10EX039

RENNER & ASSOCIATES LLC.
616 SIXTH STREET, RAPID CITY, SOUTH DAKOTA 57701
- 605-721-7310 - FAX 605-721-7310
EMAIL: GARY@RENNERASSOC.COM

DRAINAGE REPORT

OGLALA LAKOTA COLLEGE:

KNOLLWOOD DRIVE

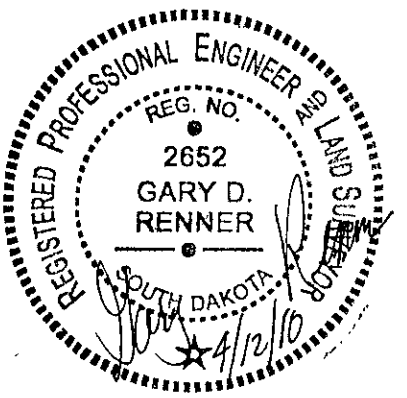
RAPID CITY, SD

By:

Renner & Associates, LLC
616 6th Street
Rapid City, SD 57701

For:

Encompass Architects
720 O Street, Lot F
Lincoln, NE 68508
Attn: Todd Hesson



April 12, 2010

RENNER & ASSOCIATES LLC.
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The following drainage report was prepared for the proposed addition to the Oglala Lakota College on Knollwood Drive in Rapid City. A proposed addition to the building will replace a portion of the asphalt parking lot. Table 1 shows the existing and proposed impervious area for the lot. Table 2 shows the peak storm flows for the historic, existing, and proposed sites.

Table 1
Existing & Proposed Impervious Area

1.787 Acre Site	Total (acre)	% of Site
Existing	1.142	63.91%
Proposed	1.169	65.42%

Table 2
Peak Storm Flow

	2 YR (CFS)	10 YR (CFS)	100 YR (CFS)
Historic	0.53	0.85	1.34
Existing	3.50	5.15	7.83
Proposed	3.56	5.24	7.96

The peak storm flows and volumes were calculated using Hydraflow Hydrographs by Intelisolve. This program uses the rational method and a time of concentration, along with the Rapid City IDF curves to compute peak storm flows and volumes.

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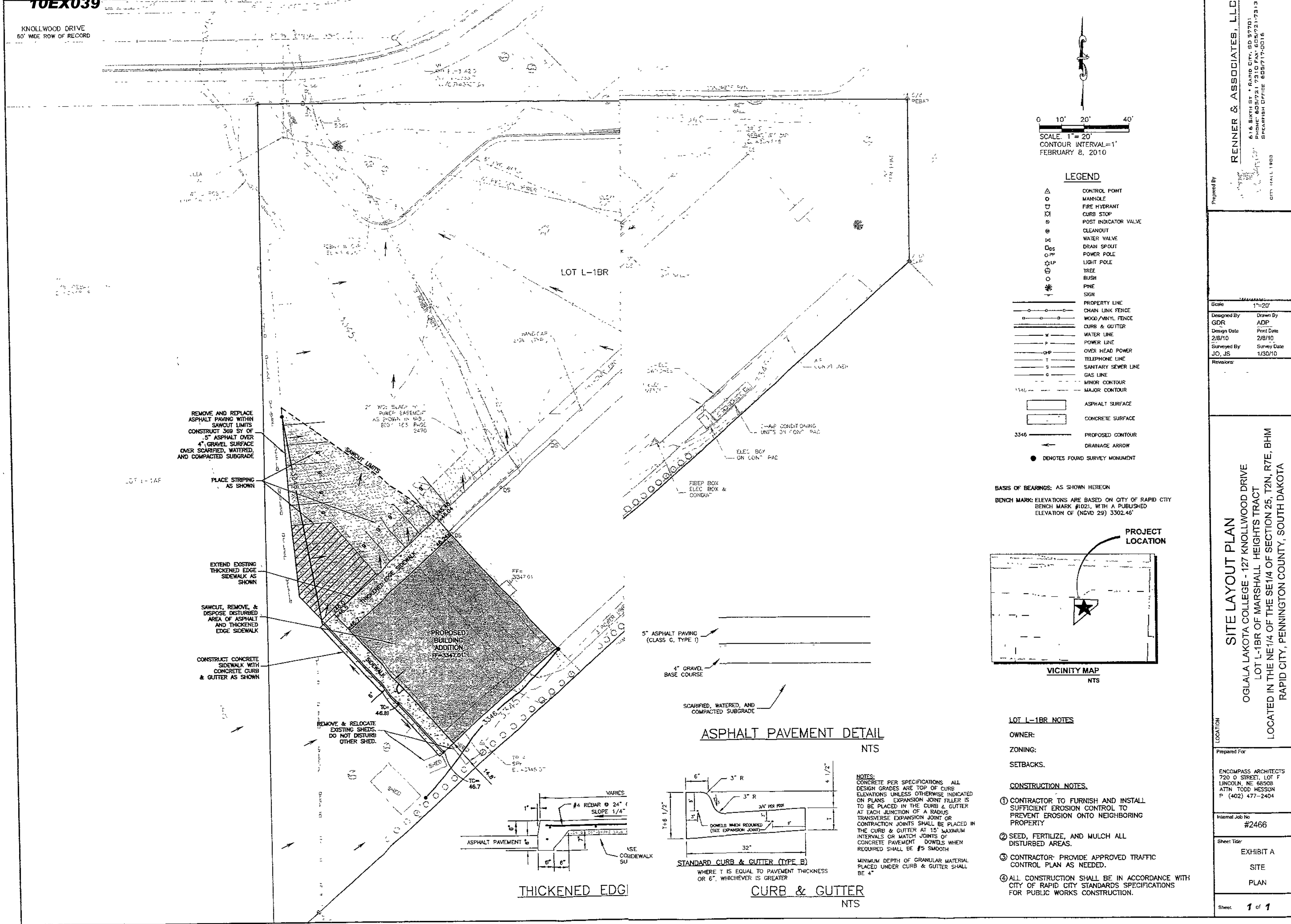
A Request for Exception to the Drainage Criteria Manual is being submitted with this report. The site as it exists today makes it unfeasible to construct a detention/treatment facility. The existing building and asphalt parking lot cover the majority of the lot. The only useable open area is on the high side of the lot and thus useless for any detention or treatment. There is also no storm sewer on Knollwood Dr. and thus no way to drain a pond on any portion of the lot. The building addition which replaces a portion of the asphalt parking lot will add an insignificant amount of storm flow to the drainage basin as it exists today and thus creates no additional adverse affects on any downstream property.

Attached:

1. Drainage Calculations and Raw Data
2. Site Plan
3. Request for Exception

10EX039



KNOLLWOOD DRIVE
60' WIDE ROW OF RECORD
LOT L-1BR
LOT L-1AF
0 10' 20' 40'
SCALE: 1"= 20'
CONTOUR INTERVAL=1'
FEBRUARY 8, 2010
LEGEND
CONTROL POINT
MANHOLE
FIRE HYDRANT
CURB STOP
POST INDICATOR VALVE
CLEANOUT
WATER VALVE
DRAIN SPOUT
POWER POLE
LIGHT POLE
TREE
BUSH
PINE
SIGN
PROPERTY LINE
CHAIN LINK FENCE
WOOD/VINYL FENCE
CURB & GUTTER
WATER LINE
POWER LINE
OVER HEAD POWER
TELEPHONE LINE
SANITARY SEWER LINE
GAS LINE
MINOR CONTOUR
MAJOR CONTOUR
ASPHALT SURFACE
CONCRETE SURFACE
PROPOSED CONTOUR
DRAINAGE ARROW
DENOTES FOUND SURVEY MONUMENT
BASIS OF BEARINGS: AS SHOWN HEREON
BENCH MARK: ELEVATIONS ARE BASED ON CITY OF RAPID CITY BENCH MARK #1021, WITH A PUBLISHED ELEVATION OF (NGVD 29) 3302.46'
PROJECT LOCATION
VICINITY MAP
NTS
REMOVE AND REPLACE ASPHALT PAVING WITHIN SAWCUT LIMITS CONSTRUCT 369 SY OF 5" ASPHALT OVER 4" GRAVEL SURFACE OVER SCARIFIED, WATERED, AND COMPACTED SUBGRADE
PLACE STRIPING AS SHOWN
EXTEND EXISTING THICKENED EDGE SIDEWALK AS SHOWN
SAWCUT, REMOVE, & DISPOSE DISTURBED AREA OF ASPHALT AND THICKENED EDGE SIDEWALK
CONSTRUCT CONCRETE SIDEWALK WITH CONCRETE CURB & GUTTER AS SHOWN
REMOVE & RELOCATE EXISTING SHEDS. DO NOT DISTURB OTHER SHED.
SAWCUT LIMITS
THICKENED EDGE SIDEWALK
SIDEWALK
PROPOSED BUILDING ADDITION FF=3347.01
FF= 3347.01
TC= 46.89
TC= 46.7
SHED
ELEC BOX ON CONC PAD
FIBER BOX ELEC BOX & CONDUIT
A/C CONDITIONING UNITS ON CONC PAD
5" ASPHALT PAVING (CLASS G, TYPE 1)
4" GRAVEL BASE COURSE
SCARIFIED, WATERED, AND COMPACTED SUBGRADE
ASPHALT PAVEMENT DETAIL
NTS
VARIES
#4 REBAR @ 24"
SLOPE 1/4"
ASPHALT PAVEMENT
THICKENED EDGE
6" 6"
3" R
3/4" PER FOOT
DOWELS WHEN REQUIRED (SEE EXPANSION JOINT)
32"
T+6 1/2"
4 1/2"
STANDARD CURB & GUTTER (TYPE B)
WHERE T IS EQUAL TO PAVEMENT THICKNESS OR 6", WHICHEVER IS GREATER
CURB & GUTTER
NTS
NOTES:
CONCRETE PER SPECIFICATIONS ALL DESIGN GRADES ARE TOP OF CURB ELEVATIONS UNLESS OTHERWISE INDICATED ON PLANS EXPANSION JOINT FILLER IS TO BE PLACED IN THE CURB & GUTTER AT EACH JUNCTION OF A RADIUS TRANSVERSE EXPANSION JOINT OR CONTRACTION JOINTS SHALL BE PLACED IN THE CURB & GUTTER AT 15' MAXIMUM INTERVALS OR MATCH JOINTS OF CONCRETE PAVEMENT DOWELS WHEN REQUIRED SHALL BE #5 SMOOTH
MINIMUM DEPTH OF GRANULAR MATERIAL PLACED UNDER CURB & GUTTER SHALL BE 4"
LOT L-1BR NOTES
OWNER:
ZONING:
SETBACKS.
CONSTRUCTION NOTES.
① CONTRACTOR TO FURNISH AND INSTALL SUFFICIENT EROSION CONTROL TO PREVENT EROSION ONTO NEIGHBORING PROPERTY
② SEED, FERTILIZE, AND MULCH ALL DISTURBED AREAS.
③ CONTRACTOR· PROVIDE APPROVED TRAFFIC CONTROL PLAN AS NEEDED.
④ ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH CITY OF RAPID CITY STANDARDS SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
Prepared By
RENNER & ASSOCIATES, LLC.
616 SIXTH ST • RAPID CITY, SD 57701
PHONE 605/721 7310 FAX 605/721-7313
SPEARFISH OFFICE 605/717-0016
Scale 1"=20'
Designed By GDR
Drawn By ADP
Design Date 2/8/10
Print Date 2/8/10
Surveyed By JO, JS
Survey Date 1/30/10
Revisions
SITE LAYOUT PLAN
OGLALA LAKOTA COLLEGE - 127 KNOLLWOOD DRIVE
LOT L-1BR OF MARSHALL HEIGHTS TRACT
LOCATED IN THE NE1/4 OF THE SE1/4 OF SECTION 25, T2N, R7E, BHM
RAPID CITY, PENNINGTON COUNTY, SOUTH DAKOTA
LOCATION
Prepared For
ENCOMPASS ARCHITECTS
720 O STREET, LOT F
LINCOLN, NE 68508
ATTN TODD HESSON
P (402) 477-2404
Internal Job No
#2466
Sheet Title
EXHIBIT A
SITE
PLAN
Sheet 1 of 1

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

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	0.533	1	41	1,312	----	------	------	Historic
2	Rational	2.747	1	13	2,142	----	------	------	Developed-North
3	Rational	0.888	1	12	640	----	------	------	Developed-South
4	Combine	3.561	1	13	2,782	2, 3	------	------	Developed-Total Site
5	Rational	2.687	1	13	2,096	----	------	------	Existing-North
6	Rational	0.887	1	12	639	----	------	------	Existing-South
7	Combine	3.500	1	13	2,735	5, 6	------	------	Existing-Total Site

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

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	0.853	1	41	2,097	----	------	------	Historic
2	Rational	4.045	1	13	3,155	----	------	------	Developed-North
3	Rational	1.308	1	12	942	----	------	------	Developed-South
4	Combine	5.244	1	13	4,097	2, 3	------	------	Developed-Total Site
5	Rational	3.957	1	13	3,086	----	------	------	Existing-North
6	Rational	1.307	1	12	941	----	------	------	Existing-South
7	Combine	5.154	1	13	4,027	5, 6	------	------	Existing-Total Site

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

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	1.337	1	41	3,288	----	------	------	Historic
2	Rational	6.144	1	13	4,792	----	------	------	Developed-North
3	Rational	1.983	1	12	1,428	----	------	------	Developed-South
4	Combine	7.962	1	13	6,220	2, 3	------	------	Developed-Total Site
5	Rational	6.010	1	13	4,688	----	------	------	Existing-North
6	Rational	1.981	1	12	1,426	----	------	------	Existing-South
7	Combine	7.826	1	13	6,114	5, 6	------	------	Existing-Total Site

Hydrograph Report

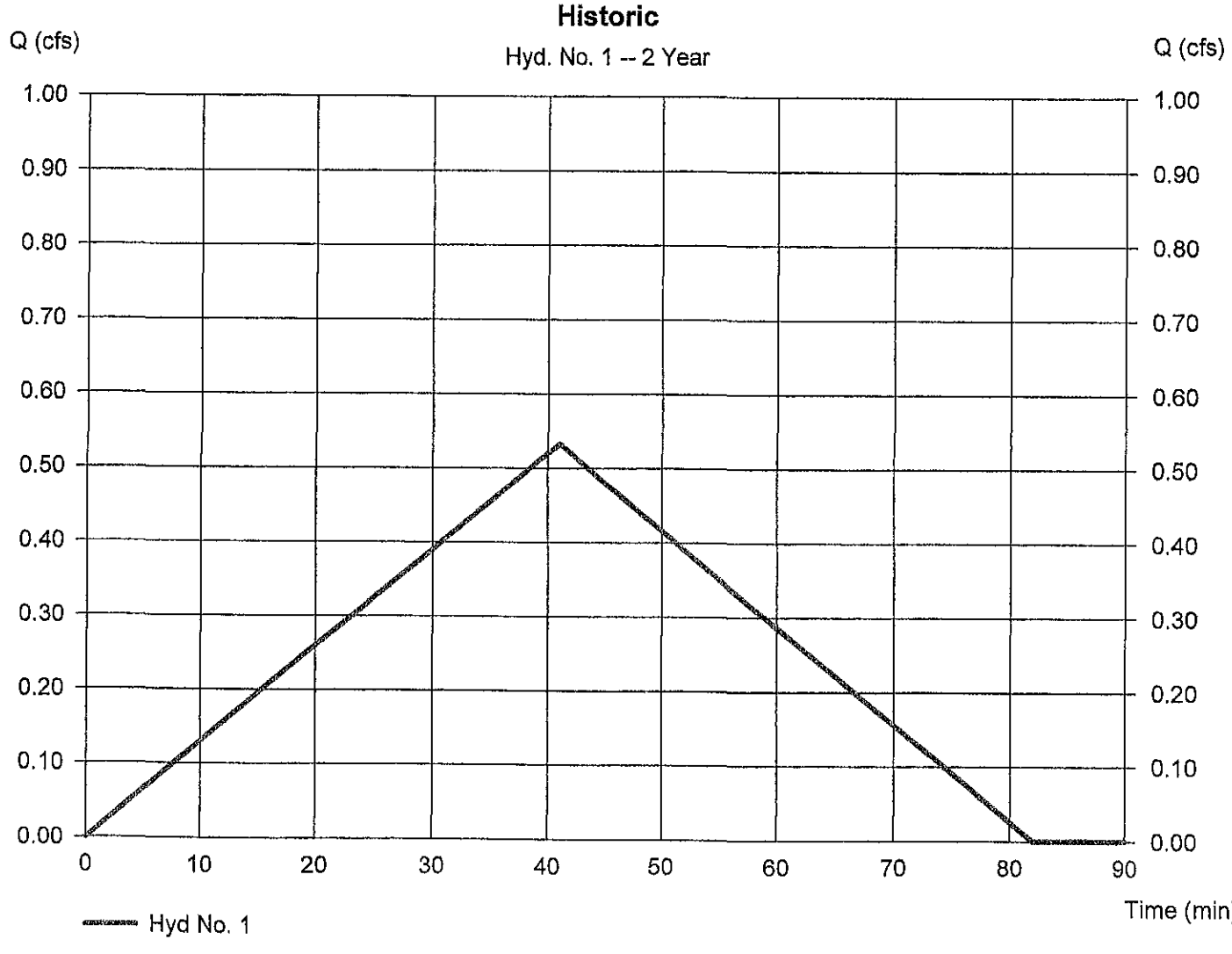
Hydraflow Hydrographs by Intelisolve v9.22

Monday, Apr 12, 2010

Hyd. No. 1

Historic

Hydrograph type	= Rational	Peak discharge	= 0.533 cfs
Storm frequency	= 2 yrs	Time to peak	= 41 min
Time interval	= 1 min	Hyd. volume	= 1,312 cuft
Drainage area	= 1.787 ac	Runoff coeff.	= 0.2
Intensity	= 1.492 in/hr	Tc by TR55	= 41.00 min
IDF Curve	= RC IDF CURVE.IDF	Asc/Rec limb fact	= 1/1



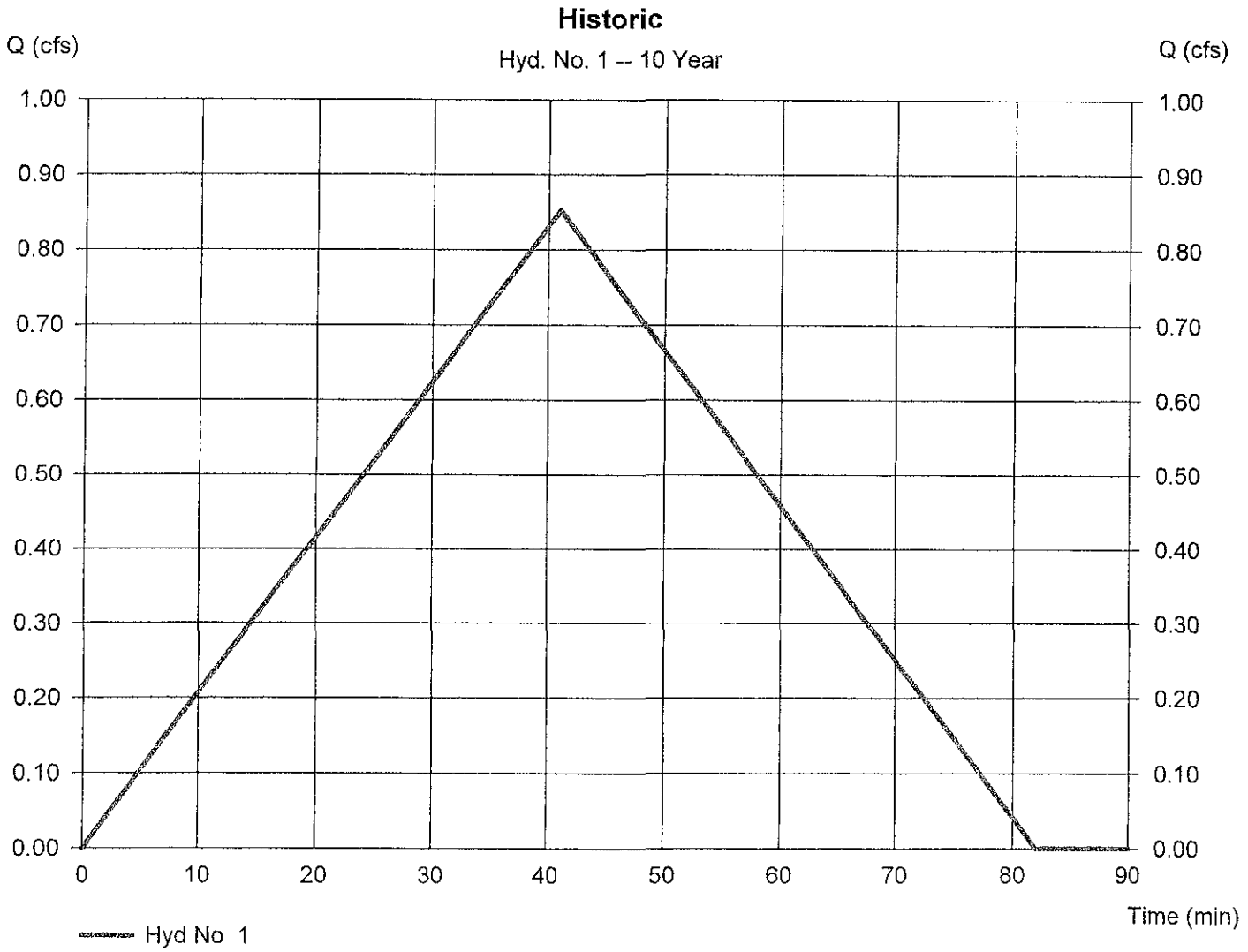
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Apr 12, 2010

Hyd. No. 1

Historic

Hydrograph type	= Rational	Peak discharge	= 0.853 cfs
Storm frequency	= 10 yrs	Time to peak	= 41 min
Time interval	= 1 min	Hyd. volume	= 2,097 cuft
Drainage area	= 1.787 ac	Runoff coeff.	= 0.2
Intensity	= 2.386 in/hr	Tc by TR55	= 41.00 min
IDF Curve	= RC IDF CURVE.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

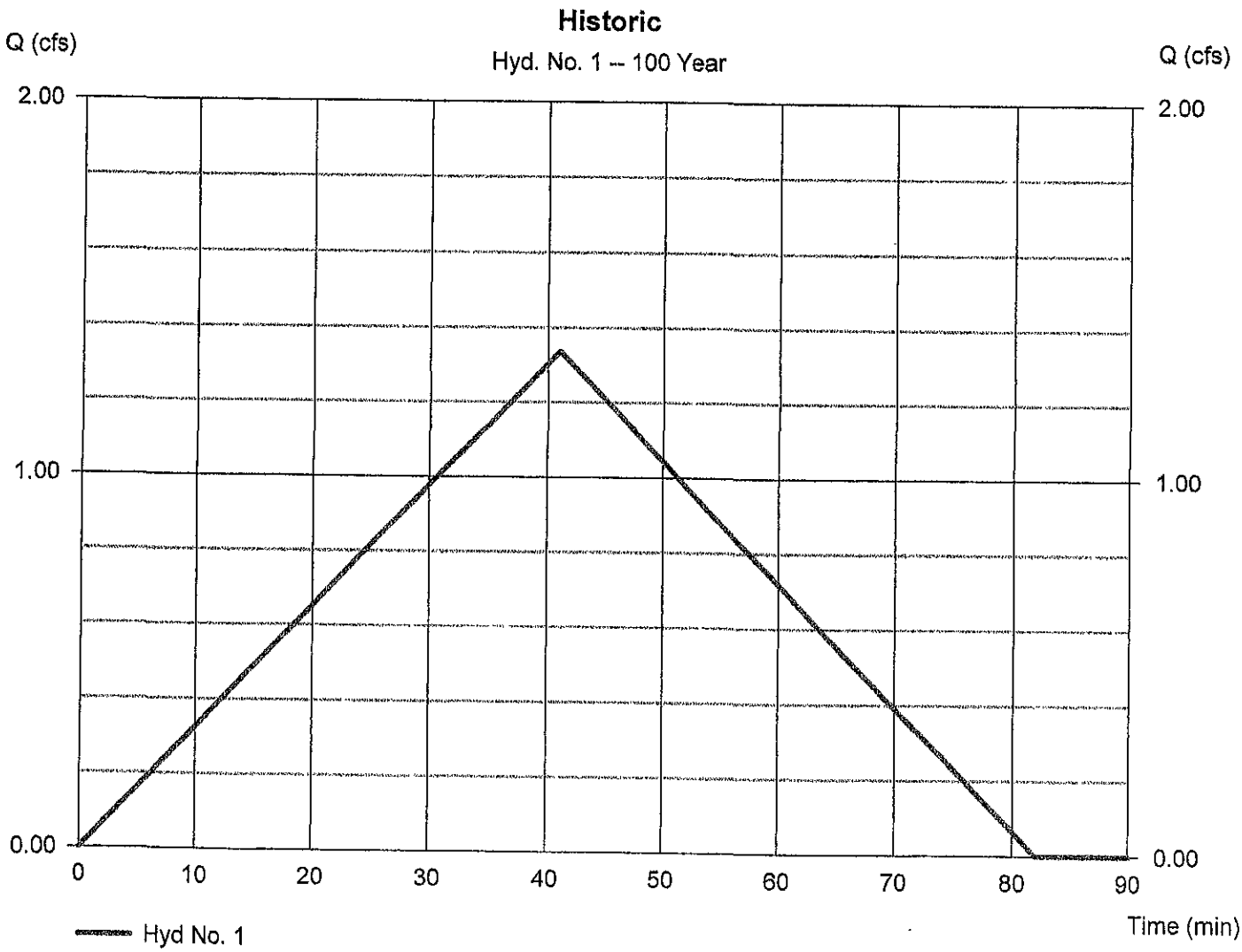
Hydraflow Hydrographs by Intelisolve v9.22

Monday, Apr 12, 2010

Hyd. No. 1

Historic

Hydrograph type	= Rational	Peak discharge	= 1.337 cfs
Storm frequency	= 100 yrs	Time to peak	= 41 min
Time interval	= 1 min	Hyd. volume	= 3,288 cuft
Drainage area	= 1.787 ac	Runoff coeff.	= 0.2
Intensity	= 3.740 in/hr	Tc by TR55	= 41.00 min
IDF Curve	= RC IDF CURVE.IDF	Asc/Rec limb fact	= 1/1



TR55 Tc Worksheet

Hydraflow Hydrographs by Intelisolve v9.22

Hyd. No. 1

Historic

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 300.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 1.96	0.00	0.00	
Land slope (%)	= 1.00	0.00	0.00	
Travel Time (min)	**= 39.78**	**+ 0.00**	**+ 0.00**	**= 39.78**
Shallow Concentrated Flow				
Flow length (ft)	= 91.00	0.00	0.00	
Watercourse slope (%)	= 1.00	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 1.61	0.00	0.00	
Travel Time (min)	**= 0.94**	**+ 0.00**	**+ 0.00**	**= 0.94**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc ..... 41.00 min

Hydrograph Report

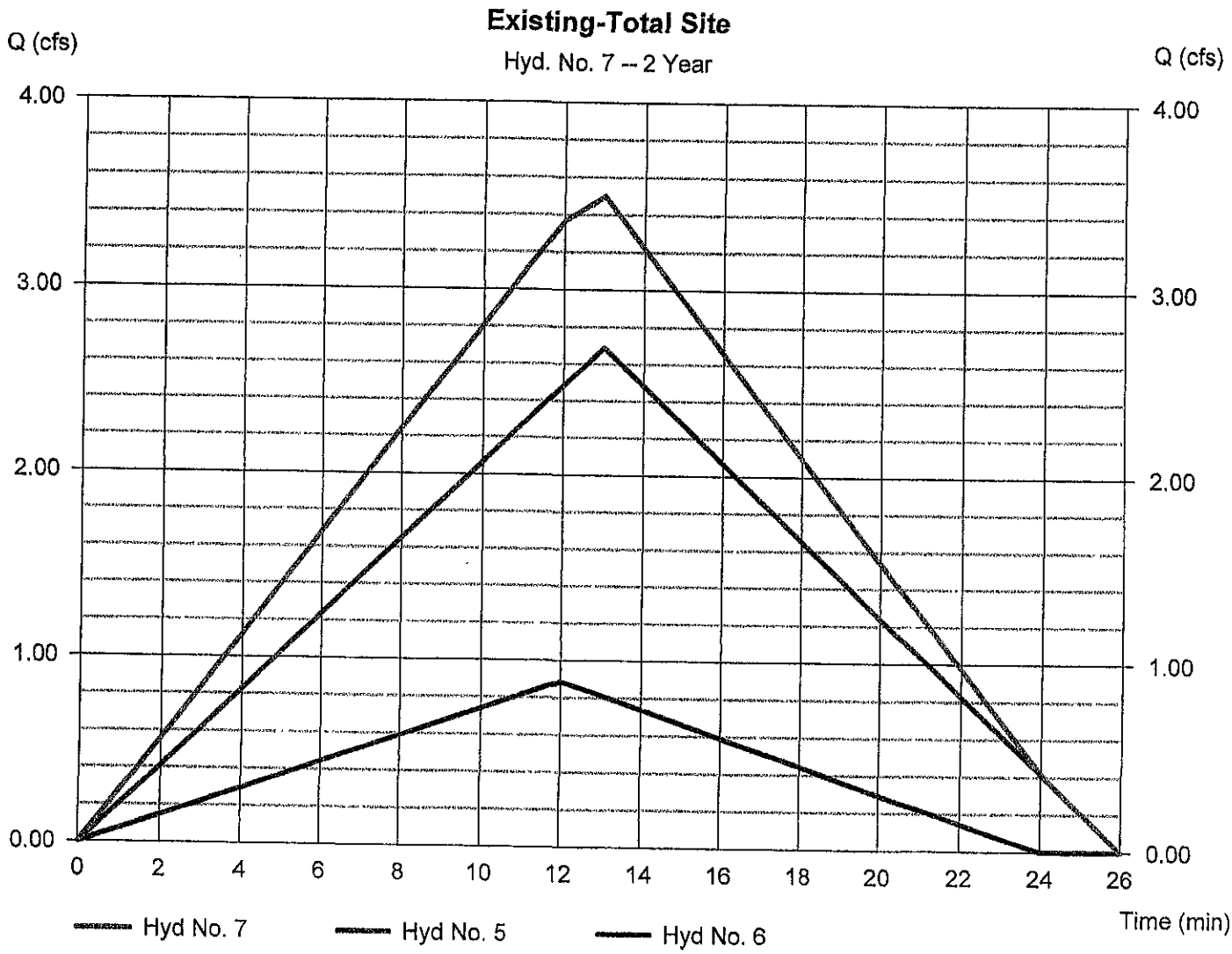
Hydraflow Hydrographs by Intelisolve v9.22

Monday, Apr 12, 2010

Hyd. No. 7

Existing-Total Site

Hydrograph type	= Combine	Peak discharge	= 3.500 cfs
Storm frequency	= 2 yrs	Time to peak	= 13 min
Time interval	= 1 min	Hyd. volume	= 2,735 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 1.790 ac



Hydrograph Report

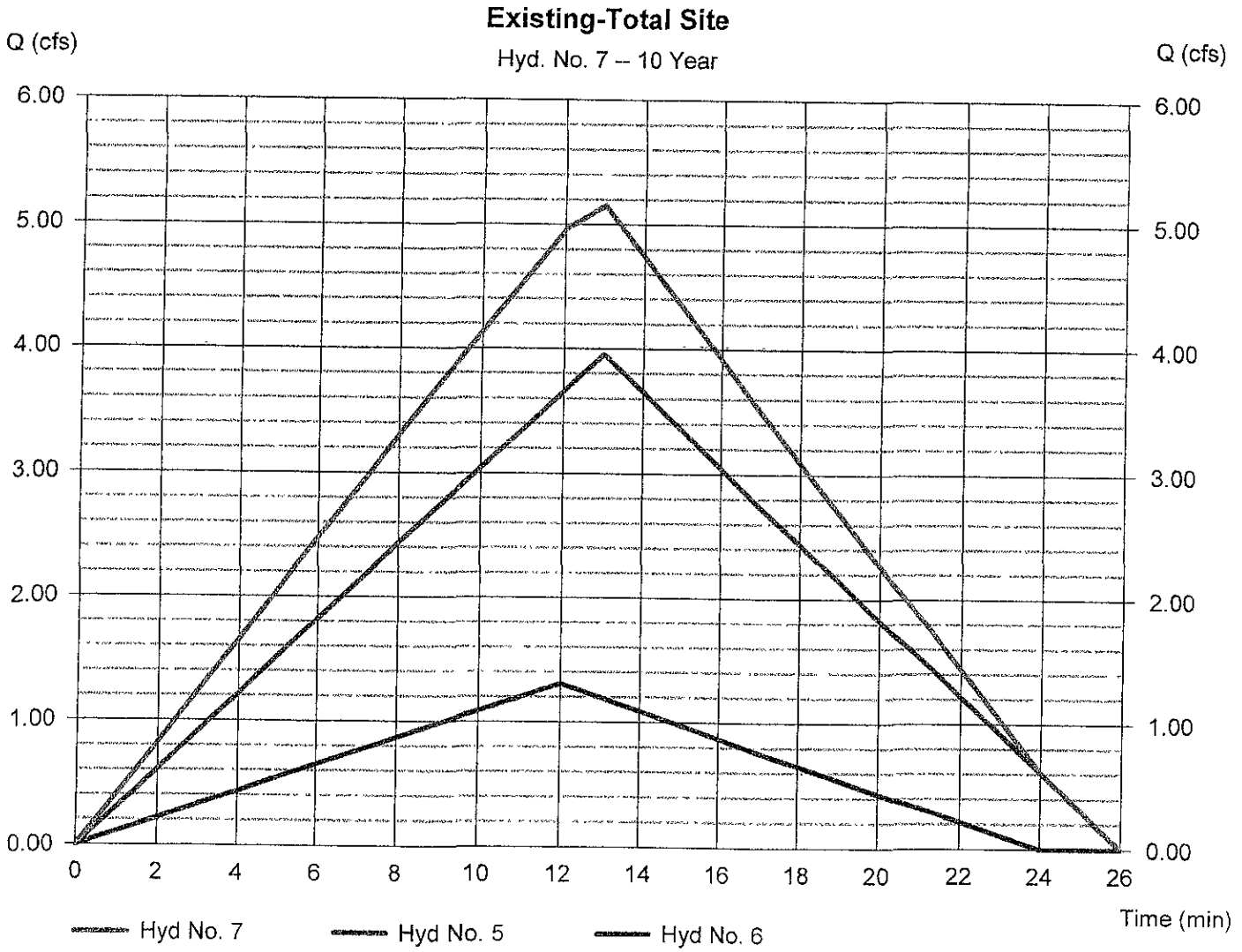
Hydraflow Hydrographs by Intelisolve v9.22

Monday, Apr 12, 2010

Hyd. No. 7

Existing-Total Site

Hydrograph type	= Combine	Peak discharge	= 5.154 cfs
Storm frequency	= 10 yrs	Time to peak	= 13 min
Time interval	= 1 min	Hyd. volume	= 4,027 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 1.790 ac



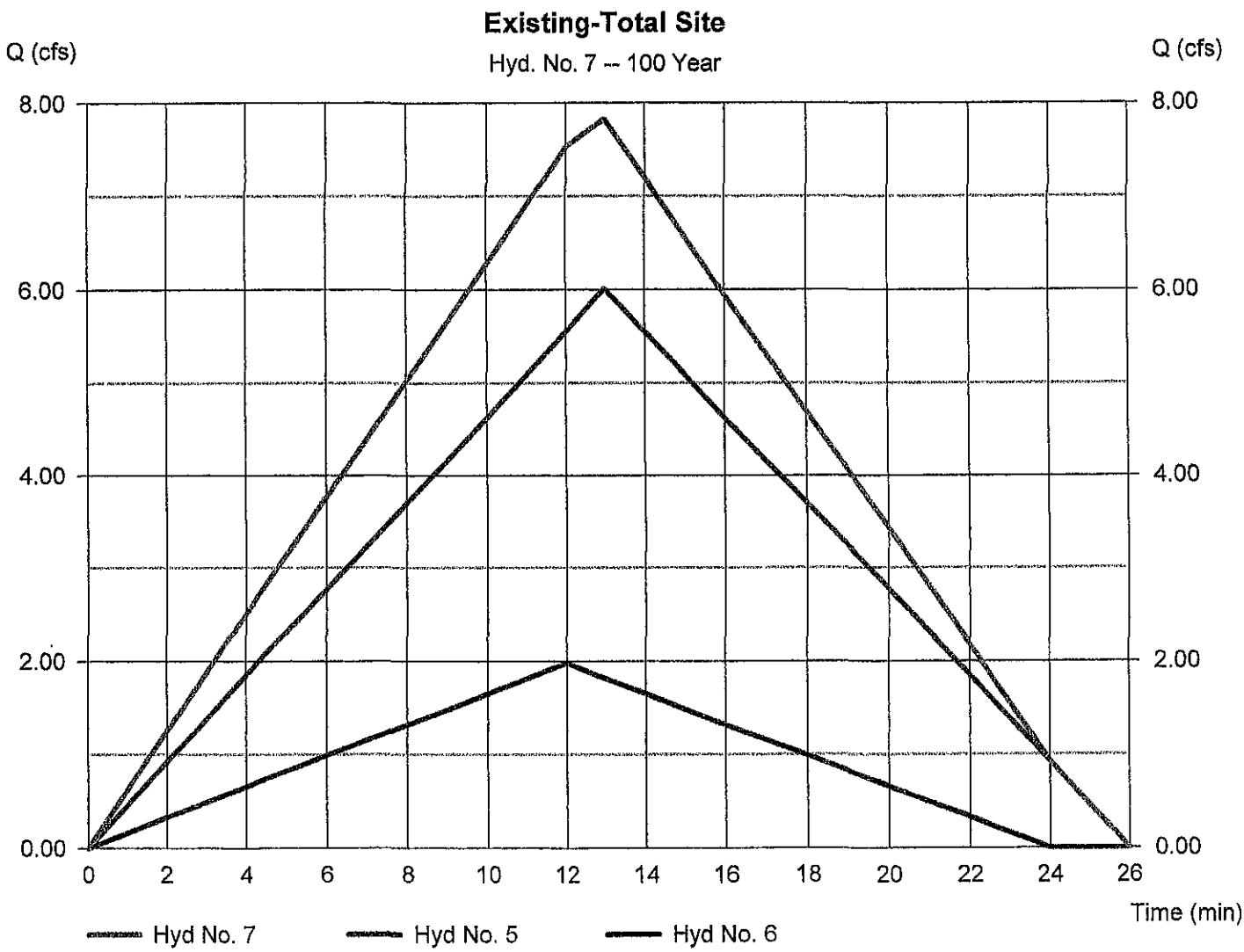
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Apr 12, 2010

Hyd. No. 7

Existing-Total Site

Hydrograph type	= Combine	Peak discharge	= 7.826 cfs
Storm frequency	= 100 yrs	Time to peak	= 13 min
Time interval	= 1 min	Hyd. volume	= 6,114 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 1.790 ac



Hydrograph Report

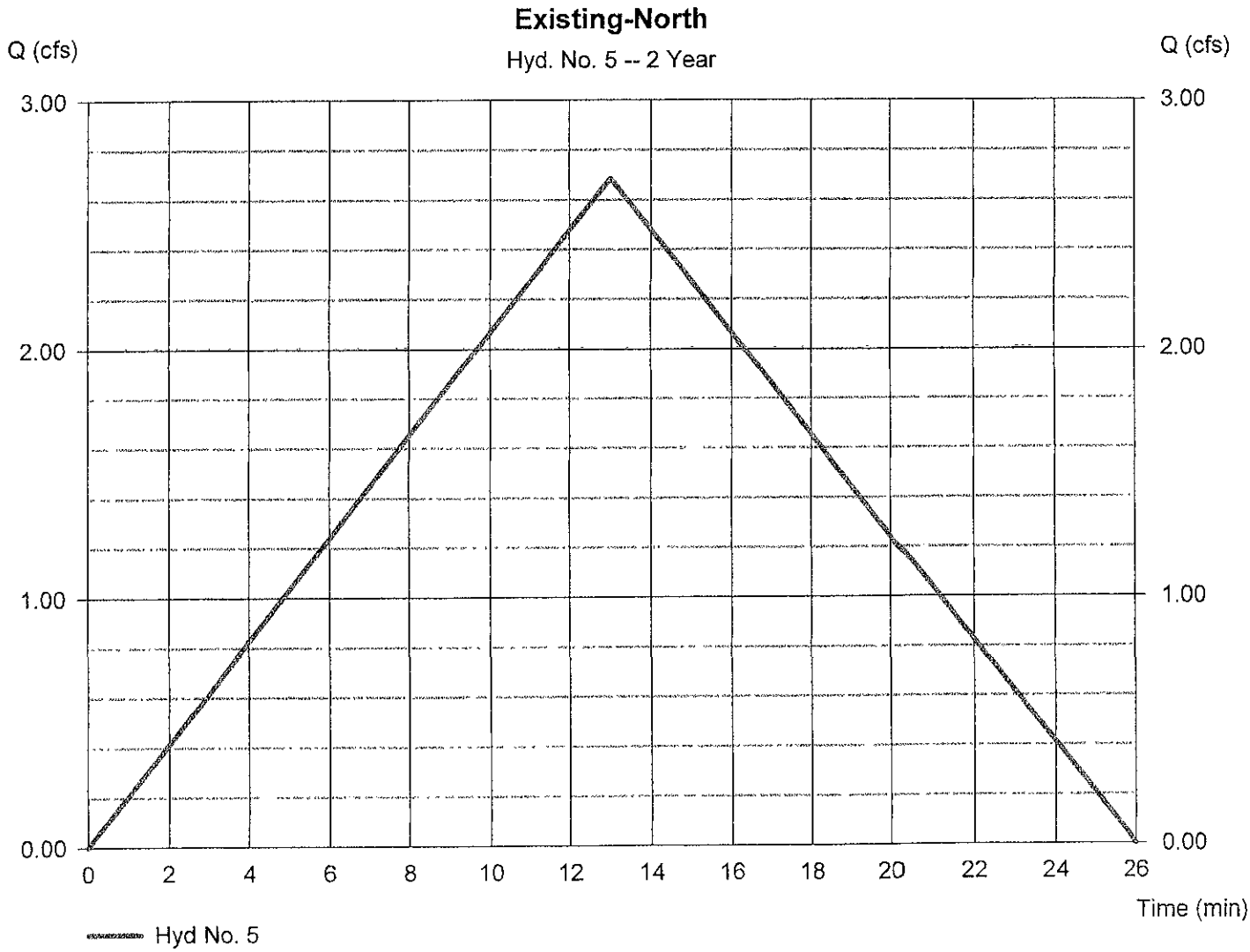
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Apr 12, 2010

Hyd. No. 5

Existing-North

Hydrograph type	= Rational	Peak discharge	= 2.687 cfs
Storm frequency	= 2 yrs	Time to peak	= 13 min
Time interval	= 1 min	Hyd. volume	= 2,096 cuft
Drainage area	= 1.240 ac	Runoff coeff.	= 0.71*
Intensity	= 3.052 in/hr	Tc by TR55	= 13.00 min
IDF Curve	= RC IDF CURVE.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.903 x 0.90) + (0 337 x 0.20)] / 1.240



Hydrograph Report

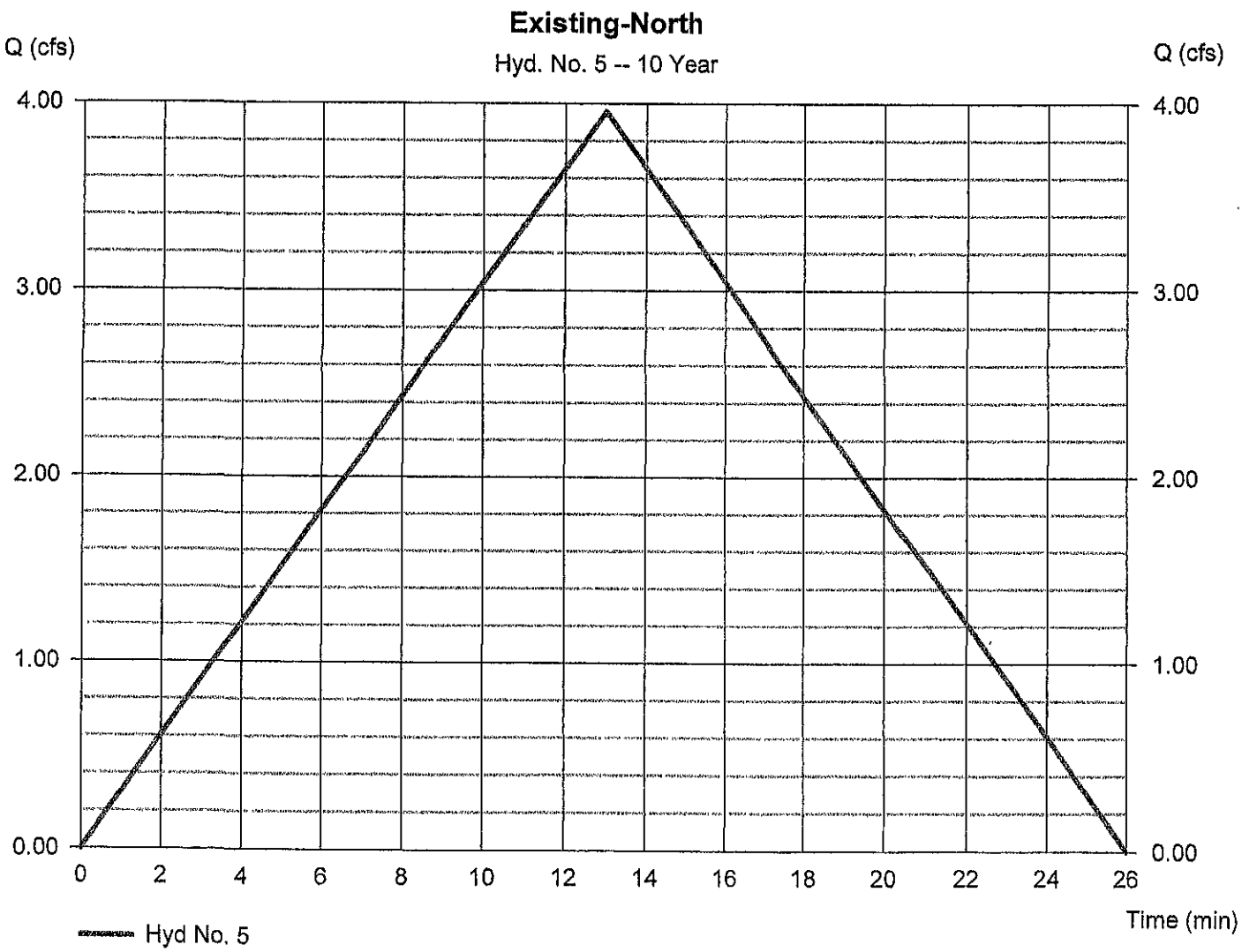
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Apr 12, 2010

Hyd. No. 5

Existing-North

Hydrograph type	= Rational	Peak discharge	= 3.957 cfs
Storm frequency	= 10 yrs	Time to peak	= 13 min
Time interval	= 1 min	Hyd. volume	= 3,086 cuft
Drainage area	= 1.240 ac	Runoff coeff.	= 0.71*
Intensity	= 4.494 in/hr	Tc by TR55	= 13.00 min
IDF Curve	= RC IDF CURVE.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.903 x 0.90) + (0.337 x 0.20)] / 1.240



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22

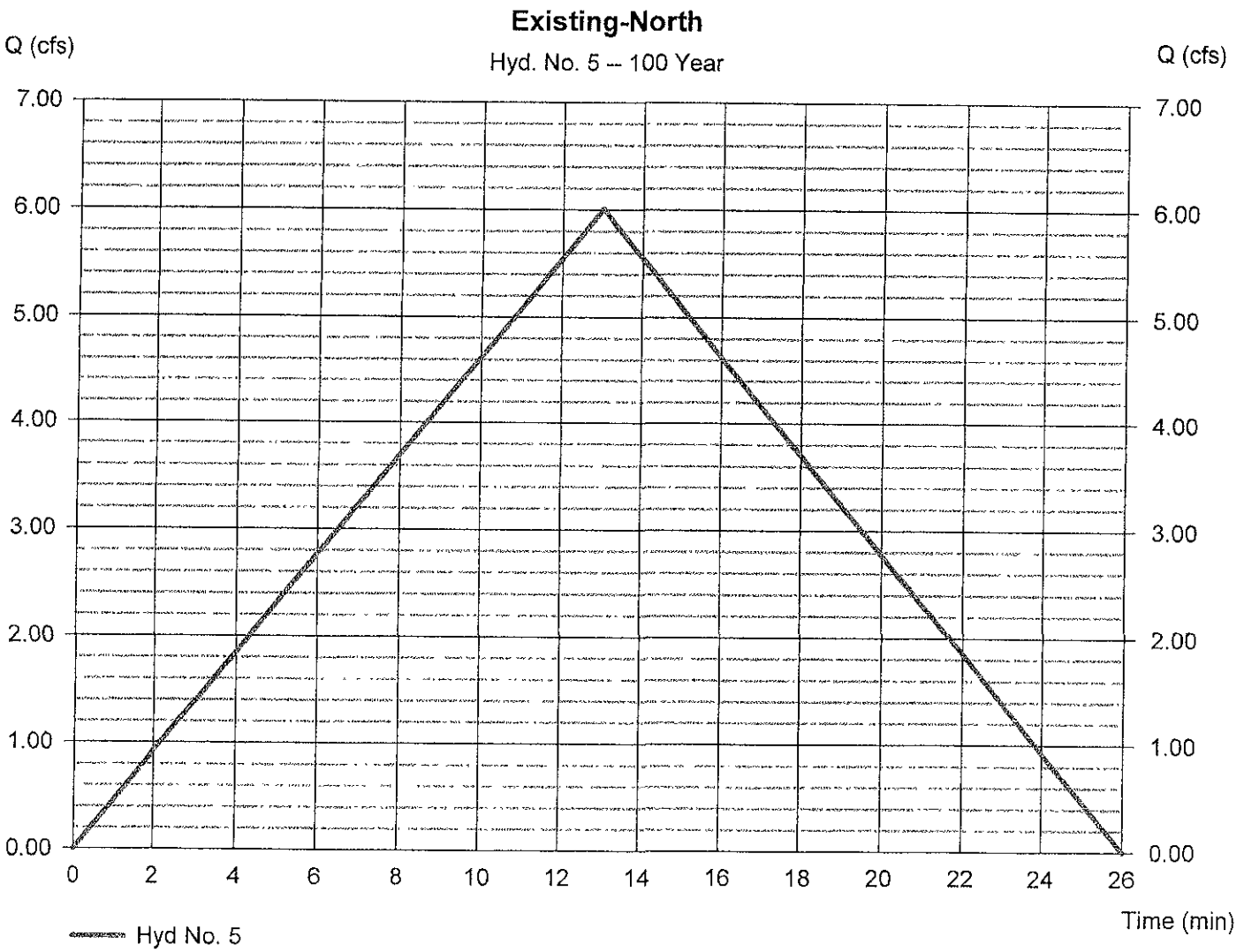
Monday, Apr 12, 2010

Hyd. No. 5

Existing-North

Hydrograph type	= Rational	Peak discharge	= 6.010 cfs
Storm frequency	= 100 yrs	Time to peak	= 13 min
Time interval	= 1 min	Hyd. volume	= 4,688 cuft
Drainage area	= 1.240 ac	Runoff coeff.	= 0.71*
Intensity	= 6.827 in/hr	Tc by TR55	= 13.00 min
IDF Curve	= RC IDF CURVE.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.903 x 0 90) + (0.337 x 0.20)] / 1.240



TR55 Tc Worksheet

Hydraflow Hydrographs by Intelisolve v9.22

Hyd. No. 5

Existing-North

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 56.0		186.0		0.0		
Two-year 24-hr precip. (in)	= 1.96		1.96		0.00		
Land slope (%)	= 1.60		0.80		0.00		
Travel Time (min)	**= 8.61**	**+**	**3.67**	**+**	**0.00**	**=**	**12.28**
Shallow Concentrated Flow							
Flow length (ft)	= 44.00		72.00		0.00		
Watercourse slope (%)	= 1.10		0.50		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 2.13		1.44		0.00		
Travel Time (min)	**= 0.34**	**+**	**0.83**	**+**	**0.00**	**=**	**1.18**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 13.00 min

Hydrograph Report

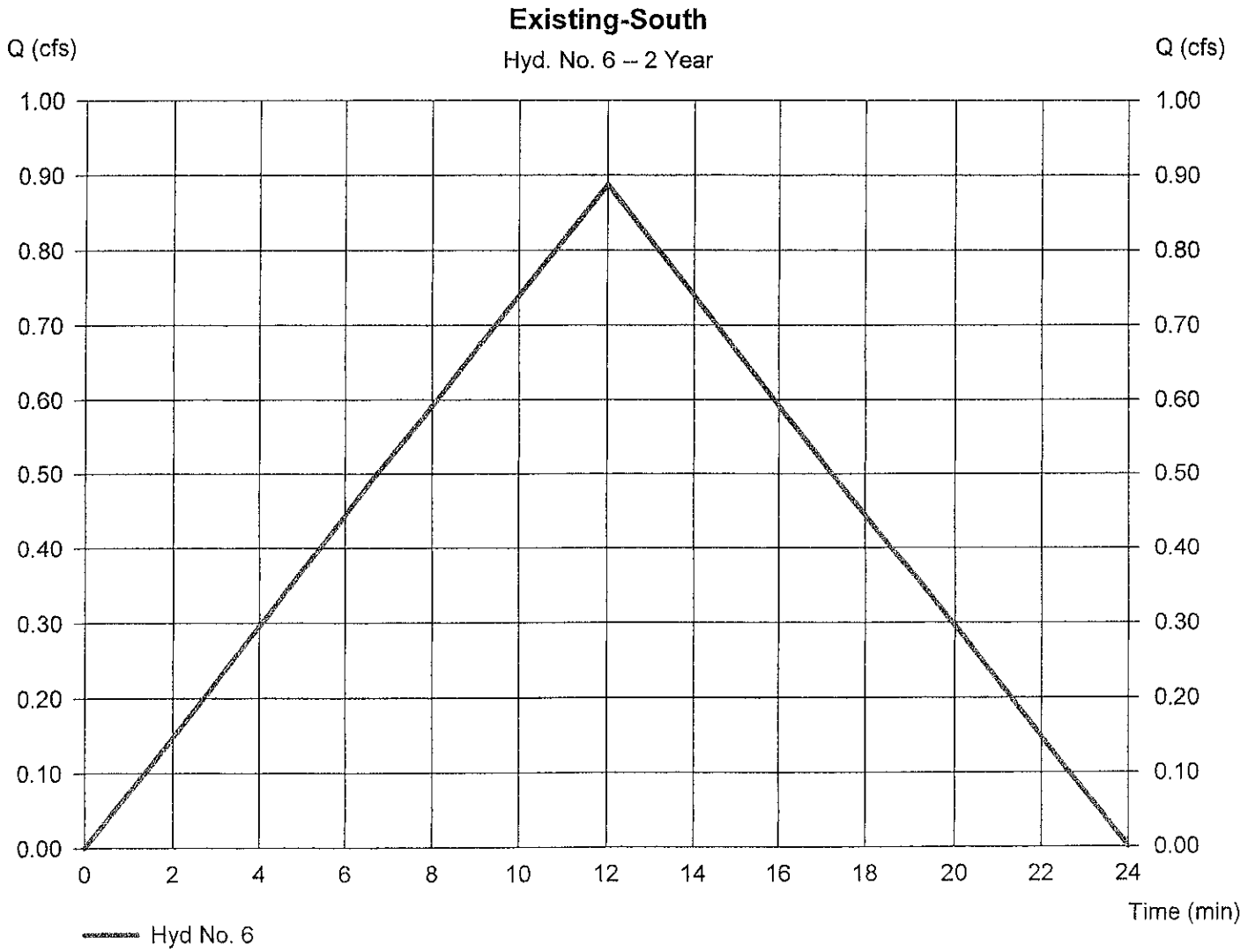
Hydraflow Hydrographs by Intelisolve v9 22 — Monday, Apr 12, 2010

Hyd. No. 6

Existing-South

Hydrograph type	= Rational	Peak discharge	= 0.887 cfs
Storm frequency	= 2 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 639 cuft
Drainage area	= 0.550 ac	Runoff coeff.	= 0.51*
Intensity	= 3.164 in/hr	Tc by TR55	= 12.00 min
IDF Curve	= RC IDF CURVE.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0 240 x 0 90) + (0.310 x 0.20)] / 0.550



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22

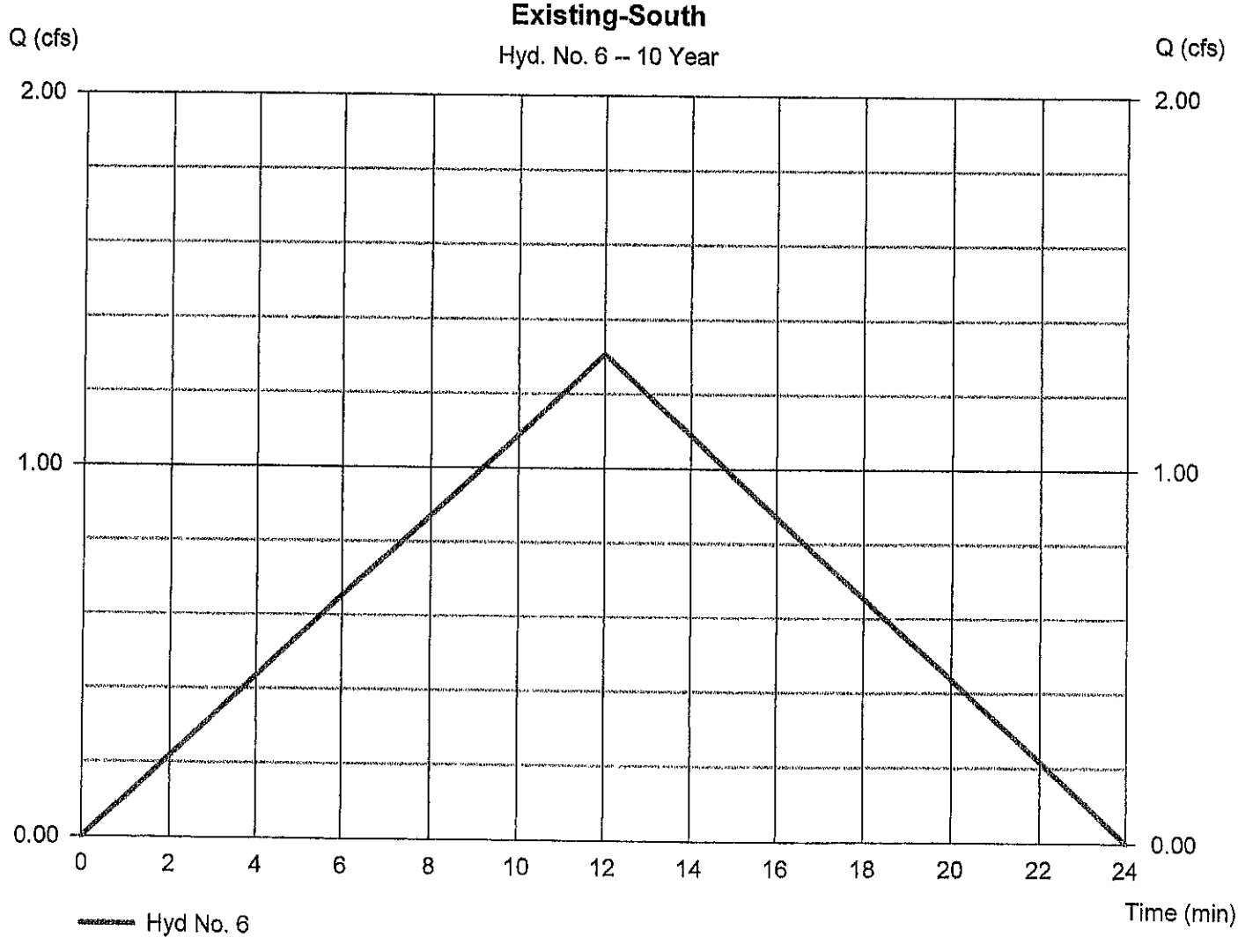
Monday, Apr 12, 2010

Hyd. No. 6

Existing-South

Hydrograph type	= Rational	Peak discharge	= 1.307 cfs
Storm frequency	= 10 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 941 cuft
Drainage area	= 0.550 ac	Runoff coeff.	= 0.51*
Intensity	= 4.658 in/hr	Tc by TR55	= 12.00 min
IDF Curve	= RC IDF CURVE.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.240 x 0.90) + (0.310 x 0.20)] / 0.550



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22

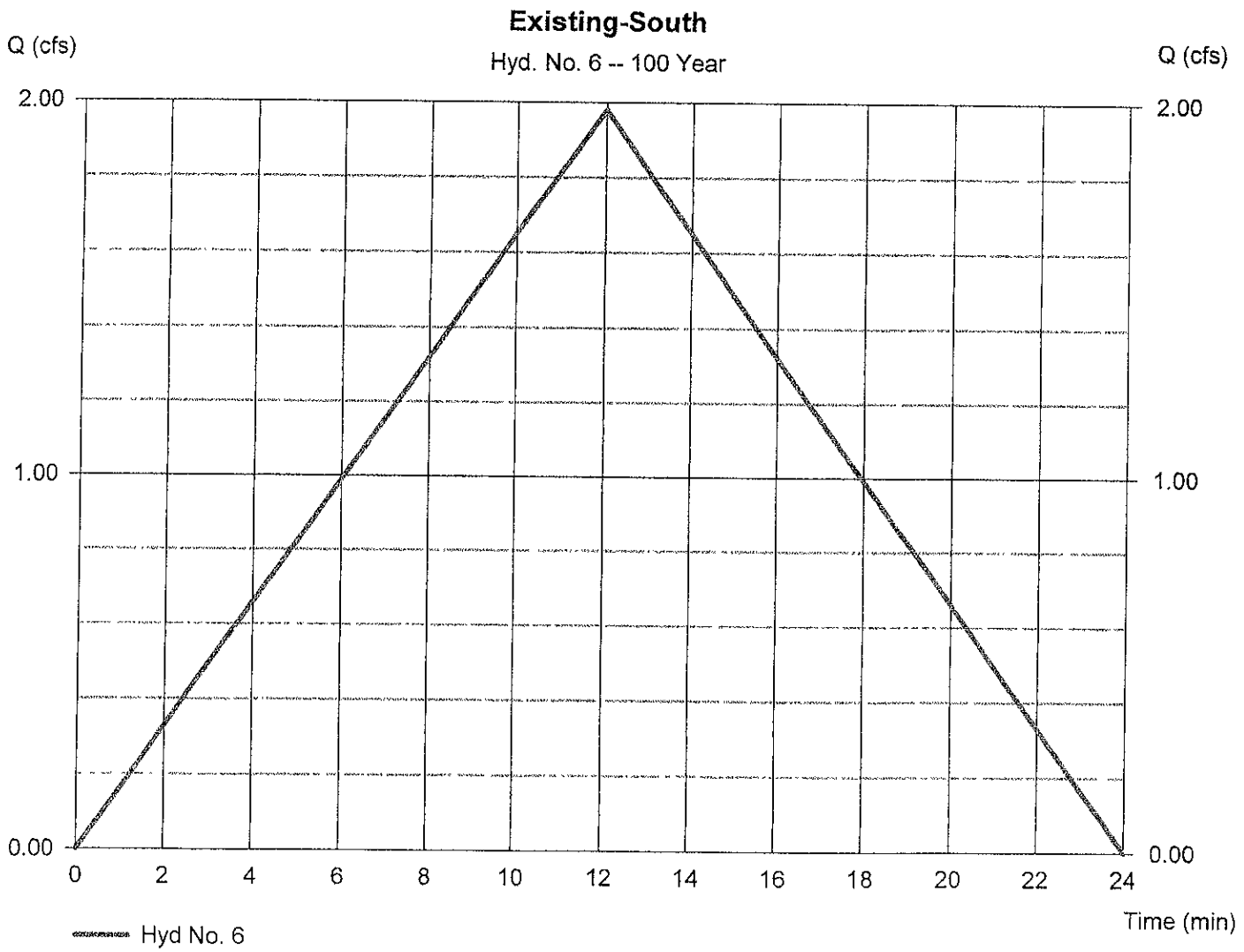
Monday, Apr 12, 2010

Hyd. No. 6

Existing-South

Hydrograph type	= Rational	Peak discharge	= 1.981 cfs
Storm frequency	= 100 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 1,426 cuft
Drainage area	= 0.550 ac	Runoff coeff.	= 0.51*
Intensity	= 7.062 in/hr	Tc by TR55	= 12.00 min
IDF Curve	= RC IDF CURVE.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.240 x 0.90) + (0.310 x 0.20)] / 0.550



TR55 Tc Worksheet

Hyd. No. 6

Existing-South

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 101.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 1.96	0.00	0.00	
Land slope (%)	= 2.50	0.00	0.00	
Travel Time (min)	**= 11.54**	**+ 0.00**	**+ 0.00**	**= 11.54**
Shallow Concentrated Flow				
Flow length (ft)	= 0.00	0.00	0.00	
Watercourse slope (%)	= 0.00	0.00	0.00	
Surface description	= Paved	Paved	Paved	
Average velocity (ft/s)	= 0.00	0.00	0.00	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc ..... 12.00 min

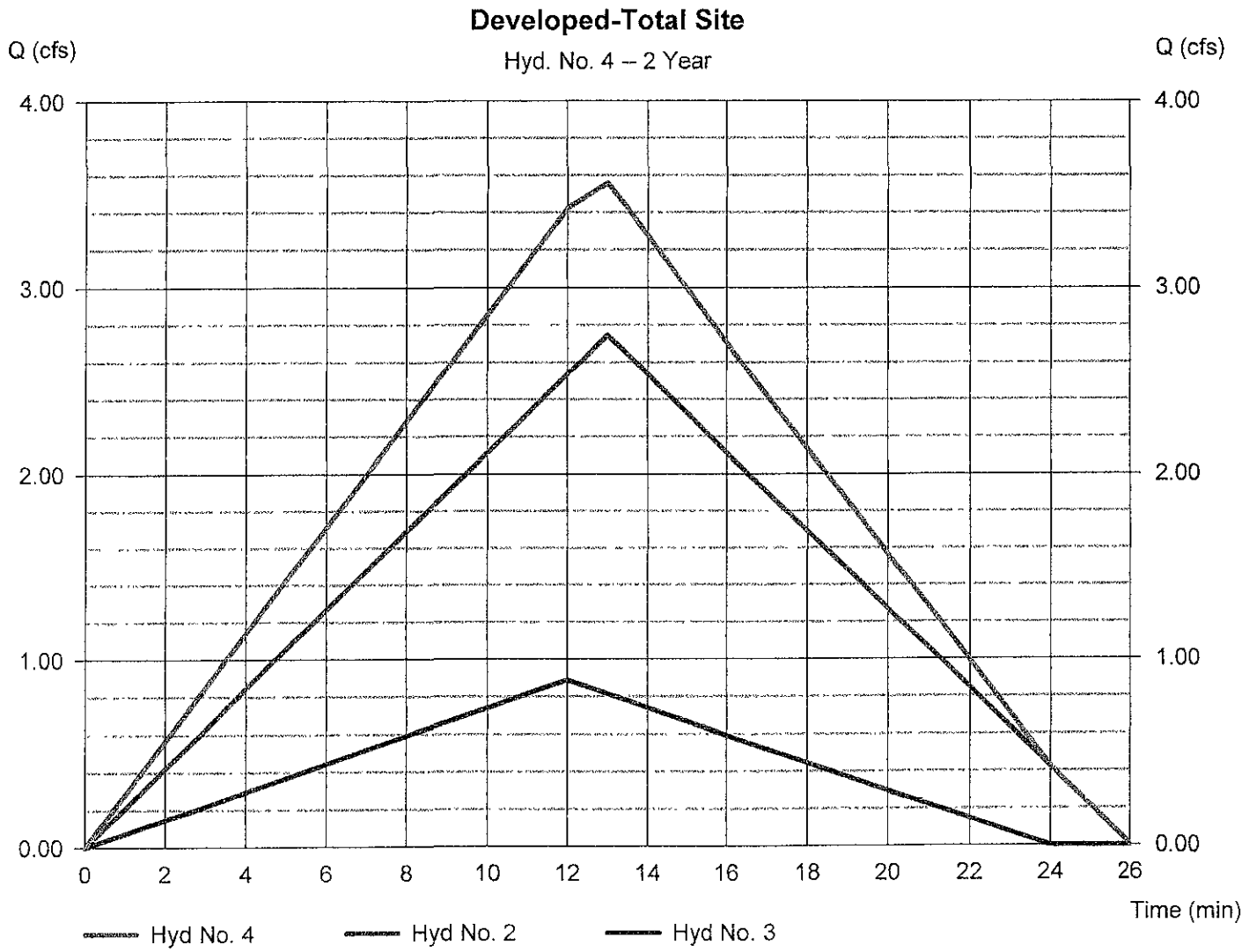
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Apr 12, 2010

Hyd. No. 4

Developed-Total Site

Hydrograph type	= Combine	Peak discharge	= 3.561 cfs
Storm frequency	= 2 yrs	Time to peak	= 13 min
Time interval	= 1 min	Hyd. volume	= 2,782 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 1.790 ac



Hydrograph Report

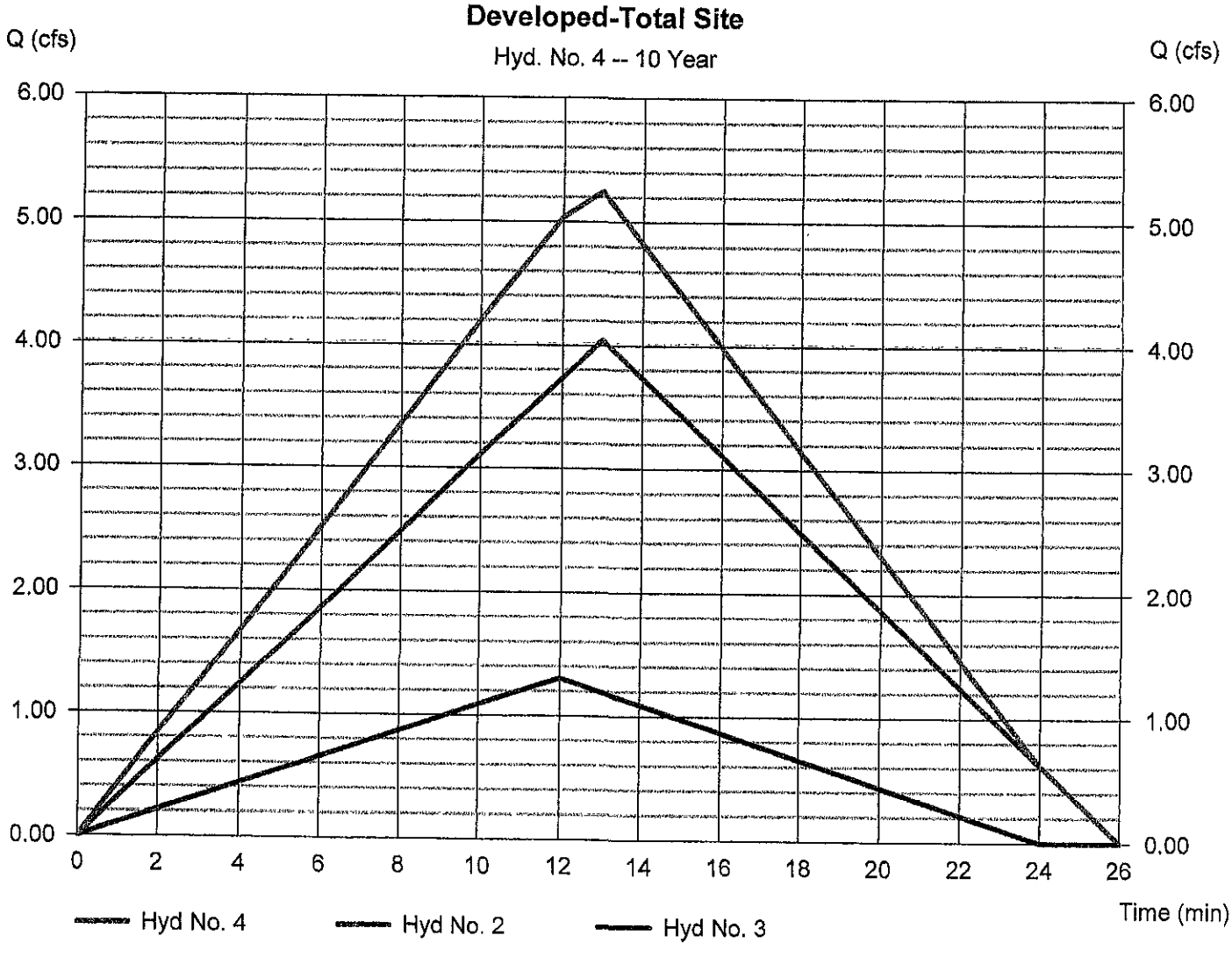
Hydraflow Hydrographs by Intelisolve v9.22

Monday, Apr 12, 2010

Hyd. No. 4

Developed-Total Site

Hydrograph type	= Combine	Peak discharge	= 5.244 cfs
Storm frequency	= 10 yrs	Time to peak	= 13 min
Time interval	= 1 min	Hyd. volume	= 4,097 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 1.790 ac



Hydrograph Report

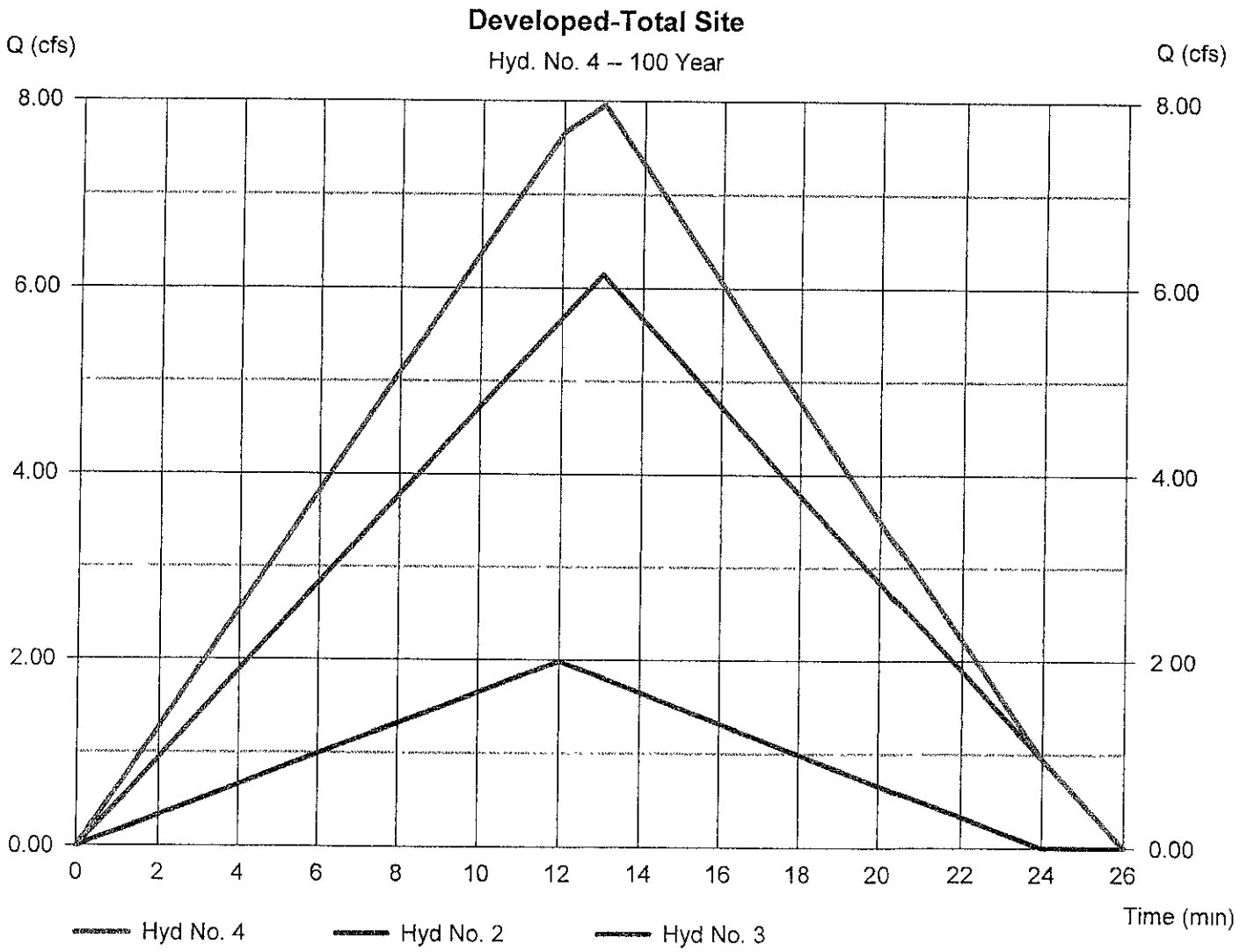
Hydraflow Hydrographs by Intelisolve v9.22

Monday, Apr 12, 2010

Hyd. No. 4

Developed-Total Site

Hydrograph type	= Combine	Peak discharge	= 7.962 cfs
Storm frequency	= 100 yrs	Time to peak	= 13 min
Time interval	= 1 min	Hyd. volume	= 6,220 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 1.790 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.22

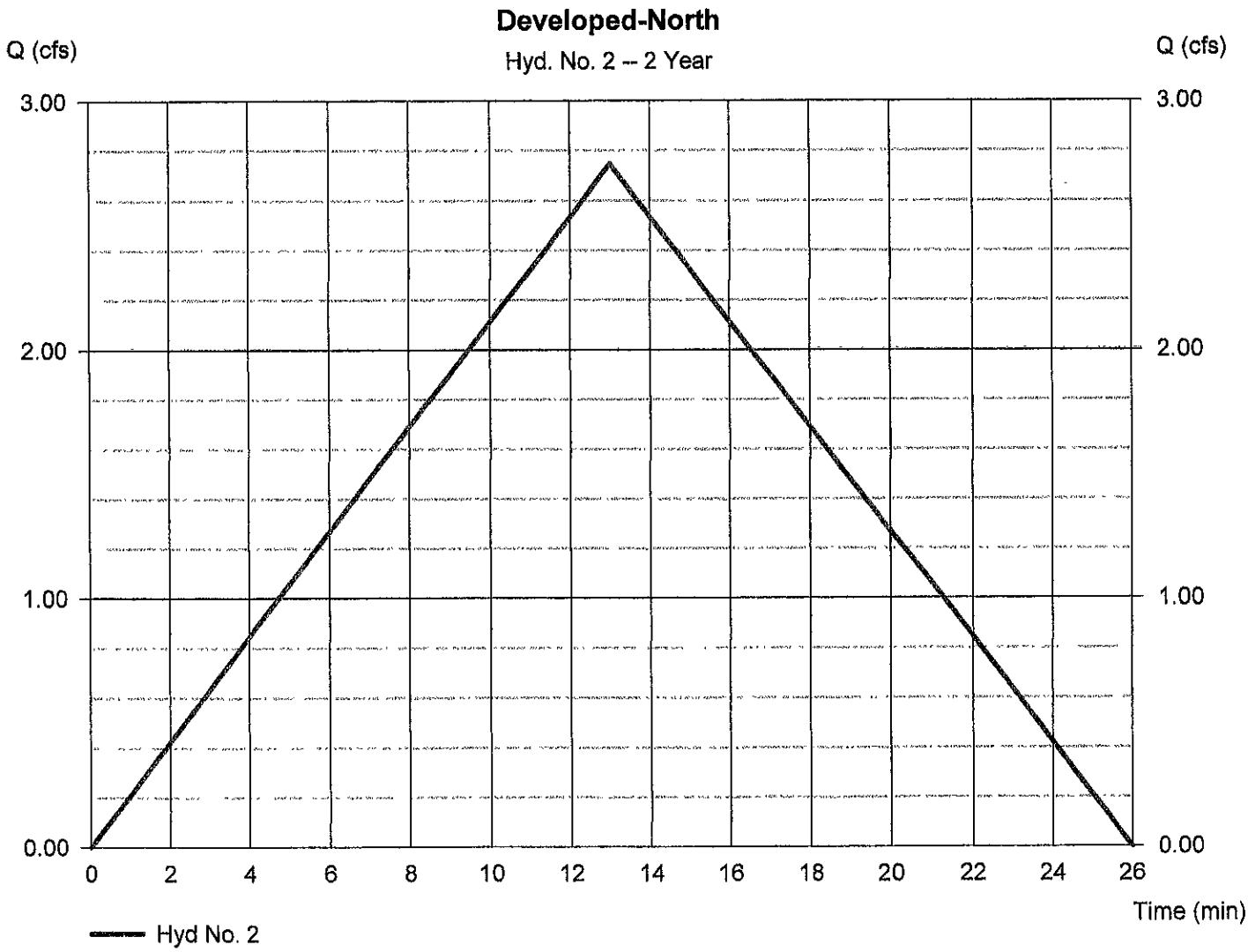
Monday, Apr 12, 2010

Hyd. No. 2

Developed-North

Hydrograph type	= Rational	Peak discharge	= 2.747 cfs
Storm frequency	= 2 yrs	Time to peak	= 13 min
Time interval	= 1 min	Hyd. volume	= 2,142 cuft
Drainage area	= 1.250 ac	Runoff coeff.	= 0.72*
Intensity	= 3.052 in/hr	Tc by TR55	= 13.00 min
IDF Curve	= RC IDF CURVE.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.922 x 0.90) + (0.323 x 0.20)] / 1.250



Hydrograph Report

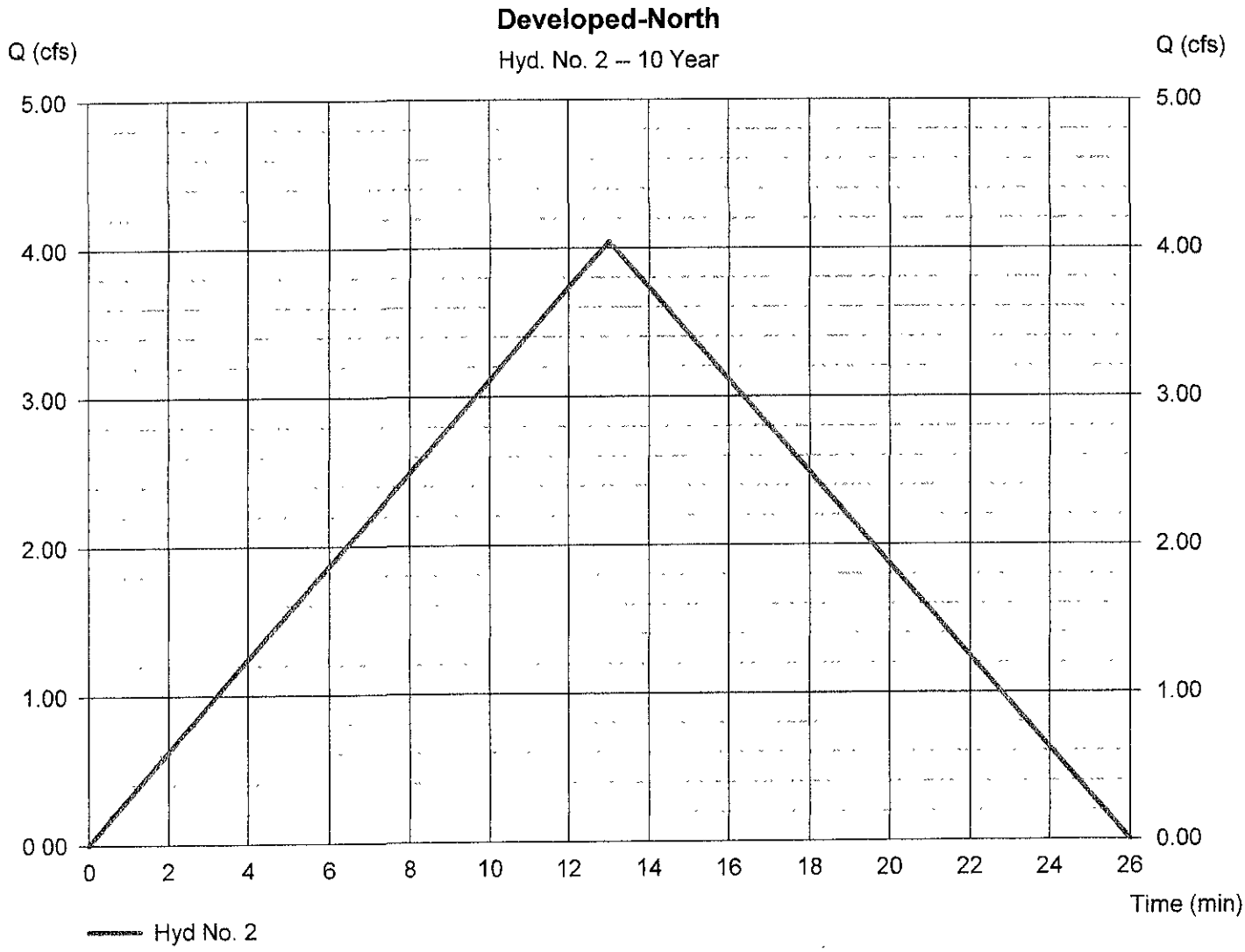
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Apr 12, 2010

Hyd. No. 2

Developed-North

Hydrograph type	= Rational	Peak discharge	= 4.045 cfs
Storm frequency	= 10 yrs	Time to peak	= 13 min
Time interval	= 1 min	Hyd. volume	= 3,155 cuft
Drainage area	= 1.250 ac	Runoff coeff.	= 0.72*
Intensity	= 4.494 in/hr	Tc by TR55	= 13.00 min
IDF Curve	= RC IDF CURVE.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.922 x 0.90) + (0 323 x 0.20)] / 1 250



Hydrograph Report

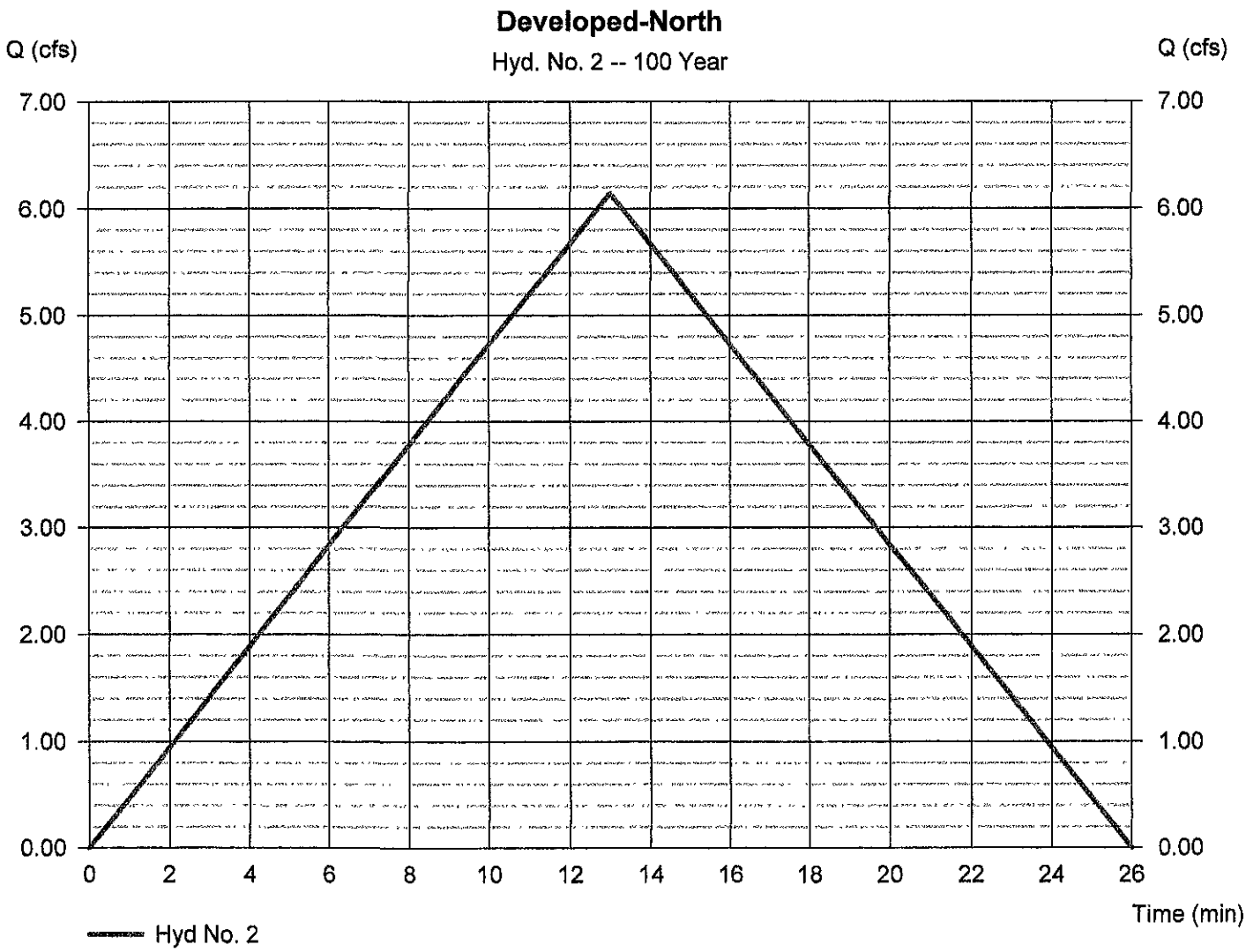
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Apr 12, 2010

Hyd. No. 2

Developed-North

Hydrograph type	= Rational	Peak discharge	= 6.144 cfs
Storm frequency	= 100 yrs	Time to peak	= 13 min
Time interval	= 1 min	Hyd. volume	= 4,792 cuft
Drainage area	= 1.250 ac	Runoff coeff.	= 0.72*
Intensity	= 6.827 in/hr	Tc by TR55	= 13.00 min
IDF Curve	= RC IDF CURVE.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.922 x 0.90) + (0.323 x 0.20)] / 1.250



TR55 Tc Worksheet

Hydraflow Hydrographs by Intelisolve v9.22

Hyd. No. 2

Developed-North

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 56.0		186.0		0.0		
Two-year 24-hr precip. (in)	= 1.96		1.96		0.00		
Land slope (%)	= 1.60		0.80		0.00		
Travel Time (min)	**= 8.61**	**+**	**3.67**	**+**	**0.00**	**=**	**12.28**
Shallow Concentrated Flow							
Flow length (ft)	= 44.00		72.00		0.00		
Watercourse slope (%)	= 1.10		0.50		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 2.13		1.44		0.00		
Travel Time (min)	**= 0.34**	**+**	**0.83**	**+**	**0.00**	**=**	**1.18**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 13.00 min

Hydrograph Report

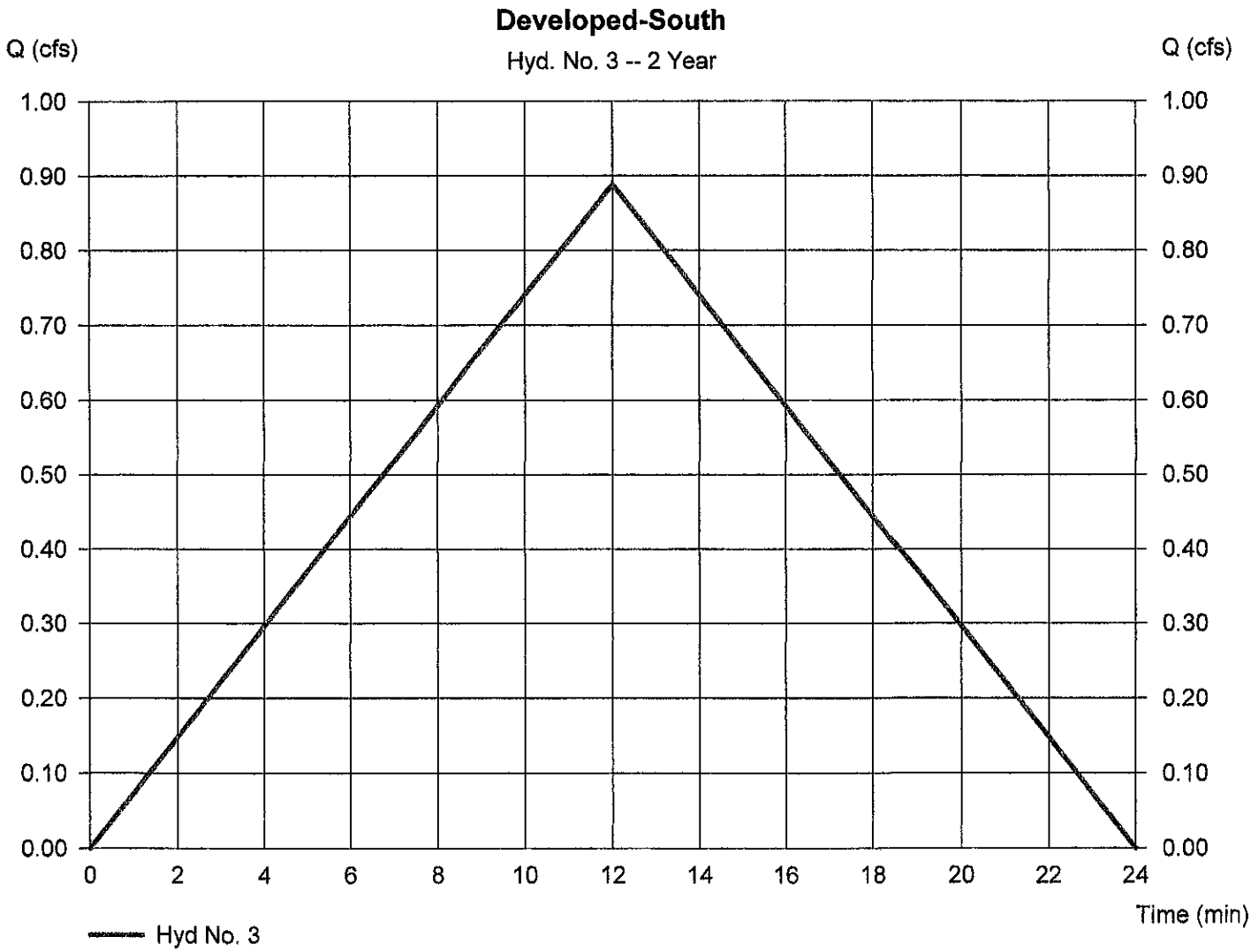
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Apr 12, 2010

Hyd. No. 3

Developed-South

Hydrograph type	= Rational	Peak discharge	= 0.888 cfs
Storm frequency	= 2 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 640 cuft
Drainage area	= 0.540 ac	Runoff coeff.	= 0.52*
Intensity	= 3.164 in/hr	Tc by TR55	= 12.00 min
IDF Curve	= RC IDF CURVE.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.247 x 0.90) + (0.295 x 0.20)] / 0.540



10EX039

Hydrograph Report

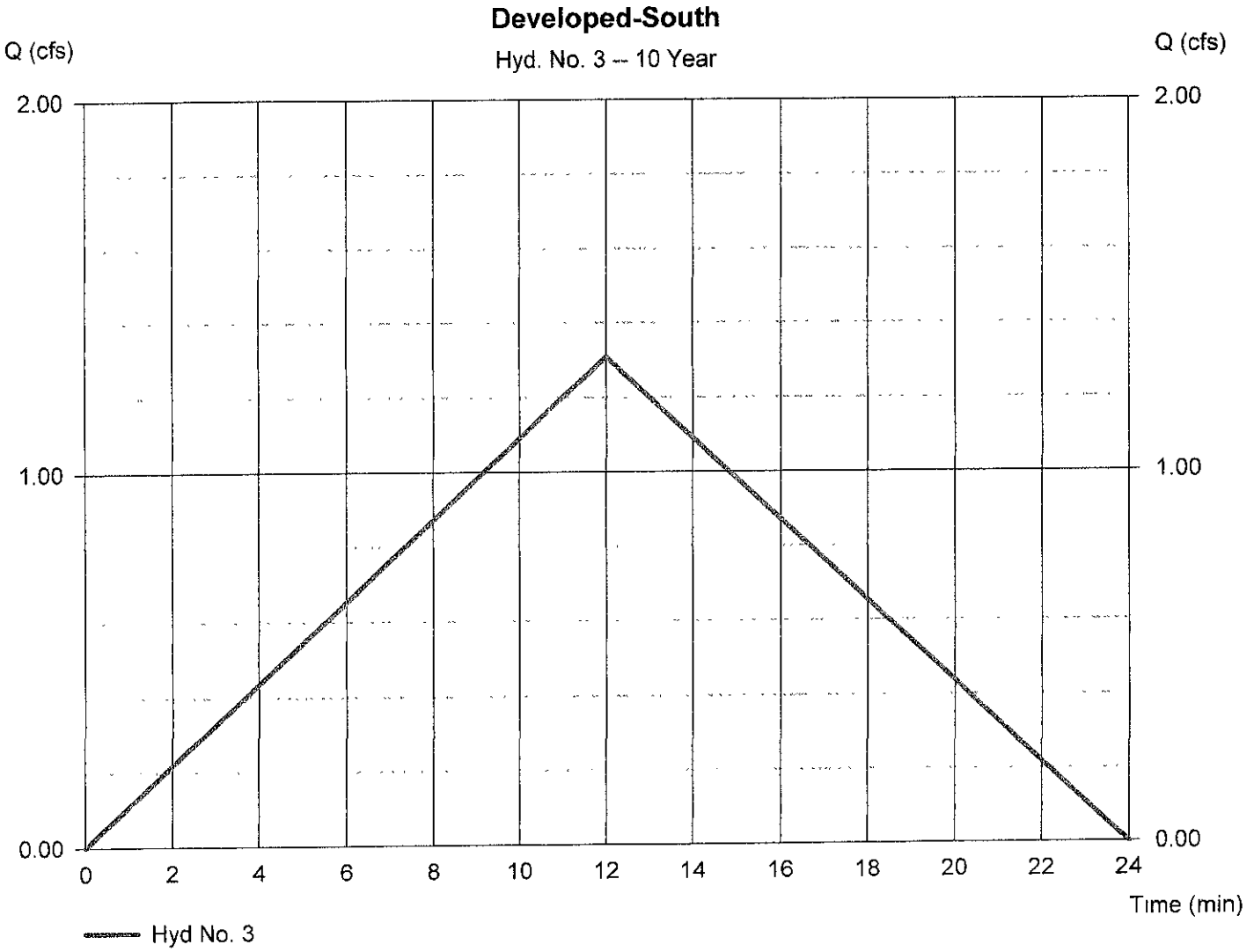
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Apr 12, 2010

Hyd. No. 3

Developed-South

Hydrograph type	= Rational	Peak discharge	= 1.308 cfs
Storm frequency	= 10 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 942 cuft
Drainage area	= 0.540 ac	Runoff coeff.	= 0.52*
Intensity	= 4.658 in/hr	Tc by TR55	= 12.00 min
IDF Curve	= RC IDF CURVE.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0 247 x 0.90) + (0.295 x 0.20)] / 0 540



Hydrograph Report

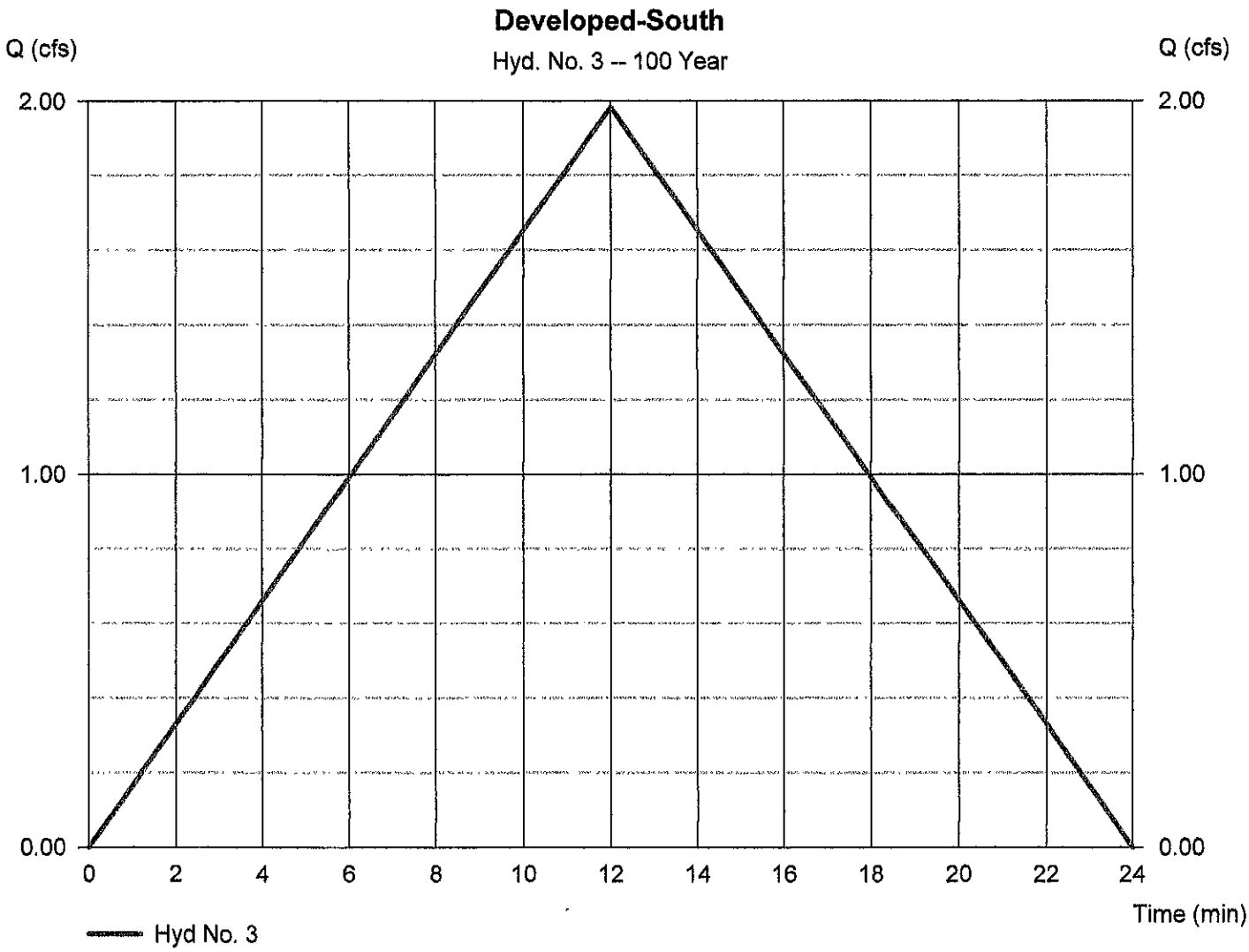
Hydraflow Hydrographs by Intelisolve v9.22 — Monday, Apr 12, 2010

Hyd. No. 3

Developed-South

Hydrograph type	= Rational	Peak discharge	= 1.983 cfs
Storm frequency	= 100 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 1,428 cuft
Drainage area	= 0.540 ac	Runoff coeff.	= 0.52*
Intensity	= 7.062 in/hr	Tc by TR55	= 12.00 min
IDF Curve	= RC IDF CURVE.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.247 x 0.90) + (0.295 x 0.20)] / 0.540



TR55 Tc Worksheet

Hydraflow Hydrographs by Intelisolve v9.22

Hyd. No. 3

Developed-South

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 101.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 1.96		0.00		0.00		
Land slope (%)	= 2.50		0.00		0.00		
Travel Time (min)	**= 11.54**	**+**	**0.00**	**+**	**0.00**	**=**	**11.54**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 12.00 min