

### **F.17 Discharge at Bahr Biyala Intake During Nov. & Dec. in 1998 & Conveyance Efficiencies on Bahr Tera**

A discharge-water level relationship was established at Bahr Biyala intake by using gate formula. Other intakes are not possible to establish discharge-water level relationship by gate formula because the gates were almost fully opened during this Phase II study. The formula at the Bahr Biyala intake is shown below, and the calculated discharges are shown in Table F.17.1;

$$Q=1.165 \times (d - 0.095) \times H^{0.5}$$

See Table F.17.2 & Figure F.17.1

Where; Q; discharge, MCM/day

d; Gate Opening, meter

H; Head difference between upstream and downstream, meter

Bahr Tera within the priority area was divided into 4 reach, and those conveyance efficiencies were studied by carrying out current measurement at the beginning and the end points of each reach simultaneously. The measurement had been done 4 times each as shown in Table F.17.3, and the average conveyance efficiency is summarized below;

Reach A-A';	97.1 % (L = 10.6 km)
Reach B-B';	98.6 % (L = 6.5 km)
Reach C-C';	92.5 % (L = 7.7 km)
Reach D-D';	98.6 % (L = 5.7 km)

Table F.17.4 shows roughness coefficient calculated on basis of current measurements done on Bahr Tera. The roughness coefficient is 0.024 to 0.028 with its average of 0.026, which is correspond to commonly experienced.

Table F.17.1 Intake Volume from Bahr Tera for Bahr Biyal Irrigation Area

Date 1998	On Off	Morning					Evening					Daily Dis. MCM	Monthly Dis. MCM	
		US M./m	DS M./m	Gear	Open. ca	Dis. MCM	US M./m	DS M./m	Gear	Open. ca	Dis. MCM			
Oct 26	Mon	2.45	2.40	43	150.4	0.184	2.4	2.4	43	150.4	0.184	0.367		
27	Tue	2.75	2.70	43	150.4	0.184	2.7	2.7	43	150.4	0.184	0.367		
28	Wed	2.65	2.60	43	150.4	0.184	2.6	2.5	43	150.4	0.184	0.367		
29	Thu	2.30	2.25	43	150.4	0.184	2.3	2.2	43	150.4	0.184	0.367		
30	Fri	2.55	1.80	13	9.4	0.047	2.5	1.8	13	9.4	0.046	0.093		
31	Sat	Off	2.60	1.80	13	9.4	0.049	2.6	1.8	13	9.4	0.047	0.096	NA
Nov 1	Sun		2.60	1.80	13	9.4	0.049	2.7	1.8	13	9.4	0.051	0.100	
2	Mon		2.80	1.80	13	9.4	0.055	2.6	1.8	13	9.4	0.049	0.104	
3	Tue		2.65	1.80	13	9.4	0.050	2.6	1.8	13	9.4	0.049	0.099	
4	Wed		2.65	1.80	13	9.4	0.050	2.6	1.8	13	9.4	0.049	0.099	
5	Thu		2.65	2.60	45	159.8	0.196	2.6	2.1	16	23.5	0.058	0.253	
6	Fri		2.65	2.10	20	42.3	0.142	2.6	2.1	20	42.3	0.128	0.270	
7	Sat		2.65	2.10	20	42.3	0.142	2.6	2.3	22	51.7	0.135	0.276	
8	Sun		2.65	2.30	22	51.7	0.145	2.6	2.3	22	51.7	0.135	0.280	
9	Mon		2.55	1.80	13	9.4	0.047	2.5	1.8	13	9.4	0.046	0.093	
10	Tue		2.35	1.80	13	9.4	0.041	2.4	1.8	13	9.4	0.041	0.081	
11	Wed		2.40	1.80	13	9.4	0.042	2.4	1.8	13	9.4	0.042	0.085	
12	Thu		2.30	1.80	13	9.4	0.039	2.3	1.7	13	9.4	0.041	0.079	
13	Fri		2.20	1.60	12	4.7	0.021	2.2	1.6	12	4.7	0.021	0.042	
14	Sat		2.25	1.60	12	4.7	0.022	2.2	1.6	12	4.7	0.021	0.043	
15	Sun		2.25	1.60	12	4.7	0.022	2.2	1.6	12	4.7	0.021	0.043	
16	Mon		2.25	1.60	12	4.7	0.022	2.3	1.6	12	4.7	0.022	0.044	
17	Tue		2.50	2.20	18	32.9	0.075	2.5	2.3	22	51.7	0.095	0.170	
18	Wed		2.50	2.30	22	51.7	0.110	2.4	2.2	22	51.7	0.110	0.220	
19	Thu		2.35	2.30	40	136.3	0.165	2.3	2.3	40	136.3	0.165	0.330	
20	Fri		2.30	2.25	40	136.3	0.165	2.3	2.3	40	136.3	0.165	0.330	
21	Sat		2.40	1.60	12	4.7	0.024	2.4	1.6	12	4.7	0.024	0.049	
22	Sun		2.40	1.60	12	4.7	0.024	2.5	1.6	12	4.7	0.025	0.050	
23	Mon		2.40	1.70	13	9.4	0.046	2.4	1.7	13	9.4	0.045	0.091	
24	Tue		2.40	1.70	13	9.4	0.046	2.4	1.7	13	9.4	0.045	0.091	
25	Wed		2.50	1.70	13	9.4	0.049	2.5	1.7	13	9.4	0.047	0.096	
26	Thu		2.50	1.70	13	9.4	0.049	2.5	1.7	13	9.4	0.047	0.096	
27	Fri		2.50	1.70	13	9.4	0.049	2.5	1.7	13	9.4	0.047	0.096	
28	Sat		2.50	1.70	13	9.4	0.049	2.5	1.7	13	9.4	0.047	0.096	
29	Sun		2.50	2.30	24	61.1	0.134	2.5	2.3	24	61.1	0.128	0.262	Cumulated
30	Mon		2.50	2.30	24	61.1	0.134	2.5	2.3	24	61.1	0.128	0.262	4.234
Dec 1	Tue		2.50	2.30	24	61.1	0.134	2.5	2.3	24	61.1	0.128	0.262	Required= 3.416 MCM
2	Wed		2.50	2.30	24	61.1	0.134	2.5	2.3	24	61.1	0.128	0.262	Excess= 24%
3	Thu		2.45	1.70	12	4.7	0.024	2.4	1.7	12	4.7	0.023	0.047	Total In= 74.712 MCM
4	Fri		2.40	1.70	12	4.7	0.023	2.4	1.7	12	4.7	0.023	0.045	B. Biyala= 6.564 MCM
5	Sat		2.40	1.70	12	4.7	0.023	2.4	1.7	12	4.7	0.023	0.045	Deficit= -36%
6	Sun		2.40	1.70	12	4.7	0.023	2.4	1.7	12	4.7	0.023	0.045	
7	Mon		2.40	1.70	12	4.7	0.023	2.4	1.7	12	4.7	0.023	0.045	
8	Tue		2.40	1.70	12	4.7	0.023	2.4	1.7	12	4.7	0.023	0.045	
9	Wed		2.55	1.70	12	4.7	0.025	2.5	1.7	12	4.7	0.024	0.050	
10	Thu		2.55	1.70	12	4.7	0.025	2.5	1.7	12	4.7	0.024	0.050	
11	Fri		2.55	2.20	22	51.7	0.145	2.5	2.2	22	51.7	0.135	0.280	
12	Sat		2.52	2.20	22	51.7	0.139	2.5	2.2	22	51.7	0.130	0.269	
13	Sun		2.40	2.20	23	56.4	0.122	2.4	2.2	23	56.4	0.122	0.244	
14	Mon		2.40	2.20	23	56.4	0.122	2.4	2.2	23	56.4	0.116	0.238	
15	Tue		2.40	1.60	12	4.7	0.024	2.4	1.6	12	4.7	0.024	0.048	
16	Wed		2.40	1.60	12	4.7	0.024	2.4	1.6	12	4.7	0.024	0.049	
17	Thu		2.50	1.60	12	4.7	0.026	2.5	1.6	12	4.7	0.026	0.052	

Note: Discharge Q = 1.165 x (Gate Opening - 0.095) x Head Dif\*\*0.5  
 Note: Discharge Q = 1.165 x (Gate Opening) x Head Dif\*\*0.5 (if G.O. < 0.095)  
 Unit: Q = MCM/Day, Gate Opening & Head Dif = Meter

Above Total (MCM) = 7.970  
 Day's Average (MCM/56) = 0.142  
 OUM/S = 1.647

Table I. 17. 1 Intake Volume from Bahr Jera for Bahr Biyal Irrigation Area

Date 1993	On Off	Morning					Evening					Daily Dis MCM	Monthly Dis MCM	
		US M. a	OS M. a	Gear	Open. cm	Dis MCM	US M. a	OS M. a	Gear	Open. cm	Dis MCM			
Oct 26	Mon	2.45	2.40	43	150.4	0.184	2.4	2.4	43	150.4	0.184	0.367		
27	Tue	2.75	2.70	43	150.4	0.184	2.7	2.7	43	150.4	0.184	0.367		
28	Wed	2.65	2.60	43	150.4	0.184	2.6	2.5	43	150.4	0.184	0.367		
29	Thu	2.30	2.25	43	150.4	0.184	2.3	2.2	43	150.4	0.184	0.367		
30	Fri	2.55	1.80	13	9.4	0.047	2.5	1.8	13	9.4	0.045	0.093		
31	Sat	Off	2.60	1.80	13	9.4	0.049	2.6	1.8	13	9.4	0.047	0.096	NA
Nov 1	Sun		2.60	1.80	13	9.4	0.049	2.7	1.8	13	9.4	0.051	0.100	
2	Mon		2.80	1.80	13	9.4	0.055	2.6	1.8	13	9.4	0.049	0.104	
3	Tue		2.65	1.80	13	9.4	0.050	2.6	1.8	13	9.4	0.049	0.099	
4	Wed		2.65	1.80	13	9.4	0.050	2.6	1.8	13	9.4	0.049	0.099	
5	Thu		2.65	2.60	45	159.8	0.195	2.6	2.1	16	23.5	0.058	0.253	
6	Fri		2.65	2.10	20	42.3	0.142	2.6	2.1	20	42.3	0.128	0.270	
7	Sat		2.65	2.10	20	42.3	0.142	2.6	2.3	22	51.7	0.135	0.276	
8	Sun		2.65	2.30	22	51.7	0.145	2.6	2.3	22	51.7	0.135	0.220	
9	Mon		2.55	1.80	13	9.4	0.047	2.5	1.8	13	9.4	0.045	0.093	
10	Tue		2.35	1.80	13	9.4	0.041	2.4	1.8	13	9.4	0.041	0.081	
11	Wed		2.40	1.80	13	9.4	0.042	2.4	1.8	13	9.4	0.042	0.085	
12	Thu		2.30	1.80	13	9.4	0.039	2.3	1.7	13	9.4	0.041	0.079	
13	Fri		2.20	1.60	12	4.7	0.021	2.2	1.6	12	4.7	0.021	0.042	
14	Sat		2.25	1.60	12	4.7	0.022	2.2	1.6	12	4.7	0.021	0.043	
15	Sun		2.25	1.60	12	4.7	0.022	2.2	1.6	12	4.7	0.021	0.043	
16	Mon		2.25	1.60	12	4.7	0.022	2.3	1.6	12	4.7	0.022	0.044	
17	Tue		2.50	2.20	18	32.9	0.075	2.5	2.3	22	51.7	0.095	0.170	
18	Wed		2.50	2.30	22	51.7	0.110	2.4	2.2	22	51.7	0.110	0.220	
19	Thu		2.35	2.30	40	136.3	0.165	2.3	2.3	40	136.3	0.165	0.330	
20	Fri		2.30	2.25	40	136.3	0.165	2.3	2.3	40	136.3	0.165	0.330	
21	Sat		2.40	1.60	12	4.7	0.024	2.4	1.6	12	4.7	0.024	0.049	
22	Sun		2.40	1.60	12	4.7	0.024	2.5	1.6	12	4.7	0.025	0.050	
23	Mon		2.40	1.70	13	9.4	0.045	2.4	1.7	13	9.4	0.045	0.091	
24	Tue		2.40	1.70	13	9.4	0.045	2.4	1.7	13	9.4	0.045	0.091	
25	Wed		2.50	1.70	13	9.4	0.049	2.5	1.7	13	9.4	0.047	0.096	
26	Thu		2.50	1.70	13	9.4	0.049	2.5	1.7	13	9.4	0.047	0.096	
27	Fri		2.50	1.70	13	9.4	0.049	2.5	1.7	13	9.4	0.047	0.096	
28	Sat		2.50	1.70	13	9.4	0.049	2.5	1.7	13	9.4	0.047	0.096	
29	Sun		2.50	2.30	24	61.1	0.134	2.5	2.3	24	61.1	0.128	0.262	Cumulated
30	Mon		2.50	2.30	24	61.1	0.134	2.5	2.3	24	61.1	0.128	0.262	4.234
Dec 1	Tue		2.50	2.30	24	61.1	0.134	2.5	2.3	24	61.1	0.128	0.262	Required= 3.416 MCM
2	Wed		2.50	2.30	24	61.1	0.134	2.5	2.3	24	61.1	0.128	0.262	Excess= 24%
3	Thu		2.45	1.70	12	4.7	0.024	2.4	1.7	12	4.7	0.023	0.047	Total In= 74.712 MCM
4	Fri		2.40	1.70	12	4.7	0.023	2.4	1.7	12	4.7	0.023	0.045	B. Biyata= 6.564 MCM
5	Sat		2.40	1.70	12	4.7	0.023	2.4	1.7	12	4.7	0.023	0.045	Deficit= -35%
6	Sun		2.40	1.70	12	4.7	0.023	2.4	1.7	12	4.7	0.023	0.045	
7	Mon		2.40	1.70	12	4.7	0.023	2.4	1.7	12	4.7	0.023	0.045	
8	Tue		2.40	1.70	12	4.7	0.023	2.4	1.7	12	4.7	0.023	0.045	
9	Wed		2.55	1.70	12	4.7	0.025	2.5	1.7	12	4.7	0.024	0.050	
10	Thu		2.55	1.70	12	4.7	0.025	2.5	1.7	12	4.7	0.024	0.050	
11	Fri		2.55	2.20	22	51.7	0.145	2.5	2.2	22	51.7	0.135	0.280	
12	Sat		2.52	2.20	22	51.7	0.139	2.5	2.2	22	51.7	0.130	0.269	
13	Sun		2.40	2.20	23	56.4	0.122	2.4	2.2	23	56.4	0.122	0.244	
14	Mon		2.40	2.20	23	56.4	0.122	2.4	2.2	23	56.4	0.116	0.238	
15	Tue		2.40	1.60	12	4.7	0.024	2.4	1.6	12	4.7	0.024	0.048	
16	Wed		2.40	1.60	12	4.7	0.024	2.4	1.6	12	4.7	0.024	0.049	
17	Thu		2.50	1.60	12	4.7	0.026	2.5	1.6	12	4.7	0.026	0.052	

Note: Discharge Q = 1.165 x Gate Opening + 0.055 x Head Diff\*\*0.5

Note: Discharge Q = 1.165 x Gate Opening x Head Diff\*\*0.5 IF G 0.00095

Unit: Q = MCM/day, Gate Opening & Head Diff: Meter

Above Total(MCM)= 7.970

Day's Average (MCM/56)= 0.142

Q/M/S= 1.647

Table F. 17.2 Gate Formula for Bahr Biyala from Bahr Tera

No.	Date	US WL, m	DS WL, m	Dif., H m	H**0.5	Dis, MCM	Abst'd, MCM	Open, m	Q/H**0.5
1	11/5/1998	2.68	2.22	0.46	0.678	0.368	0.3042	0.48	0.543
2	11/8/1998	2.56	2.27	0.29	0.539	0.599	0.6305	1.10	1.112
3	11/18/1998	2.52	2.01	0.51	0.714	0.409	0.5533	0.76	0.573
4	11/19/1998	2.31	2.26	0.05	0.224	0.660	0.6864	2.83	2.952
5	11/29/1998	2.53	2.42	0.11	0.332	0.697	0.6704	1.83	2.102
6	12/1/1998	2.42	2.27	0.15	0.387	0.585	0.5076	1.22	1.510

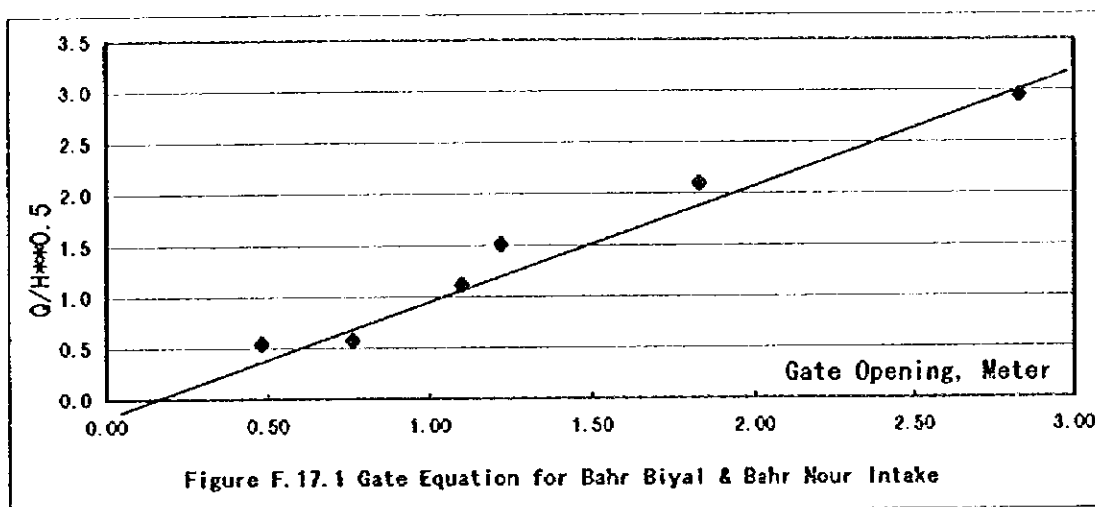


Figure F. 17.1 Gate Equation for Bahr Biyal & Bahr Nour Intake

Table F.17.3 Summary of Conveyance Efficiencies for Bahr Tera

Reach	Date	Section	Ave. Vel.	Section	Q, MCM/day	Dif	Conv. Eff., %	
A-A'	11/1/1998	A	0.530	72.610	3.358			
		A'	0.474	78.040	3.200	0.156	97.00	
	11/3/1998	A	0.530	69.220	3.150			
		A'	0.462	75.940	3.320	0.118	98.20	
	11/14/1998	A	0.465	53.690	2.157			
		A'	0.342	64.840	1.913	0.244	91.55	Excluded
11/25/1998	A	0.520	64.210	2.863				
	A'	0.440	70.470	2.680	0.183	96.00		
<b>Average</b>							L = 10.6 km	<b>97.07</b>
B-B'	11/2/1998	B	0.466	70.460	3.081			
		B'	0.46	72.600	2.903	0.178	97.86	
	11/4/1998	B	0.456	78.320	3.087			
		B'	0.47	73.380	2.961	0.116	99.71	
	11/15/1998	B	0.376	63.850	2.074			
		B'	0.344	64.930	1.928	0.146	97.73	
11/26/1998	B	0.463	66.140	2.648				
	B'	0.455	68.380	2.517	0.131	99.13		
<b>Average</b>							L = 6.5 km	<b>98.61</b>
C-C'	11/9/1998	C	0.358	42.120	1.304			
		C'	0.352	40.270	1.225	0.079	93.90	
	11/11/1998	C	0.384	53.410	1.772			
		C'	0.37	51.161	1.636	0.137	92.90	
	11/21/1998	C	0.512	57.620	2.547			
		C'	0.498	54.650	2.351	0.196	92.30	
11/23/1998	C	0.485	57.000	2.394				
	C'	0.462	54.450	2.174	0.220	90.80		
<b>Average</b>							L = 7.7 km	<b>92.48</b>
D-D'	11/10/1998	D	0.362	43.330	1.350			
		D'	0.335	44.700	1.293	0.057	98.60	
	11/12/1998	D	0.286	42.760	1.060			
		D'	0.257	45.230	1.009	0.051	98.80	
	11/22/1998	D	0.437	61.120	2.308			
		D'	0.408	58.530	2.217	0.091	97.70	
11/24/1998	D	0.421	57.370	2.090				
	D'	0.428	55.750	2.670	0.020	99.10		
<b>Average</b>							L = 5.7 km	<b>98.55</b>

Table F.17.4 Estimation of Roughness Coefficient based on Current Measurement along Behr Tera

Reach No.	US WL, m	DS WL, m	Dif.	H. Gradient	US Vel	US Sec W. Width M.	Depth H. Depth	DS Vel	DS Sec W. Width M.	Depth H. Depth	Ave Vel.	Ave. H.D.	N	
1	3.62	2.75	0.87	8.2075E-05	0.530	40.00	1.86	0.474	78.04	2.11	1.65	0.502	1.87	0.027
2	3.53	2.65	0.88	8.3019E-05	0.530	39.50	1.85	0.462	75.94	2.05	1.85	0.496	1.73	0.026
3	3.22	2.3	0.92	8.6792E-05	0.465	37.50	1.43	0.342	64.84	1.80	1.64	0.404	1.48	0.030
4	3.44	2.52	0.92	8.6792E-05	0.520	37.90	1.69	0.440	70.47	1.93	1.75	0.480	1.65	0.027
Average														0.028
1	2.38	1.3	1.08	1.4026E-04	0.358	28.20	1.49	0.352	40.27	1.22	1.14	0.355	1.24	0.039
2	2.14	1.4	0.74	9.6104E-05	0.768	29.50	1.73	0.470	42.72	1.26	1.17	0.619	1.36	0.019
3	2.31	1.8	0.51	6.6234E-05	0.512	36.50	1.58	0.498	54.65	1.48	1.37	0.505	1.41	0.020
4	2.06	1.78	0.28	3.6364E-05	0.485	35.50	1.61	0.462	54.45	1.51	1.40	0.474	1.43	0.016
Average														0.024
G. Average														0.026

Note: n = 0.03 is applied for Bahar Biyala related canals, considering of less maintenance and more woods & waste than Bahr Tera

## F.18 Water Balance Study (Irrigation Requirement) in the F/S Area

With the cropping patterns proposed and irrigation efficiencies applied, following cases are studied for the Feasibility Study (Priority) Area. Also, each case is examined with two conditions for areas, 14,550 feddan in total, currently irrigated by gravity-fed drainage. One is that no supplemental fresh water feeds the areas, thus to be irrigated by drainage only as it is (referred to as "Drainage not Supplemented"), and the other is that half of the required irrigation water is supplemented by fresh water (referred to as "Drainage Supplemented"). Therefore total number of study cases becomes 12.

Cropping Pattern	Without Project	With Project	Remarks
	Ep=0.57	Ep=0.66	
Present	0	0	
Pattern 1		0	Downstream of Tera Crop intensity; 170%
Pattern 2		0	Crop intensity; All 200%
Pattern 1'		0	Downstream of Tera Crop intensity; 170%
Pattern 2'		0	Crop intensity; All 200%

Cropping patterns 1 and 2 (1' & 2') are just same for the feasibility study (priority) area but different from each other for the downstream of Bahr Tera (after Hamoul M.P.S.). Patterns 1 & 2 are the proposed cropping pattern, and 1' & 2' are reference only for which the paddy area is different from the proposed one. The paddy area of 1' & 2' is larger than the proposed one (but smaller than the present one) in order to check the water requirement taking into consideration current trend of eagerness of planting paddy).

The results calculated are tabulated as follows;

### Cropping Pattern 1 & 2 & Present

Tables F. 18.1	Irrigation Efficiencies Applied
Tables F. 18.2	Summary of Water Requirements for Whole Bahr Tera Area, Surplus or Deficit and Modified Water Allocation, '000CUM
Figure F. 18.1	Summary of Annual Requirement (Present C.P. & C.I. DS170% & All 200%), MCM
Figure F. 18.2	Summary of Monthly Peak Requirement (Present C.P. & C.I. DS170% & All 200%), MCM
Figure F. 18.3	Summary of Modified Annual Requirement (DS C.I. DS170%), MCM
Figure F. 18.4	Water Requirement (DS C.I.170%, Drainage Suppl'ted, Ep=0.66) and Original Availability
Figure F. 18.5	Water Requirement (DS C.I.170%, Drainage Suppl'ted, Ep=0.66) and Modified Availability
Figure F. 18.6	Summary of Modified Annual Requirement (C.I. All200%), MCM
Figure F. 18.7	Water Requirement (DS C.I.200%, Drainage Suppl'ted, Ep=0.66) and Original Availability
Figure F. 18.8	Water Requirement (DS C.I.200%, Drainage Suppl'ted, Ep=0.66) and Modified Availability
Figure F. 18.9	Peak Discharge Required at Bahr Tera, CUM/sec

Table F.18.3	Summary of Water Requirements for Bahr Biyala
Figure F.18.10	Bahr Biyala Water Requirement with Project (Ep=0.66)
Figure F.18.11	Bahr Biyala Water Requirement without Project (Ep=0.56)
Table F.18.4	Summary of Water Requirements for Bahr Biyala
Figure F.18.12	Bahr El Nour Water Requirement with Project (Ep=0.66)
Figure F.18.13	Bahr El Nour Water Requirement without Project (Ep=0.56)
Figure F.18.14	Skeleton Map of Irrigation System of Upper Bahr Tera, Downstream Cropping Intensity 170%
Figure F.18.15	Skeleton Map of Irrigation System of Upper Bahr Tera, Downstream Cropping Intensity 200%
Figure F.18.16	Skeleton Map of Irrigation System of Bahr Biyala Canal
Tables F.18.5 – F.18.16	DS C.I. 170%, Ep=0.66, Drainage not Supplemented & Supplemented
Figures F.18.17 – F.18.18	ditto
Tables F.18.17 – F.18.28	DS C.I. 200%, Ep=0.66, Drainage not Supplemented & Supplemented
Figures F.18.19 – F.18.20	ditto
Tables F.18.29 – F.18.40	Present C.P., Ep=0.56, Drainage not Supplemented & Supplemented
Figures F.18.21 – F.18.22	ditto
Tables F.18.41 – F.18.52	Present C.P., Ep=0.66, Drainage not Supplemented & Supplemented
Figures F.18.23 – F.18.24	ditto

**Cropping Pattern 1' & 2'**

Tables F.18.53	Summary of Water Requirements for Whole Bahr Tera Area, Surplus or Deficit and Modified Water Allocation, '000CUM
Figure F.18.25	Summary of Annual Requirement (Present C.P. & C.I. DS170% & All 200%), MCM
Figure F.18.26	Summary of Monthly Peak Requirement (Present C.P. & C.I. DS170% & All 200%), MCM
Tables F.18.54 – F.18.65	DS C.I. 170%, Ep=0.66, Drainage not Supplemented & Supplemented
Figures F.18.27 – F.18.28	ditto
Tables F.18.66 – F.18.77	DS C.I. 200%, Ep=0.66, Drainage not Supplemented & Supplemented
Figures F.18.29 – F.18.30	ditto

**Irrigation Requirement to be Saved by IIP in the Priority Area**

Tables F.18.78	Summary of Water Requirement to be saved by IIP in the Priority Area and Supplement to the Downstream of Bahr Tera
Figure F.18.31	Water Requirements for Present and IIP (Priority Area Only)
Figure F.18.32	Water to be Saved by IIP in the Priority Area

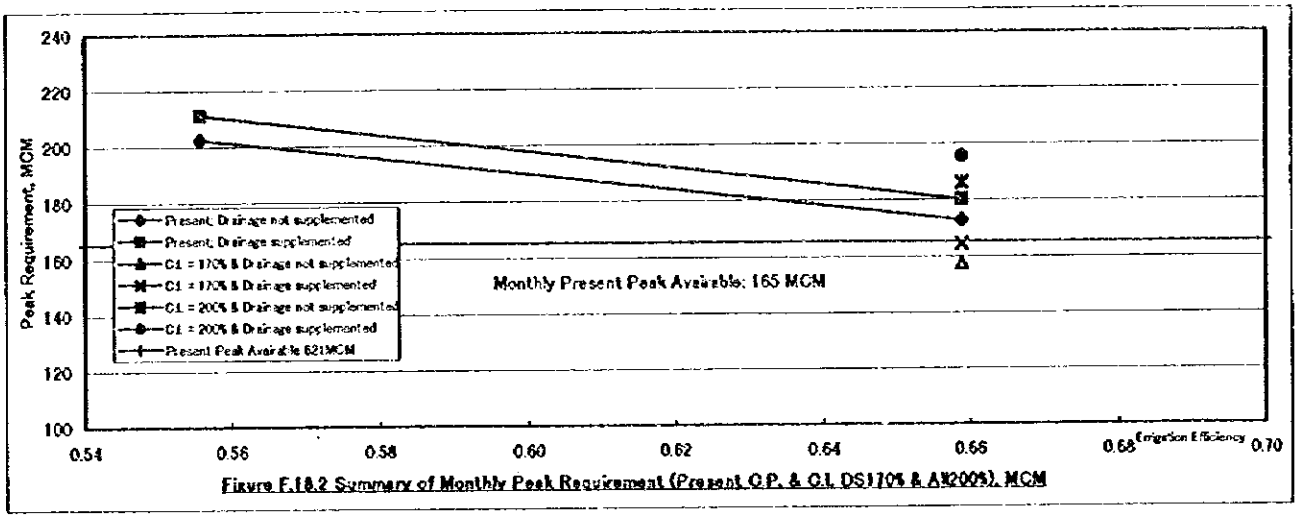
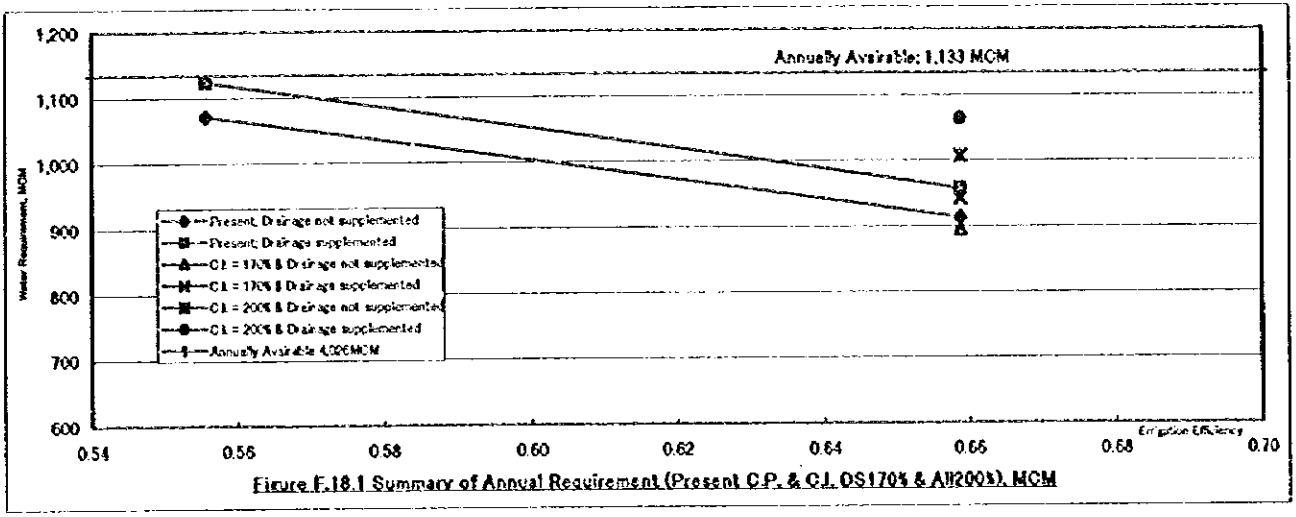


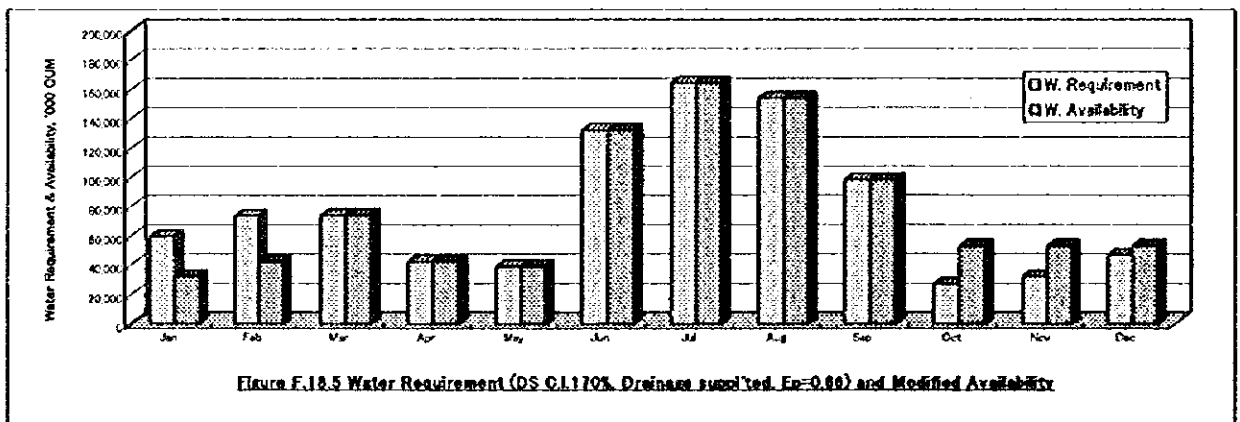
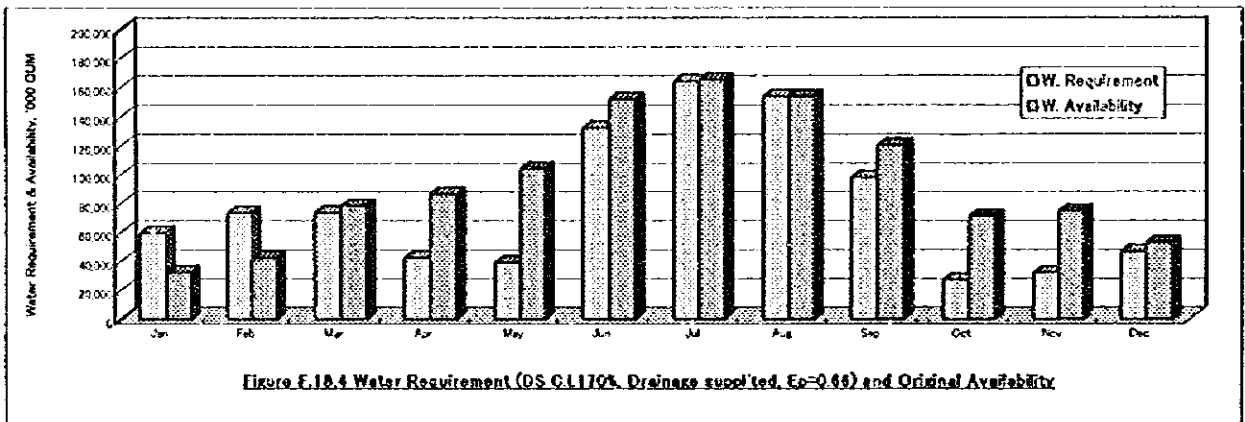
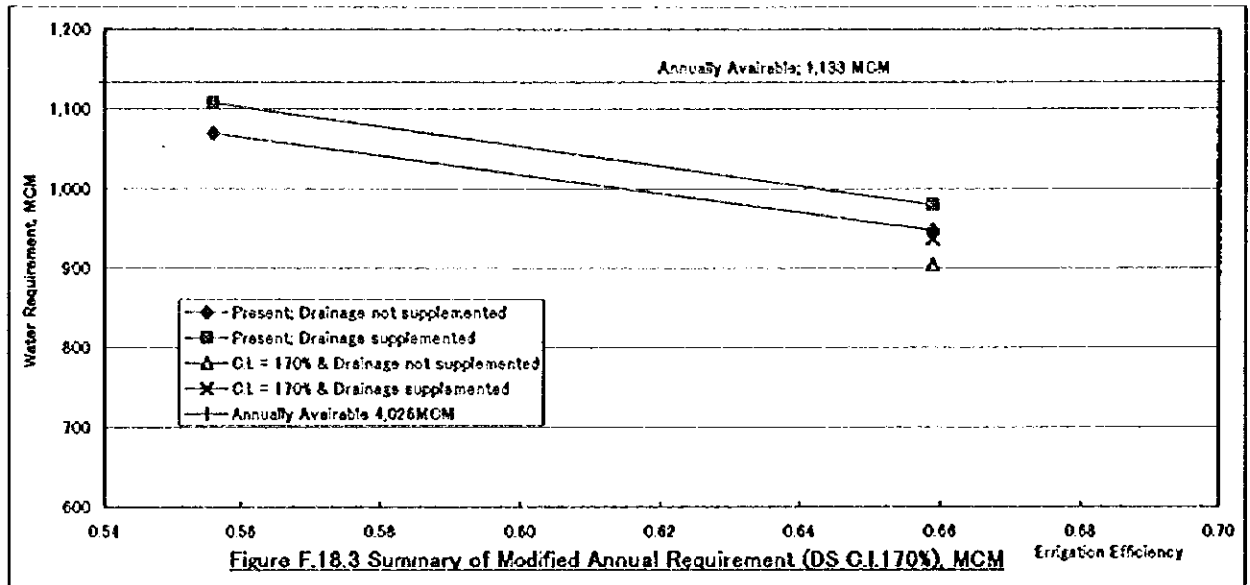
Table F.18.1 Irrigation Efficiency Applied

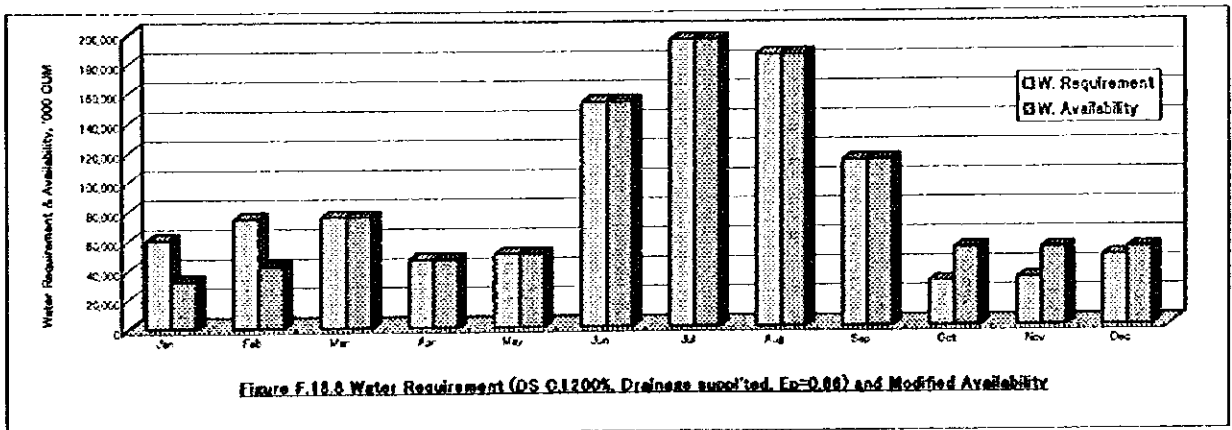
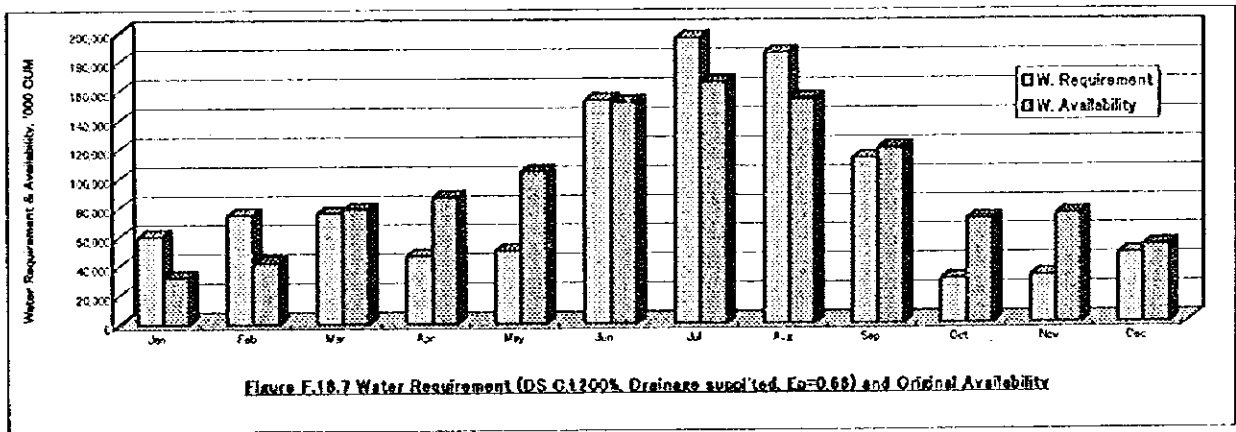
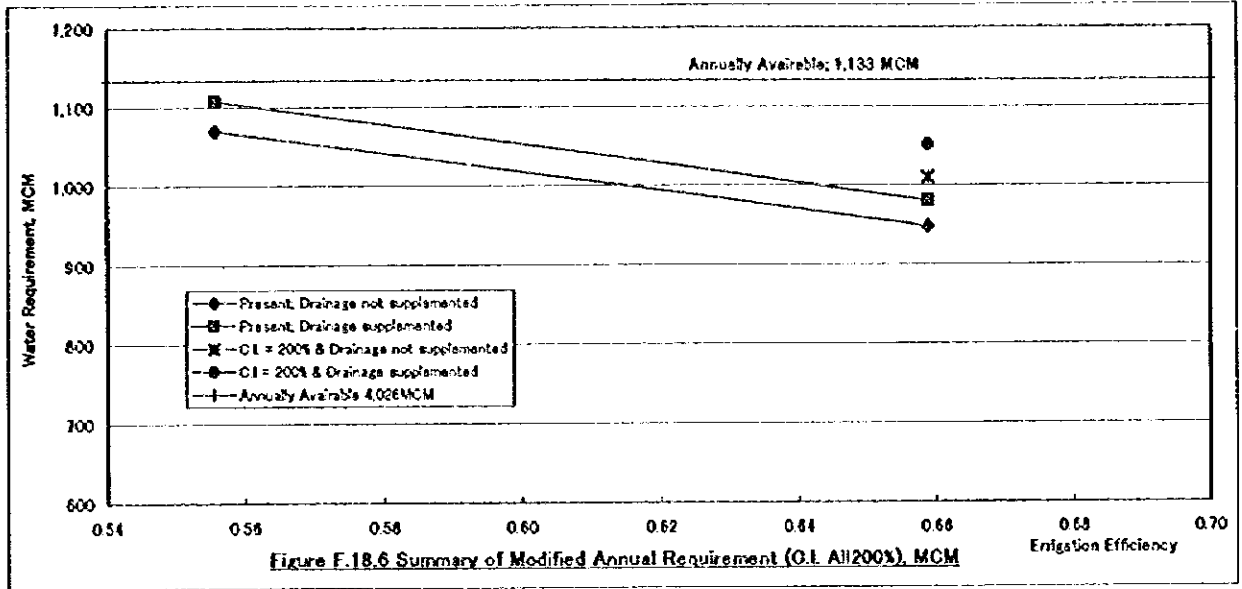
Item	Without project	With Project	With Project (enhnt)	Remarks
On-farm Application	0.65	0.73		
Meska Conveyance	0.90	0.95		Incl. direct pumping
Main. Sec. Del. Conveyance	0.95	0.95		
Overall Efficiency	0.556	0.689		

Table F.18.2 Summary of Water Requirements for Whole Bahr Tera, Surplus or Deficit and Modified Water Allocation, '000 CUM

Cropping	Ep	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	% to Original
Available for Bahr Tera		32,127	41,973	76,222	86,432	104,322	151,922	165,290	153,839	120,257	71,373	74,712	52,990	1,133,458	
Water Requirement															
Crop Intensity 170% (Drainage not supplemented)	0.66	53,893	68,896	69,149	40,075	37,385	126,840	157,272	147,005	93,737	25,760	29,930	43,798	895,340	
Surplus or Deficit, %		-73.4	-64.1	11.6	53.6	64.2	16.5	4.9	4.4	22.1	63.9	39.9	17.3	21.0	
Modified		32,127	41,973	69,149	40,075	37,385	126,840	157,272	147,005	93,737	52,990	52,990	52,990	904,534	20.20
Surplus or Deficit, %		-73.4	-64.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.4	43.5	17.3	1.0	
Crop Intensity 170% (Drainage supplemented)	0.66	59,428	73,476	73,822	42,447	36,352	132,372	164,425	153,912	98,210	26,978	31,972	46,816	942,809	
Surplus or Deficit, %		-85.0	-75.1	5.6	50.9	62.7	12.9	0.5	-0.0	18.3	62.2	57.2	11.7	16.0	
Modified		32,127	41,973	73,822	42,447	36,352	132,372	164,425	153,912	98,210	52,990	52,990	52,990	937,211	17.31
Surplus or Deficit, %		-85.0	-75.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.1	39.7	11.7	-0.6	
Crop Intensity 200% (Drainage not supplemented)	0.66	56,413	69,948	70,822	43,698	47,259	146,146	185,977	176,018	107,596	28,816	30,277	44,260	1,007,251	
Surplus or Deficit, %		-75.6	-66.6	9.5	49.4	54.7	3.8	-12.5	-14.4	10.5	59.6	59.5	16.4	11.1	
Modified		32,127	41,973	70,822	43,698	47,259	146,146	185,977	176,018	107,596	52,990	52,990	52,990	1,010,586	10.84
Surplus or Deficit, %		-75.6	-66.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.6	42.9	16.4	0.3	
Crop Intensity 200% (Drainage supplemented)	0.66	60,228	74,944	75,680	46,470	49,917	150,203	195,395	185,214	113,162	30,276	32,357	47,352	1,063,898	
Surplus or Deficit, %		-87.5	-77.8	3.2	46.2	52.2	-0.8	-18.2	-20.4	5.9	57.6	56.7	10.6	6.1	
Modified		32,127	41,973	75,680	46,470	49,917	150,203	195,395	185,214	113,162	52,990	52,990	52,990	1,052,113	7.18
Surplus or Deficit, %		-87.5	-77.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.9	38.9	10.6	-1.1	
Present Cropping (Drainage not supplemented)	0.56	57,291	69,668	68,716	45,322	49,941	172,175	202,474	180,582	117,414	30,937	31,505	45,307	1,071,301	
Surplus or Deficit, %		-78.2	-68.0	12.2	47.6	52.1	-13.3	-22.5	-17.4	2.4	56.7	57.8	14.5	5.5	
Modified		32,127	41,973	68,716	45,322	49,941	172,175	202,474	180,582	117,414	52,990	52,990	52,990	1,069,705	5.62
Surplus or Deficit, %		-78.2	-66.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.6	40.5	14.5	-0.1	
Present Cropping (Drainage supplemented)	0.56	60,894	73,797	72,848	47,885	52,548	179,006	211,116	188,702	122,527	32,295	33,455	48,120	1,122,992	
Surplus or Deficit, %		-88.9	-75.8	6.0	44.6	49.6	-17.8	-27.7	-22.7	-1.9	54.8	55.2	9.2	0.9	
Modified		32,127	41,973	72,848	47,885	52,548	179,006	211,116	188,702	122,527	52,990	52,990	52,990	1,107,703	2.27
Surplus or Deficit, %		-88.9	-75.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.1	36.9	9.2	-1.4	
Present Cropping (Drainage not supplemented)	0.66	48,294	58,768	57,965	38,231	42,128	148,928	172,703	154,244	100,890	26,733	26,576	38,219	913,677	
Surplus or Deficit, %		-50.3	-40.0	25.9	55.8	59.6	2.0	-4.5	-0.3	16.1	62.5	64.4	27.9	19.4	
Modified		32,127	41,973	57,965	38,231	42,128	148,928	172,703	154,244	100,890	52,990	52,990	52,990	948,160	16.35
Surplus or Deficit, %		-50.3	-40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.6	49.8	27.9	3.6	
Present Cropping (Drainage supplemented)	0.66	51,198	62,251	61,451	40,393	44,327	154,837	180,069	161,162	105,276	21,904	28,221	40,591	957,679	
Surplus or Deficit, %		-59.4	-48.3	21.4	53.3	57.5	-1.9	-8.9	-4.8	12.5	60.9	62.2	23.4	15.5	
Modified		32,127	41,973	61,451	40,393	44,327	154,837	180,069	161,162	105,276	52,990	52,990	52,990	980,586	13.49
Surplus or Deficit, %		-59.4	-48.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.3	46.7	23.4	2.3	







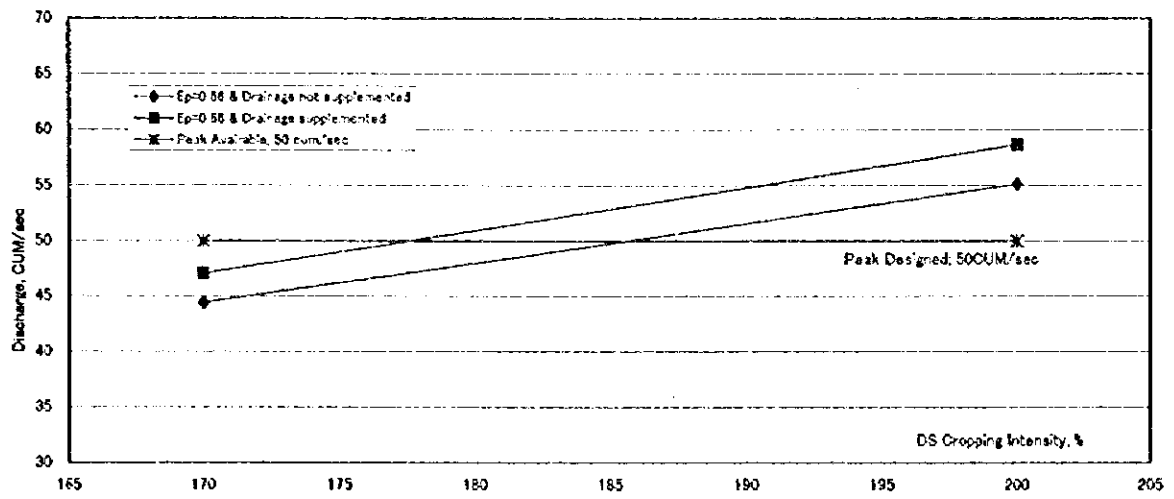


Figure F.18.9 Peak Discharge Required at Bahr Tera Intake, CUM/sec

Table F.18.3 Summary of Water Requirements for Bahr Bivala

Cropping	Ep fed												Annual	Remarks
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Crop Intensity 170% (DS only)	0.66 14,380													
'000CUM per month	5,579	7,053	6,720	4,243	5,319	14,153	16,501	14,673	9,704	2,726	2,815	4,134	93,619	
'000CUM per day	180	252	217	141	172	472	532	473	323	88	94	133	256	
CUM per second	2.08	2.92	2.51	1.64	1.99	5.46	6.16	5.48	3.74	1.02	1.09	1.54	2.97	
mm per day	2.98	4.17	3.59	2.34	2.84	7.81	8.81	7.84	5.36	1.46	1.55	2.21	4.25	
Crop Intensity 200% (All area)	0.66 14,380													
'000CUM per month	5,579	7,053	6,720	4,243	5,319	14,153	16,501	14,673	9,704	2,726	2,815	4,134	93,619	
'000CUM per day	180	252	217	141	172	472	532	473	323	88	94	133	256	
CUM per second	2.08	2.92	2.51	1.64	1.99	5.46	6.16	5.48	3.74	1.02	1.09	1.54	2.97	
mm per day	2.98	4.17	3.59	2.34	2.84	7.81	8.81	7.84	5.36	1.46	1.55	2.21	4.25	
Present Cropping (without impr't)	0.56 14,380													
'000CUM per month	6,653	8,295	7,820	5,117	6,157	21,850	23,285	19,161	13,709	3,600	3,416	4,989	124,051	
'000CUM per day	215	296	252	171	199	728	751	618	457	116	114	161	340	
CUM per second	2.48	3.43	2.92	1.97	2.30	8.43	8.69	7.15	5.29	1.34	1.32	1.86	3.93	
mm per day	3.55	4.91	4.18	2.82	3.29	12.06	12.44	10.23	7.57	1.92	1.89	2.66	5.63	
Present Cropping (with impr't)	0.66 14,380													
'000CUM per month	5,612	6,997	6,596	4,316	5,193	18,931	19,900	16,422	11,814	3,123	2,882	4,209	105,995	
'000CUM per day	181	250	213	144	168	631	642	530	394	101	96	136	290	
CUM per second	2.10	2.89	2.46	1.67	1.94	7.30	7.43	6.13	4.56	1.17	1.11	1.57	3.36	
mm per day	3.00	4.14	3.52	2.38	2.77	10.45	10.63	8.77	6.52	1.67	1.59	2.25	4.81	

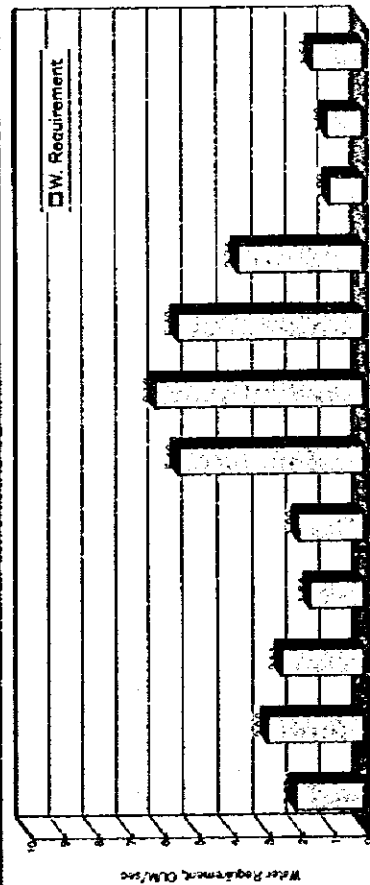


Figure E.18.10 Bahr Bivala Water Requirement with Project (Ep=0.66)

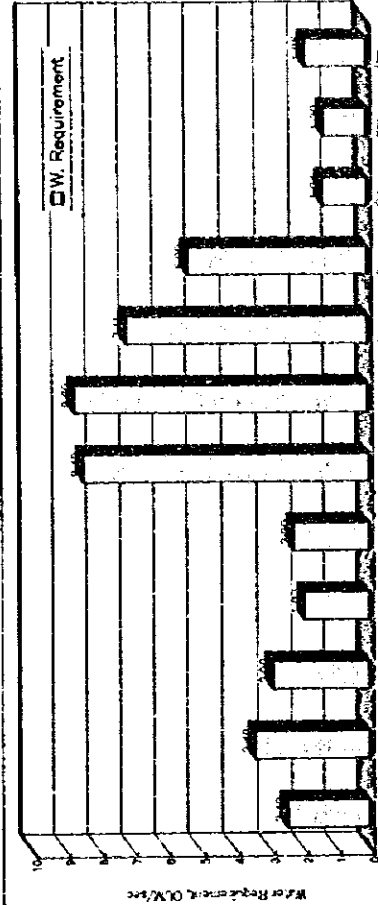


Figure E.18.11 Bahr Bivala Water Requirement without Project (Ep=0.56)

Table F.18.4 Summary of Water Requirements for Bahr El Nour

Cropping	Ep	fed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Remarks
Crop Intensity 170% (DS only)	0.66	4,000														
'000CUM per month			1,555	1,971	1,868	1,148	1,436	3,922	4,569	4,063	2,729	768	777	1,147	25,952	
'000CUM per day			50	70	60	38	46	131	147	131	91	25	26	37	71	
CUM per second			0.58	0.81	0.70	0.44	0.54	1.51	1.71	1.52	1.05	0.29	0.30	0.43	0.82	
mm per day			2.98	4.19	3.59	2.28	2.76	7.78	8.77	7.80	5.41	1.47	1.54	2.20	4.23	
Crop Intensity 200% (All area)	0.66	4,000														
'000CUM per month			1,555	1,971	1,868	1,148	1,436	3,922	4,569	4,063	2,729	768	777	1,147	25,952	
'000CUM per day			50	70	60	38	46	131	147	131	91	25	26	37	71	
CUM per second			0.58	0.81	0.70	0.44	0.54	1.51	1.71	1.52	1.05	0.29	0.30	0.43	0.82	
mm per day			2.98	4.19	3.59	2.28	2.76	7.78	8.77	7.80	5.41	1.47	1.54	2.20	4.23	
Present Cropping (without imprt)	0.56	4,000														
'000CUM per month			1,854	2,317	2,173	1,390	1,670	6,092	6,468	5,305	3,851	1,012	943	1,385	34,461	
'000CUM per day			60	83	70	46	54	203	209	171	128	33	31	45	94	
CUM per second			0.69	0.96	0.81	0.54	0.62	2.35	2.41	1.98	1.49	0.38	0.36	0.52	1.09	
mm per day			3.56	4.93	4.17	2.76	3.21	12.09	12.42	10.19	7.64	1.94	1.87	2.66	5.62	
Present Cropping (with imprt)	0.66	4,000														
'000CUM per month			1,564	1,955	1,833	1,172	1,409	5,281	5,529	4,548	3,319	878	796	1,168	29,453	
'000CUM per day			50	70	59	39	45	176	178	147	111	28	27	38	81	
CUM per second			0.58	0.81	0.68	0.45	0.53	2.04	2.06	1.70	1.28	0.33	0.31	0.44	0.93	
mm per day			3.00	4.16	3.52	2.33	2.70	10.48	10.62	8.73	6.59	1.69	1.58	2.24	4.80	

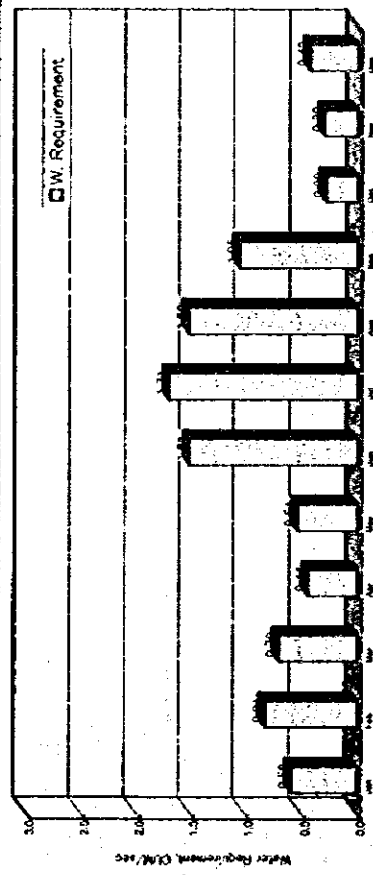


Figure F.18.12. Bahr El Nour Water Requirement with Project (Fp=0.66)

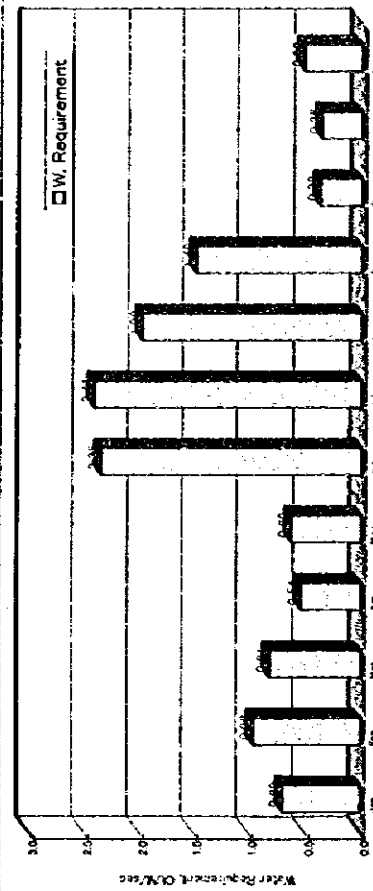


Figure F.18.13. Bahr El Nour Water Requirement without Project (Fp=0.56)

Figure F.18.11 Skeleton Map of Irrigation System of Upper Bahr Tera Canal, Downstream Cropping Intensity 170%

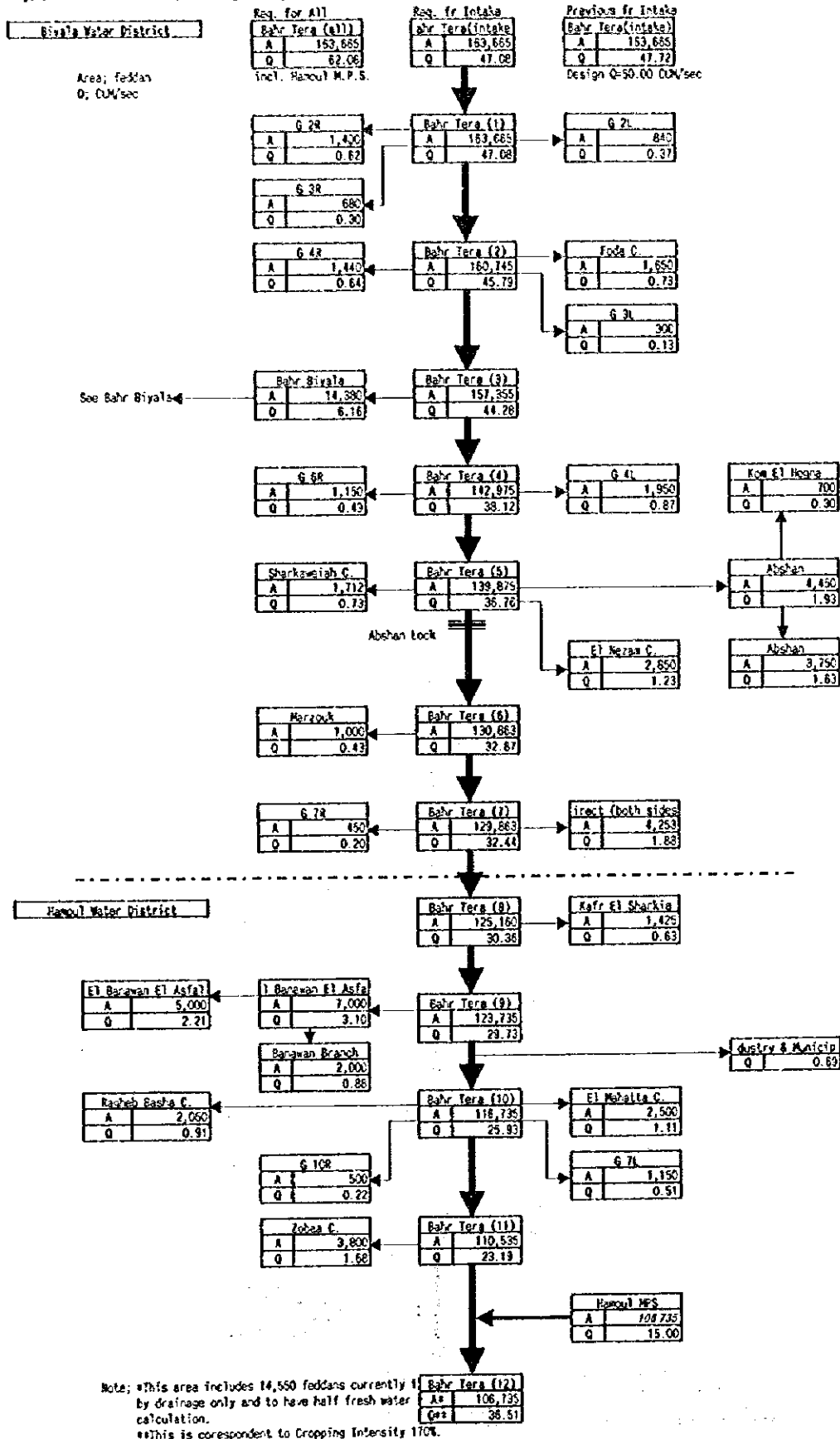




Figure F.18.15 Skeleton Map of Irrigation System of Upper Bahr Tera Canal, Downstream Cropping Intensity 200%

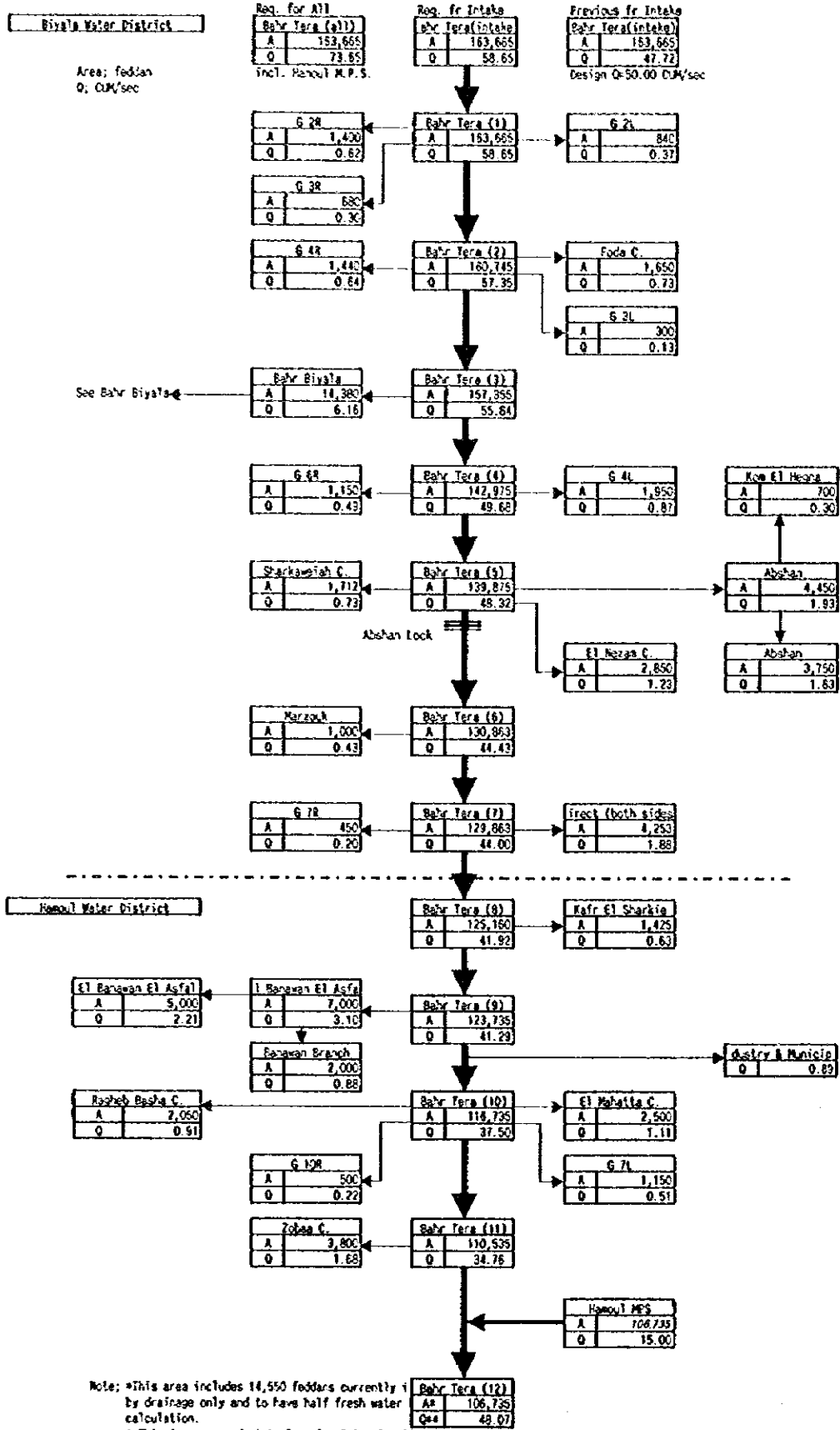


Figure F.18.16 Skeleton Map of Irrigation System of Bahr Biya'a Canal

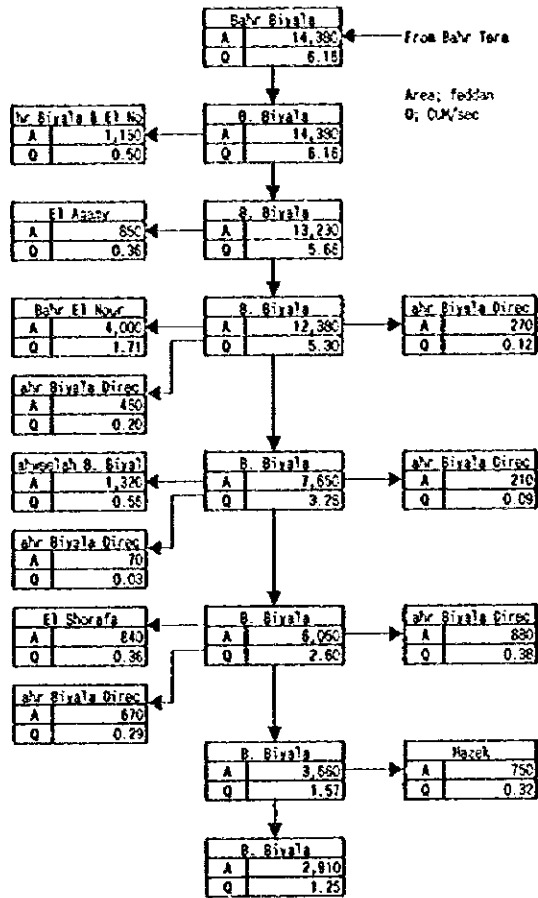






Table F-18.11 Unit Water Requirement in F/S Area based on Modified Penman Method in QUM per Topples (Midstream Area)

Code	Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Days	Area	Volume	Notes
22	22	0.28	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	31	30	0.00	0.00
40	40	0.28	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	31	30	0.00	0.00
13	13	0.28	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	31	30	0.00	0.00
19	19	0.28	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	31	30	0.00	0.00
7	7	0.28	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	31	30	0.00	0.00
8	8	0.28	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	31	30	0.00	0.00
11	11	0.28	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	31	30	0.00	0.00
33	33	0.28	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	31	30	0.00	0.00
26	26	0.28	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	31	30	0.00	0.00
11	11	0.28	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	31	30	0.00	0.00
19	19	0.28	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	31	30	0.00	0.00



Table E.10.13 Unit Water Requirement Determined from E/S Area Based on Modified Penman Method in CUM per Field

Crop	Area, %												Annual Remarks
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	
ET <sub>m</sub> , mm/month	24	24	24	25	27	28	28	29	30	31	31	31	1846
E <sub>a</sub> , mm/Day	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	1.85
Short Duration	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	
Net W. Req. (CUM/10ha)	22	22	22	22	22	22	22	22	22	22	22	22	274
Net W. Req. (CUM/10ha) / Evap	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	
Net W. Req. (CUM/10ha) / Wind	20	20	20	20	20	20	20	20	20	20	20	20	246
Net W. Req. (CUM/10ha) / Long Duration	20	20	20	20	20	20	20	20	20	20	20	20	246
Net W. Req. (CUM/10ha) / Street Drain	7	7	7	7	7	7	7	7	7	7	7	7	84
Net W. Req. (CUM/10ha) / Water Crop	6	6	6	6	6	6	6	6	6	6	6	6	72
Net W. Req. (CUM/10ha) / Sugar Beet	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	108
Net W. Req. (CUM/10ha) / Water Vegetables	10	10	10	10	10	10	10	10	10	10	10	10	120
Net W. Req. (CUM/10ha) / Cotton	12	12	12	12	12	12	12	12	12	12	12	12	144
Net W. Req. (CUM/10ha) / Summer Maize	9	9	9	9	9	9	9	9	9	9	9	9	108
Net W. Req. (CUM/10ha) / None	33	33	33	33	33	33	33	33	33	33	33	33	396
Net W. Req. (CUM/10ha) / Land Preparation, CUM/10ha	0	0	0	0	0	0	0	0	0	0	0	0	
Net W. Req. (CUM/10ha) / Fertilization, CUM/10ha	0	0	0	0	0	0	0	0	0	0	0	0	
Net W. Req. (CUM/10ha) / Summer Vegetables	10	10	10	10	10	10	10	10	10	10	10	10	120
Net W. Req. (CUM/10ha) / Tomatoes	6	6	6	6	6	6	6	6	6	6	6	6	72
Net W. Req. (CUM/10ha) / Tree Crop	2	2	2	2	2	2	2	2	2	2	2	2	24
Net W. Req. (CUM/10ha) / Net Total, CUM/10ha	148	148	148	148	148	148	148	148	148	148	148	148	1776
Net Total, CUM/10ha	158	158	158	158	158	158	158	158	158	158	158	158	1896
Net Total, CUM/10ha	159	159	159	159	159	159	159	159	159	159	159	159	1908
Net Total, CUM/10ha	159	159	159	159	159	159	159	159	159	159	159	159	1908
Net Total, CUM/10ha	159	159	159	159	159	159	159	159	159	159	159	159	1908
Net Total, CUM/10ha	159	159	159	159	159	159	159	159	159	159	159	159	1908
Net Total, CUM/10ha	159	159	159	159	159	159	159	159	159	159	159	159	1908

Table F.10.14. Summary of Gross Water Regal (Cumulative) Excess based on Modified Penman Method, OUM/Archie

Location	Area, 1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
F/S Unravenn	10,500	576	490	315	512	320	943	1100	1118	790	700	168	277	6981
F/S Molekwan	29,882	596	483	487	287	318	581	1142	1018	682	192	194	287	6488
F/S Doodlakine	28,778	594	470	437	389	462	1023	1180	1030	844	165	212	229	6673
Doodlakine S.F.S.	102,725	397	459	459	733	134	731	932	943	633	157	200	280	3614
Programme 5 (Wentworth)	0.68													

Table F.10.15. Summary of Return from Drip-fed (Cumulative) Excess based on Modified Penman Method, OUM/Archie

Location	Area, 1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
F/S Unravenn	21	0	0	0	0	0	28	44	42	32	7	0	0	156
F/S Molekwan	21	0	0	0	0	0	28	44	40	31	7	0	0	161
F/S Doodlakine	19	0	0	0	0	0	21	32	26	23	5	0	0	110
Doodlakine S.F.S.	21	0	0	0	0	0	34	20	32	39	8	0	0	130
Programme 5 (Wentworth)	0.23													
Return Value*	0.49													

Table F.10.16. Total Return Volume from Drip-fed Field, 1995/96

Location	Area, 1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
F/S Unravenn	10,500	0	0	0	0	0	210	442	439	318	73	2	0	1,642
F/S Molekwan	29,882	0	0	0	0	0	387	914	870	627	138	4	0	2,110
F/S Doodlakine	28,778	0	0	0	0	0	335	834	757	581	126	5	0	2,638
Doodlakine S.F.S.	102,725	0	0	0	0	0	3,833	2,922	2,318	4,165	897	29	0	20,232
Total Return Volume	169,685	0	0	0	0	0	5,007	8,272	7,642	5,720	1,293	30	0	27,824



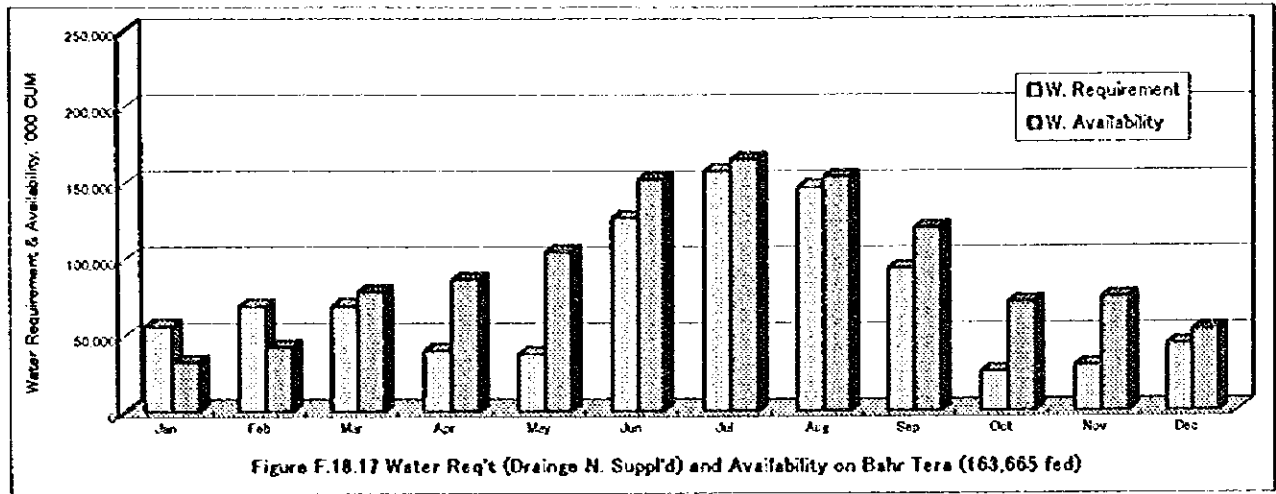


Figure F.18.17 Water Req't (Orange N. Suppl'd) and Availability on Bahr Tera (163,665 fed)

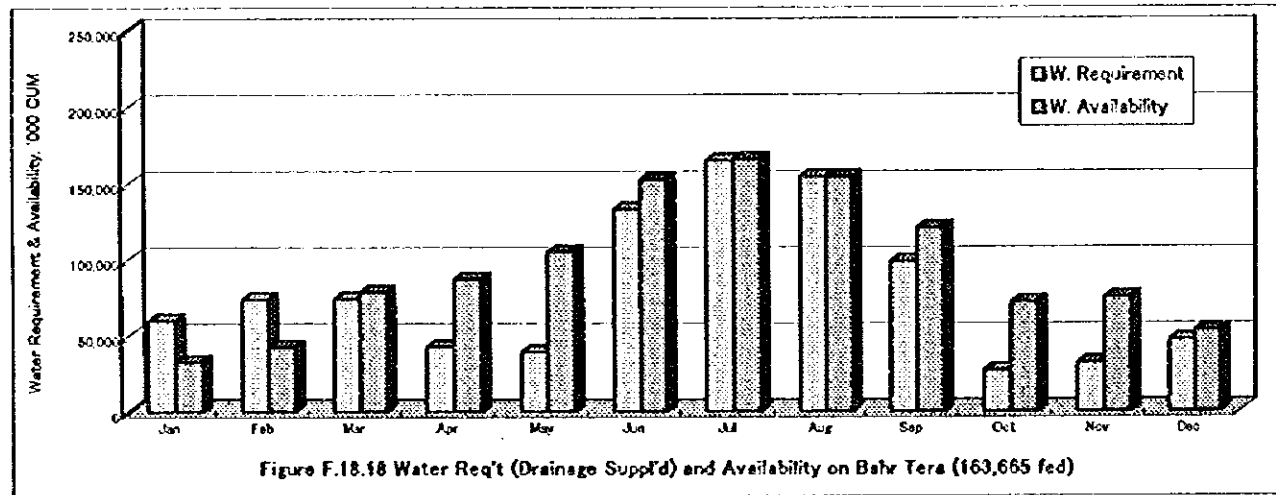


Figure F.18.18 Water Req't (Drainage Suppl'd) and Availability on Bahr Tera (163,665 fed)



Table F-18-22 Unit Water Requirements in F/25 Acres based on Modified Cropwheat Method in CUM per Acre (Upstream Area)

Table with multiple columns representing months (Jul to May) and various crop/region categories (Net W. Req., Grain, Pasture, etc.). Rows include crops like Wheat, Corn, Soybeans, and various forage types. Each row contains numerical values for each month and an 'Annual' total at the end.



Table F-19-24 Unit Water Requirement in F-25 Area based on Modified Pageau Method in QUM per Acre-ft. (Conversion Area)

Crop	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann	QUM	Ann	Remarks
1. Cotton	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
2. Sorghum	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
3. Soybean	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
4. Corn	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
5. Wheat	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
6. Oats	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
7. Barley	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
8. Rice	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
9. Sugarbeet	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
10. Sweetpotato	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
11. Watermelon	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
12. Cantaloupe	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
13. Pumpkin	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
14. Squash	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
15. Broccoli	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
16. Cabbage	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
17. Lettuce	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
18. Spinach	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
19. Potato	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
20. Tomato	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
21. Strawberry	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
22. Blueberry	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
23. Raspberry	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
24. Blackberry	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
25. Elderberry	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
26. Gooseberry	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
27. Currant	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
28. Kiwifruit	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
29. Citrus	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
30. Avocado	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
31. Peach	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
32. Apple	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
33. Pear	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
34. Plum	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
35. Cherry	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
36. Grape	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
37. Olive	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
38. Almond	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
39. Pistachio	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
40. Walnut	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
41. Cashew	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
42. Pecan	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
43. Brazilnut	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
44. Hazelnut	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
45. Macadamia	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
46. Pineapple	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
47. Mango	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
48. Papaya	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
49. Guava	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5
50. Strawberry	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5



Table E.19.28. Summary of Ozone Meter Requirements per Facility based on Modified Pankow Method (DM/Volume)

Facility	Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
F/S Unleaded	10,850	374	480	311	312	353	563	1860	1116	740	200	188	277	6,881
F/S Midstream	20,852	389	493	487	287	359	981	1142	1018	662	192	184	267	8,488
F/S Downstream	25,778	394	470	457	565	482	1023	1188	1039	594	165	212	297	6,872
Domestication & E/S	106,335	373	461	477	272	291	375	1225	1264	763	101	204	209	8,846
Impregnation (Hexamethyl)	0.64													

Table E.19.27. Summary of Return from Empty Containers (as measured from DM/Volume)

Facility	Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
F/S Unleaded	27	0	0	0	0	0	30	46	42	32	7	0	0	154
F/S Midstream	26	0	0	0	0	0	28	44	40	31	7	0	0	151
F/S Downstream	19	0	0	0	0	0	21	32	29	23	5	0	0	119
Domestication & E/S	33	0	0	0	0	0	34	35	37	35	6	0	0	190
Impregnation E (Hexamethyl)	0.73													
Return Factor	0.80													

Table E.19.29. Total Return Volumes from Pando Field (00050) Mi

Facility	Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
F/S Unleaded	10,850	0	0	0	0	0	310	482	438	308	73	2	0	1,842
F/S Midstream	20,852	0	0	0	0	0	587	914	800	637	198	4	0	3,110
F/S Downstream	25,778	0	0	0	0	0	308	654	737	381	126	5	0	2,808
Domestication & E/S	106,335	0	0	0	0	0	3,635	3,372	3,515	1,953	987	20	0	20,225
Total Return Volumes	163,815	0	0	0	0	0	5,086	5,427	7,055	5,170	1,278	30	0	21,985

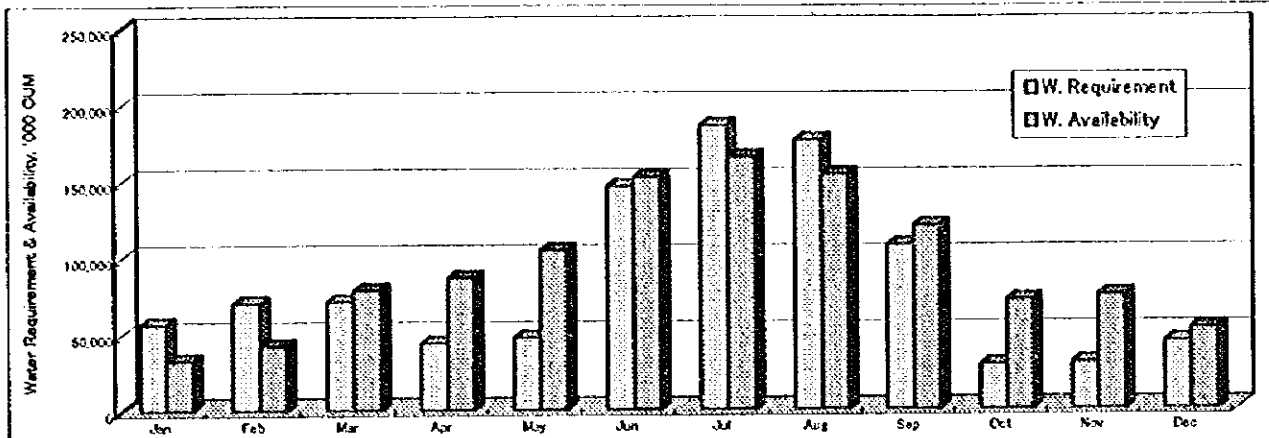


Figure F.18.19 Water Req't (Drainage N. Suppl'd) and Availability on Bahr Tera (163,665 fed)

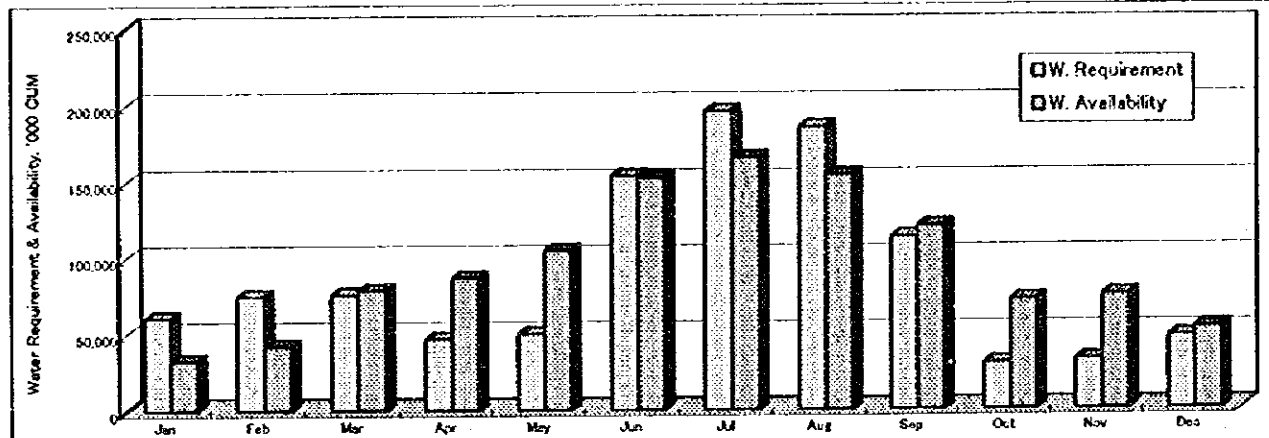


Figure F.18.20 Water Req't (Drainage Suppl'd) and Availability on Bahr Tera (163,665 fed)













Table F.18.29. Summary of Gross Water Requirement per Fraction Based on Modified Penman Method, Caha/Washin

Location	Apr. 1		Apr.		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Annual	
	Fract.	Req.	Fract.	Req.	Fract.	Req.	Fract.	Req.	Fract.	Req.	Fract.	Req.	Fract.	Req.	Fract.	Req.	Fract.	Req.	Fract.	Req.		
F/S Upland	10,200	449	576	601	367	348	1494	1047	1043	748	779	334	8,670									
F/S Midstream	20,832	464	579	543	347	417	1573	1517	1329	943	253	546	8,619									
F/S Downstream	23,778	438	564	533	430	548	1493	1923	1384	845	271	285	8,671									
Downstream F/S*	108,723	588	459	456	732	226	599	1198	1115	703	187	218	8,638									
Impoundment Reservoirs																						

Table F.18.30. Summary of Stream Base Flow (Dependent on stream type), Caha/Washin

Location	Apr. 1		Apr.		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Annual	
	Fract.	Flow	Fract.	Flow	Fract.	Flow	Fract.	Flow	Fract.	Flow	Fract.	Flow	Fract.	Flow	Fract.	Flow	Fract.	Flow	Fract.	Flow		
F/S Upland	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
F/S Midstream	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
F/S Downstream	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Downstream F/S*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Impoundment Reservoirs																						

Table F.18.40. Total Return Volume from Caha Field, 1000000 L

Location	Apr. 1		Apr.		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Annual
	Fract.	Vol.	Fract.	Vol.	Fract.	Vol.	Fract.	Vol.	Fract.	Vol.	Fract.	Vol.	Fract.	Vol.	Fract.	Vol.	Fract.	Vol.	Fract.	Vol.	
F/S Upland	10,200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F/S Midstream	20,832	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F/S Downstream	23,778	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Downstream F/S*	108,723	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Return Volume	163,533	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

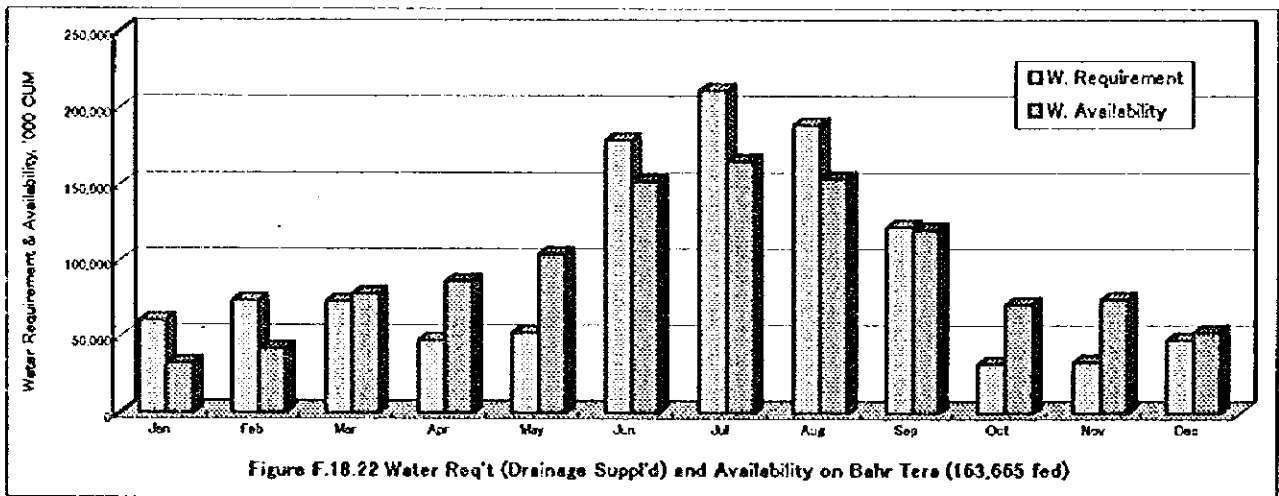
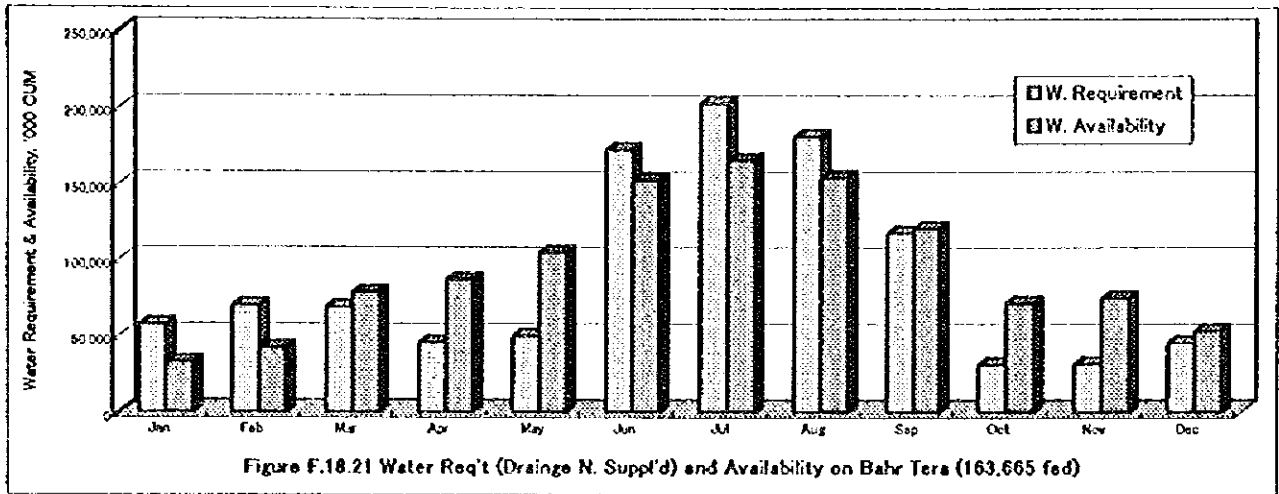








Table F-18.47 Unit Water Requirement in F/2 Area based on Modified Panam Method in QUM per Field (Midstream Area)

Table with columns: Crop, Area, and 12 months (Jan-Dec). Rows include various crops like Wheat, Sorghum, Cotton, Rice, and various vegetables. The table contains numerical data for each month and a total at the bottom.





Table F.18.30. Summary of Gross Water Requirement per Fraction Based on Modified Duration Method, QM/Year

Location	Area, f	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual	
F/S Unstream	10,100	0/8	466	467	310	280	1297	1442	690	233	193	297	297	7,386	
F/S Midstream	20,632	391	489	438	293	332	1370	1387	1127	830	270	199	292	7,380	
F/S Downstream	23,778	386	468	451	303	461	1787	1384	1156	777	191	213	301	7,389	
Downstream to E/S*	108,725	293	342	342	212	215	812	1913	951	603	181	101	203	3,302	
Instream Efficiency		0.86													

Table F.18.31. Summary of Return from Paddy Field (percentage to confirm item), QM/Year

Location	Percent	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual	
F/S Unstream	60	0	0	0	0	0	66	102	63	71	15	0	0	347	
F/S Midstream	58	0	0	0	0	0	63	99	90	69	13	0	0	316	
F/S Downstream	49	0	0	0	0	0	49	77	70	53	12	0	0	260	
Downstream to E/S*	30	0	0	0	0	0	31	38	32	33	8	0	0	158	
Efficient Efficiency		0.10													
Return Ratio		0.30													

Table F.18.32. Total Return Volume from Paddy Field, 1000CSM

Location	Area, f	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
F/S Unstream	10,100	0	0	0	0	0	850	1,032	814	744	161	0	0	5,048
F/S Midstream	20,632	0	0	0	0	0	1,209	2,038	1,832	1,421	307	4	0	5,892
F/S Downstream	23,778	0	0	0	0	0	1,248	1,974	1,743	1,377	297	5	0	6,714
Downstream to E/S*	108,725	0	0	0	0	0	2,852	3,992	3,316	4,185	867	20	0	20,232
Total Return Volume	153,665	0	0	0	0	0	6,921	11,032	10,135	7,711	1,650	30	0	37,872

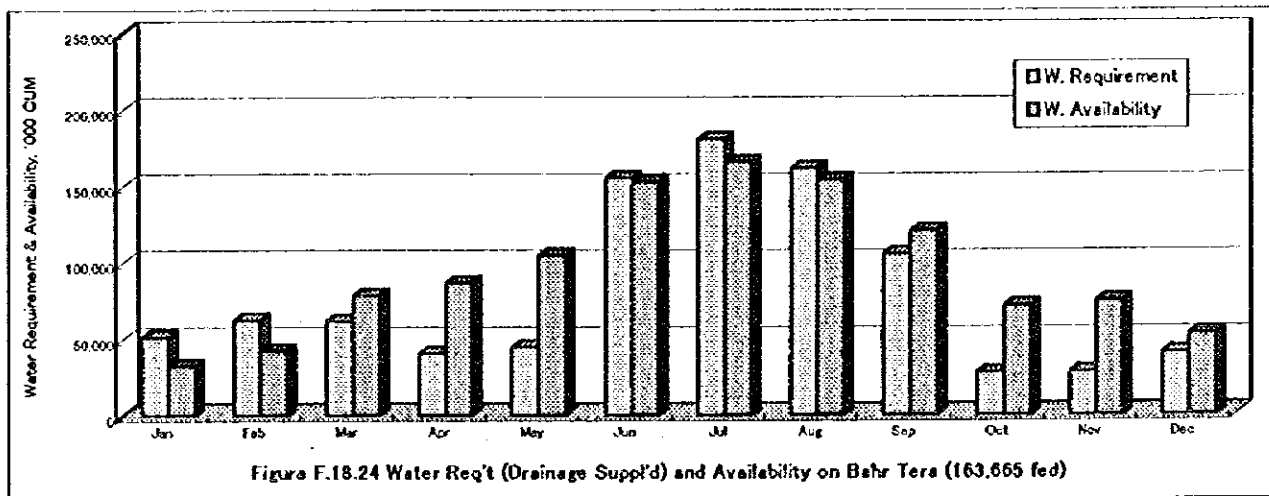
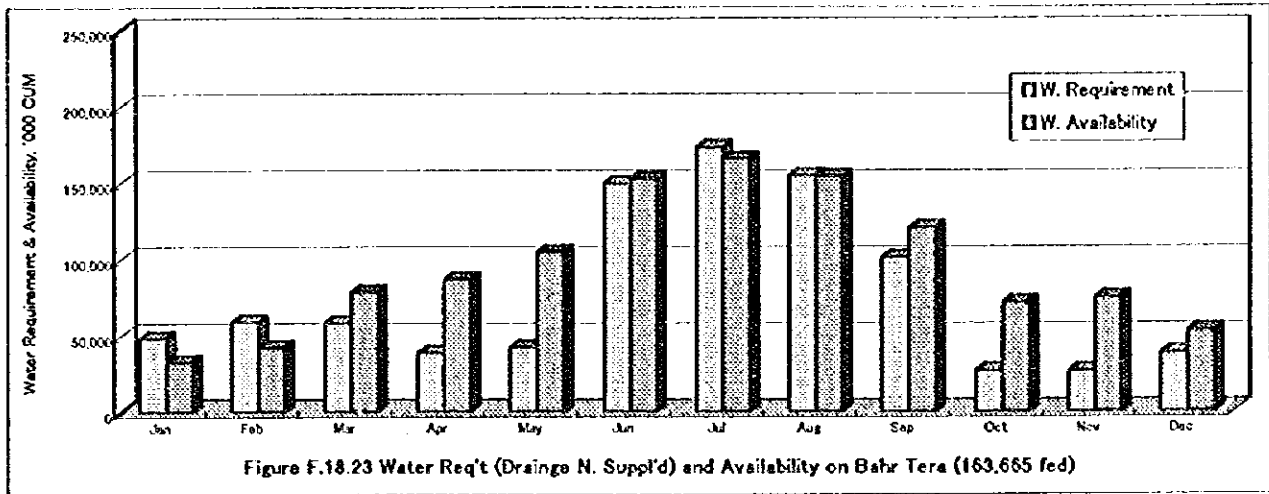


Table F.18.53 Summary of Water Requirements for Whole Bahr Tera, Surplus or Deficit and Modified Water Allocation, '000 CU.M

Cropping	EP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	% to Original
Available for Bahr Tera		32,127	41,973	78,222	86,432	104,322	151,922	165,290	153,839	120,257	71,373	74,712	52,990	1,133,458	
Water Requirement															
Crop Intensity 170% (Drainage not supplemented)	0.66	55,693	68,896	69,149	40,075	36,974	133,171	161,961	149,826	96,931	26,274	29,987	45,795	912,635	
Surplus or Deficit, %		-73.4	-64.1	11.6	53.6	64.6	12.9	2.0	2.6	19.4	63.2	60.0	17.3	19.5	
Modified		32,127	41,973	69,149	40,075	36,974	133,171	161,961	149,826	96,931	52,990	52,990	52,990	921,159	18.73
Surplus or Deficit, %		-73.4	-64.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.4	43.6	17.3	0.0	
Crop Intensity 170% (Drainage supplemented)	0.66	59,428	73,476	73,822	42,447	38,541	138,704	169,114	156,733	101,404	27,492	31,328	46,816	959,904	
Surplus or Deficit, %		-85.0	-75.1	5.6	50.9	63.1	8.7	-2.3	-1.9	15.7	61.5	57.3	11.7	15.3	
Modified		32,127	41,973	73,822	42,447	38,541	138,704	169,114	156,733	101,404	52,990	52,990	52,990	953,836	15.85
Surplus or Deficit, %		-85.0	-75.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.1	39.7	11.7	-0.6	
Crop Intensity 200% (Drainage not supplemented)	0.66	56,413	69,948	70,822	43,698	46,849	152,478	190,666	178,839	110,790	29,380	30,233	44,280	1,024,346	
Surplus or Deficit, %		-75.6	-66.6	9.5	43.4	55.1	-0.4	-15.4	-16.2	7.9	58.9	59.5	16.4	9.6	
Modified		32,127	41,973	70,822	43,698	46,849	152,478	190,666	178,839	110,790	52,990	52,990	52,990	1,027,213	9.37
Surplus or Deficit, %		-75.6	-66.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.7	42.9	16.4	0.3	
Crop Intensity 200% (Drainage supplemented)	0.66	60,228	74,644	75,680	46,470	49,507	159,535	200,084	188,035	116,356	30,789	32,313	47,352	1,080,992	
Surplus or Deficit, %		-87.5	-77.8	3.2	46.2	52.5	-5.0	-21.1	-22.2	3.2	56.9	56.8	10.6	4.8	
Modified		32,127	41,973	75,680	46,470	49,507	159,535	200,084	188,035	116,356	52,990	52,990	52,990	1,068,738	5.71
Surplus or Deficit, %		-87.5	-77.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.9	39.0	10.6	-1.1	
Present Cropping (Drainage not supplemented)	0.56	57,251	69,668	68,716	45,322	49,941	172,175	202,474	180,592	117,414	30,367	31,505	45,207	1,071,301	
Surplus or Deficit, %		-78.2	-66.0	12.2	47.6	52.1	-19.3	-22.5	-17.4	2.4	56.7	57.8	14.5	5.5	
Modified		32,127	41,973	68,716	45,322	49,941	172,175	202,474	180,592	117,414	52,990	52,990	52,990	1,069,705	5.82
Surplus or Deficit, %		-78.2	-66.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.6	40.5	14.5	-0.1	
Present Cropping (Drainage supplemented)	0.56	60,694	73,797	72,848	47,885	52,548	179,006	211,116	188,702	122,527	32,295	33,455	48,120	1,122,932	
Surplus or Deficit, %		-88.9	-75.8	6.9	44.6	49.6	-17.8	-27.7	-22.7	-1.9	54.8	55.2	9.2	0.9	
Modified		32,127	41,973	72,848	47,885	52,548	179,006	211,116	188,702	122,527	52,990	52,990	52,990	1,107,703	2.27
Surplus or Deficit, %		-88.9	-75.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.1	36.9	9.2	-1.4	
Present Cropping (Drainage not supplemented)	0.66	48,294	58,768	57,965	36,231	42,128	148,928	172,703	154,244	100,890	26,733	26,576	38,219	913,677	
Surplus or Deficit, %		-50.3	-40.0	25.9	55.8	59.6	2.0	-4.5	-0.2	16.1	62.5	64.4	27.9	19.4	
Modified		32,127	41,973	57,965	36,231	42,128	148,928	172,703	154,244	100,890	52,990	52,990	52,990	948,160	16.35
Surplus or Deficit, %		-50.3	-40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.6	49.8	27.9	3.6	
Present Cropping (Drainage supplemented)	0.66	51,198	62,251	61,451	40,393	44,327	154,837	180,069	161,162	105,276	27,904	28,221	40,591	957,879	
Surplus or Deficit, %		-59.4	-48.3	21.4	53.3	57.5	-1.9	-8.9	-4.8	12.5	60.9	62.2	23.4	15.5	
Modified		32,127	41,973	61,451	40,393	44,327	154,837	180,069	161,162	105,276	52,990	52,990	52,990	980,586	10.49
Surplus or Deficit, %		-59.4	-48.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.3	46.7	23.4	2.3	

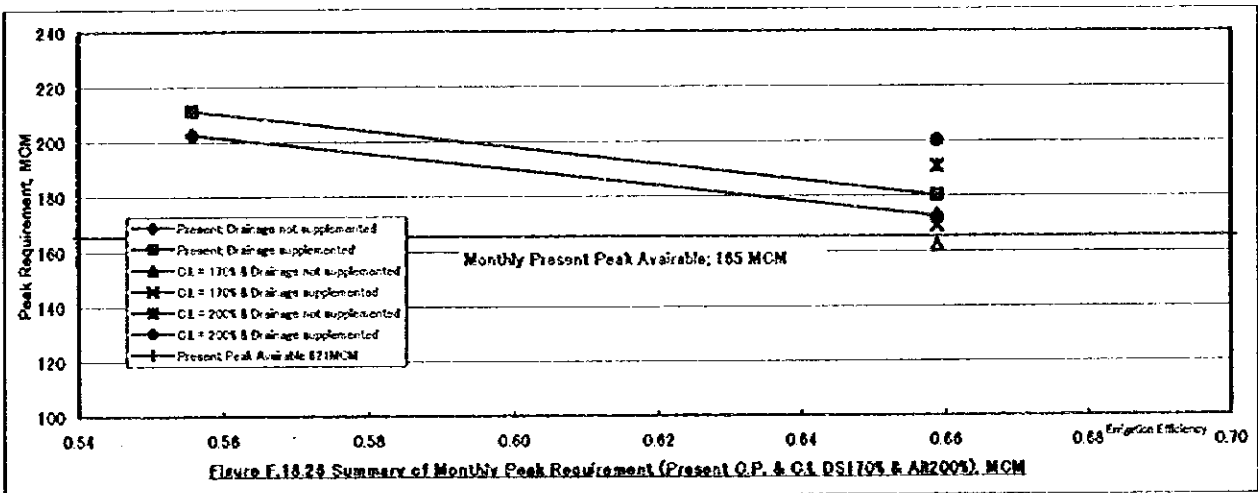
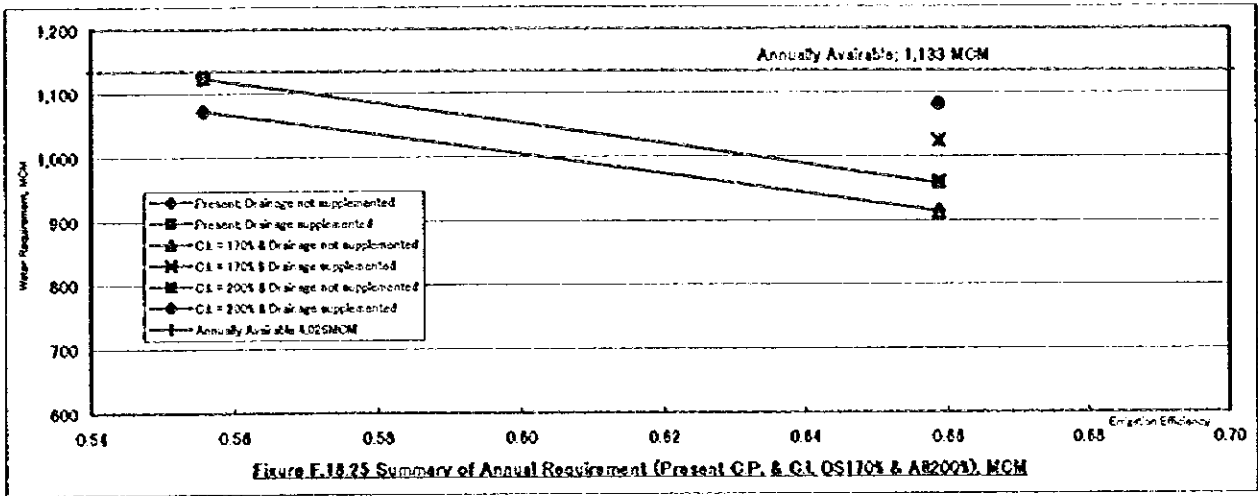












Table F.18.97. 1987 Undr. Water Requirement Determination from F/3 Areas based on Modified Panman Method in QUM per Field

Code	Area No.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Remarks
S.T. Area/1	24	24	24	24	24	24	24	24	24	24	24	24	24	1,800	
	25	25	25	25	25	25	25	25	25	25	25	25	25	1,800	
	26	26	26	26	26	26	26	26	26	26	26	26	26	1,800	
	27	27	27	27	27	27	27	27	27	27	27	27	27	1,800	
Net W. Req. QUM/1 (Shade)	28	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	11.5	
	29	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5	
	30	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5	
	31	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5	
	32	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5	
	33	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5	
	34	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5	
	35	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5	
	36	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5	
	37	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5	
38	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	7.5		

Table F.1.8.03 Summary of Gross Water Production per Facility based on Modified Parameter Method O&M/Leakage

Location	Area, 1	Area, 2	Area, 3	Area, 4	Area, 5	Area, 6	Area, 7	Area, 8	Area, 9	Area, 10	Area, 11	Area, 12	Area, 13	Area, 14	Area, 15	Area, 16	Area, 17	Area, 18	Area, 19	Area, 20	
F/S Overhead	10200	376	490	015	312	313	1019	1276	1166	99	209	188	277	6394							
F/S Midstream	20832	389	483	467	787	351	1097	1220	1067	741	791	153	287	6001							
F/S Downstream	28778	384	470	457	365	475	1128	1263	1686	647	174	211	287	6488							
Overhead w/F/S	10200	376	490	457	365	475	1128	1263	1686	647	174	211	287	6488							
Overhead w/F/S	10200	376	490	457	365	475	1128	1263	1686	647	174	211	287	6488							
Midstream																					
Downstream																					
Total																					

Table F.1.8.04 Summary of Return from Field Field Components as a Function of Field O&M/Leakage

Location	Area, 1	Area, 2	Area, 3	Area, 4	Area, 5	Area, 6	Area, 7	Area, 8	Area, 9	Area, 10	Area, 11	Area, 12	Area, 13	Area, 14	Area, 15	Area, 16	Area, 17	Area, 18	Area, 19	Area, 20
F/S Overhead	10200	376	490	015	312	313	1019	1276	1166	99	209	188	277	6394						
F/S Midstream	20832	389	483	467	787	351	1097	1220	1067	741	791	153	287	6001						
F/S Downstream	28778	384	470	457	365	475	1128	1263	1686	647	174	211	287	6488						
Overhead w/F/S	10200	376	490	457	365	475	1128	1263	1686	647	174	211	287	6488						
Midstream																				
Downstream																				
Total																				

Table F.1.8.05 Total Return Values from Field Field 100000

Location	Area, 1	Area, 2	Area, 3	Area, 4	Area, 5	Area, 6	Area, 7	Area, 8	Area, 9	Area, 10	Area, 11	Area, 12	Area, 13	Area, 14	Area, 15	Area, 16	Area, 17	Area, 18	Area, 19	Area, 20
F/S Overhead	10200	376	490	015	312	313	1019	1276	1166	99	209	188	277	6394						
F/S Midstream	20832	389	483	467	787	351	1097	1220	1067	741	791	153	287	6001						
F/S Downstream	28778	384	470	457	365	475	1128	1263	1686	647	174	211	287	6488						
Overhead w/F/S	10200	376	490	457	365	475	1128	1263	1686	647	174	211	287	6488						
Midstream																				
Downstream																				
Total																				

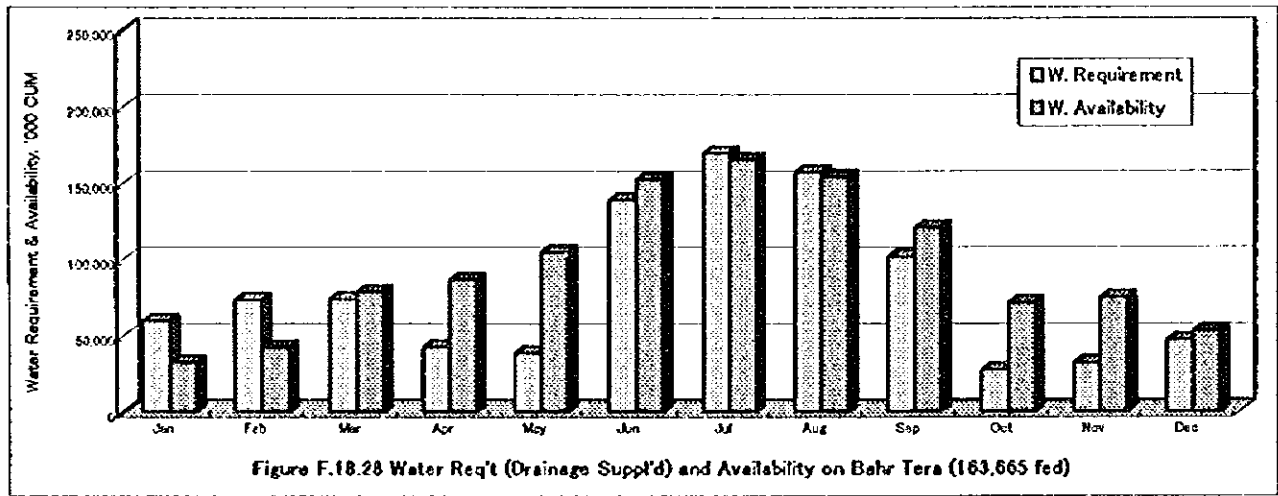
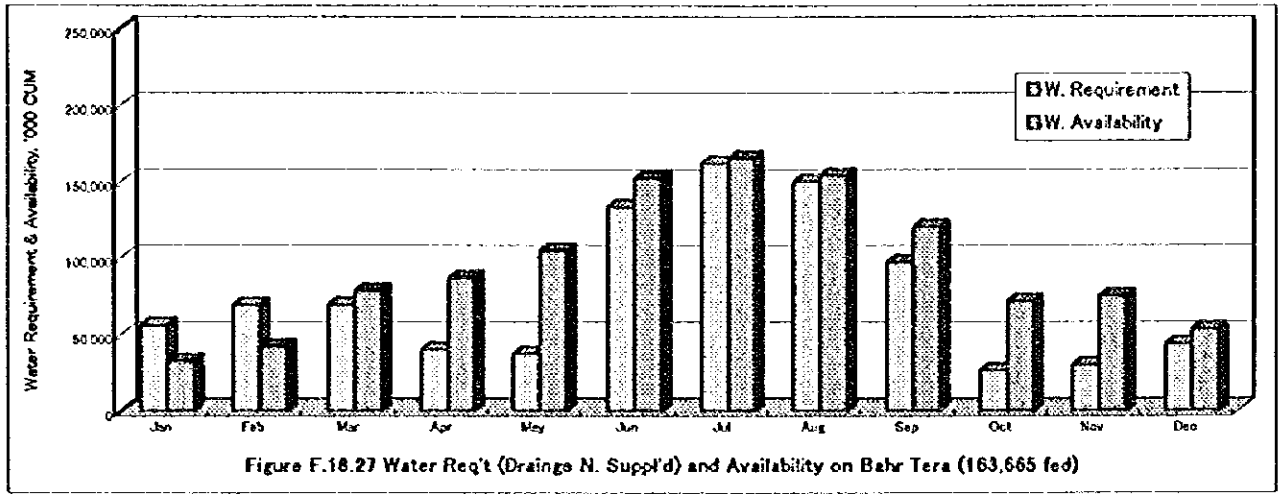














Table F.18.76 Summary of Gross Meter Requirements per Engine Based on Modified Pattern Method, QM/yr/wh

Location	Apr.	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual				
F/S Lovelorn	10,000	376	490	515	312	313	1079	1276	1169	708	209	188	777	6,984
F/S Midstream	20,652	389	493	467	287	351	1097	1228	1067	741	201	193	287	6,801
F/S Downstream	23,778	384	470	457	385	473	1128	1263	1086	647	174	211	287	6,936
Quantities, I.C./S.	180,233	273	461	477	272	263	970	1285	1204	763	201	204	292	5,848

Program Efficiency: 0.66

Table F.18.76 Summary of Electric from Peak Field (percentage of maximum level), QM/yr/wh

Location	Apr.	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual				
F/S Lovelorn	310	0	0	0	0	0	63	57	44	9	0	0	0	210
F/S Midstream	37	0	0	0	0	0	46	63	57	44	9	0	0	148
F/S Downstream	76	0	0	0	0	0	32	49	45	34	7	0	0	188
Quantities, I.C./S.	33	0	0	0	0	0	34	38	32	39	8	0	0	170

On-Hour Efficiency: 0.23  
Return Ratio: 0.50

Table F.18.77 Total Electric Volume from Peaky Gas, 1000 QM

Location	Apr.	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual				
F/S Lovelorn	10,000	0	0	0	0	0	638	679	617	473	102	2	0	2,310
F/S Midstream	20,652	0	0	0	0	0	835	1,200	1,181	907	186	4	0	4,423
F/S Downstream	23,778	0	0	0	0	0	817	1,272	1,166	887	192	5	0	4,329
Quantities, I.C./S.	106,235	0	0	0	0	0	2,653	3,992	3,516	2,183	487	20	0	20,235
Total Electric Volume	180,233	0	0	0	0	0	5,144	5,744	5,470	3,432	1,377	30	0	31,297

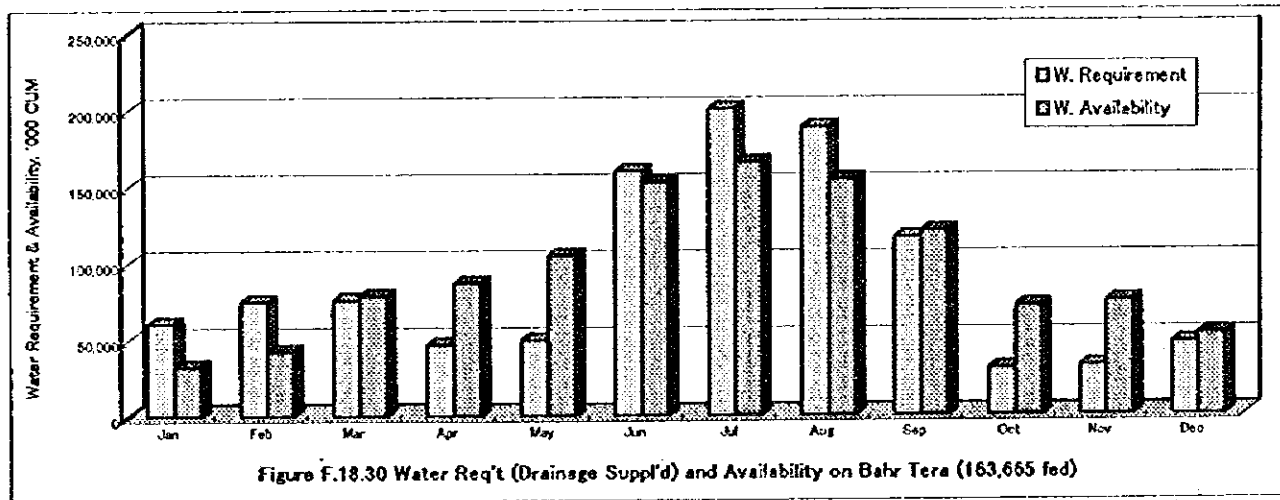
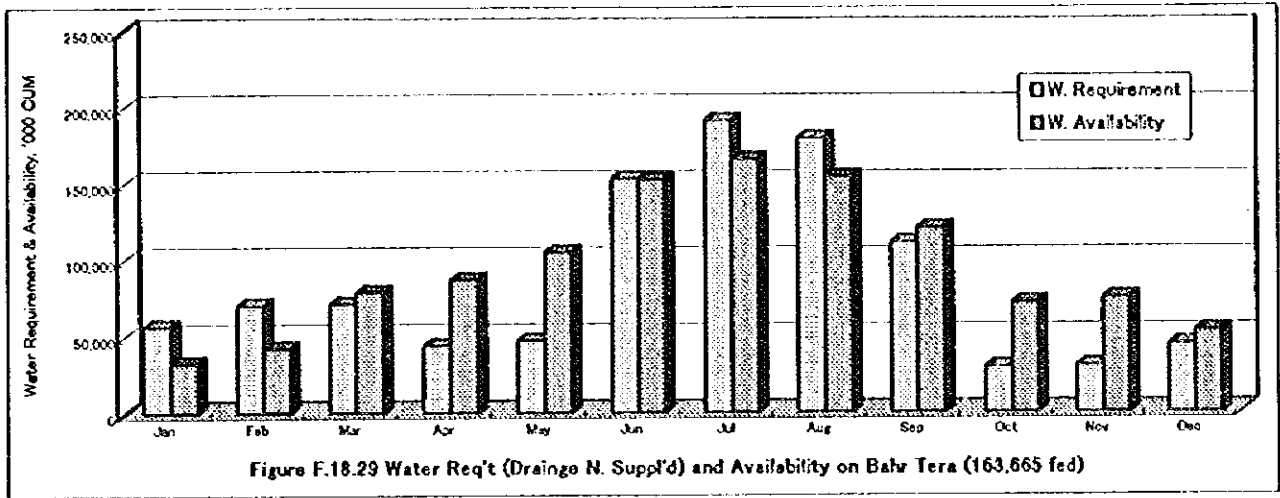


Table F.18.78 Summary of Water Requirement to be saved by Irrigation Improvement Project in the Priority Area and Supplement to the Downstream of Bahr Tern

Cropping	ED	Month												Annual	Remarks
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Present (Priority Area Only)	0.56	26,087	32,296	31,311	22,126	26,349	85,814	92,961	77,820	52,629	13,728	13,857	19,850	434,629	
Present DS Req. per feddan (148%)	0.56	338	405	406	252	256	939	1,188	1,115	793	187	191	276	6,256	
Monthly Base Cropping Intensity	%	76	76	76	76	76	72	72	72	72	72	76	76	148	
Requirement to raise 1% of C.I./feddan	CUM	4.4	5.3	5.3	3.3	3.4	13.0	16.5	15.5	9.8	2.6	2.5	3.6	85.3	
Present C.P. + IIP (Priority Area Only)	0.66	22,005	27,243	26,413	18,665	22,226	74,048	79,362	66,589	45,309	11,695	11,689	16,745	422,190	
To be created	'000CUM	4,081	5,053	4,899	3,462	4,122	11,566	13,599	11,230	7,320	1,833	2,168	3,106	72,439	
Available per feddan (DS total 106,735 feddan)	CUM	38	47	46	32	39	108	127	105	69	17	20	29	679	
Cropping intensity to be raised	%	8.6	8.9	8.6	9.8	11.5	8.3	7.7	6.8	7.0	6.6	6.6	8.1	8.0	
Area to be newly planted	feddan	9,175	9,472	9,176	10,456	12,242	8,989	8,242	7,253	7,499	7,069	8,607	8,547	8,489	
Seasonal Lowest Percent	%	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	
Seasonal Lowest, feddan	feddan	7,069	7,069	7,069	7,069	7,069	7,069	7,069	7,069	7,069	7,069	7,069	7,069	7,069	
Planted C.P. + IIP (Priority Area Only)	0.66	21,888	27,442	26,852	18,611	23,201	56,729	66,633	59,491	37,059	10,326	11,455	16,480	376,167	
To be created	'000CUM	4,199	4,854	4,459	3,516	3,147	28,885	26,328	18,329	15,570	3,402	2,402	3,370	118,462	
Available per feddan (DS total 106,735 feddan)	CUM	39	45	42	33	29	271	247	172	146	32	23	32	1,110	
Cropping intensity to be raised	%	8.8	8.5	7.8	9.9	8.8	20.8	15.0	11.1	14.9	12.3	8.9	8.7	13.9	
Area to be newly planted	feddan	9,439	9,100	8,352	10,619	9,346	22,148	15,957	11,838	15,952	13,123	9,536	9,275	13,883	
Seasonal Lowest Percent	%	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	
Seasonal Lowest, feddan	feddan	8,352	8,352	8,352	8,352	8,352	8,352	8,352	8,352	8,352	8,352	8,352	8,352	8,352	
Req. for Drg. Irr. Area (14,550 fed)	'000CUM	4,919	5,899	5,904	3,961	3,724	13,002	17,285	16,221	10,225	2,716	2,785	4,018	91,019	
Present Percent that can be supplemented	%	83	86	83	95	111	85	79	69	72	67	78	77	80	
Seasonal Lowest Percent	%	77	77	77	77	77	77	77	77	77	77	77	77	77	
Planned Percent that can be supplemented	%	85	82	76	96	85	211	152	113	152	125	85	85	130	
Seasonal Lowest Percent	%	76	76	76	76	76	76	76	76	76	76	76	76	76	

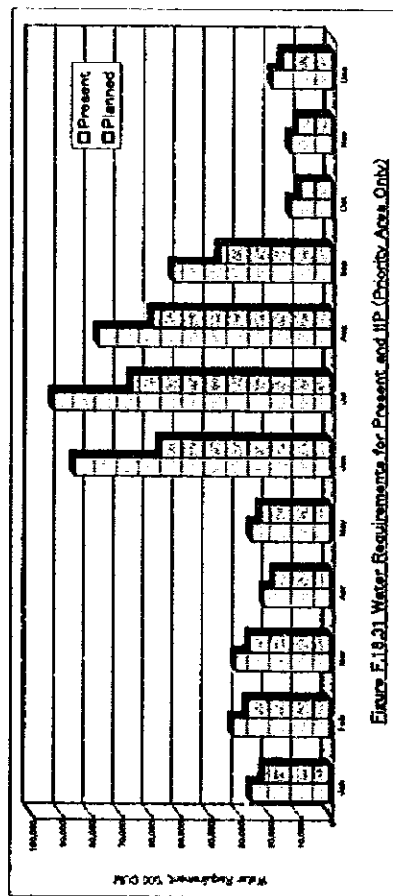


Figure F.19.31 Water Requirements for Present and IIP (Priority Area Only)

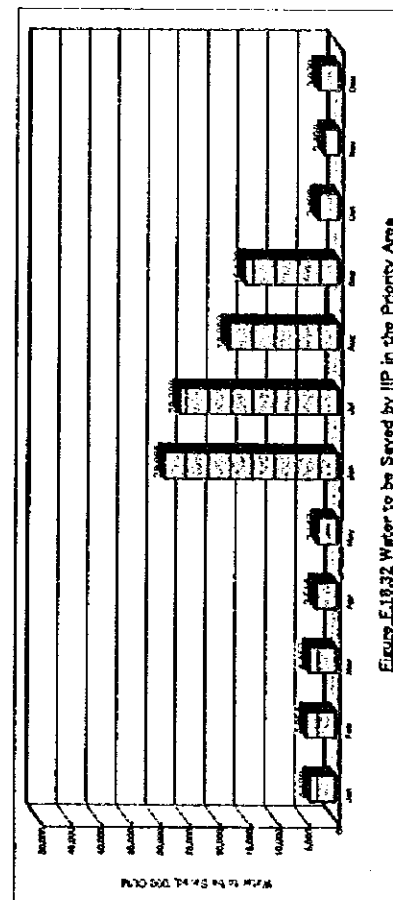


Figure F.19.32 Water to be Saved by IIP in the Priority Area

## F.19 Water Levels Recorded by Automatic Recorder

Total 12 number of water level recorders had been installed in canals and Meskas relevant to Bahr Biyala area; 1 in Bahr Tera (intake of Bahr Biyala), 2 in Bahr Biyala & El Nour, 2 in Bahr Biyala, 3 in Bahr Nour, 2 in El Shorafa, 2 in Meskas from Bahr El Nour. Of them, 3 recorders were at the tails of Bahr Biyala, El Shorafa and Bahr El Nour. The 2 recorders in Meskas were also installed at those tails (See Table F.19.1 & Figure F.19.1).

The type of the recorders is submerged one that measures water pressure including atmospheric pressure. One pressure recorder was placed in Biyala Water District Office to measure atmospheric pressure. The pressure was subtracted from the total pressure recorded by the submerged recorder, thereby water level can be known after converting the pressure into water depth.

The recorders have been measuring the pressures in every 10 minutes for 2 months from around October 20 to around December 20. The records were referred to in simulating unsteady flow of the relevant canals. Also, the records at the 5 tails identified if overflowing has occurred or not during the 2 months as summarized below;

Canal/Meska	Figure	Max WL, in	GL, m	Free, m	Remarks
Bahr Biyala(No.12)	F.19.4	1.41	1.57	0.16	
Bahr El Nour	F.19.10	2.12	2.69	0.57	
Abo Kora (No.6)	F.19.15	1.64	2.26	0.62	
El Bagara (No.7)	F.19.16	2.15	2.65	0.50	Almost same as Bahr El Nour
El Shorafa (No.10)	F.19.18	1.98	2.41	0.43	

Viewing the above results, the 5 canals/Meskas had not overflowed during the measured period with some free board ranging from 16 cm to 62 cm. Though overspillage usually occur during winter season rather than summer, this case had not occurred in the above Bahr Biyala related canals.



WL Recorder No.	Recorder No.	Sho. Location	BM REls.1	BM REls.2	REls. W.R.	Dif.1	Dif.2	RM AEls.1	RM AEls.2	AEls1 W.R.	AEls2 W.R.	AEls Plate	Supplement	AEls Sensor, m	GL E.L.
No.1	1247	Bahr Tetra	0.535	0.103	4.125	3.590	4.022	4.066	5.124	1.038	1.102	1.100	0.212	1.912	4.27
No.2	1269	After No.1247	0.640	0.570	3.650	3.010	3.080	3.444	3.505	0.434	0.425	0.430	0.031	0.460	3.47
No.3	1270	Bahr Biyala Intake	1.080	1.050	3.590	2.510	2.540	3.358	3.388	0.848	0.848	0.845	0.031	0.879	3.34
No.4	1271	After Bahr Nour Intake	0.640	0.535	3.900	3.360	3.365	3.832	3.841	0.472	0.476	0.474	0.031	0.505	3.04
No.5	1273	Middle of Bahr Nour	1.210	1.200	3.980	2.750	2.760	3.368	3.377	0.618	0.617	0.616	0.031	0.648	3.30
No.6	1272 Original	Tail of Abo. Kora	0.790	0.640	3.015	2.225	2.375	2.164	2.329	-0.041	-0.048	-0.043	0.031	-0.013	2.26
No.7	1274	Tail of El Bagara	1.330	1.040	3.640	2.310	2.900	2.721	3.010	0.411	0.410	0.411	0.031	0.441	2.65
No.8	1275	Tail of Bahr Nour	1.130	1.120	3.670	2.540	2.550	2.840	2.860	0.300	0.310	0.305	0.031	0.336	2.89
No.9	1276	After El Shorafa Intake	1.310	1.270	3.665	2.355	2.395	3.043	3.043	0.668	0.668	0.665	0.031	0.719	2.99
No.10	1279	Tail of El Shorafa	0.840	0.770	3.260	2.420	2.490	2.621	2.687	0.201	0.197	0.199	0.031	0.230	2.41
No.11	1280	Before Hazek	1.345	1.300	4.330	2.865	3.030	3.122	3.168	0.137	0.138	0.138	0.031	0.168	3.17
No.12	1281	Tail of Bahr Biyala	1.340	1.230	2.900	1.590	1.670	1.580	1.680	0.020	0.010	0.015	0.031	0.048	1.57
No.13	1276	Atmos Pressure at Tanta													
No.14	1277	Atmos Pressure at Biyala													

No.	Name	Kind	Base E.L. m	Width. m	No.	Remarks
1	Bahr Biyala & Bahr Nour	Intake	0.820	3.0	2	
2	El Agamy	Intake	1.035	2.0	1	
3	Bahr El Nour	Intake	0.785	3.0	1	
4	Bahr Biyala	Intake	1.100	2.0	2	
5	Tahweelah Bahr Biyala	Intake	1.105	Dia. 1.2	1	Pipe
6	El Shorafa	Intake	-0.005	1.5	1	Constructed in 1988
7	Hazek	Intake	-0.130	1.5	1	Need rehabilitation
8	Hazek	Regulator	-0.135	1.5	1	