FINAL DRAINAGE REPORT AND PLAN
FOR
OLDBOROUGH SUBDIVISION

September, 2003

Leigh & Whitehead Associates, Inc.

CONSULTING CIVIL ENGINEERS & SURVEYORS
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, CO 80909-5061

LWA Project No. 01013.62

TABLE OF CONTENTS

Leigh Whitehead & Associates, Inc.
ENGINEERS, SURVEYORS & PLANNERS

2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, CO 80909-5061
TELEPHONE 719-636-5179 / FAX 719-636-5199

September 9, 2003

El Paso County
Public Works Department
Engineering Division
3460 N. Marksheffel Road
Colorado Springs, CO 80922

RE: Oldborough Subdivision

Dear Representative:

In accordance with the requirements of the El Paso County Subdivision Ordinance, a final drainage report and plan has been prepared for the proposed Oldborough Subdivision.

This report has been prepared under the current City of Colorado Springs and El Paso County Drainage Criteria.

Seven (7) complete copies of the drainage report and plan are hereby transmitted for your review and approval. If there are any questions or comments concerning this report, please contact the undersigned.

Sincerely,

Leonard A. Beasley
Project Engineer

9-9-03
Date

cc: Dave Jones
PPL Development, LLC

SIGNATURES AND STATEMENTS

Engineer's Statement:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

David J. Whitehead, P.E. (Colo. 25118)

Developer's Statement:

The Developer has read and will comply with all the requirements specified in this drainage report and plan.

By: _____
Dan Potter, Managing Member

PPL Development, LLC
6189 Lehman Drive, Suite 201
Colorado Springs, CO 80918

El Paso County, Colorado:

Filed in accordance with Section 51.1 of the El Paso County Land Development Code, as amended.

John A. McCarty, P.E., County Engineer/Dir. — Date: 9-15-03

Conditions: _____

FINAL DRAINAGE REPORT

Description and Location of Property:

This report has been prepared and submitted in accordance with the requirements for the Final Plat approval for Oldborough Subdivision. This development was previously submitted as Phillips Ranch Subdivision. This study is to fulfill the drainage requirements of El Paso County. This report and included maps present results of the hydrologic analysis and drainage facility sizing. An appendix is included in this report, with the pertinent calculations used in this analysis.

Oldborough Subdivision is located in the SW 1/4 of Section 21, T 11 S, R 66 W of the 6th P.M. The site is bounded on the north by Higby Road, on the east by Roller Coaster Road and is approximately three miles south of Highway 105. Existing subdivisions adjacent to the site are: Canterbury East Subdivision, northeast of the site, and Bradley Subdivision Filing No. 1, east of the site. The property north of Higby Road is unplatted, and the adjacent area on the west and south is unplatted.

Oldborough Subdivision is located in the West Cherry Creek drainage basin, basin number CYCY0400. A drainage basin planning study has not been performed for this area, therefore this site is not subject to drainage or bridge fees. The property contains approximately 35.00 acres. Anticipated development is to construct 7 lots along with drainage conveyance areas and an interior private street.

Reference Material:

The Canterbury East Subdivision and Bradley Subdivision Filing No. 1 Drainage Reports were not available from El Paso County Department of Transportation.

Hydrologic Criteria:

In accordance with the City of Colorado Springs/El Paso County Drainage Criteria Manual, the SCS unit hydrograph method was used for drainage basins greater than 100 acres. The criteria used for the unit hydrograph method was the HEC-1 computer modeling program using a type IIa storm, 4.4" of rainfall for a 24-hour period for the 100-year event. The rational method was used for areas less than 100 acres. The rational equation used for determining runoff was Q= cia where "Q" is a maximum rate of runoff in cubic feet per second; "c" is the runoff coefficient representing the drainage area characteristics; "i" is the rainfall in inches per hour for the duration of the storm; and "a" is the drainage basin area in acres.

Time of concentration and travel time calculations were based on the procedures outlined in the City of Colorado Springs/El Paso County Drainage Criteria Manual and Chapter 3 of the TR-20 Manual prepared by SCS.

Floodplain Statement:

Oldborough Subdivision is not located in a F.E.M.A. designated 100-year floodplain, as shown on F.I.R.M. Panel No. 08041C0285 F, dated March 17, 1997.

Soils:

The SCS soils survey map indicates that this site falls within the Peyton-Pring Complex and the Tomah-Crowfoot Loamy Sands. These two soils fall within the Hydrologic Soil Group B. For the purpose of this report, this hydrologic group will be used. Offsite soils consist of the Peyton - Pring Complex and Tomah-Crowfoot Loamy Sands.

A majority of the offsite and onsite groundcover consists of grasses native to the area and some trees. Runoff coefficients of 0.25 for the 5-year event and 0.35 for the 100-year event were used for current conditions. Runoff coefficients of 0.30 for the 5-year event and 0.40 for the 100-year event were used for proposed conditions

Times of concentration was developed in accordance with the City of Colorado Springs/El Paso County Drainage Criteria Manual. For undeveloped or current condition flow, a maximum length of 1000 feet was used prior to interception of flow by upland gulleys and/or drainage ditches. These flows were then conveyed through the property to appropriate outlet points. For offsite flows entering the developed area, a maximum overland length of 1000 feet or less, for initial time of concentration was used. It is believed that the upstream area will develop in the future, and will be required to detain runoff. This site will accept current condition flows that are shown on the existing drainage plan, with the exception of Sub-Basin OS-B3. For developed runoff in other areas, a maximum initial time of concentration of 300 feet or less was used. This hydrologic analysis ignored any upstream detention or existing stock ponds.

DRAINAGE BASINS AND SUB-BASINS:

Existing Drainage Conditions:

This site has a major basin delineation that runs in a north-south direction through the center of the property. Runoff on the westerly portion drains in a northwesterly direction to an existing 24" CMP that collects runoff and conveys it under Higby Road. This portion slopes from 4% to 15% in a northwesterly direction. On the southwesterly portion of the site is an existing single family residence that will remain.

The easterly portion of the site drains northeasterly to the intersection of Higby Road and Roller Coaster Road. This portion slopes from 2% to 8% in a northeasterly direction.

The site accepts runoff from five offsite basins. Offsite flows are combined with onsite flows for peak runoff at the appropriate outlet points. A current condition drainage map, which includes the offsite drainage basins has been included for reference. These maps show basin delineations, sub-basin areas, and discharges for the 5-year and 100-year rainfall events.

This site consists of two interior sub-basins and five offsite sub-basins that direct flow to two

collection points. These collection points are located at the northeast and northwest corners.

Basin "A" flows are directed to the existing 24" CMP that conveys runoff under Higby Road. This existing CMP collects all of the 5- year flow and conveys it under Higby Road. The peak 100-year flow is 35.6 cfs; of this flow, 25.6 cfs is collected within the existing storm drain pipe, and the remaining 10.0 cfs currently tops Higby Road and continues northerly.

A ponding condition at the low point in basin "B" is located at the northeast corner of the subdivision at Higby Road and Roller Coaster Road. This condition is caused by a current deficiency created by the lack of a culvert to drain this area. Runoff currently will pond to a depth of approximately 2 feet, then top Higby Road and continue northerly within a well defined drainage ditch. Offsite basin OS-B3 has flows directed to an existing roadside ditch located on the east side of Roller Coaster Road. Currently, runoff is not contained within this ditch, which is an existing deficiency. Runoff tops Roller Coaster Road and continues to the previously mentioned low point at Higby Road.

Proposed Drainage Patterns:

The proposed Oldborough Subdivision consists of 7 single family lots with a minimum lot size of 2.8 acres. The included Proposed Final Drainage Plan shows the proposed road layout, developed drainage basins, and the detention pond locations. Also shown are the estimated peak runoff flows from the developed basins at key locations. The basic drainage patterns will remain the same as existing patterns. The presence of the road may concentrate flows in locations where sheetflow previously occurred.

There are plans to construct 2- detention facilities. One is located at the existing 24" CMP at Higby Road, and the other one is located between lots 5 and 6, west of Roller Coaster Road. The detention facility proposed for the existing 24" CMP will require some regrading and runoff will be released at or below historic rates and will not top Higby Road. This detection facility will not encroach into the Higby Road right-of-way.

The detention pond between lots 5 and 6 west of Roller Coaster Road has been sized to accept flows from sub-basins OS-B1 and B-3. The calculations for the detention facilities are in the back of this report. These facilities are shown on the grading and erosion control plan. The change in discharge quantities at selected points of interest are shown on the following table.

BASIN ID		AREA			Q5 cfs			Q100 cfs		
Exist.	Prop.	Exist.	Prop.	+/-	Exist	Prop	+/-	Exist	Prop	+/-
A	A	25.68	25.81	+0.13	13.2	15.3	+2.1	34.4	38.7	+4.3
B	B	129.57	129.44	-0.13	42.0	39.0	-3.0	133.0	115.0	-18.0
Totals				**0**			**-0.9**			**-13.7**

Similar information on all points studied for the existing and proposed conditions can be found in the appendix. The two detention ponds will detain a total of 12.2 cfs for the 5-year event, and 43.3 cfs for the 100-year event. Required detention is 4.5 cfs for the 5-year event and 9.1 cfs for the 100-year event. Pond volumes were determined by the conic method. This analysis indicates that the proposed detention facilities are adequate and should release runoff at or below current condition flows. Detention facilities were analyzed using Haestad methods "Pond Pack-Detention Pond Design and Analysis" computer program for both the 5-year and 100-year events. The detention ponds are private drainage facilities and will be maintained by the Homeowners Association. Oldborough Subdivision will accept offsite runoff that does not exceed flows from sub-basins OS-B1 and OS-B2 as shown on the Current Conditions Drainage Plan, located in the back of this report. Calculations for the 2 detention ponds are included in the back of this report. These ponds will have adequate maintenance access.

The proposed detention facilities include an outlet structure that will control both the minor and major storms. They are single-stage outlet facilities. The calculations for the emergency spillway are shown on the construction documents. Any seeding that is developed in the detention pond areas will be in accordance with the NRCS specifications that are shown on Sheet 2 of 4, of the construction documents. The access for maintenance for both these ponds will be at a slope that is

no greater than 12%. The proposed grading for these facilities are included with the construction documents. The bottom of the ponds will be constructed with a 2' wide rip-rap trickle swale that will collect and direct runoff from minor storms to the outlet structures, and are shown on the Grading and Erosion Control Plan. The type of vegetation that is planned for this area requires minimal amount of moisture. Based on the advise of the NRCS, temporary irrigation to establish the groundcover is not recommended. These ponds are private and will be maintained by the homeowners association.

The roadside ditches adjacent to the private road generate velocities that range from 2.3 fps to 3.6 fps. These velocities are shown on the street plan and profile. The soil along the proposed road consists of a sandy loam. The City of Colorado Springs/El Paso County Drainage Criteria Manual states that the maximum permissible velocities in bare earth is 2.5 fps. The maximum allowable velocities for slopes up to 10% with the various grass linings of canary grass, fescue, legumes and bermuda grass range from 3 fps to 6 fps. Any one of these ground covers should adequately protect the roadside ditches. The exception to this is that the grass-legume mixture should not be used in the area that velocities are in excess of 3.0 fps. Any of the other grass linings mentioned previously should adequately protect the roadside ditch in that area. Based on this evaluation, ditch checks are not required for the roadside ditches.

The low point at Roller Coaster Road and Higby Road, (Basin B5) will require 2 - 24" HDPE's, 70' long to safely convey developed flows under Higby Road. The peak 100-year flow with upstream detention is 43.8 cfs. This is 24.3 cfs less than the historic flow of 68.1 cfs. Based on this flow reduction and the rip-rap pad to dissipate the concentrated velocities, there should be little or no adverse impacts to downstream properties. These flows outlet into an existing drainage swale that conveys flows to adequate outfalls.

The peak flow at Basin B in its current condition, is 133 cfs. This does include all offsite basins. The peak flow at this location results in a water depth of 1.16' without any culverts at the corner of Higby Road and Roller Coaster Road. The peak 100-year developed flow is 115 cfs, which includes

the offsite Sub-basin OS-B6 as shown on the Proposed Conditions Drainage Plan. The 18 cfs reduction from the current conditions flow, is from the detention facilities functioning as designed. The proposed two 24" HDPE's have a capacity of 53.3 cfs without any road overtopping. The 115 cfs peak flow at this location does result in a water depth over the road of 0.83'. This is 60.6 cfs being conveyed underground within the two culverts and the remaining 54.4 cfs overtops the road. If 144 cfs for the developed 100-year event reaches this point, which does not include any upstream detention, and Sub-basin OS-B6 being directed to this location, it would result in a peak flow of 61.8 cfs being conveyed through the culverts and 82.2 cfs overtopping the road, which would result in a depth on Higby Road of 0.98'. This would only occur if the detention facility was not functioning as designed, or has not been installed prior to a storm of this magnitude being conveyed to this location. Once the detention facilities are in place and the borrow ditch is graded along the east side of Roller Coaster Road, the peak flow of 43.8 cfs that reaches the location at Higby Road and Roller Coaster Road, would result in no overtopping of the road. All flows would be conveyed underground through the two 24" HDPE culverts.

A portion of the existing drainage terraces will be removed during construction. This is unavoidable and damage should be kept to a minimum and repaired where possible.

Drainage Design Criteria/Development Criteria Reference:

The site is located in the West Cherry Creek Drainage Basin No. CYCY0400. There has not been a drainage basin planning study for this basin.

Grading and Erosion Control:

The grading and erosion control plan is being submitted in conjunction with the Final Drainage Report and Plan, and is part of the construction document set.

Summary:

Due to reduction in flow exiting this development, there should be no adverse impacts to the downstream properties.

Construction of this subdivision will not adversely affect the surrounding developments. This Final Drainage Report was prepared in accordance with the 1991 City of Colorado Springs/El Paso County Drainage Criteria Manual, as amended and revised. Runoff from this development should be safely conveyed and discharged to adequate outfalls.

Drainage Fees:

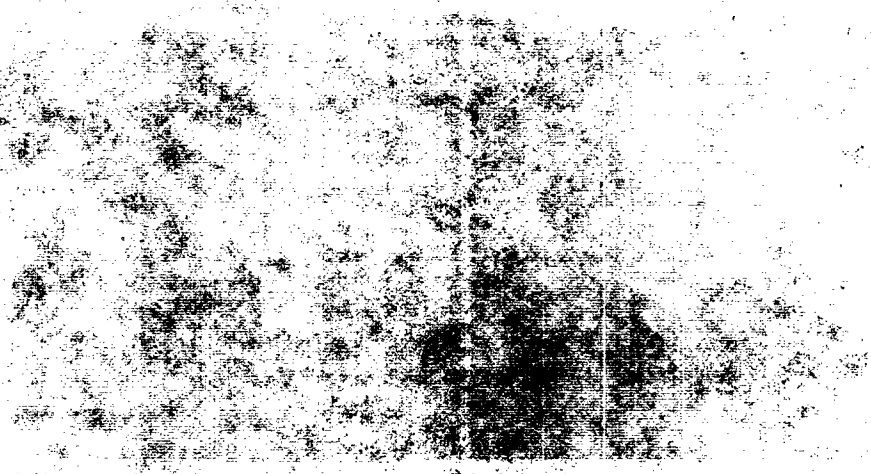
Oldborough Subdivision is located within the west of Cherry Creek Drainage Basin and is not subject to drainage or bridge fees.

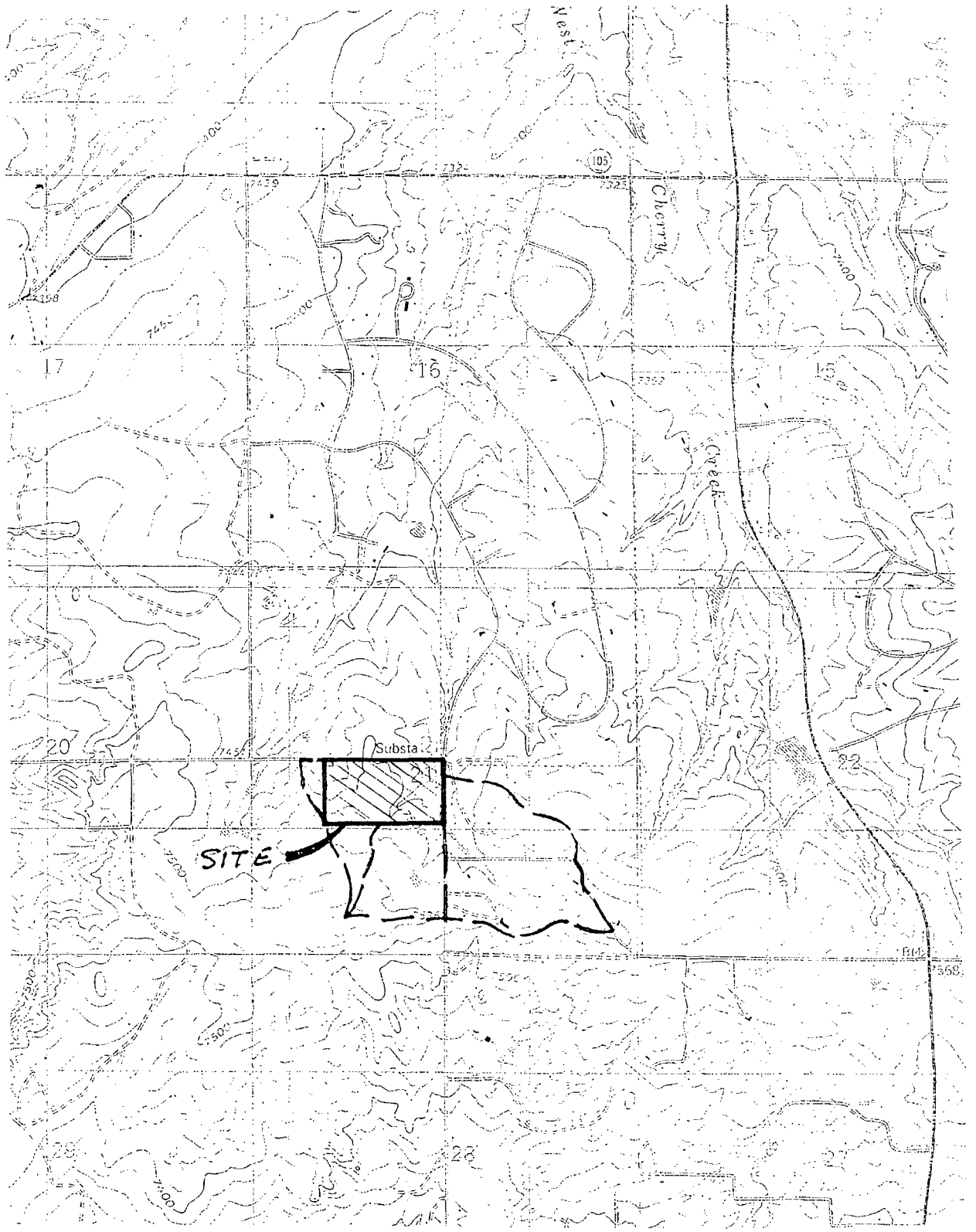
Opinion of Probable Costs:

Detention Pond (2 @ $12,755.00/ea)	$25,510.00
Erosion Control Measures (LS)	$2,516.50
24" HDPE (140 LF @ $33.00/ft.)	$4,620.00
24" HDPE FES(4 @ $400.00/ea.)	$1,600.00
Rip-Rap pad (LS)	$3,200.00
Subtotal	$37,446.50
Engineering & Contingencies (10%)	$3,744.65
TOTAL	**$41,191.15**

The owner will post the appropriate financial assurances to cover the cost of constructing these drainage improvements. Leigh Whitehead & Associates, Inc., cannot and will not guarantee that the actual construction costs will not vary from this estimate of probable costs for constructing these facilities.

MAPS AND CALCULATIONS

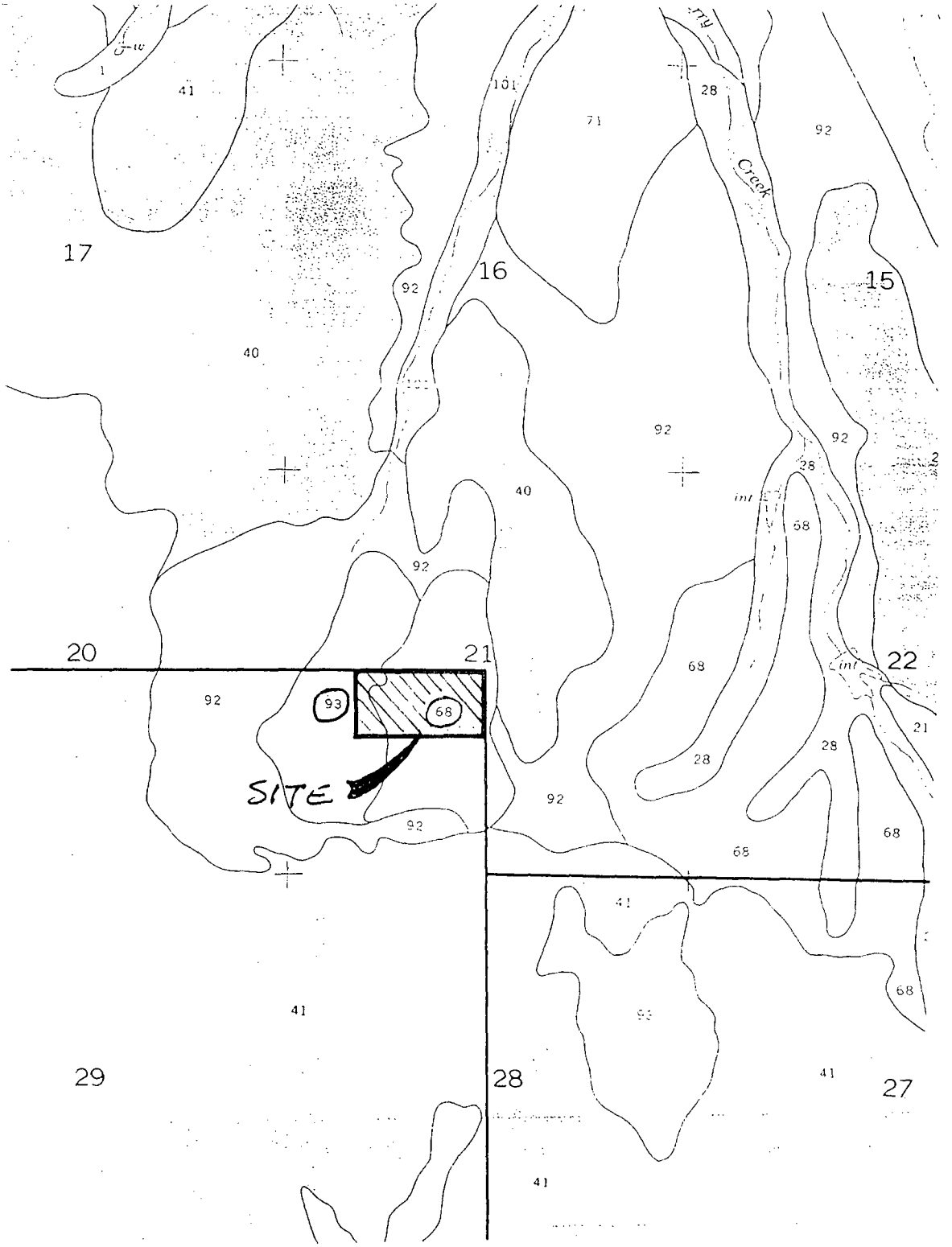




REF: MONUMENT "QUAD" - 1986

LOCATION MAP

Leigh & Whitehead Associates, Inc.
CONSULTING CIVIL ENGINEERS & SURVEYORS
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, CO 80909-5061



REF: S.C.S. SOIL SHT. 1 of 37 (MONUMENT QUAD)

SOILS MAP

Leigh & Whitehead & Associates, Inc.
CONSULTING CIVIL ENGINEERS & SURVEYORS
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, CO 80909-5061

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					In		
Manvel:							
50	C	None	---	---	>60	---	High.
Manzanola:							
51, 52, 53	C	None to rare	---	---	>60	---	Moderate.
Midway:							
54	D	None	---	---	10-20	Rippable	Moderate.
Nederland:							
55	B	None	---	---	>60	---	Moderate.
Nelson:							
[1]56:							
Nelson part	B	None	---	---	20-40	Rippable	Low.
Tassel part	D	None	---	---	10-20	Rippable	Low.
Neville:							
57	B	None	---	---	>60	---	High.
[1]58:							
Neville part	B	None	---	---	>60	---	High.
Rednun part	C	None	---	---	>60	---	Moderate.
Nunn:							
59	C	None	---	---	>60	---	Moderate.
Olney:							
60, 61	B	None	---	---	>60	---	Moderate.
[1]62:							
Olney part	B	None	---	---	>60	---	Moderate.
Vona part	B	None	---	---	>60	---	Moderate.
Paunsaugunt:							
[1]63:							
Paunsaugunt part	D	None	---	---	10-20	Hard	Moderate.
Rock outcrop part	D	---	---	---	---	---	---
Penrose:							
[1]64:							
Penrose part	D	None	---	---	10-20	Rippable	Low.
Manvel part	C	None	---	---	>60	---	High.
Perrypark:							
65	B	None	---	---	>60	---	Moderate.
Peyton:							
66, 67	B	None	---	---	>60	---	Moderate.
[1]68, [1]69:							
Peyton part	B	None	---	---	>60	---	Moderate.
Pring part	B	None	---	---	>60	---	Moderate.
Pits, gravel:							
70	A	---	---	---	---	---	---
Pring:							
71, 72	B	None	---	---	>60	---	Moderate.
Razor:							
73, 74	C	None	---	---	20-40	Rippable	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					In		
omah: [1]92, [1]93:							
Tomah part-----	B	None----------	---	---	>60	---	Moderate.
Crowfoot part--	B	None----------	---	---	>60	---	Moderate.
ravessilla: [1]94:							
Travessilla part----------	D	None----------	---	---	6-20	Hard	Low.
Rock outcrop part----------	D	---	---	---	---	---	---
ruckton: 95, 96, 97-------	B	None----------	---	---	>60	---	Moderate.
[1]98:							
Truckton part--	B	None----------	---	---	>60	---	Moderate.
Blakeland part-	A	None----------	---	---	>60	---	Low.
[1]99, [1]100:							
Truckton part--	B	None----------	---	---	>60	---	Moderate.
Bresser part---	B	None----------	---	---	>60	---	Low.
stic Torrifluvents: 101----------	B	Occasional----	Very brief----	Mar-Aug	>60	---	Moderate.
alent: 102, 103---------	A	None----------	---	---	>60	---	Low.
ona: 104, 105---------	B	None----------	---	---	>60	---	Moderate.
igton: 106----------	A	None----------	---	---	>60	---	Low.
iley: 107, 108---------	B	None----------	---	---	>60	---	Low.
oder: 109, 110---------	B	None----------	---	---	>60	---	Low.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 285 OF 1300

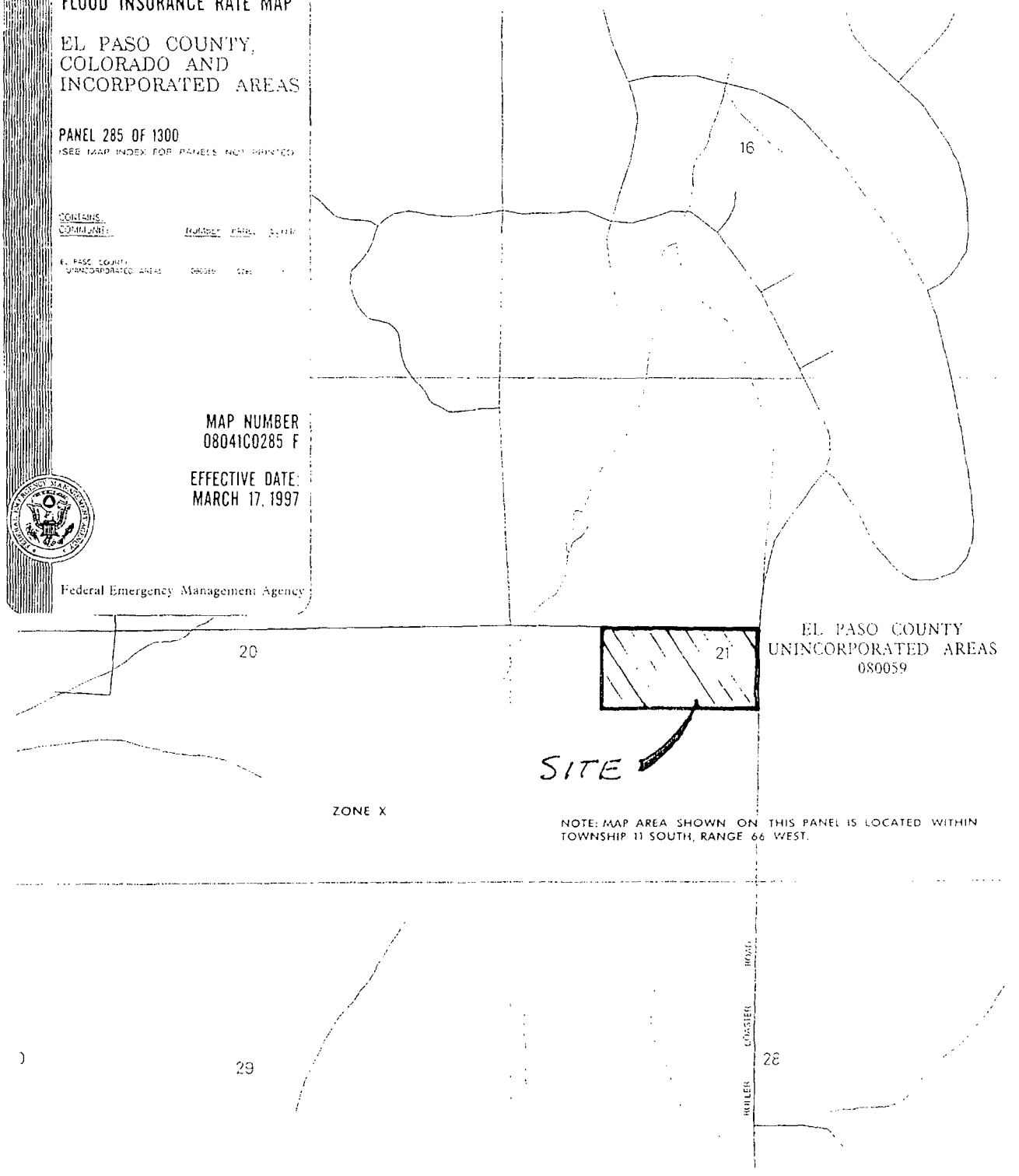
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY UNINCORPORATED AREAS	080059	0285	F

MAP NUMBER
08041C0285 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency



FEMA MAP

DATE: MARCH 17, 1997

PLATE NO. 08041C0285 F

Leigh & Whitehead Associates, Inc.

CONSULTING CIVIL ENGINEERS & SURVEYORS

2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, CO 80909-5061

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

ZONE A No base flood elevations determined.

ZONE AE Base flood elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE A99 To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.

ZONE V Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

ZONE X Areas determined to be outside 500-year floodplain.

ZONE D Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum.

D — D — Cross Section Line

(EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum.

RM7 — Elevation Reference Mark

M2 — River Mile

97°07'30", 32°22'30" — Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE DATE shown on this map to determine when actuarial rates apply to structures in zones where elevations or depths have been established.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas.

Coastal base flood elevations apply only landward of 0.0 NGVD, and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, AH, AO, A99, V, and VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

This map may incorporate approximate boundaries of Coastal Barrier Resource System Units and /or Otherwise Protected Areas established under the Coastal Barrier Improvement Act of 1990 (PL 101-591).

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

For community map revision history prior to countywide mapping, see Section 6.0 of the Flood Insurance Study Report.

For adjoining map panels and base map source see separately printed Map Index.

MAP REPOSITORY

Refer to Repository Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP:

MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL:

ELEVATION DATUM

Flood elevations on this map are referenced to the National Geodetic Vertical Datum of 1929. These flood elevations must be compared to structure and ground elevations referenced to the same datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, contact the National Geodetic Survey at the following address:

The Vertical Network Branch, NGG13
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East West Highway
Silver Spring, Maryland 20910
(301) 713-3191

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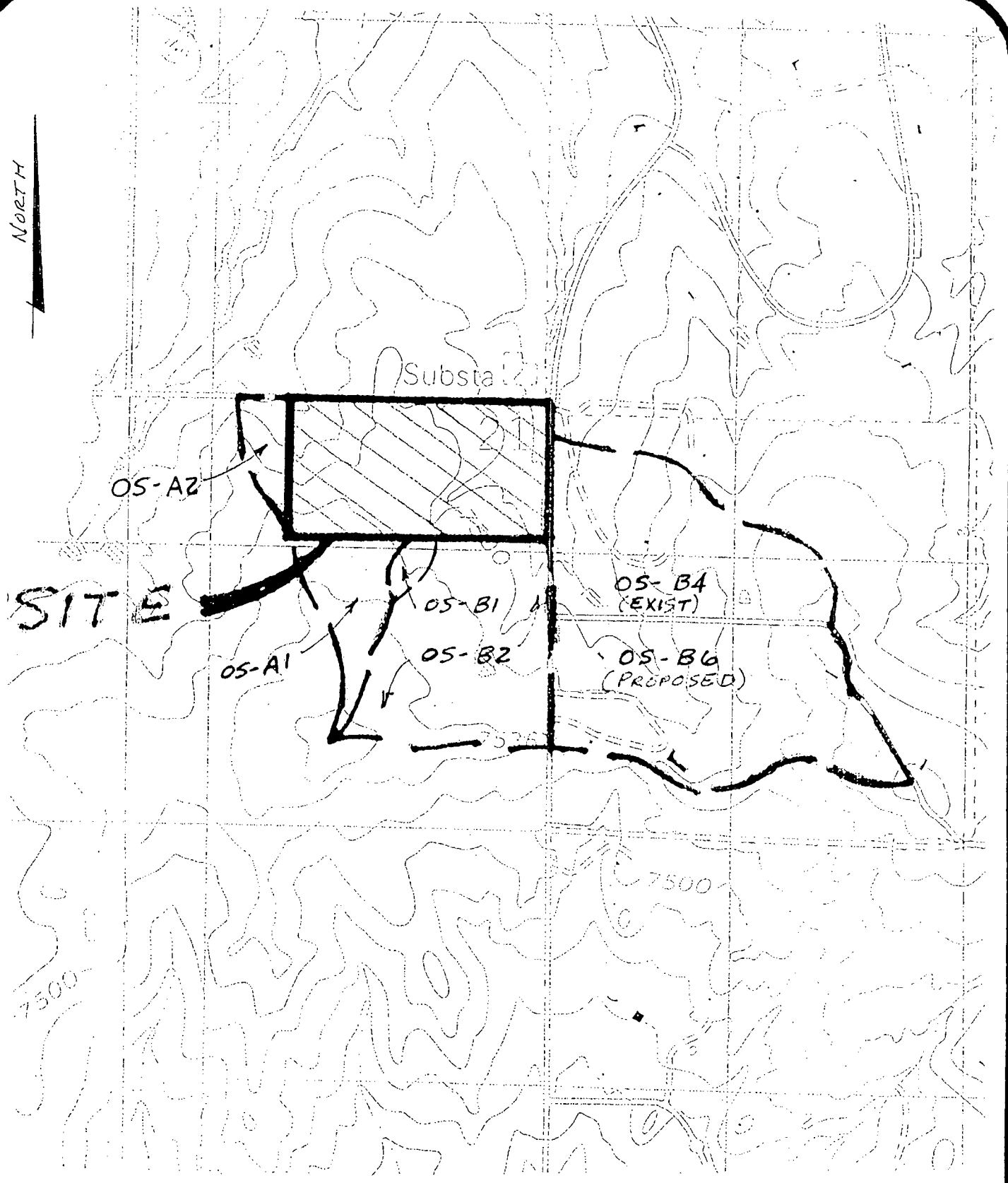

OFFSITE DRAINAGE

Leigh & Whitehead Associates, Inc.
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2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, CO 80909-5061

EXISTING CONDITIONS RUNOFF CALCULATIONS

RUNOFF COMPUTATIONS
RATIONAL METHOD

01013.WK4

OLDBOROUGH SUBDIVISION
ROLLER COASTER ROAD and HIGBY ROAD
EL PASO COUNTY, COLORADO

LEIGH WHITEHEAD & ASSOCIATES,INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

EXISTING CONDITIONS

LWA # 01013.63

12-Feb-2003

BASIN	AREA	SOIL TYPE	C 5 / C 100	GEOMETRY LENGTH / SLOPE	GEOMETRY HEIGHT	Tt 5 / Tt 100	V / Tt	tc 5 / tc 100	i 5 / i 100	Q5	Q100	COMMENTS
OS-A1	10.10	B	0.25	1000.0	42.0	31.30	2.12	32.48	2.21	5.6		
		93	0.35	4.20		27.62	1.18	28.80	4.15		14.7	
OS-A2	1.47	B	0.25	580.0	41.0	20.08		20.08	2.91	1.1		
		68 / 93	0.35	7.07		17.71		17.71	5.42		2.8	
A3	14.11	B	0.25	440.0	18.0	20.95	5.50	22.99	2.70	9.5		
		68 / 93	0.35	4.09		18.48	2.04	20.52	5.02		24.8	
A	25.68	B	0.25	1000.0	42.0	31.30	Varies	36.67	2.05	13.2		
		68 / 93	0.35	4.20		27.62	5.37	32.99	3.83		34.4	
OS-B1	13.77	B	0.25	1000.0	40.0	31.81	3.35	33.80	2.16	7.4		
		68	0.35	4.00		28.07	1.99	30.06	4.05		19.5	
OS-B2	18.37	B	0.25	1000.0	50.0	29.55	3.60	33.26	2.18	10.0		
		68	0.35	5.00		26.08	3.71	29.79	4.07		26.2	
B3	20.29	B	0.25	300.0	25.5	13.59	4.06	18.52	3.03	15.4		
		68	0.35	8.50		11.99	4.93	16.92	5.55		39.4	
DP-1	52.43	B	0.25	1000.0	50.0	29.55	Varies	38.12	2.00	26.3		OS-B1, OS-B2 & B3
		68	0.35	5.00		26.08	8.57	34.65	3.71		68.1	
OS-B4	77.14	B	0.27	300.0	15.0	15.81	Varies	32.22	2.22	46.3		
		68	0.37	5.00		13.90	16.41	30.31	4.03		114.9	
B	129.57	B	0.26	1000.0	50.0	29.21	Varies	37.78	2.02	67.9		RATIONAL
		68	0.36	5.00		25.73	8.57	34.30	3.74		174.3	
B	0.2025	B						26.48 min.		42		SCS / HEC
	Sq. Miles	68						0.44 hrs.	L = 0.26 hrs		133	

RUNOFF COMPUTATIONS WEIGHTED RUNOFF COEFFICIENT (C)

01013.WK4

OLDBOROUGH SUBDIVISION
ROLLER COASTER ROAD and HIGBY ROAD
EL PASO COUNTY, COLORADO

LEIGH WHITEHEAD & ASSOCIATES, INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

EXISTING CONDITIONS

LWA # 01013.63

12-Feb-2003

SHT. 1 of 1

Basin	Hydro Group	Area	Total Area	Percent Cover	C5"	Wtd. "C5"	C100"	Wtd. "C100"	Type Of Cover
OS-B4	B	2.96	77.14	3.84%	0.90	0.03	0.95	0.04	Existing Structures / Roads
	B	74.18	77.14	96.16%	0.25	0.24	0.35	0.34	Meadow / Pasture
		77.14		100.00%		0.27		0.37	
B	B	2.96	129.57	2.28%	0.90	0.02	0.95	0.02	Existing Structures / Roads
	B	126.61	129.57	97.72%	0.25	0.24	0.35	0.34	Meadow / Pasture
		129.57		100.00%		0.26		0.36	

RUNOFF COMPUTATIONS TRAVEL TIME CALCULATIONS

01013.WK4

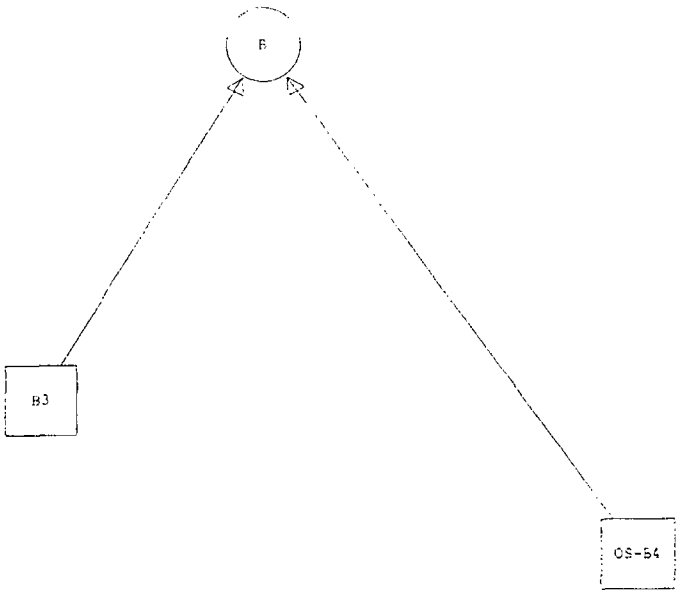
OLDBOROUGH SUBDIVISION
ROLLER COASTER ROAD and HIGBY ROAD
EL PASO COUNTY, COLORADO

LEIGH WHITEHEAD & ASSOCIATES,INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

EXISTING CONDITIONS

LWA # 01013.63

BASIN	"n"	"K"	HIGH ELEV.	LOW ELEV.	LENGTH	HEIGHT	SLOPE	"V"	"TT" (min.)	COMMENTS
OS-A1		1.5	7528.0	7525.0	150	3.0	2.00%	2.12	1.18	
A3		2.0	7512.0	7460.9	675	51.1	7.57%	5.50	2.04	
A		1.5	7528.0	7525.0	150	3.0	2.00%	2.12	1.18	
		1.5	7525.0	7512.0	365	13.0	3.56%	2.83	2.15	
		2.0	7512.0	7460.9	675	51.1	7.57%	5.50	2.04	
					1190				5.37	
OS-B1		1.5	7520.0	7500.0	400	20.0	5.00%	3.35	1.99	
OS-B2		1.5	7520.0	7474.0	800	46.0	5.75%	3.60	3.71	
B3		2.0	7506.0	7456.6	1200	49.4	4.12%	4.06	4.93	
DP-1	0.10	4.40	7570.0	7555.0	300	15.0	5.00%	0.50	10.08	Overland Flow
		1.5	7555.0	7520.0	700	35.0	5.00%	3.35	3.48	
		1.5	7520.0	7474.0	800	46.0	5.75%	3.60	3.71	
		2.0	7474.0	7456.6	840	17.4	2.07%	2.88	4.86	
					2640				22.13	
OS-B4	0.10	4.40	7605.0	7590.0	300	15.0	5.00%	0.50	10.08	Overland Flow
		1.5	7590.0	7520.0	1100	70.0	6.36%	3.78	4.85	
		*	7520.0	7466.0	2100	54.0	2.57%	3.03	11.56	Stream Calc's
					3500				26.48	
B		1.5	7520.0	7474.0	800	46.0	5.75%	3.60	3.71	
		2.0	7474.0	7456.6	840	17.4	2.07%	2.88	4.86	
					5140				8.57	


B
B3
OS-B4

HEC1 S/N: 1343001909 HMVersion: 6.33 Data File: C:\WINDOWS\TEMP\~vbh3C6A.TMP

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             MAY   1991                *
*           VERSION 4.0.1E              *
*                                       *
*  RUN DATE  04/17/2002  TIME  10:55:58 *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*         (916) 756-1104                *
*                                       *
*****************************************
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X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X               X
XXXXXXX  XXXX     X         XXXXX X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX          XXX
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::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
:::                                        :::
:::  Full Microcomputer Implementation    :::
:::              by                        :::
:::        Haestad Methods, Inc.           :::
:::                                        :::
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARE WAS CHANGED WITH REVISIONS DATED 26 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

HEC-1 INPUT PAGE

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

   1          ID  Oldborough Sub., 5 Yr. & 100 Yr. (Existing)
   2          IT       5                    300
   3          IO       5       0
   4          JR    PREC       1  0.6818
   5          KK  B3
   6          KM  Sub-Basins OS-B1, OS-B2 & B3
   7          KO                                  22
   8          BA  0.0819
   9          PB     4.4
  10          IN      15
  11          PC     0.0  0.0005  0.0015   0.003  0.0045   0.006   0.008    0.01   0.012  0.0143
  12          PC  0.0165  0.0188   0.021  0.0233  0.0255  0.0278   0.032   0.039   0.046   0.053
  13          PC    0.06   0.075     0.1     0.4     0.7   0.725    0.75   0.765    0.78    0.79
  14          PC     0.8    0.81    0.82   0.825    0.83   0.835    0.84   0.845    0.85   0.855
  15          PC    0.86  0.8638  0.8675  0.8713   0.875  0.8788  0.8825  0.8863    0.89  0.8938
  16          PC  0.8975  0.9013   0.905  0.9083  0.9115  0.9148   0.918   0.921   0.924   0.927
  17          PC    0.93  0.9325   0.935  0.9375    0.94  0.9425   0.945  0.9475    0.95  0.9525
  18          PC   0.955  0.9575    0.96  0.9625   0.965  0.9675    0.97  0.9725   0.975  0.9775
  19          PC    0.98  0.9813  0.9825  0.9838   0.985  0.9863  0.9875  0.9888    0.99  0.9913
  20          PC  0.9925  0.9938   0.995  0.9963  0.9975  0.9988     1.0     1.0     1.0     1.0
```

```
LS           61
UD  0.2213
KK  OS-B4
KM  Sub Basin OS-B4
KO                                  22
BA  0.1205
LS           61     5.0
UD  0.2648
KK  B
KM  Basin B
KO                                  22
HC     2
ZZ
```

Oldborough Sub., 5 Yr. & 100 Yr. (Existing)

*** ***

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 1.00	RATIO 2 0.68
HYDROGRAPH AT	B3	0.08	1	FLOW	51.	14.
				TIME	6.17	6.17
HYDROGRAPH AT	OS-B4	0.12	1	FLOW	82.	28.
				TIME	6.17	6.17
2 COMBINED AT	B	0.20	1	FLOW	133.	42.
				TIME	6.17	6.17

*** NORMAL END OF HEC-1 ***

PROPOSED CONDITIONS RUNOFF CALCULATIONS

RUNOFF COMPUTATIONS
RATIONAL METHOD

01013.WK4

OLDBOROUGH SUBDIVISION
ROLLER COASTER ROAD and HIGBY ROAD
EL PASO COUNTY, COLORADO

LEIGH WHITEHEAD & ASSOCIATES,INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

FUTURE CONDITIONS

LWA # 01013.63

12-Feb-2003

BASIN	AREA	SOIL TYPE	C 5 / C 100	GEOMETRY LENGTH / SLOPE	GEOMETRY HEIGHT	Tt 5 / Tt 100	V / Tt	tc 5 / tc 100	i 5 / i 100	Q5	Q100	COMMENTS
OS-A1	10.10	B	0.25	1000.0	42.0	31.30	2.12	32.48	2.21	5.6		
		93	0.35	4.20		27.62	1.18	28.80	4.15		14.7	
OS-A2	1.47	B	0.25	580.0	41.0	20.08		20.08	2.91	1.1		
		93	0.35	7.07		17.71		17.71	5.42		2.8	
A3	14.24	B	0.30	300.0	13.0	15.97	5.25	18.56	3.03	12.9		
		68 / 93	0.40	4.33		13.97	2.59	16.56	5.61		32.0	
A	25.81	B	0.28	1000.0	42.0	30.20	Varies	35.03	2.11	15.3		
		68 / 93	0.38	4.20		26.52	4.83	31.35	3.95		38.7	
OS-B1	13.77	B	0.25	1000.0	40.0	31.81	3.35	33.80	2.16	7.4		
		68	0.35	4.00		28.07	1.99	30.06	4.05		19.5	
OS-B2	18.37	B	0.25	1000.0	50.0	29.55	3.60	33.26	2.18	10.0		
		68	0.35	5.00		26.08	3.71	29.79	4.07		26.2	
B3	9.85	B	0.30	300.0	23.5	13.14	4.35	16.05	3.26	9.6		
		68	0.40	7.83		11.49	2.91	14.40	6.01		23.7	
DP-1	23.62	B	0.27	1000.0	40.0	31.06	Varies	33.44	2.17	13.9		OS-B1 & B3
		68	0.37	4.00		27.32	2.38	29.70	4.07		35.6	
B4	2.81	B	0.30	300.0	22.0	13.43	4.20	14.78	3.40	2.9		
		68	0.40	7.33		11.75	1.35	13.10	6.28		7.1	
B5	7.50	B	0.30	300.0	13.0	15.97	Varies	19.44	2.96	6.7		
		68	0.40	4.33		13.97	3.47	17.44	5.47		16.4	
OS-B1 - B5	52.30	B	0.27	1000.0	50.0	28.86	Varies	37.34	2.03	28.7		OS-B1 Through B5
		68	0.37	5.00		25.38	8.48	33.86	3.77		72.9	
OS-B6	77.14	B	0.27	300.0	15.0	15.81	Varies	32.22	2.22	46.3		
		68	0.37	5.00		13.90	16.41	30.31	4.03		114.9	
B	129.44	B	0.27	1000.0	50.0	28.86	Varies	37.43	2.03	70.8		RATIONAL
		68	0.37	5.00		25.38	8.57	33.95	3.76		180.1	
B	0.2023	B						26.48 min.		48		SCS / HEC
	Sq. Miles	68						0.44 hrs.	L = 0.26 hrs		144	

RUNOFF COMPUTATIONS WEIGHTED RUNOFF COEFFICIENT (C)

01013.WK4

OLDBOROUGH SUBDIVISION
ROLLER COASTER ROAD and HIGBY ROAD
EL PASO COUNTY, COLORADO

LEIGH WHITEHEAD & ASSOCIATES, INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

FUTURE CONDITIONS

LWA # ^01013.63

12-Feb-2003

SHT. 1 of 1

Basin	Hydro Group	Area	Total Area	Percent Cover	"C5"	Wtd. "C5"	"C100" "CN"	Wtd. "C100" Wtd. "CN"	Type Of Cover
A	B	14.24	25.81	55.17%	0.30	0.17	0.40	0.22	2.5 Acre tracts
	B	11.57	25.81	44.83%	0.25	0.11	0.35	0.16	Meadow / Pasture
		25.81		100.00%		0.28		0.38	
DP-1	B	9.36	23.13	40.47%	0.30	0.12	0.40	0.16	2.5 Acre tracts
	B	13.77	23.13	59.53%	0.25	0.15	0.35	0.21	Meadow / Pasture
		23.13		100.00%		0.27		0.37	
OS-B1 - B5	B	20.16	52.30	38.55%	0.30	0.12	0.40	0.15	2.5 Acre tracts
	B	32.14	52.30	61.45%	0.25	0.15	0.35	0.22	Meadow / Pasture
		52.30		100.00%		0.27		0.37	
OS-B6	B	2.96	77.14	3.84%	0.90	0.03	0.95	0.04	Existing Structures / Roads
	B	74.18	77.14	96.16%	0.25	0.24	0.35	0.34	Meadow / Pasture
		77.14		100.00%		0.27		0.37	
B	B	2.96	129.44	2.29%	0.90	0.02	0.95	0.02	Existing Structures / Roads
	B	20.16	129.44	15.57%	0.30	0.05	0.40	0.06	2.5 Acre tracts
	B	106.32	129.44	82.14%	0.25	0.21	0.35	0.29	Meadow / Pasture
		129.44		100.00%		0.27		0.37	

RUNOFF COMPUTATIONS
TRAVEL TIME CALCULATIONS

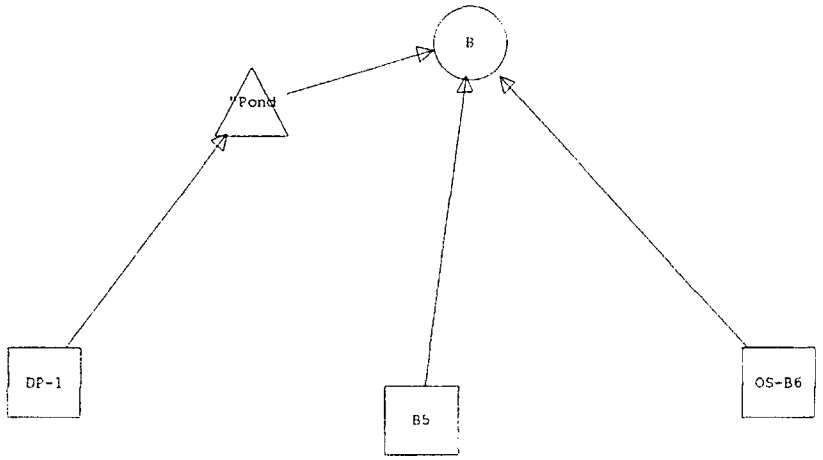
OLDBOROUGH SUBDIVISION
ROLLER COASTER ROAD and HIGBY ROAD
EL PASO COUNTY, COLORADO

01013.WK4

LEIGH WHITEHEAD & ASSOCIATES,INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

FUTURE CONDITIONS LWA # 01013.63 SHT. 1 of 1

BASIN	"n"	"K"	HIGH ELEV.	LOW ELEV.	LENGTH	HEIGHT	SLOPE	" V "	" TT " (min.)	COMMENTS
OS-A1		1.5	7528.0	7525.0	150	3.0	2.00%	2.12	1.18	
A3		2.0	7517.0	7460.9	815	56.1	6.88%	5.25	2.59	
A		1.5	7528.0	7525.0	150	3.0	2.00%	2.12	1.18	
		2.0	7525.0	7512.0	365	13.0	3.56%	3.77	1.61	
		2.0	7512.0	7460.9	675	51.1	7.57%	5.50	2.04	
					1190				4.83	
OS-B1		1.5	7520.0	7500.0	400	20.0	5.00%	3.35	1.99	
OS-B2		1.5	7520.0	7474.0	800	46.0	5.75%	3.60	3.71	
B3		2.0	7504.0	7468.0	760	36.0	4.74%	4.35	2.91	
DP-1	0.10	4.40	7560.0	7548.0	300	12.0	4.00%	0.45	11.03	Overland Flow
		1.5	7548.0	7520.0	700	28.0	4.00%	3.00	3.89	
		2.0	7520.0	7468.0	360	52.0	14.44%	7.60	0.79	
		2.0	7468.0	7462.0	280	6.0	2.14%	2.93	1.59	
					1640				17.30	
B4		2.0	7477.0	7462.0	340	15.0	4.41%	4.20	1.35	
B5		2.0	7498.0	7463.0	520	35.0	6.73%	5.19	1.67	
		2.0	7463.0	7456.6	310	6.4	2.06%	2.87	1.80	
					830				3.47	
OS-B1 - B5		1.5	7520.0	7474.0	800	46.0	5.75%	3.60	3.71	
		2.0	7474.0	7456.6	830	17.4	2.10%	2.90	4.78	
					1630				8.48	
OS-B6	0.10	4.40	7605.0	7590.0	300	15.0	5.00%	0.50	10.08	Overland Flow
		1.5	7590.0	7520.0	1100	70.0	6.36%	3.78	4.85	
		*	7520.0	7466.0	2100	54.0	2.57%	3.03	11.56	Stream Calc's
					3500				26.48	
B		1.5	7520.0	7474.0	800	46.0	5.75%	3.60	3.71	
		2.0	7474.0	7456.6	840	17.4	2.07%	2.88	4.86	
					1640				8.57	


B
Pond
DP-1
B5
OS-B6

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HEC1 S/N: 1343001909 HMVersion: 6.33 Data File: C:\WINDOWS\TEMP\~vbh1B10.TMP

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*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              MAY   1991               *
*            VERSION 4.0.1E             *
*                                       *
*  RUN DATE  05/13/2002  TIME  15:52:24 *
*                                       *
*****************************************
```


U.S. ARMY CORPS OF ENGINEERS
HYDROLOGIC ENGINEERING CENTER
609 SECOND STREET
DAVIS, CALIFORNIA 95616
(916) 756-1104


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X     X  XXXXXXX   XXXXX           X
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X     X  X       X               X
XXXXXXX  XXXX    X         XXXXX X
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X     X  X       X     X         X
X     X  XXXXXXX   XXXXX         XXX
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:::                                      :::
:::  Full Microcomputer Implementation   :::
:::               by                     :::
:::        Haestad Methods, Inc.         :::
:::                                      :::
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
```


37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STR
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERS
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

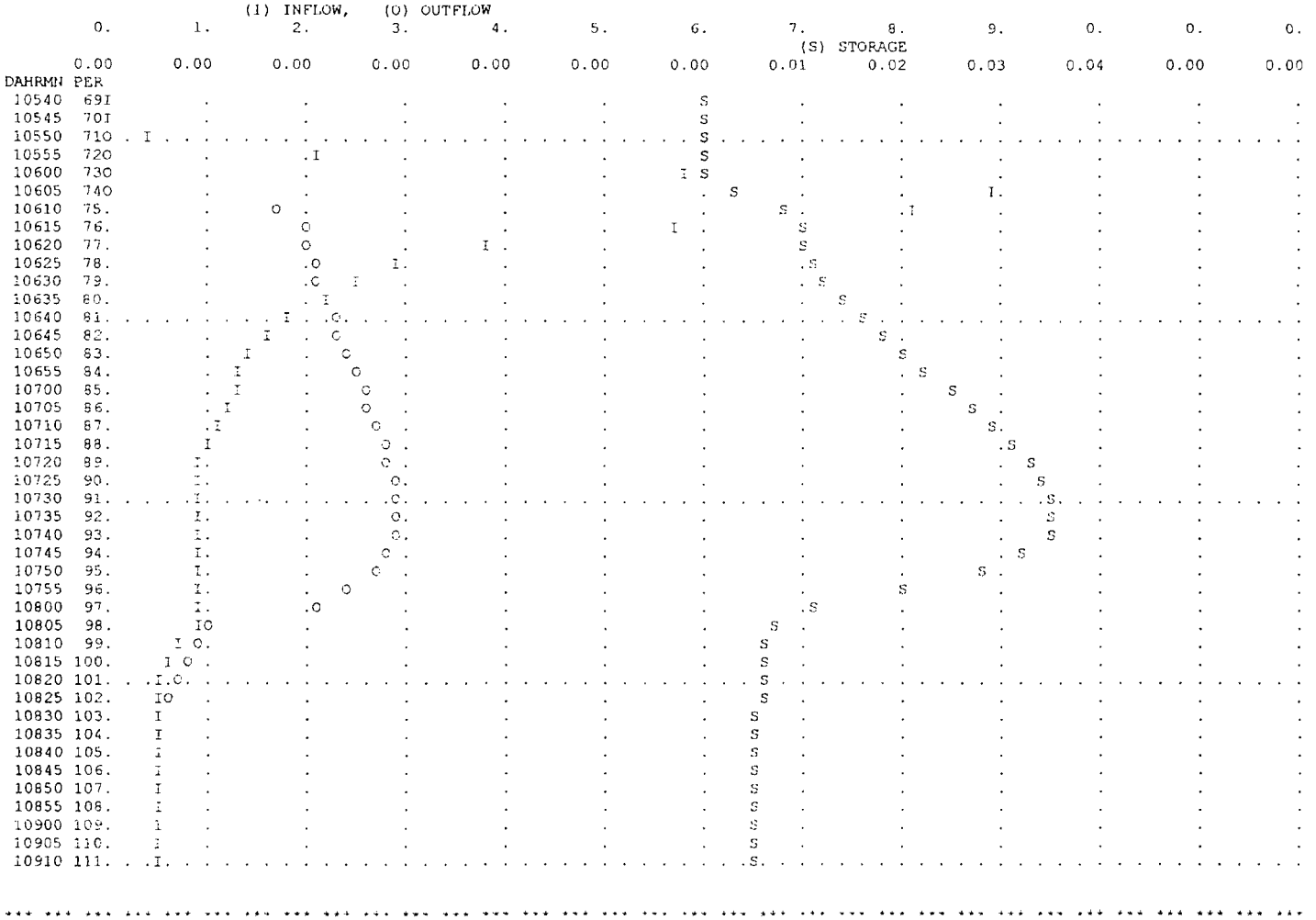
C:\HAESTAD\GHEC1\SAMPLE\01013PRO.OUT

HEC-1 INPUT

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

    1         ID  Oldborough Sub., 5 Yr. & 100 Yr. (Proposed)
    2         IT       5                   300
    3         IO       5       2
    4         JR    PREC       1  0.6818
    5         KK  DP-1
    6         KM  Sub-Basins OS-B1 & B3
    7         KO                                    22
    8         BA  0.0369
    9         PB     4.4
   10         IN      15
   11         PC     0.0  0.0005  0.0015   0.003  0.0045   0.006   0.008    0.01   0.012  0.0143
   12         PC  0.0165  0.0188   0.021  0.0233  0.0255  0.0278   0.032   0.039   0.046   0.053
   13         PC    0.06   0.075     0.1     0.4     0.7   0.725    0.75   0.765    0.78    0.79
   14         PC     0.6    0.61    0.82   0.825    0.83   0.835    0.84   0.845    0.85   0.855
   15         PC    0.66  0.8638  0.8675  0.8713   0.875  0.8788  0.8825  0.8863    0.89  0.8938
   16         PC  0.8975  0.9013   0.905  0.9088  0.9115  0.9148   0.918   0.921   0.924   0.927
   17         PC    0.93  0.9325   0.935  0.9375    0.94  0.9425   0.945  0.9475    0.95  0.9525
   18         PC   0.955  0.9575    0.96  0.9625   0.965  0.9675    0.97  0.9725   0.975  0.9775
   19         PC    0.98  0.9813  0.9825  0.9838   0.985  0.9863  0.9875  0.9888    0.99  0.9913
   20         PC  0.9925  0.9938   0.995  0.9963  0.9975  0.9988     1.0     1.0     1.0     1.0
   21         LS           62.62
   22         UD  0.1730
   23         KK  "Pond
   24         KM  Sub-Basins OS-B1 & OS-B3
   25         KO                                    22
   26         RS       5    ELEV       0
   27         SV     0.0    0.05    0.46    1.05    1.83
   28         SE    7465    7466    7468    7470    7472
   29         SL  7465.4   0.545     0.6     0.5
   30         SS  7471.0      40     3.1     1.5
   31         KK  OS-B6
   32         KM  Sub Basin OS-B6
   33         KO                                    22
   34         BA  0.1205
   35         LS              61     5.0
   36         UD  0.2648
   37         KK  B5
   38         KM  Sub-Basins OS-B2, B4 &B5
   39         KO                                    22
   40         BA  0.0448
   41         LS           62.48
   42         UD  0.2213
   43         KK  B
   44         KM  Basin B
   45         KO                                    22
   46         HC       3
   47         ZZ
```

*** ***


(I) INFLOW, (O) OUTFLOW
(S) STORAGE
DAHRMN PER

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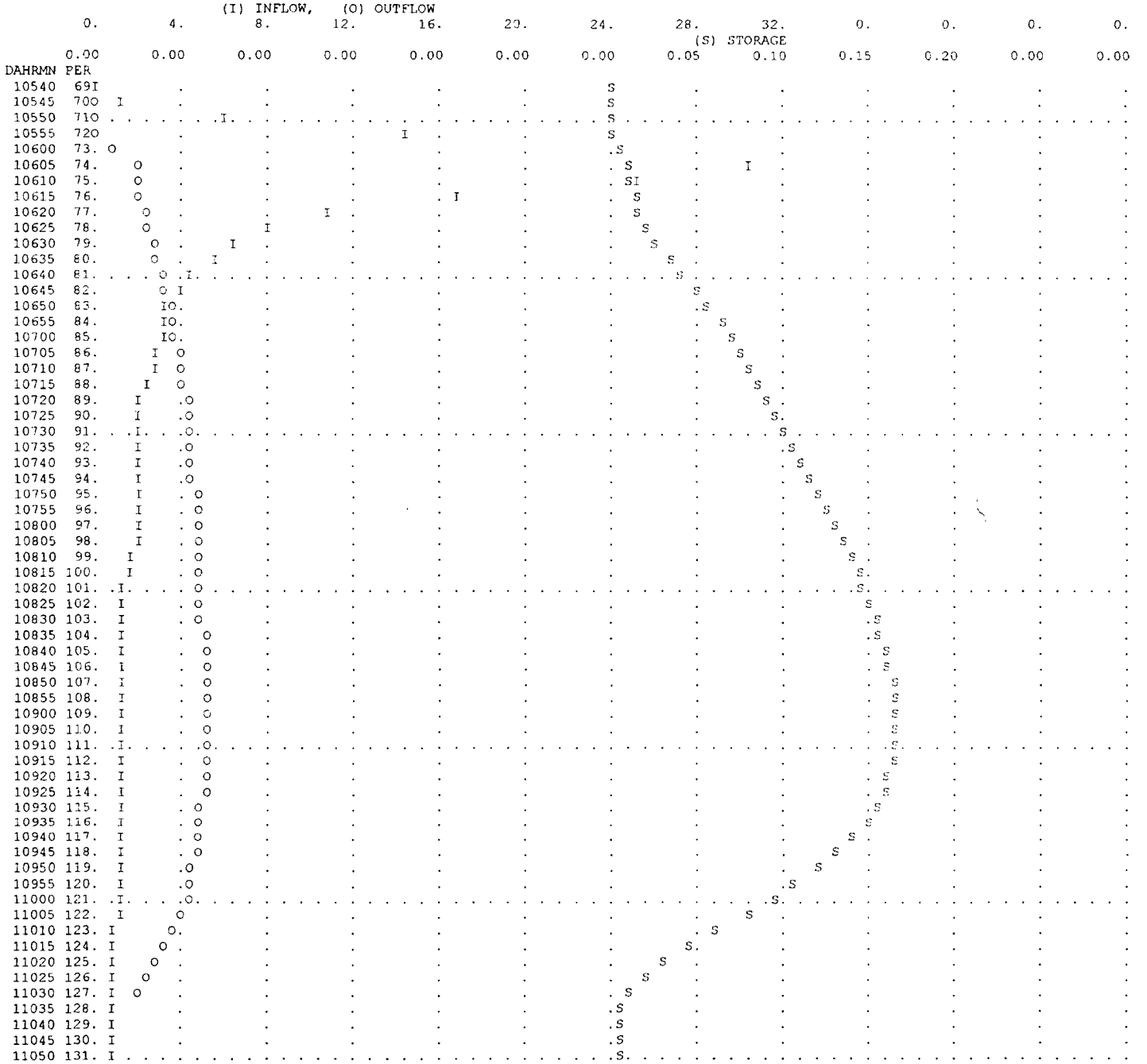
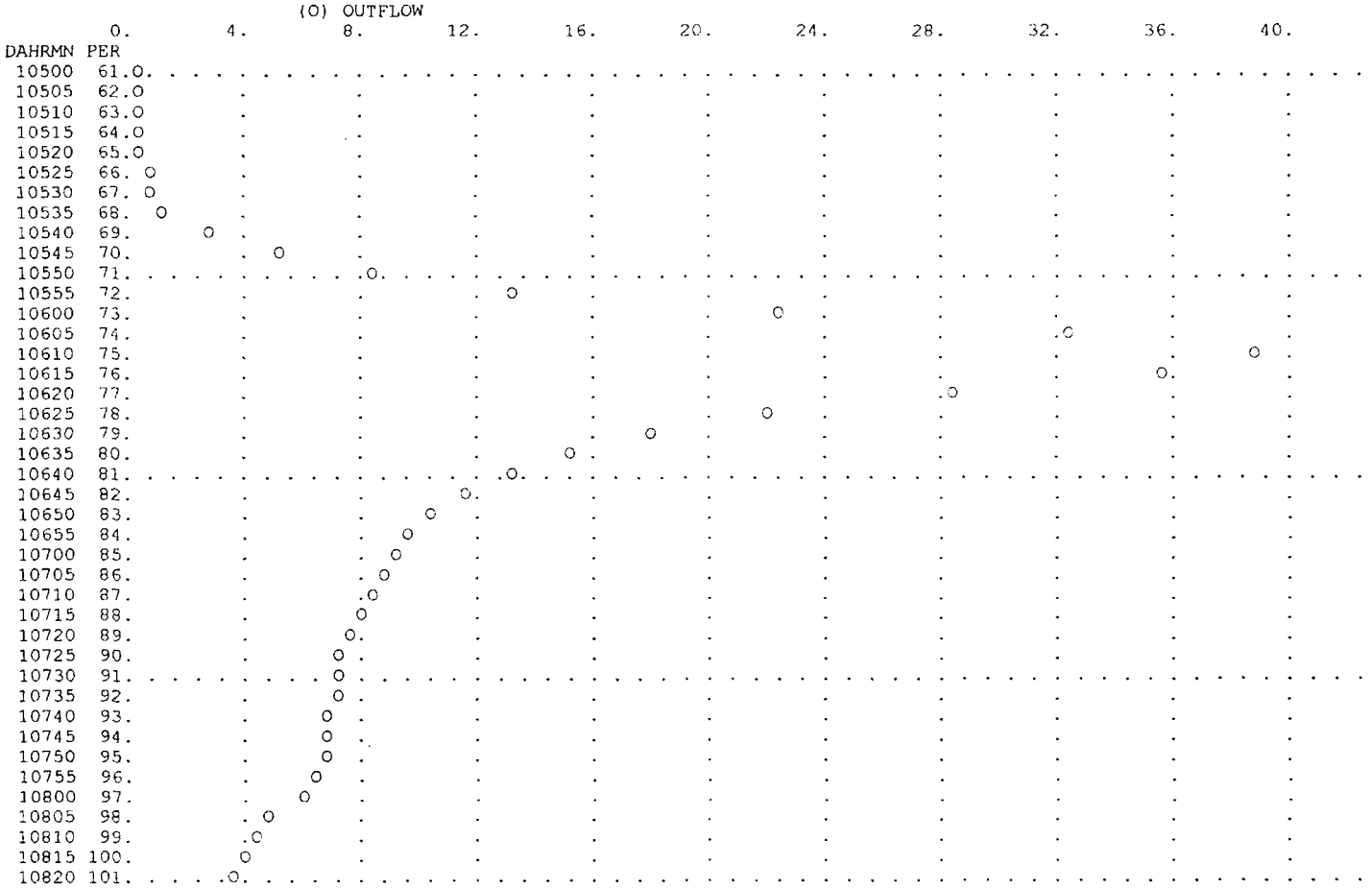
STATION "Pond




(O) OUTFLOW
0.
4.
8.
12.
16.
20.
24.
28.
32.
36.
40.
DAHRMN PER
10500 61.
10505 62.
10510 63.
10515 64.
10520 65.
10525 66.
10530 67.
10535 68.
10540 69.
10545 70.
10550 71.
10555 72.
10600 73.
10605 74.
10610 75.
10615 76.
10620 77.
10625 78.
10630 79.
10635 80.
10640 81.
10645 82.
10650 83.
10655 84.
10700 85.
10705 86.
10710 87.
10715 88.
10720 89.
10725 90.
10730 91.
10735 92.
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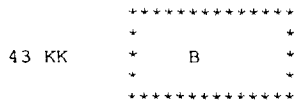
10750 95.
10755 96.
10800 97.
10805 98.
10810 99.
10815 100.
10820 101.



(O) OUTFLOW

DAHRMN	PER	0.	20.	40.	60.	80.	100.	120.	0.	0.	0.	0.
10500	610											
10505	620											
10510	630											
10515	640											
10520	650											
10525	660											
10530	67.0											
10535	68.0											
10540	69.	O										
10545	70.		O									
10550	71.			O								
10555	72.				O							
10600	73.					O						
10605	74.						O					
10610	75.							O				
10615	76.						O					
10620	77.					O						
10625	78.				O							
10630	79.				O							
10635	80.			O								
10640	81.			O								
10645	82.		O									
10650	83.		O									
10655	84.		O									
10700	85.		O									
10705	86.		O									
10710	87.		O									
10715	88.		O									
10720	89.		O									
10725	90.		O									
10730	91.		O									
10735	92.		O									
10740	93.		O									
10745	94.		O									
10750	95.		O									
10755	96.		O									
10800	97.		O									
10805	98.		O									
10810	99.		O									
10815	100.	O										
10820	101.	O										

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1	RATIO 2
					1.00	0.68
HYDROGRAPH AT	DP-1	0.04	1	FLOW	30.	9.
				TIME	6.08	6.08
ROUTED TO	"Pond	0.04	1	FLOW	5.	3.
				TIME	9.08	7.58
				** PEAK STAGES IN FEET **		
			1	STAGE	7469.26	7466.62
				TIME	9.08	7.58
HYDROGRAPH AT	OS-B6	0.12	1	FLOW	82.	28.
				TIME	6.17	6.17
HYDROGRAPH AT	B5	0.04	1	FLOW	31.	9.
				TIME	6.17	6.17
3 COMBINED AT	B	0.20	1	FLOW	115.	39.
				TIME	6.17	6.17

*** NORMAL END OF HEC-1 ***

DETENTION POND CALCULATIONS

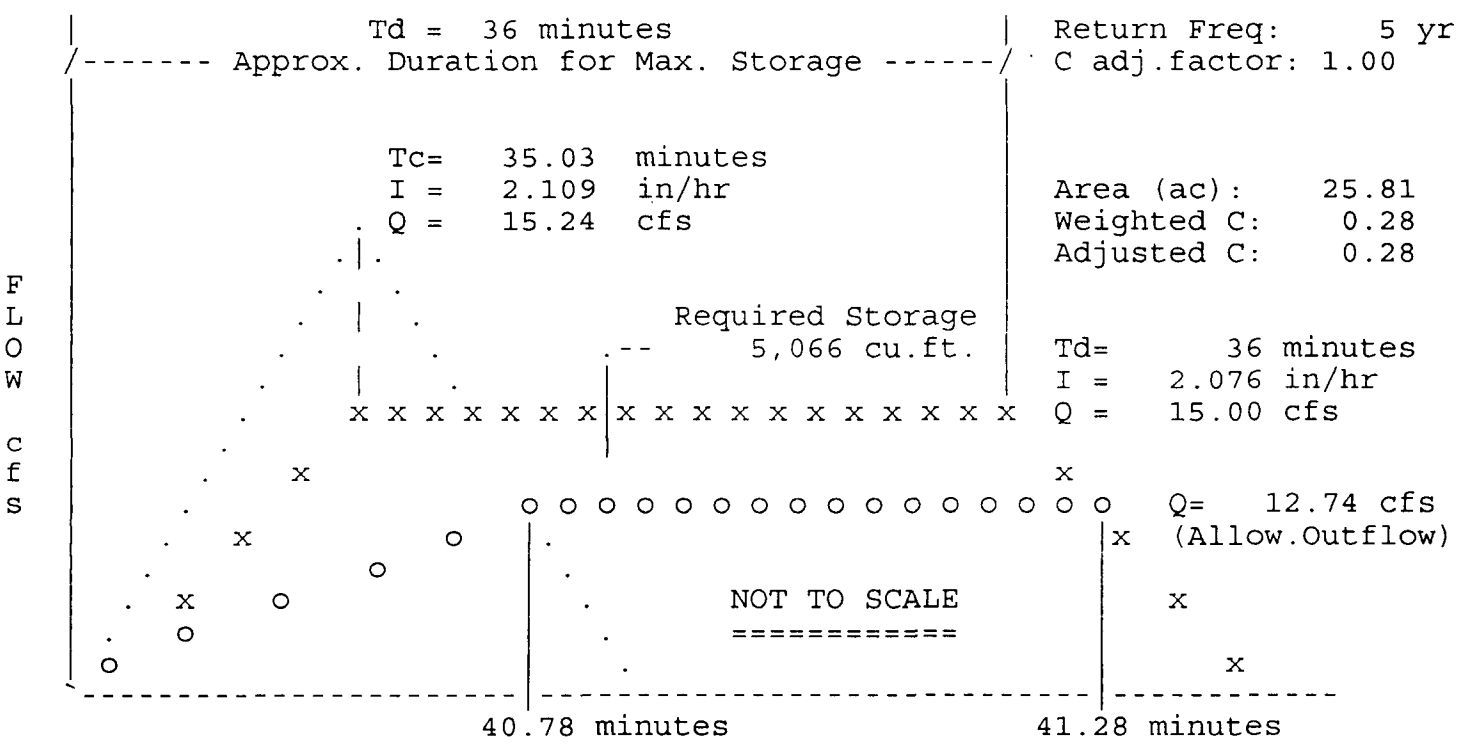
Quick TR-55 Ver.5.46 S/N:1803000009
Executed: 13:43:15 07-02-2003

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

Oldborough Subdivision
Roller Coaster Road and Higby Road
El Paso County, Colorado

RETURN FREQUENCY: 5 yr	Allowable Outflow: 12.74 cfs
'C' Adjustment: 1.000	Required Storage: 5,066 cu.ft.
Peak Inflow: 15.00 cfs	Inflow .HYD stored: 01013AV .HYD



****

Oldborough Subdivision
Roller Coaster Road & Higby Road
El Paso County, Colorado
Basin "A"

****

>>>>>> Structure No. 1 <<<<<<
(Input Data)

CULVERT-CR
Circular Culvert (With Inlet Control)

E1 elev.(ft)?	7461.32
E2 elev.(ft)?	7467.001
Diam. (ft)?	2.0
Inv. el.(ft)?	7461.32
Slope (ft/ft)?	0.077
T1 ratio?	
T2 ratio?	
K Coeff.?	0.0340
M Coeff.?	1.50
c Coeff.?	0.0553
Y Coeff.?	0.54
Form 1 or 2?	1
Slope factor?	-0.5

>>>>>> Structure No. 2 <<<<<<
(Input Data)

WEIR-XY
Weir - Defined by X, Y Coordinates
E1 (ft) =7467 E2 (ft) =7466

X dist.(ft)	Y elev.(ft)
0	7467
3	7466
26	7466
29	7467

****
*
* Oldborough Subdivision *
* Roller Coaster Road & Higby Road *
* El Paso County, Colorado *
*
*
****

Inflow Hydrograph: 01013AV .HYD
Rating Table file: 01013A .PND

----INITIAL CONDITIONS----
Elevation = 7461.32 ft
Outflow = 0.00 cfs
Storage = 0.00 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
7461.32	0.0	0.000	0.0	0.0
7461.52	0.4	0.000	0.5	0.9
7461.72	1.0	0.003	4.0	5.0
7461.92	1.9	0.009	13.5	15.4
7462.12	3.1	0.021	30.4	33.5
7462.32	4.4	0.034	49.5	53.9
7462.52	5.8	0.048	70.2	76.0
7462.72	7.2	0.064	92.6	99.8
7462.92	8.8	0.080	116.7	125.5
7463.12	10.5	0.098	142.6	153.1
7463.32	12.0	0.117	170.5	182.5
7463.52	13.5	0.138	200.3	213.8
7463.72	15.2	0.160	232.0	247.2
7463.92	16.6	0.183	265.9	282.5
7464.12	17.9	0.208	301.8	319.7
7464.32	18.9	0.234	340.0	358.9
7464.52	19.8	0.262	380.4	400.2
7464.72	20.7	0.291	423.0	443.7
7464.92	21.6	0.322	468.0	489.6
7465.12	22.3	0.355	515.3	537.6
7465.32	23.1	0.389	565.2	588.3
7465.52	23.9	0.425	617.6	641.5
7465.72	24.6	0.463	672.5	697.1
7465.92	25.4	0.503	730.1	755.5
7466.12	34.1	0.544	790.4	824.5
7466.32	64.5	0.588	853.8	918.3
7466.52	111.0	0.634	920.2	1031.2
7466.72	172.9	0.682	989.5	1162.4
7466.92	250.6	0.732	1062.2	1312.8
7467.00	28.9	0.752	1092.2	1121.1

Time increment (t) = 0.017 hrs.

Pond File: 01013A .PND
Inflow Hydrograph: 01013AV .HYD
Outflow Hydrograph: 01013AVO.HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	7461.32
0.017	0.01	0.0	0.0	0.0	0.00	7461.32
0.033	0.45	0.5	0.1	0.5	0.20	7461.42
0.050	0.88	1.3	0.4	1.4	0.47	7461.54
0.067	1.32	2.2	1.3	2.6	0.65	7461.60
0.083	1.75	3.1	2.6	4.4	0.91	7461.69
0.100	2.19	3.9	4.3	6.5	1.13	7461.75
0.117	2.62	4.8	6.4	9.1	1.35	7461.80
0.133	3.06	5.7	8.8	12.0	1.61	7461.86
0.150	3.49	6.6	11.6	15.4	1.90	7461.92
0.167	3.93	7.4	14.7	19.0	2.14	7461.96
0.183	4.36	8.3	18.2	23.0	2.41	7462.00
0.200	4.80	9.2	22.0	27.4	2.69	7462.05
0.217	5.23	10.0	26.0	32.0	3.00	7462.10
0.233	5.67	10.9	30.3	36.9	3.32	7462.15
0.250	6.10	11.8	34.7	42.0	3.65	7462.20
0.267	6.54	12.6	39.4	47.4	3.99	7462.26
0.283	6.97	13.5	44.2	52.9	4.34	7462.31
0.300	7.41	14.4	49.2	58.6	4.70	7462.36
0.317	7.84	15.3	54.3	64.5	5.07	7462.42
0.333	8.28	16.1	59.6	70.5	5.45	7462.47
0.350	8.71	17.0	64.9	76.5	5.83	7462.52
0.367	9.15	17.9	70.3	82.7	6.20	7462.58
0.383	9.59	18.7	75.9	89.1	6.57	7462.63
0.400	10.02	19.6	81.7	95.6	6.95	7462.68
0.417	10.46	20.5	87.4	102.1	7.35	7462.74
0.433	10.89	21.4	93.3	108.8	7.76	7462.79
0.450	11.33	22.2	99.1	115.5	8.18	7462.84
0.467	11.76	23.1	105.0	122.2	8.60	7462.89
0.483	12.20	24.0	111.0	129.0	9.01	7462.95
0.500	12.63	24.8	116.9	135.8	9.43	7462.99
0.517	13.07	25.7	122.9	142.6	9.85	7463.04
0.533	13.50	26.6	128.9	149.5	10.28	7463.09
0.550	13.94	27.4	135.0	156.4	10.67	7463.14
0.567	14.37	28.3	141.3	163.4	11.02	7463.19
0.583	14.81	29.2	147.7	170.5	11.39	7463.24
0.600	15.30	30.1	154.3	177.8	11.76	7463.29
0.617	14.81	30.1	160.2	184.4	12.09	7463.33
0.633	14.37	29.2	164.7	189.4	12.33	7463.36
0.650	13.94	28.3	168.0	193.0	12.51	7463.39
0.667	13.50	27.4	170.2	195.5	12.62	7463.40
0.683	13.07	26.6	171.4	196.8	12.69	7463.41
0.700	12.63	25.7	171.7	197.1	12.70	7463.41
0.717	12.20	24.8	171.2	196.5	12.67	7463.41
0.733	11.76	24.0	169.9	195.2	12.61	7463.40

Pond File: 01013A .PND
Inflow Hydrograph: 01013AV .HYD
Outflow Hydrograph: 01013AVO.HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.750	11.33	23.1	168.0	193.0	12.51	7463.39
0.767	10.89	22.2	165.5	190.2	12.37	7463.37
0.783	10.46	21.4	162.4	186.8	12.21	7463.35
0.800	10.02	20.5	158.9	182.9	12.02	7463.32
0.817	9.59	19.6	154.9	178.5	11.80	7463.29
0.833	9.15	18.7	150.5	173.6	11.55	7463.26
0.850	8.71	17.9	145.8	168.4	11.28	7463.22
0.867	8.28	17.0	140.8	162.8	11.00	7463.19
0.884	7.84	16.1	135.6	156.9	10.70	7463.15
0.900	7.41	15.3	130.1	150.8	10.36	7463.10
0.917	6.97	14.4	124.5	144.5	9.97	7463.06
0.934	6.54	13.5	118.9	138.0	9.57	7463.01
0.950	6.10	12.6	113.2	131.5	9.17	7462.96
0.967	5.67	11.8	107.4	125.0	8.77	7462.92
0.984	5.23	10.9	101.6	118.3	8.35	7462.86
1.000	4.80	10.0	95.8	111.7	7.94	7462.81
1.017	4.36	9.2	89.9	104.9	7.52	7462.76
1.034	3.93	8.3	84.0	98.2	7.11	7462.71
1.050	3.49	7.4	78.0	91.4	6.71	7462.65
1.067	3.06	6.6	71.9	84.5	6.30	7462.59
1.084	2.62	5.7	65.8	77.6	5.89	7462.53
1.100	2.19	4.8	59.7	70.6	5.46	7462.47
1.117	1.75	3.9	53.6	63.6	5.02	7462.41
1.134	1.32	3.1	47.5	56.7	4.58	7462.35
1.150	0.88	2.2	41.5	49.7	4.14	7462.28
1.167	0.45	1.3	35.4	42.8	3.69	7462.21
1.184	0.01	0.5	29.4	35.9	3.25	7462.14
1.200	0.00	0.0	23.7	29.4	2.83	7462.07

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: 01013A .PND
Inflow Hydrograph: 01013AV .HYD
Outflow Hydrograph: 01013AVO.HYD

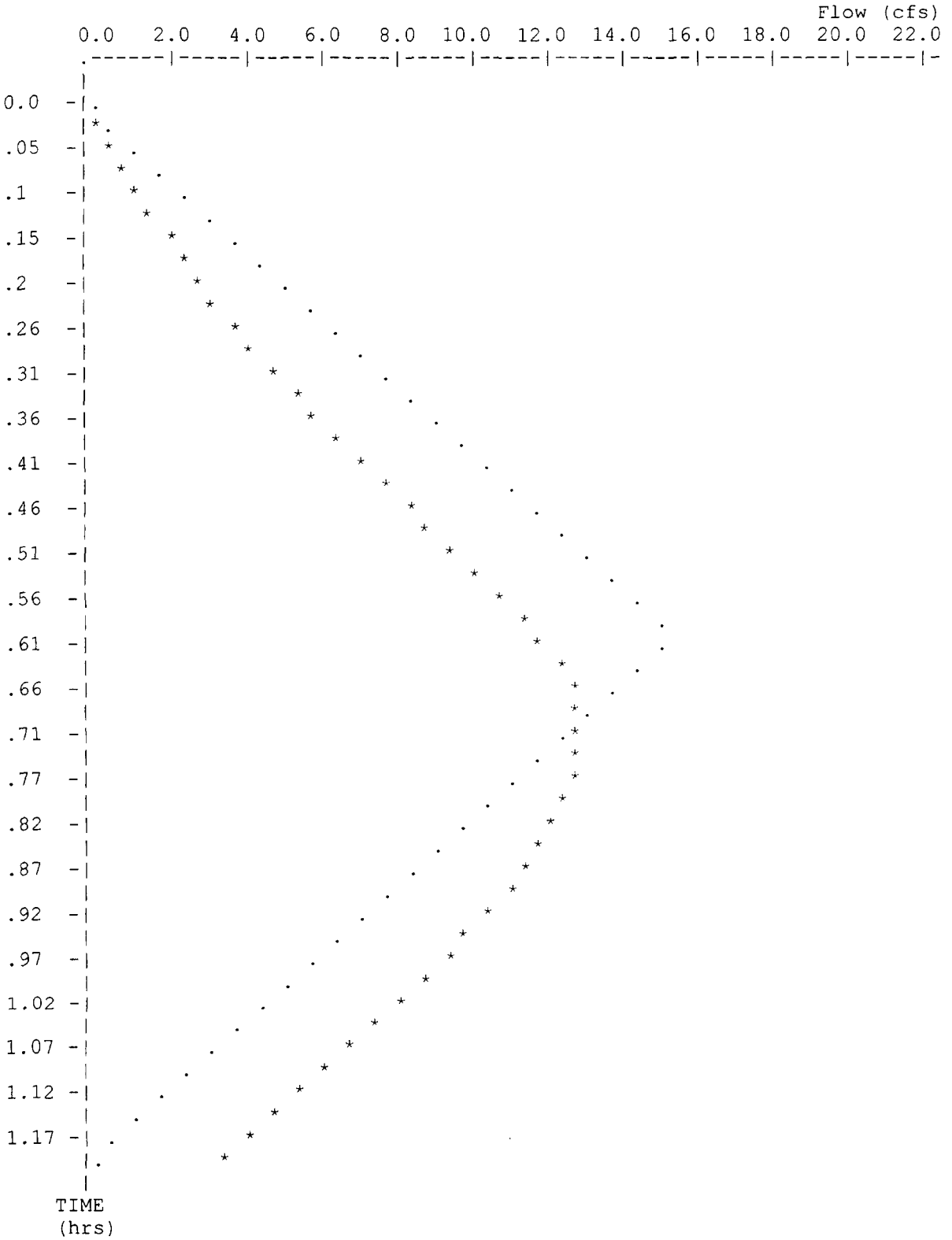
Starting Pond W.S. Elevation = 7461.32 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	15.30 cfs
Peak Outflow	=	12.70 cfs
Peak Elevation	=	7463.41 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0.00 ac-ft
Peak Storage From Storm	=	0.13 ac-ft
Total Storage in Pond	=	0.13 ac-ft



* File: 01013AVO.HYD Qmax = 12.7 cfs
. File: 01013AV .HYD Qmax = 15.3 cfs

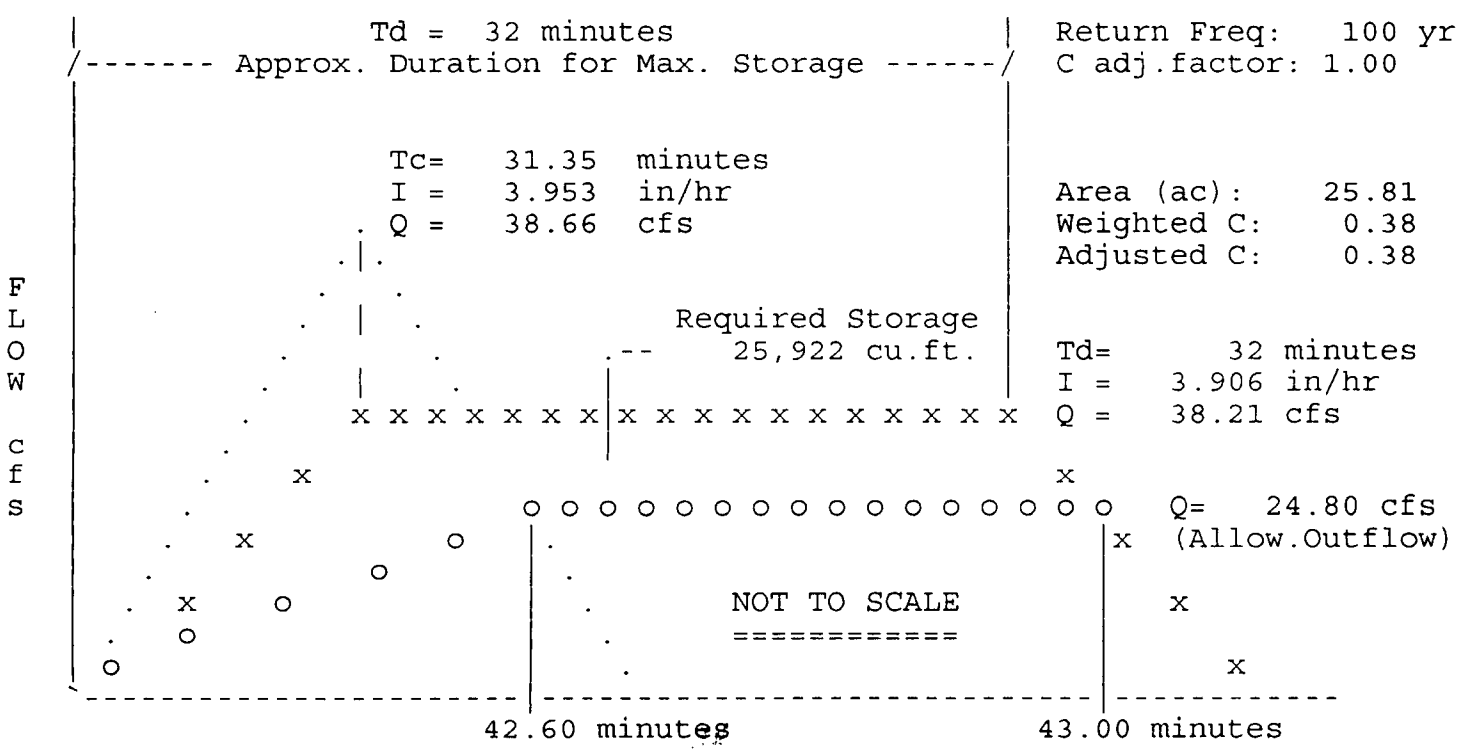
Quick TR-55 Ver.5.46 S/N:1803000009
Executed: 14:03:48 07-02-2003

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

Oldborough Subdivision
Roller Coaster Road and Higby Road
El Paso County, Colorado

RETURN FREQUENCY: 100 yr	Allowable Outflow: 24.80 cfs
'C' Adjustment: 1.000	Required Storage: 25,922 cu.ft.
Peak Inflow: 38.21 cfs	Inflow .HYD stored: 01013AC .HYD



****

Oldborough Subdivision
Roller Coaster Road & Higby Road
El Paso County, Colorado
Basin "A"

****

>>>>>> Structure No. 1 <<<<<<
(Input Data)

CULVERT-CR
Circular Culvert (With Inlet Control)

E1 elev.(ft)?	7461.32
E2 elev.(ft)?	7467.001
Diam. (ft)?	2.0
Inv. el.(ft)?	7461.32
Slope (ft/ft)?	0.077
T1 ratio?	
T2 ratio?	
K Coeff.?	0.0340
M Coeff.?	1.50
c Coeff.?	0.0553
Y Coeff.?	0.54
Form 1 or 2?	1
Slope factor?	-0.5

>>>>>> Structure No. 2 <<<<<<
(Input Data)

WEIR-XY
Weir - Defined by X, Y Coordinates
E1 (ft) =7467 E2 (ft) =7466

X dist.(ft)	Y elev.(ft)
0	7467
3	7466
26	7466
29	7467

****
*
* Oldborough Subdivision *
* Roller Coaster Road & Higby Road *
* El Paso County, Colorado *
*
*
****

Inflow Hydrograph: 01013AC .HYD
Rating Table file: 01013A .PND

----INITIAL CONDITIONS----
Elevation = 7461.32 ft
Outflow = 0.00 cfs
Storage = 0.00 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
7461.32	0.0	0.000	0.0	0.0
7461.52	0.4	0.000	0.5	0.9
7461.72	1.0	0.003	4.0	5.0
7461.92	1.9	0.009	13.5	15.4
7462.12	3.1	0.021	30.4	33.5
7462.32	4.4	0.034	49.5	53.9
7462.52	5.8	0.048	70.2	76.0
7462.72	7.2	0.064	92.6	99.8
7462.92	8.8	0.080	116.7	125.5
7463.12	10.5	0.098	142.6	153.1
7463.32	12.0	0.117	170.5	182.5
7463.52	13.5	0.138	200.3	213.8
7463.72	15.2	0.160	232.0	247.2
7463.92	16.6	0.183	265.9	282.5
7464.12	17.9	0.208	301.8	319.7
7464.32	18.9	0.234	340.0	358.9
7464.52	19.8	0.262	380.4	400.2
7464.72	20.7	0.291	423.0	443.7
7464.92	21.6	0.322	468.0	489.6
7465.12	22.3	0.355	515.3	537.6
7465.32	23.1	0.389	565.2	588.3
7465.52	23.9	0.425	617.6	641.5
7465.72	24.6	0.463	672.5	697.1
7465.92	25.4	0.503	730.1	755.5
7466.12	34.1	0.544	790.4	824.5
7466.32	64.5	0.588	853.8	918.3
7466.52	111.0	0.634	920.2	1031.2
7466.72	172.9	0.682	989.5	1162.4
7466.92	250.6	0.732	1062.2	1312.8
7467.00	28.9	0.752	1092.2	1121.1

Time increment (t) = 0.017 hrs.

Pond File: 01013A .PND
Inflow Hydrograph: 01013AC .HYD
Outflow Hydrograph: 01013ACO.HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	7461.32
0.017	0.44	0.4	0.1	0.4	0.19	7461.42
0.033	1.67	2.1	1.0	2.2	0.58	7461.58
0.050	2.90	4.6	3.5	5.6	1.05	7461.73
0.067	4.14	7.0	7.6	10.5	1.48	7461.83
0.083	5.37	9.5	13.1	17.1	2.01	7461.94
0.100	6.60	12.0	19.9	25.0	2.54	7462.03
0.117	7.84	14.4	28.1	34.4	3.16	7462.13
0.133	9.07	16.9	37.3	45.0	3.83	7462.23
0.150	10.30	19.4	47.5	56.7	4.58	7462.35
0.167	11.53	21.8	58.6	69.4	5.38	7462.46
0.183	12.77	24.3	70.5	82.9	6.21	7462.58
0.200	14.00	26.8	83.2	97.3	7.05	7462.70
0.217	15.23	29.2	96.4	112.4	7.98	7462.82
0.233	16.47	31.7	110.2	128.1	8.96	7462.94
0.250	17.70	34.2	124.4	144.4	9.96	7463.06
0.267	18.93	36.6	139.3	161.1	10.91	7463.17
0.283	20.17	39.1	154.8	178.4	11.79	7463.29
0.300	21.40	41.6	171.0	196.3	12.67	7463.41
0.317	22.63	44.0	187.9	215.0	13.57	7463.53
0.333	23.87	46.5	205.3	234.4	14.55	7463.64
0.350	25.10	49.0	223.3	254.3	15.48	7463.76
0.367	26.33	51.4	242.2	274.8	16.29	7463.88
0.383	27.57	53.9	261.9	296.1	17.07	7463.99
0.400	28.80	56.4	282.6	318.3	17.85	7464.11
0.417	30.03	58.8	304.5	341.4	18.45	7464.23
0.433	31.26	61.3	327.7	365.8	19.05	7464.35
0.450	32.50	63.8	352.2	391.5	19.61	7464.48
0.467	33.73	66.2	378.1	418.5	20.18	7464.60
0.483	34.96	68.7	405.3	446.8	20.76	7464.73
0.500	36.20	71.2	433.8	476.4	21.34	7464.86
0.517	37.43	73.6	463.7	507.4	21.86	7464.99
0.533	38.70	76.1	495.1	539.8	22.33	7465.13
0.550	37.43	76.1	525.6	571.3	22.83	7465.25
0.567	36.20	73.6	552.7	599.2	23.26	7465.36
0.583	34.96	71.2	576.6	623.9	23.63	7465.45
0.600	33.73	68.7	597.4	645.3	23.95	7465.53
0.617	32.50	66.2	615.3	663.6	24.18	7465.60
0.633	31.26	63.8	630.3	679.0	24.37	7465.66
0.650	30.03	61.3	642.5	691.6	24.53	7465.70
0.667	28.80	58.8	652.0	701.3	24.66	7465.73
0.683	27.57	56.4	658.9	708.4	24.75	7465.76
0.700	26.33	53.9	663.1	712.8	24.82	7465.77
0.717	25.10	51.4	664.9	714.6	24.84	7465.78
0.733	23.87	49.0	664.2	713.9	24.83	7465.78

Pond File: 01013A .PND
Inflow Hydrograph: 01013AC .HYD
Outflow Hydrograph: 01013ACO.HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.750	22.63	46.5	661.1	710.7	24.79	7465.77
0.767	21.40	44.0	655.7	705.2	24.71	7465.75
0.783	20.17	41.6	648.1	697.3	24.60	7465.72
0.800	18.93	39.1	638.3	687.2	24.48	7465.68
0.817	17.70	36.6	626.2	674.9	24.32	7465.64
0.833	16.47	34.2	612.1	660.4	24.14	7465.59
0.850	15.23	31.7	596.0	643.8	23.93	7465.53
0.867	14.00	29.2	577.9	625.2	23.66	7465.46
0.884	12.77	26.8	558.0	604.7	23.35	7465.38
0.900	11.53	24.3	536.3	582.3	23.01	7465.30
0.917	10.30	21.8	512.8	558.1	22.62	7465.20
0.934	9.07	19.4	487.8	532.2	22.22	7465.10
0.950	7.84	16.9	461.0	504.7	21.82	7464.98
0.967	6.60	14.4	432.8	475.5	21.32	7464.86
0.984	5.37	12.0	403.4	444.8	20.72	7464.72
1.000	4.14	9.5	372.7	412.9	20.06	7464.58
1.017	2.90	7.0	341.1	379.8	19.36	7464.42
1.034	1.67	4.6	308.5	345.6	18.56	7464.25
1.050	0.44	2.1	275.5	310.6	17.58	7464.07
1.067	0.00	0.4	243.2	275.9	16.34	7463.88

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: 01013A .PND
Inflow Hydrograph: 01013AC .HYD
Outflow Hydrograph: 01013ACO.HYD

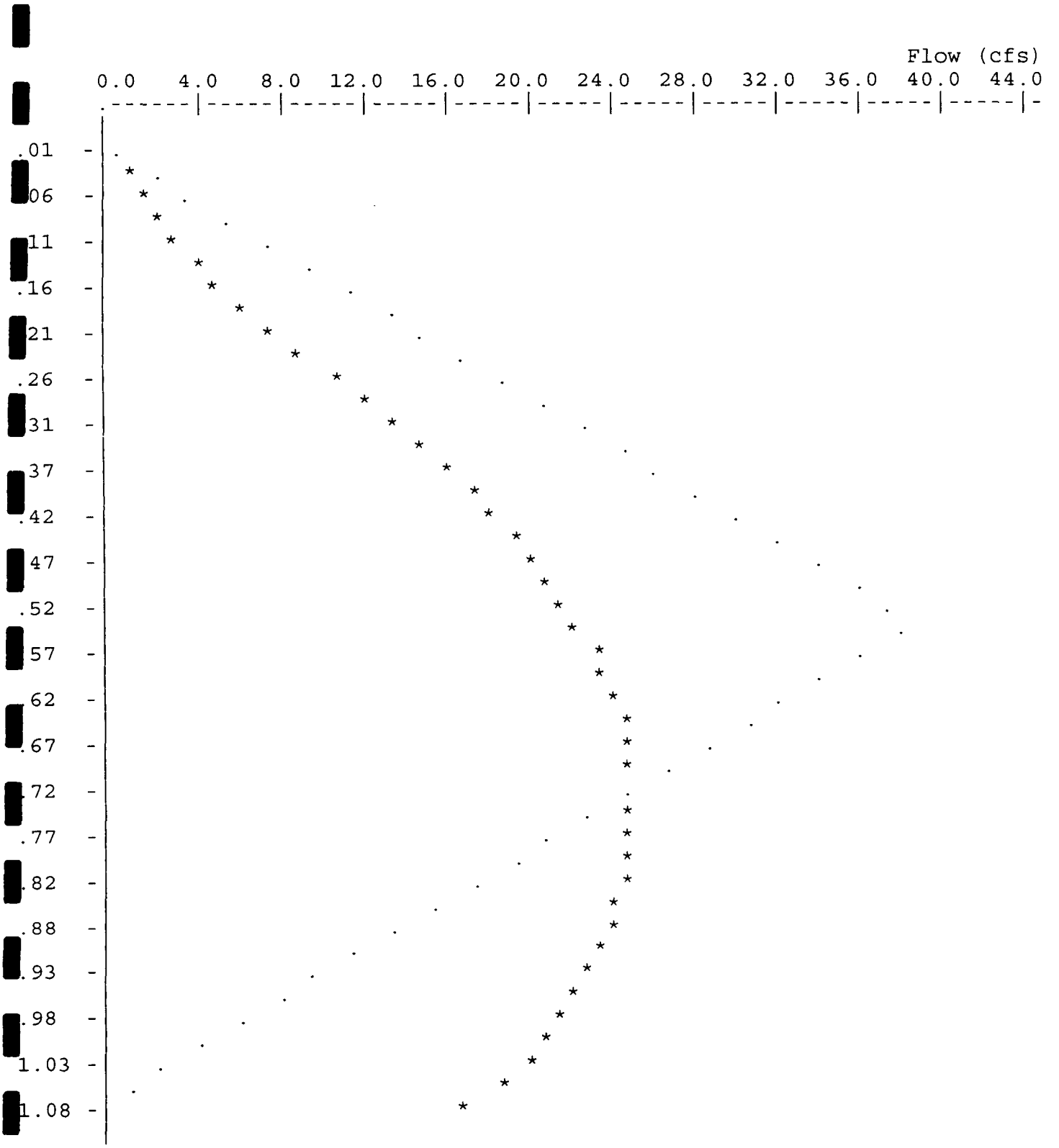
Starting Pond W.S. Elevation = 7461.32 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	38.70 cfs
Peak Outflow	=	24.84 cfs
Peak Elevation	=	7465.78 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0.00 ac-ft
Peak Storage From Storm	=	0.48 ac-ft
Total Storage in Pond	=	0.48 ac-ft


Flow (cfs)
0.0 4.0 8.0 12.0 16.0 20.0 24.0 28.0 32.0 36.0 40.0 44.0
.01
.06
.11
.16
.21
.26
.31
.37
.42
.47
.52
.57
.62
.67
.72
.77
.82
.88
.93
.98
1.03
1.08
TIME
(hrs)
* File: 01013ACO.HYD Qmax = 24.8 cfs
. File: 01013AC .HYD Qmax = 38.7 cfs

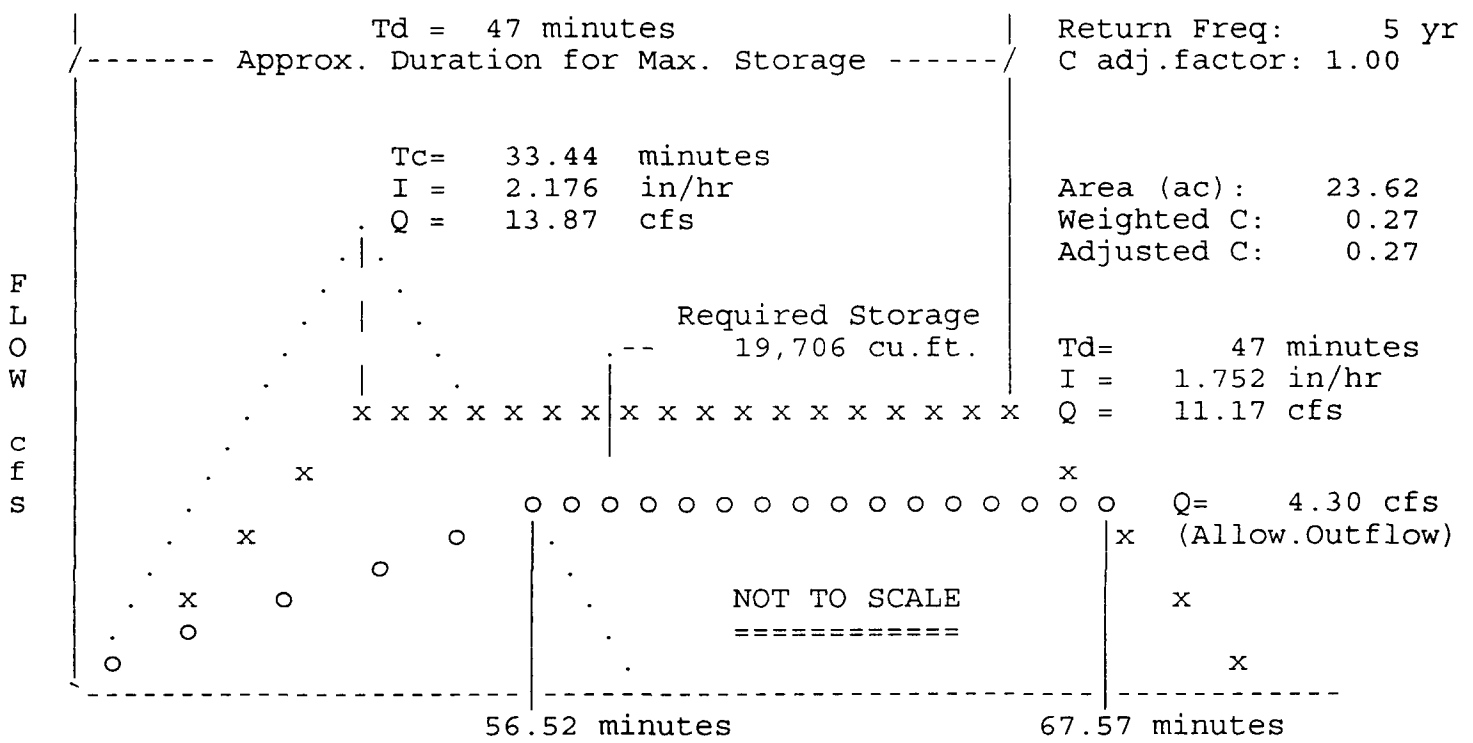
Quick TR-55 Ver.5.46 S/N:1803000009
Executed: 14:24:27 07-02-2003

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

Oldborough Subdivision
Roller Coaster Road and Higby Road
El Paso County, Colorado

RETURN FREQUENCY: 5 yr	Allowable Outflow: 4.30 cfs
'C' Adjustment: 1.000	Required Storage: 19,706 cu.ft.
Peak Inflow: 11.17 cfs	Inflow .HYD stored: 01013BV .HYD



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Oldborough Subdivision
Roller Coaster Road & Higby Road
El Paso County, Colorado
Basin "B"

****

SYSTEM CONNECTIVITY

****

Structure	No.	Q Table	Q Table
ORIFICE	1	->	1

>>>>>> Structure No. 1 <<<<<<
(Input Data)

ORIFICE
Orifice - Based on Area and Datum Elevation

E1 elev.(ft)? 7465.44
E2 elev.(ft)? 7472.001
Orifice coeff.? 0.67
Invert elev.(ft)? 7465.00
Datum elev.(ft) ? 7465.44
Orifice area (sq ft)? 0.545

Outlet Structure File: 01013B .STR
Outflow Rating Table for Structure #1
ORIFICE Orifice - Based on Area and Datum Elevation

C = .67 A = .545 sq.ft.
H (ft) = Table elev. - Datum elev. (7465.44 ft)
Q (cfs) = C * A * sqr(2g * H)

Oldborough Subdivision
Roller Coaster Road & Higby Road
El Paso County, Colorado

Inflow Hydrograph: 01013BV .HYD
Rating Table file: 01013B .PND

----INITIAL CONDITIONS----
Elevation = 7465.00 ft
Outflow = 0.00 cfs
Storage = 0.00 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
7465.00	0.0	0.000	0.0	0.0
7465.20	0.0	0.000	0.6	0.6
7465.40	0.0	0.003	5.0	5.0
7465.60	1.2	0.012	16.8	18.0
7465.80	1.8	0.027	39.8	41.6
7466.00	2.2	0.054	77.8	80.0
7466.20	2.6	0.087	126.1	128.7
7466.40	2.9	0.122	177.5	180.4
7466.60	3.2	0.160	232.5	235.7
7466.80	3.4	0.200	290.8	294.2
7467.00	3.7	0.243	352.8	356.5
7467.20	3.9	0.288	418.5	422.4
7467.40	4.1	0.336	487.9	492.0
7467.60	4.3	0.387	561.4	565.7
7467.80	4.5	0.440	638.7	643.2
7468.00	4.7	0.496	720.3	725.0
7468.20	4.9	0.555	805.3	810.2
7468.40	5.0	0.615	892.6	897.6
7468.60	5.2	0.677	982.8	988.0
7468.80	5.4	0.741	1075.4	1080.8
7469.00	5.5	0.807	1170.8	1176.3
7469.20	5.7	0.874	1269.0	1274.7
7469.40	5.8	0.944	1369.7	1375.5
7469.60	6.0	1.015	1473.5	1479.5
7469.80	6.1	1.088	1579.8	1585.9
7470.00	6.3	1.164	1689.2	1695.5
7470.20	6.4	1.241	1801.6	1808.0
7470.40	6.5	1.320	1916.6	1923.1
7470.60	6.7	1.402	2034.9	2041.6
7470.80	6.8	1.485	2156.0	2162.8
7471.00	6.9	1.571	2280.4	2287.3

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)
7471.20	7.0	1.659
7471.40	7.2	1.749
7471.60	7.3	1.841
7471.80	7.4	1.935
7472.00	7.5	2.032

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + O (cfs)
2408.0	2415.0
2538.4	2545.6
2672.3	2679.6
2809.1	2816.5
2949.5	2957.0

Time increment (t) = 0.017 hrs.

Pond File: 01013B .PND
Inflow Hydrograph: 01013BV .HYD
Outflow Hydrograph: 01013BVO.HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	7465.00
0.017	0.18	0.2	0.2	0.2	0.00	7465.06
0.033	0.60	0.8	1.0	1.0	0.00	7465.22
0.050	1.01	1.6	2.6	2.6	0.00	7465.29
0.067	1.43	2.4	5.0	5.0	0.00	7465.40
0.083	1.84	3.3	7.7	8.3	0.30	7465.45
0.100	2.26	4.1	10.5	11.8	0.63	7465.50
0.117	2.67	4.9	13.5	15.4	0.96	7465.56
0.133	3.09	5.8	16.8	19.3	1.23	7465.61
0.150	3.50	6.6	20.7	23.4	1.34	7465.65
0.167	3.92	7.4	25.2	28.2	1.46	7465.69
0.183	4.33	8.3	30.3	33.5	1.59	7465.73
0.200	4.75	9.1	35.9	39.4	1.74	7465.78
0.217	5.16	9.9	42.1	45.8	1.84	7465.82
0.233	5.58	10.7	49.0	52.9	1.92	7465.86
0.250	5.99	11.6	56.6	60.6	2.00	7465.90
0.267	6.41	12.4	64.8	69.0	2.09	7465.94
0.283	6.82	13.2	73.7	78.1	2.18	7465.99
0.300	7.24	14.1	83.2	87.8	2.26	7466.03
0.317	7.65	14.9	93.4	98.1	2.35	7466.07
0.333	8.07	15.7	104.3	109.1	2.44	7466.12
0.350	8.48	16.6	115.7	120.8	2.54	7466.17
0.367	8.90	17.4	127.9	133.1	2.63	7466.22
0.383	9.31	18.2	140.7	146.1	2.70	7466.27
0.400	9.73	19.0	154.2	159.7	2.78	7466.32
0.417	10.14	19.9	168.3	174.0	2.86	7466.38
0.433	10.55	20.7	183.1	189.0	2.95	7466.43
0.450	10.97	21.5	198.5	204.6	3.03	7466.49
0.467	11.38	22.4	214.7	220.9	3.12	7466.55
0.483	11.80	23.2	231.4	237.8	3.21	7466.61
0.500	12.21	24.0	248.9	255.4	3.27	7466.67
0.517	12.63	24.8	267.1	273.7	3.33	7466.73
0.533	13.04	25.7	286.0	292.7	3.40	7466.80
0.550	13.46	26.5	305.5	312.5	3.49	7466.86
0.567	13.90	27.4	325.7	332.8	3.59	7466.92
0.583	13.46	27.4	345.7	353.0	3.68	7466.99
0.600	13.04	26.5	364.7	372.2	3.75	7467.05
0.617	12.63	25.7	382.7	390.3	3.80	7467.10
0.633	12.21	24.8	399.9	407.6	3.85	7467.15
0.650	11.80	24.0	416.1	423.9	3.90	7467.20
0.667	11.38	23.2	431.3	439.2	3.95	7467.25
0.683	10.97	22.4	445.7	453.7	3.99	7467.29
0.700	10.55	21.5	459.2	467.2	4.03	7467.33
0.717	10.14	20.7	471.7	479.9	4.07	7467.37
0.733	9.73	19.9	483.4	491.6	4.10	7467.40

Pond File: 01013B .PND
Inflow Hydrograph: 01013BV .HYD
Outflow Hydrograph: 01013BVO.HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.750	9.31	19.0	494.2	502.5	4.13	7467.43
0.767	8.90	18.2	504.1	512.4	4.16	7467.46
0.783	8.48	17.4	513.1	521.5	4.18	7467.48
0.800	8.07	16.6	521.3	529.7	4.20	7467.50
0.817	7.65	15.7	528.5	537.0	4.22	7467.52
0.833	7.24	14.9	535.0	543.4	4.24	7467.54
0.850	6.82	14.1	540.5	549.0	4.25	7467.55
0.867	6.41	13.2	545.2	553.7	4.27	7467.57
0.884	5.99	12.4	549.0	557.6	4.28	7467.58
0.900	5.58	11.6	552.0	560.6	4.29	7467.59
0.917	5.16	10.7	554.2	562.8	4.29	7467.59
0.934	4.75	9.9	555.5	564.1	4.30	7467.60
0.950	4.33	9.1	556.0	564.6	4.30	7467.60
0.967	3.92	8.3	555.7	564.2	4.30	7467.60
0.984	3.50	7.4	554.5	563.1	4.29	7467.59
1.000	3.09	6.6	552.5	561.1	4.29	7467.59
1.017	2.67	5.8	549.7	558.3	4.28	7467.58
1.034	2.26	4.9	546.1	554.6	4.27	7467.57
1.050	1.84	4.1	541.7	550.2	4.26	7467.56
1.067	1.43	3.3	536.5	544.9	4.24	7467.54
1.084	1.01	2.4	530.4	538.9	4.23	7467.53
1.100	0.60	1.6	523.6	532.1	4.21	7467.51
1.117	0.18	0.8	516.0	524.4	4.19	7467.49
1.134	0.00	0.2	507.9	516.2	4.17	7467.47

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: 01013B .PND
Inflow Hydrograph: 01013BV .HYD
Outflow Hydrograph: 01013BVO.HYD

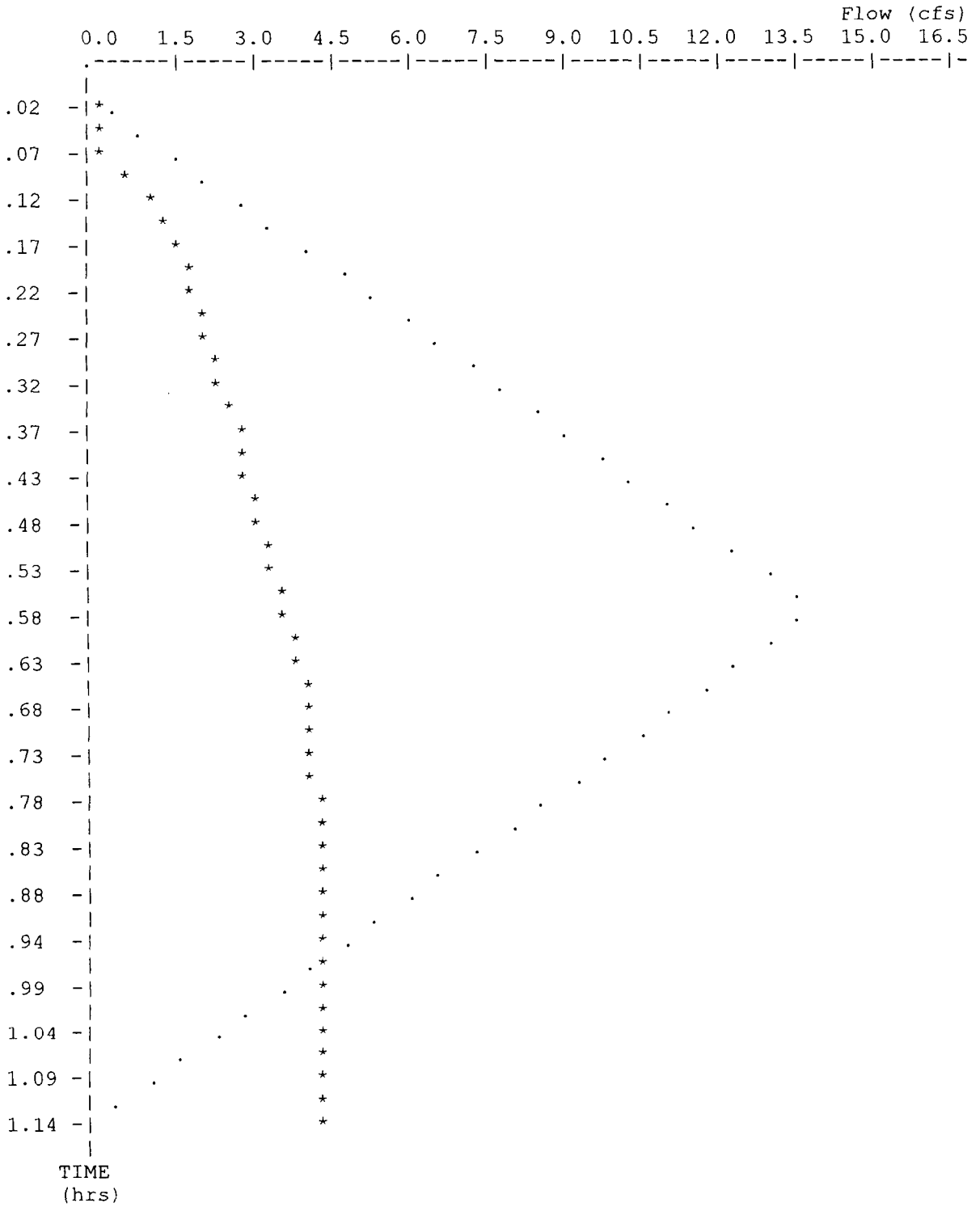
Starting Pond W.S. Elevation = 7465.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	13.90 cfs
Peak Outflow	=	4.30 cfs
Peak Elevation	=	7467.60 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0.00 ac-ft
Peak Storage From Storm	=	0.39 ac-ft
Total Storage in Pond	=	0.39 ac-ft



* File: 01013BVO.HYD Qmax = 4.3 cfs
. File: 01013BV .HYD Qmax = 13.9 cfs

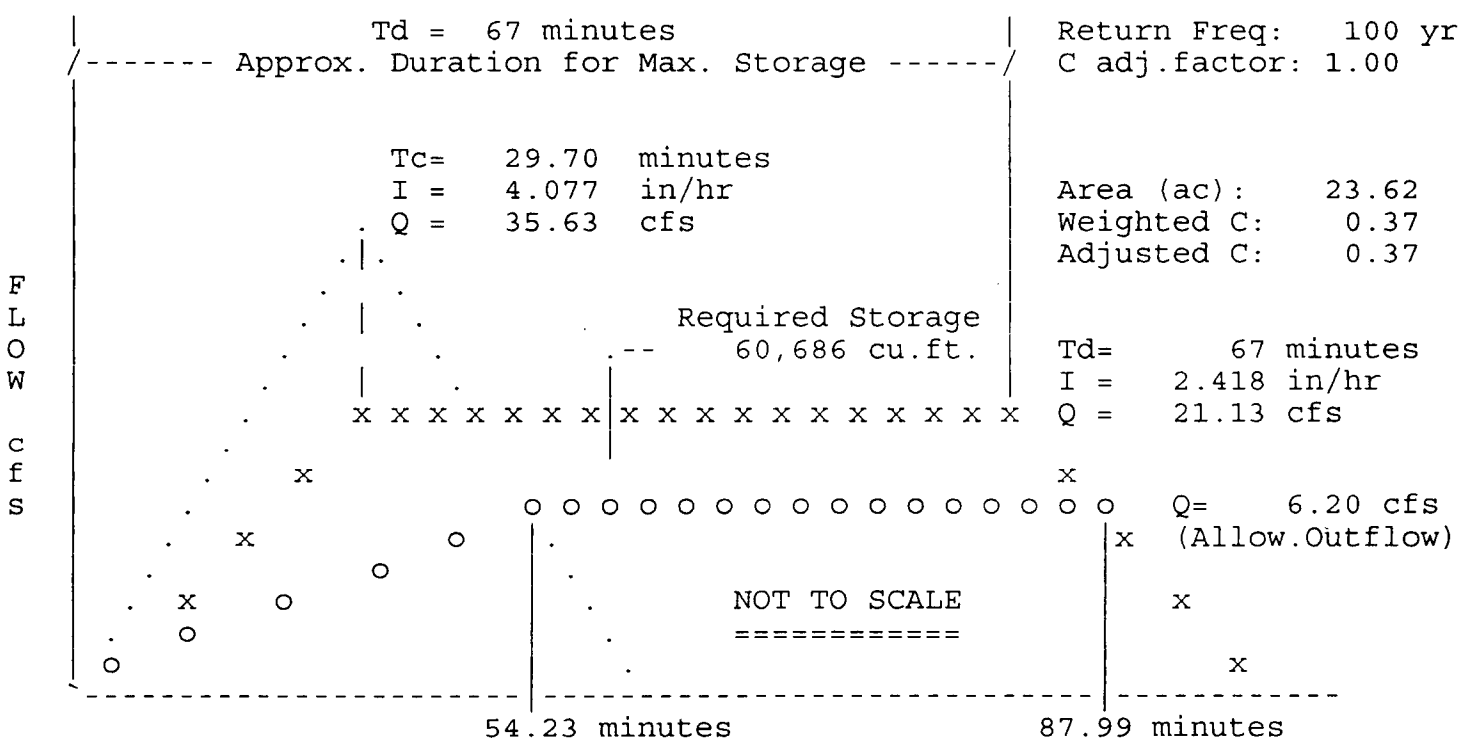
Quick TR-55 Ver.5.46 S/N:1803000009
Executed: 14:25:52 07-02-2003

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

Oldborough Subdivision
Roller Coaster Road and Higby Road
El Paso County, Colorado

RETURN FREQUENCY: 100 yr	Allowable Outflow: 6.20 cfs
'C' Adjustment: 1.000	Required Storage: 60,686 cu.ft.
Peak Inflow: 21.13 cfs	Inflow .HYD stored: 01013BC .HYD



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Oldborough Subdivision
Roller Coaster Road & Higby Road
El Paso County, Colorado
Basin "B"

****

SYSTEM CONNECTIVITY

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Structure	No.	Q Table	Q Table
ORIFICE	1	->	1

>>>>>> Structure No. 1 <<<<<<
(Input Data)

ORIFICE
Orifice - Based on Area and Datum Elevation

E1 elev.(ft)?	7465.44
E2 elev.(ft)?	7472.001
Orifice coeff.?	0.67
Invert elev.(ft)?	7465.00
Datum elev.(ft) ?	7465.44
Orifice area (sq ft)?	0.545

Outlet Structure File: 01013B .STR
Outflow Rating Table for Structure #1
ORIFICE Orifice - Based on Area and Datum Elevation

C = .67 A = .545 sq.ft.
H (ft) = Table elev. - Datum elev. (7465.44 ft)
Q (cfs) = C * A * sqr(2g * H)

****
*
* Oldborough Subdivision *
* Roller Coaster Road & Higby Road *
* El Paso County, Colorado *
*
*
****

Inflow Hydrograph: 01013BC .HYD
Rating Table file: 01013B .PND

----INITIAL CONDITIONS----
Elevation = 7465.00 ft
Outflow = 0.00 cfs
Storage = 0.00 ac-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)	2S/t (cfs)	2S/t + O (cfs)
7465.00	0.0	0.000	0.0	0.0
7465.20	0.0	0.000	0.6	0.6
7465.40	0.0	0.003	5.0	5.0
7465.60	1.2	0.012	16.8	18.0
7465.80	1.8	0.027	39.8	41.6
7466.00	2.2	0.054	77.8	80.0
7466.20	2.6	0.087	126.1	128.7
7466.40	2.9	0.122	177.5	180.4
7466.60	3.2	0.160	232.5	235.7
7466.80	3.4	0.200	290.8	294.2
7467.00	3.7	0.243	352.8	356.5
7467.20	3.9	0.288	418.5	422.4
7467.40	4.1	0.336	487.9	492.0
7467.60	4.3	0.387	561.4	565.7
7467.80	4.5	0.440	638.7	643.2
7468.00	4.7	0.496	720.3	725.0
7468.20	4.9	0.555	805.3	810.2
7468.40	5.0	0.615	892.6	897.6
7468.60	5.2	0.677	982.8	988.0
7468.80	5.4	0.741	1075.4	1080.8
7469.00	5.5	0.807	1170.8	1176.3
7469.20	5.7	0.874	1269.0	1274.7
7469.40	5.8	0.944	1369.7	1375.5
7469.60	6.0	1.015	1473.5	1479.5
7469.80	6.1	1.088	1579.8	1585.9
7470.00	6.3	1.164	1689.2	1695.5
7470.20	6.4	1.241	1801.6	1808.0
7470.40	6.5	1.320	1916.6	1923.1
7470.60	6.7	1.402	2034.9	2041.6
7470.80	6.8	1.485	2156.0	2162.8
7471.00	6.9	1.571	2280.4	2287.3

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (ac-ft)
7471.20	7.0	1.659
7471.40	7.2	1.749
7471.60	7.3	1.841
7471.80	7.4	1.935
7472.00	7.5	2.032

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + O (cfs)
2408.0	2415.0
2538.4	2545.6
2672.3	2679.6
2809.1	2816.5
2949.5	2957.0

Time increment (t) = 0.017 hrs.

Pond File: 01013B .PND
Inflow Hydrograph: 01013BC .HYD
Outflow Hydrograph: 01013BCO.HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.000	0.00	-----	0.0	0.0	0.00	7465.00
0.017	0.84	0.8	0.8	0.8	0.00	7465.21
0.033	2.04	2.9	3.7	3.7	0.00	7465.34
0.050	3.24	5.3	8.3	9.0	0.37	7465.46
0.067	4.44	7.7	13.9	15.9	1.01	7465.57
0.083	5.64	10.1	21.3	24.0	1.35	7465.65
0.100	6.84	12.5	30.6	33.8	1.60	7465.73
0.117	8.04	14.9	41.8	45.5	1.84	7465.82
0.133	9.24	17.3	55.1	59.1	1.98	7465.89
0.150	10.44	19.7	70.5	74.8	2.15	7465.97
0.167	11.64	22.1	88.0	92.6	2.30	7466.05
0.183	12.84	24.5	107.5	112.4	2.47	7466.13
0.200	14.04	26.9	129.1	134.4	2.63	7466.22
0.217	15.24	29.3	152.8	158.4	2.77	7466.31
0.233	16.44	31.7	178.7	184.5	2.92	7466.41
0.250	17.64	34.1	206.6	212.8	3.08	7466.52
0.267	18.83	36.5	236.6	243.1	3.23	7466.63
0.283	20.03	38.9	268.8	275.5	3.34	7466.74
0.300	21.23	41.3	303.1	310.1	3.48	7466.85
0.317	22.43	43.7	339.5	346.8	3.65	7466.97
0.333	23.63	46.1	378.0	385.5	3.79	7467.09
0.350	24.83	48.5	418.6	426.4	3.91	7467.21
0.367	26.03	50.9	461.4	469.5	4.04	7467.34
0.383	27.23	53.3	506.3	514.6	4.16	7467.46
0.400	28.43	55.7	553.4	562.0	4.29	7467.59
0.417	29.63	58.1	602.6	611.5	4.42	7467.72
0.433	30.83	60.5	654.0	663.1	4.55	7467.85
0.450	32.03	62.9	707.5	716.9	4.68	7467.98
0.467	33.23	65.3	763.1	772.8	4.81	7468.11
0.483	34.43	67.7	820.9	830.8	4.92	7468.25
0.500	35.60	70.0	881.0	891.0	4.99	7468.38
0.517	34.43	70.0	940.8	951.0	5.12	7468.52
0.533	33.23	67.7	998.0	1008.4	5.24	7468.64
0.550	32.03	65.3	1052.5	1063.2	5.36	7468.76
0.567	30.83	62.9	1104.5	1115.3	5.44	7468.87
0.583	29.63	60.5	1154.0	1164.9	5.49	7468.98
0.600	28.43	58.1	1200.9	1212.0	5.57	7469.07
0.617	27.23	55.7	1245.2	1256.5	5.66	7469.16
0.633	26.03	53.3	1287.0	1298.5	5.72	7469.25
0.650	24.83	50.9	1326.4	1337.9	5.76	7469.33
0.667	23.63	48.5	1363.2	1374.8	5.80	7469.40
0.683	22.43	46.1	1397.5	1409.3	5.86	7469.46
0.700	21.23	43.7	1429.4	1441.2	5.93	7469.53
0.717	20.03	41.3	1458.6	1470.6	5.98	7469.58
0.733	18.83	38.9	1485.5	1497.5	6.02	7469.63

Pond File: 01013B .PND
Inflow Hydrograph: 01013BC .HYD
Outflow Hydrograph: 01013BCO.HYD

INFLOW HYDROGRAPH		ROUTING COMPUTATIONS				
TIME (hrs)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
0.750	17.64	36.5	1509.9	1521.9	6.04	7469.68
0.767	16.44	34.1	1531.8	1543.9	6.06	7469.72
0.783	15.24	31.7	1551.3	1563.5	6.08	7469.76
0.800	14.04	29.3	1568.4	1580.6	6.10	7469.79
0.817	12.84	26.9	1583.1	1595.3	6.12	7469.82
0.833	11.64	24.5	1595.3	1607.6	6.14	7469.84
0.850	10.44	22.1	1605.0	1617.4	6.16	7469.86
0.867	9.24	19.7	1612.4	1624.7	6.17	7469.87
0.884	8.04	17.3	1617.3	1629.7	6.18	7469.88
0.900	6.84	14.9	1619.8	1632.2	6.18	7469.88
0.917	5.64	12.5	1619.9	1632.3	6.18	7469.88
0.934	4.44	10.1	1617.6	1630.0	6.18	7469.88
0.950	3.24	7.7	1613.0	1625.3	6.17	7469.87
0.967	2.04	5.3	1605.9	1618.3	6.16	7469.86
0.984	0.84	2.9	1596.5	1608.8	6.14	7469.84
1.000	0.00	0.8	1585.1	1597.4	6.12	7469.82

********** SUMMARY OF ROUTING COMPUTATIONS **********

Pond File: 01013B .PND
Inflow Hydrograph: 01013BC .HYD
Outflow Hydrograph: 01013BCO.HYD

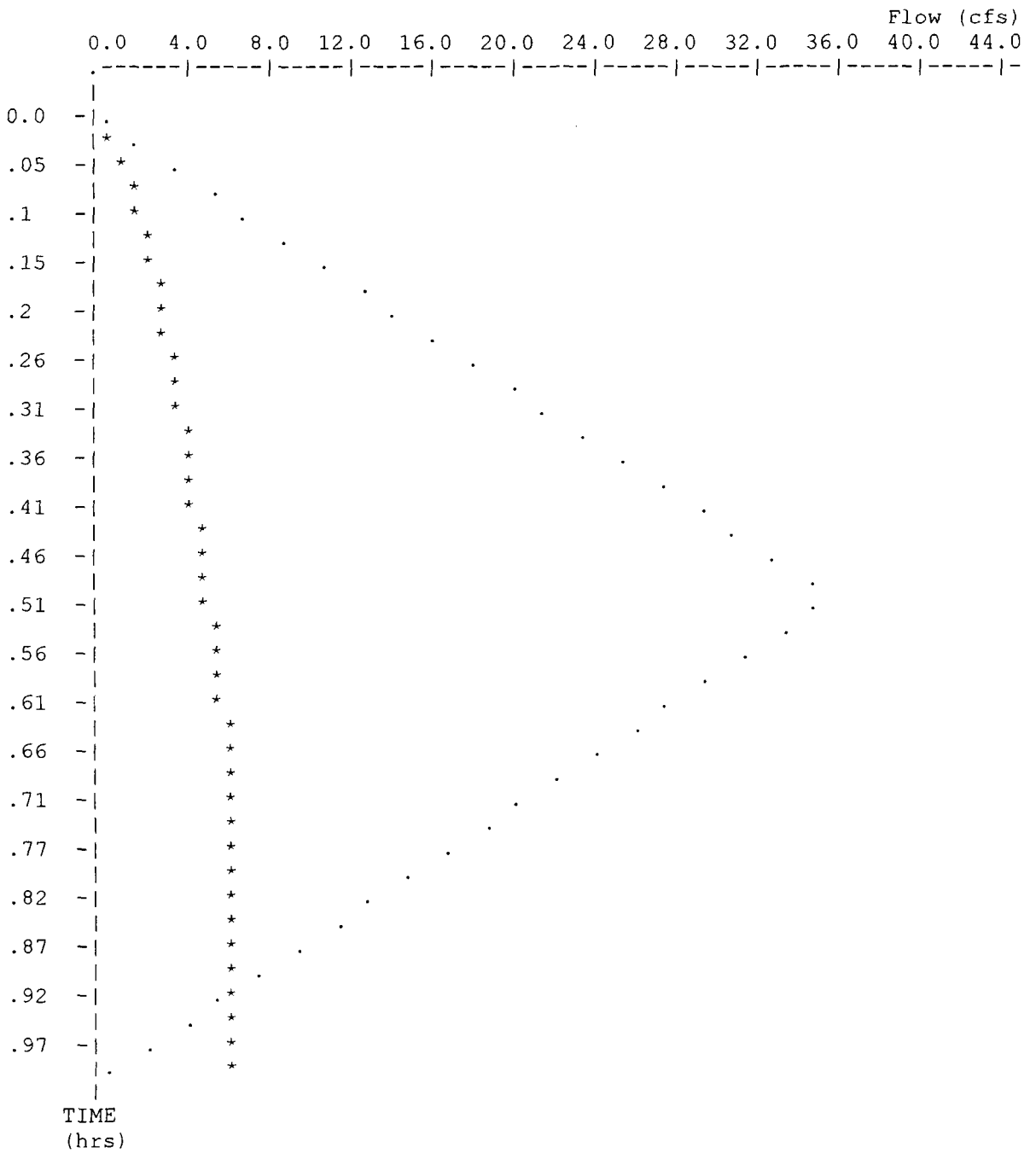
Starting Pond W.S. Elevation = 7465.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	35.60 cfs
Peak Outflow	=	6.18 cfs
Peak Elevation	=	7469.88 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0.00 ac-ft
Peak Storage From Storm	=	1.12 ac-ft
Total Storage in Pond	=	1.12 ac-ft



* File: 01013BCO.HYD Qmax = 6.2 cfs
. File: 01013BC .HYD Qmax = 35.6 cfs

CULVERT CALCULATIONS

5 YEAR

Culvert Designer/Analyzer Report
Existing 24" CMP @ Basin A (Existing)

Analysis Component			
Storm Event	Design	Discharge	13.20 cfs

Peak Discharge Method: User-Specified			
Design Discharge	13.20 cfs	Check Discharge	34.40 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-24 inch Circular	13.20 cfs	7,463.39 ft	10.14 ft/s
Weir	Roadway	0.00 cfs	7,463.39 ft	N/A
Total	----------	13.20 cfs	7,463.39 ft	N/A

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Culvert Designer/Analyzer Report
Existing 24" CMP @ Basin A (Existing)

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	7,463.39 ft	Discharge	13.20 cfs
Inlet Control HW Elev	7,463.15 ft	Tailwater Elevation	N/A ft
Outlet Control HW Elev	7,463.39 ft	Control Type	Outlet Control
Headwater Depth/ Height	1.20		

Grades			
Upstream Invert	7,461.00 ft	Downstream Invert	7,456.00 ft
Length	65.00 ft	Constructed Slope	0.076923 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	0.87 ft
Slope Type	Steep	Normal Depth	0.87 ft
Flow Regime	Supercritical	Critical Depth	1.31 ft
Velocity Downstream	10.14 ft/s	Critical Slope	0.019946 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	7,463.39 ft	Upstream Velocity Head	0.57 ft
Ke	0.90	Entrance Loss	0.51 ft

Inlet Control Properties			
Inlet Control HW Elev	7,463.15 ft	Flow Control	Unsubmerged
Inlet Type	Projecting	Area Full	3.1 ft²
K	0.03400	HDS 5 Chart	2
M	1.50000	HDS 5 Scale	3
C	0.05530	Equation Form	1
Y	0.54000		

Culvert Designer/Analyzer Report
Existing 24" CMP @ Basin A (Existing)

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.00	cfs	Allowable HW Elevation	7,463.39	ft
Roadway Width	24.00	ft	Overtopping Coefficient	2.90	US
Low Point	7,465.30	ft	Headwater Elevation	N/A	ft
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	-9,999.00	ft			

Sta (ft)	Elev (ft)
0.00	7,466.00
40.00	7,465.30
80.00	7,466.00

100 YEAR

Culvert Designer/Analyzer Report
Existing 24" CMP @ Basin A (Existing)

Analysis Component			
Storm Event	Check	Discharge	34.40 cfs

Peak Discharge Method: User-Specified			
Design Discharge	13.20 cfs	Check Discharge	34.40 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	1-24 inch Circular	25.53 cfs	7,465.65 ft	11.88 ft/s
Weir	Roadway	8.89 cfs	7,465.65 ft	N/A
Total	----------	34.42 cfs	7,465.65 ft	N/A

Culvert Designer/Analyzer Report
Existing 24" CMP @ Basin A (Existing)

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	7,465.65	ft	Discharge	25.53	cfs
Inlet Control HW Elev	7,465.65	ft	Tailwater Elevation	N/A	ft
Outlet Control HW Elev	7,464.99	ft	Control Type	Inlet Control	
Headwater Depth/ Height	2.33				

Grades					
Upstream Invert	7,461.00	ft	Downstream Invert	7,456.00	ft
Length	65.00	ft	Constructed Slope	0.076923	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.29	ft
Slope Type	Steep		Normal Depth	1.29	ft
Flow Regime	Supercritical		Critical Depth	1.77	ft
Velocity Downstream	11.88	ft/s	Critical Slope	0.038699	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	7,464.99	ft	Upstream Velocity Head	1.17	ft
Ke	0.90		Entrance Loss	1.05	ft

Inlet Control Properties					
Inlet Control HW Elev	7,465.65	ft	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	3.1	ft^2
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Designer/Analyzer Report
Existing 24" CMP @ Basin A (Existing)

Component:Weir

Hydraulic Component(s): Roadway			
Discharge	8.89 cfs	Allowable HW Elevation	7,465.65 ft
Roadway Width	24.00 ft	Overtopping Coefficient	2.95 US
Low Point	7,465.30 ft	Headwater Elevation	7,465.65 ft
Discharge Coefficient (Cr)	2.95	Submergence Factor (Kt)	1.00
Tailwater Elevation	-9,999.00 ft		

Sta (ft)	Elev (ft)
0.00	7,466.00
40.00	7,465.30
80.00	7,466.00

Culvert Designer/Analyzer Report
HW, Exist. 24" CMP @ Basin A (Proposed)

Peak Discharge Method: User-Specified			
Design Discharge	12.70 cfs	Check Discharge	23.90 cfs

Grades Model: Inverts			
Invert Upstream	7,461.00 ft	Invert Downstream	7,456.00 ft
Length	65.00 ft	Slope	0.076923 ft/ft
Drop	5.00 ft		

Headwater Model: Maximum Allowable HW	
Headwater Elevation	7,465.30 ft

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	7,456.00 ft

	Name	Desc	Discharge	HW Elev	Velocity
	Trial-1	1-24 inch Circular	12.70 cfs	7,463.33 ft	10.03 ft/s
x	Trial-2	1-24 inch Circular	23.90 cfs	7,465.20 ft	11.72 ft/s

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Culvert Designer/Analyzer Report
HW, Exist. 24" CMP @ Basin A (Proposed)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	7,465.30	ft	Storm Event	Design	
Computed Headwater Elevation	7,463.33	ft	Discharge	12.70	cfs
Headwater Depth/ Height	1.17		Tailwater Elevation	7,456.00	ft
Inlet Control HW Elev	7,463.09	ft	Control Type	Outlet Control	
Outlet Control HW Elev	7,463.33	ft			

Grades					
Upstream Invert	7,461.00	ft	Downstream Invert	7,456.00	ft
Length	65.00	ft	Constructed Slope	0.076923	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.85	ft
Slope Type	Steep		Normal Depth	0.85	ft
Flow Regime	Supercritical		Critical Depth	1.28	ft
Velocity Downstream	10.03	ft/s	Critical Slope	0.019545	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	7,463.33	ft	Upstream Velocity Head	0.55	ft
Ke	0.90		Entrance Loss	0.50	ft

Inlet Control Properties					
Inlet Control HW Elev	7,463.09	ft	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	3.1	ft²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Designer/Analyzer Report
HW, Exist. 24" CMP @ Basin A (Proposed)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	7,465.30	ft	Storm Event	Check	
Computed Headwater Elevation	7,465.20	ft	Discharge	23.90	cfs
Headwater Depth/ Height	2.10		Tailwater Elevation	7,456.00	ft
Inlet Control HW Elev	7,465.20	ft	Control Type	Inlet Control	
Outlet Control HW Elev	7,464.75	ft			

Grades					
Upstream Invert	7,461.00	ft	Downstream Invert	7,456.00	ft
Length	65.00	ft	Constructed Slope	0.076923	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.24	ft
Slope Type	Steep		Normal Depth	1.24	ft
Flow Regime	Supercritical		Critical Depth	1.73	ft
Velocity Downstream	11.72	ft/s	Critical Slope	0.034895	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	7,464.75	ft	Upstream Velocity Head	1.06	ft
Ke	0.90		Entrance Loss	0.96	ft

Inlet Control Properties					
Inlet Control HW Elev	7,465.20	ft	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	3.1	ft^2
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Designer/Analyzer Report
18" Culvert At Detention Pond In Basin B

Peak Discharge Method: User-Specified			
Design Discharge	4.30 cfs	Check Discharge	6.20 cfs

Grades Model: Inverts			
Invert Upstream	7,465.00 ft	Invert Downstream	7,464.00 ft
Length	72.00 ft	Slope	0.013889 ft/ft
Drop	1.00 ft		

Headwater Model: Maximum Allowable HW	
Headwater Elevation	7,472.00 ft

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	0.00 ft

	Name	Desc	Discharge	HW Elev	Velocity
	Trial-1	1-18 inch Circular	4.30 cfs	7,466.27 ft	6.37 ft/s
x	Trial-2	1-18 inch Circular	6.20 cfs	7,466.59 ft	7.01 ft/s

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Culvert Designer/Analyzer Report
18" Culvert At Detention Pond In Basin B

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	7,472.00	ft	Storm Event	Design	
Computed Headwater Elevation	7,466.27	ft	Discharge	4.30	cfs
Headwater Depth/ Height	0.85		Tailwater Elevation	0.00	ft
Inlet Control HW Elev	7,466.16	ft	Control Type	Outlet Control	
Outlet Control HW Elev	7,466.27	ft			

Grades					
Upstream Invert	7,465.00	ft	Downstream Invert	7,464.00	ft
Length	72.00	ft	Constructed Slope	0.013889	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.61	ft
Slope Type	Steep		Normal Depth	0.61	ft
Flow Regime	Supercritical		Critical Depth	0.80	ft
Velocity Downstream	6.37	ft/s	Critical Slope	0.005512	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.50	ft
Section Size	18 inch		Rise	1.50	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	7,466.27	ft	Upstream Velocity Head	0.32	ft
Ke	0.50		Entrance Loss	0.16	ft

Inlet Control Properties				
Inlet Control HW Elev	7,466.16 ft	Flow Control	Unsubmerged	
Inlet Type	Square edge w/headwall	Area Full	1.8	ft²
K	0.00980	HDS 5 Chart	1	
M	2.00000	HDS 5 Scale	1	
C	0.03980	Equation Form	1	
Y	0.67000			

Culvert Designer/Analyzer Report
18" Culvert At Detention Pond In Basin B

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	7,472.00	ft	Storm Event	Check	
Computed Headwater Elevation	7,466.59	ft	Discharge	6.20	cfs
Headwater Depth/ Height	1.06		Tailwater Elevation	0.00	ft
Inlet Control HW Elev	7,466.49	ft	Control Type	Outlet Control	
Outlet Control HW Elev	7,466.59	ft			

Grades					
Upstream Invert	7,465.00	ft	Downstream Invert	7,464.00	ft
Length	72.00	ft	Constructed Slope	0.013889	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.75	ft
Slope Type	Steep		Normal Depth	0.75	ft
Flow Regime	Supercritical		Critical Depth	0.96	ft
Velocity Downstream	7.01	ft/s	Critical Slope	0.006321	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.50	ft
Section Size	18 inch		Rise	1.50	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	7,466.59	ft	Upstream Velocity Head	0.42	ft
Ke	0.50		Entrance Loss	0.21	ft

Inlet Control Properties				
Inlet Control HW Elev	7,466.49 ft	Flow Control	Unsubmerged	
Inlet Type	Square edge w/headwall	Area Full	1.8	ft²
K	0.00980	HDS 5 Chart	1	
M	2.00000	HDS 5 Scale	1	
C	0.03980	Equation Form	1	
Y	0.67000			

AS DESIGNED

Culvert Designer/Analyzer Report

Required Culverts @ Low Point At Basin B

43.8 cfs

Peak Discharge Method: User-Specified			
Design Discharge	19.20 cfs	Check Discharge	43.80 cfs

Grades Model: Inverts			
Invert Upstream	7,454.39 ft	Invert Downstream	7,454.04 ft
Length	70.00 ft	Slope	0.005000 ft/ft
Drop	0.35 ft		

Headwater Model: Maximum Allowable HW	
Headwater Elevation	7,458.60 ft

Tailwater properties: Irregular Channel			
Slope	0.010000 ft/ft	Mannings Coefficient	0.035

Roughness Segments

Start Station (ft)	End Station (ft)	Mannings Coefficient
0.00	180.00	0.035

Natural Channel Points

Station (ft)	Elevation (ft)
0.00	7,460.00
15.00	7,458.00
35.00	7,456.00
95.00	7,454.00
140.00	7,456.00
170.00	7,458.00
180.00	7,460.00

Tailwater conditions for Design Storm.			
Discharge	19.20 cfs	Depth	0.62 ft
Velocity	1.93 ft/s		

Tailwater conditions for Check Storm.			
Discharge	43.80 cfs	Depth	0.84 ft
Velocity	2.38 ft/s		

	Name	Desc	Discharge	HW Elev	Velocity
	Trial-1	2-24 inch Circular	19.20 cfs	7,456.04 ft	5.66 ft/s
x	Trial-2	2-24 inch Circular	43.80 cfs	7,457.32 ft	7.81 ft/s

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Culvert Designer/Analyzer Report
Required Culverts @ Low Point At Basin B

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	7,458.60	ft	Storm Event	Design	
Computed Headwater Elevation	7,456.04	ft	Discharge	19.20	cfs
Headwater Depth/ Height	0.82		Tailwater Elevation	7,454.62	ft
Inlet Control HW Elev	7,455.98	ft	Control Type	Outlet Control	
Outlet Control HW Elev	7,456.04	ft			

Grades					
Upstream Invert	7,454.39	ft	Downstream Invert	7,454.04	ft
Length	70.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.06	ft
Slope Type	Steep		Normal Depth	1.06	ft
Flow Regime	Supercritical		Critical Depth	1.11	ft
Velocity Downstream	5.66	ft/s	Critical Slope	0.004373	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	PVC		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev	7,456.04	ft	Upstream Velocity Head	0.45	ft
Ke	0.20		Entrance Loss	0.09	ft

Inlet Control Properties					
Inlet Control HW Elev	7,455.98	ft	Flow Control	Unsubmerged	
Inlet Type	Groove end projecting		Area Full	6.3	ft²
K	0.00450		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	3	
C	0.03170		Equation Form	1	
Y	0.69000				

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Culvert Designer/Analyzer Report
Required Culverts @ Low Point At Basin B

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	7,458.60	ft	Storm Event	Check	
Computed Headwater Elevation	7,457.32	ft	Discharge	43.80	cfs
Headwater Depth/ Height	1.46		Tailwater Elevation	7,454.84	ft
Inlet Control HW Elev	7,457.31	ft	Control Type	Outlet Control	
Outlet Control HW Elev	7,457.32	ft			

Grades					
Upstream Invert	7,454.39	ft	Downstream Invert	7,454.04	ft
Length	70.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	CompositeM2Pressure		Depth, Downstream	1.67	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	1.67	ft
Velocity Downstream	7.81	ft/s	Critical Slope	0.007719	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	PVC		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev	7,457.32	ft	Upstream Velocity Head	0.76	ft
Ke	0.20		Entrance Loss	0.15	ft

Inlet Control Properties					
Inlet Control HW Elev	7,457.31	ft	Flow Control	Submerged	
Inlet Type	Groove end projecting		Area Full	6.3	ft²
K	0.00450		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	3	
C	0.03170		Equation Form	1	
Y	0.69000				

CAPACITY - NO ROAD OVERTOPPING

Culvert Designer/Analyzer Report

Pr.2-24" Culverts @ Low Point At Basin B

53.3 cfs

Analysis Component			
Storm Event	Check	Discharge	53.30 cfs

Peak Discharge Method: User-Specified			
Design Discharge	19.20 cfs	Check Discharge	53.30 cfs

Tailwater properties: Irregular Channel			
Slope	0.010000 ft/ft	Mannings Coefficient	0.035

Roughness Segments		
Start Station (ft)	End Station (ft)	Mannings Coefficient
0.00	180.00	0.035

Natural Channel Points	
Station (ft)	Elevation (ft)
0.00	7,460.00
15.00	7,458.00
35.00	7,456.00
95.00	7,454.00
140.00	7,456.00
170.00	7,458.00
180.00	7,460.00

Tailwater conditions for Check Storm.			
Discharge	53.30 cfs	Depth	0.90 ft
Velocity	2.50 ft/s		

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	2-24 inch Circular	53.30 cfs	7,458.60 ft	8.95 ft/s
Weir	Roadway	0.00 cfs	7,458.60 ft	N/A
Total	----------	53.30 cfs	7,458.60 ft	N/A

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Culvert Designer/Analyzer Report
Pr.2-24" Culverts @ Low Point At Basin B

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	7,458.60	ft	Discharge	53.30	cfs
Inlet Control HW Elev	7,458.59	ft	Tailwater Elevation	7,454.90	ft
Outlet Control HW Elev	7,458.60	ft	Control Type	Outlet Control	
Headwater Depth/ Height	2.11				

Grades					
Upstream Invert	7,454.39	ft	Downstream Invert	7,454.04	ft
Length	70.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	CompositeM2Pressure		Depth, Downstream	1.80	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	1.80	ft
Velocity Downstream	8.95	ft/s	Critical Slope	0.012216	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	PVC		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev	7,458.60	ft	Upstream Velocity Head	1.12	ft
Ke	0.50		Entrance Loss	0.56	ft

Inlet Control Properties					
Inlet Control HW Elev	7,458.59	ft	Flow Control	Submerged	
Inlet Type	Square edge w/headwall		Area Full	6.3	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

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Culvert Designer/Analyzer Report
Pr.2-24" Culverts @ Low Point At Basin B

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.00	cfs	Allowable HW Elevation	7,458.60	ft
Roadway Width	24.00	ft	Overtopping Coefficient	2.90	US
Low Point	7,458.60	ft	Headwater Elevation	N/A	ft
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	7,454.90	ft			

Sta (ft)	Elev (ft)
0.00	7,460.00
75.00	7,458.60
115.00	7,460.00

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NO OFFSITE OS-B6, NO DETENTION

Culvert Designer/Analyzer Report

Pr.2-24" Culverts @ Low Point At Basin B

72.9 cfs

Analysis Component			
Storm Event	Check	Discharge	72.90 cfs

Peak Discharge Method: User-Specified			
Design Discharge	19.20 cfs	Check Discharge	72.90 cfs

Tailwater properties: Irregular Channel			
Slope	0.010000 ft/ft	Mannings Coefficient	0.035

Roughness Segments		
Start Station (ft)	End Station (ft)	Mannings Coefficient
0.00	180.00	0.035

Natural Channel Points	
Station (ft)	Elevation (ft)
0.00	7,460.00
15.00	7,458.00
35.00	7,456.00
95.00	7,454.00
140.00	7,456.00
170.00	7,458.00
180.00	7,460.00

Tailwater conditions for Check Storm.			
Discharge	72.90 cfs	Depth	1.01 ft
Velocity	2.70 ft/s		

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	2-24 inch Circular	57.84 cfs	7,459.10 ft	9.55 ft/s
Weir	Roadway	15.02 cfs	7,459.10 ft	N/A
Total	----------	72.86 cfs	7,459.10 ft	N/A

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Culvert Designer/Analyzer Report
Pr.2-24" Culverts @ Low Point At Basin B

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	7,459.10	ft	Discharge	57.84	cfs
Inlet Control HW Elev	7,459.10	ft	Tailwater Elevation	7,455.01	ft
Outlet Control HW Elev	7,459.09	ft	Control Type	Inlet Control	
Headwater Depth/ Height	2.35				

Grades					
Upstream Invert	7,454.39	ft	Downstream Invert	7,454.04	ft
Length	70.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	CompositeM2Pressure		Depth, Downstream	1.85	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	1.85	ft
Velocity Downstream	9.55	ft/s	Critical Slope	0.014170	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	PVC		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev	7,459.09	ft	Upstream Velocity Head	1.32	ft
Ke	0.50		Entrance Loss	0.66	ft

Inlet Control Properties					
Inlet Control HW Elev	7,459.10	ft	Flow Control	Submerged	
Inlet Type	Square edge w/headwall		Area Full	6.3	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Designer/Analyzer Report
Pr.2-24" Culverts @ Low Point At Basin B

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	15.02	cfs	Allowable HW Elevation	7,459.10	ft
Roadway Width	24.00	ft	Overtopping Coefficient	2.97	US
Low Point	7,458.60	ft	Headwater Elevation	7,459.10	ft
Discharge Coefficient (Cr)	2.97		Submergence Factor (Kt)	1.00	
Tailwater Elevation	7,455.01	ft			

Sta (ft)	Elev (ft)
0.00	7,460.00
75.00	7,458.60
115.00	7,460.00

WHOLE BASIN DEVELOPED, W/ DETENTION

Culvert Designer/Analyzer Report

Pr.2-24" Culverts @ Low Point At Basin B

115 cfs

Analysis Component			
Storm Event	Check	Discharge	115.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	19.20 cfs	Check Discharge	115.00 cfs

Tailwater properties: Irregular Channel			
Slope	0.010000 ft/ft	Mannings Coefficient	0.035

Roughness Segments

Start Station (ft)	End Station (ft)	Mannings Coefficient
0.00	180.00	0.035

Natural Channel Points

Station (ft)	Elevation (ft)
0.00	7,460.00
15.00	7,458.00
35.00	7,456.00
95.00	7,454.00
140.00	7,456.00
170.00	7,458.00
180.00	7,460.00

Tailwater conditions for Check Storm.			
Discharge	115.00 cfs	Depth	1.20 ft
Velocity	3.02 ft/s		

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	2-24 inch Circular	60.61 cfs	7,459.43 ft	9.93 ft/s
Weir	Roadway	54.47 cfs	7,459.43 ft	N/A
Total	----------	115.09 cfs	7,459.43 ft	N/A

Culvert Designer/Analyzer Report
Pr.2-24" Culverts @ Low Point At Basin B

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	7,459.43	ft	Discharge	60.61	cfs
Inlet Control HW Elev	7,459.43	ft	Tailwater Elevation	7,455.20	ft
Outlet Control HW Elev	7,459.41	ft	Control Type	Inlet Control	
Headwater Depth/ Height	2.52				

Grades					
Upstream Invert	7,454.39	ft	Downstream Invert	7,454.04	ft
Length	70.00	ft	Constructed Slope	0.005000	ft/ft

Hydraulic Profile					
Profile	CompositeM2Pressure		Depth, Downstream	1.87	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	1.87	ft
Velocity Downstream	9.93	ft/s	Critical Slope	0.015517	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	PVC		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev	7,459.41	ft	Upstream Velocity Head	1.45	ft
Ke	0.50		Entrance Loss	0.72	ft

Inlet Control Properties					
Inlet Control HW Elev	7,459.43	ft	Flow Control	Submerged	
Inlet Type	Square edge w/headwall		Area Full	6.3	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Designer/Analyzer Report
Pr.2-24" Culverts @ Low Point At Basin B

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	54.47	cfs	Allowable HW Elevation	7,459.43	ft
Roadway Width	24.00	ft	Overtopping Coefficient	3.00	US
Low Point	7,458.60	ft	Headwater Elevation	7,459.43	ft
Discharge Coefficient (Cr)	3.00		Submergence Factor (Kt)	1.00	
Tailwater Elevation	7,455.20	ft			

Sta (ft)	Elev (ft)
0.00	7,460.00
75.00	7,458.60
115.00	7,460.00

WHOLE BASIN DEVELOPED, NO DETENTION

Culvert Designer/Analyzer Report

Pr.2-24" Culverts @ Low Point At Basin B

144 cfs

Analysis Component			
Storm Event	Check	Discharge	144.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	19.20 cfs	Check Discharge	144.00 cfs

Tailwater properties: Irregular Channel			
Slope	0.010000 ft/ft	Mannings Coefficient	0.035

Roughness Segments		
Start Station (ft)	End Station (ft)	Mannings Coefficient
0.00	180.00	0.035

Natural Channel Points	
Station (ft)	Elevation (ft)
0.00	7,460.00
15.00	7,458.00
35.00	7,456.00
95.00	7,454.00
140.00	7,456.00
170.00	7,458.00
180.00	7,460.00

Tailwater conditions for Check Storm.			
Discharge	144.00 cfs	Depth	1.31 ft
Velocity	3.20 ft/s		

Name	Description	Discharge	HW Elev	Velocity
Culvert-1	2-24 inch Circular	61.80 cfs	7,459.58 ft	10.10 ft/s
Weir	Roadway	82.09 cfs	7,459.58 ft	N/A
Total	----------	143.89 cfs	7,459.58 ft	N/A

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Culvert Designer/Analyzer Report
Pr.2-24" Culverts @ Low Point At Basin B

Component:Culvert-1

Culvert Summary			
Computed Headwater Elevation	7,459.58 ft	Discharge	61.80 cfs
Inlet Control HW Elev	7,459.58 ft	Tailwater Elevation	7,455.31 ft
Outlet Control HW Elev	7,459.55 ft	Control Type	Inlet Control
Headwater Depth/ Height	2.59		

Grades			
Upstream Invert	7,454.39 ft	Downstream Invert	7,454.04 ft
Length	70.00 ft	Constructed Slope	0.005000 ft/ft

Hydraulic Profile			
Profile	CompositeM2Pressure	Depth, Downstream	1.88 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.88 ft
Velocity Downstream	10.10 ft/s	Critical Slope	0.016126 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	PVC	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev	7,459.55 ft	Upstream Velocity Head	1.50 ft
Ke	0.50	Entrance Loss	0.75 ft

Inlet Control Properties			
Inlet Control HW Elev	7,459.58 ft	Flow Control	Submerged
Inlet Type	Square edge w/headwall	Area Full	6.3 ft²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Designer/Analyzer Report
Pr.2-24" Culverts @ Low Point At Basin B

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	82.09	cfs	Allowable HW Elevation	7,459.58	ft
Roadway Width	24.00	ft	Overtopping Coefficient	3.01	US
Low Point	7,458.60	ft	Headwater Elevation	7,459.58	ft
Discharge Coefficient (Cr)	3.01		Submergence Factor (Kt)	1.00	
Tailwater Elevation	7,455.31	ft			

Sta (ft)	Elev (ft)
0.00	7,460.00
75.00	7,458.60
115.00	7,460.00

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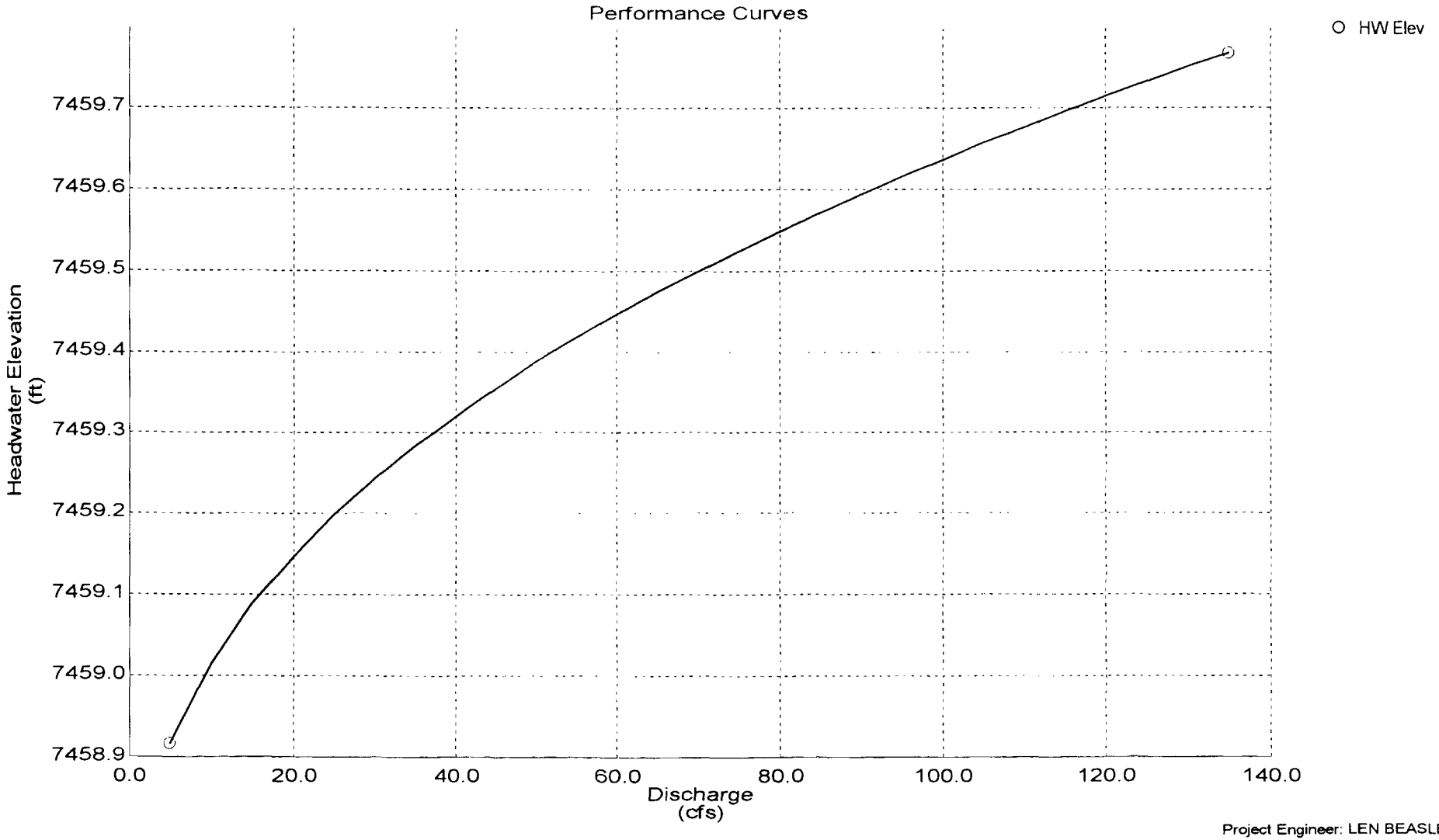
Performance Curves Report

ROAD **Overtopping**

HIGBY ROAD

Range Data:			
	Minimum	Maximum	Increment
Discharge	5.00	135.00	5.00 cfs



CULVERT OUTLET PROTECTION
C.D.O.T. STANDARD "M-601-12"

OLDBOROUGH SUBDIVISION
ROLLER COASTER ROAD and HIGBY ROAD
EL PASO COUNTY, COLORADO

01013.WK4

LEIGH WHITEHEAD & ASSOCIATES,INC.
Engineers, Surveyors & Planners
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, COLORADO
(719) 636-5179

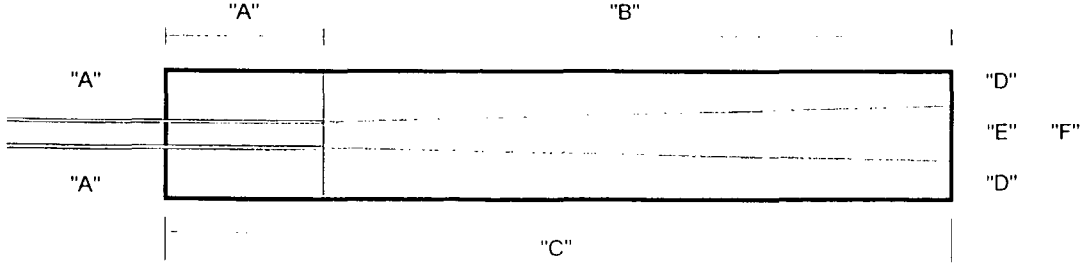
LWA #01013.63

PROPOSED CONDITIONS

01-Jul-2003

SHEET 1 OF 1

LOCATION	ROCK SIZE	PIPE SIZE	Q 100	V 100	"A"	"B"	"C"	"D"	"E"	"F"	"CY"
DP-1	12	18	6.5	7.0	1.5	6.0	7.5	0.75	3.0	4.50	2.5
OS-B1-B5	18	2-24"	43.8	7.8	3.00	20.0	23.00	1.50	6.0	9.00	23.0
										TOTAL C.Y. s =	25.5



01013.WK4

OLDBOROUGH SUBDIVISION
ROLLER COASTER ROAD and HIGBY ROAD
EL PASO COUNTY, COLORADO

LEIGH WHITEHEAD & ASSOCIATES
ENGINEERS, SURVEYORS & PLANNERS
2720 EAST YAMPA STREET, SUITE 1
COLORADO SPRINGS, CO. 80909
(719) 636-5179

PROPOSED CONDITIONS
RIP - RAP SIZE CALCULATIONS

LWA #01013.63

01-Jul-2003

Pipe No.	Pipe Data				yn	Da = D+yn / 2	Q/Da^1.5	yt	yt/Da	Min. Rip-Rap Size Required	Size of Rip - Rap To Use
	Q 100	V 100	Pipe Dia.	Froude							
DP-1	6.2	7.0	1.50	1.61	0.75	1.13	**5.20**	0.75	**0.67**	"L" (9")	Type "M", 12" dia., 24" Thick
OS-B1-B5	43.8	7.8	2.00	0.81	2.00	2.00	**15.49**	0.84	**0.42**	"H" (18")	Type "H", 18" dia., 36" Thick

Ref.: Denver's Urban Drainage & Flood Control District Manual

Da = D (For Subcritical Flow)

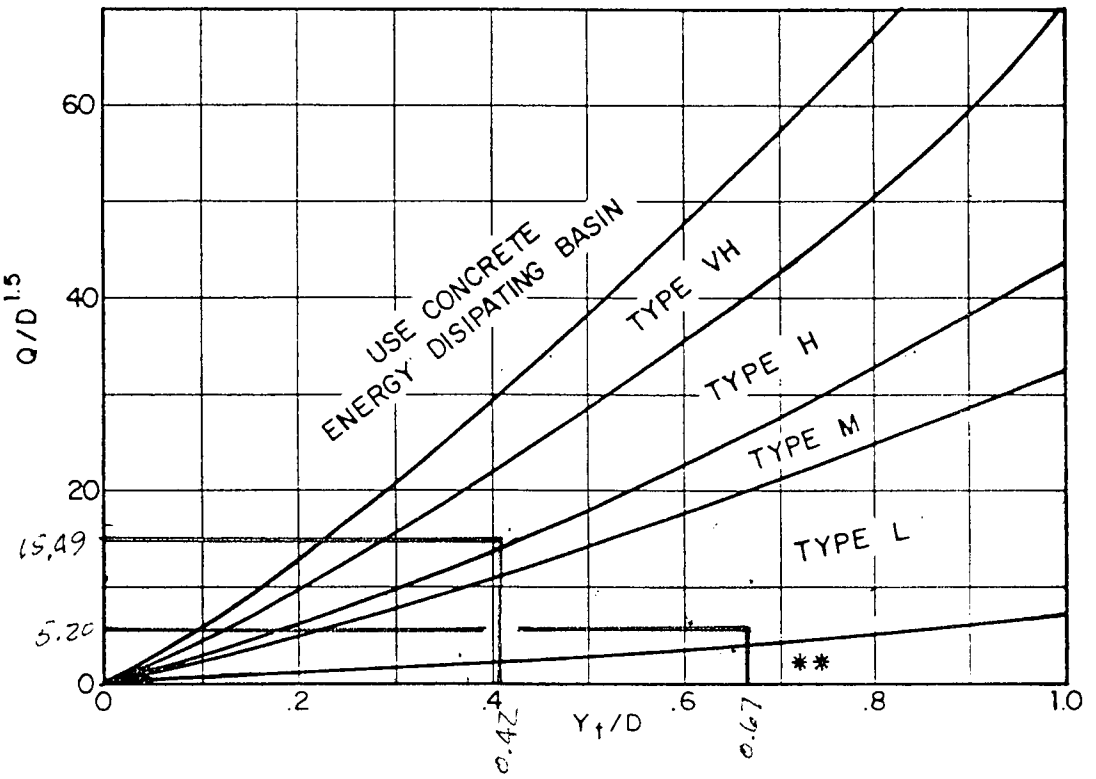
D = Pipe Diameter

yt = Tailwater Depth

yn = Normal Depth

Da = D+yn / 2 (For Supercritical Flow)

OS-B1 - B5 = 2 - 24" HDPE's



Use D_a instead of D whenever flow is supercritical in the barrel.
** Use Type L for a distance of 3D downstream.

Y_f = TAILWATER DEPTH

D = PIPE DIAMETER

FIGURE 5-7. RIPRAP EROSION PROTECTION AT CIRCULAR CONDUIT OUTLET.

BORROW DITCH CALCULATIONS

Borrow Ditch on E. & W. Side,10+00-14+00
Worksheet for Triangular Channel

Project Description	
Project File	c:\engineering\haestad\academic\fmw\01013.fm2
Worksheet	Borrow Ditch 10+00 - 14+00, E. & W. Side
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

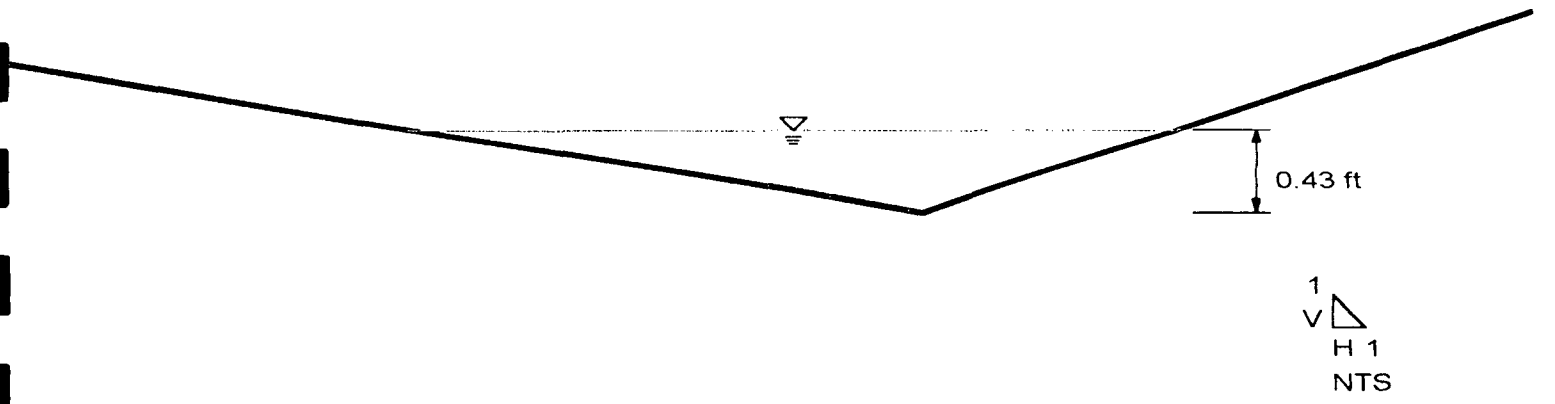
Input Data		
Mannings Coefficient	0.040	
Channel Slope	0.030000	ft/ft
Left Side Slope	6.000000	H : V
Right Side Slope	3.000000	H : V
Discharge	1.90	cfs

Results		
Depth	0.43	ft
Flow Area	0.84	ft^2
Wetted Perimeter	3.99	ft
Top Width	3.88	ft
Critical Depth	0.41	ft
Critical Slope	0.041103	ft/ft
Velocity	2.27	ft/s
Velocity Head	0.08	ft
Specific Energy	0.51	ft
Froude Number	0.86	
Flow is subcritical.		

Borrow Ditch on E. & W. Side, 10+00 - 14+00
Cross Section for Triangular Channel

Project Description	
Project File	c:\engineering\haestad\academic\fmw\01013.fm2
Worksheet	Borrow Ditch 10+00 - 14+00, E. & W. Side
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	0.030000	ft/ft
Depth	0.43	ft
Left Side Slope	6.000000	H : V
Right Side Slope	3.000000	H : V
Discharge	1.90	cfs



Borrow Ditch on North Side, 14+00 - 17+50
Worksheet for Triangular Channel

Project Description	
Project File	c:\engineering\haestad\academic\fmw\01013.fm2
Worksheet	Borrow Ditch 14+00 - 17+50, North Side
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

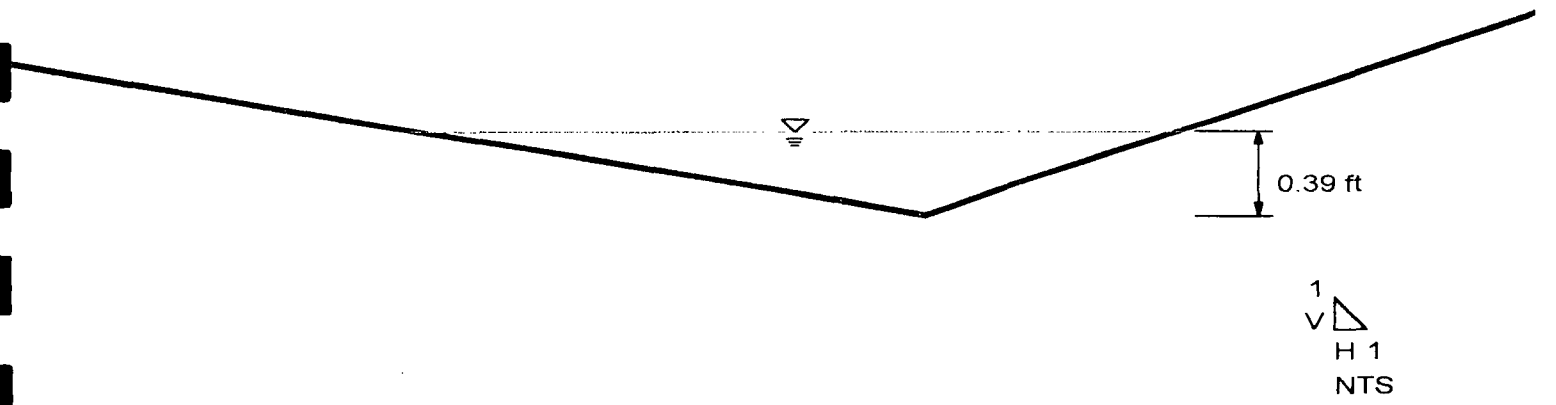
Input Data		
Mannings Coefficient	0.040	
Channel Slope	0.054000	ft/ft
Left Side Slope	6.000000	H : V
Right Side Slope	3.000000	H : V
Discharge	1.90	cfs

Results		
Depth	0.39	ft
Flow Area	0.67	ft^2
Wetted Perimeter	3.57	ft
Top Width	3.47	ft
Critical Depth	0.41	ft
Critical Slope	0.041105	ft/ft
Velocity	2.83	ft/s
Velocity Head	0.12	ft
Specific Energy	0.51	ft
Froude Number	1.14	
Flow is supercritical.		

Borrow Ditch on North Side, 14+00 - 17+50
Cross Section for Triangular Channel

Project Description	
Project File	c:\engineering\haestad\academic\fmw\01013.fm2
Worksheet	Borrow Ditch 14+00 - 17+50, North Side
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	0.054000	ft/ft
Depth	0.39	ft
Left Side Slope	6.000000	H : V
Right Side Slope	3.000000	H : V
Discharge	1.90	cfs



Borrow Ditch on South Side,14+00 - 17+50
Worksheet for Triangular Channel

Project Description	
Project File	c:\engineering\haestad\academic\fmw\01013.fm2
Worksheet	Borrow Ditch 14+00 - 17+50, South Side
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

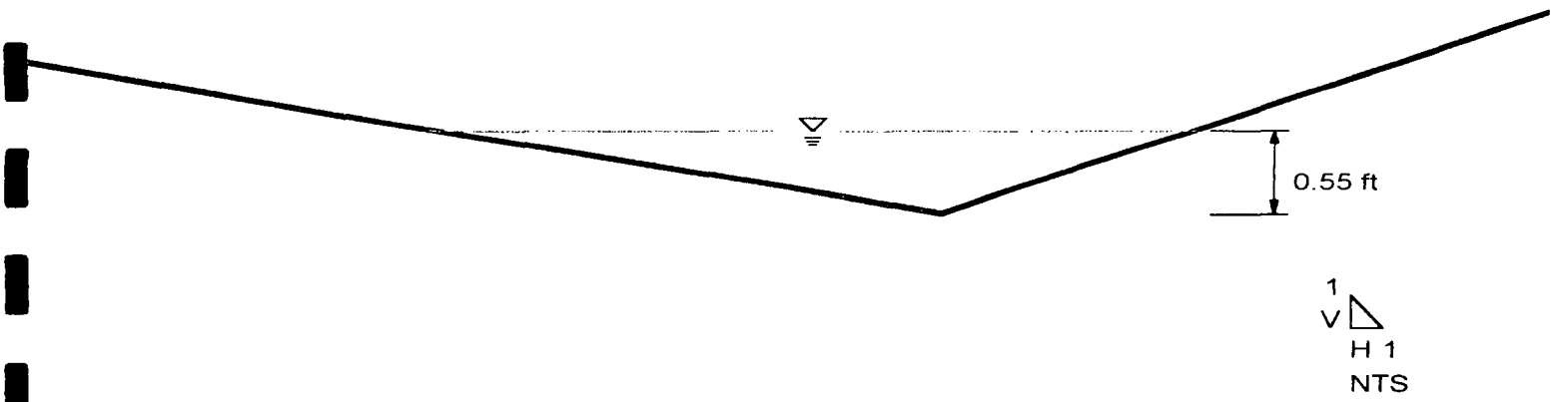
Input Data		
Mannings Coefficient	0.040	
Channel Slope	0.054000	ft/ft
Left Side Slope	6.000000	H : V
Right Side Slope	3.000000	H : V
Discharge	4.90	cfs

Results		
Depth	0.55	ft
Flow Area	1.37	ft^2
Wetted Perimeter	5.09	ft
Top Width	4.96	ft
Critical Depth	0.59	ft
Critical Slope	0.036228	ft/ft
Velocity	3.59	ft/s
Velocity Head	0.20	ft
Specific Energy	0.75	ft
Froude Number	1.21	
Flow is supercritical.		

Borrow Ditch on South Side, 14+00 - 17+50
Cross Section for Triangular Channel

Project Description	
Project File	c:\engineering\haestad\academic\fmw\01013.fm2
Worksheet	Borrow Ditch 14+00 - 17+50, South Side
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.040	
Channel Slope	0.054000	ft/ft
Depth	0.55	ft
Left Side Slope	6.000000	H : V
Right Side Slope	3.000000	H : V
Discharge	4.90	cfs



SWALE CAPACITY CALCULATIONS

Ex. Swale, Basin A3 - West
Worksheet for Irregular Channel

Project Description	
Project File	c:\engineering\haestad\academic\fmw\01013.fm2
Worksheet	Swale, Basin A3-West
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.092600	ft/ft
Elevation range: 7,484.00 ft to 7,486.00 ft.		
Discharge	11.60	cfs

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	7,486.00	0.00	63.00	0.045
20.00	7,484.00			
63.00	7,486.00			

Results		
Wtd. Mannings Coefficient	0.045	
Water Surface Elevation	7,484.45	ft
Flow Area	3.14	ft²
Wetted Perimeter	14.10	ft
Top Width	14.07	ft
Height	0.45	ft
Critical Depth	7,484.51	ft
Critical Slope	0.046751	ft/ft
Velocity	3.69	ft/s
Velocity Head	0.21	ft
Specific Energy	7,484.66	ft
Froude Number	1.38	
Flow is supercritical.		

Ex. Swale, Basin A3 - East
Worksheet for Irregular Channel

Project Description	
Project File	c:\engineering\haestad\academic\fmw\01013.fm2
Worksheet	Swale, Basin A3-East
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data				
Channel Slope	0.087000 ft/ft			
Elevation range: 7,491.80 ft to 7,494.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	7,494.00	0.00	57.00	0.045
20.00	7,492.00			
26.00	7,491.80			
35.00	7,492.00			
57.00	7,494.00			
Discharge	27.10 cfs			

Results		
Wtd. Mannings Coefficient	0.045	
Water Surface Elevation	7,492.26	ft
Flow Area	6.19	ft^2
Wetted Perimeter	20.58	ft
Top Width	20.55	ft
Height	0.46	ft
Critical Depth	7,492.35	ft
Critical Slope	0.041650	ft/ft
Velocity	4.37	ft/s
Velocity Head	0.30	ft
Specific Energy	7,492.56	ft
Froude Number	1.40	
Flow is supercritical.		

Ex. Swale, Basin B3
Worksheet for Irregular Channel

Project Description	
Project File	c:\engineering\haestad\academic\fmw\01013.fm2
Worksheet	Swale, Basin B3
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.047100	ft/ft
Elevation range: 7,480.00 ft to 7,486.00 ft.		

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	7,486.00	0.00	260.00	0.045
41.00	7,484.00			
100.00	7,482.00			
136.00	7,480.00			
167.00	7,482.00			
200.00	7,484.00			
260.00	7,486.00			

Discharge	35.60	cfs

Results		
Wtd. Mannings Coefficient	0.045	
Water Surface Elevation	7,480.75	ft
Flow Area	9.53	ft²
Wetted Perimeter	25.31	ft
Top Width	25.27	ft
Height	0.75	ft
Critical Depth	7,480.78	ft
Critical Slope	0.040558	ft/ft
Velocity	3.74	ft/s
Velocity Head	0.22	ft
Specific Energy	7,480.97	ft
Froude Number	1.07	
Flow is supercritical.		