PRIORITY PROJECT

PRELIMINARY HYDROLOGY STUDY

FOR:
NORTH COUNTY ENVIRONMENTAL RESOURCES
25568 MESA ROCK ROAD
COUNTY OF SAN DIEGO, CA
APN 187-100-23,31,33,35,37,38

PREPARED FOR:
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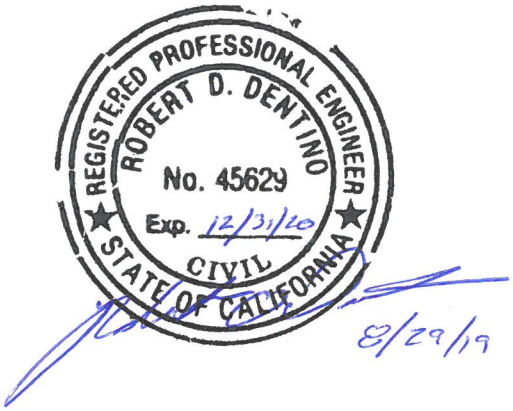
Project No: 12-039



DATE PREPARED:
December 31, 2012

DATE REVISED:
August 05, 2019

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1.0 PROJECT DESCRIPTION

1.1 Project Purpose

The purpose of this project is to receive approval from the County of San Diego on a Preliminary Grading Plan and Tentative Plot Plan to construct an improved private road, several mass graded pads, and a recycling facility on a combined 139.54 acre site (17.74 acres of disturbance).

1.2 Project Proposed Facilities

The project site is located in the County of San Diego, south of the Deer Springs Road exit off of Interstate 15 on Mesa Rock Road. The property previously was used (in the 1940's and 1950's) as the quarry pit and rock operations for the Interstate 15 construction. A dirt road was cut out of the existing, steeply sloped hillside and connected the frontage road to the quarry pit/pad area. The proposed facilities (a recycling building with a parking lot, a water storage tank, on site septic, new water service, new dry utilities, etc.) will realign the private road slightly to meet County Road Standards and to allow truck movements, and the previously graded area will be regraded to have a loop road serving several small auxiliary pads in addition to one large mass graded pad that will house the recycling center.

Normal uses of such a development will generate storm water runoff with the potential to carry pollutants to off-site tributaries. Linear configured bioretention swales are planned to be incorporated throughout the site to treat and detain runoff from impervious and landscaped areas. Detention basins are proposed to be molded out of the existing topography with newly designed and installed flow control risers to regulate 100-year flows to predeveloped rates.

- The proposed project would not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site. No significant alteration of any stream or river will occur on this site due to grading operations. All defined drainage channels are due to erosive effects of high velocity runoff from the uphill slopes. The development of the site will help mitigate further erosion downstream.

- The proposed project does not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site. No significant alteration of drainage patterns will occur on this project. All defined drainage channels are due to erosive effects of high velocity runoff from the uphill slopes. The development of the site will help mitigate further erosion downstream and all discharge is back to the existing POCs and discharge points.

- The proposed project does not create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems. The

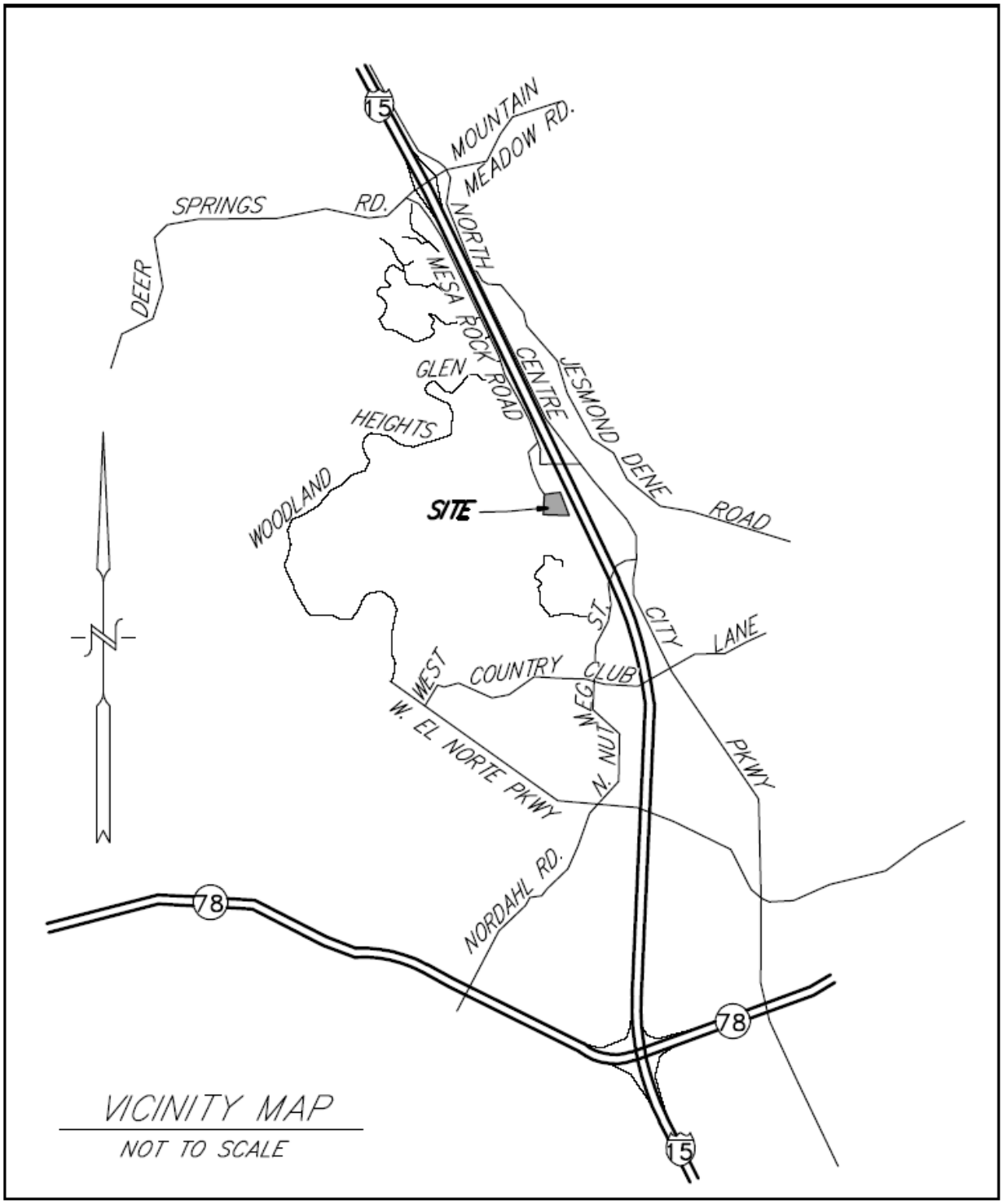
flows from the project leave the site at less than predeveloped rates per the mitigated flow rates shown.

- The proposed project does not place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map, including County Floodplain Maps. No housing is proposed and no FIRM identified flood hazard areas are located on the parcel.

- The proposed project does not place structures within a 100-year flood hazard area which would impede or redirect flood flows. No FIRM identified flood hazard areas are located on the parcel.

- The proposed project does not expose people or structures to a significant risk of loss, injury or death involving flooding as a result of the failure of a levee or dam. No levees or dams are proposed and all runoff is being mitigated in properly designed flow control basins with redundancies. This will be noted in the conclusion.

2.0 VICINITY MAP



3.0 SITE MAP

Please see Attachment A – Site map

4.0 DESCRIPTION OF WATERSHED

4.1 Existing Conditions Topography

As stated above, the property previously was used as the quarry pit and rock operations for the Interstate 15 construction. A dirt road was cut out of the existing, steeply sloped hillside and connected the frontage road to the quarry pit/pad area. The quarry pit/pad area was then left as-is and was allowed to regenerate growth of vegetation in some areas and the pad has sat, largely unused until recently when it was subjected to unauthorized grading and cited by the Planning and Development Services Department with a Grading Violation. The grading occurred within the previously graded quarry pit/pad area and caused a disturbance to the existing vegetation within the area and also extended the boundaries of where the clearing had previously been.

The topography of the site is generally quite steep to the west on up to the ridgeline of the hills that separate the Interstate 15 corridor from Twin Oaks Valley. As the slopes progress to the east towards the freeway, the slopes flatten out some and create several localized depressions that actually, in turn, make up the six individual drainage subbasins for the project (this will be further discussed below). The site is bordered to the east by Mesa Rock Road (Frontage Road) in the northeast corner, and Interstate 15 along the remainder of the eastern boundary. To the south is a parcel that is zoned residential, but is "separated" from the project by steep topography and a ridgeline roughly 500 feet south of the proposed grading operations. No portion of the developed residential parcel contributes flows to this project.

4.2 Existing Conditions + Project Conditions Topography

The preliminary grading plans show a large mass graded pad with a loop road surrounding it and four auxiliary pads surrounding the loop road itself. The area of mass grading and loop road along with the slopes to daylight encompasses the entire disturbed footprint from the previous site use and the illegal grading. The private road out to Mesa Rock has been realigned slightly within the preliminary grading plans to be up to date with County of San Diego Private Road Standards and to allow for larger trucks to perform standard truck turning movements.

The main graded pad and the auxiliary pads are all sloped at 2% except the portion of the main pad that will be developed with the proposed recycling facility (this are will be precise graded to drain to water quality control features and into the storm drain system). The loop road and the private access road is designed to match existing topography as close as possible and is mostly just a swath of grading through the existing slope. The road will have cuts and fills with brow ditches to collect and divert existing flows around the improvements. Any and all storm water generated by the proposed road and the uphill cut slopes that drain onto the road will be routed through water quality features (linear swale

configured bioretention systems), collected, and further routed to detention basins to then release the runoff at predeveloped rates.

4.3 Hydrologic Unit Contribution

The project site is within the Carlsbad Hydrologic Unit, Escondido Creek HA, Escondido HSA (904.62).

Six different collection points existing for this project along the eastern property line. All of these are located within localized depressions (in some cases the topography is quite deep and conducive to utilizing the existing "basin" as the detention pond itself) and contain existing storm drainage facilities that route the runoff underneath Interstate 15 to the east and ultimately into Escondido Creek.

Please see Attachment C – Watershed Map.

5.0 METHODOLOGY

This study complies with the 2003 San Diego Hydrology Manual. The rational method as presented in Section 3 of that manual and workbook examples were followed.

5.1 Hydrology Software

The "Rational Hydrology Method, San Diego County (2003 Manual)" module of the CIVILCADD/CIVIL DESIGN Engineering software version 7.4 is used in this study. This software was also used to developed hydrographs from the rational method results. This procedure also complies with the 2003 San Diego Hydrology Manual as presented in Section 6.

5.2 Routing Software

As part of the Hydromodification design for this project, continuous simulation routing through the proposed bioretention facilities has been performed using 58 years of rainfall data as part of the EPA Storm Water Management Model 5.0 (SWMM) computer software. While this does not take into account a full sampling of 100-year return frequency peak flows, it does generate a substantially complete picture of how these systems will function in detaining post-developed runoff at predeveloped levels for the 2-year and the 10-year storms. However, these systems are not intended to provide the storage volumes necessary to detain the 100-year storm flows from the postdeveloped site. Detention ponds for each of the individual subbasins delineated as part of this project will be used to ensure that outflows from the site will be discharged at predeveloped levels.

As part of this report, routing of the postdeveloped 100-year flows for this project (postdeveloped versus predeveloped) was performed to confirm that all new flow control facilities used in combination with the detention ponds (four of the six subbasin discharge locations are located within natural depressions and can use the contours to create "engineered ponds") located on site will indeed release the runoff at the previously anticipated levels. Hydraflow Hydrographs 2004 by Intelisolve was used in this step. Data from the hydrology software was entered

into the Rick Engineering "RatHydro" program for all six subbasins to develop a time vs. peaks graph to develop a hydrograph for the postdeveloped 100-year flows. The hydrograph was then manually entered into this software and routed into each detention basin modeled from the existing contours (Subbasins 200, 300, 400, and 500) or designed and graded out (Subbasin 100 and 600) to show how much storage was required to detain the peak post-developed flows while allowing for them to be released at below the 100-year pre-developed rates.

5.3 Hydraulics Software

Culverts conveying the stormwater from the upstream side of the development to the downstream side (in the case of the crossings under the private road) and the culverts that capture the runoff from upstream and route it into the on-site private storm drain system were analyzed as part of this report. Hydroflow Storm Sewers 2005 by Intellisolve was the software chosen to look at the hydraulics within the lines and to generate a hydraulic grade line at the entrance to the culverts and a velocity at the downstream outfall (for future energy dissipation sizing). The results from this analysis can be found later in this report.

All downstream effects from the modified hydrologic conditions on site will be mitigated by the use of on-site treatment BMPs and storage and detention of the stormwater runoff (where necessary) to pre-developed levels. A check will be performed on all existing downstream facilities at the time of final engineering to confirm that the released predeveloped rates can be handled, within reason, by the existing facilities.

6.0 CALCULATIONS

The first calculation performed at this stage is the storm volumes generated by the total basin area based on the overall C-factor and the 100-year, 6-hour storm rainfall. This volume will assist in determining the overall detention requirements.

The second calculation performed at this stage is the calculation on determining the 100-year frequency storm's peak flows. These numbers will be used to size the proposed storm drain pipes and to check if the existing storm drain facilities are adequate and to design and size the detention basins and flow control facilities.

6.1 Determine the Watershed that affects the project

Please see the "Watershed Map" in Attachment C

6.2 Calculate Runoff Coefficient

The whole project site is predominantly in type "C" soil. Therefore, we are going to use all coefficients for that type of soil. As stated in section 3.1.2 of the San Diego Hydrology Manual on the second paragraph, "impervious percentage (% Impervious) as given in Table 3-1 for any area, shall govern the selected value for C."

For all areas to remain pervious post-construction a "c" factor of c=0.30 is used. The remainder of the site's "c" factors will be based on the percentage of

impervious within that subarea and the appropriate NRCS element that relates to that percentage of impervious (e.g. 50% impervious = Medium Density Residential, 14.5 DU/A or less) will be applied.

6.3 Calculate Storm Volumes

The storm event volume is calculated using Equation 6-1 as shown in the County of San Diego Hydrology Manual section 6.2.

The equation is $VOL=CP_6A$

Where VOL = volume of runoff =volume of hydrograph (acre-inches)

P_6 = 6-hour rainfall (inches)

A = area of each of the six subbasins (acres)

C = calculated weighted runoff coefficient based on hydrologic runs

Compare the predeveloped volumes with the postdeveloped volumes to determine the volume required for detention. The volumes for all six drainage basins on site are as follows:

Basin 1
VOL(predeveloped) = 0.300x3.5x4.72 acres = 4.956 acre-inches
VOL(postdeveloped) = 0.356x3.5x4.87 acres = 6.068 acre-inches
This translates into a difference of 4,037 cubic feet of runoff that is required to be detained.

Basin 2
VOL(predeveloped) = 0.300x3.5x7.47 acres = 7.844 acre-inches
VOL(postdeveloped) = 0.322x3.5x7.57 acres = 8.531 acre-inches
This translates into a difference of 2,494 cubic feet of runoff that is required to be detained.

Basin 3
VOL(predeveloped) = 0.300x3.5x29.14 acres = 30.597 acre-inches
VOL(postdeveloped) = 0.309x3.5x29.13 acres = 31.504 acre-inches
This translates into a difference of 3,292 cubic feet of runoff that is required to be detained.

Basin 4
VOL(predeveloped) = 0.300x3.5x14.86 acres = 15.603 acre-inches
VOL(postdeveloped) = 0.304x3.5x14.14 acres = 15.045 acre-inches
NO DETENTION VOLUME REQUIRED (CHECK PEAK RATES)

Basin 5
VOL(predeveloped) = 0.300x3.5x25.97 acres = 27.269 acre-inches
VOL(postdeveloped) = 0.375x3.5x24.44 acres = 32.078 acre-inches
This translates into a difference of 17,457 cubic feet of runoff that is required to be detained.

Basin 6
VOL(predeveloped) = 0.300x3.5x 17.87 acres = 18.764 acre-inches
VOL(postdeveloped) = 0.474x3.5x19.61 acres = 32.533 acre-inches
This translates into a difference of 49,981 cubic feet of runoff that is required to be detained.

As further discussed in the Preliminary Major Storm Water Management Plan (SWMP) for this project, the development includes BMPs for Hydromodification flow mitigation. These systems also incorporate volumes for detention into them and the overall detention volume provided on the site will be substantially conservative to the actual amount required.

6.4 Calculate Storm Flows using the Rational Method

The 100-year pre- and post-developed storm flows were calculated for this project to be as follows:

Sub-Basin Number	Predeveloped				Postdeveloped				Mitigated
	Area (Acres)	C-Factor	Tc (Min)	100-Year Flowrate (cfs)	Area (Acres)	C-Factor	Tc (Min)	100-Year Flowrate (cfs)	100-Year Flowrate (cfs)
1	4.72	0.3	7.1	10.4	4.87	0.356	6.67	13.3	7.54
2	7.47	0.3	6.59	17.3	7.57	0.322	6.6	18.8	16.43
3	29.14	0.3	8.78	56.1	29.13	0.309	8.75	57.9	32.48
4	14.86	0.3	9.54	27.1	14.14	0.304	9.88	26.1	No mit Necessary
5	25.97	0.3	8.68	50.3	24.46	0.375	7.92	62.8	42.8
6	17.87	0.3	7.57	37.8	19.49	0.499	8.55	63.43	36.74

Please see the "Pre Developed 100-year Hydrology Calculations" in Attachment D and the "Post Developed 100-year Hydrology Calculations" in Attachment E for the flowrates calculated for each basin.

6.5 Design / Analyze Proposed Storm Drain Facilities

In this stage of the project, we will not get into detailed calculations for the existing storm drain systems downstream from the property, as well as the proposed private storm drain system routing stormwater throughout the project. However, culverts collecting and conveying runoff from the upstream portion of the project underneath the private road and/or into the private storm drain system were analyzed to generate data such as velocities and HGLs to confirm there will

be no overtopping of facilities and washing out of the roads and slopes. The data is as follows:

Culvert Identification (See Node Map)	Collection Area (Acres)	Flowrate (CFS)	n	Pipe Length (Feet)	Slope (%)	Pipe Diameter (Inches)	W.S. Elev Above Entrance Invert (Feet)	Velocity (FPS)
205-208	5.46	15.2	0.013	88	50	18	1.35	8.8
304-307	23.33	50.0	0.013	118	34.8	24	4.37	15.9
Blank-307	0.68	1.2	0.013	128	35.2	12	0.46	3.3
406-407	8.46	15.6	0.013	5	40.0	18	1.42	9.0
504-505	6.27	14.5	0.013	75	1.3	18	2.00	8.2
522-508	4.39	10.5	0.013	28	3.6	18	2.13	5.9
532-533	3.63	8.9	0.013	55	56.4	18	1.14	6.2
602-603	3.93	9.8	0.013	25	72	18	1.2	21.9

Complete storm drain system sizing will be shown on the Hydrology / Hydraulics study that will be part of the rough grading plan permit process.

7.0 MITIGATION MEASURES

A Preliminary Major Storm Water Management Plan (SWQMP) been prepared for this project to discuss treatment and flow control of the lower flows. This Hydrology study analyzes the higher 100-year flows.

7.1 Mitigate Increase Runoff

As discussed above, the increase in runoff from Basins 1, 2, 3, 5, and 6 will be mitigated by utilizing the existing topography to create a detention basin (Basins 1 and 6 require grading to create the volume needed) and installing newly engineered flow control devices to release rates at the predeveloped levels. The increased volumes shown in section 6.4 are mitigated by these engineered detention basins as calculated in Attachment G of this report.

7.2 Check Capacity of Storm Drain Facilities

Due to the mitigated release rates of the postdeveloped flows to predeveloped levels, the construction of this project will not negatively impact downstream storm drainage facilities. On site culverts have been shown to be able to convey the runoff from the upstream "channels" either underneath the roads or incorporate those flows into the on-site storm drainage system. This on site private system will be further analyzed for capacity and sizing at the time of final engineering.

8.0 SUMMARY

As detailed in this report, the hydrology and the hydraulics of the proposed project will not negatively impact the surrounding environment. The existing terrain within the project development boundaries form into six individual subbasins with six individual discharge points. As shown in the data table in Section 6.4, the proposed development will not significantly alter the sizes of the existing drainage basins and the existing drainage courses and "channels" will be maintained by use storm drainage facilities to either bypass the private on-site storm drainage system entirely or, once incorporated within the on-site system, routed to the original point of discharge. The resulting 100-year flowrates for the proposed drainage basins, as discussed in Section 6, will be collected at the point of natural discharge and detained, where necessary (Subbasin 400 does not require detention since the postdeveloped flows are less than the predeveloped), in order to mitigate any increase in flows. Therefore, all runoff discharging from the site will not negatively impact any existing off-site drainage facilities.

On site facilities are sized to accept the increase in flows, and additionally, the design of the project assumes that all storm water runoff from the 100-year storm bypasses the proposed improvements or is collected by storm drainage inlets and is routed immediately through treatment components and discharged to each drainage basin's outfall location. Once further design detailing is performed, all of these facilities will be shown to convey the 100-year flows without overtopping slopes and further mitigation will not be required.

Lastly, this project does not sit within a 100-year flood hazard zone as mapped on the federal Flood Insurance Rate maps for this area.

- The proposed project would not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site. No significant alteration of any stream or river will occur on this site due to grading operations. All defined drainage channels are due to erosive effects of high velocity runoff from the uphill slopes. The development of the site will help mitigate further erosion downstream.

- The proposed project does not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site. No significant alteration of drainage patterns will occur on this project. All defined drainage channels are due to erosive effects of high velocity runoff from the uphill slopes. The development of the site will help mitigate further erosion downstream and all discharge is back to the existing POCs and discharge points.

- The proposed project does not create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems. The

flows from the project leave the site at less than predeveloped rates per the mitigated flow rates shown.

- The proposed project does not place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map, including County Floodplain Maps. No housing is proposed and no FIRM identified flood hazard areas are located on the parcel.

- The proposed project does not place structures within a 100-year flood hazard area which would impede or redirect flood flows. No FIRM identified flood hazard areas are located on the parcel.

- The proposed project does not expose people or structures to a significant risk of loss, injury or death involving flooding as a result of the failure of a levee or dam. No levees or dams are proposed and all runoff is being mitigated in properly designed flow control basins with redundancies. This will be noted in the conclusion.

9.0 REFERENCES

County of San Diego, Department of Public Works, Flood Control Section, June2003 San Diego County Hydrology Manual

County of San Diego, California, BMP Design Manual, 2019

10.0 DECLARATION OF RESPONSIBLE CHARGE

I hereby declare that I am the engineer of work for this project. That I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions codes, and that the design is consistent with current design.

I understand that the check of the project drawings and specifications by the County of San Diego is confined to a review only and does not relieve me, as engineer of work, of my responsibilities for project design.

ENGINEER OF WORK
Excel Engineering
440 State Place
Escondido, CA 92029
Tel – (760)745-8118
Fax – (760)745-1890

Project Number: 12-025

Robert D. Dentino, RCE 45629
Registration Expire: December 31, 2020

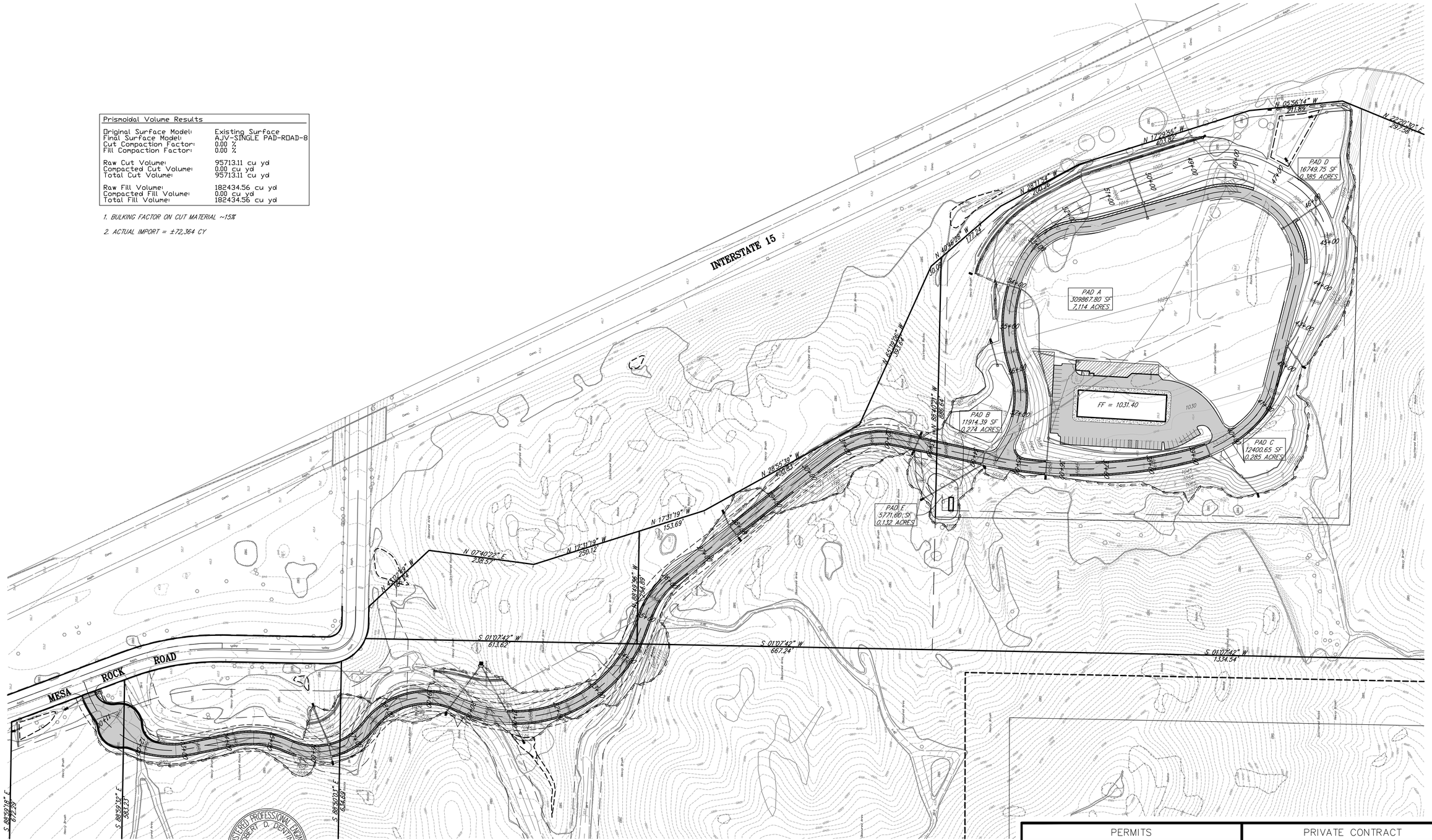
8/29/19
Date

ATTACHMENT A
SITE MAP
(Overall Grading Layout)

Prismoidal Volume Results	
Original Surface Model:	Existing Surface
Final Surface Model:	AJV-SINGLE PAD-ROAD-8
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	95713.11 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	95713.11 cu yd
Raw Fill Volume:	182434.56 cu yd
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	182434.56 cu yd

1. BULKING FACTOR ON CUT MATERIAL ~15%

2. ACTUAL IMPORT = ±72,364 CY



REGISTERED PROFESSIONAL ENGINEER
ROBERT D. DENTINO
No. 45629
Exp.12-31-14
CIVIL
STATE OF CALIFORNIA

SCALE: 1"=100'

0 100 200 300 400

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1080

RECORD PLAN

BY: _____ DATE: _____
ROBERT D. DENTINO
R.C.E. 45629
EXPIRES: 12/31/14

DECLARATION OF RESPONSIBLE CHARGE

I HEREBY DECLARE THAT I AM THE ENGINEER OF WORK FOR THIS PROJECT, THAT I HAVE EXCERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PROJECT AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONS CODE, AND THAT THE DESIGN IS CONSISTENT WITH CURRENT STANDARDS.

I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS AND SPECIFICATIONS BY THE COUNTY OF SAN DIEGO IS CONFINED TO REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITES FOR PROJECT DESIGN

BY: _____ DATE: _____

RCE NO: 45629 EXPIRES: 12/31/14

DEPT. OF PLANNING AND LAND USE

APPROVED FOR COMPLIANCE WITH THE ENVIRONMENTAL REVIEW.

APPROVED BY: _____

DATE: _____

COUNTY APPROVED CHANGES

NO.	DESCRIPTION:	APPROVED BY:	DATE:

PERMITS

REZONE PERMIT NO. _____

SPECIAL USE PERMIT NO. _____

TENTATIVE MAP NO. _____

BENCH MARK

DESCRIPTION: 2" IP WITH 2.5" BRASS DISC STAMPED "EGCS 1992 1021" IN PAVEMENT

LOCATION: 0.15MI S. OF INT. WHITING WOODS DR. & MESA ROCK RD.

RECORD FROM: MAP NO. 14236

ELEVATION: 1045.829 DATUM: USGS

PRIVATE CONTRACT

SHEET	COUNTY OF SAN DIEGO DEPARTMENT OF PUBLIC WORKS	SHEETS
1		1

GRADING EXHIBIT FOR:

SAJE COMPLEX

APN: 187-100-23,31,33,35,37&38

CALIFORNIA COORDINATE INDEX 362-1731

APPROVED
DIRECTOR OF PUBLIC WORKS
BY:

ENGINEER OF WORK
ROBERT D. DENTINO
RCE 45629

GRADING PERMIT NO:

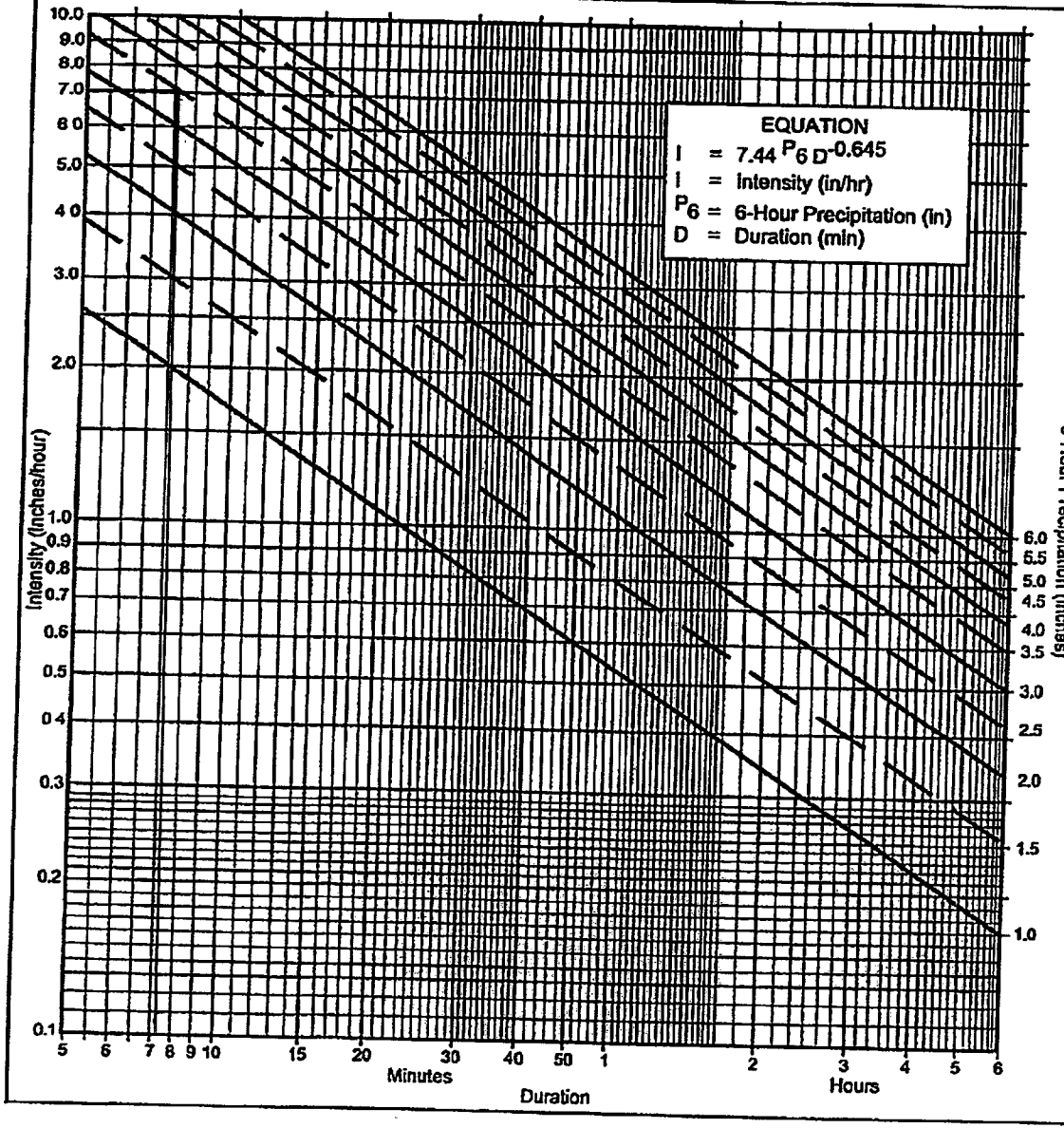
ATTACHMENT B

FIGURES & TABLES FROM THE SD HYDROLOGY MANUAL 2003

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0 55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g , the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 3.5 in., P_{24} = 7.2, $\frac{P_6}{P_{24}}$ = 48.6 %(2)

(c) Adjusted $P_6^{(2)}$ = 48.6 in.

(d) t_x = 7.10 min.

(e) I = 7.4 in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

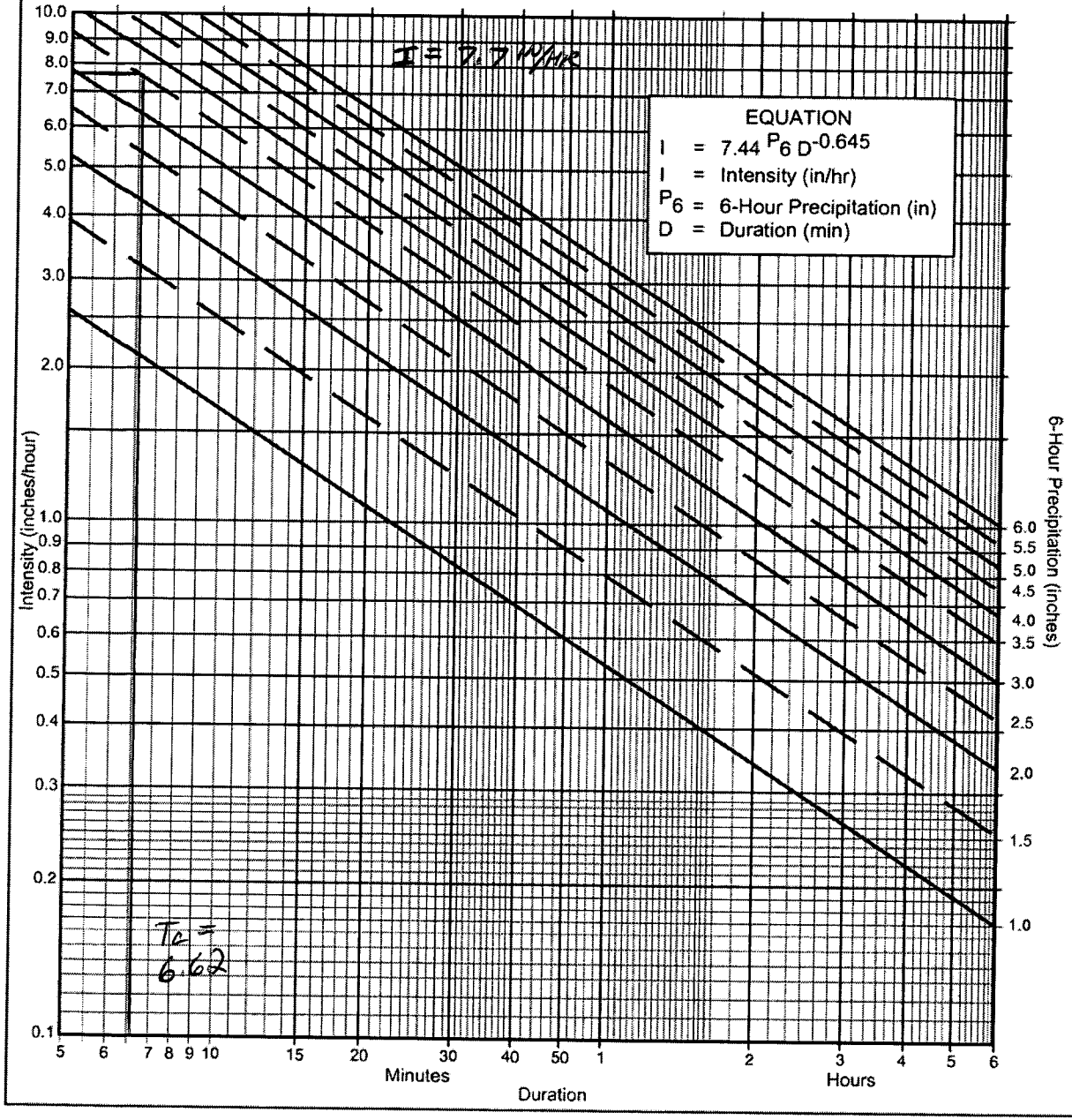
P6	1	1.5	2	2.5	3	(3.5)	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
(7)	2.12	3.18	4.24	5.30	6.36	(7.42)	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

FIGURE 3-1

Intensity-Duration Design Chart - Template

BASIN 10 - PREDEVELOPED

* SEE HYDROLOGY CALCULATIONS FOR ALL BASIN INFO - ATTACHMENT D



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 3.5 in., P_{24} = 7.2, $\frac{P_6}{P_{24}}$ = 48.6 %(2)

(c) Adjusted P_6(2) = 48.6 in.

(d) t_x = 6.62 min.

(e) I = 7.7 in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration											
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

FIGURE 3-1

Intensity-Duration Design Chart - Template

BASIN 100 - POSTDEVELOPED

* SEE HYDROLOGY CALCULATIONS FOR ALL BASIN INFO - ATTACHMENT E

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

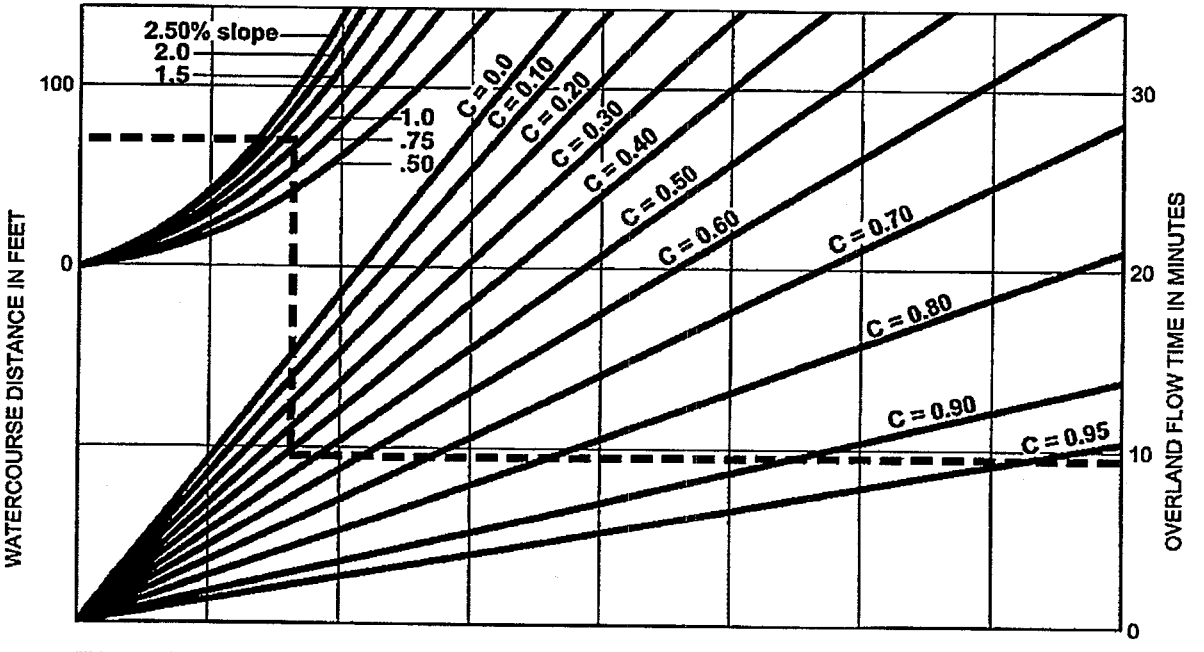
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_I)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description



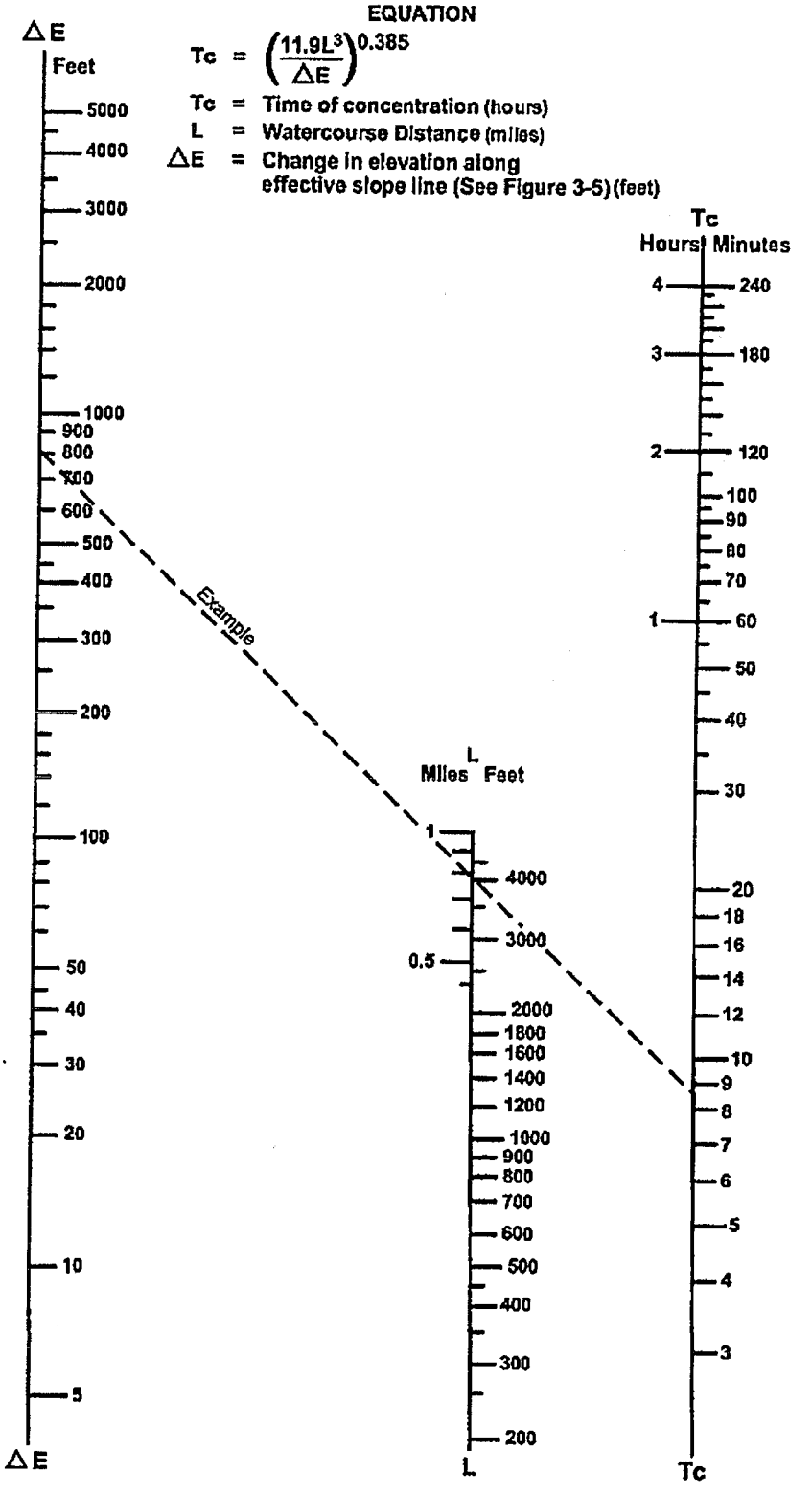
EXAMPLE:
Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE 3-3

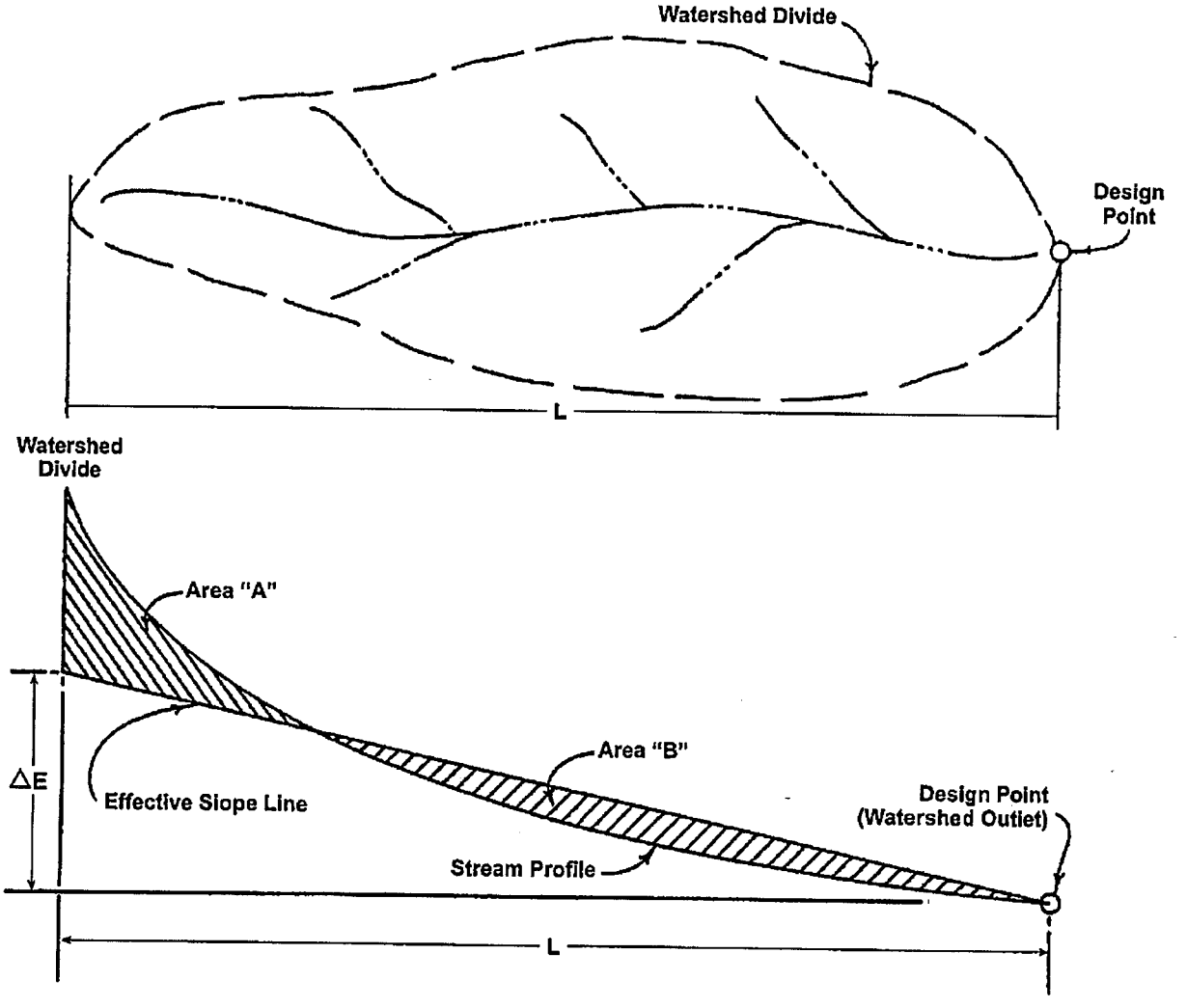
Rational Formula - Overland Time of Flow Nomograph



SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE 3-4

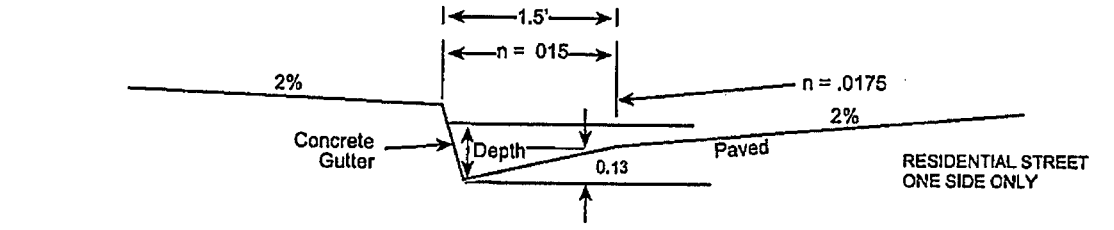
Nomograph for Determination of
Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds

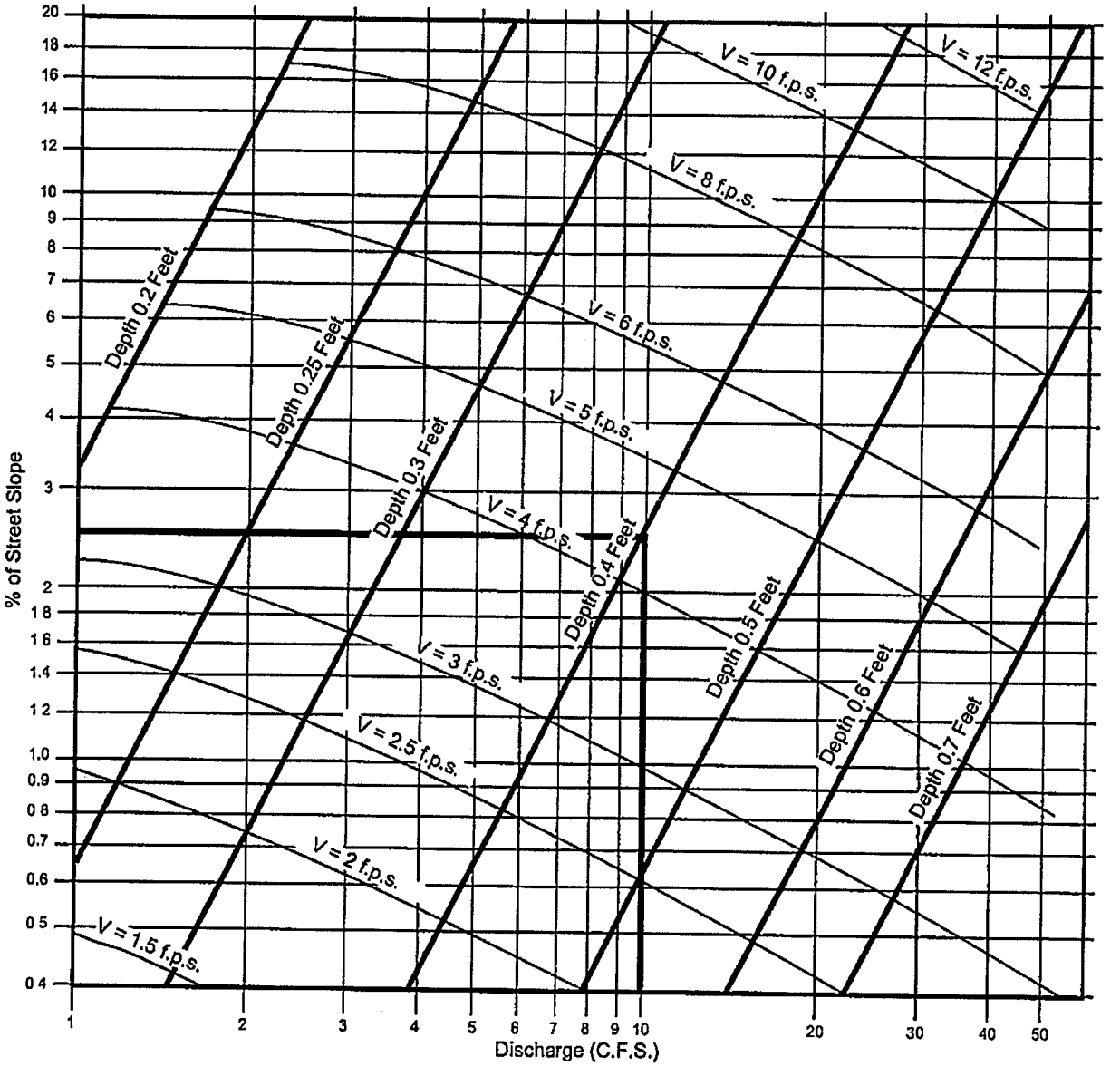


SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE 3-5

Computation of Effective Slope for Natural Watersheds





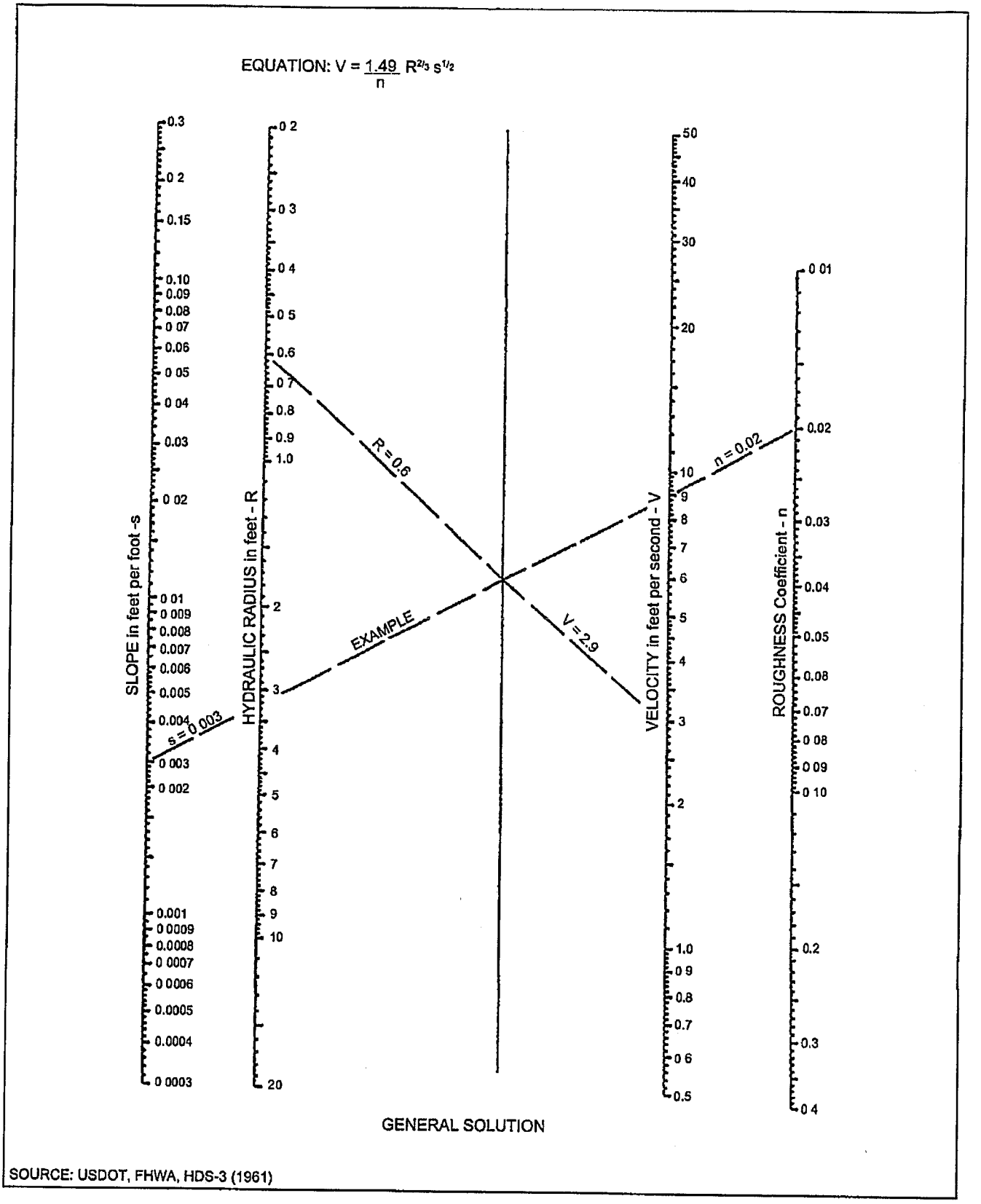
EXAMPLE:
Given: Q = 10 S = 2.5%
Chart gives: Depth = 0.4, Velocity = 4.4 f.p.s.

SOURCE. San Diego County Department of Special District Services Design Manual

FIGURE

Gutter and Roadway Discharge - Velocity Chart

3-6



SOURCE: USDOT, FHWA, HDS-3 (1961)

FIGURE 3-7

Manning's Equation Nomograph

ATTACHMENT C
WATERSHED INFORMATION

Watershed Map
Point Rainfall Isopluvial maps

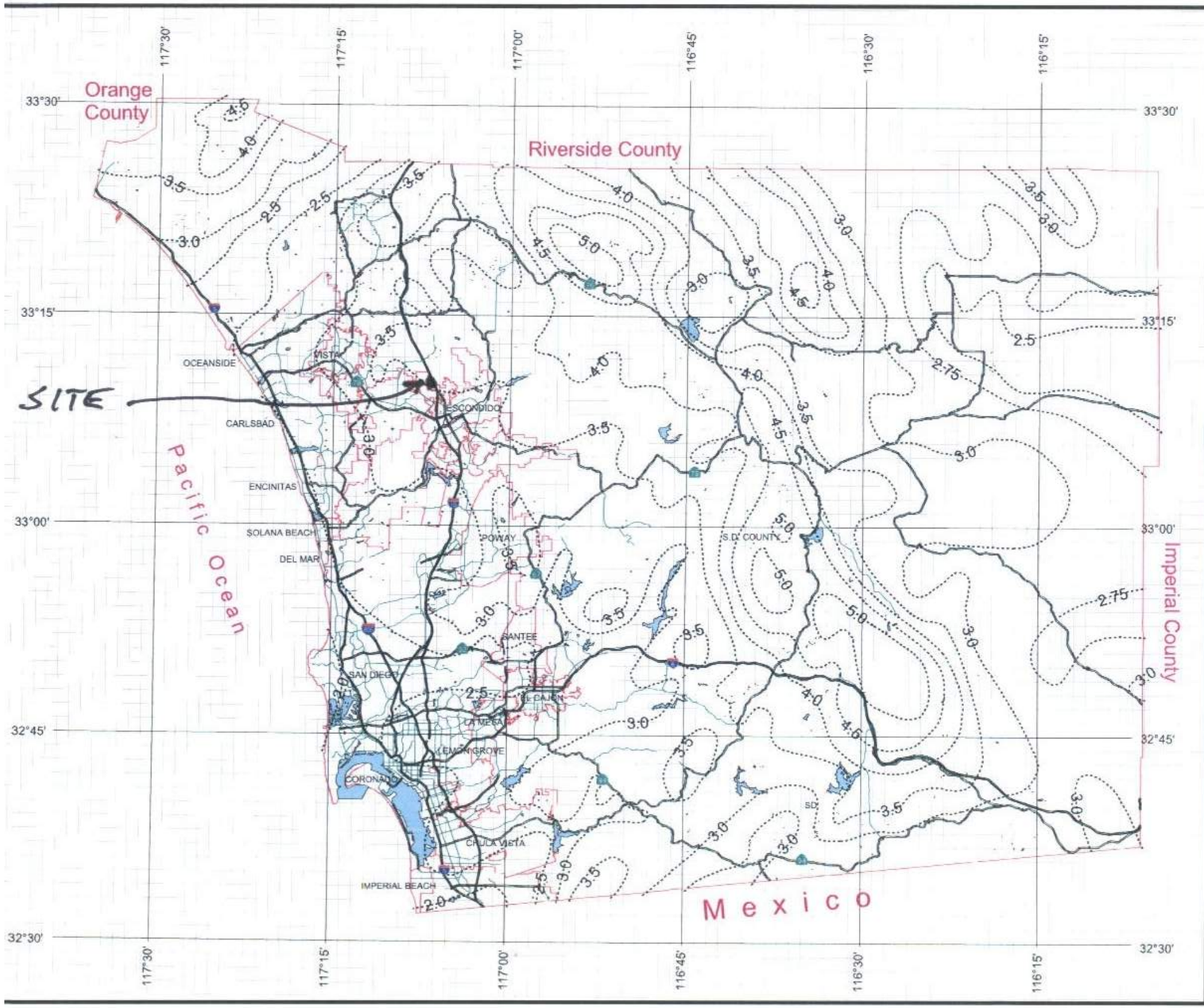
WATERSHED MAP

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)



DPW GIS — Department of Public Works, Geographic Information Division

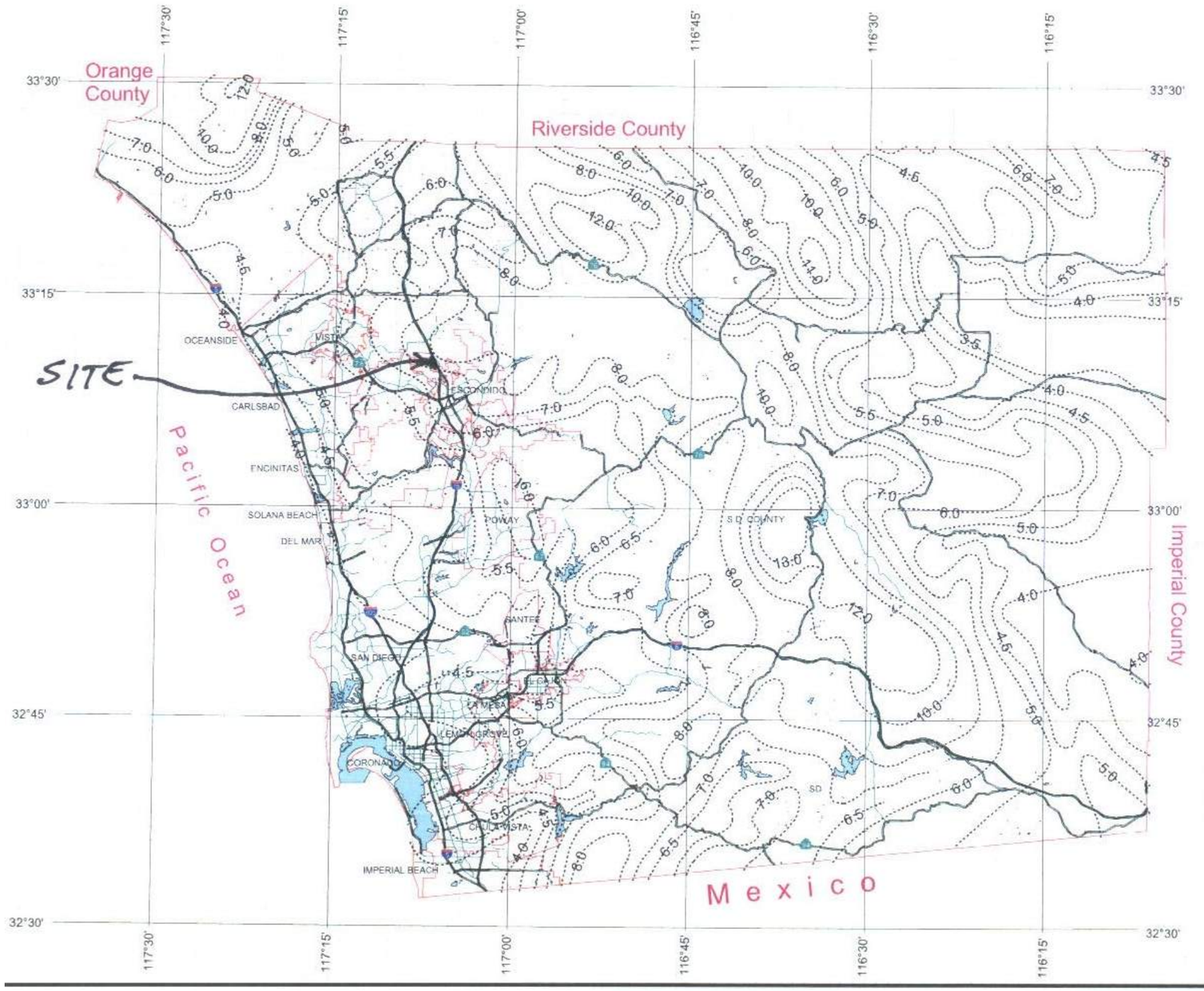
SanGIS — We Have San Diego Covered!

N W E S

3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials



100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

DPW GIS — Department of Public Works

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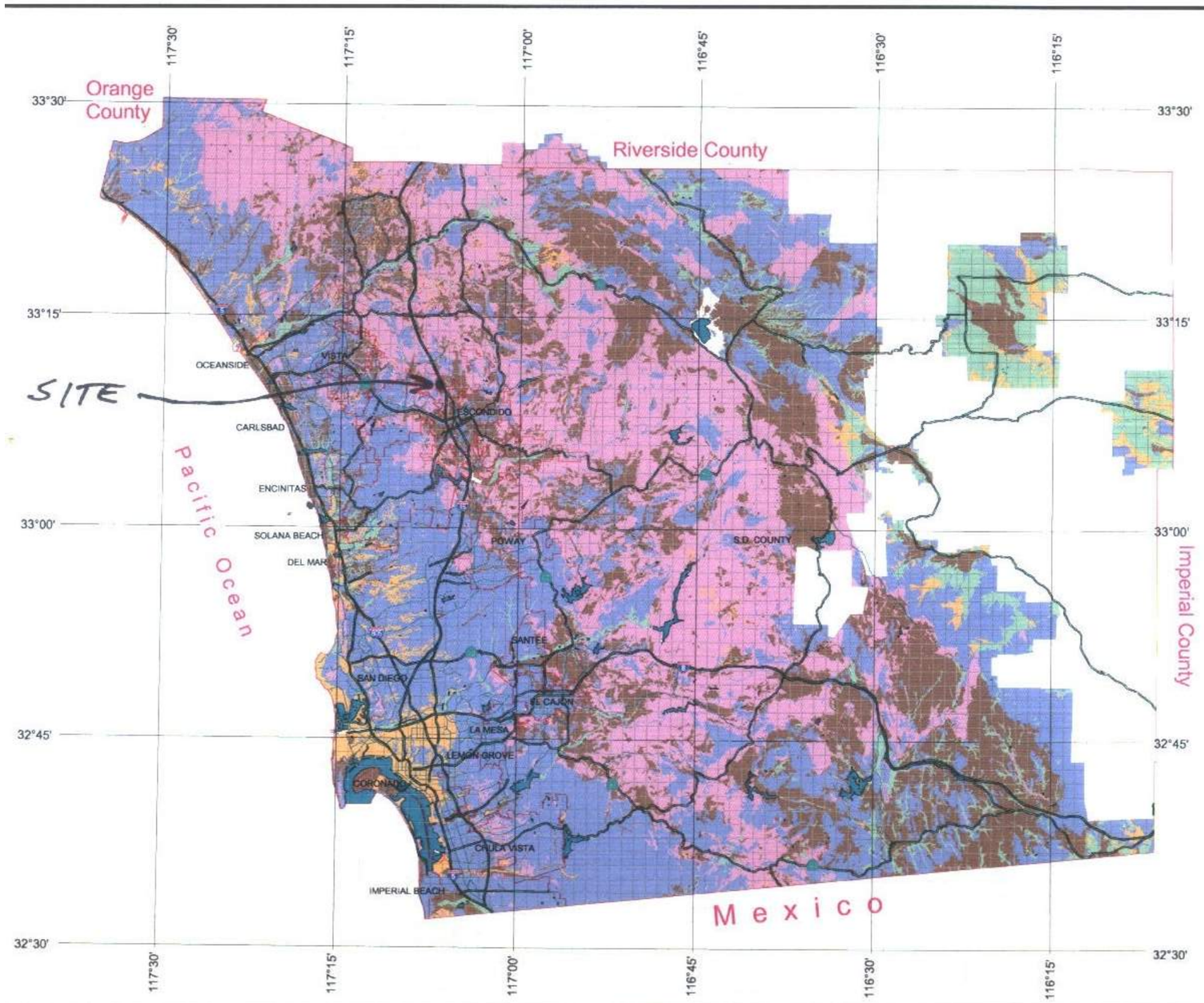
N W E S

3 0 3 Miles

County of San Diego Hydrology Manual

Soil Hydrologic Groups



Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

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Department of Public Works
Geographic Information Services

SanGIS
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N
W E
S

3 0 3 Miles

ATTACHMENT D
PRE DEVELOPED 100-YEAR HYDROLOGY CALCULATIONS

Steps Taken To Analyze This Condition
The Rational Method as outlined in section 3 of the June 2003 San Diego County Hydrology Manual is followed here. The software that we are using is the *"Rational Hydrology Method, San Diego County (2003 Manual)"* module of the CIVILCADD/CIVIL DESIGN Engineering software version 7.4.

Please see the subsequent pages for the calculations. These calculations are for the predeveloped Q100 for all six drainage subbasins. The results are outlined/summarized in Section 6 and 8.

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 12/27/12

NORTH COUNTY ENVIRONMENTAL RESOURCES HYDROLOGY STUDY
PREDEVELOPED 100 YEAR STORM EVENT
BASIN 10
Q:\12\12025\GPIP\MS\HYD\PREDEV\12025BSN10PRE100.OUT

 *********   Hydrology Study Control Information **********

Program License Serial Number 4012

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 7.200
P6/P24 =   48.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   11.000 to Point/Station   12.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance = 424.000(Ft.)
Highest elevation = 1173.000(Ft.)
Lowest elevation = 1015.000(Ft.)
Elevation difference = 158.000(Ft.) Slope = 37.264 %
Top of Initial Area Slope adjusted by User to 25.000 %
Bottom of Initial Area Slope adjusted by User to 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 25.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.92 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*(100.000^.5)/(25.000^(1/3)]=   4.92
The initial area total distance of 424.00 (Ft.) entered leaves a
remaining distance of 324.00 (Ft.)

```
Using Figure 3-4, the travel time for this distance is   1.06 minutes
for a distance of 324.00 (Ft.) and a slope of 30.00 %
with an elevation difference of  97.20(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.064 Minutes
Tt=[(11.9*0.0614^3)/( 97.20)]^.385=  1.06
Total initial area Ti =   4.92 minutes from Figure 3-3 formula plus
  1.06 minutes from the Figure 3-4 formula =   5.99 minutes
Rainfall intensity (I) =      8.208(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      1.093(CFS)
Total initial stream area =        0.444(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1015.000(Ft.)
Downstream point elevation =   963.000(Ft.)
Channel length thru subarea  =   380.000(Ft.)
Channel base width     =    2.000(Ft.)
Slope or 'Z' of left channel bank =   7.500
Slope or 'Z' of right channel bank =  15.000
Estimated mean flow rate at midpoint of channel =      5.018(CFS)
Manning's 'N'    = 0.025
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      5.018(CFS)
Depth of flow =   0.204(Ft.), Average velocity =   5.719(Ft/s)
Channel flow top width =    6.594(Ft.)
Flow Velocity =    5.72(Ft/s)
Travel time  =    1.11 min.
Time of concentration =    7.10 min.
Critical depth =      0.338(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      7.357(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      1.206
Subarea runoff =      7.780(CFS) for      3.576(Ac.)
Total runoff =      8.873(CFS)    Total area =       4.020(Ac.)
Depth of flow =   0.267(Ft.), Average velocity =   6.647(Ft/s)
Critical depth =      0.441(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       13.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
```

[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration = 7.10 min.
Rainfall intensity = 7.357(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300 CA = 1.416
Subarea runoff = 1.547(CFS) for 0.701(Ac.)
Total runoff = 10.420(CFS) Total area = 4.721(Ac.)
End of computations, total study area = 4.721 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 12/21/12

NORTH COUNTY ENVIRONMENTAL RESOURCES HYDROLOGY STUDY
PREDEVELOPED 100 YEAR STORM EVENT
BASIN 20
Q:\12\12025\GPIP\MS\HYD\PREDEV\12025BSN20PRE100.OUT

 *********   Hydrology Study Control Information **********

Program License Serial Number 4012

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 7.200
P6/P24 =   48.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   21.000 to Point/Station   22.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance = 265.000(Ft.)
Highest elevation = 1325.000(Ft.)
Lowest elevation = 1210.000(Ft.)
Elevation difference = 115.000(Ft.) Slope = 43.396 %
Top of Initial Area Slope adjusted by User to 30.000 %
Bottom of Initial Area Slope adjusted by User to 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 30.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.63 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*(100.000^.5)/(30.000^(1/3)]=   4.63
The initial area total distance of 265.00 (Ft.) entered leaves a
remaining distance of 165.00 (Ft.)

```
Using Figure 3-4, the travel time for this distance is   0.63 minutes
for a distance of 165.00 (Ft.) and a slope of 30.00 %
with an elevation difference of  49.50(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.633 Minutes
Tt=[(11.9*0.0313^3)/( 49.50)]^.385=  0.63
Total initial area Ti =   4.63 minutes from Figure 3-3 formula plus
  0.63 minutes from the Figure 3-4 formula =   5.27 minutes
Rainfall intensity (I) =      8.917(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      0.538(CFS)
Total initial stream area =        0.201(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       23.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      3.753(CFS)
Depth of flow =   0.262(Ft.), Average velocity =   8.768(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              2.00
      2             10.00              0.00
      3             25.00              2.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------
Sub-Channel flow  =      3.754(CFS)
  '     '    flow top width =      3.271(Ft.)
  '     '     velocity=    8.768(Ft/s)
  '     '    area =      0.428(Sq.Ft)
  '     '    Froude number =     4.272

Upstream point elevation =  1210.000(Ft.)
Downstream point elevation =  1082.000(Ft.)
Flow length =   384.000(Ft.)
Travel time  =    0.73 min.
Time of concentration =    6.00 min.
Depth of flow =   0.262(Ft.)
Average velocity =   8.768(Ft/s)
Total irregular channel flow =     3.753(CFS)
Irregular channel normal depth above invert elev. =   0.262(Ft.)
Average velocity of channel(s) =   8.768(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      8.201(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      0.840
Subarea runoff =      6.354(CFS) for      2.600(Ac.)
Total runoff =      6.891(CFS)    Total area =       2.801(Ac.)
Depth of flow =   0.329(Ft.), Average velocity =  10.206(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       23.000 to Point/Station       24.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     10.834(CFS)
Depth of flow =   0.497(Ft.), Average velocity =  12.509(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             20.00              0.00
      3             35.00              5.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------------
Sub-Channel flow  =     10.834(CFS)
  '     '   flow top width =      3.482(Ft.)
  '     '    velocity=   12.509(Ft/s)
  '     '   area =      0.866(Sq.Ft)
  '     '   Froude number =     4.420

Upstream point elevation =  1082.000(Ft.)
Downstream point elevation =   950.000(Ft.)
Flow length =   442.000(Ft.)
Travel time  =    0.59 min.
Time of concentration =    6.59 min.
Depth of flow =   0.497(Ft.)
Average velocity =  12.509(Ft/s)
Total irregular channel flow =    10.834(CFS)
Irregular channel normal depth above invert elev. =   0.497(Ft.)
Average velocity of channel(s) =  12.509(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      7.720(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      1.906
Subarea runoff =      7.827(CFS) for      3.554(Ac.)
Total runoff =     14.718(CFS)    Total area =       6.355(Ac.)
Depth of flow =   0.558(Ft.), Average velocity =  13.505(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       24.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
```

Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration = 6.59 min.
Rainfall intensity = 7.720(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300 CA = 2.242
Subarea runoff = 2.587(CFS) for 1.117(Ac.)
Total runoff = 17.305(CFS) Total area = 7.472(Ac.)
End of computations, total study area = 7.472 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 12/21/12

NORTH COUNTY ENVIRONMENTAL RESOURCES HYDROLOGY STUDY
PREDEVELOPED 100 YEAR STORM EVENT
BASIN 30
Q:\12\12025\GPIP\MS\HYD\PREDEV\12025BSN30PRE100.OUT

 *********   Hydrology Study Control Information **********

Program License Serial Number 4012

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 7.200
P6/P24 =   48.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   31.000 to Point/Station   32.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance = 649.000(Ft.)
Highest elevation = 1460.000(Ft.)
Lowest elevation = 1300.000(Ft.)
Elevation difference = 160.000(Ft.) Slope = 24.653 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 24.65 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.95 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*(100.000^.5)/(24.653^(1/3)]=   4.95
The initial area total distance of 649.00 (Ft.) entered leaves a
remaining distance of 549.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.72 minutes
for a distance of 549.00 (Ft.) and a slope of 24.65 %

```
with an elevation difference of 135.34(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.723 Minutes
Tt=[(11.9*0.1040^3)/(135.34)]^.385=  1.72
Total initial area Ti =   4.95 minutes from Figure 3-3 formula plus
  1.72 minutes from the Figure 3-4 formula =   6.67 minutes
Rainfall intensity (I) =      7.657(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      4.029(CFS)
Total initial stream area =        1.754(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       32.000 to Point/Station       33.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     24.125(CFS)
Depth of flow =   0.731(Ft.), Average velocity =  13.699(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             15.00              0.00
      3             33.00              5.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------
Sub-Channel flow  =     24.125(CFS)
  '     '   flow top width =      4.821(Ft.)
  '     '    velocity=   13.699(Ft/s)
  '     '   area =      1.761(Sq.Ft)
  '     '   Froude number =     3.995

Upstream point elevation =  1300.000(Ft.)
Downstream point elevation =  1076.000(Ft.)
Flow length =  1038.000(Ft.)
Travel time  =    1.26 min.
Time of concentration =    7.93 min.
Depth of flow =   0.731(Ft.)
Average velocity =  13.699(Ft/s)
Total irregular channel flow =    24.125(CFS)
Irregular channel normal depth above invert elev. =   0.731(Ft.)
Average velocity of channel(s) =  13.699(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      6.847(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      6.445
Subarea runoff =     40.101(CFS) for     19.730(Ac.)
Total runoff =     44.130(CFS)    Total area =      21.484(Ac.)
Depth of flow =   0.916(Ft.), Average velocity =  15.932(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       33.000 to Point/Station       34.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =     50.141(CFS)
Depth of flow =   1.237(Ft.), Average velocity =  16.378(Ft/s)
      ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2              8.00              0.00
      3             20.00              5.00
Manning's 'N' friction factor =   0.025
----------------------------------------------------------------
Sub-Channel flow  =     50.141(CFS)
  '     '    flow top width =      4.949(Ft.)
  '     '     velocity=   16.378(Ft/s)
  '     '    area =      3.061(Sq.Ft)
  '     '    Froude number =     3.670

Upstream point elevation =  1076.000(Ft.)
Downstream point elevation =   937.000(Ft.)
Flow length =   828.000(Ft.)
Travel time  =    0.84 min.
Time of concentration =    8.78 min.
Depth of flow =   1.237(Ft.)
Average velocity =  16.378(Ft/s)
Total irregular channel flow =    50.141(CFS)
Irregular channel normal depth above invert elev. =   1.237(Ft.)
Average velocity of channel(s) =  16.378(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      6.415(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      8.743
Subarea runoff =     11.961(CFS) for      7.660(Ac.)
Total runoff =     56.091(CFS)    Total area =      29.144(Ac.)
Depth of flow =   1.290(Ft.), Average velocity =  16.844(Ft/s)
End of computations, total study area =          29.144 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 12/21/12

NORTH COUNTY ENVIRONMENTAL RESOURCES HYDROLOGY STUDY
PREDEVELOPED 100 YEAR STORM EVENT
BASIN 40
Q:\12\12025\GPIP\MS\HYD\PREDEV\12025BSN40PRE100.OUT

 *********   Hydrology Study Control Information **********

Program License Serial Number 4012

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 7.200
P6/P24 =   48.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   41.000 to Point/Station   42.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance = 270.000(Ft.)
Highest elevation = 1354.000(Ft.)
Lowest elevation = 1320.000(Ft.)
Elevation difference =   34.000(Ft.) Slope = 12.593 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 12.59 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.19 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*(100.000^.5)/(12.593^(1/3)]=   6.19
The initial area total distance of 270.00 (Ft.) entered leaves a
remaining distance of 170.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.90 minutes
for a distance of 170.00 (Ft.) and a slope of 12.59 %

```
with an elevation difference of  21.41(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.905 Minutes
Tt=[(11.9*0.0322^3)/( 21.41)]^.385=  0.90
Total initial area Ti =   6.19 minutes from Figure 3-3 formula plus
  0.90 minutes from the Figure 3-4 formula =   7.09 minutes
Rainfall intensity (I) =      7.359(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      0.320(CFS)
Total initial stream area =        0.145(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       42.000 to Point/Station       43.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.836(CFS)
Depth of flow =   0.248(Ft.), Average velocity =   8.532(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             20.00              0.00
      3             35.00              5.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------
Sub-Channel flow  =      1.837(CFS)
  '     '    flow top width =      1.736(Ft.)
  '     '     velocity=    8.532(Ft/s)
  '     '    area =      0.215(Sq.Ft)
  '     '    Froude number =     4.270

Upstream point elevation =  1320.000(Ft.)
Downstream point elevation =  1210.000(Ft.)
Flow length =   313.000(Ft.)
Travel time  =    0.61 min.
Time of concentration =    7.71 min.
Depth of flow =   0.248(Ft.)
Average velocity =   8.532(Ft/s)
Total irregular channel flow =     1.836(CFS)
Irregular channel normal depth above invert elev. =   0.248(Ft.)
Average velocity of channel(s) =   8.532(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      6.977(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      0.468
Subarea runoff =      2.943(CFS) for      1.414(Ac.)
Total runoff =      3.263(CFS)    Total area =       1.559(Ac.)
Depth of flow =   0.308(Ft.), Average velocity =   9.850(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       43.000 to Point/Station       44.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      6.379(CFS)
Depth of flow =   0.420(Ft.), Average velocity =  10.356(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             15.00              0.00
      3             35.00              5.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------
Sub-Channel flow  =      6.379(CFS)
  '     '    flow top width =      2.937(Ft.)
  '     '     velocity=   10.356(Ft/s)
  '     '    area =      0.616(Sq.Ft)
  '     '    Froude number =     3.985

Upstream point elevation =  1210.000(Ft.)
Downstream point elevation =  1145.000(Ft.)
Flow length =   253.000(Ft.)
Travel time  =    0.41 min.
Time of concentration =    8.11 min.
Depth of flow =   0.420(Ft.)
Average velocity =  10.356(Ft/s)
Total irregular channel flow =     6.379(CFS)
Irregular channel normal depth above invert elev. =   0.420(Ft.)
Average velocity of channel(s) =  10.356(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      6.749(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      1.395
Subarea runoff =      6.152(CFS) for      3.091(Ac.)
Total runoff =      9.415(CFS)    Total area =       4.650(Ac.)
Depth of flow =   0.485(Ft.), Average velocity =  11.415(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       44.000 to Point/Station       45.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     18.282(CFS)
Depth of flow =   0.850(Ft.), Average velocity =  12.660(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             10.00              0.00
```

```
      3             20.00              5.00
Manning's 'N' friction factor =   0.025
-----------------------------------------------------------------
Sub-Channel flow  =     18.282(CFS)
  '     '   flow top width =      3.399(Ft.)
  '     '    velocity=   12.660(Ft/s)
  '     '   area =      1.444(Sq.Ft)
  '     '   Froude number =     3.423

Upstream point elevation =  1145.000(Ft.)
Downstream point elevation =   966.000(Ft.)
Flow length =  1086.000(Ft.)
Travel time  =    1.43 min.
Time of concentration =    9.54 min.
Depth of flow =   0.850(Ft.)
Average velocity =  12.660(Ft/s)
Total irregular channel flow =    18.282(CFS)
Irregular channel normal depth above invert elev. =   0.850(Ft.)
Average velocity of channel(s) =  12.660(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      6.078(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      4.458
Subarea runoff =     17.683(CFS) for     10.211(Ac.)
Total runoff =     27.098(CFS)    Total area =      14.861(Ac.)
Depth of flow =   0.985(Ft.), Average velocity =  13.969(Ft/s)
End of computations, total study area =          14.861 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 12/21/12

NORTH COUNTY ENVIRONMENTAL RESOURCES HYDROLOGY STUDY
PREDEVELOPED 100 YEAR STORM EVENT
BASIN 50
Q:\12\12025\GPIP\MS\HYD\PREDEV\12025BSN50PRE100.OUT

 *********   Hydrology Study Control Information **********

Program License Serial Number 4012

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 7.200
P6/P24 =   48.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   51.000 to Point/Station   52.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance = 303.000(Ft.)
Highest elevation = 1377.000(Ft.)
Lowest elevation = 1240.000(Ft.)
Elevation difference = 137.000(Ft.) Slope = 45.215 %
Top of Initial Area Slope adjusted by User to 30.000 %
Bottom of Initial Area Slope adjusted by User to 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 30.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.63 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*(100.000^.5)/(30.000^(1/3)]=   4.63
The initial area total distance of 303.00 (Ft.) entered leaves a
remaining distance of 203.00 (Ft.)

```
Using Figure 3-4, the travel time for this distance is   0.74 minutes
for a distance of 203.00 (Ft.) and a slope of 30.00 %
with an elevation difference of  60.90(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.742 Minutes
Tt=[(11.9*0.0384^3)/( 60.90)]^.385=  0.74
Total initial area Ti =   4.63 minutes from Figure 3-3 formula plus
  0.74 minutes from the Figure 3-4 formula =   5.38 minutes
Rainfall intensity (I) =      8.799(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      1.272(CFS)
Total initial stream area =        0.482(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       52.000 to Point/Station       53.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      5.905(CFS)
Depth of flow =   0.369(Ft.), Average velocity =   9.640(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             18.00              0.00
      3             45.00              5.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------
Sub-Channel flow  =      5.905(CFS)
  '     '    flow top width =      3.321(Ft.)
  '     '     velocity=    9.640(Ft/s)
  '     '    area =      0.613(Sq.Ft)
  '     '    Froude number =     3.955

Upstream point elevation =  1240.000(Ft.)
Downstream point elevation =  1110.000(Ft.)
Flow length =   502.000(Ft.)
Travel time  =    0.87 min.
Time of concentration =    6.24 min.
Depth of flow =   0.369(Ft.)
Average velocity =   9.640(Ft/s)
Total irregular channel flow =     5.905(CFS)
Irregular channel normal depth above invert elev. =   0.369(Ft.)
Average velocity of channel(s) =   9.640(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      7.990(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      1.310
Subarea runoff =      9.195(CFS) for      3.885(Ac.)
Total runoff =     10.467(CFS)    Total area =       4.367(Ac.)
Depth of flow =   0.457(Ft.), Average velocity =  11.123(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       53.000 to Point/Station       54.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     13.916(CFS)
Depth of flow =   0.403(Ft.), Average velocity =   7.619(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              2.00
      2             30.00              0.00
      3             45.00              2.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------
Sub-Channel flow  =     13.916(CFS)
  '     '    flow top width =      9.066(Ft.)
  '     '     velocity=    7.619(Ft/s)
  '     '    area =      1.826(Sq.Ft)
  '     '    Froude number =     2.991

Upstream point elevation =  1110.000(Ft.)
Downstream point elevation =  1035.000(Ft.)
Flow length =   536.000(Ft.)
Travel time  =    1.17 min.
Time of concentration =    7.42 min.
Depth of flow =   0.403(Ft.)
Average velocity =   7.619(Ft/s)
Total irregular channel flow =    13.916(CFS)
Irregular channel normal depth above invert elev. =   0.403(Ft.)
Average velocity of channel(s) =   7.619(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      7.150(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      2.419
Subarea runoff =      6.829(CFS) for      3.696(Ac.)
Total runoff =     17.296(CFS)    Total area =       8.063(Ac.)
Depth of flow =   0.437(Ft.), Average velocity =   8.044(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       54.000 to Point/Station       55.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     23.382(CFS)
Depth of flow =   0.556(Ft.), Average velocity =   8.899(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
```

```
      1             0.00             5.00
      2            10.00             0.00
      3            85.00             5.00
Manning's 'N' friction factor =   0.025
-----------------------------------------------------------------
Sub-Channel flow  =     23.382(CFS)
  '     '   flow top width =      9.452(Ft.)
  '     '    velocity=    8.899(Ft/s)
  '     '   area =      2.628(Sq.Ft)
  '     '   Froude number =     2.974

Upstream point elevation =  1035.000(Ft.)
Downstream point elevation =   966.000(Ft.)
Flow length =   547.000(Ft.)
Travel time  =    1.02 min.
Time of concentration =    8.44 min.
Depth of flow =   0.556(Ft.)
Average velocity =   8.899(Ft/s)
Total irregular channel flow =    23.382(CFS)
Irregular channel normal depth above invert elev. =   0.556(Ft.)
Average velocity of channel(s) =   8.899(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      6.578(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      4.467
Subarea runoff =     12.087(CFS) for      6.827(Ac.)
Total runoff =     29.384(CFS)    Total area =      14.890(Ac.)
Depth of flow =   0.606(Ft.), Average velocity =   9.422(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       55.000 to Point/Station       55.000
**** SUBAREA FLOW ADDITION ****
_________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     8.44 min.
Rainfall intensity =      6.578(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      6.727
Subarea runoff =     14.867(CFS) for      7.534(Ac.)
Total runoff =     44.251(CFS)    Total area =      22.424(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       55.000 to Point/Station       56.000
```

```
**** PIPEFLOW TRAVEL TIME (User specified size) ****
_____________________________________________________________________
Upstream point/station elevation =   966.000(Ft.)
Downstream point/station elevation =   962.000(Ft.)
Pipe length  =   176.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    44.251(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    44.251(CFS)
Normal flow depth in pipe =   18.16(In.)
Flow top width inside pipe =   36.00(In.)
Critical Depth =   26.02(In.)
Pipe flow velocity =     12.38(Ft/s)
Travel time through pipe =    0.24 min.
Time of concentration (TC) =     8.68 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       56.000 to Point/Station       56.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     8.68 min.
Rainfall intensity =      6.462(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      6.860
Subarea runoff =      0.077(CFS) for      0.444(Ac.)
Total runoff =     44.329(CFS)    Total area =      22.868(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       56.000 to Point/Station       56.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     8.68 min.
Rainfall intensity =      6.462(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      7.790
Subarea runoff =      6.005(CFS) for      3.098(Ac.)
Total runoff =     50.334(CFS)    Total area =      25.966(Ac.)
End of computations, total study area =          25.966 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 12/30/12

NORTH COUNTY ENVIRONMENTAL RESOURCES HYDROLOGY STUDY
PREDEVELOPED 100 YEAR STORM EVENT
BASIN 60
Q:\12\12025\GPIP\MS\HYD\PREDEV\12025BSN60PRE100.OUT

 *********   Hydrology Study Control Information **********

Program License Serial Number 4012

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 7.200
P6/P24 =   48.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   61.000 to Point/Station   62.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance = 932.000(Ft.)
Highest elevation = 1276.000(Ft.)
Lowest elevation = 1002.000(Ft.)
Elevation difference = 274.000(Ft.) Slope = 29.399 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 29.40 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.67 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*(100.000^.5)/(29.399^(1/3)]=   4.67
The initial area total distance of 932.00 (Ft.) entered leaves a
remaining distance of 832.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.22 minutes
for a distance of 832.00 (Ft.) and a slope of 29.40 %

```
with an elevation difference of 244.60(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.217 Minutes
Tt=[(11.9*0.1576^3)/(244.60)]^.385=  2.22
Total initial area Ti =   4.67 minutes from Figure 3-3 formula plus
  2.22 minutes from the Figure 3-4 formula =   6.88 minutes
Rainfall intensity (I) =      7.504(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =     15.569(CFS)
Total initial stream area =        6.916(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       62.000 to Point/Station       63.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =  1000.000(Ft.)
Downstream point/station elevation =   990.000(Ft.)
Pipe length  =    54.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    15.569(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =    15.569(CFS)
Normal flow depth in pipe =    7.89(In.)
Flow top width inside pipe =   17.86(In.)
Critical Depth =   17.00(In.)
Pipe flow velocity =     20.90(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     6.93 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       63.000 to Point/Station       63.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     6.93 min.
Rainfall intensity =      7.474(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      2.565
Subarea runoff =      3.603(CFS) for      1.635(Ac.)
Total runoff =     19.172(CFS)    Total area =       8.551(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       63.000 to Point/Station       64.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     28.537(CFS)
Depth of flow =   1.539(Ft.), Average velocity =   7.010(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
```

```
      1             0.00             5.00
      2            15.00             1.00
      3            16.00             0.00
      4            17.00             1.00
      5            27.00             2.00
Manning's 'N' friction factor =   0.025
-----------------------------------------------------------------
Sub-Channel flow  =     28.537(CFS)
  '     '   flow top width =      9.404(Ft.)
  '     '    velocity=    7.010(Ft/s)
  '     '   area =      4.071(Sq.Ft)
  '     '   Froude number =     1.878

Upstream point elevation =   990.000(Ft.)
Downstream point elevation =   977.000(Ft.)
Flow length =   270.000(Ft.)
Travel time  =    0.64 min.
Time of concentration =    7.57 min.
Depth of flow =   1.539(Ft.)
Average velocity =   7.010(Ft/s)
Total irregular channel flow =    28.537(CFS)
Irregular channel normal depth above invert elev. =   1.539(Ft.)
Average velocity of channel(s) =   7.010(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      7.058(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      5.360
Subarea runoff =     18.657(CFS) for      9.314(Ac.)
Total runoff =     37.830(CFS)    Total area =      17.865(Ac.)
Depth of flow =   1.637(Ft.), Average velocity =   7.464(Ft/s)
End of computations, total study area =          17.865 (Ac.)
```

ATTACHMENT E
POST DEVELOPED 100-YEAR HYDROLOGY CALCULATIONS

Steps Taken To Analyze This Condition
The Rational Method as outlined in section 3 of the June 2003 San Diego County Hydrology Manual is followed here. The software that we are using is the *"Rational Hydrology Method, San Diego County (2003 Manual)"* module of the CIVILCADD/CIVIL DESIGN Engineering software version 7.4.

Please see the subsequent pages for the calculations. These calculations are for the postdeveloped Q100 for all six drainage basins. The results are outlined/summarized in Section 6 and 8.

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 12/28/12

NORTH COUNTY ENVIRONMENTAL RESOURCES HYDROLOGY STUDY
POSTDEVELOPED 100 YEAR STORM EVENT
BASIN 100
Q:\12\12025\GPIP\MS\HYD\POSTDEV\12025BSN100POST100.OUT

 *********   Hydrology Study Control Information **********

Program License Serial Number 4012

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 7.200
P6/P24 =   48.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   101.000 to Point/Station   102.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance = 406.000(Ft.)
Highest elevation = 1164.000(Ft.)
Lowest elevation = 997.000(Ft.)
Elevation difference = 167.000(Ft.) Slope = 41.133 %
Top of Initial Area Slope adjusted by User to 25.000 %
Bottom of Initial Area Slope adjusted by User to 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 25.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.92 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*(100.000^.5)/(25.000^(1/3)]=   4.92
The initial area total distance of 406.00 (Ft.) entered leaves a
remaining distance of 306.00 (Ft.)

```
Using Figure 3-4, the travel time for this distance is   1.02 minutes
for a distance of 306.00 (Ft.) and a slope of 30.00 %
with an elevation difference of  91.80(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.018 Minutes
Tt=[(11.9*0.0580^3)/( 91.80)]^.385=  1.02
Total initial area Ti =   4.92 minutes from Figure 3-3 formula plus
  1.02 minutes from the Figure 3-4 formula =   5.94 minutes
Rainfall intensity (I) =      8.249(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      1.067(CFS)
Total initial stream area =        0.431(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   997.000(Ft.)
Downstream point elevation =   961.000(Ft.)
Channel length thru subarea  =   438.000(Ft.)
Channel base width     =    0.000(Ft.)
Slope or 'Z' of left channel bank =   1.250
Slope or 'Z' of right channel bank =   1.250
Estimated mean flow rate at midpoint of channel =      4.795(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      4.795(CFS)
Depth of flow =   0.597(Ft.), Average velocity =  10.758(Ft/s)
Channel flow top width =    1.493(Ft.)
Flow Velocity =   10.76(Ft/s)
Travel time  =    0.68 min.
Time of concentration =    6.62 min.
Critical depth =      0.984(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      7.693(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      1.098
Subarea runoff =      7.378(CFS) for      3.228(Ac.)
Total runoff =      8.445(CFS)    Total area =       3.659(Ac.)
Depth of flow =   0.738(Ft.), Average velocity =  12.394(Ft/s)
Critical depth =      1.203(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
```

```
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.480
Time of concentration =     6.62 min.
Rainfall intensity =      7.693(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.320  CA =      1.320
Subarea runoff =      1.710(CFS) for      0.463(Ac.)
Total runoff =     10.155(CFS)    Total area =       4.122(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                   ]
(43.0 DU/A or Less      )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.780
Time of concentration =     6.62 min.
Rainfall intensity =      7.693(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.361  CA =      1.630
Subarea runoff =      2.388(CFS) for      0.398(Ac.)
Total runoff =     12.543(CFS)    Total area =       4.520(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     6.62 min.
Rainfall intensity =      7.693(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.356  CA =      1.734
Subarea runoff =      0.799(CFS) for      0.346(Ac.)
Total runoff =     13.342(CFS)    Total area =       4.866(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   961.000(Ft.)
Downstream point/station elevation =   959.000(Ft.)
Pipe length  =    37.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    13.342(CFS)
```

Nearest computed pipe diameter = 18.00(In.)
Calculated individual pipe flow = 13.342(CFS)
Normal flow depth in pipe = 10.36(In.)
Flow top width inside pipe = 17.79(In.)
Critical Depth = 16.35(In.)
Pipe flow velocity = 12.66(Ft/s)
Travel time through pipe = 0.05 min.
Time of concentration (TC) = 6.67 min.
End of computations, total study area = 4.866 (Ac.)

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 12/28/12

NORTH COUNTY ENVIRONMENTAL RESOURCES HYDROLOGY STUDY
POSTDEVELOPED 100 YEAR STORM EVENT
BASIN 200
Q:\12\12025\GPIP\MS\HYD\POSTDEV\12025BSN200POST100.OUT

 *********   Hydrology Study Control Information **********

Program License Serial Number 4012

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 7.200
P6/P24 =   48.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   201.000 to Point/Station   202.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance = 265.000(Ft.)
Highest elevation = 1325.000(Ft.)
Lowest elevation = 1210.000(Ft.)
Elevation difference = 115.000(Ft.) Slope = 43.396 %
Top of Initial Area Slope adjusted by User to 30.000 %
Bottom of Initial Area Slope adjusted by User to 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 30.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.63 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*(100.000^.5)/(30.000^(1/3)]=   4.63
The initial area total distance of 265.00 (Ft.) entered leaves a
remaining distance of 165.00 (Ft.)

```
Using Figure 3-4, the travel time for this distance is   0.63 minutes
for a distance of 165.00 (Ft.) and a slope of 30.00 %
with an elevation difference of  49.50(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.633 Minutes
Tt=[(11.9*0.0313^3)/( 49.50)]^.385=  0.63
Total initial area Ti =   4.63 minutes from Figure 3-3 formula plus
  0.63 minutes from the Figure 3-4 formula =   5.27 minutes
Rainfall intensity (I) =      8.917(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      0.538(CFS)
Total initial stream area =        0.201(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      3.753(CFS)
Depth of flow =   0.262(Ft.), Average velocity =   8.768(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              2.00
      2             10.00              0.00
      3             25.00              2.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------
Sub-Channel flow  =      3.754(CFS)
  '     '    flow top width =      3.271(Ft.)
  '     '     velocity=    8.768(Ft/s)
  '     '    area =      0.428(Sq.Ft)
  '     '    Froude number =     4.272

Upstream point elevation =  1210.000(Ft.)
Downstream point elevation =  1082.000(Ft.)
Flow length =   384.000(Ft.)
Travel time  =    0.73 min.
Time of concentration =    6.00 min.
Depth of flow =   0.262(Ft.)
Average velocity =   8.768(Ft/s)
Total irregular channel flow =     3.753(CFS)
Irregular channel normal depth above invert elev. =   0.262(Ft.)
Average velocity of channel(s) =   8.768(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      8.201(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      0.840
Subarea runoff =      6.354(CFS) for      2.600(Ac.)
Total runoff =      6.891(CFS)    Total area =       2.801(Ac.)
Depth of flow =   0.329(Ft.), Average velocity =  10.206(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      204.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      9.333(CFS)
Depth of flow =   0.466(Ft.), Average velocity =  12.293(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             20.00              0.00
      3             35.00              5.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------------
Sub-Channel flow  =      9.333(CFS)
  '     '    flow top width =      3.260(Ft.)
  '     '     velocity=   12.293(Ft/s)
  '     '    area =      0.759(Sq.Ft)
  '     '    Froude number =     4.489

Upstream point elevation =  1082.000(Ft.)
Downstream point elevation =  1008.000(Ft.)
Flow length =   235.000(Ft.)
Travel time  =    0.32 min.
Time of concentration =    6.32 min.
Depth of flow =   0.466(Ft.)
Average velocity =  12.293(Ft/s)
Total irregular channel flow =     9.333(CFS)
Irregular channel normal depth above invert elev. =   0.466(Ft.)
Average velocity of channel(s) =  12.293(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      7.932(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      1.478
Subarea runoff =      4.833(CFS) for      2.126(Ac.)
Total runoff =     11.724(CFS)    Total area =       4.927(Ac.)
Depth of flow =   0.507(Ft.), Average velocity =  13.015(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      204.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
```

```
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     6.32 min.
Rainfall intensity =      7.932(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      1.637
Subarea runoff =      1.261(CFS) for      0.530(Ac.)
Total runoff =     12.985(CFS)    Total area =       5.457(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      205.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1008.000(Ft.)
Downstream point elevation =  1007.000(Ft.)
Channel length thru subarea  =    43.000(Ft.)
Channel base width     =    0.000(Ft.)
Slope or 'Z' of left channel bank =   1.250
Slope or 'Z' of right channel bank =   1.250
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     12.985(CFS)
Depth of flow =   1.082(Ft.), Average velocity =   8.928(Ft/s)
!!Warning: Water is above left or right bank elevations
Channel flow top width =    2.500(Ft.)
Flow Velocity =    8.93(Ft/s)
Travel time  =    0.08 min.
Time of concentration =    6.40 min.
Critical depth =      1.438(Ft.)
ERROR - Channel depth exceeds maximum allowable depth


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      206.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1007.000(Ft.)
Downstream point/station elevation =  1006.000(Ft.)
Pipe length  =    10.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.985(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    12.985(CFS)
Normal flow depth in pipe =    8.68(In.)
Flow top width inside pipe =   14.81(In.)
Critical depth could not be calculated.
Pipe flow velocity =     17.63(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     6.41 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      206.000 to Point/Station      206.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
```

```
(14.5 DU/A or Less      )
Impervious value, Ai = 0.500
Sub-Area C Value = 0.600
Time of concentration =     6.41 min.
Rainfall intensity =      7.860(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.314  CA =      1.802
Subarea runoff =      1.179(CFS) for      0.275(Ac.)
Total runoff =     14.164(CFS)    Total area =       5.732(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      206.000 to Point/Station      207.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1006.000(Ft.)
Downstream point/station elevation =  1005.000(Ft.)
Pipe length  =    29.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    14.164(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    14.164(CFS)
Normal flow depth in pipe =   11.37(In.)
Flow top width inside pipe =   17.37(In.)
Critical Depth =   16.63(In.)
Pipe flow velocity =     12.03(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     6.45 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      207.000 to Point/Station      207.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                    ]
(43.0 DU/A or Less      )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.780
Time of concentration =     6.45 min.
Rainfall intensity =      7.828(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.328  CA =      1.939
Subarea runoff =      1.018(CFS) for      0.176(Ac.)
Total runoff =     15.182(CFS)    Total area =       5.908(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      207.000 to Point/Station      208.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1005.000(Ft.)
Downstream point/station elevation =   961.000(Ft.)
Pipe length  =    88.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.182(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    15.182(CFS)
Normal flow depth in pipe =    6.71(In.)
```

```
Flow top width inside pipe =   11.91(In.)
Critical depth could not be calculated.
Pipe flow velocity =     33.56(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     6.49 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      208.000 to Point/Station      209.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     15.903(CFS)
Depth of flow =   0.744(Ft.), Average velocity =  10.638(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             13.00              0.00
      3             27.00              5.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------
Sub-Channel flow  =     15.903(CFS)
  '     '    flow top width =      4.018(Ft.)
  '     '     velocity=   10.638(Ft/s)
  '     '    area =      1.495(Sq.Ft)
  '     '    Froude number =     3.074

Upstream point elevation =   961.000(Ft.)
Downstream point elevation =   952.000(Ft.)
Flow length =    69.000(Ft.)
Travel time  =    0.11 min.
Time of concentration =    6.60 min.
Depth of flow =   0.744(Ft.)
Average velocity =  10.638(Ft/s)
Total irregular channel flow =    15.903(CFS)
Irregular channel normal depth above invert elev. =   0.744(Ft.)
Average velocity of channel(s) =  10.638(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      7.712(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.325  CA =      2.149
Subarea runoff =      1.391(CFS) for      0.699(Ac.)
Total runoff =     16.573(CFS)    Total area =       6.607(Ac.)
Depth of flow =   0.756(Ft.), Average velocity =  10.749(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      209.000 to Point/Station      209.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
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```
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     6.60 min.
Rainfall intensity =      7.712(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.322  CA =      2.439
Subarea runoff =      2.232(CFS) for      0.965(Ac.)
Total runoff =     18.805(CFS)    Total area =       7.572(Ac.)
End of computations, total study area =           7.572 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 12/28/12

NORTH COUNTY ENVIRONMENTAL RESOURCES HYDROLOGY STUDY
POSTDEVELOPED 100 YEAR STORM EVENT
BASIN 300
Q:\12\12025\GPIP\MS\HYD\POSTDEV\12025BSN300POST100.OUT

 *********   Hydrology Study Control Information **********

Program License Serial Number 4012

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 7.200
P6/P24 =   48.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   301.000 to Point/Station   302.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance = 649.000(Ft.)
Highest elevation = 1460.000(Ft.)
Lowest elevation = 1300.000(Ft.)
Elevation difference = 160.000(Ft.) Slope = 24.653 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 24.65 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.95 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*(100.000^.5)/(24.653^(1/3)]=   4.95
The initial area total distance of 649.00 (Ft.) entered leaves a
remaining distance of 549.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.72 minutes
for a distance of 549.00 (Ft.) and a slope of 24.65 %

```
with an elevation difference of 135.34(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.723 Minutes
Tt=[(11.9*0.1040^3)/(135.34)]^.385=  1.72
Total initial area Ti =   4.95 minutes from Figure 3-3 formula plus
  1.72 minutes from the Figure 3-4 formula =   6.67 minutes
Rainfall intensity (I) =      7.657(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      4.029(CFS)
Total initial stream area =        1.754(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      303.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     23.494(CFS)
Depth of flow =   0.723(Ft.), Average velocity =  13.609(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             15.00              0.00
      3             33.00              5.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------
Sub-Channel flow  =     23.494(CFS)
  '     '    flow top width =      4.774(Ft.)
  '     '     velocity=   13.609(Ft/s)
  '     '    area =      1.726(Sq.Ft)
  '     '    Froude number =     3.988

Upstream point elevation =  1300.000(Ft.)
Downstream point elevation =  1076.000(Ft.)
Flow length =  1038.000(Ft.)
Travel time  =    1.27 min.
Time of concentration =    7.94 min.
Depth of flow =   0.723(Ft.)
Average velocity =  13.609(Ft/s)
Total irregular channel flow =    23.494(CFS)
Irregular channel normal depth above invert elev. =   0.723(Ft.)
Average velocity of channel(s) =  13.609(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      6.842(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      6.266
Subarea runoff =     38.841(CFS) for     19.131(Ac.)
Total runoff =     42.870(CFS)    Total area =      20.885(Ac.)
Depth of flow =   0.906(Ft.), Average velocity =  15.817(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      304.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     44.830(CFS)
Depth of flow =   1.198(Ft.), Average velocity =  15.611(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2              8.00              0.00
      3             20.00              5.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------------
Sub-Channel flow  =     44.830(CFS)
  '     '    flow top width =      4.793(Ft.)
  '     '     velocity=   15.611(Ft/s)
  '     '    area =      2.872(Sq.Ft)
  '     '    Froude number =     3.554

Upstream point elevation =  1076.000(Ft.)
Downstream point elevation =  1030.000(Ft.)
Flow length =   289.000(Ft.)
Travel time  =    0.31 min.
Time of concentration =    8.25 min.
Depth of flow =   1.198(Ft.)
Average velocity =  15.611(Ft/s)
Total irregular channel flow =    44.830(CFS)
Irregular channel normal depth above invert elev. =   1.198(Ft.)
Average velocity of channel(s) =  15.611(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      6.676(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      6.998
Subarea runoff =      3.846(CFS) for      2.440(Ac.)
Total runoff =     46.716(CFS)    Total area =      23.325(Ac.)
Depth of flow =   1.217(Ft.), Average velocity =  15.773(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      305.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1030.000(Ft.)
Downstream point/station elevation =  1029.000(Ft.)
Pipe length  =    42.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    46.716(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    46.716(CFS)
Normal flow depth in pipe =   21.61(In.)
Flow top width inside pipe =   21.59(In.)
```

```
Critical depth could not be calculated.
Pipe flow velocity =     13.70(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     8.30 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      305.000 to Point/Station      305.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(7.3 DU/A or Less       )
Impervious value, Ai = 0.400
Sub-Area C Value = 0.540
Time of concentration =     8.30 min.
Rainfall intensity =      6.650(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.306  CA =      7.310
Subarea runoff =      1.893(CFS) for      0.579(Ac.)
Total runoff =     48.609(CFS)    Total area =      23.904(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      305.000 to Point/Station      306.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1029.000(Ft.)
Downstream point/station elevation =  1028.000(Ft.)
Pipe length  =    33.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    48.609(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    48.609(CFS)
Normal flow depth in pipe =   20.06(In.)
Flow top width inside pipe =   23.60(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.35(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     8.34 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      306.000 to Point/Station      306.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.690
Time of concentration =     8.34 min.
Rainfall intensity =      6.631(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.311  CA =      7.539
```

```
Subarea runoff =      1.384(CFS) for      0.332(Ac.)
Total runoff =     49.994(CFS)    Total area =      24.236(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      306.000 to Point/Station      307.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =  1028.000(Ft.)
Downstream point/station elevation =   987.000(Ft.)
Pipe length  =   118.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    49.994(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    49.994(CFS)
Normal flow depth in pipe =   12.26(In.)
Flow top width inside pipe =   16.78(In.)
Critical depth could not be calculated.
Pipe flow velocity =     38.99(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     8.39 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      307.000 to Point/Station      307.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     8.39 min.
Rainfall intensity =      6.605(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.311  CA =      7.743
Subarea runoff =      1.153(CFS) for      0.680(Ac.)
Total runoff =     51.147(CFS)    Total area =      24.916(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      307.000 to Point/Station      307.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     8.39 min.
Rainfall intensity =      6.605(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.311  CA =      7.859
Subarea runoff =      0.767(CFS) for      0.387(Ac.)
Total runoff =     51.914(CFS)    Total area =      25.303(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      307.000 to Point/Station      308.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     54.945(CFS)
Depth of flow =   1.310(Ft.), Average velocity =  16.020(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             10.00              0.00
      3             20.00              5.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------------
Sub-Channel flow  =     54.945(CFS)
  '     '   flow top width =      5.238(Ft.)
  '     '    velocity=   16.020(Ft/s)
  '     '   area =      3.430(Sq.Ft)
  '     '   Froude number =     3.489

Upstream point elevation =   987.000(Ft.)
Downstream point elevation =   936.000(Ft.)
Flow length =   344.000(Ft.)
Travel time  =    0.36 min.
Time of concentration =    8.75 min.
Depth of flow =   1.310(Ft.)
Average velocity =  16.020(Ft/s)
Total irregular channel flow =    54.945(CFS)
Irregular channel normal depth above invert elev. =   1.310(Ft.)
Average velocity of channel(s) =  16.020(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      6.430(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.309  CA =      9.008
Subarea runoff =      6.004(CFS) for      3.828(Ac.)
Total runoff =     57.917(CFS)    Total area =      29.131(Ac.)
Depth of flow =   1.336(Ft.), Average velocity =  16.233(Ft/s)
End of computations, total study area =          29.131 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 12/28/12

NORTH COUNTY ENVIRONMENTAL RESOURCES HYDROLOGY STUDY
POSTDEVELOPED 100 YEAR STORM EVENT
BASIN 400
Q:\12\12025\GPIP\MS\HYD\POSTDEV\12025BSN400POST100.OUT

 *********   Hydrology Study Control Information **********

Program License Serial Number 4012

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 7.200
P6/P24 =   48.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   401.000 to Point/Station   402.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance = 270.000(Ft.)
Highest elevation = 1354.000(Ft.)
Lowest elevation = 1320.000(Ft.)
Elevation difference =   34.000(Ft.) Slope = 12.593 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 12.59 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.19 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*(100.000^.5)/(12.593^(1/3)]=   6.19
The initial area total distance of 270.00 (Ft.) entered leaves a
remaining distance of 170.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.90 minutes
for a distance of 170.00 (Ft.) and a slope of 12.59 %

```
with an elevation difference of  21.41(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.905 Minutes
Tt=[(11.9*0.0322^3)/( 21.41)]^.385=  0.90
Total initial area Ti =   6.19 minutes from Figure 3-3 formula plus
  0.90 minutes from the Figure 3-4 formula =   7.09 minutes
Rainfall intensity (I) =      7.359(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      0.331(CFS)
Total initial stream area =        0.150(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      402.000 to Point/Station      403.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.842(CFS)
Depth of flow =   0.248(Ft.), Average velocity =   8.538(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             20.00              0.00
      3             35.00              5.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------
Sub-Channel flow  =      1.842(CFS)
  '     '    flow top width =      1.738(Ft.)
  '     '     velocity=    8.538(Ft/s)
  '     '    area =      0.216(Sq.Ft)
  '     '    Froude number =     4.271

Upstream point elevation =  1320.000(Ft.)
Downstream point elevation =  1210.000(Ft.)
Flow length =   313.000(Ft.)
Travel time  =    0.61 min.
Time of concentration =    7.71 min.
Depth of flow =   0.248(Ft.)
Average velocity =   8.538(Ft/s)
Total irregular channel flow =     1.842(CFS)
Irregular channel normal depth above invert elev. =   0.248(Ft.)
Average velocity of channel(s) =   8.538(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      6.977(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      0.468
Subarea runoff =      2.932(CFS) for      1.409(Ac.)
Total runoff =      3.263(CFS)    Total area =       1.559(Ac.)
Depth of flow =   0.308(Ft.), Average velocity =   9.850(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      403.000 to Point/Station      404.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      6.379(CFS)
Depth of flow =   0.420(Ft.), Average velocity =  10.356(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             15.00              0.00
      3             35.00              5.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------
Sub-Channel flow  =      6.379(CFS)
  '     '    flow top width =      2.937(Ft.)
  '     '     velocity=   10.356(Ft/s)
  '     '    area =      0.616(Sq.Ft)
  '     '    Froude number =     3.985

Upstream point elevation =  1210.000(Ft.)
Downstream point elevation =  1145.000(Ft.)
Flow length =   253.000(Ft.)
Travel time  =    0.41 min.
Time of concentration =    8.11 min.
Depth of flow =   0.420(Ft.)
Average velocity =  10.356(Ft/s)
Total irregular channel flow =     6.379(CFS)
Irregular channel normal depth above invert elev. =   0.420(Ft.)
Average velocity of channel(s) =  10.356(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      6.749(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      1.395
Subarea runoff =      6.152(CFS) for      3.091(Ac.)
Total runoff =      9.415(CFS)    Total area =       4.650(Ac.)
Depth of flow =   0.485(Ft.), Average velocity =  11.415(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      404.000 to Point/Station      405.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     11.843(CFS)
Depth of flow =   0.589(Ft.), Average velocity =   8.523(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              2.50
      2             10.00              0.00
```

```
      3             20.00              2.50
Manning's 'N' friction factor =   0.025
-----------------------------------------------------------------
Sub-Channel flow  =     11.843(CFS)
  '     '   flow top width =      4.715(Ft.)
  '     '    velocity=    8.523(Ft/s)
  '     '   area =      1.389(Sq.Ft)
  '     '   Froude number =     2.767

Upstream point elevation =  1145.000(Ft.)
Downstream point elevation =  1095.000(Ft.)
Flow length =   458.000(Ft.)
Travel time  =    0.90 min.
Time of concentration =    9.01 min.
Depth of flow =   0.589(Ft.)
Average velocity =   8.523(Ft/s)
Total irregular channel flow =    11.843(CFS)
Irregular channel normal depth above invert elev. =   0.589(Ft.)
Average velocity of channel(s) =   8.523(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      6.308(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      2.252
Subarea runoff =      4.792(CFS) for      2.857(Ac.)
Total runoff =     14.207(CFS)    Total area =       7.507(Ac.)
Depth of flow =   0.631(Ft.), Average velocity =   8.920(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      405.000 to Point/Station      406.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1095.000(Ft.)
Downstream point elevation =  1093.000(Ft.)
Channel length thru subarea  =   132.000(Ft.)
Channel base width     =    0.000(Ft.)
Slope or 'Z' of left channel bank =   1.250
Slope or 'Z' of right channel bank =   3.750
Estimated mean flow rate at midpoint of channel =     14.972(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     14.972(CFS)
Depth of flow =   0.932(Ft.), Average velocity =   6.894(Ft/s)
Channel flow top width =    4.660(Ft.)
Flow Velocity =    6.89(Ft/s)
Travel time  =    0.32 min.
Time of concentration =    9.33 min.
Critical depth =      1.156(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
```

```
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      6.168(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      2.537
Subarea runoff =      1.441(CFS) for      0.949(Ac.)
Total runoff =     15.647(CFS)    Total area =       8.456(Ac.)
Depth of flow =   0.948(Ft.), Average velocity =   6.970(Ft/s)
Critical depth =      1.172(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      406.000 to Point/Station      407.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1093.000(Ft.)
Downstream point/station elevation =  1092.000(Ft.)
Pipe length  =     5.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.647(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    15.647(CFS)
Normal flow depth in pipe =    9.66(In.)
Flow top width inside pipe =    9.51(In.)
Critical depth could not be calculated.
Pipe flow velocity =     23.13(Ft/s)
Travel time through pipe =    0.00 min.
Time of concentration (TC) =     9.33 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      407.000 to Point/Station      407.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.480
Time of concentration =     9.33 min.
Rainfall intensity =      6.167(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.303  CA =      2.616
Subarea runoff =      0.487(CFS) for      0.166(Ac.)
Total runoff =     16.135(CFS)    Total area =       8.622(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      407.000 to Point/Station      408.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1092.000(Ft.)
Downstream point/station elevation =  1091.000(Ft.)
Pipe length  =    29.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    16.135(CFS)
```

```
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    16.135(CFS)
Normal flow depth in pipe =   12.49(In.)
Flow top width inside pipe =   16.59(In.)
Critical depth could not be calculated.
Pipe flow velocity =     12.34(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     9.37 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      408.000 to Point/Station      408.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.690
Time of concentration =     9.37 min.
Rainfall intensity =      6.150(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.307  CA =      2.672
Subarea runoff =      0.300(CFS) for      0.081(Ac.)
Total runoff =     16.435(CFS)    Total area =       8.703(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      408.000 to Point/Station      409.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1091.000(Ft.)
Downstream point/station elevation =  1072.000(Ft.)
Pipe length  =    68.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    16.435(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    16.435(CFS)
Normal flow depth in pipe =    8.67(In.)
Flow top width inside pipe =   10.74(In.)
Critical depth could not be calculated.
Pipe flow velocity =     27.02(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     9.41 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      409.000 to Point/Station      410.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     21.290(CFS)
Depth of flow =   0.668(Ft.), Average velocity =  14.326(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              3.00
      2             10.00              0.00
```

```
      3             20.00              3.00
Manning's 'N' friction factor =   0.025
-----------------------------------------------------------------
Sub-Channel flow  =     21.290(CFS)
  '     '   flow top width =      4.451(Ft.)
  '     '    velocity=   14.326(Ft/s)
  '     '   area =      1.486(Sq.Ft)
  '     '   Froude number =     4.370

Upstream point elevation =  1072.000(Ft.)
Downstream point elevation =   966.000(Ft.)
Flow length =   399.000(Ft.)
Travel time  =    0.46 min.
Time of concentration =    9.88 min.
Depth of flow =   0.668(Ft.)
Average velocity =  14.326(Ft/s)
Total irregular channel flow =    21.290(CFS)
Irregular channel normal depth above invert elev. =   0.668(Ft.)
Average velocity of channel(s) =  14.326(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      5.945(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.304  CA =      4.386
Subarea runoff =      9.637(CFS) for      5.711(Ac.)
Total runoff =     26.072(CFS)    Total area =      14.414(Ac.)
Depth of flow =   0.720(Ft.), Average velocity =  15.071(Ft/s)
End of computations, total study area =          14.414 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 12/30/12

NORTH COUNTY ENVIRONMENTAL RESOURCES HYDROLOGY STUDY
POSTDEVELOPED 100 YEAR STORM EVENT
BASIN 500
Q:\12\12025\GPIP\MS\HYD\POSTDEV\12025BSN500POST100.OUT

 *********   Hydrology Study Control Information **********

Program License Serial Number 4012

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 7.200
P6/P24 =   48.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   501.000 to Point/Station   502.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance = 303.000(Ft.)
Highest elevation = 1377.000(Ft.)
Lowest elevation = 1240.000(Ft.)
Elevation difference = 137.000(Ft.) Slope = 45.215 %
Top of Initial Area Slope adjusted by User to 30.000 %
Bottom of Initial Area Slope adjusted by User to 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 30.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.63 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*(100.000^.5)/(30.000^(1/3)]=   4.63
The initial area total distance of 303.00 (Ft.) entered leaves a
remaining distance of 203.00 (Ft.)

```
Using Figure 3-4, the travel time for this distance is   0.74 minutes
for a distance of 203.00 (Ft.) and a slope of 30.00 %
with an elevation difference of  60.90(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.742 Minutes
Tt=[(11.9*0.0384^3)/( 60.90)]^.385=  0.74
Total initial area Ti =   4.63 minutes from Figure 3-3 formula plus
  0.74 minutes from the Figure 3-4 formula =   5.38 minutes
Rainfall intensity (I) =      8.799(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      1.272(CFS)
Total initial stream area =        0.482(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      502.000 to Point/Station      503.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      5.904(CFS)
Depth of flow =   0.369(Ft.), Average velocity =   9.632(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             18.00              0.00
      3             45.00              5.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------
Sub-Channel flow  =      5.904(CFS)
  '     '    flow top width =      3.322(Ft.)
  '     '     velocity=    9.632(Ft/s)
  '     '    area =      0.613(Sq.Ft)
  '     '    Froude number =     3.952

Upstream point elevation =  1240.000(Ft.)
Downstream point elevation =  1110.000(Ft.)
Flow length =   503.000(Ft.)
Travel time  =    0.87 min.
Time of concentration =    6.25 min.
Depth of flow =   0.369(Ft.)
Average velocity =   9.632(Ft/s)
Total irregular channel flow =     5.904(CFS)
Irregular channel normal depth above invert elev. =   0.369(Ft.)
Average velocity of channel(s) =   9.632(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      7.988(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      1.310
Subarea runoff =      9.192(CFS) for      3.885(Ac.)
Total runoff =     10.465(CFS)    Total area =       4.367(Ac.)
Depth of flow =   0.457(Ft.), Average velocity =  11.114(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      503.000 to Point/Station      504.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     12.520(CFS)
Depth of flow =   0.469(Ft.), Average velocity =   8.386(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             18.00              0.00
      3             48.00              3.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------------
Sub-Channel flow  =     12.520(CFS)
  '     '   flow top width =      6.372(Ft.)
  '     '    velocity=    8.386(Ft/s)
  '     '   area =      1.493(Sq.Ft)
  '     '   Froude number =     3.053

Upstream point elevation =  1110.000(Ft.)
Downstream point elevation =  1086.000(Ft.)
Flow length =   171.000(Ft.)
Travel time  =    0.34 min.
Time of concentration =    6.59 min.
Depth of flow =   0.469(Ft.)
Average velocity =   8.386(Ft/s)
Total irregular channel flow =    12.520(CFS)
Irregular channel normal depth above invert elev. =   0.469(Ft.)
Average velocity of channel(s) =   8.386(Ft/s)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      7.719(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300  CA =      1.880
Subarea runoff =      4.046(CFS) for      1.899(Ac.)
Total runoff =     14.511(CFS)    Total area =       6.266(Ac.)
Depth of flow =   0.495(Ft.), Average velocity =   8.701(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      504.000 to Point/Station      505.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1086.000(Ft.)
Downstream point/station elevation =  1085.000(Ft.)
Pipe length  =    75.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    14.511(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    14.511(CFS)
```

```
Normal flow depth in pipe =   14.11(In.)
Flow top width inside pipe =   19.72(In.)
Critical Depth =   16.96(In.)
Pipe flow velocity =      8.44(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =     6.74 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      505.000 to Point/Station      505.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[COMMERCIAL area type                         ]
(Neighborhod Commercial )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.780
Time of concentration =     6.74 min.
Rainfall intensity =      7.610(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.311  CA =      1.995
Subarea runoff =      0.672(CFS) for      0.148(Ac.)
Total runoff =     15.183(CFS)    Total area =       6.414(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      505.000 to Point/Station      506.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1085.000(Ft.)
Downstream point/station elevation =  1062.000(Ft.)
Pipe length  =    76.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.183(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    15.183(CFS)
Normal flow depth in pipe =    7.93(In.)
Flow top width inside pipe =   11.36(In.)
Critical depth could not be calculated.
Pipe flow velocity =     27.56(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     6.78 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      506.000 to Point/Station      506.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     6.78 min.
Rainfall intensity =      7.576(In/Hr) for a   100.0 year storm
```

```
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.310  CA =      2.237
Subarea runoff =      1.768(CFS) for      0.807(Ac.)
Total runoff =     16.951(CFS)    Total area =       7.221(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      506.000 to Point/Station      506.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.450
Time of concentration =     6.78 min.
Rainfall intensity =      7.576(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.321  CA =      2.520
Subarea runoff =      2.144(CFS) for      0.629(Ac.)
Total runoff =     19.095(CFS)    Total area =       7.850(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      506.000 to Point/Station      507.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1062.000(Ft.)
Downstream point/station elevation =  1061.000(Ft.)
Pipe length  =    30.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    19.095(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    19.095(CFS)
Normal flow depth in pipe =   14.67(In.)
Flow top width inside pipe =   13.98(In.)
Critical depth could not be calculated.
Pipe flow velocity =     12.37(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     6.82 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      507.000 to Point/Station      507.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                   ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.690
Time of concentration =     6.82 min.
Rainfall intensity =      7.547(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.331  CA =      2.667
```

```
Subarea runoff =      1.031(CFS) for      0.212(Ac.)
Total runoff =     20.126(CFS)    Total area =       8.062(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      507.000 to Point/Station      508.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =  1061.000(Ft.)
Downstream point/station elevation =  1050.000(Ft.)
Pipe length  =   144.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    20.126(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    20.126(CFS)
Normal flow depth in pipe =   11.03(In.)
Flow top width inside pipe =   17.54(In.)
Critical depth could not be calculated.
Pipe flow velocity =     17.74(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =     6.96 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      508.000 to Point/Station      508.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[COMMERCIAL area type                        ]
(Office Professional    )
Impervious value, Ai = 0.900
Sub-Area C Value = 0.840
Time of concentration =     6.96 min.
Rainfall intensity =      7.452(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.334  CA =      2.708
Subarea runoff =      0.053(CFS) for      0.049(Ac.)
Total runoff =     20.179(CFS)    Total area =       8.111(Ac.)


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Process from Point/Station      508.000 to Point/Station      508.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      8.111(Ac.)
Runoff from this stream =     20.179(CFS)
Time of concentration =    6.96 min.
Rainfall intensity =     7.452(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      521.000 to Point/Station      522.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
```

```
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance  =  759.000(Ft.)
Highest elevation = 1365.000(Ft.)
Lowest elevation = 1051.000(Ft.)
Elevation difference =  314.000(Ft.) Slope = 41.370 %
Top of Initial Area Slope adjusted by User to 30.000 %
Bottom of Initial Area Slope adjusted by User to 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  30.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.63 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*( 100.000^.5)/(  30.000^(1/3)]=   4.63
The initial area total distance of  759.00 (Ft.) entered leaves a
remaining distance of  659.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.84 minutes
for a distance of 659.00 (Ft.) and a slope of 30.00 %
with an elevation difference of 197.70(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.838 Minutes
Tt=[(11.9*0.1248^3)/(197.70)]^.385=  1.84
Total initial area Ti =   4.63 minutes from Figure 3-3 formula plus
  1.84 minutes from the Figure 3-4 formula =   6.47 minutes
Rainfall intensity (I) =      7.807(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =     10.088(CFS)
Total initial stream area =        4.307(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      522.000 to Point/Station      522.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                   ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.690
Time of concentration =     6.47 min.
Rainfall intensity =      7.807(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.307  CA =      1.347
Subarea runoff =      0.426(CFS) for      0.079(Ac.)
Total runoff =     10.513(CFS)    Total area =       4.386(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      522.000 to Point/Station      508.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1051.000(Ft.)
```

```
Downstream point/station elevation =  1050.000(Ft.)
Pipe length  =    28.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    10.513(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    10.513(CFS)
Normal flow depth in pipe =   10.73(In.)
Flow top width inside pipe =   13.53(In.)
Critical depth could not be calculated.
Pipe flow velocity =     11.19(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     6.51 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      508.000 to Point/Station      508.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      4.386(Ac.)
Runoff from this stream =     10.513(CFS)
Time of concentration =    6.51 min.
Rainfall intensity =     7.775(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1       20.179      6.96             7.452
2       10.513      6.51             7.775
Qmax(1) =
         1.000 *    1.000 *    20.179) +
         0.959 *    1.000 *    10.513) + =      30.256
Qmax(2) =
         1.000 *    0.936 *    20.179) +
         1.000 *    1.000 *    10.513) + =      29.409

Total of 2 streams to confluence:
Flow rates before confluence point:
      20.179      10.513
Maximum flow rates at confluence using above data:
       30.256       29.409
Area of streams before confluence:
        8.111        4.386
Results of confluence:
Total flow rate =     30.256(CFS)
Time of concentration =     6.957 min.
Effective stream area after confluence =     12.497(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      508.000 to Point/Station      509.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1050.000(Ft.)
Downstream point/station elevation =  1029.000(Ft.)
Pipe length  =    53.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    30.256(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    30.256(CFS)
```

```
Normal flow depth in pipe =    9.63(In.)
Flow top width inside pipe =   14.38(In.)
Critical depth could not be calculated.
Pipe flow velocity =     36.30(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =     6.98 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      509.000 to Point/Station      509.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     12.497(Ac.)
Runoff from this stream =     30.256(CFS)
Time of concentration =    6.98 min.
Rainfall intensity =     7.435(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      531.000 to Point/Station      532.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance  =  556.000(Ft.)
Highest elevation = 1320.000(Ft.)
Lowest elevation = 1065.000(Ft.)
Elevation difference =  255.000(Ft.) Slope = 45.863 %
Top of Initial Area Slope adjusted by User to 30.000 %
Bottom of Initial Area Slope adjusted by User to 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  30.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.63 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*( 100.000^.5)/(  30.000^(1/3)]=   4.63
The initial area total distance of  556.00 (Ft.) entered leaves a
remaining distance of  456.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.38 minutes
for a distance of 456.00 (Ft.) and a slope of 30.00 %
with an elevation difference of 136.80(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.385 Minutes
Tt=[(11.9*0.0864^3)/(136.80)]^.385=  1.38
Total initial area Ti =   4.63 minutes from Figure 3-3 formula plus
  1.38 minutes from the Figure 3-4 formula =   6.02 minutes
Rainfall intensity (I) =      8.182(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      8.908(CFS)
Total initial stream area =        3.629(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      532.000 to Point/Station      533.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1065.000(Ft.)
Downstream point/station elevation =  1039.000(Ft.)
Pipe length  =    55.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.908(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     8.908(CFS)
Normal flow depth in pipe =    6.00(In.)
Flow top width inside pipe =    8.49(In.)
Critical depth could not be calculated.
Pipe flow velocity =     28.50(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     6.05 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      533.000 to Point/Station      533.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[COMMERCIAL area type                         ]
(Neighborhod Commercial )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.780
Time of concentration =     6.05 min.
Rainfall intensity =      8.154(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.366  CA =      1.541
Subarea runoff =      3.658(CFS) for      0.580(Ac.)
Total runoff =     12.566(CFS)    Total area =       4.209(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      533.000 to Point/Station      534.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1039.000(Ft.)
Downstream point/station elevation =  1033.000(Ft.)
Pipe length  =    85.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.566(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    12.566(CFS)
Normal flow depth in pipe =    9.53(In.)
Flow top width inside pipe =   14.44(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.27(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =     6.14 min.


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Process from Point/Station      534.000 to Point/Station      534.000
**** SUBAREA FLOW ADDITION ****
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```
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(2.0 DU/A or Less       )
Impervious value, Ai = 0.200
Sub-Area C Value = 0.420
Time of concentration =     6.14 min.
Rainfall intensity =      8.074(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.371  CA =      1.715
Subarea runoff =      1.285(CFS) for      0.415(Ac.)
Total runoff =     13.850(CFS)    Total area =       4.624(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      534.000 to Point/Station      535.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1033.000(Ft.)
Downstream point/station elevation =  1032.000(Ft.)
Pipe length  =    28.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.850(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    13.850(CFS)
Normal flow depth in pipe =   11.07(In.)
Flow top width inside pipe =   17.52(In.)
Critical Depth =   16.52(In.)
Pipe flow velocity =     12.15(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     6.18 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      535.000 to Point/Station      535.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                   ]
(43.0 DU/A or Less      )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.780
Time of concentration =     6.18 min.
Rainfall intensity =      8.042(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.383  CA =      1.821
Subarea runoff =      0.797(CFS) for      0.136(Ac.)
Total runoff =     14.648(CFS)    Total area =       4.760(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      535.000 to Point/Station      509.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1032.000(Ft.)
```

```
Downstream point/station elevation =  1029.000(Ft.)
Pipe length  =   361.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    14.648(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    14.648(CFS)
Normal flow depth in pipe =   14.94(In.)
Flow top width inside pipe =   23.27(In.)
Critical Depth =   16.56(In.)
Pipe flow velocity =      7.12(Ft/s)
Travel time through pipe =    0.84 min.
Time of concentration (TC) =     7.03 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      509.000 to Point/Station      509.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      4.760(Ac.)
Runoff from this stream =     14.648(CFS)
Time of concentration =    7.03 min.
Rainfall intensity =     7.404(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1       30.256      6.98             7.435
2       14.648      7.03             7.404
Qmax(1) =
         1.000 *    1.000 *    30.256) +
         1.000 *    0.994 *    14.648) + =      44.809
Qmax(2) =
         0.996 *    1.000 *    30.256) +
         1.000 *    1.000 *    14.648) + =      44.777

Total of 2 streams to confluence:
Flow rates before confluence point:
      30.256      14.648
Maximum flow rates at confluence using above data:
       44.809       44.777
Area of streams before confluence:
       12.497        4.760
Results of confluence:
Total flow rate =     44.809(CFS)
Time of concentration =     6.981 min.
Effective stream area after confluence =     17.257(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      509.000 to Point/Station      510.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  1029.000(Ft.)
Downstream point/station elevation =  1026.000(Ft.)
Pipe length  =   195.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    44.809(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    44.809(CFS)
```

```
Normal flow depth in pipe =   21.84(In.)
Flow top width inside pipe =   26.70(In.)
Critical Depth =   26.65(In.)
Pipe flow velocity =     11.69(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =     7.26 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      510.000 to Point/Station      510.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.690
Time of concentration =     7.26 min.
Rainfall intensity =      7.251(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.380  CA =      7.398
Subarea runoff =      8.831(CFS) for      2.206(Ac.)
Total runoff =     53.640(CFS)    Total area =      19.463(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      510.000 to Point/Station      511.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1026.000(Ft.)
Downstream point/station elevation =  1024.000(Ft.)
Pipe length  =   135.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    53.640(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    53.640(CFS)
Normal flow depth in pipe =   23.02(In.)
Flow top width inside pipe =   30.32(In.)
Critical Depth =   28.72(In.)
Pipe flow velocity =     12.13(Ft/s)
Travel time through pipe =    0.19 min.
Time of concentration (TC) =     7.44 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      511.000 to Point/Station      511.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                    ]
(43.0 DU/A or Less      )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.780
The area added to the existing stream causes a
a lower flow rate of Q =     53.258(CFS)
```

```
therefore the upstream flow rate of Q =     53.640(CFS) is being used
Time of concentration =     7.44 min.
Rainfall intensity =      7.134(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.382  CA =      7.466
Subarea runoff =      0.000(CFS) for      0.087(Ac.)
Total runoff =     53.640(CFS)    Total area =      19.550(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      511.000 to Point/Station      512.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1024.000(Ft.)
Downstream point/station elevation =  1023.000(Ft.)
Pipe length  =    28.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    53.640(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    53.640(CFS)
Normal flow depth in pipe =   20.34(In.)
Flow top width inside pipe =   23.27(In.)
Critical depth could not be calculated.
Pipe flow velocity =     16.69(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     7.47 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      512.000 to Point/Station      512.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                    ]
(43.0 DU/A or Less      )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.780
Time of concentration =     7.47 min.
Rainfall intensity =      7.116(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.384  CA =      7.543
Subarea runoff =      0.039(CFS) for      0.099(Ac.)
Total runoff =     53.679(CFS)    Total area =      19.649(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      512.000 to Point/Station      513.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1023.000(Ft.)
Downstream point/station elevation =  1020.000(Ft.)
Pipe length  =    23.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    53.679(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    53.679(CFS)
Normal flow depth in pipe =   16.15(In.)
Flow top width inside pipe =   17.70(In.)
Critical depth could not be calculated.
```

```
Pipe flow velocity =     27.05(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     7.49 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      513.000 to Point/Station      514.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________________
Upstream point elevation =  1020.000(Ft.)
Downstream point elevation =   968.000(Ft.)
Channel length thru subarea  =   130.000(Ft.)
Channel base width     =   10.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Manning's 'N'    = 0.025
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     53.679(CFS)
Depth of flow =   0.233(Ft.), Average velocity =  10.671(Ft/s)
Channel flow top width =   33.258(Ft.)
Flow Velocity =   10.67(Ft/s)
Travel time  =    0.20 min.
Time of concentration =    7.69 min.
Critical depth =      0.500(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      514.000 to Point/Station      514.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
The area added to the existing stream causes a
a lower flow rate of Q =     53.092(CFS)
therefore the upstream flow rate of Q =     53.679(CFS) is being used
Time of concentration =     7.69 min.
Rainfall intensity =      6.986(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.383  CA =      7.600
Subarea runoff =      0.000(CFS) for      0.189(Ac.)
Total runoff =     53.679(CFS)    Total area =      19.838(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      514.000 to Point/Station      514.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[COMMERCIAL area type                       ]
(Neighborhod Commercial )
Impervious value, Ai = 0.800
```

```
Sub-Area C Value = 0.780
Time of concentration =     7.69 min.
Rainfall intensity =      6.986(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.391  CA =      7.906
Subarea runoff =      1.549(CFS) for      0.392(Ac.)
Total runoff =     55.228(CFS)    Total area =      20.230(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      514.000 to Point/Station      514.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     7.69 min.
Rainfall intensity =      6.986(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.379  CA =      8.769
Subarea runoff =      6.032(CFS) for      2.878(Ac.)
Total runoff =     61.260(CFS)    Total area =      23.108(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      514.000 to Point/Station      514.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     7.69 min.
Rainfall intensity =      6.986(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.378  CA =      8.861
Subarea runoff =      0.641(CFS) for      0.306(Ac.)
Total runoff =     61.901(CFS)    Total area =      23.414(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      514.000 to Point/Station      515.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Depth of flow =   0.499(Ft.), Average velocity =   7.833(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             28.00              0.00
```

```
      3             41.00              0.00
      4             70.00              5.00
Manning's 'N' friction factor =   0.025
-----------------------------------------------------------------
Sub-Channel flow  =     61.901(CFS)
  '     '   flow top width =     18.686(Ft.)
  '     '    velocity=    7.833(Ft/s)
  '     '   area =      7.903(Sq.Ft)
  '     '   Froude number =     2.123

Upstream point elevation =   968.000(Ft.)
Downstream point elevation =   962.000(Ft.)
Flow length =   109.000(Ft.)
Travel time  =    0.23 min.
Time of concentration =    7.92 min.
Depth of flow =   0.499(Ft.)
Average velocity =   7.833(Ft/s)
Total irregular channel flow =    61.901(CFS)
Irregular channel normal depth above invert elev. =   0.499(Ft.)
Average velocity of channel(s) =   7.833(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      515.000 to Point/Station      515.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     7.92 min.
Rainfall intensity =      6.853(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.375  CA =      9.167
Subarea runoff =      0.924(CFS) for      1.021(Ac.)
Total runoff =     62.825(CFS)    Total area =      24.435(Ac.)
End of computations, total study area =          24.435 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
      Rational Hydrology Study   Date: 03/12/13

NORTH COUNTY ENVIRONMENTAL RESOURCES HYDROLOGY STUDY
POSTDEVELOPED 100 YEAR STORM EVENT
BASIN 600
Q:\12\12025\GPIP\MS\HYD\POSTDEV\12025BSN600POST100.OUT

 *********   Hydrology Study Control Information **********

Program License Serial Number 4012

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 7.200
P6/P24 =   48.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   601.000 to Point/Station   602.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN   ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance = 479.000(Ft.)
Highest elevation = 1267.000(Ft.)
Lowest elevation = 1042.000(Ft.)
Elevation difference = 225.000(Ft.) Slope = 46.973 %
Top of Initial Area Slope adjusted by User to 30.000 %
Bottom of Initial Area Slope adjusted by User to 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 30.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.63 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*(100.000^.5)/(30.000^(1/3)]=   4.63
The initial area total distance of 479.00 (Ft.) entered leaves a
remaining distance of 379.00 (Ft.)

```
Using Figure 3-4, the travel time for this distance is   1.20 minutes
for a distance of 379.00 (Ft.) and a slope of 30.00 %
with an elevation difference of 113.70(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.201 Minutes
Tt=[(11.9*0.0718^3)/(113.70)]^.385=  1.20
Total initial area Ti =   4.63 minutes from Figure 3-3 formula plus
  1.20 minutes from the Figure 3-4 formula =   5.84 minutes
Rainfall intensity (I) =      8.347(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      9.831(CFS)
Total initial stream area =        3.926(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      602.000 to Point/Station      603.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1042.000(Ft.)
Downstream point/station elevation =  1028.000(Ft.)
Pipe length  =    25.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.831(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     9.831(CFS)
Normal flow depth in pipe =    6.06(In.)
Flow top width inside pipe =    8.44(In.)
Critical depth could not be calculated.
Pipe flow velocity =     31.09(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     5.85 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      603.000 to Point/Station      603.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(14.5 DU/A or Less      )
Impervious value, Ai = 0.500
Sub-Area C Value = 0.600
Time of concentration =     5.85 min.
Rainfall intensity =      8.335(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.309  CA =      1.252
Subarea runoff =      0.601(CFS) for      0.123(Ac.)
Total runoff =     10.432(CFS)    Total area =       4.049(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      603.000 to Point/Station      604.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1028.000(Ft.)
Downstream point/station elevation =  1027.000(Ft.)
Pipe length  =    31.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    10.432(CFS)
```

```
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    10.432(CFS)
Normal flow depth in pipe =   11.11(In.)
Flow top width inside pipe =   13.15(In.)
Critical depth could not be calculated.
Pipe flow velocity =     10.70(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     5.90 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      604.000 to Point/Station      604.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                    ]
(43.0 DU/A or Less      )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.780
Time of concentration =     5.90 min.
Rainfall intensity =      8.291(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.343  CA =      1.500
Subarea runoff =      2.001(CFS) for      0.318(Ac.)
Total runoff =     12.433(CFS)    Total area =       4.367(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      604.000 to Point/Station      605.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1027.000(Ft.)
Downstream point/station elevation =  1009.000(Ft.)
Pipe length  =   337.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.433(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    12.433(CFS)
Normal flow depth in pipe =   10.45(In.)
Flow top width inside pipe =   13.79(In.)
Critical depth could not be calculated.
Pipe flow velocity =     13.61(Ft/s)
Travel time through pipe =    0.41 min.
Time of concentration (TC) =     6.31 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      605.000 to Point/Station      605.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(7.3 DU/A or Less       )
Impervious value, Ai = 0.400
Sub-Area C Value = 0.540
```

```
Time of concentration =     6.31 min.
Rainfall intensity =      7.937(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.362  CA =      1.743
Subarea runoff =      1.398(CFS) for      0.450(Ac.)
Total runoff =     13.831(CFS)    Total area =       4.817(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      605.000 to Point/Station      605.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                    ]
(43.0 DU/A or Less      )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.780
Time of concentration =     6.31 min.
Rainfall intensity =      7.937(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.403  CA =      2.152
Subarea runoff =      3.250(CFS) for      0.525(Ac.)
Total runoff =     17.081(CFS)    Total area =       5.342(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      605.000 to Point/Station      606.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1009.000(Ft.)
Downstream point/station elevation =  1008.000(Ft.)
Pipe length  =    28.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    17.081(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    17.081(CFS)
Normal flow depth in pipe =   12.87(In.)
Flow top width inside pipe =   16.25(In.)
Critical depth could not be calculated.
Pipe flow velocity =     12.63(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     6.35 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      606.000 to Point/Station      606.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(2.0 DU/A or Less       )
Impervious value, Ai = 0.200
Sub-Area C Value = 0.420
Time of concentration =     6.35 min.
Rainfall intensity =      7.907(In/Hr) for a   100.0 year storm
```

```
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.405  CA =      2.392
Subarea runoff =      1.835(CFS) for      0.572(Ac.)
Total runoff =     18.916(CFS)    Total area =       5.914(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      606.000 to Point/Station      607.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1008.000(Ft.)
Downstream point/station elevation =  1001.000(Ft.)
Pipe length  =   123.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    18.916(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    18.916(CFS)
Normal flow depth in pipe =   11.68(In.)
Flow top width inside pipe =   17.18(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.58(Ft/s)
Travel time through pipe =    0.13 min.
Time of concentration (TC) =     6.48 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      607.000 to Point/Station      608.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1001.000(Ft.)
Downstream point elevation =  1000.000(Ft.)
Channel length thru subarea  =    92.000(Ft.)
Channel base width     =   10.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Estimated mean flow rate at midpoint of channel =     18.942(CFS)
Manning's 'N'    = 0.025
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     18.942(CFS)
Depth of flow =   0.332(Ft.), Average velocity =   2.149(Ft/s)
Channel flow top width =   43.162(Ft.)
Flow Velocity =    2.15(Ft/s)
Travel time  =    0.71 min.
Time of concentration =    7.19 min.
Critical depth =      0.305(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
The area added to the existing stream causes a
a lower flow rate of Q =     18.018(CFS)
therefore the upstream flow rate of Q =     18.916(CFS) is being used
Rainfall intensity =      7.294(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.400  CA =      2.470
Subarea runoff =      0.000(CFS) for      0.259(Ac.)
```

```
Total runoff =     18.916(CFS)    Total area =       6.173(Ac.)
Depth of flow =   0.331(Ft.), Average velocity =   2.148(Ft/s)
Critical depth =      0.305(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      608.000 to Point/Station      608.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      6.173(Ac.)
Runoff from this stream =     18.916(CFS)
Time of concentration =    7.19 min.
Rainfall intensity =     7.294(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      621.000 to Point/Station      622.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance  =  432.000(Ft.)
Highest elevation = 1267.000(Ft.)
Lowest elevation = 1058.000(Ft.)
Elevation difference =  209.000(Ft.) Slope = 48.380 %
Top of Initial Area Slope adjusted by User to 30.000 %
Bottom of Initial Area Slope adjusted by User to 30.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  30.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.63 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*( 100.000^.5)/(  30.000^(1/3)]=   4.63
The initial area total distance of  432.00 (Ft.) entered leaves a
remaining distance of  332.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.08 minutes
for a distance of 332.00 (Ft.) and a slope of 30.00 %
with an elevation difference of  99.60(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.084 Minutes
Tt=[(11.9*0.0629^3)/( 99.60)]^.385=  1.08
Total initial area Ti =   4.63 minutes from Figure 3-3 formula plus
  1.08 minutes from the Figure 3-4 formula =   5.72 minutes
Rainfall intensity (I) =      8.456(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      0.241(CFS)
Total initial stream area =        0.095(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      622.000 to Point/Station      623.000
```

**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 1058.000(Ft.)
Downstream point elevation = 1016.000(Ft.)
Channel length thru subarea = 494.000(Ft.)
Channel base width = 0.000(Ft.)
Slope or 'Z' of left channel bank = 1.250
Slope or 'Z' of right channel bank = 3.750
Estimated mean flow rate at midpoint of channel = 6.375(CFS)
Manning's 'N' = 0.025
Maximum depth of channel = 1.000(Ft.)
Flow(q) thru subarea = 6.375(CFS)
Depth of flow = 0.593(Ft.), Average velocity = 7.249(Ft/s)
Channel flow top width = 2.965(Ft.)
Flow Velocity = 7.25(Ft/s)
Travel time = 1.14 min.
Time of concentration = 6.85 min.
Critical depth = 0.836(Ft.)
Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity = 7.524(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.300 CA = 1.655
Subarea runoff = 12.214(CFS) for 5.423(Ac.)
Total runoff = 12.455(CFS) Total area = 5.518(Ac.)
Depth of flow = 0.762(Ft.), Average velocity = 8.570(Ft/s)
Critical depth = 1.078(Ft.)

++
Process from Point/Station 623.000 to Point/Station 624.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 1016.000(Ft.)
Downstream point/station elevation = 1007.000(Ft.)
Pipe length = 53.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 12.455(CFS)
Given pipe size = 18.00(In.)
Calculated individual pipe flow = 12.455(CFS)
Normal flow depth in pipe = 6.61(In.)
Flow top width inside pipe = 17.35(In.)
Critical Depth = 15.99(In.)
Pipe flow velocity = 21.17(Ft/s)
Travel time through pipe = 0.04 min.
Time of concentration (TC) = 6.90 min.

++
Process from Point/Station 624.000 to Point/Station 624.000
**** SUBAREA FLOW ADDITION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000

```
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[COMMERCIAL area type                        ]
(Neighborhod Commercial )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.780
Time of concentration =     6.90 min.
Rainfall intensity =      7.494(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.340  CA =      2.044
Subarea runoff =      2.862(CFS) for      0.498(Ac.)
Total runoff =     15.317(CFS)    Total area =       6.016(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      624.000 to Point/Station      625.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =  1007.000(Ft.)
Downstream point/station elevation =  1001.000(Ft.)
Pipe length  =    33.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.317(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =    15.317(CFS)
Normal flow depth in pipe =    7.26(In.)
Flow top width inside pipe =   17.66(In.)
Critical Depth =   16.95(In.)
Pipe flow velocity =     22.96(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =     6.92 min.


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Process from Point/Station      625.000 to Point/Station      608.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =  1001.000(Ft.)
Downstream point elevation =  1000.000(Ft.)
Channel length thru subarea  =    67.000(Ft.)
Channel base width     =   10.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Manning's 'N'    = 0.025
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     15.317(CFS)
Depth of flow =   0.280(Ft.), Average velocity =   2.285(Ft/s)
Channel flow top width =   37.953(Ft.)
Flow Velocity =    2.29(Ft/s)
Travel time  =    0.49 min.
Time of concentration =    7.41 min.
Critical depth =      0.273(Ft.)


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Process from Point/Station      608.000 to Point/Station      608.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      6.016(Ac.)
Runoff from this stream =     15.317(CFS)
```

```
Time of concentration =    7.41 min.
Rainfall intensity =     7.156(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1       18.916      7.19             7.294
2       15.317      7.41             7.156
Qmax(1) =
         1.000 *    1.000 *    18.916) +
         1.000 *    0.971 *    15.317) + =      33.784
Qmax(2) =
         0.981 *    1.000 *    18.916) +
         1.000 *    1.000 *    15.317) + =      33.874

Total of 2 streams to confluence:
Flow rates before confluence point:
      18.916      15.317
Maximum flow rates at confluence using above data:
       33.784       33.874
Area of streams before confluence:
        6.173        6.016
Results of confluence:
Total flow rate =     33.874(CFS)
Time of concentration =     7.409 min.
Effective stream area after confluence =     12.189(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      608.000 to Point/Station      609.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =  1000.000(Ft.)
Downstream point/station elevation =   993.000(Ft.)
Pipe length  =    52.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    33.874(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    33.874(CFS)
Normal flow depth in pipe =   11.59(In.)
Flow top width inside pipe =   23.99(In.)
Critical depth could not be calculated.
Pipe flow velocity =     22.56(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     7.45 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      609.000 to Point/Station      609.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     12.189(Ac.)
Runoff from this stream =     33.874(CFS)
Time of concentration =    7.45 min.
Rainfall intensity =     7.132(In/Hr)


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```
Process from Point/Station      626.000 to Point/Station      609.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance  =  653.000(Ft.)
Highest elevation = 1191.000(Ft.)
Lowest elevation =  993.000(Ft.)
Elevation difference =  198.000(Ft.) Slope = 30.322 %
Top of Initial Area Slope adjusted by User to 30.000 %
Bottom of Initial Area Slope adjusted by User to 10.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  30.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.63 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*( 100.000^.5)/(  30.000^(1/3)]=   4.63
The initial area total distance of  653.00 (Ft.) entered leaves a
remaining distance of  553.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.45 minutes
for a distance of 553.00 (Ft.) and a slope of 10.00 %
with an elevation difference of  55.30(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.452 Minutes
Tt=[(11.9*0.1047^3)/( 55.30)]^.385=  2.45
Total initial area Ti =   4.63 minutes from Figure 3-3 formula plus
  2.45 minutes from the Figure 3-4 formula =   7.09 minutes
Rainfall intensity (I) =      7.364(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      1.491(CFS)
Total initial stream area =        0.675(Ac.)


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Process from Point/Station      609.000 to Point/Station      609.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.675(Ac.)
Runoff from this stream =      1.491(CFS)
Time of concentration =    7.09 min.
Rainfall intensity =     7.364(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       33.874      7.45             7.132
2        1.491      7.09             7.364
Qmax(1) =
        1.000 *    1.000 *    33.874) +
```

```
        0.968 *    1.000 *     1.491) + =      35.318
Qmax(2) =
        1.000 *    0.952 *    33.874) +
        1.000 *    1.000 *     1.491) + =      33.723

Total of 2 streams to confluence:
Flow rates before confluence point:
      33.874       1.491
Maximum flow rates at confluence using above data:
       35.318       33.723
Area of streams before confluence:
       12.189        0.675
Results of confluence:
Total flow rate =     35.318(CFS)
Time of concentration =     7.447 min.
Effective stream area after confluence =     12.864(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      609.000 to Point/Station      610.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Depth of flow =   1.576(Ft.), Average velocity =   7.966(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              5.00
      2             15.00              1.00
      3             16.00              0.00
      4             17.00              1.00
      5             27.00              2.00
Manning's 'N' friction factor =   0.025
------------------------------------------------------------------------
Sub-Channel flow  =     35.318(CFS)
  '     '    flow top width =      9.921(Ft.)
  '     '     velocity=    7.966(Ft/s)
  '     '    area =      4.434(Sq.Ft)
  '     '    Froude number =     2.100

Upstream point elevation =   993.000(Ft.)
Downstream point elevation =   977.000(Ft.)
Flow length =   270.000(Ft.)
Travel time  =    0.56 min.
Time of concentration =    8.01 min.
Depth of flow =   1.576(Ft.)
Average velocity =   7.966(Ft/s)
Total irregular channel flow =    35.318(CFS)
Irregular channel normal depth above invert elev. =   1.576(Ft.)
Average velocity of channel(s) =   7.966(Ft/s)


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Process from Point/Station      610.000 to Point/Station      610.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     12.864(Ac.)
Runoff from this stream =     35.318(CFS)
Time of concentration =    8.01 min.
```

```
Rainfall intensity =     6.803(In/Hr)


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Process from Point/Station      631.000 to Point/Station      632.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[COMMERCIAL area type                          ]
(Neighborhod Commercial )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.780
Initial subarea total flow distance  =  546.000(Ft.)
Highest elevation = 1031.000(Ft.)
Lowest elevation = 1021.000(Ft.)
Elevation difference =   10.000(Ft.) Slope =  1.832 %
Top of Initial Area Slope adjusted by User to  2.000 %
Bottom of Initial Area Slope adjusted by User to  2.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 75.00 (Ft)
for the top area slope value of   2.00 %, in a development type of
 Neighborhod Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.96 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.7800)*(  75.000^.5)/(   2.000^(1/3)]=   3.96
The initial area total distance of  546.00 (Ft.) entered leaves a
remaining distance of  471.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   4.03 minutes
for a distance of 471.00 (Ft.) and a slope of  2.00 %
with an elevation difference of   9.42(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    4.026 Minutes
Tt=[(11.9*0.0892^3)/(  9.42)]^.385=  4.03
Total initial area Ti =   3.96 minutes from Figure 3-3 formula plus
  4.03 minutes from the Figure 3-4 formula =   7.99 minutes
Rainfall intensity (I) =      6.818(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.780
Subarea runoff =     22.963(CFS)
Total initial stream area =        4.318(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      632.000 to Point/Station      633.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =  1021.000(Ft.)
Downstream point/station elevation =  1020.000(Ft.)
Pipe length  =    35.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    22.963(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    22.963(CFS)
Normal flow depth in pipe =   14.98(In.)
Flow top width inside pipe =   19.00(In.)
Critical Depth =   19.85(In.)
Pipe flow velocity =     12.52(Ft/s)
Travel time through pipe =    0.05 min.
```

```
Time of concentration (TC) =     8.03 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      633.000 to Point/Station      633.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.690
Time of concentration =     8.03 min.
Rainfall intensity =      6.792(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.768  CA =      3.814
Subarea runoff =      2.942(CFS) for      0.646(Ac.)
Total runoff =     25.904(CFS)    Total area =       4.964(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      633.000 to Point/Station      634.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =  1020.000(Ft.)
Downstream point/station elevation =  1009.000(Ft.)
Pipe length  =    29.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    25.904(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    25.904(CFS)
Normal flow depth in pipe =    8.82(In.)
Flow top width inside pipe =   14.76(In.)
Critical depth could not be calculated.
Pipe flow velocity =     34.53(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     8.05 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      634.000 to Point/Station      634.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.690
Time of concentration =     8.05 min.
Rainfall intensity =      6.785(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.763  CA =      4.048
Subarea runoff =      1.558(CFS) for      0.339(Ac.)
Total runoff =     27.462(CFS)    Total area =       5.303(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      634.000 to Point/Station      635.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1009.000(Ft.)
Downstream point/station elevation =  1008.000(Ft.)
Pipe length  =    28.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    27.462(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    27.462(CFS)
Normal flow depth in pipe =   15.82(In.)
Flow top width inside pipe =   18.10(In.)
Critical depth could not be calculated.
Pipe flow velocity =     14.12(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     8.08 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      635.000 to Point/Station      635.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                    ]
(43.0 DU/A or Less      )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.780
Time of concentration =     8.08 min.
Rainfall intensity =      6.767(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.764  CA =      4.187
Subarea runoff =      0.867(CFS) for      0.178(Ac.)
Total runoff =     28.329(CFS)    Total area =       5.481(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      635.000 to Point/Station      636.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1008.000(Ft.)
Downstream point/station elevation =   994.000(Ft.)
Pipe length  =    44.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    28.329(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    28.329(CFS)
Normal flow depth in pipe =    9.94(In.)
Flow top width inside pipe =   14.19(In.)
Critical depth could not be calculated.
Pipe flow velocity =     32.81(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =     8.10 min.


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Process from Point/Station      636.000 to Point/Station      637.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
```

```
Upstream point/station elevation =   994.000(Ft.)
Downstream point/station elevation =   988.000(Ft.)
Pipe length  =   173.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    28.329(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    28.329(CFS)
Normal flow depth in pipe =   15.89(In.)
Flow top width inside pipe =   22.70(In.)
Critical Depth =   22.01(In.)
Pipe flow velocity =     12.84(Ft/s)
Travel time through pipe =    0.22 min.
Time of concentration (TC) =     8.33 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      637.000 to Point/Station      610.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   988.000(Ft.)
Downstream point elevation =   977.000(Ft.)
Channel length thru subarea  =   120.000(Ft.)
Channel base width     =    5.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     28.701(CFS)
Manning's 'N'    = 0.025
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     28.701(CFS)
Depth of flow =   0.456(Ft.), Average velocity =   8.926(Ft/s)
Channel flow top width =    9.104(Ft.)
Flow Velocity =    8.93(Ft/s)
Travel time  =    0.22 min.
Time of concentration =    8.55 min.
Critical depth =      0.789(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      6.524(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.700  CA =      4.447
Subarea runoff =      0.682(CFS) for      0.868(Ac.)
Total runoff =     29.012(CFS)    Total area =       6.349(Ac.)
Depth of flow =   0.459(Ft.), Average velocity =   8.955(Ft/s)
Critical depth =      0.797(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      610.000 to Point/Station      610.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
```

```
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     8.55 min.
Rainfall intensity =      6.524(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.690  CA =      4.498
Subarea runoff =      0.331(CFS) for      0.169(Ac.)
Total runoff =     29.342(CFS)    Total area =       6.518(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      610.000 to Point/Station      610.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     8.55 min.
Rainfall intensity =      6.524(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.684  CA =      4.531
Subarea runoff =      0.217(CFS) for      0.111(Ac.)
Total runoff =     29.560(CFS)    Total area =       6.629(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      610.000 to Point/Station      610.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      6.629(Ac.)
Runoff from this stream =     29.560(CFS)
Time of concentration =    8.55 min.
Rainfall intensity =     6.524(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1       35.318      8.01             6.803
2       29.560      8.55             6.524
Qmax(1) =
         1.000 *    1.000 *    35.318) +
         1.000 *    0.937 *    29.560) + =      63.017
Qmax(2) =
         0.959 *    1.000 *    35.318) +
         1.000 *    1.000 *    29.560) + =      63.428

Total of 2 streams to confluence:
Flow rates before confluence point:
      35.318      29.560
```

```
Maximum flow rates at confluence using above data:
       63.017       63.428
Area of streams before confluence:
       12.864        6.629
Results of confluence:
Total flow rate =     63.428(CFS)
Time of concentration =     8.550 min.
Effective stream area after confluence =     19.493(Ac.)
End of computations, total study area =          19.493 (Ac.)
```

ATTACHMENT F
PRE AND POST DEVELOPED HYDROLOGY MAPS

LEGEND

WATERCOURSE	— · · — · · —
WATERSHED BOUNDARY	— — — — —
SUB-AREA BOUNDARY	— — — — —
NODE NUMBER	(101)

BASIN #	TOTAL
10	4.719 AC
20	7.472 AC
30	29.144 AC
40	14.861 AC
50	25.966 AC
60	17.865 AC

SCALE 1":150'

0 150 300 450 600

PRE-DEVELOPMENT HYDROLOGY MAP

NORTH COUNTY ENVIRONMENTAL RESOURCES

LEGEND

- WATERCOURSE
- WATERSHED BOUNDARY
- SUB-AREA BOUNDARY
- NODE NUMBER (101)

BASIN 100
4.867 Acres

BASIN 200
7.570 Acres

BASIN 300
29.129 Acres

BASIN 400
14.413 Acres

BASIN 500
24.435 Acres

BASIN 600
19.493 Acres

MESA ROCK RD.

INTERSTATE 15

100-YEAR INUNDATION ELEVATION

BASIN 1 – EXIST. DISCHARGE LOCATION
–DETENTION REQUIRED
–ADDITIONAL GRADING NECESSARY

BASIN 2 – EXIST. DISCHARGE LOCATION
–DETENTION REQUIRED
–NO ADDITIONAL GRADING NECESSARY
(NATURAL BASIN CONFIGURATION)

BASIN 3 – EXIST. DISCHARGE LOCATION
–DETENTION REQUIRED
–NO ADDITIONAL GRADING NECESSARY
(NATURAL BASIN CONFIGURATION)

BASIN 4 – EXIST. DISCHARGE LOCATION
–100-YEAR Q REDUCED
–NO DETENTION REQUIRED
–NO ADDITIONAL GRADING REQUIRED

BASIN 5 – EXIST. DISCHARGE LOCATION
–DETENTION REQUIRED
–NO ADDITIONAL GRADING NECESSARY
(NATURAL BASIN CONFIGURATION)

BASIN 6 – EXIST. DISCHARGE LOCATION
–DETENTION REQUIRED
–ADDITIONAL GRADING NECESSARY

BASIN #	TOTAL
100	4.867 AC
200	7.570 AC
300	29.129 AC
400	14.413 AC
500	24.435 AC
600	19.493 AC

SCALE 1"=150'

0 150 300 450 600

POST-DEVELOPMENT HYDROLOGY MAP

REVISED: 3-13-13

BASIN 300
29.129 Acres

BASIN 200
7.570 Acres

BASIN 100
4.867 Acres

BASIN 400
14.413 Acres

19.131 Acres
2.440 Acres
2.126 Acres
3.228 Acres
0.680 Acres
0.530 Acres
0.431 Acres
0.463 Acres
0.398 Acres
0.346 Acres
0.275 Acres
0.176 Acres
0.387 Acres
0.699 Acres
0.965 Acres
2.857 Acres
0.244 Acres
0.157 Acres
3.828 Acres
0.949 Acres
0.168 Acres
0.087 Acres
5.711 Acres

100-YEAR CHANNEL WITH SURFACE ELEVATION

Q OUT=50.0 CFS
V OUT=15.9 FPS

Q OUT=1.2 CFS
V OUT=3.3 FPS

Q OUT=15.2 CFS
V OUT=8.8 FPS

Q OUT=16.4 CFS
V OUT=9.4 FPS

100-YEAR INUNDATION ELEVATION

100-YEAR INUNDATION ELEVATION

100-YEAR INUNDATION ELEVATION

BASIN 1 P.O.C.
PREDEV: 4.72 ACRES
Tc=7.10 MIN
Q100=10.4 CFS
POSTDEV: 4.87 ACRES
Tc=6.67 MIN
Q100=13.3 CFS

POSTDEV MITIGATED
Q100= 7.54 CFS

BASIN 2 P.O.C.
PREDEV: 7.47 ACRES
Tc=6.59 MIN
Q100=17.3 CFS
POSTDEV: 7.57 ACRES
Tc=6.62 MIN
Q100=18.8 CFS

POSTDEV MITIGATED
Q100= 16.43 CFS

BASIN 3 P.O.C.
PREDEV: 29.14 ACRES
Tc=8.78 MIN
Q100=56.1 CFS
POSTDEV: 29.13 ACRES
Tc=8.75 MIN
Q100=57.9 CFS

POSTDEV MITIGATED
Q100= 32.48 CFS

BASIN 4 P.O.C.
PREDEV: 14.86 ACRES
Tc=9.54 MIN
Q100=27.10 CFS
POSTDEV: 14.14 ACRES
Tc=9.88 MIN
Q100=26.10 CFS
POSTDEV MITIGATED
NOT NEEDED

100-YEAR INUNDATION ELEVATION

MESA ROCK RD.

INTERSTATE 15

SEE SHEET 3

LEGEND

- WATERCOURSE
- WATERSHED BOUNDARY
- SUB-AREA BOUNDARY
- NODE NUMBER (101)

BASIN #	TOTAL
100	4.867 AC
200	7.570 AC
300	29.129 AC
400	14.413 AC

SCALE 1":50'

0 50 100 150 200

POST-DEVELOPMENT HYDROLOGY MAP

REVISED: 3-13-13

SEE SHEET 2

POST-DEVELOPMENT HYDROLOGY MAP

INTERSTATE 15

BASIN 500
24.435 Acres

BASIN 400
14.413 Acres

BASIN 600
19.493 Acres

Q OUT=12.6 CFS
V OUT=7.1 FPS

Q OUT=30.3 CFS
V OUT=9.9 FPS

Q OUT=15.2 CFS
V OUT=8.6 FPS

Q OUT=9.8 CFS
V OUT=21.9 FPS

Q IN=8.90 CFS

BASIN 6 P.O.C.
PREDEV: 17.87 ACRES
Tc=7.57 MIN
Q100=37.8 CFS
POSTDEV: 19.49 ACRES
Tc=8.55 MIN
Q100=63.4 CFS
POSTDEV MITIGATED
Q100= 36.74 CFS

BASIN 5 P.O.C.
PREDEV: 25.97 ACRES
Tc=8.68 MIN
Q100=50.3 CFS
24.46 ACRES
Tc=7.92 MIN
62.8 CFS
POSTDEV MITIGATED
Q100= 42.8 CFS

100-YEAR INUNDATION ELEVATION

100-YEAR INUNDATION ELEVATION

3.629 Acres
4.307 Acres
0.807 Acres
1.899 Acres
0.949 Acres
3.926 Acres
0.580 Acres
0.415 Acres
0.136 Acres
0.079 Acres
0.049 Acres
0.148 Acres
0.189 Acres
0.166 Acres
0.081 Acres
0.629 Acres
0.212 Acres
0.392 Acres
2.206 Acres
0.318 Acres
0.123 Acres
0.147 Acres
0.163 Acres
0.095 Acres
2.815 Acres
4.318 Acres
0.525 Acres
0.572 Acres
0.430 Acres
0.349 Acres
1.038 Acres
5.423 Acres
0.646 Acres
0.178 Acres
0.339 Acres
0.498 Acres
0.169 Acres
0.259 Acres
0.868 Acres
0.111 Acres
0.046 Acres
0.675 Acres

LEGEND

WATERCOURSE
WATERSHED BOUNDARY
SUB-AREA BOUNDARY
NODE NUMBER (n)

BASIN #	TOTAL
400	14.413 AC
500	24.435 AC
600	19.493 AC

SCALE 1"=50'

0 50 100 150 200

REVISED: 3-13-13

ATTACHMENT G

DETENTION BASIN SIZING

(Subbasins 100, 200, 300, 500, & 600)

RATIONAL METHOD HYDROGRAPH PROGRAM

SUBBASIN 100
BASIN @ NODE 104

RUN DATE 2/26/2013
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 7 MIN.
6 HOUR RAINFALL 3.5 INCHES
BASIN AREA 4.87 ACRES
RUNOFF COEFFICIENT 0.356
PEAK DISCHARGE 13.3 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 7	DISCHARGE (CFS) = 0.4
TIME (MIN) = 14	DISCHARGE (CFS) = 0.4
TIME (MIN) = 21	DISCHARGE (CFS) = 0.4
TIME (MIN) = 28	DISCHARGE (CFS) = 0.4
TIME (MIN) = 35	DISCHARGE (CFS) = 0.4
TIME (MIN) = 42	DISCHARGE (CFS) = 0.4
TIME (MIN) = 49	DISCHARGE (CFS) = 0.4
TIME (MIN) = 56	DISCHARGE (CFS) = 0.4
TIME (MIN) = 63	DISCHARGE (CFS) = 0.4
TIME (MIN) = 70	DISCHARGE (CFS) = 0.4
TIME (MIN) = 77	DISCHARGE (CFS) = 0.5
TIME (MIN) = 84	DISCHARGE (CFS) = 0.5
TIME (MIN) = 91	DISCHARGE (CFS) = 0.5
TIME (MIN) = 98	DISCHARGE (CFS) = 0.5
TIME (MIN) = 105	DISCHARGE (CFS) = 0.5
TIME (MIN) = 112	DISCHARGE (CFS) = 0.5
TIME (MIN) = 119	DISCHARGE (CFS) = 0.6
TIME (MIN) = 126	DISCHARGE (CFS) = 0.6
TIME (MIN) = 133	DISCHARGE (CFS) = 0.6
TIME (MIN) = 140	DISCHARGE (CFS) = 0.6
TIME (MIN) = 147	DISCHARGE (CFS) = 0.7
TIME (MIN) = 154	DISCHARGE (CFS) = 0.7
TIME (MIN) = 161	DISCHARGE (CFS) = 0.7
TIME (MIN) = 168	DISCHARGE (CFS) = 0.7
TIME (MIN) = 175	DISCHARGE (CFS) = 0.8
TIME (MIN) = 182	DISCHARGE (CFS) = 0.9
TIME (MIN) = 189	DISCHARGE (CFS) = 0.9
TIME (MIN) = 196	DISCHARGE (CFS) = 1
TIME (MIN) = 203	DISCHARGE (CFS) = 1.1
TIME (MIN) = 210	DISCHARGE (CFS) = 1.2
TIME (MIN) = 217	DISCHARGE (CFS) = 1.5
TIME (MIN) = 224	DISCHARGE (CFS) = 1.7
TIME (MIN) = 231	DISCHARGE (CFS) = 2.5
TIME (MIN) = 238	DISCHARGE (CFS) = 3.2
TIME (MIN) = 245	DISCHARGE (CFS) = 13.3
TIME (MIN) = 252	DISCHARGE (CFS) = 2
TIME (MIN) = 259	DISCHARGE (CFS) = 1.4
TIME (MIN) = 266	DISCHARGE (CFS) = 1.1
TIME (MIN) = 273	DISCHARGE (CFS) = 0.9
TIME (MIN) = 280	DISCHARGE (CFS) = 0.8
TIME (MIN) = 287	DISCHARGE (CFS) = 0.7
TIME (MIN) = 294	DISCHARGE (CFS) = 0.6
TIME (MIN) = 301	DISCHARGE (CFS) = 0.6
TIME (MIN) = 308	DISCHARGE (CFS) = 0.5
TIME (MIN) = 315	DISCHARGE (CFS) = 0.5
TIME (MIN) = 322	DISCHARGE (CFS) = 0.5
TIME (MIN) = 329	DISCHARGE (CFS) = 0.4
TIME (MIN) = 336	DISCHARGE (CFS) = 0.4
TIME (MIN) = 343	DISCHARGE (CFS) = 0.4
TIME (MIN) = 350	DISCHARGE (CFS) = 0.4
TIME (MIN) = 357	DISCHARGE (CFS) = 0.4
TIME (MIN) = 364	DISCHARGE (CFS) = 0

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Manual	13.30	7	245	21,546	----	------	------	Postdeveloped @ Node 104
2	Reservoir	7.54	7	252	21,545	1	957.43	2,373	Outflow from Detention

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 9:44 AM

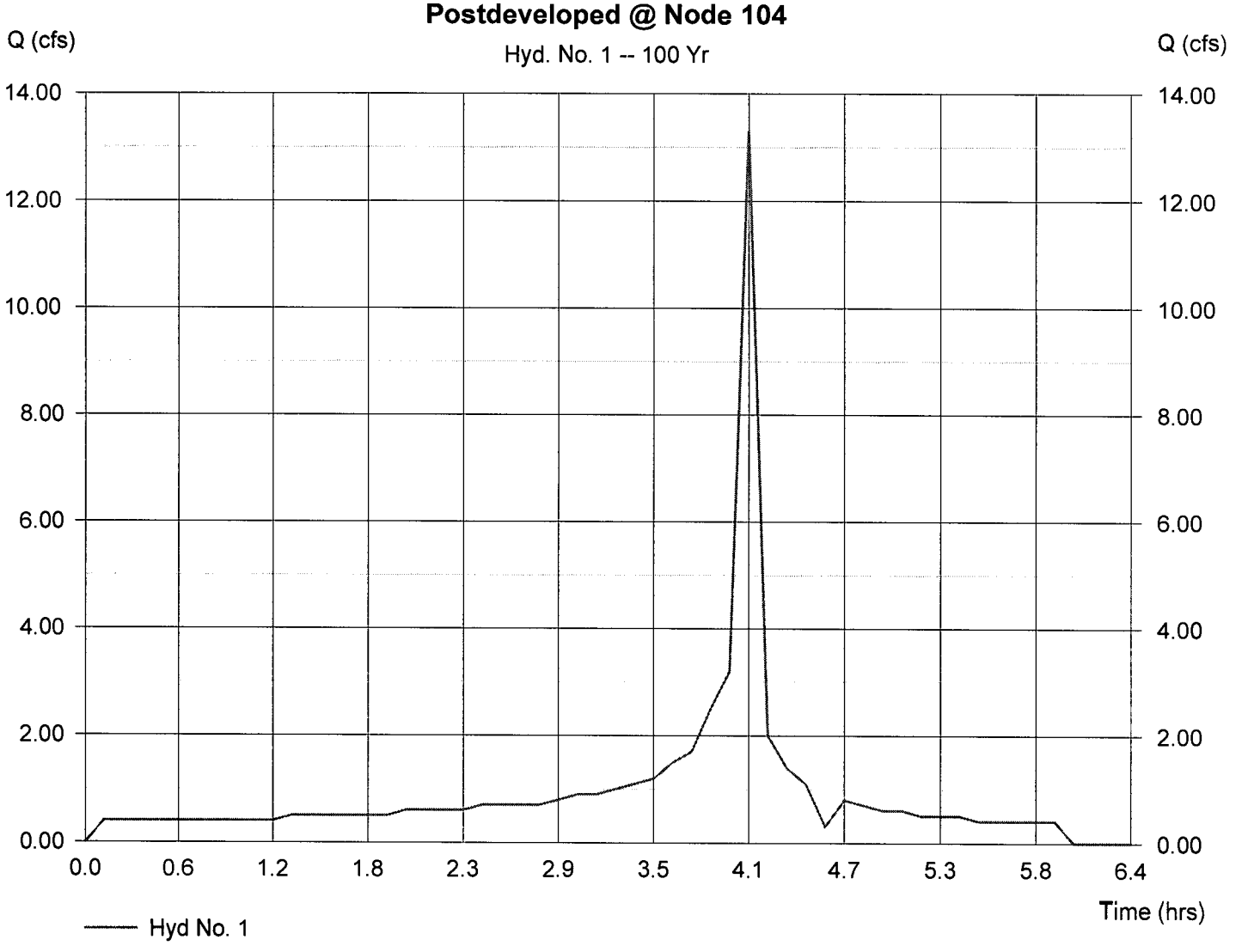
Hyd. No. 1

Postdeveloped @ Node 104

Hydrograph type = Manual
Storm frequency = 100 yrs

Peak discharge = 13.30 cfs
Time interval = 7 min

Hydrograph Volume = 21,546 cuft



Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 9:47 AM

Hyd. No. 1

Postdeveloped @ Node 104

Hydrograph type	= Manual	Peak discharge	= 13.30 cfs
Storm frequency	= 100 yrs	Time interval	= 7 min

Hydrograph Volume = 21,546 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow cfs)	Time (hrs)	Outflow cfs)
0.12	0.40	4.08	13.30 <<
0.23	0.40	4.20	2.00
0.35	0.40	4.32	1.40
0.47	0.40	4.43	1.10
0.58	0.40	4.55	0.30
0.70	0.40	4.67	0.80
0.82	0.40	4.78	0.70
0.93	0.40	4.90	0.60
1.05	0.40	5.02	0.60
1.17	0.40	5.13	0.50
1.28	0.50	5.25	0.50
1.40	0.50	5.37	0.50
1.52	0.50	5.48	0.40
1.63	0.50	5.60	0.40
1.75	0.50	5.72	0.40
1.87	0.50	5.83	0.40
1.98	0.60	5.95	0.40
2.10	0.60		
2.22	0.60		
2.33	0.60	*...End*	
2.45	0.70		
2.57	0.70		
2.68	0.70		
2.80	0.70		
2.92	0.80		
3.03	0.90		
3.15	0.90		
3.27	1.00		
3.38	1.10		
3.50	1.20		
3.62	1.50		
3.73	1.70		
3.85	2.50		
3.97	3.20		

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 9:44 AM

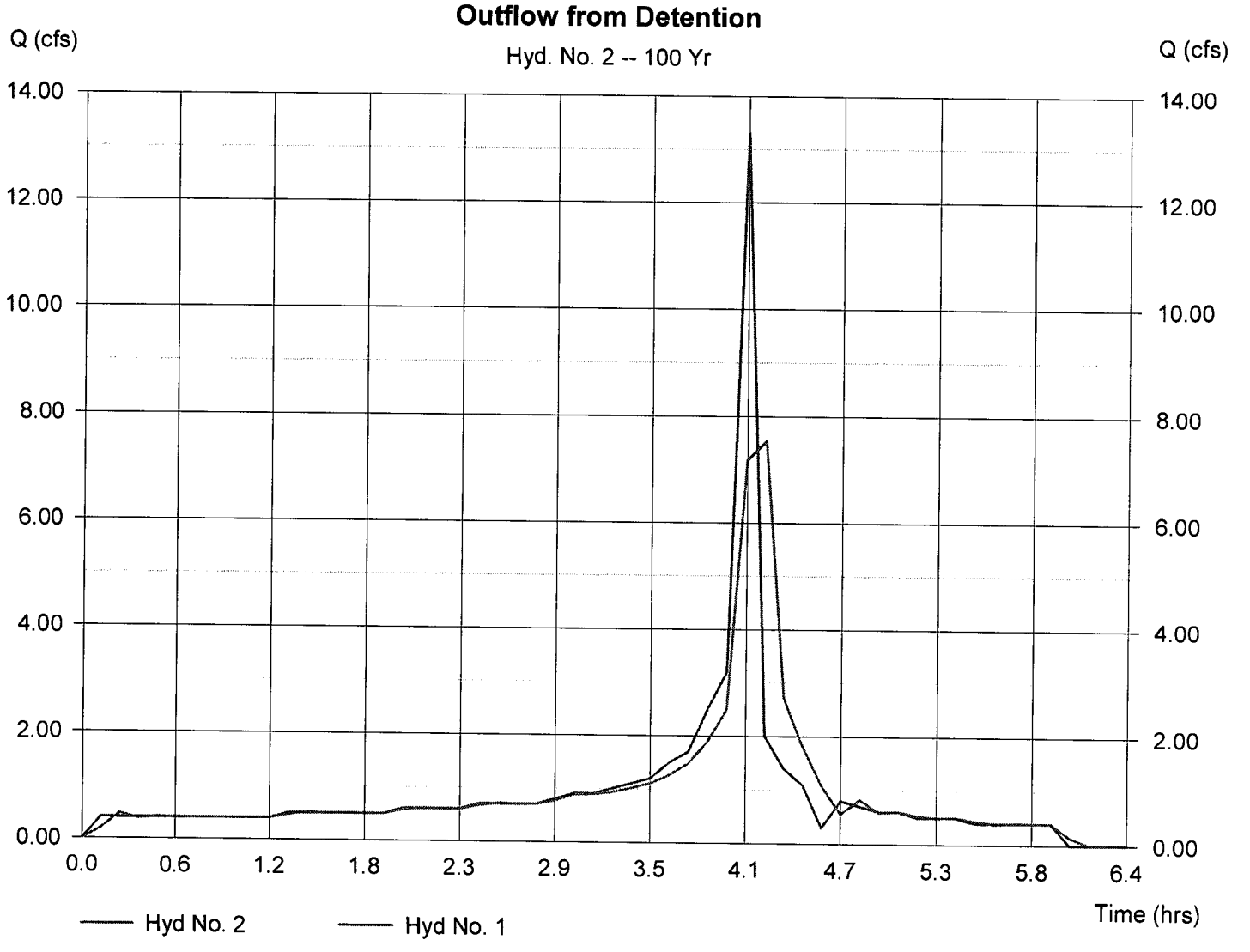
Hyd. No. 2

Outflow from Detention

Hydrograph type	= Reservoir	Peak discharge	= 7.54 cfs
Storm frequency	= 100 yrs	Time interval	= 7 min
Inflow hyd. No.	= 1	Max. Elevation	= 957.43 ft
Reservoir name	= Det. Basin @ Node 104	Max. Storage	= 2,373 cuft

Storage Indication method used.

Hydrograph Volume = 21,545 cuft



Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 9:47 AM

Hyd. No. 2

Outflow from Detention

Hydrograph type	= Reservoir	Peak discharge	= 7.54 cfs
Storm frequency	= 100 yrs	Time interval	= 7 min
Inflow hyd. No.	= 1	Reservoir name	= Det. Basin @ Node
Max. Elevation	= 957.43 ft	Max. Storage	= 2,373 cuft

Storage Indication method used.

Outflow hydrograph volume = 21,545 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
0.12	0.40	955.70	0.19	-----	-----	-----	-----	-----	-----	-----	-----	0.19
0.23	0.40	955.83	0.47	-----	-----	-----	-----	-----	-----	-----	-----	0.47
0.35	0.40	955.79	0.38	-----	-----	-----	-----	-----	-----	-----	-----	0.38
0.47	0.40	955.80	0.41	-----	-----	-----	-----	-----	-----	-----	-----	0.41
0.58	0.40	955.80	0.40	-----	-----	-----	-----	-----	-----	-----	-----	0.40
0.70	0.40	955.80	0.40	-----	-----	-----	-----	-----	-----	-----	-----	0.40
0.82	0.40	955.80	0.40	-----	-----	-----	-----	-----	-----	-----	-----	0.40
0.93	0.40	955.80	0.40	-----	-----	-----	-----	-----	-----	-----	-----	0.40
1.05	0.40	955.80	0.40	-----	-----	-----	-----	-----	-----	-----	-----	0.40
1.17	0.40	955.80	0.40	-----	-----	-----	-----	-----	-----	-----	-----	0.40
1.28	0.50	955.83	0.47	-----	-----	-----	-----	-----	-----	-----	-----	0.47
1.40	0.50	955.85	0.51	-----	-----	-----	-----	-----	-----	-----	-----	0.51
1.52	0.50	955.84	0.50	-----	-----	-----	-----	-----	-----	-----	-----	0.50
1.63	0.50	955.84	0.50	-----	-----	-----	-----	-----	-----	-----	-----	0.50
1.75	0.50	955.84	0.50	-----	-----	-----	-----	-----	-----	-----	-----	0.50
1.87	0.50	955.84	0.50	-----	-----	-----	-----	-----	-----	-----	-----	0.50
1.98	0.60	955.87	0.57	-----	-----	-----	-----	-----	-----	-----	-----	0.57
2.10	0.60	955.89	0.61	-----	-----	-----	-----	-----	-----	-----	-----	0.61
2.22	0.60	955.88	0.60	-----	-----	-----	-----	-----	-----	-----	-----	0.60
2.33	0.60	955.89	0.60	-----	-----	-----	-----	-----	-----	-----	-----	0.60
2.45	0.70	955.91	0.67	-----	-----	-----	-----	-----	-----	-----	-----	0.67
2.57	0.70	955.94	0.71	-----	-----	-----	-----	-----	-----	-----	-----	0.71
2.68	0.70	955.93	0.70	-----	-----	-----	-----	-----	-----	-----	-----	0.70
2.80	0.70	955.93	0.70	-----	-----	-----	-----	-----	-----	-----	-----	0.70
2.92	0.80	955.96	0.77	-----	-----	-----	-----	-----	-----	-----	-----	0.77
3.03	0.90	956.00	0.88	-----	-----	-----	-----	-----	-----	-----	-----	0.88
3.15	0.90	956.00	0.89	-----	-----	-----	-----	-----	-----	-----	-----	0.89
3.27	1.00	956.02	0.93	-----	-----	-----	-----	-----	-----	-----	-----	0.93
3.38	1.10	956.05	1.01	-----	-----	-----	-----	-----	-----	-----	-----	1.01
3.50	1.20	956.08	1.10	-----	-----	-----	-----	-----	-----	-----	-----	1.10
3.62	1.50	956.14	1.26	-----	-----	-----	-----	-----	-----	-----	-----	1.26
3.73	1.70	956.23	1.48	-----	-----	-----	-----	-----	-----	-----	-----	1.48
3.85	2.50	956.38	1.89	-----	-----	-----	-----	-----	-----	-----	-----	1.89
3.97	3.20	956.61	2.50	-----	-----	-----	-----	-----	-----	-----	-----	2.50
4.08	13.30 <<	957.38	7.19	-----	-----	-----	-----	-----	-----	-----	-----	7.19
4.20	2.00	957.43 <<	7.54	-----	-----	-----	-----	-----	-----	-----	-----	7.54 <<
4.32	1.40	956.71	2.72	-----	-----	-----	-----	-----	-----	-----	-----	2.72
4.43	1.10	956.34	1.81	-----	-----	-----	-----	-----	-----	-----	-----	1.81

Continues on next page...

Outflow from Detention

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
4.55	0.30	956.07	1.08	-----	-----	-----	-----	-----	-----	-----	-----	1.08
4.67	0.80	955.87	0.56	-----	-----	-----	-----	-----	-----	-----	-----	0.56
4.78	0.70	955.98	0.82	-----	-----	-----	-----	-----	-----	-----	-----	0.82
4.90	0.60	955.88	0.58	-----	-----	-----	-----	-----	-----	-----	-----	0.58
5.02	0.60	955.89	0.61	-----	-----	-----	-----	-----	-----	-----	-----	0.61
5.13	0.50	955.86	0.53	-----	-----	-----	-----	-----	-----	-----	-----	0.53
5.25	0.50	955.84	0.49	-----	-----	-----	-----	-----	-----	-----	-----	0.49
5.37	0.50	955.84	0.50	-----	-----	-----	-----	-----	-----	-----	-----	0.50
5.48	0.40	955.81	0.43	-----	-----	-----	-----	-----	-----	-----	-----	0.43
5.60	0.40	955.79	0.39	-----	-----	-----	-----	-----	-----	-----	-----	0.39
5.72	0.40	955.80	0.40	-----	-----	-----	-----	-----	-----	-----	-----	0.40
5.83	0.40	955.80	0.40	-----	-----	-----	-----	-----	-----	-----	-----	0.40
5.95	0.40	955.80	0.40	-----	-----	-----	-----	-----	-----	-----	-----	0.40
6.07	0.00	955.66	0.14	-----	-----	-----	-----	-----	-----	-----	-----	0.14

...End

Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 9:44 AM

Pond No. 1 - Det. Basin @ Node 104

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	955.50	20	0	0
0.50	956.00	425	111	111
1.50	957.00	1,886	1,156	1,267
2.50	958.00	3,300	2,593	3,860
3.00	958.50	4,346	1,912	5,771

Culvert / Orifice Structures

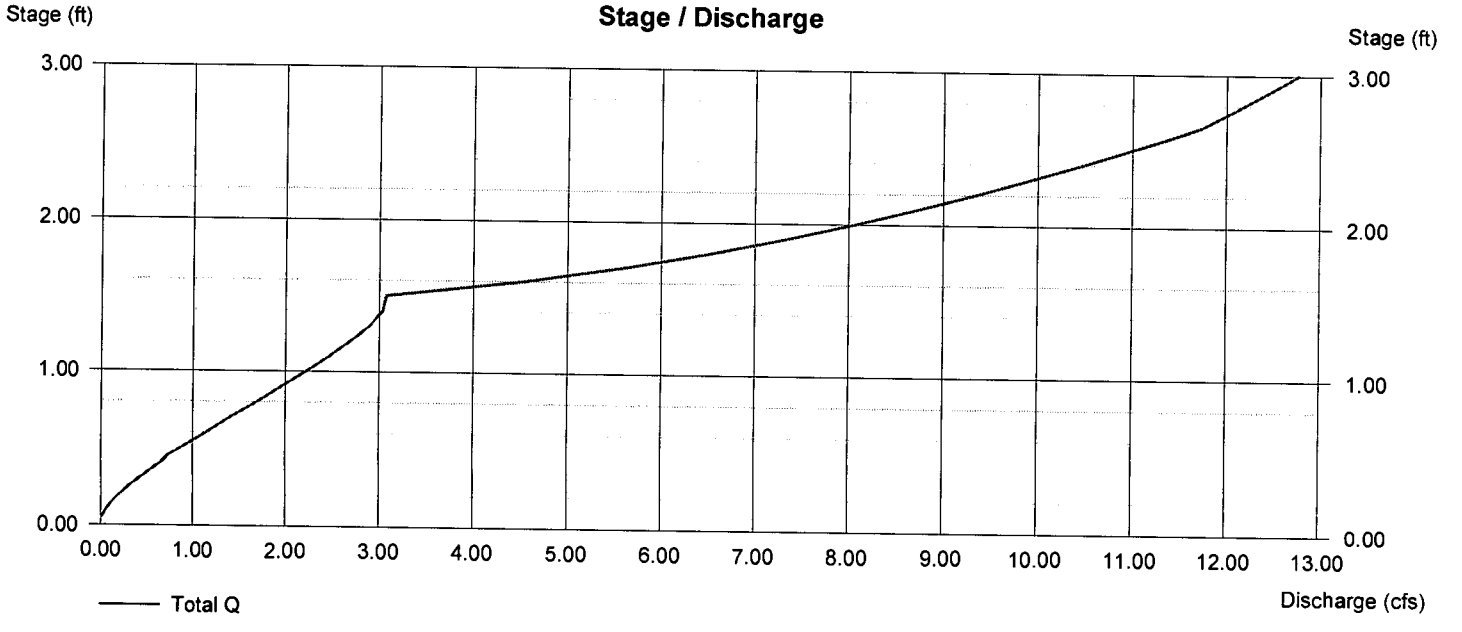
	[A]	[B]	[C]	[D]
Rise (in)	= 18.00	18.00	0.00	0.00
Span (in)	= 18.00	18.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 955.50	955.50	0.00	0.00
Length (ft)	= 17.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 1.50	0.00	0.00	0.00
Crest El. (ft)	= 957.25	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	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.



Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 9:47 AM

Pond No. 1 - Det. Basin @ Node 104

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	955.50	20	0	0
0.50	956.00	425	111	111
1.50	957.00	1,886	1,156	1,267
2.50	958.00	3,300	2,593	3,860
3.00	958.50	4,346	1,912	5,771

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 18.00	18.00	0.00	0.00
Span (in)	= 18.00	18.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 955.50	955.50	0.00	0.00
Length (ft)	= 17.00	0.00	0.00	0.00
Slope (%)	= 0.50	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 1.50	0.00	0.00	0.00
Crest El. (ft)	= 957.25	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

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

Stage / Storage / Discharge Table

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

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	955.50	0.00	0.00	---	---	0.00	---	---	---	---	0.00
0.05	11	955.55	0.01	0.00	---	---	0.00	---	---	---	---	0.01
0.10	22	955.60	0.06	0.00	---	---	0.00	---	---	---	---	0.06
0.15	33	955.65	0.12	0.00	---	---	0.00	---	---	---	---	0.12
0.20	45	955.70	0.20	0.00	---	---	0.00	---	---	---	---	0.20
0.25	56	955.75	0.29	0.00	---	---	0.00	---	---	---	---	0.29
0.30	67	955.80	0.41	0.00	---	---	0.00	---	---	---	---	0.41
0.35	78	955.85	0.52	0.00	---	---	0.00	---	---	---	---	0.52
0.40	89	955.90	0.64	0.00	---	---	0.00	---	---	---	---	0.64
0.45	100	955.95	0.74	0.00	---	---	0.00	---	---	---	---	0.74
0.50	111	956.00	0.88	0.00	---	---	0.00	---	---	---	---	0.88
0.60	227	956.10	1.15	0.00	---	---	0.00	---	---	---	---	1.15
0.70	342	956.20	1.41	0.00	---	---	0.00	---	---	---	---	1.41
0.80	458	956.30	1.70	0.00	---	---	0.00	---	---	---	---	1.70
0.90	573	956.40	1.95	0.00	---	---	0.00	---	---	---	---	1.95
1.00	689	956.50	2.22	0.00	---	---	0.00	---	---	---	---	2.22
1.10	805	956.60	2.47	0.00	---	---	0.00	---	---	---	---	2.47
1.20	920	956.70	2.69	0.00	---	---	0.00	---	---	---	---	2.69
1.30	1,036	956.80	2.90	0.00	---	---	0.00	---	---	---	---	2.90
1.40	1,151	956.90	3.04	0.00	---	---	0.00	---	---	---	---	3.04
1.50	1,267	957.00	3.08	0.00	---	---	0.00	---	---	---	---	3.08
1.60	1,526	957.10	4.54	0.00	---	---	0.00	---	---	---	---	4.54
1.70	1,785	957.20	5.63	0.00	---	---	0.00	---	---	---	---	5.63
1.80	2,045	957.30	6.54	0.00	---	---	0.00	---	---	---	---	6.54
1.90	2,304	957.40	7.34	0.00	---	---	0.00	---	---	---	---	7.34
2.00	2,563	957.50	8.07	0.00	---	---	0.00	---	---	---	---	8.07
2.10	2,823	957.60	8.73	0.00	---	---	0.00	---	---	---	---	8.73
2.20	3,082	957.70	9.34	0.00	---	---	0.00	---	---	---	---	9.34
2.30	3,341	957.80	9.92	0.00	---	---	0.00	---	---	---	---	9.92
2.40	3,600	957.90	10.47	0.00	---	---	0.00	---	---	---	---	10.47
2.50	3,860	958.00	10.99	0.00	---	---	0.00	---	---	---	---	10.99
2.55	4,051	958.05	11.24	0.00	---	---	0.00	---	---	---	---	11.24
2.60	4,242	958.10	11.48	0.00	---	---	0.00	---	---	---	---	11.48

Continues on next page...

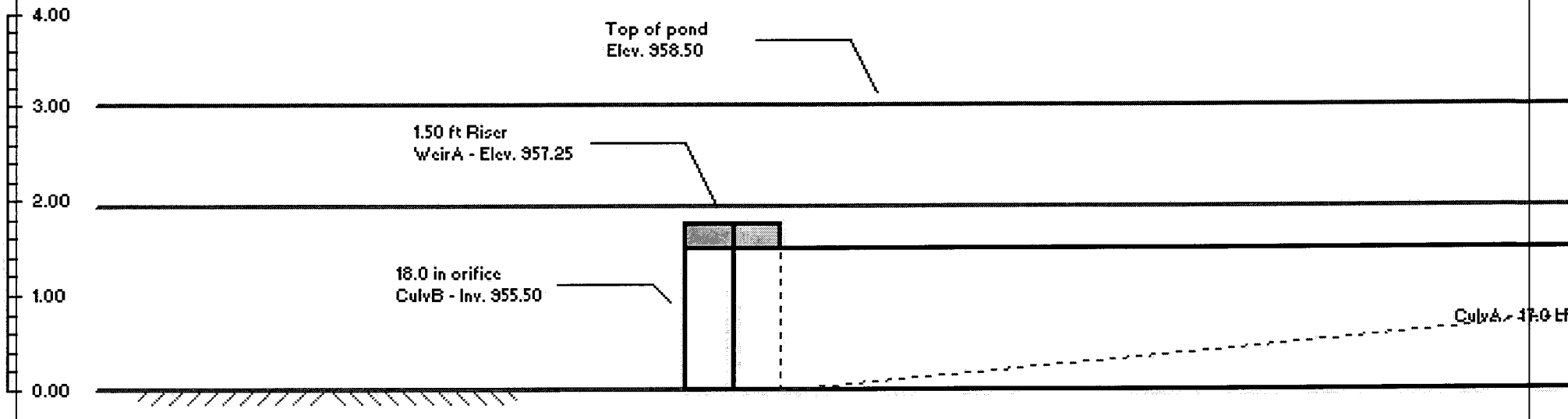
Det. Basin @ Node 104

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
2.65	4,433	958.15	11.72	0.00	---	---	0.00	---	---	---	---	11.72
2.70	4,624	958.20	11.88	0.00	---	---	0.00	---	---	---	---	11.88
2.75	4,816	958.25	12.03	0.00	---	---	0.00	---	---	---	---	12.03
2.80	5,007	958.30	12.18	0.00	---	---	0.00	---	---	---	---	12.18
2.85	5,198	958.35	12.33	0.00	---	---	0.00	---	---	---	---	12.33
2.90	5,389	958.40	12.47	0.00	---	---	0.00	---	---	---	---	12.47
2.95	5,580	958.45	12.62	0.00	---	---	0.00	---	---	---	---	12.62
3.00	5,771	958.50	12.76	0.00	---	---	0.00	---	---	---	---	12.76

...End

Det. Basin @ Node 104



Section

NTS

Side slope estimated average from contours

(100 yr)

Schematic only. Not for construction.

RATIONAL METHOD HYDROGRAPH PROGRAM

SUBBASIN 200

BASIN @ NODE 209

RUN DATE 2/26/2013
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 7 MIN.
6 HOUR RAINFALL 3.5 INCHES
BASIN AREA 7.57 ACRES
RUNOFF COEFFICIENT 0.322
PEAK DISCHARGE 18.8 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 7	DISCHARGE (CFS) = 0.5
TIME (MIN) = 14	DISCHARGE (CFS) = 0.5
TIME (MIN) = 21	DISCHARGE (CFS) = 0.5
TIME (MIN) = 28	DISCHARGE (CFS) = 0.5
TIME (MIN) = 35	DISCHARGE (CFS) = 0.6
TIME (MIN) = 42	DISCHARGE (CFS) = 0.6
TIME (MIN) = 49	DISCHARGE (CFS) = 0.6
TIME (MIN) = 56	DISCHARGE (CFS) = 0.6
TIME (MIN) = 63	DISCHARGE (CFS) = 0.6
TIME (MIN) = 70	DISCHARGE (CFS) = 0.6
TIME (MIN) = 77	DISCHARGE (CFS) = 0.6
TIME (MIN) = 84	DISCHARGE (CFS) = 0.7
TIME (MIN) = 91	DISCHARGE (CFS) = 0.7
TIME (MIN) = 98	DISCHARGE (CFS) = 0.7
TIME (MIN) = 105	DISCHARGE (CFS) = 0.7
TIME (MIN) = 112	DISCHARGE (CFS) = 0.7
TIME (MIN) = 119	DISCHARGE (CFS) = 0.8
TIME (MIN) = 126	DISCHARGE (CFS) = 0.8
TIME (MIN) = 133	DISCHARGE (CFS) = 0.8
TIME (MIN) = 140	DISCHARGE (CFS) = 0.9
TIME (MIN) = 147	DISCHARGE (CFS) = 0.9
TIME (MIN) = 154	DISCHARGE (CFS) = 0.9
TIME (MIN) = 161	DISCHARGE (CFS) = 1
TIME (MIN) = 168	DISCHARGE (CFS) = 1.1
TIME (MIN) = 175	DISCHARGE (CFS) = 1.1
TIME (MIN) = 182	DISCHARGE (CFS) = 1.2
TIME (MIN) = 189	DISCHARGE (CFS) = 1.3
TIME (MIN) = 196	DISCHARGE (CFS) = 1.4
TIME (MIN) = 203	DISCHARGE (CFS) = 1.6
TIME (MIN) = 210	DISCHARGE (CFS) = 1.8
TIME (MIN) = 217	DISCHARGE (CFS) = 2.1
TIME (MIN) = 224	DISCHARGE (CFS) = 2.4
TIME (MIN) = 231	DISCHARGE (CFS) = 3.6
TIME (MIN) = 238	DISCHARGE (CFS) = 4.3
TIME (MIN) = 245	DISCHARGE (CFS) = 18.8
TIME (MIN) = 252	DISCHARGE (CFS) = 2.9
TIME (MIN) = 259	DISCHARGE (CFS) = 1.9
TIME (MIN) = 266	DISCHARGE (CFS) = 1.5
TIME (MIN) = 273	DISCHARGE (CFS) = 1.3
TIME (MIN) = 280	DISCHARGE (CFS) = 1.1
TIME (MIN) = 287	DISCHARGE (CFS) = 1
TIME (MIN) = 294	DISCHARGE (CFS) = 0.9
TIME (MIN) = 301	DISCHARGE (CFS) = 0.8
TIME (MIN) = 308	DISCHARGE (CFS) = 0.8
TIME (MIN) = 315	DISCHARGE (CFS) = 0.7
TIME (MIN) = 322	DISCHARGE (CFS) = 0.7
TIME (MIN) = 329	DISCHARGE (CFS) = 0.6
TIME (MIN) = 336	DISCHARGE (CFS) = 0.6
TIME (MIN) = 343	DISCHARGE (CFS) = 0.6
TIME (MIN) = 350	DISCHARGE (CFS) = 0.5
TIME (MIN) = 357	DISCHARGE (CFS) = 0.5
TIME (MIN) = 364	DISCHARGE (CFS) = 0

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Manual	18.80	7	245	30,618	----	------	------	Postdeveloped @ Node 209
2	Reservoir	16.43	7	245	30,931	1	954.18	616	Outflow from Detention

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 10:18 AM

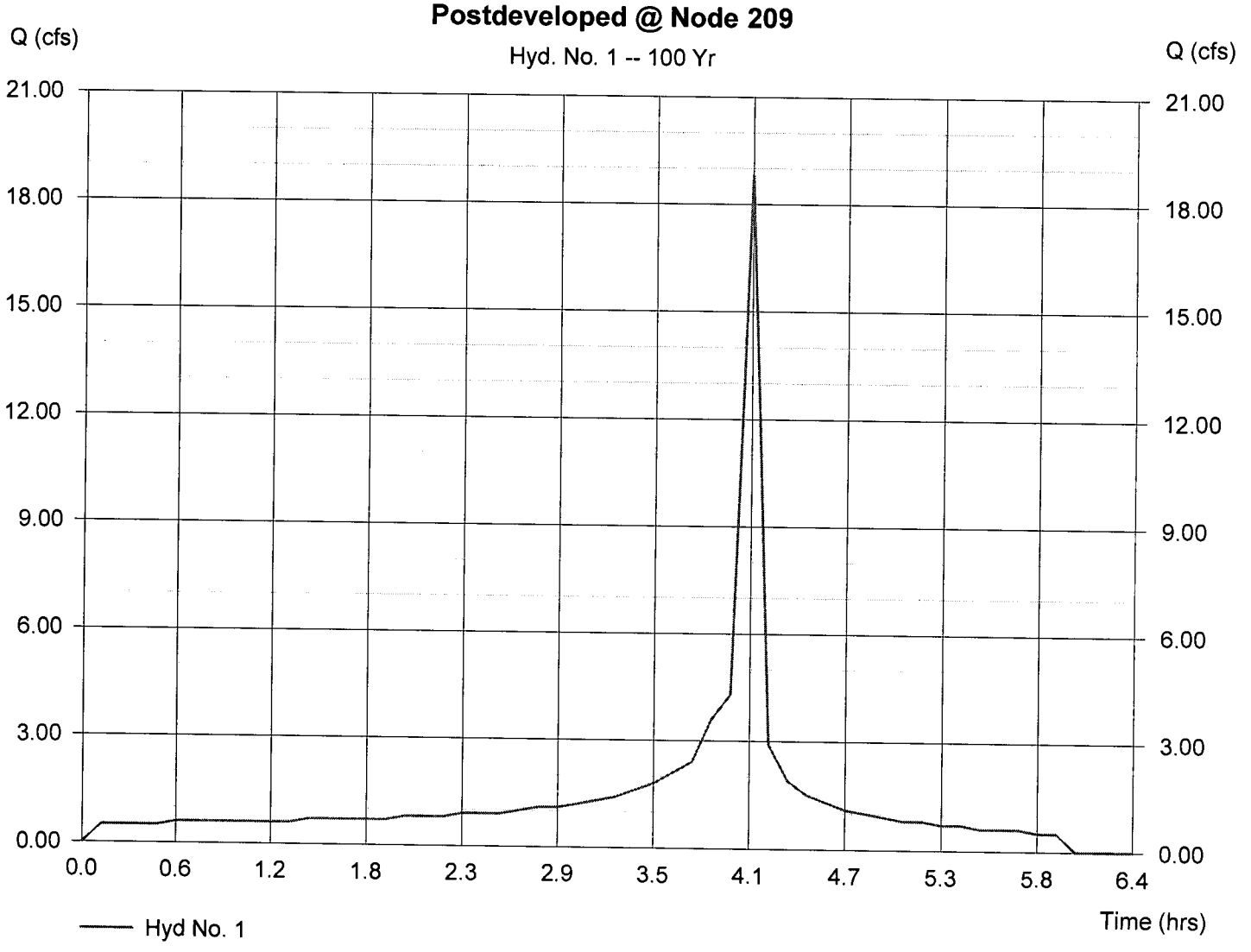
Hyd. No. 1

Postdeveloped @ Node 209

Hydrograph type = Manual
Storm frequency = 100 yrs

Peak discharge = 18.80 cfs
Time interval = 7 min

Hydrograph Volume = 30,618 cuft



Hydrograph Report

Hydraflow Hydrographs by Intelisolve | Wednesday, Feb 27 2013, 10:16 AM

Hyd. No. 1

Postdeveloped @ Node 209

Hydrograph type	= Manual	Peak discharge	= 18.80 cfs
Storm frequency	= 100 yrs	Time interval	= 7 min

Hydrograph Volume = 30,618 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow cfs)	Time (hrs)	Outflow cfs)
0.12	0.50	4.08	18.80 <<
0.23	0.50	4.20	2.90
0.35	0.50	4.32	1.90
0.47	0.50	4.43	1.50
0.58	0.60	4.55	1.30
0.70	0.60	4.67	1.10
0.82	0.60	4.78	1.00
0.93	0.60	4.90	0.90
1.05	0.60	5.02	0.80
1.17	0.60	5.13	0.80
1.28	0.60	5.25	0.70
1.40	0.70	5.37	0.70
1.52	0.70	5.48	0.60
1.63	0.70	5.60	0.60
1.75	0.70	5.72	0.60
1.87	0.70	5.83	0.50
1.98	0.80	5.95	0.50
2.10	0.80		
2.22	0.80		
2.33	0.90	*...End*	
2.45	0.90		
2.57	0.90		
2.68	1.00		
2.80	1.10		
2.92	1.10		
3.03	1.20		
3.15	1.30		
3.27	1.40		
3.38	1.60		
3.50	1.80		
3.62	2.10		
3.73	2.40		
3.85	3.60		
3.97	4.30		

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 10:18 AM

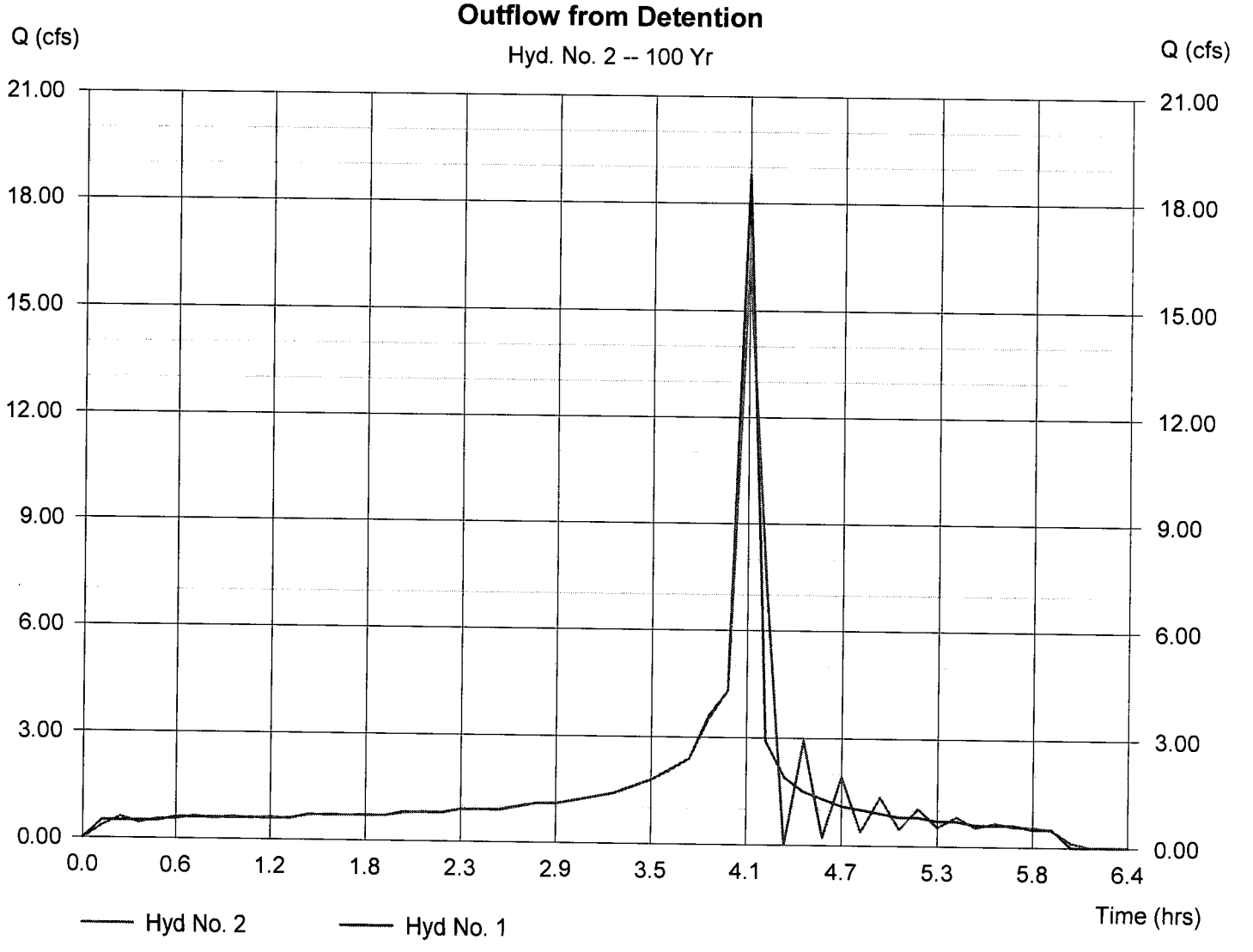
Hyd. No. 2

Outflow from Detention

Hydrograph type	= Reservoir	Peak discharge	= 16.43 cfs
Storm frequency	= 100 yrs	Time interval	= 7 min
Inflow hyd. No.	= 1	Max. Elevation	= 954.18 ft
Reservoir name	= Det. Basin @ Node 209	Max. Storage	= 616 cuft

Storage Indication method used.

Hydrograph Volume = 30,931 cuft



Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 10:16 AM

Hyd. No. 2

Outflow from Detention

Hydrograph type	= Reservoir	Peak discharge	= 16.43 cfs
Storm frequency	= 100 yrs	Time interval	= 7 min
Inflow hyd. No.	= 1	Reservoir name	= Det. Basin @ Node
Max. Elevation	= 954.18 ft	Max. Storage	= 616 cuft

Storage Indication method used.

Outflow hydrograph volume = 30,931 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
0.12	0.50	952.23	15.12	0.35	-----	-----	-----	-----	-----	-----	-----	0.35
0.23	0.50	952.31	15.12	0.60	-----	-----	-----	-----	-----	-----	-----	0.60
0.35	0.50	952.26	15.12	0.43	-----	-----	-----	-----	-----	-----	-----	0.43
0.47	0.50	952.29	15.12	0.54	-----	-----	-----	-----	-----	-----	-----	0.54
0.58	0.60	952.30	15.12	0.55	-----	-----	-----	-----	-----	-----	-----	0.55
0.70	0.60	952.32	15.12	0.63	-----	-----	-----	-----	-----	-----	-----	0.63
0.82	0.60	952.30	15.12	0.57	-----	-----	-----	-----	-----	-----	-----	0.57
0.93	0.60	952.31	15.12	0.62	-----	-----	-----	-----	-----	-----	-----	0.62
1.05	0.60	952.31	15.12	0.59	-----	-----	-----	-----	-----	-----	-----	0.59
1.17	0.60	952.31	15.12	0.61	-----	-----	-----	-----	-----	-----	-----	0.61
1.28	0.60	952.31	15.12	0.59	-----	-----	-----	-----	-----	-----	-----	0.59
1.40	0.70	952.33	15.12	0.69	-----	-----	-----	-----	-----	-----	-----	0.69
1.52	0.70	952.33	15.12	0.71	-----	-----	-----	-----	-----	-----	-----	0.71
1.63	0.70	952.33	15.12	0.70	-----	-----	-----	-----	-----	-----	-----	0.70
1.75	0.70	952.33	15.12	0.70	-----	-----	-----	-----	-----	-----	-----	0.70
1.87	0.70	952.33	15.12	0.70	-----	-----	-----	-----	-----	-----	-----	0.70
1.98	0.80	952.35	15.12	0.79	-----	-----	-----	-----	-----	-----	-----	0.79
2.10	0.80	952.36	15.12	0.81	-----	-----	-----	-----	-----	-----	-----	0.81
2.22	0.80	952.35	15.12	0.79	-----	-----	-----	-----	-----	-----	-----	0.79
2.33	0.90	952.37	15.12	0.89	-----	-----	-----	-----	-----	-----	-----	0.89
2.45	0.90	952.38	15.12	0.91	-----	-----	-----	-----	-----	-----	-----	0.91
2.57	0.90	952.38	15.12	0.90	-----	-----	-----	-----	-----	-----	-----	0.90
2.68	1.00	952.40	15.12	0.99	-----	-----	-----	-----	-----	-----	-----	0.99
2.80	1.10	952.42	15.12	1.10	-----	-----	-----	-----	-----	-----	-----	1.10
2.92	1.10	952.42	15.12	1.10	-----	-----	-----	-----	-----	-----	-----	1.10
3.03	1.20	952.44	15.12	1.19	-----	-----	-----	-----	-----	-----	-----	1.19
3.15	1.30	952.46	15.12	1.30	-----	-----	-----	-----	-----	-----	-----	1.30
3.27	1.40	952.48	15.12	1.39	-----	-----	-----	-----	-----	-----	-----	1.39
3.38	1.60	952.51	15.12	1.59	-----	-----	-----	-----	-----	-----	-----	1.59
3.50	1.80	952.55	15.12	1.79	-----	-----	-----	-----	-----	-----	-----	1.79
3.62	2.10	952.60	15.12	2.08	-----	-----	-----	-----	-----	-----	-----	2.08
3.73	2.40	952.64	15.12	2.39	-----	-----	-----	-----	-----	-----	-----	2.39
3.85	3.60	952.78	15.12	3.51	-----	-----	-----	-----	-----	-----	-----	3.51
3.97	4.30	952.88	15.12	4.32	-----	-----	-----	-----	-----	-----	-----	4.32
4.08	18.80 <<	954.18 <<	16.43	16.43	-----	-----	-----	-----	-----	-----	-----	16.43 <<
4.20	2.90	953.19	15.12	7.23	-----	-----	-----	-----	-----	-----	-----	7.23
4.43	1.50	952.71	15.12	2.93	-----	-----	-----	-----	-----	-----	-----	2.93
4.55	1.30	952.18	15.12	0.22	-----	-----	-----	-----	-----	-----	-----	0.22

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Outflow from Detention

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
4.67	1.10	952.57	15.12	1.93	-----	-----	-----	-----	-----	-----	-----	1.93
4.78	1.00	952.24	15.12	0.39	-----	-----	-----	-----	-----	-----	-----	0.39
4.90	0.90	952.47	15.12	1.36	-----	-----	-----	-----	-----	-----	-----	1.36
5.02	0.80	952.27	15.12	0.47	-----	-----	-----	-----	-----	-----	-----	0.47
5.13	0.80	952.41	15.12	1.04	-----	-----	-----	-----	-----	-----	-----	1.04
5.25	0.70	952.29	15.12	0.54	-----	-----	-----	-----	-----	-----	-----	0.54
5.37	0.70	952.36	15.12	0.82	-----	-----	-----	-----	-----	-----	-----	0.82
5.48	0.60	952.29	15.12	0.53	-----	-----	-----	-----	-----	-----	-----	0.53
5.60	0.60	952.32	15.12	0.65	-----	-----	-----	-----	-----	-----	-----	0.65
5.72	0.60	952.30	15.12	0.56	-----	-----	-----	-----	-----	-----	-----	0.56
5.83	0.50	952.29	15.12	0.54	-----	-----	-----	-----	-----	-----	-----	0.54
5.95	0.50	952.27	15.12	0.47	-----	-----	-----	-----	-----	-----	-----	0.47

...End

Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 10:18 AM

Pond No. 1 - Det. Basin @ Node 209

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	952.00	55	0	0
1.00	953.00	221	138	138
2.00	954.00	496	359	497
3.00	955.00	831	664	1,160
4.00	956.00	1,233	1,032	2,192
5.00	957.00	1,713	1,473	3,665
6.00	958.00	2,251	1,982	5,647
7.00	959.00	2,818	2,535	8,182
8.00	960.00	3,455	3,137	11,318

Culvert / Orifice Structures

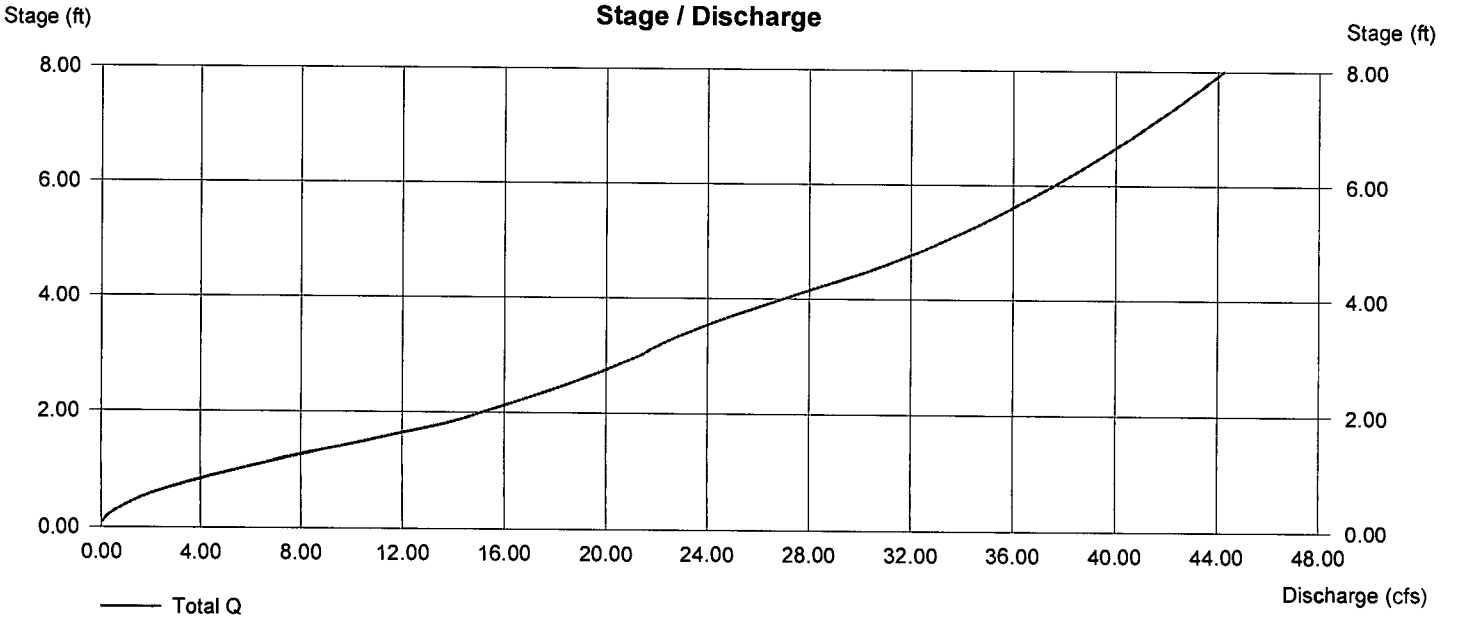
	[A]	[B]	[C]	[D]
Rise (in)	= 24.00	24.00	0.00	0.00
Span (in)	= 24.00	24.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 950.00	952.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 2.00	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.00	0.00	0.00	0.00
Crest El. (ft)	= 955.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	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.



Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 10:16 AM

Pond No. 1 - Det. Basin @ Node 209

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	952.00	55	0	0
1.00	953.00	221	138	138
2.00	954.00	496	359	497
3.00	955.00	831	664	1,160
4.00	956.00	1,233	1,032	2,192
5.00	957.00	1,713	1,473	3,665
6.00	958.00	2,251	1,982	5,647
7.00	959.00	2,818	2,535	8,182
8.00	960.00	3,455	3,137	11,318

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 24.00	24.00	0.00	0.00
Span (in)	= 24.00	24.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 950.00	952.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 2.00	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.00	0.00	0.00	0.00
Crest El. (ft)	= 955.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	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.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	952.00	0.00	0.00	---	---	0.00	---	---	---	---	0.00
0.10	14	952.10	15.12	0.07	---	---	0.00	---	---	---	---	0.07
0.20	28	952.20	15.12	0.25	---	---	0.00	---	---	---	---	0.25
0.30	41	952.30	15.12	0.56	---	---	0.00	---	---	---	---	0.56
0.40	55	952.40	15.12	1.01	---	---	0.00	---	---	---	---	1.01
0.50	69	952.50	15.12	1.50	---	---	0.00	---	---	---	---	1.50
0.60	83	952.60	15.12	2.10	---	---	0.00	---	---	---	---	2.10
0.70	97	952.70	15.12	2.82	---	---	0.00	---	---	---	---	2.82
0.80	110	952.80	15.12	3.65	---	---	0.00	---	---	---	---	3.65
0.90	124	952.90	15.12	4.47	---	---	0.00	---	---	---	---	4.47
1.00	138	953.00	15.12	5.46	---	---	0.00	---	---	---	---	5.46
1.10	174	953.10	15.12	6.39	---	---	0.00	---	---	---	---	6.39
1.20	210	953.20	15.12	7.36	---	---	0.00	---	---	---	---	7.36
1.30	246	953.30	15.12	8.46	---	---	0.00	---	---	---	---	8.46
1.40	281	953.40	15.12	9.55	---	---	0.00	---	---	---	---	9.55
1.50	317	953.50	15.12	10.60	---	---	0.00	---	---	---	---	10.60
1.60	353	953.60	15.12	11.61	---	---	0.00	---	---	---	---	11.61
1.70	389	953.70	15.12	12.68	---	---	0.00	---	---	---	---	12.68
1.80	425	953.80	15.12	13.65	---	---	0.00	---	---	---	---	13.65
1.90	461	953.90	15.12	14.49	---	---	0.00	---	---	---	---	14.49
2.00	497	954.00	15.12	15.12	---	---	0.00	---	---	---	---	15.12
2.10	563	954.10	15.86	15.86	---	---	0.00	---	---	---	---	15.86
2.20	629	954.20	16.57	16.57	---	---	0.00	---	---	---	---	16.57
2.30	696	954.30	17.24	17.24	---	---	0.00	---	---	---	---	17.24
2.40	762	954.40	17.90	17.90	---	---	0.00	---	---	---	---	17.90
2.50	828	954.50	18.52	18.52	---	---	0.00	---	---	---	---	18.52
2.60	895	954.60	19.13	19.13	---	---	0.00	---	---	---	---	19.13
2.70	961	954.70	19.72	19.72	---	---	0.00	---	---	---	---	19.72
2.80	1,027	954.80	20.29	20.29	---	---	0.00	---	---	---	---	20.29

Continues on next page...

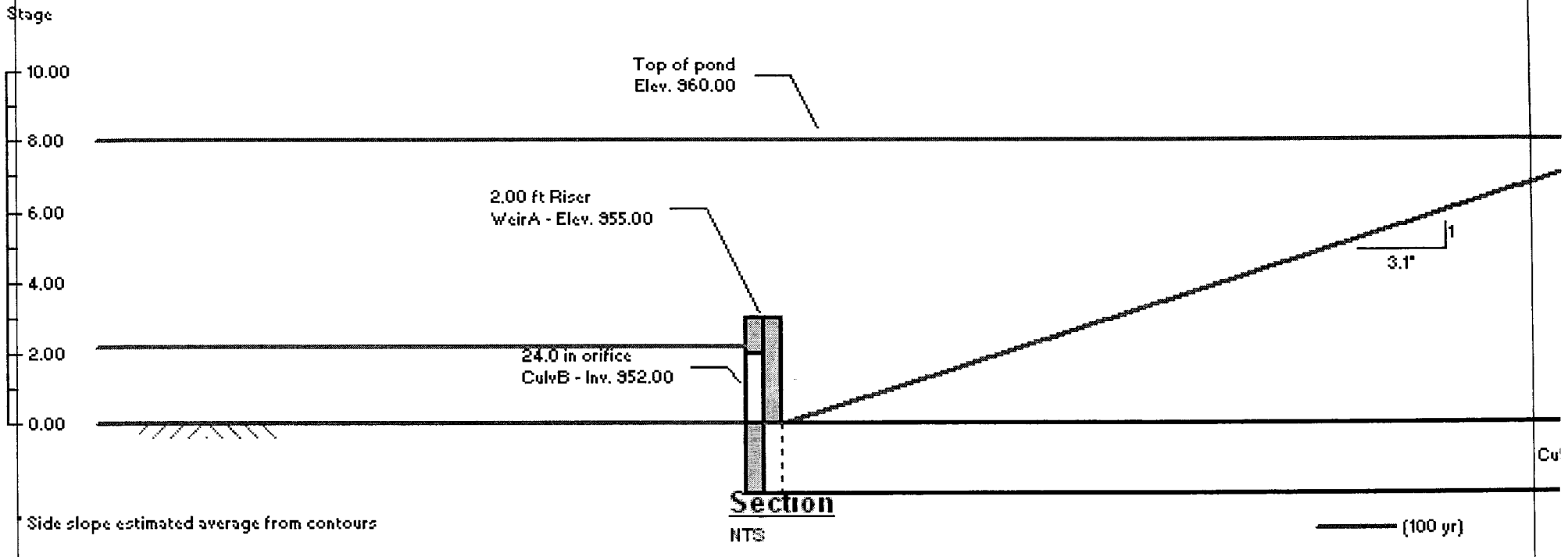
Det. Basin @ Node 209

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
2.90	1,094	954.90	20.85	20.85	---	---	0.00	---	---	---	---	20.85
3.00	1,160	955.00	21.39	21.39	---	---	0.00	---	---	---	---	21.39
3.10	1,263	955.10	21.76	21.55	---	---	0.21	---	---	---	---	21.76
3.20	1,366	955.20	22.21	21.62	---	---	0.60	---	---	---	---	22.21
3.30	1,470	955.30	22.72	21.62	---	---	1.09	---	---	---	---	22.72
3.40	1,573	955.40	23.26	21.58	---	---	1.68	---	---	---	---	23.26
3.50	1,676	955.50	23.83	21.48	---	---	2.35	---	---	---	---	23.83
3.60	1,779	955.60	24.43	21.34	---	---	3.09	---	---	---	---	24.43
3.70	1,882	955.70	25.05	21.15	---	---	3.90	---	---	---	---	25.05
3.80	1,986	955.80	25.69	20.93	---	---	4.76	---	---	---	---	25.69
3.90	2,089	955.90	26.34	20.66	---	---	5.68	---	---	---	---	26.34
4.00	2,192	956.00	27.01	20.35	---	---	6.66	---	---	---	---	27.01
4.10	2,339	956.10	27.69	20.00	---	---	7.68	---	---	---	---	27.69
4.20	2,487	956.20	28.37	19.61	---	---	8.75	---	---	---	---	28.37
4.30	2,634	956.30	29.06	19.19	---	---	9.87	---	---	---	---	29.06
4.40	2,781	956.40	29.75	18.72	---	---	11.03	---	---	---	---	29.75
4.50	2,929	956.50	30.43	18.22	---	---	12.21	---	---	---	---	30.43
4.60	3,076	956.60	31.04	17.82	---	---	13.22	---	---	---	---	31.04
4.70	3,223	956.70	31.61	17.45	---	---	14.17	---	---	---	---	31.61
4.80	3,370	956.80	32.16	17.10	---	---	15.06	---	---	---	---	32.16
4.90	3,518	956.90	32.69	16.76	---	---	15.93	---	---	---	---	32.69
5.00	3,665	957.00	33.20	16.44	---	---	16.76	---	---	---	---	33.20
5.10	3,863	957.10	33.69	16.13	---	---	17.56	---	---	---	---	33.69
5.20	4,061	957.20	34.17	15.83	---	---	18.35	---	---	---	---	34.17
5.30	4,260	957.30	34.64	15.53	---	---	19.10	---	---	---	---	34.64
5.40	4,458	957.40	35.09	15.25	---	---	19.84	---	---	---	---	35.09
5.50	4,656	957.50	35.53	14.98	---	---	20.56	---	---	---	---	35.53
5.60	4,854	957.60	35.96	14.71	---	---	21.26	---	---	---	---	35.96
5.70	5,052	957.70	36.39	14.45	---	---	21.94	---	---	---	---	36.38
5.80	5,251	957.80	36.80	14.20	---	---	22.60	---	---	---	---	36.80
5.90	5,449	957.90	37.20	13.95	---	---	23.25	---	---	---	---	37.20
6.00	5,647	958.00	37.59	13.71	---	---	23.88	---	---	---	---	37.59
6.10	5,900	958.10	37.98	13.48	---	---	24.49	---	---	---	---	37.98
6.20	6,154	958.20	38.36	13.26	---	---	25.10	---	---	---	---	38.36
6.30	6,407	958.30	38.73	13.04	---	---	25.69	---	---	---	---	38.73
6.40	6,661	958.40	39.09	12.83	---	---	26.26	---	---	---	---	39.09
6.50	6,914	958.50	39.45	12.62	---	---	26.83	---	---	---	---	39.45
6.60	7,168	958.60	39.80	12.42	---	---	27.38	---	---	---	---	39.80
6.70	7,421	958.70	40.15	12.23	---	---	27.92	---	---	---	---	40.15
6.80	7,675	958.80	40.49	12.04	---	---	28.45	---	---	---	---	40.49
6.90	7,928	958.90	40.82	11.86	---	---	28.97	---	---	---	---	40.82
7.00	8,182	959.00	41.16	11.68	---	---	29.48	---	---	---	---	41.15
7.10	8,495	959.10	41.48	11.50	---	---	29.98	---	---	---	---	41.48
7.20	8,809	959.20	41.80	11.33	---	---	30.47	---	---	---	---	41.80
7.30	9,122	959.30	42.12	11.17	---	---	30.95	---	---	---	---	42.12
7.40	9,436	959.40	42.43	11.01	---	---	31.42	---	---	---	---	42.43
7.50	9,750	959.50	42.74	10.85	---	---	31.89	---	---	---	---	42.74
7.60	10,063	959.60	43.04	10.70	---	---	32.34	---	---	---	---	43.04
7.70	10,377	959.70	43.35	10.55	---	---	32.79	---	---	---	---	43.34
7.80	10,691	959.80	43.64	10.41	---	---	33.23	---	---	---	---	43.64
7.90	11,004	959.90	43.94	10.27	---	---	33.67	---	---	---	---	43.94
8.00	11,318	960.00	44.23	10.13	---	---	34.10	---	---	---	---	44.23

...End

Det. Basin @ Node 209



* Side slope estimated average from contours

Schematic only. Not for construction.

RATIONAL METHOD HYDROGRAPH PROGRAM
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SUBBASIN 300

BASIN @ NODE 308

RUN DATE 2/26/2013
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 9 MIN.
6 HOUR RAINFALL 3.5 INCHES
BASIN AREA 29.13 ACRES
RUNOFF COEFFICIENT 0.309
PEAK DISCHARGE 57.9 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 9	DISCHARGE (CFS) = 0.5
TIME (MIN) = 18	DISCHARGE (CFS) = 1.9
TIME (MIN) = 27	DISCHARGE (CFS) = 1.9
TIME (MIN) = 36	DISCHARGE (CFS) = 2
TIME (MIN) = 45	DISCHARGE (CFS) = 2.1
TIME (MIN) = 54	DISCHARGE (CFS) = 2.1
TIME (MIN) = 63	DISCHARGE (CFS) = 2.2
TIME (MIN) = 72	DISCHARGE (CFS) = 2.3
TIME (MIN) = 81	DISCHARGE (CFS) = 2.3
TIME (MIN) = 90	DISCHARGE (CFS) = 2.4
TIME (MIN) = 99	DISCHARGE (CFS) = 2.5
TIME (MIN) = 108	DISCHARGE (CFS) = 2.6
TIME (MIN) = 117	DISCHARGE (CFS) = 2.7
TIME (MIN) = 126	DISCHARGE (CFS) = 2.9
TIME (MIN) = 135	DISCHARGE (CFS) = 3
TIME (MIN) = 144	DISCHARGE (CFS) = 3.2
TIME (MIN) = 153	DISCHARGE (CFS) = 3.3
TIME (MIN) = 162	DISCHARGE (CFS) = 3.6
TIME (MIN) = 171	DISCHARGE (CFS) = 3.8
TIME (MIN) = 180	DISCHARGE (CFS) = 4.2
TIME (MIN) = 189	DISCHARGE (CFS) = 4.4
TIME (MIN) = 198	DISCHARGE (CFS) = 5.1
TIME (MIN) = 207	DISCHARGE (CFS) = 5.5
TIME (MIN) = 216	DISCHARGE (CFS) = 6.7
TIME (MIN) = 225	DISCHARGE (CFS) = 7.7
TIME (MIN) = 234	DISCHARGE (CFS) = 11.2
TIME (MIN) = 243	DISCHARGE (CFS) = 14.8
TIME (MIN) = 252	DISCHARGE (CFS) = 57.9
TIME (MIN) = 261	DISCHARGE (CFS) = 9
TIME (MIN) = 270	DISCHARGE (CFS) = 6
TIME (MIN) = 279	DISCHARGE (CFS) = 4.7
TIME (MIN) = 288	DISCHARGE (CFS) = 4
TIME (MIN) = 297	DISCHARGE (CFS) = 3.4
TIME (MIN) = 306	DISCHARGE (CFS) = 3.1
TIME (MIN) = 315	DISCHARGE (CFS) = 2.8
TIME (MIN) = 324	DISCHARGE (CFS) = 2.6
TIME (MIN) = 333	DISCHARGE (CFS) = 2.4
TIME (MIN) = 342	DISCHARGE (CFS) = 2.2
TIME (MIN) = 351	DISCHARGE (CFS) = 2.1
TIME (MIN) = 360	DISCHARGE (CFS) = 2
TIME (MIN) = 369	DISCHARGE (CFS) = 0

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Manual	57.90	9	252	112,914	----	------	------	Post Developed at Node 308
2	Reservoir	32.48	9	261	112,914	1	943.02	10,270	Detetion Basin Outflow

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Tuesday, Feb 26 2013, 4:36 PM

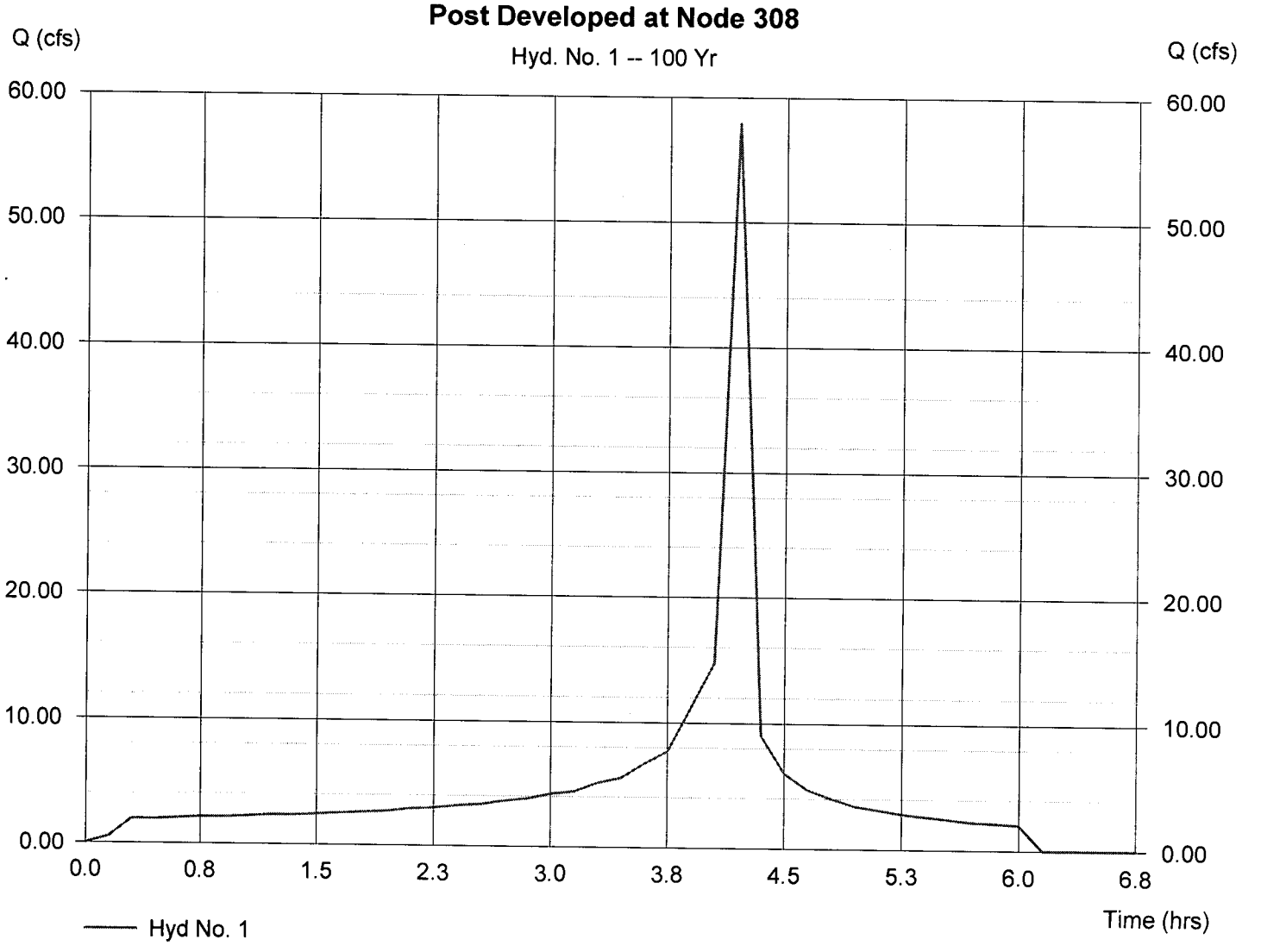
Hyd. No. 1

Post Developed at Node 308

Hydrograph type = Manual
Storm frequency = 100 yrs

Peak discharge = 57.90 cfs
Time interval = 9 min

Hydrograph Volume = 112,914 cuft



Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Feb 26 2013, 4:39 PM

Hyd. No. 1

Post Developed at Node 308

Hydrograph type	= Manual	Peak discharge	= 57.90 cfs
Storm frequency	= 100 yrs	Time interval	= 9 min

Hydrograph Volume = 112,914 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Outflow cfs)	Time (hrs)	Outflow cfs)
0.30	1.90	5.40	2.60
0.45	1.90	5.55	2.40
0.60	2.00	5.70	2.20
0.75	2.10	5.85	2.10
0.90	2.10	6.00	2.00
1.05	2.20		
1.20	2.30		
1.35	2.30	*...End*	
1.50	2.40		
1.65	2.50		
1.80	2.60		
1.95	2.70		
2.10	2.90		
2.25	3.00		
2.40	3.20		
2.55	3.30		
2.70	3.60		
2.85	3.80		
3.00	4.20		
3.15	4.40		
3.30	5.10		
3.45	5.50		
3.60	6.70		
3.75	7.70		
3.90	11.20		
4.05	14.80		
4.20	57.90 <<		
4.35	9.00		
4.50	6.00		
4.65	4.70		
4.80	4.00		
4.95	3.40		
5.10	3.10		
5.25	2.80		

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Tuesday, Feb 26 2013, 4:36 PM

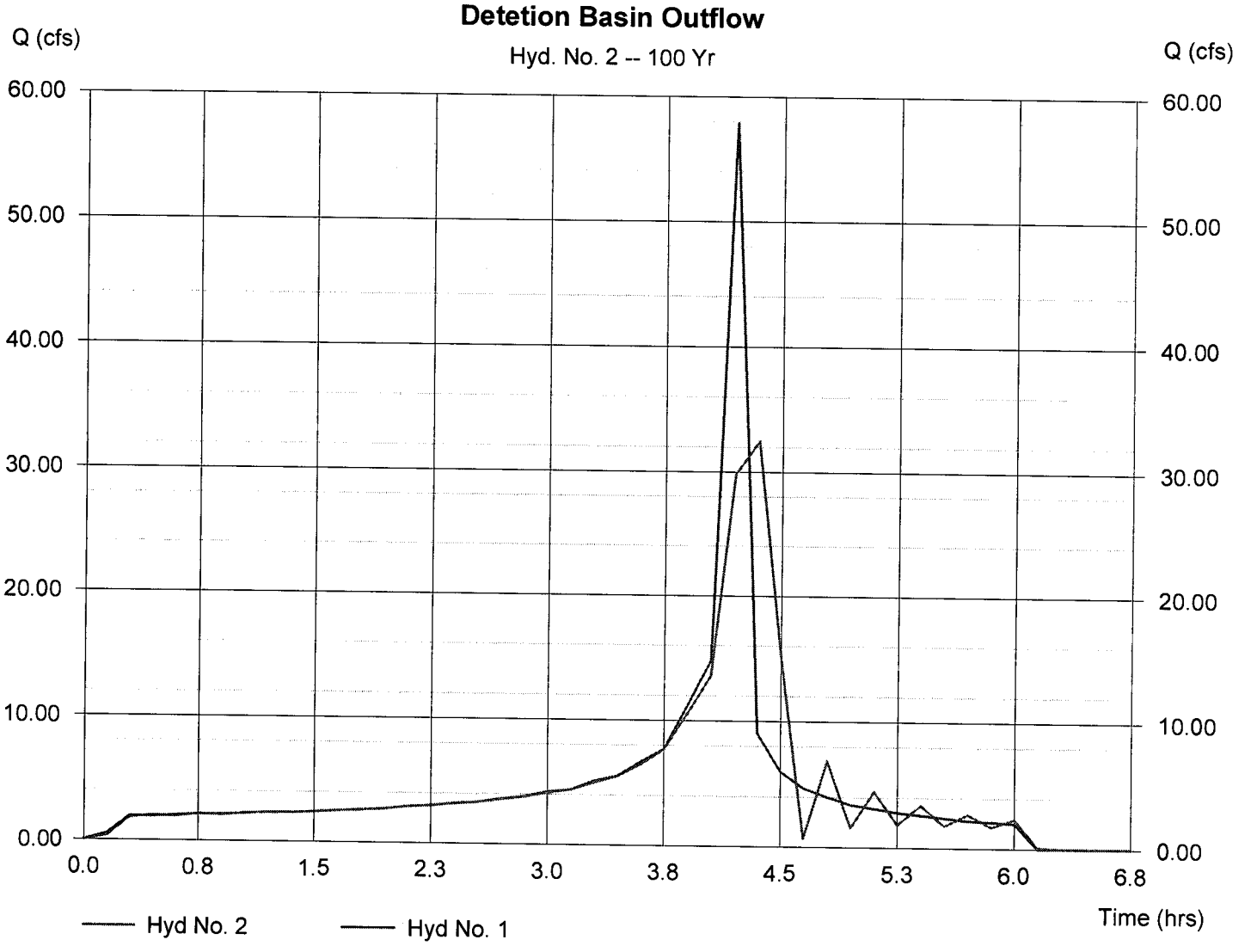
Hyd. No. 2

Detetion Basin Outflow

Hydrograph type	= Reservoir	Peak discharge	= 32.48 cfs
Storm frequency	= 100 yrs	Time interval	= 9 min
Inflow hyd. No.	= 1	Max. Elevation	= 943.02 ft
Reservoir name	= Det. Basin @ Node 308	Max. Storage	= 10,270 cuft

Storage Indication method used.

Hydrograph Volume = 112,914 cuft



Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Feb 26 2013, 4:39 PM

Hyd. No. 2

Detetion Basin Outflow

Hydrograph type	= Reservoir	Peak discharge	= 32.48 cfs
Storm frequency	= 100 yrs	Time interval	= 9 min
Inflow hyd. No.	= 1	Reservoir name	= Det. Basin @ Node
Max. Elevation	= 943.02 ft	Max. Storage	= 10,270 cuft

Storage Indication method used.

Outflow hydrograph volume = 112,914 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
0.15	0.50	936.28	0.34	0.33	-----	-----	-----	-----	-----	-----	-----	0.33
0.30	1.90	936.70	1.82	1.82	-----	-----	-----	-----	-----	-----	-----	1.82
0.45	1.90	936.73	1.97	1.96	-----	-----	-----	-----	-----	-----	-----	1.96
0.60	2.00	936.72	1.94	1.94	-----	-----	-----	-----	-----	-----	-----	1.94
0.75	2.10	936.76	2.15	2.14	-----	-----	-----	-----	-----	-----	-----	2.14
0.90	2.10	936.75	2.08	2.07	-----	-----	-----	-----	-----	-----	-----	2.07
1.05	2.20	936.77	2.22	2.21	-----	-----	-----	-----	-----	-----	-----	2.21
1.20	2.30	936.78	2.29	2.28	-----	-----	-----	-----	-----	-----	-----	2.28
1.35	2.30	936.79	2.33	2.32	-----	-----	-----	-----	-----	-----	-----	2.32
1.50	2.40	936.80	2.39	2.38	-----	-----	-----	-----	-----	-----	-----	2.38
1.65	2.50	936.83	2.52	2.51	-----	-----	-----	-----	-----	-----	-----	2.51
1.80	2.60	936.84	2.59	2.58	-----	-----	-----	-----	-----	-----	-----	2.58
1.95	2.70	936.86	2.71	2.70	-----	-----	-----	-----	-----	-----	-----	2.70
2.10	2.90	936.89	2.88	2.88	-----	-----	-----	-----	-----	-----	-----	2.88
2.25	3.00	936.91	3.01	3.01	-----	-----	-----	-----	-----	-----	-----	3.01
2.40	3.20	936.94	3.17	3.17	-----	-----	-----	-----	-----	-----	-----	3.17
2.55	3.30	936.96	3.31	3.31	-----	-----	-----	-----	-----	-----	-----	3.31
2.70	3.60	937.00	3.56	3.56	-----	-----	-----	-----	-----	-----	-----	3.56
2.85	3.80	937.04	3.78	3.78	-----	-----	-----	-----	-----	-----	-----	3.78
3.00	4.20	937.09	4.13	4.13	-----	-----	-----	-----	-----	-----	-----	4.13
3.15	4.40	937.13	4.40	4.40	-----	-----	-----	-----	-----	-----	-----	4.40
3.30	5.10	937.21	4.96	4.96	-----	-----	-----	-----	-----	-----	-----	4.96
3.45	5.50	937.29	5.52	5.51	-----	-----	-----	-----	-----	-----	-----	5.51
3.60	6.70	937.42	6.52	6.47	-----	-----	-----	-----	-----	-----	-----	6.47
3.75	7.70	937.58	7.67	7.67	-----	-----	-----	-----	-----	-----	-----	7.67
3.90	11.20	937.99	10.55	10.55	-----	-----	-----	-----	-----	-----	-----	10.55
4.05	14.80	938.60	13.59	13.59	-----	-----	-----	-----	-----	-----	-----	13.59
4.20	57.90 <<	942.61	29.82	19.84	-----	-----	9.98	-----	-----	-----	-----	29.82
4.35	9.00	943.02 <<	32.48	17.94	-----	-----	14.54	-----	-----	-----	-----	32.48 <<
4.50	6.00	939.01	15.16	15.16	-----	-----	-----	-----	-----	-----	-----	15.16
4.65	4.70	936.42	0.69	0.69	-----	-----	-----	-----	-----	-----	-----	0.69
4.80	4.00	937.47	6.87	6.85	-----	-----	-----	-----	-----	-----	-----	6.85
4.95	3.40	936.64	1.56	1.56	-----	-----	-----	-----	-----	-----	-----	1.56
5.10	3.10	937.14	4.48	4.48	-----	-----	-----	-----	-----	-----	-----	4.48
5.25	2.80	936.70	1.85	1.84	-----	-----	-----	-----	-----	-----	-----	1.84
5.40	2.60	936.98	3.39	3.39	-----	-----	-----	-----	-----	-----	-----	3.39
5.55	2.40	936.69	1.78	1.78	-----	-----	-----	-----	-----	-----	-----	1.78
5.70	2.20	936.86	2.72	2.71	-----	-----	-----	-----	-----	-----	-----	2.71

Continues on next page...

Detetion Basin Outflow

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
5.85	2.10	936.67	1.70	1.70	-----	-----	-----	-----	-----	-----	-----	1.70
6.00	2.00	936.79	2.34	2.33	-----	-----	-----	-----	-----	-----	-----	2.33

...End

Pond Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Feb 26 2013, 4:36 PM

Pond No. 1 - Det. Basin @ Node 308

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	936.00	37	0	0
1.00	937.00	292	165	165
2.00	938.00	619	456	620
3.00	939.00	1,035	827	1,447
4.00	940.00	1,580	1,308	2,755
5.00	941.00	2,257	1,919	4,673
6.00	942.00	2,770	2,514	7,187
7.00	943.00	3,271	3,021	10,207
8.00	944.00	3,754	3,513	13,720
9.00	945.00	4,314	4,034	17,754

Culvert / Orifice Structures

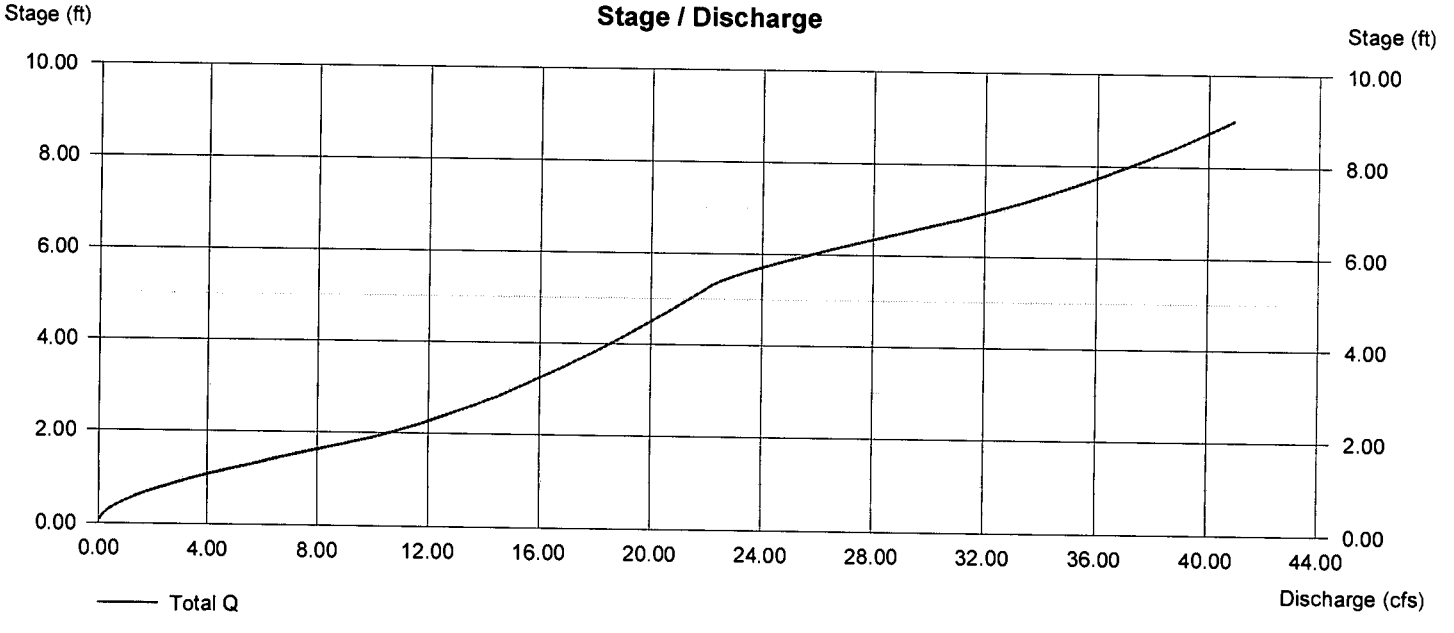
	[A]	[B]	[C]	[D]
Rise (in)	= 24.00	24.00	0.00	0.00
Span (in)	= 24.00	24.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 936.00	936.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 5.00	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.00	0.00	0.00	0.00
Crest El. (ft)	= 941.30	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	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.



Pond Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Feb 26 2013, 4:39 PM

Pond No. 1 - Det. Basin @ Node 308

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	936.00	37	0	0
1.00	937.00	292	165	165
2.00	938.00	619	456	620
3.00	939.00	1,035	827	1,447
4.00	940.00	1,580	1,308	2,755
5.00	941.00	2,257	1,919	4,673
6.00	942.00	2,770	2,514	7,187
7.00	943.00	3,271	3,021	10,207
8.00	944.00	3,754	3,513	13,720
9.00	945.00	4,314	4,034	17,754

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 24.00	24.00	0.00	0.00
Span (in)	= 24.00	24.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 936.00	936.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 5.00	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.00	0.00	0.00	0.00
Crest El. (ft)	= 941.30	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

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

Stage / Storage / Discharge Table

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

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	936.00	0.00	0.00	---	---	0.00	---	---	---	---	0.00
0.10	16	936.10	0.04	0.04	---	---	0.00	---	---	---	---	0.04
0.20	33	936.20	0.16	0.16	---	---	0.00	---	---	---	---	0.16
0.30	49	936.30	0.38	0.36	---	---	0.00	---	---	---	---	0.36
0.40	66	936.40	0.64	0.64	---	---	0.00	---	---	---	---	0.64
0.50	82	936.50	0.96	0.96	---	---	0.00	---	---	---	---	0.96
0.60	99	936.60	1.35	1.35	---	---	0.00	---	---	---	---	1.35
0.70	115	936.70	1.82	1.82	---	---	0.00	---	---	---	---	1.82
0.80	132	936.80	2.38	2.36	---	---	0.00	---	---	---	---	2.36
0.90	148	936.90	2.92	2.92	---	---	0.00	---	---	---	---	2.92
1.00	165	937.00	3.53	3.53	---	---	0.00	---	---	---	---	3.53
1.10	210	937.10	4.18	4.18	---	---	0.00	---	---	---	---	4.18
1.20	256	937.20	4.87	4.87	---	---	0.00	---	---	---	---	4.87
1.30	301	937.30	5.61	5.59	---	---	0.00	---	---	---	---	5.59
1.40	347	937.40	6.37	6.31	---	---	0.00	---	---	---	---	6.31
1.50	392	937.50	7.04	7.04	---	---	0.00	---	---	---	---	7.04
1.60	438	937.60	7.81	7.81	---	---	0.00	---	---	---	---	7.81
1.70	483	937.70	8.60	8.60	---	---	0.00	---	---	---	---	8.60
1.80	529	937.80	9.38	9.29	---	---	0.00	---	---	---	---	9.29
1.90	574	937.90	10.02	10.01	---	---	0.00	---	---	---	---	10.01
2.00	620	938.00	10.63	10.63	---	---	0.00	---	---	---	---	10.63
2.10	703	938.10	11.17	11.17	---	---	0.00	---	---	---	---	11.17
2.20	785	938.20	11.70	11.70	---	---	0.00	---	---	---	---	11.70
2.30	868	938.30	12.20	12.20	---	---	0.00	---	---	---	---	12.20
2.40	951	938.40	12.67	12.67	---	---	0.00	---	---	---	---	12.67
2.50	1,034	938.50	13.12	13.12	---	---	0.00	---	---	---	---	13.12
2.60	1,116	938.60	13.58	13.58	---	---	0.00	---	---	---	---	13.58
2.70	1,199	938.70	14.00	14.00	---	---	0.00	---	---	---	---	14.00

Continues on next page...

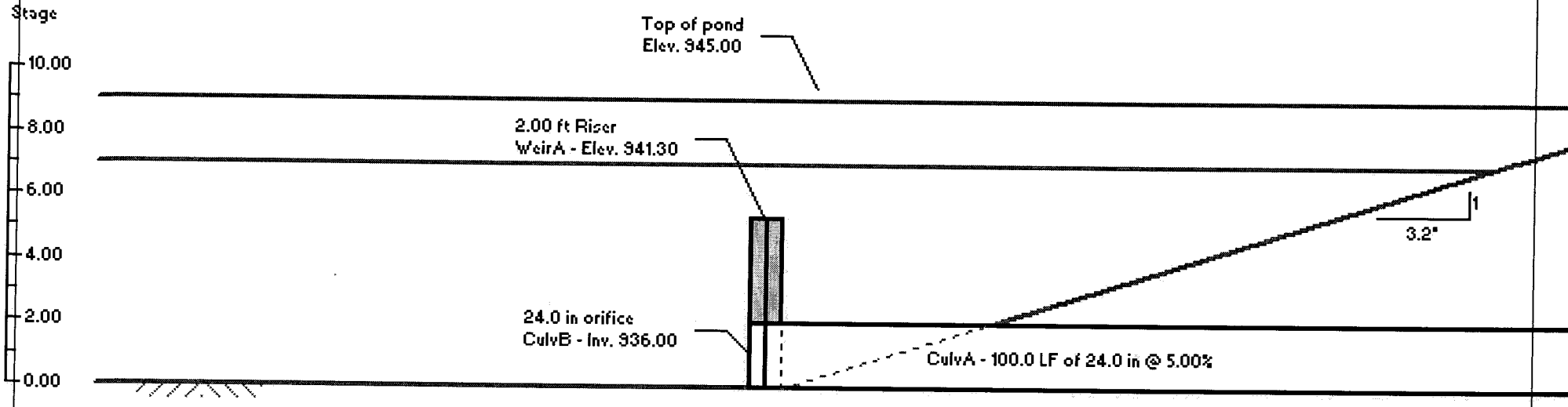
Det. Basin @ Node 308

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
2.80	1,282	938.80	14.43	14.42	---	---	0.00	---	---	---	---	14.42
2.90	1,364	938.90	14.80	14.80	---	---	0.00	---	---	---	---	14.80
3.00	1,447	939.00	15.13	15.12	---	---	0.00	---	---	---	---	15.12
3.10	1,578	939.10	15.50	15.50	---	---	0.00	---	---	---	---	15.50
3.20	1,709	939.20	15.86	15.86	---	---	0.00	---	---	---	---	15.86
3.30	1,839	939.30	16.22	16.22	---	---	0.00	---	---	---	---	16.22
3.40	1,970	939.40	16.57	16.57	---	---	0.00	---	---	---	---	16.57
3.50	2,101	939.50	16.91	16.91	---	---	0.00	---	---	---	---	16.91
3.60	2,232	939.60	17.25	17.24	---	---	0.00	---	---	---	---	17.24
3.70	2,362	939.70	17.57	17.57	---	---	0.00	---	---	---	---	17.57
3.80	2,493	939.80	17.90	17.89	---	---	0.00	---	---	---	---	17.89
3.90	2,624	939.90	18.21	18.21	---	---	0.00	---	---	---	---	18.21
4.00	2,755	940.00	18.52	18.52	---	---	0.00	---	---	---	---	18.52
4.10	2,946	940.10	18.83	18.83	---	---	0.00	---	---	---	---	18.83
4.20	3,138	940.20	19.13	19.13	---	---	0.00	---	---	---	---	19.13
4.30	3,330	940.30	19.43	19.43	---	---	0.00	---	---	---	---	19.43
4.40	3,522	940.40	19.72	19.72	---	---	0.00	---	---	---	---	19.72
4.50	3,714	940.50	20.01	20.01	---	---	0.00	---	---	---	---	20.01
4.60	3,906	940.60	20.29	20.29	---	---	0.00	---	---	---	---	20.29
4.70	4,097	940.70	20.57	20.57	---	---	0.00	---	---	---	---	20.57
4.80	4,289	940.80	20.85	20.85	---	---	0.00	---	---	---	---	20.85
4.90	4,481	940.90	21.12	21.12	---	---	0.00	---	---	---	---	21.12
5.00	4,673	941.00	21.39	21.39	---	---	0.00	---	---	---	---	21.39
5.10	4,924	941.10	21.66	21.66	---	---	0.00	---	---	---	---	21.66
5.20	5,176	941.20	21.92	21.92	---	---	0.00	---	---	---	---	21.92
5.30	5,427	941.30	22.18	22.18	---	---	0.00	---	---	---	---	22.18
5.40	5,678	941.40	22.54	22.33	---	---	0.21	---	---	---	---	22.54
5.50	5,930	941.50	22.98	22.39	---	---	0.60	---	---	---	---	22.98
5.60	6,181	941.60	23.48	22.38	---	---	1.09	---	---	---	---	23.48
5.70	6,432	941.70	24.01	22.33	---	---	1.68	---	---	---	---	24.01
5.80	6,684	941.80	24.58	22.22	---	---	2.35	---	---	---	---	24.58
5.90	6,935	941.90	25.17	22.08	---	---	3.09	---	---	---	---	25.17
6.00	7,187	942.00	25.79	21.88	---	---	3.90	---	---	---	---	25.79
6.10	7,489	942.10	26.42	21.65	---	---	4.77	---	---	---	---	26.42
6.20	7,791	942.20	27.06	21.38	---	---	5.69	---	---	---	---	27.06
6.30	8,093	942.30	27.72	21.07	---	---	6.66	---	---	---	---	27.72
6.40	8,395	942.40	28.40	20.71	---	---	7.68	---	---	---	---	28.39
6.50	8,697	942.50	29.07	20.32	---	---	8.75	---	---	---	---	29.07
6.60	8,999	942.60	29.76	19.89	---	---	9.87	---	---	---	---	29.76
6.70	9,301	942.70	30.45	19.41	---	---	11.03	---	---	---	---	30.45
6.80	9,603	942.80	31.14	18.90	---	---	12.23	---	---	---	---	31.14
6.90	9,905	942.90	31.79	18.42	---	---	13.37	---	---	---	---	31.79
7.00	10,207	943.00	32.38	18.01	---	---	14.37	---	---	---	---	32.38
7.10	10,558	943.10	32.93	17.63	---	---	15.30	---	---	---	---	32.93
7.20	10,910	943.20	33.47	17.27	---	---	16.19	---	---	---	---	33.46
7.30	11,261	943.30	33.98	16.93	---	---	17.05	---	---	---	---	33.98
7.40	11,612	943.40	34.47	16.60	---	---	17.87	---	---	---	---	34.47
7.50	11,963	943.50	34.95	16.28	---	---	18.67	---	---	---	---	34.95
7.60	12,315	943.60	35.42	15.97	---	---	19.45	---	---	---	---	35.42
7.70	12,666	943.70	35.87	15.67	---	---	20.20	---	---	---	---	35.87
7.80	13,017	943.80	36.32	15.39	---	---	20.93	---	---	---	---	36.32
7.90	13,368	943.90	36.75	15.10	---	---	21.64	---	---	---	---	36.75
8.00	13,720	944.00	37.17	14.83	---	---	22.33	---	---	---	---	37.17
8.10	14,123	944.10	37.58	14.57	---	---	23.01	---	---	---	---	37.58
8.20	14,526	944.20	37.98	14.31	---	---	23.66	---	---	---	---	37.98
8.30	14,930	944.30	38.37	14.06	---	---	24.31	---	---	---	---	38.37
8.40	15,333	944.40	38.75	13.82	---	---	24.93	---	---	---	---	38.75
8.50	15,737	944.50	39.13	13.59	---	---	25.54	---	---	---	---	39.13
8.60	16,140	944.60	39.50	13.36	---	---	26.14	---	---	---	---	39.50
8.70	16,543	944.70	39.86	13.14	---	---	26.72	---	---	---	---	39.86
8.80	16,947	944.80	40.21	12.92	---	---	27.29	---	---	---	---	40.21
8.90	17,350	944.90	40.56	12.72	---	---	27.85	---	---	---	---	40.56
9.00	17,754	945.00	40.91	12.51	---	---	28.39	---	---	---	---	40.91

...End

Det. Basin @ Node 308



* Side slope estimated average from contours

Section

NTS

(100 yr)

Schematic only. Not for construction.

RATIONAL METHOD HYDROGRAPH PROGRAM

SUBBASIN 400
EXISTING OUTFLOW @ NODE 410
(NO DETENTION NECESSARY)

RUN DATE 2/27/2013
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 10 MIN.
6 HOUR RAINFALL 3.5 INCHES
BASIN AREA 14.414 ACRES
RUNOFF COEFFICIENT 0.304
PEAK DISCHARGE 26.07 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 10	DISCHARGE (CFS) = 0.9
TIME (MIN) = 20	DISCHARGE (CFS) = 0.9
TIME (MIN) = 30	DISCHARGE (CFS) = 1
TIME (MIN) = 40	DISCHARGE (CFS) = 1
TIME (MIN) = 50	DISCHARGE (CFS) = 1
TIME (MIN) = 60	DISCHARGE (CFS) = 1.1
TIME (MIN) = 70	DISCHARGE (CFS) = 1.1
TIME (MIN) = 80	DISCHARGE (CFS) = 1.1
TIME (MIN) = 90	DISCHARGE (CFS) = 1.2
TIME (MIN) = 100	DISCHARGE (CFS) = 1.2
TIME (MIN) = 110	DISCHARGE (CFS) = 1.3
TIME (MIN) = 120	DISCHARGE (CFS) = 1.4
TIME (MIN) = 130	DISCHARGE (CFS) = 1.4
TIME (MIN) = 140	DISCHARGE (CFS) = 1.5
TIME (MIN) = 150	DISCHARGE (CFS) = 1.6
TIME (MIN) = 160	DISCHARGE (CFS) = 1.7
TIME (MIN) = 170	DISCHARGE (CFS) = 1.9
TIME (MIN) = 180	DISCHARGE (CFS) = 2
TIME (MIN) = 190	DISCHARGE (CFS) = 2.3
TIME (MIN) = 200	DISCHARGE (CFS) = 2.5
TIME (MIN) = 210	DISCHARGE (CFS) = 3.1
TIME (MIN) = 220	DISCHARGE (CFS) = 3.5
TIME (MIN) = 230	DISCHARGE (CFS) = 5.1
TIME (MIN) = 240	DISCHARGE (CFS) = 7
TIME (MIN) = 250	DISCHARGE (CFS) = 26.07
TIME (MIN) = 260	DISCHARGE (CFS) = 4.1
TIME (MIN) = 270	DISCHARGE (CFS) = 2.7
TIME (MIN) = 280	DISCHARGE (CFS) = 2.1
TIME (MIN) = 290	DISCHARGE (CFS) = 1.8
TIME (MIN) = 300	DISCHARGE (CFS) = 1.6
TIME (MIN) = 310	DISCHARGE (CFS) = 1.4
TIME (MIN) = 320	DISCHARGE (CFS) = 1.3
TIME (MIN) = 330	DISCHARGE (CFS) = 1.2
TIME (MIN) = 340	DISCHARGE (CFS) = 1.1
TIME (MIN) = 350	DISCHARGE (CFS) = 1
TIME (MIN) = 360	DISCHARGE (CFS) = 1
TIME (MIN) = 370	DISCHARGE (CFS) = 0

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Manual	23.07	10	250	53,502	----	------	------	Postdeveloped @ Node 410
2	Reservoir	20.76	10	250	53,945	1	968.88	894	Natural Pond Outflow

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 11:15 AM

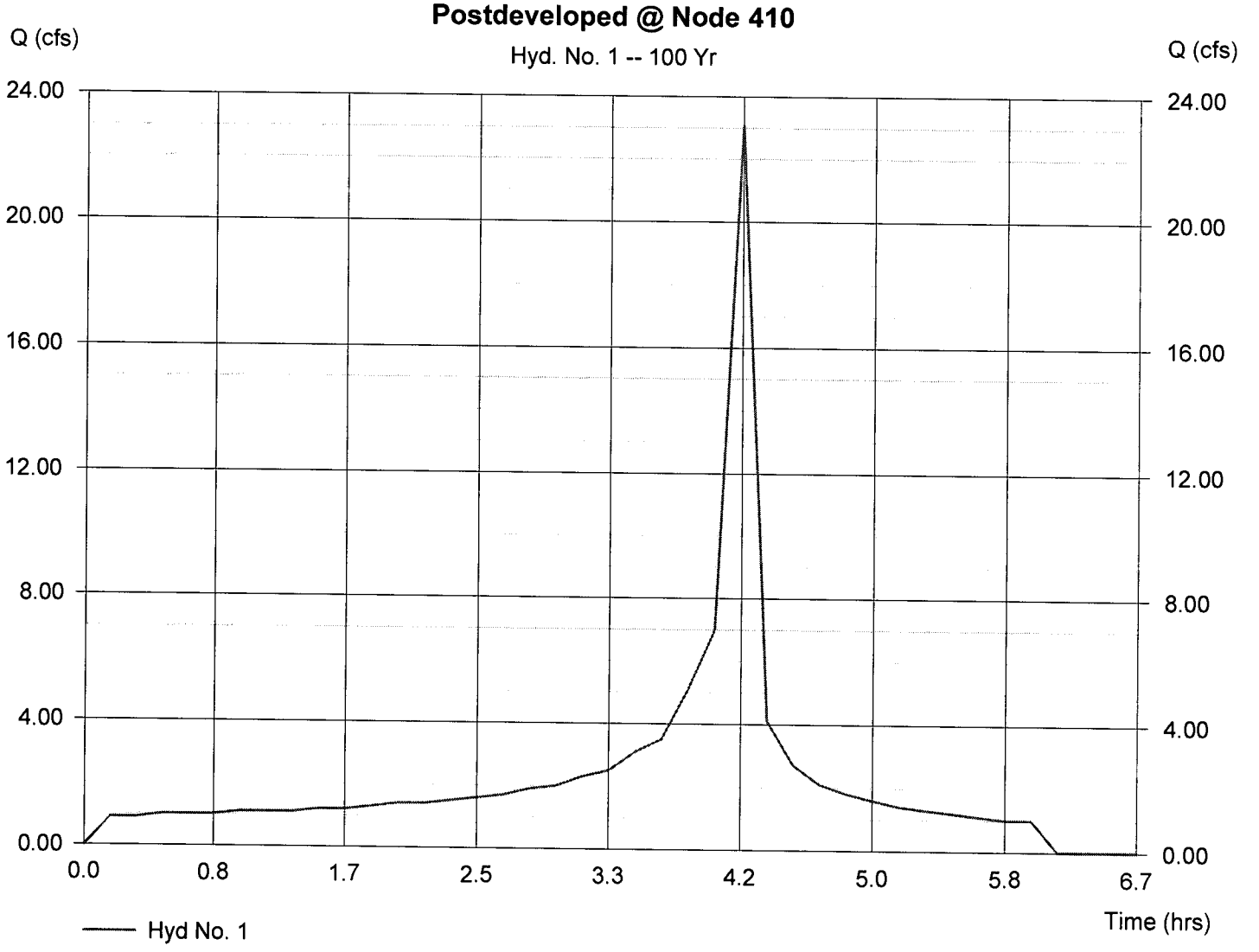
Hyd. No. 1

Postdeveloped @ Node 410

Hydrograph type = Manual
Storm frequency = 100 yrs

Peak discharge = 23.07 cfs
Time interval = 10 min

Hydrograph Volume = 53,502 cuft



Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 11:15 AM

Hyd. No. 1

Postdeveloped @ Node 410

Hydrograph type	= Manual	Peak discharge	= 23.07 cfs
Storm frequency	= 100 yrs	Time interval	= 10 min

Hydrograph Volume = 53,502 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)		Time -- Outflow (hrs cfs)	
0.17	0.90	5.83	1.00
0.33	0.90	6.00	1.00
0.50	1.00		
0.67	1.00		
0.83	1.00	*...End*	
1.00	1.10		
1.17	1.10		
1.33	1.10		
1.50	1.20		
1.67	1.20		
1.83	1.30		
2.00	1.40		
2.17	1.40		
2.33	1.50		
2.50	1.60		
2.67	1.70		
2.83	1.90		
3.00	2.00		
3.17	2.30		
3.33	2.50		
3.50	3.10		
3.67	3.50		
3.83	5.10		
4.00	7.00		
4.17	23.07 <<		
4.33	4.10		
4.50	2.70		
4.67	2.10		
4.83	1.80		
5.00	1.60		
5.17	1.40		
5.33	1.30		
5.50	1.20		
5.67	1.10		

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 11:15 AM

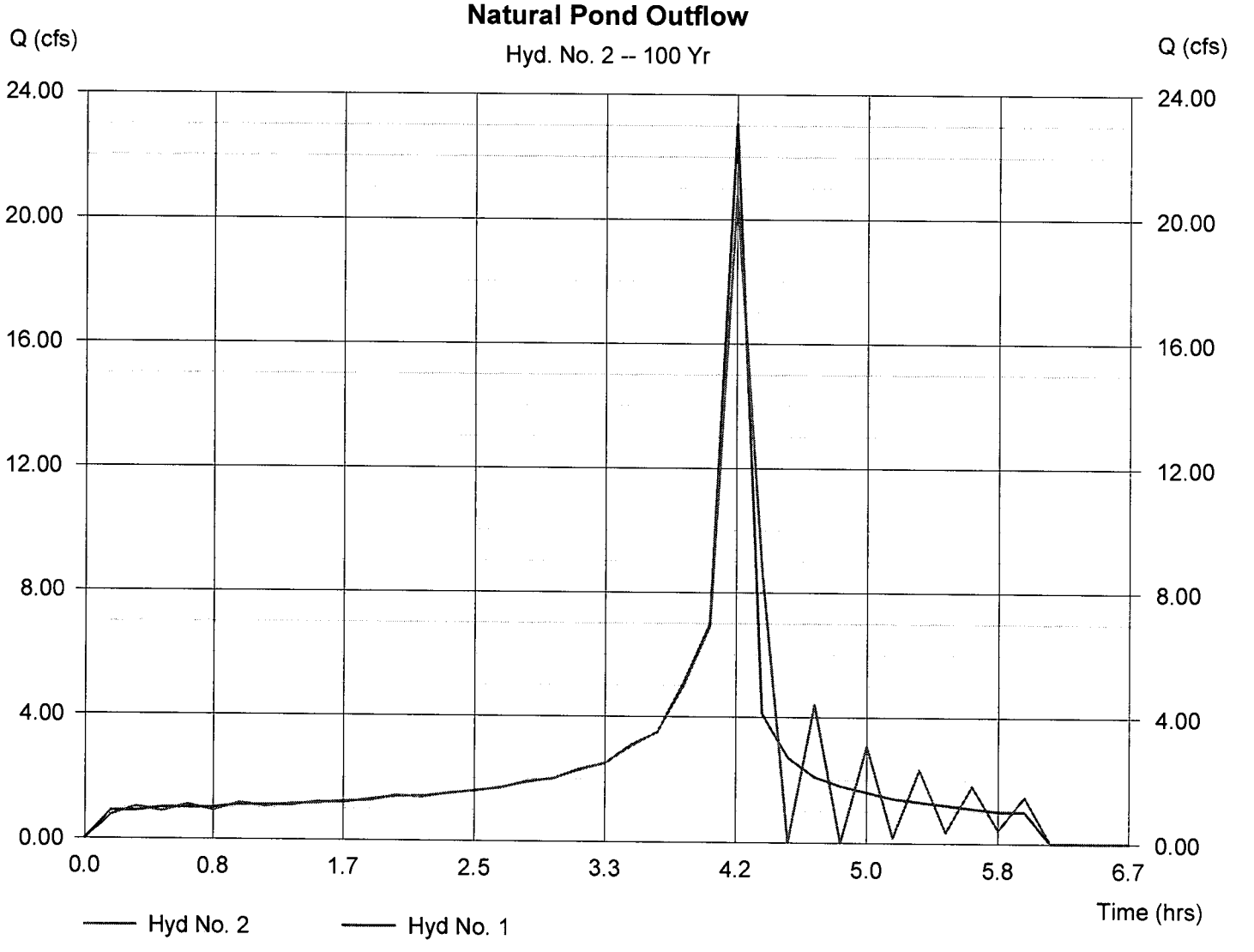
Hyd. No. 2

Natural Pond Outflow

Hydrograph type	= Reservoir	Peak discharge	= 20.76 cfs
Storm frequency	= 100 yrs	Time interval	= 10 min
Inflow hyd. No.	= 1	Max. Elevation	= 968.88 ft
Reservoir name	= Natural Basin @ Node 410	Max. Storage	= 894 cuft

Storage Indication method used.

Hydrograph Volume = 53,945 cuft



Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 11:15 AM

Hyd. No. 2

Natural Pond Outflow

Hydrograph type	= Reservoir	Peak discharge	= 20.76 cfs
Storm frequency	= 100 yrs	Time interval	= 10 min
Inflow hyd. No.	= 1	Reservoir name	= Natural Basin @ N
Max. Elevation	= 968.88 ft	Max. Storage	= 894 cuft

Storage Indication method used.

Outflow hydrograph volume = 53,945 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
0.17	0.90	966.34	0.75	-----	-----	-----	-----	-----	-----	-----	-----	0.75
0.33	0.90	966.40	1.02	-----	-----	-----	-----	-----	-----	-----	-----	1.02
0.50	1.00	966.37	0.89	-----	-----	-----	-----	-----	-----	-----	-----	0.89
0.67	1.00	966.42	1.09	-----	-----	-----	-----	-----	-----	-----	-----	1.09
0.83	1.00	966.38	0.92	-----	-----	-----	-----	-----	-----	-----	-----	0.92
1.00	1.10	966.43	1.15	-----	-----	-----	-----	-----	-----	-----	-----	1.15
1.17	1.10	966.41	1.05	-----	-----	-----	-----	-----	-----	-----	-----	1.05
1.33	1.10	966.43	1.14	-----	-----	-----	-----	-----	-----	-----	-----	1.14
1.50	1.20	966.43	1.16	-----	-----	-----	-----	-----	-----	-----	-----	1.16
1.67	1.20	966.45	1.23	-----	-----	-----	-----	-----	-----	-----	-----	1.23
1.83	1.30	966.45	1.26	-----	-----	-----	-----	-----	-----	-----	-----	1.26
2.00	1.40	966.48	1.42	-----	-----	-----	-----	-----	-----	-----	-----	1.42
2.17	1.40	966.48	1.38	-----	-----	-----	-----	-----	-----	-----	-----	1.38
2.33	1.50	966.50	1.51	-----	-----	-----	-----	-----	-----	-----	-----	1.51
2.50	1.60	966.51	1.59	-----	-----	-----	-----	-----	-----	-----	-----	1.59
2.67	1.70	966.53	1.70	-----	-----	-----	-----	-----	-----	-----	-----	1.70
2.83	1.90	966.56	1.88	-----	-----	-----	-----	-----	-----	-----	-----	1.88
3.00	2.00	966.58	2.01	-----	-----	-----	-----	-----	-----	-----	-----	2.01
3.17	2.30	966.62	2.27	-----	-----	-----	-----	-----	-----	-----	-----	2.27
3.33	2.50	966.66	2.51	-----	-----	-----	-----	-----	-----	-----	-----	2.51
3.50	3.10	966.73	3.06	-----	-----	-----	-----	-----	-----	-----	-----	3.06
3.67	3.50	966.78	3.52	-----	-----	-----	-----	-----	-----	-----	-----	3.52
3.83	5.10	966.96	5.00	-----	-----	-----	-----	-----	-----	-----	-----	5.01
4.00	7.00	967.15	6.92	-----	-----	-----	-----	-----	-----	-----	-----	6.92
4.17	23.07 <<	968.88 <<	20.76	-----	-----	-----	-----	-----	-----	-----	-----	20.76 <<
4.33	4.10	967.32	8.64	-----	-----	-----	-----	-----	-----	-----	-----	8.64
4.67	2.10	966.89	4.41	-----	-----	-----	-----	-----	-----	-----	-----	4.41
5.00	1.60	966.73	3.08	-----	-----	-----	-----	-----	-----	-----	-----	3.08
5.33	1.30	966.63	2.33	-----	-----	-----	-----	-----	-----	-----	-----	2.33
5.50	1.20	966.23	0.35	-----	-----	-----	-----	-----	-----	-----	-----	0.35
5.67	1.10	966.55	1.82	-----	-----	-----	-----	-----	-----	-----	-----	1.82
5.83	1.00	966.25	0.41	-----	-----	-----	-----	-----	-----	-----	-----	0.41
6.00	1.00	966.50	1.48	-----	-----	-----	-----	-----	-----	-----	-----	1.48

...End

Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Feb 27 2013, 11:15 AM

Pond No. 1 - Natural Basin @ Node 410

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	966.00	60	0	0
1.00	967.00	200	130	130
2.00	968.00	408	304	434
3.00	969.00	634	521	955
4.00	970.00	969	802	1,757
4.50	970.50	1,250	555	2,311

Culvert / Orifice Structures

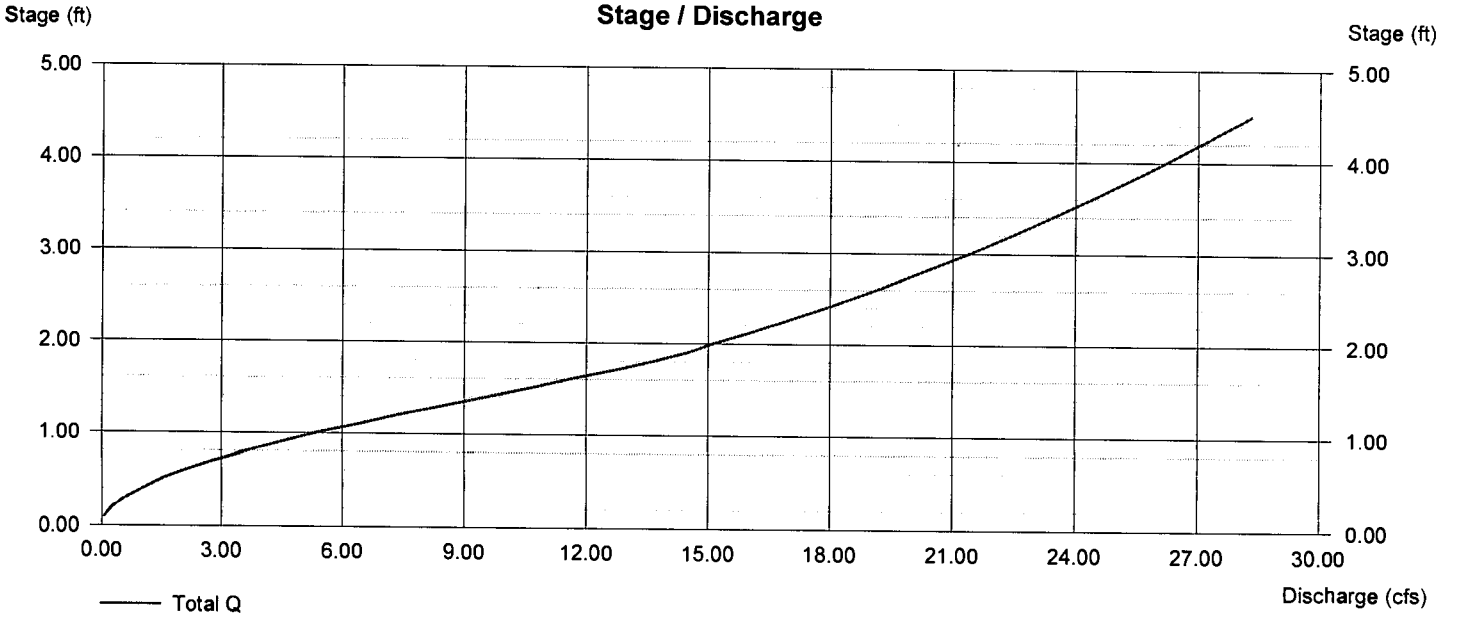
	[A]	[B]	[C]	[D]
Rise (in)	= 24.00	24.00	0.00	0.00
Span (in)	= 24.00	24.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 966.00	952.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 20.00	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= ---	---	---	---
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.



Pond Report

Pond No. 1 - Natural Basin @ Node 410

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	966.00	60	0	0
1.00	967.00	200	130	130
2.00	968.00	408	304	434
3.00	969.00	634	521	955
4.00	970.00	969	802	1,757
4.50	970.50	1,250	555	2,311

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 24.00	24.00	0.00	0.00
Span (in)	= 24.00	24.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 966.00	952.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 20.00	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= ---	---	---	---
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.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	966.00	0.00	0.00	---	---	---	---	---	---	---	0.00
0.10	13	966.10	0.06	0.00	---	---	---	---	---	---	---	0.06
0.20	26	966.20	0.25	0.00	---	---	---	---	---	---	---	0.25
0.30	39	966.30	0.56	0.00	---	---	---	---	---	---	---	0.56
0.40	52	966.40	1.01	0.00	---	---	---	---	---	---	---	1.01
0.50	65	966.50	1.50	0.00	---	---	---	---	---	---	---	1.50
0.60	78	966.60	2.10	0.00	---	---	---	---	---	---	---	2.10
0.70	91	966.70	2.82	0.00	---	---	---	---	---	---	---	2.82
0.80	104	966.80	3.65	0.00	---	---	---	---	---	---	---	3.65
0.90	117	966.90	4.47	0.00	---	---	---	---	---	---	---	4.47
1.00	130	967.00	5.35	0.00	---	---	---	---	---	---	---	5.35
1.10	160	967.10	6.39	0.00	---	---	---	---	---	---	---	6.39
1.20	191	967.20	7.36	0.00	---	---	---	---	---	---	---	7.36
1.30	221	967.30	8.46	0.00	---	---	---	---	---	---	---	8.46
1.40	252	967.40	9.55	0.00	---	---	---	---	---	---	---	9.55
1.50	282	967.50	10.60	0.00	---	---	---	---	---	---	---	10.60
1.60	312	967.60	11.61	0.00	---	---	---	---	---	---	---	11.61
1.70	343	967.70	12.68	0.00	---	---	---	---	---	---	---	12.68
1.80	373	967.80	13.65	0.00	---	---	---	---	---	---	---	13.65
1.90	404	967.90	14.49	0.00	---	---	---	---	---	---	---	14.49
2.00	434	968.00	15.12	0.00	---	---	---	---	---	---	---	15.12
2.10	486	968.10	15.86	0.00	---	---	---	---	---	---	---	15.86
2.20	538	968.20	16.57	0.00	---	---	---	---	---	---	---	16.57
2.30	590	968.30	17.24	0.00	---	---	---	---	---	---	---	17.24
2.40	642	968.40	17.90	0.00	---	---	---	---	---	---	---	17.90
2.50	694	968.50	18.52	0.00	---	---	---	---	---	---	---	18.52
2.60	747	968.60	19.13	0.00	---	---	---	---	---	---	---	19.13
2.70	799	968.70	19.72	0.00	---	---	---	---	---	---	---	19.72
2.80	851	968.80	20.29	0.00	---	---	---	---	---	---	---	20.29
2.90	903	968.90	20.85	0.00	---	---	---	---	---	---	---	20.85
3.00	955	969.00	21.39	0.00	---	---	---	---	---	---	---	21.39
3.10	1,035	969.10	21.92	0.00	---	---	---	---	---	---	---	21.92

Continues on next page...

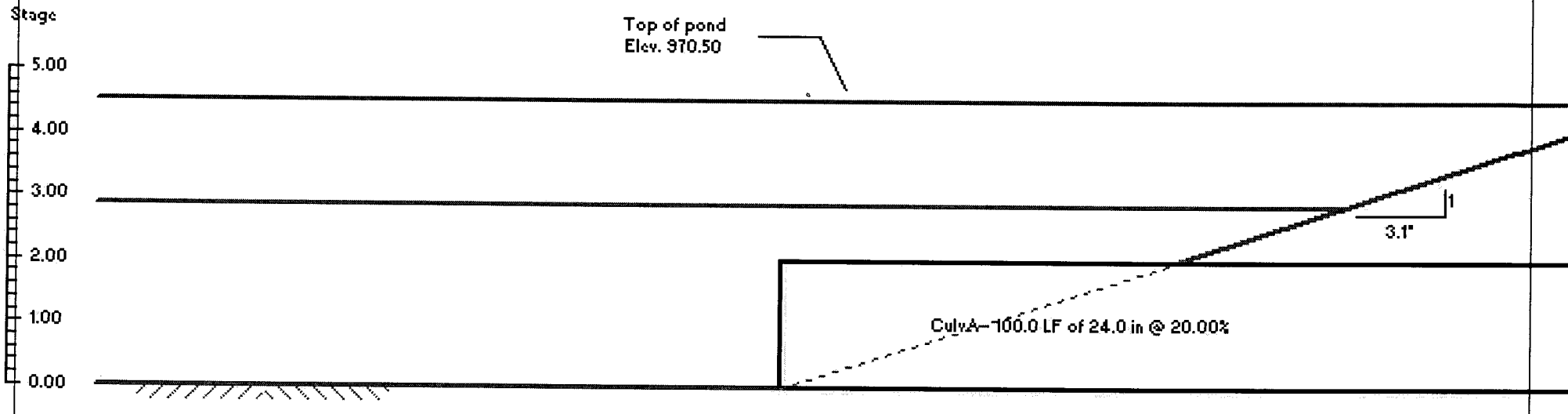
Natural Basin @ Node 410

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
3.20	1,115	969.20	22.43	0.00	---	---	---	---	---	---	---	22.43
3.30	1,195	969.30	22.94	0.00	---	---	---	---	---	---	---	22.94
3.40	1,276	969.40	23.43	0.00	---	---	---	---	---	---	---	23.43
3.50	1,356	969.50	23.91	0.00	---	---	---	---	---	---	---	23.91
3.60	1,436	969.60	24.39	0.00	---	---	---	---	---	---	---	24.39
3.70	1,516	969.70	24.85	0.00	---	---	---	---	---	---	---	24.85
3.80	1,596	969.80	25.31	0.00	---	---	---	---	---	---	---	25.31
3.90	1,676	969.90	25.76	0.00	---	---	---	---	---	---	---	25.76
4.00	1,757	970.00	26.20	0.00	---	---	---	---	---	---	---	26.20
4.05	1,812	970.05	26.41	0.00	---	---	---	---	---	---	---	26.41
4.10	1,867	970.10	26.63	0.00	---	---	---	---	---	---	---	26.63
4.15	1,923	970.15	26.84	0.00	---	---	---	---	---	---	---	26.84
4.20	1,978	970.20	27.06	0.00	---	---	---	---	---	---	---	27.06
4.25	2,034	970.25	27.27	0.00	---	---	---	---	---	---	---	27.27
4.30	2,089	970.30	27.48	0.00	---	---	---	---	---	---	---	27.48
4.35	2,145	970.35	27.68	0.00	---	---	---	---	---	---	---	27.68
4.40	2,200	970.40	27.89	0.00	---	---	---	---	---	---	---	27.89
4.45	2,256	970.45	28.09	0.00	---	---	---	---	---	---	---	28.09
4.50	2,311	970.50	28.30	0.00	---	---	---	---	---	---	---	28.30

...End

Natural Basin @ Node 410



* Side slope estimated average from contours

Section

NTS

(100 yr)

Schematic only. Not for construction.

RATIONAL METHOD HYDROGRAPH PROGRAM

SUBBASIN 500

BASIN @ NODE 517

RUN DATE 2/26/2013
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 8 MIN.
6 HOUR RAINFALL 3.5 INCHES
BASIN AREA 24.44 ACRES
RUNOFF COEFFICIENT 0.375
PEAK DISCHARGE 62.8 CFS

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 8	DISCHARGE (CFS) = 1.9
TIME (MIN) = 16	DISCHARGE (CFS) = 1.9
TIME (MIN) = 24	DISCHARGE (CFS) = 2
TIME (MIN) = 32	DISCHARGE (CFS) = 2
TIME (MIN) = 40	DISCHARGE (CFS) = 2.1
TIME (MIN) = 48	DISCHARGE (CFS) = 2.1
TIME (MIN) = 56	DISCHARGE (CFS) = 2.2
TIME (MIN) = 64	DISCHARGE (CFS) = 2.3
TIME (MIN) = 72	DISCHARGE (CFS) = 2.3
TIME (MIN) = 80	DISCHARGE (CFS) = 2.4
TIME (MIN) = 88	DISCHARGE (CFS) = 2.5
TIME (MIN) = 96	DISCHARGE (CFS) = 2.6
TIME (MIN) = 104	DISCHARGE (CFS) = 2.7
TIME (MIN) = 112	DISCHARGE (CFS) = 2.7
TIME (MIN) = 120	DISCHARGE (CFS) = 2.9
TIME (MIN) = 128	DISCHARGE (CFS) = 3
TIME (MIN) = 136	DISCHARGE (CFS) = 3.2
TIME (MIN) = 144	DISCHARGE (CFS) = 3.3
TIME (MIN) = 152	DISCHARGE (CFS) = 3.5
TIME (MIN) = 160	DISCHARGE (CFS) = 3.6
TIME (MIN) = 168	DISCHARGE (CFS) = 3.9
TIME (MIN) = 176	DISCHARGE (CFS) = 4.1
TIME (MIN) = 184	DISCHARGE (CFS) = 4.6
TIME (MIN) = 192	DISCHARGE (CFS) = 4.9
TIME (MIN) = 200	DISCHARGE (CFS) = 5.6
TIME (MIN) = 208	DISCHARGE (CFS) = 6
TIME (MIN) = 216	DISCHARGE (CFS) = 7.4
TIME (MIN) = 224	DISCHARGE (CFS) = 8.4
TIME (MIN) = 232	DISCHARGE (CFS) = 12.4
TIME (MIN) = 240	DISCHARGE (CFS) = 17
TIME (MIN) = 248	DISCHARGE (CFS) = 62.8
TIME (MIN) = 256	DISCHARGE (CFS) = 9.9
TIME (MIN) = 264	DISCHARGE (CFS) = 6.6
TIME (MIN) = 272	DISCHARGE (CFS) = 5.2
TIME (MIN) = 280	DISCHARGE (CFS) = 4.3
TIME (MIN) = 288	DISCHARGE (CFS) = 3.8
TIME (MIN) = 296	DISCHARGE (CFS) = 3.4
TIME (MIN) = 304	DISCHARGE (CFS) = 3.1
TIME (MIN) = 312	DISCHARGE (CFS) = 2.8
TIME (MIN) = 320	DISCHARGE (CFS) = 2.6
TIME (MIN) = 328	DISCHARGE (CFS) = 2.4
TIME (MIN) = 336	DISCHARGE (CFS) = 2.3
TIME (MIN) = 344	DISCHARGE (CFS) = 2.2
TIME (MIN) = 352	DISCHARGE (CFS) = 2.1
TIME (MIN) = 360	DISCHARGE (CFS) = 2
TIME (MIN) = 368	DISCHARGE (CFS) = 0

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Manual	62.80	8	248	115,680	----	------	------	Post Developed at Node 517
2	Reservoir	42.84	8	248	118,448	1	964.71	5,022	Detetion Basin Outflow

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Tuesday, Feb 26 2013, 3:44 PM

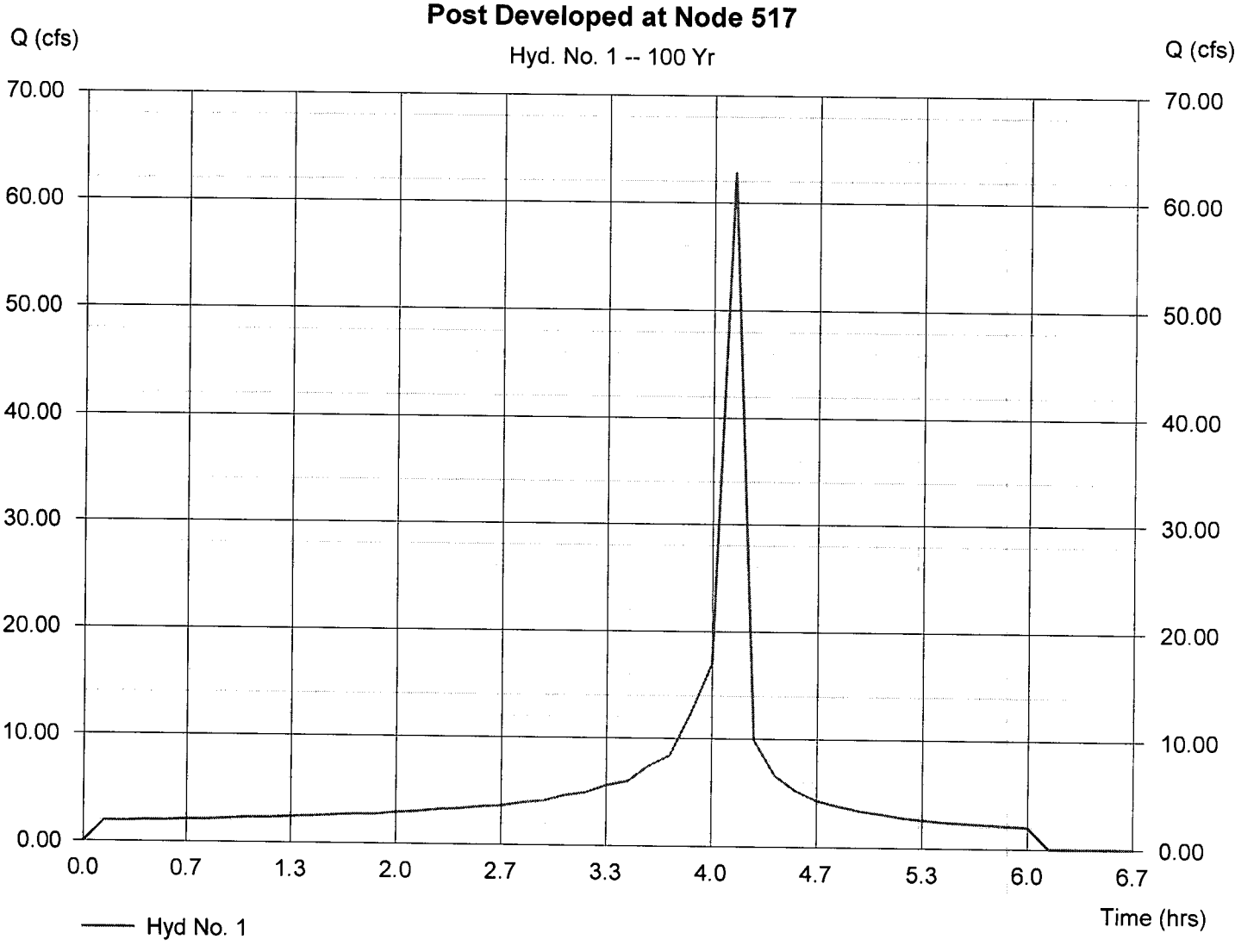
Hyd. No. 1

Post Developed at Node 517

Hydrograph type = Manual
Storm frequency = 100 yrs

Peak discharge = 62.80 cfs
Time interval = 8 min

Hydrograph Volume = 115,680 cuft



Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Feb 26 2013, 3:36 PM

Hyd. No. 1

Post Developed at Node 517

Hydrograph type	= Manual	Peak discharge	= 62.80 cfs
Storm frequency	= 100 yrs	Time interval	= 8 min

Hydrograph Volume = 115,680 cuft

Hydrograph Discharge Table

(Printed values >= 1% of Qp.)

Time (hrs)	Outflow cfs)	Time (hrs)	Outflow cfs)
0.13	1.90	4.67	4.30
0.27	1.90	4.80	3.80
0.40	2.00	4.93	3.40
0.53	2.00	5.07	3.10
0.67	2.10	5.20	2.80
0.80	2.10	5.33	2.60
0.93	2.20	5.47	2.40
1.07	2.30	5.60	2.30
1.20	2.30	5.73	2.20
1.33	2.40	5.87	2.10
1.47	2.50	6.00	2.00
1.60	2.60		
1.73	2.70		
1.87	2.70	...*End*	
2.00	2.90		
2.13	3.00		
2.27	3.20		
2.40	3.30		
2.53	3.50		
2.67	3.60		
2.80	3.90		
2.93	4.10		
3.07	4.60		
3.20	4.90		
3.33	5.60		
3.47	6.00		
3.60	7.40		
3.73	8.40		
3.87	12.40		
4.00	17.00		
4.13	62.80 <<		
4.27	9.90		
4.40	6.60		
4.53	5.20		

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Tuesday, Feb 26 2013, 3:44 PM

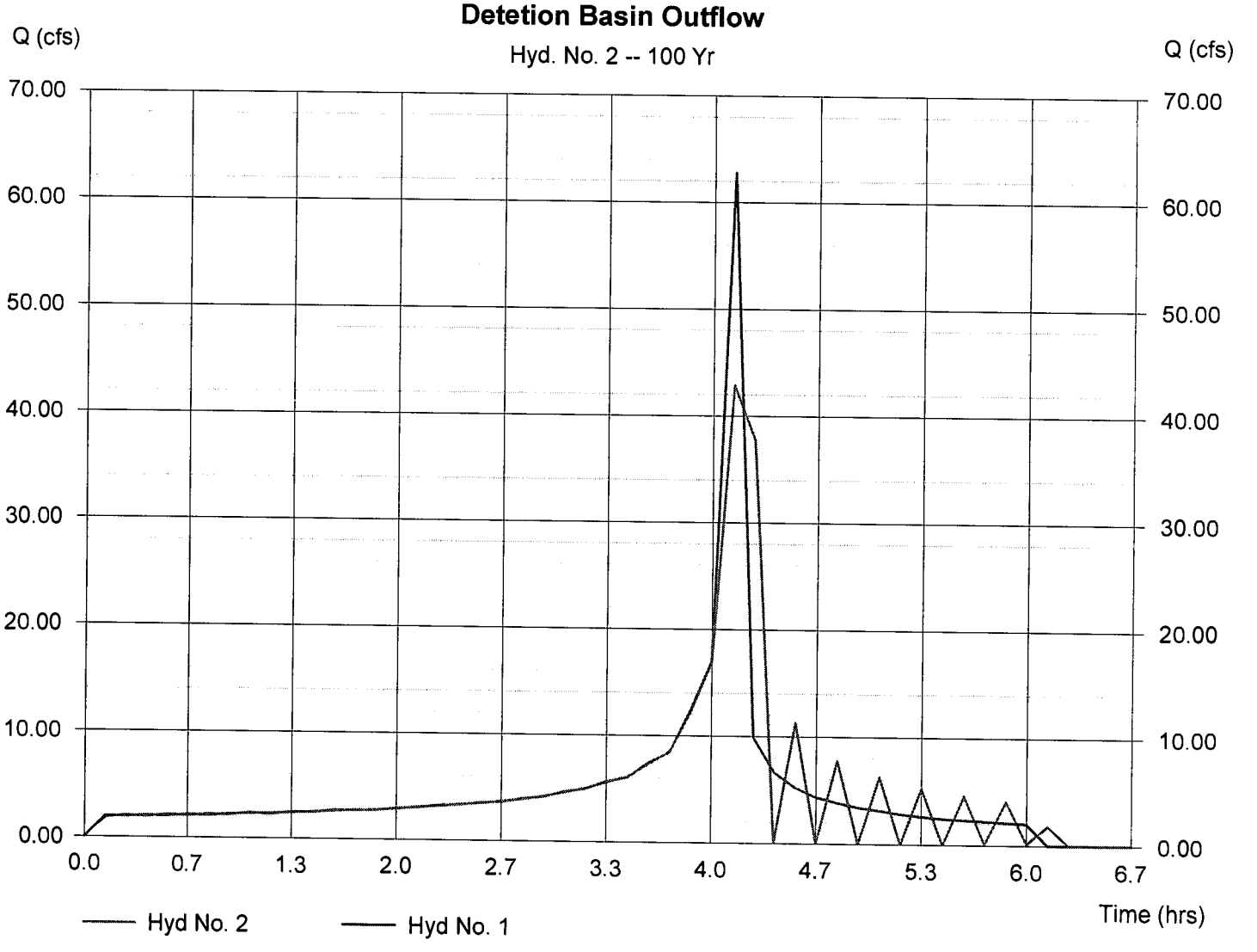
Hyd. No. 2

Detetion Basin Outflow

Hydrograph type	= Reservoir	Peak discharge	= 42.84 cfs
Storm frequency	= 100 yrs	Time interval	= 8 min
Inflow hyd. No.	= 1	Max. Elevation	= 964.71 ft
Reservoir name	= Det. Basin @ Node 517	Max. Storage	= 5,022 cuft

Storage Indication method used.

Hydrograph Volume = 118,448 cuft



Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Feb 26 2013, 3:36 PM

Hyd. No. 2

Detetion Basin Outflow

Hydrograph type	= Reservoir	Peak discharge	= 42.84 cfs
Storm frequency	= 100 yrs	Time interval	= 8 min
Inflow hyd. No.	= 1	Reservoir name	= Det. Basin @ Node
Max. Elevation	= 964.71 ft	Max. Storage	= 5,022 cuft

Storage Indication method used.

Outflow hydrograph volume = 118,448 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
0.13	1.90	959.64	1.81	1.81	-----	-----	-----	-----	-----	-----	-----	1.81
0.27	1.90	959.68	1.99	1.99	-----	-----	-----	-----	-----	-----	-----	1.99
0.40	2.00	959.67	1.91	1.91	-----	-----	-----	-----	-----	-----	-----	1.91
0.53	2.00	959.70	2.08	2.08	-----	-----	-----	-----	-----	-----	-----	2.08
0.67	2.10	959.69	2.02	2.02	-----	-----	-----	-----	-----	-----	-----	2.02
0.80	2.10	959.71	2.18	2.18	-----	-----	-----	-----	-----	-----	-----	2.18
0.93	2.20	959.70	2.13	2.12	-----	-----	-----	-----	-----	-----	-----	2.12
1.07	2.30	959.74	2.37	2.37	-----	-----	-----	-----	-----	-----	-----	2.37
1.20	2.30	959.72	2.24	2.23	-----	-----	-----	-----	-----	-----	-----	2.23
1.33	2.40	959.76	2.47	2.46	-----	-----	-----	-----	-----	-----	-----	2.46
1.47	2.50	959.76	2.45	2.44	-----	-----	-----	-----	-----	-----	-----	2.44
1.60	2.60	959.79	2.67	2.66	-----	-----	-----	-----	-----	-----	-----	2.66
1.73	2.70	959.79	2.65	2.64	-----	-----	-----	-----	-----	-----	-----	2.64
1.87	2.70	959.81	2.76	2.75	-----	-----	-----	-----	-----	-----	-----	2.75
2.00	2.90	959.82	2.85	2.84	-----	-----	-----	-----	-----	-----	-----	2.85
2.13	3.00	959.85	3.06	3.05	-----	-----	-----	-----	-----	-----	-----	3.05
2.27	3.20	959.87	3.15	3.15	-----	-----	-----	-----	-----	-----	-----	3.15
2.40	3.30	959.90	3.35	3.35	-----	-----	-----	-----	-----	-----	-----	3.35
2.53	3.50	959.91	3.45	3.45	-----	-----	-----	-----	-----	-----	-----	3.45
2.67	3.60	959.94	3.66	3.65	-----	-----	-----	-----	-----	-----	-----	3.65
2.80	3.90	959.96	3.87	3.85	-----	-----	-----	-----	-----	-----	-----	3.85
2.93	4.10	960.00	4.17	4.14	-----	-----	-----	-----	-----	-----	-----	4.14
3.07	4.60	960.05	4.55	4.54	-----	-----	-----	-----	-----	-----	-----	4.54
3.20	4.90	960.10	4.94	4.94	-----	-----	-----	-----	-----	-----	-----	4.94
3.33	5.60	960.18	5.53	5.53	-----	-----	-----	-----	-----	-----	-----	5.53
3.47	6.00	960.24	6.05	6.05	-----	-----	-----	-----	-----	-----	-----	6.05
3.60	7.40	960.37	7.30	7.30	-----	-----	-----	-----	-----	-----	-----	7.30
3.73	8.40	960.49	8.46	8.45	-----	-----	-----	-----	-----	-----	-----	8.45
3.87	12.40	960.87	12.19	12.19	-----	-----	-----	-----	-----	-----	-----	12.19
4.00	17.00	961.31	16.88	16.87	-----	-----	-----	-----	-----	-----	-----	16.87
4.13	62.80 <<	964.71 <<	42.84	25.58	-----	-----	17.26	-----	-----	-----	-----	42.84 <<
4.27	9.90	964.15	37.72	27.47	-----	-----	10.25	-----	-----	-----	-----	37.72
4.53	5.20	960.78	11.34	11.33	-----	-----	-----	-----	-----	-----	-----	11.33
4.80	3.80	960.43	7.78	7.78	-----	-----	-----	-----	-----	-----	-----	7.78
5.07	3.10	960.26	6.25	6.25	-----	-----	-----	-----	-----	-----	-----	6.25
5.33	2.60	960.14	5.20	5.20	-----	-----	-----	-----	-----	-----	-----	5.20
5.60	2.30	960.05	4.54	4.53	-----	-----	-----	-----	-----	-----	-----	4.53
5.87	2.10	959.99	4.08	4.06	-----	-----	-----	-----	-----	-----	-----	4.06

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Detetion Basin Outflow

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
6.13	0.00	959.64	1.78	1.78	-----	-----	-----	-----	-----	-----	-----	1.78

...*End*

Pond Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Feb 26 2013, 3:44 PM

Pond No. 1 - Det. Basin @ Node 517

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	959.00	20	0	0
1.00	960.00	50	35	35
2.00	961.00	150	100	135
3.00	962.00	276	213	348
4.00	963.00	963	620	968
5.00	964.00	2,377	1,670	2,638
6.00	965.00	4,353	3,365	6,003
7.00	966.00	7,747	6,050	12,053

Culvert / Orifice Structures

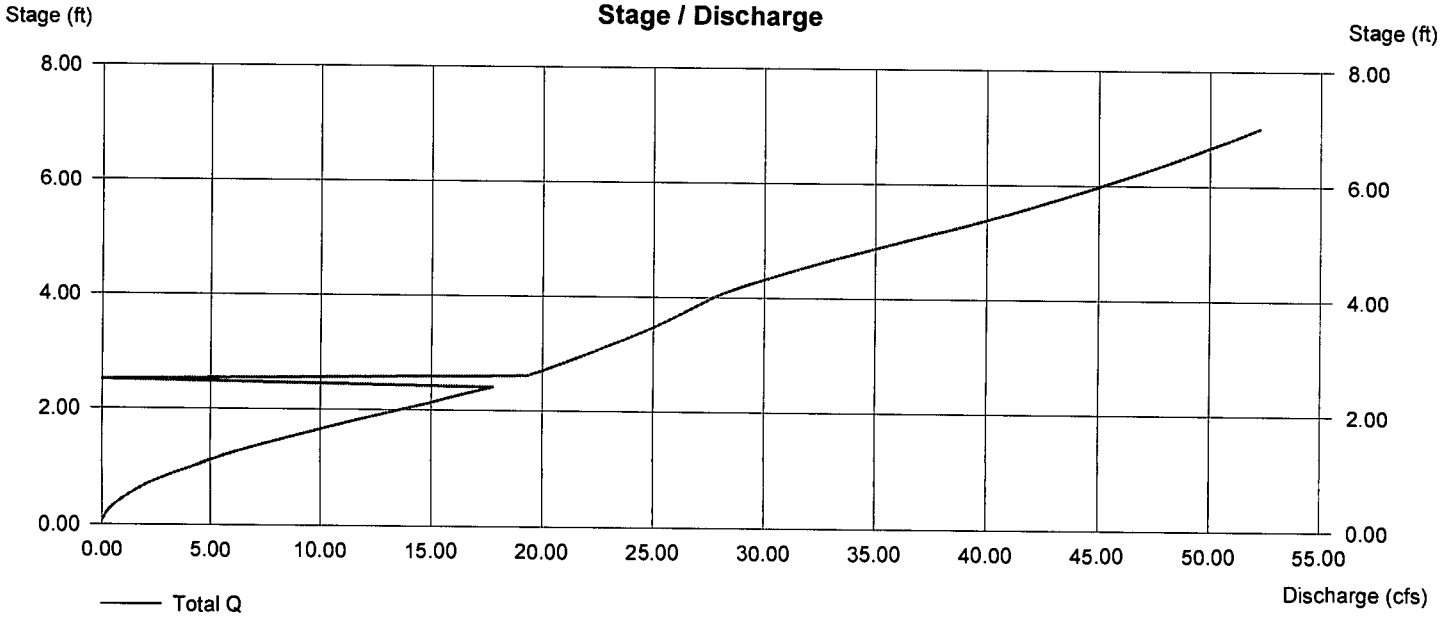
	[A]	[B]	[C]	[D]
Rise (in)	= 30.00	30.00	0.00	0.00
Span (in)	= 30.00	30.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 959.00	959.00	0.00	0.00
Length (ft)	= 72.00	0.00	0.00	0.00
Slope (%)	= 24.00	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.50	0.00	0.00	0.00
Crest El. (ft)	= 963.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	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.



Pond Report

Pond No. 1 - Det. Basin @ Node 517

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	959.00	20	0	0
1.00	960.00	50	35	35
2.00	961.00	150	100	135
3.00	962.00	276	213	348
4.00	963.00	963	620	968
5.00	964.00	2,377	1,670	2,638
6.00	965.00	4,353	3,365	6,003
7.00	966.00	7,747	6,050	12,053

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 30.00	30.00	0.00	0.00
Span (in)	= 30.00	30.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 959.00	959.00	0.00	0.00
Length (ft)	= 72.00	0.00	0.00	0.00
Slope (%)	= 24.00	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.50	0.00	0.00	0.00
Crest El. (ft)	= 963.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

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

Stage / Storage / Discharge Table

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

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	959.00	0.00	0.00	---	---	0.00	---	---	---	---	0.00
0.10	4	959.10	0.05	0.05	---	---	0.00	---	---	---	---	0.05
0.20	7	959.20	0.19	0.19	---	---	0.00	---	---	---	---	0.19
0.30	11	959.30	0.43	0.42	---	---	0.00	---	---	---	---	0.42
0.40	14	959.40	0.72	0.72	---	---	0.00	---	---	---	---	0.72
0.50	18	959.50	1.12	1.12	---	---	0.00	---	---	---	---	1.12
0.60	21	959.60	1.57	1.57	---	---	0.00	---	---	---	---	1.57
0.70	25	959.70	2.09	2.09	---	---	0.00	---	---	---	---	2.09
0.80	28	959.80	2.73	2.72	---	---	0.00	---	---	---	---	2.72
0.90	32	959.90	3.34	3.34	---	---	0.00	---	---	---	---	3.34
1.00	35	960.00	4.16	4.13	---	---	0.00	---	---	---	---	4.13
1.10	45	960.10	4.91	4.91	---	---	0.00	---	---	---	---	4.91
1.20	55	960.20	5.73	5.73	---	---	0.00	---	---	---	---	5.73
1.30	65	960.30	6.61	6.61	---	---	0.00	---	---	---	---	6.61
1.40	75	960.40	7.53	7.53	---	---	0.00	---	---	---	---	7.53
1.50	85	960.50	8.50	8.50	---	---	0.00	---	---	---	---	8.50
1.60	95	960.60	9.54	9.54	---	---	0.00	---	---	---	---	9.54
1.70	105	960.70	10.59	10.50	---	---	0.00	---	---	---	---	10.50
1.80	115	960.80	11.47	11.47	---	---	0.00	---	---	---	---	11.47
1.90	125	960.90	12.56	12.56	---	---	0.00	---	---	---	---	12.56
2.00	135	961.00	13.65	13.65	---	---	0.00	---	---	---	---	13.65
2.10	156	961.10	14.75	14.75	---	---	0.00	---	---	---	---	14.75
2.20	178	961.20	15.85	15.70	---	---	0.00	---	---	---	---	15.70
2.30	199	961.30	16.73	16.73	---	---	0.00	---	---	---	---	16.73
2.40	220	961.40	17.75	17.74	---	---	0.00	---	---	---	---	17.74
2.50	242	961.50	17.51	0.00	---	---	0.00	---	---	---	---	0.00
2.60	263	961.60	19.31	19.31	---	---	0.00	---	---	---	---	19.31
2.70	284	961.70	20.03	20.03	---	---	0.00	---	---	---	---	20.03
2.80	305	961.80	20.73	20.73	---	---	0.00	---	---	---	---	20.73
2.90	327	961.90	21.52	21.44	---	---	0.00	---	---	---	---	21.44

Continues on next page...

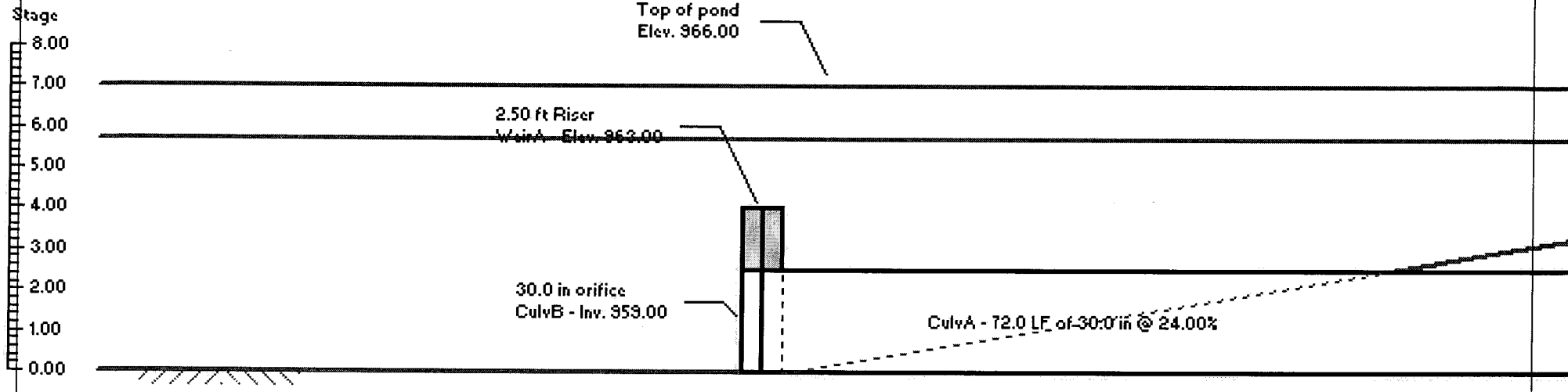
Det. Basin @ Node 517

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
3.00	348	962.00	22.14	22.14	---	---	0.00	---	---	---	---	22.14
3.10	410	962.10	22.75	22.75	---	---	0.00	---	---	---	---	22.75
3.20	472	962.20	23.41	23.41	---	---	0.00	---	---	---	---	23.41
3.30	534	962.30	24.02	24.02	---	---	0.00	---	---	---	---	24.02
3.40	596	962.40	24.66	24.61	---	---	0.00	---	---	---	---	24.61
3.50	658	962.50	25.20	25.19	---	---	0.00	---	---	---	---	25.19
3.60	720	962.60	25.72	25.72	---	---	0.00	---	---	---	---	25.72
3.70	782	962.70	26.22	26.21	---	---	0.00	---	---	---	---	26.21
3.80	844	962.80	26.68	26.68	---	---	0.00	---	---	---	---	26.68
3.90	906	962.90	27.20	27.20	---	---	0.00	---	---	---	---	27.20
4.00	968	963.00	27.71	27.71	---	---	0.00	---	---	---	---	27.71
4.10	1,135	963.10	28.34	28.08	---	---	0.26	---	---	---	---	28.34
4.20	1,302	963.20	29.07	28.33	---	---	0.74	---	---	---	---	29.07
4.30	1,469	963.30	29.86	28.49	---	---	1.37	---	---	---	---	29.86
4.40	1,636	963.40	30.69	28.59	---	---	2.11	---	---	---	---	30.69
4.50	1,803	963.50	31.56	28.62	---	---	2.94	---	---	---	---	31.56
4.60	1,970	963.60	32.46	28.59	---	---	3.87	---	---	---	---	32.46
4.70	2,137	963.70	33.38	28.50	---	---	4.87	---	---	---	---	33.38
4.80	2,304	963.80	34.32	28.37	---	---	5.95	---	---	---	---	34.32
4.90	2,471	963.90	35.28	28.17	---	---	7.11	---	---	---	---	35.28
5.00	2,638	964.00	36.25	27.93	---	---	8.33	---	---	---	---	36.25
5.10	2,974	964.10	37.24	27.63	---	---	9.60	---	---	---	---	37.24
5.20	3,311	964.20	38.23	27.29	---	---	10.94	---	---	---	---	38.23
5.30	3,647	964.30	39.23	26.89	---	---	12.34	---	---	---	---	39.23
5.40	3,984	964.40	40.16	26.54	---	---	13.62	---	---	---	---	40.16
5.50	4,320	964.50	41.06	26.22	---	---	14.84	---	---	---	---	41.06
5.60	4,657	964.60	41.93	25.91	---	---	16.01	---	---	---	---	41.93
5.70	4,993	964.70	42.77	25.61	---	---	17.16	---	---	---	---	42.77
5.80	5,330	964.80	43.59	25.31	---	---	18.28	---	---	---	---	43.59
5.90	5,666	964.90	44.40	25.01	---	---	19.38	---	---	---	---	44.40
6.00	6,003	965.00	45.19	24.72	---	---	20.47	---	---	---	---	45.19
6.10	6,608	965.10	45.96	24.42	---	---	21.53	---	---	---	---	45.96
6.20	7,213	965.20	46.71	24.13	---	---	22.58	---	---	---	---	46.71
6.30	7,818	965.30	47.45	23.85	---	---	23.60	---	---	---	---	47.45
6.40	8,423	965.40	48.18	23.56	---	---	24.62	---	---	---	---	48.18
6.50	9,028	965.50	48.89	23.28	---	---	25.61	---	---	---	---	48.89
6.60	9,633	965.60	49.59	23.00	---	---	26.58	---	---	---	---	49.59
6.70	10,238	965.70	50.27	22.73	---	---	27.54	---	---	---	---	50.27
6.80	10,843	965.80	50.94	22.45	---	---	28.49	---	---	---	---	50.94
6.90	11,448	965.90	51.61	22.19	---	---	29.42	---	---	---	---	51.60
7.00	12,053	966.00	52.26	21.92	---	---	30.33	---	---	---	---	52.25

...End

Det. Basin @ Node 517



Section

NTS

* Side slope estimated average from contours

(100 yr)

Schematic only. Not for construction.

RATIONAL METHOD HYDROGRAPH PROGRAM
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RUN DATE 3/12/2013
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 7 MIN.
6 HOUR RAINFALL 3.5 INCHES
BASIN AREA 12.189 ACRES
RUNOFF COEFFICIENT 0.388
PEAK DISCHARGE 33.874 CFS

SUBBASIN 600

BASIN @ NODE 608
W/ BYPASS AREA
TO OUTLET @ NODE 610

TIME (MIN) = 0	DISCHARGE (CFS) = 0
TIME (MIN) = 7	DISCHARGE (CFS) = 1
TIME (MIN) = 14	DISCHARGE (CFS) = 1
TIME (MIN) = 21	DISCHARGE (CFS) = 1
TIME (MIN) = 28	DISCHARGE (CFS) = 1
TIME (MIN) = 35	DISCHARGE (CFS) = 1.1
TIME (MIN) = 42	DISCHARGE (CFS) = 1.1
TIME (MIN) = 49	DISCHARGE (CFS) = 1.1
TIME (MIN) = 56	DISCHARGE (CFS) = 1.1
TIME (MIN) = 63	DISCHARGE (CFS) = 1.2
TIME (MIN) = 70	DISCHARGE (CFS) = 1.2
TIME (MIN) = 77	DISCHARGE (CFS) = 1.2
TIME (MIN) = 84	DISCHARGE (CFS) = 1.3
TIME (MIN) = 91	DISCHARGE (CFS) = 1.3
TIME (MIN) = 98	DISCHARGE (CFS) = 1.3
TIME (MIN) = 105	DISCHARGE (CFS) = 1.4
TIME (MIN) = 112	DISCHARGE (CFS) = 1.4
TIME (MIN) = 119	DISCHARGE (CFS) = 1.5
TIME (MIN) = 126	DISCHARGE (CFS) = 1.5
TIME (MIN) = 133	DISCHARGE (CFS) = 1.6
TIME (MIN) = 140	DISCHARGE (CFS) = 1.7
TIME (MIN) = 147	DISCHARGE (CFS) = 1.8
TIME (MIN) = 154	DISCHARGE (CFS) = 1.8
TIME (MIN) = 161	DISCHARGE (CFS) = 2
TIME (MIN) = 168	DISCHARGE (CFS) = 2
TIME (MIN) = 175	DISCHARGE (CFS) = 2.2
TIME (MIN) = 182	DISCHARGE (CFS) = 2.3
TIME (MIN) = 189	DISCHARGE (CFS) = 2.6
TIME (MIN) = 196	DISCHARGE (CFS) = 2.7
TIME (MIN) = 203	DISCHARGE (CFS) = 3.1
TIME (MIN) = 210	DISCHARGE (CFS) = 3.4
TIME (MIN) = 217	DISCHARGE (CFS) = 4.2
TIME (MIN) = 224	DISCHARGE (CFS) = 4.7
TIME (MIN) = 231	DISCHARGE (CFS) = 7
TIME (MIN) = 238	DISCHARGE (CFS) = 11
TIME (MIN) = 245	DISCHARGE (CFS) = 33.874
TIME (MIN) = 252	DISCHARGE (CFS) = 5.6
TIME (MIN) = 259	DISCHARGE (CFS) = 3.7
TIME (MIN) = 266	DISCHARGE (CFS) = 2.9
TIME (MIN) = 273	DISCHARGE (CFS) = 2.4
TIME (MIN) = 280	DISCHARGE (CFS) = 2.1
TIME (MIN) = 287	DISCHARGE (CFS) = 1.9
TIME (MIN) = 294	DISCHARGE (CFS) = 1.7
TIME (MIN) = 301	DISCHARGE (CFS) = 1.6
TIME (MIN) = 308	DISCHARGE (CFS) = 1.5
TIME (MIN) = 315	DISCHARGE (CFS) = 1.4
TIME (MIN) = 322	DISCHARGE (CFS) = 1.3
TIME (MIN) = 329	DISCHARGE (CFS) = 1.2
TIME (MIN) = 336	DISCHARGE (CFS) = 1.2
TIME (MIN) = 343	DISCHARGE (CFS) = 1.1
TIME (MIN) = 350	DISCHARGE (CFS) = 1.1
TIME (MIN) = 357	DISCHARGE (CFS) = 1
TIME (MIN) = 364	DISCHARGE (CFS) = 0

```
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[COMMERCIAL area type                          ]
(Neighborhod Commercial )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.780
Time of concentration =     6.90 min.
Rainfall intensity =      7.494(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.340  CA =      2.044
Subarea runoff =      2.862(CFS) for      0.498(Ac.)
Total runoff =     15.317(CFS)     Total area =       6.016(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      624.000 to Point/Station      625.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =  1007.000(Ft.)
Downstream point/station elevation =  1001.000(Ft.)
Pipe length  =    33.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.317(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =    15.317(CFS)
Normal flow depth in pipe =    7.26(In.)
Flow top width inside pipe =   17.66(In.)
Critical Depth =   16.95(In.)
Pipe flow velocity =     22.96(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =     6.92 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      625.000 to Point/Station      608.000
**** IMPROVED CHANNEL TRAVEL TIME ****
----------------------------------------------------------------------------
Upstream point elevation =  1001.000(Ft.)
Downstream point elevation =  1000.000(Ft.)
Channel length thru subarea  =    67.000(Ft.)
Channel base width     =   10.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Manning's 'N'    = 0.025
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     15.317(CFS)
Depth of flow =   0.280(Ft.), Average velocity =   2.285(Ft/s)
Channel flow top width =   37.953(Ft.)
Flow Velocity =    2.29(Ft/s)
Travel time  =    0.49 min.
Time of concentration =    7.41 min.
Critical depth =      0.273(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      608.000 to Point/Station      608.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      6.016(Ac.)
Runoff from this stream =     15.317(CFS)
```

```
Time of concentration =    7.41 min.
Rainfall intensity =     7.156(In/Hr)
Summary of stream data:

Stream    Flow rate      TC            Rainfall Intensity
 No.        (CFS)       (min)                 (In/Hr)


1        18.916       7.19              7.294
2        15.317       7.41              7.156
Qmax(1) =
          1.000 *     1.000 *     18.916) +
          1.000 *     0.971 *     15.317) + =       33.784
Qmax(2) =
          0.981 *     1.000 *     18.916) +
          1.000 *     1.000 *     15.317) + =       33.874

Total of 2 streams to confluence:
Flow rates before confluence point:
      18.916       15.317
Maximum flow rates at confluence using above data:
       33.784        33.874
Area of streams before confluence:
        6.173         6.016
Results of confluence:
Total flow rate =      33.874(CFS)
Time of concentration =     7.409 min.
Effective stream area after confluence =      12.189(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      608.000 to Point/Station      609.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1000.000(Ft.)
Downstream point/station elevation =   993.000(Ft.)
Pipe length  =    52.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    33.874(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    33.874(CFS)
Normal flow depth in pipe =   11.59(In.)
Flow top width inside pipe =   23.99(In.)
Critical depth could not be calculated.
Pipe flow velocity =     22.56(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     7.45 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      609.000 to Point/Station      609.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     12.189(Ac.)
Runoff from this stream =     33.874(CFS)
Time of concentration =    7.45 min.
Rainfall intensity =     7.132(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Manual	33.87	7	245	59,377	----	------	------	Post Developed at Node 608
2	Reservoir	11.41	7	252	59,371	1	1003.38	15,297	Detention Pond Outflow

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Tuesday, Mar 12 2013, 2:46 PM

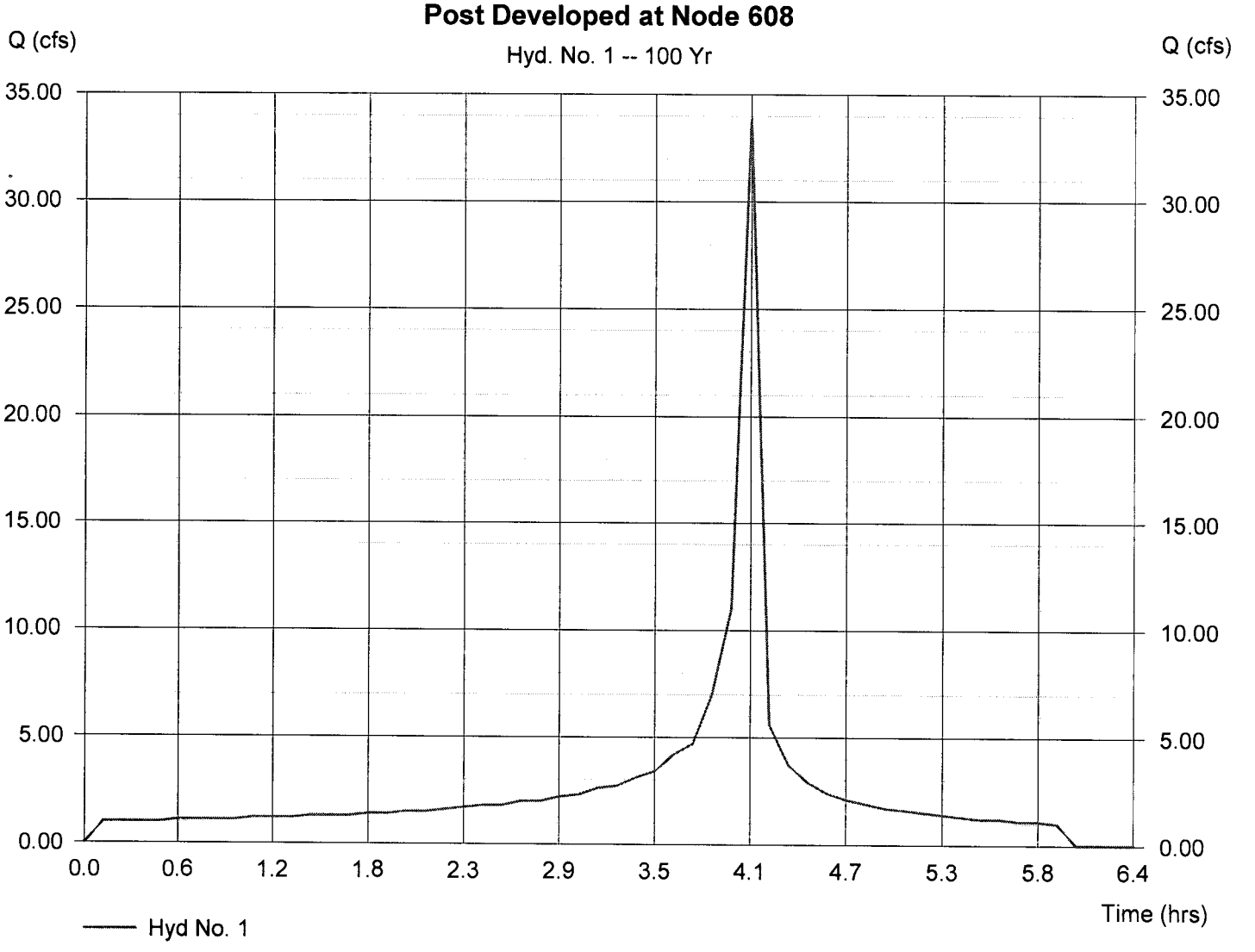
Hyd. No. 1

Post Developed at Node 608

Hydrograph type = Manual
Storm frequency = 100 yrs

Peak discharge = 33.87 cfs
Time interval = 7 min

Hydrograph Volume = 59,377 cuft



Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Mar 12 2013, 2:46 PM

Hyd. No. 1

Post Developed at Node 608

Hydrograph type	= Manual	Peak discharge	= 33.87 cfs
Storm frequency	= 100 yrs	Time interval	= 7 min

Hydrograph Volume = 59,377 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time (min)	Outflow (cfs)	Time (min)	Outflow (cfs)
7	1.00	245	33.87 <<
14	1.00	252	5.60
21	1.00	259	3.70
28	1.00	266	2.90
35	1.10	273	2.40
42	1.10	280	2.10
49	1.10	287	1.90
56	1.10	294	1.70
63	1.20	301	1.60
70	1.20	308	1.50
77	1.20	315	1.40
84	1.30	322	1.30
91	1.30	329	1.20
98	1.30	336	1.20
105	1.40	343	1.10
112	1.40	350	1.10
119	1.50	357	1.00
126	1.50		
133	1.60		
140	1.70	*...End*	
147	1.80		
154	1.80		
161	2.00		
168	2.00		
175	2.20		
182	2.30		
189	2.60		
196	2.70		
203	3.10		
210	3.40		
217	4.20		
224	4.70		
231	7.00		
238	11.00		

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Tuesday, Mar 12 2013, 2:46 PM

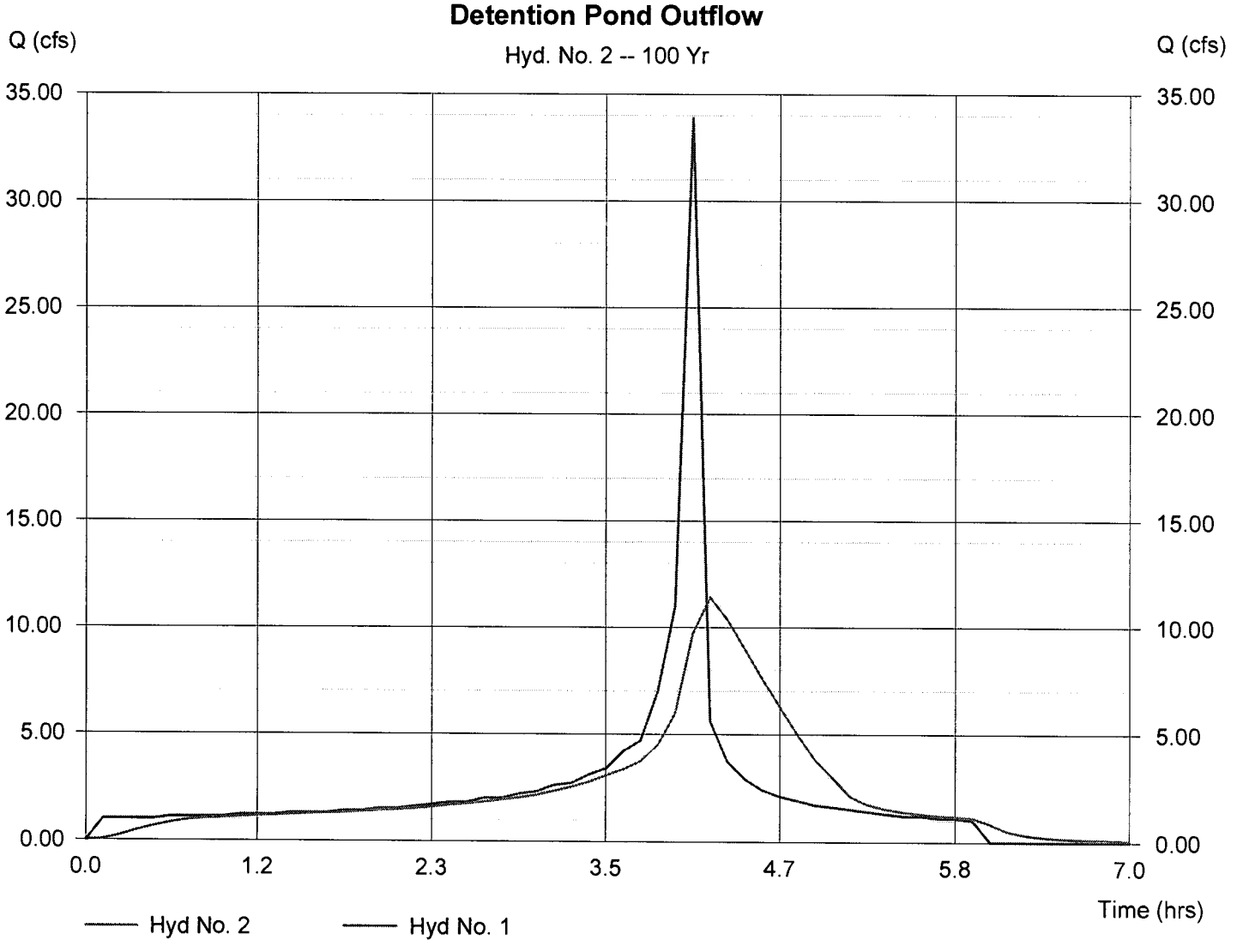
Hyd. No. 2

Detention Pond Outflow

Hydrograph type	= Reservoir	Peak discharge	= 11.41 cfs
Storm frequency	= 100 yrs	Time interval	= 7 min
Inflow hyd. No.	= 1	Max. Elevation	= 1003.38 ft
Reservoir name	= Det. Basin @ Node 608	Max. Storage	= 15,297 cuft

Storage Indication method used.

Hydrograph Volume = 59,371 cuft



Hydrograph Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Mar 12 2013, 2:46 PM

Hyd. No. 2

Detention Pond Outflow

Hydrograph type	= Reservoir	Peak discharge	= 11.41 cfs
Storm frequency	= 100 yrs	Time interval	= 7 min
Inflow hyd. No.	= 1	Reservoir name	= Det. Basin @ Node
Max. Elevation	= 1003.38 ft	Max. Storage	= 15,297 cuft

Storage Indication method used.

Outflow hydrograph volume = 59,371 cuft

(Printed values >= 1% of Qp.)

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
14	1.00	1000.24	0.22	0.22	-----	-----	-----	-----	-----	-----	-----	0.22
21	1.00	1000.35	0.48	0.46	-----	-----	-----	-----	-----	-----	-----	0.46
28	1.00	1000.43	0.68	0.67	-----	-----	-----	-----	-----	-----	-----	0.67
35	1.10	1000.48	0.83	0.83	-----	-----	-----	-----	-----	-----	-----	0.83
42	1.10	1000.52	0.95	0.95	-----	-----	-----	-----	-----	-----	-----	0.95
49	1.10	1000.54	1.03	1.02	-----	-----	-----	-----	-----	-----	-----	1.02
56	1.10	1000.55	1.07	1.06	-----	-----	-----	-----	-----	-----	-----	1.06
63	1.20	1000.56	1.11	1.10	-----	-----	-----	-----	-----	-----	-----	1.10
70	1.20	1000.57	1.16	1.15	-----	-----	-----	-----	-----	-----	-----	1.15
77	1.20	1000.58	1.18	1.17	-----	-----	-----	-----	-----	-----	-----	1.17
84	1.30	1000.59	1.22	1.21	-----	-----	-----	-----	-----	-----	-----	1.21
91	1.30	1000.60	1.27	1.25	-----	-----	-----	-----	-----	-----	-----	1.25
98	1.30	1000.61	1.29	1.28	-----	-----	-----	-----	-----	-----	-----	1.28
105	1.40	1000.62	1.32	1.31	-----	-----	-----	-----	-----	-----	-----	1.31
112	1.40	1000.63	1.37	1.36	-----	-----	-----	-----	-----	-----	-----	1.36
119	1.50	1000.64	1.41	1.41	-----	-----	-----	-----	-----	-----	-----	1.41
126	1.50	1000.65	1.46	1.45	-----	-----	-----	-----	-----	-----	-----	1.45
133	1.60	1000.66	1.51	1.50	-----	-----	-----	-----	-----	-----	-----	1.50
140	1.70	1000.68	1.58	1.58	-----	-----	-----	-----	-----	-----	-----	1.58
147	1.80	1000.70	1.67	1.67	-----	-----	-----	-----	-----	-----	-----	1.67
154	1.80	1000.72	1.74	1.74	-----	-----	-----	-----	-----	-----	-----	1.74
161	2.00	1000.74	1.83	1.83	-----	-----	-----	-----	-----	-----	-----	1.83
168	2.00	1000.76	1.93	1.93	-----	-----	-----	-----	-----	-----	-----	1.93
175	2.20	1000.78	2.02	2.02	-----	-----	-----	-----	-----	-----	-----	2.02
182	2.30	1000.81	2.16	2.15	-----	-----	-----	-----	-----	-----	-----	2.15
189	2.60	1000.85	2.33	2.33	-----	-----	-----	-----	-----	-----	-----	2.33
196	2.70	1000.89	2.52	2.52	-----	-----	-----	-----	-----	-----	-----	2.52
203	3.10	1000.93	2.77	2.75	-----	-----	-----	-----	-----	-----	-----	2.75
210	3.40	1000.99	3.10	3.06	-----	-----	-----	-----	-----	-----	-----	3.06
217	4.20	1001.04	3.37	3.35	-----	-----	-----	-----	-----	-----	-----	3.35
224	4.70	1001.12	3.74	3.74	-----	-----	-----	-----	-----	-----	-----	3.74
231	7.00	1001.26	4.51	4.51	-----	-----	-----	-----	-----	-----	-----	4.51
238	11.00	1001.56	6.03	5.99	-----	-----	-----	-----	-----	-----	-----	5.99
245	33.87 <<	1002.73	9.77	9.72	-----	-----	-----	-----	-----	-----	-----	9.72
252	5.60	1003.38 <<	11.42	11.41	-----	-----	-----	-----	-----	-----	-----	11.41 <<
259	3.70	1002.96	10.35	10.35	-----	-----	-----	-----	-----	-----	-----	10.35
266	2.90	1002.45	8.95	8.95	-----	-----	-----	-----	-----	-----	-----	8.95
273	2.40	1002.01	7.56	7.55	-----	-----	-----	-----	-----	-----	-----	7.55

Continues on next page...

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
280	2.10	1001.63	6.32	6.27	-----	-----	-----	-----	-----	-----	-----	6.27
287	1.90	1001.34	4.98	4.98	-----	-----	-----	-----	-----	-----	-----	4.98
294	1.70	1001.13	3.82	3.82	-----	-----	-----	-----	-----	-----	-----	3.82
301	1.60	1000.98	3.02	2.99	-----	-----	-----	-----	-----	-----	-----	2.99
308	1.50	1000.80	2.11	2.11	-----	-----	-----	-----	-----	-----	-----	2.11
315	1.40	1000.72	1.74	1.74	-----	-----	-----	-----	-----	-----	-----	1.74
322	1.30	1000.67	1.53	1.53	-----	-----	-----	-----	-----	-----	-----	1.53
329	1.20	1000.63	1.39	1.39	-----	-----	-----	-----	-----	-----	-----	1.39
336	1.20	1000.61	1.30	1.29	-----	-----	-----	-----	-----	-----	-----	1.29
343	1.10	1000.59	1.23	1.22	-----	-----	-----	-----	-----	-----	-----	1.22
350	1.10	1000.58	1.17	1.16	-----	-----	-----	-----	-----	-----	-----	1.16
357	1.00	1000.56	1.12	1.11	-----	-----	-----	-----	-----	-----	-----	1.11
364	0.00	1000.48	0.83	0.83	-----	-----	-----	-----	-----	-----	-----	0.83
371	0.00	1000.36	0.51	0.49	-----	-----	-----	-----	-----	-----	-----	0.49
378	0.00	1000.29	0.33	0.32	-----	-----	-----	-----	-----	-----	-----	0.32
385	0.00	1000.25	0.24	0.23	-----	-----	-----	-----	-----	-----	-----	0.23
392	0.00	1000.21	0.17	0.17	-----	-----	-----	-----	-----	-----	-----	0.17
399	0.00	1000.18	0.13	0.13	-----	-----	-----	-----	-----	-----	-----	0.13

...End

Pond Report

Hydraflow Hydrographs by Intelisolve — Tuesday, Mar 12 2013, 2:46 PM

Pond No. 1 - Det. Basin @ Node 608

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	1000.00	100	0	0
1.00	1001.00	4,725	2,413	2,413
2.00	1002.00	5,698	5,212	7,624
3.00	1003.00	4,840	5,269	12,893
4.00	1004.00	7,896	6,368	19,261
5.00	1005.00	9,118	8,507	27,768

Culvert / Orifice Structures

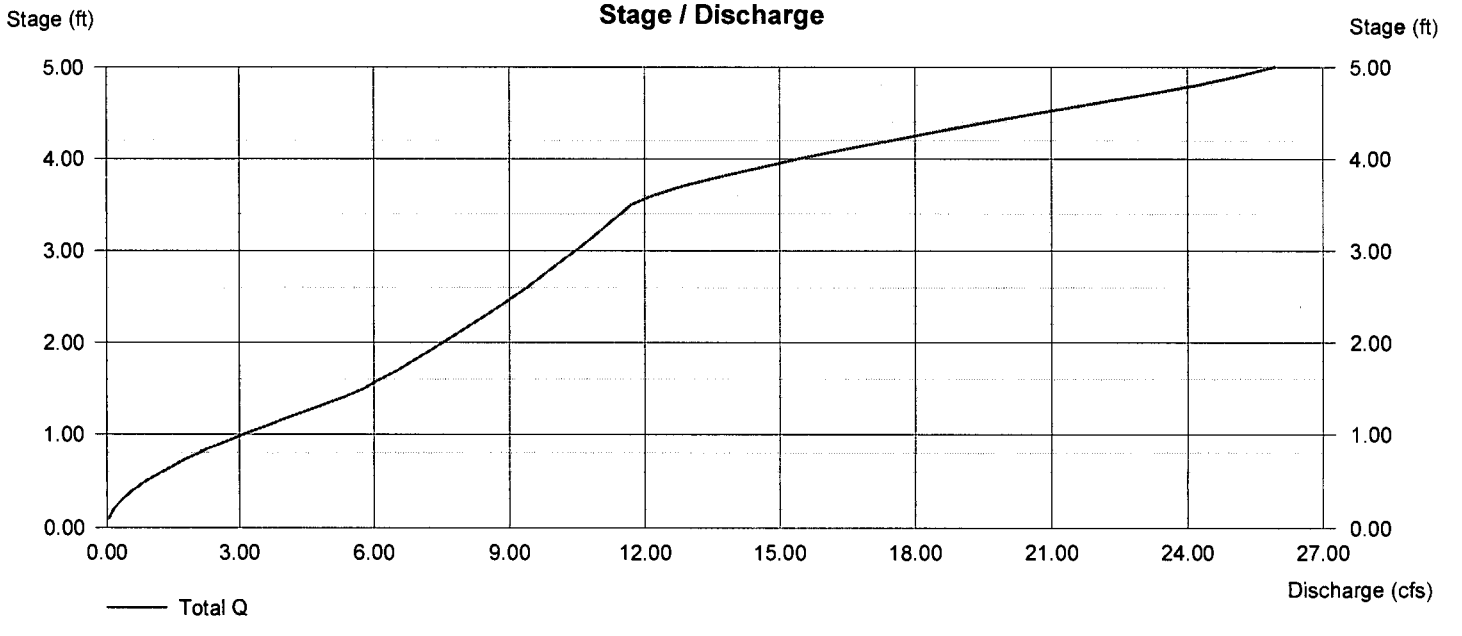
	[A]	[B]	[C]	[D]
Rise (in)	= 24.00	18.00	0.00	0.00
Span (in)	= 24.00	18.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 1000.00	1000.00	0.00	0.00
Length (ft)	= 52.00	0.00	0.00	0.00
Slope (%)	= 15.00	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.00	0.00	0.00	0.00
Crest El. (ft)	= 1003.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	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.



Pond Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Mar 12 2013, 2:46 PM

Pond No. 1 - Det. Basin @ Node 608

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	1000.00	100	0	0
1.00	1001.00	4,725	2,413	2,413
2.00	1002.00	5,698	5,212	7,624
3.00	1003.00	4,840	5,269	12,893
4.00	1004.00	7,896	6,368	19,261
5.00	1005.00	9,118	8,507	27,768

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise (in)	= 24.00	18.00	0.00	0.00
Span (in)	= 24.00	18.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 1000.00	1000.00	0.00	0.00
Length (ft)	= 52.00	0.00	0.00	0.00
Slope (%)	= 15.00	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.00	0.00	0.00	0.00
Crest El. (ft)	= 1003.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	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.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	1000.00	0.00	0.00	---	---	0.00	---	---	---	---	0.00
0.10	241	1000.10	0.04	0.04	---	---	0.00	---	---	---	---	0.04
0.20	483	1000.20	0.15	0.15	---	---	0.00	---	---	---	---	0.15
0.30	724	1000.30	0.35	0.34	---	---	0.00	---	---	---	---	0.34
0.40	965	1000.40	0.60	0.58	---	---	0.00	---	---	---	---	0.58
0.50	1,206	1000.50	0.89	0.89	---	---	0.00	---	---	---	---	0.89
0.60	1,448	1000.60	1.26	1.25	---	---	0.00	---	---	---	---	1.25
0.70	1,689	1000.70	1.65	1.65	---	---	0.00	---	---	---	---	1.65
0.80	1,930	1000.80	2.10	2.10	---	---	0.00	---	---	---	---	2.10
0.90	2,171	1000.90	2.59	2.59	---	---	0.00	---	---	---	---	2.59
1.00	2,413	1001.00	3.15	3.11	---	---	0.00	---	---	---	---	3.11
1.10	2,934	1001.10	3.65	3.65	---	---	0.00	---	---	---	---	3.65
1.20	3,455	1001.20	4.19	4.19	---	---	0.00	---	---	---	---	4.19
1.30	3,976	1001.30	4.76	4.75	---	---	0.00	---	---	---	---	4.75
1.40	4,497	1001.40	5.31	5.31	---	---	0.00	---	---	---	---	5.31
1.50	5,018	1001.50	5.78	5.78	---	---	0.00	---	---	---	---	5.78
1.60	5,539	1001.60	6.22	6.14	---	---	0.00	---	---	---	---	6.14
1.70	6,061	1001.70	6.53	6.53	---	---	0.00	---	---	---	---	6.53
1.80	6,582	1001.80	6.87	6.87	---	---	0.00	---	---	---	---	6.87
1.90	7,103	1001.90	7.20	7.20	---	---	0.00	---	---	---	---	7.20
2.00	7,624	1002.00	7.53	7.53	---	---	0.00	---	---	---	---	7.53
2.10	8,151	1002.10	7.96	7.85	---	---	0.00	---	---	---	---	7.85
2.20	8,678	1002.20	8.17	8.17	---	---	0.00	---	---	---	---	8.17
2.30	9,205	1002.30	8.48	8.48	---	---	0.00	---	---	---	---	8.48
2.40	9,732	1002.40	8.79	8.79	---	---	0.00	---	---	---	---	8.79
2.50	10,259	1002.50	9.09	9.09	---	---	0.00	---	---	---	---	9.09
2.60	10,785	1002.60	9.38	9.38	---	---	0.00	---	---	---	---	9.38
2.70	11,312	1002.70	9.69	9.66	---	---	0.00	---	---	---	---	9.66
2.80	11,839	1002.80	10.00	9.92	---	---	0.00	---	---	---	---	9.92
2.90	12,366	1002.90	10.19	10.19	---	---	0.00	---	---	---	---	10.19
3.00	12,893	1003.00	10.46	10.46	---	---	0.00	---	---	---	---	10.46
3.10	13,530	1003.10	10.73	10.73	---	---	0.00	---	---	---	---	10.73

Continues on next page...

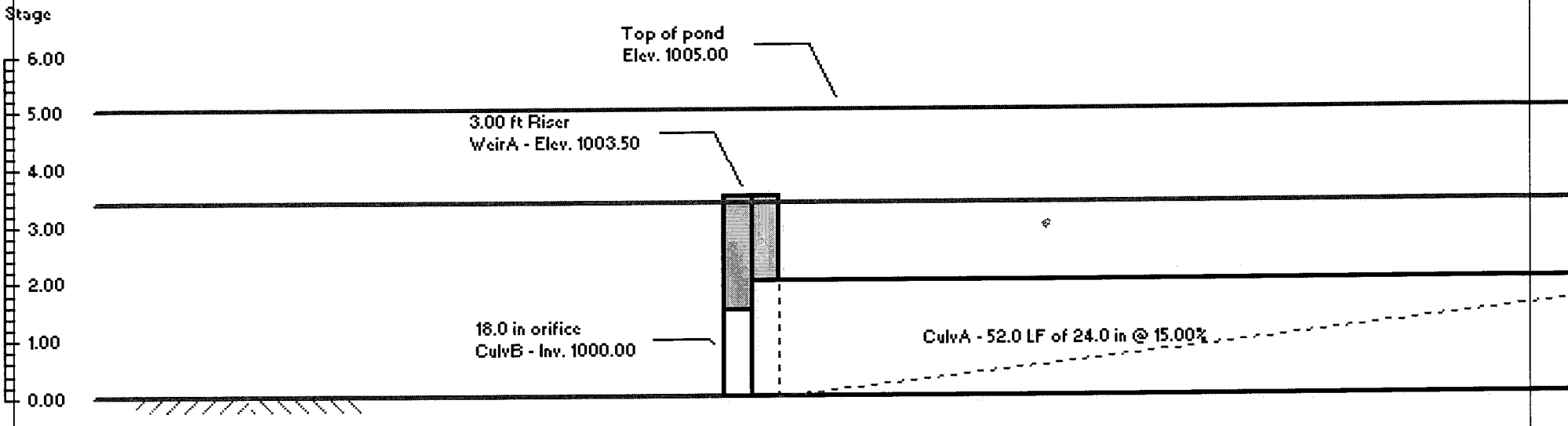
Det. Basin @ Node 608

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
3.20	14,167	1003.20	11.02	10.97	---	---	0.00	---	---	---	---	10.97
3.30	14,803	1003.30	11.29	11.22	---	---	0.00	---	---	---	---	11.22
3.40	15,440	1003.40	11.46	11.46	---	---	0.00	---	---	---	---	11.46
3.50	16,077	1003.50	11.71	11.71	---	---	0.00	---	---	---	---	11.71
3.60	16,714	1003.60	12.20	11.88	---	---	0.32	---	---	---	---	12.20
3.70	17,351	1003.70	12.88	11.98	---	---	0.89	---	---	---	---	12.87
3.80	17,987	1003.80	13.66	12.02	---	---	1.64	---	---	---	---	13.66
3.90	18,624	1003.90	14.54	12.01	---	---	2.53	---	---	---	---	14.54
4.00	19,261	1004.00	15.44	11.91	---	---	3.53	---	---	---	---	15.44
4.10	20,112	1004.10	16.43	11.79	---	---	4.64	---	---	---	---	16.43
4.20	20,962	1004.20	17.47	11.62	---	---	5.85	---	---	---	---	17.47
4.30	21,813	1004.30	18.55	11.40	---	---	7.15	---	---	---	---	18.55
4.40	22,664	1004.40	19.66	11.13	---	---	8.53	---	---	---	---	19.66
4.50	23,515	1004.50	20.79	10.80	---	---	9.99	---	---	---	---	20.79
4.60	24,365	1004.60	21.93	10.41	---	---	11.52	---	---	---	---	21.93
4.70	25,216	1004.70	23.09	9.96	---	---	13.13	---	---	---	---	23.09
4.80	26,067	1004.80	24.21	9.46	---	---	14.74	---	---	---	---	24.21
4.90	26,917	1004.90	25.12	9.09	---	---	16.03	---	---	---	---	25.12
5.00	27,768	1005.00	25.93	8.76	---	---	17.17	---	---	---	---	25.93

...End

Det. Basin @ Node 608



Section

NTS

* Side slope estimated average from contours

(100 yr)

Schematic only. Not for construction.

Hydraflow Hydrographs Pond Draw	Project: Basin6.gpw	Tuesday, Mar 12 2013, 2:44 PM

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 03/12/13

NORTH COUNTY ENVIRONMENTAL RESOURCES HYDROLOGY STUDY
POSTDEVELOPED 100-YEAR STORM EVENT - ROUTED THROUGH DETENTION BASIN
BASIN 600
Q:\12\12025\GPIP\MS\HYD\POSTDEV\12025BSN600DETENTION.OUT

********* Hydrology Study Control Information **********

Program License Serial Number 4012

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.500
24 hour precipitation(inches) = 7.200
P6/P24 = 48.6%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 631.000 to Point/Station 632.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[COMMERCIAL area type]
(Neighborhod Commercial)
Impervious value, Ai = 0.800
Sub-Area C Value = 0.780
Initial subarea total flow distance = 546.000(Ft.)
Highest elevation = 1031.000(Ft.)
Lowest elevation = 1021.000(Ft.)
Elevation difference = 10.000(Ft.) Slope = 1.832 %
Top of Initial Area Slope adjusted by User to 2.000 %
Bottom of Initial Area Slope adjusted by User to 2.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 75.00 (Ft)
for the top area slope value of 2.00 %, in a development type of
Neighborhod Commercial
In Accordance With Figure 3-3
Initial Area Time of Concentration = 3.96 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.7800)*(75.000^.5)/(2.000^(1/3)]= 3.96
The initial area total distance of 546.00 (Ft.) entered leaves a
remaining distance of 471.00 (Ft.)

```
Using Figure 3-4, the travel time for this distance is   4.03 minutes
for a distance of 471.00 (Ft.) and a slope of  2.00 %
with an elevation difference of   9.42(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    4.026 Minutes
Tt=[(11.9*0.0892^3)/(  9.42)]^.385=  4.03
Total initial area Ti =   3.96 minutes from Figure 3-3 formula plus
  4.03 minutes from the Figure 3-4 formula =   7.99 minutes
Rainfall intensity (I) =      6.818(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.780
Subarea runoff =     22.963(CFS)
Total initial stream area =        4.318(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      632.000 to Point/Station      633.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1021.000(Ft.)
Downstream point/station elevation =  1020.000(Ft.)
Pipe length  =    35.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    22.963(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    22.963(CFS)
Normal flow depth in pipe =   14.98(In.)
Flow top width inside pipe =   19.00(In.)
Critical Depth =   19.85(In.)
Pipe flow velocity =     12.52(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     8.03 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      633.000 to Point/Station      633.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.690
Time of concentration =     8.03 min.
Rainfall intensity =      6.792(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.768  CA =      3.814
Subarea runoff =      2.942(CFS) for      0.646(Ac.)
Total runoff =     25.904(CFS)    Total area =       4.964(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      633.000 to Point/Station      634.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =  1020.000(Ft.)
Downstream point/station elevation =  1009.000(Ft.)
Pipe length  =    29.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    25.904(CFS)
```

```
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    25.904(CFS)
Normal flow depth in pipe =    8.82(In.)
Flow top width inside pipe =   14.76(In.)
Critical depth could not be calculated.
Pipe flow velocity =     34.53(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     8.05 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      634.000 to Point/Station      634.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.690
Time of concentration =     8.05 min.
Rainfall intensity =      6.785(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.763  CA =      4.048
Subarea runoff =      1.558(CFS) for      0.339(Ac.)
Total runoff =     27.462(CFS)    Total area =       5.303(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      634.000 to Point/Station      635.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1009.000(Ft.)
Downstream point/station elevation =  1008.000(Ft.)
Pipe length  =    29.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    27.462(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    27.462(CFS)
Normal flow depth in pipe =   16.08(In.)
Flow top width inside pipe =   17.79(In.)
Critical depth could not be calculated.
Pipe flow velocity =     13.90(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     8.08 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      635.000 to Point/Station      635.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                    ]
(43.0 DU/A or Less      )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.780
```

```
Time of concentration =      8.08 min.
Rainfall intensity =       6.766(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.764  CA =       4.187
Subarea runoff =       0.863(CFS) for       0.178(Ac.)
Total runoff =      28.326(CFS)     Total area =        5.481(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      635.000 to Point/Station      636.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =  1008.000(Ft.)
Downstream point/station elevation =   994.000(Ft.)
Pipe length  =    44.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    28.326(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    28.326(CFS)
Normal flow depth in pipe =    9.94(In.)
Flow top width inside pipe =   14.19(In.)
Critical depth could not be calculated.
Pipe flow velocity =     32.81(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =     8.10 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      636.000 to Point/Station      637.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
----------------------------------------------------------------------------
Upstream point/station elevation =   994.000(Ft.)
Downstream point/station elevation =   988.000(Ft.)
Pipe length  =   173.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    28.326(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    28.326(CFS)
Normal flow depth in pipe =   15.89(In.)
Flow top width inside pipe =   22.70(In.)
Critical Depth =   22.01(In.)
Pipe flow velocity =     12.84(Ft/s)
Travel time through pipe =    0.22 min.
Time of concentration (TC) =     8.33 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      637.000 to Point/Station      610.000
**** IMPROVED CHANNEL TRAVEL TIME ****
----------------------------------------------------------------------------
Upstream point elevation =   988.000(Ft.)
Downstream point elevation =   977.000(Ft.)
Channel length thru subarea  =   120.000(Ft.)
Channel base width     =    5.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     28.697(CFS)
Manning's 'N'    = 0.025
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     28.697(CFS)
Depth of flow =   0.456(Ft.), Average velocity =   8.926(Ft/s)
Channel flow top width =    9.103(Ft.)
```

```
Flow Velocity =    8.93(Ft/s)
Travel time  =    0.22 min.
Time of concentration =    8.55 min.
Critical depth =      0.789(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Rainfall intensity =      6.523(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.700  CA =      4.447
Subarea runoff =      0.682(CFS) for      0.868(Ac.)
Total runoff =     29.008(CFS)    Total area =       6.349(Ac.)
Depth of flow =   0.459(Ft.), Average velocity =   8.955(Ft/s)
Critical depth =      0.797(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      610.000 to Point/Station      610.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     8.55 min.
Rainfall intensity =      6.523(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.690  CA =      4.498
Subarea runoff =      0.331(CFS) for      0.169(Ac.)
Total runoff =     29.339(CFS)    Total area =       6.518(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      610.000 to Point/Station      610.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                  ]
(Permanent Open Space    )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Time of concentration =     8.55 min.
Rainfall intensity =      6.523(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.684  CA =      4.531
Subarea runoff =      0.217(CFS) for      0.111(Ac.)
Total runoff =     29.556(CFS)    Total area =       6.629(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      610.000 to Point/Station      610.000
**** CONFLUENCE OF MAIN STREAMS ****

------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      6.629(Ac.)
Runoff from this stream =     29.556(CFS)
Time of concentration =    8.55 min.
Rainfall intensity =     6.523(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      608.000 to Point/Station      608.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****

------------------------------------------------------------------------------
User specified 'C' value of 0.388 given for subarea
Rainfall intensity (I) =      4.747(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  14.00 min.  Rain intensity =       4.75(In/Hr)
Total area =       12.189(Ac.)  Total runoff =    11.410(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      608.000 to Point/Station      609.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

------------------------------------------------------------------------------
Upstream point/station elevation =  1000.000(Ft.)
Downstream point/station elevation =   993.000(Ft.)
Pipe length  =    52.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.410(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    11.410(CFS)
Normal flow depth in pipe =    6.01(In.)
Flow top width inside pipe =   20.80(In.)
Critical Depth =   14.53(In.)
Pipe flow velocity =     18.53(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =    14.05 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      609.000 to Point/Station      609.000
**** CONFLUENCE OF MINOR STREAMS ****

------------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =     12.189(Ac.)
Runoff from this stream =     11.410(CFS)
Time of concentration =   14.05 min.
Rainfall intensity =     4.736(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      626.000 to Point/Station      609.000
**** INITIAL AREA EVALUATION ****

------------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
```

```
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                    ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.300
Initial subarea total flow distance  =  653.000(Ft.)
Highest elevation = 1191.000(Ft.)
Lowest elevation =  609.000(Ft.)
Elevation difference =  582.000(Ft.) Slope = 89.127 %
Top of Initial Area Slope adjusted by User to 30.000 %
Bottom of Initial Area Slope adjusted by User to 10.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  30.00 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.63 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3000)*( 100.000^.5)/(  30.000^(1/3)]=   4.63
The initial area total distance of  653.00 (Ft.) entered leaves a
remaining distance of  553.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.45 minutes
for a distance of 553.00 (Ft.) and a slope of 10.00 %
with an elevation difference of  55.30(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.452 Minutes
Tt=[(11.9*0.1047^3)/( 55.30)]^.385=  2.45
Total initial area Ti =   4.63 minutes from Figure 3-3 formula plus
  2.45 minutes from the Figure 3-4 formula =   7.09 minutes
Rainfall intensity (I) =      7.364(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.300
Subarea runoff =      1.491(CFS)
Total initial stream area =        0.675(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      609.000 to Point/Station      609.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.675(Ac.)
Runoff from this stream =      1.491(CFS)
Time of concentration =    7.09 min.
Rainfall intensity =     7.364(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       11.410     14.05             4.736
2        1.491      7.09             7.364
Qmax(1) =
         1.000 *    1.000 *    11.410) +
         0.643 *    1.000 *     1.491) + =      12.369
Qmax(2) =
         1.000 *    0.504 *    11.410) +
         1.000 *    1.000 *     1.491) + =       7.247
```

```
Total of 2 streams to confluence:
Flow rates before confluence point:
      11.410        1.491
Maximum flow rates at confluence using above data:
       12.369        7.247
Area of streams before confluence:
       12.189        0.675
Results of confluence:
Total flow rate =      12.369(CFS)
Time of concentration =     14.047 min.
Effective stream area after confluence =      12.864(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      609.000 to Point/Station      610.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Depth of flow =    1.242(Ft.), Average velocity =    6.548(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00               5.00
      2             15.00               1.00
      3             16.00               0.00
      4             17.00               1.00
      5             27.00               2.00
Manning's 'N' friction factor =    0.025
-----------------------------------------------------------------
Sub-Channel flow  =      12.369(CFS)
  '      '    flow top width =       5.334(Ft.)
  '      '     velocity=     6.548(Ft/s)
  '      '    area =       1.889(Sq.Ft)
  '      '    Froude number =      1.939

Upstream point elevation =    993.000(Ft.)
Downstream point elevation =    977.000(Ft.)
Flow length =    270.000(Ft.)
Travel time  =     0.69 min.
Time of concentration =    14.73 min.
Depth of flow =    1.242(Ft.)
Average velocity =    6.548(Ft/s)
Total irregular channel flow =     12.369(CFS)
Irregular channel normal depth above invert elev. =    1.242(Ft.)
Average velocity of channel(s) =    6.548(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      610.000 to Point/Station      610.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      12.864(Ac.)
Runoff from this stream =      12.369(CFS)
Time of concentration =    14.73 min.
Rainfall intensity =      4.593(In/Hr)
Summary of stream data:
```

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	29.556	8.55	6.523
2	12.369	14.73	4.593

Qmax(1) =
1.000 * 1.000 * 29.556) +
1.000 * 0.580 * 12.369) + = 36.735

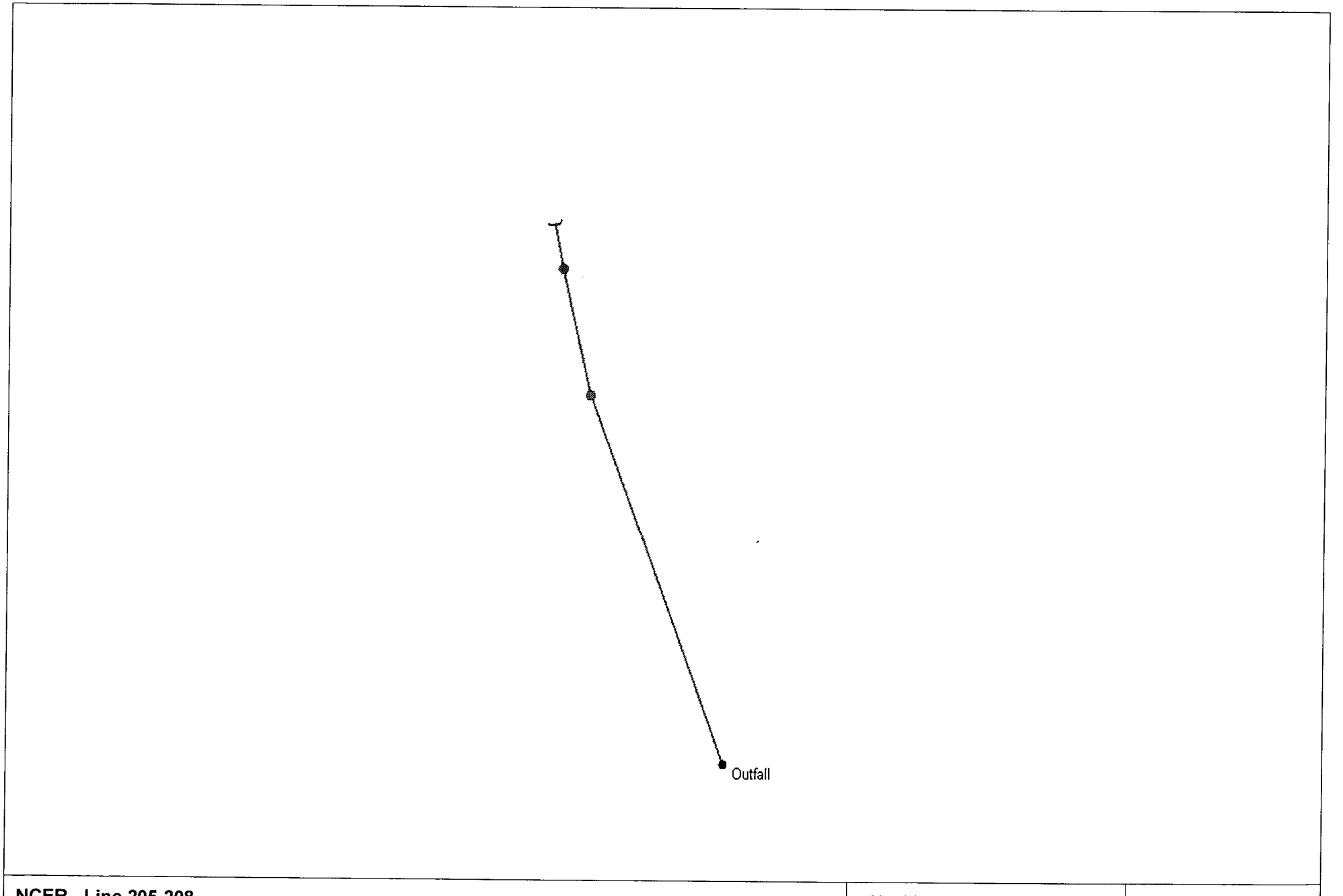
Qmax(2) =
0.704 * 1.000 * 29.556) +
1.000 * 1.000 * 12.369) + = 33.179

Total of 2 main streams to confluence:
Flow rates before confluence point:
29.556 12.369
Maximum flow rates at confluence using above data:
36.735 33.179
Area of streams before confluence:
6.629 12.864

Results of confluence:
Total flow rate = 36.735(CFS)
Time of concentration = 8.552 min.
Effective stream area after confluence = 19.493(Ac.)
End of computations, total study area = 19.493 (Ac.)

ATTACHMENT H
CULVERT DESIGN
(Hydraulic Design Runs)

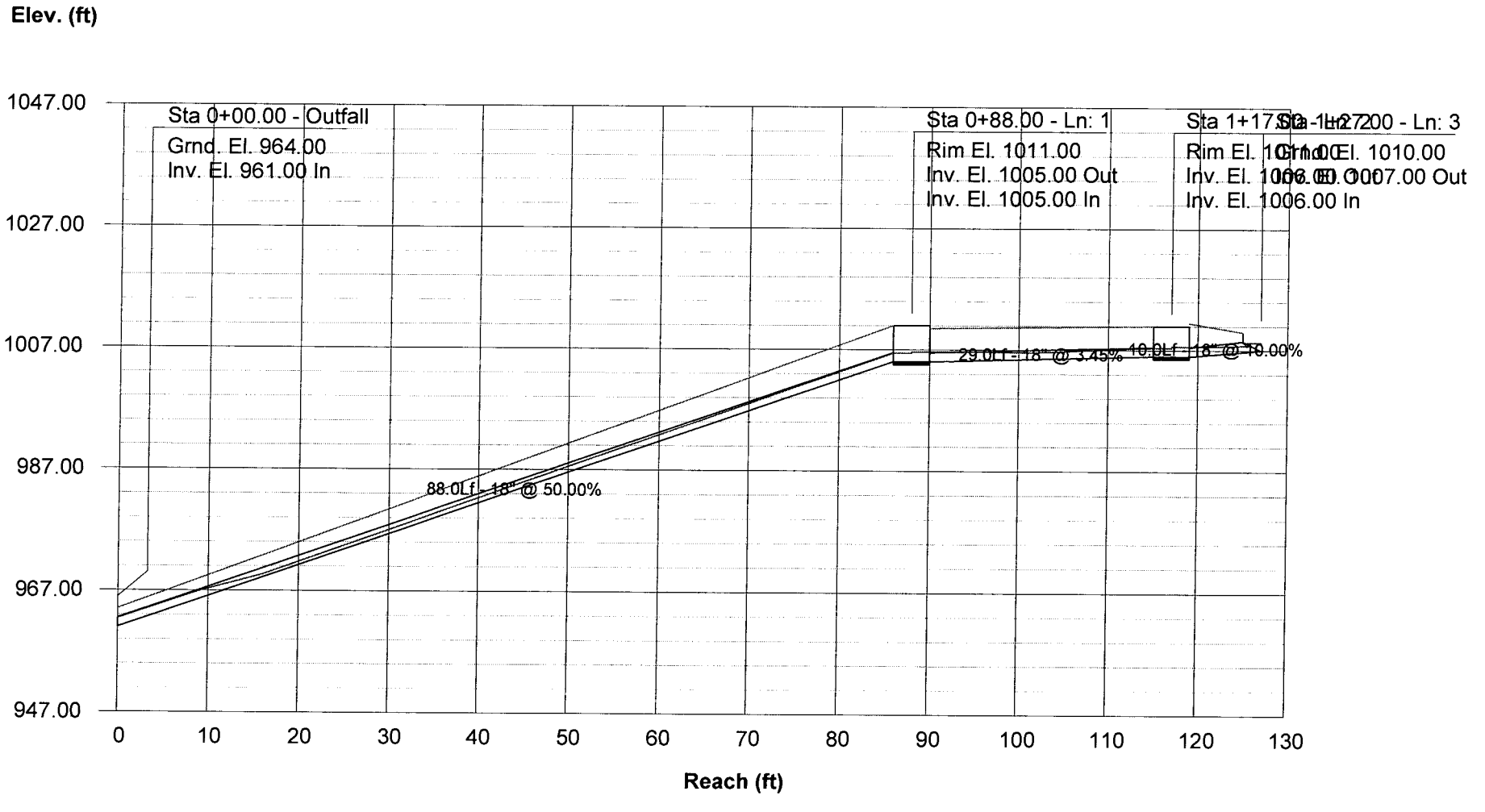
Hydraflow Plan View



NCER - Line 205-208	No. Lines: 3	03-13-2013

Storm Sewer Profile

Proj. file: Line 205-208 TM.stm



Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	207-208	15.20	18 c	88.0	961.00	1005.00	50.000	962.41	1006.41	n/a	1006.41 j	End
2	206-207	14.20	18 c	29.0	1005.00	1006.00	3.448	1006.62	1007.39	n/a	1007.39 j	1
3	205-206	13.00	18 c	10.0	1006.00	1007.00	10.000	1007.62	1008.35	n/a	1008.35 j	2

NCER - Line 205-208 | Number of lines: 3 | Run Date: 03-13-2013

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; j - Line contains hyd. jump.

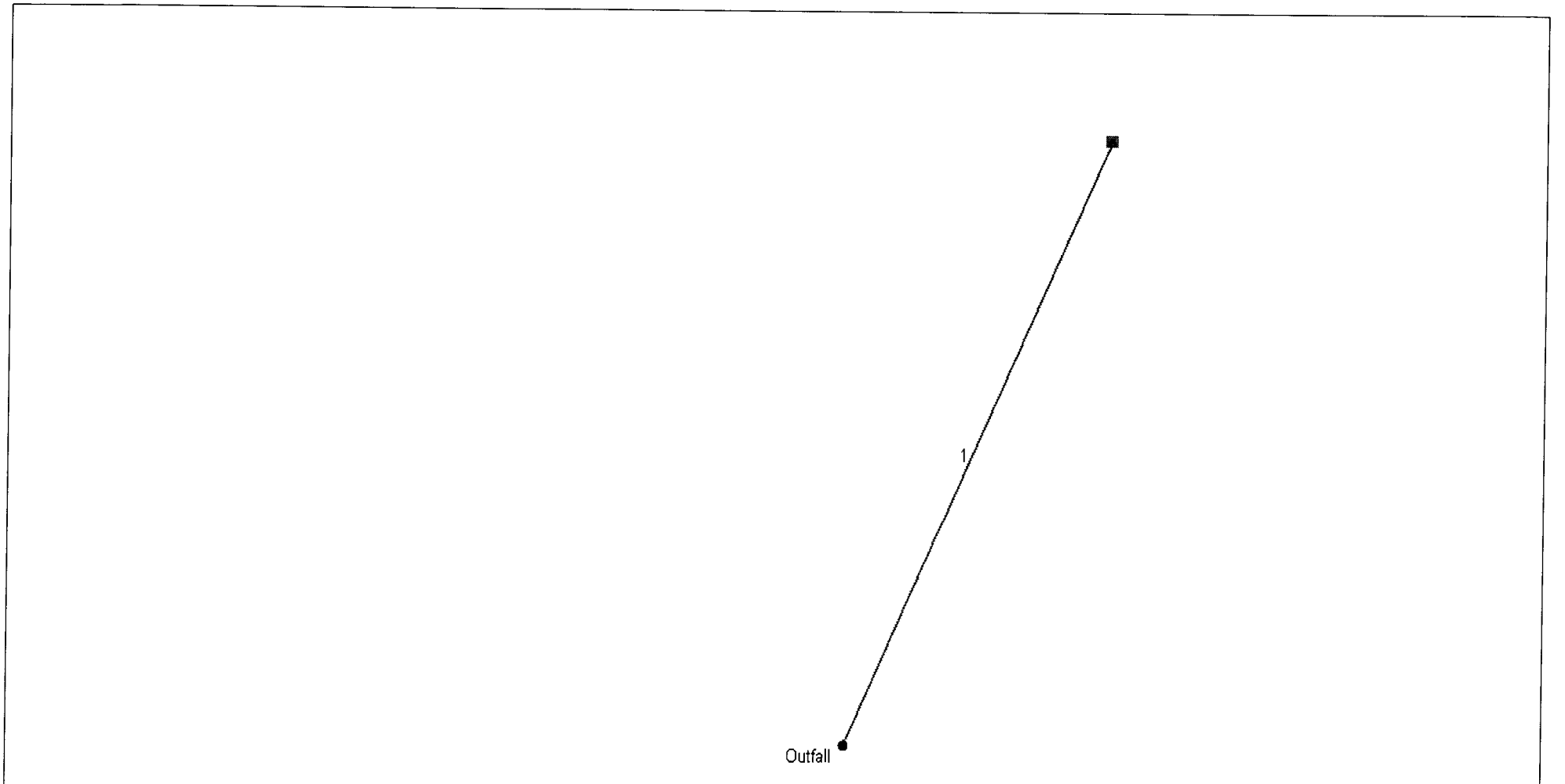
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
(1)	(in)	(cfs)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(ft)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(K)	(ft)
1	18	15.20	961.00	962.41	1.41	1.72	8.81	1.21	963.62	1.811	88.0	1005.00	1006.41	1.41**	1.72	8.81	1.21	1007.62	1.811	1.811	n/a	0.17	0.21
2	18	14.20	1005.00	1006.62	1.50	1.71	8.04	1.00	1007.62	1.829	29.0	1006.00	1007.39	1.39**	1.71	8.31	1.07	1008.46	1.583	1.706	n/a	0.15	0.16
3	18	13.00	1006.00	1007.62	1.50	1.68	7.36	0.84	1008.46	1.533	10.0	1007.00	1008.35	1.35**	1.68	7.75	0.93	1009.29	1.347	1.440	n/a	1.00	n/a

NCER - Line 205-208 | Number of lines: 3 | Run Date: 03-13-2013

Notes: ; ** Critical depth.; j-Line contains hyd. jump.

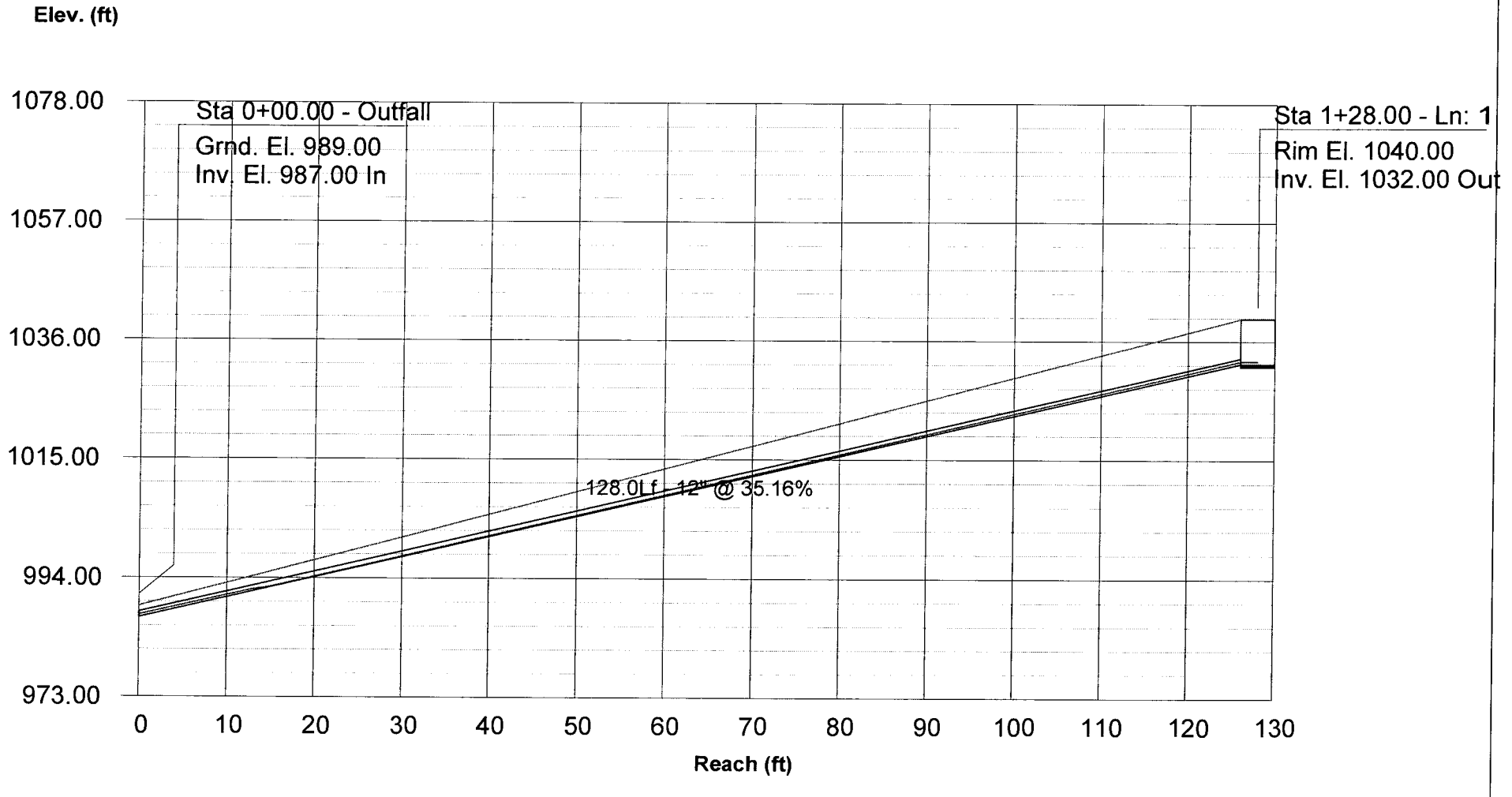
Hydraflow Plan View



NCER - Blank to 307	No. Lines: 1	03-13-2013

Storm Sewer Profile

Proj. file: New.stm



Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	Blank-307	1.15	12 c	128.0	987.00	1032.00	35.156	987.46	1032.46	n/a	1032.46 j	End

NCER - Blank to 307 | Number of lines: 1 | Run Date: 03-13-2013

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; j - Line contains hyd. jump.

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
	(in)	(cfs)									(ft)												
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1	12	1.15	987.00	987.46	0.46	0.35	3.26	0.17	987.63	0.556	128	1032.00	1032.46	0.45**	0.35	3.31	0.17	1032.63	0.579	0.568	n/a	1.00	0.17

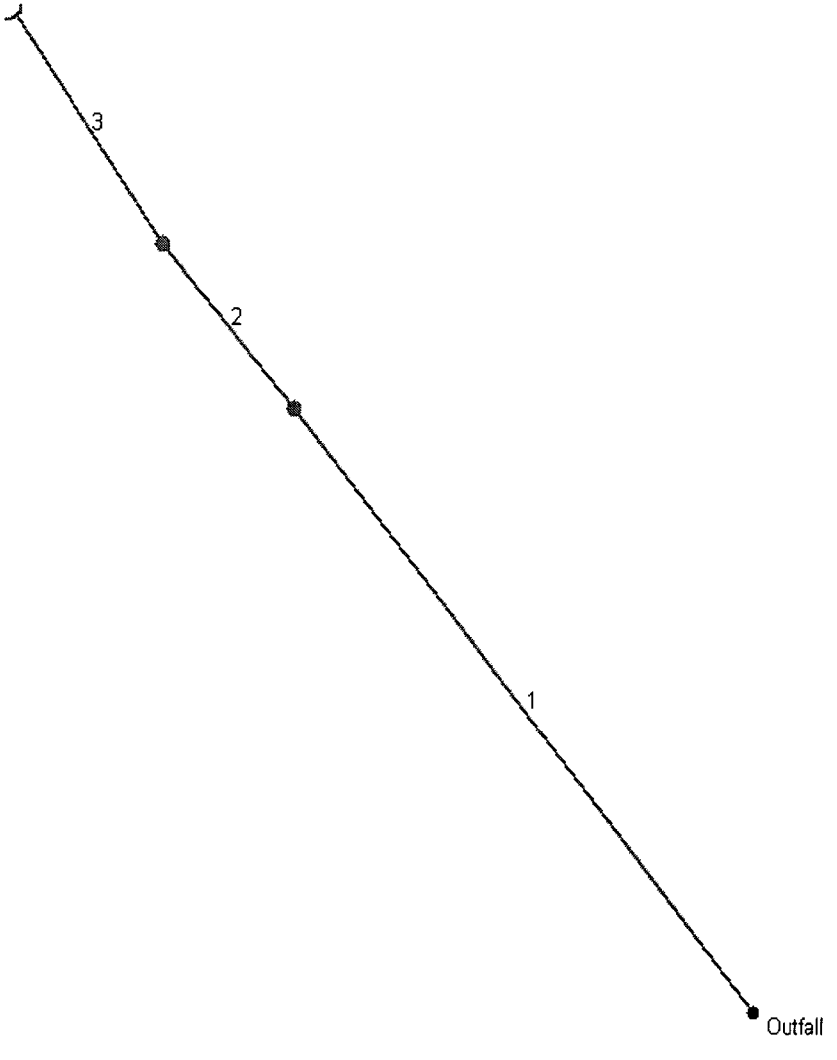
NCER - Blank to 307

Number of lines: 1

Run Date: 03-13-2013

Notes: ; ** Critical depth.; j-Line contains hyd. jump.

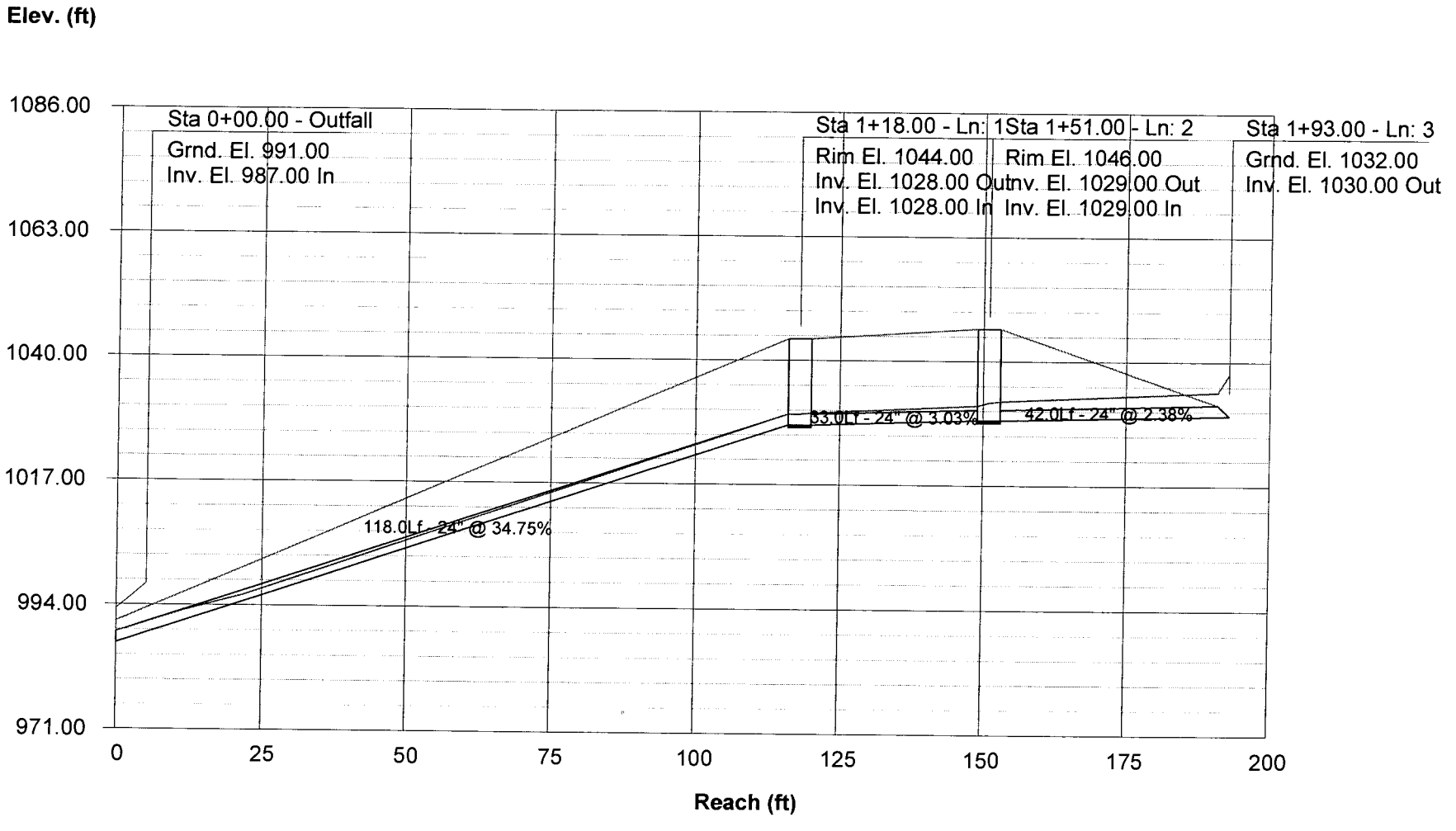
Hydraflow Plan View



NCER - Line 304-307	No. Lines: 3	03-13-2013

Storm Sewer Profile

Proj. file: New.stm



Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	306-307	50.00	24 c	118.0	987.00	1028.00	34.746	988.98	1029.98	n/a	1029.98 j	End
2	305-306	48.60	24 c	33.0	1028.00	1029.00	3.030	1030.21*	1031.74*	0.56	1032.29	1
3	304-305	46.70	24 c	42.0	1029.00	1030.00	2.381	1032.58*	1034.37*	3.44	1037.80	2

NCER - Line 304-307 | Number of lines: 3 | Run Date: 03-13-2013

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

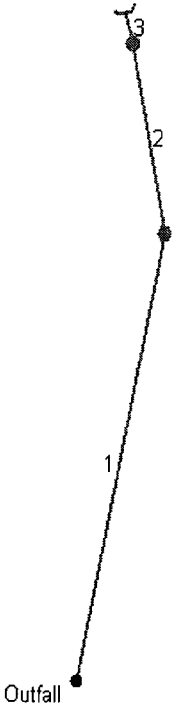
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
(1)	(in)	(cfs)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(ft) (12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(K) (23)	(ft) (24)
1	24	50.00	987.00	988.98	1.98	3.14	15.94	3.95	992.93	4.507	118	1028.00	1029.98 j	1.98**	3.14	15.94	3.95	1033.93	4.508	4.507	n/a	0.15	n/a
2	24	48.60	1028.00	1030.21	2.00	3.14	15.47	3.72	1033.93	4.619	33.0	1029.00	1031.74	2.00	3.14	15.47	3.72	1035.46	4.617	4.618	1.524	0.15	0.56
3	24	46.70	1029.00	1032.58	2.00	3.14	14.87	3.44	1036.01	4.265	42.0	1030.00	1034.37	2.00	3.14	14.87	3.44	1037.80	4.263	4.264	1.791	1.00	3.44

NCER - Line 304-307 | Number of lines: 3 | Run Date: 03-13-2013

Notes: ; ** Critical depth.; j-Line contains hyd. jump.

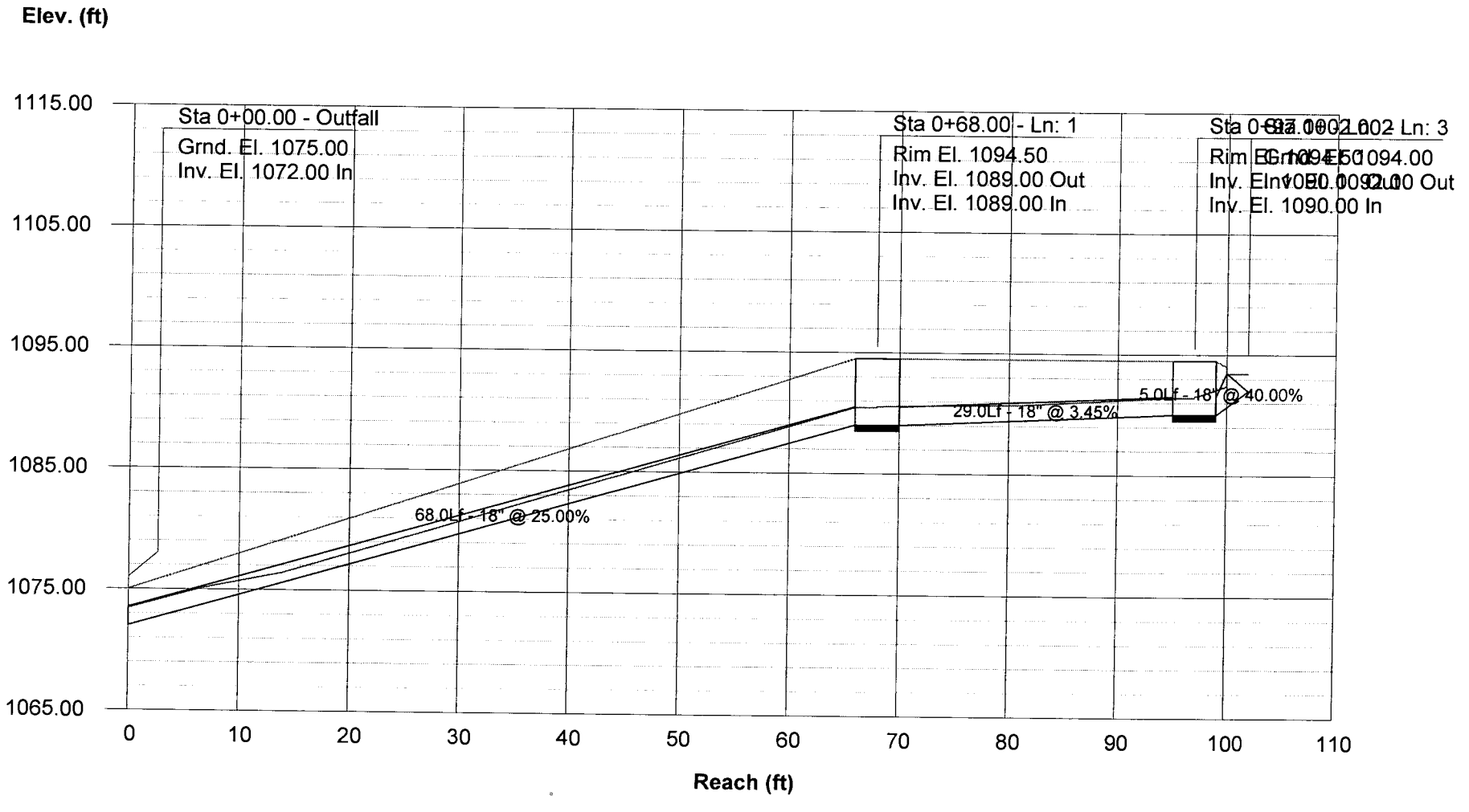
Hydraflow Plan View



NCER - Line 406-409	No. Lines: 3	03-13-2013

Storm Sewer Profile

Proj. file: New.stm



Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	408-409	16.40	18 c	68.0	1072.00	1089.00	25.000	1073.43	1090.43	n/a	1090.43 j	End
2	407-408	16.10	18 c	29.0	1089.00	1090.00	3.448	1090.52	1091.43	n/a	1091.43 j	1
3	406-407	15.60	18 c	5.0	1090.00	1092.00	40.000	1091.55	1093.42	n/a	1093.42 j	2

NCER - Line 406-409 | Number of lines: 3 | Run Date: 03-13-2013

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; j - Line contains hyd. jump.

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
(1)	(in) (2)	(cfs) (3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(ft) (12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(K) (23)	(ft) (24)
1	18	16.40	1072.00	1073.43	1.43	1.74	9.43	1.38	1074.82	2.118	68.0	1089.00	1090.43	1.43**	1.74	9.43	1.38	1091.82	2.118	2.118	n/a	0.44	n/a
2	18	16.10	1089.00	1090.52	1.50	1.74	9.11	1.29	1091.82	2.352	29.0	1090.00	1091.43	1.43**	1.74	9.27	1.34	1092.77	2.038	2.195	n/a	0.15	0.20
3	18	15.60	1090.00	1091.55	1.50	1.73	8.83	1.21	1092.77	2.208	5.0	1092.00	1093.42	1.42**	1.73	9.01	1.26	1094.68	1.909	2.058	n/a	1.00	n/a

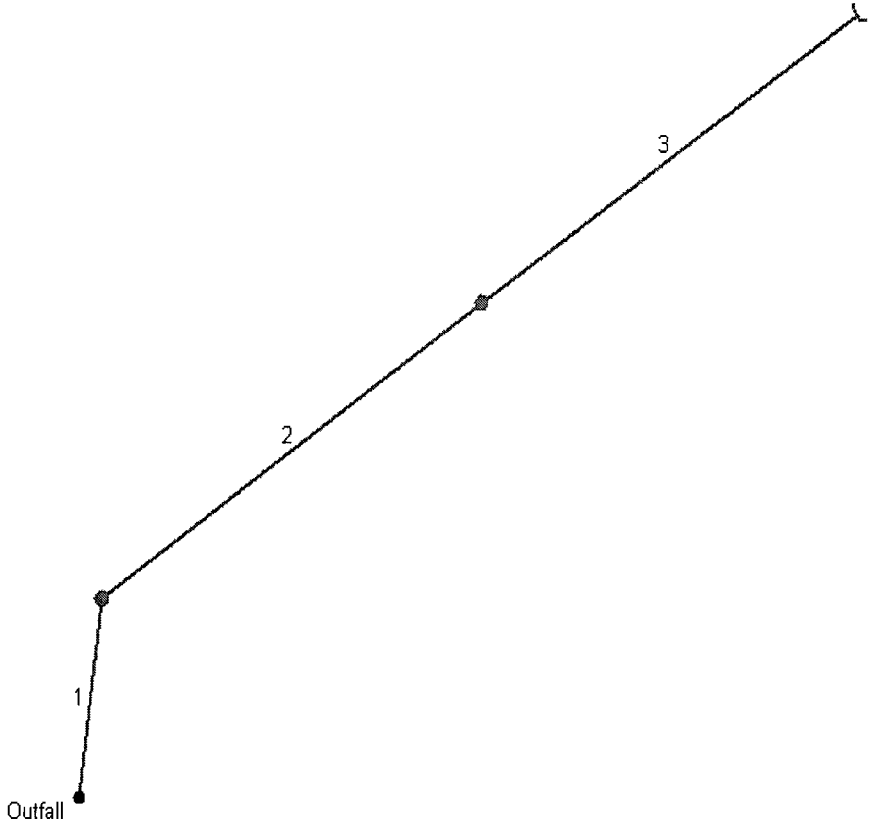
NCER - Line 406-409

Number of lines: 3

Run Date: 03-13-2013

Notes: ; ** Critical depth.; j-Line contains hyd. jump.

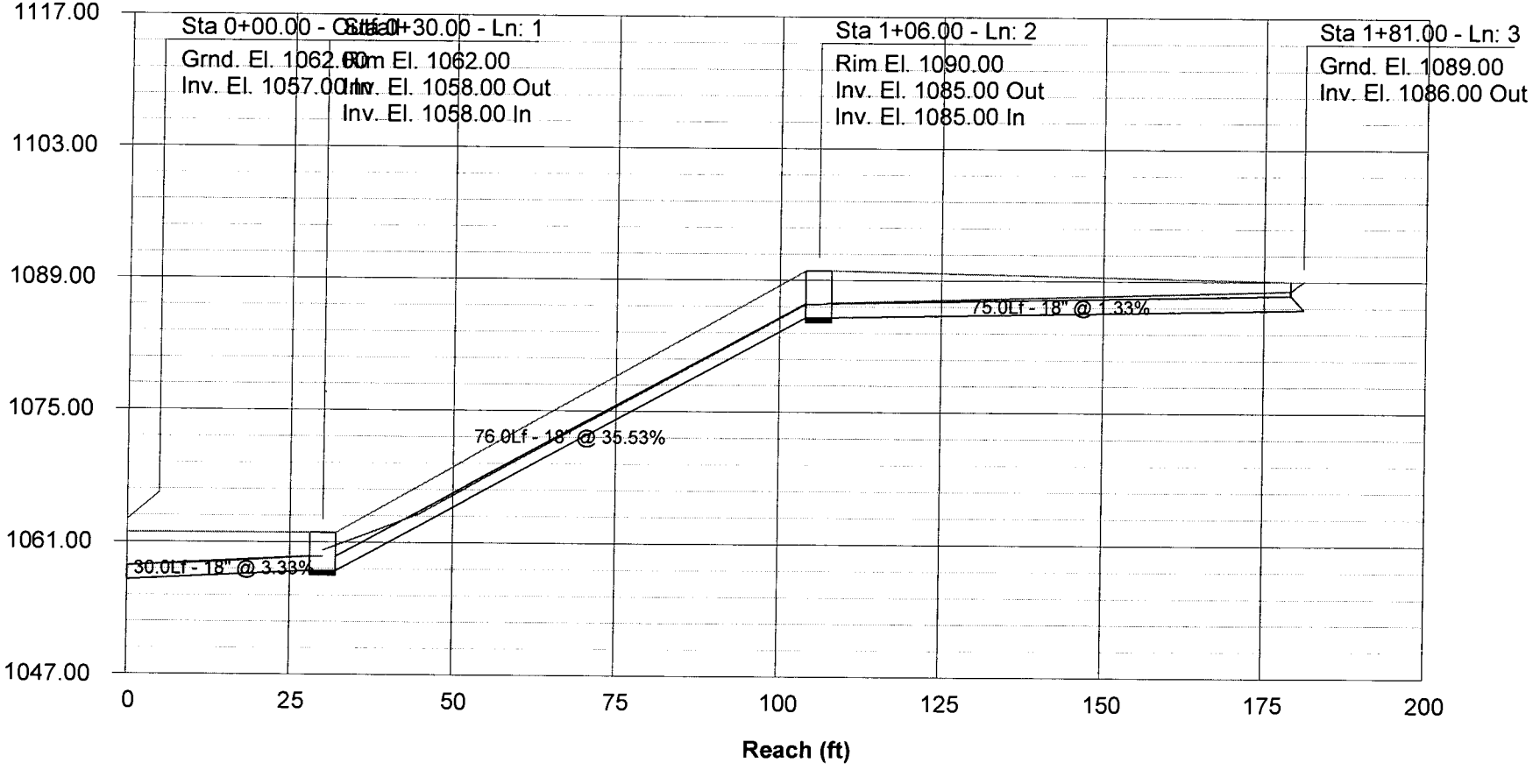
Hydraflow Plan View



NCER - Line 504-507	No. Lines: 3	03-13-2013

Storm Sewer Profile

Proj. file: New.stm



Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	506-507	19.10	18 c	30.0	1057.00	1058.00	3.333	1058.46	1059.46	n/a	1059.46 j	End
2	505-506	15.20	18 c	76.0	1058.00	1085.00	35.526	1060.15	1086.41	n/a	1086.41 j	1
3	504-505	14.50	18 c	75.0	1085.00	1086.00	1.333	1086.57*	1088.00*	1.05	1089.05	2

NCER - Line 504-507 | Number of lines: 3 | Run Date: 03-13-2013

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

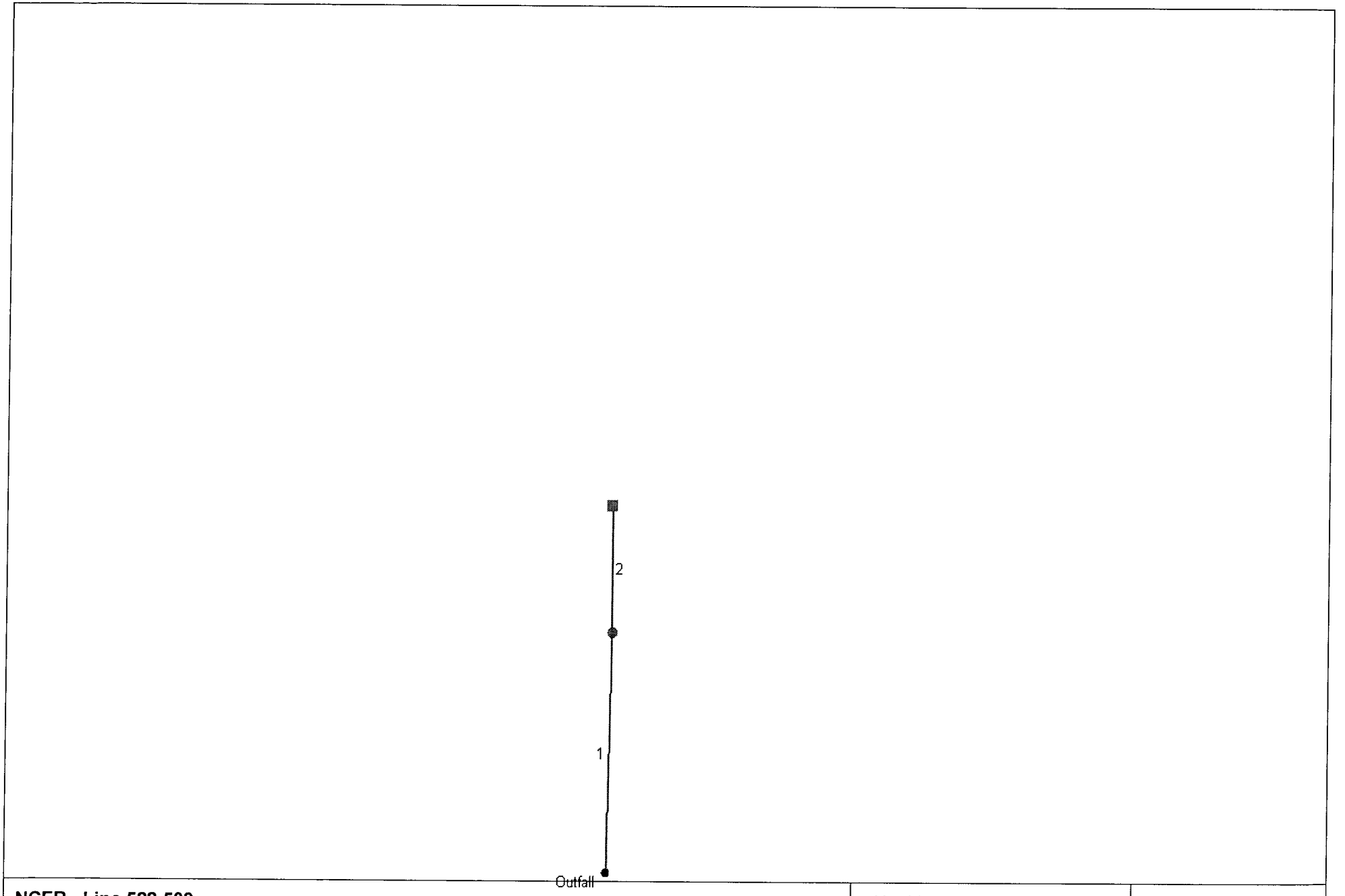
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
	(in)	(cfs)									(ft)											(K)	(ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1	18	19.10	1057.00	1058.46	1.46	1.76	10.88	1.84	1060.30	2.936	30.0	1058.00	1059.46	1.46**	1.76	10.88	1.84	1061.30	2.935	2.935	n/a	0.78	1.44
2	18	15.20	1058.00	1060.15	1.50	1.72	8.60	1.15	1061.30	2.096	76.0	1085.00	1086.41	1.41**	1.72	8.81	1.21	1087.62	1.811	1.953	n/a	0.15	n/a
3	18	14.50	1085.00	1086.57	1.50	1.77	8.21	1.05	1087.62	1.907	75.0	1086.00	1088.00	1.50	1.77	8.21	1.05	1089.05	1.907	1.907	1.430	1.00	1.05

NCER - Line 504-507 | Number of lines: 3 | Run Date: 03-13-2013

Notes: ; ** Critical depth.; j-Line contains hyd. jump.

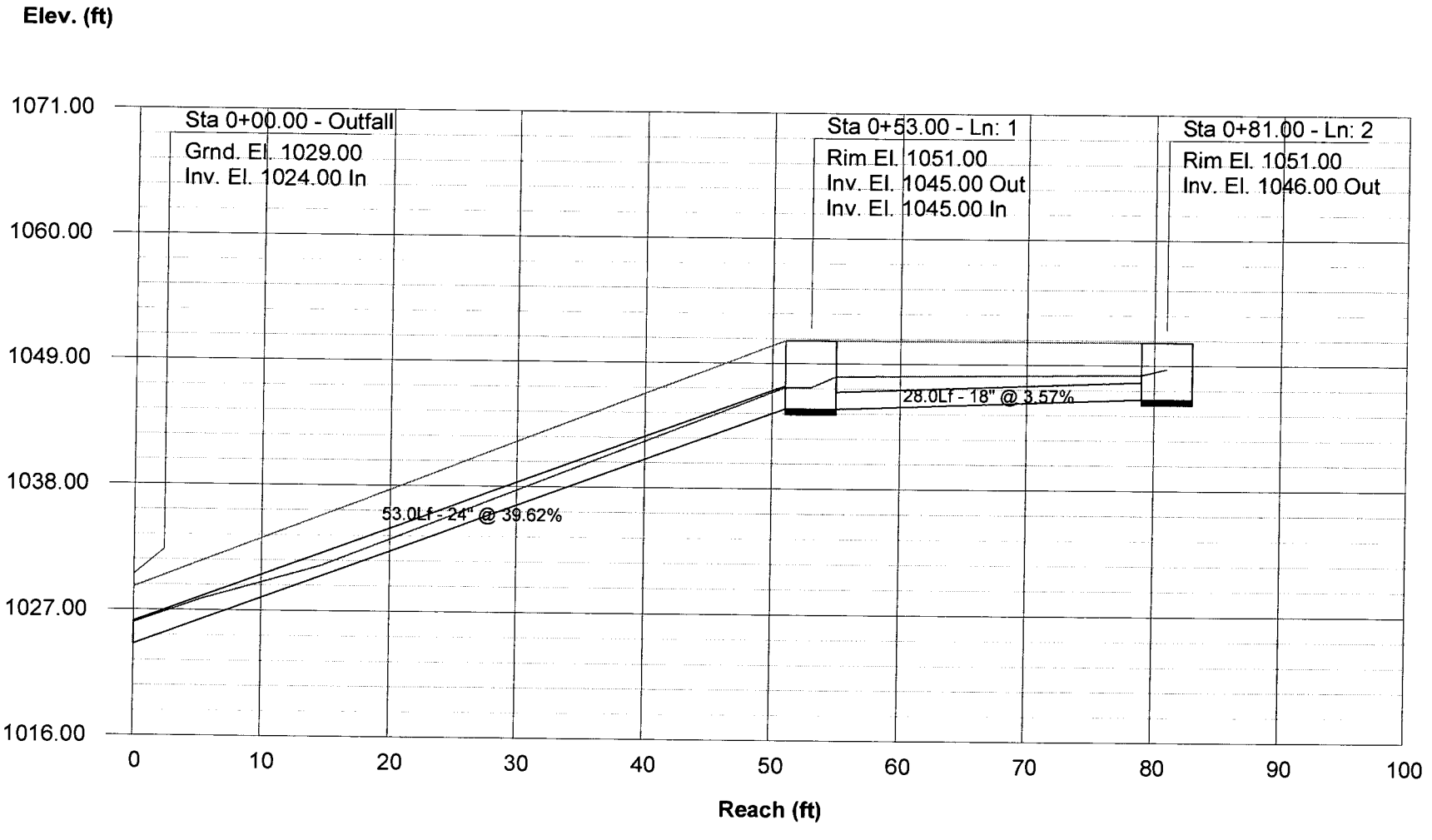
Hydraflow Plan View



NCER - Line 522-509	No. Lines: 2	03-13-2013

Storm Sewer Profile

Proj. file: New.stm



Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	508-509	30.30	24 c	53.0	1024.00	1045.00	39.623	1025.87	1046.87	n/a	1046.87 j	End
2	522-508	10.50	18 c	28.0	1045.00	1046.00	3.571	1047.85*	1048.13*	0.55	1048.68	1

NCER - Line 522-509 | Number of lines: 2 | Run Date: 03-13-2013

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

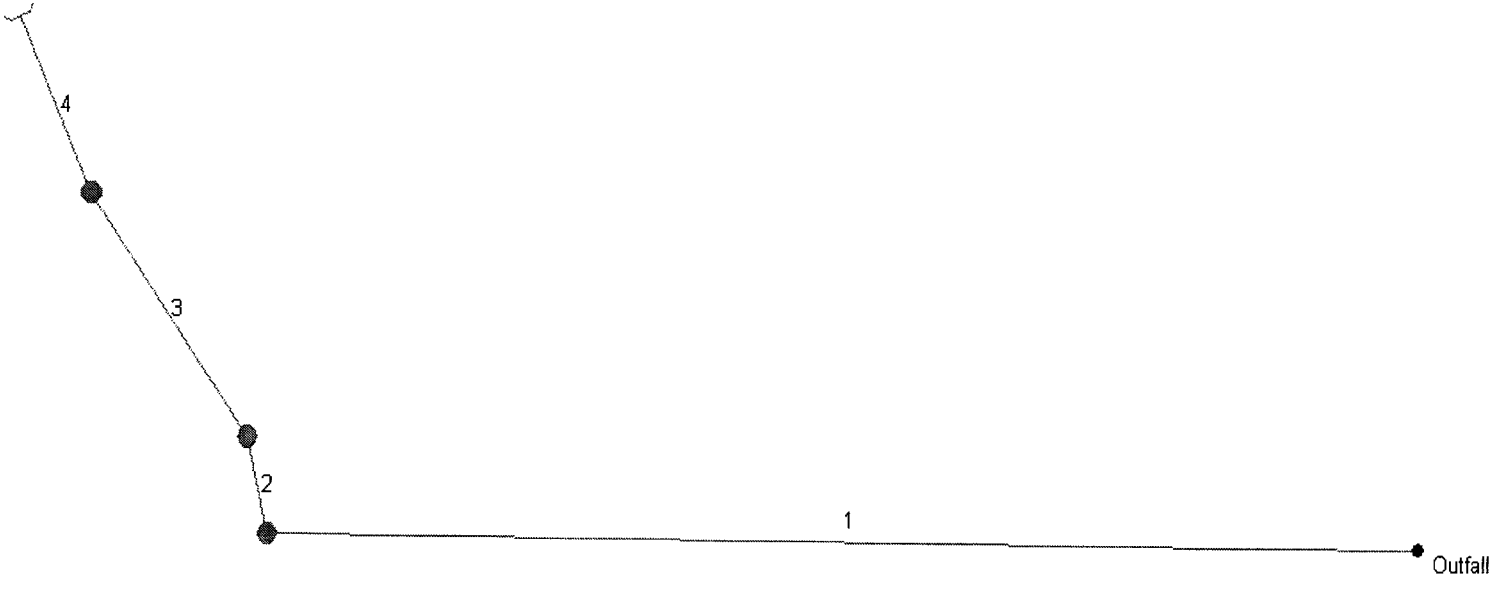
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
	(in)	(cfs)									(ft)											(K)	(ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1	24	30.30	1024.00	1025.87	1.87	3.05	9.92	1.53	1027.40	1.551	53.0	1045.00	1046.87 j	1.87**	3.05	9.92	1.53	1048.40	1.551	1.551	n/a	0.15	n/a
2	18	10.50	1045.00	1047.85	1.50	1.77	5.94	0.55	1048.40	1.000	28.0	1046.00	1048.13	1.50	1.77	5.94	0.55	1048.68	1.000	1.000	0.280	1.00	0.55

NCER - Line 522-509 | Number of lines: 2 | Run Date: 03-13-2013

Notes: ; ** Critical depth.; j-Line contains hyd. jump.

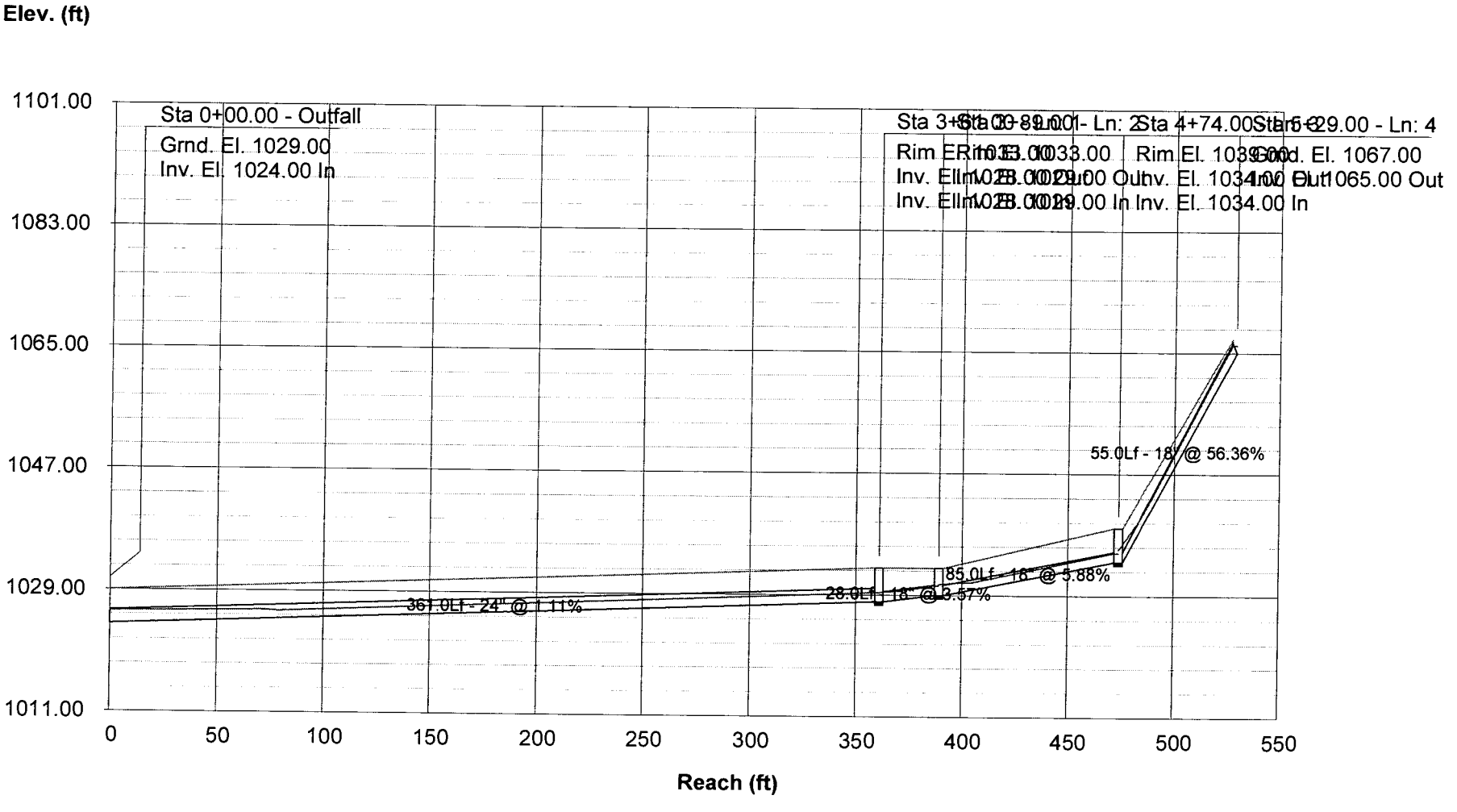
Hydraflow Plan View



NCER - Line 532-509	No. Lines: 4	03-13-2013

Storm Sewer Profile

Proj. file: Line 532-509 TM.stm



Storm Sewer Summary Report

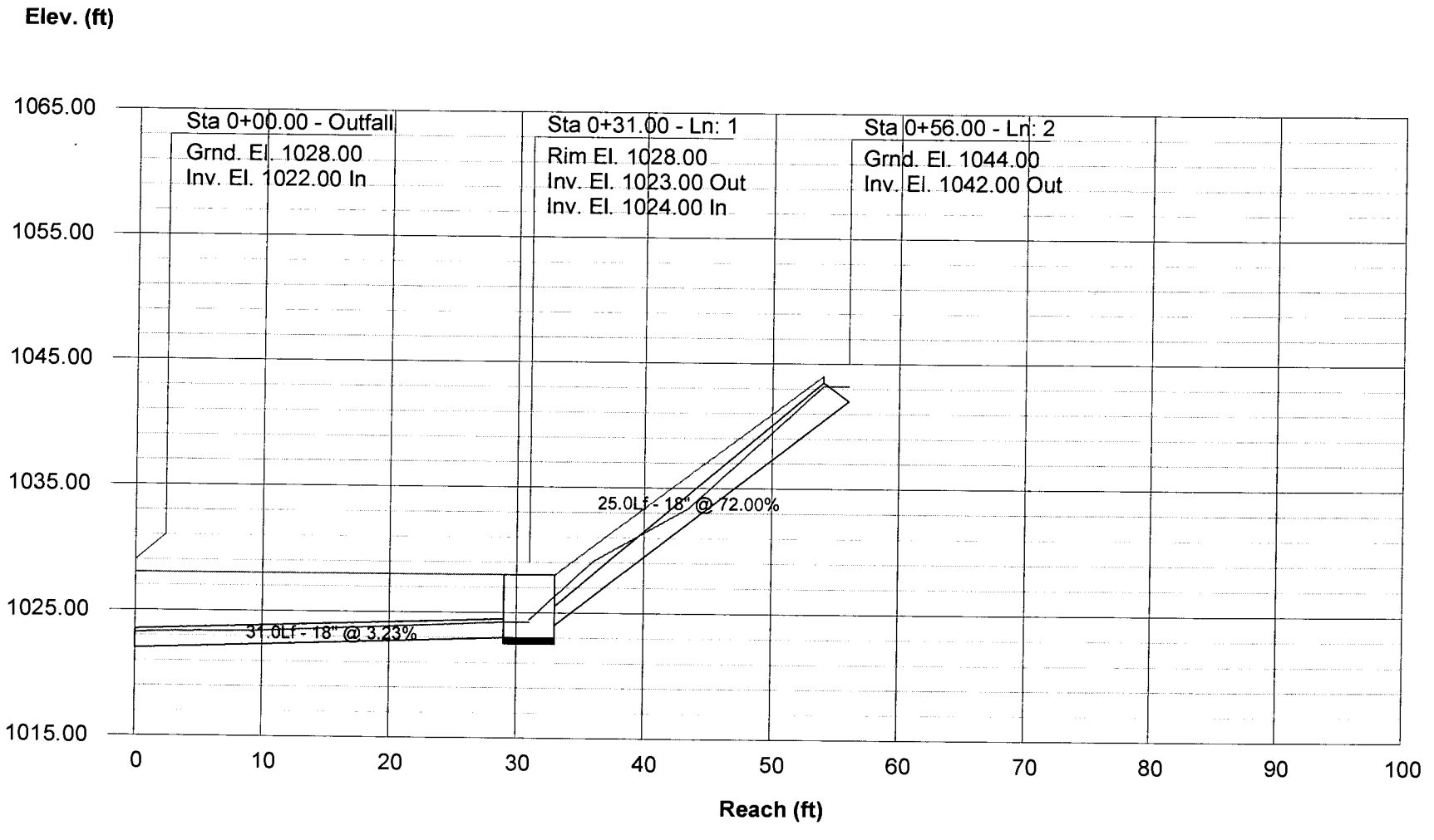
Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	535-509	14.60	24 c	361.0	1024.00	1028.00	1.108	1025.87	1029.35	n/a	1029.35 j	End
2	534-535	13.90	18 c	28.0	1028.00	1029.00	3.571	1029.35	1030.38	n/a	1030.38 j	1
3	533-534	12.60	18 c	85.0	1029.00	1034.00	5.882	1030.63	1035.34	n/a	1035.34 j	2
4	532-533	8.90	18 c	55.0	1034.00	1065.00	56.364	1035.84	1066.14	n/a	1066.14 j	3

NCER - Line 532-509 | Number of lines: 4 | Run Date: 03-13-2013

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Profile

Proj. file: Line 602-604 TM.stm



Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1	603-604	10.40	18 c	31.0	1022.00	1023.00	3.226	1023.23	1024.23	n/a	1024.23 j	End
2	602-603	9.80	18 c	25.0	1024.00	1042.00	72.000	1024.45	1043.20	n/a	1043.20 j	1

NCER - Line 602-604 | Number of lines: 2 | Run Date: 03-13-2013

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; j - Line contains hyd. jump.

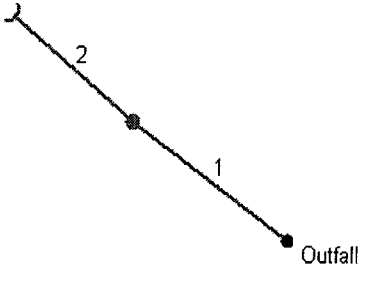
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
	(in)	(cfs)									(ft)												
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1	24	14.60	1024.00	1025.87	1.87	3.05	4.78	0.36	1026.23	0.360	361	1028.00	1029.35 j	1.35**	2.26	6.45	0.65	1030.00	0.651	0.505	n/a	0.98	n/a
2	18	13.90	1028.00	1029.35	1.35	1.70	8.28	1.07	1030.42	1.539	28.0	1029.00	1030.38 j	1.38**	1.70	8.17	1.04	1031.42	1.521	1.530	n/a	0.43	n/a
3	18	12.60	1029.00	1030.63	1.50	1.67	7.13	0.79	1031.42	1.440	85.0	1034.00	1035.34 j	1.34**	1.67	7.57	0.89	1036.23	1.276	1.358	n/a	0.23	0.20
4	18	8.90	1034.00	1035.84	1.50	1.77	5.04	0.39	1036.23	0.719	55.0	1065.00	1066.14 j	1.14**	1.44	6.18	0.59	1066.73	0.840	0.779	n/a	1.00	n/a

NCER - Line 532-509 | Number of lines: 4 | Run Date: 03-13-2013

Notes: ; ** Critical depth.; j-Line contains hyd. jump.

Hydraflow Plan View



NCER - Line 602-604	No. Lines: 2	03-13-2013

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
	(in)	(cfs)									(ft)												
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1	18	10.40	1022.00	1023.23	1.23	1.55	6.70	0.70	1023.93	0.979	31.0	1023.00	1024.23 j	1.23**	1.55	6.70	0.70	1024.93	0.979	0.979	n/a	0.15	0.10
2	18	9.80	1024.00	1024.45	0.45	0.45	21.92	7.47	1031.92	22.536	25.0	1042.00	1043.20 j	1.19**	1.51	6.49	0.66	1043.85	0.919	11.728	n/a	1.00	n/a

NCER - Line 602-604 | Number of lines: 2 | Run Date: 03-13-2013

Notes: ; ** Critical depth.; j-Line contains hyd. jump.