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**DUMBARTON OAKS - PHASE I
HYDROLOGIC SURVEY**

100% Submission

August 1999

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1. PROJECT NEED

Increased stormwater runoff generated from the impervious surfaces surrounding the park property is adversely impacting the morphology of the unnamed tributary to Rock Creek that flows through Dumbarton Oaks Park, and is damaging the series of stone waterfall dams along it. The stream alignment and waterfalls are integral components of the designed historic landscape of Dumbarton Oaks Park. Thus a stormwater management plan that includes a watershed delineation and hydrologic analysis of the site is needed as a basis for developing a stormwater management plan to control stormwater flows that are initiated from outside the park boundaries. Until such a structure is constructed, the stream channel, waterfall structures and pools, which are integral components of the historic landscape design cannot be restored.

The purpose of the proposed stormwater management plan will be to regulate the outflow of stormwater into the existing stream. This is necessary so that the flows will not continue to erode the stream channel and flow out and over the stream banks or around the small dams in the stream during frequent storm events.

2. DESCRIPTION OF THE SITE

Portions of two (2) different parks are included in this project – Dumbarton Oaks Park, which is a designed historic landscape, and Whitehaven Parkway, an undesigned natural area.

Dumbarton Oaks Park (DOP) is reach via Lover's Lane, which runs north from R Street, NW, east of 31st Street, between the east wall of Dumbarton Oaks Gardens and the west boundary of Montrose Park in the Georgetown Historic District of Washington, D.C. It shares its southern boundary with Dumbarton Oaks Gardens and other private property, its western boundary with Whitehaven Parkway, its eastern boundary with Rock Creek Park, and its northern boundaries with private property and the District of Columbia right-of-way for Whitehaven Road. It is administered and managed by the staff of Rock Creek Park for the National Capital Region of the National Park Service.

The portion of Whitehaven Parkway, which is included in this project, abuts the western boundary of DOP, the southern boundary of the U.S. Naval Observatory, and the eastern edge of Whitehaven Road.

3. HYDROLOGY

The hydrologic modeling of the watershed was accomplished using the Soil Conservation Service (SCS) TR-20 program dated September 1, 1983. The runoff curve numbers and times of concentration for the subareas were derived from the method specified in the SCS Technical Release No. 55, "Urban Hydrology for Small Watersheds," updated in June 1986. The Hydrologic Soils Groups were obtained from the 1976 SCS "Soil Survey of the District of Columbia," and are mainly 'B' and 'C' type soils. The land uses for the existing conditions come from the National Capital Planning Commission 1" = 200' Topo. Land uses were field verified.

4. DESCRIPTION OF WATER SHEDS

Watersheds were delineated utilizing National Capital Planning Commission 1" = 200' Topo, District of Columbia Sewer Plans, and the U.S. Naval Observatory Stormwater Pollution Prevention Maps prepared by Rust Environmental & Infrastructure.

Subarea No. 1 was delineated to determine the amount of drainage from the U.S. Naval Observatory to the thirty-inch (30") RCP. The drainage area of Subarea No. 1 is 45.9 acres (25% impervious). **Subarea No. 2** delineates the 5.8 acre (28% impervious) contribution from the U.S. Naval Observatory through a twenty-four inch (24") RCP, which is located about 600 feet east of the 30" RCP. **Subarea No. 3** was delineated to include drainage to a potential onsite detention pond site. The drainage area is 21.8 acres (49% impervious), and includes drainage from Whitehaven Street, which connects to the 30" RCP and portion of the park property. **Subarea No. 4** covers the remaining 51.4 acres (30% impervious) draining to the tributary at Lover's Lane. This subarea is mostly parkland, but includes portions of the surrounding development.

5. STREAM CAPACITY

From the existing 30" RCP to East Falls, the stream drops sixty feet (60') over a distance of 1,717 feet, for an average slope of 3.5%. From Clapper Bridge Falls to East Falls the stream drops 34.5 feet over a distance of 827 feet, for an average slope of 4.2%. The eleven (11) man-made dams in this reach provide for a total drop of 23.2 feet, which reduces the effective slope to 1.4%.

For the base flow and small storm events the manmade dams form a stable step/pool stream condition. Each dam functions as a drop structure with a stilling pool at its base. The run from the stilling pool to the next dam is flat and stable, ending in a pool at the upstream side of the dam.

Field evidence indicates that larger flows will exceed the capacity of some of the dams causing flows to pass around the dams and causing erosion in the area that the flow re-enters the stream.

Field measurements verified that the dams are all narrower and more restrictive than the stream reaches between dams. The following table lists the approximate capacity of each dam. The capacity of the stream is therefore determined by the capacity of the dams. Dimensions of each weir were measured in the field.

Table 1
Capacity of Existing Dams

Existing Dam	Capacity
East Falls	14.3 cfs
Three Bridges Falls	7.4 cfs
Three Bridges Falls	5.9 cfs
Three Bridges Falls	12.7 cfs
Three Sisters Falls	11.7 cfs
Three Sisters Falls	9.2 cfs
Laurel Pool	6.7 cfs
West Falls	4.3 cfs
Old Waterwheel Falls	18.9 cfs
Arbor Falls	18.4 cfs
Clapper Bridge Falls	6.7 cfs

6. DETENTION

Three (3) potential pond sites were briefly investigated. **Pond No. 1** would be located on U.S. Naval Observatory Property. **Pond No. 2** would be located just downstream of the 30" RCP. The Volume of storage available at Pond No. 2 was not nearly enough to provide downstream reductions in flows, so **Pond No. 2A** was located further downstream, just upstream of Jungle Falls. Table 2 indicates a summary of discharges at upstream and downstream ends of the project.

Table 2
Summary of Discharges

	6-Month	1-Year	2-Year	10-Year	100-Year
At Pond No. 2/2A Site (Just Downstream of 30" RCP)					
Existing Conditions	25.9 cfs	70.3 cfs	104.9 cfs	224 cfs	379 cfs
Existing Conditions with Pond No. 1	20.4 cfs	42.7 cfs	58.7 cfs	110 cfs	307 cfs
Existing Conditions with Pond Nos. 1 and 2	21.8 cfs	41.1 cfs	57.5 cfs	110 cfs	303 cfs
Existing Conditions with Pond No. 2A	8.2 cfs	67.4 cfs	100.9 cfs	228 cfs	370 cfs
Existing Conditions with Pond Nos. 1 and 2A	7.0 cfs	33.1 cfs	55.8 cfs	109 cfs	301 cfs
At Lover's Lane					
Existing Conditions	32.8 cfs	106.9 cfs	166.8 cfs	396 cfs	659 cfs
Existing Conditions with Pond No. 1	26.3 cfs	77.2 cfs	117.5 cfs	271 cfs	591 cfs
Existing Conditions with Pond Nos. 1 and 2	28.9 cfs	77.4 cfs	117.5 cfs	272 cfs	594 cfs
Existing Conditions with Pond No. 2A	17.6 cfs	107.7 cfs	167.5 cfs	397 cfs	660 cfs
Existing Conditions with Pond Nos. 1 and 2A	16.9 cfs	74.0 cfs	118.4 cfs	274 cfs	593 cfs
Pond No. 1 (U.S. Naval Observatory)					
Flow into Pond	9.3 cfs	34.7 cfs	55.7 cfs	138 cfs	233 cfs
Flow out of Pond	1.0 cfs	2.1 cfs	2.5 cfs	90 cfs	207 cfs

Pond No. 1 has been sized to provide significant reductions in flows for the 6-month, 1-year and 2-year storms; however, the contribution from the storm drain draining Whitehaven Street does not drain to Pond No. 1. Therefore, a large portion of the flow is unaffected by Pond No. 1.

Pond No. 2A is located so as to capture all of Subarea Nos. 1 and 3; however, the volume of storage available is not enough to effectively reduce discharges except for the 6-month storm and smaller. **Pond Nos. 1 and 2A** together produce sizable reductions in the 6-month peak discharge, and modest reductions in the 1-year and 2-year peak discharges, but do not reduce even the 6-month storm to below the capacity of all of the existing dams. Due to its size and potential negative impact on the restoration of historical features, **Pond No. 2A** may not be feasible.

Pond No. 2 has too little volume to reduce peak discharges, even for the 6-month storm. It could provide water quality benefits in the form of sediment removal.

7. BASE FLOW

Base flow at the 30" RCP at the upstream end of the project was measured at approximately twenty (20) gallons per minute (gpm) on June 7, 1999. The latest rainfall event prior to June 7 was on May 28, 1999. On May 11, 1999 the stream was walked with NPS personnel. No measurements were taken on that date, but based on visual observation. It is estimated that base flow was slightly more on May 11 than on June 7.

Rainfall for the month of May was about 2.5 inches below normal, and it has not rained in June. It is reasonable to assume that 20 gpm is a conservative average base flow.

An onsite pond would have a small surface area (approximately 0.06 acres) and a small volume (approximately 0.06 Ac.-ft.). The 20-gpm base flow would replace the permanent pool volume about every seventeen (17) hours. This quantity of base flow can easily sustain a permanent pool pond on the site.

8. STORM DRAIN DIVERSION

An alternative to providing on-site detention would be to construct a storm drain diversion structure. Base flow and the runoff from small storm events would be permitted to flow downstream through the existing dams. For storms from the 6-month storm through the 10-year storm, the runoff would be diverted out of Pond No. 2 and into a storm drain diversion.

The storm drain diversion would be approximately 1,600 LF of 42" RCP. Storm drain yard inlets along the system could be utilized to further reduce the runoff to the stream.

Storms larger than the 10-year storm would (beyond the capacity of the storm drain diversion) overflow into the stream.

Pond No. 2 would need to be constructed as part of the storm drain diversion in order to hydraulically control the discharges for the various storms. Table No. 3 indicates a summary of discharges entering and leaving Pond No. 2.

Table 3
Summary of Discharges

	6-Month	1-Year	2-Year	10-Year	100-Year
At Pond No. 2					
Entering Pond	20.4 cfs	42.7 cfs	587 cfs	110.4 cfs	306.9 cfs
Entering Stream from Pond	6.3 cfs	6.7 cfs	6.9 cfs	7.4 cfs	192.8 cfs
Entering Storm Drain from Pond	14.1 cfs	36.0 cfs	50.6 cfs	102.6 cfs	110.0 cfs

9. CONCLUSIONS

- The capacity of the stream to convey flows is determined by the capacity of the small dams along the stream. Once the capacity of a dam is exceeded, a portion of the discharge flows around the dam. Modifications could be made to increase the capacity of the dams, but would need to be made in a manner, which does not affect the historical context.
- There appears to be ample area on the Naval Observatory property to construct a pond that effectively reduces discharges entering the Park from the Naval Observatory. The existing 30" storm drain would need to be diverted into the pond and a control structure would need to be constructed to regulate flows and reconnect to the existing 30" storm drain. This pond provides no benefits for the discharges from Whitehaven Street, which appears to be the largest contributor of runoff for the small storms.
- A pond (Pond No. 2A) located on park property between the 30" RCP outfall and Jungle Falls would only have enough volume to effectively reduce flows on the 6-month storm.
- Providing a pond on the Naval Observatory and within the park (Pond No. 2A) would provide significant reductions in discharges for the 6-month, 1-year and 2-year storms, but would not reduce flows below the capacity of the existing dams.

- The location of Pond No. 2A is likely to have an unacceptable degree of impact to historical features on the site.
- A pond (Pond No. 2) located at the 30" RCP outfall would be too small to reduce peak discharges, but would provide a small measure of water quality benefits and could serve as the control structure for a storm drain diversion.
- It appears to be feasible to construct a storm drain diversion structure, which would significantly reduce discharges to the stream, for storms up to the 10-year storm. The control structure would be designed to allow base flow and very small storms to remain flowing through the stream. Excess flow for larger storms would be diverted to the storm drain diversion. Storms larger than the 10-year storm would be permitted to overflow into the stream in order to reduce the size of the storm drain. It is recommended that the low flow control to the stream be fitted with an oversized valve in order to allow for future regulation of discharges.

BY R-LP DATE 5/28/99 SUBJECT Dumbarton Oaks SHEET NO. _____ OF _____
 CHKD. BY MKS DATE 6/7/99 JOB NO. _____
 REV. BY _____ DATE _____ FILE NO. _____

Sc	Sassafras		B - Soil
Sg	Sassafras Urban Complex		B - Soil
Ju	Joppa Urban Complex		B - Soil
Jt	Joppa		B - Soil
Wp	Woodstown Urban Complex		C - Soil
Nu	Neshaminy Urban Complex		B - Soil
Nc	Neshaminy		B - Soil
Ch	Codorus		C - Soil
U1	Udorthents	Say	C - Soil
U8	Udorthents Sandy	Say	C - Soil
U0	Urban Land	Say	C - Soil
U9	Udorthents loamy	Say	C - Soil
U4	Udorthents loamy	Say	C - Soil
U0	Urban Land Joppa		B - Soil
Ux	Urban Land Sassafras		B - Soil

APPENDIX I

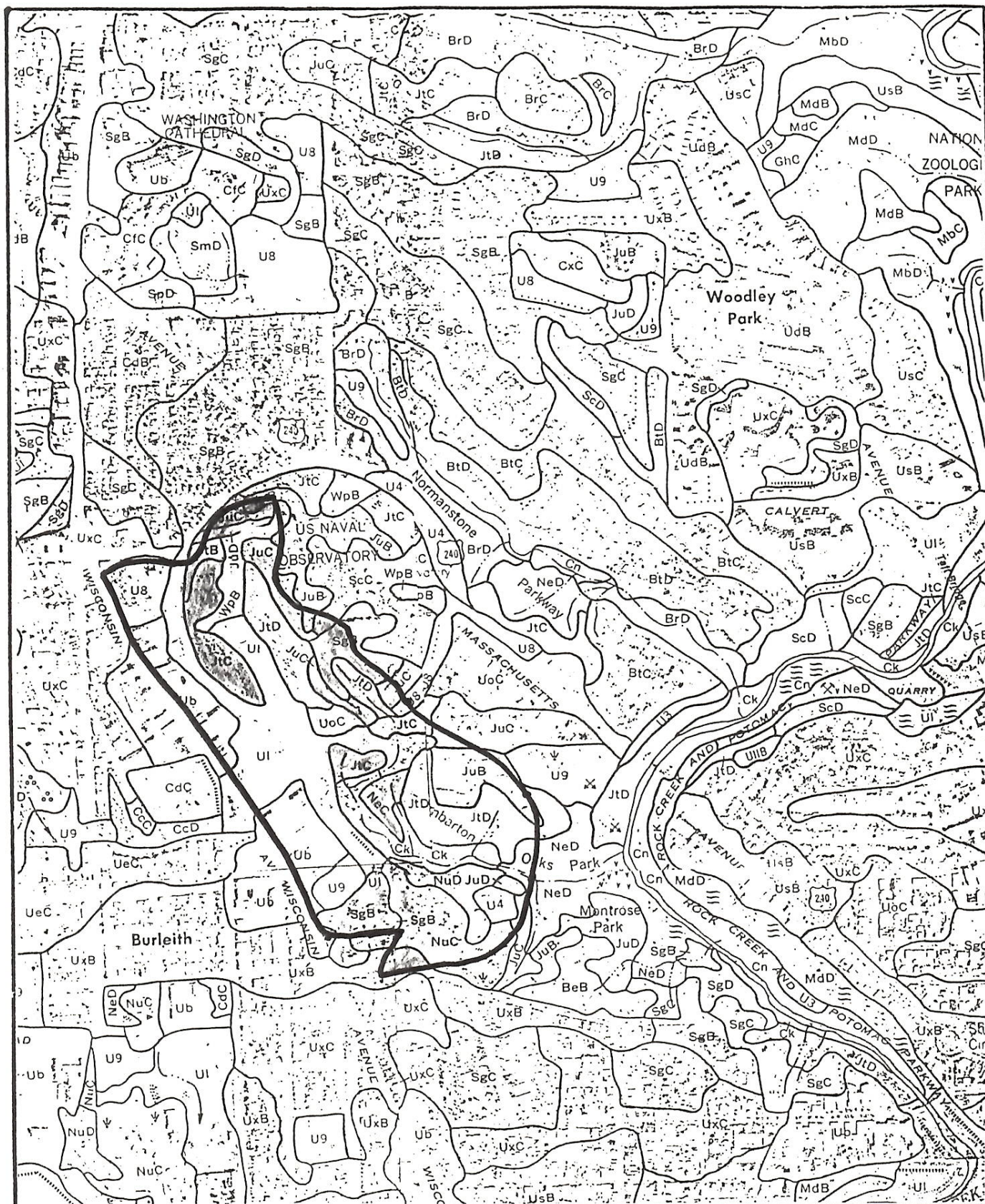
Hydrology

BY RLP DATE 5/28/99 SUBJECT Dumbarton Oaks SHEET NO. _____ OF _____
 CHKD. BY MKS DATE 6/7/99 JOB NO. _____
 REV. BY _____ DATE _____ FILE NO. _____

P.G. Co. Mont Co

<u>6 Mo Storm</u>	<u>1.8"</u>	
<u>1-Year Storm</u>	<u>2.7"</u>	<u>2.6"</u>
<u>2-Year Storm</u>	<u>3.3"</u>	<u>3.2"</u>
<u>10-Year Storm</u>	<u>5.3"</u>	<u>5.1"</u>
<u>100-Year Storm</u>	<u>7.4"</u>	<u>7.2"</u>

Use P.G. Co Rainfall Amounts



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Dumbarton Oaks

Greenhorne & O'Mara, Inc.

Site Conditions:	☐ Existing ☐ Proposed	Project <u>Dumarton Oaks</u>	Sheet _____ of _____
Off Site Land Use:	☐ Predeveloped ☒ Existing ☐ Ultimate	<u>Existing Condition</u>	Subarea Number <u>1</u>
			By <u>RLP</u> Date <u>6/1/99</u> Chkd. By <u>MKS</u> Date <u>6/7/99</u>

11

[illegible]

Weighted RCN = $\frac{100 \times 0.73}{100} = 73.1$, Use $\boxed{73}$

ID	Type of Flow	n	U/S Elev. (feet)	D/S Elev. (feet)	Length (feet)	Slope (%)	Area (sq ft)	Wet Per (feet)	Velocity (fps)	T _c (hours)
	Sheet Flow ($P = \underline{0.2}$ in.)									
		.15			100	2.0	$T_r = \frac{0.007(L)^{0.8}}{(P)^{0.6}(S)^{0.4}}$			.16
	-	.								.
	Shallow Concentrated Flow									
	☐ Paved ☒ Unpaved				500	2.0			4.3	.03
	☐ Paved ☐ Unpaved									
	☐ Paved ☐ Unpaved									
	Channel Flow									
	Other S.D.				1150				6.0	.05
								Total		.24

*Based on the June 1986 version of SCS TR-55

* Based on the June 1986 version of SCS TR-55

Greenhorne & O'Mara, Inc.

Site Conditions:	☒ Existing ☐ Proposed	Project <u>Dumbarton Oaks</u>	Sheet _____ of _____
Off Site Land Use:	☐ Predeveloped ☒ Existing ☐ Ultimate	<u>Existing - Condition</u>	Subarea Number 3
			By <u>RLP</u> Date <u>6/1/99</u> Chkd. By <u>MKS</u> Date <u>6/7/99</u>

三

Runoff Curve Number

Soil Group	Land Use or Zoning	Area 1 (sq in)	Area 2 (sq in)	Ave. Area (sq in)	.Area (acres)	RCN	RCN X Area
	Total Area						
B	Woods (Park)						
C	Woods (Park)				1.3	55	71.5
B	Grass (Park)				1.3	70	91.0
C	Grass (Park)				0.4	61	24.4
	Inpruvius (Offsite)				2.8	74	207.2
C	Woods (offsite)				10.7	98	1048.6
B	Grass (offsite)				0.3	70	21.0
C	Grass (offsite)				0.6	61	36.6
					4.4	74	325.6
Totals					21.8		1825.9

Total Area = _____ acres = .0341 sq. mi.

Weighted RCN = $\frac{1000000}{12000} = 83.8$, Use 84

Time of Concentration

ID	Type of Flow	n	U/S Elev. (feet)	D/S Elev. (feet)	Length (feet)	Slope (%)	Area (sq ft)	Wet Per (feet)	Velocity (fps)	T _c (hours)
	Sheet Flow (P = in.)						$T_t = \frac{0.007(L)^{0.8}}{(P)^{0.6}(S)^{0.4}}$			
	Shallow Concentrated Flow									
	☒ Paved ☐ Unpaved				600	5.0			4.5	.04
	☐ Paved ☐ Unpaved									
	☐ Paved ☐ Unpaved									
	Channel Flow									
	Other SD.				900	—			6.0	.04
									Total	.08

* Based on the June 1986 version of SCS TR-55

*Based on the June 1986 version of SCS TR-55

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Site Conditions:	☐ Existing ☐ Proposed	Project <u>Dumbarton Oaks</u>	Sheet _____ of _____
	☐ Predeveloped		Subarea Number 2
Off Site Land Use:	☒ Existing ☐ Ultimate	<u>Existing = Conditions</u>	By <u>RLP</u> Date <u>6/1/99</u> Chkd. By <u>MKS</u> Date <u>6/7/99</u>

5

Runoff Curve Number

Soil Group	Land Use or Zoning	Area 1 (sq in)	Area 2 (sq in)	Ave. Area (sq in)	Area (acres)	RCN	RCN X Area
	Total Area						
B	Impervious (U.S. Naval Obsrv)				1.6	98	156.8
B	Floods (U.S. Naval Obsrv)				1.1	55	60.5
B	Grass (U.S. Naval Obsrv)				3.1	61	189.1
	Totals				5.8		406.4

Total Area = _____ acres = .0091 sq. mi.

Weighted RCN = $\frac{100}{2} = 50$, Use **50**

Time of Concentration

ID	Type of Flow	n	U/S Elev. (feet)	D/S Elev. (feet)	Length (feet)	Slope (%)	Area (sq ft)	Wet Per (feet)	Velocity (fps)	T _c (hours)
	Sheet Flow (P = <u>3.3</u> in.)									
		<u>.15</u>			<u>100</u>	<u>2.0</u>	$T_t = \frac{0.007(L)^{0.8}}{(P)^{0.8}(S)^{0.4}}$			<u>.16</u>
	Shallow Concentrated Flow									
	☐ Paved ☒ Unpaved				<u>500</u>	<u>7.0</u>			<u>4.3</u>	<u>.03</u>
	☐ Paved ☐ Unpaved									
	☐ Paved ☐ Unpaved									
	Channel Flow									
	Other <u>SD</u>				<u>250</u>				<u>6.0</u>	<u>.01</u>
*Based on the June 1985 version of SCS TR-55.									Total	<u>.20</u>

* Based on the June 1986 version of SCS TR-55

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Site Conditions:	☒ Existing ☐ Proposed	Project <u>Dumbarton Oaks</u>	Sheet _____ of _____
	☐ Predeveloped		Subarea Number 4
Off Site Land Use:	☒ Existing ☐ Ultimate	<u>Existing = Conditions.</u>	By <u>RLP</u> Date <u>6/1/99</u>
			Chkd. By <u>MKS</u> Date <u>6/7/99</u>

$$\overline{E}_x$$

Runoff Curve Number

Soil Group	Land Use or Zoning	Area 1 (sq in)	Area 2 (sq in)	Ave. Area (sq in)	Area (acres)	RCN	RCN X Area
	Total Area						
B	Woods (Park)				16.0	55	880.0
C	Woods "				3.6	70	252.0
B	Grass "				1.2	61	73.2
C	Grass "				1.2	74	88.8
	Impervious (offs.to)				15.2	98	1489.6
B	Woods "				2.8	55	154.0
C	Woods "				1.2	70	84.0
B	Grass "				6.7	61	408.7
C	Grass "				3.5	74	259.0
Totals					51.4		3689.3

Total Area = _____ acres = .0803 sq. mi.

Weighted RCN = $\frac{100}{2.25} = 44.4$, Use **72**

Time of Concentration

ID	Type of Flow	n	U/S Elev. (feet)	D/S Elev. (feet)	Length (feet)	Slope (%)	Area (sq ft)	Wet Per (feet)	Velocity (fps)	T _c (hours)
	Sheet Flow ($P = \underline{3.3}$ in.)									
		.15			100	4.0	$T_t = \frac{0.007(L)^{0.8}}{(P)^{0.6}(S)^{0.4}}$			.12
	Shallow Concentrated Flow									
	☐ Paved ☒ Unpaved				1200	10.0			5.2	.06
	☐ Paved ☐ Unpaved									
	☐ Paved ☐ Unpaved									
	Channel Flow				900				6.0	.04
	Other									
									Total	.22

* Based on the June 1986 version of SCS TR-55

*Based on the June 1986 version of SCS TR-55

BY RLP
✓ MKS 6/7/99

*****80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****

OB TR-20	SUMMARY		NOLOTS	
TITLE	DUMBARTON OAKS EXISTING CONDITIONS			
TITLE	FILENAME; 1507_DOEX.T20			
6 RUNOFF 1 1 1	0.0717	73.	0.24	SA1
6 RUNOFF 1 3 2	0.0341	84.	0.08	SA3
6 ADDHYD 4 3 1 2 5				
6 RUNOFF 1 2 1	0.0091	70.	0.20	SA2
6 ADDHYD 4 2 1 5 3				
6 RUNOFF 1 4 2	0.0803	72.	0.22	SA4
6 ADDHYD 4 4 3 2 5				
ENDATA				
7 INCREM 6	0.05			
7 COMPUT 7 1 4	0.	1.8	1.2 2 0 0	6-MONTH
ENDCMP 1				
7 COMPUT 7 1 4	0.	2.7	1.2 2 0 1	1-YEAR
ENDCMP 1				
7 COMPUT 7 1 4	0.	3.3	1.2 2 0 2	2-YEAR
ENDCMP 1				
7 COMPUT 7 1 4	0.	5.3	1.2 2 0 10	10-YEAR
ENDCMP 1				
7 COMPUT 7 1 4	0.	7.4	1.2 2 0 99	100-YEAR
ENDCMP 1				
ENDJOB 2				

*****END OF 80-80 LIST*****

COMPUTER PROGRAM FOR PROJECT FORMULATION - HYDROLOGY USER NOTES

THE USERS MANUAL FOR THIS PROGRAM IS THE MAY 1982 DRAFT OF TR-20. CHANGES FROM THE 2/14/74 VERSION INCLUDE:

REACH ROUTING - THE MODIFIED ATT-KIN ROUTING PROCEDURE REPLACES THE CONVEX METHOD. INPUT DATA PREPARED FOR PREVIOUS PROGRAM VERSIONS USING CONVEX ROUTING COEFFICIENTS WILL NOT RUN ON THIS VERSION.

THE PREFERRED TYPE OF DATA ENTRY IS CROSS SECTION DATA REPRESENTATIVE OF A REACH. IT IS RECOMMENDED THAT THE OPTIONAL CROSS SECTION DISCHARGE-AREA PLOTS BE OBTAINED WHENEVER NEW CROSS SECTION DATA IS ENTERED. THE PLOTS SHOULD BE CHECKED FOR REASONABLENESS AND ADEQUACY OF INPUT DATA FOR THE COMPUTATION OF "M" VALUES USED IN THE ROUTING PROCEDURE.

GUIDELINES FOR DETERMINING OR ANALYZING REACH LENGTHS AND COEFFICIENTS (X,M) ARE AVAILABLE IN THE USERS MANUAL. SUMMARY TABLE 2 DISPLAYS REACH ROUTING RESULTS AND ROUTING PARAMETERS FOR COMPARISON AND CHECKING.

HYDROGRAPH GENERATION - THE PROCEDURE TO CALCULATE THE INTERNAL TIME INCREMENT AND PEAK TIME OF THE UNIT HYDROGRAPH HAVE BEEN IMPROVED. PEAK DISCHARGES AND TIMES MAY DIFFER FROM THE PREVIOUS VERSION. OUTPUT HYDROGRAPHS ARE STILL INTERPOLATED, PRINTED, AND ROUTED AT THE USER SELECTED MAIN TIME INCREMENT.

INTERMEDIATE PEAKS - METHOD ADDED TO PROVIDE DISCHARGES AT INTERMEDIATE POINTS WITHIN REACHES WITHOUT ROUTING.

OTHER - THIS VERSION CONTAINS SOME ADDITIONS TO THE INPUT AND NUMEROUS MODIFICATIONS TO THE OUTPUT. USER OPTIONS HAVE BEEN MODIFIED AND AUGMENTED ON THE JOB RECORD, RAINTABLES ADDED, ERROR AND WARNING MESSAGES EXPANDED, AND THE SUMMARY TABLES COMPLETELY REVISED. THE HOLDOUT OPTION IS NOT OPERATIONAL AT THIS TIME.

PROGRAM QUESTIONS OR PROBLEMS SHOULD BE DIRECTED TO HYDRAULIC ENGINEERS AT THE SCS NATIONAL TECHNICAL CENTERS:

CHESTER, PA (NORTHEAST)	-- 215-499-3933,	FORT WORTH, TX (SOUTH)	-- 334-5242 (FTS)
LINCOLN, NB (MIDWEST)	-- 541-5318 (FTS),	PORTLAND, OR (WEST)	-- 423-4099 (FTS)

PROGRAM CHANGES SINCE MAY 1982:

12/17/82 - CORRECT PEAK RATE FACTOR FOR USER ENTERED DIMHYD

CORRECT REACH ROUTING PEAK TRAVEL TIME PRINTED WITH FULLPRINT OPTION

5/02/83 - CORRECT COMPUTATIONS FOR ---

1. DIVISION OF BASEFLOW IN DIVERT OPERATION
2. HYDROGRAPH VOLUME SPLIT BETWEEN BASEFLOW AND ABOVE BASEFLOW
3. CROSS SECTION DATA PLOTTING POSITION
4. INTERMEDIATE PEAK WHEN "FROM" AREA IS LARGER THAN "THRU" AREA
5. STORAGE ROUTED REACH TRAVEL TIME FOR MULTYPEAK HYDROGRAPH
6. ORDERING "FLOW-FREQ" FILE FROM SUMMARY TABLE #3 DATA
7. BASEFLOW ENTERED WITH READHYD
8. LOW FLOW SPLIT DURING DIVERT PROCEDURE #2 WHEN SECTION RATINGS START AT DIFFERENT ELEVATIONS

ENHANCEMENTS ---

1. REPLACE USER MANUAL ERROR CODES (PAGE 4-9 TO 4-11) WITH MESSAGES
2. LABEL OUTPUT HYDROGRAPH FILES WITH CROSS SECTION/STRUCTURE, ALTERNATE AND STORM NO'S

09/01/83 - CORRECT INPUT AND OUTPUT ERRORS FOR INTERMEDIATE PEAKS

CORRECT COMBINATION OF RATING TABLES FOR DIVERT

CHECK REACH ROUTING PARAMETERS FOR ACCEPTABLE LIMITS

ELIMINATE MINIMUM REACH TRAVEL TIME WHEN ATT-KIN COEFFICIENT EQUALS ONE

TR20 XEQ 06-01-99 12:37
REV PC 09/83(.1)

DUMBARTON OAKS EXISTING CONDITIONS
FILENAME; 1507_DOEX.T20

JOB 1 PASS 1
PAGE 2

RECORD ID

EXECUTIVE CONTROL OPERATION INCREM MAIN TIME INCREMENT = .05 HOURS

RECORD ID 6-MONTH

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4
STARTING TIME = .00 RAIN DEPTH = 1.80 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.= 0 MAIN TIME INCREMENT = .05 HOURS

** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .07 CFS.

RECORD ID

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 1

RECORD ID 1-YEAR

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4
STARTING TIME = .00 RAIN DEPTH = 2.70 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.= 1 MAIN TIME INCREMENT = .05 HOURS

RECORD ID

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 2

RECORD ID 2-YEAR

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4
STARTING TIME = .00 RAIN DEPTH = 3.30 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.= 2 MAIN TIME INCREMENT = .05 HOURS

RECORD ID

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 3

RECORD ID 10-YEAR

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4
STARTING TIME = .00 RAIN DEPTH = 5.30 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.=10 MAIN TIME INCREMENT = .05 HOURS

RECORD ID

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 4

TR20 XEQ 06-01-99 12:37
REV PC 09/83(.1)

DUMBARTON OAKS EXISTING CONDITIONS
FILENAME; 1507_DOEX.T20

JOB 1 PASS 5
PAGE 3

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4
STARTING TIME = .00 RAIN DEPTH = 7.40 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.=99 MAIN TIME INCREMENT = .05 HOURS
RECORD ID 100-YEAR

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 5
RECORD ID

EXECUTIVE CONTROL OPERATION ENDJOB
RECORD ID

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION			RUNOFF AMOUNT (IN)	PEAK DISCHARGE				
						BEGIN (HR)	AMOUNT (IN)	DURATION (HR)		ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)	
ALTERNATE 0 STORM 0														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	1.80	24.00	.14	---	12.10	9.32	129.9
XSECTION	3	RUNOFF	.03	2	2	.05	.0	1.80	24.00	.43	---	11.99	20.28	594.7
XSECTION	3	ADDHYD	.11	2	2	.05	.0	1.80	24.00	.23	---	12.00	25.88	244.6
XSECTION	2	RUNOFF	.01	2	2	.05	.0	1.80	24.00	.09	---	12.10	.72	79.1
XSECTION	2	ADDHYD	.11	2	2	.05	.0	1.80	24.00	.22	---	12.01	26.30	228.9
XSECTION	4	RUNOFF	.08	2	2	.05	.0	1.80	24.00	.12	---	12.09	9.10	113.4
XSECTION	4	ADDHYD	.20	2	2	.05	.0	1.80	24.00	.18	---	12.02	32.82	168.1
ALTERNATE 0 STORM 1														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	2.70	24.00	.46	---	12.07	34.65	483.2
XSECTION	3	RUNOFF	.03	2	2	.05	.0	2.70	24.00	.96	---	11.98	41.95	1230.1
XSECTION	3	ADDHYD	.11	2	2	.05	.0	2.70	24.00	.62	---	12.00	70.25	664.0
XSECTION	2	RUNOFF	.01	2	2	.05	.0	2.70	24.00	.36	---	12.06	3.73	409.8
XSECTION	2	ADDHYD	.11	2	2	.05	.0	2.70	24.00	.60	---	12.00	73.49	639.6
XSECTION	4	RUNOFF	.08	2	2	.05	.0	2.70	24.00	.43	---	12.06	37.27	464.1
XSECTION	4	ADDHYD	.20	2	2	.05	.0	2.70	24.00	.53	---	12.02	106.93	547.8
ALTERNATE 0 STORM 2														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	3.30	24.00	.74	---	12.07	55.65	776.1
XSECTION	3	RUNOFF	.03	2	2	.05	.0	3.30	24.00	1.36	---	11.98	57.35	1681.9
XSECTION	3	ADDHYD	.11	2	2	.05	.0	3.30	24.00	.94	---	12.00	104.87	991.2
XSECTION	2	RUNOFF	.01	2	2	.05	.0	3.30	24.00	.61	---	12.05	6.34	696.3
XSECTION	2	ADDHYD	.11	2	2	.05	.0	3.30	24.00	.91	---	12.00	110.61	962.7
XSECTION	4	RUNOFF	.08	2	2	.05	.0	3.30	24.00	.69	---	12.06	60.89	758.2
XSECTION	4	ADDHYD	.20	2	2	.05	.0	3.30	24.00	.82	---	12.02	166.80	854.5
ALTERNATE 0 STORM 10														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	5.30	24.00	1.89	---	12.05	137.56	1918.5
XSECTION	3	RUNOFF	.03	2	2	.05	.0	5.30	24.00	2.83	---	11.98	110.36	3236.2
XSECTION	3	ADDHYD	.11	2	2	.05	.0	5.30	24.00	2.20	---	12.00	233.86	2210.4
XSECTION	2	RUNOFF	.01	2	2	.05	.0	5.30	24.00	1.68	---	12.04	16.81	1847.0
XSECTION	2	ADDHYD	.11	2	2	.05	.0	5.30	24.00	2.16	---	12.00	249.73	2173.5
XSECTION	4	RUNOFF	.08	2	2	.05	.0	5.30	24.00	1.82	---	12.05	153.83	1915.7
XSECTION	4	ADDHYD	.20	2	2	.05	.0	5.30	24.00	2.02	---	12.01	396.03	2028.8

TR20 XEQ 06-01-99 12:37
REV PC 09/83(.1)

DUMBARTON OAKS EXISTING CONDITIONS
FILENAME; 1507_DOEX.T20

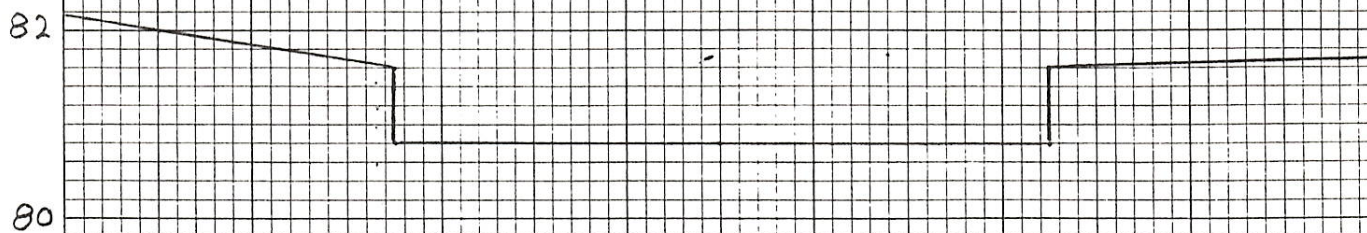
JOB 1 SUMMARY
PAGE 5

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

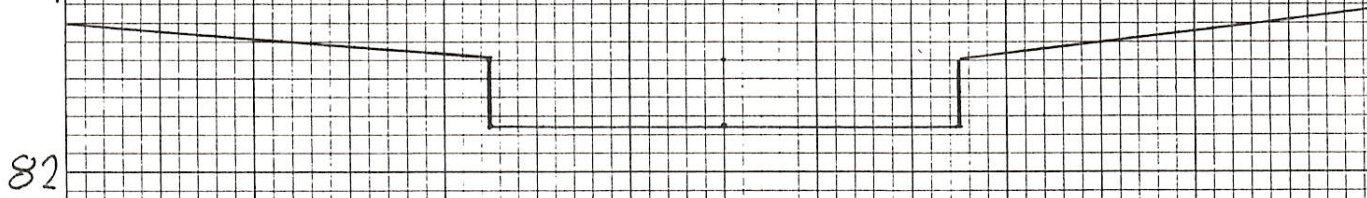
SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION			RUNOFF AMOUNT (IN)	PEAK DISCHARGE				
						BEGIN (HR)	AMOUNT (IN)	DURATION (HR)		ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)	
ALTERNATE	0	STORM	99											
XSECTION	1	RUNOFF	.07	2	2	.05	.0	7.40	24.00	3.32	---	12.05	232.66	3244.9
XSECTION	3	RUNOFF	.03	2	2	.05	.0	7.40	24.00	4.48	---	11.98	166.31	4877.1
XSECTION	3	ADDHYD	.11	2	2	.05	.0	7.40	24.00	3.70	---	12.00	379.12	3583.4
XSECTION	2	RUNOFF	.01	2	2	.05	.0	7.40	24.00	3.04	---	12.03	29.26	3214.9
XSECTION	2	ADDHYD	.11	2	2	.05	.0	7.40	24.00	3.64	---	12.00	407.13	3543.3
XSECTION	4	RUNOFF	.08	2	2	.05	.0	7.40	24.00	3.23	---	12.04	262.51	3269.1
XSECTION	4	ADDHYD	.20	2	2	.05	.0	7.40	24.00	3.47	---	12.01	659.41	3378.1

84 East Falls

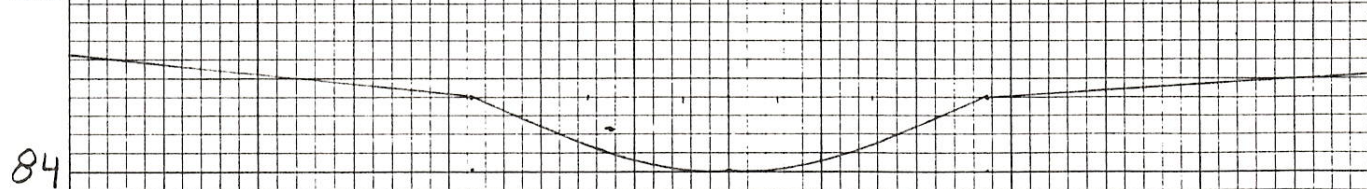
✓ MXS 6/8/99



84 Three Bridge Falls (First)



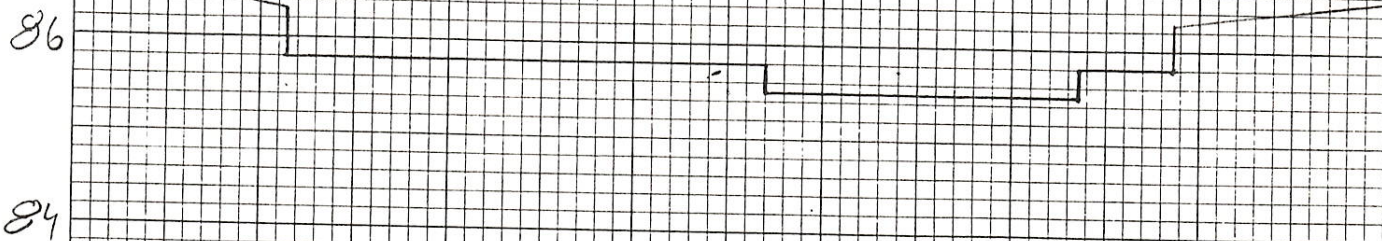
86 Three Bridge Falls (Second)



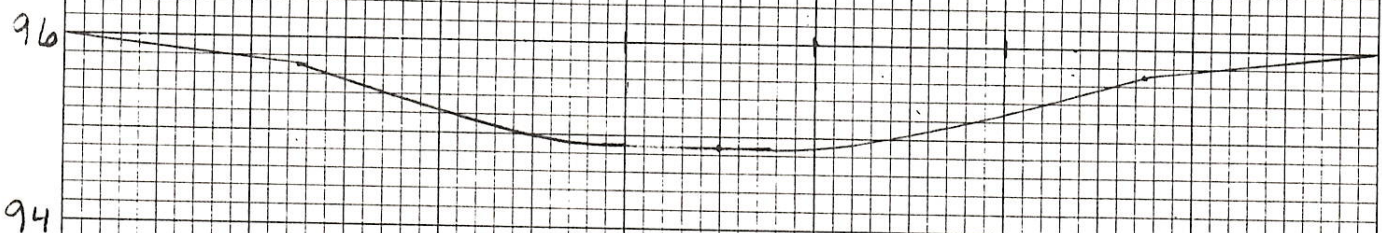
SCALE: HOR - 1" = 2'
VERT - 1" = 2'

88 Three Bridges Falls (Third)

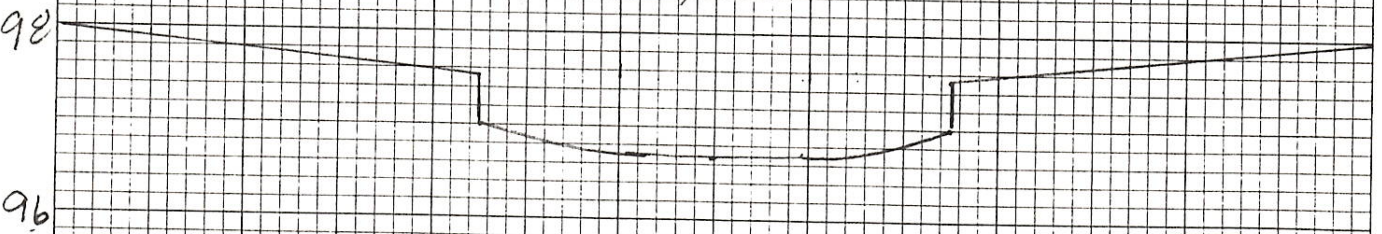
✓ MKS 6/10/17



Three Sisters Falls (First)



Three Sisters Falls (Second)



Laurel Pool

102

100

West Falls

102

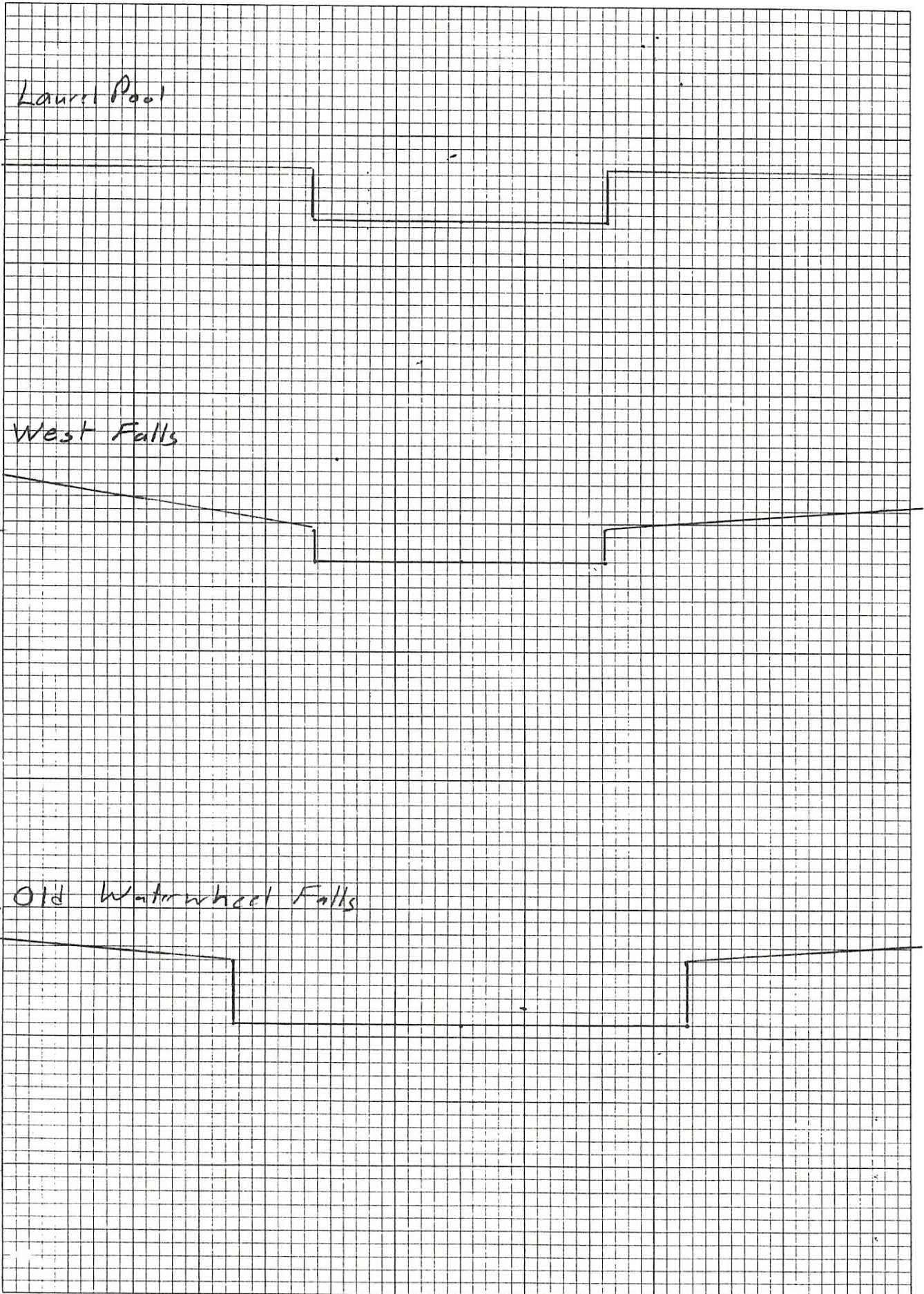
100

Old Waterwheel Falls

106

104

102



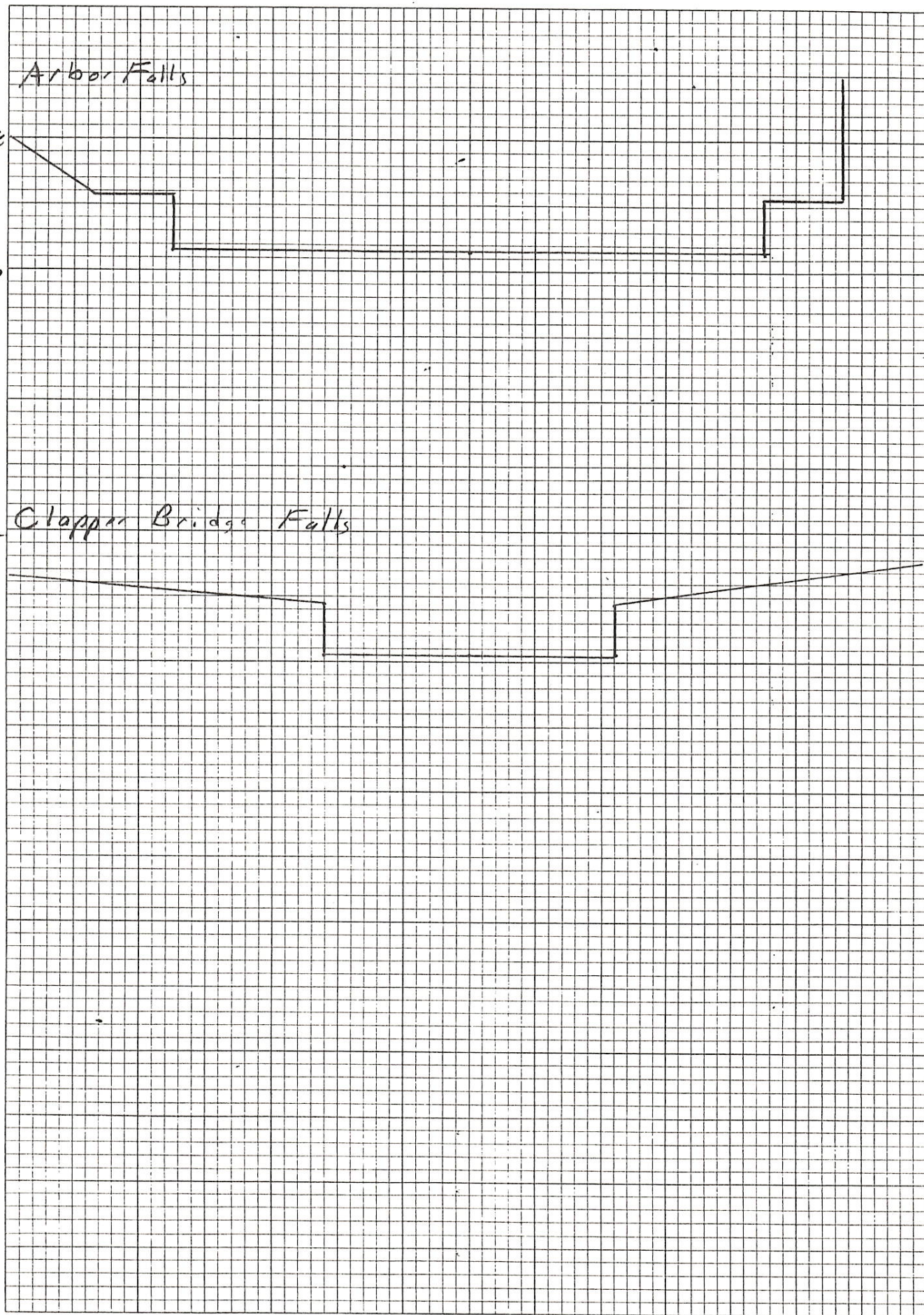
Arbor Falls

108

106

112 Clapper Bridge Falls

110



BY MKS DATE 6/8/99 SUBJECT DUMBARTON OAKS SHEET NO. _____ OF _____
 CHKD. BY RLP DATE 6/8/99 JOB NO. _____
 REV. BY _____ DATE _____ WEIR CAPACITY COMPS. FILE NO. _____

EAST FALLS

$$Q = CLH^{3/2} \quad , \quad \text{USE } C = 2.7 \text{ for all weirs}$$

$$Q = (2.7)(7)(0.83)^{3/2}$$

$$Q = 14.29 \text{ cfs}$$

$$V = Q/A = \frac{14.29 \text{ cfs}}{(0.83)(7) \text{ ft}^2}$$

$$V = 2.46 \text{ fps}$$

THREE BRIDGE FALLS (FIRST)

$$Q = (2.7)(5)(0.67)^{3/2}$$

$$Q = 7.40 \text{ cfs}$$

$$V = \frac{7.40 \text{ cfs}}{(0.67)(5)}$$

$$V = 2.21 \text{ fps}$$

THREE BRIDGE FALLS (SECOND)

$$Q = (2.7)(5.5)(0.8)^{3/2} = 10.63 \text{ cfs}$$

$$Q = (2.7)(5.5)(0.8)^{3/2} = 5.31 \text{ cfs}$$

$$Q = (2.7)(5.5)(0.8)^{3/2} = 3.76 \text{ cfs}$$

$$Q_1 = (2.7)(1)(0.8)^{3/2} = 1.93 \text{ cfs}$$

$$Q_2 = (2.7)(2)(0.65)^{3/2} = 2.83 \text{ cfs}$$

$$Q_3 = (2.7)(2.5)(0.3)^{3/2} = 1.11 \text{ cfs}$$

$$Q_T = 5.87 \text{ cfs}$$

$$V = Q/A$$

$$V = \frac{5.87 \text{ cfs}}{2.85 \text{ ft}^2}$$

$$V = 2.06 \text{ fps}$$

THREE BRIDGE FALLS (THIRD)

3'-4" WEIR

H	C	Q
0		
0.33	2.7	1.70
0.83	2.7	6.80

6'-2" 9'-6" WEIR

H	C	Q
0		5.90
0.5	2.7	9.07

TOTAL Q (cfs)

$$1.70$$

$$\underline{15.87} \quad 12.7$$

$$V = Q/A$$

$$V = \frac{15.87 \text{ cfs}}{(3.33)(1.33) + (9.5)(0.5)}$$

$$V = \frac{2.77 \text{ fps}}{2.17}$$

THREE SISTERS FALLS (FIRST)

$$Q = (2.7)(9)(0.83)^{3/2} = 18.37 \text{ cfs}$$

$$Q = (2.7)(9)(0.83)^{3/2} = 9.19 \text{ cfs}$$

$$Q = (2.7)(9)(0.83)^{3/2} = 6.50 \text{ cfs}$$

$$Q_1 = (2.7)(2)(0.83)^{3/2} = 4.08 \text{ cfs}$$

$$Q_2 = (2.7)(4)(0.7)^{3/2} = 6.33 \text{ cfs}$$

$$Q_3 = (2.7)(3)(0.3)^{3/2} = 1.33 \text{ cfs}$$

$$Q_T = 11.74 \text{ cfs}$$

$$V = \frac{Q}{A} = \frac{11.74}{(5.36)} = 2.19 \text{ fps}$$

BY MKS DATE 6/8/99 SUBJECT DUMBARTON OAKS SHEET NO. _____ OF _____
 CHKD. BY R.L.P. DATE 6/8/99 JOB NO. _____
 REV. BY _____ DATE _____ WEIR CAPACITY COMPS FILE NO. _____

THREE SISTERS FALLS (SECOND)

$$Q = (2.7)(5)(0.83)^{3/2} = 10.21 \text{ cfs}$$

$$Q = (2.7)(5/2)(0.83)^{3/2} = 5.10 \text{ cfs}$$

$$Q = (2.7)(5)(0.83/2)^{3/2} = 3.61 \text{ cfs}$$

$$V = \frac{Q}{A} = \frac{9.19 \text{ cfs}}{3.86 \text{ ft}^2} = 2.38 \text{ fps}$$

$$Q_1 = (2.7)(2)(0.83)^{3/2} = 4.08 \text{ cfs}$$

$$Q_2 = (2.7)(2)(0.8)^{3/2} = 3.86 \text{ cfs}$$

$$Q_3 = (2.7)(1)(0.6)^{3/2} = 1.25 \text{ cfs}$$

$$Q_T = 9.19 \text{ cfs}$$

LAUREL POOL

$$Q = (2.7)(4.5)(0.67)^{3/2}$$

$$Q = 6.67 \text{ cfs}$$

$$V = Q/A$$

$$V = \frac{6.67}{(4.5)(0.67)}$$

$$V = 2.12 \text{ fps}$$

WEST FALLS

$$Q = (2.7)(4.5)(0.5)^{3/2}$$

$$Q = 4.30 \text{ cfs}$$

$$V = Q/A$$

$$V = \frac{4.3}{(4.5)(0.5)}$$

$$V = 1.91 \text{ fps}$$

OLD WATERWHEEL FALLS

$$Q = (2.7)(7)(1)^{3/2}$$

$$Q = 18.9 \text{ cfs}$$

$$V = Q/A$$

$$V = \frac{18.9}{(7)(1)}$$

$$V = 2.7 \text{ fps}$$

BY MKS DATE 6/8/99 SUBJECT DUMBARTON OAKS SHEET NO. _____ OF _____
CHKD. BY PLP DATE 6/8/99 JOB NO. _____
REV. BY _____ DATE _____ WEIR CAPACITY COMPS FILE NO. _____

ARBOR FALLS

$$Q = CLH^{3/2} \leftarrow \text{Weir Equation}$$

$$Q = (2.7)(9)(0.83)^{3/2}$$

$$Q = 18.37 \text{ cfs}$$

$$V = \frac{Q}{A}$$

$$V = \frac{18.37}{(9)(0.83)}$$

$$V = 2.46 \text{ fps}$$

CLAPPER BRIDGE FALLS

$$Q = (2.7)(4.5)(0.67)^{3/2}$$

$$Q = 6.66 \text{ cfs}$$

$$V = Q/A$$

$$V = \frac{6.66}{(4.5)(0.67)}$$

$$V = 2.21 \text{ fps}$$

BY MKS DATE 6/9/99 SUBJECT DUMBARTON OAKS SHEET NO. _____ OF _____
 CHKD. BY _____ DATE _____ WEIR CAPACITY COMPS JOB NO. _____
 REV. BY _____ DATE _____ (w/ ADD'L 6" HEAD) FILE NO. _____

* COMPS. DONE w/ ADDITIONAL 0.5' HEAD

USE $C = 3.0$ for all weirs

EAST FALLS: N/A (EX. $Q = 14.29$ cfs)

THREE BRIDGE FALLS (FIRST): $H = 0.67' + 0.5' = 1.17'$, $L = 5'$, $C = 3.0$

$$Q = CLH^{3/2}$$

$$Q = (3.0)(5)(1.17)^{3/2}$$

$$Q = 19.0 \text{ cfs}$$

$$V = \frac{Q}{A} = \frac{19.0 \text{ cfs}}{(5)(1.17) \text{ ft}^2}$$

$$V = 3.25 \text{ fps}$$

THREE BRIDGE FALLS (SECOND): $H_1 = 0.8 + 0.5 = 1.3'$, $H_2 = 0.65 + 0.5 = 1.15'$, $H_3 = 0.3 + 0.5 = 0.8'$

$$Q_1 = (3.0)(1)(1.3)^{3/2} = 4.5 \text{ cfs}$$

$$Q_2 = (3.0)(2)(1.15)^{3/2} = 7.4 \text{ cfs}$$

$$Q_3 = (3.0)(2.5)(0.8)^{3/2} = 5.4 \text{ cfs}$$

$$Q_T = 17.3 \text{ cfs}$$

$$V = \frac{Q}{A} = \frac{17.3 \text{ cfs}}{5.43 \text{ ft}^2}$$

$$V = 3.19 \text{ fps}$$

THREE BRIDGE FALLS (THIRD): N/A, EX. $Q = 12.7$ cfs

THREE SISTERS FALLS (FIRST): N/A, EX. $Q = 11.74$ cfs

THREE SISTERS FALLS (SECOND): $H_1 = 0.83 + 0.5 = 1.33'$, $H_2 = 0.8 + 0.5 = 1.3'$, $H_3 = 0.0 + 0.5 = 1.1'$

$$Q_1 = (3.0)(2)(1.33)^{3/2} = 9.2 \text{ cfs}$$

$$Q_2 = (3.0)(2)(1.3)^{3/2} = 8.9 \text{ cfs}$$

$$Q_3 = (3.0)(1)(1.1)^{3/2} = 3.5 \text{ cfs}$$

$$Q_T = 21.6 \text{ cfs}$$

$$V = \frac{Q}{A} = \frac{21.6}{6.5} = 3.4 \text{ fps}$$

BY MKS DATE 10/9/99 SUBJECT DUMBARTON OAKS SHEET NO. _____ OF _____
 CHKD. BY _____ DATE _____ WEIR CAPACITY COMPS. JOB NO. _____
 REV. BY _____ DATE _____ (W/ ADST'L. 6" HEAD) FILE NO. _____

LAUREL POOL : $H = 0.67 + 0.5 = 1.17'$, $L = 4.5$, $C = 3.0$

$$Q = CLH^{3/2}$$

$$Q = (3.0)(4.5)(1.17)^{3/2}$$

$$\underline{Q = 17.1 \text{ cfs}}$$

$$V = \frac{Q}{A} = \frac{17.1 \text{ cfs}}{5.3 \text{ ft}^2}$$

$$\underline{V = 3.2 \text{ fps}}$$

WEST FALLS : $H = 0.5 + 0.5 = 1.0'$, $L = 4.5$, $C = 3.0$

$$Q = CLH^{3/2}$$

$$Q = (3.0)(4.5)(1)^{3/2}$$

$$\underline{Q = 13.5 \text{ cfs}}$$

$$V = \frac{Q}{A} = \frac{13.5}{4.5}$$

$$\underline{V = 3.0 \text{ fps}}$$

OLD WATERWHEEL FALLS : N/A, EX. $Q = 18.9 \text{ cfs}$

ARBOR FALLS : N/A, EX. $Q = 18.37 \text{ cfs}$

CLAPPER BRIDGE FALLS : $H = 0.67 + 0.5 = 1.17'$, $L = 4.5$, $C = 3.0$

$$Q = CLH^{3/2}$$

$$Q = (3.0)(4.5)(1.17)^{3/2}$$

$$\underline{Q = 17.1 \text{ cfs}}$$

$$V = \frac{Q}{A} = \frac{17.1 \text{ cfs}}{5.3 \text{ ft}^2}$$

$$\underline{V = 3.2 \text{ fps}}$$

BY MKS DATE 2/9/00 SUBJECT DUMBARSON CREEK SHEET NO. _____ OF _____
 CHKD. BY _____ DATE _____ WEIR (FACILITY COMPS) JOB NO. _____
 REV. BY _____ DATE _____ N/A 1.0' ADD'L. HEAD FILE NO. _____

* COMPS. DONE W/ ADDITIONAL 1.0' HEAD

USE $C = 3.07$ for all weirs

EAST FALLS: N/A, EX. Q = 14.29 cfs

THREE BRIDGE FALLS (FIRST): $H = 0.67 + 1 = 1.67'$, $L = 5'$, $C = 3.07$

$$Q = CLH^{3/2}$$

$$Q = (3.07)(5)(1.67)^{3/2}$$

$$Q = 33.1 \text{ cfs}$$

$$V = \frac{Q}{A} = \frac{33.1 \text{ cfs}}{8.35 \text{ ft}^2}$$

$$V = 4.0 \text{ fps}$$

THREE BRIDGE FALLS (SECOND): $H_1 = 0.8 + 1 = 1.8'$, $H_2 = 0.65 + 1 = 1.65'$, $H_3 = 0.3 + 1 = 1.3'$

$$Q_1 = (3.07)(1)(1.8)^{3/2} = 7.4 \text{ cfs}$$

$$Q_2 = (3.07)(2)(1.65)^{3/2} = 13.0 \text{ cfs}$$

$$Q_3 = (3.07)(2.5)(1.3)^{3/2} = 11.4 \text{ cfs}$$

$$Q_T = 31.8 \text{ cfs}$$

$$V = \frac{Q}{A} = \frac{31.8 \text{ cfs}}{8.35 \text{ ft}^2}$$

$$V = 3.8 \text{ fps}$$

THREE BRIDGE FALLS (THIRD): N/A, EX. Q = 12.7 cfs

THREE SISTERS FALLS (FIRST): N/A, EX. Q = 11.74 cfs

THREE SISTERS FALLS (SECOND): $H_1 = 0.83 + 1 = 1.83'$, $H_2 = 0.8 + 1 = 1.8'$, $H_3 = 0.6 + 1 = 1.6'$

$$Q_1 = (3.07)(2)(1.83)^{3/2} = 15.2 \text{ cfs}$$

$$Q_2 = (3.07)(2)(1.8)^{3/2} = 14.8 \text{ cfs}$$

$$Q_3 = (3.07)(1)(1.6)^{3/2} = 6.2 \text{ cfs}$$

$$Q_T = 36.2 \text{ cfs}$$

$$V = \frac{Q}{A} = \frac{36.2 \text{ cfs}}{8.86 \text{ ft}^2} = 4.1 \text{ fps}$$

BY MKS DATE 6/9/90 SUBJECT DUNBAR OAKS SHEET NO. _____ OF _____
 CHKD. BY _____ DATE _____ WEIR (CAPACITY COMPS JOB NO. _____
 REV. BY _____ DATE _____ (W/ ADJT' L. 1' HEAD) FILE NO. _____

LAUREL POOL: $H = 0.67 + 1 = 1.67'$, $L = 4.5$, $C = 3.07$

$$Q = CLH^{3/2}$$

$$Q = (3.07)(4.5)(1.67)^{3/2}$$

$$Q = 29.8 \text{ cfs}$$

$$V = \frac{Q}{A} = \frac{29.8 \text{ cfs}}{7.52 \text{ ft}^2}$$

$$V = 4.0 \text{ fps}$$

WEST FALLS: $H = 0.5 + 1 = 1.5'$, $L = 4.5$, $C = 3.07$

$$Q = CLH^{3/2}$$

$$Q = (3.07)(4.5)(1.5)^{3/2}$$

$$Q = 25.4 \text{ cfs}$$

$$V = \frac{Q}{A} = \frac{25.4 \text{ cfs}}{6.75 \text{ ft}^2}$$

$$V = 3.8 \text{ fps}$$

OLD WATERWHEEL FALLS: N/A, EX. Q = 18.9 cfs

ARROW FALLS: N/A, EX. Q = 18.37 cfs

CLARKE BRIDGE FALLS: $H = 0.67 + 1 = 1.67'$, $L = 4.5$, $C = 3.07$

$$Q = CLH^{3/2}$$

$$Q = (3.07)(4.5)(1.67)^{3/2}$$

$$Q = 29.8 \text{ cfs}$$

$$V = \frac{Q}{A} = \frac{29.8 \text{ cfs}}{7.52 \text{ ft}^2}$$

$$V = 4.0 \text{ fps}$$

BY MKS DATE 6/10/99 SUBJECT DUMBARTON OAKS SHEET NO. _____ OF _____
 CHKD. BY _____ DATE _____ WEIR CAPACITY COMPS. JOB NO. _____
 REV. BY _____ DATE _____ (SUMMARY) FILE NO. _____

STRUCTURE	EXISTING Q (cfs)	Q @ (H+6") (cfs)	Q @ (H+1') (cfs)	EXISTING V (fps)	V @ (H+6") (fps)	V @ (H+1') (fps)
EAST FALLS	14.29	—	—	2.46	—	—
THREE BRIDGE FALLS (FIRST)	7.40	19.0	33.1	2.21	3.25	4.0
THREE BRIDGE FALLS (SECOND)	5.87	17.3	31.8	2.06	3.19	3.8
THREE BRIDGE FALLS (THIRD)	12.7	—	—	2.17	—	—
THREE SISTERS FALLS (FIRST)	11.74	—	—	2.19	—	—
THREE SISTERS FALLS (SECOND)	9.19	21.6	36.2	2.38	3.4	4.1
LAUREL POOL	6.67	17.1	29.8	2.12	3.2	4.0
WEST FALLS	4.30	13.5	25.4	1.91	3.0	3.8
OLD WATERWHEEL FALLS	18.9	—	—	2.7	—	—
ARBOR FALLS	18.37	—	—	2.46	—	—
CLAPPER BRIDGE FALLS	6.66	17.1	29.8	2.21	3.2	4.0

*Brater & King*Table 5-3. Values of C in the Formula $Q = CLH^{3/2}$ for Broad-crested Weirs

Measured head in feet, H	Breadth of crest of weir in feet										
	0.50	0.75	1.00	1.50	2.00	2.50	3.00	4.00	5.00	10.00	15.00
0.2	2.80	2.75	2.69	2.62	2.54	2.48	2.44	2.38	2.31	2.49	2.68
0.4	2.92	2.80	2.72	2.64	2.61	2.60	2.58	2.54	2.50	2.56	2.70
0.6	3.08	2.89	2.75	2.64	2.61	2.60	2.63	2.69	2.70	2.70	2.70
0.8	3.30	3.04	2.85	2.68	2.60	2.60	2.67	2.68	2.68	2.69	2.64
1.0	3.32	3.14	2.95	2.75	2.66	2.64	2.65	2.67	2.68	2.68	2.63
1.2	3.32	3.20	3.05	2.86	2.70	2.65	2.64	2.67	2.66	2.69	2.64
1.4	3.32	3.26	3.20	2.92	2.77	2.68	2.64	2.65	2.65	2.67	2.64
1.6	3.32	3.29	3.28	3.07	2.89	2.75	2.68	2.66	2.65	2.64	2.63
1.8	3.32	3.32	3.31	3.07	2.88	2.74	2.68	2.66	2.65	2.64	2.63
2.0	3.32	3.31	3.30	3.03	2.85	2.76	2.72	2.68	2.65	2.64	2.63
2.5	3.32	3.32	3.31	3.28	3.07	2.89	2.81	2.72	2.67	2.64	2.63
3.0	3.32	3.32	3.32	3.32	3.20	3.05	2.92	2.73	2.66	2.64	2.63
3.5	3.32	3.32	3.32	3.32	3.32	3.19	2.97	2.76	2.68	2.64	2.63
4.0	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.70	2.64	2.63
4.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.74	2.64	2.63
5.0	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.64	2.63
5.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.64	2.63

Use average
"C" value of 2.7
for all weirs

Table 5-5. Values of C in the Formula $Q = CLH^{3/2}$ for Broad-crested Weirs with Crests Inclined Slightly Downward

Crest	Energy head = H_e									
	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.5	
Level.....	2.78	2.79	2.80	2.81	2.82	2.83	2.85	2.85	2.85	
Slope = 0.004.....	2.05	2.04	2.03	2.02	2.01	2.00	2.88	2.87	2.87	
Slope = 0.020.....	3.07	3.06	3.05	3.04	3.03	3.02	3.00	2.99		

(b)

Slope of crest	Length of weir in feet	Head in feet, H							
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	
12 to 1.....	3.0	2.58	2.87	2.57	2.60	2.84	2.81	2.70	
18 to 1.....	3.0	2.91	2.92	2.53	2.60	2.80	2.74	2.62	
18 to 1.....	10.0	2.52	2.68	2.73	2.80	2.90	2.80	2.68	

Table 5-6. Values of C in the Formula $Q = CLH^{3/2}$ for Weirs of Triangular Cross Section with Vertical Upstream Face and Sloping Downstream Face

Slope of down- stream face	Height of weir in feet, P	Head in feet, H										
		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.5
Hor. Vert.												
1 to 1	2.46	3.88	3.85	3.85	3.85	3.85	3.85	3.85	3.85	3.85	3.85	3.85
2 to 1	2.46	3.48	3.48	3.49	3.49	3.50	3.50	3.50	3.50	3.50	3.51	3.51
2 to 1	1.64	3.56	3.47	3.47	3.51	3.54	3.57	3.58	3.58	3.58	3.59	3.57
3 to 1	1.64	2.90	3.11	3.22	3.26	3.33	3.37	3.40	3.40	3.41	3.41	
5 to 1	2.46	3.08	3.06	3.05	3.05	3.07	3.09	3.12	3.13	3.13	3.13	
10 to 1	2.46	2.82	2.83	2.84	2.86	2.89	2.90	2.91	2.91	2.92	2.92	2.93

Table 5-4. Values of C in the Formula $Q = CLH^{3/2}$ for Models of Broad-crested Weirs with Rounded Upstream Corner

Name of experimenter	Radius of curve in feet	Breadth of weir in feet, B	Height of weir in feet, P	Head in feet, H									
				0.4	0.6	0.8	1.0	1.5	2.0	2.5	3.0	4.0	5.0
Bazin.....	0.33	2.62	2.46	2.93	2.97	2.98	3.01	3.04					
Bazin, S. Deep	0.33	6.56	2.46	2.70	2.82	2.87	2.89	2.92					
U. Waterways.....	0.33	2.62	4.57	2.77	2.80	2.83	2.92	3.00	3.08	3.17	3.31	3.50	
U. Waterways, S. Deep	0.33	6.56	4.56	2.83	2.83	2.83	2.89	2.89	2.89	2.89	2.89	2.89	2.81

DUMBARTON OAKS: STREAM CROSS-SECTIONS
 (* ALL CROSS-SECTIONS LOOKING DOWNSTREAM)

SCALE:
 1" = 10'
 1" = 5'

CROSS-SECTION "A-A"

110

105

100

AREA = 36 ft²

Manning's "n" = 0.04

WP = 23 ft

$R = \frac{A}{WP} = \frac{36}{23} = 1.57 \text{ ft}$

$S = 0.01 \text{ ft/ft}$

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$$Q = \frac{1.49}{0.04} (36) (1.57)^{2/3} (0.01)^{1/2}$$

$$Q = 181 \text{ cfs}$$

Scale:
 1" = 10'
 1" = 5'

CROSS-SECTION "B-B"

90

85

80

AREA = 33 ft²

Manning's "n" = 0.04

WP = 23 ft

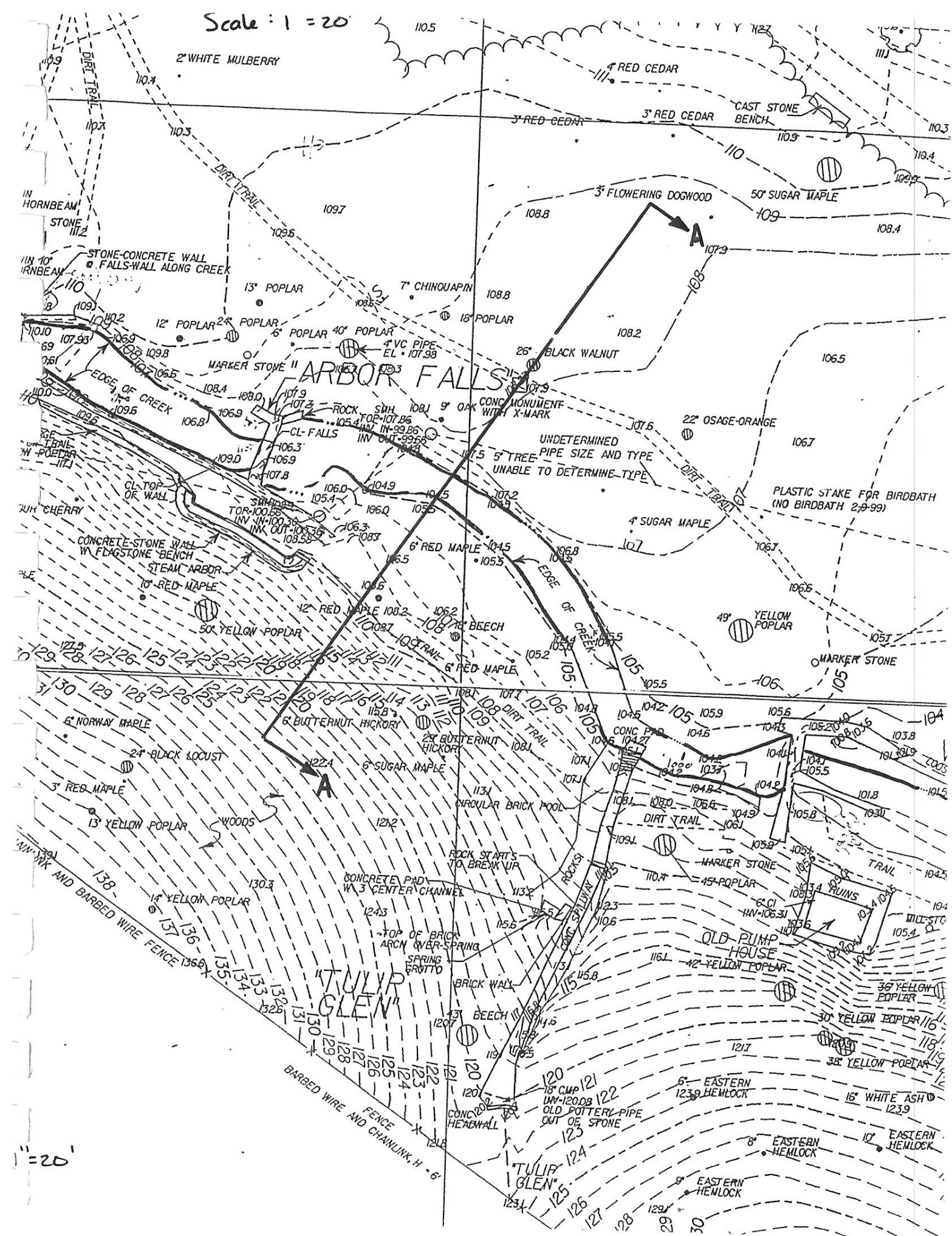
$R = \frac{A}{WP} = \frac{33}{23} = 1.4$

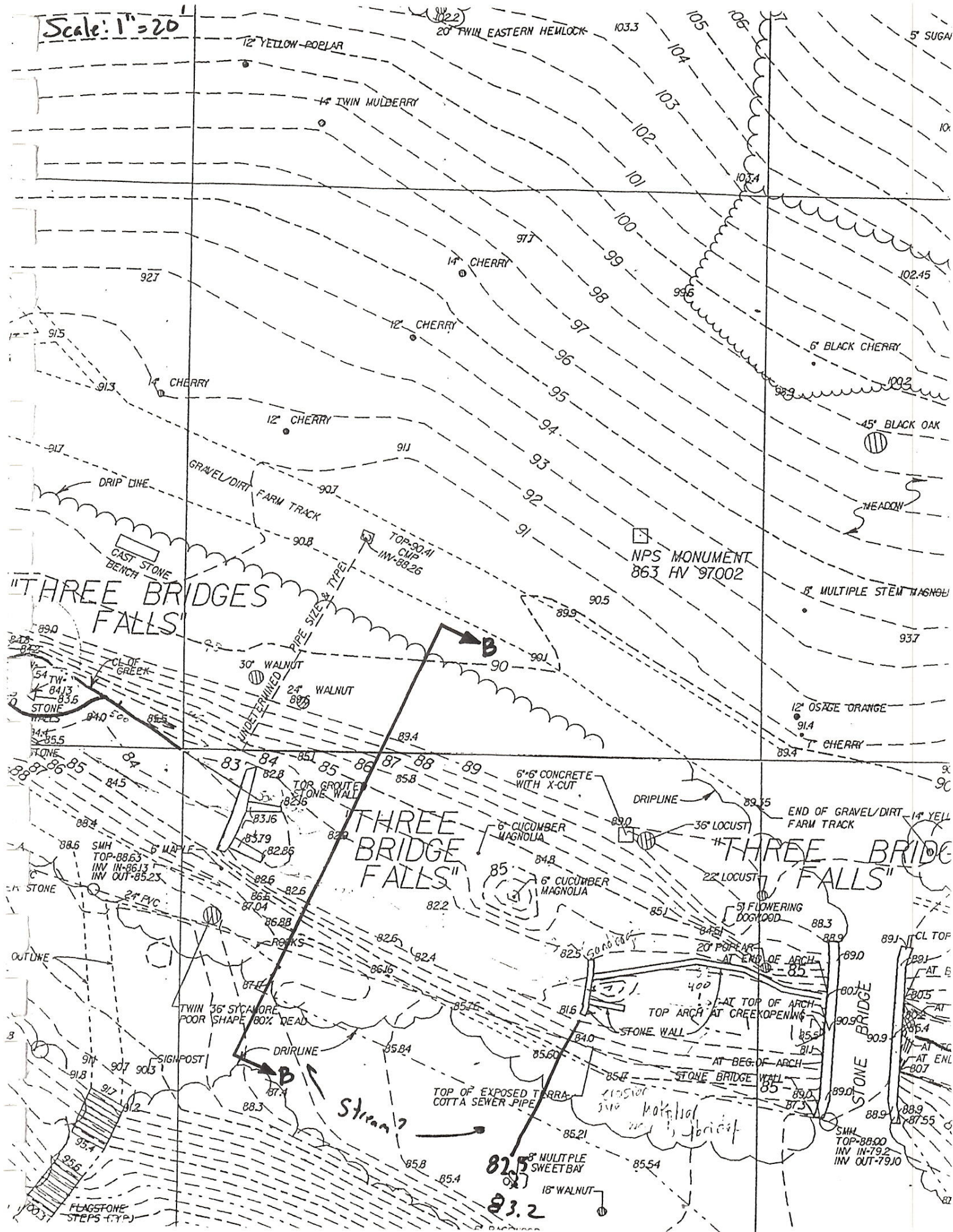
$S = 0.015 \text{ ft/ft}$

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$$Q = \frac{1.49}{0.04} (33) (1.4)^{2/3} (0.015)^{1/2}$$

$$Q = 188 \text{ cfs}$$





APPENDIX II

Detention Hydraulics

BY RLP DATE 6/8/99 SUBJECT Dumbarton Oaks SHEET NO. _____ OF _____
 CHKD. BY _____ DATE _____ Pond 1 - on U.S. Naval Obs. JOB NO. _____
 REV. BY _____ DATE _____ FILE NO. _____

Elev (ft)	Area (Ac)	Increment Vol (Ac-ft)	Σ Vol Ac-ft
--------------	--------------	-----------------------------	-----------------------

200	0.11	0	0
205	0.39	1.25	1.25
210	0.79	2.95	4.20
215	1.27	5.15	9.35

6" Φ Low Flow			15" Weir			Q_T (cfs)
h (ft)	Q (cfs)		H (ft)	C	Q (cfs)	
200.0	0	0				0.0
201.0	0.75	0.8				0.8
202.0	1.75	1.3				1.3
203.0	2.75	1.6				1.6
204.0	3.75	1.8				1.8
205.0	4.75	2.1				2.1
206.0	5.75	2.3				2.3
207.0	6.75	2.5	0		0	2.5
208.0	—	↓	1.0	2.98	44.7	47.2
209.0	—		2.0	3.30	140.0	142.5
210.0	—		3.0	3.32	258.8	261.3

$$Q = 0.6 A \sqrt{2gh}$$

$$Q = 0.95 \sqrt{h}$$

$$Q = CL H^{3/2}$$

*****80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****

```

DB TR-20
TITLE
DUMBARTON OAKS POND 1 ON U. S. NAVAL OBS.
TITLE
FILENAME 1507_D01.T20
3 STRUCT 1
8 200.0 0.0 0.00 POND 1
8 201.0 0.8 0.25
8 202.0 1.3 0.50
8 203.0 1.6 0.75
8 204.0 1.8 1.00
8 205.0 2.1 1.25
8 206.0 2.3 1.84
8 207.0 2.5 2.33
8 208.0 47.2 2.92
8 209.0 142.5 3.51
8 210.0 261.3 4.20
9 ENDTBL
6 RUNOFF 1 1 3 0.0717 73. 0.24 SA1
6 RESVOR 2 1 3 2 200.0
6 RUNOFF 1 3 1 0.0341 84. 0.08 SA3
6 ADDHYD 4 3 1 2 3
6 RUNOFF 1 2 2 0.0091 70. 0.20 SA2
6 ADDHYD 4 2 3 2 5
6 RUNOFF 1 3 1 0.0803 72. 0.22 SA4
6 ADDHYD 4 4 5 1 4
ENDATA
7 INCREM 6 0.05
7 COMPUT 7 1 4 0. 1.8 1.2 2 0 0 6-MONTH
ENDCMP 1
7 COMPUT 7 1 4 0. 2.7 1.2 2 0 1 1-YEAR
ENDCMP 1
7 COMPUT 7 1 4 0. 3.3 1.2 2 0 2 2-YEAR
ENDCMP 1
7 COMPUT 7 1 4 0. 5.3 1.2 2 0 10 10-YEAR
ENDCMP 1
7 COMPUT 7 1 4 0. 7.4 1.2 2 0 99 100-YEAR
ENDCMP 1
ENDJOB 2

```

*****END OF 80-80 LIST*****

COMPUTER PROGRAM FOR PROJECT FORMULATION - HYDROLOGY USER NOTES

THE USERS MANUAL FOR THIS PROGRAM IS THE MAY 1982 DRAFT OF TR-20. CHANGES FROM THE 2/14/74 VERSION INCLUDE:

REACH ROUTING - THE MODIFIED ATT-KIN ROUTING PROCEDURE REPLACES THE CONVEX METHOD. INPUT DATA PREPARED FOR PREVIOUS PROGRAM VERSIONS USING CONVEX ROUTING COEFFICIENTS WILL NOT RUN ON THIS VERSION.

THE PREFERRED TYPE OF DATA ENTRY IS CROSS SECTION DATA REPRESENTATIVE OF A REACH. IT IS RECOMMENDED THAT THE OPTIONAL CROSS SECTION DISCHARGE-AREA PLOTS BE OBTAINED WHENEVER NEW CROSS SECTION DATA IS ENTERED. THE PLOTS SHOULD BE CHECKED FOR REASONABLENESS AND ADEQUACY OF INPUT DATA FOR THE COMPUTATION OF "M" VALUES USED IN THE ROUTING PROCEDURE.

GUIDELINES FOR DETERMINING OR ANALYZING REACH LENGTHS AND COEFFICIENTS (X,M) ARE AVAILABLE IN THE USERS MANUAL. SUMMARY TABLE 2 DISPLAYS REACH ROUTING RESULTS AND ROUTING PARAMETERS FOR COMPARISON AND CHECKING.

HYDROGRAPH GENERATION - THE PROCEDURE TO CALCULATE THE INTERNAL TIME INCREMENT AND PEAK TIME OF THE UNIT HYDROGRAPH HAVE BEEN IMPROVED. PEAK DISCHARGES AND TIMES MAY DIFFER FROM THE PREVIOUS VERSION. OUTPUT HYDROGRAPHS ARE STILL INTERPOLATED, PRINTED, AND ROUTED AT THE USER SELECTED MAIN TIME INCREMENT.

INTERMEDIATE PEAKS - METHOD ADDED TO PROVIDE DISCHARGES AT INTERMEDIATE POINTS WITHIN REACHES WITHOUT ROUTING.

OTHER - THIS VERSION CONTAINS SOME ADDITIONS TO THE INPUT AND NUMEROUS MODIFICATIONS TO THE OUTPUT. USER OPTIONS HAVE BEEN MODIFIED AND AUGMENTED ON THE JOB RECORD, RAINTABLES ADDED, ERROR AND WARNING MESSAGES EXPANDED, AND THE SUMMARY TABLES COMPLETELY REVISED. THE HOLDOUT OPTION IS NOT OPERATIONAL AT THIS TIME.

PROGRAM QUESTIONS OR PROBLEMS SHOULD BE DIRECTED TO HYDRAULIC ENGINEERS AT THE SCS NATIONAL TECHNICAL CENTERS:

CHESTER, PA (NORTHEAST) -- 215-499-3933, FORT WORTH, TX (SOUTH) -- 334-5242 (FTS)
LINCOLN, NB (MIDWEST) -- 541-5318 (FTS), PORTLAND, OR (WEST) -- 423-4099 (FTS)

PROGRAM CHANGES SINCE MAY 1982:

12/17/82 - CORRECT PEAK RATE FACTOR FOR USER ENTERED DIMHYD

CORRECT REACH ROUTING PEAK TRAVEL TIME PRINTED WITH FULLPRINT OPTION

5/02/83 - CORRECT COMPUTATIONS FOR ---

1. DIVISION OF BASEFLOW IN DIVERT OPERATION
2. HYDROGRAPH VOLUME SPLIT BETWEEN BASEFLOW AND ABOVE BASEFLOW
3. CROSS SECTION DATA PLOTTING POSITION
4. INTERMEDIATE PEAK WHEN "FROM" AREA IS LARGER THAN "THRU" AREA
5. STORAGE ROUTED REACH TRAVEL TIME FOR MULTYPEAK HYDROGRAPH
6. ORDERING "FLOW-FREQ" FILE FROM SUMMARY TABLE #3 DATA
7. BASEFLOW ENTERED WITH READHYD
8. LOW FLOW SPLIT DURING DIVERT PROCEDURE #2 WHEN SECTION RATINGS START AT DIFFERENT ELEVATIONS

ENHANCEMENTS ---

1. REPLACE USER MANUAL ERROR CODES (PAGE 4-9 TO 4-11) WITH MESSAGES
2. LABEL OUTPUT HYDROGRAPH FILES WITH CROSS SECTION/STRUCTURE, ALTERNATE AND STORM NO'S

09/01/83 - CORRECT INPUT AND OUTPUT ERRORS FOR INTERMEDIATE PEAKS

CORRECT COMBINATION OF RATING TABLES FOR DIVERT

CHECK REACH ROUTING PARAMETERS FOR ACCEPTABLE LIMITS

ELIMINATE MINIMUM REACH TRAVEL TIME WHEN ATT-KIN COEFFICIENT EQUALS ONE

TR20 XEQ 06-08-99 13:29
REV PC 09/83(.1)

DUMBARTON OAKS POND 1 ON U. S. NAVAL OBS.
FILENAME 1507_DO1.T20

JOB 1 PASS 1
PAGE 2

EXECUTIVE CONTROL OPERATION INCREM MAIN TIME INCREMENT = .05 HOURS

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4

RECORD ID 6-MONTH

STARTING TIME = .00 RAIN DEPTH = 1.80 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.= 0 MAIN TIME INCREMENT = .05 HOURS

** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .96 CFS.

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .07 CFS.

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 1

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4

RECORD ID 1-YEAR

STARTING TIME = .00 RAIN DEPTH = 2.70 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.= 1 MAIN TIME INCREMENT = .05 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = 2.11 CFS.

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 2

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4

RECORD ID 2-YEAR

STARTING TIME = .00 RAIN DEPTH = 3.30 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.= 2 MAIN TIME INCREMENT = .05 HOURS

** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = 2.46 CFS.

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 3

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4

RECORD ID 10-YEAR

STARTING TIME = .00 RAIN DEPTH = 5.30 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.=10 MAIN TIME INCREMENT = .05 HOURS

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 4

RECORD ID

TR20 XEQ 06-08-99 13:29
REV PC 09/83(.1)

DUMBARTON OAKS POND 1 ON U. S. NAVAL OBS.
FILENAME 1507_DO1.T20

JOB 1 PASS 5
PAGE 3

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4 RECORD ID 100-YEAR
STARTING TIME = .00 RAIN DEPTH = 7.40 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.=99 MAIN TIME INCREMENT = .05 HOURS

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 5 RECORD ID

EXECUTIVE CONTROL OPERATION ENDJOB RECORD ID

TR20 XEQ 06-08-99 13:29
REV PC 09/83(.1)

DUMBARTON OAKS POND 1 ON U. S. NAVAL OBS.
FILENAME 1507_D01.T20

JOB 1 SUMMARY
PAGE 4

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION			RUNOFF AMOUNT (IN)	PEAK DISCHARGE				
						BEGIN (HR)	AMOUNT (IN)	DURATION (HR)		ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)	
ALTERNATE 0 STORM 0														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	1.80	24.00	.14	---	12.10	9.32	129.9
STRUCTURE	1	RESVOR	.07	2	2	.05	.0	1.80	24.00	.05	201.31	14.20?	.96?	13.3
SECTION	3	RUNOFF	.03	2	2	.05	.0	1.80	24.00	.43	---	11.99	20.28	594.7
XSECTION	3	ADDHYD	.11	2	2	.05	.0	1.80	24.00	.18	---	11.99	20.36	192.4
SECTION	2	RUNOFF	.01	2	2	.05	.0	1.80	24.00	.09	---	12.10	.72	79.1
XSECTION	2	ADDHYD	.11	2	2	.05	.0	1.80	24.00	.17	---	11.99	20.71	180.2
XSECTION	3	RUNOFF	.08	2	2	.05	.0	1.80	24.00	.12	---	12.09	9.10	113.4
SECTION	4	ADDHYD	.20	2	2	.05	.0	1.80	24.00	.15	---	12.01	26.34	134.9
ALTERNATE 0 STORM 1														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	2.70	24.00	.46	---	12.07	34.65	483.2
STRUCTURE	1	RESVOR	.07	2	2	.05	.0	2.70	24.00	.13	205.04	14.45?	2.11?	29.4
SECTION	3	RUNOFF	.03	2	2	.05	.0	2.70	24.00	.96	---	11.98	41.95	1230.1
XSECTION	3	ADDHYD	.11	2	2	.05	.0	2.70	24.00	.40	---	11.98	42.72	403.8
SECTION	2	RUNOFF	.01	2	2	.05	.0	2.70	24.00	.36	---	12.06	3.73	409.8
SECTION	2	ADDHYD	.11	2	2	.05	.0	2.70	24.00	.39	---	11.99	45.70	397.7
XSECTION	3	RUNOFF	.08	2	2	.05	.0	2.70	24.00	.43	---	12.06	37.27	464.1
SECTION	4	ADDHYD	.20	2	2	.05	.0	2.70	24.00	.41	---	12.01	77.17	395.4
ALTERNATE 0 STORM 2														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	3.30	24.00	.74	---	12.07	55.65	776.1
STRUCTURE	1	RESVOR	.07	2	2	.05	.0	3.30	24.00	.15	206.80	14.95?	2.46?	34.3
SECTION	3	RUNOFF	.03	2	2	.05	.0	3.30	24.00	1.36	---	11.98	57.35	1681.9
XSECTION	3	ADDHYD	.11	2	2	.05	.0	3.30	24.00	.54	---	11.98	58.66	554.4
SECTION	2	RUNOFF	.01	2	2	.05	.0	3.30	24.00	.61	---	12.05	6.34	696.3
SECTION	2	ADDHYD	.11	2	2	.05	.0	3.30	24.00	.55	---	11.99	64.02	557.1
XSECTION	3	RUNOFF	.08	2	2	.05	.0	3.30	24.00	.69	---	12.06	60.89	758.2
SECTION	4	ADDHYD	.20	2	2	.05	.0	3.30	24.00	.61	---	12.00	117.51	602.0
ALTERNATE 0 STORM 10														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	5.30	24.00	1.89	---	12.05	137.56	1918.5
STRUCTURE	1	RESVOR	.07	2	2	.05	.0	5.30	24.00	1.28	208.45	12.18	89.89	1253.7
SECTION	3	RUNOFF	.03	2	2	.05	.0	5.30	24.00	2.83	---	11.98	110.36	3236.2
XSECTION	3	ADDHYD	.11	2	2	.05	.0	5.30	24.00	1.78	---	11.98	110.44	1043.8
XSECTION	2	RUNOFF	.01	2	2	.05	.0	5.30	24.00	1.68	---	12.04	16.81	1847.0

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION			RUNOFF AMOUNT (IN)	PEAK DISCHARGE				
						BEGIN (HR)	AMOUNT (IN)	DURATION (HR)		ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)	
ALTERNATE 0 STORM 10														
XSECTION	2	ADDHYD	.11	2	2	.05	.0	5.30	24.00	1.77	---	11.99	125.77	1094.6
SECTION	3	RUNOFF	.08	2	2	.05	.0	5.30	24.00	1.82	---	12.05	153.83	1915.7
SECTION	4	ADDHYD	.20	2	2	.05	.0	5.30	24.00	1.79	---	12.02	271.06	1388.6
ALTERNATE 0 STORM 99														
SECTION	1	RUNOFF	.07	2	2	.05	.0	7.40	24.00	3.32	---	12.05	232.66	3244.9
STRUCTURE	1	RESVOR	.07	2	2	.05	.0	7.40	24.00	2.69	209.54	12.11	207.21	2890.0
XSECTION	3	RUNOFF	.03	2	2	.05	.0	7.40	24.00	4.48	---	11.98	166.31	4877.1
SECTION	3	ADDHYD	.11	2	2	.05	.0	7.40	24.00	3.27	---	12.02	306.89	2900.6
SECTION	2	RUNOFF	.01	2	2	.05	.0	7.40	24.00	3.04	---	12.03	29.26	3214.9
XSECTION	2	ADDHYD	.11	2	2	.05	.0	7.40	24.00	3.25	---	12.02	335.58	2920.6
SECTION	3	RUNOFF	.08	2	2	.05	.0	7.40	24.00	3.23	---	12.04	262.51	3269.1
SECTION	4	ADDHYD	.20	2	2	.05	.0	7.40	24.00	3.24	---	12.03	591.13	3028.3

BY RLP DATE 7/12/90 SUBJECT Lumbar Oaks SHEET NO. _____ OF _____
 CHKD. BY _____ DATE _____ Pond #2 JOB NO. _____
 REV. BY _____ DATE _____ FILE NO. _____

Elev (ft)	Area (A _c)	Increment Vol (A _c -ft)	Σ Vol (A _c -ft)	V _s (A _c -ft)
133.0	0	0	0	
134.0	.01	.005	.005	
135.0	.02	.015	.020	
136.0	.06	.040	.060	0
137.0	.09	.075	.135	.075
138.0	.11	.100	.235	.175
139.0	.13	.120	.355	.295
140.0	.15	.140	.495	.435

Normal Pool @ 136.0
 Vol = .060 A_c-ft = 2614 ft³

Base flow = 20 Gal/M.in = 2.67 ft³/Min $2614 \text{ ft}^3 / 2.67 \text{ ft}^3/\text{min} = 979 \text{ min}$

Volume of Normal Pool is replaced every 979 Min (16.3 hrs).

12" x 12" Slot			40' Weir			
h (ft)	Q (cfs)		H (ft)	C	Q (cfs)	Q _T (cfs)
136.0	0	0				0
136.5	*0.5	1.0				1.0
137.0	0.5	3.4				3.4
137.5	1.0	4.8				4.8
138.0	1.5	5.9	0		0	5.9
138.5	2.0	6.8	0.5	2.74	38.7	45.5
139.0	2.5	7.6	1.0	2.98	119.2	126.8
139.5	3.0	8.3	1.5	3.24	238.1	246.4
140.0	3.5	9.0	2.0	3.30	373.4	382.4

* Weir flow

$$Q = CLH^{3/2} \quad C = 2.74$$

$$Q = CLH^{3/2}$$

Orifice flow

$$Q = 0.6 A \sqrt{2gh}$$

*****80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****

```

JOB TR-20
TITLE
DUMBARTON OAKS POND 1 ON U. S. NAVAL OBS.
AND POND 2 FILENAME 1507_D03.T20
SUMMARY NOPLOTS

3 STRUCT 1
8 200.0 0.0 0.00 POND 1
8 201.0 0.8 0.25
8 202.0 1.3 0.50
8 203.0 1.6 0.75
8 204.0 1.8 1.00
8 205.0 2.1 1.25
8 206.0 2.3 1.84
8 207.0 2.5 2.33
8 208.0 47.2 2.92
8 209.0 142.5 3.51
8 210.0 261.3 4.20
9 ENDTBL

3 STRUCT 2
8 136.0 0.0 0.00
8 136.5 1.0 0.037
8 137.0 3.4 0.075
8 137.5 4.8 0.125
8 138.0 5.9 0.175
8 138.5 45.5 0.235
8 139.0 126.8 0.295
8 139.5 246.4 0.365
8 140.0 382.4 0.435
9 ENDTBL

6 RUNOFF 1 1 3 0.0717 73. 0.24 SA1
6 RESVOR 2 1 3 2 200.0
6 RUNOFF 1 3 1 0.0341 84. 0.08 SA3
6 ADDHYD 4 3 1 2 3
6 RESVOR 2 2 3 4 136.0
6 RUNOFF 1 2 2 0.0091 70. 0.20 SA2
6 ADDHYD 4 2 4 2 5
6 RUNOFF 1 3 1 0.0803 72. 0.22 SA4
6 ADDHYD 4 4 5 1 4
ENDATA

7 INCREM 6 0.05
7 COMPUT 7 1 4 0. 1.8 1.2 2 0 0 6-MONTH
ENDCMP 1
7 COMPUT 7 1 4 0. 2.7 1.2 2 0 1 1-YEAR
ENDCMP 1
7 COMPUT 7 1 4 0. 3.3 1.2 2 0 2 2-YEAR
ENDCMP 1
7 COMPUT 7 1 4 0. 5.3 1.2 2 0 10 10-YEAR
ENDCMP 1

```

*****80-80 LIST OF INPUT DATA (CONTINUED)*****

7 COMPUT 7 1 4 0. 7.4 1.2 2 0 99 100-YEAR
ENDCMP 1
ENDJOB 2

*****END OF 80-80 LIST*****

COMPUTER PROGRAM FOR PROJECT FORMULATION - HYDROLOGY USER NOTES

THE USERS MANUAL FOR THIS PROGRAM IS THE MAY 1982 DRAFT OF TR-20. CHANGES FROM THE 2/14/74 VERSION INCLUDE:

REACH ROUTING - THE MODIFIED ATT-KIN ROUTING PROCEDURE REPLACES THE CONVEX METHOD. INPUT DATA PREPARED FOR PREVIOUS PROGRAM VERSIONS USING CONVEX ROUTING COEFFICIENTS WILL NOT RUN ON THIS VERSION.

THE PREFERRED TYPE OF DATA ENTRY IS CROSS SECTION DATA REPRESENTATIVE OF A REACH. IT IS RECOMMENDED THAT THE OPTIONAL CROSS SECTION DISCHARGE-AREA PLOTS BE OBTAINED WHENEVER NEW CROSS SECTION DATA IS ENTERED. THE PLOTS SHOULD BE CHECKED FOR REASONABLENESS AND ADEQUACY OF INPUT DATA FOR THE COMPUTATION OF "M" VALUES USED IN THE ROUTING PROCEDURE.

GUIDELINES FOR DETERMINING OR ANALYZING REACH LENGTHS AND COEFFICIENTS (X,M) ARE AVAILABLE IN THE USERS MANUAL. SUMMARY TABLE 2 DISPLAYS REACH ROUTING RESULTS AND ROUTING PARAMETERS FOR COMPARISON AND CHECKING.

HYDROGRAPH GENERATION - THE PROCEDURE TO CALCULATE THE INTERNAL TIME INCREMENT AND PEAK TIME OF THE UNIT HYDROGRAPH HAVE BEEN IMPROVED. PEAK DISCHARGES AND TIMES MAY DIFFER FROM THE PREVIOUS VERSION. OUTPUT HYDROGRAPHS ARE STILL INTERPOLATED, PRINTED, AND ROUTED AT THE USER SELECTED MAIN TIME INCREMENT.

INTERMEDIATE PEAKS - METHOD ADDED TO PROVIDE DISCHARGES AT INTERMEDIATE POINTS WITHIN REACHES WITHOUT ROUTING.

OTHER - THIS VERSION CONTAINS SOME ADDITIONS TO THE INPUT AND NUMEROUS MODIFICATIONS TO THE OUTPUT. USER OPTIONS HAVE BEEN MODIFIED AND AUGMENTED ON THE JOB RECORD, RAINTABLES ADDED, ERROR AND WARNING MESSAGES EXPANDED, AND THE SUMMARY TABLES COMPLETELY REVISED. THE HOLDOUT OPTION IS NOT OPERATIONAL AT THIS TIME.

PROGRAM QUESTIONS OR PROBLEMS SHOULD BE DIRECTED TO HYDRAULIC ENGINEERS AT THE SCS NATIONAL TECHNICAL CENTERS:
CHESTER, PA (NORTHEAST) -- 215-499-3933, FORT WORTH, TX (SOUTH) -- 334-5242 (FTS)
LINCOLN, NB (MIDWEST) -- 541-5318 (FTS), PORTLAND, OR (WEST) -- 423-4099 (FTS)

PROGRAM CHANGES SINCE MAY 1982:

12/17/82 - CORRECT PEAK RATE FACTOR FOR USER ENTERED DIMHYD
CORRECT REACH ROUTING PEAK TRAVEL TIME PRINTED WITH FULLPRINT OPTION

5/02/83 - CORRECT COMPUTATIONS FOR ---

1. DIVISION OF BASEFLOW IN DIVERT OPERATION
2. HYDROGRAPH VOLUME SPLIT BETWEEN BASEFLOW AND ABOVE BASEFLOW
3. CROSS SECTION DATA PLOTTING POSITION
4. INTERMEDIATE PEAK WHEN "FROM" AREA IS LARGER THAN "THRU" AREA
5. STORAGE ROUTED REACH TRAVEL TIME FOR MULTYPEAK HYDROGRAPH
6. ORDERING "FLOW-FREQ" FILE FROM SUMMARY TABLE #3 DATA
7. BASEFLOW ENTERED WITH READHYD
8. LOW FLOW SPLIT DURING DIVERT PROCEDURE #2 WHEN SECTION RATINGS START AT DIFFERENT ELEVATIONS

ENHANCEMENTS ---

1. REPLACE USER MANUAL ERROR CODES (PAGE 4-9 TO 4-11) WITH MESSAGES
2. LABEL OUTPUT HYDROGRAPH FILES WITH CROSS SECTION/STRUCTURE, ALTERNATE AND STORM NO'S

09/01/83 - CORRECT INPUT AND OUTPUT ERRORS FOR INTERMEDIATE PEAKS
CORRECT COMBINATION OF RATING TABLES FOR DIVERT
CHECK REACH ROUTING PARAMETERS FOR ACCEPTABLE LIMITS
ELIMINATE MINIMUM REACH TRAVEL TIME WHEN ATT-KIN COEFFICIENT EQUALS ONE

TR20 XEQ 07-12-99 12:14
REV PC 09/83(.1)

DUMBARTON OAKS POND 1 ON U. S. NAVAL OBS.
AND POND 2 FILENAME 1507_DO3.T20

JOB 1 PASS 1
PAGE 2

EXECUTIVE CONTROL OPERATION INCREM MAIN TIME INCREMENT = .05 HOURS

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4
STARTING TIME = .00 RAIN DEPTH = 1.80 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.= 0 MAIN TIME INCREMENT = .05 HOURS
RECORD ID 6-MONTH

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .96 CFS.

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .07 CFS.

*** WARNING-MAIN TIME INCREMENT MAY BE TOO LARGE.

COMPUTED PEAK(28.94) AT XSECTION 4 EXCEEDS MAX. ADJACENT HYDROGRAPH COORDINATE BY 6 %.

TIME(HRS)	FIRST HYDROGRAPH POINT = .00 HOURS	TIME INCREMENT = .05 HOURS	DRAINAGE AREA = .20 SQ.MI.
10.50 DISCHG	.00 .00 .00 .00 .00 .00 .00 .00 .01 .01 .02		
11.00 DISCHG	.03 .04 .05 .06 .08 .09 .11 .13 .16 .18		
11.50 DISCHG	.21 .28 .43 .65 .91 1.42 2.40 3.91 5.88 9.37		
12.00 DISCHG	27.22 25.71 19.05 14.17 12.11 10.75 9.91 9.18 8.50 7.96		
12.50 DISCHG	7.59 7.28 6.98 6.68 6.43 6.25 6.09 5.88 5.63 5.42		
13.00 DISCHG	5.22 4.99 4.75 4.53 4.35 4.23 4.13 4.01 3.89 3.80		
13.50 DISCHG	3.73 3.68 3.59 3.49 3.40 3.35 3.31 3.25 3.20 3.15		
14.00 DISCHG	3.12 3.10 3.05 3.00 2.96 2.93 2.91 2.86 2.81 2.77		
14.50 DISCHG	2.74 2.71 2.67 2.62 2.57 2.54 2.52 2.51 2.50 2.50		

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 1

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4
STARTING TIME = .00 RAIN DEPTH = 2.70 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.= 1 MAIN TIME INCREMENT = .05 HOURS
RECORD ID 1-YEAR

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = 2.11 CFS.

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 2

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4
STARTING TIME = .00 RAIN DEPTH = 3.30 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.= 2 MAIN TIME INCREMENT = .05 HOURS
RECORD ID 2-YEAR

TR20 XEQ 07-12-99 12:14
REV PC 09/83(.1)

DUMBARTON OAKS POND 1 ON U. S. NAVAL OBS.
AND POND 2 FILENAME 1507_D03.T20

JOB 1 PASS 3
PAGE 3

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = 2.46 CFS.

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 3

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4 RECORD ID 10-YEAR
STARTING TIME = .00 RAIN DEPTH = 5.30 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.=10 MAIN TIME INCREMENT = .05 HOURS

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 4

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4 RECORD ID 100-YEAR
STARTING TIME = .00 RAIN DEPTH = 7.40 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.=99 MAIN TIME INCREMENT = .05 HOURS

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 5

RECORD ID

EXECUTIVE CONTROL OPERATION ENDJOB

RECORD ID

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION			RUNOFF AMOUNT (IN)	PEAK DISCHARGE				
						BEGIN (HR)	AMOUNT (IN)	DURATION (HR)		ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)	
ALTERNATE 0 STORM 0														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	1.80	24.00	.14	---	12.10	9.32	129.9
STRUCTURE	1	RESVOR	.07	2	2	.05	.0	1.80	24.00	.05	201.31	14.20?	.96?	13.3
XSECTION	3	RUNOFF	.03	2	2	.05	.0	1.80	24.00	.43	---	11.99	20.28	594.7
XSECTION	3	ADDHYD	.11	2	2	.05	.0	1.80	24.00	.18	---	11.99	20.36	192.4
STRUCTURE	2	RESVOR	.11	2	?	.05	.0	1.80	24.00	.17	138.20	12.01	21.75	205.6
XSECTION	2	RUNOFF	.01	2	2	.05	.0	1.80	24.00	.09	---	12.10	.72	79.1
XSECTION	2	ADDHYD	.11	2	2	.05	.0	1.80	24.00	.16	---	12.01	22.22	193.4
XSECTION	3	RUNOFF	.08	2	2	.05	.0	1.80	24.00	.12	---	12.09	9.10	113.4
XSECTION	4	ADDHYD	.20	2	2	.05	.0	1.80	24.00	.14	---	12.02	28.94	148.3
ALTERNATE 0 STORM 1														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	2.70	24.00	.46	---	12.07	34.65	483.2
STRUCTURE	1	RESVOR	.07	2	2	.05	.0	2.70	24.00	.13	205.04	14.45?	2.11?	29.4
XSECTION	3	RUNOFF	.03	2	2	.05	.0	2.70	24.00	.96	---	11.98	41.95	1230.1
XSECTION	3	ADDHYD	.11	2	2	.05	.0	2.70	24.00	.40	---	11.98	42.72	403.8
STRUCTURE	2	RESVOR	.11	2	2	.05	.0	2.70	24.00	.38	138.44	11.99	41.05	388.0
XSECTION	2	RUNOFF	.01	2	2	.05	.0	2.70	24.00	.36	---	12.06	3.73	409.8
XSECTION	2	ADDHYD	.11	2	2	.05	.0	2.70	24.00	.38	---	12.00	44.15	384.2
XSECTION	3	RUNOFF	.08	2	2	.05	.0	2.70	24.00	.43	---	12.06	37.27	464.1
XSECTION	4	ADDHYD	.20	2	2	.05	.0	2.70	24.00	.40	---	12.02	77.35	396.2
ALTERNATE 0 STORM 2														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	3.30	24.00	.74	---	12.07	55.65	776.1
STRUCTURE	1	RESVOR	.07	2	2	.05	.0	3.30	24.00	.15	206.80	14.95?	2.46?	34.3
XSECTION	3	RUNOFF	.03	2	2	.05	.0	3.30	24.00	1.36	---	11.98	57.35	1681.9
XSECTION	3	ADDHYD	.11	2	2	.05	.0	3.30	24.00	.54	---	11.98	58.66	554.4
STRUCTURE	2	RESVOR	.11	2	2	.05	.0	3.30	24.00	.52	138.57	11.99	57.46	543.1
XSECTION	2	RUNOFF	.01	2	2	.05	.0	3.30	24.00	.61	---	12.05	6.34	696.3
XSECTION	2	ADDHYD	.11	2	2	.05	.0	3.30	24.00	.53	---	11.99	62.89	547.4
XSECTION	3	RUNOFF	.08	2	2	.05	.0	3.30	24.00	.69	---	12.06	60.89	758.2
XSECTION	4	ADDHYD	.20	2	2	.05	.0	3.30	24.00	.60	---	12.01	117.52	602.1
ALTERNATE 0 STORM 10														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	5.30	24.00	1.89	---	12.05	137.56	1918.5
STRUCTURE	1	RESVOR	.07	2	2	.05	.0	5.30	24.00	1.28	208.45	12.18	89.89	1253.7

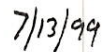
TR20 XEQ 07-12-99 12:14
REV PC 09/83(.1)

DUMBARTON OAKS POND 1 ON U. S. NAVAL OBS.
AND POND 2 FILENAME 1507_DO3.T20

JOB 1 SUMMARY
PAGE 5

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION			RUNOFF AMOUNT (IN)	PEAK DISCHARGE				
						BEGIN (HR)	AMOUNT (IN)	DURATION (HR)		ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)	
ALTERNATE 0 STORM 10														
XSECTION	3	RUNOFF	.03	2	2	.05	.0	5.30	24.00	2.83	---	11.98	110.36	3236.2
XSECTION	3	ADDHYD	.11	2	2	.05	.0	5.30	24.00	1.78	---	11.98	110.44	1043.8
STRUCTURE	2	RESVOR	.11	2	2	.05	.0	5.30	24.00	1.75	138.90	12.20	110.02	1039.9
XSECTION	2	RUNOFF	.01	2	2	.05	.0	5.30	24.00	1.68	---	12.04	16.81	1847.0
XSECTION	2	ADDHYD	.11	2	2	.05	.0	5.30	24.00	1.74	---	11.99	124.88	1086.8
XSECTION	3	RUNOFF	.08	2	2	.05	.0	5.30	24.00	1.82	---	12.05	153.83	1915.7
XSECTION	4	ADDHYD	.20	2	2	.05	.0	5.30	24.00	1.77	---	12.03	272.11	1394.0
ALTERNATE 0 STORM 99														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	7.40	24.00	3.32	---	12.05	232.66	3244.9
STRUCTURE	1	RESVOR	.07	2	2	.05	.0	7.40	24.00	2.69	209.54	12.11	207.21	2890.0
XSECTION	3	RUNOFF	.03	2	2	.05	.0	7.40	24.00	4.48	---	11.98	166.31	4877.1
XSECTION	3	ADDHYD	.11	2	2	.05	.0	7.40	24.00	3.27	---	12.02	306.89	2900.6
STRUCTURE	2	RESVOR	.11	2	2	.05	.0	7.40	24.00	3.24	139.71	12.03	302.84	2862.4
XSECTION	2	RUNOFF	.01	2	2	.05	.0	7.40	24.00	3.04	---	12.03	29.26	3214.9
XSECTION	2	ADDHYD	.11	2	2	.05	.0	7.40	24.00	3.22	---	12.03	332.08	2890.1
XSECTION	3	RUNOFF	.08	2	2	.05	.0	7.40	24.00	3.23	---	12.04	262.51	3269.1
XSECTION	4	ADDHYD	.20	2	2	.05	.0	7.40	24.00	3.22	---	12.03	594.06	3043.3



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Alexandria, Virginia
Pat. 2,422,663

It may be possible to pick up inlets along the storm drain pipe without increasing the size of pipe.

BY RLP DATE 2/13/99 SUBJECT Dumbarton Oaks SHEET NO. _____ OF _____
 CHKD. BY _____ DATE _____ JOB NO. _____
 REV. BY _____ DATE _____ FILE NO. _____

2" x 12" Slot @ 136.0 Normal Pool EI = 136.0

40' Weir @ 138.0

Capacity of 12" x 12" slot @ 138.0 = 5.9 cfs

Divert flow from weir into S.D. Diversion

Length of SD diversion $\approx 1600'$

Approximate drop = $130 - 74 = 56'$

Approximately 9 Structures (inlets & Manholes). Say 0.5' drop in

each $\frac{56 - 9(0.5)}{1600} = 3.22\%$ Average Slope

Try 42" RCP w/ Invert @ 130.0

@ EI = 136.0 $H_w = 136.0 - 130.0 = 6.0'$ $H_w/D = 6.0/3.5 = 1.71$

From Chart 1 Inlet Control $Q = 101$ cfs w/ improved ent.

From TR-20 $Q_{10} = 110$ cfs

$\therefore \sim 7.5$ cfs will go through 12" x 12" slot & directly into the stream. ~ 102.5 cfs will be diverted to the Storm Drain.

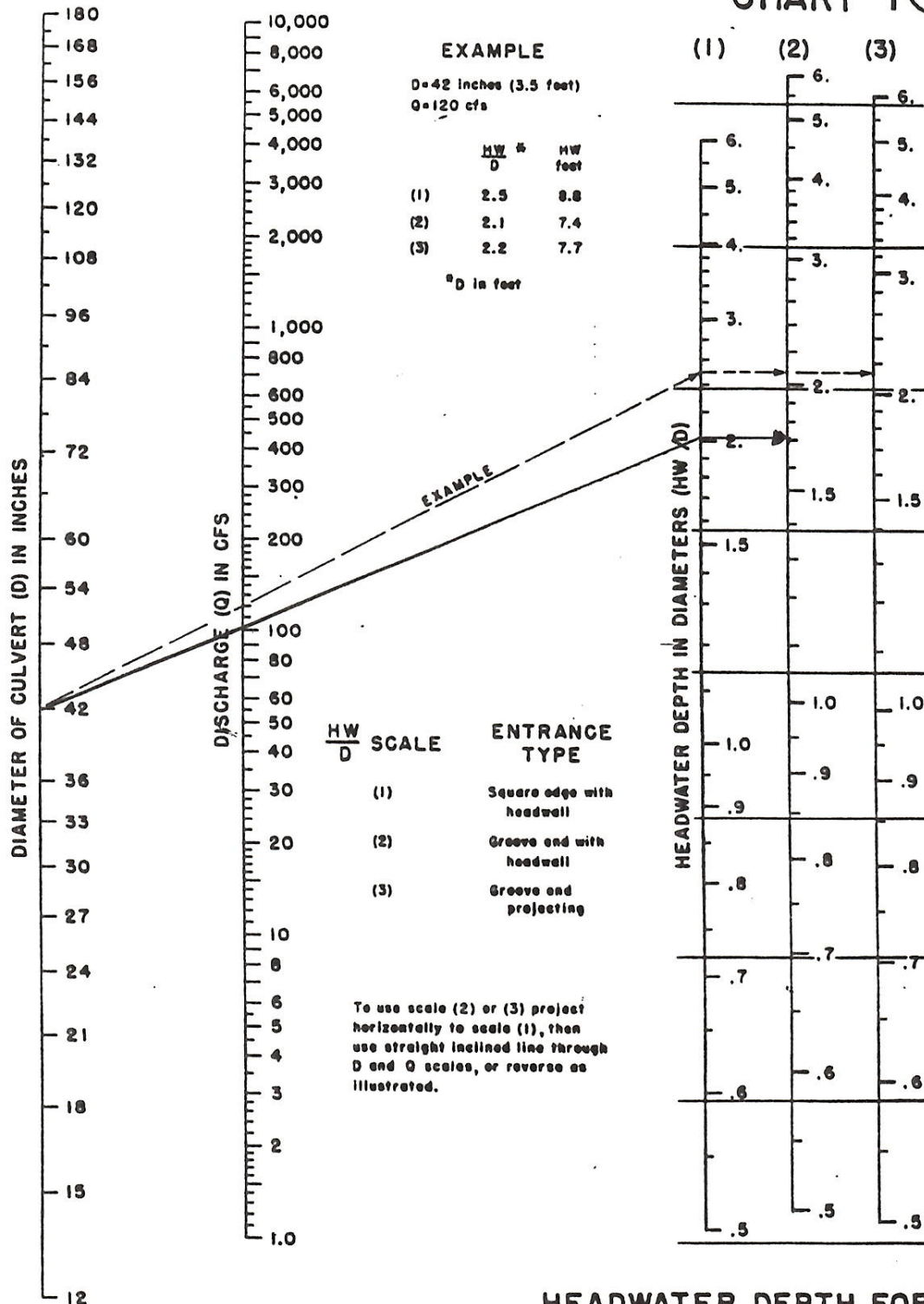
$\therefore$ All storms up to the 10-yr storm will have most of the flow diverted to the S.D.

From TR-20 $Q_{100} = 303$ cfs

Set up structure so that storms larger than the 10-yr storm overflow back into the stream.

$\therefore$ For 100-yr storm SD $Q \approx 110$ cfs Stream $Q \approx 193$ cfs

CHART 1



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 283

REVISED MAY 1964

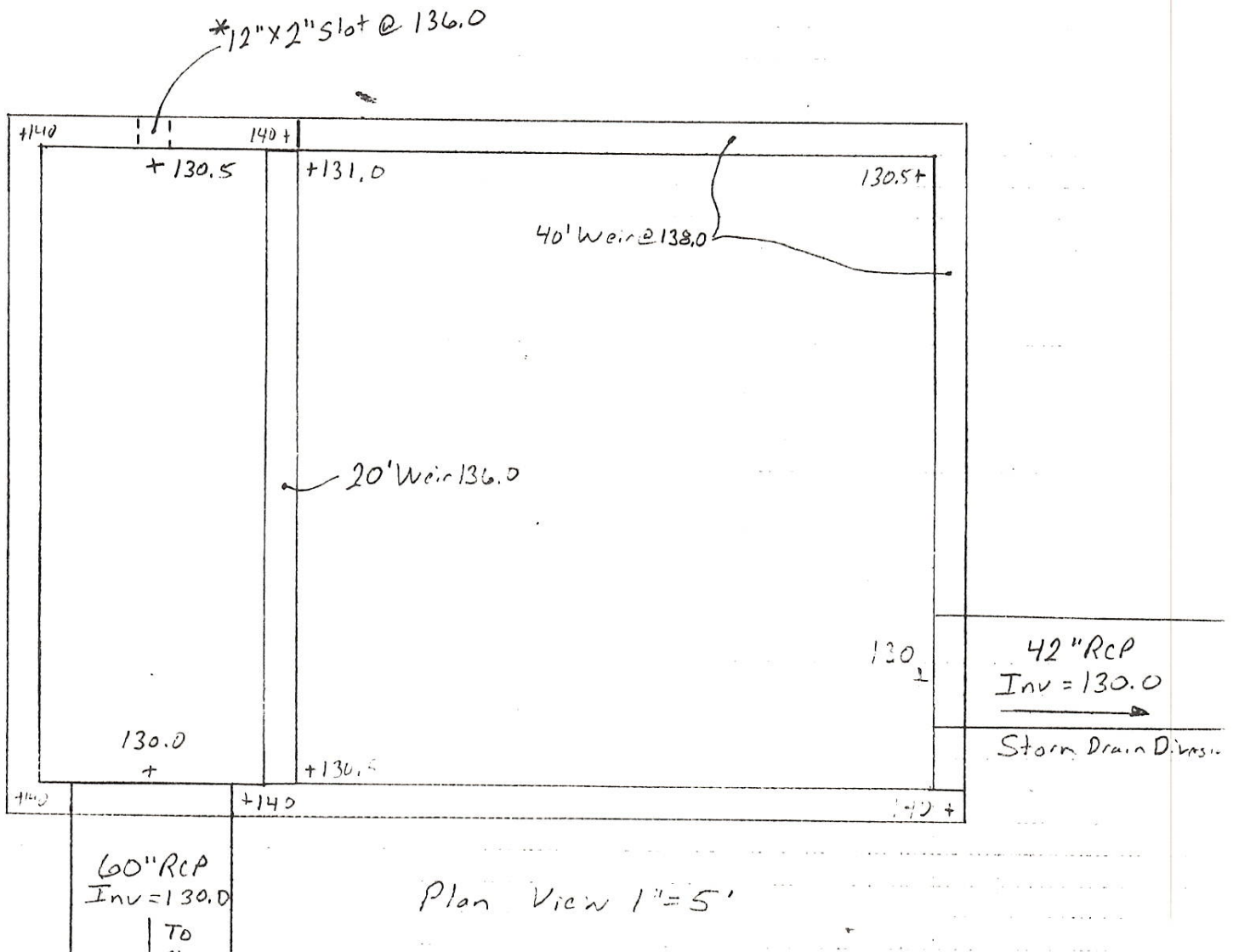
BUREAU OF PUBLIC ROADS JAN. 1963

BY RLP DATE 2/14/99 SUBJECT Dunbarton Oaks SHEET NO. _____ OF _____
CHKD. BY _____ DATE _____ Diversion Pipe Control Structure JOB NO. _____
REV. BY _____ DATE _____ FILE NO. _____

Structure Might Function Somewhat Like This.

Note: The more SWM we can get out of the Nays Pond
The smaller the pipes & the smaller the structure can
become.

* Consider making the low flow Control a 15" or 18" Valve. This
will cost more but will give more flexibility in the
operation of the structure.



BY RLP DATE 6/8/99 SUBJECT Dumbarton Oaks SHEET NO. _____ OF _____
 CHKD. BY _____ DATE _____ Pond 2A JOB NO. _____
 REV. BY _____ DATE _____ FILE NO. _____

Elev (ft)	Area (Ac)	Incremental Vol (100-ft)	Σ Vol (Ac-ft)	Vs (Ac-ft)
120	0.01	0	0	
121	0.02	.015	.015	
122	0.03	.025	.04	
123	0.07	.05	.09	0
124	0.10	.085	.175	.085
125	0.13	.115	.29	.20
126	0.17	.15	.44	.35
127	0.21	.19	.63	.54
128	0.29	.25	.88	.79
129	0.37	.33	1.21	1.12

Normal Pool @ 123.0
 Vol = .09 Ac-ft = 3920 ft³

Base flow = $\frac{20 \text{ Gal}}{\text{Min}} = \frac{(20 \text{ Gal})}{(\text{Min})(7.48 \text{ Gal/ft}^3)} = \frac{2.67 \text{ ft}^3}{\text{Min}}$ $\frac{3920}{2.67} = 1468 \text{ min}$

Volume of Normal Pool is replaced every 24.5 hrs. This is excellent. = 24.5 hrs

12" X 12" Slot			40' Weir		
h (ft)	Q (cfs)		H (ft)	C	Q _T (cfs)
123.0	0				0
123.5	*.5	1.0			1.0
124.0	.5	3.4			3.4
124.5	1.0	4.8			4.8
125.0	1.5	5.9			5.9
125.5	2.0	6.8			6.8
126.0	2.5	7.6			7.6
126.5	3.0	8.3			8.3
127.0	3.5	9.0			9.0
127.5	4.0	9.6	0.5	2.74	48.3
128.0	4.5	10.2	1.0	2.98	119.2
129.0	5.5	11.3	2.0	3.30	373.4

* Weir flow

$Q = CLH^{3/2}$ $C = 2.74$

Orific flow

$Q = .6A\sqrt{2gh} = 4.81\sqrt{h}$

$Q = CLH^{3/2}$

C from Brater & King
 Table 5-3

Brater & King

Table 5-3. Values of C in the Formula $Q = CLH^{3/2}$ for Broad-crested Weirs

Measured head in feet, H	Breadth of crest of weir in feet									
	0.50	0.75	1.00	1.50	2.00	2.50	3.00	4.00	5.00	10.00
0.2	2.80	2.75	2.69	2.62	2.54	2.48	2.44	2.38	2.34	2.49
0.4	2.92	2.87	2.81	2.74	2.66	2.59	2.54	2.50	2.56	2.70
0.6	3.08	2.99	2.92	2.84	2.76	2.68	2.63	2.69	2.70	2.84
0.8	3.30	3.04	2.85	2.68	2.60	2.60	2.67	2.68	2.69	2.84
1.0	3.32	3.14	2.98	2.75	2.66	2.64	2.65	2.67	2.68	2.83
1.2	3.32	3.20	3.08	2.86	2.70	2.65	2.64	2.67	2.66	2.84
1.4	3.32	3.26	3.20	2.92	2.77	2.68	2.64	2.65	2.65	2.87
1.6	3.32	3.29	3.28	3.07	2.89	2.75	2.68	2.66	2.65	2.84
1.8	3.32	3.32	3.31	3.07	2.88	2.74	2.68	2.66	2.65	2.84
2.0	3.32	3.31	3.30	3.03	2.85	2.72	2.68	2.65	2.64	2.83
2.5	3.32	3.32	3.31	3.28	3.07	2.89	2.81	2.72	2.67	2.84
3.0	3.32	3.32	3.32	3.32	3.20	3.05	2.92	2.73	2.66	2.84
3.5	3.32	3.32	3.32	3.32	3.32	3.19	2.97	2.76	2.68	2.84
4.0	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.70	2.84
4.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.74	2.84
5.0	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.84
5.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.84

Table 5-4. Values of C in the Formula $Q = CLH^{3/2}$ for Models of Broad-crested Weirs with Rounded Upstream Corner

Name of experimenter	Head in feet, H									
	Radius of curve in feet	Breadth of weir in feet, B	Height of weir in feet, P	0.4	0.6	0.8	1.0	1.5	2.0	2.5
Bazin.....	0.33	2.62	2.46	2.93	2.97	2.98	3.01	3.04		
Bazin, S.	0.33	6.56	2.46	2.70	2.82	2.87	2.89	2.92		
U. S. Waterways.....	0.33	2.62	4.57		2.77	2.80	2.83	2.92	3.00	3.08
U. S. Waterways.....	0.33	6.56	4.56			2.83	2.83	2.83	2.82	2.82

Table 5-5. Values of C in the Formula $Q = CLH^{3/2}$ for Broad-crested Weirs with Crests Inclined Slightly Downward

Crest	Energy head = H_e									
	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.5	
Level.....										
Slope = 0.004.....										
Slope = 0.026.....										

(a)

Slope of crest	Length of weir in feet	Head in feet, H						
		0.1	0.2	0.3	0.4	0.5	0.6	0.7
12 to 1.....	3.0	2.58	2.87	2.57	2.60	2.84	2.81	2.70
18 to 1.....	3.0	2.91	2.92	2.53	2.60	2.80	2.74	2.62
18 to 1.....	10.0	2.52	2.68	2.73	2.80	2.90	2.80	2.68

(b)

Table 5-6. Values of C in the Formula $Q = CLH^{3/2}$ for Weirs of Triangular Cross Section with Vertical Upstream Face and Sloping Downstream Face

Slope of downstream face	Height of weir in feet, P	Head in feet, H									
		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.5
Hor. Vert. 1 to 1	2.46	3.88	3.85	3.85	3.85	3.85	3.85	3.85	3.85	3.85	3.85
2 to 1	2.46	3.48	3.48	3.49	3.50	3.50	3.50	3.50	3.50	3.51	3.51
3 to 1	1.64	3.56	3.47	3.51	3.54	3.57	3.58	3.58	3.58	3.59	3.57
5 to 1	1.64		2.90	3.11	3.22	3.26	3.33	3.37	3.40	3.41	3.41
10 to 1	2.46		3.08	3.06	3.05	3.05	3.07	3.09	3.12	3.13	3.13

*****80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****

```

DB TR-20
TITLE
3 STRUCT      2      POND 2A
8             123.0      0.0      0.00      POND 2A
8             123.5      1.0      0.04
8             124.0      3.4      0.09
8             124.5      4.8      0.14
8             125.0      5.9      0.20
8             125.5      6.8      0.27
8             126.0      7.6      0.35
8             126.5      8.3      0.44
8             127.0      9.0      0.54
8             127.5     48.3      0.66
8             128.0     129.4     0.79
8             129.0     384.7     1.12
9 ENDTBL
6 RUNOFF 1 1 1 0.0717 73. 0.24 SA1
6 RUNOFF 1 3 2 0.0341 84. 0.08 SA3
6 ADDHYD 4 3 1 2 3
6 RESVOR 2 2 3 4 123.0 POND 2A
6 RUNOFF 1 2 2 0.0091 70. 0.20 SA2
6 ADDHYD 4 2 4 2 5
6 RUNOFF 1 3 1 0.0803 72. 0.22 SA4
6 ADDHYD 4 4 5 1 4
ENDATA
7 INCREM 6 0.05
7 COMPUT 7 1 4 0. 1.8 1.2 2 0 0 6-MONTH
ENDCMP 1
7 COMPUT 7 1 4 0. 2.7 1.2 2 0 1 1-YEAR
ENDCMP 1
7 COMPUT 7 1 4 0. 3.3 1.2 2 0 2 2-YEAR
ENDCMP 1
7 COMPUT 7 1 4 0. 5.3 1.2 2 0 10 10-YEAR
ENDCMP 1
7 COMPUT 7 1 4 0. 7.4 1.2 2 0 99 100-YEAR
ENDCMP 1
ENDJOB 2

```

*****END OF 80-80 LIST*****

COMPUTER PROGRAM FOR PROJECT FORMULATION - HYDROLOGY USER NOTES

THE USERS MANUAL FOR THIS PROGRAM IS THE MAY 1982 DRAFT OF TR-20. CHANGES FROM THE 2/14/74 VERSION INCLUDE:

REACH ROUTING - THE MODIFIED ATT-KIN ROUTING PROCEDURE REPLACES THE CONVEX METHOD. INPUT DATA PREPARED FOR PREVIOUS PROGRAM VERSIONS USING CONVEX ROUTING COEFFICIENTS WILL NOT RUN ON THIS VERSION.

THE PREFERRED TYPE OF DATA ENTRY IS CROSS SECTION DATA REPRESENTATIVE OF A REACH. IT IS RECOMMENDED THAT THE OPTIONAL CROSS SECTION DISCHARGE-AREA PLOTS BE OBTAINED WHENEVER NEW CROSS SECTION DATA IS ENTERED. THE PLOTS SHOULD BE CHECKED FOR REASONABLENESS AND ADEQUACY OF INPUT DATA FOR THE COMPUTATION OF "M" VALUES USED IN THE ROUTING PROCEDURE.

GUIDELINES FOR DETERMINING OR ANALYZING REACH LENGTHS AND COEFFICIENTS (X,M) ARE AVAILABLE IN THE USERS MANUAL. SUMMARY TABLE 2 DISPLAYS REACH ROUTING RESULTS AND ROUTING PARAMETERS FOR COMPARISON AND CHECKING.

HYDROGRAPH GENERATION - THE PROCEDURE TO CALCULATE THE INTERNAL TIME INCREMENT AND PEAK TIME OF THE UNIT HYDROGRAPH HAVE BEEN IMPROVED. PEAK DISCHARGES AND TIMES MAY DIFFER FROM THE PREVIOUS VERSION. OUTPUT HYDROGRAPHS ARE STILL INTERPOLATED, PRINTED, AND ROUTED AT THE USER SELECTED MAIN TIME INCREMENT.

INTERMEDIATE PEAKS - METHOD ADDED TO PROVIDE DISCHARGES AT INTERMEDIATE POINTS WITHIN REACHES WITHOUT ROUTING.

OTHER - THIS VERSION CONTAINS SOME ADDITIONS TO THE INPUT AND NUMEROUS MODIFICATIONS TO THE OUTPUT. USER OPTIONS HAVE BEEN MODIFIED AND AUGMENTED ON THE JOB RECORD, RAINTABLES ADDED, ERROR AND WARNING MESSAGES EXPANDED, AND THE SUMMARY TABLES COMPLETELY REVISED. THE HOLDOUT OPTION IS NOT OPERATIONAL AT THIS TIME.

PROGRAM QUESTIONS OR PROBLEMS SHOULD BE DIRECTED TO HYDRAULIC ENGINEERS AT THE SCS NATIONAL TECHNICAL CENTERS:

CHESTER, PA (NORTHEAST)	-- 215-499-3933,	FORT WORTH, TX (SOUTH)	-- 334-5242 (FTS)
LINCOLN, NB (MIDWEST)	-- 541-5318 (FTS),	PORTLAND, OR (WEST)	-- 423-4099 (FTS)

PROGRAM CHANGES SINCE MAY 1982:

12/17/82 - CORRECT PEAK RATE FACTOR FOR USER ENTERED DIMHYD

CORRECT REACH ROUTING PEAK TRAVEL TIME PRINTED WITH FULLPRINT OPTION

5/02/83 - CORRECT COMPUTATIONS FOR ---

1. DIVISION OF BASEFLOW IN DIVERT OPERATION
2. HYDROGRAPH VOLUME SPLIT BETWEEN BASEFLOW AND ABOVE BASEFLOW
3. CROSS SECTION DATA PLOTTING POSITION
4. INTERMEDIATE PEAK WHEN "FROM" AREA IS LARGER THAN "THRU" AREA
5. STORAGE ROUTED REACH TRAVEL TIME FOR MULTIPLE PEAK HYDROGRAPH
6. ORDERING "FLOW-FREQ" FILE FROM SUMMARY TABLE #3 DATA
7. BASEFLOW ENTERED WITH READHYD
8. LOW FLOW SPLIT DURING DIVERT PROCEDURE #2 WHEN SECTION RATINGS START AT DIFFERENT ELEVATIONS

ENHANCEMENTS ---

1. REPLACE USER MANUAL ERROR CODES (PAGE 4-9 TO 4-11) WITH MESSAGES
2. LABEL OUTPUT HYDROGRAPH FILES WITH CROSS SECTION/STRUCTURE, ALTERNATE AND STORM NO'S

09/01/83 - CORRECT INPUT AND OUTPUT ERRORS FOR INTERMEDIATE PEAKS

CORRECT COMBINATION OF RATING TABLES FOR DIVERT

CHECK REACH ROUTING PARAMETERS FOR ACCEPTABLE LIMITS

ELIMINATE MINIMUM REACH TRAVEL TIME WHEN ATT-KIN COEFFICIENT EQUALS ONE

TR20 XEQ 06-08-99 12:35
REV PC 09/83(.1)

POND 2A

DUMBARTON OAKS POND 2A
FILENAME: 1507_DOS.T20

JOB 1 PASS 1
PAGE 2

EXECUTIVE CONTROL OPERATION INCREM MAIN TIME INCREMENT = .05 HOURS

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4
STARTING TIME = .00 RAIN DEPTH = 1.80 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.= 0 MAIN TIME INCREMENT = .05 HOURS

RECORD ID 6-MONTH

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .07 CFS.

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 1

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4
STARTING TIME = .00 RAIN DEPTH = 2.70 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.= 1 MAIN TIME INCREMENT = .05 HOURS

RECORD ID 1-YEAR

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 2

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4
STARTING TIME = .00 RAIN DEPTH = 3.30 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.= 2 MAIN TIME INCREMENT = .05 HOURS

RECORD ID 2-YEAR

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 3

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4
STARTING TIME = .00 RAIN DEPTH = 5.30 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.=10 MAIN TIME INCREMENT = .05 HOURS

RECORD ID 10-YEAR

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 4

RECORD ID

TR20 XEQ 06-08-99 12:35
REV PC 09/83(.1)

POND 2A

DUMBARTON OAKS POND 2A
FILENAME: 1507_DOS.T20

JOB 1 PASS 5
PAGE 3

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4 RECORD ID 100-YEAR
STARTING TIME = .00 RAIN DEPTH = 7.40 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.=99 MAIN TIME INCREMENT = .05 HOURS

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 5 RECORD ID

EXECUTIVE CONTROL OPERATION ENDJOB RECORD ID

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION			RUNOFF AMOUNT (IN)	PEAK DISCHARGE				
						BEGIN (HR)	AMOUNT (IN)	DURATION (HR)		ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)	
ALTERNATE 0 STORM 0														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	1.80	24.00	.14	---	12.10	9.32	129.9
SECTION	3	RUNOFF	.03	2	2	.05	.0	1.80	24.00	.43	---	11.99	20.28	594.7
SECTION	3	ADDHYD	.11	2	2	.05	.0	1.80	24.00	.23	---	12.00	25.88	244.6
STRUCTURE	2	RESVOR	.11	2	2	.05	.0	1.80	24.00	.23	126.42	12.28	8.19	77.5
YSECTION	2	RUNOFF	.01	2	2	.05	.0	1.80	24.00	.09	---	12.10	.72	79.1
SECTION	2	ADDHYD	.11	2	2	.05	.0	1.80	24.00	.21	---	12.16	8.63	75.1
XSECTION	3	RUNOFF	.08	2	2	.05	.0	1.80	24.00	.12	---	12.09	9.10	113.4
SECTION	4	ADDHYD	.20	2	2	.05	.0	1.80	24.00	.18	---	12.10	17.64	90.4
ALTERNATE 0 STORM 1														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	2.70	24.00	.46	---	12.07	34.65	483.2
SECTION	3	RUNOFF	.03	2	2	.05	.0	2.70	24.00	.96	---	11.98	41.95	1230.1
SECTION	3	ADDHYD	.11	2	2	.05	.0	2.70	24.00	.62	---	12.00	70.25	664.0
STRUCTURE	2	RESVOR	.11	2	2	.05	.0	2.70	24.00	.60	127.62	12.04	67.40	637.1
XSECTION	2	RUNOFF	.01	2	2	.05	.0	2.70	24.00	.36	---	12.06	3.73	409.8
SECTION	2	ADDHYD	.11	2	2	.05	.0	2.70	24.00	.58	---	12.04	71.07	618.5
XSECTION	3	RUNOFF	.08	2	2	.05	.0	2.70	24.00	.43	---	12.06	37.27	464.1
YSECTION	4	ADDHYD	.20	2	2	.05	.0	2.70	24.00	.52	---	12.04	107.72	551.9
ALTERNATE 0 STORM 2														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	3.30	24.00	.74	---	12.07	55.65	776.1
SECTION	3	RUNOFF	.03	2	2	.05	.0	3.30	24.00	1.36	---	11.98	57.35	1681.9
SECTION	3	ADDHYD	.11	2	2	.05	.0	3.30	24.00	.94	---	12.00	104.87	991.2
STRUCTURE	2	RESVOR	.11	2	2	.05	.0	3.30	24.00	.90	127.82	12.02	100.94	954.0
XSECTION	2	RUNOFF	.01	2	2	.05	.0	3.30	24.00	.61	---	12.05	6.34	696.3
SECTION	2	ADDHYD	.11	2	2	.05	.0	3.30	24.00	.87	---	12.03	107.87	938.8
XSECTION	3	RUNOFF	.08	2	2	.05	.0	3.30	24.00	.69	---	12.06	60.89	758.2
YSECTION	4	ADDHYD	.20	2	2	.05	.0	3.30	24.00	.80	---	12.04	167.51	858.2
ALTERNATE 0 STORM 10														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	5.30	24.00	1.89	---	12.05	137.56	1918.5
SECTION	3	RUNOFF	.03	2	2	.05	.0	5.30	24.00	2.83	---	11.98	110.36	3236.2
SECTION	3	ADDHYD	.11	2	2	.05	.0	5.30	24.00	2.20	---	12.00	233.86	2210.4
STRUCTURE	2	RESVOR	.11	2	2	.05	.0	5.30	24.00	2.11	128.39	12.02	228.02	2155.2
XSECTION	2	RUNOFF	.01	2	2	.05	.0	5.30	24.00	1.68	---	12.04	16.81	1847.0

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION			RUNOFF AMOUNT (IN)	PEAK DISCHARGE				
						BEGIN (HR)	AMOUNT (IN)	DURATION (HR)		ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)	
ALTERNATE		0	STORM	10										
XSECTION	2	ADDHYD	.11	2	2	.05	.0	5.30	24.00	2.07	---	12.02	244.33	2126.5
SECTION	3	RUNOFF	.08	2	2	.05	.0	5.30	24.00	1.82	---	12.05	153.83	1915.7
SECTION	4	ADDHYD	.20	2	2	.05	.0	5.30	24.00	1.97	---	12.03	396.89	2033.2
ALTERNATE		0	STORM	99										
SECTION	1	RUNOFF	.07	2	2	.05	.0	7.40	24.00	3.32	---	12.05	232.66	3244.9
SECTION	3	RUNOFF	.03	2	2	.05	.0	7.40	24.00	4.48	---	11.98	166.31	4877.1
XSECTION	3	ADDHYD	.11	2	2	.05	.0	7.40	24.00	3.70	---	12.00	379.12	3583.4
STRUCTURE	2	RESVOR	.11	2	2	.05	.0	7.40	24.00	3.60	128.94	12.02	370.22	3499.2
SECTION	2	RUNOFF	.01	2	2	.05	.0	7.40	24.00	3.04	---	12.03	29.26	3214.9
XSECTION	2	ADDHYD	.11	2	2	.05	.0	7.40	24.00	3.56	---	12.02	398.81	3470.9
SECTION	3	RUNOFF	.08	2	2	.05	.0	7.40	24.00	3.23	---	12.04	262.51	3269.1
SECTION	4	ADDHYD	.20	2	2	.05	.0	7.40	24.00	3.42	---	12.03	659.95	3380.9

*****80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****

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OB TR-20
TITLE
DUMBARTON OAKS POND 1 ON U. S. NAVAL OBS.
AND POND 2A FILENAME 1507_DO2.T20
SUMMARY NOPLOTS

3 STRUCT 1
8 200.0 0.0 0.00 POND 1
8 201.0 0.8 0.25
8 202.0 1.3 0.50
8 203.0 1.6 0.75
8 204.0 1.8 1.00
8 205.0 2.1 1.25
8 206.0 2.3 1.84
8 207.0 2.5 2.33
8 208.0 47.2 2.92
8 209.0 142.5 3.51
8 210.0 261.3 4.20
9 ENDTBL

3 STRUCT 2
8 123.0 0.0 0.00
8 123.5 1.0 0.04
8 124.0 3.4 0.09
8 124.5 4.8 0.14
8 125.0 5.9 0.20
8 125.5 6.8 0.27
8 126.0 7.6 0.35
8 126.5 8.3 0.44
8 127.0 9.0 0.54
8 127.5 48.3 0.66
8 128.0 129.4 0.79
8 129.0 384.7 1.12
9 ENDTBL

6 RUNOFF 1 1 3 0.0717 73. 0.24 SA1
6 RESVOR 2 1 3 2 200.0
6 RUNOFF 1 3 1 0.0341 84. 0.08 SA3
6 ADDHYD 4 3 1 2 3
6 RESVOR 2 2 3 4 123.0
6 RUNOFF 1 2 2 0.0091 70. 0.20 SA2
6 ADDHYD 4 2 4 2 5
6 RUNOFF 1 3 1 0.0803 72. 0.22 SA4
6 ADDHYD 4 4 5 1 4
ENDATA

7 INCREM 6 0.05
7 COMPUT 7 1 4 0. 1.8 1.2 2 0 0 6-MONTH
ENDCMP 1
7 COMPUT 7 1 4 0. 2.7 1.2 2 0 1 1-YEAR
ENDCMP 1
7 COMPUT 7 1 4 0. 3.3 1.2 2 0 2 2-YEAR

```

*****80-80 LIST OF INPUT DATA (CONTINUED)*****

ENDCMP 1

7 COMPUT 7 1 4 0. 5.3 1.2 2 0 10 10-YEAR

ENDCMP 1

7 COMPUT 7 1 4 0. 7.4 1.2 2 0 99 100-YEAR

ENDCMP 1

ENDJOB 2

*****END OF 80-80 LIST*****

COMPUTER PROGRAM FOR PROJECT FORMULATION - HYDROLOGY USER NOTES

THE USERS MANUAL FOR THIS PROGRAM IS THE MAY 1982 DRAFT OF TR-20. CHANGES FROM THE 2/14/74 VERSION INCLUDE:

REACH ROUTING - THE MODIFIED ATT-KIN ROUTING PROCEDURE REPLACES THE CONVEX METHOD. INPUT DATA PREPARED FOR PREVIOUS PROGRAM VERSIONS USING CONVEX ROUTING COEFFICIENTS WILL NOT RUN ON THIS VERSION.

THE PREFERRED TYPE OF DATA ENTRY IS CROSS SECTION DATA REPRESENTATIVE OF A REACH. IT IS RECOMMENDED THAT THE OPTIONAL CROSS SECTION DISCHARGE-AREA PLOTS BE OBTAINED WHENEVER NEW CROSS SECTION DATA IS ENTERED. THE PLOTS SHOULD BE CHECKED FOR REASONABLENESS AND ADEQUACY OF INPUT DATA FOR THE COMPUTATION OF "M" VALUES USED IN THE ROUTING PROCEDURE.

GUIDELINES FOR DETERMINING OR ANALYZING REACH LENGTHS AND COEFFICIENTS (X,M) ARE AVAILABLE IN THE USERS MANUAL. SUMMARY TABLE 2 DISPLAYS REACH ROUTING RESULTS AND ROUTING PARAMETERS FOR COMPARISON AND CHECKING.

HYDROGRAPH GENERATION - THE PROCEDURE TO CALCULATE THE INTERNAL TIME INCREMENT AND PEAK TIME OF THE UNIT HYDROGRAPH HAVE BEEN IMPROVED. PEAK DISCHARGES AND TIMES MAY DIFFER FROM THE PREVIOUS VERSION. OUTPUT HYDROGRAPHS ARE STILL INTERPOLATED, PRINTED, AND ROUTED AT THE USER SELECTED MAIN TIME INCREMENT.

INTERMEDIATE PEAKS - METHOD ADDED TO PROVIDE DISCHARGES AT INTERMEDIATE POINTS WITHIN REACHES WITHOUT ROUTING.

OTHER - THIS VERSION CONTAINS SOME ADDITIONS TO THE INPUT AND NUMEROUS MODIFICATIONS TO THE OUTPUT. USER OPTIONS HAVE BEEN MODIFIED AND AUGMENTED ON THE JOB RECORD, RAINTABLES ADDED, ERROR AND WARNING MESSAGES EXPANDED, AND THE SUMMARY TABLES COMPLETELY REVISED. THE HOLDOUT OPTION IS NOT OPERATIONAL AT THIS TIME.

PROGRAM QUESTIONS OR PROBLEMS SHOULD BE DIRECTED TO HYDRAULIC ENGINEERS AT THE SCS NATIONAL TECHNICAL CENTERS:
CHESTER, PA (NORTHEAST) -- 215-499-3933, FORT WORTH, TX (SOUTH) -- 334-5242 (FTS)
LINCOLN, NB (MIDWEST) -- 541-5318 (FTS), PORTLAND, OR (WEST) -- 423-4099 (FTS)

PROGRAM CHANGES SINCE MAY 1982:

- 12/17/82 - CORRECT PEAK RATE FACTOR FOR USER ENTERED DIMHYD
CORRECT REACH ROUTING PEAK TRAVEL TIME PRINTED WITH FULLPRINT OPTION
- 5/02/83 - CORRECT COMPUTATIONS FOR ---
 - 1. DIVISION OF BASEFLOW IN DIVERT OPERATION
 - 2. HYDROGRAPH VOLUME SPLIT BETWEEN BASEFLOW AND ABOVE BASEFLOW
 - 3. CROSS SECTION DATA PLOTTING POSITION
 - 4. INTERMEDIATE PEAK WHEN "FROM" AREA IS LARGER THAN "THRU" AREA
 - 5. STORAGE ROUTED REACH TRAVEL TIME FOR MULTYPEAK HYDROGRAPH
 - 6. ORDERING "FLOW-FREQ" FILE FROM SUMMARY TABLE #3 DATA
 - 7. BASEFLOW ENTERED WITH READHYD
 - 8. LOW FLOW SPLIT DURING DIVERT PROCEDURE #2 WHEN SECTION RATINGS START AT DIFFERENT ELEVATIONS
- ENHANCEMENTS ---
 - 1. REPLACE USER MANUAL ERROR CODES (PAGE 4-9 TO 4-11) WITH MESSAGES
 - 2. LABEL OUTPUT HYDROGRAPH FILES WITH CROSS SECTION/STRUCTURE, ALTERNATE AND STORM NO'S
- 09/01/83 - CORRECT INPUT AND OUTPUT ERRORS FOR INTERMEDIATE PEAKS
CORRECT COMBINATION OF RATING TABLES FOR DIVERT
CHECK REACH ROUTING PARAMETERS FOR ACCEPTABLE LIMITS
ELIMINATE MINIMUM REACH TRAVEL TIME WHEN ATT-KIN COEFFICIENT EQUALS ONE

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DUMBARTON OAKS POND 1 ON U. S. NAVAL OBS.
AND POND 2A FILENAME 1507_DO2.T20

JOB 1 PASS 1
PAGE 2

EXECUTIVE CONTROL OPERATION INCREM MAIN TIME INCREMENT = .05 HOURS

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4

RECORD ID 6-MONTH

STARTING TIME = .00 RAIN DEPTH = 1.80 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.= 0 MAIN TIME INCREMENT = .05 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .96 CFS.

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = .07 CFS.

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 1

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4

RECORD ID 1-YEAR

STARTING TIME = .00 RAIN DEPTH = 2.70 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.= 1 MAIN TIME INCREMENT = .05 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = 2.11 CFS.

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 2

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4

RECORD ID 2-YEAR

STARTING TIME = .00 RAIN DEPTH = 3.30 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.= 2 MAIN TIME INCREMENT = .05 HOURS

*** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE = 2.46 CFS.

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 3

RECORD ID

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4

RECORD ID 10-YEAR

STARTING TIME = .00 RAIN DEPTH = 5.30 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.=10 MAIN TIME INCREMENT = .05 HOURS

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 4

RECORD ID

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DUMBARTON OAKS POND 1 ON U. S. NAVAL OBS.
AND POND 2A FILENAME 1507_D02.T20

JOB 1 PASS 5
PAGE 3

EXECUTIVE CONTROL OPERATION COMPUT FROM XSECTION 1 TO XSECTION 4
STARTING TIME = .00 RAIN DEPTH = 7.40 RAIN DURATION= 1.00 RAIN TABLE NO.= 2 ANT. MOIST. COND= 2
ALTERNATE NO.= 0 STORM NO.=99 MAIN TIME INCREMENT = .05 HOURS
RECORD ID 100-YEAR

EXECUTIVE CONTROL OPERATION ENDCMP COMPUTATIONS COMPLETED FOR PASS 5
RECORD ID

EXECUTIVE CONTROL OPERATION ENDJOB
RECORD ID

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION			RUNOFF AMOUNT (IN)	PEAK DISCHARGE				
						BEGIN (HR)	AMOUNT (IN)	DURATION (HR)		ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)	
ALTERNATE 0 STORM 0														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	1.80	24.00	.14	---	12.10	9.32	129.9
STRUCTURE	1	RESVOR	.07	2	2	.05	.0	1.80	24.00	.05	201.31	14.20?	.96?	13.3
XSECTION	3	RUNOFF	.03	2	2	.05	.0	1.80	24.00	.43	---	11.99	20.28	594.7
XSECTION	3	ADDHYD	.11	2	2	.05	.0	1.80	24.00	.18	---	11.99	20.36	192.4
STRUCTURE	2	RESVOR	.11	2	2	.05	.0	1.80	24.00	.17	125.65	12.11	7.04	66.6
XSECTION	2	RUNOFF	.01	2	2	.05	.0	1.80	24.00	.09	---	12.10	.72	79.1
XSECTION	2	ADDHYD	.11	2	2	.05	.0	1.80	24.00	.16	---	12.10	7.76	67.5
XSECTION	3	RUNOFF	.08	2	2	.05	.0	1.80	24.00	.12	---	12.09	9.10	113.4
XSECTION	4	ADDHYD	.20	2	2	.05	.0	1.80	24.00	.15	---	12.09	16.86	86.4
ALTERNATE 0 STORM 1														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	2.70	24.00	.46	---	12.07	34.65	483.2
STRUCTURE	1	RESVOR	.07	2	2	.05	.0	2.70	24.00	.13	205.04	14.45?	2.11?	29.4
XSECTION	3	RUNOFF	.03	2	2	.05	.0	2.70	24.00	.96	---	11.98	41.95	1230.1
XSECTION	3	ADDHYD	.11	2	2	.05	.0	2.70	24.00	.40	---	11.98	42.72	403.8
STRUCTURE	2	RESVOR	.11	2	2	.05	.0	2.70	24.00	.38	127.31	12.05	33.13	313.2
XSECTION	2	RUNOFF	.01	2	2	.05	.0	2.70	24.00	.36	---	12.06	3.73	409.8
XSECTION	2	ADDHYD	.11	2	2	.05	.0	2.70	24.00	.38	---	12.05	36.86	320.8
XSECTION	3	RUNOFF	.08	2	2	.05	.0	2.70	24.00	.43	---	12.06	37.27	464.1
XSECTION	4	ADDHYD	.20	2	2	.05	.0	2.70	24.00	.40	---	12.05	74.01	379.2
ALTERNATE 0 STORM 2														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	3.30	24.00	.74	---	12.07	55.65	776.1
STRUCTURE	1	RESVOR	.07	2	2	.05	.0	3.30	24.00	.15	206.80	14.95?	2.46?	34.3
XSECTION	3	RUNOFF	.03	2	2	.05	.0	3.30	24.00	1.36	---	11.98	57.35	1681.9
XSECTION	3	ADDHYD	.11	2	2	.05	.0	3.30	24.00	.54	---	11.98	58.66	554.4
STRUCTURE	2	RESVOR	.11	2	2	.05	.0	3.30	24.00	.52	127.55	12.00	55.77	527.1
XSECTION	2	RUNOFF	.01	2	2	.05	.0	3.30	24.00	.61	---	12.05	6.34	696.3
XSECTION	2	ADDHYD	.11	2	2	.05	.0	3.30	24.00	.53	---	12.01	61.56	535.7
XSECTION	3	RUNOFF	.08	2	2	.05	.0	3.30	24.00	.69	---	12.06	60.89	758.2
XSECTION	4	ADDHYD	.20	2	2	.05	.0	3.30	24.00	.60	---	12.02	118.43	606.7
ALTERNATE 0 STORM 10														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	5.30	24.00	1.89	---	12.05	137.56	1918.5
STRUCTURE	1	RESVOR	.07	2	2	.05	.0	5.30	24.00	1.28	208.45	12.18	89.89	1253.7

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DUMBARTON OAKS POND 1 ON U. S. NAVAL OBS.
AND POND 2A FILENAME 1507_DO2.T20

JOB 1 SUMMARY
PAGE 5

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION			RUNOFF AMOUNT (IN)	PEAK DISCHARGE				
						BEGIN (HR)	AMOUNT (IN)	DURATION (HR)		ELEVATION (FT)	TIME (HR)	RATE (CFS)	RATE (CSM)	
ALTERNATE 0 STORM 10														
XSECTION	3	RUNOFF	.03	2	2	.05	.0	5.30	24.00	2.83	---	11.98	110.36	3236.2
XSECTION	3	ADDHYD	.11	2	2	.05	.0	5.30	24.00	1.78	---	11.98	110.44	1043.8
STRUCTURE	2	RESVOR	.11	2	2	.05	.0	5.30	24.00	1.68	127.87	12.20	108.58	1026.3
XSECTION	2	RUNOFF	.01	2	2	.05	.0	5.30	24.00	1.68	---	12.04	16.81	1847.0
XSECTION	2	ADDHYD	.11	2	2	.05	.0	5.30	24.00	1.68	---	12.00	124.01	1079.3
XSECTION	3	RUNOFF	.08	2	2	.05	.0	5.30	24.00	1.82	---	12.05	153.83	1915.7
XSECTION	4	ADDHYD	.20	2	2	.05	.0	5.30	24.00	1.74	---	12.03	273.70	1402.2
ALTERNATE 0 STORM 99														
XSECTION	1	RUNOFF	.07	2	2	.05	.0	7.40	24.00	3.32	---	12.05	232.66	3244.9
STRUCTURE	1	RESVOR	.07	2	2	.05	.0	7.40	24.00	2.69	209.54	12.11	207.21	2890.0
XSECTION	3	RUNOFF	.03	2	2	.05	.0	7.40	24.00	4.48	---	11.98	166.31	4877.1
XSECTION	3	ADDHYD	.11	2	2	.05	.0	7.40	24.00	3.27	---	12.02	306.89	2900.6
STRUCTURE	2	RESVOR	.11	2	2	.05	.0	7.40	24.00	3.17	128.67	12.04	301.42	2849.0
XSECTION	2	RUNOFF	.01	2	2	.05	.0	7.40	24.00	3.04	---	12.03	29.26	3214.9
XSECTION	2	ADDHYD	.11	2	2	.05	.0	7.40	24.00	3.16	---	12.04	330.62	2877.5
XSECTION	3	RUNOFF	.08	2	2	.05	.0	7.40	24.00	3.23	---	12.04	262.51	3269.1
XSECTION	4	ADDHYD	.20	2	2	.05	.0	7.40	24.00	3.19	---	12.04	593.12	3038.5