F-4.2. Improvement of Irrigation System

Improvement of the present irrigation system would be composed of the following components;

- Secure irrigation water resources sufficiently to cover the area,
- Improve the irrigation facilities by constructing garnabia canals, additional lateral canals and vents, and
- Establish the farmer's organization to expect users cooperative operation of the irrigation system.

(1) Irrigation Water Resources

As reported in the previous paragraph F-1.3, new irrigation water resources of 4.5 cubic meters per second from the reuse of drainage water lifted up at Tamiah are expected for the Project. Out of 4.5 cubic meters per second, about 2.5 cubic meters per second would be utilized for the development of the reclamation area in North Wahby and Com Osheem areas and the rest about 2.0 cubic meters per second would cover over the Wahby Downstream area. This water resources is equivalent to about 10 cubic meters per day per feddan covering in the Wahby Downstream area of 17,200 feddan.

As stated in the previous paragraph F-4.1, the present amount of irrigation water delivered in this area was 13.9 cubic meters per day per feddan. When the Project is realized, available water resources becomes about 23.9 cubic meters per day per feddan at the peak stage in adding an additional water resources of about 10 cubic meters per day per feddan to the present amount of 13.9 cubic meters per day per feddan. This amount just coincide with the monthly maximum discharge in keeping the balance of the distribution in the area.

(2) Improvement of Irrigation Facilities

One of solution of the present difficulties in unbalanced distribution of the irrigation water would be an improvement of the existing irrigation facilities. As discussed in the previous paragraph, an unification of vents located alongside the main canal, rehabilitation of the existing canals, improvement of lateral/sub-lateral canal's network and rehabilitation/construction of vents located alongside the lateral/sub-lateral canals are major undertakings for the improvement of the existing irrigation facilities.

There exist a lot of vents along the main canal which are making complicated operation of the present irrigation system. Once unification of the vents would be made, difficulties in the complicated operation can be reduced. For the unification of the vents, lateral canals in parallel with the main canal, so-called Ganabiah canal, should be constructed. Five Ganabiah canals are proposed to unify several vents alongside Bahr Wahby at the downstream reach.

The existing canal network composed of main canal, branch canals and lateral/sub-lateral canals would be rehabilitated to keep canals in proper shape and adequate capacity.

Aside from the rehabilitation of the canal network, construction of additional lateral canals such as New Hayar canal and New Koddoba canal are proposed to shorten the length of lateral canal. Entire area of the Wahby Downstream Area is suffering from the insufficient distribution of the irrigation water, especially the area surrounding Casr Rashuwan in Tamiah district is seriously affected by the shortage of the water.

The said area is located at the downstream of the lateral canals, Bahr Fanaus (Length: 5.48 km), Bahr El Hayar (Length: 1.64 km) and Bahr Koddoba (Length: 2.18 km).

The length of laterals to serve this area is too long for carrying out proper water management. It is very effective to construct two new lateral canals for serving this area by lateral canals with reasonable length.

Moreover, the present service area by a vent of the lateral/sub-lateral canal is about 152 feddan (64 ha) on an average which is too wide for carrying out proper water management. Adequate size of irrigation block covered by a vent is generally considered as less than 120 feddan (50 ha). Service area of the lateral/sub-lateral canals is 10,206.4 feddan having vents of 67 units. Therefore, it is proposed to construct at least 18 units of additional vents along the lateral/sub-lateral canals in the area.

(3) Farmer's Organization

In addition to provision of additional water resources and rehabilitation/construction of the existing irrigation facilities, establishment or reorganization of the farmer's organization is needed for cooperative operation of the irrigation system. Shortage of the irrigation water would be caused partly by artificial inadequacy on the operation of the irrigation system and also not cooperative farmers each other for effective utilization of the irrigation water.

Training and diffusing knowledge and techniques on proper water management would be significant role. For this purpose, establishment of the model farm is recommended in this project as discussed in Appendix H-8.

TABLE F4-1 Summary of Present Irrigation System in Wahby Downstream Area

	Service Area (fed)	Length (km)	Number of Appurtenant Structure: Check Weir	Vents	Intake	Bridge
Main Canal						
1. Bahr Wahby	3,338.6	21.30	42	41	8	10
(From Bahr Unsi at 46.823 to End at 68.120)						
Branch Canal						
2. Bahr Unsi	528.2	2.10	-	5	1	-
3. Bahr Green	609.1	2.54	2	4	1	-
4. Bahr Fanous	1,241.8	5.48	14	13	3	9
5. Com Osheem Canal	1,215.1	3.33	3	4	1	1
6. Gomhoria Canal	2,915.7	14.61	4	25	3	-
Sub-total	6,509.9	28.06	23	49	9	10
Excluding Items 5 & 6	2,379.1	10.12	16	22	5	9
Lateral and Sub-lateral						
7. Bahr El Khadrawy	2,434.7	3.68	17	20	-	1
8. Bahr Gernabiet	750.5	1.15	-	4	-	-
9. Bahr Khore el-sheer	1,020.7	0.16	-	3	-	-
10. Bahr Kaheel	1,349.1	4.33	7	9	-	2
11. Bahr Malaab	691.0	3.40	1	13	-	2
12. Bahr Hayar	1,666.1	6.16	1	7	1	1
13. Bahr El Koddoba	2,294.3	2.81	6	11	-	5
Sub-total	10,206.4	21.69	32	67	1	11
T O T A L	20,054.9	71.05	97	157	18	31
Excluding Items 5 & 6	15,924.1	55.11	90	130	14	30

Note : Detailed information of the present irrigation system can be found in TABLE F4-2.

TABLE F 4-2 LIST OF CANAL STRUCTURE 1/19

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L
1. Bahr Wahby							
Bahr Umsi Intake	L.	46.823	2,837.4	2,980.4	1.490	13.88	14.42
Garnabia Khaled Intake	L.	46.848	750.5	750.5			
Mahmoud Sudky Pipe	R.	46.851	17.1	17.1			
Abdel Hady Weir	M.	46.851	18,271.9	19,644.1	9.608	13.88	14.42
Mohamed Bekhoet pipe	R.	47.570	73.9	103.3			14.10
Abdel Kholek Zarakay pipe	R.	47.680	33.4	33.4			
Fotna Henein vent	R.	48.033	105.4	105.4	0.052	13.08	
Nabawy vent	R.	48.112	155.7	155.7	0.078	13.08	
Kamel Ibrahim vent	R.	48.480	50.0	50.0			
Fowad Moha Aly vent	L.	48.470	96.5	96.5	0.048	13.21	
Mohamed Haefez vent	L.	48.600	13.5	13.5			
Mohamed Honeeb	R.	49.400	338.6	338.6	0.210	13.17	
Dr. Lakeeb Bdtros vent	R.	49.695	48.8	48.8			
Bahr Green Intake	L.	49.707	1,622.2	1,629.7	0.815	13.17	13.71
Private Green vent	L.	49.715	97.5	97.5	0.560	13.17	12.95
Mashaalla vent	L.	49.791	89.8	119.6			
Bridge (Atle)	M.	50.310					
Mashaalla pump	R.	50.450	103.2	103.2	0.052		
Bridge	M.	51.008					
Hafez Ramadan vent	L.	51.016	202.4	202.4	0.101		
Private vent (Sabry Shenoda)		51.115	30.0	30.0			
Azzam pump vent	R.	51.530	118.9	118.9			
Ismail Rady vent	R.	51.831	190.1	190.1			

LIST OF CANAL STRUCTURE 2/19

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L
Shavarky vent	R.	51.835	49.4	49.4			
Elsayed Bayomy vent	R.	52.117	360.5	365.0			
Mohamed Deyob	L.	52.117	161.5	161.5	0.081	13.11	
Bahr Banous Intake	L.	52.120	6,117.8	6,289.9	4.030		
Atle Barrage	M.	52.128	11,245.3	11,929.1	7.244	13.11	
Asses vent	L.	53.912	126.5	126.5	0.630	11.86	
Moh-Salem vent	R.	54.000	72.7	72.7			
Mohamed Mahdy vent	R.	54.006	132.2	132.2	0.660	11.39	
Radwan vent	L.	54.015	220.9	220.9	0.111	11.79	
Abdel Shemeeh vent	R.	54.015	336.7	336.7	0.168	11.79	
Pipe no. 10 vent	R.	54.060	10.1	10.1			
Right Garnabia vent	R.	45.063	1,076.9	1,078.6	0.540	11.77	12.29
Left Garnabia vent	L.	54.063	131.0	144.2	0.072	11.72	11.70
Weir no. (1)	M.	54.063	9,261.6	9,900.7	6.002	11.72	12.26
Zaky vent	L.	55.470	226.8	226.8	0.114	10.10	10.89
Com Osheem Intake	R.	55.640	4,086.1	4,490.4	2.245	10.03	10.57
Weir no. (2)	M.	55.642	4,948.6	5,185.4	3.155	10.03	10.57
Saad El Hagar vent	L.	56.690	147.1	147.1	0.074	9.12	9.85
Weir no. (3)	M.	56.795	4,801.5	5,036.1	3.064	9.08	9.62
Ebada vent	L.	56.924	368.1	378.0	0.189	7.51	8.65
Weir no. (4)	M.	56.930	4,433.4	4,658.4	2.833	7.51	8.05
Weir no. (5)	M.	57.054			4.000	6.08	
Weir no. (6)	M.	57.423			4.000	4.66	
Weir no. (7)	M.	57.636			4.000	4.51	

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L.
Weir no. (8)	M.	58.145			4.000	3.29	
New Samir vent	L.	58.200	310.5	310.5	0.156	2.02	
Weir no. (9)	M.	58.206	4,122.9	4,347.9	2.642	2.02	2.56
Weir no. (10)	M.	58.290			4.000	0.83	1.31 1.27
Weir no. (11)	M.	58.357			4.000	0.12	0.20 0.66
Weir no. (12)	M.	58.556			4.000	0.94	0.37 0.40
Weir no. (13)	M.	58.600			4.000	2.21	1.57 1.67
Weir no. (14)	M.	58.680			4.000	3.21	2.61 2.67
Weir no. (15)	M.	58.823			4.000	4.23	3.62 3.69
Rafla vent	R.	58.992	78.8	78.8	0.400	5.23	4.60
Weir no. (16)	M.	59.006	4,269.1	4,269.1	2.594	5.23	4.69 5.39
El Khashal vent	L.	59.150	101.0	101.0	0.060	6.05	
Weir no. (17)	M.	59.237	3,943.0	4,168.1	2.532	6.05	
Weir no. (18)	M.	59.363			4.000	8.01	
Youran vent	L.	59.390	236.8	236.8	0.118	9.54	
Akbat no. (1)	L.	59.390	57.0	57.0	0.029	9.54	
Weir no. (19)	M.	59.402	3,649.2	3,874.3	2.352	9.54	9.00
Weir no. (20)	M.	59.600			3.000	11.36	10.73
Weir no. (21)	M.	60.015			3.000	12.27	
Weir no. (22)	M.	60.265			3.000	13.94	
Weir no. (23)	M.	60.564			3.000	13.94	
Weir no. (24)	M.	60.624			3.000	16.10	
Akbat no. (2) vent	L.	60.764	27.9	27.9	0.014	17.04	
Weir no. (25)	M.	60.764	3,621.3	3,846.4		17.04	16.50

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L.
Dr. Seelem Shenada vent	L.	61.243	49.6	75.7	0.038	18.52	17.75
Mekhazen vent	L.	61.666	212.0	212.0	0.106	18.74	
Akbat No. (3) vent	L.	61.672	33.3	33.3	0.017	18.74	
Weir no. (26)	M.	61.672	3,347.4	3,525.3	2.143	18.24	
Weir no. (27)	M.	62.207	3,347.4	3,525.3	2.143	19.89	19.35
Weir no. (28)	M.	62.600	3,347.4	3,525.3	3.000	20.92	20.15 20.38
El darey vent	L.	62.915	83.9	83.9	0.043	22.41	21.57
Dawood Rofail vent	R.	62.915	27.0	27.0	0.014	22.41	
Mesalat weir (29.30)	M.	62.920	3,236.6	3,414.5	2.075	22.41	21.87
Arakeel vent	L.	62.920	266.0	266.0	0.133	23.81	23.06
Weir no. (31)	M.	63.003	2,930.6	3,414.5	1.912	23.82	23.28
Misbet el tahon canal (intake)	L.	63.376	752.9	820.4	0.410	24.91	24.21 24.37
Ghabour sharbia vent	L.	63.376	202.8	214.2	0.107	24.94	25.48
Weir no. (32)	M.	63.376	2,014.4	2,113.9	0.129	24.94	24.40
Weir no. (33)	M.	63.964			2.500	26.04	25.23 25.50
Weir no. (34)	M.	64.296			2.500	27.05	26.33 26.51
Weir no. (35)	M.	64.555			2.500	28.13	27.41 27.59
Ghabour Gharbia vent	L.	64.823	199.0	199.0	0.100	29.32	
Weir no. (36)	M.	64.825	1,815.9	1,914.9	1.163	29.32	28.78
Weir no. (37)	M.	65.180			2.500	30.25	29.54 29.89
Weir no. (38)	M.	65.412			2.500	31.85	13.29
Weir no. (39)	M.	65.716			2.500	33.63	
weir no. (40)	M.	65.876			2.500	34.09	33.73
	R.	66.164	32.5	32.5	0.033	34.08	

LIST OF CANAL STRUCTURE

5/19

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L
Wabby Extension Intake	R.	66.164	999.6	1,001.8	1.002	34.08	33.72
Right vent	R.	66.164	91.3	91.3	0.091	34.08	
Moderia Weir no. (41)	M.	66.164	692.5	789.3	0.947	34.08	33.72
Baseer vent	R.	67.660	209.0	209.0	0.209	36.74	35.06 36.38
Baseer weir no. (42)	M.	67.483	483.6	580.3	0.690	36.74	36.38
Mohra vent	R.	67.990	132.1	140.6	0.140	37.56	36.88
Naguib Motee vent	R.	68.118	14.6	34.0	0.034	37.56	
Motee of parteners vent	R.	68.120	336.9	405.8	0.406	37.56	
2. Bahr Unsi							
Bahr Unsi Intake			2,810.4	2,962.9	1.481	13.88	
Bebesh of Morkos vent	R.	0.870	64.1	64.1	0.064	12.63	
Shokry Guirgis vent	L.	1.000	2.0	2.0	0.001	12.61	
Faseed Morkos no. (1)	R.	1.940	78.8	78.8	0.079	12.53	
Bahr el Khadrawy Intake	L.	1.997	2,332.2	2,434.7			12.88
Fareed Morkos No.2	L.	2.100	90.0	90.0	0.09	12.51	
Guirges Demerry vent	M.	2.100	79.2	79.2	0.079	12.51	
3. Bahr Khaarawy							
Intake			2,372.2	2,434.7			
Fareed Morkos no. (1)	L.	0.156	49.5	49.5	0.099	12.51	
Baharwa vent	L.	0.160	37.0	78.0	0.078	12.51	

LIST OF CANAL STRUCTURE

6/19

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L
Bahr Nashed Intake	L.	0.164	923.7	937.7	0.937	12.51	
Fareed Morkos no. (2)	L.	0.187	103.1	121.7	0.159	12.51	
Weir no. (1)	M.	0.212	1,258.0	1,338.2	1.353	12.51	12.87
Weir no. (2)	M.	0.653					
Ayad Masood vent	L.	0.865	63.0	63.0	0.063	10.12	
El Kasses no. (1)	R.	0.934	66.5	66.5	0.067	10.12	
El Koby vent	R.	0.943	187.9	187.9	0.188	10.12	
El Kasses no. (2)	R.	0.952	81.1	81.1	0.081	10.12	
Weir no. (3)	M.	1.052	882.9	939.7	1.019	10.12	
Weir no. (4)	M.	1.155					
Weir no. (5)	M.	1.242					
El Chamry (1) vent	L.	1.322	35.7	35.7	0.036	8.68	
El Chamry (2) vent	R.	1.322	98.1	98.1	0.099	8.68	
Weir no. (6)	M.	1.360	732.5	752.3	0.767	8.68	
Weir no. (7)	M.	1.460					
Wahba Ghaleb vent	L.	1.524	64.0	64.0	0.064	7.23	
Wahba Ghaleb vent (2)	R.	1.574	22.3	27.8	0.030	7.23	
Weir no. (8)	M.	1.580	646.2	660.5	0.676	7.23	7.59
Weir no. (9)	M.	1.935				5.25	
Weir no. (10)	M.	1.986				4.96	
Omar Sobeeh no. (1)	L.	2.044	95.3	95.3	0.096	4.64	
Omar Sobeeh no. (2)	R.	2.044	105.4	119.6	0.120	4.64	
Weir no. (11)	M.	2.048	455.5	455.5	0.525		
Weir no. (12)	M.	2.215				3.13	

LIST OF CANAL STRUCTURE 7/19

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L
Weir no. (13)	M.	2.550					
Shakry Waddad vent	R.	2.560	43.1	43.1	0.036	2.30	
Shakralla Mereb (1)	R.	2.660	74.3	74.3	0.074	2.30	
Shakralla Mereb (2)	L.	2.660	81.9	81.9	0.082	2.30	
Weir no. (14)	M.	2.670	255.2	255.2	0.320	2.30	
Weir no. (15)	M.	2.920				0.28	
Weir no. (16)	M.	3.275				0.93	
Shakry Mereb (3)	R.	3.670	53.2	53.2	0.064	3.04	
Shakry Mereb (4)	L	3.670	50.6	50.6	0.051	3.04	
Weir no. (17) (the end)	M.	3.678	151.4	151.4	0.152	3.04	2.68
4. Bahr Garnabiet Khaled							
Intake			750.5	750.5			
Ibrahim Sarhan vent	L.	0.020	27.6	27.6	0.028	13.86	15.46
Abdel Kholek vent	L.	0.330	73.8	73.8	0.100	13.83	
Hanna Saleh vent	L.	1.050	563.6	563.6	0.564	13.75	
Henen Shenoda vent	M.	1.150	85.5	85.5	0.111	13.75	
5. Bahr Green							
Bahr Green Intake			1,622.5	1,629.7	0.815	13.17	13.71
Halem vent	L.	0.040	295.8	295.8	0.148	12.40	12.95 12.95
Weir no. (1)	M.	0.042	1,326.4	1,333.9	0.667	12.40	12.94

LIST OF CANAL STRUCTURE 8/19

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L
Arab vent	L.	1.362	29.3	29.3	0.015	11.07	11.88 11.61
Khore el Sheer Intake	L.	1.446	1,013.2	1,020.7	0.511	11.06	11.60
Fanous vent	L.	1.450	162.4	162.5	0.082	11.06	11.06
Middle weir	M.	1.250	121.5	121.5	0.061	11.06	11.06
Balsam Shenata vent	L.	2.540	121.5	121.5	0.061	9.99	10.95
6. Bahr Fanous							
Intake			6,117.8	6,289.9	4.033	13.03	13.57
Weir	M.	0.500					12.50 12.35
Aquiduct	M.	0.640					10.78
Bridge & Syphon	M.	0.860					
Aquiduct for private dr.	M.	1.420					
Right Fanous vent	R.	1.430	98.7	98.7	0.049	9.98	
Balsam Sheneda vent	L.	1.425	121.5	121.5	0.061		
Weir & Bridge	M.	1.430	5,898.2	6,070.1	3.911	9.98	10.52 9.93
Fanous no. (1) vent	R.	1.520	97.8	97.8	0.049	9.36	
Weir	M.	1.930	5,800.5	5,972.4	3.849		
Fanous no. (2) vent	R.	1.730	43.4	43.4	0.022	8.16	
Weir	M.	1.730	5,757.0	5,929.1	3.822	8.16	8.70 6.90
Bridge	M.	2.060					
New vent	R.	2.340	107.2	107.2	0.054	6.18	
Weir	M.	2.340	5,649.8	5,821.9	3.755	6.18	6.72 5.48
Bridge	M.	2.560					

LIST OF CANAL STRUCTURE

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L.
Shakry Haddad vent	R.	2.785	235.6	235.6	0.121	4.81	5.35
Azzam pacha vent	L.	2.785	144.3	144.3	0.072	4.81	
Weir	M.	2.785	5,629.9	5,442.0	3.515	4.81	5.35
Bahr Kaheel Intake	R.	3.070	1,245.1	1,349.1	0.680	3.66	4.28 4.20
Weir	M.	3.070	4,024.8	4,092.9	2.558	3.66	4.20
Weir	M.	3.360					2.89
Weir	M.	3.500					
Weir	M.	3.665					
Concrete Bridge	M.	3.935					
Hanna Saleh vent	R.	4.580	13.3	13.3	0.010	1.14	
Bahr Elmalab Intake	L.	4.680	628.1	691.0	0.341	1.14	
Left green vent	L.	4.700	72.4	72.4	0.036	1.14	
Right green vent	R.	4.700	153.0	153.0	0.077	1.14	
Weir & Bridge	M.	4.700	3,158.0	3,953.2	1.976	1.14	0.60
Weir	M.	4.900					2.00
Weir	M.	5.100					
Left vent	L.	5.360	34.3	34.3	0.017	5.12	4.58
Weir & Bridge	M.	5.360	3,123.3	3,911.0	1.955	5.12	4.58
Right vent	R.	5.480	115.1	115.1	0.058	6.54	5.98 6.00
Left vent	L.	5.480	5.2	5.2	0.010	6.54	6.00
Bahr El Hayar Intake	M.	5.480	3,003.4	3,960.4	1.980		
7. Right Garnabia (Intake at Sta. 54,065 on Wahby)							

LIST OF CANAL STRUCTURE

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L.
Intake			1,154.0	1,155.5	0.574	11.77	12.29 11.70
Vent (1)	R.	0.100	10.1	10.1			11.60
Vent (2)	R.	0.295	4.2	4.2			11.67
Vent (3)	R.	0.530	18.6	18.6	0.019	11.29	11.65
Vent (4)	R.	0.760	8.7	8.7			11.62
Vent (5)	R.	1.000	96.7	96.7	0.097	11.24	11.60
Vent (6)	R.	1.400	127.0	127.0	0.177	11.20	11.56
Vent (7)	R.	1.500	4.0	4.0			11.55
Vent (8)	L.	1.650	19.7	19.7	0.020	11.18	11.54
Vent (9)	R.	1.650	20.9	20.9	0.021	11.18	11.54
Weir (1)	M.	1.650	796.5	798.3	0.798	11.18	11.54
Vent (10)	L.	1.950	14.0	14.0	0.028	10.33	10.60 10.57
Vent (11)	R.	2.133	24.8	24.8	0.050	10.32	10.56
Vent (12)	L.	2.141	20.8	20.8	0.042	10.32	10.56
El Ghroory vent	R.	2.257	2.0	2.0	0.010	10.30	10.54
Vent (13)	R.	2.260	41.1	41.1	0.082	10.30	10.54
Vent (14)	R.	2.530	48.6	50.2	0.100	10.27	10.51
Vent (15)	R.	2.540	6.0	6.0			10.51
Vent (16)	R.	2.825	347.9	347.9	0.694	10.24	10.48
Vent (17)	R.	3.010	115.1	115.1	0.230	10.22	10.46
Vent (18)	R.	3.025	176.5	176.5	0.353	10.22	10.46
The tale	M.	3.050					

LIST OF CANAL STRUCTURE 11 / 19

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L.
8. Com Osheem Canal							
Intake			4,286.1	4,690.4	2.345	10.03	10.57 10.18
Azzam vent	R.	0.700	96.0	103.2	0.052	9.36	
Vent no. (2)	L.	1.120	219.7	230.8	0.125		
Gomhoria Canal Intake	R.	1.120	3,455.7	3,455.7	3.455		
Weir no. (1)	M.	1.140	495.0	881.1	0.881		
Weir no. (2)	M.	1.617	495.0	881.1			
Weir no. (3)	L.	2.225	25.0	36.1		0.15	
Bridge	M.	2.620					
Weir no. 3 (End)	M.	3.325	470.0	845.0	0.423	6.12	6.66 6.00
9. Gomhouria Canal							
Intake			3,455.7	3,455.7	3.455	9.53	9.89
Weir	M.	0.050				9.04	
Private vent	R.	0.890	14.6	14.6	0.015		
New vent	L.	1.386	6.1	6.1	0.010		
vent for chicban & Cattle	R.	2.350	50.0	50.0	0.050		
vent (closed)	L.	3.355	100.0	100.0		8.87	
vent no. (1)	L.	5.570	40.0	40.0	0.040	8.69	7.05
vent no. (2)	L.	5.876	40.0	40.0	0.040	8.67	9.03
vent no. (3)	L.	6.413	120.0	120.0	0.120	8.63	8.99
vent no. (4)	L.	7.340	100.0	100.0	0.100	8.55	8.91
vent no. (5)	L.	7.792	60.0	60.0	0.060	8.52	8.88

LIST OF CANAL STRUCTURE 12 / 19

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L.
Branch no. (1) Intake	R.	8.300	260.0	260.0	0.260	8.48	8.84
vent no. (6)	L.	9.120	120.0	120.0	0.120	8.41	8.44
vent no. (7)	L.	9.370	150.0	150.0	0.150	8.39	8.75
vent no. (8)	L.	9.380	539.1	539.1	0.540	8.39	8.75
Private vent		9.590	60.9	60.9	0.061		
Weir	M.	9.640	1,645.0	1,645.0	1.645	8.37	8.73
Branch (2) Intake	R.	9.820	140.0	140.0	0.140	7.92	8.30 8.28
vent	L.	9.990	45.0	45.0	0.045	7.91	8.27
vent	R.	10.165	130.0	130.0	0.130	7.89	8.25
vent	L.	11.300	140.0	140.0	0.140	7.77	8.13
vent	L.	11.720	270.0	270.0	0.270	7.73	8.09
Branch (3) Intake	L.	11.750	320.0	320.0	0.320	7.73	8.09
vent	L.	12.020	50.0	50.0	0.050	7.70	8.06
vent	R.	12.020	50.0	50.0	0.050	7.70	8.06
Weir	M.	12.030	500.0	500.0	0.500	7.70	8.06
vent	R.	12.560	30.0	30.0	0.030	6.62	8.10 6.98
vent	L.	12.990	50.0	50.0	0.050	6.05	
Weir	M.	13.910	360.0	360.0	0.360		
Private new vent		14.610	30.0	30.0	0.030		
10. Bahr Koddaha (Intake from Bahr Mayar)							
Intake of Koddaha			1,835.3	1,835.3	1.835	12.96	12.60 13.74
Drain Syphon	M.	0.370	1,835.3				

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L.
Koddab branch Intake	R.	0.380	382.2	526.5	0.527		
Weir	M.	0.380	1,260.4	1,260.4	1.575	15.30	14.94
Bridge	M.	0.725					15.51
vent (1)	L.	0.874	32.1	32.1	0.032	16.59	16.23
vent (2)	L.	0.990	23.4	23.4	0.023	16.77	17.40
vent (3)	L.	0.018	45.3	45.3	0.045	16.80	17.44
vent (4)	R.	1.018	102.5	102.5	0.103	16.80	16.44
Weir	M.	1.018	1,057.0	1,057.0	1.322	16.80	16.44
Weir	M.	1.285	1,057.0	1,057.0	1.057	18.50	17.28 18.14
Drain Syphon	M.	1.350					19.70
vent (5)	L.	1.766	58.6	58.6	0.059	21.50	21.14
Weir	M.	1.766	998.4	1,248.4	1.248	21.50	21.64 21.14
Acquidact	M.		1,860.0				21.64
vent (6)	L.	1.908	199.6		4.100	22.30	21.94
Weir	M.	1.908	898.1	1,123.9	1.123	22.30	21.94
vent (7)	L.	2.180	22.5	22.5	0.023	23.20	22.84
vent (8) (end)	M.	2.180	876.3	876.3	0.876	23.20	22.84
11. Bahr Koddoba Branch							
Koddaba branch Intake			382.2	526.6	0.527	15.30	14.94
acquidact	M.	0.400					15.70
Weir	M.	0.400	574.9	574.9	0.575	15.96	15.60
vent (1)	R.	0.630	173.4	173.4	0.173	17.27	16.80

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L.
vent (2)	L.	0.630	119.5	119.5	0.120	17.27	16.91
vent (3)	M.	0.630	89.7	89.7	0.090	17.27	16.91
12. Bahr El Bayar							
Bahr El Bayar Intake			3,003.4	3,060.4	1.980	9.60	9.06
El Bohaiey	L.	1.775	158.4	162.4	0.162	10.86	10.50
El Koddaba	M.	1.775	3,004.4	3,009.4	3.010	10.86	10.50 11.06
Abd Alla Soiyman	L.	3.190	42.8	42.8	0.043	11.45	11.09
Purouma	R.	3.250	38.0	38.0	0.038	11.46	11.10
El Gadida	L.	3.260	226.6	226.6	0.227		
Ganabya left intake	L.	4.210	175.0	180.3	0.180	11.46	11.10
Ganubya left (2)		4.450	373.2	373.2	0.373	11.56	11.20
El Badogly Weir	M.	4.450	2,375.4	2,969.4	2.569	11.56	11.20 11.80
Annehaya	M.	6.160	193.1	193.1	0.193	12.96	12.60
Koddaba Canal intake	M.	6.160	1,643.0	2,102.0	2.102	12.96	12.60 13.74
13. Bahr Kaheel							
Bahr Kaheel intake	R.	1.617	1,245.1	1,349.0	0.790	3.66	4.20
Folla	L.	0.560	339.4	346.2	0.173	2.92	3.44
Weir (1)	M.	0.880	905.7	1,003.0	0.616	2.90	3.44
Abdel Gawad	L.	1.405	83.0	83.0	0.084	1.24	1.60
Kaheel extension Nasr Weir	L.	1.110	822.6	919.8	1.149	1.24	1.60
Malla	R.	0.330	76.3	75.3	0.077	0.01	0.37

LIST OF CANAL STRUCTURE 15 / 19

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L
Malla Weir (1)	M.	0.330	745.9	843.0	1.054	0.01	0.37
Eddeiky Vent	R.	0.920	141.0	141.0	0.141	1.05	0.69
Eddeiky Weir (2)	M.		605.0	802.2	0.877	1.05	0.69
Weir (3)	M.	1.200				2.23	1.87
Weir (4)		1.450				3.23	2.87
Kings drain Syphon	M.	1.625					
Allam	L.	1.650	51.3	51.3	0.052	4.17	3.81
Mohamed Said (Elias)	L.	1.950	74.8	74.8	0.076	4.18	3.92
Adib Nakhla	R.	2.050	109.8	164.1	0.164	4.19	3.83
Adib W. Weir (5)	M.	2.050	369.1	583.3	0.466	4.19	3.83
14. Bahr El Malaab							
Intake			727.5	690.4	0.431	1.14	0.68
Garda Sharaf Nasr Gerzy	L.	0.440	49.9	49.9	0.050	1.80	
Garda Sharaf of Weir	M.	0.440	577.6	640.5	0.800	1.80	1.44
draining pepe	L.	0.500					
Nasr Guirguis	L.	0.996	26.0	26.0	0.026	3.49	0.10
Mohamed Aled el Bagu	R.	1.000	13.7	13.7	0.014	3.49	0.10
Khor el Sheer (1)	L.	1.368	29.5	32.6	0.033	3.50	0.10
M. Abdel Bagie Mahey	R.	1.450	44.8	44.8	0.045	3.51	0.04
Abdel Magid Pipe	L.	1.666	7.2	7.2	0.010	3.52	
Bridge	M.	1.760					
el omda	L.	1.767	44.0	44.0	0.044	3.53	

LIST OF CANAL STRUCTURE 16 / 19

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L
M. Abdel Bagui Abu Said	R.	2.227	35.6	35.6	0.360	3.55	
Khor el Sheer (2)	L.	2.267	10.7	10.7	0.011	3.55	
Maichel Salyman	L.	2.396	116.4	144.2	0.144	3.56	
Gad Esseed	L.	2.791	73.1	101.6	0.088	3.57	
Mahmoud Mabry	R.	3.170	37.9	37.9	0.038	3.59	
Abdel Kadir Nour	L.	3.390	50.3	54.0	0.060	3.60	
El Hallak	L.	3.400	13.8	13.8	0.022	3.60	
Ennehayon	M.	3.400	68.3	68.3	0.067	3.60	
Mohamed Bek Khaled	R.	3.400	6.8	6.8	0.010		
15. Bahr Khor El Sheer (Intake from Bahr Green)							
Intake of Khor el Sheer			1,013.2	1,020.7	0.511	11.06	11.60
Fanous	R.	0.155	255.0	262.5	0.152	10.43	10.84
Sheer Saleh	R.	0.156	360.5	360.5	0.181	10.43	10.84
Ennehaya	M.	0.158	397.7	397.7	0.199	10.97	10.84
16. Bahr Nashed (Intake from Khadrawy Ec)							
B. Nashed Intake			923.6	937.7	0.937	12.51	12.86 12.29
Onsi vent no. (2)	L.	0.640	100.8	104.9	0.109	11.80	
Weir no. (1)	M.	0.645	823.0	832.5	0.832	11.80	
Weir no. (2)		0.727	823.0	832.5			
Onsi vent no. (2)	L.	0.983	823.0	832.5	0.172	10.83	

LIST OF CANAL STRUCTURE 17/19

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L.
Weir no.(3)	M.	0.988	651.2	660.7			
Weir no.(4)	M.	1.098	651.2	660.7	0.694	9.37	
Weir no.(5)	M.	1.460	651.2	660.7			
El Mazottly vent	L.	1.634	245.3	245.3	0.245	7.91	
Weir no.(6)	M.	1.642	406.0	415.5	0.415	7.91	
Weir no.(7)	M.	1.675	433.0	433.0	0.412	6.35	
Weir no.(8)	M.	1.850	406.0	415.5		5.37	
Special vent	L.	2.413	20.0	20.0	0.020		
El Youzboshy V.	L.	2.480	128.9	128.9	0.129	4.84	
Mizarvent	L.	2.482	51.8	51.8	0.052	4.84	
El Nehayar.	M.	2.493	205.3	214.8	0.214	5.20	
17. Bahr Misket El Tahoun (Intake from Bahr Wahby)							
Miskit El Tahoum Intake	L.	63.376	752.9	820.4	0.410	24.91	74.37 25.48
Weir no.(1)	M.	0.042	752.9	820.4	0.410	25.86	
Weir no.(2)	M.	0.101	752.9	820.4	0.410	27.54	
Weir no.(3)	M.	0.239	752.9	820.4	0.410	29.25	
Shaw Bak left vent	L.	0.890	107.4	107.7	0.108	31.18	30.82
Shaw Bak right vent	R.	0.931	63.0	115.0	0.115	31.18	30.82
Shaw Bak weir no.4	M.	0.933	582.5	597.7	0.598	31.18	30.82
Hawary vent	L.	1.630	46.4	46.4	0.047	33.27	32.91
ABU Zaid Bak Tam Tawiv	L.	1.610	263.1	278.4	0.314	33.27	32.91
AZIZ vent	M.	1.610	273.0	273.0	0.273	33.27	32.91

LIST OF CANAL STRUCTURE 18/19

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L.
18. Branch no.1 (from Fomhoria Canal)							
Intake			260.0	260.0	0.260	8.48	8.84
Vent	L.	0.350	50.0	50.0			
Vent	L.	0.700	40.0	40.0			
Vent	L.	1.000	80.0	80.0			
Vent	L.	1.500	90.0	90.0			
19. Branch No. 2							
Intake			140.0	140.0	0.140	7.92	8.28
Vent	R.	0.100	140.0	140.0			
20. Branch No.3							
Intake			320.0	320.0	0.320	7.73	8.09
Vent	R.	0.350	90.0	90.0			
Vent	R.	0.500	150.0	150.0			
Weir	M.	0.650	80.0	80.0			
Vent	R.	0.950	40.0	40.0			
End		1.390	40.0	40.0			
21. Bahr Wahby Extension							
0. extension intake	L.		999.6	1,001.8	1.002	34.08	33.72

LIST OF CANAL STRUCTURE 19/19

NAME OF VENT OR WEIR	SITE	STATION (km)	ACTUAL AREA	TOTAL AREA	WIDTH OF WEIR	CREST ELEVATION	HIGH W.L.
vent no. (1)	L.	0.595	84.3	84.3	0.084	35.90	35.54
Weir no. (1)	M.	0.600	915.3	917.6	0.918	35.90	35.54
vent no. (2)	L.	1.130	26.0	26.0	0.026	36.49	36.16
Weir no. (2)	M.	1.200	889.3	891.6	0.892	36.49	36.16
vent no. (3)	R.	1.848	20.0	20.0	0.020	37.40	
vent no. (4)	L.	1.848	60.0	62.3	0.062	37.40	
Weir no. (3)	M.	1.900	809.3	809.3	0.809	37.40	37.04
vent no. (5)	L.	2.412	168.0	168.0	0.168	38.02	
vent no. (6)	R.	2.665	246.8	246.8	0.247	38.02	
Ibrahim Halim vent	L.	2.665	59.0	59.0	0.059	38.02	37.66
Weir no. (4)	M.	2.680	335.5	335.5	0.336	38.02	37.66
vent no. (7) (Rasmun)	R.	3.210	152.0	152.0	0.152	39.15	38.19
Weir no. (5)	M.	3.210	140.5	140.5	0.144	39.15	38.19
			43.0	43.0	0.043		

Table F4-3(1)

AUGER-HOLE TESTS FOR PERMEABILITY

Hole No. K-1 Location Ez. el-Shamikh Abu Masud in Tersa

Date July 23, 1984

Hole Cased ☐ Uncased ☒ Hole Dia. 4 inches Radius 0.167 feet

LOG

Surface (-)42.8

m

July 25 — 0.85 — Sandy Loam — Sample K-1-a

Sample K-1-b

1.00

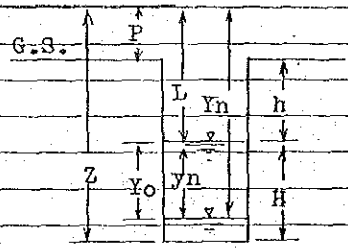
1.125 — x

Sandy Loam

2.00 — Sample K-1-c

2.12

Measuring Point



1. Measuring point to ground sur. = P = 1.31 ft
2. " " to static water sur. = L = 3.69 ft
3. " " to bot. of hole = Z = Ini. 8.27 ft
Final 8.27 ft
4. Ground surface to static w.s. = h = 2.38 ft
5. Static w.s. to bottom of hole = H = 3.72 ft
6. Depth of hole h + H = 6.10 ft
7. Initial drawdown in hole = Yo = 0.90 ft

Time sec Ini	Time sec Final	Δt Diff	Yn Ini	Yn Final	Yn=(Yn-L) Ini	Yn=(Yn-L) Final	Δy
					(0.90)		
0	0:30	30	1.400	1.390	0.275	0.265	
	1:00	"		1.290		0.165	
	30	"		1.285		0.160	
	2:00	"		1.280		0.155	
	30	"		1.278		0.153	
	3:00	"		1.273		0.148	
	30	"		1.267		0.142	
	4:00	"		1.266		0.141	
	30	"		1.262		0.137	
	5:00	"		1.260		0.135	
	30	"		1.253		0.128	
	6:00	"		1.243		0.118	
	30	"		1.225		0.100	
	7:00	"		1.206		0.081	
0.8Yo	30	"		1.174		0.049	
	8:00	"		+.150		0.025	

0.8 Yo = 0.72 ft

$\overline{yn} = \frac{0.90+0.16}{2} = 0.53$ ft

Δt = 30 seconds

$\overline{\Delta y} = \frac{0.74}{15} = 0.049$ ft

H/r = 3.72/0.167 = 22.28

yn/r = 0.53/0.167 = 3.17

C (from chart) = 1,500

k = C × Δy = 2.45 ft/d

k = ft/day / 2 = 1.23 in/hr

= 8.7×10^{-4} cm/s

Table F4-3(2)

AUGER-HOLE TESTS FOR PERMEABILITY

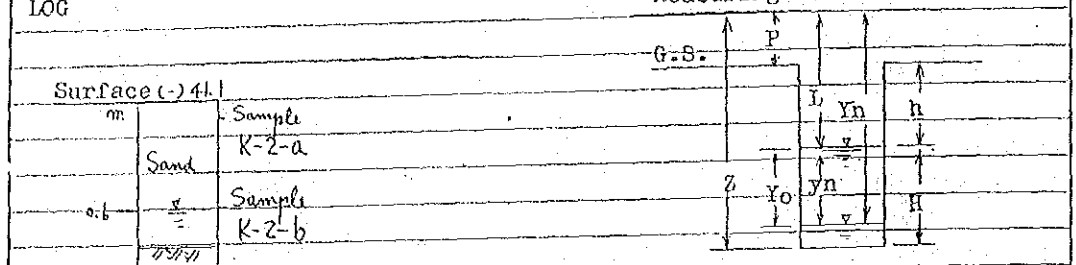
Hole No. K-2 Location Ez. el-Shamikh Abu Masud in Tersa

Date July 23 , 1984

Hole Cased [ ] Uncased [X] Hole Dia. 4 inches Radius 0.167 feet

The wall of the augered hole was collapsed due to sandy layer at about 0.60 meters in depth. No measurement was made for permeability.

LOG



1. Measuring point to ground sur. = P = ft
2. " " to static water sur. = L = ft
3. " " to bot. of hole = Z = Ini. ft
Final ft
4. Ground surface to static w.s. = h = 2.0 ft
5. Static w.s. to bottom of hole = H = 1.0 ft
6. Depth of hole h + H 3.0 ft
7. Initial drawdown in hole = Yo= ft

Time sec Ini	Time sec Final	Δt Diff	Yn Ini	Yn Final	Yn =(Yn-L) Ini	Yn =(Yn-L) Final	Δy

0.8 Yo= ft

$\overline{yn}$ = + = ft
2

$\overline{\Delta t}$ = seconds

$\overline{\Delta y}$ = = ft

H/r = /0.167 =

yn/r = / =

C(from chart) =

k=C X $\frac{\Delta y}{\Delta t}$ =

k=ft/day / 2 = m/hr

= x10⁻

Table P4-3(3)

AUGER-HOLE TESTS FOR PERMEABILITY

Hole No. K-3 Location Ez. el-Shamikh Abu Masud in Tersa

Date July 23 , 1984

Hole Cased [ ] Uncased [X] Hole Dia. 4 inches Radius 0.167 feet

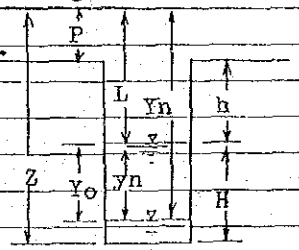
Recovering the water level after bailing was very slow at about one centimeter rising per 50 minutes due to heavy clay layer.

LOG No permeability test was performed.

Surface (-) 39.7

m		
		Sample K-3-a
	Clay Loam	
0.96		
1.00		Sample K-3-b
2.00		Sample K-3-c
2.30		

Measuring Point



1. Measuring point to ground sur. = P = ft
2. " " to static water sur. = L = ft
3. " " to bot. of hole = Z = Ini. ft
Final ft
4. Ground surface to static w.s. = h = 2.49 ft
5. Static w.s. to bottom of hole = H = 1.45 ft
6. Depth of hole h + H 3.94 ft
7. Initial drawdown in hole = Yo= ft

Time Min sec Ini	Time Min sec Final	Δt_{min} Diff	Yn Ini	Yn Final	Yn =(Yn-L) Ini	Yn =(Yn-L) Final	Δy

0.8 Yo= ft

$\overline{yn}$ = + = ft
2

$\overline{\Delta t}$ = seconds

$\overline{\Delta y}$ = = ft

H/r = /0.167 =

yn/r = / =

C(from chart) =

$k = C \times \frac{\Delta y}{\Delta t}$ =

~~k-ft/day~~ / 2 = ~~m/hr~~

= $\times 10^{-}$

Table F4-3(4)

AUGER-HOLE TESTS FOR PERMEABILITY

Hole No. K-4 Location Ez.el-Shamikh Abu Masud in Tersa

Date July 23 , 1984

Hole Cased ☐ Uncased ☒ Hole Dia. 4 inches Radius 0.167 feet

LOG

Surface (-)3.80 m

Sample K-4-a

Clay

July 25 0.19 1.0

Sample K-4-b

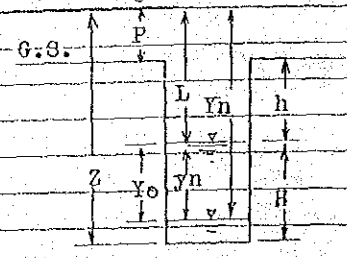
July 23 1.21

Sandy Loam

1.85 2.0

Sample K-4-C

Measuring Point



1. Measuring point to ground sur. = P = 1.28 ft
2. " " to static water sur. = L = 5.41 ft
3. " " to bot. of hole = Z = Ini. 7.35 ft
Final 7.35 ft
4. Ground surface to static w.s. = h = 4.13 ft
5. Static w.s. to bottom of hole = H = 1.94 ft
6. Depth of hole h + H 6.07 ft
7. Initial drawdown in hole = Yo = 1.62 ft

Time min		Δt	Yn		Yn = (Yn-L)		Δy
Ini	Final	Diff	Ini	Final	Ini	Final	
0	5	300	2.143	2.068	(1.62) 0.493	0.418	
	10	"		2.002		0.352	
	15	"		1.938		0.288	
	20	"		1.882		0.232	
	25	"		1.828		0.178	
	30	"		1.783		0.133	
0.8Yo	35	"		1.735		(0.28) 0.085	
	40	"		1.695		0.045	

0.8 Yo = 1.29 ft

$\overline{yn} = \frac{1.62 + 0.28}{2} = 0.95$ ft

Δt = 300 seconds

$\overline{\Delta y} = \frac{1.34}{7} = 0.191$ ft

H/r = 1.94/0.167 = 11.62

yn/r = 0.95/0.167 = 5.69

C (from chart) = 1,600

$k = C \times \frac{\Delta y}{\Delta t}$ = 1.02 ft/d

k = ft/day / 2 = 0.51 m/hr

$= 3.6 \times 10^{-4}$ cm/s

Table F4-3(5)

AUGER-HOLE TESTS FOR PERMEABILITY

Hole No. K-5 Location Ez.Ah Bey Yusef in Menshat Sennores

Date July 25 , 1984

Hole Cased ☐ Uncased ☒ Hole Dia. 4 inches Radius 0.167 feet

LOG

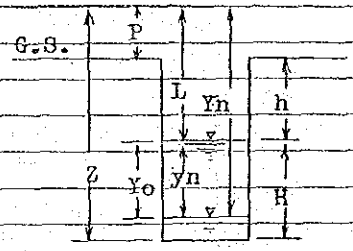
Surface (-)42.4 m

0.65 — Sample K-5-a

1.00 — Silty Loam — Sample K-5-b

2.00 — Sample K-5-c

Measuring Point



1. Measuring point to ground sur. = P = 1.15 ft
2. " " to static water sur. = L = 3.28 ft
3. " " to bot. of hole = Z = Ini. 7.71 ft
   Final 7.71 ft
4. Ground surface to static w.s. = h = 2.13 ft
5. Static w.s. to bottom of hole = H = 4.43 ft
6. Depth of hole h + H = 6.56 ft
7. Initial drawdown in hole = Yn = 0.64 ft

	Time sec Ini	Time sec Final	Δt Diff	Yn Ini	Yn Final	Yn = (Yn-L) Ini	Yn = (Yn-L) Final	Δy
	0	10	600	1.196	0.090	(0.64) 0.196	0.090	
		20	"		0.057		0.057	
		30	"		0.042		0.042	
		40	"		0.039		0.039	
		50	"		0.037		0.037	
		60	"		0.035		0.035 (0.11)	
0.8Yo		70	"		0.033		0.033	
		80	"		0.031		0.031	

0.8 Yo = 0.52 ft

$\overline{yn} = \frac{0.64 + 0.11}{2} = 0.38$ ft

Δt = 600 seconds

$\overline{\Delta y} = \frac{0.53}{7} = 0.076$ ft

H/r = 4.43/0.167 = 26.53

yn/r = 0.38/0.167 = 2.28

C (from chart) = 1,700

$k = C \times \frac{\Delta y}{\Delta t} = 0.22$ ft/d

k = ~~ft/day~~ / 2 = 0.11 m/hr

$= 2.8 \times 10^{-5}$ cm/s

Table F4-3(6)

AUGER-HOLE TESTS FOR PERMEABILITY

Hole No. K-6 Location Ez.Ab Bey Yusef in Mensnat Sennores

Date July 25, 1984

Hole Cased ☐ Uncased ☒ Hole Dia. 4 inches Radius 0.167 feet

LOG

Surface (-)4.13

m

Sample K-6-a

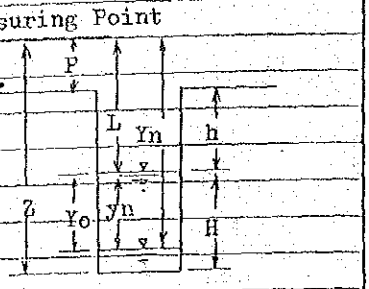
0.813 ▽

Sample K-6-b

Clay Loam

Sample K-6-c

2.10



1. Measuring point to ground sur. = P = 1.12 ft
2. " " to static water sur. = L = 3.78 ft
3. " " to bot. of hole = Z = Ini. 8.01 ft
   Final 8.01 ft
4. Ground surface to static w.s. = h = 2.67 ft
5. Static w.s. to bottom of hole = H = 4.22 ft
6. Depth of hole h + H = 6.89 ft
7. Initial drawdown in hole = Yo = 0.32 ft

Time min. sec. Ini	Final	Δt Diff	Yn Ini	Yn Final	Yn = (Yn-L) Ini	Yn = (Yn-L) Final	Δy
0	10	600	1.250	1.225	(0.32) 0.097	0.072	
	20	"		1.212		0.059	
	30	"		1.206		0.053	
	40	"		1.200		0.047	
	50	"		1.194		0.041	
	60	"		1.188		0.035	
	70	"		1.182		0.029	
	80	"		1.176		0.023	
0.8Yo	90	"		1.172		(0.06) 0.019	
	100	"		1.172		0.019	

0.8 Yo = 0.26 ft

$\overline{yn} = \frac{0.32 + 0.06}{2} = 0.24$ ft

Δt = 600 seconds

$\overline{\Delta y} = \frac{0.26}{9} = 0.029$ ft

H/r = 4.22/0.167 = 25.27

yn/r = 0.24/0.167 = 1.44

C (from chart) = 1,800

$k = C \times \frac{\overline{\Delta y}}{\Delta t}$ = 0.087 ft/d

k = ft/day / 2 = 0.044 m/hr

$= 3.1 \times 10^{-5}$ cm/s

Table F4-3(7)

AUGER-HOLE TESTS FOR PERMEABILITY

Hole No. K-7 Location Ez.Muftah Abu Zeid el-Zul in Menshat Sannores

Date July 25, 1984

Hole Cased [ ] Uncased [X] Hole Dia. 4 inches Radius 0.167 feet

LOG

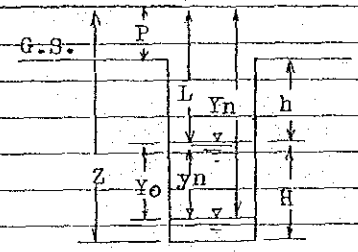
Surface (-)40.6 m

0.33 — Sample K-7-a

Clay Loam — Sample K-7-b

1.10 — Sample K-7-C

Measuring Point



1. Measuring point to ground sur. = P = 0.79 ft
2. " " to static water sur. = L = 1.87 ft
3. " " to bot. of hole = Z = Ini. 4.40 ft
   Final 4.40 ft
4. Ground surface to static w.s. = h = 1.08 ft
5. Static w.s. to bottom of hole = H = 2.53 ft
6. Depth of hole h + H = 3.61 ft
7. Initial drawdown in hole = Yo = 1.26 ft

Time min. sec Ini	Final	Δt Diff	Yn Ini	Yn Final	Yn = (Yn-L) Ini	Yn = (Yn-L) Final	Δy
0	5	300	0.955	0.839	(1.26) 0.385	0.269	
	10	"		0.771		0.201	
	15	"		0.730		0.160	
	20	"		0.703		0.133	
	25	"		0.684		0.114	
	30	"		0.670		0.100	
	35	"		0.663		0.093	
	40	"		0.657		0.087	
	45	"		0.651		0.081	
0.8Yo	50	"		0.645	(0.25)	0.075	
	55	"		0.639		0.069	

0.8 Yo = 1.01 ft

$\overline{yn} = \frac{1.26+0.25}{2} = 0.76$ ft

$\overline{\Delta t}$ = 300 seconds

$\overline{\Delta y} = \frac{1.01}{10} = 0.101$ ft

H/r = 2.53/0.167 = 15.15

yn/r = 0.76/0.167 = 4.55

C (from chart) = 1,550

$k = C \times \frac{\overline{\Delta y}}{\overline{\Delta t}}$ = 0.52 ft/d

k = ft/day / 2 = 0.26 m/hr

$= 1.8 \times 10^{-4}$ cm/s

Table F4-3(8)

AUGER-HOLE TESTS FOR PERMEABILITY

Hole No. K-8 Location Ez. Fawzi Pasha el-Mutei'i in Menshat Tantawi

Date July 26 , 1984

Hole Cased ☐ Uncased ☒ Hole Dia. 4 inches Radius 0.167 feet

LOG

Surface (-)42.2 m

Sample K-8-a

0.40 m Aug. 1

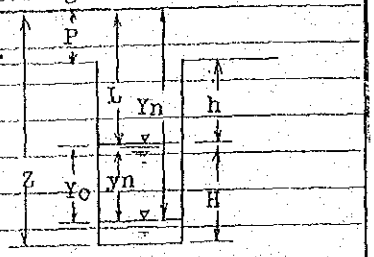
Sample K-8-b

0.64 July 24

Sample K-8-C

1.80

Measuring Point



1. Measuring point to ground sur. = P = 1.12 ft
2. " " to static water sur. = L = 3.22 ft
3. " " to bot. of hole = Z = Ini. 7.02 ft
Final 7.02 ft
4. Ground surface to static w.s. = h = 2.11 ft
5. Static w.s. to bottom of hole = H = 3.80 ft
6. Depth of hole h + H = 5.91 ft
7. Initial drawdown in hole = Yo = 0.87 ft

0.8 Yo = 0.70 ft

$\overline{yn} = \frac{0.87 + 0.17}{2} = 0.52$ ft

Δt = 300 seconds

$\overline{\Delta y} = \frac{0.70}{11} = 0.064$ ft

H/r = 3.80/0.167 = 22.75

yn/r = 0.52/0.167 = 3.11

C (from chart) = 1,530

$k = C \times \frac{\Delta y}{\Delta t}$

k = ft/day / 2 = 0.0032 in/hr

$= 4.5 \times 10^{-6}$ cm/s

Time min-sec Ini	Time min-sec Final	Δt Diff	Yn Ini	Yn Final	Yn = (Yn-L) Ini	Yn = (Yn-L) Final	Δy
0	5	300	1.248	1.203	(0.871) 0.266	0.221	0.045
	10	"		1.168	0.221	0.186	
	15	"		1.138	0.186	0.156	
	20	"		1.114	0.156	0.132	
	25	"		1.092	0.132	0.110	
	30	"		1.081	0.110	0.099	
	35	"		1.070	0.099	0.088	
	40	"		1.060	0.088	0.078	
	45	"		1.050	0.078	0.068	
	50	"		1.040	0.068	0.058	
0.8 Y_o	55	"		1.034	0.058	(0.170) 0.052	0.006
	60			1.029	0.052	0.047	0.005

Table F4-3(9)

AUGER-HOLE TESTS FOR PERMEABILITY

Hole No. K-9 Location Ez. Fawzi Pasha el-Mutei'i in Menshat Tantawi

Date July 26 , 1984

Hole Cased [ ] Uncased [X] Hole Dia. 4 inches Radius 0.167 feet

LOG

Surface (-)42.2

m

0.74 Fine Sand / Silty Clay

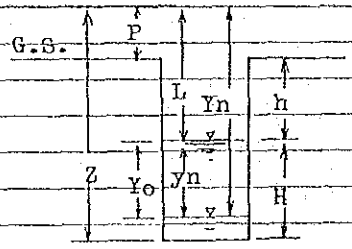
1.50

Sample K-9-a

Sample K-9-b

Sample K-9-C

Measuring Point



1. Measuring point to ground sur. = P = 1.08 ft
2. " " to static water sur. = L = 3.50 ft
3. " " to bot. of hole = Z = Ini. 6.00 ft
Final 6.00 ft
4. Ground surface to static w.s. = h = 2.42 ft
5. Static w.s. to bottom of hole = H = 2.50 ft
6. Depth of hole h + H = 4.92 ft
7. Initial drawdown in hole = Yo = 0.29 ft

Time sec Ini	Time sec Final	Δt Diff	Yn Ini	Yn Final	Yn=(Yn-L) Ini	Yn=(Yn-L) Final	Δy
0	0:30	30	1.155	1.143	(0.29) 0.087	0.075	
	1:00	"		1.130		0.062	
	30	"		1.122		0.054	
	2:00	"		1.114		0.046	
	30	"		1.107		0.039	
	3:00	"		1.099		0.031	
	30	"		1.095		0.027	
	4:00	"		1.092		0.024	
	30	"		1.088		0.020	
	5:00	"		1.087		0.019	
0.8Yo	30	"		1.084		(0.05) 0.016	
	6:00	"		1.082		0.014	
	30	"		1.080		0.012	
	7:00	"		1.078		0.010	

0.8 Yo = 0.23 ft

$\overline{yn} = \frac{0.29 + 0.05}{2} = 0.17$ ft

Δt = 30 seconds

$\overline{\Delta y} = \frac{0.24}{11} = 0.022$ ft

H/r = 2.50/0.167 = 14.97

yn/r = 0.17/0.167 = 1.018

C (from chart) = 2,500

k = C X $\frac{\Delta y}{\Delta t}$ = 1.83 ft/d

k = ft/day / 2 = 0.92 in/hr

$= 6.5 \times 10^{-4}$ cm/s

Table F4-3(10)

AUGER-HOLE TESTS FOR PERMEABILITY

Hole No. K-10 Location Ez.el-Saiyid Rahil in Saadia

Date July 28 , 1984

Hole Cased [ ] Uncased [X] Hole Dia. 4 inches Radius 0.167 feet

LOG

Surface (-)43.0 m

Sample K-10-a

Clay

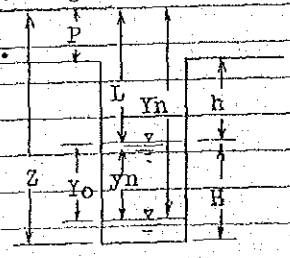
Sample K-10-b

0.85

Sample K-10-C

2.65

Measuring Point



1. Measuring point to ground sur. = P = (-)0.52ft
2. " " to static water sur. = L = 2.26ft
3. " " to bot. of hole = Z = Ini. 8.01ft
   Final 5.38ft
4. Ground surface to static w.s. = h = 2.79ft
5. Static w.s. to bottom of hole = H = 5.91ft
6. Depth of hole h + H = 8.69ft
7. Initial drawdown in hole = Yo = 0.88 ft

Time min Ini	Time sec Final	Δt Diff	Yn Ini	Yn Final	Yn =(Yn-L) Ini	Yn =(Yn-L) Final	Δy
0	5	300	0.958	0.888	(0.88) 0.268	0.198	
	10	"		0.848		0.158	
	15	"		0.819		0.129	
	20	"		0.803		0.113	
	25	"		0.790		0.100	
	30	"		0.778		0.088	
	35	"		0.773		0.083	
	40	"		0.763		0.073	
	45	"		0.760		0.070	
	50	"		0.750		0.060	
0.8Yo	55	"		0.740		(0.16) 0.050	
	60	"		0.730		0.040	

0.8 Yo = 0.70 ft

$\overline{yn} = \frac{0.88 + 0.16}{2} = 0.52$ ft

$\overline{\Delta t} = 300$ seconds

$\overline{\Delta y} = \frac{0.72}{11} = 0.065$ ft

H/r = 5.91/0.167 = 35.39

yn/r = 0.52/0.167 = 3.11

C (from chart) = 1,400

$k = C \times \frac{\Delta y}{\Delta t}$

k = ft/day / 2 = 0.45 m/hr

$= 1.1 \times 10^{-4}$ cm/s

Table F4-3(11)

AUGER-HOLE TESTS FOR PERMEABILITY

Hole No. K-11 Location Ez. el-Saiyid Rahil in Saadia

Date July 29 , 1984

Hole Cased ☐ Uncased ☒ Hole Dia. 4 inches Radius 0.167 feet

LOG

Surface (-)40.8 m

Sample K-11-a

Silty Loam

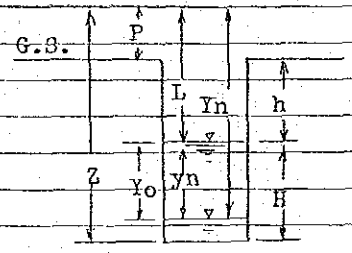
Sample K-11-b

0.92

Sample K-11-c

1.85

Measuring Point



1. Measuring point to ground sur. = P = (-)0.49 ft
2. " " to static water sur. = L = 2.53 ft
3. " " to bot. of hole = Z = Ini. 5.58 ft
   Final 5.58 ft
4. Ground surface to static w.s. = h = 3.02 ft
5. Static w.s. to bottom of hole = H = 3.05 ft
6. Depth of hole h + H = 6.07 ft
7. Initial drawdown in hole = Yo = 1.18 ft

Time min. sec Ini	Time min. sec Final	Δt Diff	Yn Ini	Yn Final	Yn = (Yn-L) Ini	Yn = (Yn-L) Final	Δy
0	2	120	1.130	1.066	(1.18) 0.360	0.296	
	4	"		1.014		0.244	
	6	"		0.979		0.209	
	8	"		0.943		0.173	
	10	"		0.914		0.144	
	12	"		0.892		0.122	
	14	"		0.876		0.106	
	16	"		0.858		0.088	
	18	"		0.846		0.076	
0.8Yo	20	"		0.837		(0.22) 0.067	
	22	"		0.826		0.056	

0.8 Yo = 0.94 ft

$\overline{yn} = \frac{1.18 + 0.22}{2} = 0.70$ ft

$\overline{\Delta t}$ = 120 seconds

$\overline{\Delta y} = \frac{0.96}{10} = 0.096$ ft

H/r ~~3.05/0.167 = 18.26~~

yn/r = 0.70/0.162 = 4.19

C (from chart) = 1,150

$k = C \times \frac{\Delta y}{\Delta t}$ = 0.92 ft/d

k = ft/day / 2 = 0.46 in/hr

= 3.3×10^{-4} cm/s

Table F4-3(12)

AUGER-HOLE TESTS FOR PERMEABILITY

Hole No. K-12 Location Ez. el-Sabakhaya in Kasr Rashwan

Date July 29 , 1984

Hole Cased [ ] Uncased [X] Hole Dia. 4 inches Radius 0.167 feet

No permeability test was performed because groundwater table was very low, so that bailing water in the augered hole could not made.

LOG

Surface (-)31.5

m

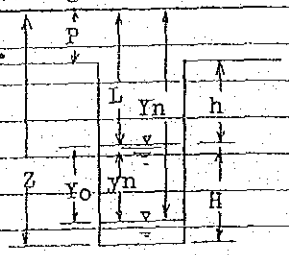
Sample K-12-a

Sample K-12-b

1.00

2.00

Measuring Point



1. Measuring point to ground sur. = P = ft
2. " " to static water sur. = L = ft
3. " " to bot. of hole = Z = Ini. ft
Final ft
4. Ground surface to static w.s. = h = ft
5. Static w.s. to bottom of hole = H = ft
6. Depth of hole h + H ft
7. Initial drawdown in hole = Yo= ft

Time sec Ini	Time sec Final	Δt Diff	Yn Ini	Yn Final	Yn =(Yn-L) Ini	Yn =(Yn-L) Final	Δy

0.8 Yo= ft

$\overline{yn}$ = + = ft
2

$\overline{\Delta t}$ = seconds

$\overline{\Delta y}$ = = ft

H/r = /0.167 =

yn/r = / =

C(from chart) =

$k = C \times \frac{\Delta y}{\Delta t}$ =

k=ft/day / 2 = m/hr

= x10⁻

Table F4-3(13)

AUGER-HOLE TESTS FOR PERMEABILITY

Hole No. K-13 Location Ez. el-Bileidi in Kasr Rashwan

Date July 30 , 1984

Hole Cased ☐ Uncased ☒ Hole Dia. 4 inches Radius 0.167 feet

LOG

Surface (-)323 m

Sample K-13-a

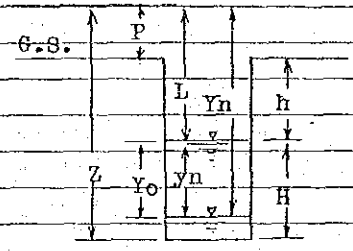
Clay Sample K-13-b

0.91

Sample K-13-C

1.97

Measuring Point



1. Measuring point to ground sur. = P = 0.49 ft
2. " " to static water sur. = L = 3.97 ft
3. " " to bot. of hole = Z = Ini. 8.37 ft
   Final 8.37 ft
4. Ground surface to static w.s. = h = 2.99 ft
5. Static w.s. to bottom of hole = H = 3.48 ft
6. Depth of hole h + H = 6.46 ft
7. Initial drawdown in hole = Yo = 0.59 ft

Time min. Ini	Time min. Final	Δt Diff	Yn Ini	Yn Final	Yn = (Yn-L) Ini	Yn = (Yn-L) Final	Δy
0	20	1,200	1.390	1.376	(0.59) 0.18	0.166	
	40	"		1.365		0.155	
	60	"		1.353		0.143	
	80	"		1.34		0.131	
	100	"		1.329		0.119	
	120	"		1.317		0.107	
	140	"		1.305		0.095	
	160	"		1.292		0.082	
	180	"		1.280		0.070	
	200	"		1.268		0.058	
	220	"		1.256		0.046	
0.8Yo	240	"		1.244	(0.11) 0.034		
	260	"		1.232		0.022	

0.8 Yo = 0.47 ft

$\overline{yn} = \frac{0.59 + 0.11}{2} = 0.35$ ft

Δt = 1,200 seconds

$\overline{\Delta y} = \frac{0.48}{12} = 0.04$ ft

H/r = 3.48 / 0.167 = 20.84

yn/r = 0.35 / 0.167 = 2.10

C (from chart) = 2,100

k = C X Δy = 0.07 ft/d

k = ft/day / $\frac{\Delta t}{2}$ = 0.035 in/hr

= 2.5×10^{-3} cm/s

Table F4-3(14)

AUGER-HOLE TESTS FOR PERMEABILITY

Hole No. K-14 Location Ez.Murad Gindi in Fanous

Date July 30 , 1984

Hole Cased ☐ Uncased ☐ Hole Dia. 4 inches Radius 0.167 feet

LOG

Surface (-)6.7

m

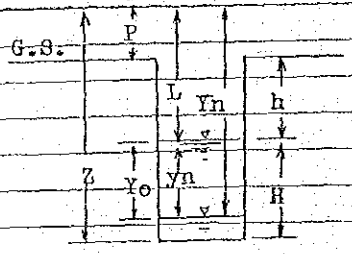
Sample K-14-a

0.56 ▽ Sample K-14-b

Sandy loam

1.40 Sample K-14-C

Measuring Point



1. Measuring point to ground sur. = P = 0.23 ft
2. " " to static water sur. = L = 2.07 ft
3. " " to bot. of hole = Z = Ini. 4.82 ft
Final 4.82 ft
4. Ground surface to static w.s. = h = 1.84 ft
5. Static w.s. to bottom of hole = H = 2.76 ft
6. Depth of hole h + H = 4.59 ft
7. Initial drawdown in hole = Yo = 0.46 ft

0.8 Yo = 0.37 ft

	Time sec Ini	Time sec Final	Δt Diff	Yn Ini	Yn Final	Yn = (Yn-L) Ini	Yn = (Yn-L) Final	Δy
	0	0:30	30	0.77	0.740	(0.46) 0.440	0.440	
		1:00	"		0.700		0.070	
		30	"		0.665		0.035	
0.8Yo		2:00	"		0.650		(0.07) 0.020	
		30	"		0.650		0.020	
		3:00	"		0.645		0.015	

$\overline{yn} = \frac{0.46 + 0.07}{2} = 0.265$ ft

Δt = 30 seconds

$\overline{\Delta y} = \frac{0.39}{4} = 0.098$ ft

H/r = 2.76/0.167 = 16.53

yn/r = 0.265/0.167 = 1.59

C (from chart) = 2,500

k = C X Δy = 8.17 ft/d

k = ft/day / $\frac{\Delta t}{2}$ = 4.08 m/hr

$= 2.9 \times 10^{-3}$

TABLE F4-4 Results of Ec and Ph Analysis at Permeability Observation

No.	EC (mmhos/cm)			P H		
	A	B	C	A	B	C
K- 1	51.96	12.31	19.59	7.50	7.75	7.45
K- 2	84.78	12.58	-	7.25	7.55	-
K- 3	5.19	5.06	17.32	7.70	7.90	7.10
K- 4	11.39	11.08	34.18	7.25	7.20	7.40
K- 5	124.43	7.93	12.44	7.05	7.45	7.50
K- 6	1.73	1.07	1.37	8.40	7.70	7.70
K- 7	1.67	7.11	4.10	7.60	7.90	8.15
K- 8	7.93	12.17	15.04	7.20	8.25	7.65
K- 9	1.87	1.78	2.69	7.20	8.40	7.25
K-10	11.39	60.90	53.33	7.25	7.75	7.50
K-11	15.04	10.39	4.38	7.75	7.60	7.60
K-12	6.29	8.07	-	8.35	8.15	-
K-13	2.28	5.22	14.13	8.60	8.25	8.10
K-14	3.74	12.76	11.02	7.95	8.20	8.15

Note : Location of samples and profile are found in Tables F4-3(1) to F4-3(14).

FIG. F4-1 SKELTON OF IRRIGATION SYSTEM IN FAYOUM

Source : Ministry of Irrigation, Fayoum

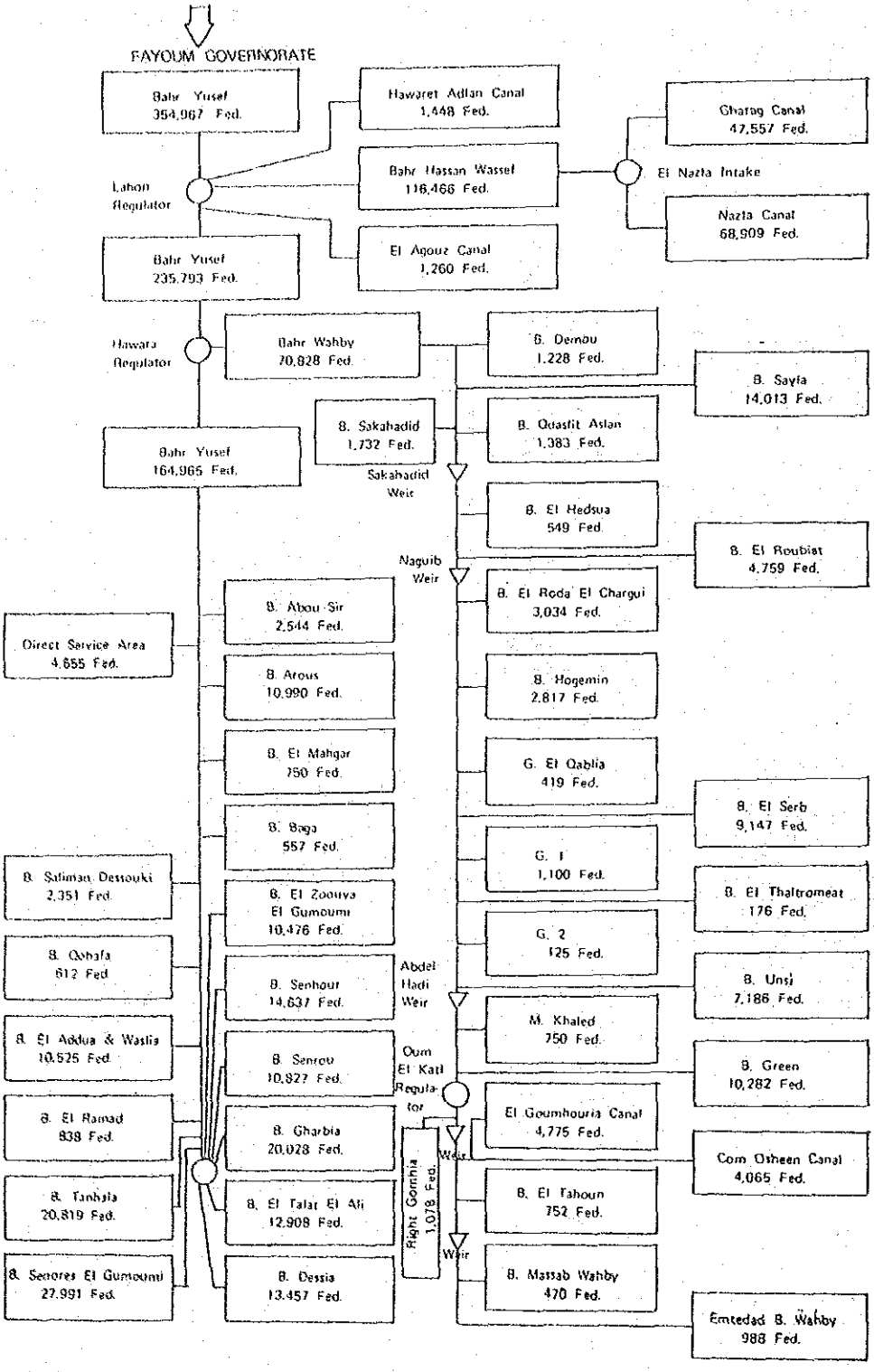


FIG F4-2 PRESENT IRRIGATION SYSTEM IN WAHBY DOWNSTREAM AREA.

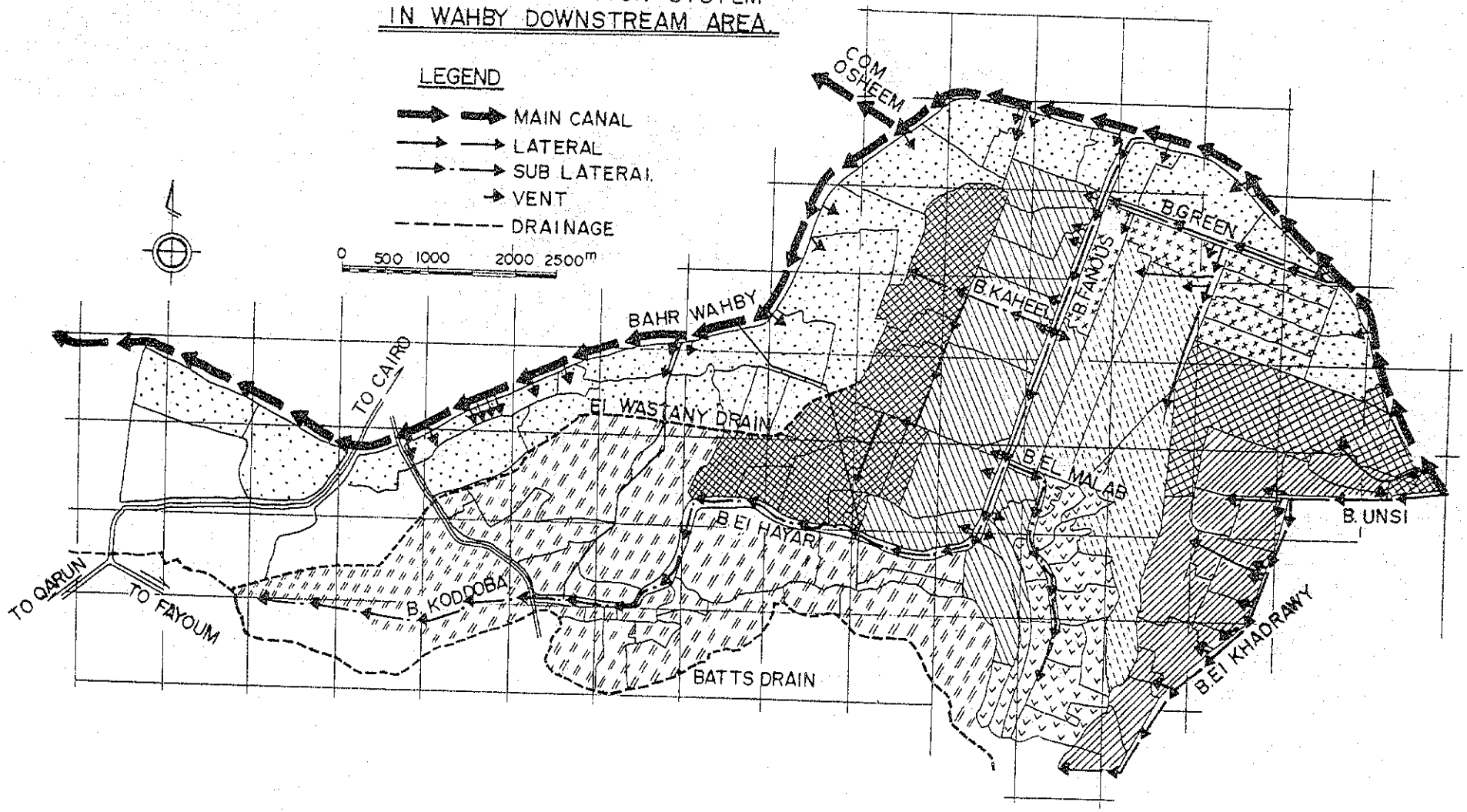


FIG. P4-3 LOCATION OF FIELD OBSERVATION FOR PERMEABILITY

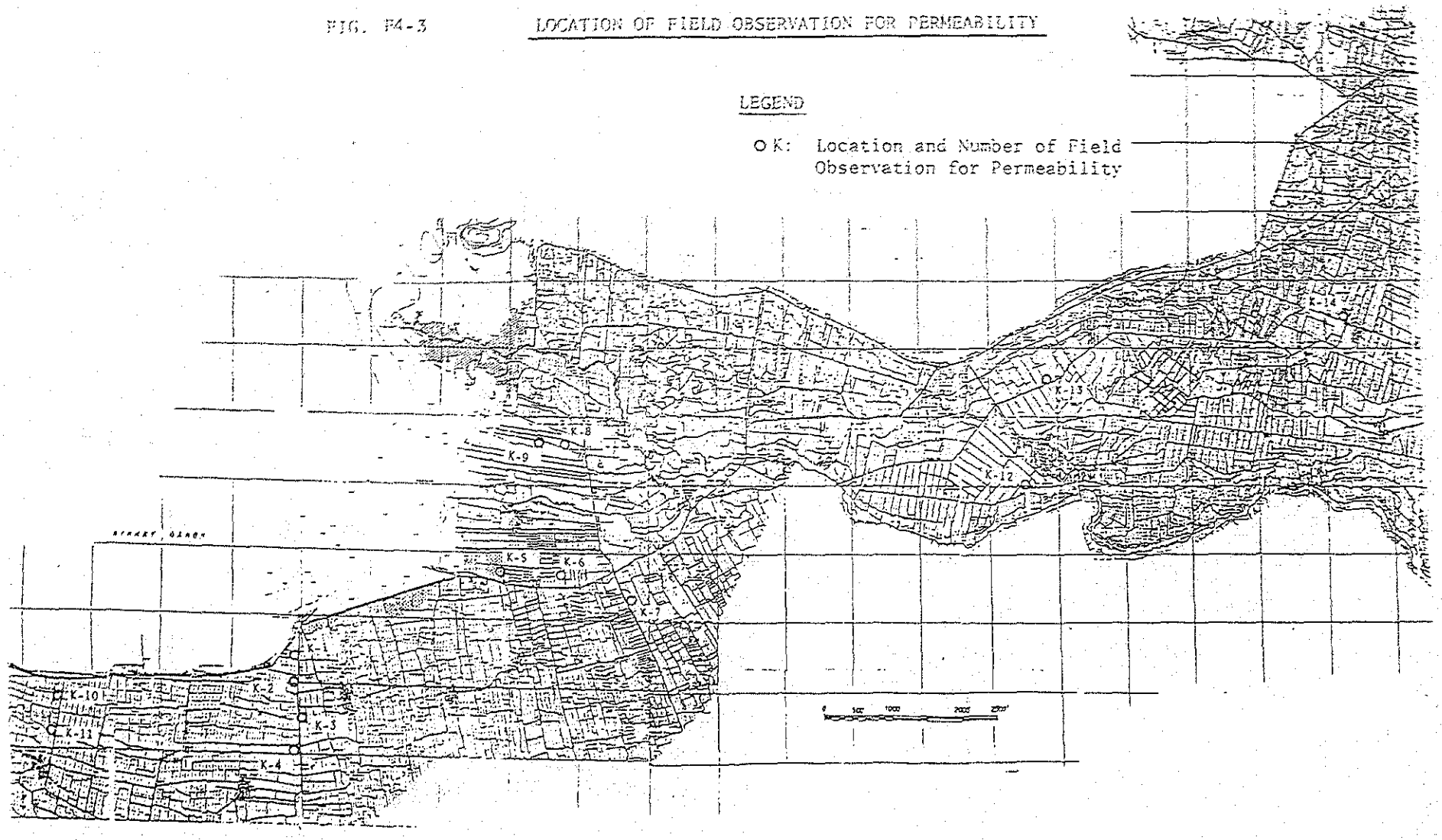
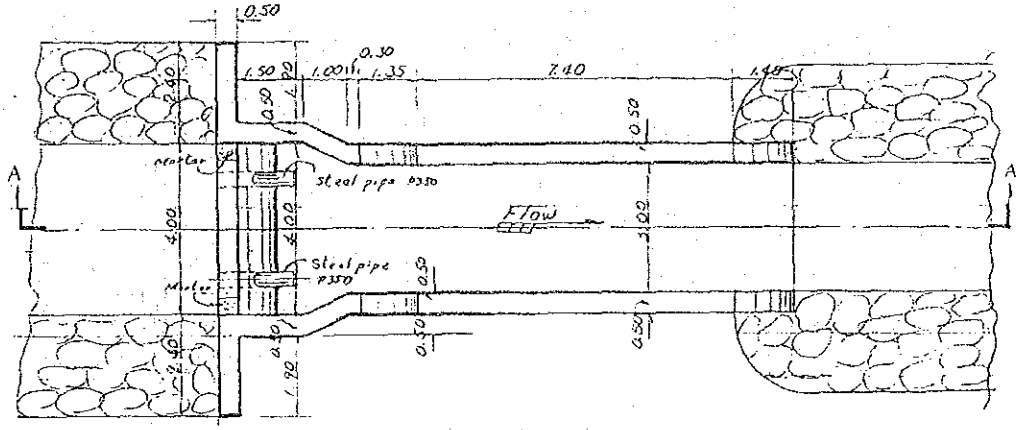
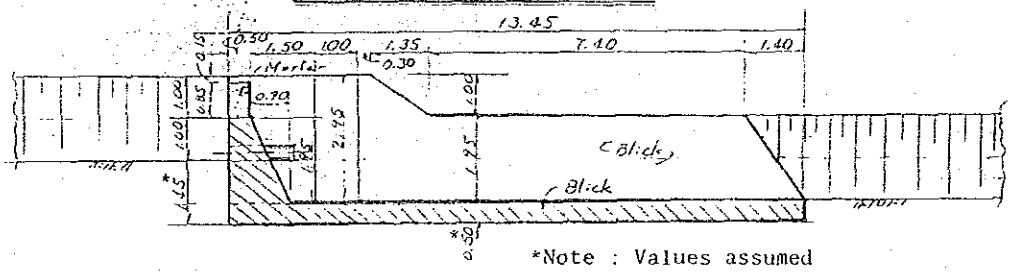


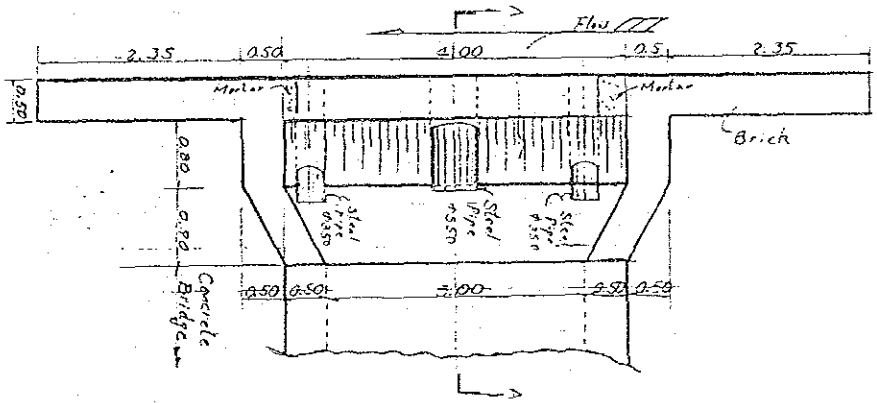
Fig. F4-4 EXISTING CANAL STRUCTURE (1)



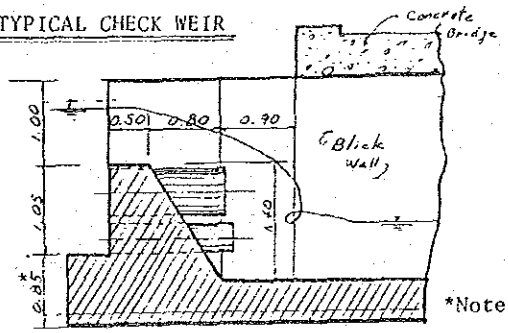
TYPICAL CHECK WEIR AND DROP



*Note : Values assumed

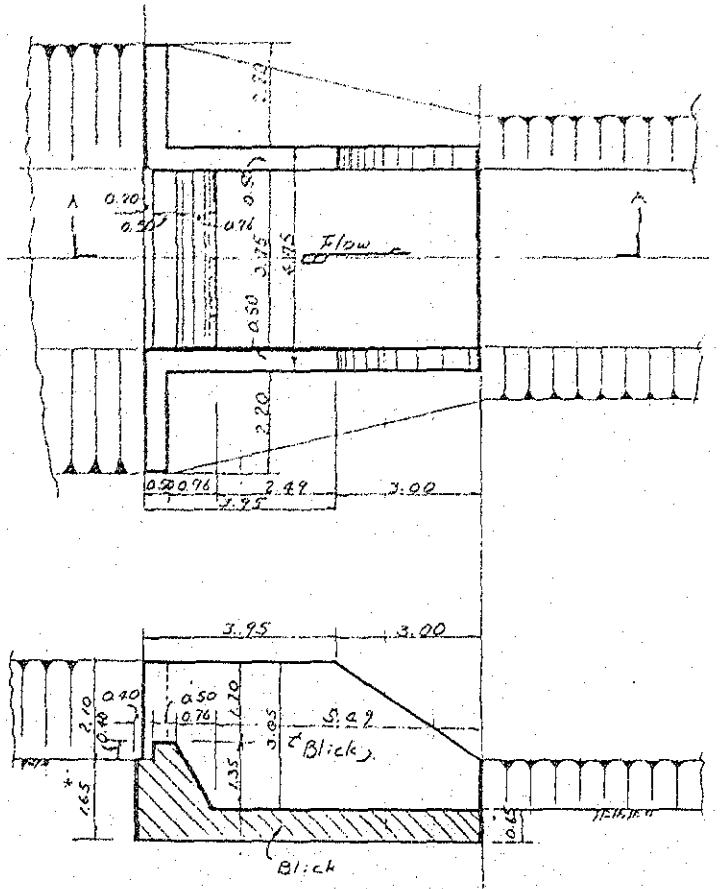


TYPICAL CHECK WEIR



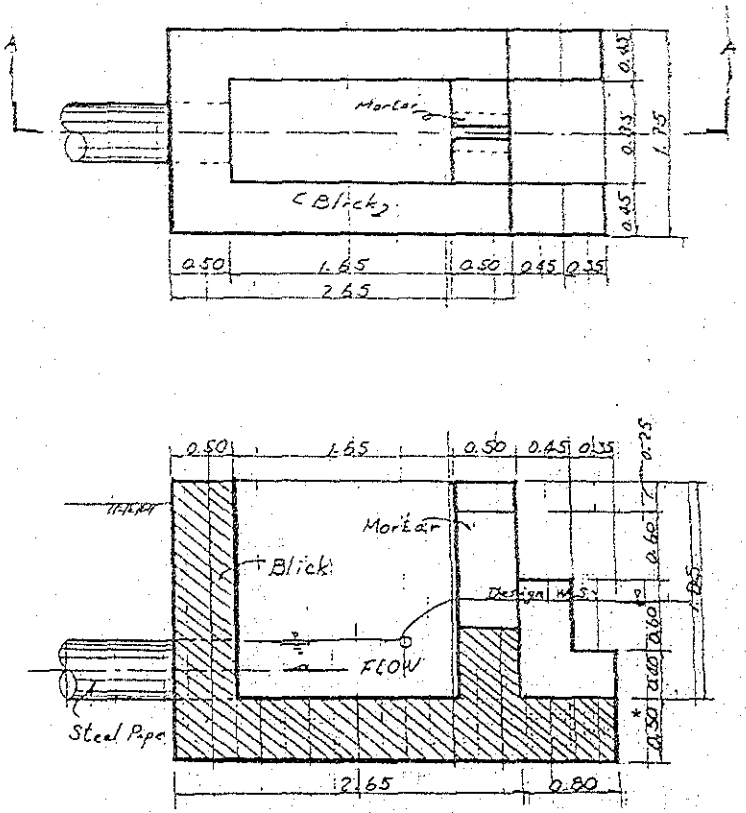
*Note : Values assumed

Fig. P4-5 EXISTING CANAL STRUCTURE (2)



TYPICAL DROP AT BAHR WAHBY

*Note : Values assumed



TYPICAL VENT

*Note : Values assumed

F-5. Drainage Plan in South Area of Lake Qarun

F-5.1. Present Drainage System

Drainage in this area is being made by gravity and supplementally by drainage pump. Water level of Lake Qarun is fluctuating in the range between (-)43.2 and (-)44.0 meters (below the mean sea level) while the ground level of the area close to the shore of Lake Qarun is about (-)43.0 meters. According to the difference of the elevation between the water level of Lake Qarun and the ground level of the area, drainage of the surface water can be made by the gravity method.

There exist a pumping station alongside the shore of Lake Qarun which operated by Land Reform Directorate, Fayoum, Ministry of Agriculture to drain leakage water through the existing dike into the drainage pond in the area. The said pumping station is handling on the drainage for the leakage water of the dike separating the drainage system in the area. Table F5-1 shows the monthly record of drainage pump operation recorded by the Land Reform Directorate, Fayoum. According to the said record, operation hour has no any correlation between water level of Lake Qarun and the total operation hour (coefficient of correlation r = 0.46) as shown in Fig. F5-1.

Taking into consideration the water level of Lake Qarun, ground level and groundwater table, the project area is bounded by the elevation of (-)38.0 meters and covered an area of about 6,770 feddan (2,830 ha) as shown in the general map and Table F5-3. The Project Area so-called the south area of Lake Qarun is divided into the two sub-areas which are a sub-area without dike at the shore of the Lake bounded by Batts Drain and Bats Said Drain and a sub-area with dike at the shore of the Lake located between Bats Said Drain and Khor el-Hitan Drain.

The former sub-area lies at the area higher than the elevation of about (-)44.0 meters and water of the lake inflow to the area. During the winter season and high water level of the Lake, the water may flow to more higher portion due to wind wave.

The later sub-area is prevented by the dike, however, there exist no effective drainage facility so as to owing to the gravity drainage. Drainage of ground surface water can be made by the gravity. However, the groundwater level is very high and it causes one of factors prevailing high salt contents in this area.

F-5.2. Drainage Plan

Drainage capacity in this area would be studied based on the drainage modulus as shown in Tables F5-4, F5-5 and F5-6. Fayoum depression has three major drainage system such as Batts Drain, Wadi El Rayan and direct drains. Discharge in Batts Drain and Wadi El Rayan was observed since 1974 as shown in Table F5-4 and monthly mean drain modulus was calculated as shown in Table F5-5. Discharge in the direct drain of 12 streams were not observed. Therefore, discharge in the Project area is estimated based on the above-mentioned monthly mean drain modulus as shown in Table F5-6.

Considering in the drainage discharge in Table F5-6, drainage facilities is planned as discussed in Appendix H-7.

Improvement of this area is dealt with lowering groundwater table as well as drainage of surface water for restoring agricultural land and agricultural productivity in the area. High groundwater table obstructs agricultural productivity and also leaching the salt contents from the top layer of farm land.

Suitable moisture contents of the root zone of crops is generally considered as the soil moisture factor PF of 1.5 - 2.0. To keep the soil moisture of the root zone at the said extent, the groundwater table should be kept by 0.3 to 0.5 meters lower than the depth of the root zone. It is desirable for successful growth of crops that the groundwater table is kept at more than 0.7 to 0.8 meters underneath and water level of the lateral drain and sub-lateral drain are kept at 1.5 meters and 1.0 meter, respectively below ground surface.

Table F5-1 Monthly Record of Drainage Pump Operation

Souce : Land Reform Directorate, Fayoum, Ministry of Agriculture
Pump Station : Senhour el Bahoria, Sennores
Capacity : Centrifugal Pump ø10 inches, 26 HP engine 5 units

Month	Operation Record in 1979					Operation Record in 1980					Operation Record in 1981					Operation Record in 1983/84				
	Operation Hour	No. of Unit Operated	Average Operation Hour	Fuel Consumption	Estimated Discharge	Operation Hour	No. of Unit Operated	Average Operation Hour	Fuel Consumption	Estimated Discharge	Operation Hour	No. of Unit Operated	Average Operation Hour	Fuel Consumption	Estimated Discharge	Operation Hour	No. of Unit Operated	Average Operation Hour	Fuel Consumption	Estimated Discharge
	(hr)	(Unit)	(hr/day)	(ℓ)	($\times 10^3 m^3$)	(hr)	(Unit)	(hr/day)	(ℓ)	($\times 10^3 m^3$)	(hr)	(Unit)	(hr/day)	(ℓ)	($\times 10^3 m^3$)	(hr)	(Unit)	(hr/day)	(ℓ)	($\times 10^3 m^3$)
Jan.	72.5	1	2.3	15	435	211	2	6.8	44	1,266	791.5	4	25.5	166	4,748	719 (in 1984)		8.6 (in 1984)		
Feb.	62.5	1	2.2	13	472	89	2	3.2	19	534	661	3	23.6	139	3,966					
Mar.	63.5	1	2.0	13	379	126	2	4.1	26	756	589	3	19.0	124	3,534	No operation due to lack of fund				
Apr.	56.5	1	1.9	12	337	211	2	7.0	44	1,266	504	3	16.8	106	3,024	250	2	3.3	53	
May.	60.5	1	2.0	13	362	57	1	1.8	12	342	221	2	7.1	46	1,326	398	2	7.1	84	
Jun.	69.5	1	2.3	15	417	201	2	6.7	42	1,206	207	2	6.9	43	1,240	517	3	6.4	109	
Jul.	28.0	1	0.9	6	167	194	2	6.3	41	1,164	504	3	16.3	106	3,024	111	2	3.1	23	
Aug.	72.5	1	2.3	15	435	201	2	6.5	42	1,206	567	3	18.3	119	2,405	213	2	3.9	45	
Sept.	56.5	1	1.9	12	337	126	2	4.2	26	756	384	3	12.8	81	2,306	190	2	4.5	40	
Oct.	28.0	1	0.9	6	167	211	2	6.8	44	1,266	337	3	10.9	71	2,024	No operation				
Nov.	70.0	1	2.3	15	420	57	1	1.9	12	342	225	2	7.5	47	1,350					
Dec.	72.5	1	2.3	15	435	89	2	2.9	19	534	221	2	7.1	46	1,326	604	3	6.9	127	
Total	721.5			150	4,363	1,773			371	10,638	5,211.5			1,094	30,273	2,283	3		481	

$[481 \times \frac{12 mos.}{7} = 825]$

Table F5-2 Daily Record of Drainage Pump Operation (in 1983 & 1984)

Pump Station : Sanhour el Bahoria, Sennores

Unit: hour/day

Day	1983																1984		
	April		May		June			July		August		September		December			January		
	①	②	①	②	①	②	③	①	②	①	③	①	③	①	②	③	①	②	③
1	-	-	-	-	12	12	-	-	-	6	6	-	8	8	5	7	9	9	9
2	5	5	3	5	12	12	-	2	-	6	6	-	-	-	-	-	9	8	8
3	5	4	5	-	12	12	4	-	2	6	6	-	8	8	5	7	9	8	8
4	4	4	5	-	12	12	-	-	-	6	6	-	8	6	5	7	9	8	8
5	4	5	5	4	12	12	8	2	2	-	-	-	8	6	5	7	9	8	8
6	4	5	-	-	12	12	8	-	-	6	6	-	8	6	-	7	9	8	8
7	5	6	5	5	8	8	8	2	-	6	6	-	8	6	5	7	9	8	8
8	-	6	8	5	8	8	8	-	-	6	6	-	8	6	5	-	9	8	8
9	6	-	5	-	8	8	8	-	2	6	6	-	-	-	-	-	9	8	8
10	6	6	5	5	-	-	-	-	-	6	6	-	6	6	5	-	9	8	8
11	5	5	5	5	5	5	5	-	-	5	4	-	6	6	5	-	9	8	8
12	5	5	5	5	5	5	5	-	-	-	-	-	6	6	5	-	9	8	8
13	5	5	-	-	5	5	5	-	-	5	5	-	6	6	-	-	-	-	-
14	5	5	8	8	5	5	7	-	-	-	5	-	6	10	5	-	9	8	8
15	-	-	9	9	5	5	7	-	-	-	5	-	6	15	15	15	9	8	8
16	5	5	8	8	7	7	7	4	4	-	4	-	-	10	15	15	9	8	8
17	5	5	8	8	-	-	-	4	4	-	4	-	-	15	15	15	9	8	8
18	5	5	8	8	7	7	7	4	4	-	4	-	-	14	14	14	8	8	8
19	5	5	8	8	7	7	7	4	-	-	-	-	-	14	14	14	8	8	8
20	5	5	8	8	7	7	7	3	3	-	3	-	-	8	8	6	-	-	-
21	5	5	8	8	7	5	7	3	4	-	3	-	8	8	8	6	8	8	8
22	-	-	8	8	7	5	7	-	-	-	4	5	8	8	8	6	8	8	8
23	5	5	8	8	7	5	5	-	-	-	5	-	-	6	6	-	8	8	8
24	5	5	8	8	-	-	-	4	4	-	5	5	8	6	6	6	8	8	8
25	5	5	8	8	6	6	-	4	4	-	4	5	8	6	6	-	8	8	8
26	5	5	8	8	6	6	-	4	4	-	8	5	8	6	6	6	10	10	10
27	5	5	8	8	6	6	-	4	4	-	-	5	8	7	7	-	-	-	-
28	5	5	10	10	5	6	-	4	4	-	8	5	8	7	7	6	10	10	10
29	-	-	10	10	5	6	-	-	-	-	8	5	8	7	7	6	10	10	10
30	5	5	10	10	-	-	-	4	4	-	8	-	-	7	7	-	10	10	10
31	-	-	12	12	-	-	-	5	5	-	8	-	-	8	8	8	10	10	10
Total	124	126	198	200	198	194	125	57	54	64	149	35	155	232	207	165	250	235	234
	250		398		517			111		213		190		604			719		

Table F5-3 IMPROVEMENT OF ARABLE LAND IN SOUTH AREA OF LAKE QARUN

Unit : feddan (hectare)

Sub-area	Gross Area Below El-38.00	Present			Future Improvement		
		Submerged Below-43.	Direst Below-40.	Indirect Below-38.	Submerged Area	Improvement Class A	Improvement Class B
Abd el-Rahman & Abu Harawa	2,120	330	1,590	200	60	1,860	200
Sub-area	(880)	(140)	(660)	(80)	(25)	(775)	(80)
Bats Said Sub-area	2,890	100	1,590	1,200	60	1,630	1,200
	(1,210)	(40)	(670)	(500)	(25)	(685)	(500)
Abu Tarfaya & Khor el-Hitan	1,760	50	1,140	570	50	1,140	570
Sub-area	(740)	(20)	(480)	(240)	(20)	(480)	(240)
Total	6,770	480	4,320	1,970	170	4,630	1,970
	(2,830)	(200)	(1,810)	(820)	(70)	(1,940)	(820)

Table F5-4 Total Drain Discharge to Lake Qarun and Wadi El Rayan

Unit : MCM

		1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	Mean
January	Q	7.1	13.5	22.6	9.3	9.8	13.1	12.2	25.1	14.4	13.3	
	W	13.6	1.1	0.6	15.8	3.4	5.4	6.2	4.1	7.4	11.2	
	T	20.7	14.6	23.2	25.1	13.2	18.5	18.4	29.2	21.8	24.5	20.9
February	Q	8.9	22.5	26.1	12.8	13.5	18.0	16.8	23.8	16.0	4.7	
	W	1.1	1.7	4.1	1.4	5.6	14.3	5.8	12.9	6.6	12.7	
	T	10.0	24.2	30.2	14.2	19.1	32.3	22.6	36.7	22.6	17.4	22.9
March	Q	26.6	28.6	26.0	20.3	21.4	28.6	26.7	37.6	31.3	27.2	
	W	15.8	12.4	14.6	7.0	15.8	15.8	15.8	22.0	11.2	23.1	
	T	42.4	41.0	40.6	27.3	37.2	44.4	42.5	59.6	42.5	50.3	42.8
April	Q	19.0	18.7	18.6	16.8	17.7	23.7	22.1	30.3	28.2	25.9	
	W	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.0	10.8	22.6	
	T	34.3	34.0	33.9	32.1	33.0	39.0	37.4	45.3	39.0	48.5	37.7
May	Q	20.4	24.0	23.8	17.6	18.6	24.8	23.2	30.2	26.5	29.2	
	W	15.8	15.8	15.8	15.8	15.8	15.8	15.8	20.6	18.4	23.2	
	T	36.2	39.8	39.6	33.4	34.4	40.6	39.0	50.8	44.9	52.4	41.1
June	Q	19.8	18.6	18.4	14.9	15.7	21.0	19.5	26.4	22.5	27.0	
	W	15.3	15.3	10.5	12.0	15.5	15.3	15.3	13.2	22.0	22.2	
	T	35.1	33.9	28.9	26.9	31.0	36.3	34.8	39.6	44.5	49.2	36.0
July	Q	18.8	15.5	22.0	15.7	16.6	22.2	20.7	24.7	20.6	27.1	
	W	15.8	15.8	2.5	12.4	10.9	15.8	23.3	9.6	24.0	23.2	
	T	34.6	31.3	24.5	28.1	27.5	38.0	44.0	34.3	44.6	50.3	35.7
August	Q	20.4	20.8	20.7	16.3	17.2	22.9	21.4	27.3	19.7	23.5	
	W	15.8	15.8	15.8	12.4	15.6	15.8	23.3	9.6	23.0	23.3	
	T	36.2	36.6	36.5	28.7	30.8	38.7	34.7	36.9	42.7	46.8	36.9
September	Q	32.6	22.7	22.5	18.3	19.3	25.8	24.0	27.9	18.7	20.2	
	W	15.3	15.3	15.3	15.3	15.3	15.3	22.5	9.3	22.0	22.6	
	T	47.9	38.0	37.8	33.6	34.6	41.1	46.5	37.2	40.7	42.8	40.0
October	Q	31.8	25.5	25.4	20.1	21.2	28.3	26.4	30.9	26.4	25.9	
	W	15.8	15.8	15.8	15.8	15.8	15.8	23.3	12.5	22.0	23.2	
	T	47.6	41.3	41.2	35.9	37.0	44.1	49.7	43.4	48.4	49.1	43.8
November	Q	34.6	26.6	26.5	21.3	22.5	30.0	28.0	30.1	29.1	30.0	
	W	15.3	15.3	15.3	15.3	15.3	15.3	4.2	9.3	22.3	22.4	
	T	49.9	41.9	41.8	36.6	37.8	45.3	32.2	39.4	51.4	52.4	42.9
Desember	Q	43.9	33.6	44.9	28.5	30.0	40.1	37.5	41.4	39.3	34.3	
	W	15.8	15.8	15.8	15.8	15.8	15.8	23.3	9.6	23.0	23.5	
	T	59.7	49.4	60.7	44.3	45.8	55.9	60.8	51.0	62.3	57.8	54.8

455.6

Table F5-5 Monthly Mean Drain Modulus

1. Drainage Area in Fayoum Depression

Batts Drain	637.75 sq.km
Wadi Drain	735.00
Direct Drains (12 Drains)	161.61
Total	1,534.36

2. Calculation of Monthly Mean Drain Modulus

Month	Mean Drain* Discharge (MCM)	Discharge (cu.m/sec/100sq.km)
Jan.	20.9	0.51
Feb.	22.9	0.62
Mar.	42.8	1.04
Apr.	37.7	0.95
May.	41.1	1.00
Jun.	36.0	0.91
Jul.	35.7	0.87
Aug.	36.9	0.90
Sept.	40.0	1.01
Oct.	43.8	1.07
Nov.	42.9	1.08
Dec.	54.0	1.33
Annual Mean		0.94

Note * : Number is gat from Table F5-4.

Table F5-6 Discharge of Drainage in South Area of Lake Qarun

unit : m^3/min

Month	Modulus	Abu el-Rahman	Abu Harawa	Bats Said	Abu Tarfaya	Khor el-Hitan
Total Drainage Area		10.50 km^2		33.60 km^2	6.72 km^2	5.88 km^2
Drainage Area in the Project Area		0.90 km^2	2.70 km^2	5.10 km^2	3.00 km^2	1.60 km^2
	$m^3/s/100km^2$	m^3/min	m^3/min	m^3/min	m^3/min	m^3/min
Jan.	0.51	0.275	0.826	1.561	0.918	0.490
Feb.	0.62	0.335	1.004	1.897	1.116	0.595
Mar.	1.04	0.562	1.685	3.182	1.872	0.998
Apr.	0.95	0.513	1.539	2.907	1.710	0.912
May.	1.00	0.540	1.620	3.060	1.800	0.960
Jun.	0.91	0.491	1.474	2.785	1.638	0.874
Jul.	0.87	0.470	1.409	2.662	1.566	0.835
Aug.	0.90	0.486	1.458	2.754	1.620	0.864
Sept.	1.01	0.545	1.636	3.091	1.818	0.970
Oct.	1.07	0.578	1.733	3.274	1.926	1.027
Nov.	1.08	0.583	1.750	3.305	1.944	1.037
Dec.	1.33	0.718	2.155	4.070	2.394	1.277
Drainage Dischage based on Irrigation						
	3.31*	1.787	5.362	10.129	5.958	3.178
Discharge for Operation based on 12 hrs/day						
		3.574	10.724	20.258	11.916	6.536

Note * : Assuming irrigation efficiency of 60 % and irrigation water of 30 m^3/day/feddam, the drainage modulus per 100 sq.km is computed at 3.31 $m^3/sec/100km^2$.

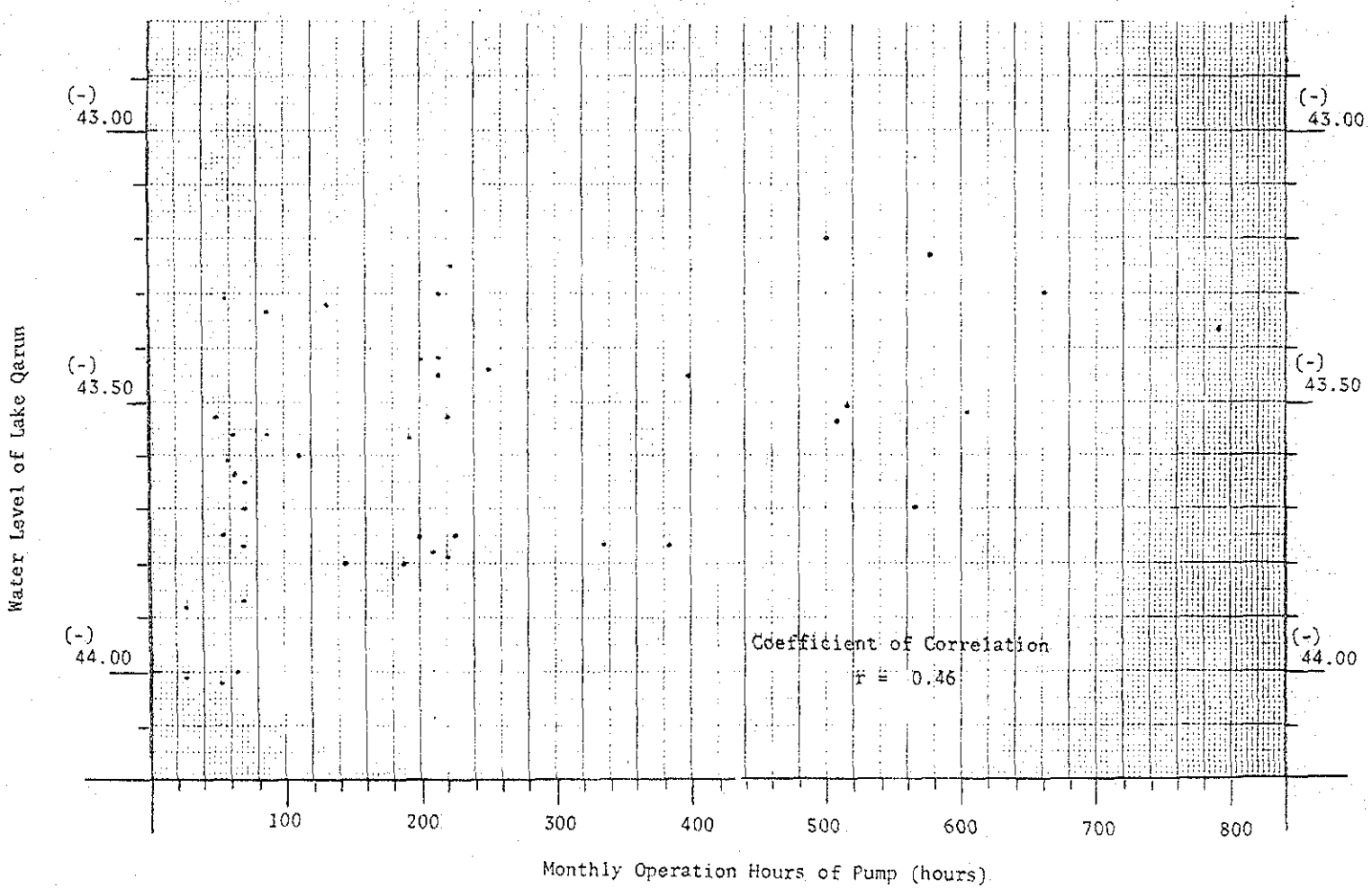
Table F5-7 Operation Hour of Drainage Pumps

Month	Abu el-Rahman V 1/ m³	Abu el-Rahman T 2/ hr	Abu Harama V m³	Abu Harama T hr	Bats Said V m³	Bats Said T hr	Abu Tarfaya V m³	Abu Tarfaya T hr	Khor el-Hitan V m³	Khor el-Hitan T hr
Jan.	20,500	95	61,500	190	116,200	285	68,300	190	36,500	95
Feb.	22,600	105	67,500	208	127,500	313	75,000	208	40,000	104
Mar.	41,900	194	125,400	387	112,800	276	139,300	387	73,300	191
Apr.	37,000	171	110,900	342	209,400	513	123,200	342	65,700	171
May.	40,200	186	120,600	372	227,700	558	134,000	372	71,500	186
Jun.	35,400	164	106,200	328	200,600	492	118,000	328	63,000	164
Jul.	35,000	162	104,900	324	198,100	486	116,500	324	62,200	162
Aug.	36,200	168	108,500	335	205,000	503	120,600	335	64,300	167
Sept.	39,300	182	117,800	364	222,600	546	130,900	364	69,900	182
Oct.	43,000	199	129,000	398	243,600	597	143,300	398	76,500	199
Nov.	42,000	194	126,000	389	238,000	583	140,000	389	74,700	195
Dec.	53,500	248	160,400	495	302,900	742	178,200	495	95,100	248
Total	436,600	2,068	1,338,700	4,132	2,404,400	5,894	1,487,300	4,132	792,700	2,064
Pump Facilities	$\phi 200 \times 9^{PS} \times 2^{set}$		$\phi 250 \times 18^{PS} \times 3^{set}$		$\phi 250 \times 18^{PS} \times 4^{set}$		$\phi 250 \times 18^{PS} \times 3^{set}$		$\phi 250 \times 18^{PS} \times 2^{set}$	
Capacity (m^3/min/unit)	3.6		5.4		6.8		6.0		6.4	

Note : 1/ V: Total volume of drainage water per month (m^3/month)

2/ T: Total operation hour of pumps (hours/month)

FIG. F5-1 CORRELATION BETWEEN WATER LEVEL AND MONTHLY OPERATION HOURS OF DRAINAGE PUMP



APPENDIX G.

AGRO-INDUSTRY AND RURAL DEVELOPMENT

Appendix G. AGRO-INDUSTRY AND RURAL DEVELOPMENT

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Appendix G. AGRO-INDUSTRY AND RURAL DEVELOPMENT

G-1. Processing of Agricultural Products

G-1.1. Availability of Materials

Since the Project Area enjoys favorable climate, soil and marketing conditions as well, the proposed crops for vegetables and fruits have been selected considering these favorable conditions and ones which will give high benefits were chosen. Therefore, crops which are meant only for processing were not selected. In studying the possibility of processing production from the Project Area only those crops which might be in surplus were considered.

Crops which were studied are tomato, groundnuts, olive, citrus, mango, and guava. The annual production of these crops by the Project and the item into which they can be processed is shown in Table G1-1.

Table G1-1. Crop Production and Processing

Crops		Total Production (ton/year)	Harvesting Season	Processing
Vegetable	Tomato	11,505	Dec. - Mar.	Puree, Paste
	Groundnuts	1,227	Aug.	-
Fruit	Olive	4,340	Aug. - Oct.	Juice
	Citrus	3,736	Nov. - Jan.	Juice
	Mango	1,860	Aug.	Juice
	Guava	1,099	Sept. - Oct.	Juice

Tomatoes will be cultivated in winter since they can be marketed at a high price in Cairo as fresh produce. Also, a portion can be exported. Therefore, the amount of tomato product which may be applied for processing is limited, however, for the farmers to receive a stable income it is possible to commit a certain portion for processing.

Groundnuts in Egypt are marketed as edible nuts after shelling and roasting. This processing is carried out by the farmers themselves or wholesalers, therefore, this crop is not considered for study.

Olives can be processed into pickles or oil. However, from the viewpoint of demand in Egypt practically all of the production will be processed into pickles. Processing of olives into pickles is quite a sample process involving removal of astringency by application of caustic soda and then pickling them in salt. This process is carried out by wholesalers, therefore, this crop is not considered for study.

Fruits such as citrus, mango and guava can be processed into juice. Since there is a shortage in the production of these fruits and there is sufficient reason to believe demand for them will continue to increase it is considered that at this point it is more profitable for the farmers to market them as fresh produce than as products for processing. As a result of the above considerations the processing of tomatoes will be studied.

G-1.2. Tomato Processing

(1) Introduction

Establishment of tomato processing factory on agro-industrial development by the Project is necessary to protect tomato growers who will be suffered from overproduction in future. Color, fungal spore count, bacterial count, amount of insect fragments and other impurities, sugar/acid ratio and flavor of tomatoes should be considered for paste processing.

A high quality tomato paste to be acceptable in an international market can only be produced from quality tomatoes. The suitable varieties of high quality tomato should be selected for

growing in the Project Area. It is most desirable, therefore, that the tomato producers who took a contract with the factory, will be put under a careful control of the factory through their co-operatives.

Good quality and enough quantity of potable water which is indispensable for washing fresh tomatoes as well as for the operating an evaporator-condenser and an can cooling should be supplied to the factory. Fuel and electric power should also be continuously supplied to the factory, since power failure and/or shortage of fuel would cause plant shut-downs and deterioration or loss of fresh tomatoes. High quality tin cans and corrugated paper boxes are essential for export of the products.

In Egypt, vegetable and fruit processing industry is almost monopolized by KAHA and EDFINA companies which have some 10 factories in total. The vegetable and fruit processing factories except the sugarbeet plant are run by the government companies in the public sector.

As regards the international phases, number of the tomato processing enterprises in Italy were 341 in 1979. These factories produced 360,000 tons of tomato paste in 1979.

Fresh tomato was produced at 5.13 million tons of which the destination to processing, domestic and export was 3.73, 4.85 and 0.017 million tons, respectively. This tomato processing industry has been developed through the lowest price system for row tomato and subsidize by EC. Hence, if this subsidize for low prices is stopped, the tomato processing enterprises will loss the international competition.

It is reported that a number of tomato producer in the Florida in USA is at 40 percent lower than that in Italy. ISTAT (Istituo Nazionale di Statistica) reported that the price of tomato paste is at 0.47 US$ or 0.39 LE (570.6 Lira) per kilogram in 1980.

(2) Processing Capacity

1) North Wahby and Com Osheem Areas

Tomatoes as processing material would be supplied during a period of a three-months from January to March based on the proposed cropping pattern. Production and destination of tomato at the full development stage are assumed as follows.

- Destination of Tomato in the North Wahby and Com Osheem Areas in 1998 -

(Unit: tons)

	Dec.	Jan.	Feb.	Mar.	Total	
Production (ton)	2,301	3,452	3,451	2,301	11,505	
	(20%)	(30%)	(30%)	(20%)	(100%)	
Domestic	20%	-	-	-	20%	2,301
Export	-	10%	10%	-	20%	2,301
Processing	-	20%	20%	20%	60%	6,903

Daily processing capacity in the maximum processing period is estimated at 2,301 tons/25 days = 92 tons.

Processing volume per hour is calculated at 6.1 tons as follows.

* Operating hours ..... one shift 5 hours (8:00 to 14:00), three shift 15 hours
* Processing volume per hour ... 92 tons/15 hours = 6.1 tons/hours

2) Wahby Downstream Project Area and South Area of Lake Qarun

At present production of tomato in Wahby Downstream Area and South Area of Lake Qarun amounted at 10,326 tons and 693 tons, respectively.

Production in 1994 would be projected at 15,600 tons and 1,053 tons, respectively. Monthly production would be estimated as follows;

- Projected Tomato Production in 1994 -

(Unit: tons)

	Dec.	Jan.	Feb.	Mar.	Total
a. Wahby Downstream Area	3,120	4,680	4,680	3,120	15,600
b. South Area of Lake Qarun	210	317	316	210	1,053

Since tomato paste factory would process only the high quality fresh tomatoes, the available quantities for raw materials would be limited. In consideration with this limiting factor, fresh tomato equivalent to incremental quantities projected in full development stage would the considered as target for material supply.

The following table shows the factory capacity to meet the incremental volume.

- Tons of Fresh Tomato for Processing -

	30% of Total Production	40% of Total Production
a. Wahby Downstream Area: per year	4,680	6,240
per day in Feb. (25 days/Month)	56	75
per hour (15 hours/day)	3.7	5.0
b. South Area of Lake Qarun: per year	315	420
per day in Feb. (25 days/Month)	3.8	5.1
per hour (15 hours/day)	0.3	0.3

Note: Incremental volume a: 15,600 - 10,326 = 5,274 tons
b: 1,053 - 693 = 360 tons

3) Fayoum Governorate Excluding Wahby Downstream Project Area and South Area of Lake Qarun

Average production of tomato in 1981 to 1982 amounts to about 432,500 tons excluding about 11,019 tons in Wahby Downstream Project Area and South Area of Lake Qarun. The projection in future would be conservatively estimated in order to avoid risk with surplus supply of raw tomato. Hence, supplying quantities of material are estimated on a part of incremental production projected in future.

Available tomato would be estimated using annual growth rate of four percent as follows.

$432,500 \text{ tons} \times 1.04^{16} = 810,000 \text{ tons}$

$810,000 \text{ tons} - 432,500 \text{ tons} = 377,500 \text{ tons}$

Ratio of supply: 5% ... $377,500 \times 0.05 = 18,800$ tons
10% ... 37,700 tons
20% ... 75,500 tons

These tomato shall be supplied through three season.

- Material Supply by Season -

	Summer Season (2%)	Nili Season (43%)	Winter Season (55%)	Total (100%)
5%	380	8,080	10,340	18,800
10%	750	16,200	20,750	37,700
20%	1,500	32,460	41,540	75,500

Monthly quantities are estimated at Table G1-2.

4) Integrated Material Source

Internal tomatoes would be available in the Project Area and overall area of Fayoum Governorate. When the material is collected from the whole area of Fayoum Governorate, the

factory capacity should be enlarged. However, there are many unknown-factors on supply of material tomatoes. Then factory capacity would be studied conservatively.

As the first process, maximum daily capacity of processing in North Wahby and Com Osheem Project Area is estimated as 92 tons. Processing volume per hour is estimated at 6.1 tons by using 15 hours operation per day. The 92 tons per day is smaller than unit capacity with 150 tons line per day.

Considering this unit capacity, as the second process, material source has to be extended to the Wahby Downstream Area, South Area of Lake Qarun and other area in Fayoum Governorate.

Table G1-3 shows the alternative case on factory capacity. As regards Case H and Case I, the raw material's volume collected from Fayoum Governorate reach to about four times and six times respectively in comparison with maximum available volume of 13,560 tons in the three Project Area.

It can not be said that Case H and Case I represent the agro-industrial development for the Project Area. These must be treated as an isolated study in Fayoum Governorate.

Hence, Case A, Case E, Case F and Case G would be studied as representative of factory capacity with 10 tons and 20 tons per hour.

(3) Factory Location

The factory is proposed to locate at Center of Unit site decided by the land use plan.

(4) Processing Equipment

The factory would accommodate the modernized, medium size, automatic processing equipment; a flow sheet for a single line is shown in Fig.G1-1. The following three sections may describe the proposed operations and plant:

- Juice Preparation Line
- Juice Concentration and Paste Sterilization
- Filling, Seaming and Cooling Filled Cans

(5) Capital Cost

In estimating the processing equipment costs, the standard equipment is taken into consideration and priced at CIF Alexandria port. Capital costs of plant items for 150 tons per day or ten tons per hour and 300 tons per day or 20 tons per hour are roughly estimated at LE 806,000 and LE 1,048,000 per one line, respectively.

Material supply by years is projected in accordance with the production plan in the Project. As shown in Table G1-4, material supply reach to about 70 percent in 1994 and 90 percent in 1995. Then, in this study, the construction period would be schemed for 1991 to 1993.

Capital cost of tomato factory consist of main plant, building, laboratory, equipment and installation. The following table shows total capital cost for tomato factory estimated roughly.

- Total Capital Cost for Tomato Factory -

(Unit: 1,000 LE)

	10t/hour	20t/hour
Main Plant	806.0	1,048.0
Office equipment and furniture	15.0	15.0
Laboratory equipment and furniture	31.0	31.0
Installation costs and spare parts	154.0	200.0
Processing buildings	500.0	700.0
Warehouse	200.0	400.0
Laboratory and office	46.0	46.0
Architect fees and supervision	60.0	92.0
Staff housing	220.0	374.0
Staff vehicles	41.0	41.0
Total	2,073.0	2,947.0

Note: Physical contingency is not included.

(6) Material Supplies

The proposed plant would process only the high quality fresh tomatoes and the production of tomato paste for export would take place by stage as the experience of tomato growers groups in sorting and delivery would be advancing year after year. Thus, the plant would start processing according to the quantities shown as follows:

- Processing Materials of Fresh Tomato -

(Unit: tons)

	1994	1995	1996	1997	1998
Case A	3,450	5,730	6,420	6,900	6,900
Case E	8,445	10,725	11,415	11,895	11,895
Case F	10,110	12,390	13,080	13,560	13,560
Case G	26,110	28,990	30,380	31,560	32,360

(7) Gross Income

The tomato growers and the plant would be put in awkward position as regards determination of the purchasing price would apparently be beneficial for the growers, low purchasing price should be more favorable for the factory. Hence, three cases of (X), (Y) and (Z) have been compared by fixing the unit purchasing price per ton of fresh tomato at LE 60, LE 80 and LE 100, respectively.

Yielding recovery rate of tomato processing from fresh tomato is estimated at 12.7 percent and price of tomato paste per ton is LE 1,200.

(8) Production Cost (Operating Cost)

Production cost items are as follows.

1. Raw tomato
2. Other material and supplies: Can, fuel oil, carton and electricity
3. Overhead cost : Salaries, wages, maintenance of equipment, insurance, building repair.

Working capital is added at 20 percent of O & M cost for 1994 to 1996.

(9) Gross Cash Flow (Income)

Gross cash flow (income) at financial price is estimated deducting production cost from gross income.

Gross cash flow in 1998 by alternative is shown as the following table.

- Gross Cash Flow (Income) in 1998 -

(Unit: LE)

		Case A	Case E	Case F	Case G
Gross Income		1,056	1,812	2,064	4,812
Production Cost					
LE 60/ton of raw tomato	(X)	822.6	1,297.8	1,456.1	3,266.4
LE 80/ton "	(Y)	960.6	1,535.8	1,727.1	3,897.4
LE 100/ton "	(Z)	1,098.6	1,773.8	1,998.1	4,528.4
Gross Cash Flow					
	(X)	233.4	514.2	607.9	1,545.6
	(Y)	95.4	276.2	336.9	914.6
	(Z)	-42.6	38.2	65.9	283.6

(10) Economic Internal Rate of Return

EIRR by alternative is estimated as follows.

- EIRR -

(Unit: Percent)

Item	Case A	Case E	Case F	Case G
LE 60/ton of raw tomato (X)	-	9.31	12.79	28.62
LE 80/ton " (Y)	-	-	-	14.21
LE 100/ton " (Z)	-	-	-	-
Quantity of material (tons)	6,900	11,895	13,560	32,360

Material sources

Case A : North Wahby and Com Osheem areas
E : Whole Project Area
F : - do -
G : Whole Fayoum Governorate Area

Note: Marks of (-) means the negative EIRR. Case A was estimated using capital cost, that is, 2,073 LE x 10^3 for 10 tons per hour, and alternative capital cost of 75 percent of aforesaid 2,073 LE x 10^3 taking into consideration the capital cost for 40 tons per day.

(11) Conclusion

- Main resource of material was studied based on the incremental production planned in the three Projects, North Wahby & Com Osheem, Wahby Downstream and South Area of Lake Qarun. Amount of material collected from other area in Fayoum Governorate was conservatively estimated. Alternatives depending on a large volume supplied in Governorate area excluding the Projets would be considered as an isolated project.

- Tomato paste industry project (Case A) depending on the material supplied from the North Wahby & Com Osheem Area only is not economically.

- Economic Internal Rate of Return on tomato paste industry project (Case E & Case F) in Case of extending the area from new reclamation area to Wahby Downstream area and South Area of Lake Qarun is estimated at 9.3 percent to 12.8 percent based on LE 60 per ton of raw tomato. In this case the project is not feasible.

- Tomato paste industry project in case of including the whole area of Fayoum Governorate excluding three Projects mentioned before would obtain a larger output than those in three Projects. Therefore, EIRR is estimated at 28.6 percent by using LE 60 per ton of raw material and 14.2 percent with LE 80 per ton.

- Unit price of tomato paste is used at LE 1.2 per kilogram. This price is three times higher than that in Italy. The products may be internationally un-competitive. Thus, it is considered that the successful management of tomato paste factory will be possible through subsidize by the Government.

Table G1-2. Material Supply in Fayoum Governorate

(Unit : tons)

	5%				10%				20%			
Month	S	N	W	To.	S	N	W	To.	S	N	W	To.
Jan.	-	-	3,102	3,102	-	-	6,225	6,225	-	-	12,462	12,462
Feb.	-	-	4,136	4,136	-	-	8,300	8,300	-	-	16,616	16,616
Mar.	-	-	3,102	3,102	-	-	6,225	6,225	-	-	12,462	12,462
Apr.	114	-	-	114	225	-	-	225	450	-	-	450
May	152	-	-	152	300	-	-	300	600	-	-	600
Jun.	114	-	-	114	225	-	-	225	450	-	-	450
Jul.	-	-	-	-	-	-	-	-	-	-	-	-
Aug.	-	2,424	-	2,424	-	4,860	-	4,860	-	9,738	-	9,738
Sept.	-	3,232	-	3,232	-	6,480	-	6,480	-	12,984	-	12,984
Oct.	-	2,424	-	2,424	-	4,860	-	4,860	-	9,738	-	9,738
Nov.	-	-	-	-	-	-	-	-	-	-	-	-
Dec.	-	-	-	-	-	-	-	-	-	-	-	-
Total	380	8,080	10,340	18,800	750	16,200	20,750	37,700	1,500	32,460	41,540	75,500

Note: S.... Summer Crops N.... Nili Crops W.... Winter Crops To..... Total

Table G1-3. Alternative of Factory Capacity

(Unit:tons)

	Annual Production	Capacity	
		Daily	Hourly
Case A	6,900	92	6.1
Case B			
B1 (30%)	4,680	56	3.7
B2 (40%)	6,240	75	5.0
Case C			
C1 (30%)	315	4	0.3
C2 (40%)	420	5	0.3
Case D			
D1 (5%)	18,800	165	11.0
D2 (10%)	37,700	332	22.1
D3 (20%)	75,500	665	44.3
Case E			
A+B1+C1	11,895	151.8	10.1
Case F			
A+B2+C2	13,560	172.1	11.4
Case G			
A+B2+C2+D1	32,360	337.1	22.4
Case H			
A+B2+C2+D2	51,260	504.1	33.5
Case I			
A+B2+C2+D3	89,060	837.1	55.7

Note : Case A .... North Wahby and Com Osheem areas

Case B .... Wahby Downstream Area

Case C .... South Area of Lake Qarun

Case D .... Whole Fayoum Area excluding Case B & C area

Table G1-4 Material Supply by Year

(Unit : tons)

Year	NC	Wahby Downstream 30%	Wahby Downstream 40%	South Area Lake Qarun 30%	South Area Lake Qarun 40%	Fayoum Area 5%
1991	-	440	580	30	40	14,200
1992	-	1,870	2,490	120	170	14,800
1993	1,380	3,380	4,510	230	300	15,400
1994	3,450	4,680	6,240	315	420	16,000
1995	5,730	4,680	6,240	315	420	16,600
1996	6,420	4,680	6,240	315	420	17,300
1997	6,900	4,680	6,240	315	420	18,000
1998	6,900	4,680	6,240	315	420	18,800

Note: NC.... North Wahby and Com Osheem areas

Table G1-5 Capital Cost of Plant Items

- 150 ton/day or 10 ton/hour Line -

(Unit: LE)

	Plant Items	Cost
1.	Juice Preparation Line	93,840
2.	Juice Concentration and Paste Sterilization	328,450
3.	Can Filling, Seaming and Cooling	140,760
4.	Other Equipment	204,600
5.	Total Price CIF Port of Alexandria	767,650
6.	5.0 percent internal costs	38,380
	Total	806,030
		(say 806,000)

Table G1-6 Index of Capital Cost of Tomato Paste Factory

Processing Capacity per Hour	No. of Line	Index
10 tons	1	100%
15 "	1	100"
20 "	1	130"
25 "	1	130"
30 "	1	150"
40 "	1	150"
50 "	1	200"

Note: Data of index was collected in Japan.

Table G1-7 Capital Cost of plant Items

- 300 ton/day or 20 ton/hour Line -

(Unit: LE)

Items	20 ton/hour Line Cost
1. Price CIF Port of Alexandria	767,650
2. 300 ton/day or 20 ton/hour Line 767,650 x 1.3	997,950
3. 5.0% internal cost	49,900
Total	1,047,850
	(say 1,048,000)

Note: The above items of 1 to 3 are based on the index of capital cost of tomato paste factory

Table G1-8. Project Economic Cost and Return
(Case A-X)

(UNIT : MILLION L.E.)

YEAR	PROJECT COST			INCREMENTAL BENEFITS (2)	PROJECT RETURN (3) =(2)-(1)	PRESENT WORTH VALUE (3)*DISCOUNT RATE	
	CAPITAL REPLACEMENT	O & M	TOTAL (1)			(-1 %)	(0 %)
1 1991	0.275	0.0	0.275	0.0	-0.275	0.0	-0.275
2 1992	1.613	0.0	1.613	0.0	-1.613	0.0	-1.613
3 1993	0.322	0.067	0.389	0.0	-0.389	0.0	-0.389
4 1994	0.096	0.479	0.575	0.528	-0.047	0.0	-0.047
5 1995	0.145	0.723	0.868	0.876	0.008	0.0	0.008
6 1996	0.153	0.764	0.917	0.984	0.067	0.0	0.067
7 1997	0.0	0.809	0.809	1.056	0.247	0.0	0.247
8 1998	0.0	0.809	0.809	1.056	0.247	0.0	0.247
9 1999	0.0	0.809	0.809	1.056	0.247	0.0	0.247
10 2000	0.275	0.809	1.084	1.056	-0.028	0.0	-0.028
11 2001	1.613	0.809	2.422	1.056	-1.366	0.0	-1.366
12 2002	0.322	0.809	1.131	1.056	-0.075	0.0	-0.075
13 2003	0.0	0.809	0.809	1.056	0.247	0.0	0.247
14 2004	0.0	0.809	0.809	1.056	0.247	0.0	0.247
15 2005	0.0	0.809	0.809	1.056	0.247	0.0	0.247
16 2006	0.0	0.809	0.809	1.056	0.247	0.0	0.247
17 2007	0.0	0.809	0.809	1.056	0.247	0.0	0.247
18 2008	0.0	0.809	0.809	1.056	0.247	0.0	0.247
19 2009	0.0	0.809	0.809	1.056	0.247	0.0	0.247
20 2010	0.275	0.809	1.084	1.056	-0.028	0.0	-0.028
21 2011	1.613	0.809	2.422	1.056	-1.366	0.0	-1.366
22 2012	0.322	0.809	1.131	1.056	-0.075	0.0	-0.075
23 2013	0.0	0.809	0.809	1.056	0.247	0.0	0.247
24 2014	0.0	0.809	0.809	1.056	0.247	0.0	0.247
25 2015	0.362	0.809	1.171	1.056	-0.115	0.0	-0.115
TOTAL	7.386	17.404	24.790	22.452	-2.338	0.0	-2.338

I R R = -1 ..... -1 + 0.0 / (0.0 + 2.34) = -1.00

Table G1-9. Project Economic Cost and Return
(Case E-X)

(UNIT : MILLION L.E.)

YEAR	PROJECT COST			INCREMENTAL BENEFITS	PROJECT RETURN	PRESENT WORTH VALUE	
	CAPITAL REPLACEMENT	O & M	TOTAL (1)	(2)	(3) =(2)-(1)	(3)*DISCOUNT RATE (9 %)	(10 %)
1 1991	0.275	0.0	0.275	0.0	-0.275	-0.252	-0.250
2 1992	1.613	0.0	1.613	0.0	-1.613	-1.358	-1.333
3 1993	0.322	0.067	0.389	0.0	-0.389	-0.300	-0.292
4 1994	0.190	0.951	1.141	1.284	0.143	0.101	0.098
5 1995	0.239	1.195	1.434	1.632	0.198	0.129	0.123
6 1996	0.247	1.235	1.482	1.740	0.258	0.154	0.146
7 1997	0.0	1.281	1.281	1.812	0.531	0.290	0.272
8 1998	0.0	1.281	1.281	1.812	0.531	0.266	0.248
9 1999	0.0	1.281	1.281	1.812	0.531	0.244	0.225
10 2000	0.275	1.281	1.556	1.812	0.256	0.108	0.099
11 2001	1.613	1.281	2.894	1.812	-1.082	-0.419	-0.379
12 2002	0.322	1.281	1.603	1.812	0.209	0.074	0.067
13 2003	0.0	1.281	1.281	1.812	0.531	0.173	0.154
14 2004	0.0	1.281	1.281	1.812	0.531	0.159	0.140
15 2005	0.0	1.281	1.281	1.812	0.531	0.146	0.127
16 2006	0.0	1.281	1.281	1.812	0.531	0.134	0.116
17 2007	0.0	1.281	1.281	1.812	0.531	0.123	0.105
18 2008	0.0	1.281	1.281	1.812	0.531	0.113	0.096
19 2009	0.0	1.281	1.281	1.812	0.531	0.103	0.087
20 2010	0.275	1.281	1.556	1.812	0.256	0.046	0.038
21 2011	1.613	1.281	2.894	1.812	-1.082	-0.177	-0.146
22 2012	0.322	1.281	1.603	1.812	0.209	0.031	0.026
23 2013	0.0	1.281	1.281	1.812	0.531	0.073	0.059
24 2014	0.0	1.281	1.281	1.812	0.531	0.067	0.054
25 2015	0.362	1.281	1.643	1.812	0.169	0.020	0.016
TOTAL	7.668	27.787	35.455	39.084	3.629	0.048	-0.108

I R R = 9 ..... 9 + 0.05 / (0.05 + 0.11) = 9.31

Table G1-10. Project Economic Cost and Return
(Case F-X)

(UNIT : MILLION L.E.)

YEAR	PROJECT COST			INCREMENTAL BENEFITS	PROJECT RETURN	PRESENT WORTH VALUE (3)*DISCOUNT RATE	
	CAPITAL REPLACEMENT	O & M	TOTAL (1)	(2)	(3) =(2)-(1)	(12 %)	(13 %)
1 1991	0.275	0.0	0.275	0.0	-0.275	-0.246	-0.243
2 1992	1.613	0.0	1.613	0.0	-1.613	-1.286	-1.263
3 1993	0.322	0.067	0.389	0.0	-0.389	-0.277	-0.270
4 1994	0.222	1.108	1.330	1.536	0.206	0.131	0.126
5 1995	0.270	1.351	1.621	1.884	0.263	0.149	0.143
6 1996	0.279	1.393	1.672	1.992	0.320	0.162	0.154
7 1997	0.0	1.438	1.438	2.064	0.626	0.283	0.266
8 1998	0.0	1.438	1.438	2.064	0.626	0.253	0.235
9 1999	0.0	1.438	1.438	2.064	0.626	0.226	0.208
10 2000	0.275	1.438	1.713	2.064	0.351	0.113	0.103
11 2001	1.613	1.438	3.051	2.064	-0.987	-0.284	-0.257
12 2002	0.322	1.438	1.760	2.064	0.304	0.078	0.070
13 2003	0.0	1.438	1.438	2.064	0.626	0.143	0.128
14 2004	0.0	1.438	1.438	2.064	0.626	0.128	0.113
15 2005	0.0	1.438	1.438	2.064	0.626	0.114	0.100
16 2006	0.0	1.438	1.438	2.064	0.626	0.102	0.089
17 2007	0.0	1.438	1.438	2.064	0.626	0.091	0.078
18 2008	0.0	1.438	1.438	2.064	0.626	0.081	0.069
19 2009	0.0	1.438	1.438	2.064	0.626	0.073	0.061
20 2010	0.275	1.438	1.713	2.064	0.351	0.036	0.030
21 2011	1.613	1.438	3.051	2.064	-0.987	-0.091	-0.076
22 2012	0.322	1.438	1.760	2.064	0.304	0.025	0.021
23 2013	0.0	1.438	1.438	2.064	0.626	0.046	0.038
24 2014	0.0	1.438	1.438	2.064	0.626	0.041	0.033
25 2015	0.362	1.438	1.800	2.064	0.264	0.016	0.012
TOTAL	7.763	31.241	39.004	44.628	5.624	0.109	-0.030

I R R = 13 ..... 12 + 0.11 / (0.11 + 0.03) = 12.79

Table G1-11. Project Economic Cost and Return
(Case G-X)

(UNIT : MILLION L.E.)

YEAR	PROJECT COST		TOTAL	INCREMENTAL BENEFITS	PROJECT RETURN	PRESENT WORTH VALUE	
	CAPITAL REPLACEMENT	O & M	(1)	(2)	(3) =(2)-(1)	(3)*DISCOUNT RATE (28 %)	(29 %)
1 1991	0.560	0.0	0.560	0.0	-0.560	-0.438	-0.434
2 1992	1.657	0.0	1.657	0.0	-1.657	-1.011	-0.996
3 1993	0.587	0.070	0.657	0.0	-0.657	-0.313	-0.306
4 1994	0.534	2.670	3.204	3.972	0.768	0.286	0.277
5 1995	0.595	2.974	3.569	4.416	0.847	0.247	0.237
6 1996	0.623	3.116	3.739	4.632	0.893	0.203	0.194
7 1997	0.0	3.218	3.218	4.812	1.594	0.283	0.268
8 1998	0.0	3.218	3.218	4.812	1.594	0.221	0.208
9 1999	0.0	3.218	3.218	4.812	1.594	0.173	0.161
10 2000	0.560	3.218	3.778	4.812	1.034	0.088	0.081
11 2001	1.657	3.218	4.875	4.812	-0.063	-0.004	-0.004
12 2002	0.587	3.218	3.805	4.812	1.007	0.052	0.047
13 2003	0.0	3.218	3.218	4.812	1.594	0.064	0.058
14 2004	0.0	3.218	3.218	4.812	1.594	0.050	0.045
15 2005	0.0	3.218	3.218	4.812	1.594	0.039	0.035
16 2006	0.0	3.218	3.218	4.812	1.594	0.031	0.027
17 2007	0.0	3.218	3.218	4.812	1.594	0.024	0.021
18 2008	0.0	3.218	3.218	4.812	1.594	0.019	0.016
19 2009	0.0	3.218	3.218	4.812	1.594	0.015	0.013
20 2010	0.560	3.218	3.778	4.812	1.034	0.007	0.006
21 2011	1.657	3.218	4.875	4.812	-0.063	-0.000	-0.000
22 2012	0.587	3.218	3.805	4.812	1.007	0.004	0.004
23 2013	0.0	3.218	3.218	4.812	1.594	0.005	0.005
24 2014	0.0	3.218	3.218	4.812	1.594	0.004	0.004
25 2015	0.570	3.218	3.788	4.812	1.024	0.002	0.002
TOTAL	10.734	69.972	80.706	104.448	23.742	0.052	-0.031

I R R = 29 ..... 28 + 0.05 / (0.05 + 0.03) = 28.62

Table G1-12. Project Economic Cost and Return
(Case G-Y)

(UNIT : MILLION L.E.)

YEAR	PROJECT COST			INCREMENTAL BENEFITS (2)	PROJECT RETURN (3) =(2)-(1)	PRESENT WORTH VALUE (3)*DISCOUNT RATE	
	CAPITAL REPLACEMENT	O & M	TOTAL (1)			(14 %)	(15 %)
1 1991	0.560	0.0	0.560	0.0	-0.560	-0.491	-0.487
2 1992	1.657	0.0	1.657	0.0	-1.657	-1.275	-1.253
3 1993	0.587	0.070	0.657	0.0	-0.657	-0.443	-0.432
4 1994	0.638	3.192	3.830	3.972	0.142	0.084	0.081
5 1995	0.711	3.554	4.265	4.416	0.151	0.078	0.075
6 1996	0.745	3.723	4.468	4.632	0.164	0.075	0.071
7 1997	0.0	3.849	3.849	4.812	0.963	0.385	0.362
8 1998	0.0	3.849	3.849	4.812	0.963	0.338	0.315
9 1999	0.0	3.849	3.849	4.812	0.963	0.296	0.274
10 2000	0.560	3.849	4.409	4.812	0.403	0.109	0.100
11 2001	1.657	3.849	5.506	4.812	-0.694	-0.164	-0.149
12 2002	0.587	3.849	4.436	4.812	0.376	0.078	0.070
13 2003	0.0	3.849	3.849	4.812	0.963	0.175	0.157
14 2004	0.0	3.849	3.849	4.812	0.963	0.154	0.136
15 2005	0.0	3.849	3.849	4.812	0.963	0.135	0.118
16 2006	0.0	3.849	3.849	4.812	0.963	0.118	0.103
17 2007	0.0	3.849	3.849	4.812	0.963	0.104	0.089
18 2008	0.0	3.849	3.849	4.812	0.963	0.091	0.078
19 2009	0.0	3.849	3.849	4.812	0.963	0.080	0.068
20 2010	0.560	3.849	4.409	4.812	0.403	0.029	0.025
21 2011	1.657	3.849	5.506	4.812	-0.694	-0.044	-0.037
22 2012	0.587	3.849	4.436	4.812	0.376	0.021	0.017
23 2013	0.0	3.849	3.849	4.812	0.963	0.047	0.039
24 2014	0.0	3.849	3.849	4.812	0.963	0.041	0.034
25 2015	0.570	3.849	4.419	4.812	0.393	0.015	0.012
TOTAL	11.076	83.670	94.746	104.448	9.702	0.036	-0.135

I R R = 14 ..... 14 + 0.04 / (0.04 + 0.14) = 14.21

Table G1-13 Tomato Paste Processing Plant - Gross Cash Flow at Financial Prices - Case A

(Unit: L.E. 1,000)

Project Year	1993	1994	1995	1996	1997	1998
Factory Year	3	4	5	6	7	8
Physical Output (000's tons)						
Tomato Paste @12.7% of fresh tonnage	-	0.44	0.73	0.82	0.88	0.88
Income (L.E. '000)						
Tomato Paste @ L.E. 1,200	-	528	876	984	1,056	1,056
Purchase of Tomatoes (000's tons)	-	3.45	5.75	6.42	6.9	6.9
Tomato Purchase (A)						
@ L.E. 60/ton (X)	-	207	344	385	414	414
@ L.E. 80/ton (Y)	-	276	458	514	552	552
@ L.E. 100/ton (Z)	-	345	573	642	690	690
Other Material and Supplies (B)						
- 5 kg (Gross) Cans (4.5 kg net) @ L.E. 0.70	-	68.4	113.6	127.6	136.9	136.9
- Fuel Oil @ L.E. 12/ton of Tomato Processed	-	41.4	68.8	77.0	82.8	82.8
- Cartons @ L.E. 22.5/ton Paste	-	9.9	16.4	18.5	19.8	19.8
- Electricity @ L.E. 0.6/ton of Tomato Processed	-	2.1	3.4	3.9	4.1	4.1
Sub-total	-	121.8	202.2	227.0	243.6	243.6
Overhead Costs (C)						
- Perm, Management, Labor & Clerical Salaries	64.3	91.7	116.9	89.4	89.4	89.4
- Temporary Labor	-	5.6	11.2	16.8	16.8	16.8
- Administration	2.7	5.5	5.5	5.5	5.5	5.5
- Maintenance of Equipment @ 4% of Capital Cost	-	41.8	41.8	41.8	41.8	41.8
- Insurance @ 0.3% of Value (Building & Equipment)	-	1.5	1.5	1.5	1.5	1.5
- Building Repairs @ 2% of Capital Cost	-	10.2	10.2	10.2	10.2	10.2
Sub-total	67.0	156.1	186.9	165.0	165.0	165.0
Total Cost (A) + (B) + (C) (X)	67.0	484.9	733.1	777.0	822.6	822.6
(Y)	67.0	553.9	847.1	906.0	960.6	960.6
(Z)	67.0	622.9	962.1	1,034.0	1,098.6	1,098.6
Gross Cash Flow (X)	-67.0	43.1	142.9	207.0	233.4	233.4
(Y)	-67.0	-25.9	28.9	78.0	95.4	95.4
(Z)	-67.0	-94.9	-86.1	-50.0	-42.6	-42.6

Table G1-14 Tomato Paste Processing Plant - Gross Cash Flow at Financial Prices - Case F

(Unit: L.E. 1,000)

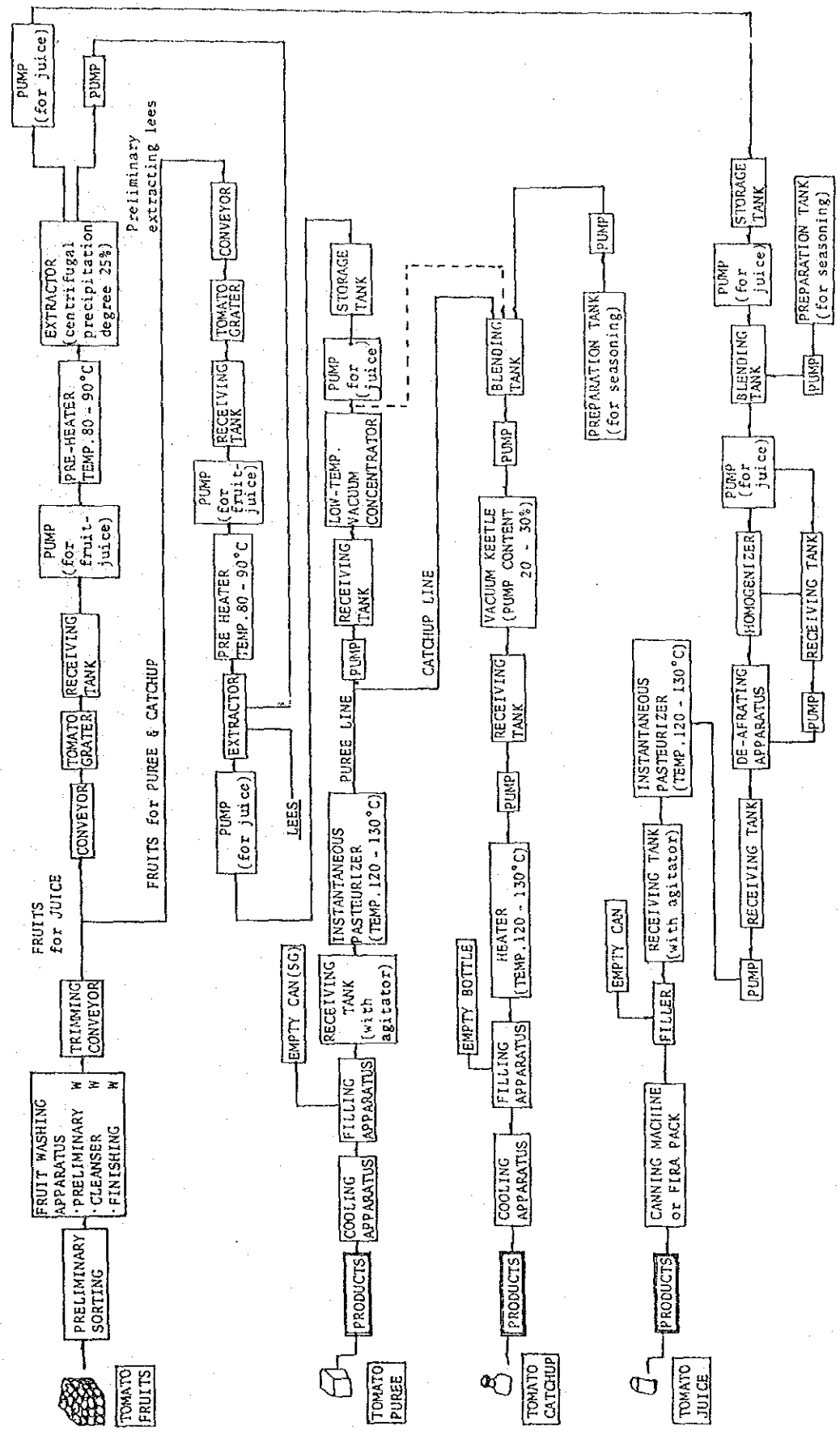
		1993	1994	1995	1996	1997	1998
Project Year							
Factory Year		3	4	5	6	7	8
Physical Output (000's tons)							
Tomato Paste @12.7% of fresh tonnage		-	1.28	1.57	1.66	1.72	1.72
Income (L.E. '000)							
Tomato Paste @ L.E. 1,200		-	1,536	1,884	1,992	2,064	2,064
Purchase of Tomatoes (000's tons)		-	10.11	12.39	13.08	13.56	13.56
Tomato Purchase (A)							
@ L.E. 60/ton (X)		-	607	745	785	814	814
@ L.E. 80/ton (Y)		-	809	991	1,046	1,085	1,085
@ L.E. 100/ton (Z)		-	1,011	1,239	1,308	1,356	1,356
Other Material and Supplies (B)							
- 5 kg (Gross) Cans (4.5 kg net) @ L.E. 0.70		-	199.1	244.2	258.2	267.6	267.6
- Fuel Oil @ L.E. 12/ton of Tomato Processed		-	121.3	148.7	157.0	162.7	162.7
- Cartons @ L.E. 22.5/ton Paste		-	28.8	35.3	37.4	38.7	38.7
- Electricity @ L.E. 0.6/ton of Tomato Processed		-	6.1	7.4	7.8	8.1	8.1
Sub-total		-	355.3	435.6	460.4	477.1	477.1
Overhead Costs (C)							
- Perm. Management, Labor & Clerical Salaries		64.3	91.7	116.9	89.4	89.4	89.4
- Temporary Labor		-	5.6	11.2	16.8	16.8	16.8
- Administration		2.7	5.3	5.3	5.3	5.3	5.3
- Maintenance of Equipment @4% of Capital Cost		-	41.8	41.8	41.8	41.8	41.8
- Insurance @0.5% of Value (Building & Equipment)		-	1.5	1.5	1.5	1.5	1.5
- Building Repairs @2% of Capital Cost		-	10.2	10.2	10.2	10.2	10.2
Sub-total		67.0	156.1	186.9	165.0	165.0	165.0
Total Cost (A) + (B) + (C)	(X)	67.0	1,118.4	1,565.5	1,410.4	1,456.1	1,456.1
	(Y)	67.0	1,320.4	1,613.5	1,671.4	1,727.1	1,727.1
	(Z)	67.0	1,522.4	1,861.5	1,933.4	1,998.1	1,998.1
Gross Cash Flow	(X)	-67.0	417.6	518.5	581.6	607.9	607.9
	(Y)	-67.0	215.6	270.5	320.6	336.9	336.9
	(Z)	-67.0	13.6	22.5	58.6	65.9	65.9

Table G1-15 Tomato Paste Processing Plant - Gross Cash Flow at Financial Prices - Case G

(Unit: L.E. 1,000)

Project Year		1993	1994	1995	1996	1997	1998
Factory Year		3	4	5	6	7	8
Physical Output (000's tons)							
Tomato Paste @ 12.7% of fresh tonnage		-	3.31	3.68	3.86	4.01	4.01
Income (L.E. '000)							
Tomato Paste @ L.E. 1,200		-	3,972	4,416	4,632	4,812	4,812
Purchase of Tomatoes (000's tons)		-	26.11	28.99	30.38	31.56	32.36
Tomato Purchase (A)							
@ L.E. 60/ton (X)		-	1,567	1,739	1,823	1,894	1,894
@ L.E. 80/ton (Y)		-	2,089	2,319	2,430	2,525	2,525
@ L.E. 100/ton (Z)		-	2,611	2,899	3,038	3,156	3,236
Other Material and Supplies (B)							
- 5 kg (Gross) Cans (4.5 kg net) @ L.E. 0.70		-	514.9	572.4	600.4	623.8	623.9
- Fuel Oil @ L.E. 12/ton of Tomato Processed		-	313.3	347.9	364.6	378.7	378.7
- Cartons @ L.E. 22.5/ton Paste		-	74.5	82.8	86.9	90.2	90.2
- Electricity @ L.E. 0.6/ton of Tomato Processed		-	15.7	17.4	18.2	18.9	18.9
Sub-total		-	918.4	1,020.5	1,070.1	1,111.6	1,111.6
Overhead Costs (C)							
- Perm, Management, Labor & Clerical Salaries		65.9	116.1	159.7	146.2	146.2	146.2
- Temporary Labor		-	11.2	22.4	33.6	33.6	33.6
- Administration		4.5	9.0	9.0	9.0	9.0	9.0
- Maintenance of Equipment @4% of Capital Cost		-	52.0	52.0	52.0	52.0	52.0
- Insurance @ 0.3% of Value (Building & Equipment)		-	2.6	2.6	2.6	2.6	2.6
- Building Repairs @ 2% of Capital Cost		-	17.4	17.4	17.4	17.4	17.4
Sub-total		70.4	208.3	263.1	260.8	260.8	260.8
Total Cost (A) + (B) + (C)	(X)	70.4	2,695.7	3,022.6	3,153.9	3,266.4	3,266.4
	(Y)	70.4	3,215.7	3,602.6	3,760.9	3,897.4	3,897.4
	(Z)	70.4	3,737.7	4,182.6	4,368.9	4,528.4	4,528.4
Gross Cash Flow	(X)	-70.4	1,278.3	1,393.4	1,478.1	1,545.6	1,545.6
	(Y)	-70.4	756.3	813.4	871.1	914.6	914.6
	(Z)	-70.4	234.3	233.4	263.1	283.6	283.6

Fig. G1-1. Tomato Paste and Ketchup Factory



G-2. Processing of Animal Products

G-2.1. Slaughterhouse

1) Introduction

There are 12 slaughterhouses in the Fayoum Governorate and annually about 22,000 head of animals have been slaughtered and about 23,000 head of cattle and buffaloes are transported to Cairo.

In addition, according to the information from the Supply Directorate in the Fayoum Governorate, 715 tons of frozen meat were transported into Fayoum Governorate in 1983.

All of existing slaughterhouses are not hygienic and modernized facilities. Even the biggest slaughterhouse in the Fayoum city no cold storage and water supply system and sewage disposal facilities are equipped. The butchers take animals to slaughterhouse and slaughter for themselves on the concrete slab. Sometimes dogs are observed inside the facilities. In order to distribute fresh and hygienic meat to consumers slaughtering should be done in hygienic circumstances.

There is no slaughterhouse in the Wahby Downstream area and South Area of Lake Qarun and it is not desirable to slaughter livestock produced in the Project Area in the existing 12 slaughterhouses because of the reasons as mentioned above.

To improve present circumstances, it is recommended to establish a slaughterhouse with modernized facilities in the Project Area.

2) Capacity

The slaughterhouse is designed to slaughter and dress 7,430 head of cattle and sheep annually. Operation will be started in 1991.

3) Location

It is considered that a portion along the road to Cairo in North Wahby will be suitable for transportation of livestock came from the Project Area and other area.

4) Layout

Figures G2-1 and G2-2 show a layout of the facility and flow sheet of procedures. The building is composed of two floors.

5) Capital Costs

Table G2-5 shows the estimated capital cost of the necessary components for the slaughterhouse. Building construction will be carried out for three years.

6) Material Supply

Livestock to be treated in the facility will be transported from the Project Area and other areas. Material supply in each year was estimated as follows.

Year	Cattle (head)	Sheep (head)
1991	2,300	510
1992	3,100	770
1993	5,200	970
1994	6,000	1,200
after 1995	6,200	1,230

7) Operation costs

Operation costs comprise personnel cost, water and electricity, maintenance costs, vehicles and others. As for the personnel cost, LE 76,140 for 76 persons will be annually needed as shown in Table G2-6.

8) Financial Evaluation

Table G2-8 shows the gross cash flow and Table G2-9 shows the costs and benefit streams for the period of 25 years and the financial rate of return of 28 percent.

G-2.2. Milk Processing Factory

1) Introduction

In the Fayoum Governorate, there is no processing factory for dairy products. All of dairy products such as UHT milk, butter, yoghurt, ice cream is brought from Misr Company for Milk and Food in Cairo. Misr Company for Milk and Food has nine factories in the Whole Egypt.

A little amount of milk produced by small-scale farmers have been processed into white cheese and so on by farmers themselves. Misr Company for Milk and Food send trucks every day to collect the milk produced in the large-scale farms.

The Fayoum Governorate is located in favorable circumstances of supplying agricultural products and animal products to Cairo, the biggest consuming area in Egypt. The role of Fayoum as a supplier of agricultural products for Cairo would not be changed and goes on increasing with an increase in population in Cairo. In addition, the establishment of milk

processing factory will contribute to give people employment opportunities and to make progress animal husbandry and other agricultural industries in future.

2) Capacity

When an annual capacity of the factory is decided, the Cattle Breeding and Fattening Project in Com Osheem which have been carried out by Department of Agriculture since 1983, should be taken into account.

Department of Agriculture expects to establish eight units, of which four units (three is for friesian and one for baladi cow) would be included to the Fayoum Agricultural Development Project.

According to the Department of Agriculture one unit have 1,000 head of adult cow and items of eight units are as follows;

Baladi cow	1 unit
Buffalo	1 "
Friesian	6 "

As the result of calculation taking into account these units and amount of milk to be offered to calves for nursing, annually some 31,100 tons of milk would be processed in the factory.

3) Location

As same as the proposed slaughterhouse, a portion along the road to Cairo in North Wahby would be suitable for transportation of raw milk and commodities.

4) Layout

Figure G2-3 shows a layout of the factory. The building is composed of two floors.

5) Capital Costs

Table G2-10 shows the estimated capital costs of the necessary components for the factory. Building construction will be carried out for three years.

6) Material Supply

Raw milk will be brought from the Project Area and the other areas.

Material supply in each year was estimated as follows:

	Year	Quantity
	1991	10,220 tons
	1992	17,010 "
	1993	24,600 "
	1994	29,000 "
after	1995	31,100 "

7) Operation Costs

Operation costs comprise (i) personnel cost, (ii) water and electricity, (iii) maintenance costs, (iv) vehicles and others. As for personnel cost 127,680 LE for 175 persons will be needed annually as given in Table G2-11.

8) Financial Evaluation

Tables G2-13 and G2-14 show the gross cash flow and the costs and benefit streams for the period of 25 years and the financial rate of return of 22 percent, respectively.

Tabel G2-1 Number of Slaughtered Animals in Fayoum Governorate

(Unit: head)

1978	1979	1980	1981	1982	1983
21,893	22,119	21,620	22,049	24,227	20,205

Source : Veterinary Department, Fayoum

Table G2-2 Number of Slaughterhouses (1981)

District	No. of Slaughterhouses	No. of Slaughtered Animals (head)
Fayoum	1	12,113
Senorus	4	3,134
Ibshwai	3	3,819
Itsa	2	1,826
Tamiah	2	1,157
Total	12	22,049

Source : Veterinary Department, Fayoum

Table G2-3 Market Prices of Animal Products (1983)

Items	Prices
Beef (bone less)	4.50/kg
Chicken	1.30/kg
Egg	0.085/kg
Mutton	4.50/kg
White cheese	2.00/kg
Butter	4.00/kg
UHT Milk	0.70/kg
Yoghult	0.10/kg

Table G2-4 Structure of Slaughtered Animals
(1981)

(Unit: head)

District	Old Animals			Cattle				Veal	Sheep	Goats	Total
				Buffaloes		Cows					
	Cows	Buffaloes	Camels	Males	Females	Males	Females				
Fayoum	96	74	14	333	1	8,853	1	874	1,867	-	12,113
Senorus	808	54	1	38	-	1,029	-	1,072	68	64	3,134
Ibshwai	108	5	3	"	-	830	-	1,559	854	422	3,819
Itsa	11	10	-	14	-	346	-	712	648	85	1,826
Tamiah	336	1	-	17	-	503	-	212	64	24	1,157
Total	1,359	144	18	440	1	11,561	1	4,429	3,501	595	22,049

Source : Veterinary Department, Fayoum

Table G2-5 Capital Costs of Slaughterhouse

1. Ground Works	65,000 LE
2. Building Works	200,000
3. Equipment Works	290,000
4. Electric Works	39,000
5. Cold Storage Works	215,000
6. Water, Drainage, Sanitary, Boiler Works	34,500
7. Sewage Treatment Works	190,000
8. Burning Facility Works	43,000
9. Vehicles	31,000
10. Enclosure Works	69,000
11. Freight and Insurance (15%)	34,700
12. Internal Transportation Cost	58,800
13. Contingency (15%)	224,000
Total	1,495,000

Note : Price escalation is not included

Table G2-6 Personnel Cost of Slaughterhouse

Position	No. of Persons	Monthly Salary (LE/person)	Annual Cost
Factory Manager	1	840	10,080 LE
Head of Department	4	420	20,160
Head of Sections	6	200	14,400
Skilled Laborers	25	45	13,500
Unskilled Labores	30	35	12,600
Administration	10	45	5,400
Total	76		76,140

Table G2-7 *Disbursement Schedule for Slaughterhouse*

	1990			1991			1992			Grand Total
	F C	L C	Total	F C	L C	Total	F C	L C	Total	
Capital Costs (LE)	239,200	59,800	299,000	478,400	119,600	598,000	478,400	119,600	598,000	1,495,000
Price Escalation	1,308	1,868	-	1,374	2,090	-	1,442	2,340	-	-
Cost *	312,870	111,710	424,580	657,320	249,960	907,280	698,850	279,860	978,710	2,310,570

Note : Price escalation rate is applied 5 percent for foreign currency and 12 percent for local currency, respectively.

FC ; Foreign Currency

LC ; Local Currency

* ; Cost including price escalation

Table G2-8 Gross Cash Flow for Slaughterhouse

	1991	1992	1993	1994	1995
Amount of Boneless Meat (tons)	426	574	963	1,112	1,149
Offals (10 kg/head - tons)	23	31	52	60	62
Hide (pieces)	2,300	3,100	5,200	6,000	6,200
Income					
Boneless Meat (4.0 LE/kg)	1,704,000	2,296,000	3,852,000	4,448,000	4,596,000
Offals (3 LE/kg)	69,000	93,000	156,000	180,000	186,000
Hide (25 LE/piece)	57,500	77,500	130,000	150,000	155,000
Total	1,830,500	2,466,500	4,138,000	4,778,000	4,937,000
Cost					
Purchasing Cost (1.5 LE/kg)	1,328,850	1,820,540	3,059,200	3,527,090	3,534,000
Personnel Cost	11,420	34,260	60,910	68,520	76,140
Water & Electricity	150	450	800	900	1,000
Maintenance	2,780	8,320	14,800	16,650	18,500
Vehicles	2,610	7,830	13,920	15,660	17,400
Others	890	2,680	4,770	5,360	5,960
Total	1,346,700	1,874,080	3,154,400	3,634,180	3,653,000
Gross Cash Flow	483,800	592,420	983,600	1,143,820	1,284,000

Table G2-9 Project Financial Cost and Return

SLAUGHTERHOUSE

(UNIT : MILLION L.L.)

YEAR	PROJECT COST		TOTAL	INCREMENTAL BENEFITS	PROJECT RETURN	PRESENT WORTH VALUE	
	CAPITAL	O & M	(1)	(2)	(3) (2) - (1)	(3)*DISCOUNT RATE (28 %)	(29 %)
1 1990	0.43	0.0	0.43	0.0	0.43	0.33	0.33
2 1991	1.31	1.35	2.66	1.83	0.83	0.50	0.50
3 1992	1.53	1.87	3.40	2.47	0.93	0.44	0.43
4 1993	1.06	3.15	4.21	4.14	-0.07	-0.03	-0.03
5 1994	1.06	3.63	4.69	4.78	0.09	0.03	0.03
6 1995	0.03	3.65	3.68	4.94	1.26	0.29	0.27
7 1996	0.0	3.65	3.65	4.94	1.29	0.23	0.22
8 1997	0.0	3.65	3.65	4.94	1.29	0.18	0.17
9 1998	0.0	3.65	3.65	4.94	1.29	0.14	0.13
10 1999	0.0	3.65	3.65	4.94	1.29	0.11	0.10
11 2000	0.32	3.65	3.97	4.94	0.97	0.06	0.05
12 2001	0.0	3.65	3.65	4.94	1.29	0.07	0.06
13 2002	0.0	3.65	3.65	4.94	1.29	0.05	0.05
14 2003	0.0	3.65	3.65	4.94	1.29	0.04	0.04
15 2004	0.0	3.65	3.65	4.94	1.29	0.03	0.03
16 2005	0.03	3.65	3.68	4.94	1.26	0.02	0.02
17 2006	0.0	3.65	3.65	4.94	1.29	0.02	0.02
18 2007	0.0	3.65	3.65	4.94	1.29	0.02	0.01
19 2008	0.0	3.65	3.65	4.94	1.29	0.01	0.01
20 2009	0.0	3.65	3.65	4.94	1.29	0.01	0.01
21 2010	0.32	3.65	3.97	4.94	0.97	0.01	0.00
22 2011	0.0	3.65	3.65	4.94	1.29	0.01	0.00
23 2012	0.0	3.65	3.65	4.94	1.29	0.00	0.00
24 2013	0.0	3.65	3.65	4.94	1.29	0.00	0.00
25 2014	0.0	3.65	3.65	4.94	1.29	0.00	0.00
TOTAL	6.08	83.00	89.08	112.02	22.94	0.02	0.05

I R R = 28 ..... 28 + 0.02 / (0.02 + 0.05) = 28.3

Table G2-10 Capital Cost of Milk Processing Factory

1. Ground Works	118,300
2. Building Works (1,820 m^2)	364,000
3. Equipment Works	2,490,000
4. Electric Works	39,000
5. Refrigeration Works	275,000
6. Water Treatment Facilities	66,000
7. Sewege Treatment Works	125,000
8. Vehicles	51,000
9. Enclosure Works	125,600
10. Freight and Insurance (15 %)	373,500
11. Internal Transportation Cost	201,000
12. Contingency (15 %)	751,600
Total	4,980,000

Table G2-11 Personnel Cost of Milk Processing Factory

Position	No. of Persons	Monthly Salory (LE/person)	Annual Cost (LE)
Factory Manager	1	840	10,080
Head of Departments	4	420	20,160
Head of Sections	10	200	24,000
Skilled Laborers	32	45	17,280
Unskilled Laborers	108	35	45,360
Administration	20	45	10,800
Total	175		127,680

Table G2-12 Disbursement Schedule for Milk Processing Factory

(Unit: 1,000 LE)

	1990			1991			1992			Grand Total
	FC	LC	Total	FC	LC	Total	FC	LC	Total	
Capital (LE)	840.00	160.00	1,000.00	1,690.00	300.00	1,990.00	1,690.00	300.00	1,990.00	4,980.00
Price Escalation	1.308	1.868	-	1.374	2.090	-	1.442	2.340	-	-
Cost *	1,120.00	320.00	1,440.00	2,370.00	660.00	3,030.00	2,490.00	740.00	3,230.00	7,700.00

Note : Price escalation rate is applied 5 percent for foreign currency and 12 percent for local currency, respectively.

FC ; Foreign Currency

LC ; Local Currency

* ; Cost including price escalation

Table G2-13 Gross Cash Flow for Milk Processing Factory

	1991	1992	1993	1994	1995
Physical Output					
UHT Milk (40%)	4,088	6,804	9,840	11,600	12,220
White Cheese (40%)	1,022	1,701	2,460	2,900	3,055
Yoghurt (20%)	1,635	2,722	3,936	4,640	4,888
Income					
UHT Milk (400 LE/ton)	LE 1,635,200	LE 2,721,600	LE 3,936,000	LE 4,640,000	LE 4,888,000
White Cheese (1,500 LE/ton)	1,533,000	2,551,500	3,690,000	4,350,000	4,582,500
Yoghurt (600 LE/ton)	981,000	1,633,200	2,361,600	2,784,000	2,932,800
Total	4,149,200	6,906,300	9,987,600	11,774,000	12,403,300
Costs					
Materials Cost (1)					
Raw Milk					
0.30 LE/kg (X)	3,066,000	5,103,000	7,380,000	8,700,000	9,165,000
0.25 LE/kg (Y)	2,555,000	4,252,500	6,150,000	7,250,000	7,637,500
0.20 LE/kg (Z)	2,044,000	3,402,000	4,920,000	5,800,000	6,110,000
Personnel Cost (2)	19,150	57,450	102,140	114,910	127,680
Materials (3)	4,050	12,150	21,600	24,300	27,000
Water & Electricity (4)	290	860	1,520	1,710	1,900
Maintenance (5)	10,890	32,670	58,080	65,340	72,600
Packaging (6)	137,100	411,300	731,200	822,600	914,000
Vehicles (7)	2,610	7,830	13,920	15,660	17,400
Others (8)	67,500	202,500	360,000	405,000	450,000
Total (1) - (8)					
(X)	3,307,590	5,827,760	8,668,460	10,149,520	10,775,580
(Y)	2,796,590	4,977,260	7,438,460	8,699,520	9,248,080
(Z)	2,285,590	4,126,760	6,208,460	7,249,520	7,720,580
Gross Cash Flow					
(X)	841,610	1,078,540	1,319,140	1,624,480	1,627,720
(Y)	1,352,610	1,929,040	2,549,140	3,074,480	3,155,220
(Z)	1,863,610	2,779,540	3,779,140	4,524,480	4,682,720

Note : Construction works starts from 1989 and will be completed in 1991 production of dairy products starts in 1991.

Table G2-14 Project Financial Cost and Return

-Milk Processing Factory-

(UNIT : MILLION T.L.)

YEAR	PROJECT COST		TOTAL	INCREMENTAL BENEFITS	PROJECT RETURN	PRESENT WORTH VALUE	
	CAPITAL REPLACEMENT	O & M	(1)	(2)	(3)=(2)-(1)	(3)*DISCOUNT RATE (21 %)	(22 %)
1 1990	1.440	0.0	1.440	0.0	-1.440	-1.190	-1.180
2 1991	3.870	2.800	6.670	4.150	-2.520	-1.721	-1.693
3 1992	4.770	4.980	9.700	6.910	-2.790	1.575	-1.536
4 1993	2.230	7.440	9.670	9.990	0.320	0.149	0.144
5 1994	2.400	8.700	11.100	11.770	0.670	0.258	0.248
6 1995	2.830	9.250	12.080	12.400	0.320	0.102	0.097
7 1996	0.0	9.250	9.250	12.400	3.150	0.829	0.783
8 1997	0.0	9.250	9.250	12.400	3.150	0.686	0.642
9 1998	0.0	9.250	9.250	12.400	3.150	0.567	0.526
10 1999	0.0	9.250	9.250	12.400	3.150	0.468	0.431
11 2000	2.540	9.250	11.790	12.400	0.610	0.075	0.068
12 2001	0.0	9.250	9.250	12.400	3.150	0.320	0.290
13 2002	0.0	9.250	9.250	12.400	3.150	0.264	0.237
14 2003	0.0	9.250	9.250	12.400	3.150	0.218	0.195
15 2004	0.0	9.250	9.250	12.400	3.150	0.181	0.160
16 2005	0.050	9.250	9.300	12.400	3.100	0.147	0.129
17 2006	0.0	9.250	9.250	12.400	3.150	0.123	0.107
18 2007	0.0	9.250	9.250	12.400	3.150	0.102	0.088
19 2008	0.0	9.250	9.250	12.400	3.150	0.084	0.072
20 2009	0.0	9.250	9.250	12.400	3.150	0.070	0.059
21 2010	2.540	9.250	11.790	12.400	0.610	0.011	0.009
22 2011	0.0	9.250	9.250	12.400	3.150	0.048	0.040
23 2012	0.0	9.250	9.250	12.400	3.150	0.039	0.033
24 2013	0.0	9.250	9.250	12.400	3.150	0.032	0.027
25 2014	0.0	9.250	9.250	12.400	3.150	0.027	0.022
TOTAL	22.620	208.920	231.540	280.820	49.280	0.314	-0.003

IRR = 22 ..... 21 + 0.31 / (0.31 + 0.00) = 21.99

Table G2-15 Daily Calory Intake per Capita

	1969 - 71 (Kcal)	1978 - 80 (Kcal)
EGYPT	2,540	2,949
ALGERIA	1,866	2,404
ETHIOPIA	2,028	1,729
SOUTH AFRICA	2,767	2,827
SUDAN	2,082	2,371
TANZANIA	2,021	2,025
IRAN	2,199	2,912
IRAO	2,244	2,643
ISRAEL	3,024	3,045
SYRIA	2,493	2,863
LEBANON	2,503	2,496
JAPAN	2,741	2,916
INDIA	1,999	1,998
PAKISTAN	2,195	2,300
FRANCE	3,371	3,390
ITALY	3,496	3,650
UK	3,352	3,316
USA	3,462	3,652
BRAZIL	2,493	2,517
PERU	2,254	2,166

Source : FAO Production Yearbook 1981.

Table G2-16 Imports of Frozen Foodstuffs

(Unit: ton)

Commodities	1978	1979	1980	1981	1982
Beef	46,597	34,277	73,814	117,071	100,308
Chicken	8,582	27,453	54,354	82,796	37,580
Fish	52,974	23,070	36,144	55,469	65,975
Cheese	12,207	15,067	14,146	16,842	20,758
Butter	27,174	22,008	35,207	43,732	18,738
Total	147,534	121,875	213,665	315,910	243,359

Source : Monthly Bulletin of Foreign Tyade, Central Agency for public Mobilization and statistics.

Table G2-17 Forecast of per Capita Consumption

(Unit: kg/year)

Year	Meat and Chicken	Daily Products
1985	13.5	48.8
1990	14.9	48.9
1995	16.3	49.0
2000	17.7	49.1

Table G2-18 Annual per Capita Consumption in ARE

(Unit: kg)

Year	Seeds	Starch Products	Sugar & Sweet	Pulses & Nuts	Vegetables	Fruits	Meat & Poultry	Fish	Dairy Products	Eggs	Vegetable Oils
1969	216.9	10.9	17.0	9.2	98.8	52.6	8.8	2.4	48.1	1.3	5.6
1970	218.2	11.1	18.0	11.9	91.1	57.2	8.8	2.2	48.5	1.4	6.4
1971	225.8	12.6	18.5	9.9	89.3	51.2	9.1	2.2	48.8	1.4	8.5
1972	231.0	9.5	21.9	10.2	92.3	54.4	10.9	2.2	49.3	1.5	9.1
1973	244.6	16.8	22.3	13.1	85.4	58.8	10.9	2.2	48.5	1.5	9.9
1974	249.3	16.1	23.4	12.0	92.7	66.4	10.9	2.6	48.2	1.5	10.9
1975	254.5	13.1	27.4	11.7	96.0	63.9	10.6	2.9	48.2	1.8	11.5
1976	275.9	16.8	28.8	12.8	99.3	63.1	10.2	3.7	50.4	1.5	11.0
1977	266.1	20.4	28.8	9.1	107.3	58.0	10.6	3.3	48.2	1.8	11.0
1978	281.1	19.0	26.2	10.2	90.2	62.4	12.0	4.7	47.5	3.3	12.8

Source : Statistical Indicators, Central Agency for Public Mabilization and Statistics.

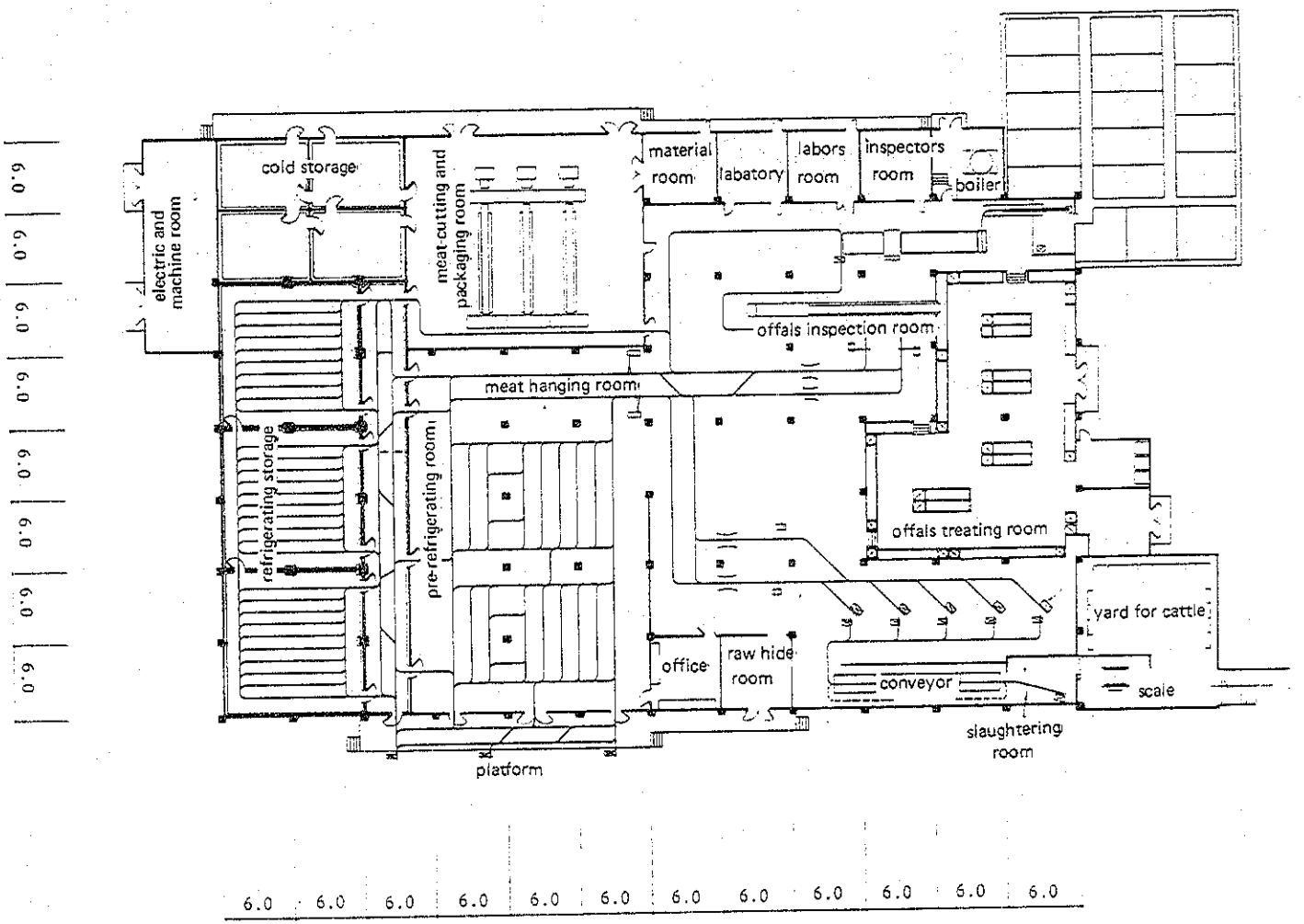


Fig. G2-I FLOOR PLAN OF SLAUGHTERHOUSE

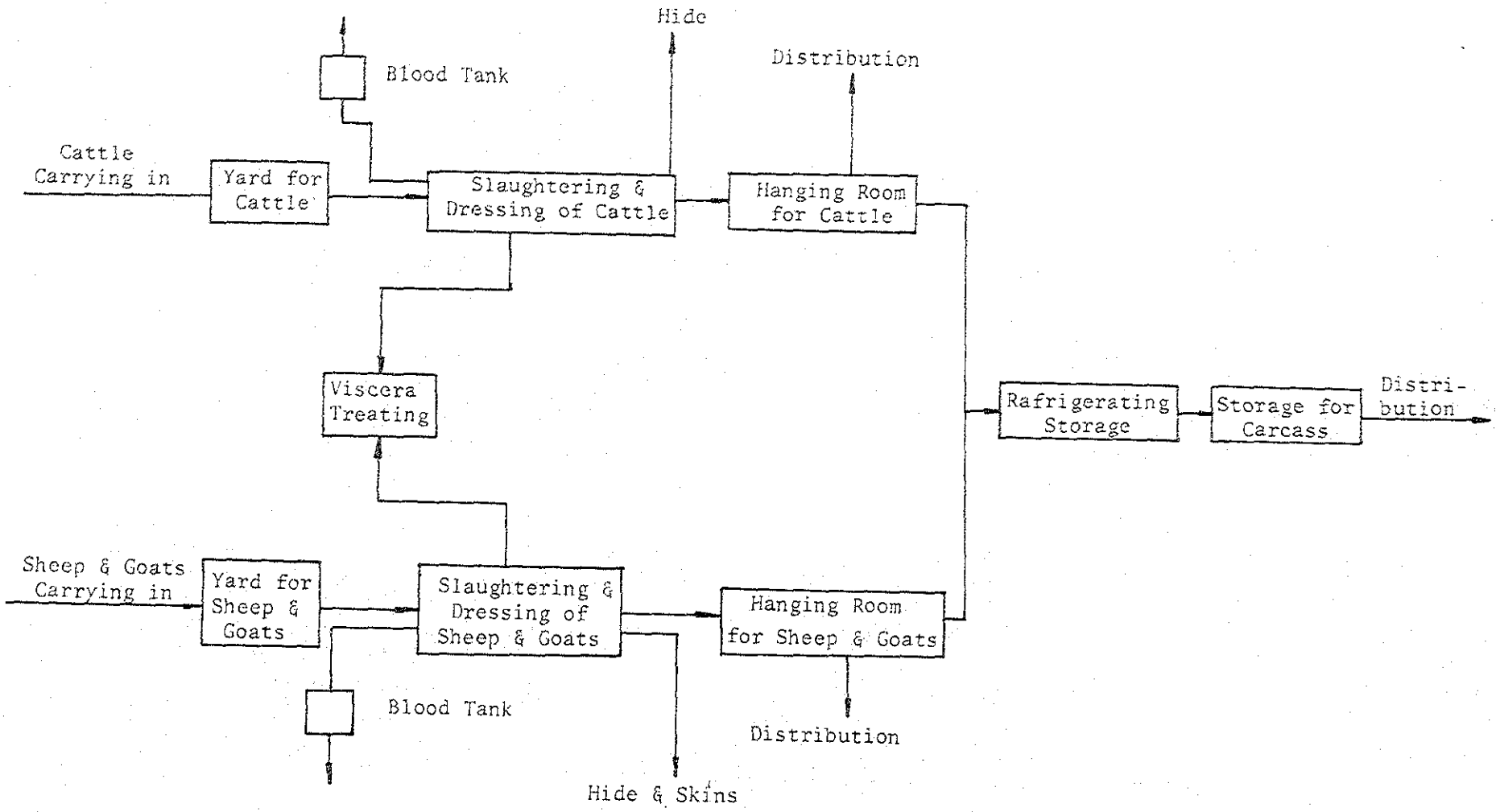
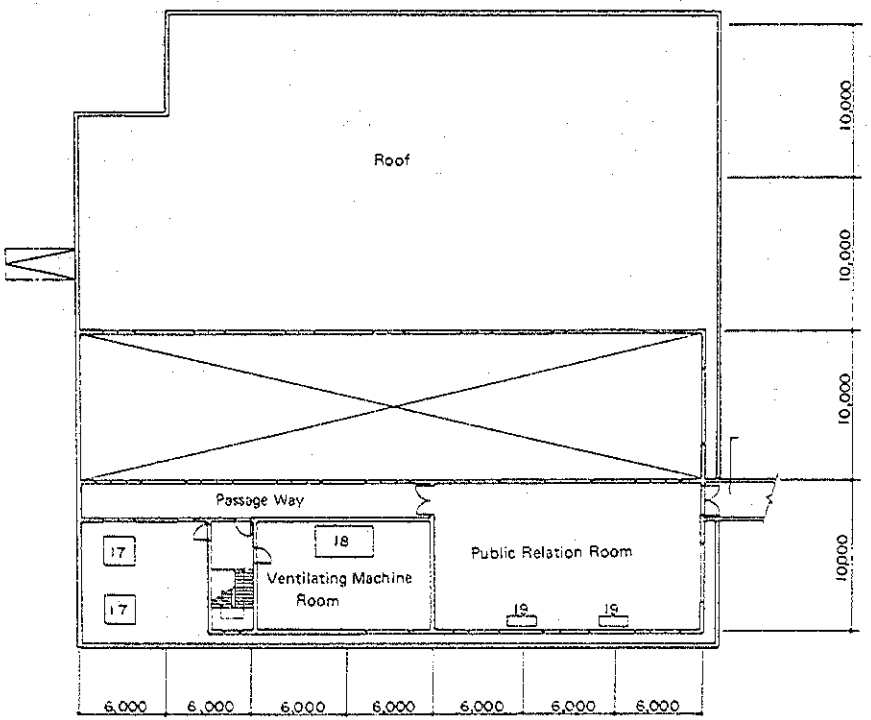
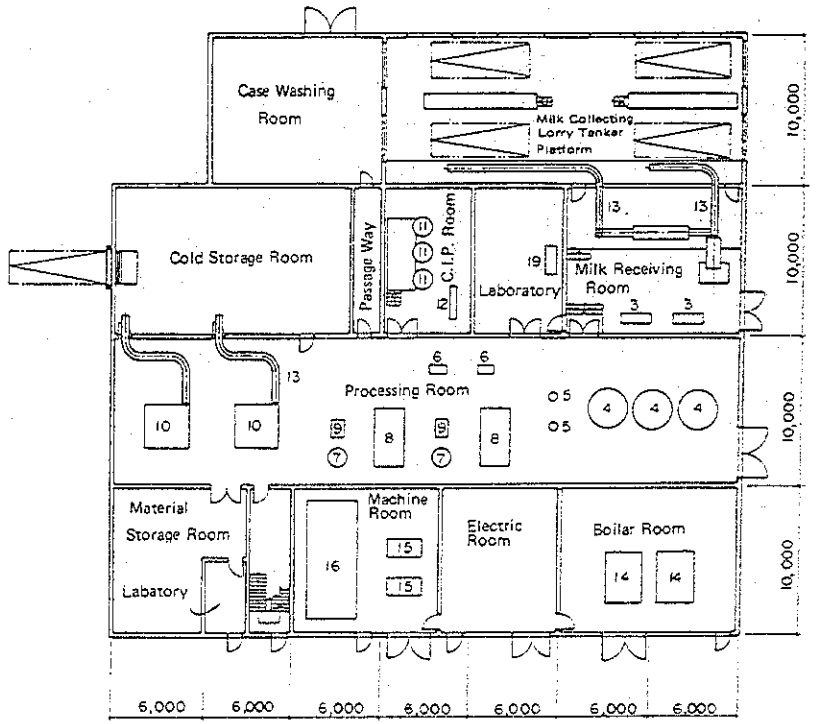


Figure G2-2 Flow Sheet of Slaughtering



Second Floor



First Floor

Legend

1 weighing unit
2 churn washer
3 raw milk cooler
4 raw milk storage tank
5 float balance tank
6 separator
7 balance tank
8 sterilizer
9 homoginizer
10 filler
11 TIP tank
12 CIP heater
13 conveyor
14 boiler
15 regrigerator
16 ice bank
17 remote condensor
18 ventilator
19 air conditioner

Fig. G2-3 FLOOR PLAN OF MILK PROCESSING FACTORY

G-3. Rural Development Plan of North Wahby Area

G-3.1. Settlement Plan

(1) Settlement Form

The administrative organization in Fayoum Governorate is divided into five levels, namely; Governorate, District, Local Unit, Village and Hamlet.

There are a total of five districts and 37 Local Units located in Fayoum Governorate. The planned scale of each Local Unit is an average area of 12,000 feddan and a population of 30,000. Tamiah district which is situated adjacent to the Project Area is divided into five Local Units. A centrally located village in each Local Unit serves as a center. In this central village are located branch offices of governmental offices and stores selling daily necessaries.

In Tamiah district each local unit has an average of four villages. The approximate area and population is 4,300 feddan and 8,500 persons, respectively. A primary school, a mosque and a few stores are located in the center of each village.

Hamlets ('Ezbet' in Arabic) located in Tamiah district consist of approximately 20 to 30 farm households. Public facilities are rarely found, however, the farmers' homes are gathered in one place.

Basically, the settlement plan will follow the existing system and be set up as follows.

- From the viewpoint of location and scale of the new reclamation area which will be situated in Tamiah district, the area will constitute one Local Unit. The reason for this is that the area is located too far from the center of the nearest local

unit and also the type of agriculture to be practiced differs from that in the neighboring area. A village located in a central place within the local unit will contain the main facilities such as local governmental offices and stores.

- One primary school with an enrollment capacity of 200-240 pupils will be established in each village so that the farthest any student has to commute will be four to five kilometers. Also, a branch office of the agricultural cooperative association will be established.

- The scale of one hamlet will be set at 30 farm households. This is in line with the present situation and is also the maximum number of households for carrying out efficient water management. Furthermore, the distance to the farmer's field will be less than one kilometer creating no hindrance to agricultural work. Although there will be no main facilities located in the hamlet itself a mosque will be constructed for every four to five hamlets.

- For the following reasons, the farmers' houses will be located in one place in each hamlet and be constructed along the main road.

  * reduction of the cost of water and electrical facilities
  * importance of communication
  * distance to the farmer's field is less than one kilometer causing no problems for agricultural works

(2) Alignment of Settlement

One local unit is planned to be established to serve both North North Wahby and Com Osheem areas. This center (town) is planned to be located in the middle of the North Wahby area along the Cairo Highway.

There will be one village located in North Wahby area. In the village a primary school, stores, and a cooperative sub-station will be established.

One hamlet will be established for about every 30 households considering the topography and road layout there will be 16 Hamlets located in North Wahby area.

The layout of these settlements is shown in Fig. G3-1.

(3) Household and Population

Number of households in the Project Area is as follows;

Type	Number of Households
Small Farmer (5 feddan)	442
Large Farmer (15 feddan)	74
Large Farmer (20 feddan)	55
Sub-total	571
Non Farmer	80
Total	651

The number of farmers' houses is 571 and that of non-farmers' houses is 80 giving a total of 651 households and a total population of 3,255 persons. The population has been estimated based on the assumption that one household has five persons. The average number of farmers' houses in each hamlet is 32 and the population is 160 persons.

Settlers will be comprised of the following number of farmer and non-farmers' households.

Unit	Number of Unit	Farmer Households (Average)	Non-Farmer Households (Average)
Town	1	32	70
Village	1	32	10
Hamlet	16	32	-

G-3.2. Housing

The type of houses is divided into five types as follows;

Farmers' houses:
Small: Five(5) feddan tenure
Large: 15 or 20 feddan tenure
Directors' houses
Technicians' houses
Laborers' houses and others

Non-farmers' housing is of three type, Directors' house, Technicians' house, and Laborers and Others. Persons coming under each type of housing are determined according to their position and income.

Type	Person
Directors' house;	One house for every office Director (person in charge of a public office such as post office, school, etc.). Two houses for the medical clinic, one for each of the two doctors assigned their. The General Manager of the cattle breeding and fattening farm will also come under this category.
Technicians' house;	Subordinates of the Directors, office workers and teachers will live in this type.
Laborers and others;	Assistants to Technicians and laborers will live in this type. Also, store keepers will be included in this rank.

Building area and lot of these houses are shown in Table G3-1. Number of household of each type is shown in Table G3-2.