A

Seminar report

On

Hydrology

Submitted in partial fulfillment of the requirement for the award of degree
Of Civil

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Preface

I have made this report file on the topic **Hydrology**; I have tried my best to elucidate all the relevant detail to the topic to be included in the report. While in the beginning I have tried to give a general view about this topic.

My efforts and wholehearted co-corporation of each and everyone has ended on a successful note. I express my sincere gratitude to …………..who assisting me throughout the preparation of this topic. I thank him for providing me the reinforcement, confidence and most importantly the track for the topic whenever I needed it.

Acknowledgement

I would like to thank respected Mr…….. and Mr. ……..for giving me such a wonderful opportunity to expand my knowledge for my own branch and giving me guidelines to present a seminar report. It helped me a lot to realize of what we study for.

Secondly, I would like to thank my parents who patiently helped me as i went through my work and helped to modify and eliminate some of the irrelevant or un-necessary stuffs.

Thirdly, I would like to thank my friends who helped me to make my work more organized and well-stacked till the end.

Next, I would thank Microsoft for developing such a wonderful tool like MS Word. It helped my work a lot to remain error-free.

Last but clearly not the least, I would thank The Almighty for giving me strength to complete my report on time.

Content

Introduction

Engineering or applied hydrology – a study concerned with engineering application like design dam, our seminar given realistic case study (of catchment) in west bank. In our seminar we want to calculate the peak flow that produced from the excess rainfall at the area that we want to design the Dam.

Precipitation

The atmospheric air always contains moisture. Evaporation from the oceans is the major source (about 90%) of the atmospheric moisture for precipitation. Continental evaporation contributes only about 10% of the atmospheric moisture for precipitation. The atmosphere contains the moisture even on days of bright sun-shine. However, for the occurrence of precipitation, some mechanism is required to cool the atmospheric air sufficiently to bring it to (or near) saturation.

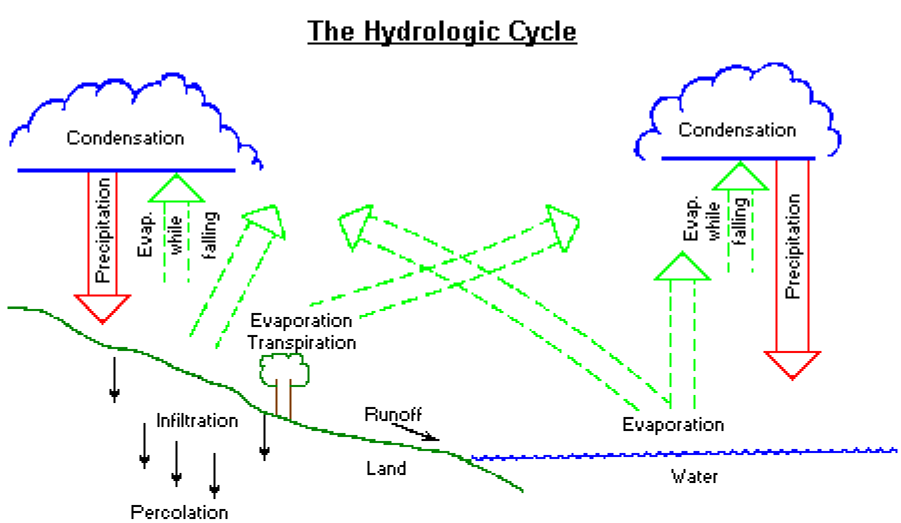
Applications

- Determining the water balance of a region.
- Determining the agricultural water balance.
- Designing riparian restoration projects.
- Mitigating and predicting flood, landslide and drought risk.
- Real-time flood forecasting and flood warning.
- Designing irrigation schemes and managing agricultural productivity.
- Part of the hazard module in catastrophe modeling.
- Providing drinking water.
- Designing dams for water supply or hydroelectric power generation.
- Designing bridges.
- Designing sewers and urban drainage system.
- Analyzing the impacts of antecedent moisture on sanitary sewer systems.
- Predicting geomorphologic changes, such as erosion or sedimentation.
- Assessing the impacts of natural and anthropogenic environmental change on water resources.
- Assessing contaminant transport risk and establishing environmental policy guidelines.

The Hydrologic Cycle

The hydrologic cycle is a very important scientific process. Without it, there would not be precipitation (rain, snow, sleet, etc.). Without precipitation, plant life would not grow and produce oxygen. And without oxygen, humans could not live. Here's how the hydrologic process works:

1. Water vapor enters the atmosphere by **evaporation** and **transpiration**. Evaporation is the process of water (oceans, lakes, rivers, etc.) changing into water vapor, while transpiration is the discharging of water vapor into the atmosphere from living vegetation such as leaves, grass, etc.
2. Once water vapor enters the atmosphere, it rises and cools. As the water vapor cools, **condensation** (change from water vapor into liquid water) begins to form small drops of water. These small droplets of water are what you look at when you see a cloud. As these droplets bounce around and hit one another, they stick together and make larger drops.
3. When the drops of water become too heavy to be held up, they fall back to the earth. Depending on the temperature, it can fall as rain, snow, sleet, and many other forms of **precipitation**.
4. Once the precipitation hits the ground, it begins to seep into the ground. This process is called **infiltration**. But the soil can hold only so much water. And when the ground becomes saturated, the excess water drains into lakes, rivers, oceans, etc. This excess water is called runoff. Then the hydrologic cycle starts all over again.

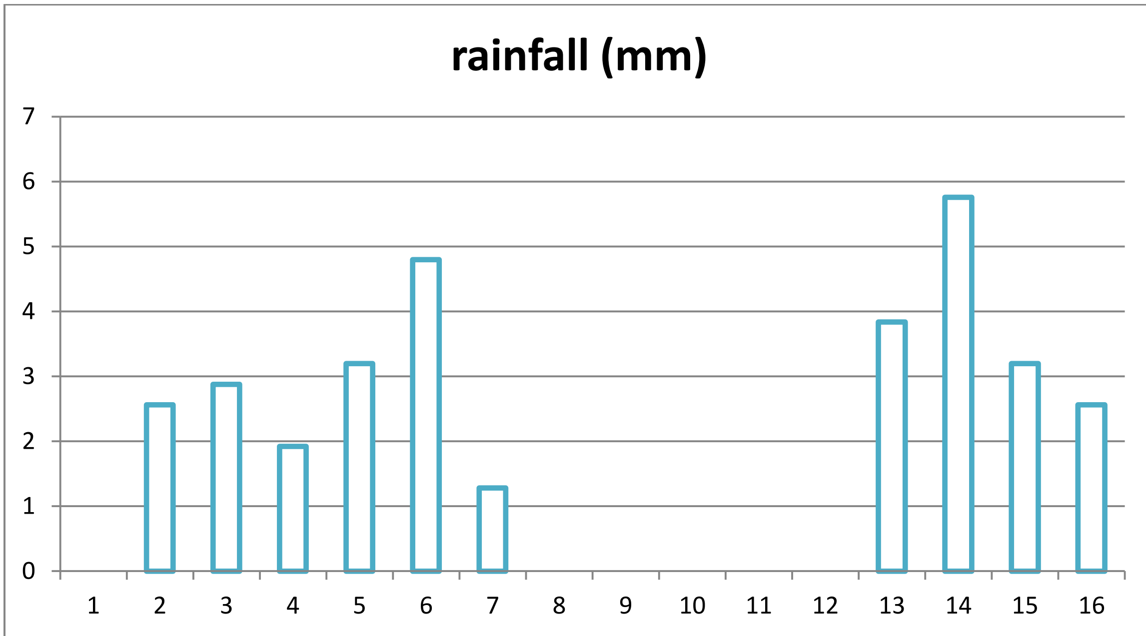


Project Analysis

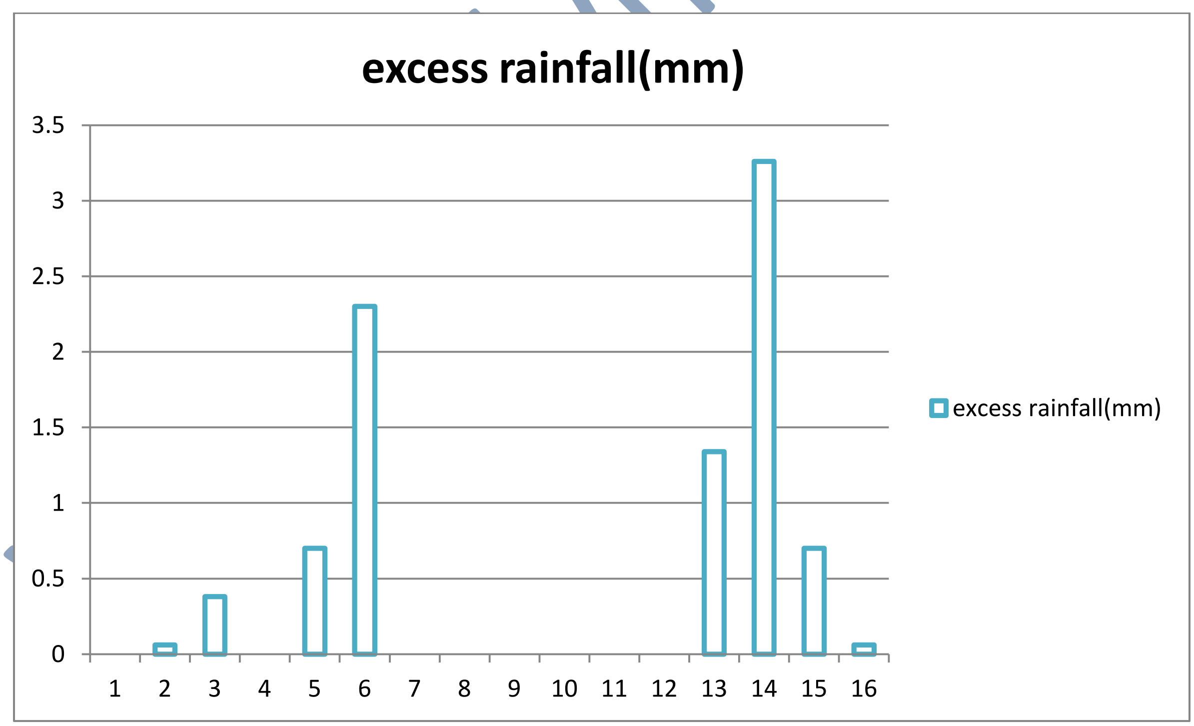
To estimate the volume, calculate each value for each hour of total rainfall by multiplying the percentage of rainfall by total amount of rainfall (32mm). Calculate the excess rainfall from the total rainfall by subtracting the losses (Φ-index which 2.5mm/hr) from each value for each hour of total rainfall which is not less than 2.5mm/hr.

Data analysis

time (hr)	rainfail(%)	R (mm)	rainfall%*R = rainfall(mm)	φ-index	excess rainfall(mm)
1	0	32	0	2.5	0
2	8	32	2.56	2.5	0.06
3	9	32	2.88	2.5	0.38
4	6	32	1.92	2.5	0
5	10	32	3.2	2.5	0.7
6	15	32	4.8	2.5	2.3
7	4	32	1.28	2.5	0
8	0	32	0	2.5	0
9	0	32	0	2.5	0
10	0	32	0	2.5	0
11	0	32	0	2.5	0
12	0	32	0	2.5	0
13	12	32	3.84	2.5	1.34
14	18	32	5.76	2.5	3.26
15	10	32	3.2	2.5	0.7
16	8	32	2.56	2.5	0.06
sum			32	depth of DRO =	8.8



rainfall (mm)
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16



excess rainfall(mm)
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
excess rainfall(mm)

- Estimate the volume of direct runoff and volume of infiltration (in million cubic meters) for 1 and 2 sub-catchments.

V= d*A

depth under φ-index
23.2
depth of excess rainfall
8.8

Sub.	Area(KM²)	vol. of infil.m³	vol. of dir. runoff m³	vol. of infil. Mm³	vol. of dir.runoff Mm³
1	84	1948800	739200	1.9488	0.7392
2	64	1484800	563200	1.4848	0.5632

- We calculate the hydrograph then estimate the volume of direct runoff from hydrograph (Compare your results with those of part 1.) Will be discussed in discussion and conclusion part(1).

We have 1 h.u.H , and the storm divide by 1 hr so, we don't need convert between D h.u.H.

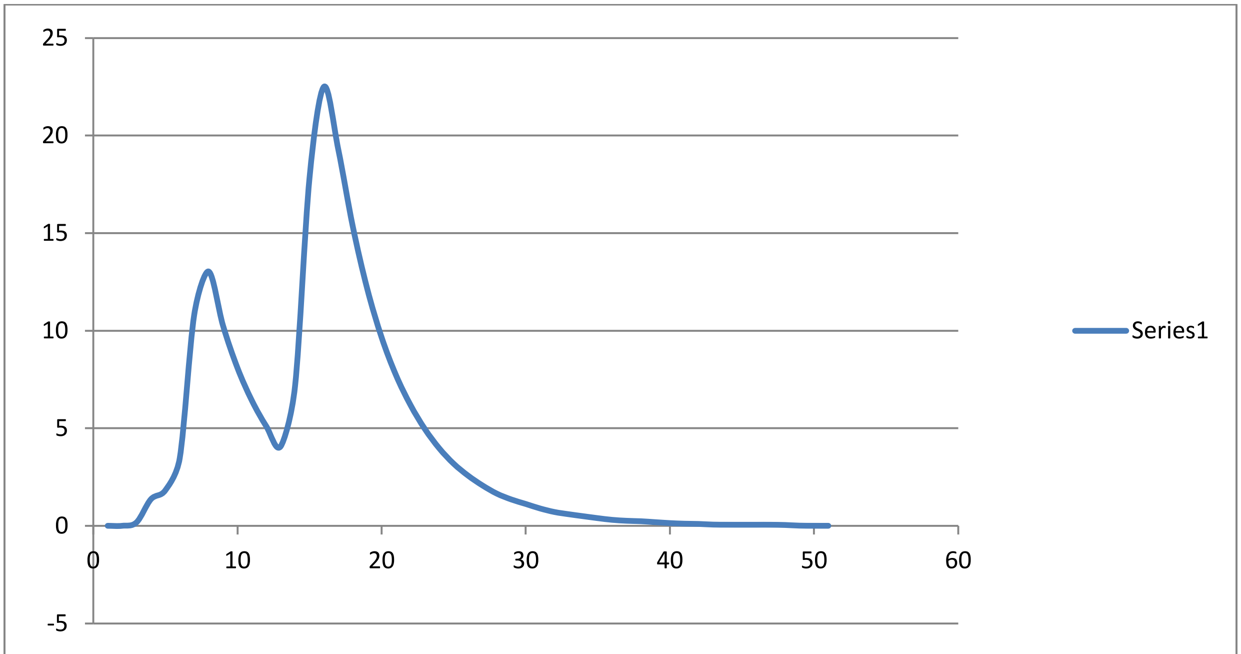
for sub-catchment 1 and 2 as follow:

For 1:

hydrograph for 1									
time	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	sum
1									0
2	0								0
3	0.1746	0							0.1746
4	0.2556	1.1058							1.3614
5	0.201	1.6188	0						1.8198
6	0.1584	1.273	2.037	0					3.4684
7	0.1254	1.0032	2.982	6.693					10.804
8	0.0996	0.7942	2.345	9.798					13.03

									7
9	0.0792	0.6308	1.848	7.705					10.263
10	0.0636	0.5016	1.463	6.072					8.1002
11	0.051	0.4028	1.162	4.807					6.4228
12	0.0408	0.323	0.924	3.818					5.1058
13	0.0324	0.2584	0.742	3.036	0				4.0688
14	0.0264	0.2052	0.595	2.438	3.8994	0			7.164
15	0.021	0.1672	0.476	1.955	5.7084	9.4866	0		17.814
16	0.0168	0.133	0.378	1.564	4.489	13.888	2.037	0	22.505
17	0.0138	0.1064	0.308	1.242	3.5376	10.921	2.982	0.1746	19.285
18	0.0114	0.0874	0.245	1.012	2.8006	8.6064	2.345	0.2556	15.363
19	0.009	0.0722	0.196	0.805	2.2244	6.8134	1.848	0.201	12.169
20	0.0072	0.057	0.161	0.644	1.7688	5.4116	1.463	0.1584	9.671
21	0.006	0.0456	0.133	0.529	1.4204	4.3032	1.162	0.1254	7.7246
22	0.0048	0.038	0.105	0.437	1.139	3.4556	0.924	0.0996	6.203
23	0.0042	0.0304	0.084	0.345	0.9112	2.771	0.742	0.0792	4.967
24	0.003	0.0266	0.07	0.276	0.7236	2.2168	0.595	0.0636	3.9746
25	0.0024	0.019	0.056	0.23	0.5896	1.7604	0.476	0.051	3.1844
26	0.0024	0.0152	0.049	0.184	0.469	1.4344	0.378	0.0408	2.5728
27	0.0018	0.0152	0.035	0.161	0.3752	1.141	0.308	0.0324	2.0696
28	0.0012	0.0114	0.028	0.115	0.3082	0.9128	0.245	0.0264	1.648
29	0.0012	0.0076	0.028	0.092	0.2546	0.7498	0.196	0.021	1.3502
30	0.0012	0.0076	0.021	0.092	0.201	0.6194	0.161	0.0168	1.12
31	0.0006	0.0076	0.014	0.069	0.1608	0.489	0.133	0.0138	0.8878
32	0.0006	0.0038	0.014	0.046	0.134	0.3912	0.105	0.0114	0.706
33	0.0006	0.0038	0.014	0.046	0.1072	0.326	0.084	0.009	0.5906
34	0.0006	0.0038	0.007	0.046	0.0938	0.2608	0.07	0.0072	0.489

									2
35	0.0006	0.0038	0.007	0.023	0.067	0.2282	0.056	0.006	0.391 6
36	0.0006	0.0038	0.007	0.023	0.0536	0.163	0.049	0.0048	0.304 8
37	0	0.0038	0.007	0.023	0.0536	0.1304	0.035	0.0042	0.257
38		0	0.007	0.023	0.0402	0.1304	0.028	0.003	0.231 6
39			0.007	0.023	0.0268	0.0978	0.028	0.0024	0.185
40			0	0.023	0.0268	0.0652	0.021	0.0024	0.138 4
41				0	0.0268	0.0652	0.014	0.0018	0.107 8
42					0.0134	0.0652	0.014	0.0012	0.093 8
43					0.0134	0.0326	0.014	0.0012	0.061 2
44					0.0134	0.0326	0.007	0.0012	0.054 2
45					0.0134	0.0326	0.007	0.0006	0.053 6
46					0.0134	0.0326	0.007	0.0006	0.053 6
47					0.0134	0.0326	0.007	0.0006	0.053 6
48					0	0.0326	0.007	0.0006	0.040 2
49						0	0.007	0.0006	0.007 6
50							0	0.0006	0.000 6
51								0	0
		Vol. dir.runof f	0.74923 2	Mm^3					208.1 2



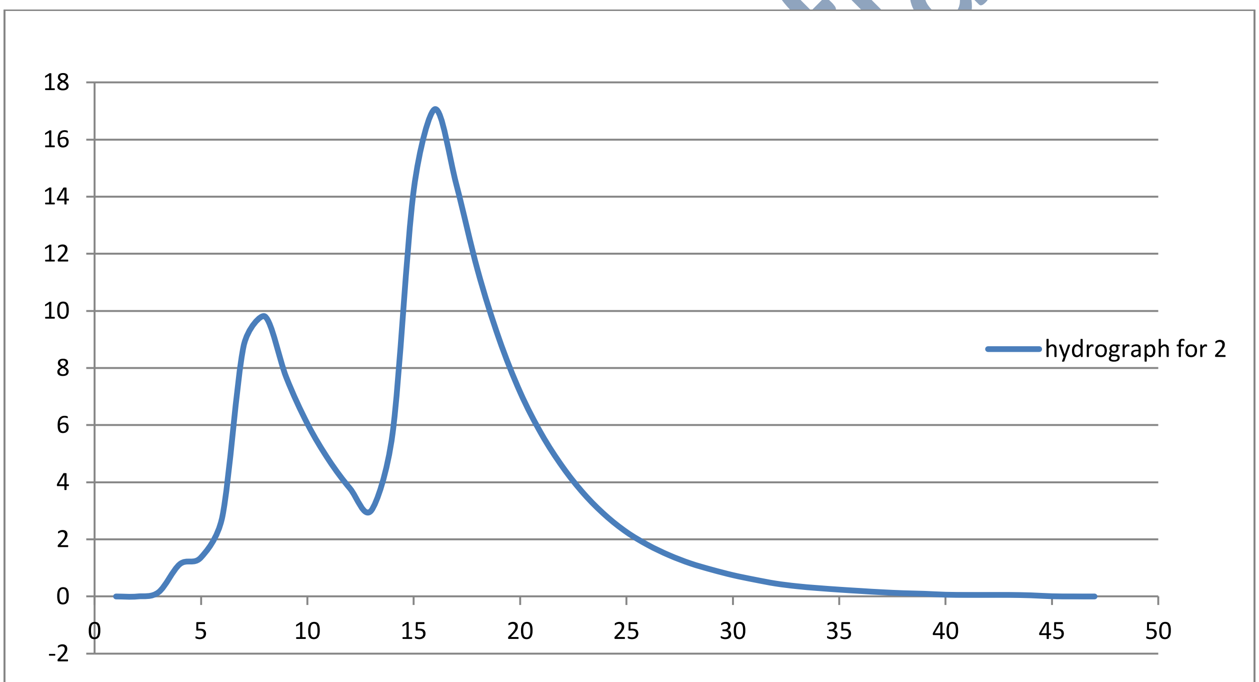
Hydrograph for sub-cat. 1

For 2:

hydrograph for 2									
time	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	sum
1									0
2	0								0
3	0.1482	0							0.1482
4	0.1926	0.9386							1.1312
5	0.1506	1.2198	0						1.3704
6	0.1182	0.9538	1.729	0					2.801
7	0.0936	0.7486	2.247	5.681					8.7702
8	0.0738	0.5928	1.757	7.383					9.8066
9	0.0588	0.4674	1.379	5.773					7.6782
10	0.0468	0.3724	1.092	4.531					6.0422
11	0.0372	0.2964	0.861	3.588					4.7826

12	0.0294	0.2356	0.686	2.829					3.78
13	0.0234	0.1862	0.546	2.254	0				3.0096
14	0.0186	0.1482	0.434	1.794	3.3098	0			5.7046
15	0.015	0.1178	0.343	1.426	4.3014	8.0522	0		14.255
16	0.012	0.095	0.273	1.127	3.3634	10.465	1.729	0	17.064
17	0.0096	0.076	0.217	0.897	2.6398	8.1826	2.247	0.1482	14.417
18	0.0078	0.0608	0.175	0.713	2.0904	6.4222	1.757	0.1926	11.419
19	0.006	0.0494	0.14	0.575	1.6482	5.0856	1.379	0.1506	9.0338
20	0.0048	0.038	0.112	0.46	1.3132	4.0098	1.092	0.1182	7.148
21	0.0036	0.0304	0.091	0.368	1.0452	3.1948	0.861	0.0936	5.6876
22	0.003	0.0228	0.07	0.299	0.8308	2.5428	0.686	0.0738	4.5282
23	0.0024	0.019	0.056	0.23	0.6566	2.0212	0.546	0.0588	3.59
24	0.0018	0.0152	0.042	0.184	0.5226	1.5974	0.434	0.0468	2.8438
25	0.0018	0.0114	0.035	0.138	0.4154	1.2714	0.343	0.0372	2.2532
26	0.0012	0.0114	0.028	0.115	0.335	1.0106	0.273	0.0294	1.8036
27	0.0012	0.0076	0.021	0.092	0.268	0.815	0.217	0.0234	1.4452
28	0.0006	0.0076	0.021	0.069	0.2144	0.652	0.175	0.0186	1.1582
29	0.0006	0.0038	0.014	0.069	0.1742	0.5216	0.14	0.015	0.9382
30	0.0006	0.0038	0.014	0.046	0.134	0.4238	0.112	0.012	0.7462
31	0.0006	0.0038	0.007	0.046	0.1072	0.326	0.091	0.0096	0.5912
32	0.0006	0.0038	0.007	0.023	0.0804	0.2608	0.07	0.0078	0.4534
33	0	0.0038	0.007	0.023	0.067	0.1956	0.056	0.006	0.3584
34		0	0.007	0.023	0.0536	0.163	0.042	0.0048	0.2934
35			0.007	0.023	0.0402	0.1304	0.035	0.0036	0.2392
36			0	0.023	0.0402	0.0978	0.028	0.003	0.192
37				0	0.0268	0.0978	0.021	0.0024	0.148
38					0.0268	0.0652	0.021	0.0018	0.1148
39					0.0134	0.0652	0.014	0.0018	0.0944
40					0.0134	0.0326	0.014	0.0012	0.0612

41					0.0134	0.0326	0.007	0.0012	0.0542
42					0.0134	0.0326	0.007	0.0006	0.0536
43					0.0134	0.0326	0.007	0.0006	0.0536
44					0	0.0326	0.007	0.0006	0.0402
45						0	0.007	0.0006	0.0076
46							0	0.0006	0.0006
47								0	0
		Vol. dir.runoff	0.562003	Mm³					156.11

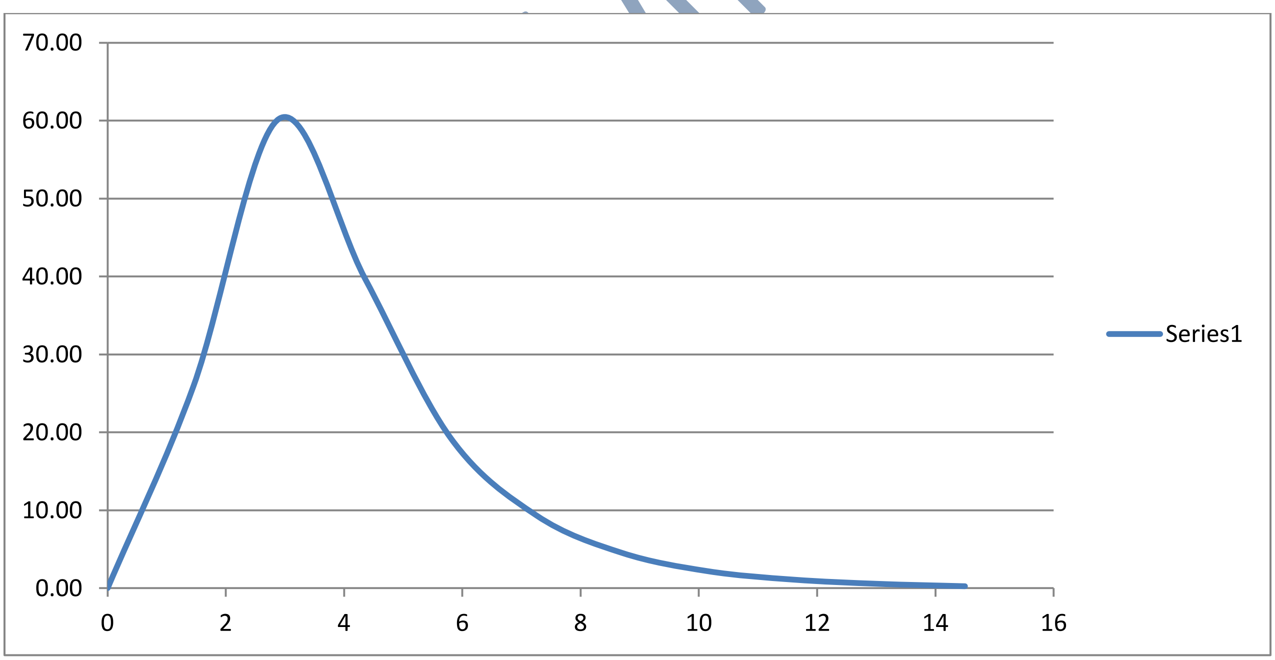


Hydrograph for sub-cat. 2

- We use the SCS method to derive a 1hr-UH using the SCS method (Compare your results with the given UHs.) Will be discussed in discussion and conclusion(2). By using SCS Dimensionless method unit hydrograph, this method is analyzed and illustrated in the next tables.

For 1:

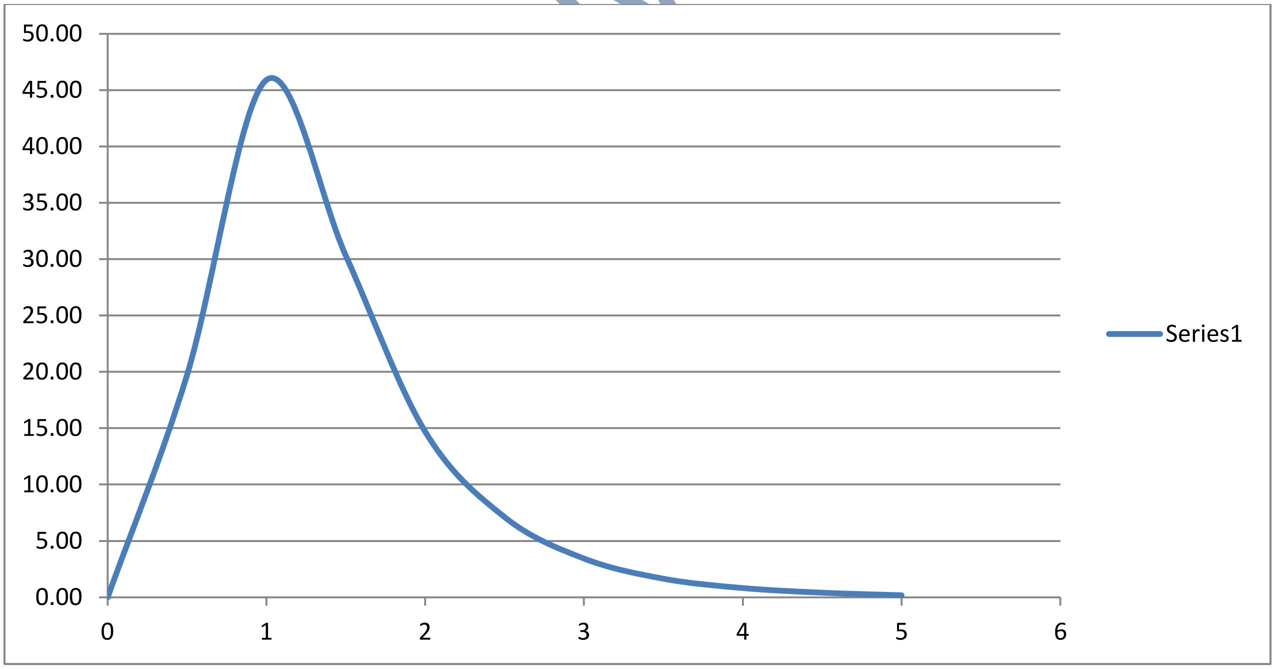
Assume tc=4 hr		1 h.u.h		**T/Tp**	**Q/Qp**	**T (hr)**	**Q (m^3/s)**
tr=1 hr				**0**	**0**	**0**	**0.00**
Tp=	2.9	hr		**0.5**	**0.43**	**1.45**	**25.91**
Tb=	7.743	hr		**1**	**1**	**2.9**	**60.25**
Qp=	60.24828	m^3/s		**1.5**	**0.66**	**4.35**	**39.76**
				2	**0.32**	**5.8**	**19.28**
				2.5	**0.155**	**7.25**	**9.34**
				3	**0.075**	**8.7**	**4.52**
				3.5	**0.036**	**10.15**	**2.17**
				4	**0.018**	**11.6**	**1.08**
				4.5	**0.009**	**13.05**	**0.54**
				5	**0.004**	**14.5**	**0.24**



1hr-UH using the SCS method for 1

For 2:

Assume tc=4 hr		1 h.u.h		**T/Tp**	**Q/Qp**	**T (hr)**	**Q (m^3/s)**
tr=1 hr				**0**	**0**	**0**	**0.00**
Tp=	2.9	hr		**0.5**	**0.43**	**1.45**	**19.74**
Tb=	7.743	hr		**1**	**1**	**2.9**	**45.90**
Qp=	45.90345	m^3/s		**1.5**	**0.66**	**4.35**	**30.30**
				2	**0.32**	**5.8**	**14.69**
				2.5	**0.155**	**7.25**	**7.12**
				3	**0.075**	**8.7**	**3.44**
				3.5	**0.036**	**10.15**	**1.65**
				4	**0.018**	**11.6**	**0.83**
				4.5	**0.009**	**13.05**	**0.41**
				5	**0.004**	**14.5**	**0.18**



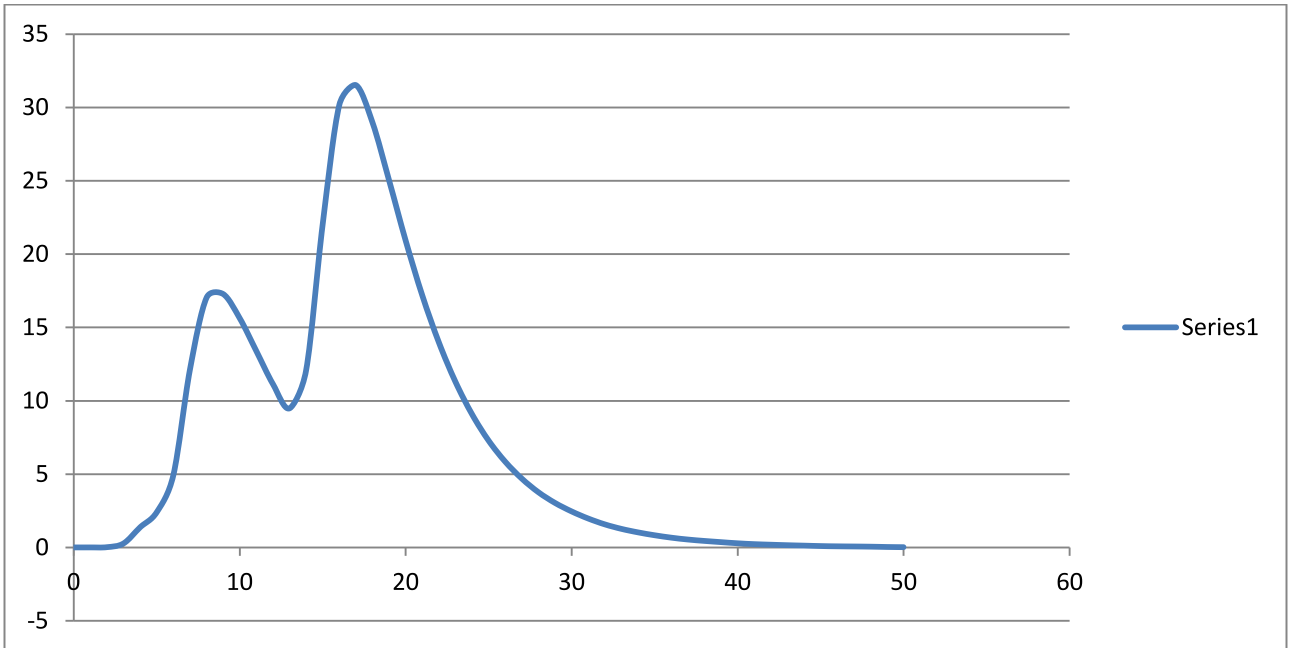
1hr-UH using the SCS method for 2

- we calculate the hydrograph after 3km because we want to design the dam as follow, first we calculate the constant for the equation

k=	2
x =	0.2
t	1
Kx=	0.4
k-kx+.5t	2.1
C0	0.05
C1	0.43
C2	0.52
	1

sub	1	2					
t(hr)	Q1(m3/s)	Q2(m3/s)	∑(Q1+Q2)	C_oI_2	C_1I_1	C_2O_1	O_2
0	0	0	0	0			0
1	0	0	0	0	0	0	0
2	0.1746	0.1482	0.3228	0.01614	0	0	0.01614
3	1.3614	1.1312	2.4926	0.12463	0.138804	0.008393	0.271827
4	1.8198	1.3704	3.1902	0.15951	1.071818	0.14135	1.372678
5	3.4684	2.801	6.2694	0.31347	1.371786	0.713793	2.399049
6	10.8036	8.7702	19.5738	0.97869	2.695842	1.247505	4.922037
7	13.0368	9.8066	22.8434	1.14217	8.416734	2.559459	12.11836
8	10.263	7.6782	17.9412	0.89706	9.822662	6.301549	17.02127
9	8.1002	6.0422	14.1424	0.70712	7.714716	8.851061	17.2729
10	6.4228	4.7826	11.2054	0.56027	6.081232	8.981906	15.62341
11	5.1058	3.78	8.8858	0.44429	4.818322	8.124172	13.38678
12	4.0688	3.0096	7.0784	0.35392	3.820894	6.961128	11.13594
13	7.164	5.7046	12.8686	0.64343	3.043712	5.79069	9.477832
14	17.8142	14.2554	32.0696	1.60348	5.533498	4.928473	12.06545
15	22.5054	17.064	39.5694	1.97847	13.78993	6.274034	22.04243
16	19.2854	14.4172	33.7026	1.68513	17.01484	11.46206	30.16204
17	15.3634	11.4188	26.7822	1.33911	14.49212	15.68426	31.51549
18	12.169	9.0338	21.2028	1.06014	11.51635	16.38805	28.96454
19	9.671	7.148	16.819	0.84095	9.117204	15.06156	25.01971
20	7.7246	5.6876	13.4122	0.67061	7.23217	13.01025	20.91303

21	6.203	4.5282	10.7312	0.53656	5.767246	10.87478	17.17858
22	4.967	3.59	8.557	0.42785	4.614416	8.932863	13.97513
23	3.9746	2.8438	6.8184	0.34092	3.67951	7.267067	11.2875
24	3.1844	2.2532	5.4376	0.27188	2.931912	5.869498	9.07329
25	2.5728	1.8036	4.3764	0.21882	2.338168	4.718111	7.275099
26	2.0696	1.4452	3.5148	0.17574	1.881852	3.783051	5.840643
27	1.648	1.1582	2.8062	0.14031	1.511364	3.037135	4.688809
28	1.3502	0.9382	2.2884	0.11442	1.206666	2.43818	3.759266
29	1.12	0.7462	1.8662	0.09331	0.984012	1.954819	3.032141
30	0.8878	0.5912	1.479	0.07395	0.802466	1.576713	2.453129
31	0.706	0.4534	1.1594	0.05797	0.63597	1.275627	1.969567
32	0.5906	0.3584	0.949	0.04745	0.498542	1.024175	1.570167
33	0.4892	0.2934	0.7826	0.03913	0.40807	0.816487	1.263687
34	0.3916	0.2392	0.6308	0.03154	0.336518	0.657117	1.025175
35	0.3048	0.192	0.4968	0.02484	0.271244	0.533091	0.829175
36	0.257	0.148	0.405	0.02025	0.213624	0.431171	0.665045
37	0.2316	0.1148	0.3464	0.01732	0.17415	0.345823	0.537293
38	0.185	0.0944	0.2794	0.01397	0.148952	0.279393	0.442315
39	0.1384	0.0612	0.1996	0.00998	0.120142	0.230004	0.360126
40	0.1078	0.0542	0.162	0.0081	0.085828	0.187265	0.281193
41	0.0938	0.0536	0.1474	0.00737	0.06966	0.146221	0.223251
42	0.0612	0.0536	0.1148	0.00574	0.063382	0.11609	0.185212
43	0.0542	0.0402	0.0944	0.00472	0.049364	0.09631	0.150394
44	0.0536	0.0076	0.0612	0.00306	0.040592	0.078205	0.121857
45	0.0536	0.0006	0.0542	0.00271	0.026316	0.063366	0.092392
46	0.0536	0	0.0536	0.00268	0.023306	0.048044	0.07403
47	0.0402	0	0.0402	0.00201	0.023048	0.038495	0.063553
48	0.0076	0	0.0076	0.00038	0.017286	0.033048	0.050714
49	0.0006	0	0.0006	0.00003	0.003268	0.026371	0.029669
50	0	0	0	0	0.000258	0.015428	0.015686
						total=	364.215



Hydrograph after 3 Km that produce from storm

Discussion and Conclusion:

(1) From part 1, the volume of direct runoff and volume of infiltration (in million cubic meters) for 1 and 2 sub-catchments.

Sub.	vol. of dir.runoff Mm³
1	0.7392
2	0.5632

From part 3, the volume of direct runoff from hydrograph (in million cubic meters) for 1 and 2 sub-catchments.

Sub.	vol. of dir.runoff Mm³
1	0.749232
2	0.562003

By comparing between it, approximate equal but there very small error , this inequality is because the depth of the given 1-mm UH for each catchment doesn't equal 1-mm.

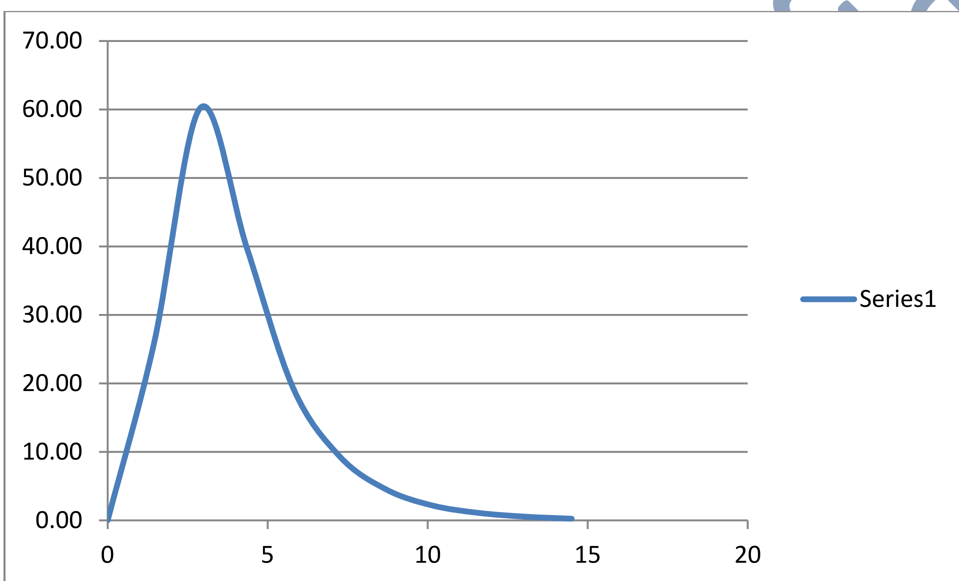
(2) Compare between derive a 1hr-UH using the SCS method and results with the given UHs.

From 1hr-UH using the SCS method:
Catchment 1:

Tp=	2.9	hr
Tb=	7.743	hr
Qp=	60.24828	m^3/s

From given 1hr-UH

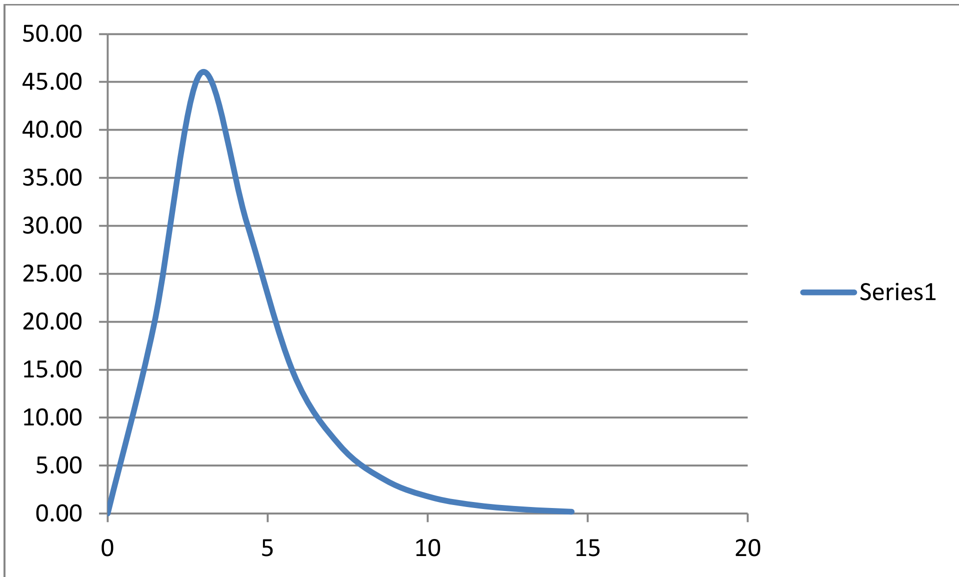
As we shown 1hr-UH



The peak of the given 1-hr UH and the peak of the estimated 1-hr UH by SCS method are the same for each catchment. But the time base different from those in the given 1-hr UH.

The time base of 1 catchment for the given 1-hr UH is 35 hrs, but for the estimated 1-hr UH by SCS method is 14.5 hrs.

Catchment 2:



The peak of the given 1-hr UH and the peak of the estimated 1-hr UH by SCS method are the same for each catchment. But the time base different from those in the given 1-hr UH.

The time base of 2 catchment for the given 1-hr UH is 31 hrs, but for the estimated 1-hr UH by SCS method is 14.5 hrs.

Also, note that the two time base for the estimated 1-hr UHs by SCS method for the two catchments are the same and equal 10 hrs.

Conclusion

The Hydrologic Cycle is constantly happening all around us each and every day and is an essential part of life. It is necessary so that we have shade from clouds, to water our plants with the falling rain, and for fish to swim in. I hope you found this unit interesting and enjoyable, and appreciate water even more!

To learn more about water and the Hydrologic Cycle refer to the links on the websites given, look in your school library, or ask your teacher to direct you to other resources.

References

- www.google.com
- www.wikipedia.com
- www.studymafia.org