is during winter and 30 to 45 inches during summer. The plains of the Punjab are generally irrigated and have mild climate. Typical range of evaporation for northern, central and southern Punjab is exhibited in Figures-8 and 9 for Mangla, Dhok Pathan. Gujranwala, Sargodha, Mianwali and Khanpur. Average annual evaporation lies between 60 to 70 inches except in a part of Chaj Doab and Thal where it comes to 80 and 90 inches. During winter it lies between 20 to 30 inches and in summer it increases to 40 and 60 inches.

In Sind high order of evaporation occurs at certain sites. Typical variation for Ghotki, Khairpur, Sehwan, Hub Dam, Chhor and Badin is shown in Figures 10 and 11. The range of annual evaporation is 90 to 120 inches so that during summer six months it ranges between 45 to 60 inches and during winter it also lies between 40 to 60 inches.

Baluchistan is mountainous and lies at a high elevation. During winter much of its area is snow covered. Evaporation order is very variable. Near Quetta and Harnai it is 90 to 95 inches per year. In central Baluchistan around Goth Haji Karim Bux it rises to 125 inches per year. The range of evaporation during summer six months is about 70 inches whereas in winter six months it falls to about 30 to 40 inches. Typical variation of evaporation for Harnai, Goth Haji Karim Bux and Sibi is shown in Figure-12.

4.2 Equi-Evaporation Contours

The data given in Table-13 was utilized to prepare diagrams showing equi-evaporation contours. Twelve figures showing equi-evaporation for each month of a year and three figures each showing annual and six monthly contours for Kharif and Rabi seasons were also prepared. These contours are plotted in Figures 12a, b, and c. These were utilized to estimate the evaporation loss from different storage, lakes and ponds.

5.0 LOSS OF WATER BY EVAPORATION FROM STORAGES, LAKES, PONDS ETC.

Large stretches of water from which evaporation occur are grouped into:

i) Big storage dams with significant water reservoir;

ii) Very small storage dams;

iii) Natural lakes;

iv) Village ponds and

v) Ponds existing upstream of barrages between marginal bunds and guide banks.

5.1 Loss from major Storage Dams.

There are 15 storage dams in Pakistan some of which have extensive free water surface. In Table-14 name of such storage, year of its construction, province and river where located and name of important city nearby are mentioned. The extent of free water surface during six summer months particularly after flood was collected from WAPDA Dam Monitoring Organization. This information was available for only nine

dams. As the winter free water surface continues to decrease with depletion of storage an average value was assumed. The order of summer and winter evaporation where the dams are located, was determined with reference to Figures 14 and 15. The evaporation loss was worked out separately for both seasons and their sum gave the annual loss which was found equal to 2940 cusecs. Loss from certain small storages like Hub Dam near Karachi, Spinkariz and Wali Tangi Dam in Quetta, Rawal Dam in Rawalpindi and Chashma Storage near Mianwali are so high as to impair their usefulness.

5.2 Evaporation Losses from Small Dams

In the barani areas of Potwar mostly located in the district of Rawalpindi, Attock (Campbellpur), Jhelum, Mianwali, small dams are being constructed to supply water for irrigation and drinking. A list of 13 small dams under the control of Small Dam Organization of the Punjab is given in Table-15. A few additional dams are under construction. Some small dams exist in the North West Frontier Province. These dams mostly get their supplies from run-off of rainfall during summer months of July and August. The water surface area of these small dams was not available. It was assumed on the basis of their capacity. The surface area was assumed ½ square mile for dams with capacity of 500 to 1000 acre feet, one square mile for dams with capacity equal to 1000 to 2000 acre feet and 2 square miles for dams of capacity equal to 2000 acre feet and above.

It was also assumed that the small dams have full capacity for 4 summer months. During the next 4 months before complete depletion their surface is reduced to about ½ that of the summer months. The total evaporation during eight months was estimated equal to 210 cusecs. If this is spread over one year it is reduced to 140 cusecs.

5.3 Evaporation Losses from Lakes.

There are very few lakes in Pakistan and most of them are in Sind. Two small lakes called Lullusir and Saif-ul-Muluk exist on Khunar River. These get frozen during winter. Their surface area even in summer is not much besides these lie in the zone of 50 inches of annual evaporation. There are several small depressions which are full of water. In this study small lakes and depressions have not been included.

Manchhar is the biggest lake in Sind with a surface area of nearly 90 sq. miles. Another lake called Namel lies about 80 miles west of Sukkur. It receives summer flood runoff from hill torrents. Normally it is dry but generally once every fifth years some flood water gets collected in this lake. The disposal of this water is either to Manchhar Lake or is lost by evaporation. Kalri is another big lake with a surface area of about 60 sq. miles. Halegi lake of 10 sq.miles surface area lies close to Kalri . In these lakes the water surface area during summer and winter remains nearly the same. The fws evaporation in the area is

very high, varying between 90 to 65 inches in summer and 40 inches during winter. The expected water loss from these lakes is given in Table 16. It works out equal to 2630 cusecs.

5.4 Evaporation Losses from Village Ponds

In every village there exit at least two ponds. Water of one of the ponds is used for live stock and the second for human consumption. In big villages there are sometimes more than two ponds. In the area where the groundwater is saline, ponds are the only source of water for human consumption. In the irrigated areas ponds are included in warabandi and are fed from the canal supplies. In the barani area very often ponds are the only source of water supply. At some sites springs are in existence and village women folks walk long distances to carry the spring water for drinking purposes. In the dry months these sources continue to dwindle and in certain cases ponds completely dry out. The major loss of water through ponds of barani area is a result of evaporation. As for the size of the village ponds, these vary in extent but generally lie in the range of one to four acres. For estimating the loss of water from the village ponds, the free water surface area was assumed equal to 2 acres. In Table-17 the number of villages in each district of a province are given. With ponds of 2 acres per village the total extent of free water surface in acres for each district is determined. Evaporation loss for each site, both for summer and winter six months was determined from Figures 14 and

15. The loss was worked out in cusecs. The results are given in Table 17. In Table 18 the evaporation loss through the village ponds existing in the four provinces is given.

The data about the number of villages was obtained from Pakistan Census of Agriculture, 1971. This report did not include Mauzas of Mari-Bughti in Baluchistan and a part of D.G. Khan. Similarly some area of Nagar Parkar in Sind, Cholistan in Bahawalpur, and Shakargarh Tehsil in Sialkot, were not surveyed. The area of Gilgit Agency and Baltistan, the tribal areas and the Malakand Agency adjacent to the settled areas of North West Frontier Province were also not included in the survey. This estimate is thus for 41233 Mauzas only.

5.5 Evaporation Loss from Ponds existing Upstream of Barrages.

There are twenty barrages and weirs constructed on various rivers of the country. The names of these existing on different rivers are given in Table-19.

Some of the barrages are located at sites where the river flow is restricted in narrow streams with rigid sides. These have limited training works. Such headworks are Munda on the Swat and Kurrum Ghari on the Kurrum. Such barrages on the mighty Indus are Jinnah, Sukkur and Kotri. At these sites the river flows through rigid mountainous banks or lime stone gorges. Sidhnai headworks is another example of location on narrow stream with rigid banks.

and Wali Tangi storages in Quetta, Hub Dam near Karachi, Rawal Dam in Rawalpindi are a few examples, evaporation reduction of which can directly pay the dividend.

6.0 EVAPORATION LOSS FROM SOILS, SALINE WATER AND SNOW.

6.1 Evaporation from Soils with high Water-Table.

Water is lost from a soil surface by evaporation. The rate of loss depends upon the position of water-table. Soil evaporation continues even from a deep groundwater but after a depth of ten feet the loss is insignificant. A typical bare soil evaporation curve with depth of water-table is shown in Figure-13. Generally with depth of groundwater at 2.0 feet, the evaporation loss is nearly 50 percent of the free water surface evaporation. With groundwater at 5 feet, the evaporation loss is reduced to about 15 to 20 percent of free water surface. In case of groundwater at 10 feet depth, the evaporation loss is only 2 to 3 percent of free water surface evaporation. With further increase in depth of groundwater, the evaporation loss curve becomes asympotatic.

In the Indus Plains of Pakistan there are vast areas in which the groundwater depth is within five feet. In Table-22 Culturable Commanded Areas with depth of groundwater between 0 to 5 feet as recorded in June 1978, is given. At a mean depth of water table, equal to 2.5 feet the evaporation loss from bare soil is about 35% of the free water surface evaporation. The annual free water surface evaporation on the average is 60, 70 and 85 inches in the province of

North West Frontier, the Punjab and Sind respectively. In Table-23 using 35 percent of the annual evaporation loss from the area with water table depth between 0 to 5 feet in the three provinces, the total loss by evaporation is worked out.

Table-23 : Loss of Water by Evaporation from bare soil having water table upto 5 ft.depth

Sr. No.	Province	C.C.A. in acres with water upto 5 ft. depth.	Annual free water surface evapo-ration Inches/ unit area	Av.Annual Evap.in ft. per unit area	Loss by evap.in scre ft. from the area.	Loss by Evap.in Cs. from the area.
1.	N.W.F.P.	18410	60	$\frac{60}{12} \times .35 = 1.75$	32217.5	44.13
2.	Sind and Baluchis-tan.	2482960	85	$\frac{85}{12} \times .35 = 2.479$	6155671.5	8432.43
3.	Punjab	1858460	70	$\frac{70}{12} \times .35 = 2.0417$	3794355.7	5197.75
	Total:	4359830			9982244.7	13674,31

From the irrigated areas of Pakistan where the water-table exists within 5 feet, a loss of 13674 cusecs corresponding to 9.9822 million acre feet takes place. Actually evaporation loss from soil with water table deeper than 5 feet also occurs.

6.2 Evaporation from Saline Water

The presence of soluble salts reduces the vapour pressure of a solution which decreases the rate of evaporation. This results in increase of temperature, thus off-setting the effect of reduction of vapour pressure. There is thus very little change in evaporation from saline water. For example it has been determined that vapour pressure of sea water with about 35000 ppm of soluble salts at a given temperature is about 2 percent less than that of pure water at the same temperature. Thus with slight variation of salinity as usually is found in groundwater, there is practically no change in the order of evaporation.

6.3 Evaporation from Snow

Evaporation from snow can occur only when the vapour pressure of air is less than that of the snow surface, i.e. the dew point is lower than the temperature of the snow. With a snow temperature of 30 °F and a dew point of 20 °F, the evaporation rate is only one-fifth of that as from a water surface at 80°F when the dew point is 70 °F with the wind speed assumed the same in both cases. Evaporation from snow needs more heat than from water at the same temperature. From snow to vapour, the latent heat required is 677 calories per gram, i.e. 80 calories per gram from snow at 32 °F to water at the same temperature plus 597 calories per gram from water to vapour state.

With rise of temperature above freezing point the snow melt exceeds evaporation. It is generally assumed that the maximum evaporation from a snow

surface is about 0.2 inch per day.

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Table - 3 Harza Estimate of Seepage and Evaporation, loss from Indus System - Northern Area - Punjab and Bahawalpur

All units of measurements are in maf (million acre feet)

S. No.	Sites	Inflow at Head	Outflow at tail	See-page	Eva-pora-tion	Total loss	Evap.% of Total loss	Evap.% of flow at head	Seepage % of Total loss	Seepage % of flow at head
A-Period of Estimate, pre-1970 conditions.										
1.	Rivers	164.5	69.0	3.0	9.00	12.0	75.0	-	25.0	-
2.	Canals	48.2	35.8	11.5	2.9	14.4	20.1	6.0	80.0	23.9
3.	Water Courses	35.8	32.2	1.8	1.8	3.6	50.0	5.3	50.0	50.3
4.	Crop use (fields)	32.2	-	4.8	3.2	8.0	40.0	9.94	60.0	14.9
5.	Rainfall	-	-	1.0	-	-	-	-	- -	-
	Total	-	-	22.1	16.9	39.0	43.3	-	56.7	-
B-Period of Estimate Post-1970										
6.	Rivers	140.0	73.9	1.9	8.2	10.0	81.0	5.86	19.0	1.4
7.	Canals	61.0	40.4	16.8	3.8	20.6	18.4	6.23	81.6	27.5
8.	Water Courses Source									
	from Canals	40.4								
	G.Water	22.4								
	Total	62.8	56.5	3.1	3.2	6.3	50.8	5.1	49.2	4.9
9.	Crop use (fields)	56/5	-	8.5	5.6	14.1	39.7	9.9	60.3	15.0
10	Rainfall	-	-	2.3	-	-	-	-	-	-
	Total	-	-	32.6	20.8	53.4	39.0	-	61.0	-

Table-4 Harza Estimate of seepage and evaporation loss from Indus Basin System ~~Southern Area Sind~~. (All units of measurement are in MAF(Million Acre ft.)

Sr. No.	Sites	Inflow at Head	Outflow at tail	See-page	Evap.	Total Loss	Evap. % of total loss	Evap. % of flow at Head	Seepage % of total loss	Seepage % of flow at Head
A.	Period of Estimate, pre-1970									
1	Rivers	69.0	60.9	1.0	7.1	8.1	87.1	10.3	12.3	1.4
2	Canals	35.3	24.7	8.5	2.1	10.6	19.8	5.95	80.2	24.0
3	Water Courses	24.7	22.3	1.2	1.2	2.4	50.0	4.86	50.0	4.9
4.	Crop Use (Field)	22.3	-	3.4	2.2	5.6	39.3	9.87	60.7	15.2
5	Rain percolation	-	-	0.2	-	-	-	-	-	-
	Total	-	-	14.3	12.6	26.9	46.8	-	53.16	-
B.	Period of Estimate Post 1970 (Projected values)									
6.	Rivers	73.9	37.9	1.2	3.7	4.9	75.5	5.00	24.5	1.6
7	Canals	31.1	21.8	7.4	1.9	9.3	20.4	6.10	79.6	23.8
8.	Water Courses from) Canal) from) G.water)	21.8 4,5								
		26.3	23.7	1.3	1.3	2.6	50.0	4.94	50.0	4.94
9	Crop Use (field)	23.7	-	3.5	2.4	5.9	40.7	10.1	59.3	14.8
10	Percolation from Rain	-	-	0.2	-	-	-	-	-	
	Total	-	-	13.6	9.3	22.9	40.6	-	-	59.4

TABLE-8

ANNUAL FWS EVAPORATION WORKED OUT BY USE OF FORMULA OF NAZIR, BLANEY CRIDDLE, PENMAN, ROHWER AND HARGREAVES AND COMPARED WITH ACTUALLY OBSERVED VALUE.

Sr. No.	Station	Actual Obs. Lake Evapo.	Instt.For-mula Nazir et al	Blaney Criddle Formula	Penman For-mula, Reve-lle Report	Rohwer For-mula Revelle Report	Hargrea-ves.
1	2	3	4	5	6	7	8
1	Bahawalpur	103.0	66.22	79.10	56.04	-	154.13
2	Bahawalnagar	66.15	75.46	83.74	-	-	-
3	Bannu	63.00	69.4	75.26	-	-	95.50
4	Balakot	61.77	55.91	66.18	-	-	-
5	Baran Dam	73.00	76.97	79.72	-	-	-
6	Campbellpur	-	67.00	78.63	-	-	132.38
7	Cherat	-	53.93	66.34	-	-	-
8	Chuharkana	64.90	58.14	81.31	-	-	-
9	Darwat	129.30	108.21	83.83	-	-	-
10	D.I.Khan	-	62.40	77.32	-	-	-
11	Drosh	-	48.31	64.53	-	-	-
12	Gujranwala	67.42	71.96	71.52	-	-	-
13	Haripur	-	60.59	73.48	-	-	-
14	Hub Dam	113.0	87.43	81.07	-	-	-
15	Hyderabad	63.60	67.42	84.38	64.65	113.11	-
16	Jacobabad	-	72.87	81.73	-	-	168.29
17	Jhelum	-	67.43	75.49	-	-	138.57
18	Kalat	-	45.67	55.85	-	-	62.49
19	Kakul	-	55.62	65.65	-	-	95.12

(continued)

TABLE-8 (Continued)

1	2	3	4	5	6	7	8
20	Karachi	58.57	60.01	79.27	48.79	70.24	105.74
21	Khanpur	70.1	71.92	79.68	62.14	-	172.92
22	Khushab	-	73.82	77.88	-	-	163.02
23	Kohat	62.49	62.26	77.20	-	-	-
24	Lahore	51.77	55.87	78.27	48.89	56.77	-
25	Lasbela	-	56.15	80.11	-	-	187.73
26	Leiah	70.8	71.66	79.00	-	-	-
27	Loralai	-	60.93	65.32	-	-	159.28
28	Lyallpur(FSD)	-	68.02	77.31	-	-	157.23
29	Mangla	64.32	67.89	76.37	-	-	-
30	Mianwali	66.00	68.54	75.89	-	-	-
31	Montgomery (Sahiwal)	-	61.88	78.73	-	-	127.79
32	Multan	-	64.90	78.78	53.10	68.38	153.56
33	Muzaffargarh	67.50	69.59	78.12	-	-	-
34	Murree	-	38.02	56.58	-	-	54.97
35	Nawab Shah	-	62.81	81.20	-	-	160.18
36	Nokundi	-	95.37	78.09	-	-	173.15
37	Ormara	-	47.51	79.61	-	-	96.68
38	Panjgur	-	61.81	72.64	-	-	154.26
39	Pasni	-	47.66	77.57	-	-	83.28
40	Parachinar	-	45.83	60.67	-	-	85.79
41	Peshawar	-	-	74.43	42.64	-	-
42	Quetta	34.20	42.57	60.73	44.34	44.13	94.56

TABLE-8 (continued)

1	2	3	4	5	6	7	8
43	Rawalpindi	-	64.96	71.64	43.49	53.90	-
44	Sargodha	65.22	63.48	76.65	-	-	136.28
45	Sialkot	58.0	62.38	76.90	47.66	-	124.08
46	Sibi	117.0	100.56	82.16	- -	-	-
47	Sukkur	-	67.31	82.18	-	-	-
48	Tarbela	98.31	92.72	73.78	-	-	-
49	Wana	-	51.87	66.73	-	-	-

TABLE No.9 : POTENTIAL EVAPORATION FOR SELECTED STATIONS IN PAKISTAN (SOURCE REVELLE REPORT)

(Inches of Evap.)

Method	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
LAHORE													
1. Kohler(H-W-W)	1.97	2.32	4.55	6.71	9.58	8.83	6.93	6.30	6.52	5.40	3.09	1.80	64.00
2. Kohler (Brunt)	1.57	1.83	3.78	5.83	8.61	7.95	6.25	5.52	5.80	4.97	2.69	1.51	56.31
3. Penman	1.06	1.46	3.26	4.62	7.22	7.49	6.70	6.03	4.94	3.56	1.58	.97	48.89
4. Thornthwaite(Ahmad)													54.0
5. Rohwer (Raman)	1.15	1.46	3.44	6.55	10.25	10.11	6.62	4.80	4.67	4.39	2.04	1.29	56.77
6. Nazir	1.6	2.2	3.5	6.3	8.3	8.1	7.4	6.4	5.3	4.2	2.6	1.6	57.4
Recommended	1.6	1.9	3.7	5.6	8.2	7.6	6.3	5.6	5.2	4.5	2.6	1.5	54.3
RAWALPINDI													
1. Kohler(H-W-W)	1.61	1.87	3.62	5.56	8.64	8.17	6.81	5.80	5.38	4.63	2.80	1.61	56.50
2. Kohler(Brunt)	1.27	1.44	2.96	4.72	7.66	7.32	6.06	5.12	4.74	4.08	2.37	1.35	49.09
3 Penman	.84	1.19	2.71	4.07	6.72	6.86	6.47	5.60	4.10	2.93	1.24	.76	43.49
4. Thornthwaite													46.8
5. Rohwer	1.74	1.73	3.11	4.90	9.39	10.27	5.88	3.42	4.19	4.49	2.82	1.96	53.90
6 Nazir	1.4	1.6	3.6	6.2	11.7	13.1	7.3	5.9	5.9	5.0	2.7	1.6	66.0
Recommended	1.3	1.5	3.0	4.6	7.3	7.0	6.1	5.2	4.5	3.5	2.3	1.3	47.6
M U L T A N													
1. Kohler(H-W-W)	2.34	2.68	4.91	7.08	9.76	9.21	8.37	7.71	7.03	5.65	3.56	2.31	70.61
2. Kohler (Brunt)	1.86	2.10	4.09	6.02	8.96	8.36	7.43	6.79	6.46	5.12	3.07	1.93	62.19
3 Penman	1.17	1.58	3.36	4.79	7.58	7.97	7.66	7.04	5.38	3.71	1.73	1.12	53.10
4 Thornthwaite	.39	.66	2.83	6.38	8.23	8.43	8.50	7.84	6.85	4.85	1.61	.51	57.08
5 Rohwer	1.98	2.22	4.04	6.78	10.21	11.38	8.03	6.04	5.85	4.26	3.35	2.24	66.38
6 Nazir	2.0	2.4	4.4	7.1	10.0	9.6	9.3	6.4	5.7	5.2	3.3	2.2	65.6
Recommended	1.9	2.2	4.0	5.9	8.4	8.0	7.5	6.8	5.8	4.5	2.7	1.9	59.6

(continued)

TABLE-9 (Continued)

(Inches of Evap.)

SIALKOT

Method	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1. Kohler (H-W-W)	1.82	2.22	4.01	6.77	9.40	8.81	6.87	5.84	6.07	5.49	2.92	1.70	61.92
2. Kohler (Brunt)	1.44	1.73	3.27	5.84	8.69	7.96	6.14	5.10	5.40	5.04	2.53	1.44	54.48
3. Penman	.95	1.36	2.95	4.62	7.27	7.49	6.65	5.83	4.68	3.58	1.42	.86	47.66
4. Thornthwaite													53.0
5. Rohwer													
6. Nazir	1.6	2.4	3.7	7.6	11.8	10.3	6.4	5.2	4.9	4.6	2.7	1.7	62.9
Recommended	1.5	1.8	3.3	5.7	8.1	7.5	6.2	5.3	5.2	4.4	2.3	1.4	52.7

PESHAWAR

1. Kohler (H-W-W)	1.55	1.61	3.07	4.59	7.64	8.61	7.26	6.32	5.74	4.22	2.68	1.57	54.86
2. Kohler (Brunt)	1.26	1.24	2.45	3.87	6.83	7.88	6.66	5.63	5.15	4.00	2.30	1.33	48.60
3. Penman	.91	1.14	2.47	3.63	6.37	6.17	6.75	5.93	4.24	2.91	1.28	.84	42.64
4. Thornthwaite													48.5
5. Rohwer													
Recommended	1.3	1.3	2.5	3.8	6.5	7.4	6.5	5.6	4.9	3.7	2.2	1.3	47.0

Q U E T T A

1. Kohler (H-W-W)	1.46	1.71	3.17	5.07	7.37	8.09	8.29	7.69	6.34	4.72	7.87	1.70	58.48
2. Kohler (Brunt)	1.11	1.30	2.54	4.18	6.41	7.27	7.46	6.89	5.87	4.24	2.46	1.40	51.13
3. Penman	.87	1.16	2.47	3.74	6.00	6.65	6.97	6.20	4.18	2.84	1.35	.91	43.34
4. Thornthwaite	.24	.39	1.46	2.68	4.06	5.16	5.68	5.19	3.35	1.81	.83	.43	31.20
5. Rohwer	.98	1.21	2.37	3.72	5.71	7.10	6.62	5.57	4.49	3.13	2.01	1.22	44.13
6. Nazir	0.6	0.8	2.1	4.0	5.5	6.6	6.6	5.5	5.1	3.5	1.8	0.9	43.0
Recommended	1.2	1.4	2.6	4.2	6.2	6.9	7.1	6.6	5.5	4.0	2.4	1.4	49.5

Table-9 (continued)

Method	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
HYDERABAD													
1. Kohler (H-W-W)	3.70	4.51	7.00	8.97	10.71	9.50	7.70	7.30	7.67	7.11	5.01	3.85	83.03
2. Kohler (Brunt)	3.25	3.68	5.83	7.95	9.86	8.32	6.56	6.21	6.83	6.53	4.29	3.28	72.59
3. Penman	2.14	2.54	4.71	6.32	9.42	8.95	7.56	7.07	6.17	5.06	2.65	2.06	64.65
4. Thornthwaite													61.0
5. Rohwer	4.54	4.45	8.53	11.84	16.51	15.59	13.21	10.23	9.14	8.20	5.94	4.93	113.11
6. Nazir	3.4	3.8	6.1	7.2	8.1	7.4	6.7	6.0	5.4	5.9	4.8	3.6	68.6
Recommended	3.1	3.7	5.8	7.6	9.3	8.4	7.0	6.5	6.5	5.6	4.0	2.9	70.4
KARACHI													
1. Kohler (H-W-W)	3.78	4.08	5.61	6.56	7.01	5.65	4.32	3.90	4.86	5.40	4.37	3.69	59.23
2. Kohler (Brunt)	3.04	3.20	4.55	5.39	5.88	4.69	3.38	3.10	3.90	4.70	3.69	3.04	48.56
3. Penman	2.25	2.49	4.27	5.21	6.70	5.76	4.54	4.19	4.16	4.36	2.68	2.18	48.79
4. Thornthwaite													57.0
5. Rohwer	5.83	5.61	6.32	5.44	5.67	6.55	6.12	4.71	4.88	6.62	6.15	6.34	70.74
6. Nazir	3.7	3.5	4.8	5.6	6.2	6.3	5.7	5.7	5.2	4.9	4.9	4.0	60.5
Recommended	3.1	3.3	4.6	5.4	6.2	5.2	4.0	3.7	3.9	4.4	3.2	2.8	49.8
BAHAWALPUR													
1. Kohler (H-W-W)	2.39	3.16	5.60	7.31	9.89	9.68	8.32	7.64	7.33	5.90	3.60	2.42	73.24
2. Kohler (Brunt)	1.90	2.51	4.70	6.32	8.98	8.77	7.42	6.83	6.75	5.41	3.14	2.03	64.76
3. Penman	1.26	1.83	3.80	5.02	7.84	8.47	7.84	7.17	5.69	4.04	1.85	1.23	56.04
4. Thornthwaite													57.0
5. Rohwer													
6. Nazir	2.0	2.6	4.5	7.2	10.2	9.3	7.6	6.6	5.9	5.5	3.3	2.3	67.0
Recommended	1.9	2.6	4.6	6.1	8.5	8.3	7.5	6.8	6.2	4.8	2.7	2.0	62.0
KHANPUR													
1. Kohler (H-W-W)	3.01	3.56	5.81	8.25	10.64	10.35	9.01	8.06	8.00	6.60	4.27	3.03	80.59
2. Kohler (Brunt)	2.51	2.92	4.93	7.19	9.88	9.41	8.12	7.24	7.41	6.16	3.84	2.61	72.22
3. Penman	1.64	2.12	4.08	5.56	8.80	9.31	8.56	7.64	6.17	4.45	2.21	1.60	62.14
4. Thorntwaite													58.5
5. Rohwer													
6. Nazir	2.4	2.7	4.4	10.1	11.1	9.0	7.6	6.5	6.3	6.0	3.4	2.0	71.7
Recommended	2.5	2.9	4.8	6.9	9.2	9.0	8.2	7.2	6.8	5.5	3.4	2.3	68.7

Note:- Methods 1,2 and 3 based on averages for period 1881-1940 except Bahawalpur and Khanpur which are 1926-1940.

TABLE-13

Average Lake Evaporation values of stationary water Reservoirs at different climatological Stations in Pakistan.

1	Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Kharif Apr to Sep.	Rabi Oct-Mar.	Annual Total	Data collected for
1.	Baber Kach	2.61	3.39	6.19	10.32	12.41	13.26	11.64	10.24	8.66	6.78	3.89	2.54	65.14	25.42	90.56	1965-71
2.	Badin	4.71	5.23	7.64	10.03	12.25	10.99	9.25	8.32	8.00	7.05	5.18	4.52	58.87	34.34	93.22	1966-75
3.	Badin Zai	2.30	2.20	3.38	7.14	10.83	12.04	9.73	9.05	8.71	5.02	1.77	1.99	57.52	16.66	74.18	1975
4.	Bahawal-nagar.	2.12	2.94	5.26	7.00	8.88	9.46	7.94	6.75	5.88	4.68	2.81	2.06	45.95	20.20	66.15	1963-74
5.	Bahawalpur	2.59	3.75	7.07	10.71	13.89	15.09	14.05	11.90	9.38	7.69	5.23	2.99	75.05	27.94	102.99	1970-74
6.	Balakot	1.79	2.26	4.13	5.36	8.06	10.90	8.19	5.99	5.86	4.92	2.67	1.72	43.89	18.13	62.02	1963-74
7.	Bandat Jungle	1.64	2.15	3.97	6.83	9.92	10.52	17.51	9.79	7.72	6.33	4.56	2.64	55.32	21.51	76.83	1969-74
8.	Bannu	1.98	2.40	4.13	5.62	8.05	9.20	7.80	7.25	6.10	4.78	3.51	2.03	44.06	18.71	62.77	1970-74
9.	Bela	3.85	4.45	7.25	10.39	12.75	10.67	10.07	8.63	8.52	8.37	5.46	4.10	61.07	33.52	94.59	1963-74
10.	Besham Qila	2.16	2.50	4.31	6.16	8.95	9.35	7.86	7.28	5.95	4.70	3.39	2.96	45.57	20.05	65.62	1970-74
11.	Bhag	3.28	4.03	5.85	11.22	15.48	15.61	14.92	12.33	10.90	9.07	5.19	3.01	80.48	30.47	110.95	1966-71
12.	Bhakkar	2.33	3.07	5.10	8.26	11.03	10.94	9.19	8.41	7.17	5.11	3.05	1.92	55.00	20.63	75.63	1970-74
13.	Chak Daphar	1.36	2.14	3.35	5.39	8.77	9.19	8.28	6.30	5.51	4.27	2.47	1.63	43.48	15.20	58.68	1965-70
14.	Chhor	4.85	6.11	7.63	8.79	11.73	9.97	8.70	4.84	8.83	7.95	5.92	4.70	56.88	37.20	94.08	1966-69
15.	Chilya	5.46	6.03	7.86	9.58	11.35	10.53	9.40	8.62	8.17	8.13	6.33	5.34	57.67	37.57	95.54	1966-74
16.	Chuhatkana	1.85	2.59	4.34	6.77	9.94	10.23	8.02	6.11	5.53	4.66	2.88	1.85	46.82	18.27	64.89	1963-74
17.	Dadu	2.81	3.61	6.16	8.50	13.43	13.33	11.83	9.81	6.75	6.74	3.73	2.55	65.77	25.64	91.41	1966-71
18.	Daggar	1.04	1.34	2.86	3.83	7.65	8.83	6.97	6.02	4.74	4.01	2.04	1.14	38.68	12.45	51.13	1970-74
19.	Darband	2.15	2.83	4.72	6.98	10.13	11.18	8.61	6.31	5.36	5.15	3.27	2.24	47.95	19.73	67.68	1963-73
20.	Darwat	2.49	2.48	4.89	7.74	10.11	10.62	9.12	7.61	5.82	4.19	2.97	2.22	51.66	19.59	71.25	1966-74
21.	Dhok Pathan	1.61	2.31	4.83	8.26	11.60	11.42	9.53	8.15	6.79	5.18	3.17	1.54	55.76	18.15	73.91	1971-74
22.	Dokri	2.49	2.48	4.89	7.74	10.11	10.82	9.12	7.61	5.82	4.19	2.97	2.22	51.66	19.59	71.25	1966-74
23.	Duki	2.29	2.83	5.54	9.00	12.05	11.86	10.47	9.35	7.23	5.95	4.44	3.11	59.62	24.16	83.78	1970-74
24.	Dureji	4.28	5.58	8.02	11.57	13.55	11.76	10.69	8.77	8.88	8.61	5.93	4.28	65.24	36.72	101.96	1970-71
25.	Fort Lock Gart	2.48	2.28	4.00	6.57	8.29	10.78	7.49	4.83	5.16	5.43	3.68	2.74	43.14	20.62	63.76	1970-74
26.	Gaggar	6.73	6.65	9.34	10.50	10.92	13.33	10.13	8.76	9.00	9.30	7.54	6.44	61.35	45.24	106.59	1966-74

(continued)

TABLE-13 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
27.	Gharo	4,74	4.73	6.61	8.00	9.41	8.52	7.78	6.71	6.95	6.22	5.36	4.68	47.49	32.65	80.14	1966-71
28.	Gaj R/House	5.76	6.54	11.15	15.54	19.37	19.25	15.31	13.70	12.28	10.63	6.57	4.93	95.48	45.47	140.95	1966-74
29.	Gandawa	3.02	3.66	6.52	10.08	13.01	13.13	10.62	9.67	8.52	6.66	4.56	3.37	65.06	27.81	92.87	1966-71
30.	Ghotki	2.61	2.89	4.91	7.31	10.39	10.76	9.85	8.30	6.66	5.17	3.55	2.68	53.68	21.76	75.44	1966-74
31.	Gohar	1.52	2.07	4.05	5.16	9.62	8.97	8.34	5.67	5.60	4.42	2.47	1.47	43.37	17.32	60.69	1965-68
32.	Goharwala	2.38	3.50	6.55	11.57	14.17	11.75	12.12	11.11	8.21	6.86	3.97	2.93	68.94	26.20	95.14	1970-71
33.	Gojra	1.99	2.35	4.32	6.27	9.48	10.27	8.47	7.06	5.87	4.59	2.86	1.93	47.45	18.19	65.64	1963-74
34.	Goth Amun	4.49	4.57	7.62	8.66	11.96	10.99	9.17	8.65	7.59	8.41	5.51	4.91	57.06	35.53	92.59	1972-74
35.	Goth Haji Karim Bux	5.48	6.03	10.20	11.60	15.47	15.70	14.37	13.98	12.28	10.55	7.45	3.65	83.39	45.48	128.87	1970-74
36.	Gujar Khan	2.06	2.74	5.14	7.57	10.08	11.27	8.89	6.24	5.65	4.82	3.22	2.03	49.65	20.03	69.68	1969-74
37.	Gujranwala	1.61	2.45	3.53	5.95	8.21	8.31	6.70	5.14	4.83	4.11	2.46	1.58	38.22	16.45	55.67	1963-74
38.	Haripur	1.05	1.48	2.76	3.69	5.32	6.12	1.43	4.29	3.30	2.39	2.54	1.19	27.17	10.68	37.85	1970-72
39.	Harnai	3.69	4.10	8.17	8.76	12.29	12.17	13.15	10.69	11.00	9.84	6.93	5.52	68.09	41.04	109.10	1963-64
40.	Hub Dam Site	6.00	6.56	9.85	11.55	13.88	12.00	11.17	9.41	9.58	9.54	7.26	6.13	87.58	45.38	112.96	1963-71
41.	Jemesabad	4.16	4.65	6.09	9.71	11.62	10.25	9.31	7.51	7.29	6.62	5.12	4.11	55.70	31.18	86.88	1966-71
42.	Jati	5.52	5.43	8.47	11.20	12.46	10.28	9.28	7.82	7.82	7.40	5.76	5.35	58.85	38.98	97.83	1966-71
43.	Jatoi Janubi	2.34	3.00	5.33	7.19	9.20	9.69	8.44	7.93	6.70	4.74	3.01	2.34	40.17	19.59	68.76	1970-71
44.	Kach	2.24	3.00	5.90	9.44	12.35	13.95	14.03	12.59	10.21	8.31	6.10	3.24	72.60	28.79	101.39	1970-71,74
45.	Kachura	0.85	-	2.52	5.44	7.29	8.78	9.58	9.13	7.83	5.46	3.01	0.96	48.07	12.62	60.69	1970-74
46.	Kalam	-	-	-	2.79	5.65	6.86	6.25	5.98	4.35	3.28	2.11	0.46	31.90	5.88	37.76	1963-74
47.	Kathiala Khurd	1.83	2.27	4.40	5.87	9.60	10.27	7.91	6.81	5.99	4.98	2.68	1.68	46.46	17.92	64.38	1965-68
	Khairpur	2.47	3.24	5.88	7.80	10.63	11.44	10.82	9.61	7.75	5.71	3.90	2.90	58.03	24.12	82.15	1966-74
	Kuri Kach	1.92	2.66	3.91	6.55	6.85	9.12	9.94	9.91	6.74	5.34	3.51	2.52	48.12	21.98	70.10	1963-68
	Kotpur	2.38	2.49	3.12	4.60	9.67	11.34	11.00	8.78	6.12	4.00	3.43	2.52	51.53	18.55	70.08	1969-71
	Likotwal	1.94	2.58	5.24	8.35	12.15	13.56	12.93	11.61	9.11	7.07	4.48	2.44	67.63	23.11	90.74	1970-74
	Kot	2.35	2.71	4.41	5.70	8.39	9.89	9.13	7.98	7.26	5.60	3.72	2.32	48.68	20.80	69.54	1963-74
	Koh	2.01	2.80	5.03	7.09	9.87	10.35	8.88	7.69	6.70	4.98	2.91	1.82	50.61	20.18	70.79	1963-74
	Kot	2.95	2.87	2.07	3.15	18.17	16.38	9.66	8.68	11.33	10.23	7.89	6.98	62.39	33.00	95.39	1973
	Koli	3.11	3.28	6.25	9.37	12.32	10.09	11.07	8.29	8.78	7.98	6.29	3.51	59.94	30.10	90.04	1970-74

TABLE-13 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
56.	Mangla	2.18	2.83	4.94	7.28	9.85	9.65	7.17	5.35	5.09	4.86	3.04	2.08	44.41	10.85	64.26	1963-74
57.	Mardan	1.07	1.56	2.91	4.37	6.61	8.01	7.89	6.60	4.83	3.11	1.47	0.98	38.33	11.13	49.46	1963-74
58.	Massan	1.80	2.06	4.37	7.08	10.03	10.87	9.58	8.47	7.52	5.10	2.69	1.56	53.10	18.58	71.68	1972-74
59.	Miani Forest	3.52	4.30	6.97	8.76	12.93	13.03	11.69	9.87	9.22	7.33	4.23	3.35	65.53	29.93	95.46	1966-74
60.	Mianwali	1.92	2.40	4.13	6.16	9.21	10.15	8.52	7.17	5.75	8.37	2.91	1.79	18.00	17.90	65.90	1963-74
61.	Muzaffarabad	1.11	1.74	3.01	4.14	6.21	6.86	5.5	4.66	4.18	3.27	1.77	1.04	31.56	11.99	43.55	1969-75
62.	Muzaffargarh	2.19	2.71	4.77	6.55	9.12	9.52	8.80	7.45	6.33	4.44	3.08	2.15	48.00	19.45	67.45	1963-74
63.	Nabisar Road	4.31	5.05	7.82	9.96	11.16	11.30	9.24	8.09	7.26	7.97	4.91	3.81	57.08	33.52	90.57	1966-74
64.	Oghi	1.42	1.68	3.08	4.30	5.93	6.35	5.16	4.90	4.59	3.72	2.60	1.62	31.10	14.20	45.30	1970-74
65.	Paddidan	3.02	1.82	6.03	10.34	12.76	12.82	11.76	10.75	3.36	6.86	4.21	2.77	66.51	27.67	94.18	1966-74
66.	Padri-jo-Goth	3.50	3.81	6.02	7.69	9.87	10.21	9.39	8.08	7.55	5.93	3.90	3.14	52.84	24.95	77.79	1966-74
67.	Panjgur	2.85	3.44	5.31	6.83	8.57	10.24	11.14	10.45	7.00	6.96	4.33	4.12	54.28	28.44	82.69	1970-74
68.	Pai Forest	2.76	3.08	6.44	5.94	7.43	7.49	7.60	5.28	5.56	4.83	3.00	2.45	39.30	22.57	61.87	1966-74
69.	Phularwan	1.67	2.41	4.44	7.23	10.81	10.89	7.96	5.98	5.72	4.36	2.34	1.73	48.61	16.98	65.59	1969-74
70.	Phulra	1.28	1.68	3.18	5.53	8.36	8.47	6.83	5.66	5.02	3.97	2.15	1.31	39.89	13.61	53.50	1969-74
71.	Rawal Dam	1.57	2.43	4.15	5.86	8.60	10.46	7.11	5.40	4.89	4.74	2.53	1.82	42.36	17.32	59.68	1963-74
72.	Saiflu Sharif	1.46	1.82	3.06	3.87	5.88	7.49	6.28	3.82	4.81	3.68	2.23	1.43	34.18	13.89	43.07	1963-74
73.	Sakrand	3.16	3.74	5.42	8.72	11.13	11.34	10.21	9.13	7.86	6.39	4.09	3.14	58.40	25.92	84.32	1967-74
74.	Sargodha	1.85	2.46	4.43	6.19	9.01	9.86	8.40	6.69	8.35	4.86	2.87	1.75	46.70	18.38	65.08	1963-74
75.	Sehwan	3.82	5.38	9.25	15.17	18.97	19.24	16.95	14.17	12.28	9.73	5.60	4.05	96.79	37.86	134.65	1970-74
76.	Shinkiari	1.61	1.59	3.37	4.84	6.70	7.17	6.34	4.92	4.61	4.56	3.20	1.68	34.61	16.02	50.63	1973-74
77.	Sialkot	3.11	2.29	4.06	6.53	9.83	8.96	7.04	4.93	4.74	4.32	2.28	1.38	41.64	16.17	57.81	1970-74
78.	Sibi	4.11	4.78	7.41	11.08	16.18	16.57	14.43	13.15	11.70	8.96	4.61	2.30	83.13	33.82	116.95	1966-74
79.	Tank	2.39	2.47	4.13	6.33	10.37	11.95	10.04	8.63	8.20	6.75	4.84	3.34	55.54	23.94	79.48	19
80.	Tarbela Dam	2.37	2.84	4.81	6.90	10.02	12.73	9.32	6.99	6.77	6.63	3.91	2.44	52.75	23.09	75.84	1
81.	Thaho Bula Khan.	6.15	7.13	11.75	16.24	19.37	19.08	16.09	13.40	12.68	12.09	8.37	6.22	96.87	51.75	148.62	
82.	Turbat	5.28	5.37	8.34	10.62	12.13	12.65	9.87	9.31	9.10	8.58	6.04	4.76	63.44	34.59	98.03	
83.	Usta Mohammad	2.40	3.13	5.65	8.33	12.76	11.23	9.90	8.66	7.38	5.98	3.49	1.97	58.29	22.64	80.93	
84.	Uthal	4.04	4.74	6.96	8.82	10.31	9.36	8.08	7.54	7.18	7.47	5.37	3.83	51.31	31.82	83.13	
85.	Wadh	3.03	3.69	6.67	9.00	10.19	12.70	10.76	9.89	8.55	7.04	5.43	3.86	61.10	29.74	90.84	
86	Wasu	1.38	1.87	3.46	5.09	7.40	7.53	6.58	4.81	4.47	3.55	1.93	1.26	35.91	13.40	49.31	