1. Problem # 8.2.2

Use the level pool routing method to route the hydrograph given below through the reservoir whose storage-outflow characteristics are given in Prob. 8.2.1. What is the maximum reservoir discharge and storage? Assume that the reservoir initially contains $75 \times 10^6 m^3$ of storage.

Time (h)	**0**	**2**	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**
Inflow (m^3/s)	**60**	**100**	**232**	**300**	**520**	**1,310**	**1,930**	**1,460**	**930**	**650**

Storage (10^6 m^3)	**75**	**81**	**87.5**	**100**	**110.2**
Outflow (m^3/s)	**57**	**227**	**519**	**1330**	**2270**

$\Delta t = 2h = 7{,}200s$

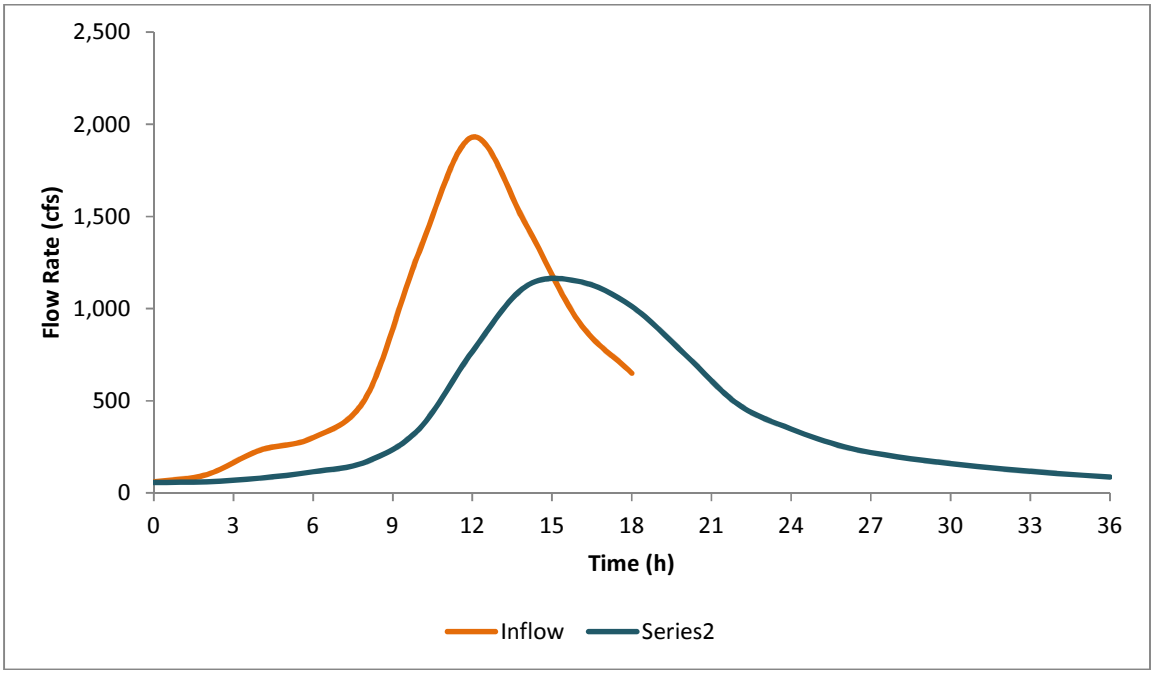
Discharge (m3/s)	Storage (m3)	2S/Δt + Q
57	75,000,000	20,890
227	81,000,000	22,727
519	87,500,000	24,825
1,330	100,000,000	29,108
2,270	110,200,000	32,881

Initial Storage = $75x10^6 m^3$
(Initial Outflow = $57 m^3/s$)

Time Index j	Time (h)	Inflow (m3/s)	I_j+I_{j+1} (m3/s)	$2S_j/\Delta t - Q_j$	$2S_{j+1}/\Delta t + Q_{j+1}$	Outflow Q_j(m3/s)
1	0	60		20,776		57.0
2	2	100	160	20,814	20,936	61.3
3	4	232	332	20,985	21,146	80.6
4	6	300	532	21,287	21,517	115.0
5	8	520	820	21,767	22,107	169.6
6	10	1310	1830	22,901	23,597	348.2
7	12	1930	3240	24,604	26,141	768.3
8	14	1460	3390	25,756	27,994	1,119.2
9	16	930	2390	25,850	28,146	**1,147.9**
10	18	650	1580	25,406	27,430	1,012.3
11	20		650	24,551	26,056	752.1
12	22			23,589	24,551	481.0
13	24			22,895	23,589	347.0
14	26			22,395	22,895	250.4
15	28			22,002	22,395	196.2
16	30			21,682	22,002	159.9
17	32			21,422	21,682	130.3
18	34			21,209	21,422	106.2
19	36			21,036	21,209	86.5

Maximum Discharge: 1,148m^3/s

Maximum Storage: 97,193,000m^3
(Interpolating values in the first table for Maximum discharge)



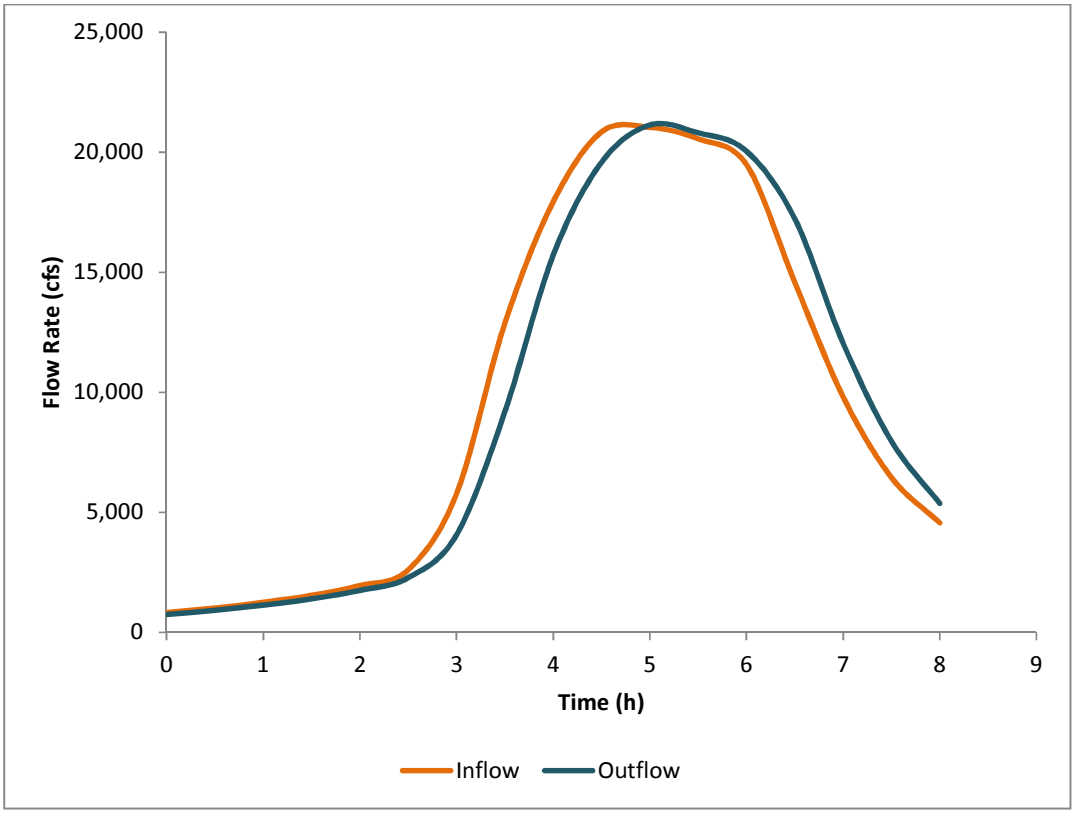
2. Problem # 8.4.4
A 4400-foot reach of channel has a Muskingum $K = 0.24$ and $X = 0.25$. Route the following inflow hydrograph through this reach. Assume the initial outflow =739cfs.

Time (h)	**0**	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
Inflow (cfs)	**819**	**1,012**	**1,244**	**1,537**	**1,948**	**2,600**	**5,769**
Time	**3.5**	**4.0**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**
Inflow	**12,866**	**17,929**	**20,841**	**21,035**	**20,557**	**19,485**	**14,577**
Time	**7.0**	**7.5**	**8.0**				
Inflow	**9,810**	**6,448**	**4,558**				

K= 0.24
X= 0.25
Initial Outflow= 739 cfs

$$C_1 = \frac{\Delta t - 2KX}{2K(1-X) + \Delta t} = \frac{0.5 - 2(0.24)(0.25)}{2(0.24)(1-0.25) + 0.5} = 0.44$$
$$C_2 = \frac{\Delta t + 2KX}{2K(1-X) + \Delta t} = \frac{0.5 + 2(0.24)(0.25)}{2(0.24)(1-0.25) + 0.5} = 0.72$$
$$C_3 = \frac{2K(1-X) - \Delta t}{2K(1-X) + \Delta t} = \frac{2(0.24)(1-0.25) - 0.5}{2(0.24)(1-0.25) + 0.5} = -0.16$$

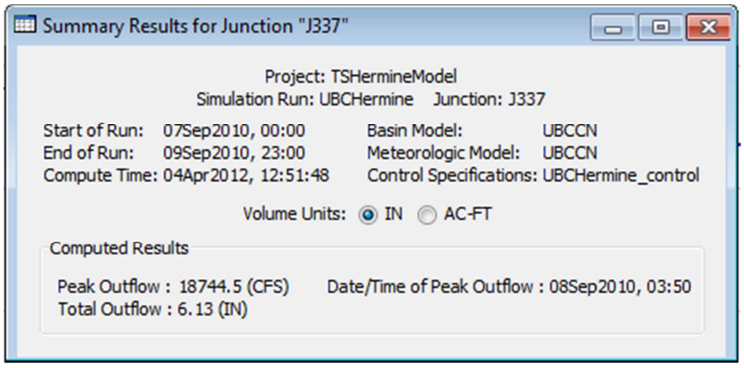
Routing Period j	Time (h)	Inflow I_j (cfs)	$C1*I_{j+1}$	$C2*I_j$	$C3*Q_j$	Outflow Q (cfs)
1	0.0	819				739
2	0.5	1012	447	590	- 120	917
3	1.0	1244	550	730	- 149	1,130
4	1.5	1537	679	897	- 184	1,392
5	2.0	1948	861	1,108	- 227	1,742
6	2.5	2600	1,149	1,404	- 284	2,270
7	3.0	5769	2,549	1,874	- 369	4,054
8	3.5	12866	5,685	4,159	- 660	9,184
9	4.0	17929	7,922	9,275	- 1,495	15,703
10	4.5	20841	9,209	12,926	- 2,556	19,578
11	5.0	21035	9,295	15,025	- 3,187	21,132
12	5.5	20557	9,083	15,165	- 3,440	20,808
13	6.0	19485	8,610	14,820	- 3,387	20,042
14	6.5	14577	6,441	14,047	- 3,263	17,226
15	7.0	9810	4,335	10,509	- 2,804	12,039
16	7.5	6448	2,849	7,072	- 1,960	7,962
17	8.0	4558	2,014	4,649	- 1,296	5,366



3. “Texas Megadrought” summary

4.a During Tropical Storm Hermine, what was the peak discharge (cfs) that occurred at Walsh Dr? What proportion of the runoff came from the North Branch and the South Branch of Brushy Creek? Were the peak flows coincident from both branches? (Show a graph to discuss this).

Peak Discharge at Walsh Dr. = **18,744.5 cfs**

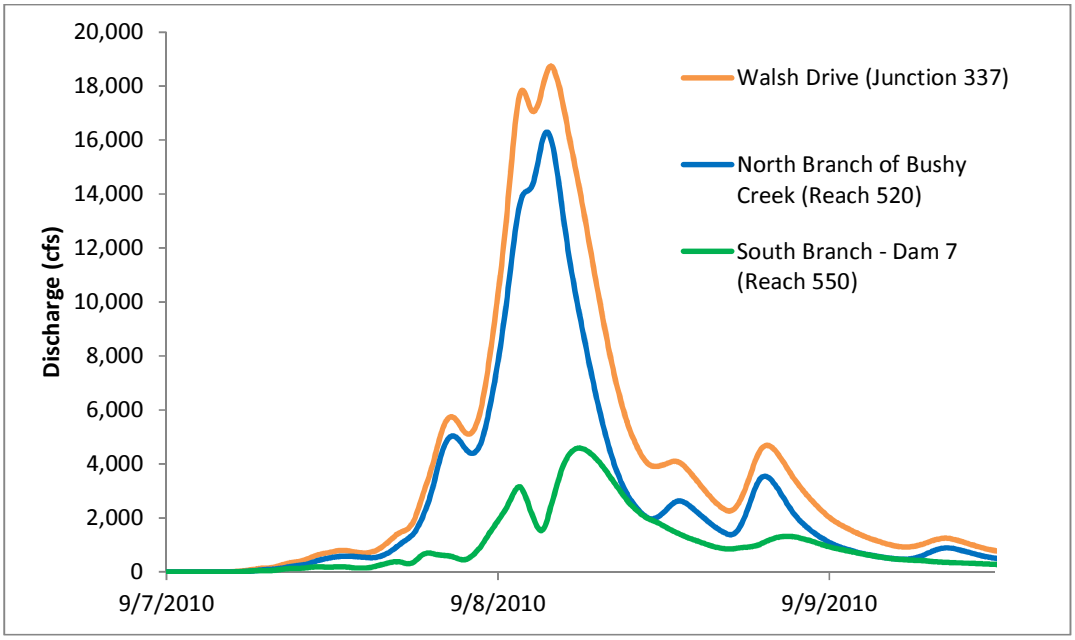


The peak occurred at 9/8/2010 3:50:00 AM. The discharges are summarized in the following table:

Element	Discharge
Walsh Drive (Junction 337)	18,744.5
North Branch (Reach 520)	16,048.6
South Branch (Reach 550)	2,425.1

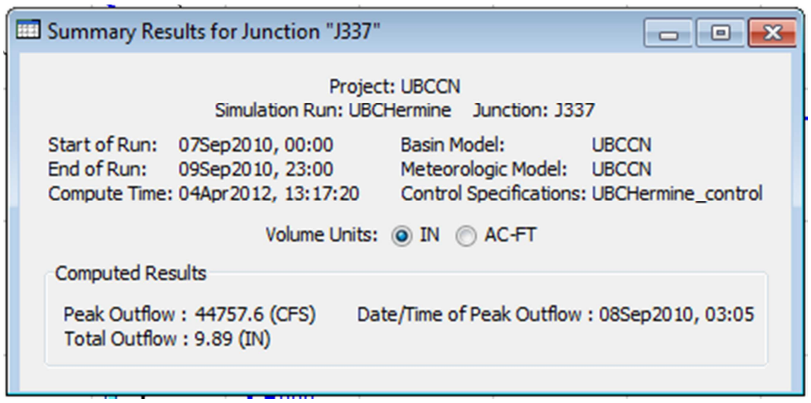
Proportion from North Branch (Reach 520) = 16,299.8/18,744.5 = **87%**

Proportion from South Branch (Reach 550) = 2,425.1/18,744.5 = **13%**



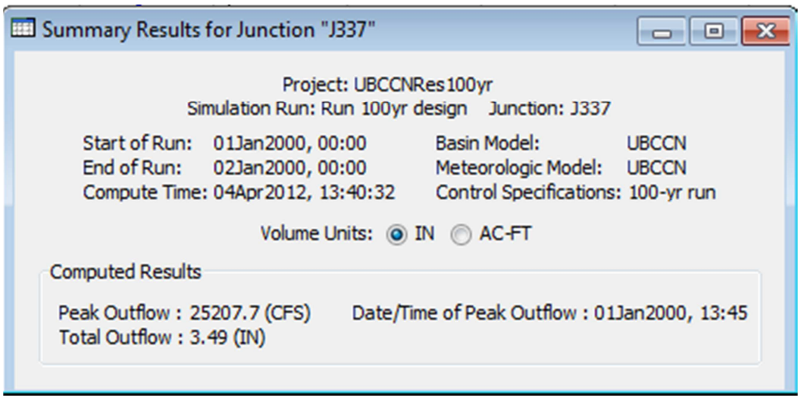
4.b If the flood control reservoirs did not exist, what would have been the peak discharge at Walsh Dr?

Peak Discharge at Walsh Dr. = **44,757.6 cfs** (without reservoir)



4.c During a 100-year flood, what is the peak discharge (cfs) at Walsh Dr?

Peak Discharge = 25,207.7 cfs (without reservoir)



4.d Please fill in the values in the following table:

Brushy Creek	**Peak Discharge (cfs)**			
	Hermine	Hermine with Dams	100-year	100-year with dams
J337	44,757.6	18,744.5	71,508.6	25,207.7
R520	30,637.6	16,299.8	48,258.5	21,739.8
R550	15,354.8	4,587.5	23,586.9	4,298.8
W1300	**Storm Precipitation and Losses (in)**			
	Hermine	100-year		
Total Precip	12.25	10.20		
Loss	2.35	2.27		
Excess Precip	9.90	7.93		

4.e Comments