ac	Runoff coeff.	=	0.75
Intensity	=	1.447 in/hr	Tc by User	=	55.00 min
IDF Curve	=	1992_Bulletin 71_NW Indiana.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Report

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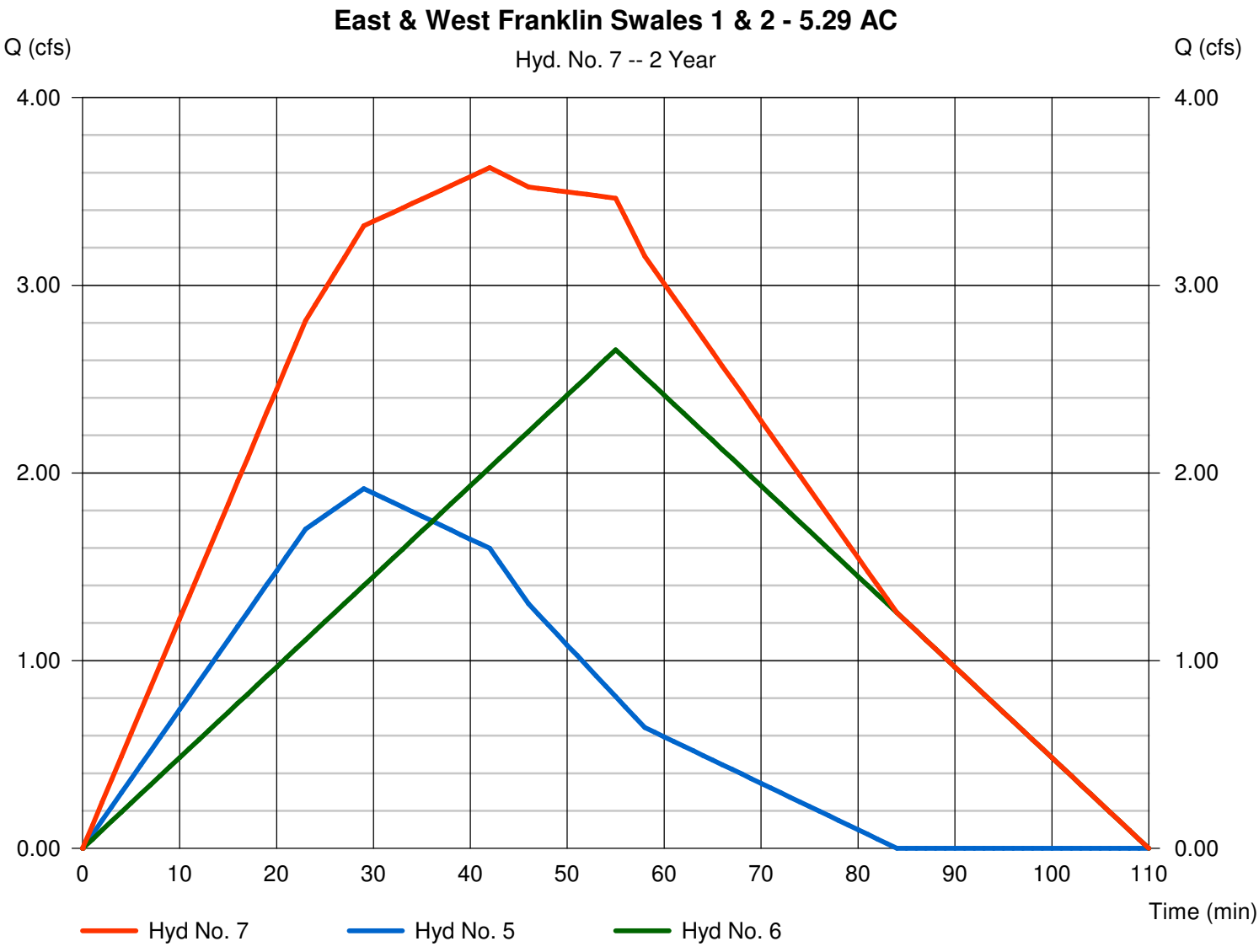
Hyd. No. 7

East & West Franklin Swales 1 & 2 - 5.29 AC

Hydrograph type	=	Combine	Peak discharge	=	3.626 cfs
Storm frequency	=	2 yrs	Time to peak	=	42 min
Time interval	=	1 min	Hyd. volume	=	13,509 cuft
Inflow hyds.	=	5, 6	Contrib. drain. area	=	2.447 ac



Hydrograph Report

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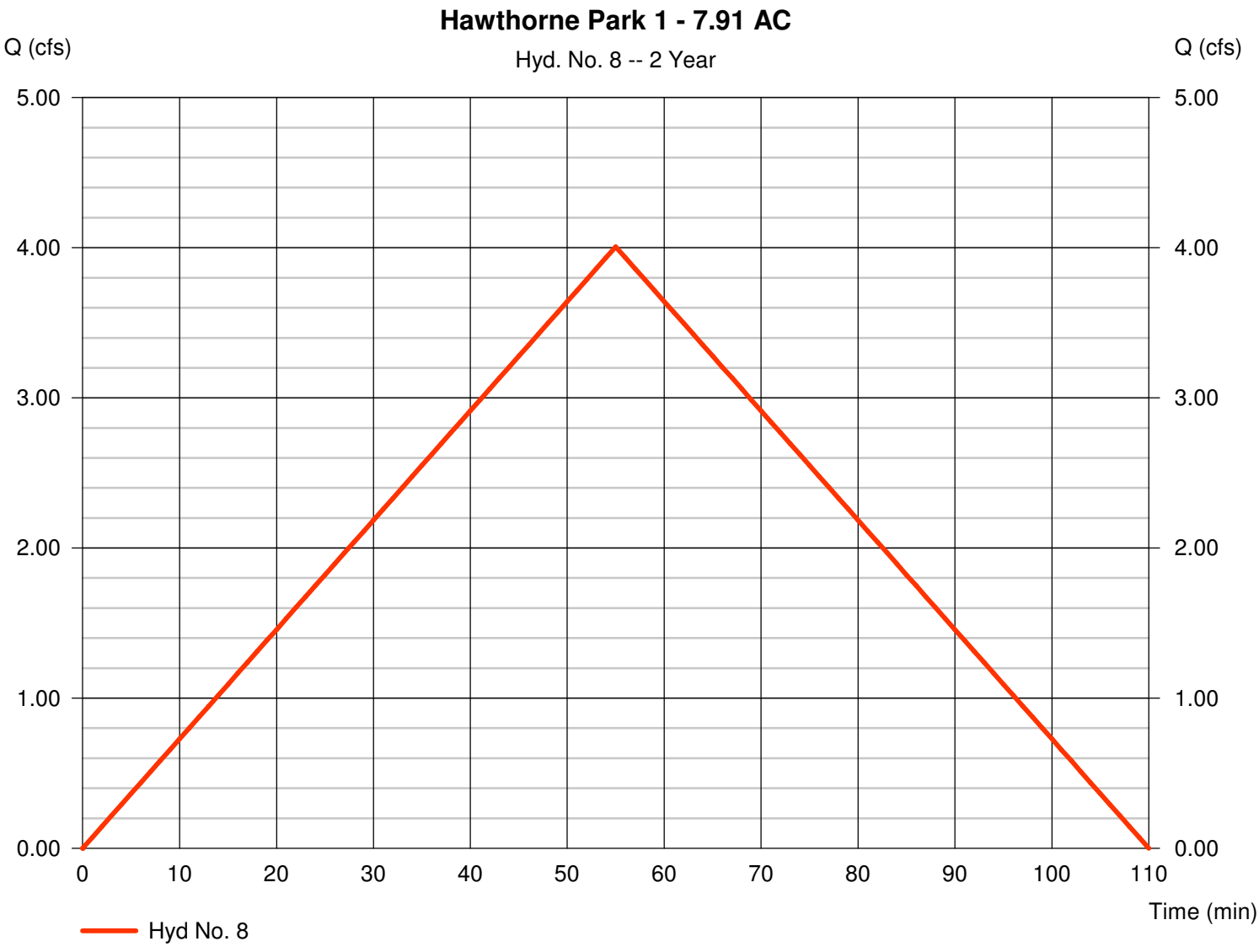
Hyd. No. 8

Hawthorne Park 1 - 7.91 AC

Hydrograph type	=	Rational	Peak discharge	=	4.007 cfs
Storm frequency	=	2 yrs	Time to peak	=	55 min
Time interval	=	1 min	Hyd. volume	=	13,222 cuft
Drainage area	=	7.910 ac	Runoff coeff.	=	0.35
Intensity	=	1.447 in/hr	Tc by User	=	55.00 min
IDF Curve	=	1992_Bulletin 71_NW Indiana.IDF	Asc/Rec limb fact	=	1/1



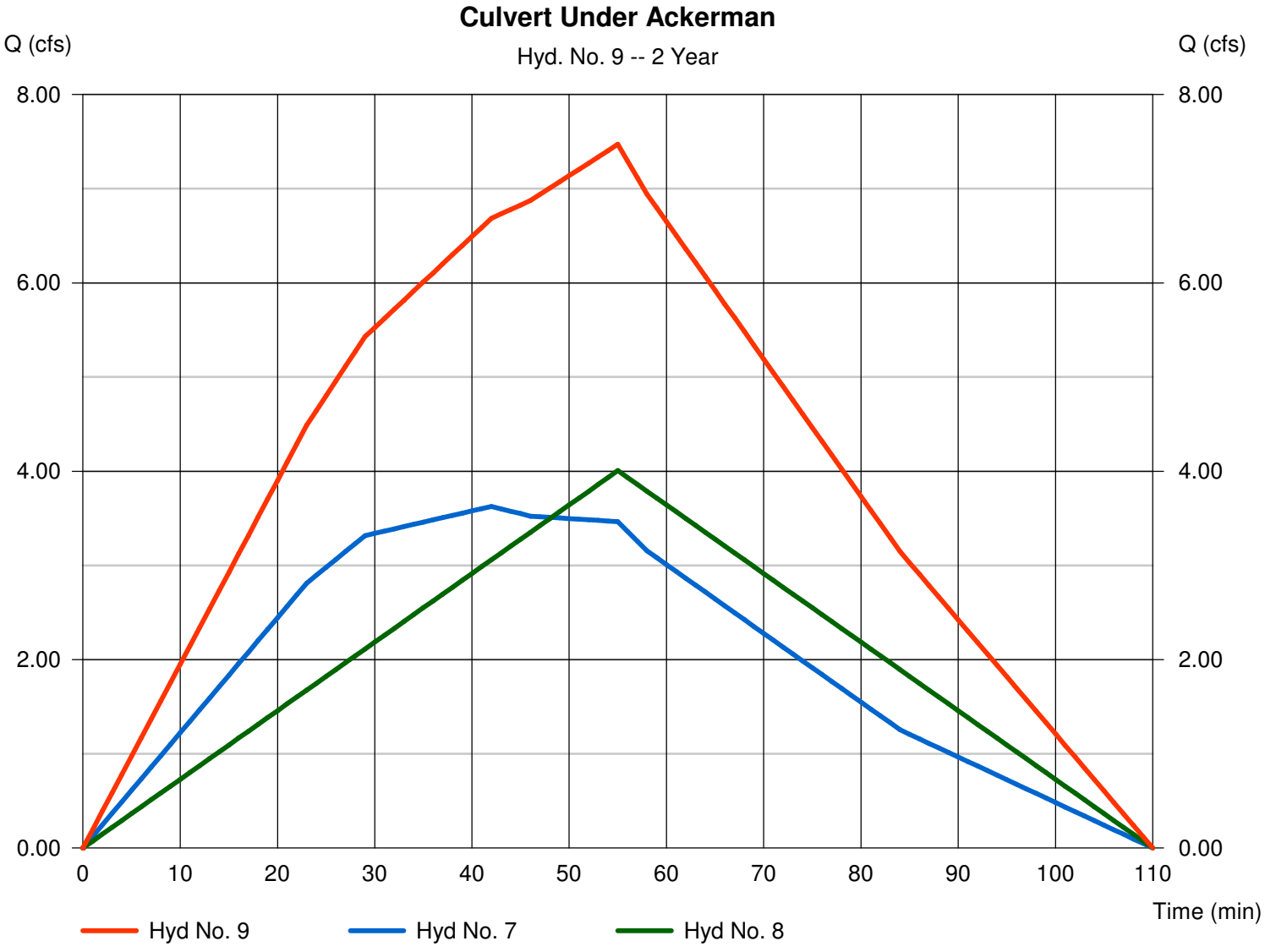
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 9

Culvert Under Ackerman

Hydrograph type	=	Combine	Peak discharge	=	7.470 cfs
Storm frequency	=	2 yrs	Time to peak	=	55 min
Time interval	=	1 min	Hyd. volume	=	26,731 cuft
Inflow hyds.	=	7, 8	Contrib. drain. area	=	7.910 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	Rational	1.277	1	29	2,221	------	------	------	Lincoln St. North Of Railroad Track -
2	Rational	0.637	1	23	879	------	------	------	Waverly Swale 1 - 0.50 AC
3	Combine	1.748	1	29	3,101	1, 2	------	------	Combined Lincoln St. into Waverly S
4	Rational	1.514	1	42	3,815	------	------	------	FRANKLIN SWALE 1 - 1.20 AC
5	Combine	2.793	1	29	6,916	3, 4	------	------	Combined East Franklin Swale 1
6	Rational	3.868	1	55	12,763	------	------	------	Hageman & Franklin Swale 2 - 2.45 A
7	Combine	5.283	1	42	19,679	5, 6	------	------	East & West Franklin Swales 1 & 2 -
8	Rational	5.834	1	55	19,254	------	------	------	Hawthorne Park 1 - 7.91 AC
9	Combine	10.88	1	55	38,933	7, 8	------	------	Culvert Under Ackerman

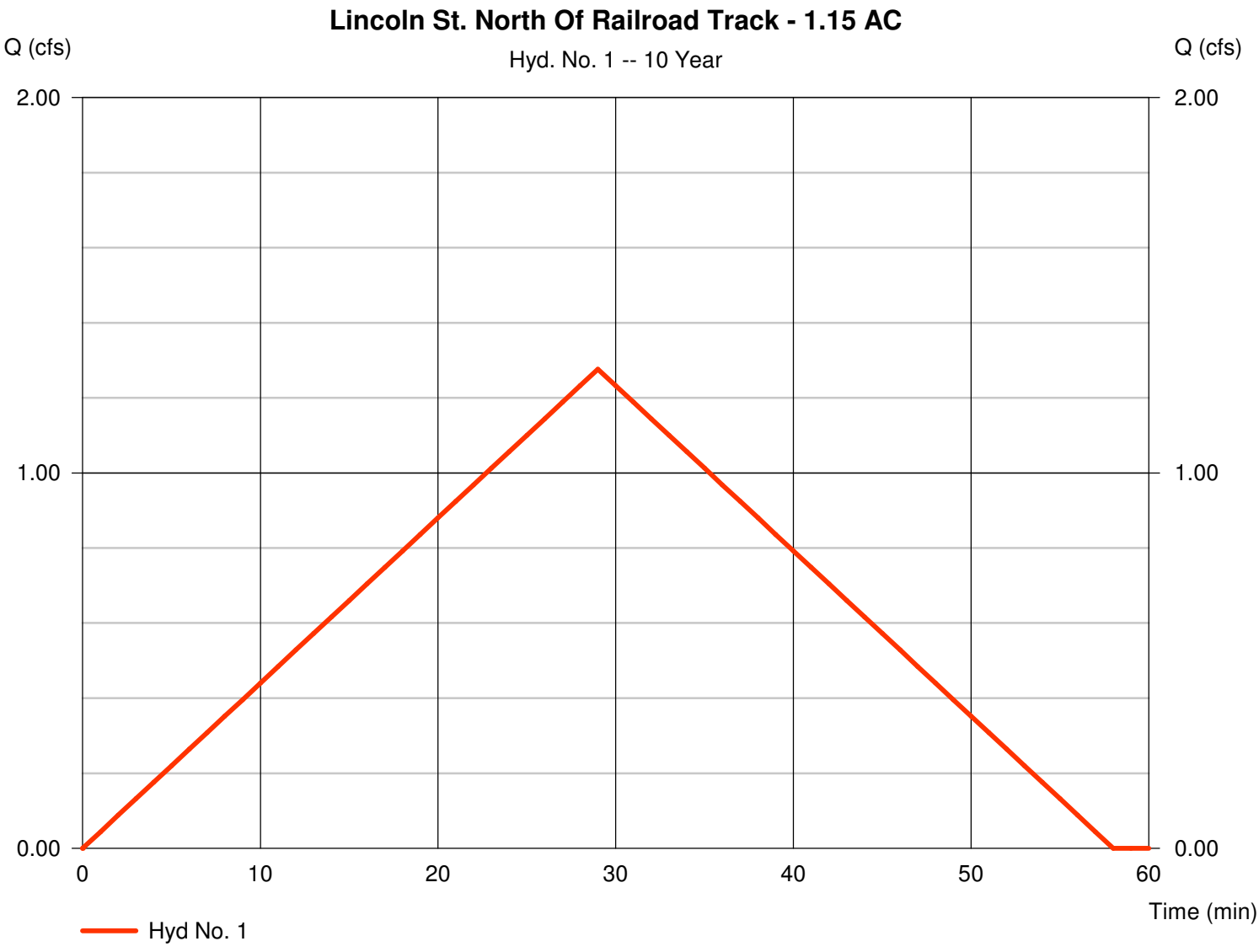
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 1

Lincoln St. North Of Railroad Track - 1.15 AC

Hydrograph type	=	Rational	Peak discharge	=	1.277 cfs
Storm frequency	=	10 yrs	Time to peak	=	29 min
Time interval	=	1 min	Hyd. volume	=	2,221 cuft
Drainage area	=	1.146 ac	Runoff coeff.	=	0.35
Intensity	=	3.182 in/hr	Tc by FAA	=	29.00 min
IDF Curve	=	1992_Bulletin 71_NW Indiana.IDF	Asc/Rec limb fact	=	1/1



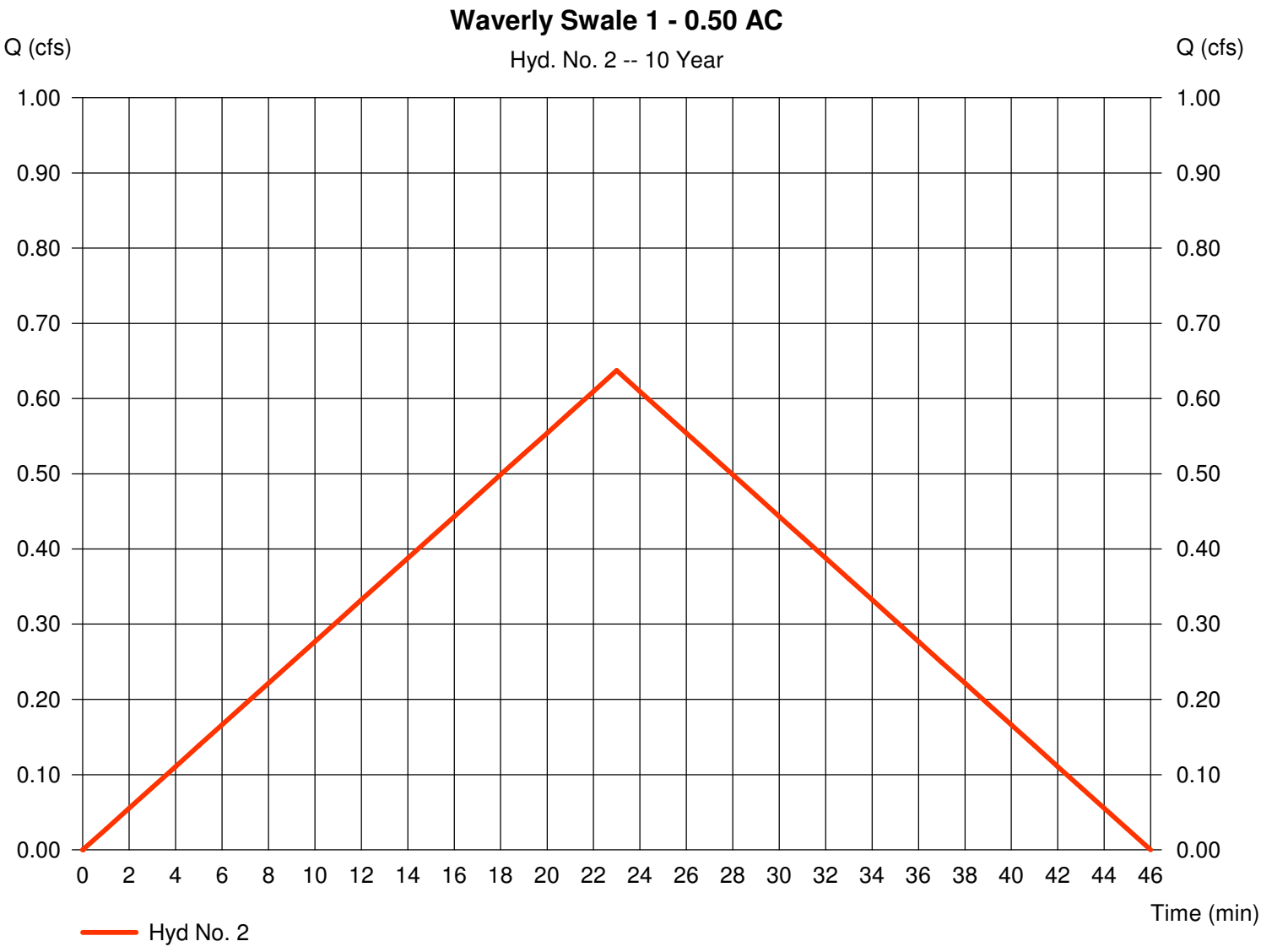
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 2

Waverly Swale 1 - 0.50 AC

Hydrograph type	=	Rational	Peak discharge	=	0.637 cfs
Storm frequency	=	10 yrs	Time to peak	=	23 min
Time interval	=	1 min	Hyd. volume	=	879 cuft
Drainage area	=	0.504 ac	Runoff coeff.	=	0.35
Intensity	=	3.611 in/hr	Tc by FAA	=	23.00 min
IDF Curve	=	1992_Bulletin 71_NW Indiana.IDF	Asc/Rec limb fact	=	1/1



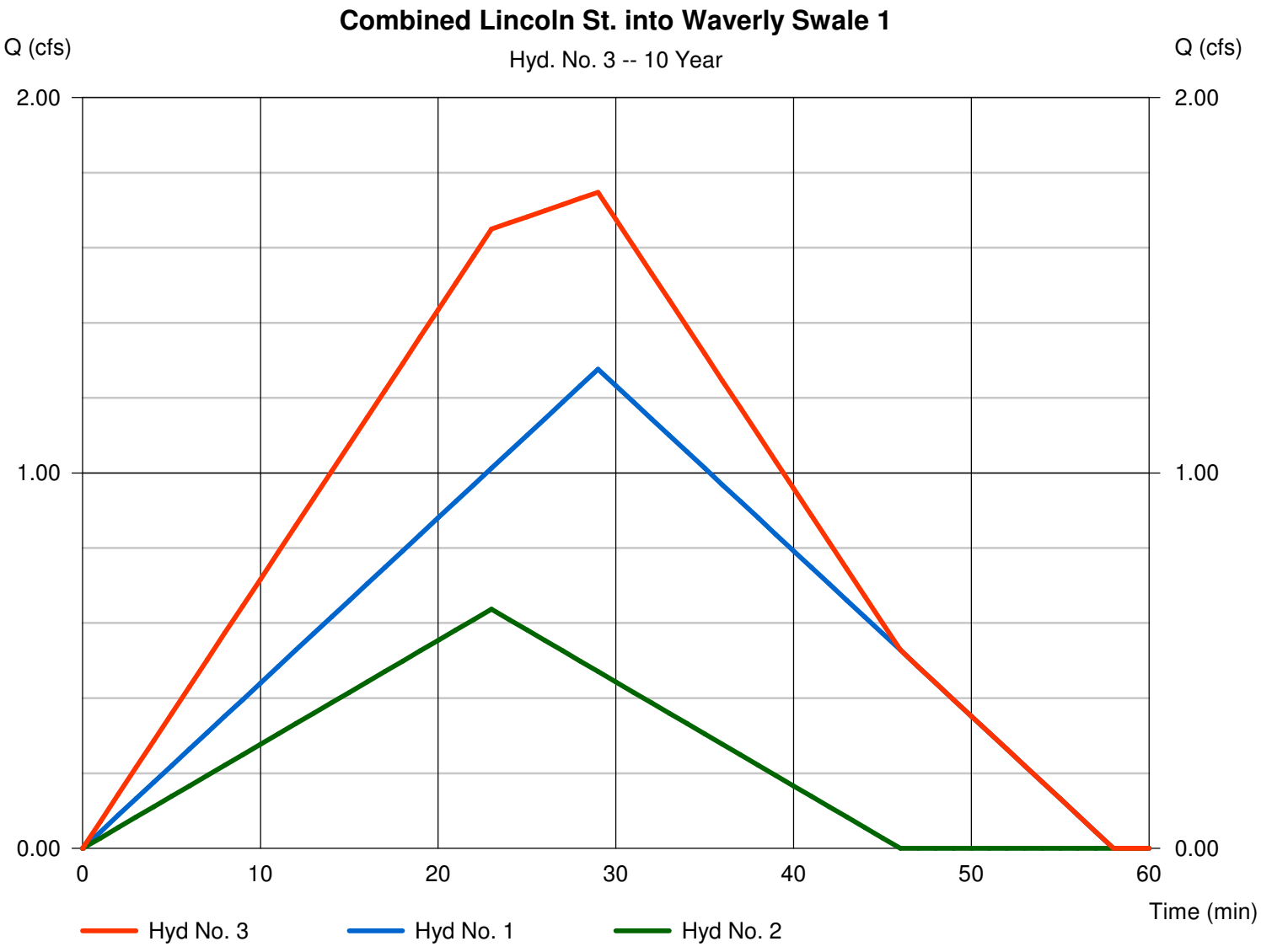
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 3

Combined Lincoln St. into Waverly Swale 1

Hydrograph type	= Combine	Peak discharge	= 1.748 cfs
Storm frequency	= 10 yrs	Time to peak	= 29 min
Time interval	= 1 min	Hyd. volume	= 3,101 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 1.651 ac



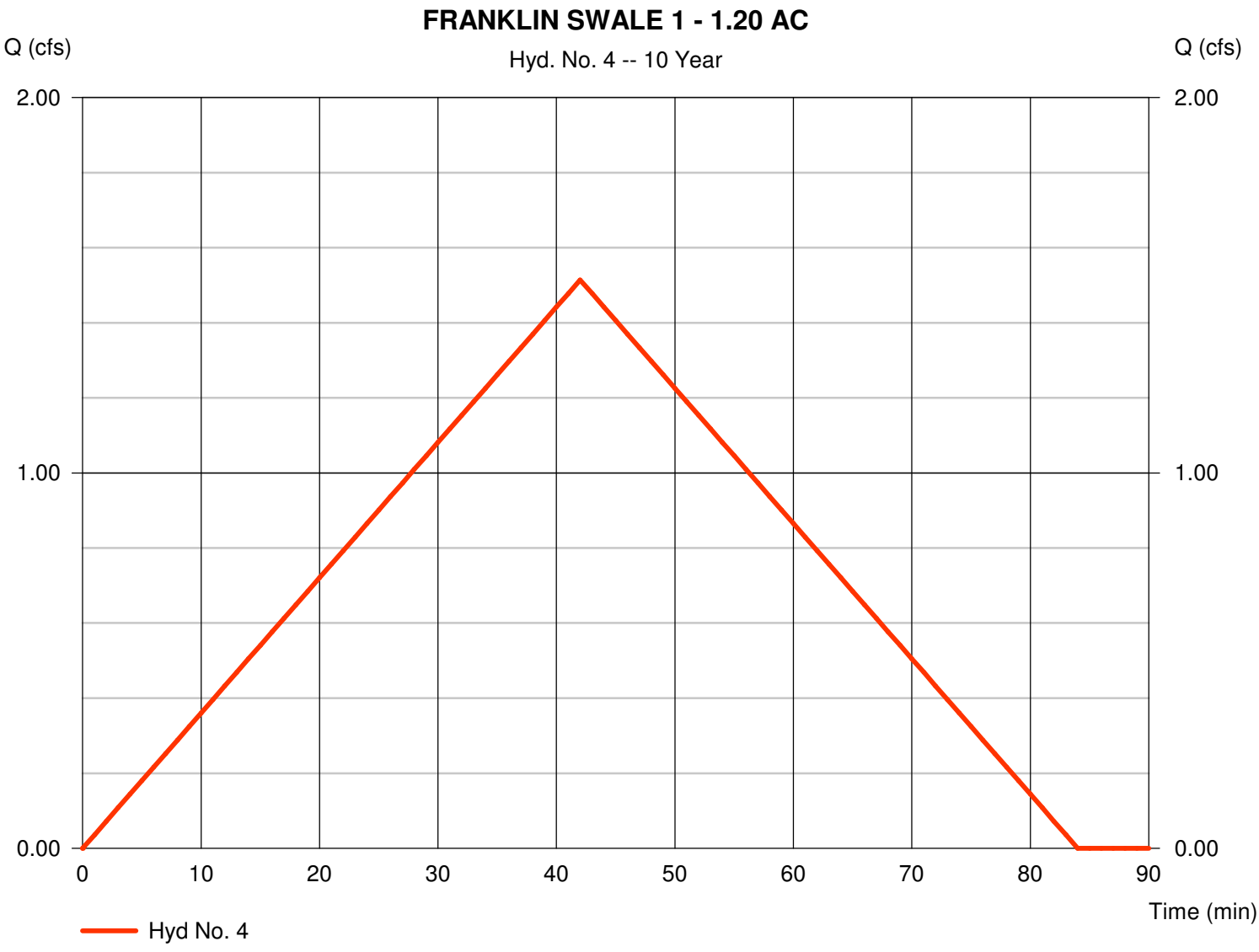
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 4

FRANKLIN SWALE 1 - 1.20 AC

Hydrograph type	=	Rational	Peak discharge	=	1.514 cfs
Storm frequency	=	10 yrs	Time to peak	=	42 min
Time interval	=	1 min	Hyd. volume	=	3,815 cuft
Drainage area	=	1.195 ac	Runoff coeff.	=	0.5
Intensity	=	2.533 in/hr	Tc by User	=	42.00 min
IDF Curve	=	1992_Bulletin 71_NW Indiana.IDF	Asc/Rec limb fact	=	1/1



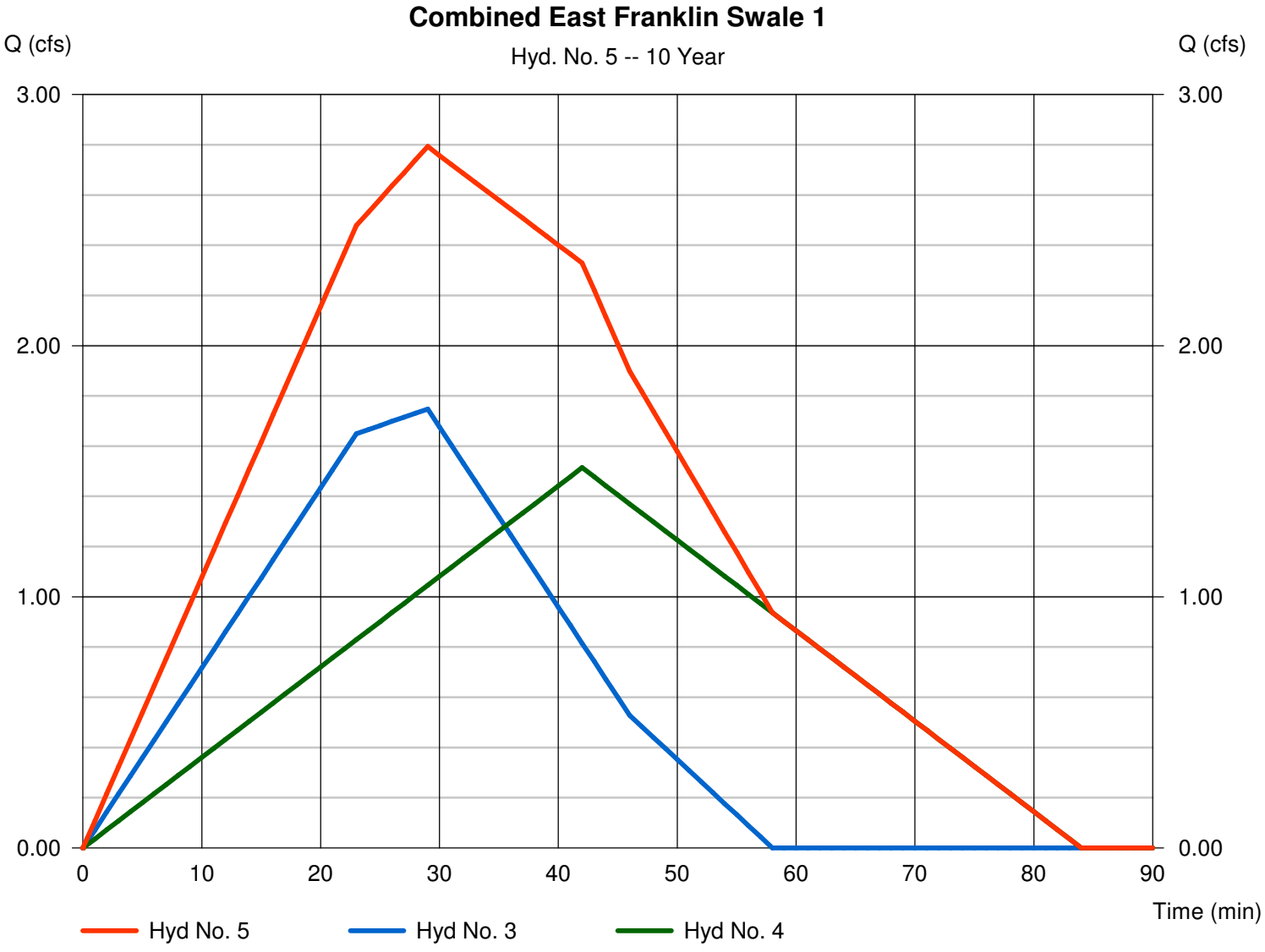
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 5

Combined East Franklin Swale 1

Hydrograph type	=	Combine	Peak discharge	=	2.793 cfs
Storm frequency	=	10 yrs	Time to peak	=	29 min
Time interval	=	1 min	Hyd. volume	=	6,916 cuft
Inflow hyds.	=	3, 4	Contrib. drain. area	=	1.195 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 6

Hageman & Franklin Swale 2 - 2.45 AC

Hydrograph type	=	Rational	Peak discharge	=	3.868 cfs
Storm frequency	=	10 yrs	Time to peak	=	55 min
Time interval	=	1 min	Hyd. volume	=	12,763 cuft
Drainage area	=	2.447 ac	Runoff coeff.	=	0.75
Intensity	=	2.107 in/hr	Tc by User	=	55.00 min
IDF Curve	=	1992_Bulletin 71_NW Indiana.IDF	Asc/Rec limb fact	=	1/1

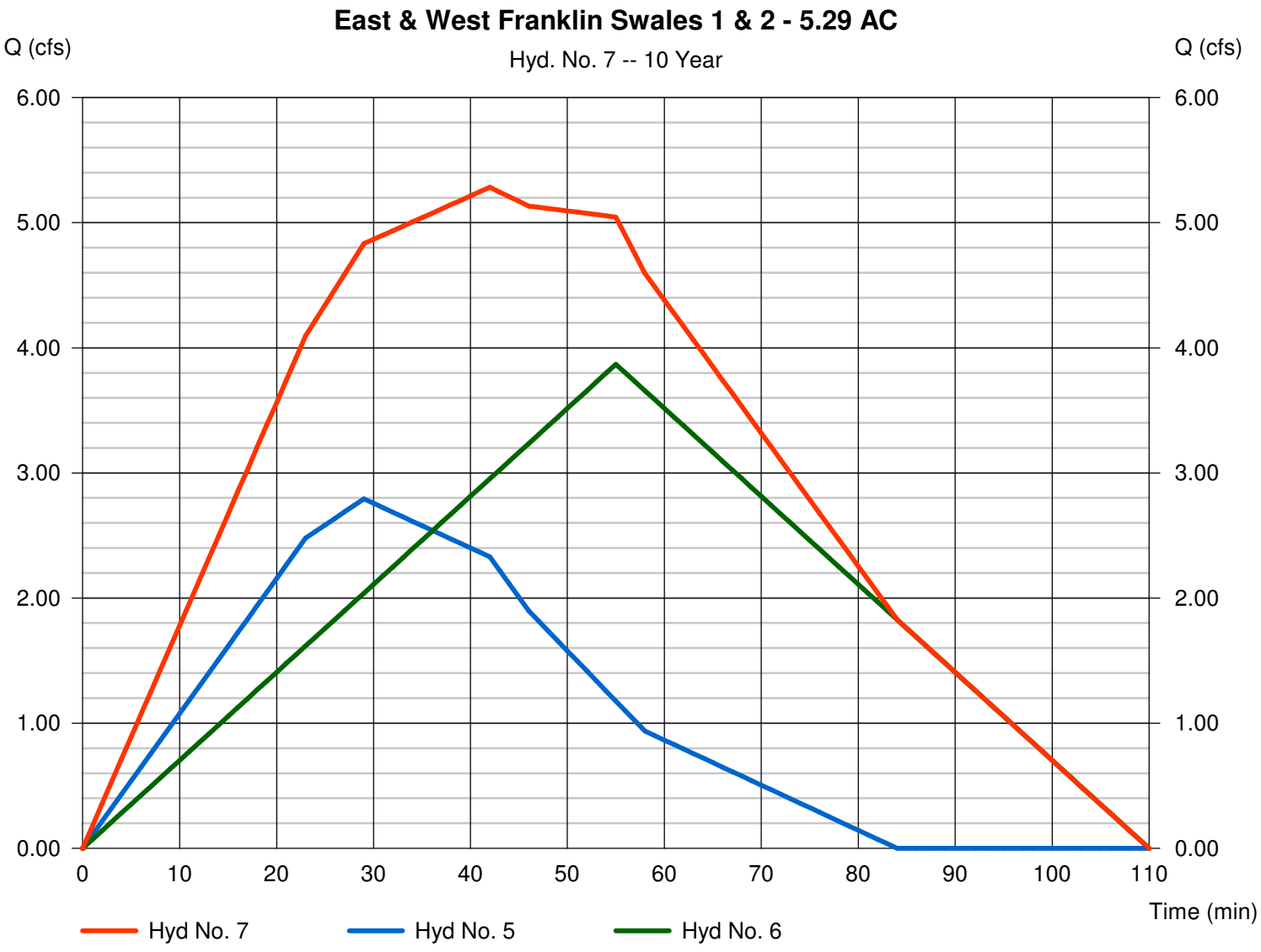
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 7

East & West Franklin Swales 1 & 2 - 5.29 AC

Hydrograph type	= Combine	Peak discharge	= 5.283 cfs
Storm frequency	= 10 yrs	Time to peak	= 42 min
Time interval	= 1 min	Hyd. volume	= 19,679 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 2.447 ac



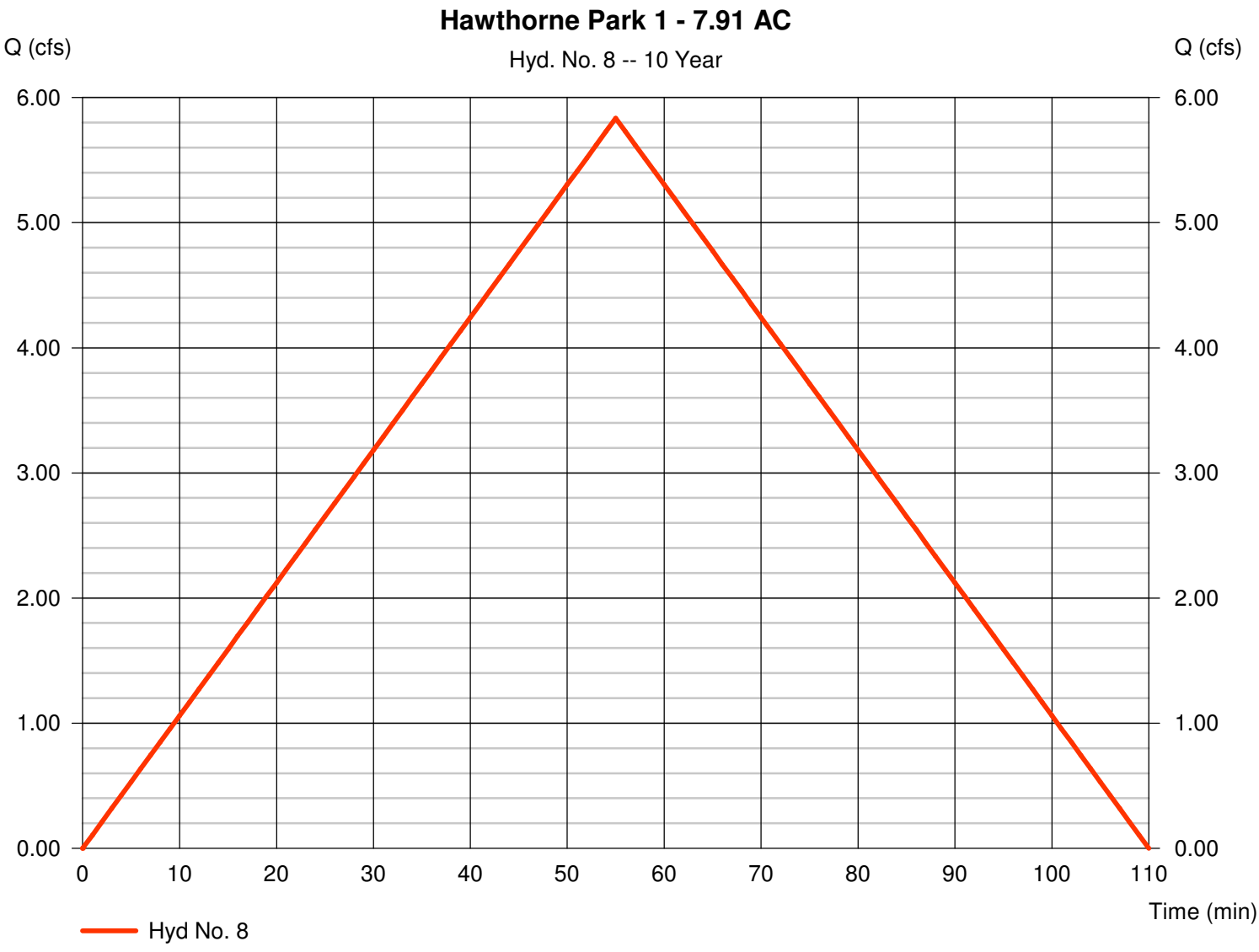
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 8

Hawthorne Park 1 - 7.91 AC

Hydrograph type	=	Rational	Peak discharge	=	5.834 cfs
Storm frequency	=	10 yrs	Time to peak	=	55 min
Time interval	=	1 min	Hyd. volume	=	19,254 cuft
Drainage area	=	7.910 ac	Runoff coeff.	=	0.35
Intensity	=	2.107 in/hr	Tc by User	=	55.00 min
IDF Curve	=	1992_Bulletin 71_NW Indiana.IDF	Asc/Rec limb fact	=	1/1



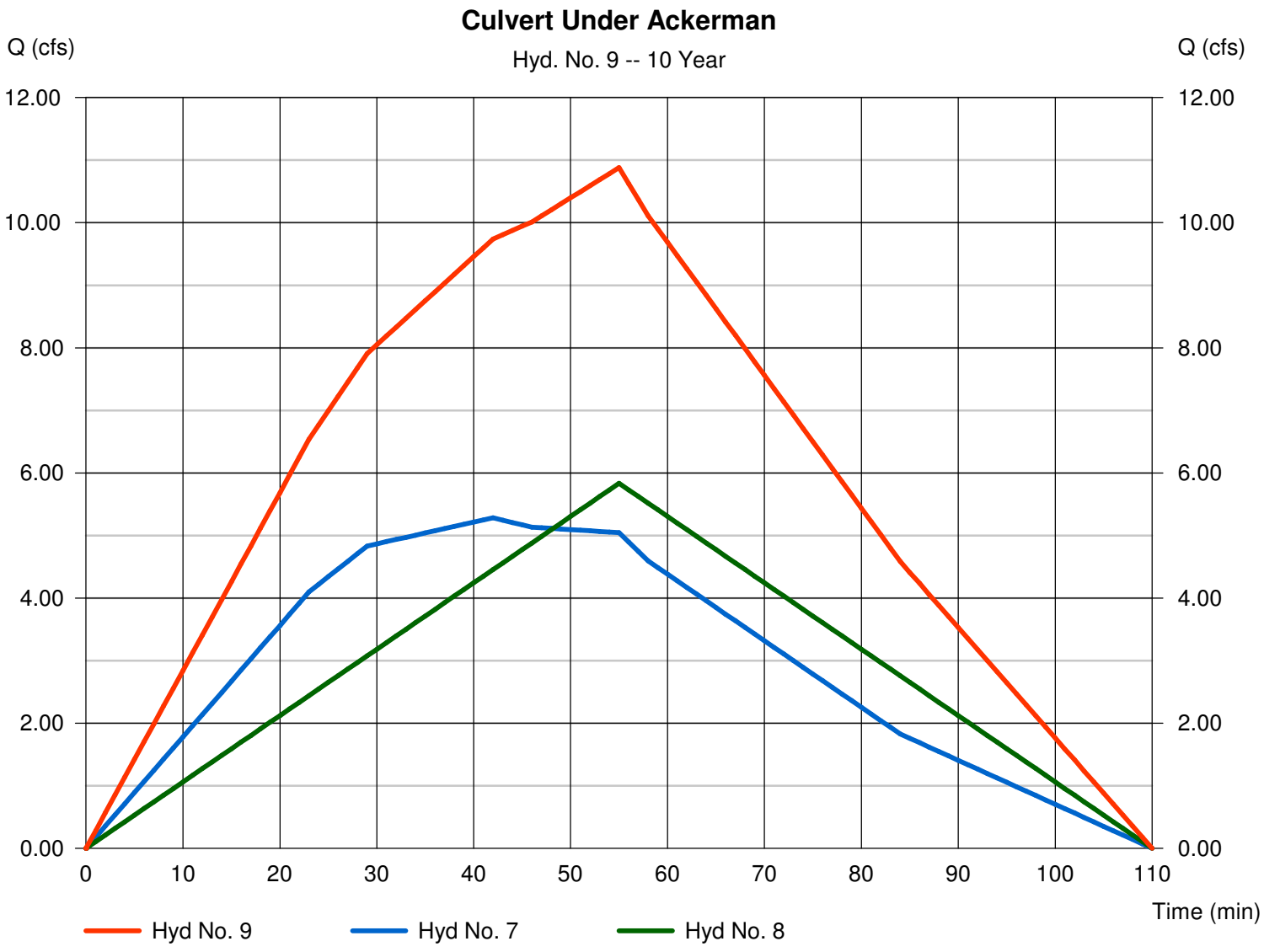
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 9

Culvert Under Ackerman

Hydrograph type	= Combine	Peak discharge	= 10.88 cfs
Storm frequency	= 10 yrs	Time to peak	= 55 min
Time interval	= 1 min	Hyd. volume	= 38,933 cuft
Inflow hyds.	= 7, 8	Contrib. drain. area	= 7.910 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	Rational	2.152	1	29	3,744	------	------	------	Lincoln St. North Of Railroad Track -
2	Rational	1.072	1	23	1,480	------	------	------	Waverly Swale 1 - 0.50 AC
3	Combine	2.944	1	29	5,224	1, 2	------	------	Combined Lincoln St. into Waverly S
4	Rational	2.557	1	42	6,445	------	------	------	FRANKLIN SWALE 1 - 1.20 AC
5	Combine	4.710	1	29	11,668	3, 4	------	------	Combined East Franklin Swale 1
6	Rational	6.542	1	55	21,587	------	------	------	Hageman & Franklin Swale 2 - 2.45 A
7	Combine	8.926	1	42	33,255	5, 6	------	------	East & West Franklin Swales 1 & 2 -
8	Rational	9.868	1	55	32,564	------	------	------	Hawthorne Park 1 - 7.91 AC
9	Combine	18.40	1	55	65,820	7, 8	------	------	Culvert Under Ackerman

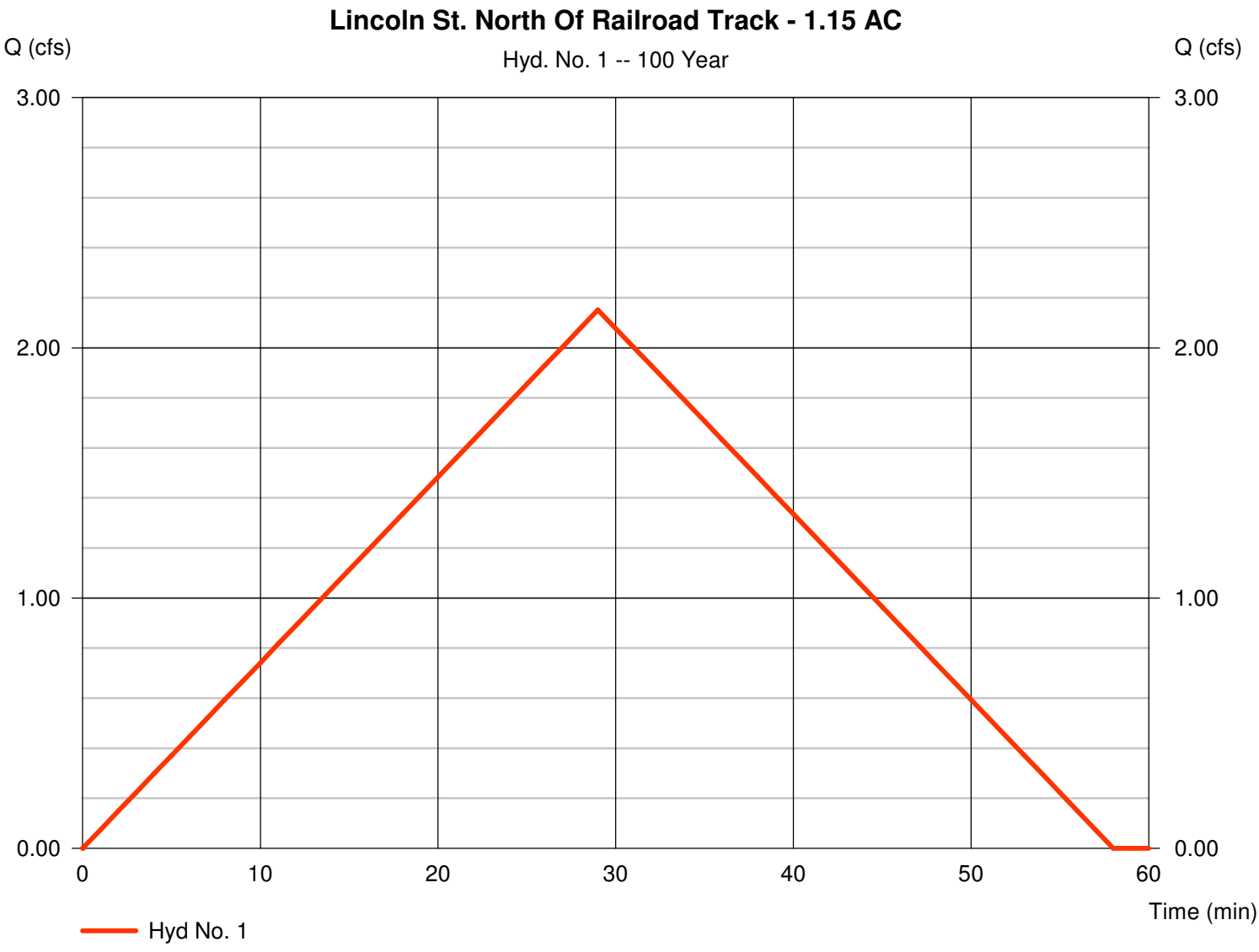
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 1

Lincoln St. North Of Railroad Track - 1.15 AC

Hydrograph type	=	Rational	Peak discharge	=	2.152 cfs
Storm frequency	=	100 yrs	Time to peak	=	29 min
Time interval	=	1 min	Hyd. volume	=	3,744 cuft
Drainage area	=	1.146 ac	Runoff coeff.	=	0.35
Intensity	=	5.363 in/hr	Tc by FAA	=	29.00 min
IDF Curve	=	1992_Bulletin 71_NW Indiana.IDF	Asc/Rec limb fact	=	1/1



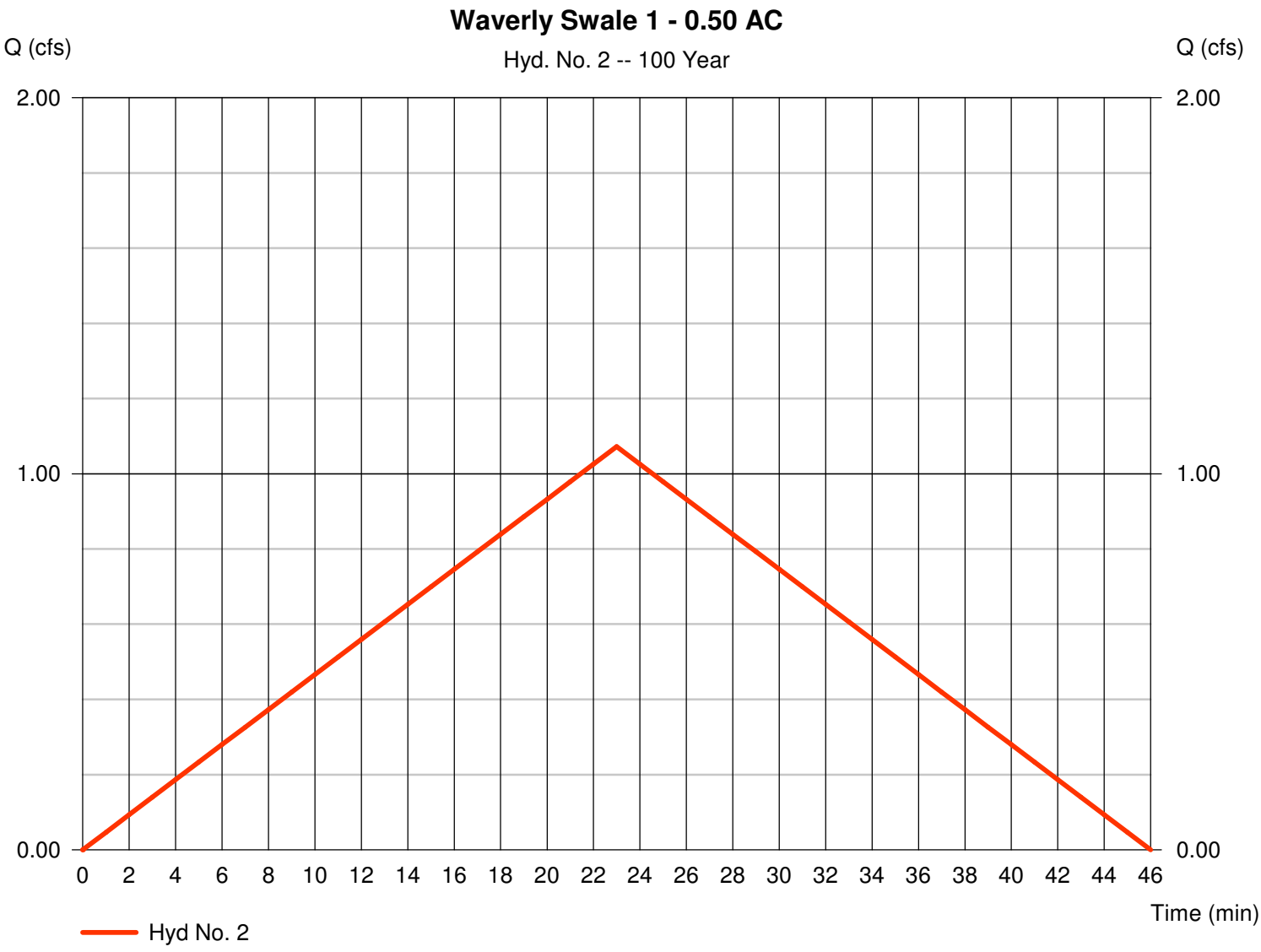
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 2

Waverly Swale 1 - 0.50 AC

Hydrograph type	=	Rational	Peak discharge	=	1.072 cfs
Storm frequency	=	100 yrs	Time to peak	=	23 min
Time interval	=	1 min	Hyd. volume	=	1,480 cuft
Drainage area	=	0.504 ac	Runoff coeff.	=	0.35
Intensity	=	6.077 in/hr	Tc by FAA	=	23.00 min
IDF Curve	=	1992_Bulletin 71_NW Indiana.IDF	Asc/Rec limb fact	=	1/1



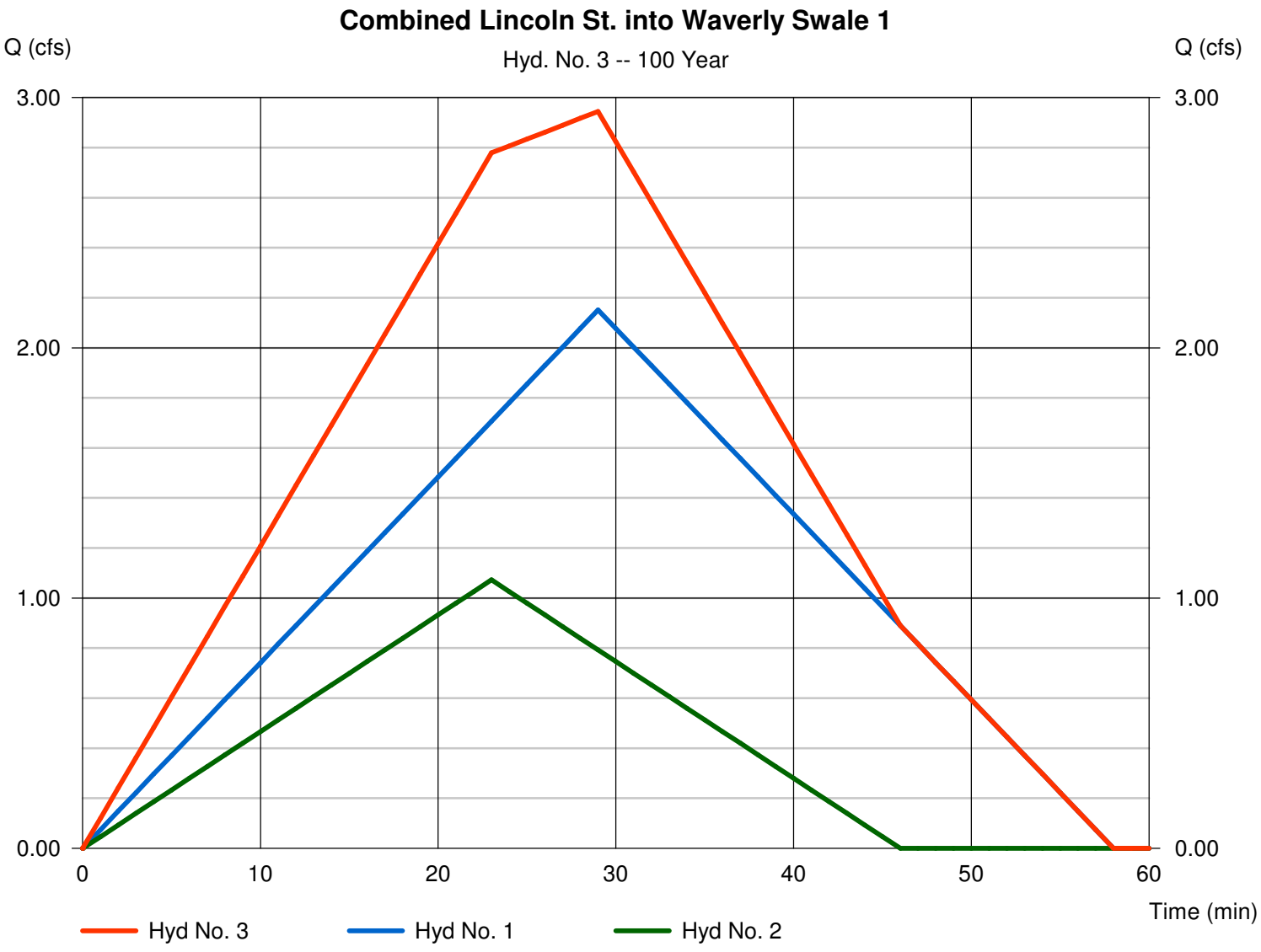
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 3

Combined Lincoln St. into Waverly Swale 1

Hydrograph type	= Combine	Peak discharge	= 2.944 cfs
Storm frequency	= 100 yrs	Time to peak	= 29 min
Time interval	= 1 min	Hyd. volume	= 5,224 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 1.651 ac



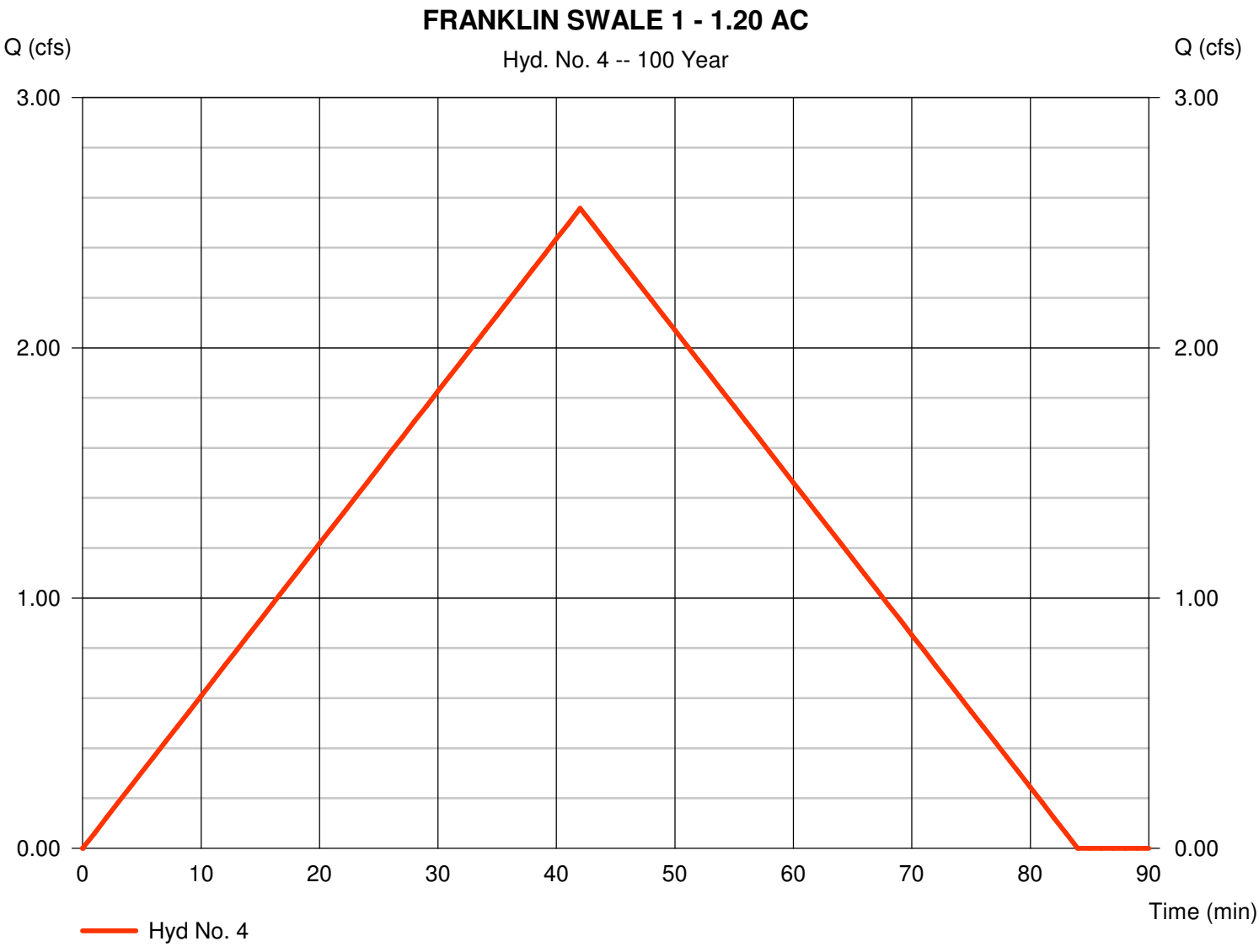
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 4

FRANKLIN SWALE 1 - 1.20 AC

Hydrograph type	=	Rational	Peak discharge	=	2.557 cfs
Storm frequency	=	100 yrs	Time to peak	=	42 min
Time interval	=	1 min	Hyd. volume	=	6,445 cuft
Drainage area	=	1.195 ac	Runoff coeff.	=	0.5
Intensity	=	4.279 in/hr	Tc by User	=	42.00 min
IDF Curve	=	1992_Bulletin 71_NW Indiana.IDF	Asc/Rec limb fact	=	1/1



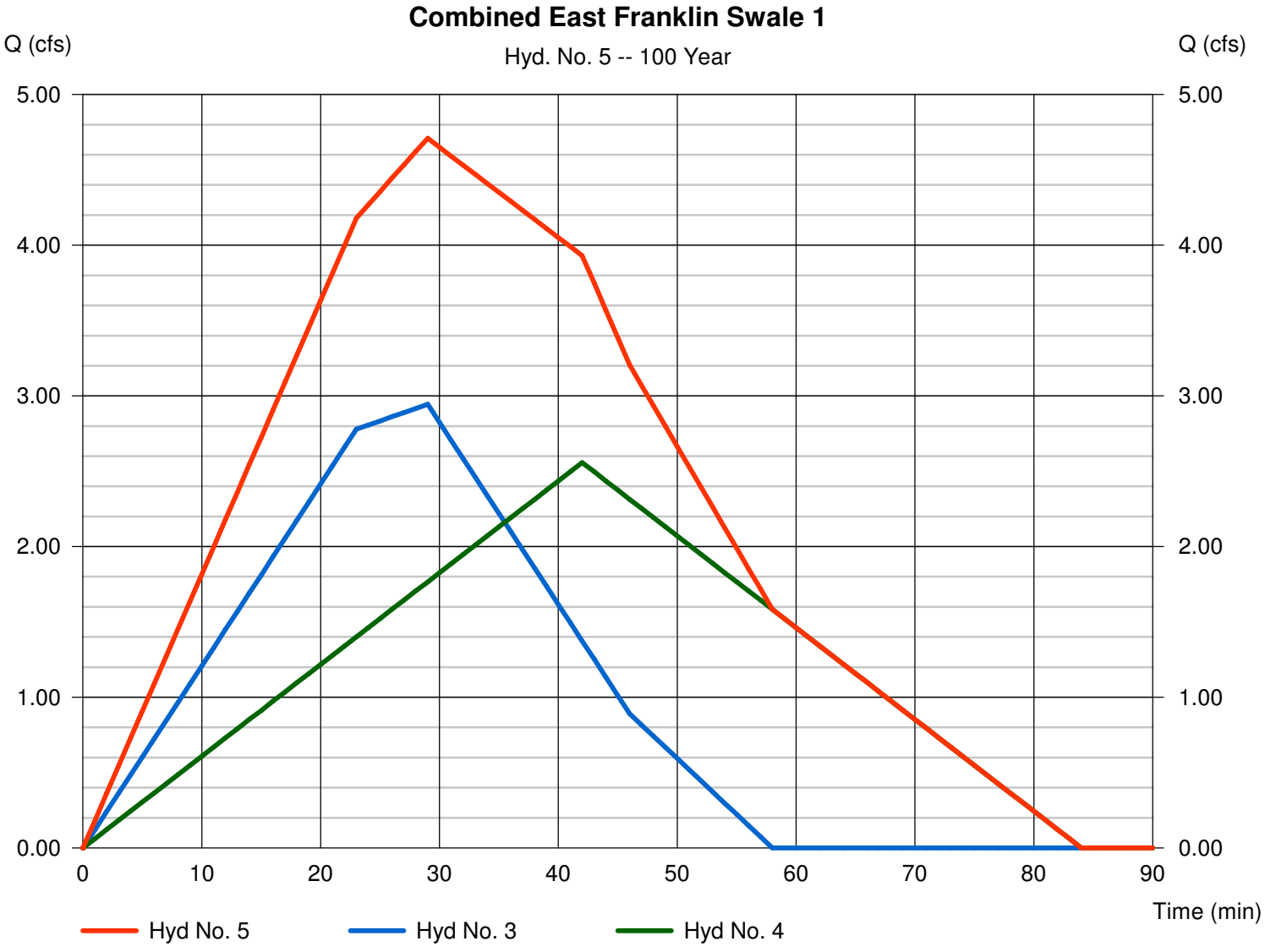
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 5

Combined East Franklin Swale 1

Hydrograph type	=	Combine	Peak discharge	=	4.710 cfs
Storm frequency	=	100 yrs	Time to peak	=	29 min
Time interval	=	1 min	Hyd. volume	=	11,668 cuft
Inflow hyds.	=	3, 4	Contrib. drain. area	=	1.195 ac



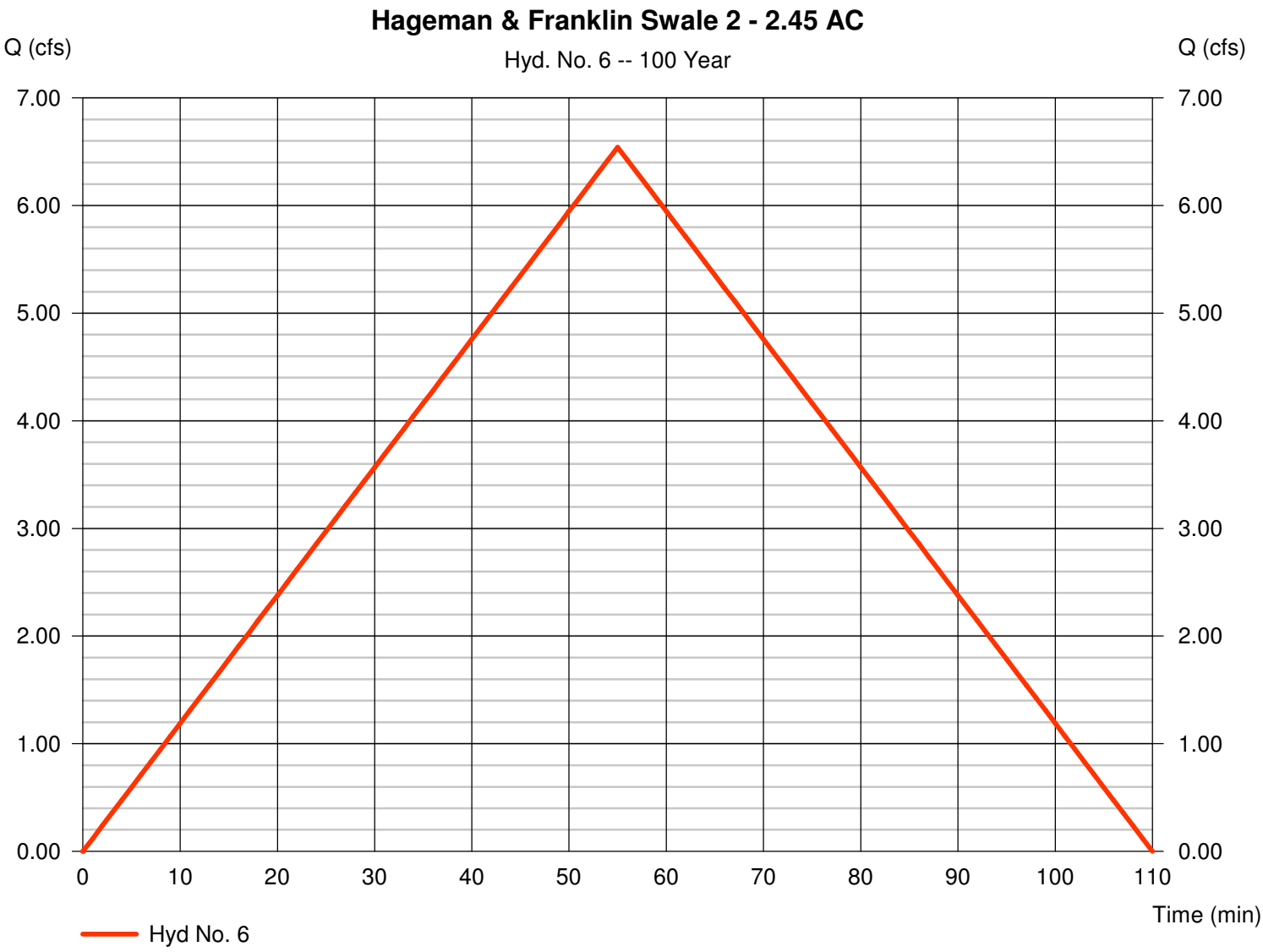
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 6

Hageman & Franklin Swale 2 - 2.45 AC

Hydrograph type	=	Rational	Peak discharge	=	6.542 cfs
Storm frequency	=	100 yrs	Time to peak	=	55 min
Time interval	=	1 min	Hyd. volume	=	21,587 cuft
Drainage area	=	2.447 ac	Runoff coeff.	=	0.75
Intensity	=	3.564 in/hr	Tc by User	=	55.00 min
IDF Curve	=	1992_Bulletin 71_NW Indiana.IDF	Asc/Rec limb fact	=	1/1



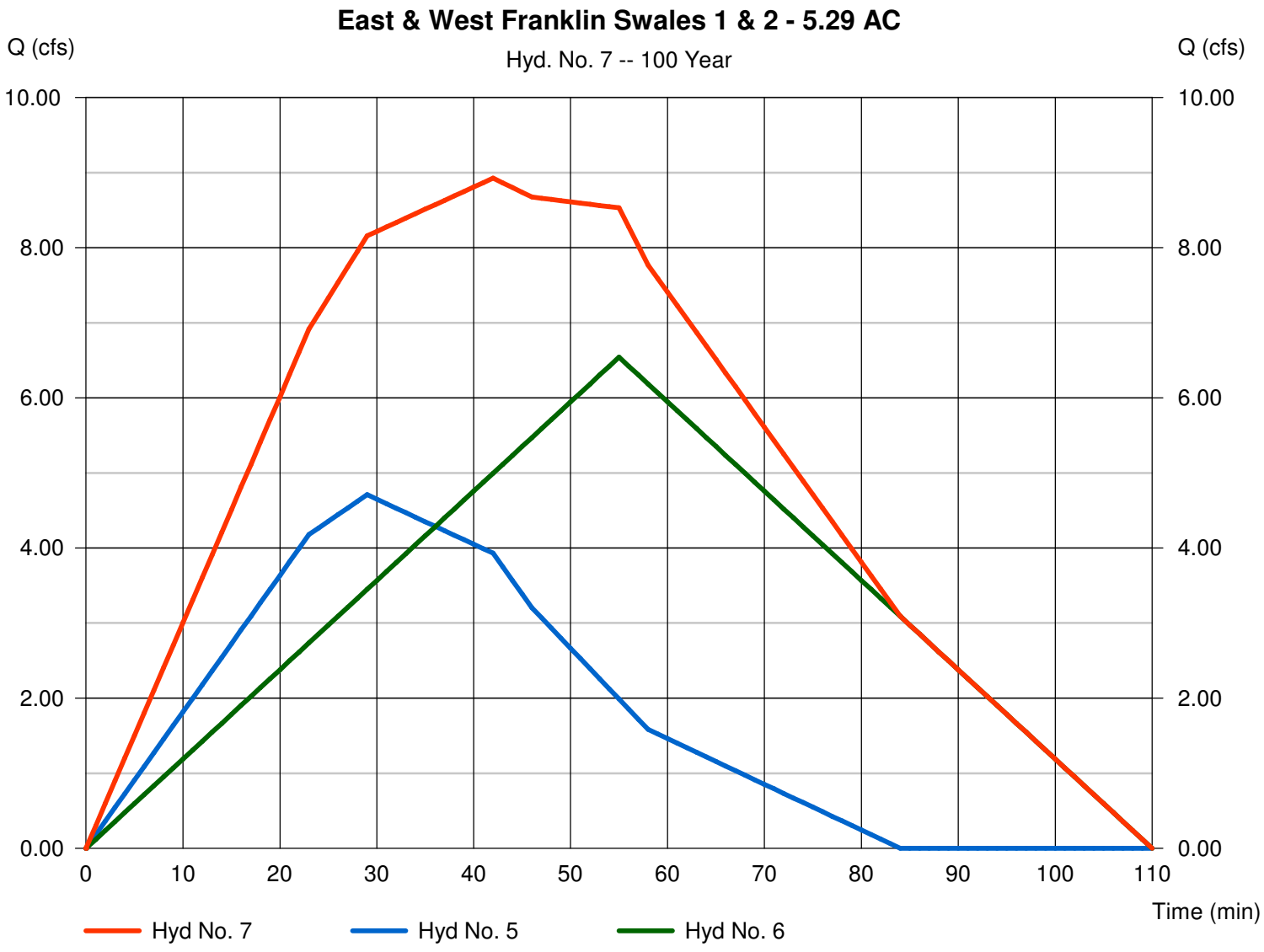
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 7

East & West Franklin Swales 1 & 2 - 5.29 AC

Hydrograph type	=	Combine	Peak discharge	=	8.926 cfs
Storm frequency	=	100 yrs	Time to peak	=	42 min
Time interval	=	1 min	Hyd. volume	=	33,255 cuft
Inflow hyds.	=	5, 6	Contrib. drain. area	=	2.447 ac



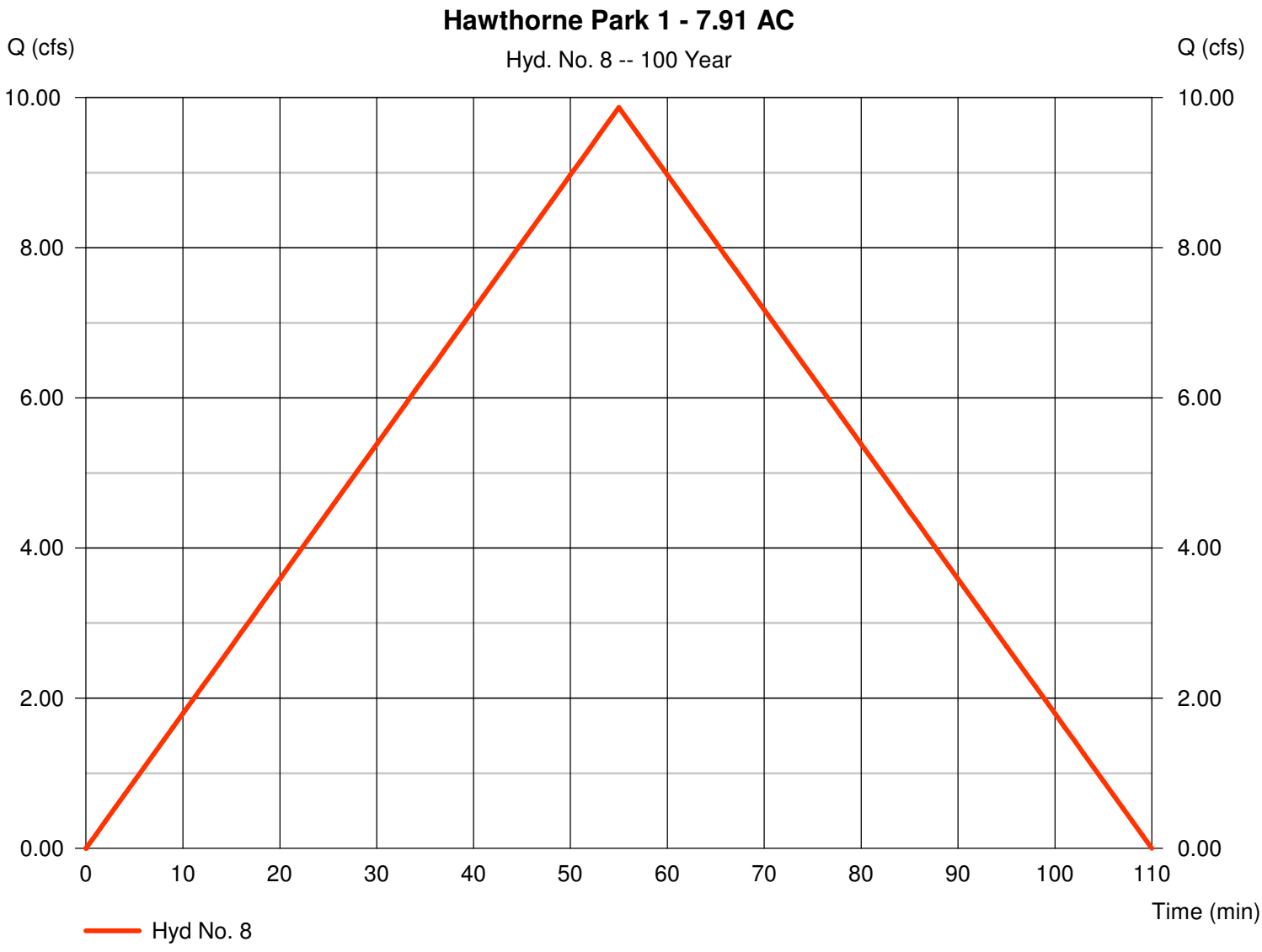
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 8

Hawthorne Park 1 - 7.91 AC

Hydrograph type	=	Rational	Peak discharge	=	9.868 cfs
Storm frequency	=	100 yrs	Time to peak	=	55 min
Time interval	=	1 min	Hyd. volume	=	32,564 cuft
Drainage area	=	7.910 ac	Runoff coeff.	=	0.35
Intensity	=	3.564 in/hr	Tc by User	=	55.00 min
IDF Curve	=	1992_Bulletin 71_NW Indiana.IDF	Asc/Rec limb fact	=	1/1



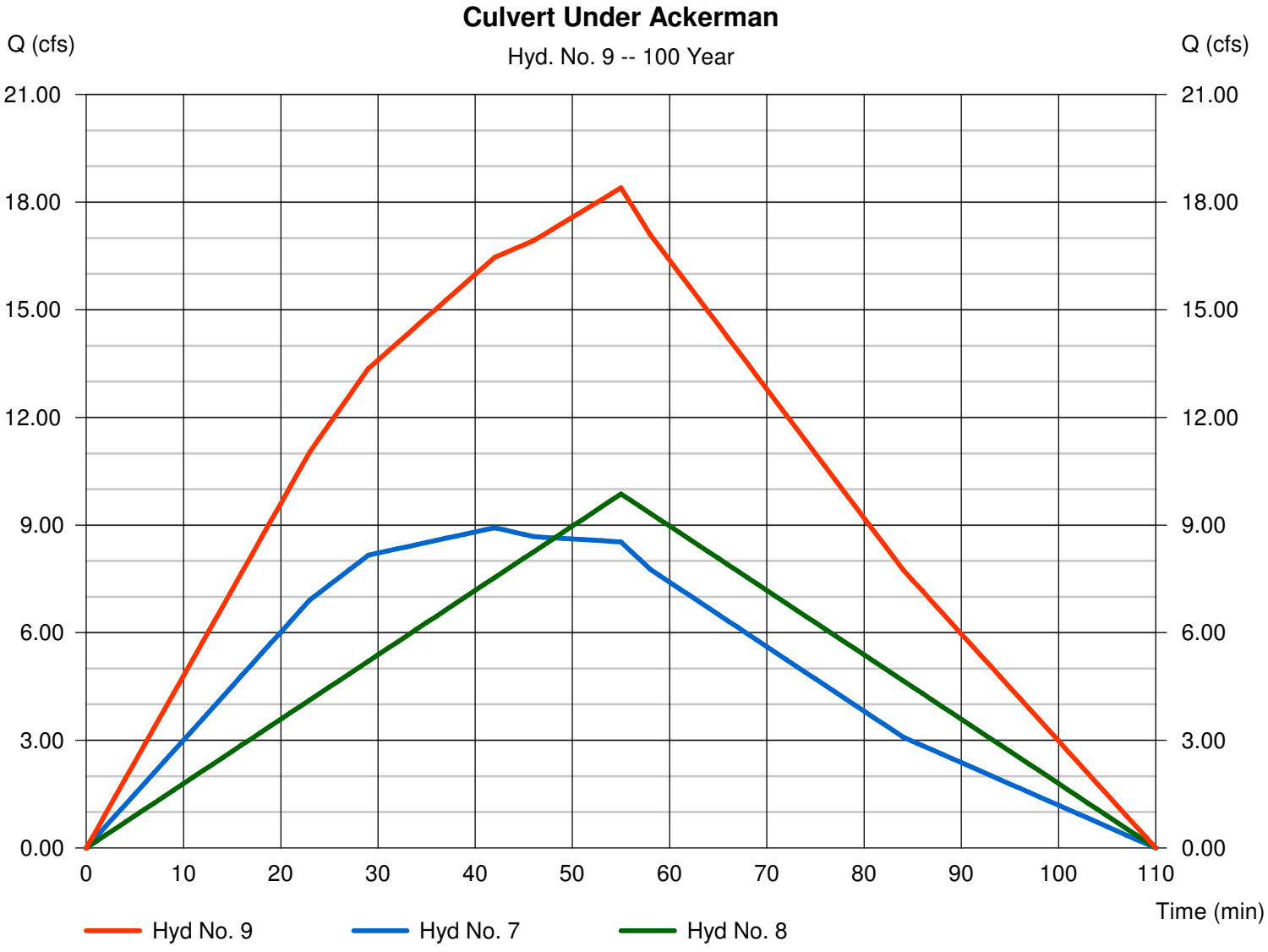
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Friday, Nov 4, 2011

Hyd. No. 9

Culvert Under Ackerman

Hydrograph type	=	Combine	Peak discharge	=	18.40 cfs
Storm frequency	=	100 yrs	Time to peak	=	55 min
Time interval	=	1 min	Hyd. volume	=	65,820 cuft
Inflow hyds.	=	7, 8	Contrib. drain. area	=	7.910 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	88.7935	19.4000	0.9553	--------
3	0.0000	0.0000	0.0000	--------
5	139.0142	22.0001	0.9994	--------
10	134.1374	19.7000	0.9629	--------
25	167.0621	19.8000	0.9641	--------
50	214.5947	21.0000	0.9818	--------
100	232.0766	20.4000	0.9661	--------

File name: 1992_Bulletin 71_NW Indiana.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	4.20	3.51	3.02	2.66	2.37	2.14	1.95	1.79	1.66	1.55	1.45	1.36
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.16	4.35	3.77	3.32	2.96	2.68	2.45	2.25	2.08	1.94	1.81	1.70
10	6.12	5.12	4.41	3.87	3.46	3.12	2.84	2.62	2.42	2.25	2.11	1.98
25	7.56	6.33	5.45	4.79	4.27	3.86	3.52	3.24	2.99	2.79	2.61	2.45
50	8.76	7.37	6.36	5.60	5.00	4.52	4.12	3.79	3.51	3.27	3.06	2.87
100	10.20	8.57	7.40	6.51	5.82	5.26	4.80	4.42	4.09	3.81	3.56	3.35

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	2.20	0.00	3.30	4.25	5.77	6.80	7.95
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

APPENDIX B

CULVERT REPORTS

FRANKLIN STREET

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Wednesday, Nov 9 2011

Existing 12in Culvert Under Franklin

Invert Elev Dn (ft)	=	625.80
Pipe Length (ft)	=	77.00
Slope (%)	=	4.04
Invert Elev Up (ft)	=	628.91
Rise (in)	=	12.0
Shape	=	Cir
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.024
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

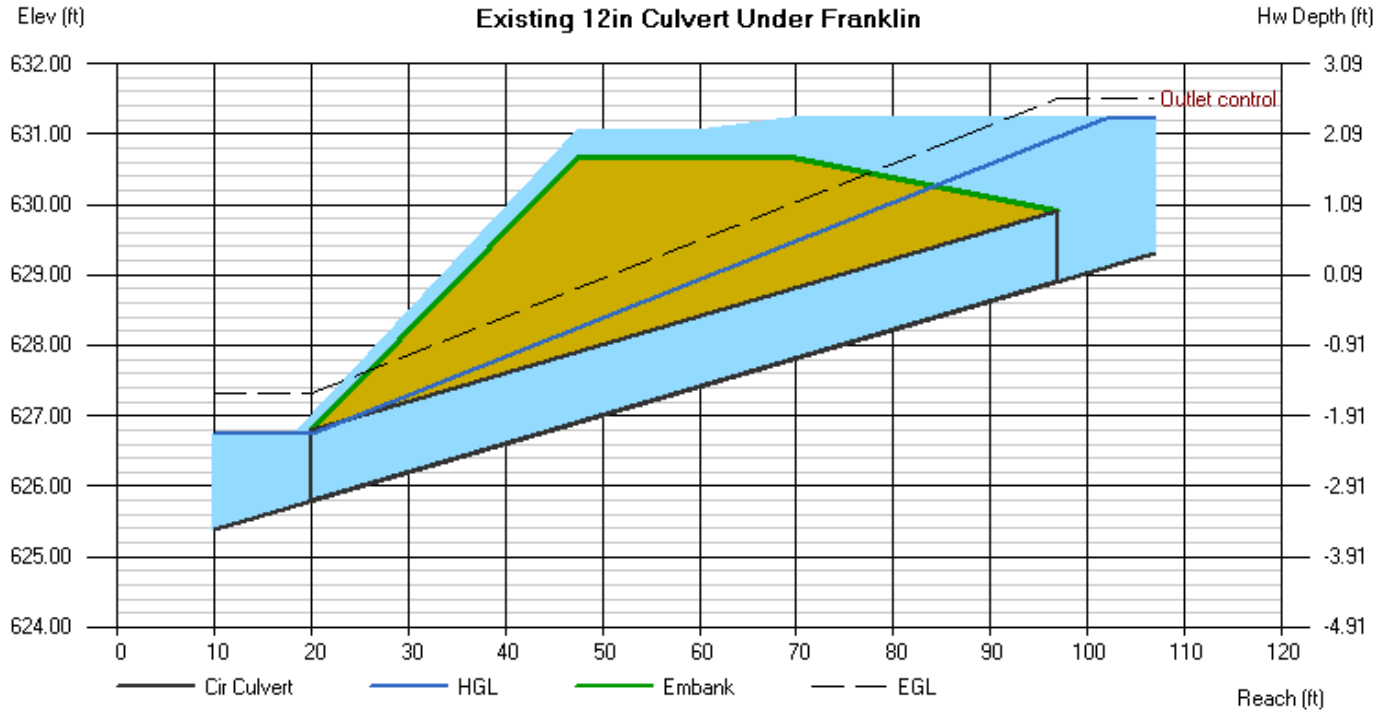
Top Elevation (ft)	=	630.67
Top Width (ft)	=	22.00
Crest Width (ft)	=	0.50

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	5.30
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	5.30
Qpipe (cfs)	=	4.66
Qovertop (cfs)	=	0.64
Veloc Dn (ft/s)	=	6.04
Veloc Up (ft/s)	=	5.93
HGL Dn (ft)	=	626.75
HGL Up (ft)	=	630.96
Hw Elev (ft)	=	631.23
Hw/D (ft)	=	2.32
Flow Regime	=	Outlet Control



Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Wednesday, Nov 9 2011

Proposed Franklin Street Two Midblock Arch 11x22in Culverts (15in Equivalent)

Invert Elev Dn (ft)	=	629.00
Pipe Length (ft)	=	45.50
Slope (%)	=	0.40
Invert Elev Up (ft)	=	629.18
Rise (in)	=	11.0
Shape	=	Arch
Span (in)	=	22.0
No. Barrels	=	2
n-Value	=	0.013
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0496, 0.57, 0.9

Embankment

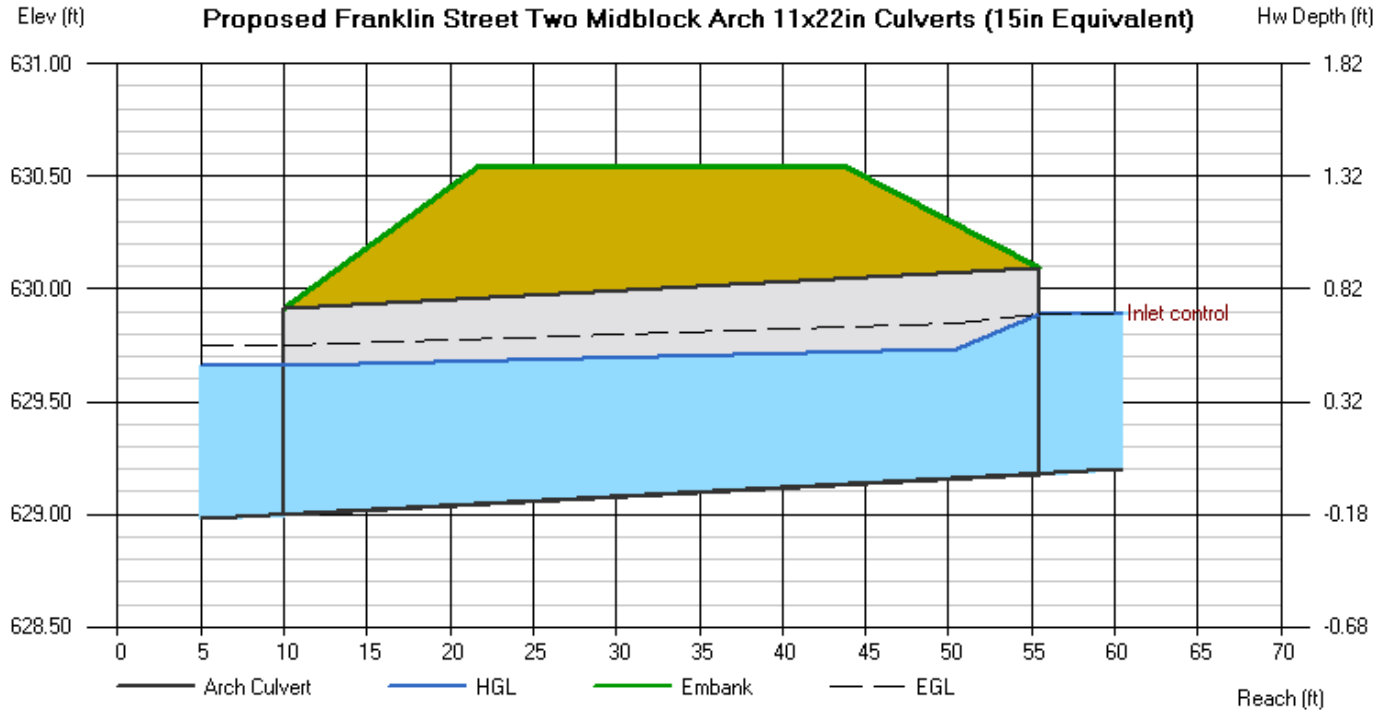
Top Elevation (ft)	=	630.54
Top Width (ft)	=	22.00
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	5.30
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	5.30
Qpipe (cfs)	=	5.30
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.41
Veloc Up (ft/s)	=	2.75
HGL Dn (ft)	=	629.66
HGL Up (ft)	=	629.74
Hw Elev (ft)	=	629.89
Hw/D (ft)	=	0.78
Flow Regime	=	Inlet Control



APPENDIX C

CULVERT REPORTS

ACKERMAN DRIVE

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Wednesday, Nov 9 2011

Existing 12in Culvert Under Ackerman

Invert Elev Dn (ft)	=	617.00
Pipe Length (ft)	=	125.00
Slope (%)	=	0.64
Invert Elev Up (ft)	=	617.80
Rise (in)	=	12.0
Shape	=	Cir
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.024
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

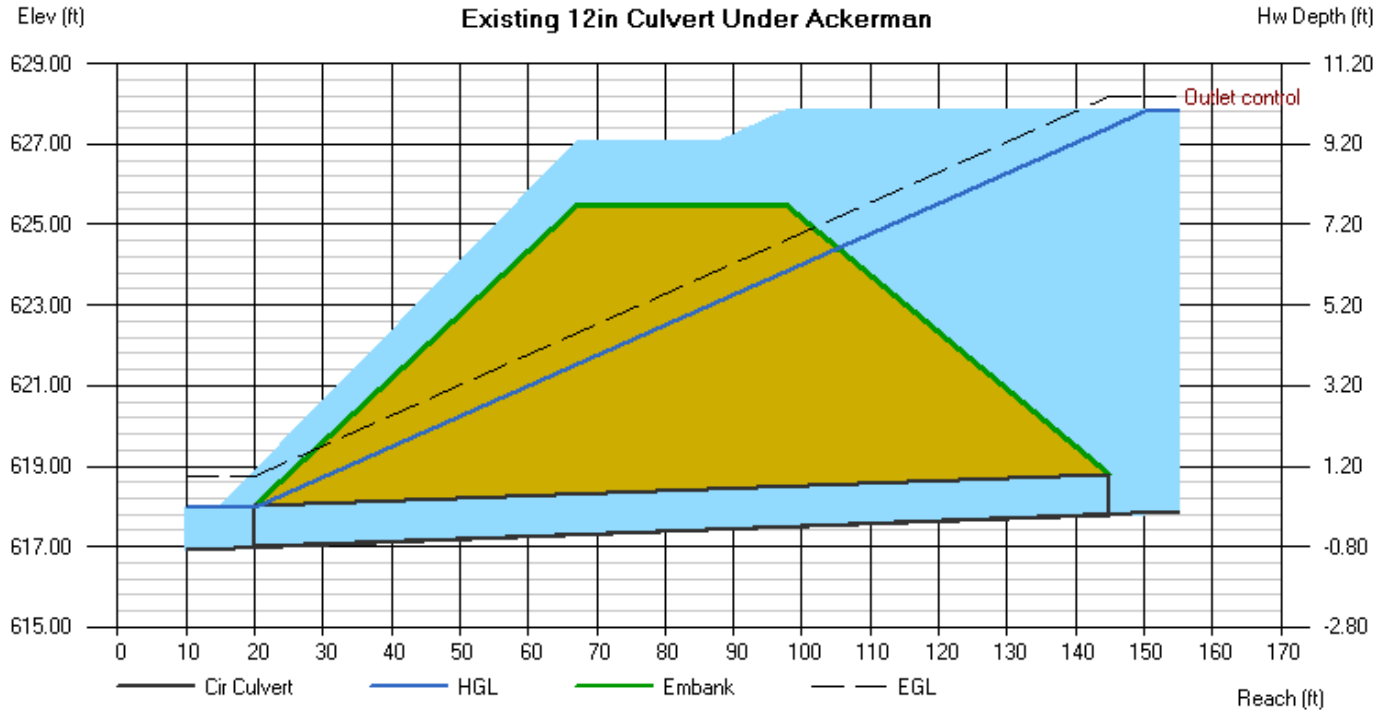
Top Elevation (ft)	=	625.50
Top Width (ft)	=	30.50
Crest Width (ft)	=	0.50

Calculations

Qmin (cfs)	=	5.27
Qmax (cfs)	=	10.88
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	10.87
Qpipe (cfs)	=	5.47
Qovertop (cfs)	=	5.40
Veloc Dn (ft/s)	=	7.02
Veloc Up (ft/s)	=	6.96
HGL Dn (ft)	=	617.97
HGL Up (ft)	=	627.42
Hw Elev (ft)	=	627.80
Hw/D (ft)	=	10.00
Flow Regime	=	Outlet Control



Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Wednesday, Nov 9 2011

Proposed 24in Culvert Under Ackerman

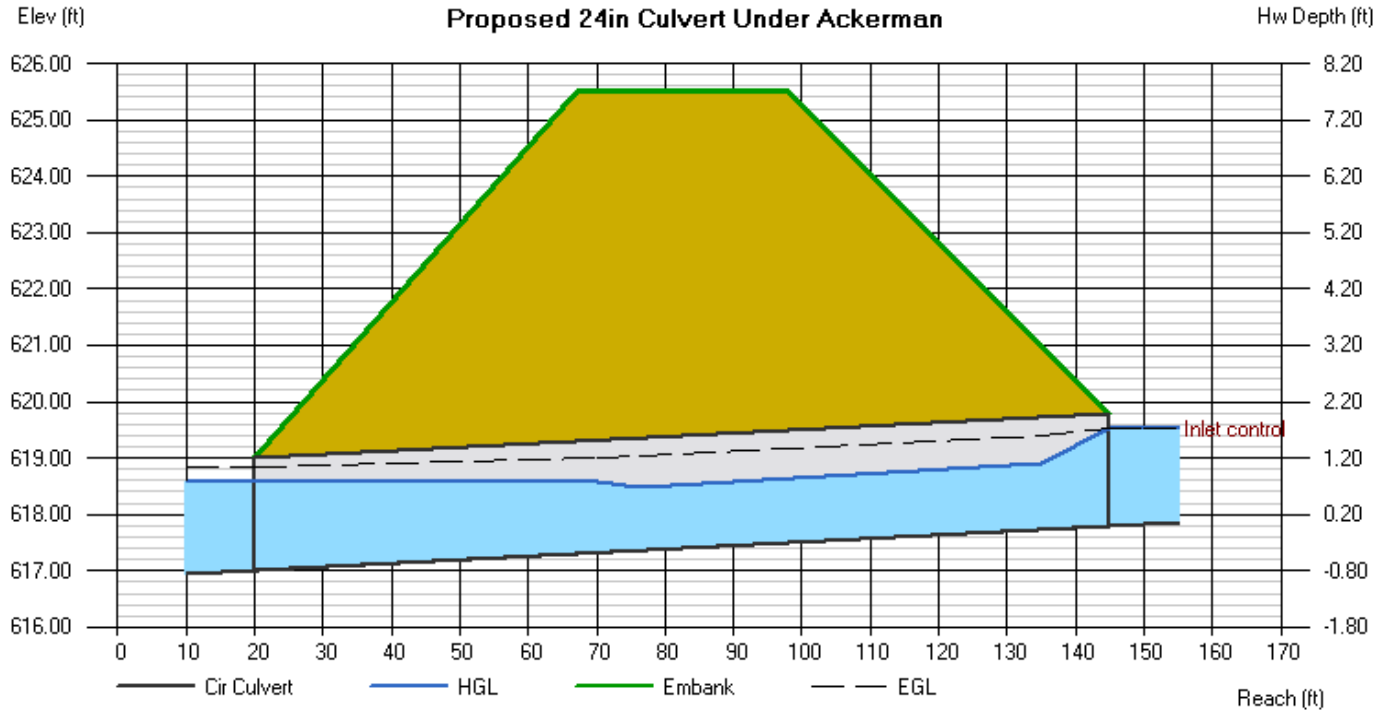
Invert Elev Dn (ft)	=	617.00
Pipe Length (ft)	=	125.00
Slope (%)	=	0.64
Invert Elev Up (ft)	=	617.80
Rise (in)	=	24.0
Shape	=	Cir
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.013
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	625.50
Top Width (ft)	=	30.50
Crest Width (ft)	=	0.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	10.88
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	10.80
Qpipe (cfs)	=	10.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.03
Veloc Up (ft/s)	=	5.58
HGL Dn (ft)	=	618.59
HGL Up (ft)	=	618.98
Hw Elev (ft)	=	619.52
Hw/D (ft)	=	0.86
Flow Regime	=	Inlet Control