

## 6.5 Example Problem 5 - Reservoirs

HEC-6 simulates reservoirs by allowing the water surface elevation at the reservoir location to be a function of time, as defined by input data. The hydraulic computations are still steady state; therefore, there is no routing of the water (i.e. outflow equals inflow at all times).

### 6.5.1 Reservoir Data

Example Problem 5 input is shown in Table 6-5a and illustrates the data for a problem with two reservoirs; one at the downstream boundary (Section No. 1.0) and one at Silver Lake - which begins at Section No. 35.0 and extends upstream to Section No. 53.0 (much farther upstream than is illustrated in Figure 6-1). Section No. 33.3 is at the approximate upstream extent of the pool for the downstream reservoir and Section No. 53.0 is at the upstream end of Silver Lake. The operation of the downstream reservoir is simulated by the time history of pool elevations entered in field 1 of the R records in the flow data. Similarly, the X5 record at Section No. 35.0 that defines the downstream boundary of the Silver Lake reservoir indicates that the time history of pool elevations will be in Field 2 of the R record. The X5 record at Section No. 53.1 marks the upstream limit of Silver Lake. The two X5 records divide the model into 3 subreaches; the first, which represents the downstream reservoir, is bounded by Sections 1.0 and 33.9, the second subreach, Silver Lake, is bounded by Sections 35.0 and 53.0, and the third, the contributing upstream reach, is bounded by Sections 53.1 and 58.0. Thus the information produced for each subreach can be used to analyze the behavior of the two reservoirs and the contributing upstream reach.

Table 6-5a  
Example Problem 5 - Input  
Reservoir Model

EXAMPLE PROBLEM NO 5. RESERVOIRS.										
2 RESERVOIRS, 3 LOCAL INFLOWS.										
SOUTH FORK, ZUMBRO RIVER ** Example Problem 5 **										
NC	.1	.1	.04	.1	.3					
X1	1.0	31	10077.	10275.	0.	0.	0.			
GR	1004.	9915.	978.4	10002.	956.0	10060.	959.2	10077.	959.3	10081.
GR	950.0	10092.	948.48	10108.	946.6	10138.	944.7	10158.	955.2	10225.
GR	956.2	10243.	958.9	10250.	959.8	10275.	959.8	10300.	959.9	10325.
GR	958.8	10350.	957.4	10400.	970.0	10700.	966.0	10960.	970.0	11060.
GR	968.0	11085.	968.0	11240.	970.0	11365.	970.0	11500.	970.0	11615.
GR	962.0	11665.	962.0	12400.	976.0	12550.	980.0	12670.	982.0	12730.
GR	984.0	12735.								
HD	1.0	10.	10081.	10250.						
NV	22	.045	965.6	.064	988.8					
NV	12	.08	965.6	.13	988.8					
NV	33	.1	965.6	.11	982.0	.12	988.8			
X1	15.0	27	10665.	10850.	3560.	3030.	3280.			
X3				10700.	961.0	11000.	970.0			
GR	992.0	9570.	982.0	10110.	976.0	10300.	976.0	10490.	966.0	10610.
GR	964.7	10665.	956.0	10673.	953.0	10693	954.0	10703.	955.6	10723.
GR	958.6	10750.	959.3	10800.	957.0	10822.	957.3	10825.	961.5	10850.
GR	962.0	10852.	964.0	10970.	966.0	11015.	961.0	11090.	962.0	11150.
GR	970.0	11190.	972.0	11310.	980.0	11410.	984.0	11570.	990.0	11770.
GR	990.0	11865.	1000.0	12150.						
HD	15.0	10.	10673.	10852.						
CASCADE CREEK - LOCAL INFLOW										
QT										
NC	.1	.1	.05							
X1	32.0	29	10057.	10271.	3630.	3060.	4240.			
GR	998.0	9080.	982.0	9250.	982.0	9510.	980.0	9600.	980.01	9925.
GR	979.48	10000.	978.5	10057.	968.6	10075.	959.82	10087.	956.5	10097.
GR	956.8	10117.	957.8	10137.	959.4	10157.	959.6	10177.	959.82	10196.
GR	966.5	10225.	971.2	10250.	978.5	10271.	978.5	10300.	978.6	10350.
GR	978.91	10370.	978.96	10387.	980.0	10610.	982.0	10745.	982.0	11145.
GR	984.0	11150.	992.0	11240.	1000.0	11330.	1008.	11425.		
HD	32.0	10.	10075.	10275.						
X1	33.0	21	1850.	2150.	3130.	3250.	3320.			
XL			250.							
GR	1000.	980.	990.0	1060.	980.0	1150.	982.0	1180.	982.0	1215.

GR	980.0	1260.	982.0	1300.	982.0	1350.	980.0	1420.	980.0	1540.
GR	982.0	1730.	982.0	1830.	984.41	1850.	979.19	1851.	961.0	1900.8
GR	961.0	2099.2	976.0	2149.	984.5	2150.	982.0	2800.	990.0	3100.
GR	1000.	3170.								
HD	33.0	0.	1851.	2149.						
	NOTE:	Section 33.3 is a duplicate of Section 33.0.								
X1	33.3	21	1850.0	2150.0	1550.	1750.	1750.	.95	1.49	
XL			250.							
GR	1000.	980.	990.0	1060.	980.0	1150.	982.0	1180.	982.0	1215.
GR	980.0	1260.	982.0	1300.	982.0	1350.	980.0	1420.	980.0	1540.
GR	982.0	1730.	982.0	1830.	984.41	1850.	979.19	1851.	961.0	1900.8
GR	961.0	2099.2	976.0	2149.	984.5	2150.	982.0	2800.	990.0	3100.
GR	1000.	3170.								
HD	33.3	0.	1851.	2149.				.95	1.65	
	Section	33.9 is a duplicate of Sec 33.3, needed to model IBC at Sec 35.0								
X1	33.9	21	1850.0	2150.0	1050.	1050.	1050.			
X3	10									
GR	1000.	980.	990.0	1060.	980.0	1150.	982.0	1180.	982.0	1215.
GR	980.0	1260.	982.0	1300.	982.0	1350.	980.0	1420.	980.0	1540.
GR	982.0	1730.	982.0	1830.	984.41	1850.	979.19	1851.	961.0	1900.8
GR	961.0	2099.2	976.0	2149.	984.5	2150.	982.0	2800.	990.0	3100.
GR	1000.	3170.								
HD	33.9	0.	1851.	2149.						
X1	35.0	22	9894.	10245.	0	0	0			
X3	10									
X5				2						
GR	984.0	9035.	980.0	9070.	978.0	9135.	980.0	9185.	982.0	9270.
GR	980.0	9465.	981.7	9595.	983.7	9745.	984.7	9894.	963.4	9894.1
GR	963.3	9954.	967.1	9974.	967.4	10004.	968.2	10044.	967.6	10054.
GR	973.4	10115.	977.4	10120.	983.7	10155.	984.0	10245.	982.0	10695.
GR	982.0	10895.	1004.0	11085.						
HD	35.0	0.	9954.	10155.						
	SILVER LAKE									
NC	.06	.06	.045							
X1	42.0	32	9880.	10130.	5370.	5000.	5210.			
GR	996.0	7130.	998.0	7310.	998.0	7930.	992.0	8205.	990.0	8495.
GR	988.0	8780.	986.0	8990.	985.7	9570.	986.4	9707.	989.4	9857.
GR	990.0	9880.	969.8	9881.	969.8	9941.	985.8	9941.	985.8	9943.
GR	969.8	9943.	969.8	10001.	986.7	10001.	986.7	10003.	969.8	10003.
GR	969.8	10067.	985.8	10067.	985.8	10069.	969.8	10069.	969.8	10129.
GR	989.9	10130.	989.5	10180.	988.6	10230.	987.6	10280.	985.2	10430.
GR	986.8	11720.	989.9	12310.						
HD	42.0	0.	9881.	10021.						
	SILVER CREEK - LOCAL INFLOW									
QT										
X1	44.0	28	9845.	10127.	3200.	3800.	3500.			
XL			9850.0	10200.0						
GR	1002.	8035.	992.0	8150.	990.0	8305.	990.0	8735.	988.0	8835.
GR	996.0	9285.	1017.6	9425.	990.0	9505.	986.0	9650.	984.1	9788.
GR	980.6	9845.	970.9	9868.	972.2	9898.	970.5	9968.	967.5	9998.
GR	968.9	10028.	967.4	10058.	967.1	10078.	971.9	10118.	976.8	10127.
GR	977.8	10150.	976.9	10193.	982.0	10206.	981.2	10300.	979.2	10325.
GR	983.1	10400.	999.8	10450.	1002.4	10464.				
HD	44.0	10.	9868.	10193.						
X1	53.0	22	10000.	10136.	3366.	2832.	2942.			
GR	1004.	7550.	1000.0	7760.	998.0	8440.	996.0	8640.	996.0	8780.
GR	994.0	8940.	986.0	9245.	986.3	9555.	986.3	9825.	983.8	9900.
GR	982.8	10000.	978.2	10011.	974.0	10041.	972.2	10071.	972.6	10101.
GR	978.2	10121.	988.7	10136.	989.3	10154.	999.2	10200.	1000.	10320.
GR	1002.	10470.	1004.0	10700.						
HD	53.0	10.	10000.	10136.						
	Section 53.1 is a REPEAT of Sec 53.0, needed to model an IBC at THIS location.									
	NOTE: no water surface is defined at this IBC, i.e. No Hydraulic Cntrl Strctr									
X1	53.1	0	10000.	10136.	0	0	0			
X5										
HD	53.1	10.	10000.	10136.						
	BEAR CREEK - LOCAL INFLOW									
QT										
X1	55.0	18	9931.	10062.	2275.	3430.	2770.			
GR	1004.	7592.	1000.0	7947.	996.0	8627.	990.0	9052.	986.0	9337.
GR	984.3	9737.	984.7	9837.	985.5	9910.	987.2	9931.	978.1	9955.
GR	974.8	9975.	974.2	10005.	972.9	10035.	973.2	10045.	983.8	10062.
GR	985.8	10187.	986.0	10307.	990.0	10497.				
HD	55.0	10.	9931.	10062.						
X1	58.0	22	9912.	10015.	1098.	1012.	1462.			
GR	1006.	8542.	1004.0	8952.	1000.0	9702.	997.2	9812.	996.3	9912.
GR	976.2	9944.	975.4	9974.	978.2	9991.	990.4	10015.	988.3	10062.
GR	988.8	10065.	988.3	10065.	989.3	10169.	990.0	10172.	992.0	10242.
GR	992.0	10492.	988.0	10642.	986.7	10852.	988.0	11022.	986.0	11097.
GR	986.0	11137.	988.0	11192.						
HD	58.0	3.4	9912.	10015.						
EJ										
T4		South Fork, Zumbro River - Stream Segment 1 ** Example Problem 5 **								
T5		LOAD CURVE FROM GAGE DATA.								

T6	BED GRADATIONS FROM FIELD SAMPLES.									
T7	Use full range of Sands and Gravels									
T8	SEDIMENT TRANSPORT BY Yang' s STREAM POWER [ref ASCE JOURNAL (YANG 1971)]									
I1	5									
I4	SAND	4	1	10						
I5		.5	.5	.25	.5	.25	0	1.0		
LQ		1	50	1000	5800	90000				
LT	TOTAL	.0110	1.5	320	4500.	400000				
LF	VFS	.119	.119	.498	.511	.582				
LF	FS	.328	.328	.331	.306	.280				
LF	MS	.553	.553	.156	.154	.110				
LF	CS	.000	.000	.011	.016	.020				
LF	VCS	.000	.000	.004	.008	.005				
LF	VFG	.000	.000	.000	.004	.002				
LF	FG	.000	.000	.000	.001	.001				
LF	MG	.000	.000	.000	.000	.000				
LF	CG	.000	.000	.000	.000	.000				
LF	VCG	.0	.0	.000	.000	.000				
PF	EXAMP	1.0	1.0	32.0	16.0	96.5	8.0	95.0	4.0	91.0
PFC	2.0	85.0	1.0	73.0	.5	37.0	.25	8.0	.125	1.0
PFC.	0625	0.0								
PF	EXAMP	32.0	1.0	64.0	32.0	99.5	16.0	99.0	8.0	98.5
PFC	4.0	96.0	2.0	93.5	1.0	83.0	.50	45.5	.250	8.0
PFC	.125	1.0	.0625	0.0						
PF	EXAMP	58.0	1.0	64.0	32.0	97.0	16.0	94.0	8.0	94.0
PFC	4.0	90.0	2.0	79.0	1.0	56.0	.50	4.0	.125	0.0
SLOCAL										
LOAD TABLE - CASCADE CREEK - A LOCAL INFLOW										
LQL		1	100	1000	10000					
LTL	TOTAL	.0040	10	500	30000					
LFL	VFS	.664	.664	.015	.198					
LFL	FS	.207	.207	.245	.181					
LFL	MS	.086	.086	.605	.107					
LFL	CS	.031	.031	.052	.098					
LFL	VCS	.008	.008	.039	.127					
LFL	VFG	.0030	.0030	.0200	.1160					
LFL	FG	.0010	.0010	.0110	.0910					
LFL	MG	.0000	.0000	.0110	.0530					
LFL	CG	.0000	.0000	.0000	.0220					
LFL	VCG	.0000	.0000	.0000	.0060					
LOAD TABLE - SILVER CREEK - A LOCAL INFLOW										
LQL		1	100	1000	10000					
LTL	TOTAL	.0040	10	500	30000					
LFL	VFS	.664	.664	.015	.198					
LFL	FS	.207	.207	.245	.181					
LFL	MS	.086	.086	.605	.107					
LFL	CS	.031	.031	.052	.098					
LFL	VCS	.008	.008	.039	.127					
LFL	VFG	.0030	.0030	.0200	.1160					
LFL	FG	.0010	.0010	.0110	.0910					
LFL	MG	.0000	.0000	.0110	.0530					
LFL	CG	.0000	.0000	.0000	.0220					
LFL	VCG	.0000	.0000	.0000	.0060					
LOAD TABLE - BEAR CREEK - A LOCAL INFLOW										
LQL		1.	100.	500.	1000.	30000.				
LTL	TOTAL	.0020	30.0	500.	1200	22500				
LFL	VFS	.201	.201	.078	.078	.137				
LFL	FS	.342	.342	.172	.175	.218				
LFL	MS	.451	.451	.454	.601	.476				
LFL	CS	.001	.001	.197	.142	.158				
LFL	VCS	.000	.000	.000	.003	.008				
LFL	VFG	.0000	.0000	.0000	.0000	.0020				
LFL	FG	.0000	.000	.0000	.0000	.0010				
LFL	MG	.0000	.000	.0000	.0000	.0000				
LFL	CG	.0000	.000	.0000	.0000	.0000				
LFL	VCG	.0000	.000	.0000	.0000	.0000				
SHYD										
SPRT										
CP		1								
PS		1.0	35.0	53.1						
END										
SVOL	X	0								
VJ	16									
VR	944	946	948	950	952	954	956	958	960	962
VR	964	966	968	970	972	974				
SPRT A										
Q	A	FLOW 1 = BASE FLOW OF 750 CFS								
Q	750	61	29	128						
R	960.	973.5								
T	65	72	70	67						
W	10.									
Q	A	FLOW 2 = 50 DAYS AT BANK FULL DISCHARGE								
Q	2500.0	300.	150.	650.						
R	965.	975								

```

X          2.5    50.
Q   A      FLOW 3 = NEAR BANK FULL DISCHARGE
Q 1250.    150.    78.    340.
R  963.    974.5
W          1.
Q   B      FLOW 4 = BASE FLOW OF 750 CFS
Q  750.     61     29     128
R  960.     973
W          1.
SPRT
CP          1
PS         1.0    35.0    53.1
END
SVOL  X
VJ    16         0
VR   944        946    948    950    952    954    956    958    960    962
VR   964        966    968    970    972    974
SSEND
    
```

### 6.5.2 Elevation-Surface Area and Elevation-Storage Tables

Tables of elevation vs. surface area and storage can be obtained by use of the SVOL, VJ, and VR records in the flow data. In this example, these records were used to request that these tables be produced for a series of horizontal planes extending from elevation 944 ft (the approximate thalweg of Section No. 1.0) to elevation 974 ft (the approximate thalweg of section No. 53.0) in 2 ft increments. Care should be taken to ensure that the endpoints of each cross section are higher than these elevations; otherwise, HEC-6 will extend the ends of the sections vertically and the surface areas and volumes will be too small.

The output for Example Problem 5 is shown in Table 6-5b. Prior to time step 1 and after time step 4, tables containing the surface areas and storage volumes for Sections 1.0, 35.0, and 53.1 at each elevation specified on the VR records. (The SPRT option was used to limit the SVOL output to these cross sections.) For example, at Section No. 35.0, the initial storage volume at elevation 968 ft is 859.78 acre-ft; and after the last time step, the storage volume is 855.45 acre-ft. This indicates that approximately 4.3 acre-ft of sediment was deposited between Sections 35.0 and 58.0 below elevation 968 ft, reducing the storage capability of Silver Lake. One only needs to use information in the table for elevations above the thalweg of the cross section at the dam of interest. These tables can be used to construct elevation-deposition and deposition-distance relations.

### 6.5.3 Trap Efficiency

The computation of trap efficiency and the interpretation of "TABLE SA-1" were presented in Section 6.3.8 for Example Problem 3. In this example, the X5 records were used to delineate the upstream and downstream extent of the reservoirs causing trap efficiency to be computed for each. For example, looking at TABLE SA-1 of time step 4 for the middle reach which represents Silver Lake, 42.71 acre-ft has entered the reservoir from the upstream reach, 0.37 acre-ft from Silver Creek and 3.55 acre-ft have passed through Silver Lake, giving it a trap efficiency of 91% for this simulation. The downstream reservoir has a trap efficiency of 99%. Negative trap efficiencies indicate scour.

**Table 6-5b**  
**Example Problem 5 - Output**  
**Reservoir Model**

```
*****
* SCOUR AND DEPOSITION IN RIVERS AND RESERVOIRS *
* Version: 4.1.00 - AUGUST 1993 *
* INPUT FILE: EXAMPLE5.DAT *
* OUTPUT FILE: EXAMPLE5.OUT *
* RUN DATE: 31 AUG 93 RUN TIME: 15:53:06 *
*****
```

```
*****
* U. S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616-4687 *
* (916) 756-1104 *
*****
```

```

X   X   XXXXXXX   XXXXX   XXXXX
X   X   X       X   X       X   X
X   X   X       X       X       X
XXXXXX XXXX   X       XXXXX XXXXXX
X   X   X       X       X       X
X   X   X       X       X       X
X   X   XXXXXXX   XXXXX   XXXXX

```

```
*****
* MAXIMUM LIMITS FOR THIS VERSION ARE: *
* 10 Stream Segments (Main Stem + Tributaries) *
* 150 Cross Sections *
* 100 Elevation/Station Points per Cross Section *
* 20 Grain Sizes *
* 10 Control Points *
*****
```

```
T1 EXAMPLE PROBLEM NO 5. RESERVOIRS.
T2 2 RESERVOIRS, 3 LOCAL INFLOWS.
T3 SOUTH FORK, ZUMBRO RIVER ** Example Problem 5 **
```

```
N values... Left Channel Right Contraction Expansion
            0.1000 0.0400 0.1000 1.1000 0.7000
```

```
SECTION NO. 1.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.
```

```
N-Values vs. Elevation Table
Channel Left Overbank Right Overbank
0.0450 966. 0.0800 966. 0.1000 966.
0.0640 989. 0.1300 989. 0.1100 982.
0.0000 0. 0.0000 0. 0.1200 989.
```

```
SECTION NO. 15.000
...Left Encroachment defined at station 10700.000 at elevation 961.000
...Right Encroachment defined at station 11000.000 at elevation 970.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.
```

```
LOCAL INFLOW POINT 1 occurs upstream from Section No. 15.000
```

```
N values... Left Channel Right Contraction Expansion
            0.1000 0.0500 0.1000 1.1000 0.7000
```

```
SECTION NO. 32.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.
```

```
SECTION NO. 33.000
...Limit CONVEYANCE to 250.000 ft. centered about midpoint of channel.
...DEPTH of the Bed Sediment Control Volume = 0.00 ft.
```

```
SECTION NO. 33.300
...Adjust Section WIDTH to 95.00% of original.
...Adjust Section ELEVATIONS by 1.490 ft.
...Limit CONVEYANCE to 250.000 ft. centered about midpoint of channel.
...DEPTH of the Bed Sediment Control Volume = 0.00 ft.
```

```
SECTION NO. 33.900
...Ineffective Flow Area - Method 1 - Left Overbank Right Overbank
Natural Levees at Station 1850.000 2150.000
Ineffective Elevation 984.410 984.500
...DEPTH of the Bed Sediment Control Volume = 0.00 ft.
```

```
SECTION NO. 35.000
...Internal Boundary Condition
Water Surface Elevation will be read from R-RECORD, Field 2
Head Loss = 0.000
...Ineffective Flow Area - Method 1 - Left Overbank Right Overbank
Natural Levees at Station 9894.000 10245.000
Ineffective Elevation 984.700 984.000
...DEPTH of the Bed Sediment Control Volume = 0.00 ft.
```

```
N values... Left Channel Right Contraction Expansion
            0.0600 0.0450 0.0600 1.1000 0.7000
```

```
SECTION NO. 42.000
...DEPTH of the Bed Sediment Control Volume = 0.00 ft.
```

```

LOCAL INFLOW POINT 2 occurs upstream from Section No.      42.000
SECTION NO.      44.000
...Limit CONVEYANCE between stations      9850.000 and 10200.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO.      53.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO.      53.100
...Internal Boundary Condition
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

LOCAL INFLOW POINT 3 occurs upstream from Section No.      53.100

SECTION NO.      55.000
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO.      58.000
...DEPTH of the Bed Sediment Control Volume = 3.40 ft.

NO. OF CROSS SECTIONS IN STREAM SEGMENT= 13
NO. OF INPUT DATA MESSAGES = 0

TOTAL NO. OF CROSS SECTIONS IN THE NETWORK = 13
TOTAL NO. OF STREAM SEGMENTS IN THE NETWORK= 1
END OF GEOMETRIC DATA
    
```

The output produced during processing of the sediment data does not differ from that produced for Example Problem 3. It has therefore, been omitted from this table. Refer to Table 6-3b.

```

=====
SHYD
BEGIN COMPUTATIONS.

-----
SPRT
...Selective Printout Option
- Print at the following cross sections
CP      1
PS      1.0  35.0  53.1
END
    
```

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-----
$VOL X
STREAM SEGMENT # 1: EXAMPLE PROBLEM NO 5. RESERVOIRS.
    
```

SUMMARY TABLE: MASS AND VOLUME OF SEDIMENT

SECTION	SEDIMENT THROUGH SECTION (tons)				SEDIMENT DEPOSITED IN REACH in cu. yds				
	TOTAL	SAND	SILT	CLAY	TOTAL	CUMULATIVE	SAND	SILT	CLAY
INFLOW	0.	0.	0.	0.	0.				
58.000	0.	0.	0.	0.	0.	0.	0.	0.	0.
55.000	0.	0.	0.	0.	0.	0.	0.	0.	0.
53.100	0.	0.	0.	0.	0.	0.	0.	0.	0.
53.000	0.	0.	0.	0.	0.	0.	0.	0.	0.
44.000	0.	0.	0.	0.	0.	0.	0.	0.	0.
42.000	0.	0.	0.	0.	0.	0.	0.	0.	0.
35.000	0.	0.	0.	0.	0.	0.	0.	0.	0.
33.900	0.	0.	0.	0.	0.	0.	0.	0.	0.
33.300	0.	0.	0.	0.	0.	0.	0.	0.	0.
33.000	0.	0.	0.	0.	0.	0.	0.	0.	0.
32.000	0.	0.	0.	0.	0.	0.	0.	0.	0.
15.000	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.000	0.	0.	0.	0.	0.	0.	0.	0.	0.

SECTION NO.	ELEV	SURFACE AREA	VOLUME AC-FT	VOLUME CY
1.000	974.00	0.00	0.00	0.00
35.000	944.00	0.00	0.00	0.00
	946.00	0.83	0.54	867.78
	948.00	2.39	3.67	5915.09
	950.00	3.76	9.89	15949.33
	952.00	4.33	17.97	28994.35
	954.00	5.16	27.24	43939.75
	956.00	8.11	40.39	65164.13

958.00	17.48	64.33	103778.95
960.00	36.80	116.56	188053.68
962.00	83.01	210.59	339749.19
964.00	102.86	399.48	644489.52
966.00	114.88	616.41	994482.30
968.00	133.90	859.78	1387110.86
970.00	174.82	1146.51	1849704.72
972.00	188.44	1509.87	2435927.43
974.00	195.16	1893.47	3054796.73

SECTION NO. 53.100

944.00	0.00	0.00	0.00
946.00	0.83	0.54	867.78
948.00	2.39	3.67	5915.09
950.00	3.76	9.89	15949.33
952.00	4.33	17.97	28994.35
954.00	5.16	27.24	43939.75
956.00	8.11	40.39	65164.13
958.00	17.48	64.33	103778.95
960.00	36.80	116.56	188053.68
962.00	83.01	210.59	339749.19
964.00	106.66	401.88	648370.52
966.00	119.32	627.06	1011649.74
968.00	147.00	883.72	1425731.27
970.00	219.64	1211.25	1954147.00
972.00	242.73	1671.97	2697446.67
974.00	254.16	2170.41	3501589.08

SPRT A  
 ...Selective Printout Option  
 A - Print at all cross sections

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TIME STEP # 1  
 Q A FLOW 1 = BASE FLOW OF 750 CFS

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1  
 EXAMPLE PROBLEM NO 5. RESERVOIRS.  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```
*****
```

TIME	ENTRY	SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF
10.00	58.000	0.46		*
	53.100	0.21		*
TOTAL=	53.100	0.67	5.24	-6.78

```
*****
```

TIME	ENTRY	SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF
10.00	53.100	5.24		*
	42.000	0.01		*
TOTAL=	35.000	5.25	0.00	1.00

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*****
```

TIME	ENTRY	SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF
10.00	35.000	0.00		*
	15.000	0.02		*
TOTAL=	1.000	0.02	0.00	0.98

```
*****
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=====

TIME STEP # 2  
 Q A FLOW 2 = 50 DAYS AT BANK FULL DISCHARGE  
 COMPUTING FROM TIME= 10.0000 DAYS TO TIME= 60.0000 DAYS IN 20 COMPUTATION STEPS

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1  
 EXAMPLE PROBLEM NO 5. RESERVOIRS.  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```
*****
```

TIME	ENTRY	SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF
60.00	58.000	13.54		*
	53.100	16.20		*
TOTAL=	53.100	29.74	40.95	-0.38

```
*****
```

TIME	ENTRY	SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF
60.00	53.100	40.95		*
	42.000	0.36		*
TOTAL=	35.000	41.31	3.55	0.91

```
*****
```

TIME	ENTRY	SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF
60.00	35.000	3.55		*
	15.000	1.01		*
TOTAL=	1.000	4.56	0.06	0.99

```
*****
```

=====

TIME STEP # 3  
 Q A FLOW 3 = NEAR BANK FULL DISCHARGE

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1  
 EXAMPLE PROBLEM NO 5. RESERVOIRS.  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW  TRAP EFF *
61.00    58.000 *      13.62   41.19   -0.38 *
          53.100 *      16.30
TOTAL=   53.100 *      29.92
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW  TRAP EFF *
61.00    53.100 *      41.19   3.55    0.91 *
          42.000 *      0.37
TOTAL=   35.000 *      41.56
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW  TRAP EFF *
61.00    35.000 *      3.55   0.06    0.99 *
          15.000 *      1.02
TOTAL=   1.000 *      4.57
*****
```

=====

TIME STEP # 4  
 Q B FLOW 4 = BASE FLOW OF 750 CFS

EXAMPLE PROBLEM NO 5. RESERVOIRS.  
 ACCUMULATED TIME (yrs).... 0.170  
 FLOW DURATION (days)..... 1.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No.	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	532.00	93.30	63.44
Upstream of SECTION NO. LOCAL INFLOW POINT # 3	53.100 is... DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAIN STEM INFLOW	532.00	93.30	63.44
LOCAL INFLOW	128.00	43.20	67.00
TOTAL	660.00	136.50	64.13
Upstream of SECTION NO. LOCAL INFLOW POINT # 2	42.000 is... DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAIN STEM INFLOW	660.00	136.50	64.13
LOCAL INFLOW	29.00	1.22	70.00
TOTAL	689.00	137.72	64.38
Upstream of SECTION NO. LOCAL INFLOW POINT # 1	15.000 is... DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAIN STEM INFLOW	689.00	137.72	64.38
LOCAL INFLOW	61.00	4.32	72.00
TOTAL	750.00	142.04	65.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1  
 EXAMPLE PROBLEM NO 5. RESERVOIRS.  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW  TRAP EFF *
62.00    58.000 *      13.66   41.34   -0.38 *
          53.100 *      16.32
TOTAL=   53.100 *      29.99
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW  TRAP EFF *
62.00    53.100 *      41.34   3.55    0.91 *
          42.000 *      0.37
TOTAL=   35.000 *      41.71
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW  TRAP EFF *
62.00    35.000 *      3.55   0.06    0.99 *
          15.000 *      1.02
TOTAL=   1.000 *      4.57
*****
```

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND...	38.08	VERY FINE GRAVEL..	0.00
FINE SAND.....	34.16	FINE GRAVEL.....	0.00
MEDIUM SAND.....	21.06	MEDIUM GRAVEL....	0.00
COARSE SAND.....	0.00	COARSE GRAVEL....	0.00
VERY COARSE SAND..	0.00	VERY COARSE GRAVEL	0.00
TOTAL =			93.30
SEDIMENT OUTFLOW from the Downstream Boundary			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND....	0.06	VERY FINE GRAVEL..	0.00
FINE SAND.....	0.05	FINE GRAVEL.....	0.00
MEDIUM SAND.....	0.11	MEDIUM GRAVEL....	0.00
COARSE SAND.....	0.08	COARSE GRAVEL....	0.00
VERY COARSE SAND..	0.02	VERY COARSE GRAVEL	0.00
TOTAL =			0.32

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 62.000 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) SAND
58.000	-2.12	978.00	973.28	532.	196.
55.000	-0.97	977.02	971.93	532.	237.
53.100	-1.18	975.27	971.02	660.	303.
53.000	-2.09	975.27	970.11	660.	243.
44.000	1.98	974.14	969.08	660.	85.
42.000	0.68	973.32	970.48	689.	17.
35.000	0.23	973.00	963.53	689.	1.
33.900	0.00	965.13	961.00	689.	1.
33.300	0.00	964.81	962.49	689.	7.
33.000	0.00	963.72	961.00	689.	11.
32.000	-0.55	962.68	955.95	689.	159.
15.000	0.25	960.18	953.95	750.	175.
1.000	0.93	960.00	945.63	750.	0.

SPRT  
 ...Selective Printout Option  
 - Print at the following cross sections  
 CP 1  
 PS 1.0 35.0 53.1  
 END

SVOL X

STREAM SEGMENT # 1: EXAMPLE PROBLEM NO 5. RESERVOIRS.

SUMMARY TABLE: MASS AND VOLUME OF SEDIMENT

SECTION	SEDIMENT THROUGH SECTION (tons)			SEDIMENT DEPOSITED IN REACH in cu. yds			CLAY
	TOTAL	SAND	SILT	TOTAL	CUMULATIVE	SAND	
INFLOW	27675.	27675.	0.	0.	22043.		
58.000	33913.	33913.	0.	0.	-4968.	-4968.	0.
55.000	43560.	43560.	0.	0.	-7684.	-12652.	0.
LOCAL	33067.	33067.	0.	0.	26338.		
53.100	83742.	83742.	0.	0.	-5667.	-18319.	0.
53.000	104383.	104383.	0.	0.	-16441.	-34760.	0.
44.000	38587.	38587.	0.	0.	52407.	17646.	0.
LOCAL	742.	742.	0.	0.	591.		
42.000	12452.	12452.	0.	0.	21408.	39054.	0.
35.000	7197.	7197.	0.	0.	4185.	43240.	0.
33.900	7193.	7193.	0.	0.	3.	43243.	0.
33.300	7192.	7192.	0.	0.	0.	43243.	0.
33.000	7186.	7186.	0.	0.	5.	43248.	0.
32.000	25290.	25290.	0.	0.	-14420.	28828.	0.
LOCAL	2062.	2062.	0.	0.	1642.		
15.000	16144.	16144.	0.	0.	8927.	37755.	0.
1.000	119.	119.	0.	0.	12764.	50519.	0.

SECTION NO.	ELEV	SURFACE AREA	VOLUME AC-FT	VOLUME CY
1.000	974.00	0.00	0.00	0.00
35.000	944.00	0.00	0.00	0.00
	946.00	0.23	0.04	68.42
	948.00	1.60	1.80	2907.75

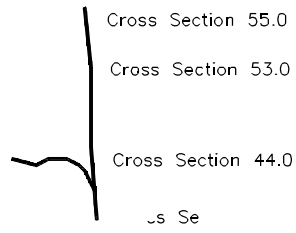
950.00	3.16	6.65	10729.40
952.00	4.06	14.05	22667.32
954.00	4.67	22.74	36692.89
956.00	7.60	34.72	56007.76
958.00	17.55	59.75	96392.34
960.00	36.89	112.36	181277.81
962.00	83.15	206.06	332439.56
964.00	103.07	394.36	636234.41
966.00	115.08	611.72	986900.29
968.00	134.04	855.45	1380128.58
970.00	174.87	1142.37	1843028.68
972.00	188.44	1505.77	2429301.12
974.00	195.16	1889.36	3048170.38
SECTION NO. 53.100			
944.00	0.00	0.00	0.00
946.00	0.23	0.04	68.42
948.00	1.60	1.80	2907.75
950.00	3.16	6.65	10729.40
952.00	4.06	14.05	22667.32
954.00	4.67	22.74	36692.89
956.00	7.60	34.72	56007.76
958.00	17.55	59.75	96392.34
960.00	36.89	112.36	181277.81
962.00	83.15	206.06	332439.56
964.00	106.80	396.31	639386.72
966.00	119.44	621.76	1003106.83
968.00	142.01	875.94	1413188.12
970.00	197.85	1186.47	1914179.58
972.00	236.59	1632.71	2634112.44
974.00	253.24	2120.94	3421777.07

-----  
 SSEND

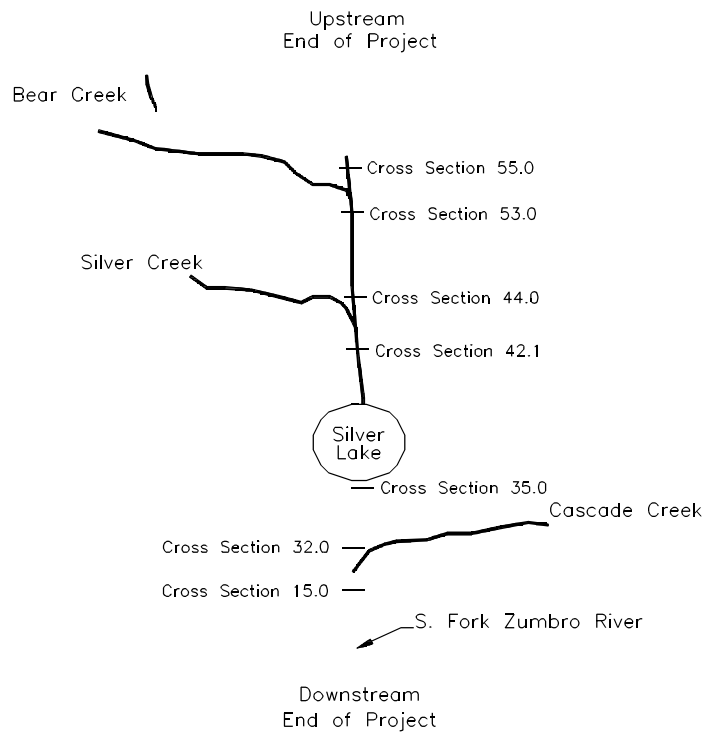
0 DATA ERRORS DETECTED.

TOTAL NO. OF TIME STEPS READ = 4  
 TOTAL NO. OF WS PROFILES = 23  
 ITERATIONS IN EXNER EQ = 1495

COMPUTATIONS COMPLETED  
 RUN TIME = 0 HOURS, 0 MINUTES & 6.00 SECONDS



Silver  
Lake



NV	33	.1	965.6	.11	982.0	.12	988.8			
X1	15.0	27	10665.	10850.	3560.	3030.	3280.			
X3				10700.	961.0	11000.	970.0			
GR	992.0	9570.	982.0	10110.	976.0	10300.	976.0	10490.	966.0	10610.
GR	964.7	10665.	956.0	10673.	953.0	10693.	954.0	10703.	955.6	10723.
GR	958.6	10750.	959.3	10800.	957.0	10822.	957.3	10825.	961.5	10850.
GR	962.0	10852.	964.0	10970.	966.0	11015.	961.0	11090.	962.0	11150.
GR	970.0	11190.	972.0	11310.	980.0	11410.	984.0	11570.	990.0	11770.
GR	990.0	11865.	1000.0	12150.						
HD	15.0	10.	10673.	10852.						
CASCADE CREEK - TRIBUTARY										
QT	2									
NC	.10	.10	.05							
X1	32.0	29	10057.	10271.	3630.	3060.	4240.			
GR	998.0	9080.	982.0	9250.	982.0	9510.	980.0	9600.	980.01	9925.
GR	979.48	10000.	978.5	10057.	968.6	10075.	959.82	10087.	956.5	10097.
GR	956.8	10117.	957.8	10137.	959.4	10157.	959.6	10177.	959.82	10196.
GR	966.5	10225.	971.2	10250.	978.5	10271.	978.5	10300.	978.6	10350.
GR	978.91	10370.	978.96	10387.	980.0	10610.	982.0	10745.	982.0	11145.
GR	984.0	11150.	992.0	11240.	1000.0	11330.	1008.	11425.		
HD	32.0	10.	10075.	10275.						
X1	33.0	21	1850.	2150.	3130.	3250.	3320.			
XL			250							
GR	1000.	980.	990.0	1060.	980.0	1150.	982.0	1180.	982.0	1215.
GR	980.0	1260.	982.0	1300.	982.0	1350.	980.0	1420.	980.0	1540.
GR	982.0	1730.	982.0	1830.	984.41	1850.	979.19	1851.	961.0	1900.8
GR	961.0	2099.2	976.0	2149.	984.5	2150.	982.0	2800.	990.0	3100.
GR	1000.	3170.	0.0	0.	0.0	0.	0.0	0.	0.0	0.
HD	33.0	0.0	1851.	2149.						
Section 33.3 is a duplicate of Section 33.0.										
X1	33.3	21	1850.	2150.	1550.	1750.	1750.	.95	1.49	
XL			250							
GR	1000.	980.	990.0	1060.	980.0	1150.	982.0	1180.	982.0	1215.
GR	980.0	1260.	982.0	1300.	982.0	1350.	980.0	1420.	980.0	1540.
GR	982.0	1730.	982.0	1830.	984.41	1850.	979.19	1851.	961.0	1900.8
GR	961.0	2099.2	976.0	2149.	984.5	2150.	982.0	2800.	990.0	3100.
GR	1000.	3170.	0.0	0.	0.0	0.	0.0	0.	0.0	0.
HD	33.3	0.0	1851.	2149.						
Section 33.9 is a duplicate of Sec 33.3, needed to model IBC at Sec 35.0										
X1	33.9	21	1850.	2150.	1050.	1050.	1050.	.95	1.65	
X3	10									
GR	1000.	980.	990.0	1060.	980.0	1150.	982.0	1180.	982.0	1215.
GR	980.0	1260.	982.0	1300.	982.0	1350.	980.0	1420.	980.0	1540.
GR	982.0	1730.	982.0	1830.	984.41	1850.	979.19	1851.	961.0	1900.8
GR	961.0	2099.2	976.0	2149.	984.5	2150.	982.0	2800.	990.0	3100.
GR	1000.	3170.	0.0	0.	0.0	0.	0.0	0.	0.0	0.
HD	33.9	0.0	1851.	2149.						
X1	35.0	22	9894.	10245.	0	0	0			
X3	10									
X5				2						
GR	984.0	9035.	980.0	9070.	978.0	9135.	980.0	9185.	982.0	9270.
GR	980.0	9465.	981.7	9595.	983.7	9745.	984.7	9894.	963.4	9894.1
GR	963.3	9954.	967.1	9974.	967.4	10004.	968.2	10044.	967.6	10054.
GR	973.4	10115.	977.4	10120.	983.7	10155.	984.0	10245.	982.0	10695.
GR	982.0	10895.	1004.0	11085.						
HD	35.0	0	9954.	10155.						
SILVER LAKE										
NC	.06	.06	.045							
X1	42.0	32	9880.	10130.	5370.	5000.	5210.			
GR	996.0	7130.	998.0	7310.	998.0	7930.	992.0	8205.	990.0	8495.
GR	988.0	8780.	986.0	8990.	985.7	9570.	986.45	9707.	989.44	9857.
GR	990.0	9880.	969.8	9881.	969.8	9941.	985.8	9941.	985.8	9943.
GR	969.8	9943.	969.8	10001.	986.7	10001.	986.7	10003.	969.8	10003.
GR	969.8	10067.	985.8	10067.	985.8	10069.	969.8	10069.	969.8	10129.
GR	989.9	10130.	989.5	10180.	988.6	10230.	987.6	10280.	985.2	10430.
GR	986.8	11720	989.9	12310.						
HD	42.0	0	9881.	10021.						
SILVER CREEK - LOCAL INFLOW										
QT										
X1	44.0	28	9845.	10127.	3200.	3800.	3500.			
XL				9850	10200					
GR	1002.	8035.	992.0	8150.	990.0	8305.	990.0	8735.	988.0	8835.
GR	996.0	9285.	1017.	9425.	990.0	9505.	986.0	9650.	984.1	9788.
GR	980.6	9845.	970.9	9868.	972.2	9898.	970.5	9968.	967.5	9998.
GR	968.9	10028.	967.4	10058.	967.1	10078.	971.9	10118.	976.8	10127.
GR	977.8	10150.	976.9	10193.	982.0	10206.	981.2	10300.	979.2	10325.
GR	983.1	10400.	999.8	10450.	1002.4	10464.				
HD	44.0	10.	9868.	10193.						
X1	53.0	22	10000.	10136.	3366.	2832.	2942.			
GR	1004.	7550.	1000.0	7760.	998.0	8440.	996.0	8640.	996.0	8780.
GR	994.0	8940.	986.0	9245.	986.3	9555.	986.3	9825.	983.8	9900.
GR	982.8	10000.	978.2	10011.	974.0	10041.	972.2	10071.	972.6	10101.
GR	978.2	10121.	988.7	10136.	989.3	10154.	999.2	10200.	1000.1	10320.
GR	1002.	10470.	1004.0	10700.						

HD	53.0	10.	1000.	10136.						
BEAR CREEK - TRIBUTARY										
QT	3									
X1	55.0	18	9931.	10062.	2275.	3430.	2770.			
GR	1004.	7592.	1000.0	7947.	996.0	8627.	990.0	9052.	986.0	9337.
GR	984.3	9737.	984.7	9837.	985.5	9910.	987.2	9931.	978.1	9955.
GR	974.8	9975.	974.2	10005.	972.9	10035.	973.2	10045.	983.8	10062.
GR	985.8	10187.	986.0	10307.	990.0	10497.				
HD	55.0	10.	9931.	10062.						
X1	58.0	22	9912.	10015.	1098.	1012.	1462.			
GR	1006.	8542.	1004.0	8952.	1000.0	9702.	997.2	9812.	996.3	9912.
GR	976.2	9944.	975.4	9974.	978.2	9991.	990.4	10015.	988.3	10062.
GR	988.8	10065.	988.3	10065.	989.3	10169.	990.0	10172.	992.0	10242.
GR	992.0	10492.	988.0	10642.	986.7	10852.	988.0	11022.	986.0	11097.
GR	986.0	11137.	988.0	11192.						
HD	58.0	3.4	9912.	10015.						
EJ										
STRIB CASCADE GEOMETRY, SEGMENT 2, CONTROL POINT 2										
CP	2									
T1	EXAMPLE 6 Cont. ZUMBRO RIVER Project - CASCADE CREEK - Stream Segment 2									
T2	CASCADE IS A TRIBUTARY OF THE ZUMBRO RIVER DOWNSTREAM OF SILVER LAKE									
T3	CASCADE CREEK GEOMETRY - STREAM SEGMENT 2 ** Example Problem 6 **									
NC	.120	.120	.045	.1	.3					
X1	1.0	25	5000.	5100.	0.	0.	0.			
GR	995.0	4570.	980.0	4600.	970.0	4690.	968.0	4740.	968.0	4850.
GR	965.24	4900.	964.6	4950.	964.0	4975.	963.7	5000.	961.5	5003.
GR	959.8	5014.	960.2	5025.	959.9	5038.	960.1	5068.	960.4	5073.
GR	962.5	5075.	963.1	5083.	968.9	5094.	969.6	5100.	970.3	5150.
GR	970.0	5260.	972.0	5280.	972.0	5400.	980.0	5460.	982.	5780.
H	1.0		4925.	5121.						
X1	3.0	24	4942.	5050.	460.	280.	537.			
GR	1000.	4715.	983.9	4897.	982.9	4942.	973.2	4959.	973.0	4967.
GR	970.2	5000.	964.78	5007.	964.3	5017.	965.1	5027.	965.17	5027.
GR	968.7	5042.	969.9	5050.	969.4	5067.	971.1	5092.	970.3	5103.
GR	972.7	5180.	970	5207.	972.8	5217.	971.1	5242.	970.7	5267.
GR	975.2	5277.	976.56	5300.	980.0	5360.	982.0	5690.		
H	3.0		4942.	5103.						
X1	4.0	18	4950.	5045.	300.	280.	240.			
GR	1000.	4775.	991.3	4875.	988.1	4931.	981.6	4941.	981.7	4950.
GR	975.4	4961.	972.9	4975.	970.6	5004.	968.3	5015.	969.2	5025.
GR	969.4	5040.	981.2	5045.	981.2	5075.	985.7	5082.	985.9	5100.
GR	980.0	5270.	982.0	5330.	982.0	5700.				
H	4.0		4950.	5047.						
X1	6.2	17	5000.	5130.	405.	350.	474.			
X3	10									
GR	994.0	4700.	990.0	4720.	986.0	4750.	986.0	4940.	987.4	5000.
GR	983.1	5000.	979.0	5016.	972.0	5032.	972.0	5092.	974.0	5100.
GR	976.0	5109.	982.7	5126.	987.5	5130.	986.0	5210.	980.0	5420.
GR	980.0	5830.	982.0	5900.						
H	6.2		972.0	5130.						
EJ										
STRIB BEAR CREEK GEOMETRY, SEGMENT 3 CONTROL POINT 3										
CP	3									
T1	EXAMPLE 6 Cont. ZUMBRO RIVER Project - BEAR CREEK - Stream Segment 3									
T2	BEAR IS A TRIBUTARY OF THE ZUMBRO RIVER UPSTREAM OF SILVER CREEK									
T3	BEAR CREEK GEOMETRY - STREAM SEGMENT 3 ** Example Problem 6 **									
NC	.090	.090	.046	.3	.5					
X1	1.0	19	10115.	10250.	0.	0.	0.			
GR	996.0	9020.	990.0	9420.	988.0	9550.	994.0	9780.	985.3	10055.
GR	985.0	10115.	978.18	10137.	977.2	10147.	977.0	10157.	977.1	10200.
GR	978.2	10209.	981.6	10216.	982.8	10225.	984.7	10250.	985.9	10275.
GR	987.1	10300.	988.0	10380.	990.0	10560.	1000.0	10890.		
H	1.0		10115.	10275.						
X1	2.1	21	1511.	1629.	210.	310.	260.			
GR	995.2	600.	992.0	790.	990.0	970.	990.0	971.	990.0	972.
GR	989.0	1000.	988.0	1080.	988.0	1290.	990.0	1450.	990.8	1490.
GR	989.8	1493.	986.7	1511.	977.3	1516.	977.3	1629.	986.7	1629.
GR	990.7	1650.	988.0	1840.	992.0	2000.	994.0	2100.	998.0	2450.
GR	1002.	2580.								
H	2.1		1511.	1629.						
TAKEO CREEK - TRIBUTARY										
QT	4									
X1	4.0	30	10537.	10660.	1053.	533.	708.			
GR	998.0	8370.	997.0	8860.	998.3	9100.	994.5	9350.	996.0	9480.
GR	999.0	9560.	996.0	9640.	994.0	9900.	992.0	9980.	993.9	10400.
GR	994.0	10425.	995.2	10506.	993.1	10523.	986.3	10537.	986.0	10550.
GR	985.8	10561.	980.9	10570.	978.7	10585.	978.3	10595.	978.4	10600.
GR	980.5	10625.	980.8	10636.	991.77	10657.	992.3	10660.	991.3	10675.
GR	991.4	10700.	998.0	10970.	998.0	11120.	1000.0	11290.	1006.0	11400.
H	4.0		978.3	10537.						
X1	6.0	29	10100.	10222.	330.	570.	665.			
X3	10									
GR	998.0	8500.	997.1	8650.	1000.0	8900.	1002.0	9110.	1001.0	9400.
GR	999.8	9525.	1002.0	9610.	1002.0	9730.	1000.0	9840.	995.16	10000.

GR	995.6	10100.	994.2	10109.	990.8	10125.	987.3	10140.	985.8	10150.
GR	986.2	10161.	985.24	10162.	983.3	10172.	983.3	10182.	982.8	10202.
GR	985.24	10210.	992.0	10222.	992.2	10250.	993.5	10300.	994.2	10325.
GR	1000.	10470.	997.8	10640.	998.0	10770.	1004.6	10910.		
H	6.0	982.7	10100.0	10325.0						
EJ										
STRIB										
CP	4									
T1										
T2										
T3										
NC	.090	.090	.046	.3	.5					
X1	1.0	19	10115.	10250.	0.	0.	0.	2.		
GR	996.0	9020.	990.0	9420.	988.0	9550.	994.0	9780.	985.3	10055.
GR	985.0	10115.	978.18	10137.	977.2	10147.	977.0	10157.	977.1	10200.
GR	978.2	10209.	981.6	10216.	982.8	10225.	984.7	10250.	985.9	10275.
GR	987.1	10300.	988.0	10380.	990.0	10560.	1000.0	10890.		
H	1.0		10115.	10275.						
X1	2.1	21	1511.	1629.	210.	310.	260.	2.		
GR	995.2	600.	992.0	790.	990.0	970.	990.0	971.	990.0	972.
GR	989.0	1000.	988.0	1080.	988.0	1290.	990.0	1450.	990.8	1490.
GR	989.8	1493.	986.7	1511.	977.3	1516.	977.3	1629.	986.7	1629.
GR	990.7	1650.	988.0	1840.	992.0	2000.	994.0	2100.	998.0	2450.
GR	1002.0	2580.								
H	2.1		1511.0	1629.0						
X1	4.0	30	10537.	10660.	1053.	533.	708.	2.		
GR	998.0	8370.	997.0	8860.	998.3	9100.	994.5	9350.	996.0	9480.
GR	999.0	9560.	996.0	9640.	994.0	9900.	992.0	9980.	993.9	10400.
GR	994.0	10425.	995.2	10506.	993.1	10523.	986.3	10537.	986.0	10550.
GR	985.8	10561.	980.	10570.	978.7	10585.	978.3	10595.	978.4	10600.
GR	980.5	10625.	980.8	10636.	991.77	10657.	992.3	10660.	991.3	10675.
GR	991.4	10700.	998.0	10970.	998.0	11120.	1000.0	11290.	1006.0	11400.0
H	4.0	978.3	10537.	10660.						
X1	6.0	29	10100.	10222.	330.	570.	665.	2.		
X3	10									
GR	998.0	8500.	997.1	8650.	1000.0	8900.	1002.0	9110.	1001.0	9400.
GR	999.8	9525.	1002.0	9610.	1002.0	9730.	1000.0	9840.	995.16	10000.
GR	995.6	10100.	994.2	10109.	990.8	10125.	987.3	10140.	985.8	10150.
GR	986.2	10161.	985.24	10162.	983.3	10172.	983.3	10182.	982.8	10202.
GR	985.24	10210.	992.0	10222.	992.2	10250.	993.5	10300.	994.2	10325.
GR	1000.	10470.	997.8	10640.	998.0	10770.	1004.6	10910.		
H	6.0	982.7	10100.	10325.						
EJ										
T4										
T5										
T6										
T7										
T8										
I1	0	5								
I4	SAND	4	1	10						
I5		.5	.5	.25	.5	.25	0	1.0		
LQ		1	50	1000	5800	90000				
LT	TOTAL	.0110	1.5	320	4500.	400000				
LF	VFS	.119	.119	.498	.511	.582				
LF	FS	.328	.328	.331	.306	.280				
LF	MS	.553	.553	.156	.154	.110				
LF	CS	.000	.000	.011	.016	.020				
LF	VCS	.000	.000	.004	.008	.005				
LF	VFG	.000	.000	.000	.004	.002				
LF	FG	.000	.000	.000	.001	.001				
LF	MG	.000	.000	.000	.000	.000				
LF	CG	.000	.000	.000	.000	.000				
LF	VCG	.0	.0	.000	.000	.000				
PF	EXAMP	1.0	1.0	32.0	16.0	96.5	8.0	95.0	4.0	91.0
PFC	2.0	85.0	1.0	73.0	.5	37.0	.25	8.0	.125	1.0
PFC	0625	0.0								
PF	EXAMP	32.0	1.0	64.0	32.0	99.5	16.0	99.0	8.0	98.5
PFC	4.0	96.0	2.0	93.5	1.0	83.0	.50	45.5	.250	8.0
PFC	.125	1.0	.0625	0.0						
PF	EXAMP	58.0	1.0	64.0	32.0	97.0	16.0	94.0	8.0	94.0
PFC	4.0	90.0	2.0	79.0	1.0	56.0	.50	4.0	.125	0.0
SLOCAL										
LQ		1	100	1000	10000					
LT	TOTAL	.0040	10	500	30000					
LF	VFS	.664	.664	.015	.198					
LF	FS	.207	.207	.245	.181					
LF	MS	.086	.086	.605	.107					
LF	CS	.031	.031	.052	.098					

LF	VCS	.008	.008	.039	.127					
LF	VFG	.0030	.0030	.0200	.1160					
LF	FG	.0010	.0010	.0110	.0910					
LF	MG	.0000	.0000	.0110	.0530					
LF	CG	.0000	.0000	.0000	.0220					
LF	VCG	.0000	.0000	.0000	.0060					
STRIB										
T4	CASCADE CREEK - STREAM SEGMENT 2				** Example Problem 6 **					
T5	FIRST TRIB ON Zumbro River.									
T6	LOAD CURVE FROM GAGE DATA. BED GRADATIONS FROM FIELD SAMPLES.									
T7	Use full range of sands and gravels - Yang's Stream Power.									
T8	Zumbro River Project									
LQL		1	100	1000	10000					
LTLTOTAL		.0040	10	500	30000					
LFL	VFS	.664	.664	.015	.198					
LFL	FS	.207	.207	.245	.181					
LFL	MS	.086	.086	.605	.107					
LFL	CS	.031	.031	.052	.098					
LFL	VCS	.008	.008	.039	.127					
LFL	VFG	.0030	.0030	.0200	.1160					
LFL	FG	.0010	.0010	.0110	.0910					
LFL	MG	.0000	.0000	.0110	.0530					
LFL	CG	.0000	.0000	.0000	.0220					
LFL	VCG	.0000	.0000	.0000	.0060					
PF	CASC	1.0	1.0	64.	32.	94.	16.	85.	8.	70.
PFC		4.	50.	2.	32.	1.	18.	.5	9.	.25
PFC	.125	2.5	.0625	0.						
STRIB										
T4	BEAR CREEK - Stream Segment 3				** Example Problem 6 **					
T5	SECOND UPSTREAM TRIB ON Zumbro River.									
T6	LOAD CURVE FROM GAGE DATA. BED GRADATIONS FROM FIELD SAMPLES									
T7	Use full range of sands and gravels. Yang's Stream Power.									
T8	Zumbro River Project									
LQL		1	100	500	1000	30000				
LTLTOTAL		.0020	30.0	500.	1200	22500				
LFL	VFS	.201	.201	.078	.078	.137				
LFL	FS	.342	.342	.172	.175	.218				
LFL	MS	.451	.451	.454	.601	.476				
LFL	CS	.001	.001	.197	.142	.158				
LFL	VCS	.000	.000	.000	.003	.008				
LFL	VFG	.0000	.0000	.0000	.0000	.0020				
LFL	FG	.0000	.000	.0000	.0000	.0010				
LFL	MG	.0000	.000	.0000	.0000	.0000				
LFL	CG	.0000	.000	.0000	.0000	.0000				
LFL	VCG	.0000	.000	.0000	.0000	.0000				
PF	BEAR	1.	1.	4.	2.	99.5	1.	99.	.5	93.
PFC	.25	27	.125	3.	.0625	0.				
PF	BEAR	6.	1.	4.	2.	99.5	1.	99.	.5	89.5
PFC	.25	22.5	.125	2.5	.0625	0.				
STRIB										
T4	TAKEO CREEK - Stream Segment 4				** Example Problem 6 **					
T5	FIRST TRIBUTARY ON Bear Creek.									
T6	LOAD CURVE IS FROM GAGE DATA. BED GRADATIONS FROM FIELD SAMPLES.									
T7	Use full range of sands and gravels. Yang's Stream Power.									
T8	Zumbro River Project									
LQL		1	100	500	1000	30000				
LTLTOTAL		.0020	30.0	500.	1200	22500				
LFL	VFS	.201	.201	.078	.078	.137				
LFL	FS	.342	.342	.172	.175	.218				
LFL	MS	.451	.451	.454	.601	.476				
LFL	CS	.001	.001	.197	.142	.158				
LFL	VCS	.000	.000	.000	.003	.008				
LFL	VFG	.0000	.0000	.0000	.0000	.0020				
LFL	FG	.0000	.000	.0000	.0000	.0010				
LFL	MG	.0000	.000	.0000	.0000	.0000				
LFL	CG	.0000	.000	.0000	.0000	.0000				
LFL	VCG	.0000	.000	.0000	.0000	.0000				
PF	TAKEO	1.	1.	4.	2.	99.5	1.	99.	.5	93.
PFC	.25	27	.125	3.	.0625	0.				
PF	TAKEO	6.	1.	4.	2.	99.5	1.	99.	.5	89.5
PFC	.25	22.5	.125	2.5	.0625	0.				
SHYD										
Q	AB	FLOW 1 = BASE FLOW OF 750 CFS								
Q	750	29	61	128	90					
R	956.	970.								
T	65	70	72	67	73					
W	2									
SPRT										
Zumbro River, Sections 35.1 and 55.0										
CP		1								
PS	35.1	55.0								

```

Takeo Creek, Section 6.0
CP      4
PS     6.0
END
Q      AC      FLOW 2 = 50 DAYS AT BANK FULL DISCHARGE
Q 2500.0      150      300      650      450
R      965.      978.
X
Q      A      FLOW 3 = NEAR BANK FULL DISCHARGE
Q 1250.      78      150      340.      250
R      960.      975.
W
Q      B      FLOW 4 = BASE FLOW OF 500 CFS
Q 500      29      61      128      90
R      955.      973.
W
SSEND

```

---

### 6.6.5 Network Output

The output produced for a network system is very similar to that of a single stream problem. The output for Example Problem 6 is shown in Table 6-6b. The geometric data is output (as entered) in increasing segment order. Sediment data are then given for the main stem, the local inflow (Silver Creek), and the tributaries. The user is advised to take advantage of the title (and comment) records to annotate the output file. The information from the T1 records is used throughout the output so they should contain the name of each stream segment.

The A-level hydrologic data are output in the sequence in which the backwater computation is performed. Segment 1 is calculated first, from downstream to upstream and the water surface elevation at each control point is printed. When segment 1 is complete, the backwater computations start at the downstream boundary of segment 2 using the water surface computed at control point 2 as the starting water surface. This process continues through the remainder of the tributaries in order.

The temperature in each stream segment changes as differing water temperatures enter from the tributaries and local inflows. For example, in time step 1, the inflow from Cascade Creek is 61 cfs at 72°F and the flow in the main stem below that confluence is 750 cfs at 65°F. Therefore, the flow in the main stem above the confluence is 689 cfs at 64.38°F ( $689 = 750 - 61$ ).

In previous examples it was noted that the sedimentation computations proceed from upstream to downstream, in reverse order from the hydraulic computations. In this example network system, this means that the sedimentation computations begin at the upstream boundary of segment 4, work downstream to the confluence with segment 3, then proceed to the upstream boundary of segment 3 and so on. Sediment output contains the same information previously discussed; identified primarily by cross section and segment.

Output can be limited to specified cross sections on any stream segment. As seen in the previous example problems, this is done via the SPRT, CP, and PN records. The output level is governed by the output options on the Q record. For example, prior to time step 2, the SPRT option was used to limit output to Sections 35.1 and 55.0 on the main river segment and Section No. 6.0 on segment 4, Takeo Creek; A-level hydraulic and C-level sediment output was requested for time step 2 on the Q record.

Table 6-6b  
Example Problem 6 - Output  
Network System

```
*****
* SCOUR AND DEPOSITION IN RIVERS AND RESERVOIRS *
* Version: 4.1.00 - AUGUST 1993
* INPUT FILE: example6.DAT
* OUTPUT FILE: example6.OUT
* RUN DATE: 31 AUG 93 RUN TIME: 18:54:00
*****
* U. S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616-4687
* (916) 756-1104
*****
```

```

X X XXXXXX XXXX XXXX
X X X X X X
X X X X X
XXXXXX XXXX X XXXX XXXXX
X X X X X X
X X X X X
X X XXXXXX XXXX XXXX

```

```
*****
* MAXIMUM LIMITS FOR THIS VERSION ARE:
* 10 Stream Segments (Main Stem + Tributaries)
* 150 Cross Sections
* 100 Elevation/Station Points per Cross Section
* 20 Grain Sizes
* 10 Control Points
*****
```

T1 EXAMPLE PROBLEM NO 6. South Fork, ZUMBRO RIVER - Stream Segment 1  
T2 CASCADE & BEAR: TRIBS OF ZUMBRO; TAKEO: TRIB OF BEAR; SILVER: LOCAL  
T3 ZUMBRO RIVER PROJECT - Dendritic System \*\* Example Problem 6 \*\*

N values... Left Channel Right Contraction Expansion  
0.1000 0.0400 0.1000 1.1000 0.7000

SECTION NO. 1.000  
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

N-Values vs. Elevation Table

Left Overbank	Channel	Right Overbank
0.0800 966.	0.0450 966.	0.1000 966.
0.1300 989.	0.0640 989.	0.1100 982.
0.0000 0.	0.0000 0.	0.1200 989.

SECTION NO. 15.000  
...Left Encroachment defined at station 10700.000 at elevation 961.000  
...Right Encroachment defined at station 11000.000 at elevation 970.000  
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

TRIBUTARY ENTRY POINT 1 occurs upstream from Section No. 15.000 at Control Point # 2

N values... Left Channel Right Contraction Expansion  
0.1000 0.0500 0.1000 1.1000 0.7000

SECTION NO. 32.000  
...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 33.000  
...Limit CONVEYANCE to 250.000 ft. centered about midpoint of channel.  
...DEPTH of the Bed Sediment Control Volume = 0.00 ft.

SECTION NO. 33.300  
...Adjust Section WIDTH to 95.00% of original.  
...Adjust Section ELEVATIONS by 1.490 ft.  
...Limit CONVEYANCE to 250.000 ft. centered about midpoint of channel.  
...DEPTH of the Bed Sediment Control Volume = 0.00 ft.

SECTION NO. 33.900  
...Adjust Section WIDTH to 95.00% of original.  
...Adjust Section ELEVATIONS by 1.650 ft.  
...Ineffective Flow Area - Method 1 - Left Overbank Right Overbank  
Natural Levees at Station 1757.500 2042.500  
Ineffective Elevation 986.060 986.150  
...DEPTH of the Bed Sediment Control Volume = 0.00 ft.

SECTION NO. 35.000  
...Internal Boundary Condition  
Water Surface Elevation will be read from R-RECORD, Field 2  
Head Loss = 0.000  
...Ineffective Flow Area - Method 1 - Left Overbank Right Overbank  
Natural Levees at Station 9894.000 10245.000  
Ineffective Elevation 984.700 984.000  
...DEPTH of the Bed Sediment Control Volume = 0.00 ft.

N values... Left Channel Right Contraction Expansion  
0.0600 0.0450 0.0600 1.1000 0.7000

SECTION NO. 42.000  
...DEPTH of the Bed Sediment Control Volume = 0.00 ft.

LOCAL INFLOW POINT 1 occurs upstream from Section No. 42.000

SECTION NO. 44.000  
 ...Limit CONVEYANCE between stations 9850.000 and 10200.000  
 ...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 53.000  
 ...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

TRIBUTARY ENTRY POINT 2 occurs upstream from Section No. 53.000 at Control Point # 3

SECTION NO. 55.000  
 ...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 58.000  
 ...DEPTH of the Bed Sediment Control Volume = 3.40 ft.

NO. OF CROSS SECTIONS IN STREAM SEGMENT= 12  
 NO. OF INPUT DATA MESSAGES = 0

-----  
 T1 EXAMPLE 6 Cont. ZUMBRO RIVER Project - CASCADE CREEK - Stream Segment 2  
 T2 CASCADE IS A TRIBUTARY OF THE ZUMBRO RIVER DOWNSTREAM OF SILVER LAKE  
 T3 CASCADE CREEK GEOMETRY - STREAM SEGMENT 2 \*\* Example Problem 6 \*\*

N values... Left Channel Right Contraction Expansion  
 0.1200 0.0450 0.1200 1.1000 0.7000

SECTION NO. 1.000  
 ...ELEVATION of Model Bottom = 949.800 ft.

SECTION NO. 3.000  
 ...ELEVATION of Model Bottom = 964.300 ft.

SECTION NO. 4.000  
 ...ELEVATION of Model Bottom = 968.300 ft.

SECTION NO. 6.200  
 ...Ineffective Flow Area - Method 1 - Left Overbank Right Overbank  
 Natural Levees at Station 5000.000 5130.000  
 Ineffective Elevation 987.400 987.500  
 ...ELEVATION of Model Bottom = 972.000 ft.

NO. OF CROSS SECTIONS IN STREAM SEGMENT= 4  
 NO. OF INPUT DATA MESSAGES = 0

-----  
 T1 EXAMPLE 6 Cont. ZUMBRO RIVER Project - BEAR CREEK - Stream Segment 3  
 T2 BEAR IS A TRIBUTARY OF THE ZUMBRO RIVER UPSTREAM OF SILVER CREEK  
 T3 BEAR CREEK GEOMETRY - STREAM SEGMENT 3 \*\* Example Problem 6 \*\*

N values... Left Channel Right Contraction Expansion  
 0.0900 0.0460 0.0900 1.3000 0.5000

SECTION NO. 1.000  
 ...ELEVATION of Model Bottom = 967.000 ft.

SECTION NO. 2.100  
 ...ELEVATION of Model Bottom = 967.300 ft.

TRIBUTARY ENTRY POINT 1 occurs upstream from Section No. 2.100 at Control Point # 4

SECTION NO. 4.000  
 ...ELEVATION of Model Bottom = 978.300 ft.

SECTION NO. 6.000  
 ...Ineffective Flow Area - Method 1 - Left Overbank Right Overbank  
 Natural Levees at Station 10100.000 10222.000  
 Ineffective Elevation 995.600 992.000  
 ...ELEVATION of Model Bottom = 982.700 ft.

NO. OF CROSS SECTIONS IN STREAM SEGMENT= 4  
 NO. OF INPUT DATA MESSAGES = 0

-----  
 T1 EXAMPLE 6 Cont. ZUMBRO RIVER Project - TAKEO CREEK - Stream Segment 4  
 T2 TAKEO CREEK IS A TRIBUTARY OF BEAR CREEK UPSTREAM OF SECTION 2.1  
 T3 TAKEO CREEK GEOMETRY - STREAM SEGMENT 4 \*\* Example Problem 6 \*\*

N values... Left Channel Right Contraction Expansion  
 0.0900 0.0460 0.0900 1.3000 0.5000

SECTION NO. 1.000  
 ...Adjust Section ELEVATIONS by 2.000 ft.  
 ...ELEVATION of Model Bottom = 969.000 ft.

SECTION NO. 2.100  
 ...Adjust Section ELEVATIONS by 2.000 ft.  
 ...ELEVATION of Model Bottom = 969.300 ft.

SECTION NO. 4.000  
 ...Adjust Section ELEVATIONS by 2.000 ft.

```

...ELEVATION of Model Bottom = 980.300 ft.
SECTION NO. 6.000
...Adjust Section ELEVATIONS by 2.000 ft.
...Ineffective Flow Area - Method 1 - Left Overbank Right Overbank
      Natural Levees at Station 10100.000 10222.000
      Ineffective Elevation 997.600 994.000
...ELEVATION of Model Bottom = 984.700 ft.
NO. OF CROSS SECTIONS IN STREAM SEGMENT= 4
NO. OF INPUT DATA MESSAGES = 0
TOTAL NO. OF CROSS SECTIONS IN THE NETWORK = 24
TOTAL NO. OF STREAM SEGMENTS IN THE NETWORK= 4
END OF GEOMETRIC DATA
    
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T4 South Fork, Zumbro River - Stream Segment 1 ** Example Problem 6 **
T5 LOAD CURVE FROM GAGE DATA.
T6 BED GRADATIONS FROM FIELD SAMPLES.
T7 Use full range of sands and gravels
T8 SEDIMENT TRANSPORT BY Yang's STREAM POWER [ref ASCE JOURNAL (YANG 1971)]

EXAMPLE PROBLEM NO 6. South Fork, ZUMBRO RIVER - Stream Segment 1
CASCADE & BEAR: TRIBS OF ZUMBRO; TAKEO: TRIB OF BEAR; SILVER: LOCAL
ZUMBRO RIVER PROJECT - Dendritic System ** Example Problem 6 **
    
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 SEDIMENT PROPERTIES AND PARAMETERS

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I1 SPI 5. IBG 0 MNQ 1 SPGF 1.000 ACGR 32.174 NFALL 2 IBSHER 1
-----
SANDS - BOULDERS ARE PRESENT
I4 MFC 4 IASA 1 LASA 10 SPGS 2.650 GSF 0.667 BSAE 0.500 PSI 30.000 UWDLB 93.000
    
```

USING TRANSPORT CAPACITY RELATIONSHIP # 4, YANG  
 GRAIN SIZES UTILIZED (mean diameter - mm)

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-----
VERY FINE SAND... 0.088 | VERY FINE GRAVEL.. 2.828
FINE SAND..... 0.177 | FINE GRAVEL..... 5.657
MEDIUM SAND..... 0.354 | MEDIUM GRAVEL.... 11.314
COARSE SAND..... 0.707 | COARSE GRAVEL.... 22.627
VERY COARSE SAND.. 1.414 | VERY COARSE GRAVEL 45.255
-----
    
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COEFFICIENTS FOR COMPUTATION SCHEME WERE SPECIFIED

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I5 DBI 0.500 DBN 0.500 XID 0.250 XIN 0.500 XIU 0.250 UBI 0.000 UBN 1.000 JSL 1
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SEDIMENT LOAD TABLE FOR STREAM SEGMENT # 1  
 LOAD BY GRAIN SIZE CLASS (tons/day)

LQ	1.00000	50.0000	1000.00	5800.00	90000.0
LF VFS	0.130900E-02	0.178500	159.360	2299.50	232800.
LF FS	0.360800E-02	0.492000	105.920	1377.00	112000.
LF MS	0.608300E-02	0.829500	49.9200	693.000	44000.0
LF CS	0.100000E-19	0.100000E-19	3.52000	72.0000	8000.00
LF VCS	0.100000E-19	0.100000E-19	1.28000	36.0000	2000.00
LF VFG	0.100000E-19	0.100000E-19	0.100000E-19	18.0000	800.000
LF FG	0.100000E-19	0.100000E-19	0.100000E-19	4.50000	400.000
LF ME	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19
LF CG	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19
LF VCG	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19
TOTAL	0.110000E-01	1.50000	320.000	4500.00	400000.

REACH GEOMETRY FOR STREAM SEGMENT 1

CROSS SECTION NO.	REACH LENGTH (ft)	MOVABLE BED WIDTH	INITIAL BED-ELEVATIONS LEFT SIDE (ft)	INITIAL BED-ELEVATIONS THALWEG (ft)	INITIAL BED-ELEVATIONS RIGHT SIDE (ft)	ACCUMULATED CHANNEL DISTANCE FROM DOWNSTREAM (ft)	ACCUMULATED CHANNEL DISTANCE (miles)
	0.000						
1.000	3280.000	183.500	959.300	944.700	958.900	0.000	0.000
15.000	4240.000	242.000	961.000	953.700	962.000	3280.000	0.621
32.000	3320.000	219.500	968.600	956.500	978.500	7520.000	1.424
33.000	1750.000	299.000	979.190	961.000	976.000	10840.000	2.053
33.300	1050.000	284.050	980.680	962.490	977.490	12590.000	2.384
33.900	0.000	284.050	980.840	962.650	977.650	13640.000	2.583
35.000	5210.000	275.950	963.300	963.300	983.700	13640.000	2.583
42.000	3500.000	154.500	969.800	969.800	969.800	18850.000	3.570
44.000		337.500	970.900	967.100	976.900	22350.000	4.233

53.000	2942.000	195.000	982.800	972.200	988.700	25292.000	4.790
55.000	2770.000	204.000	987.200	972.900	983.800	28062.000	5.315
58.000	1462.000	176.500	996.300	975.400	990.400	29524.000	5.592

BED MATERIAL GRADATION

SECNO	SAE	D <sub>MAX</sub> (ft)	D <sub>XPI</sub> (ft)	XPI	TOTAL BED	BED MATERIAL FRACTIONS per grain size																			
1.000	1.000	0.105	0.105	1.000	1.000	VF SAND	0.010	VC SAND	0.120	M GRVL	0.015	F SAND	0.070	VF GRVL	0.060	C GRVL	0.035	M SAND	0.290	F GRVL	0.040	VC GRVL	0.000	C SAND	0.360
15.000	1.000	0.151	0.151	1.000	1.000	VF SAND	0.010	VC SAND	0.113	M GRVL	0.011	F SAND	0.070	VF GRVL	0.045	C GRVL	0.022	M SAND	0.327	F GRVL	0.033	VC GRVL	0.002	C SAND	0.367
32.000	1.000	0.210	0.210	1.000	1.000	VF SAND	0.010	VC SAND	0.105	M GRVL	0.005	F SAND	0.070	VF GRVL	0.025	C GRVL	0.005	M SAND	0.375	F GRVL	0.025	VC GRVL	0.005	C SAND	0.375
33.000	1.000	0.210	0.210	1.000	1.000	VF SAND	0.008	VC SAND	0.124	M GRVL	0.004	F SAND	0.062	VF GRVL	0.038	C GRVL	0.009	M SAND	0.321	F GRVL	0.027	VC GRVL	0.009	C SAND	0.397
33.300	1.000	0.210	0.210	1.000	1.000	VF SAND	0.008	VC SAND	0.134	M GRVL	0.004	F SAND	0.058	VF GRVL	0.045	C GRVL	0.011	M SAND	0.293	F GRVL	0.028	VC GRVL	0.011	C SAND	0.408
33.900	1.000	0.210	0.210	1.000	1.000	VF SAND	0.007	VC SAND	0.140	M GRVL	0.004	F SAND	0.056	VF GRVL	0.049	C GRVL	0.012	M SAND	0.276	F GRVL	0.029	VC GRVL	0.012	C SAND	0.415
35.000	1.000	0.210	0.210	1.000	1.000	VF SAND	0.007	VC SAND	0.140	M GRVL	0.004	F SAND	0.056	VF GRVL	0.049	C GRVL	0.012	M SAND	0.276	F GRVL	0.029	VC GRVL	0.012	C SAND	0.415
42.000	1.000	0.210	0.210	1.000	1.000	VF SAND	0.005	VC SAND	0.169	M GRVL	0.002	F SAND	0.044	VF GRVL	0.069	C GRVL	0.018	M SAND	0.192	F GRVL	0.033	VC GRVL	0.018	C SAND	0.450
44.000	1.000	0.210	0.210	1.000	1.000	VF SAND	0.003	VC SAND	0.189	M GRVL	0.002	F SAND	0.036	VF GRVL	0.082	C GRVL	0.022	M SAND	0.136	F GRVL	0.035	VC GRVL	0.022	C SAND	0.473
53.000	1.000	0.210	0.210	1.000	1.000	VF SAND	0.002	VC SAND	0.206	M GRVL	0.001	F SAND	0.030	VF GRVL	0.094	C GRVL	0.025	M SAND	0.088	F GRVL	0.037	VC GRVL	0.025	C SAND	0.492
55.000	1.000	0.210	0.210	1.000	1.000	VF SAND	0.001	VC SAND	0.222	M GRVL	0.000	F SAND	0.023	VF GRVL	0.104	C GRVL	0.028	M SAND	0.044	F GRVL	0.039	VC GRVL	0.028	C SAND	0.510
58.000	1.000	0.210	0.210	1.000	1.000	VF SAND	0.000	VC SAND	0.230	M GRVL	0.000	F SAND	0.020	VF GRVL	0.110	C GRVL	0.030	M SAND	0.020	F GRVL	0.040	VC GRVL	0.030	C SAND	0.520

.. LOCAL INFLOW DATA ..

SEDIMENT LOAD TABLE FOR STREAM SEGMENT # 1  
 AT LOCAL INFLOW POINT # 1  
 LOAD BY GRAIN SIZE CLASS (tons/day)

LQ		1.00000	100.000	1000.00	10000.0
LF	VFS	0.265600E-02	6.64000	7.50000	5940.00
LF	FS	0.828000E-03	2.07000	122.500	5430.00
LF	MS	0.344000E-03	0.860000	302.500	3210.00
LF	CS	0.124000E-03	0.310000	26.0000	2940.00
LF	VCS	0.320000E-04	0.800000E-01	19.5000	3810.00
LF	VFG	0.120000E-04	0.300000E-01	10.0000	3480.00
LF	FG	0.400000E-05	0.100000E-01	5.50000	2730.00
LF	ME	0.100000E-19	0.100000E-19	5.50000	1590.00
LF	CG	0.100000E-19	0.100000E-19	0.100000E-19	660.000
LF	VCG	0.100000E-19	0.100000E-19	0.100000E-19	180.000
TOTAL		0.400000E-02	10.0000	499.000	29970.0

T4 CASCADE CREEK - STREAM SEGMENT 2 \*\* Example Problem 6 \*\*  
 T5 FIRST TRIB ON Zumbro River.  
 T6 LOAD CURVE FROM GAGE DATA. BED GRADATIONS FROM FIELD SAMPLES.  
 T7 Use full range of sands and gravels - Yang's Stream Power.  
 T8 Zumbro River Project

EXAMPLE 6 Cont. ZUMBRO RIVER Project - CASCADE CREEK - Stream Segment 2  
 CASCADE IS A TRIBUTARY OF THE ZUMBRO RIVER DOWNSTREAM OF SILVER LAKE  
 CASCADE CREEK GEOMETRY - STREAM SEGMENT 2 \*\* Example Problem 6 \*\*

SEDIMENT LOAD TABLE FOR STREAM SEGMENT # 2  
 LOAD BY GRAIN SIZE CLASS (tons/day)

LQL	1. 00000	100. 000	1000. 00	10000. 0
LFL VFS	0. 265600E-02	6. 64000	7. 50000	5940. 00
LFL FS	0. 828000E-03	2. 07000	122. 500	5430. 00
LFL MS	0. 344000E-03	0. 860000	302. 500	3210. 00
LFL CS	0. 124000E-03	0. 310000	26. 0000	2940. 00
LFL VCS	0. 320000E-04	0. 800000E-01	19. 5000	3810. 00
LFL VFG	0. 120000E-04	0. 300000E-01	10. 0000	3480. 00
LFL FG	0. 400000E-05	0. 100000E-01	5. 50000	2730. 00
LFL ME	0. 100000E-19	0. 100000E-19	5. 50000	1590. 00
LFL CG	0. 100000E-19	0. 100000E-19	0. 100000E-19	660. 000
LFL VCG	0. 100000E-19	0. 100000E-19	0. 100000E-19	180. 000
TOTAL	0. 400000E-02	10. 0000	499. 000	29970. 0

REACH GEOMETRY FOR STREAM SEGMENT 2

CROSS SECTION NO.	REACH LENGTH (ft)	MOVABLE BED WIDTH	INITIAL LEFT SIDE (ft)	BED-ELEVATIONS THALWEG (ft)	RIGHT SIDE (ft)	ACCUMULATED CHANNEL DISTANCE FROM DOWNSTREAM (ft)	(miles)
1. 000	0. 000	200. 000	964. 600	959. 800	969. 600	0. 000	0. 000
3. 000	537. 000	222. 000	982. 900	964. 300	970. 300	537. 000	0. 102
4. 000	240. 000	114. 500	981. 700	968. 300	981. 200	777. 000	0. 147
6. 200	474. 000	200. 000	987. 400	972. 000	987. 500	1251. 000	0. 237

BED MATERIAL GRADATION

SECNO	SAE	DMAX (ft)	DXPI (ft)	XPI	TOTAL BED	BED MATERIAL FRACTIONS per grain size					
1. 000	1. 000	0. 210	0. 210	1. 000	1. 000	VF SAND	0. 025	VC SAND	0. 140	M GRVL	0. 150
						F SAND	0. 025	VF GRVL	0. 180	C GRVL	0. 090
						M SAND	0. 040	F GRVL	0. 200	VC GRVL	0. 060
						C SAND	0. 090				
3. 000	1. 000	0. 210	0. 210	1. 000	1. 000	VF SAND	0. 025	VC SAND	0. 140	M GRVL	0. 150
						F SAND	0. 025	VF GRVL	0. 180	C GRVL	0. 090
						M SAND	0. 040	F GRVL	0. 200	VC GRVL	0. 060
						C SAND	0. 090				
4. 000	1. 000	0. 210	0. 210	1. 000	1. 000	VF SAND	0. 025	VC SAND	0. 140	M GRVL	0. 150
						F SAND	0. 025	VF GRVL	0. 180	C GRVL	0. 090
						M SAND	0. 040	F GRVL	0. 200	VC GRVL	0. 060
						C SAND	0. 090				
6. 200	1. 000	0. 210	0. 210	1. 000	1. 000	VF SAND	0. 025	VC SAND	0. 140	M GRVL	0. 150
						F SAND	0. 025	VF GRVL	0. 180	C GRVL	0. 090
						M SAND	0. 040	F GRVL	0. 200	VC GRVL	0. 060
						C SAND	0. 090				

T4 BEAR CREEK - Stream Segment 3 \*\* Example Problem 6 \*\*  
 T5 SECOND UPSTREAM TRIB ON Zumbro River.  
 T6 LOAD CURVE FROM GAGE DATA. BED GRADATIONS FROM FIELD SAMPLES  
 T7 Use full range of sands and gravels. Yang's Stream Power.  
 T8 Zumbro River Project

EXAMPLE 6 Cont. ZUMBRO RIVER Project - BEAR CREEK - Stream Segment 3  
 BEAR IS A TRIBUTARY OF THE ZUMBRO RIVER UPSTREAM OF SILVER CREEK  
 BEAR CREEK GEOMETRY - STREAM SEGMENT 3 \*\* Example Problem 6 \*\*

SEDIMENT LOAD TABLE FOR STREAM SEGMENT # 3  
 LOAD BY GRAIN SIZE CLASS (tons/day)

LQL	1. 00000	100. 000	500. 000	1000. 00	30000. 0
LFL VFS	0. 402000E-03	6. 03000	39. 0000	93. 6000	3082. 50
LFL FS	0. 684000E-03	10. 2600	86. 0000	210. 000	4905. 00
LFL MS	0. 902000E-03	13. 5300	227. 000	721. 200	10710. 0
LFL CS	0. 200000E-05	0. 300000E-01	98. 5000	170. 400	3555. 00
LFL VCS	0. 100000E-19	0. 100000E-19	0. 100000E-19	3. 60000	180. 000
LFL VFG	0. 100000E-19	0. 100000E-19	0. 100000E-19	0. 100000E-19	45. 0000
LFL FG	0. 100000E-19	0. 100000E-19	0. 100000E-19	0. 100000E-19	22. 5000
LFL MG	0. 100000E-19	0. 100000E-19	0. 100000E-19	0. 100000E-19	0. 100000E-19

LFL CG	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19
LFL VCG	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19
TOTAL	0.199000E-02	29.8500	450.500	1198.80	22500.0

REACH GEOMETRY FOR STREAM SEGMENT 3

CROSS SECTION NO.	REACH LENGTH (ft)	MOVABLE BED WIDTH	INITIAL LEFT SIDE (ft)	BED-ELEVATIONS THALWEG (ft)	RIGHT SIDE (ft)	ACCUMULATED CHANNEL DISTANCE FROM DOWNSTREAM (ft)	CHANNEL DISTANCE (miles)
1.000	0.000	202.500	985.000	977.000	985.900	0.000	0.000
2.100	260.000	137.500	986.700	977.300	986.700	260.000	0.049
4.000	708.000	137.500	986.300	978.300	992.300	968.000	0.183
6.000	665.000	347.500	995.600	982.800	994.200	1633.000	0.309

BED MATERIAL GRADATION

SECNO	SAE	DMAX (ft)	DXPI (ft)	XPI	TOTAL BED	BED MATERIAL FRACTIONS per grain size							
1.000	1.000	0.013	0.013	1.000	1.000	VF SAND	0.030	VC SAND	0.005	M GRVL	0.000		
						F SAND	0.240	VF GRVL	0.005	C GRVL	0.000		
						M SAND	0.660	F GRVL	0.000	VC GRVL	0.000		
						C SAND	0.060						
2.100	1.000	0.013	0.013	1.000	1.000	VF SAND	0.029	VC SAND	0.005	M GRVL	0.000		
						F SAND	0.234	VF GRVL	0.005	C GRVL	0.000		
						M SAND	0.662	F GRVL	0.000	VC GRVL	0.000		
						C SAND	0.066						
4.000	1.000	0.013	0.013	1.000	1.000	VF SAND	0.027	VC SAND	0.005	M GRVL	0.000		
						F SAND	0.216	VF GRVL	0.005	C GRVL	0.000		
						M SAND	0.666	F GRVL	0.000	VC GRVL	0.000		
						C SAND	0.081						
6.000	1.000	0.013	0.013	1.000	1.000	VF SAND	0.025	VC SAND	0.005	M GRVL	0.000		
						F SAND	0.200	VF GRVL	0.005	C GRVL	0.000		
						M SAND	0.670	F GRVL	0.000	VC GRVL	0.000		
						C SAND	0.095						

T4 TAKEO CREEK - Stream Segment 4 \*\* Example Problem 6 \*\*  
 T5 FIRST TRIBUTARY ON Bear Creek.  
 T6 LOAD CURVE IS FROM GAGE DATA. BED GRADATIONS FROM FIELD SAMPLES.  
 T7 Use full range of sands and gravels. Yang's Stream Power.  
 T8 Zumbro River Project

EXAMPLE 6 Cont. ZUMBRO RIVER Project - TAKEO CREEK - Stream Segment 4  
 TAKEO CREEK IS A TRIBUTARY OF BEAR CREEK UPSTREAM OF SECTION 2.1  
 TAKEO CREEK GEOMETRY - STREAM SEGMENT 4 \*\* Example Problem 6 \*\*

SEDIMENT LOAD TABLE FOR STREAM SEGMENT # 4  
 LOAD BY GRAIN SIZE CLASS (tons/day)

LQL	1.00000	100.000	500.000	1000.00	30000.0
LFL VFS	0.402000E-03	6.03000	39.0000	93.6000	3082.50
LFL FS	0.684000E-03	10.2600	86.0000	210.000	4905.00
LFL MS	0.902000E-03	13.5300	227.000	721.200	10710.0
LFL CS	0.200000E-05	0.300000E-01	98.5000	170.400	3555.00
LFL VCS	0.100000E-19	0.100000E-19	0.100000E-19	3.60000	180.000
LFL VFG	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	45.0000
LFL FG	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	22.5000
LFL ME	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19
LFL CG	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19
LFL VCG	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19
TOTAL	0.199000E-02	29.8500	450.500	1198.80	22500.0

REACH GEOMETRY FOR STREAM SEGMENT 4

CROSS SECTION NO.	REACH LENGTH (ft)	MOVABLE BED WIDTH	INITIAL LEFT SIDE (ft)	BED-ELEVATIONS THALWEG (ft)	RIGHT SIDE (ft)	ACCUMULATED CHANNEL DISTANCE FROM DOWNSTREAM (ft)	CHANNEL DISTANCE (miles)
1.000	0.000	202.500	987.000	979.000	987.900	0.000	0.000
2.100	260.000	137.500	988.700	979.300	988.700	260.000	0.049
4.000	708.000	137.500	988.300	980.300	994.300	968.000	0.183
6.000	665.000	347.500	997.600	984.800	996.200	1633.000	0.309

BED MATERIAL GRADATION

SECNO	SAE	DMAX (ft)	DXPI (ft)	XPI	TOTAL BED	BED MATERIAL FRACTIONS per grain size					
1.000	1.000	0.013	0.013	1.000	1.000	VF SAND	0.030	VC SAND	0.005	M GRVL	0.000
						F SAND	0.240	VF GRVL	0.005	C GRVL	0.000
						M SAND	0.660	F GRVL	0.000	VC GRVL	0.000
						C SAND	0.060				
2.100	1.000	0.013	0.013	1.000	1.000	VF SAND	0.029	VC SAND	0.005	M GRVL	0.000
						F SAND	0.234	VF GRVL	0.005	C GRVL	0.000
						M SAND	0.662	F GRVL	0.000	VC GRVL	0.000
						C SAND	0.066				
4.000	1.000	0.013	0.013	1.000	1.000	VF SAND	0.027	VC SAND	0.005	M GRVL	0.000
						F SAND	0.216	VF GRVL	0.005	C GRVL	0.000
						M SAND	0.666	F GRVL	0.000	VC GRVL	0.000
						C SAND	0.081				
6.000	1.000	0.013	0.013	1.000	1.000	VF SAND	0.025	VC SAND	0.005	M GRVL	0.000
						F SAND	0.200	VF GRVL	0.005	C GRVL	0.000
						M SAND	0.670	F GRVL	0.000	VC GRVL	0.000
						C SAND	0.095				

BED SEDIMENT CONTROL VOLUMES

STREAM SEGMENT # 1: EXAMPLE PROBLEM NO 6. South Fork, ZUMBRO RIVER - Stream Segment 1

SECTION NUMBER	LENGTH (ft)	WIDTH (ft)	DEPTH (ft)	VOLUME (cu. ft) (cu. yd)	
1.000	1640.000	203.000	10.000	0.332920E+07	123304.
15.000	3760.000	229.266	10.000	0.862040E+07	319274.
32.000	3780.000	235.344	10.000	0.889600E+07	329481.
33.000	2535.000	279.927	0.000	0.000000	0.000000
33.300	1400.000	287.165	0.000	0.000000	0.000000
33.900	525.000	284.050	0.000	0.000000	0.000000
35.000	2605.000	235.467	0.000	0.000000	0.000000
42.000	4355.000	203.228	0.000	0.000000	0.000000
44.000	3221.000	282.665	10.000	0.910465E+07	337209.
53.000	2856.000	220.920	10.000	0.630947E+07	233684.
55.000	2116.000	198.870	10.000	0.420808E+07	155855.
58.000	731.000	185.667	3.400	461456.	17091.0

BED SEDIMENT CONTROL VOLUMES

STREAM SEGMENT # 2: EXAMPLE 6 Cont. ZUMBRO RIVER Project - CASCADE CREEK - Stream Segment 2

SECTION NUMBER	LENGTH (ft)	WIDTH (ft)	DEPTH (ft)	VOLUME (cu. ft) (cu. yd)	
1.000	268.500	207.333	10.000	556690.	20618.1
3.000	388.500	205.864	0.000	0.000000	0.000000
4.000	357.000	145.465	0.000	0.000000	0.000000
6.200	237.000	171.500	0.000	0.000000	0.000000

BED SEDIMENT CONTROL VOLUMES

STREAM SEGMENT # 3: EXAMPLE 6 Cont. ZUMBRO RIVER Project - BEAR CREEK - Stream Segment 3

SECTION NUMBER	LENGTH (ft)	WIDTH (ft)	DEPTH (ft)	VOLUME (cu. ft) (cu. yd)	
1.000	130.000	180.833	10.000	235083.	8706.79
2.100	484.000	143.320	10.000	693667.	25691.4
4.000	686.500	171.404	0.000	0.000000	0.000000
6.000	332.500	277.500	0.100	9226.87	341.736

BED SEDIMENT CONTROL VOLUMES

STREAM SEGMENT # 4: EXAMPLE 6 Cont. ZUMBRO RIVER Project - TAKEO CREEK - Stream Segment 4

SECTION NUMBER	LENGTH (ft)	WIDTH (ft)	DEPTH (ft)	VOLUME (cu. ft) (cu. yd)	
1.000	130.000	180.833	10.000	235083.	8706.79
2.100	484.000	143.320	10.000	693667.	25691.4
4.000	686.500	171.404	0.000	0.000000	0.000000
6.000	332.500	277.500	0.100	9226.87	341.736

NO. OF INPUT DATA MESSAGES= 0  
END OF SEDIMENT DATA

SHYD  
BEGIN COMPUTATIONS.

TIME STEP # 1  
Q AB FLOW 1 = BASE FLOW OF 750 CFS

EXAMPLE PROBLEM NO 6. South Fork, ZUMBRO RIVER - Stream Segment 1  
ACCUMULATED TIME (yrs)..... 0.000

--- Downstream Boundary Condition Data for STREAM SEGMENT NO. 1 at Control Point # 1 ---  
DISCHARGE TEMPERATURE WATER SURFACE  
(cfs) (deg F) (ft)

		750.000	65.00	956.000						
**** DISCHARGE	WATER	ENERGY	VELOCITY	ALPHA	TOP	AVG	AVG VEL (by subsection)			
(CFS)	SURFACE	LINE	HEAD		WIDTH	BED	1	2	3	
SECTION NO.	1.000									
****	750.000	956.009	0.009	1.000	154.497	949.519	0.000	0.749	0.000	
							FLOW DISTRIBUTION (%) =			
							0.000	100.000	0.000	
SECTION NO.	15.000									
** SUPERCRITICAL ** Using Critical Water Surface +										
SECTION NO.	15.000	TIME =		2.000 DAYS.						
TRIAL	TRIAL	COMPUTED	CRITICAL							
NO.	WS	WS	WS							
0.	957.779	956.256								
1.	957.873	956.309	957.823							
****	750.000	957.873	958.688	0.815	1.000	58.210	956.094	0.000	7.243	0.000
							FLOW DISTRIBUTION (%) =			
							0.000	100.000	0.000	
--- TRIBUTARY JUNCTION - CONTROL POINT # 2 is upstream of Section No.							15.000 ---			
		DISCHARGE	TEMPERATURE							
		(cfs)	(deg F)							
Tributary Inflow:		61.000	72.00							
Total:		689.000	64.38							
SECTION NO.	32.000									
****	689.000	963.275	963.297	0.022	1.000	128.771	958.809	0.000	1.198	0.000
							FLOW DISTRIBUTION (%) =			
							0.000	100.000	0.000	
SECTION NO.	33.000									
****	689.000	964.126	964.144	0.018	1.000	217.196	961.158	0.000	1.069	0.000
							FLOW DISTRIBUTION (%) =			
							0.000	100.000	0.000	
SECTION NO.	33.300									
****	689.000	964.929	964.962	0.032	1.000	202.548	962.570	0.000	1.442	0.000
							FLOW DISTRIBUTION (%) =			
							0.000	100.000	0.000	
SECTION NO.	33.900									
****	689.000	965.528	965.551	0.023	1.000	205.131	962.752	0.000	1.210	0.000
							FLOW DISTRIBUTION (%) =			
							0.000	100.000	0.000	
SECTION NO.	35.000									
... Internal Boundary Condition - Water Surface = 970.000										
Head Loss = 0.000										
****	689.000	970.000	970.014	0.014	1.000	185.172	966.132	0.000	0.962	0.000
							FLOW DISTRIBUTION (%) =			
							0.000	100.000	0.000	
SECTION NO.	42.000									
****	689.000	971.707	971.743	0.036	1.000	242.186	969.833	0.000	1.517	0.000
							FLOW DISTRIBUTION (%) =			
							0.000	100.000	0.000	
--- LOCAL INFLOW POINT # 1 is upstream of Section No.							42.000 ---			
		DISCHARGE	TEMPERATURE							
		(cfs)	(deg F)							
Local Inflow:		29.000	70.00							
Total:		660.000	64.13							
SECTION NO.	44.000									
****	660.000	972.831	972.842	0.011	1.000	256.448	969.726	0.000	0.829	0.000
							FLOW DISTRIBUTION (%) =			
							0.000	100.000	0.000	
SECTION NO.	53.000									
****	660.000	974.325	975.010	0.685	1.000	68.355	972.871	0.000	6.641	0.000
							FLOW DISTRIBUTION (%) =			
							0.000	100.000	0.000	
--- TRIBUTARY JUNCTION - CONTROL POINT # 3 is upstream of Section No.							53.000 ---			
		DISCHARGE	TEMPERATURE							
		(cfs)	(deg F)							
Tributary Inflow:		128.000	67.00							
Total:		532.000	63.44							
SECTION NO.	55.000									
****	532.000	978.436	978.466	0.030	1.000	99.479	974.567	0.000	1.382	0.000
							FLOW DISTRIBUTION (%) =			
							0.000	100.000	0.000	
SECTION NO.	58.000									
****	532.000	979.363	979.535	0.172	1.000	54.345	976.417	0.000	3.323	0.000
							FLOW DISTRIBUTION (%) =			
							0.000	100.000	0.000	
EXAMPLE 6 Cont. ZUMBRO RIVER Project - CASCADE CREEK - Stream Segment 2										
--- Downstream Boundary Condition Data for STREAM SEGMENT NO. 2 at Control Point # 2 ---										
		DISCHARGE	TEMPERATURE	WATER SURFACE						
		(cfs)	(deg F)	(ft)						
		61.000	72.00	957.873						
**** DISCHARGE	WATER	ENERGY	VELOCITY	ALPHA	TOP	AVG	AVG VEL (by subsection)			
(CFS)	SURFACE	LINE	HEAD		WIDTH	BED	1	2	3	
SECTION NO.	1.000									
** CRITICAL WATER SURFACE USED AT SECTION NO. 1.000 AT TIME = 2.000 DAYS. **										
****	61.000	960.360	960.545	0.186	1.000	60.932	960.070	0.000	3.457	0.000
							FLOW DISTRIBUTION (%) =			
							0.000	100.000	0.000	
SECTION NO.	3.000									
****	61.000	965.937	966.008	0.071	1.000	24.774	964.785	0.000	2.137	0.000
							FLOW DISTRIBUTION (%) =			
							0.000	100.000	0.000	
SECTION NO.	4.000									
** SUPERCRITICAL ** Using Critical Water Surface +										
SECTION NO.	4.000	TIME =		2.000 DAYS.						

\*\*ELOEQ\*\*

TRIAL NO.	TRIAL WS	COMPUTED WS	CRITICAL WS							
0.	969.500	968.272								
1.	969.594	967.882	969.544							
****	61.000	969.594	969.797	0.203	1.000	31.272	969.055	0.000	3.616	0.000
FLOW DISTRIBUTION (%) = 0.000 100.000 0.000										
SECTION NO.	6.200									
****	61.000	972.744	972.771	0.026	1.000	64.729	972.019	0.000	1.300	0.000
FLOW DISTRIBUTION (%) = 0.000 100.000 0.000										

EXAMPLE 6 Cont. ZUMBRO RIVER Project - BEAR CREEK - Stream Segment 3

--- Downstream Boundary Condition Data for STREAM SEGMENT NO. 3 at Control Point # 3 ---

		DISCHARGE	TEMPERATURE	WATER SURFACE						
		(cfs)	(deg F)	(ft)						
		128.000	67.00	974.325						
****	DISCHARGE (CFS)	WATER SURFACE	ENERGY LINE	VELOCITY HEAD	ALPHA	TOP WIDTH	AVG BED	AVG VEL (by subsection)		
		1	2	3						
SECTION NO.	1.000									
** CRITICAL WATER SURFACE USED AT SECTION NO.	1.000 AT TIME =	2.000 DAYS.**								
****	128.000	977.612	977.924	0.312	1.000	60.598	977.140	0.000	4.478	0.000
FLOW DISTRIBUTION (%) = 0.000 100.000 0.000										
SECTION NO.	2.100									
****	128.000	978.595	978.607	0.011	1.000	113.709	977.267	0.000	0.847	0.000
FLOW DISTRIBUTION (%) = 0.000 100.000 0.000										

\*\*ELOEQ\*\*

--- TRIBUTARY JUNCTION - CONTROL POINT # 4 is upstream of Section No. 2.100 ---

		DISCHARGE	TEMPERATURE
		(cfs)	(deg F)
Tributary Inflow:		90.000	73.00
Total:		38.000	52.79

SECTION NO.	TRIAL NO.	TRIAL WS	COMPUTED WS	CRITICAL WS						
** SUPERCRITICAL **	4.000									
Using Critical Water Surface +										
SECTION NO.	4.000	TIME =		2.000 DAYS.						
****	38.000	979.014	978.687	978.964	1.000	24.453	978.563	0.000	3.441	0.000
FLOW DISTRIBUTION (%) = 0.000 100.000 0.000										
SECTION NO.	6.000									
****	38.000	983.945	983.973	0.028	1.000	37.207	983.189	0.000	1.351	0.000
FLOW DISTRIBUTION (%) = 0.000 100.000 0.000										

EXAMPLE 6 Cont. ZUMBRO RIVER Project - TAKEO CREEK - Stream Segment 4

--- Downstream Boundary Condition Data for STREAM SEGMENT NO. 4 at Control Point # 4 ---

		DISCHARGE	TEMPERATURE	WATER SURFACE						
		(cfs)	(deg F)	(ft)						
		90.000	73.00	978.595						
****	DISCHARGE (CFS)	WATER SURFACE	ENERGY LINE	VELOCITY HEAD	ALPHA	TOP WIDTH	AVG BED	AVG VEL (by subsection)		
		1	2	3						
SECTION NO.	1.000									
** CRITICAL WATER SURFACE USED AT SECTION NO.	1.000 AT TIME =	2.000 DAYS.**								
****	90.000	979.501	979.688	0.188	1.000	59.777	979.067	0.000	3.475	0.000
FLOW DISTRIBUTION (%) = 0.000 100.000 0.000										
SECTION NO.	2.100									
****	90.000	980.319	980.328	0.009	1.000	113.557	979.275	0.000	0.759	0.000
FLOW DISTRIBUTION (%) = 0.000 100.000 0.000										
SECTION NO.	4.000									
****	90.000	981.486	981.662	0.176	1.000	37.369	980.771	0.000	3.369	0.000
FLOW DISTRIBUTION (%) = 0.000 100.000 0.000										
SECTION NO.	6.000									
****	90.000	986.358	986.422	0.064	1.000	40.719	985.269	0.000	2.029	0.000
FLOW DISTRIBUTION (%) = 0.000 100.000 0.000										

\*\*ELOEQ\*\*

EXAMPLE 6 Cont. ZUMBRO RIVER Project - TAKEO CREEK - Stream Segment 4

ACCUMULATED TIME (yrs)....	0.005
FLOW DURATION (days).....	2.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment #	DISCHARGE	SEDIMENT LOAD	TEMPERATURE
Section No.	(cfs)	(tons/day)	(deg F)
6.000	90.00	23.96	73.00
INFLOW			

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 4  
EXAMPLE 6 Cont. ZUMBRO RIVER Project - TAKEO CREEK - Stream Segment 4  
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME	ENTRY	SAND		
DAYS	POINT	INFLOW	OUTFLOW	TRAP EFF
2.00	6.000	0.02		*
TOTAL=	1.000	0.02	0.93	-38.26 *

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 4

SEDIMENT INFLOW at the Upstream Boundary:			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND. . . . .	4.84	VERY FINE GRAVEL. . . . .	0.00
FINE SAND. . . . .	8.23	FINE GRAVEL. . . . .	0.00
MEDIUM SAND. . . . .	10.86	MEDIUM GRAVEL. . . . .	0.00
COARSE SAND. . . . .	0.02	COARSE GRAVEL. . . . .	0.00
VERY COARSE SAND. . . . .	0.00	VERY COARSE GRAVEL. . . . .	0.00
			TOTAL = 23.96
SEDIMENT OUTFLOW from the Downstream Boundary			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND. . . . .	31.85	VERY FINE GRAVEL. . . . .	1.42
FINE SAND. . . . .	231.57	FINE GRAVEL. . . . .	0.00
MEDIUM SAND. . . . .	615.85	MEDIUM GRAVEL. . . . .	0.00
COARSE SAND. . . . .	55.40	COARSE GRAVEL. . . . .	0.00
VERY COARSE SAND. . . . .	4.42	VERY COARSE GRAVEL. . . . .	0.00
			TOTAL = 940.52

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 2.000 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) SAND
6.000	-0.10	986.36	984.70	90.	53.
4.000	0.01	981.49	980.31	90.	42.
2.100	-0.20	980.32	979.10	90.	250.
1.000	-2.85	979.50	976.15	90.	941.

EXAMPLE 6 Cont. ZUMBRO RIVER Project - BEAR CREEK - Stream Segment 3  
 ACCUMULATED TIME (yrs).... 0.005  
 FLOW DURATION (days)..... 2.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment #	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
Section No. 6.000	38.00	3.96	52.79
INFLOW			
Upstream of SECTION NO. 2.100 is...			
TRIBUTARY JUNCTION # 4	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
MAIN STEM INFLOW	38.00	3.96	52.79
TRIBUTARY INFLOW	90.00	940.52	73.00
TOTAL			
	128.00	944.48	67.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 3  
 EXAMPLE 6 Cont. ZUMBRO RIVER Project - BEAR CREEK - Stream Segment 3  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME DAYS	ENTRY POINT	SAND INFLOW	SAND OUTFLOW	TRAP EFF
2.00	6.000	0.00		*
	2.100	0.93		*
TOTAL=	1.000	0.93	1.31	-0.41 *

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 3

SEDIMENT INFLOW at the Upstream Boundary:			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND. . . . .	0.80	VERY FINE GRAVEL. . . . .	0.00
FINE SAND. . . . .	1.36	FINE GRAVEL. . . . .	0.00
MEDIUM SAND. . . . .	1.79	MEDIUM GRAVEL. . . . .	0.00
COARSE SAND. . . . .	0.00	COARSE GRAVEL. . . . .	0.00
VERY COARSE SAND. . . . .	0.00	VERY COARSE GRAVEL. . . . .	0.00
			TOTAL = 3.96
SEDIMENT OUTFLOW from the Downstream Boundary			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND. . . . .	51.95	VERY FINE GRAVEL. . . . .	1.95
FINE SAND. . . . .	363.17	FINE GRAVEL. . . . .	0.00
MEDIUM SAND. . . . .	838.78	MEDIUM GRAVEL. . . . .	0.00
COARSE SAND. . . . .	69.59	COARSE GRAVEL. . . . .	0.00
VERY COARSE SAND. . . . .	5.54	VERY COARSE GRAVEL. . . . .	0.00
			TOTAL = 1330.97

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 2.000 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) SAND
6.000	-0.10	983.95	982.70	38.	32.
4.000	0.01	979.01	978.31	38.	26.
2.100	0.51	978.60	977.81	128.	447.
1.000	-3.65	977.61	973.35	128.	1331.

EXAMPLE 6 Cont. ZUMBRO RIVER Project - CASCADE CREEK - Stream Segment 2  
 ACCUMULATED TIME (yrs).... 0.005  
 FLOW DURATION (days)..... 2.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # Section No.	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
2 6.200	61.00	4.32	72.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 2  
 EXAMPLE 6 Cont. ZUMBRO RIVER Project - CASCADE CREEK - Stream Segment 2  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```

*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW TRAP EFF *
2.00     6.200 *      0.00    0.02    -3.99 *
TOTAL=   1.000 *      0.00    0.02    -3.99 *
*****
    
```

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 2

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND...	2.87	VERY FINE GRAVEL..	0.01
FINE SAND.....	0.89	FINE GRAVEL.....	0.00
MEDIUM SAND.....	0.37	MEDIUM GRAVEL....	0.00
COARSE SAND.....	0.13	COARSE GRAVEL....	0.00
VERY COARSE SAND..	0.03	VERY COARSE GRAVEL	0.00
		TOTAL =	4.32

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND...	2.57	VERY FINE GRAVEL..	3.14
FINE SAND.....	1.56	FINE GRAVEL.....	2.08
MEDIUM SAND.....	1.96	MEDIUM GRAVEL....	0.00
COARSE SAND.....	4.05	COARSE GRAVEL....	0.00
VERY COARSE SAND..	6.21	VERY COARSE GRAVEL	0.00
		TOTAL =	21.57

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 2.000 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) SAND
6.200	0.00	972.74	972.00	61.	3.
4.000	0.00	969.59	968.30	61.	3.
3.000	0.00	965.94	964.30	61.	2.
1.000	-0.06	960.36	959.74	61.	22.

EXAMPLE PROBLEM NO 6. South Fork, ZUMBRO RIVER - Stream Segment 1  
 ACCUMULATED TIME (yrs).... 0.005  
 FLOW DURATION (days)..... 2.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # Section No.	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
1 58.000	532.00	93.30	63.44

Upstream of SECTION NO. TRIBUTARY JUNCTION # 3	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
53.000 is..			
MAIN STEM INFLOW	532.00	93.30	63.44
TRIBUTARY INFLOW	128.00	1330.97	67.00
TOTAL	660.00	1424.27	64.13

Upstream of SECTION NO. LOCAL INFLOW POINT # 1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
42.000 is..			
MAIN STEM INFLOW	660.00	1424.27	64.13
LOCAL INFLOW	29.00	1.22	70.00
TOTAL	689.00	1425.49	64.38

Upstream of SECTION NO. TRIBUTARY JUNCTION # 2	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
15.000 is..			
MAIN STEM INFLOW	689.00	1425.49	64.38
TRIBUTARY INFLOW	61.00	21.57	72.00
TOTAL	750.00	1447.06	65.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1  
 EXAMPLE PROBLEM NO 6. South Fork, ZUMBRO RIVER - Stream Segment 1  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```

*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW  TRAP EFF *
2. 00    58.000 *      0.09   0.00     0.00 *
          53.000 *      1.31   0.00     0.00 *
          42.000 *      0.00   0.00     0.00 *
TOTAL=   35.000 *      1.41   0.03     0.98 *
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW  TRAP EFF *
2. 00    35.000 *      0.03   0.00     0.00 *
          15.000 *      0.02   0.00     0.00 *
TOTAL=   1.000 *      0.05   0.02     0.62 *
*****
    
```

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

```

-----
SEDIMENT INFLOW at the Upstream Boundary:
GRAIN SIZE      LOAD (tons/day) | GRAIN SIZE      LOAD (tons/day)
-----
VERY FINE SAND. . . . . 38.08 | VERY FINE GRAVEL. . . . . 0.00
FINE SAND. . . . . 34.16 | FINE GRAVEL. . . . . 0.00
MEDIUM SAND. . . . . 21.06 | MEDIUM GRAVEL. . . . . 0.00
COARSE SAND. . . . . 0.00 | COARSE GRAVEL. . . . . 0.00
VERY COARSE SAND. . . . . 0.00 | VERY COARSE GRAVEL. . . . . 0.00
-----
TOTAL = 93.30
-----
SEDIMENT OUTFLOW from the Downstream Boundary
GRAIN SIZE      LOAD (tons/day) | GRAIN SIZE      LOAD (tons/day)
-----
VERY FINE SAND. . . . . 0.99 | VERY FINE GRAVEL. . . . . 0.60
FINE SAND. . . . . 2.37 | FINE GRAVEL. . . . . 0.72
MEDIUM SAND. . . . . 5.74 | MEDIUM GRAVEL. . . . . 0.25
COARSE SAND. . . . . 5.70 | COARSE GRAVEL. . . . . 0.00
VERY COARSE SAND. . . . . 2.49 | VERY COARSE GRAVEL. . . . . 0.00
-----
TOTAL = 18.86
    
```

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 2.000 DAYS

```

-----
SECTION  BED CHANGE  WS ELEV  THALWEG  Q      TRANSPORT RATE (tons/day)
NUMBER   (ft)          (ft)    (ft)    (cfs)   SAND
58.000   -0.13         979.36  975.27  532.    284.
55.000   -0.07         978.44  972.83  532.    616.
53.000   0.07          974.32  972.27  660.    1413.
44.000   0.07          972.83  967.17  660.    326.
42.000   0.01          971.71  969.81  689.    56.
35.000   0.00          970.00  963.30  689.    28.
33.900   0.00          965.53  962.65  689.    22.
33.300   0.00          964.93  962.49  689.    18.
33.000   0.00          964.13  961.00  689.    13.
32.000   -0.05         963.28  956.45  689.    602.
15.000   -0.14         957.87  953.56  750.    1724.
1.000    0.37          956.00  945.07  750.    19.
-----
    
```

SPRT

```

... Selective Printout Option
- Print at the following cross sections
CP      1
PS 35.1  55.0
CP      4
PS 6.0
END
    
```

```

=====
TIME STEP # 2
Q AC FLOW 2 = 50 DAYS AT BANK FULL DISCHARGE
COMPUTING FROM TIME= 2.0000 DAYS TO TIME= 52.0000 DAYS IN 10 COMPUTATION STEPS
    
```

EXAMPLE PROBLEM NO 6. South Fork, ZUMBRO RIVER - Stream Segment 1  
 ACCUMULATED TIME (yrs)..... 0.005

```

--- Downstream Boundary Condition Data for STREAM SEGMENT NO. 1 at Control Point # 1 ---
DISCHARGE      TEMPERATURE  WATER SURFACE
(cfs)          (deg F)      (ft)
2500.000      65.00      965.000
    
```

```

**** DISCHARGE      WATER SURFACE  ENERGY VELOCITY  ALPHA  TOP  AVG  AVG VEL (by subsection)
      (CFS)        SURFACE      LINE    HEAD    1    WIDTH  BED    1    2    3
    
```

```

--- TRIBUTARY JUNCTION - CONTROL POINT # 3 is upstream of Section No. 53.000 ---
DISCHARGE      TEMPERATURE
(cfs)          (deg F)
Tributary Inflow: 650.000  87.00
Total:          1400.000  62.04
    
```

```

SECTION NO. 55.000
**** 1400.000  980.829  980.903  0.074  1.000  109.662  974.980  0.000  2.182  0.000
      FLOW DISTRIBUTION (%) = 0.000  100.000  0.000
    
```

EXAMPLE 6 Cont. ZUMBRO RIVER Project - TAKEO CREEK - Stream Segment 4

--- Downstream Boundary Condition Data for STREAM SEGMENT NO. 4 at Control Point # 4 ---

DISCHARGE (cfs)	TEMPERATURE (deg F)	WATER SURFACE (ft)
450.000	73.00	979.221

DISCHARGE (CFS)	WATER SURFACE	ENERGY LINE	VELOCITY HEAD	ALPHA	TOP WIDTH	AVG BED	AVG VEL (by subsection)		
							1	2	3
SECTION NO. 6.000									
**** 450.000	988.475	988.626	0.151	1.000	67.244	986.328	0.000	3.117	0.000
FLOW DISTRIBUTION (%) =							0.000	100.000	0.000

EXAMPLE 6 Cont. ZUMBRO RIVER Project - TAKEO CREEK - Stream Segment 4

ACCUMULATED TIME (yrs).... 0.142  
 FLOW DURATION (days)..... 5.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment #	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
Section No. 6.000			
INFLOW	450.00	356.05	73.00

SEDIMENT INFLOW at SECTION NO. 6.000			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND....	34.51	VERY FINE GRAVEL..	0.00
FINE SAND.....	74.83	FINE GRAVEL.....	0.00
MEDIUM SAND.....	188.73	MEDIUM GRAVEL....	0.00
COARSE SAND.....	57.98	COARSE GRAVEL....	0.00
VERY COARSE SAND..	0.00	VERY COARSE GRAVEL	0.00
TOTAL =		356.05	

FALL VELOCITIES - Method 2				
	DIAMETER	VELOCITY	REY. NO.	CD
VF SAND	0.000290	0.2115882E-01	0.6021239	45.84847
F SAND	0.000580	0.6288557E-01	3.579113	10.38092
M SAND	0.001160	0.1423402	16.20246	4.052398
C SAND	0.002320	0.2905100	66.13704	1.945695
VC SAND	0.004640	0.4865262	221.5240	1.387444
VF GRVL	0.009280	0.7223283	657.7777	1.258893
F GRVL	0.018559	1.041785	1897.368	1.210406
M GRVL	0.037118	1.472894	5365.081	1.211086
C GRVL	0.074237	2.082985	15174.71	1.211086
VC GRVL	0.148474	2.945788	42920.64	1.211086

\*\*\*\*\*  
 TRACE OUTPUT FOR SECTION NO. 6.000  
 -----

HYDRAULIC PARAMETERS:								
VEL	SLO	EPD	EFW	N-VALUE	TAU	USTARM	FROUDE NO.	
3.117	0.008268	2.838	50.874	0.0460	1.46520	0.86883	0.326	

BED SEDIMENT CONTROL VOLUME COMPUTATIONS:			
NEW SURFACE AREA (SQ FT):	TOTAL	K-PORITION	S-PORITION
	22942.50	22942.50	0.00

GRADATION OF ACTIVE PLUS INACTIVE DEPOSITS							
BED MATERIAL PER GRAIN SIZE:	BED FRACTION	PERCENT FINER		BED FRACTION	PERCENT FINER		
VF SAND	0.080074	8.007434	VF GRVL	0.000000	99.999999		
F SAND	0.214080	29.415438	F GRVL	0.000000	99.999999		
M SAND	0.539976	83.413004	M GRVL	0.000000	99.999999		
C SAND	0.165870	99.999999	C GRVL	0.000000	99.999999		
VC SAND	0.000000	99.999999	VC GRVL	0.000000	99.999999		

SAND  
 \*\* ARMOR LAYER \*\*  
 STABILITY COEFFICIENT= 0.04195  
 MN. GRAIN DIAM = 0.013194  
 BED SURFACE EXPOSED = 0.00000

INACTIVE LAYER		ACTIVE LAYER	
%	DEPTH	%	DEPTH
CLAY 0.0000	0.00	0.0000	0.00
SILT 0.0000	0.00	0.0000	0.00
SAND 1.0000	0.00	1.0000	0.36
TOTAL 1.0000	0.00	1.0000	0.36

AVG. UNIT WEIGHT 0.046500  
 AVG. UNIT WEIGHT 0.046500

-- CAUTION --  
 SECTION NO. 6.000 AT TIME = 52.00 DAYS.  
 ACTIVE LAYER THICKNESS EXCEEDS DEPTH OF SEDIMENT RESERVOIR.  
 ... LOWER THE MODEL BOTTOM BY MORE THAN 1.35 FT.

COMPOSITE UNIT WT OF ACTIVE LAYER (t/cf)= 0.046500  
 COMPOSITE UNIT WT OF INACTIVE LAYER (t/cf)= 0.046500  
 DEPTH OF SURFACE LAYER (ft) DSL= 0.1  
 WEIGHT IN SURFACE LAYER (tons) WTSL= 88.9  
 DEPTH OF NEW ACTIVE LAYER (ft) DSE= 0.3588  
 WEIGHT IN NEW ACTIVE LAYER(tons) WTMKAL= 382.8  
 WEIGHT IN OLD ACTIVE LAYER(tons) WAL= 382.8  
 USEABLE WEIGHT, OLD INACTIVE LAYER WL= 0.0  
 SURFACE AREA OF DEPOSIT (sq ft) SABK= 0.22942500E+05

\*\* INACTIVE LAYER \*\*

BED MATERIAL PER GRAIN	SIZE:	BED FRACTION	PERCENT FINER	BED MATERIAL PER GRAIN	SIZE:	BED FRACTION	PERCENT FINER
VF SAND		0.000000	0.000000	VF GRVL		0.000000	0.000000
F SAND		0.000000	0.000000	F GRVL		0.000000	0.000000
M SAND		0.000000	0.000000	M GRVL		0.000000	0.000000
C SAND		0.000000	0.000000	C GRVL		0.000000	0.000000
VC SAND		0.000000	0.000000	VC GRVL		0.000000	0.000000

\*\* ACTIVE LAYER \*\*

BED MATERIAL PER GRAIN	SIZE:	BED FRACTION	PERCENT FINER	BED MATERIAL PER GRAIN	SIZE:	BED FRACTION	PERCENT FINER
VF SAND		0.080074	8.007434	VF GRVL		0.000000	100.000000
F SAND		0.214080	29.415438	F GRVL		0.000000	100.000000
M SAND		0.539976	83.413004	M GRVL		0.000000	100.000000
C SAND		0.165870	100.000000	C GRVL		0.000000	100.000000
VC SAND		0.000000	100.000000	VC GRVL		0.000000	100.000000

C FINES, COEF(CFFML), MK POTENTIAL= 0.000000E+00 0.100000E+01 0.972000E+06  
 POTENTIAL TRANSPORT (tons/day): VF SAND 0.897832E+05 VF GRVL 0.204164E+02  
 F SAND 0.221666E+05 F GRVL 0.182502E+02  
 M SAND 0.964949E+04 M GRVL 0.846757E+00  
 C SAND 0.557199E+04 C GRVL 0.100000E-06  
 VC SAND 0.432242E+04 VC GRVL 0.100000E-06

SEDIMENT OUTFLOW FROM SECTION NO. 6.000		SEDIMENT OUTFLOW FROM SECTION NO. 6.000	
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND. . . . .	40.64	VERY FINE GRAVEL. . . . .	0.00
FINE SAND. . . . .	91.22	FINE GRAVEL. . . . .	0.00
MEDIUM SAND. . . . .	230.08	MEDIUM GRAVEL. . . . .	0.00
COARSE SAND. . . . .	70.67	COARSE GRAVEL. . . . .	0.00
VERY COARSE SAND. . . . .	0.00	VERY COARSE GRAVEL. . . . .	0.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 4  
 EXAMPLE 6 Cont. ZUMBRO RIVER Project - TAKEO CREEK - Stream Segment 4  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME	ENTRY *	SAND	
DAYS	POINT *	INFLOW	OUTFLOW TRAP EFF *
52.00	6.000 *	8.81	*
TOTAL=	1.000 *	8.81	15.35 -0.74 *

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 4

SEDIMENT INFLOW at the Upstream Boundary:			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND. . . . .	34.51	VERY FINE GRAVEL. . . . .	0.00
FINE SAND. . . . .	74.83	FINE GRAVEL. . . . .	0.00
MEDIUM SAND. . . . .	188.73	MEDIUM GRAVEL. . . . .	0.00
COARSE SAND. . . . .	57.98	COARSE GRAVEL. . . . .	0.00
VERY COARSE SAND. . . . .	0.00	VERY COARSE GRAVEL. . . . .	0.00
		TOTAL =	356.05
SEDIMENT OUTFLOW from the Downstream Boundary			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND. . . . .	34.75	VERY FINE GRAVEL. . . . .	0.01
FINE SAND. . . . .	90.86	FINE GRAVEL. . . . .	0.00
MEDIUM SAND. . . . .	261.12	MEDIUM GRAVEL. . . . .	0.00
COARSE SAND. . . . .	68.94	COARSE GRAVEL. . . . .	0.00
VERY COARSE SAND. . . . .	0.35	VERY COARSE GRAVEL. . . . .	0.00
		TOTAL =	456.03

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 52.000 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) SAND
6.000	-0.10	988.47	984.70	450.	433.
4.000	0.08	982.54	980.38	450.	428.
2.100	-5.56	979.39	973.74	450.	461.
1.000	-2.93	979.22	976.07	450.	456.

EXAMPLE 6 Cont. ZUMBRO RIVER Project - BEAR CREEK - Stream Segment 3  
 ACCUMULATED TIME (yrs).... 0.142  
 FLOW DURATION (days)..... 5.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 3	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
Section No. 6.000			
INFLOW	200.00	85.67	53.50

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 3  
 EXAMPLE 6 Cont. ZUMBRO RIVER Project - BEAR CREEK - Stream Segment 3  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```

*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW TRAP EFF *
52.00    6.000 *      2.12   15.35   -0.07 *
TOTAL=   1.000 *      17.46   18.72   -0.07 *
*****
    
```

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 3

```

-----
SEDIMENT INFLOW at the Upstream Boundary:
GRAIN SIZE      LOAD (tons/day) | GRAIN SIZE      LOAD (tons/day)
-----
VERY FINE SAND... 13.47 | VERY FINE GRAVEL.. 0.00
FINE SAND..... 25.63 | FINE GRAVEL..... 0.00
MEDIUM SAND..... 45.58 | MEDIUM GRAVEL.... 0.00
COARSE SAND..... 0.98 | COARSE GRAVEL.... 0.00
VERY COARSE SAND.. 0.00 | VERY COARSE GRAVEL 0.00
-----
TOTAL = 85.67

SEDIMENT OUTFLOW from the Downstream Boundary
GRAIN SIZE      LOAD (tons/day) | GRAIN SIZE      LOAD (tons/day)
-----
VERY FINE SAND... 37.77 | VERY FINE GRAVEL.. 0.00
FINE SAND..... 62.53 | FINE GRAVEL..... 0.00
MEDIUM SAND..... 97.21 | MEDIUM GRAVEL.... 0.00
COARSE SAND..... 19.34 | COARSE GRAVEL.... 0.00
VERY COARSE SAND.. 0.13 | VERY COARSE GRAVEL 0.00
-----
TOTAL = 216.98
    
```

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 52.000 DAYS

```

-----
SECTION  BED CHANGE  WS ELEV  THALWEG  Q      TRANSPORT RATE (tons/day)
NUMBER   (ft)         (ft)     (ft)     (cfs)  SAND
-----
6.000    0.05         985.16  982.85  200.   69.
4.000    0.02         979.89  978.32  200.   73.
2.100   -2.39         979.22  974.91  650.  589.
1.000    4.42         979.11  972.82  650.  217.
-----
    
```

EXAMPLE 6 Cont. ZUMBRO RIVER Project - CASCADE CREEK - Stream Segment 2  
 ACCUMULATED TIME (yrs).... 0.142  
 FLOW DURATION (days)..... 5.000

UPSTREAM BOUNDARY CONDITIONS

```

-----
Stream Segment # 2 | DISCHARGE | SEDIMENT LOAD | TEMPERATURE
Section No. 6.200 | (cfs)     | (tons/day)    | (deg F)
-----
INFLOW | 300.00 | 40.00 | 72.00
-----
    
```

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 2  
 EXAMPLE 6 Cont. ZUMBRO RIVER Project - CASCADE CREEK - Stream Segment 2  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```

*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW TRAP EFF *
52.00    6.200 *      0.99   0.76   0.23 *
TOTAL=   1.000 *      0.99   0.76   0.23 *
*****
    
```

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 2

```

-----
SEDIMENT INFLOW at the Upstream Boundary:
GRAIN SIZE      LOAD (tons/day) | GRAIN SIZE      LOAD (tons/day)
-----
VERY FINE SAND... 7.04 | VERY FINE GRAVEL.. 0.48
FINE SAND..... 14.50 | FINE GRAVEL..... 0.20
MEDIUM SAND..... 14.10 | MEDIUM GRAVEL.... 0.00
COARSE SAND..... 2.57 | COARSE GRAVEL.... 0.00
VERY COARSE SAND.. 1.10 | VERY COARSE GRAVEL 0.00
-----
TOTAL = 40.00

SEDIMENT OUTFLOW from the Downstream Boundary
GRAIN SIZE      LOAD (tons/day) | GRAIN SIZE      LOAD (tons/day)
-----
VERY FINE SAND... 5.88 | VERY FINE GRAVEL.. 0.65
FINE SAND..... 13.30 | FINE GRAVEL..... 1.02
MEDIUM SAND..... 11.37 | MEDIUM GRAVEL.... 0.57
COARSE SAND..... 2.01 | COARSE GRAVEL.... 0.00
VERY COARSE SAND.. 0.99 | VERY COARSE GRAVEL 0.00
-----
TOTAL = 35.77
    
```

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 52.000 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) SAND
6.200	0.06	973.80	972.06	300.	32.
4.000	0.03	970.92	968.33	300.	26.
3.000	0.02	966.52	964.32	300.	22.
1.000	0.21	965.15	960.01	300.	36.

EXAMPLE PROBLEM NO 6. South Fork, ZUMBRO RIVER - Stream Segment 1  
 ACCUMULATED TIME (yrs)..... 0.142  
 FLOW DURATION (days)..... 5.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No.	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
	1400.00	529.98	62.04

SEDIMENT INFLOW at SECTION NO. 58.000

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND.....	265.63	VERY FINE GRAVEL..	0.00
FINE SAND.....	173.06	FINE GRAVEL.....	0.00
MEDIUM SAND.....	82.59	MEDIUM GRAVEL.....	0.00
COARSE SAND.....	6.27	COARSE GRAVEL.....	0.00
VERY COARSE SAND..	2.42	VERY COARSE GRAVEL	0.00
		TOTAL =	529.98

FALL VELOCITIES - Method 2

	DIAMETER	VELOCITY	REY. NO.	CD
VF SAND	0.000290	0.1863592E-01	0.4575463	59.10251
F SAND	0.000580	0.5772227E-01	2.834376	12.32115
M SAND	0.001160	0.1329160	13.05331	4.647428
C SAND	0.002320	0.2804704	55.08844	2.087483
VC SAND	0.004640	0.4808243	188.8821	1.420545
VF GRVL	0.009280	0.7191678	565.0209	1.269982
F GRVL	0.018559	1.039734	1633.750	1.215185
M GRVL	0.037118	1.472894	4628.774	1.211086
C GRVL	0.074237	2.082985	13092.12	1.211086
VC GRVL	0.148474	2.945788	37030.19	1.211086

\*\*\*\*\*  
 TRACE OUTPUT FOR SECTION NO. 55.000

HYDRAULIC PARAMETERS:

VEL	SLO	EFD	EFW	N-VALUE	TAU	USTARM	FROUDE NO.
2.978	0.000661	6.346	86.708	0.0450	0.26180	0.36726	0.208

BED SEDIMENT CONTROL VOLUME COMPUTATIONS:

NEW SURFACE AREA (SQ FT):	TOTAL	K-PORTION	S-PORTION
	230938.67	230938.67	0.00

GRADATION OF ACTIVE PLUS INACTIVE DEPOSITS

BED MATERIAL PER GRAIN SIZE:	BED FRACTION	PERCENT FINER	BED FRACTION	PERCENT FINER
VF SAND	0.003404	0.340403	VF GRVL	0.106364
F SAND	0.023017	2.642100	F GRVL	0.039881
M SAND	0.043820	7.024101	M GRVL	0.000336
C SAND	0.506025	57.626611	C GRVL	0.028706
VC SAND	0.219762	79.602775	VC GRVL	0.028685

SAND

\*\* ARMOR LAYER \*\*

STABILITY COEFFICIENT=	0.84259
MIN.GRAIN DIAM =	0.003556
BED SURFACE EXPOSED =	1.00000

	INACTIVE LAYER		ACTIVE LAYER	
	%	DEPTH	%	DEPTH
CLAY	0.0000	0.00	0.0000	0.00
SILT	0.0000	0.00	0.0000	0.00
SAND	1.0000	9.82	1.0000	0.06
TOTAL	1.0000	9.82	1.0000	0.06

AVG. UNIT WEIGHT	AVG. UNIT WEIGHT
0.046500	0.046500

COMPOSITE UNIT WT OF ACTIVE LAYER (t/cf)=	0.046500
COMPOSITE UNIT WT OF INACTIVE LAYER (t/cf)=	0.046500
DEPTH OF SURFACE LAYER (ft)	DSL= 0.1
WEIGHT IN SURFACE LAYER (tons)	WTSL= 894.9
DEPTH OF NEW ACTIVE LAYER (ft)	DSE= 0.0159
WEIGHT IN NEW ACTIVE LAYER(tons)	WTMKAL= 170.4
WEIGHT IN OLD ACTIVE LAYER(tons)	WAL= 625.6
USEABLE WEIGHT, OLD INACTIVE LAYER	WL= 105466.0
SURFACE AREA OF DEPOSIT (sq ft)	SABK= 0.23093867E+06

\*\* INACTIVE LAYER \*\*

BED MATERIAL PER GRAIN	SIZE:	BED FRACTION	PERCENT FINER		BED FRACTION	PERCENT FINER
VF SAND		0.000671	0.067089	VF GRVL	0.105367	90.305284
F SAND		0.023154	2.382439	F GRVL	0.039383	94.243549
M SAND		0.043769	6.759378	M GRVL	0.000335	94.277093
C SAND		0.509027	57.662047	C GRVL	0.028615	97.138545
VC SAND		0.221065	79.768566	VC GRVL	0.028615	99.999998

\*\* ACTIVE LAYER \*\*

BED MATERIAL PER GRAIN	SIZE:	BED FRACTION	PERCENT FINER		BED FRACTION	PERCENT FINER
VF SAND		0.464173	46.417286	VF GRVL	0.274462	79.098798
F SAND		0.000000	46.417286	F GRVL	0.123966	91.495417
M SAND		0.052353	51.652597	M GRVL	0.000440	91.539461
C SAND		0.000000	51.652597	C GRVL	0.044068	95.946230
VC SAND		0.000000	51.652597	VC GRVL	0.040538	100.000000

C FINES, COEF(CFFML), MK POTENTIAL= 0.000000E+00 0.100000E+01 0.302400E+07  
 POTENTIAL TRANSPORT (tons/day):  
 VF SAND 0.101876E+05 VF GRVL 0.133530E+02  
 F SAND 0.305709E+04 F GRVL 0.122091E+02  
 M SAND 0.170276E+04 M GRVL 0.100000E-06  
 C SAND 0.126234E+04 C GRVL 0.100000E-06  
 VC SAND 0.124827E+04 VC GRVL 0.100000E-06

SEDIMENT OUTFLOW FROM SECTION NO. 55.000			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND. . . . .	294.06	VERY FINE GRAVEL. . . . .	2.48
FINE SAND. . . . .	175.65	FINE GRAVEL. . . . .	0.96
MEDIUM SAND. . . . .	69.90	MEDIUM GRAVEL. . . . .	0.00
COARSE SAND. . . . .	30.28	COARSE GRAVEL. . . . .	0.00
VERY COARSE SAND. . . . .	13.04	VERY COARSE GRAVEL. . . . .	0.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1

Q A FLOW 3 = NEAR BANK FULL DISCHARGE

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 4  
EXAMPLE 6 Cont. ZUMBRO RIVER Project - TAKEO CREEK - Stream Segment 4  
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW  TRAP EFF *
53.00    6.000 *      8.87   15.87   -0.79 *
TOTAL=   1.000 *      8.87   15.87   -0.79 *
*****
```

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 3  
EXAMPLE 6 Cont. ZUMBRO RIVER Project - BEAR CREEK - Stream Segment 3  
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW  TRAP EFF *
53.00    6.000 *      2.13   20.27   -0.13 *
TOTAL=   1.000 *      15.87  18.00   -0.13 *
*****
```

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 2  
EXAMPLE 6 Cont. ZUMBRO RIVER Project - CASCADE CREEK - Stream Segment 2  
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW  TRAP EFF *
53.00    6.200 *      1.00   0.97    0.03 *
TOTAL=   1.000 *      1.00   0.97    0.03 *
*****
```

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1  
EXAMPLE PROBLEM NO 6. South Fork, ZUMBRO RIVER - Stream Segment 1  
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW  TRAP EFF *
53.00    58.000 *     13.25   20.27   *
          53.000 *     20.27   0.36    *
          42.000 *     0.36   0.34    0.99 *
TOTAL=   35.000 *     33.88   0.34    0.99 *
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW  TRAP EFF *
53.00    35.000 *      0.34   0.97    *
          15.000 *      0.97   0.08    0.94 *
TOTAL=   1.000 *      1.31   0.08    0.94 *
*****
```

=====
TIME STEP # 4
Q B FLOW 4 = BASE FLOW OF 500 CFS

-----
EXAMPLE 6 Cont. ZUMBRO RIVER Project - TAKEO CREEK - Stream Segment 4
ACCUMULATED TIME (yrs).... 0.151
FLOW DURATION (days)..... 2.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 4 Section No.	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
INFLOW	90.00	23.96	73.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 4  
EXAMPLE 6 Cont. ZUMBRO RIVER Project - TAKEO CREEK - Stream Segment 4  
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW  TRAP EFF *
55.00    6.000 *      8.90   16.24   -0.83 *
TOTAL=   1.000 *      8.90   16.24   -0.83 *
*****
```

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 4

SEDIMENT INFLOW at the Upstream Boundary:			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND...	4.84	VERY FINE GRAVEL..	0.00
FINE SAND.....	8.23	FINE GRAVEL.....	0.00
MEDIUM SAND.....	10.86	MEDIUM GRAVEL....	0.00
COARSE SAND.....	0.02	COARSE GRAVEL....	0.00
VERY COARSE SAND..	0.00	VERY COARSE GRAVEL	0.00
			TOTAL = 23.96
SEDIMENT OUTFLOW from the Downstream Boundary			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND...	15.35	VERY FINE GRAVEL..	0.09
FINE SAND.....	91.96	FINE GRAVEL.....	0.00
MEDIUM SAND.....	244.08	MEDIUM GRAVEL....	0.00
COARSE SAND.....	22.05	COARSE GRAVEL....	0.00

VERY COARSE SAND..	1.39	VERY COARSE GRAVEL	0.00
		TOTAL =	374.91

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 55.000 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) SAND
6.000	-0.10	986.44	984.70	90.	34.
4.000	0.00	981.30	980.30	90.	35.
2.100	-6.28	976.88	973.02	90.	375.
1.000	-2.99	976.52	976.01	90.	375.

EXAMPLE 6 Cont. ZUMBRO RIVER Project - BEAR CREEK - Stream Segment 3  
 ACCUMULATED TIME (yrs).... 0.151  
 FLOW DURATION (days)..... 2.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment #	Section No.	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
3	6.000			
INFLOW		38.00	3.96	52.79

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 3  
 EXAMPLE 6 Cont. ZUMBRO RIVER Project - BEAR CREEK - Stream Segment 3  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW TRAP EFF *
55.00    6.000 *      2.13   16.24   *
        2.100 *      16.24  20.32   *
TOTAL=   1.000 *      18.37  20.32  -0.11 *
*****
```

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 3

SEDIMENT INFLOW at the Upstream Boundary:

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND....	0.80	VERY FINE GRAVEL..	0.00
FINE SAND.....	1.36	FINE GRAVEL.....	0.00
MEDIUM SAND.....	1.79	MEDIUM GRAVEL....	0.00
COARSE SAND.....	0.00	COARSE GRAVEL....	0.00
VERY COARSE SAND..	0.00	VERY COARSE GRAVEL	0.00
		TOTAL =	3.96

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND....	9.72	VERY FINE GRAVEL..	0.01
FINE SAND.....	15.97	FINE GRAVEL.....	0.00
MEDIUM SAND.....	26.14	MEDIUM GRAVEL....	0.00
COARSE SAND.....	2.18	COARSE GRAVEL....	0.00
VERY COARSE SAND..	0.09	VERY COARSE GRAVEL	0.00
		TOTAL =	54.11

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 55.000 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) SAND
6.000	-0.10	983.91	982.70	38.	3.
4.000	0.00	978.95	978.30	38.	9.
2.100	-2.90	975.20	974.40	128.	718.
1.000	4.08	974.82	972.48	128.	54.

EXAMPLE 6 Cont. ZUMBRO RIVER Project - CASCADE CREEK - Stream Segment 2  
 ACCUMULATED TIME (yrs).... 0.151  
 FLOW DURATION (days)..... 2.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment #	Section No.	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
2	6.200			
INFLOW		61.00	4.32	72.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 2  
 EXAMPLE 6 Cont. ZUMBRO RIVER Project - CASCADE CREEK - Stream Segment 2  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      INFLOW  OUTFLOW TRAP EFF *
55.00    6.200 *      1.00   0.98   *
TOTAL=   1.000 *      1.00   0.98   0.02 *
*****
```

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 2

SEDIMENT INFLOW at the Upstream Boundary:			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND. . . . .	2. 87	VERY FINE GRAVEL. . . . .	0. 01
FINE SAND. . . . .	0. 89	FINE GRAVEL. . . . .	0. 00
MEDIUM SAND. . . . .	0. 37	MEDIUM GRAVEL. . . . .	0. 00
COARSE SAND. . . . .	0. 13	COARSE GRAVEL. . . . .	0. 00
VERY COARSE SAND. . . . .	0. 03	VERY COARSE GRAVEL. . . . .	0. 00
			TOTAL = 4. 32
SEDIMENT OUTFLOW from the Downstream Boundary			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND. . . . .	1. 47	VERY FINE GRAVEL. . . . .	3. 51
FINE SAND. . . . .	0. 46	FINE GRAVEL. . . . .	1. 94
MEDIUM SAND. . . . .	0. 19	MEDIUM GRAVEL. . . . .	0. 00
COARSE SAND. . . . .	0. 07	COARSE GRAVEL. . . . .	0. 00
VERY COARSE SAND. . . . .	0. 02	VERY COARSE GRAVEL. . . . .	0. 00
			TOTAL = 7. 65

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 55.000 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) SAND
6. 200	0. 00	972. 81	972. 00	61.	3.
4. 000	0. 00	969. 50	968. 30	61.	3.
3. 000	0. 00	965. 80	964. 30	61.	2.
1. 000	-0. 30	960. 06	959. 50	61.	8.

EXAMPLE PROBLEM NO 6. South Fork, ZUMBRO RIVER - Stream Segment 1  
 ACCUMULATED TIME (yrs) . . . . . 0. 151  
 FLOW DURATION (days) . . . . . 2. 000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment # 1 Section No.	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
58. 000	282. 00	28. 81	62. 06

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1  
 EXAMPLE PROBLEM NO 6. South Fork, ZUMBRO RIVER - Stream Segment 1  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

```

*****
TIME      ENTRY *      SAND *
DAYS     POINT *      OUTFLOW TRAP EFF *
55. 00   58. 000 *      13. 28 *
          53. 000 *      20. 32 *
          42. 000 *      0. 36 *
TOTAL=   35. 000 *      33. 96   0. 34   0. 99 *
*****
TIME      ENTRY *      SAND *
DAYS     POINT *      OUTFLOW TRAP EFF *
55. 00   35. 000 *      0. 34 *
          15. 000 *      0. 98 *
TOTAL=   1. 000 *      1. 32   0. 09   0. 93 *
*****
    
```

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND. . . . .	9. 03	VERY FINE GRAVEL. . . . .	0. 00
FINE SAND. . . . .	10. 94	FINE GRAVEL. . . . .	0. 00
MEDIUM SAND. . . . .	8. 84	MEDIUM GRAVEL. . . . .	0. 00
COARSE SAND. . . . .	0. 00	COARSE GRAVEL. . . . .	0. 00
VERY COARSE SAND. . . . .	0. 00	VERY COARSE GRAVEL. . . . .	0. 00
			TOTAL = 28. 81
SEDIMENT OUTFLOW from the Downstream Boundary			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
VERY FINE SAND. . . . .	1. 82	VERY FINE GRAVEL. . . . .	0. 12
FINE SAND. . . . .	1. 76	FINE GRAVEL. . . . .	0. 15
MEDIUM SAND. . . . .	4. 38	MEDIUM GRAVEL. . . . .	0. 05
COARSE SAND. . . . .	3. 89	COARSE GRAVEL. . . . .	0. 00
VERY COARSE SAND. . . . .	1. 61	VERY COARSE GRAVEL. . . . .	0. 00
			TOTAL = 13. 77

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 55.000 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day) SAND
58. 000	-1. 28	977. 69	974. 12	282.	81.
55. 000	-0. 13	976. 93	972. 77	282.	111.
53. 000	0. 12	974. 82	972. 32	410.	279.
44. 000	1. 53	973. 46	968. 63	410.	78.
42. 000	0. 26	973. 12	970. 06	439.	1.
35. 000	0. 02	973. 00	963. 32	439.	0.
33. 900	0. 00	964. 90	962. 65	439.	0.

33.300	0.00	964.25	962.49	439.	0.
33.000	0.00	962.87	961.00	439.	0.
32.000	-0.54	961.80	955.96	439.	211.
15.000	-0.12	957.22	953.58	500.	1054.
1.000	1.37	955.00	946.07	500.	14.

-----  
SSEND

0 DATA ERRORS DETECTED.

TOTAL NO. OF TIME STEPS READ = 4

TOTAL NO. OF WS PROFILES = 13

ITERATIONS IN EXNER EQ = 1560

COMPUTATIONS COMPLETED

RUN TIME = 0 HOURS, 0 MINUTES & 9.00 SECONDS

## 6.7 Example Problem 7 - Cohesive Sediment

Example Problem 7 illustrates the deposition of clays and silts in an impoundment at the downstream end of a single stream segment. Subsequent lowering of the pool level in that impoundment causes erosion of the cohesive deposits. Table 6-7a shows the input data for this example and Table 6-7b shows the output.

### 6.7.1 Cohesive Sediment Data

This example uses Method 2 (see Sections 2.3.8, 3.3.4.1 and the I2 record in Appendix A) to compute the deposition and erosion rates for clay and silts. This method requires the addition of two Special I2 records to provide the data; one for the active layer and one for the inactive layer. The data for the active layer is described below and is illustrated (along with the data for the inactive layer) in Figure 6-7.

The shear stress threshold above which clays and silts will not deposit is  $0.02 \text{ lb/ft}^2$ . The shear stress at which deposited cohesive material will scour is  $0.05 \text{ lb/ft}^2$ . The shear stress above which mass erosion occurs is  $0.10 \text{ lb/ft}^2$ . The erosion rate at that shear stress is  $1.5 \text{ lb/ft}^2/\text{hr}$ . The slope of the mass erosion rate curve is  $60/\text{hr}$ . These values are depicted in Figure 30 for both the active and inactive layers. Note that the shear strength of the inactive layer is larger than that of the active layer and it erodes more slowly. This represents, perhaps, the effect of consolidation.

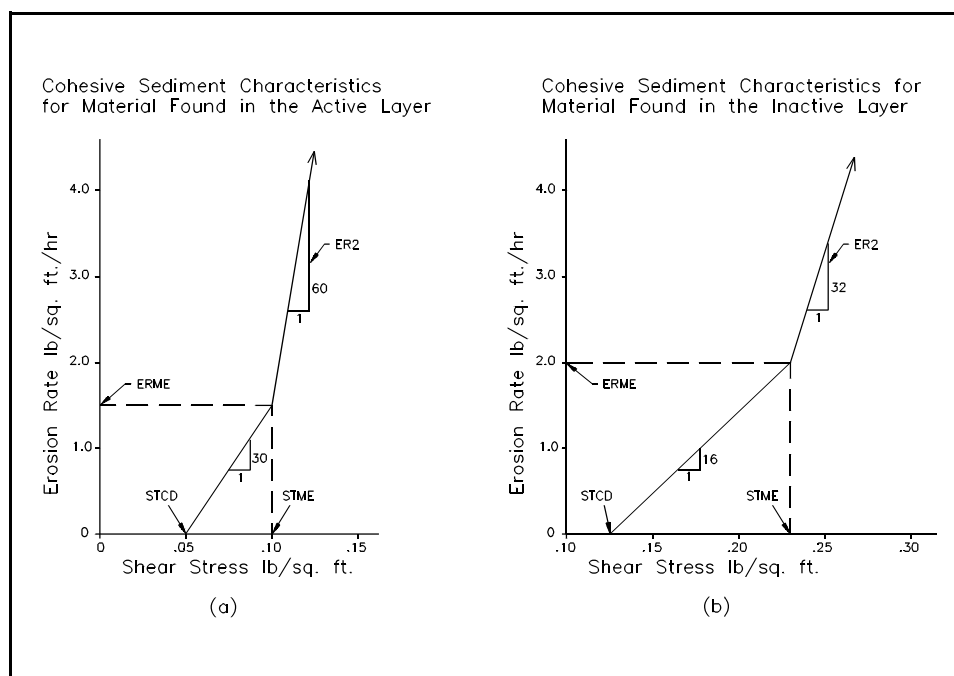


Figure 6-7  
Erosion Rate Characteristics

Cauti on,  
the  
cohesi ve

sediment values given in Example Problem 7 are not factual and should not be used under any circumstances without field verification. To determine these values, laboratory tests must be performed on the sediments to be simulated. These tests must be done under the same physical and chemical conditions as in the prototype (see Section 2.3.8).

Table 6-7a  
Example Problem 7 - Input  
Cohesive Sediment

EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.										
A LAKE IS CREATED.										
SOUTH FORK, ZUMBRO RIVER ** Example Problem 7 **										
NC	.1	.1	.04	.1	.3	0.	0.	0.		
X1	1.0	31	10077.	10275.	0.	0.	0.			
GR	1004.	9915.	978.4	10002.	956.0	10060.	959.2	10077.	959.3	10081.
GR	950.0	10092.	948.48	10108.	946.6	10138.	944.7	10158.	955.2	10225.
GR	956.2	10243.	958.9	10250.	959.8	10275.	959.8	10300.	959.9	10325.
GR	958.8	10350.	957.4	10400.	970.0	10700.	966.0	10960.	970.0	11060.
GR	968.0	11085.	968.0	11240.	970.0	11365.	970.0	11500.	970.0	11615.
GR	962.0	11665.	962.0	12400.	976.0	12550.	980.0	12670.	982.0	12730.
GR	984.0	12735.								
HD	1.0	10.	10081.	10250.						
NV	22	.045	965.6	.064	988.8					
NV	12	.08	965.6	.13	988.8					
NV	33	.1	965.6	.11	982.0	.12	988.8			
X1	15.0	27	10665.	10850.	3560.	3030.	3280.			
X3				10700.	961.0	11000.	970.0			
GR	992.0	9570.	982.0	10110.	976.0	10300.	976.0	10490.	966.0	10610.
GR	964.7	10665.	956.0	10673.	953.0	10693.	954.0	10703.	955.6	10723.
GR	958.6	10750.	959.3	10800.	957.0	10822.	957.3	10825.	961.5	10850.
GR	962.0	10852.	964.0	10970.	966.0	11015.	961.0	11090.	962.0	11150.
GR	970.0	11190.	972.0	11310.	980.0	11410.	984.0	11570.	990.0	11770.
GR	990.0	11865.	1000.0	12150.						
HD	15.0	10.	10673.	10852.						
NC	.1	.1	.05							
CASCADE CREEK										
X1	32.0	29	10057.	10271.	3630.	3060.	4240.			
GR	998.0	9080.	982.0	9250.	982.0	9510.	980.0	9600.	980.01	9925.
GR	979.48	10000.	978.5	10057.	968.6	10075.	959.82	10087.	956.5	10097.
GR	956.8	10117.	957.8	10137.	959.4	10157.	959.6	10177.	959.82	10196.
GR	966.5	10225.	971.2	10250.	978.5	10271.	978.5	10300.	978.6	10350.
GR	978.91	10370.	978.96	10387.	980.0	10610.	982.0	10745.	982.0	11145.
GR	984.0	11150.	992.0	11240.	1000.0	11330.	1008.	11425.		
HD	32.0	10.	10075.	10275.						
NC	.06	.06	.045							
X1	42.0	32	9880.	10130.	8500.	8250.	8530.			
GR	996.0	7130.	998.0	7310.	998.0	7930.	992.0	8205.	990.0	8495.
GR	988.0	8780.	986.0	8990.	985.7	9570.	986.45	9707.	989.44	9857.
GR	990.0	9880.	969.8	9881.	969.8	9941.	985.8	9941.	985.8	9943.
GR	969.8	9943.	969.8	10001.	986.7	10001.	986.7	10003.	969.8	10003.
GR	969.8	10067.	985.8	10067.	985.8	10069.	969.8	10069.	969.8	10129.
GR	989.9	10130.	989.5	10180.	988.6	10230.	987.6	10280.	985.2	10430.
GR	986.8	11720.	989.9	12310.						
HD	42.0	0	9881.	10021.						
SILVER CREEK										
X1	44.0	28	9845.	10127.	3200.	3800.	3500.			
XL				9850.	10200.					
GR	1002.	8035.	992.0	8150.	990.0	8305.	990.0	8735.	988.0	8835.
GR	996.0	9285.	1017.6	9425.	990.0	9505.	986.0	9650.	984.1	9788.
GR	980.6	9845.	970.9	9868.	972.2	9898.	970.5	9968.	967.5	9998.
GR	968.9	10028.	967.4	10058.	967.1	10078.	971.9	10118.	976.8	10127.
GR	977.8	10150.	976.9	10193.	982.0	10206.	981.2	10300.	979.2	10325.
GR	983.1	10400.	999.8	10450.	1002.4	10464.				
HD	44.0	10.	9868.	10193.						
X1	53.0	22	10000.	10136.	3366.	2832.	2942.			
GR	1004.	7550.	1000.0	7760.	998.0	8440.	996.0	8640.	996.0	8780.
GR	994.0	8940.	986.0	9245.	986.3	9555.	986.3	9825.	983.8	9900.
GR	982.8	10000.	978.2	10011.	974.0	10041.	972.2	10071.	972.6	10101.
GR	978.2	10121.	988.7	10136.	989.3	10154.	999.2	10200.	1000.1	10320.
GR	1002.	10470.	1004.0	10700.						
HD	53.0	10.	10000.	10136.						
BEAR CREEK										
X1	55.0	18	9931.	10062.	2275.	3430.	2770.			
GR	1004.	7592.	1000.0	7947.	996.0	8627.	990.0	9052.	986.0	9337.
GR	984.3	9737.	984.7	9837.	985.5	9910.	987.2	9931.	978.1	9955.
GR	974.8	9975.	974.2	10005.	972.9	10035.	973.2	10045.	983.8	10062.
GR	985.8	10187.	986.0	10307.	990.0	10497.				
HD	55.0	10.	9931.	10062.						
X1	58.0	22	9912.	10015.	1098.	1012.	1462.			
GR	1006.	8542.	1004.0	8952.	1000.0	9702.	997.2	9812.	996.3	9912.
GR	976.2	9944.	975.4	9974.	978.2	9991.	990.4	10015.	988.3	10062.
GR	988.8	10065.	988.3	10065.	989.3	10169.	990.0	10172.	992.0	10242.
GR	992.0	10492.	988.0	10642.	986.7	10852.	988.0	11022.	986.0	11097.
GR	986.0	11137.	988.0	11192.						
HD	58.0	3.4	9912.	10015.						
EJ										

```

T4      South Fork, Zumbro River      ** Example Problem 7 **
T5      LOAD CURVE FROM GAGE DATA.
T6      BED GRADATIONS FROM FIELD SAMPLES.
T7      CLAY and SILT added to full range of Sands and Gravels.
T8      SEDIMENT TRANSPORT BY Yang' s STREAM POWER [ref ASCE JOURNAL (YANG 1971)]
I1      0          5
I2      CLAY      2
I2      CLAY      1          .02          .05          .1          1.5          60.
I2      CLAY      2          .02          .125          .23          2.0          32.
I3      SILT      2          1          4
I4      SAND      4          1          10
I5      .5        .5          .25          .5          .25          0          1.0
LQ      1          50          1000          5800          90000
LT      TOTAL    .0220          3.0          640          9000.          800000
LF      CLAY      .22          .22          .15          .13          .10
LF      SILT1     .25          .25          .15          .104          .07
LF      SILT2     .18          .18          .13          .12          .05
LF      SILT3     .13          .13          .17          .145          .08
LF      SILT4     .10          .10          .185          .170          .150
LF      VFS       .06          .06          .105          .156          .230
LF      FS        .04          .04          .066          .090          .160
LF      MS        .02          .02          .027          .060          .115
LF      CS        0          0          .014          .016          .030
LF      VCS      0          0          .003          .005          .010
LF      VFG      0          0          0          .002          .004
LF      FG       0          0          0          .001          .001
LF      MG       0          0          0          0          0
LF      CG       0          0          0          0          0
LF      VCG      0          0          0          0          0
PF      EXAMP    1.0          1.0          32.0          16.0          96.5          8.0          95.0          4.0          91.0
PFC    2.0      85.0          1.0          73.0          .5          37.0          .25          8.0          .125          1.0
PFC    0.625   0.0
PF      EXAMP    32.0          1.0          64.0          32.0          99.5          16.0          99.0          8.0          98.5
PFC    4.0      96.0          2.0          93.5          1.0          83.0          .50          45.5          .250          8.0
PFC    .125    1.0          .0625          0.0
PF      EXAMP    58.0          1.0          64.0          32.0          97.0          16.0          94.0          8.0          94.0
PFC    4.0      90.0          2.0          79.0          1.0          56.0          .50          4.0          .125          0.0
SHYD
Q      B          FLOW 1 = WARM-UP BASE FLOW OF 750 CFS, LAKE IMPOUNDED.
Q      750
R      985
T      65
W      1
SPRT
CP      1
PS      32.0
END
Q      AB        FLOW 2 = 100 DAYS AT BANK FULL Q, LAKE IMPOUNDED.
Q      1250.
R      985
X      10          100
SRATING
RC      40          2000          0          0          950.0          955.1          958.0          960.0          962.0
RC      963.6          965.1          966.2          967.0          967.7          968.3          968.9          969.4          969.8
RC      970.2          970.6          971.0          971.4          971.8          972.1          972.4          972.7          972.9
RC      973.1          973.3          973.5          973.7          973.8          973.9          974.0          974.1          974.2
RC      974.3          974.4          974.5          974.6          974.7          974.8          974.9          975.0
Q      AC        FLOW 3 = NEAR BANK FULL Q, LAKE LOWERED.
Q      1250.
W      .2
SPRT    A
Q      B          FLOW 4 = NEAR BANK FULL Q, LAKE LOWERED.
Q      1250.
X      1          20.
Q      B          FLOW 5 = LAST FLOW, BASE FLOW OF 750 CFS, LAKE IS LOWERED.
Q      750.
X      2          20.
SSEND

```

## 6. 7. 2 Output

EFFICIENCY..." table, TABLE SA-1, shows that only 7% of the inflowing clay load was deposited in the reservoir since the beginning of the simulation, while 73% of the inflowing silts and 100% of the inflowing sands and gravels were deposited. TABLE SB-2, the "STATUS OF THE BED PROFILE...", shows the outflowing load at each cross section for this time step and the cumulative bed change since the start of the simulation. Only Section No. 58.0 shows a significant bed change, but because there are no local inflows, diversions, or tributaries affecting the load at any cross section, the progressive decrease in the outflowing load at each cross section indicates deposition.

In this example, time step 2 represents 10 separate (incremental) time steps each having a duration of 10 days with a starting water surface of 985 ft and a flow of 1250 cfs. At the end of the last incremental time step, output is produced depicting the state of the reservoir for the last 10 day time step (i.e., instantaneous values such as the sediment load data in TABLE SB-2 are only for the last 10 days, while cumulative data, such as trap efficiency and bed change, represent changes since the start of the simulation - 101 days.) Because of this, output produced by this time step can be misleading. For example, the trap efficiency of clay has decreased since time step 1 indicating that erosion has occurred during the 100 days of this time step. However, the outflowing clay load compared to the inflowing clay load (as shown in TABLE SB-1) indicates that deposition is occurring which reflects the difference between instantaneous and cumulative values.

A rating curve representing channel control at the downstream-most section precedes the data for time step 3. Although the flow for time step 3 and 4 remains at 1250 cfs, the starting water surface obtained from the rating curve is much lower, significantly altering the hydraulic parameters. C-level output was requested for time step 3 and limited to Sections 32.0 and 42.0. The increased velocity at Section No. 32.0 results in a bed shear stress of 0.2980 lb/sq ft, which, from Figure 6-7, results in mass erosion of both layers. The computed potential erosion rates for both clay and silt are 141,700 and 44,214 tons/day for the active and inactive layers respectively. The actual erosion rates will be limited by the availability of these materials.

Table 6-7b  
Example Problem 7 - Output  
Cohesive Sediment

```
*****
* SCOUR AND DEPOSITION IN RIVERS AND RESERVOIRS *
* Version: 4.1.00 - AUGUST 1993 *
* INPUT FILE: EXAMPLE7.DAT *
* OUTPUT FILE: EXAMPLE7.OUT *
* RUN DATE: 31 AUG 93 RUN TIME: 08:21:08 *
*****
* U. S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616-4687 *
* (916) 756-1104 *
*****
```

```

X X XXXXXX XXXX XXXX
X X X X X
X X X X
XXXXXXXX XXXX X XXXX XXXXXX
X X X X X
X X X X X
X X XXXXXX XXXX XXXX

```

```
*****
* MAXIMUM LIMITS FOR THIS VERSION ARE: *
* 10 Stream Segments (Main Stem + Tributaries) *
* 150 Cross Sections *
* 100 Elevation/Station Points per Cross Section *
* 20 Grain Sizes *
* 10 Control Points *
*****
```

```
T1 EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.
T2 A LAKE IS CREATED.
T3 SOUTH FORK, ZUMBRO RIVER ** Example Problem 7 **
```

```
N values... Left Channel Right Contraction Expansion
0.1000 0.0400 0.1000 1.1000 0.7000
```

SECTION NO. 1.000  
 ...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

N-Values vs. Elevation Table

Channel	Left Overbank	Right Overbank
0.0450 966.	0.0800 966.	0.1000 966.
0.0640 989.	0.1300 989.	0.1100 982.
0.0000 0.	0.0000 0.	0.1200 989.

SECTION NO. 15.000  
 ...Left Encroachment defined at station 10700.000 at elevation 961.000  
 ...Right Encroachment defined at station 11000.000 at elevation 970.000  
 ...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

N values... Left Channel Right Contraction Expansion  
 0.1000 0.0500 0.1000 1.1000 0.7000

SECTION NO. 32.000  
 ...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

N values... Left Channel Right Contraction Expansion  
 0.0600 0.0450 0.0600 1.1000 0.7000

SECTION NO. 42.000  
 ...DEPTH of the Bed Sediment Control Volume = 0.00 ft.

SECTION NO. 44.000  
 ...Limit CONVEYANCE between stations 9850.000 and 10200.000  
 ...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 53.000  
 ...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 55.000  
 ...DEPTH of the Bed Sediment Control Volume = 10.00 ft.

SECTION NO. 58.000  
 ...DEPTH of the Bed Sediment Control Volume = 3.40 ft.

NO. OF CROSS SECTIONS IN STREAM SEGMENT= 8  
 NO. OF INPUT DATA MESSAGES = 0

TOTAL NO. OF CROSS SECTIONS IN THE NETWORK = 8  
 TOTAL NO. OF STREAM SEGMENTS IN THE NETWORK= 1  
 END OF GEOMETRIC DATA

=====  
 T4 South Fork, Zumbro River \*\* Example Problem 7 \*\*  
 T5 LOAD CURVE FROM GAGE DATA.  
 T6 BED GRADATIONS FROM FIELD SAMPLES.  
 T7 CLAY and SILT added to full range of Sands and Gravels.  
 T8 SEDIMENT TRANSPORT BY Yang's STREAM POWER [ref ASCE JOURNAL (YANG 1971)]

EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.  
 A LAKE IS CREATED.  
 SOUTH FORK, ZUMBRO RIVER \*\* Example Problem 7 \*\*

-----  
 SEDIMENT PROPERTIES AND PARAMETERS

I1	SPI	IBG	MNQ	SPGF	ACGR	NFALL	IBSHER
	5.	0	1	1.000	32.174	2	1

CLAY IS PRESENT.

I2	MCCL	SPGC	PUCD	UWCL	CCCD
	2	2.650	78.000	30.000	16.000

DEPOSITION COEFFICIENTS BY LAYER

LAYER NO.	DEPOSITION THRESHOLD SHEAR STRESS lb/sq. ft
ACTIVE LAYER 1	0.0200
INACTIVE LAYER 2	0.0200

EROSION COEFFICIENTS BY LAYER

LAYER NO	PARTICLE EROSION SHEAR STRESS lb/sq. ft	MASS EROSION SHEAR STRESS lb/sq. ft.	MASS EROSION RATE 1b/sf/hr	SLOPE OF PARTICLE EROSION LINE=ER1 1/hr	SLOPE OF MASS EROSION LINE=ER2 1/hr
ACTIVE LAYER 1	0.0500	0.1000	1.5000	30.0000	60.0000
INACTIVE LAYER 2	0.1250	0.2300	2.0000	19.0476	32.0000

SILT IS PRESENT

I3	MCCL	IASL	LASL	SGSL	PUSDLB	UWSDLB	CCSDLB
	2	1	4	2.650	82.000	65.000	5.700

DEPOSITION COEFFICIENTS BY LAYER

LAYER NO.	DEPOSITION THRESHOLD SHEAR STRESS lb/sq. ft
ACTIVE LAYER 1	0.0200
INACTIVE LAYER 2	0.0200

EROSION COEFFICIENTS BY LAYER

LAYER NO	PARTICLE EROSION SHEAR STRESS lb/sq. ft	MASS EROSION SHEAR STRESS lb/sq. ft.	MASS EROSION RATE lb/sf/hr	SLOPE OF PARTICLE EROSION LINE=ER1 1/hr	SLOPE OF MASS EROSION LINE=ER2 1/hr
ACTIVE LAYER 1	0.0500	0.1000	1.5000	30.0000	60.0000
INACTIVE LAYER 2	0.1250	0.2300	2.0000	19.0476	32.0000

SANDS - BOULDERS ARE PRESENT

I4	MFC	IASA	LASA	SPGS	GSF	BSAE	PSI	UWDLB
4	4	1	10	2.650	0.667	0.500	30.000	93.000

USING TRANSPORT CAPACITY RELATIONSHIP # 4, YANG  
GRAIN SIZES UTILIZED (mean diameter - mm)

CLAY.....	0.003	COARSE SAND.....	0.707
VERY FINE SILT.....	0.006	VERY COARSE SAND..	1.414
FINE SILT.....	0.011	VERY FINE GRAVEL..	2.828
MEDIUM SILT.....	0.022	FINE GRAVEL.....	5.657
COARSE SILT.....	0.044	MEDIUM GRAVEL....	11.314
VERY FINE SAND....	0.088	COARSE GRAVEL....	22.627
FINE SAND.....	0.177	VERY COARSE GRAVEL	45.255
MEDIUM SAND.....	0.354		

COEFFICIENTS FOR COMPUTATION SCHEME WERE SPECIFIED

I5	DBI	DBN	XID	XIN	XIU	UBI	UBN	JSL
0.500	0.500	0.250	0.500	0.250	0.000	1.000	1	

SEDIMENT LOAD TABLE FOR STREAM SEGMENT # 1  
LOAD BY GRAIN SIZE CLASS (tons/day)

LQ	1.00000	50.0000	1000.00	5800.00	90000.0
LF CLAY	0.484000E-02	0.660000	96.0000	1170.00	80000.0
LF SILT1	0.550000E-02	0.750000	96.0000	936.000	56000.0
LF SILT2	0.396000E-02	0.540000	83.2000	1080.00	40000.0
LF SILT3	0.286000E-02	0.390000	108.800	1305.00	64000.0
LF SILT4	0.220000E-02	0.300000	118.400	1530.00	120000.
LF VFS	0.132000E-02	0.180000	67.2000	1404.00	184000.
LF FS	0.880000E-03	0.120000	42.2400	810.000	128000.
LF MS	0.440000E-03	0.600000E-01	17.2800	540.000	92000.0
LF CS	0.100000E-19	0.100000E-19	8.96000	144.000	24000.0
LF VCS	0.100000E-19	0.100000E-19	1.92000	45.0000	8000.00
LF VFG	0.100000E-19	0.100000E-19	0.100000E-19	18.0000	3200.00
LF FG	0.100000E-19	0.100000E-19	0.100000E-19	9.00000	800.000
LF ME	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19
LF CG	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19
LF VCG	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19	0.100000E-19
TOTAL	0.220000E-01	3.00000	640.000	8991.00	800000.

REACH GEOMETRY FOR STREAM SEGMENT 1

CROSS SECTION NO.	REACH LENGTH (ft)	MOVABLE BED WIDTH	INITIAL BED-ELEVATIONS			ACCUMULATED CHANNEL DISTANCE FROM DOWNSTREAM	
			LEFT SIDE (ft)	THALWEG (ft)	RIGHT SIDE (ft)	(ft)	(miles)
	0.000						
1.000	3280.000	183.500	959.300	944.700	958.900	0.000	0.000
15.000	4240.000	242.000	961.000	953.700	962.000	3280.000	0.621
32.000	8530.000	219.500	968.600	956.500	978.500	7520.000	1.424
42.000	3500.000	154.500	969.800	969.800	969.800	16050.000	3.040
44.000	2942.000	337.500	970.900	967.100	976.900	19550.000	3.703
53.000	2770.000	195.000	982.800	972.200	988.700	22492.000	4.260
55.000	1462.000	204.000	987.200	972.900	983.800	25262.000	4.784
58.000		176.500	996.300	975.400	990.400	26724.000	5.061

BED MATERIAL GRADATION

SECNO	SAE	DMAX (ft)	DXPI (ft)	XPI	TOTAL BED	BED MATERIAL FRACTIONS per grain size																													
1.000	1.000	0.105	0.105	1.000	1.000	CLAY	0.000	C SILT	0.000	C SAND	0.360	M GRVL	0.015	VF SILT	0.000	VF SAND	0.010	VC SAND	0.120	C GRVL	0.035	F SILT	0.000	F SAND	0.070	VF GRVL	0.060	VC GRVL	0.000	M SILT	0.000	M SAND	0.290	F GRVL	0.040
15.000	1.000	0.151	0.151	1.000	1.000	CLAY	0.000	C SILT	0.000	C SAND	0.367	M GRVL	0.011	VF SILT	0.000	VF SAND	0.010	VC SAND	0.113	C GRVL	0.022	F SILT	0.000	F SAND	0.070	VF GRVL	0.045	VC GRVL	0.002	M SILT	0.000	M SAND	0.327	F GRVL	0.033
32.000	1.000	0.210	0.210	1.000	1.000	CLAY	0.000	C SILT	0.000	C SAND	0.375	M GRVL	0.005	VF SILT	0.000	VF SAND	0.010	VC SAND	0.105	C GRVL	0.005	F SILT	0.000	F SAND	0.070	VF GRVL	0.025	VC GRVL	0.005	M SILT	0.000	M SAND	0.375	F GRVL	0.025
42.000	1.000	0.210	0.210	1.000	1.000	CLAY	0.000	C SILT	0.000	C SAND	0.439	M GRVL	0.003	VF SILT	0.000	VF SAND	0.006	VC SAND	0.161	C GRVL	0.016	F SILT	0.000	F SAND	0.048	VF GRVL	0.063	VC GRVL	0.016	M SILT	0.000	M SAND	0.217	F GRVL	0.032
44.000	1.000	0.210	0.210	1.000	1.000	CLAY	0.000	C SILT	0.000	C SAND	0.466	M GRVL	0.002	VF SILT	0.000	VF SAND	0.004	VC SAND	0.183	C GRVL	0.021	F SILT	0.000	F SAND	0.039	VF GRVL	0.078	VC GRVL	0.021	M SILT	0.000	M SAND	0.153	F GRVL	0.034
53.000	1.000	0.210	0.210	1.000	1.000	CLAY	0.000	C SILT	0.000	C SAND	0.488	M GRVL	0.001	VF SILT	0.000	VF SAND	0.002	VC SAND	0.202	C GRVL	0.024	F SILT	0.000	F SAND	0.031	VF GRVL	0.091	VC GRVL	0.024	M SILT	0.000	M SAND	0.098	F GRVL	0.037
55.000	1.000	0.210	0.210	1.000	1.000	CLAY	0.000	C SILT	0.000	C SAND	0.509	M GRVL	0.000	VF SILT	0.000	VF SAND	0.001	VC SAND	0.220	C GRVL	0.028	F SILT	0.000	F SAND	0.024	VF GRVL	0.104	VC GRVL	0.028	M SILT	0.000	M SAND	0.047	F GRVL	0.039
58.000	1.000	0.210	0.210	1.000	1.000	CLAY	0.000	C SILT	0.000	C SAND	0.520	M GRVL	0.000	VF SILT	0.000	VF SAND	0.000	VC SAND	0.230	C GRVL	0.030	F SILT	0.000	F SAND	0.020	VF GRVL	0.110	VC GRVL	0.030	M SILT	0.000	M SAND	0.020	F GRVL	0.040

BED SEDIMENT CONTROL VOLUMES

STREAM SEGMENT # 1: EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.

SECTION NUMBER	LENGTH (ft)	WIDTH (ft)	DEPTH (ft)	VOLUME (cu. ft)	U M E (cu. yd)
1.000	1640.000	203.000	10.000	0.332920E+07	123304.
15.000	3760.000	229.266	10.000	0.862040E+07	319274.
32.000	6385.000	207.517	10.000	0.132500E+08	490740.
42.000	6015.000	187.610	0.000	0.000000	0.000000
44.000	3221.000	282.665	10.000	0.910465E+07	337209.
53.000	2856.000	220.920	10.000	0.630947E+07	233684.
55.000	2116.000	198.870	10.000	0.420808E+07	155855.
58.000	731.000	185.667	3.400	461456.	17091.0

NO. OF INPUT DATA MESSAGES= 0  
 END OF SEDIMENT DATA

SHYD  
 BEGIN COMPUTATIONS.

TIME STEP # 1  
 Q B FLOW 1 = WARM-UP BASE FLOW OF 750 CFS, LAKE IMPOUNDED.

EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.  
 ACCUMULATED TIME (yrs).... 0.003  
 FLOW DURATION (days)..... 1.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment #	Section No.	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
1	58.000	750.00	373.33	65.00
	INFLOW			

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1  
 EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME DAYS	ENTRY POINT	CLAY INFLOW	CLAY OUTFLOW	TRAP EFF *	SILT INFLOW	SILT OUTFLOW	TRAP EFF *	SAND INFLOW	SAND OUTFLOW	TRAP EFF *
1.00	58.000	0.09		*	0.17		*	0.04		*
TOTAL=	1.000	0.09	0.09	0.07 *	0.17	0.05	0.73 *	0.04	0.00	1.00 *

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.....	59.51	COARSE SAND.....	0.09
VERY FINE SILT....	60.24	VERY COARSE SAND..	0.02
FINE SILT.....	51.29	VERY FINE GRAVEL..	0.00
MEDIUM SILT.....	63.35	FINE GRAVEL.....	0.00
COARSE SILT.....	66.69	MEDIUM GRAVEL.....	0.00
VERY FINE SAND....	38.05	COARSE GRAVEL.....	0.00
FINE SAND.....	24.05	VERY COARSE GRAVEL	0.00
MEDIUM SAND.....	10.03		
		TOTAL =	373.33
SEDIMENT OUTFLOW from the Downstream Boundary			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.....	55.63	COARSE SAND.....	0.00
VERY FINE SILT....	45.88	VERY COARSE SAND..	0.00
FINE SILT.....	17.36	VERY FINE GRAVEL..	0.00
MEDIUM SILT.....	0.88	FINE GRAVEL.....	0.00
COARSE SILT.....	0.00	MEDIUM GRAVEL.....	0.00
VERY FINE SAND....	0.00	COARSE GRAVEL.....	0.00
FINE SAND.....	0.00	VERY COARSE GRAVEL	0.00
MEDIUM SAND.....	0.00		
		TOTAL =	119.76

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 1.000 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	CLAY	SILT	SAND
58.000	0.02	985.12	975.42	750.	60.	242.	5.
55.000	0.00	985.06	972.90	750.	60.	242.	0.
53.000	0.00	985.01	972.20	750.	59.	196.	0.
44.000	0.00	985.01	967.10	750.	59.	144.	0.
42.000	0.00	985.01	969.80	750.	58.	100.	0.
32.000	0.00	985.00	956.50	750.	57.	79.	0.
15.000	0.00	985.00	953.70	750.	56.	69.	0.
1.000	0.00	985.00	944.70	750.	56.	64.	0.

SPRT  
 ...Selective Printout Option  
 - Print at the following cross sections  
 CP 1  
 PS 32.0  
 END

=====

TIME STEP # 2  
 Q AB FLOW 2 = 100 DAYS AT BANK FULL Q, LAKE IMPOUNDED.  
 COMPUTING FROM TIME= 1.0000 DAYS TO TIME= 101.0000 DAYS IN 10 COMPUTATION STEPS

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EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.  
 ACCUMULATED TIME (yrs)..... 0.003

--- Downstream Boundary Condition Data for STREAM SEGMENT NO. 1 at Control Point # 1 ---

DISCHARGE (cfs)	TEMPERATURE (deg F)	WATER SURFACE (ft)
1250.000	65.00	985.000

SECTION NO.	DISCHARGE (CFS)	WATER SURFACE	ENERGY LINE	VELOCITY HEAD	ALPHA	TOP WIDTH	AVG BED	AVG VEL (by subsection)		
								1	2	3
32.000	1250.000	985.002	985.002	0.001	3.255	1943.167	963.558	0.037	0.214	0.037
FLOW DISTRIBUTION (%) =								10.548	78.455	10.997

-----

EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.  
 ACCUMULATED TIME (yrs).... 0.277  
 FLOW DURATION (days)..... 10.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment #	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
1	1250.00	890.88	65.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1  
 EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME DAYS	ENTRY POINT *	CLAY			SILT			SAND		
		INFLOW	OUTFLOW	TRAP EFF *	INFLOW	OUTFLOW	TRAP EFF *	INFLOW	OUTFLOW	TRAP EFF *
101.00	58.000 *	20.27			39.47			10.04		
TOTAL=	1.000 *	20.27	19.54	0.04 *	39.47	13.42	0.66 *	10.04	0.00	1.00 *

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.....	131.86	COARSE SAND.....	12.75
VERY FINE SILT....	128.18	VERY COARSE SAND..	2.87
FINE SILT.....	115.20	VERY FINE GRAVEL..	0.00
MEDIUM SILT.....	149.14	FINE GRAVEL.....	0.00
COARSE SILT.....	163.84	MEDIUM GRAVEL....	0.00
VERY FINE SAND....	98.84	COARSE GRAVEL....	0.00
FINE SAND.....	61.46	VERY COARSE GRAVEL	0.00
MEDIUM SAND.....	26.75		
		TOTAL =	890.88
SEDIMENT OUTFLOW from the Downstream Boundary			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.....	127.12	COARSE SAND.....	0.00
VERY FINE SILT....	110.63	VERY COARSE SAND..	0.00
FINE SILT.....	64.14	VERY FINE GRAVEL..	0.00
MEDIUM SILT.....	14.76	FINE GRAVEL.....	0.00
COARSE SILT.....	0.02	MEDIUM GRAVEL....	0.00
VERY FINE SAND....	0.00	COARSE GRAVEL....	0.00
FINE SAND.....	0.00	VERY COARSE GRAVEL	0.00
MEDIUM SAND.....	0.00		
		TOTAL =	316.67

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 101.000 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	CLAY	SILT	SAND
58.000	-0.25	985.38	975.15	1250.	132.	556.	216.
55.000	1.18	985.20	974.08	1250.	132.	556.	79.
53.000	0.24	985.04	972.44	1250.	132.	556.	3.
44.000	0.43	985.03	967.53	1250.	131.	430.	0.
42.000	0.35	985.01	970.15	1250.	130.	292.	0.
32.000	0.14	985.00	956.64	1250.	129.	232.	0.
15.000	0.10	985.00	953.80	1250.	128.	202.	0.
1.000	0.12	985.00	944.82	1250.	127.	190.	0.

SRATING

Downstream Boundary Condition - Rating Curve			Stage		
Elevation	Stage	Discharge	Elevation	Stage	Discharge
950.000	950.000	0.000	972.400	972.400	40000.000
955.100	955.100	2000.000	972.700	972.700	42000.000
958.000	958.000	4000.000	972.900	972.900	44000.000
960.000	960.000	6000.000	973.100	973.100	46000.000
962.000	962.000	8000.000	973.300	973.300	48000.000
963.600	963.600	10000.000	973.500	973.500	50000.000
965.100	965.100	12000.000	973.700	973.700	52000.000
966.200	966.200	14000.000	973.800	973.800	54000.000
967.000	967.000	16000.000	973.900	973.900	56000.000
967.700	967.700	18000.000	974.000	974.000	58000.000
968.300	968.300	20000.000	974.100	974.100	60000.000
968.900	968.900	22000.000	974.200	974.200	62000.000
969.400	969.400	24000.000	974.300	974.300	64000.000
969.800	969.800	26000.000	974.400	974.400	66000.000
970.200	970.200	28000.000	974.500	974.500	68000.000
970.600	970.600	30000.000	974.600	974.600	70000.000
971.000	971.000	32000.000	974.700	974.700	72000.000
971.400	971.400	34000.000	974.800	974.800	74000.000
971.800	971.800	36000.000	974.900	974.900	76000.000
972.100	972.100	38000.000	975.000	975.000	78000.000

TIME STEP # 3  
 Q AC FLOW 3 = NEAR BANK FULL Q, LAKE LOWERED.

EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.  
 ACCUMULATED TIME (yrs)..... 0.277

--- Downstream Boundary Condition Data for STREAM SEGMENT NO. 1 at Control Point # 1 ---

DISCHARGE		TEMPERATURE		WATER SURFACE					
(cfs)	(deg F)	(ft)	(ft)	(ft)	(ft)				
1250.000	65.00	953.188							
**** DISCHARGE (CFS)	WATER SURFACE	ENERGY LINE	VELOCITY HEAD	ALPHA	TOP WIDTH	AVG BED	AVG VEL 1	AVG VEL 2	AVG VEL 3
SECTION NO. 32.000	1250.000	965.170	0.037	1.000	138.791	959.334	0.000	1.543	0.000
FLOW DISTRIBUTION (%) =							0.000	100.000	0.000

EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.  
 ACCUMULATED TIME (yrs).... 0.277  
 FLOW DURATION (days)..... 0.200

UPSTREAM BOUNDARY CONDITIONS

Stream Segment #	DISCHARGE	SEDIMENT LOAD	TEMPERATURE
Section No.	(cfs)	(tons/day)	(deg F)
# 1 58.000	1250.00	890.88	65.00

SEDIMENT INFLOW at SECTION NO. 58.000

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.....	131.86	COARSE SAND.....	12.75
VERY FINE SILT....	128.18	VERY COARSE SAND..	2.87
FINE SILT.....	115.20	VERY FINE GRAVEL..	0.00
MEDIUM SILT.....	149.14	FINE GRAVEL.....	0.00
COARSE SILT.....	163.84	MEDIUM GRAVEL....	0.00
VERY FINE SAND....	98.84	COARSE GRAVEL....	0.00
FINE SAND.....	61.46	VERY COARSE GRAVEL	0.00
MEDIUM SAND.....	26.75		
		TOTAL =	890.88

FALL VELOCITIES - Method 2

	DIAMETER	VELOCITY	REY. NO.	CD
CLAY	0.000009	0.2105298E-04	0.1671599E-04	1437286.
VF SILT	0.000018	0.8390687E-04	0.1332435E-03	180969.4

SAND  
**\*\* ARMOR LAYER \*\***  
 STABILITY COEFFICIENT= 0. 71485  
 MN. GRAIN DIAM = 0. 000290  
 BED SURFACE EXPOSED = 1. 00000

INACTIVE LAYER		ACTIVE LAYER	
%	DEPTH	%	DEPTH
CLAY 0. 0000	0. 00	0. 0121	0. 01
SILT 0. 0000	0. 00	0. 5279	0. 14
SAND 1. 0000	9. 92	0. 4600	0. 08
TOTAL 1. 0000	9. 92	1. 0000	0. 23

AVG. UNIT WEIGHT 0. 046500      AVG. UNIT WEIGHT 0. 037114

COMPOSITE UNIT WT OF ACTIVE LAYER (t/cf)= 0. 037114  
 COMPOSITE UNIT WT OF INACTIVE LAYER (t/cf)= 0. 046500  
 DEPTH OF SURFACE LAYER (ft) DSL= 0. 1  
 WEIGHT IN SURFACE LAYER (tons) WTSL= 3419. 4  
 DEPTH OF NEW ACTIVE LAYER (ft) DSE= 0. 0032  
 WEIGHT IN NEW ACTIVE LAYER(tons) WTMKAL= 0. 0  
 WEIGHT IN OLD ACTIVE LAYER(tons) WAL= 7434. 0  
 USEABLE WEIGHT, OLD INACTIVE LAYER WL= 406905. 7  
 SURFACE AREA OF DEPOSIT (sq ft) SABK= 0. 88241952E+06

**\*\* INACTIVE LAYER \*\***

BED MATERIAL PER GRAIN SIZE:	BED FRACTION	PERCENT FINER	BED FRACTION	PERCENT FINER
CLAY	0. 000000	0. 000000	C SAND	0. 375000
VF SILT	0. 000000	0. 000000	VC SAND	0. 105000
F SILT	0. 000000	0. 000000	VF GRVL	0. 025000
M SILT	0. 000000	0. 000000	F GRVL	0. 025000
C SILT	0. 000000	0. 000000	M GRVL	0. 005000
VF SAND	0. 010000	1. 000000	C GRVL	0. 005000
F SAND	0. 070000	8. 000000	VC GRVL	0. 005000
M SAND	0. 375000	45. 499999		

**\*\* ACTIVE LAYER \*\***

BED MATERIAL PER GRAIN SIZE:	BED FRACTION	PERCENT FINER	BED FRACTION	PERCENT FINER
CLAY	0. 012145	1. 214493	C SAND	0. 172485
VF SILT	0. 045067	5. 721205	VC SAND	0. 048296
F SILT	0. 130056	18. 726806	VF GRVL	0. 011499
M SILT	0. 290883	47. 815126	F GRVL	0. 011499
C SILT	0. 061889	54. 003994	M GRVL	0. 002300
VF SAND	0. 004600	54. 463954	C GRVL	0. 002300
F SAND	0. 032197	57. 683674	VC GRVL	0. 002300
M SAND	0. 172485	74. 932177		

C FINES, COEF(CFFML), MK POTENTIAL= 0. 329756E+05 0. 208796E+01 0. 258871E+07  
 POTENTIAL TRANSPORT (tons/day):  
 CLAY 0. 142505E+06 C SAND 0. 443530E+04  
 VF SILT 0. 144493E+06 VC SAND 0. 420230E+04  
 F SILT 0. 150708E+06 VF GRVL 0. 729210E+02  
 M SILT 0. 176257E+06 F GRVL 0. 831880E+02  
 C SILT 0. 205679E+06 M GRVL 0. 212266E+02  
 VF SAND 0. 420247E+05 C GRVL 0. 208796E-06  
 F SAND 0. 119823E+05 VC GRVL 0. 208796E-06  
 M SAND 0. 630429E+04

SEDIMENT OUTFLOW FROM SECTION NO. 32. 000		GRAIN SIZE LOAD (tons/day)	
CLAY	1286. 69	COARSE SAND	1543. 60
VERY FINE SILT	4498. 13	VERY COARSE SAND	411. 34
FINE SILT	13872. 54	VERY FINE GRAVEL	1. 77
MEDIUM SILT	45399. 24	FINE GRAVEL	2. 01
COARSE SILT	66309. 32	MEDIUM GRAVEL	0. 10
VERY FINE SAND	709. 63	COARSE GRAVEL	0. 00
FINE SAND	723. 23	VERY COARSE GRAVEL	0. 00
MEDIUM SAND	2142. 73		

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1  
 EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.  
 ACCUMULATED AC- FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME	ENTRY *	CLAY *			SILT *			SAND *		
DAYS	POINT *	INFLOW	OUTFLOW	TRAP EFF *	INFLOW	OUTFLOW	TRAP EFF *	INFLOW	OUTFLOW	TRAP EFF *
101. 20	58. 000 *	20. 31			39. 55			10. 06		
TOTAL=	1. 000 *	20. 31	20. 04	0. 01 *	39. 55	33. 04	0. 16 *	10. 06	0. 25	0. 97 *

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:		GRAIN SIZE LOAD (tons/day)	
CLAY	131. 86	COARSE SAND	12. 75
VERY FINE SILT	128. 18	VERY COARSE SAND	2. 87
FINE SILT	115. 20	VERY FINE GRAVEL	0. 00
MEDIUM SILT	149. 14	FINE GRAVEL	0. 00
COARSE SILT	163. 84	MEDIUM GRAVEL	0. 00
VERY FINE SAND	98. 84	COARSE GRAVEL	0. 00
FINE SAND	61. 46	VERY COARSE GRAVEL	0. 00
MEDIUM SAND	26. 75		
		TOTAL =	890. 88

SEDIMENT OUTFLOW from the Downstream Boundary

GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.....	1653.47	COARSE SAND.....	688.85
VERY FINE SILT...	5805.04	VERY COARSE SAND..	226.85
FINE SILT.....	17130.54	VERY FINE GRAVEL..	7.90
MEDIUM SILT.....	49534.84	FINE GRAVEL.....	8.66
COARSE SILT.....	66420.63	MEDIUM GRAVEL....	3.69
VERY FINE SAND...	381.98	COARSE GRAVEL.....	0.76
FINE SAND.....	369.78	VERY COARSE GRAVEL	0.00
MEDIUM SAND.....	859.25		
		TOTAL = 143092.25	

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 101.200 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day)		
					CLAY	SILT	SAND
58.000	-0.39	982.31	975.01	1250.	132.	556.	2349.
55.000	0.98	981.20	973.88	1250.	132.	556.	12521.
53.000	0.23	976.09	972.43	1250.	132.	694.	13246.
44.000	0.07	974.32	967.17	1250.	304.	49975.	1816.
42.000	0.00	971.56	969.80	1250.	835.	110457.	1550.
32.000	-0.02	965.17	956.48	1250.	1287.	130079.	5534.
15.000	-0.07	959.04	953.63	1250.	1512.	136006.	11706.
1.000	0.23	953.19	944.93	1250.	1653.	138891.	2548.

Accumulated Water Discharge from day zero (sfd)

MAIN  
1000.00

SPRT A  
...Selective Printout Option  
A - Print at all cross sections

=====

TIME STEP # 4  
Q B FLOW 4 = NEAR BANK FULL Q, LAKE LOWERED.  
COMPUTING FROM TIME= 101.2000 DAYS TO TIME= 121.2000 DAYS IN 20 COMPUTATION STEPS

EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.  
ACCUMULATED TIME (yrs).... 0.332  
FLOW DURATION (days)..... 1.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment #	1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
Section No.	58.000			
	INFLOW	1250.00	890.88	65.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1  
EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.  
ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME DAYS	ENTRY POINT	INFLOW	CLAY OUTFLOW	TRAP EFF *	INFLOW	SILT OUTFLOW	TRAP EFF *	INFLOW	SAND OUTFLOW	TRAP EFF *
121.20	58.000 *	24.35	24.08	0.01 *	47.41	40.90	0.14 *	12.06	23.31	-0.93 *
TOTAL=	1.000 *	24.35	24.08	0.01 *	47.41	40.90	0.14 *	12.06	23.31	-0.93 *

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.....	131.86	COARSE SAND.....	12.75
VERY FINE SILT...	128.18	VERY COARSE SAND..	2.87
FINE SILT.....	115.20	VERY FINE GRAVEL..	0.00
MEDIUM SILT.....	149.14	FINE GRAVEL.....	0.00
COARSE SILT.....	163.84	MEDIUM GRAVEL....	0.00
VERY FINE SAND...	98.84	COARSE GRAVEL.....	0.00
FINE SAND.....	61.46	VERY COARSE GRAVEL	0.00
MEDIUM SAND.....	26.75		
		TOTAL = 890.88	
SEDIMENT OUTFLOW from the Downstream Boundary			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.....	131.86	COARSE SAND.....	766.23
VERY FINE SILT...	128.18	VERY COARSE SAND..	223.60
FINE SILT.....	115.20	VERY FINE GRAVEL..	0.27
MEDIUM SILT.....	149.14	FINE GRAVEL.....	0.18
COARSE SILT.....	163.84	MEDIUM GRAVEL....	0.00
VERY FINE SAND...	124.04	COARSE GRAVEL.....	0.00
FINE SAND.....	317.26	VERY COARSE GRAVEL	0.00
MEDIUM SAND.....	833.35		
		TOTAL = 2953.15	

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 121.200 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day)		
					CLAY	SILT	SAND
58.000	-1.32	980.72	974.08	1250.	132.	556.	225.
55.000	-0.89	979.73	972.01	1250.	132.	556.	581.
53.000	-0.28	975.71	971.92	1250.	132.	556.	888.
44.000	0.10	973.98	967.20	1250.	132.	556.	1078.
42.000	0.06	971.56	969.86	1250.	132.	556.	1029.
32.000	-0.23	964.05	956.27	1250.	132.	556.	1091.
15.000	-0.96	959.43	952.74	1250.	132.	556.	2278.
1.000	1.63	953.19	946.33	1250.	132.	556.	2265.

=====

TIME STEP # 5  
 Q B FLOW 5 = LAST FLOW BASE FLOW OF 750 CFS, LAKE IS LOWERED.  
 COMPUTING FROM TIME= 121.2000 DAYS TO TIME= 141.2000 DAYS IN 10 COMPUTATION STEPS

-----

EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.  
 ACCUMULATED TIME (yrs).... 0.387  
 FLOW DURATION (days)..... 2.000

UPSTREAM BOUNDARY CONDITIONS

Stream Segment #	1	DISCHARGE (cfs)	SEDIMENT LOAD (tons/day)	TEMPERATURE (deg F)
Section No.	58.000			
	INFLOW	750.00	373.33	65.00

TABLE SA-1. TRAP EFFICIENCY ON STREAM SEGMENT # 1  
 EXAMPLE PROBLEM NO 7. COHESIVE SEDIMENT.  
 ACCUMULATED AC-FT ENTERING AND LEAVING THIS STREAM SEGMENT

TIME DAYS	ENTRY POINT	CLAY INFLOW	CLAY OUTFLOW	TRAP EFF *	SILT INFLOW	SILT OUTFLOW	TRAP EFF *	SAND INFLOW	SAND OUTFLOW	TRAP EFF *
141.20	58.000	26.17	25.90	0.01	50.82	44.32	0.13	12.78	32.67	-1.56
TOTAL=	1.000	26.17	25.90	0.01	50.82	44.32	0.13	12.78	32.67	-1.56

TABLE SB-1: SEDIMENT LOAD PASSING THE BOUNDARIES OF STREAM SEGMENT # 1

SEDIMENT INFLOW at the Upstream Boundary:			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.....	59.51	COARSE SAND.....	0.09
VERY FINE SILT....	60.24	VERY COARSE SAND..	0.02
FINE SILT.....	51.29	VERY FINE GRAVEL..	0.00
MEDIUM SILT.....	63.35	FINE GRAVEL.....	0.00
COARSE SILT.....	66.69	MEDIUM GRAVEL....	0.00
VERY FINE SAND...	38.05	COARSE GRAVEL....	0.00
FINE SAND.....	24.05	VERY COARSE GRAVEL	0.00
MEDIUM SAND.....	10.03		
		TOTAL =	373.33
SEDIMENT OUTFLOW from the Downstream Boundary			
GRAIN SIZE	LOAD (tons/day)	GRAIN SIZE	LOAD (tons/day)
CLAY.....	59.51	COARSE SAND.....	334.69
VERY FINE SILT....	60.24	VERY COARSE SAND..	120.51
FINE SILT.....	51.29	VERY FINE GRAVEL..	0.21
MEDIUM SILT.....	63.35	FINE GRAVEL.....	0.10
COARSE SILT.....	66.69	MEDIUM GRAVEL....	0.00
VERY FINE SAND...	40.39	COARSE GRAVEL....	0.00
FINE SAND.....	51.68	VERY COARSE GRAVEL	0.00
MEDIUM SAND.....	156.84		
		TOTAL =	1005.51

TABLE SB-2: STATUS OF THE BED PROFILE AT TIME = 141.200 DAYS

SECTION NUMBER	BED CHANGE (ft)	WS ELEV (ft)	THALWEG (ft)	Q (cfs)	TRANSPORT RATE (tons/day)		
					CLAY	SILT	SAND
58.000	-1.76	978.97	973.64	750.	60.	242.	168.
55.000	-1.15	978.10	971.75	750.	60.	242.	254.
53.000	-0.57	974.57	971.63	750.	60.	242.	507.
44.000	0.12	973.19	967.22	750.	60.	242.	437.
42.000	0.03	970.80	969.83	750.	60.	242.	532.
32.000	-0.23	962.77	956.27	750.	60.	242.	558.
15.000	-1.13	958.12	952.57	750.	60.	242.	582.
1.000	1.09	951.91	945.79	750.	60.	242.	704.

SSEND

0 DATA ERRORS DETECTED.

TOTAL NO. OF TIME STEPS READ = 5  
 TOTAL NO. OF WS PROFILES = 42  
 ITERATIONS IN EXNER EQ = 1680

COMPUTATIONS COMPLETED  
 RUN TIME = 0 HOURS, 0 MINUTES & 10.00 SECONDS