H.3.2 Construction Mode and Method

The open domestic competitive bidding would be conducted with financial assistance from international institution. The procedures of pre-qualification and bidding for the contract works have not been authorized. According to the draft procedure, the Awarding Committee chaired by a leader of the DGGR would be created under the Ministry of Agriculture. Every matter would be dealt with by the department concerned under the present organization and approved by the committee, through administrative arrangement of Construction Section or Planning Section.

H.3.3 Construction Schedule

Upon approval of the project, the detailed design as well as bidding documents, specifications and other documents/drawings necessary for the approval and implementation of the project works should be commenced and at the same time the selection of consultants would be carried out. The consultants would be selected first by the technical proposal. After approval of the selection, the contract conditions would be concluded. The pre-qualification documents would be reviewed by the consultants upon the commencement of consulting services and advertised after the Approval. The contract works would be bidden upon the approval of detailed design and construction drawings and started in the construction. The arrangement of all right-of-way should be accomplished before the construction with every efforts. These pre-construction activities are estimated to take about one year. Overall construction schedule is shown in Table H.3.3.1.

Table H.1.2.1 Irrigation efficiencies at present condition

(1) Gafsa Governorate

Cord No.	Name of Oasis	Planned Area(ha)	No. of Sample	Sample Area(ha)	Sample A./ Planned A.	Irrigation Efficiency			Total Effici.
						Main	Secondary	Applica.	
GF- 1	Kasba	698	4	46.320	6.6	0.9	0.672	0.80	0.484
GF- 2	Sud Ouest	703	3	41.750	5.9	0.9	0.439	0.80	0.316
GF- 3	El Guettar	450	1	46.400	10.3	0.9	0.290	0.80	0.209
GF- 4	Lalla	700	4	46.030	6.6	0.9	0.520	0.80	0.374
GF- 5	El Ksar	578	3	44.620	7.7	0.9	0.682	0.80	0.491
GF- 6	Oued Shili	56	1	4.620	8.3	0.9	0.490	0.85	0.375
GF- 7	Thelja	65	1	2.560	3.9	0.9	0.678	0.85	0.519
GF- 8	Segdoud	217	2	15.360	7.1	0.9	0.650	0.85	0.497
	Total/Average	3,467	19	247.660	7.1	0.9	0.553	0.82	0.408

(2) Tozeur Governorate

Cord No.	Name of Oasis	Planned Area(ha)	No. of Sample	Sample Area(ha)	Sample A./ Planned A.	Irrigation Efficiency			Total Effici.
						Main	Secondary	Applica.	
TZ- 1	Tozeur	929	5	24.390	2.6	0.9	0.616	0.80	0.444
TZ- 2	Kastilia	50	1	3.200	6.4	0.9	0.614	0.80	0.442
TZ- 3	Oued El Koucha	62	1	4.000	6.5	0.9	0.680	0.80	0.490
TZ- 4	Neflayette	72	1	5.400	7.5	0.9	0.660	0.80	0.475
TZ- 5	Chemsa	90	1	5.920	6.6	0.9	0.730	0.80	0.526
TZ- 6	Helba Est	75	1	4.950	6.6	0.9	0.524	0.80	0.377
TZ- 7	Helba Ouest	50	1	4.095	8.2	0.9	0.710	0.80	0.511
TZ- 8	Jhim 1	40	1	8.000	20.0	0.9	0.480	0.80	0.346
TZ- 9	Jhim 2	167	1	6.000	3.6	0.9	0.670	0.80	0.482
TZ- 10	Ibn Chabbat 3 (*)	325	1	9.600	3.0	0.9	0.920	0.85	0.704
TZ- 11	Nefta	852	4	26.388	3.1	0.9	0.542	0.80	0.390
TZ- 12	Ghardgaya	40	1	4.725	11.8	0.9	0.614	0.80	0.442
TZ- 13	Ibn Chabbat 1 (*)	240	1	6.810	2.8	0.9	0.920	0.85	0.704
TZ- 14	Ibn Chabbat 2 (*)	272	1	7.470	2.7	0.9	0.920	0.85	0.704
TZ- 15	Draa Sud	198	2	10.850	5.5	0.9	0.832	0.85	0.636
TZ- 16	Hazoua 1	72	2	6.645	9.2	0.9	0.598	0.80	0.431
TZ- 17	Hazoua 2	48	2	4.030	8.4	0.9	0.678	0.85	0.519
TZ- 18	Hazoua 3	238	4	19.346	8.1	0.9	0.678	0.85	0.519
TZ- 19	Oued Loghrissi	78	1	4.100	5.3	0.9	0.650	0.80	0.468
TZ- 20	Tazrarit	48	1	4.340	9.0	0.9	0.650	0.80	0.468
TZ- 21	Cedada	55	1	4.250	7.7	0.9	0.587	0.80	0.423
TZ- 22	Oghoumes	104	2	6.320	6.1	0.9	0.650	0.80	0.468
TZ- 23	Degache	822	3	26.500	3.2	0.9	0.533	0.80	0.384
TZ- 24	Chakmou	90	1	7.700	8.6	0.9	0.578	0.80	0.416
TZ- 25	El Hamma	400	2	9.900	2.5	0.9	0.542	0.80	0.390
TZ- 26	Tamerza	80	1	6.680	8.4	0.9	0.798	0.80	0.575
TZ- 27	Chebika	23	1	1.380	6.0	0.9	0.798	0.80	0.575
TZ- 28	Foum El Khanga	48	1	1.380	2.9	0.9	0.798	0.80	0.575
TZ- 29	Mides	29	1	2.500	8.6	0.9	0.798	0.80	0.575
TZ- 30	Ain El Karma	25	1	1.910	7.6	0.9	0.798	0.80	0.575
	Total/Average	5,622	47	238.779	4.2	0.9	0.686	0.81	0.501

(3) Kebili Governorate

Cord No.	Name of Oasis	Planned Area(ha)	No. of Sample	Sample Area(ha)	Sample A./ Planned A.	Irrigation Efficiency			Total Effici.
						Main	Secondary	Applica.	
KB- 1	Bechri	162	1	4.480	2.8	0.9	0.650	0.80	0.468
KB- 2	Bouabdallah	270	2	16.510	6.1	0.9	0.609	0.80	0.438
KB- 3	Fatnassa	205	2	12.260	6.0	0.9	0.714	0.80	0.514
KB- 4	El Gliaa	94	1	6.550	7.0	0.9	0.632	0.80	0.455
KB- 5	Menchia	140	1	9.240	6.6	0.9	0.533	0.80	0.384
KB- 6	Nagga	181	2	9.940	5.5	0.9	0.614	0.80	0.442
KB- 7	Oum Somaa	162	1	10.010	6.2	0.9	0.533	0.80	0.384
KB- 8	Oued Zira	176	1	9.600	5.5	0.9	0.506	0.80	0.364
KB- 9	Ouled Touati	62	1	5.720	9.2	0.9	0.398	0.80	0.287
KB- 10	Tenchig	54	1	3.520	6.5	0.9	0.614	0.80	0.442
KB- 11	Zaouiet El Anes	125	1	5.060	4.0	0.9	0.560	0.80	0.403
KB- 12	Zaouiet El Harth	81	1	8.870	11.0	0.9	0.452	0.80	0.325
KB- 13	Ziret Louhichi	86	1	5.100	5.9	0.9	0.650	0.80	0.468
KB- 14	Chouchet Nagga	26	1	2.000	7.7	0.9	0.596	0.85	0.456
KB- 15	Guataya	150	2	9.540	6.4	0.9	0.560	0.80	0.403
KB- 16	Jedida	133	1	10.500	7.9	0.9	0.690	0.80	0.497
KB- 17	Mansoura	86	2	4.100	4.8	0.9	0.452	0.80	0.325
KB- 18	Rabta	162	2	9.470	5.8	0.9	0.636	0.80	0.458
KB- 19	Telmine	240	2	14.140	5.9	0.9	0.614	0.80	0.442
KB- 20	Tembib	118	1	7.070	6.0	0.9	0.690	0.80	0.497
KB- 21	Tombar	127	2	4.400	3.5	0.9	0.578	0.80	0.416
KB- 22	Limagues	57	1	3.270	5.7	0.9	0.632	0.80	0.455
KB- 23	Mazraa Neji	66	1	3.000	4.5	0.9	0.710	0.80	0.511
KB- 24	Oum El Farth let2	55	1	6.840	12.4	0.9	0.720	0.80	0.518
KB- 25	Stiftimi	82	1	3.600	4.4	0.9	0.730	0.80	0.526
KB- 26	Saidane	30	1	2.000	6.7	0.9	0.576	0.85	0.441
KB- 27	Barghouthia	52	1	6.230	12.0	0.9	0.614	0.80	0.442
KB- 28	Bazma	146	2	9.480	6.5	0.9	0.710	0.80	0.511
KB- 29	B'chelli	135	3	8.060	6.0	0.9	0.614	0.80	0.442
KB- 30	Blidette	75	1	4.530	6.0	0.9	0.614	0.80	0.442
KB- 31	Zarcine	70	1	5.500	7.9	0.9	0.470	0.80	0.338
KB- 32	Jemna	112	1	6.640	5.9	0.9	0.774	0.80	0.557
KB- 33	Mtouria	81	1	6.260	7.7	0.9	0.560	0.80	0.403
KB- 34	Msaid	95	1	6.106	6.4	0.9	0.560	0.80	0.403
KB- 35	Rahmat	85	1	4.310	5.1	0.9	0.670	0.80	0.482
KB- 36	Ras El Ain	268	2	15.010	5.6	0.9	0.650	0.80	0.468
KB- 37	Souk El Baiez	65	1	3.890	6.0	0.9	0.660	0.80	0.475
KB- 38	Ben Zitoun let2	147	2	7.390	5.0	0.9	0.614	0.80	0.442
KB- 39	Bourzine	94	2	6.440	6.9	0.9	0.730	0.80	0.526
KB- 40	Gueliada	103	1	6.960	6.8	0.9	0.614	0.80	0.442
KB- 41	Kelwamen	47	1	2.060	4.4	0.9	0.650	0.80	0.468
KB- 42	Klibia	92	1	5.050	5.5	0.9	0.740	0.80	0.533
KB- 43	Sidi Hamed	100	1	7.890	7.9	0.9	0.614	0.80	0.442
KB- 44	Atilet	220	3	16.100	7.3	0.9	0.530	0.85	0.405
KB- 45	Douz	280	3	14.830	5.3	0.9	0.614	0.80	0.442
KB- 46	El Ghoula (*)	75	1	4.710	6.3	0.9	0.935	0.80	0.673
KB- 47	El Golaa (*)	65	1	2.350	3.6	0.9	0.935	0.80	0.673
KB- 48	Grad (*)	111	1	6.980	6.3	0.9	0.935	0.80	0.673
KB- 49	El H'say	90	1	5.700	6.3	0.9	0.650	0.80	0.468
KB- 50	Nouiel	97	1	6.720	6.9	0.9	0.560	0.80	0.403
KB- 51	Zaafrane	101	1	4.620	4.6	0.9	0.834	0.80	0.600
KB- 52	Bouhamza	80	1	6.200	7.8	0.9	0.650	0.80	0.468
KB- 53	Ksar Ghilane	100	1	5.200	5.2	0.9	0.650	0.80	0.468
KB- 54	Sakkouma (*)	80	1	4.110	5.1	0.9	0.935	0.80	0.673
KB- 55	Tarfaya (*)	77	1	4.620	6.0	0.9	0.935	0.80	0.673
KB- 56	Dhomrana	45	1	2.200	4.9	0.9	0.784	0.85	0.600
KB- 57	Smida	64	1	4.700	7.3	0.9	0.667	0.85	0.510

KB- 58	Ghidma	80	1	4.580	5.7	0.9	0.851	0.80	0.613
KB- 59	Sabria	60	1	3.000	5.0	0.9	0.632	0.80	0.455
KB- 60	El Faouar 1	87	1	6.840	7.9	0.9	0.722	0.80	0.520
KB- 61	El Faouar 2	80	1	6.650	8.3	0.9	0.690	0.80	0.497
KB- 62	Bechni	100	2	8.630	8.6	0.9	0.671	0.85	0.513
KB- 63	Dargine (*)	72	1	4.730	6.6	0.9	0.920	0.85	0.704
KB- 64	Matrouha	100	1	4.000	4.0	0.9	0.650	0.80	0.468
KB- 65	Regim Maatoug 1	104	1	4.000	3.8	0.9	0.766	0.85	0.586
KB- 66	Regim Maatoug 2	96	1	6.000	6.3	0.9	0.742	0.85	0.568
KB- 67	Tarfayet Elma	52	1	2.050	3.9	0.9	0.689	0.85	0.527
	Total/Average	7,213	86	438.116	6.1	0.9	0.663	0.81	0.482

(4) Gabes Governorate

Cord No.	Name of Oasis	Planned Area(ha)	No. of Sample	Sample Area(ha)	Sample A./ Planned A.	Irrigation Efficiency			Total Effici.
						Main	Secondary	Applica.	
GB- 1	Ain Zrig	140	2	8.840	6.3	0.9	0.650	0.80	0.468
GB- 2	Temoula 1	40	1	3.220	8.1	0.9	0.720	0.80	0.518
GB- 3	Temoula 2	20	1	1.080	5.4	0.9	0.710	0.80	0.511
GB- 4	Zrig Dakhlania	30	1	2.230	7.4	0.9	0.670	0.80	0.482
GB- 5	Teboulbou	520	4	36.090	6.9	0.9	0.528	0.80	0.380
GB- 6	Oasis de Gabes	734	6	49.600	6.8	0.9	0.578	0.80	0.416
GB- 7	Limaoua 1 et 2	148	3	13.850	9.4	0.9	0.527	0.85	0.403
GB- 8	M'dou	40	1	4.070	10.2	0.9	0.614	0.80	0.442
GB- 9	Chott El Ferik	31	1	4.570	14.7	0.9	0.650	0.80	0.468
GB- 10	Bouchamma	143	1	9.380	6.6	0.9	0.632	0.80	0.455
GB- 11	Mahjoub	374	5	24.390	6.5	0.9	0.594	0.80	0.428
GB- 12	Salem	99	1	8.250	8.3	0.9	0.605	0.80	0.436
GB- 13	Sboui	72	1	4.240	5.9	0.9	0.670	0.80	0.482
GB- 14	Faycal	260	3	14.950	5.8	0.9	0.634	0.80	0.456
GB- 15	M'ziraa Ghannouch	280	2	18.330	6.5	0.9	0.674	0.80	0.485
GB- 16	Methouia	268	3	14.080	5.3	0.9	0.628	0.80	0.452
GB- 17	Ouedhref	263	3	13.910	5.3	0.9	0.506	0.80	0.364
GB- 18	Aouinette	232	2	17.940	7.7	0.9	0.641	0.80	0.462
GB- 19	Chenchou 1	57	1	4.000	7.0	0.9	0.560	0.80	0.403
GB- 20	Chenchou 2	40	1	3.970	9.9	0.9	0.667	0.85	0.510
GB- 21	Tekouri	32	1	1.700	5.3	0.9	0.599	0.80	0.431
GB- 22	Hamma Oasis	400	5	19.440	4.9	0.9	0.614	0.80	0.442
GB- 23	Mziraa Hamma	80	2	6.660	8.3	0.9	0.660	0.80	0.475
GB- 24	Bechima 1	280	2	15.420	5.5	0.9	0.690	0.80	0.497
GB- 25	Bechima 2	290	1	16.050	5.5	0.9	0.560	0.80	0.403
GB- 26	Khebayet	96	1	6.660	6.9	0.9	0.720	0.80	0.518
GB- 27	Ben Ghilouf	180	2	10.330	5.7	0.9	0.774	0.80	0.557
GB- 28	Glib Dokhane	70	1	5.420	7.7	0.9	0.680	0.80	0.490
GB- 29	Oued Nekhla	30	1	2.420	8.1	0.9	0.690	0.80	0.497
GB- 30	Arram	163	1	11.210	6.9	0.9	0.680	0.80	0.490
GB- 31	Mareth 1	100	2	5.920	5.9	0.9	0.614	0.80	0.442
GB- 32	Mareth 2	180	2	9.290	5.2	0.9	0.560	0.80	0.403
GB- 33	Mareth 3	30	1	2.250	7.5	0.9	0.750	0.80	0.540
GB- 34	Mareth 5	115	1	6.620	5.8	0.9	0.407	0.80	0.293
GB- 35	Mareth 6	88	1	5.000	5.7	0.9	0.560	0.80	0.403
GB- 36	Zarat 2	174	1	6.040	3.5	0.9	0.650	0.80	0.468
GB- 37	Zerkine 1 et 3	116	1	6.480	5.6	0.9	0.700	0.80	0.504
GB- 38	Zerkine 2	156	1	6.240	4.0	0.9	0.596	0.80	0.429
GB- 39	Ayoune Zerkine	30	1	2.490	8.3	0.9	0.596	0.80	0.429
GB- 40	Hadssia(*)	58	1	3.380	5.8	0.9	0.935	0.80	0.673
GB- 41	Kettana 1	98	1	7.000	7.1	0.9	0.416	0.80	0.300
GB- 42	Kettana 3	140	2	8.420	6.0	0.9	0.614	0.80	0.442
GB- 43	Kettana 4	125	1	6.610	5.3	0.9	0.497	0.80	0.358
GB- 44	Sidi Sellam	120	1	6.870	5.7	0.9	0.690	0.80	0.497
GB- 45	Zrig Barrania	71	1	4.760	6.7	0.9	0.632	0.80	0.455
GB- 46	Ghandri	30	1	3.300	11.0	0.9	0.650	0.80	0.468
GB- 47	Laaradh 1	35	1	2.320	6.6	0.9	0.650	0.80	0.468
GB- 48	Laaradh 3	55	1	2.380	4.3	0.9	0.750	0.80	0.540
	Total/Average	7,133	81	447.670	6.3	0.9	0.633	0.80	0.457

Table H.1.2.2 Irrigation efficiencies with Project

(1) Gafsa Governorate

Cord No.	Name of Oasis	Planned Area(ha)	No. of Sample	Sample Area(ha)	Sample A./ Planned A.	Irrigation Efficiency			Total Effici.
						Main	Secondary	Applica.	
GF- 1	Kasba	698	4	46.320	6.6	0.9	0.935	0.80	0.673
GF- 2	Sud Ouest	703	3	41.750	5.9	0.9	0.935	0.80	0.673
GF- 3	El Guettar	450	1	46.400	10.3	0.9	0.935	0.80	0.673
GF- 4	Lalla	700	4	46.030	6.6	0.9	0.935	0.80	0.673
GF- 5	El Ksar	578	3	44.620	7.7	0.9	0.935	0.80	0.673
GF- 6	Oued Shili	56	1	4.620	8.3	0.9	0.920	0.85	0.704
GF- 7	Thelja	65	1	2.560	3.9	0.9	0.920	0.85	0.704
GF- 8	Segdoud	217	2	15.360	7.1	0.9	0.920	0.85	0.704
	Total/Average	3,467	19	247.660	7.1	0.9	0.929	0.82	0.685

(2) Tozeur Governorate

Cord No.	Name of Oasis	Planned Area(ha)	No. of Sample	Sample Area(ha)	Sample A./ Planned A.	Irrigation Efficiency			Total Effici.
						Main	Secondary	Applica.	
TZ- 1	Tozeur	929	5	24.390	2.6	0.9	0.935	0.80	0.673
TZ- 2	Kastilia	50	1	3.200	6.4	0.9	0.935	0.80	0.673
TZ- 3	Oued El Koucha	62	1	4.000	6.5	0.9	0.935	0.80	0.673
TZ- 4	Neflayette	72	1	5.400	7.5	0.9	0.935	0.80	0.673
TZ- 5	Chemsa	90	1	5.920	6.6	0.9	0.935	0.80	0.673
TZ- 6	Helba Est	75	1	4.950	6.6	0.9	0.935	0.80	0.673
TZ- 7	Helba Ouest	50	1	4.095	8.2	0.9	0.935	0.80	0.673
TZ- 8	Jhim 1	40	1	8.000	20.0	0.9	0.935	0.80	0.673
TZ- 9	Jhim 2	167	1	6.000	3.6	0.9	0.935	0.80	0.673
TZ- 10	Ibn Chabbat 3 (*)	325	1	9.600	3.0	0.9	0.960	0.85	0.734
TZ- 11	Nefta	852	4	26.388	3.1	0.9	0.935	0.80	0.673
TZ- 12	Ghardgaya	40	1	4.725	11.8	0.9	0.935	0.80	0.673
TZ- 13	Ibn Chabbat 1 (*)	240	1	6.810	2.8	0.9	0.960	0.85	0.734
TZ- 14	Ibn Chabbat 2 (*)	272	1	7.470	2.7	0.9	0.960	0.85	0.734
TZ- 15	Draa Sud	198	2	10.850	5.5	0.9	0.920	0.85	0.704
TZ- 16	Hazoua 1	72	2	6.645	9.2	0.9	0.935	0.80	0.673
TZ- 17	Hazoua 2	48	2	4.030	8.4	0.9	0.920	0.85	0.704
TZ- 18	Hazoua 3	238	4	19.346	8.1	0.9	0.920	0.85	0.704
TZ- 19	Oued Loghrissi	78	1	4.100	5.3	0.9	0.935	0.80	0.673
TZ- 20	Tazrarit	48	1	4.340	9.0	0.9	0.935	0.80	0.673
TZ- 21	Cedada	55	1	4.250	7.7	0.9	0.935	0.80	0.673
TZ- 22	Dghoumes	104	2	6.320	6.1	0.9	0.935	0.80	0.673
TZ- 23	Degache	822	3	26.500	3.2	0.9	0.935	0.80	0.673
TZ- 24	Chakmou	90	1	7.700	8.6	0.9	0.935	0.80	0.673
TZ- 25	El Hamma	400	2	9.900	2.5	0.9	0.935	0.80	0.673
TZ- 26	Tamerza	80	1	6.680	8.4	0.9	0.935	0.80	0.673
TZ- 27	Chebika	23	1	1.380	6.0	0.9	0.935	0.80	0.673
TZ- 28	Foum El Khanga	48	1	1.380	2.9	0.9	0.935	0.80	0.673
TZ- 29	Mides	29	1	2.500	8.6	0.9	0.935	0.80	0.673
TZ- 30	Ain El Karma	25	1	1.910	7.6	0.9	0.935	0.80	0.673
	Total/Average	5,622	47	238.779	4.2	0.9	0.936	0.81	0.682

(3) Kebili Governorate

Cord No.	Name of Oasis	Planned Area(ha)	No. of Sample	Sample Area(ha)	Sample A./ Planned A.	Irrigation Efficiency			Total Effici.
						Main	Secondary	Applica.	
KB- 1	Bechri	162	1	4.480	2.8	0.9	0.935	0.80	0.673
KB- 2	Bouabdallah	270	2	16.510	6.1	0.9	0.935	0.80	0.673
KB- 3	Fatnassa	205	2	12.260	6.0	0.9	0.935	0.80	0.673
KB- 4	El Gliaa	94	1	6.550	7.0	0.9	0.935	0.80	0.673
KB- 5	Menchia	140	1	9.240	6.6	0.9	0.935	0.80	0.673
KB- 6	Nagga	181	2	9.940	5.5	0.9	0.935	0.80	0.673
KB- 7	Oum Somaa	162	1	10.010	6.2	0.9	0.935	0.80	0.673
KB- 8	Oued Zira	176	1	9.600	5.5	0.9	0.935	0.80	0.673
KB- 9	Ouled Touati	62	1	5.720	9.2	0.9	0.935	0.80	0.673
KB- 10	Tenchig	54	1	3.520	6.5	0.9	0.935	0.80	0.673
KB- 11	Zaouiet El Anes	125	1	5.060	4.0	0.9	0.935	0.80	0.673
KB- 12	Zaouiet El Harth	81	1	8.870	11.0	0.9	0.935	0.80	0.673
KB- 13	Ziret Louhichi	86	1	5.100	5.9	0.9	0.935	0.80	0.673
KB- 14	Chouchet Nagga	26	1	2.000	7.7	0.9	0.920	0.85	0.704
KB- 15	Guataya	150	2	9.540	6.4	0.9	0.935	0.80	0.673
KB- 16	Jedida	133	1	10.500	7.9	0.9	0.935	0.80	0.673
KB- 17	Mansoura	86	2	4.100	4.8	0.9	0.935	0.80	0.673
KB- 18	Rabta	162	2	9.470	5.8	0.9	0.935	0.80	0.673
KB- 19	Telmine	240	2	14.140	5.9	0.9	0.935	0.80	0.673
KB- 20	Tembib	118	1	7.070	6.0	0.9	0.935	0.80	0.673
KB- 21	Tombar	127	2	4.400	3.5	0.9	0.935	0.80	0.673
KB- 22	Limagues	57	1	3.270	5.7	0.9	0.935	0.80	0.673
KB- 23	Mazraa Neji	66	1	3.000	4.5	0.9	0.935	0.80	0.673
KB- 24	Oum El Farth let2	55	1	6.840	12.4	0.9	0.935	0.80	0.673
KB- 25	Stiftimi	82	1	3.600	4.4	0.9	0.935	0.80	0.673
KB- 26	Saidane	30	1	2.000	6.7	0.9	0.920	0.85	0.704
KB- 27	Barghouthia	52	1	6.230	12.0	0.9	0.935	0.80	0.673
KB- 28	Bazma	146	2	9.480	6.5	0.9	0.935	0.80	0.673
KB- 29	B'chelli	135	3	8.060	6.0	0.9	0.935	0.80	0.673
KB- 30	Blidette	75	1	4.530	6.0	0.9	0.935	0.80	0.673
KB- 31	Zarcine	70	1	5.500	7.9	0.9	0.935	0.80	0.673
KB- 32	Jemna	112	1	6.640	5.9	0.9	0.935	0.80	0.673
KB- 33	Ntouria	81	1	6.260	7.7	0.9	0.935	0.80	0.673
KB- 34	Msaid	95	1	6.106	6.4	0.9	0.935	0.80	0.673
KB- 35	Rahmat	85	1	4.310	5.1	0.9	0.935	0.80	0.673
KB- 36	Ras El Ain	268	2	15.010	5.6	0.9	0.935	0.80	0.673
KB- 37	Souk El Baiez	65	1	3.890	6.0	0.9	0.935	0.80	0.673
KB- 38	Ben Zitoun let2	147	2	7.390	5.0	0.9	0.935	0.80	0.673
KB- 39	Bourzine	94	2	6.440	6.9	0.9	0.935	0.80	0.673
KB- 40	Gueliada	103	1	6.960	6.8	0.9	0.935	0.80	0.673
KB- 41	Kelwamen	47	1	2.060	4.4	0.9	0.935	0.80	0.673
KB- 42	Klibia	92	1	5.050	5.5	0.9	0.935	0.80	0.673
KB- 43	Sidi Hamed	100	1	7.890	7.9	0.9	0.935	0.80	0.673
KB- 44	Atilet	220	3	16.100	7.3	0.9	0.920	0.85	0.704
KB- 45	Douz	280	3	14.830	5.3	0.9	0.935	0.80	0.673
KB- 46	El Ghoula (*)	75	1	4.710	6.3	0.9	0.968	0.80	0.697
KB- 47	El Golaa (*)	65	1	2.350	3.6	0.9	0.968	0.80	0.697
KB- 48	Grad (*)	111	1	6.980	6.3	0.9	0.968	0.80	0.697
KB- 49	El H'say	90	1	5.700	6.3	0.9	0.935	0.80	0.673
KB- 50	Nouiel	97	1	6.720	6.9	0.9	0.935	0.80	0.673
KB- 51	Zaafrane	101	1	4.620	4.6	0.9	0.935	0.80	0.673
KB- 52	Bouhamza	80	1	6.200	7.8	0.9	0.935	0.80	0.673
KB- 53	Ksar Ghilane	100	1	5.200	5.2	0.9	0.935	0.80	0.673
KB- 54	Sakkouma (*)	80	1	4.110	5.1	0.9	0.968	0.80	0.697
KB- 55	Tarfaya (*)	77	1	4.620	6.0	0.9	0.968	0.80	0.697
KB- 56	Dhomrana	45	1	2.200	4.9	0.9	0.920	0.85	0.704
KB- 57	Smida	64	1	4.700	7.3	0.9	0.920	0.85	0.704

KB- 58	Ghidma	80	1	4.580	5.7	0.9	0.935	0.80	0.673
KB- 59	Sabria	60	1	3.000	5.0	0.9	0.935	0.80	0.673
KB- 60	El Faouar 1	87	1	6.840	7.9	0.9	0.935	0.80	0.673
KB- 61	El Faouar 2	80	1	6.650	8.3	0.9	0.935	0.80	0.673
KB- 62	Bechni	100	2	8.630	8.6	0.9	0.920	0.85	0.704
KB- 63	Dargine (*)	72	1	4.730	6.6	0.9	0.960	0.85	0.734
KB- 64	Matrouha	100	1	4.000	4.0	0.9	0.935	0.80	0.673
KB- 65	Regim Maatoug 1	104	1	4.000	3.8	0.9	0.920	0.85	0.704
KB- 66	Regim Maatoug 2	96	1	6.000	6.3	0.9	0.920	0.85	0.704
KB- 67	Tarfayet Elma	52	1	2.050	3.9	0.9	0.920	0.85	0.704
	Total/Average	7,213	86	438.116	6.1	0.9	0.936	0.81	0.680

(4) Gabes Governorate

Cord No.	Name of Oasis	Planned Area(ha)	No. of Sample	Sample Area(ha)	Sample A./ Planned A.	Irrigation Efficiency			Total Effici.
						Main	Secondary	Applica.	
GB- 1	Ain Zrig	140	2	8.840	6.3	0.9	0.935	0.80	0.673
GB- 2	Temoula 1	40	1	3.220	8.1	0.9	0.935	0.80	0.673
GB- 3	Temoula 2	20	1	1.080	5.4	0.9	0.935	0.80	0.673
GB- 4	Zrig Dakhlania	30	1	2.230	7.4	0.9	0.935	0.80	0.673
GB- 5	Teboulbou	520	4	36.090	6.9	0.9	0.935	0.80	0.673
GB- 6	Oasis de Gabes	734	6	49.600	6.8	0.9	0.935	0.80	0.673
GB- 7	Limaoua 1 et 2	148	3	13.850	9.4	0.9	0.920	0.85	0.704
GB- 8	M'dou	40	1	4.070	10.2	0.9	0.935	0.80	0.673
GB- 9	Chott El Ferik	31	1	4.570	14.7	0.9	0.935	0.80	0.673
GB- 10	Bouchamma	143	1	9.380	6.6	0.9	0.935	0.80	0.673
GB- 11	Mahjoub	374	5	24.390	6.5	0.9	0.935	0.80	0.673
GB- 12	Salem	99	1	8.250	8.3	0.9	0.935	0.80	0.673
GB- 13	Sboui	72	1	4.240	5.9	0.9	0.935	0.80	0.673
GB- 14	Faycal	260	3	14.950	5.8	0.9	0.935	0.80	0.673
GB- 15	M'ziraa Ghannouch	280	2	18.330	6.5	0.9	0.935	0.80	0.673
GB- 16	Methouia	268	3	14.080	5.3	0.9	0.935	0.80	0.673
GB- 17	Ouedhref	263	3	13.910	5.3	0.9	0.935	0.80	0.673
GB- 18	Aouinette	232	2	17.940	7.7	0.9	0.935	0.80	0.673
GB- 19	Chenchou 1	57	1	4.000	7.0	0.9	0.935	0.80	0.673
GB- 20	Chenchou 2	40	1	3.970	9.9	0.9	0.920	0.85	0.704
GB- 21	Tekouri	32	1	1.700	5.3	0.9	0.935	0.80	0.673
GB- 22	Hamma Oasis	400	5	19.440	4.9	0.9	0.935	0.80	0.673
GB- 23	Mziraa Hamma	80	2	6.660	8.3	0.9	0.935	0.80	0.673
GB- 24	Bechima 1	280	2	15.420	5.5	0.9	0.935	0.80	0.673
GB- 25	Bechima 2	290	1	16.050	5.5	0.9	0.935	0.80	0.673
GB- 26	Khebayet	96	1	6.660	6.9	0.9	0.935	0.80	0.673
GB- 27	Ben Ghilouf	180	2	10.330	5.7	0.9	0.935	0.80	0.673
GB- 28	Glib Dokhane	70	1	5.420	7.7	0.9	0.935	0.80	0.673
GB- 29	Oued Nekhla	30	1	2.420	8.1	0.9	0.935	0.80	0.673
GB- 30	Arram	163	1	11.210	6.9	0.9	0.935	0.80	0.673
GB- 31	Mareth 1	100	2	5.920	5.9	0.9	0.935	0.80	0.673
GB- 32	Mareth 2	180	2	9.290	5.2	0.9	0.935	0.80	0.673
GB- 33	Mareth 3	30	1	2.250	7.5	0.9	0.935	0.80	0.673
GB- 34	Mareth 5	115	1	6.620	5.8	0.9	0.935	0.80	0.673
GB- 35	Mareth 6	88	1	5.000	5.7	0.9	0.935	0.80	0.673
GB- 36	Zarat 2	174	1	6.040	3.5	0.9	0.935	0.80	0.673
GB- 37	Zerkine 1 et 3	116	1	6.480	5.6	0.9	0.935	0.80	0.673
GB- 38	Zerkine 2	156	1	6.240	4.0	0.9	0.935	0.80	0.673
GB- 39	Ayoune Zerkine	30	1	2.490	8.3	0.9	0.935	0.80	0.673
GB- 40	Madssia (*)	58	1	3.380	5.8	0.9	0.968	0.80	0.697
GB- 41	Kettana 1	98	1	7.000	7.1	0.9	0.935	0.80	0.673
GB- 42	Kettana 3	140	2	8.420	6.0	0.9	0.935	0.80	0.673
GB- 43	Kettana 4	125	1	6.610	5.3	0.9	0.935	0.80	0.673
GB- 44	Sidi Sellam	120	1	6.870	5.7	0.9	0.935	0.80	0.673
GB- 45	Zrig Barrania	71	1	4.760	6.7	0.9	0.935	0.80	0.673
GB- 46	Ghandri	30	1	3.300	11.0	0.9	0.935	0.80	0.673
GB- 47	Laaradh 1	35	1	2.320	6.6	0.9	0.935	0.80	0.673
GB- 48	Laaradh 3	55	1	2.380	4.3	0.9	0.935	0.80	0.673
	Total/Average	7,133	81	447.670	6.3	0.9	0.935	0.80	0.675

Table H.1.2.3 Velocity and hydraulic gradient of PVC pipe

ϕ	Area	Velocity(m/sec) and Hydraulic Gradient (I)									
		Q=40 l/s		Q=30 l/s		Q=26 l/s		Q=20 l/s		Q=18 l/s	
(mm)	(m2)	V(m/sec)	I	V(m/sec)	I	V(m/sec)	I	V(m/sec)	I	V(m/sec)	I
75	0.00442	9.06	1	6.79	2	5.89	2	4.53	4	4.08	5
90	0.00636	6.29	3	4.72	5	4.09	6	3.15	10	2.83	12
110	0.00950	4.21	7	3.16	12	2.74	16	2.11	26	1.90	32
125	0.01227	3.26	13	2.45	23	2.12	30	1.63	49	1.47	59
140	0.01539	2.60	23	1.95	40	1.69	52	1.30	85	1.17	103
160	0.02010	1.99	51	1.49	87	1.29	113	1.00	184	0.90	224
200	0.03140	1.27	151	0.96	258	0.83	336	0.64	545	0.57	663
250	0.04906	0.82	448	0.61	764	0.53	995	0.41	1617	0.37	1965
315	0.07789	0.51	1382	0.39	2353	0.33	3067	0.26	4983	0.23	6055
400	0.12560	0.32	4424	0.24	7533	0.21	9816	0.16	15949	0.14	19381

Table H.1.2.4 Hydraulic calculation for irrigation canal

DESIGN DISCHARGE Q= .040 (M**3/S)
COEFFICIENT OF ROUGHNESS N= .015

WIDTH B (M)	HEIGHT H (M)	SLOPE I	DEPTH D (M)	AREA A (M**2)	WETTED PERIMETER P (M)	VELOCITY V (M/S)	VELOCITY HEAD HV (M)	FREE BOAD FB (M)	ALLOWABLE VELOCITY 2/3VC (M/S)	REMARK
.10	1.00	1/ 300	.798	.080	1.696	.502	.013	.202	1.050	
.15	.55	1/ 300	.434	.065	1.018	.616	.019	.116	.916	
.20	.35	1/ 300	.294	.059	.788	.682	.024	.056	.833	
.25	.30	1/ 300	.224	.056	.698	.716	.026	.076	.773	
.30	.25	1/ 300	.183	.055	.666	.729	.027	.067	.729	V CHECK
.35	.20	1/ 300	.157	.055	.664	.731	.027	.043	.686	V CHECK
.40	.20	1/ 300	.139	.056	.678	.727	.027	.061	.660	V CHECK

DESIGN DISCHARGE Q= .030 (M**3/S)
COEFFICIENT OF ROUGHNESS N= .015

WIDTH B (M)	HEIGHT H (M)	SLOPE I	DEPTH D (M)	AREA A (M**2)	WETTED PERIMETER P (M)	VELOCITY V (M/S)	VELOCITY HEAD HV (M)	FREE BOAD FB (M)	ALLOWABLE VELOCITY 2/3VC (M/S)	REMARK
.10	.75	1/ 300	.606	.061	1.312	.495	.013	.144	.952	
.15	.40	1/ 300	.335	.050	.820	.598	.018	.065	.833	
.20	.30	1/ 300	.231	.046	.662	.652	.022	.069	.758	
.25	.25	1/ 300	.178	.044	.606	.675	.023	.072	.702	
.30	.20	1/ 300	.148	.044	.596	.681	.024	.052	.660	V CHECK

DESIGN DISCHARGE Q= .026 (M**3/S)
COEFFICIENT OF ROUGHNESS N= .015

WIDTH B (M)	HEIGHT H (M)	SLOPE I	DEPTH D (M)	AREA A (M**2)	WETTED PERIMETER P (M)	VELOCITY V (M/S)	VELOCITY HEAD HV (M)	FREE BOAD FB (M)	ALLOWABLE VELOCITY 2/3VC (M/S)	REMARK
.10	.65	1/ 300	.529	.053	1.158	.492	.012	.121	.908	
.15	.35	1/ 300	.295	.044	.740	.589	.018	.055	.791	
.20	.25	1/ 300	.205	.041	.610	.636	.021	.045	.722	
.25	.20	1/ 300	.160	.040	.570	.655	.022	.040	.667	

DESIGN DISCHARGE Q= .020 (M**3/S)
COEFFICIENT OF ROUGHNESS N= .015

WIDTH B (M)	HEIGHT H (M)	SLOPE I	DEPTH D (M)	AREA A (M**2)	WETTED PERIMETER P (M)	VELOCITY V (M/S)	VELOCITY HEAD HV (M)	FREE BOAD FB (M)	ALLOWABLE VELOCITY 2/3VC (M/S)	REMARK
.10	.50	1/ 300	.414	.041	.928	.484	.012	.086	.833	
.15	.30	1/ 300	.235	.035	.620	.569	.017	.065	.729	
.20	.20	1/ 300	.166	.033	.532	.606	.019	.034	.660	

Table H.1.3.1 Relation between leaching water requirements and irrigation water loss

Governorate	Name of Oasis	Conductivity of Irr. Water (mmhos/cm)	Ratio of Leaching Water Requirements				Ratio of Irrigation Water Loss after Hydrant				
			Date palm	Fig,Olive, Pomegranate	Alfalfa	Tomato	Irrigation Efficiency				
							Secondary ①	Applica. ②	Efficiency ③=①*②	Water Loss ④=1.0-③	Ratio= Loss/Net W.Req ⑤=④/③
Gafsa	Kasba	1.7	0.05	0.10	0.11	0.11	0.935	0.800	0.748	0.252	0.34
	Oued Shili	4.8	0.16	0.34	0.39	0.38	0.920	0.850	0.782	0.218	0.28
Tozeur	Tozeur	2.4	0.08	0.14	0.16	0.16	0.935	0.800	0.748	0.252	0.34
	Draa Sud	2.9	0.09	0.18	0.21	0.20	0.960	0.850	0.816	0.184	0.23
Kebili	Mansoura	3.3	0.11	0.21	0.24	0.23	0.935	0.800	0.748	0.252	0.34
	Atilet	3.7	0.12	0.24	0.28	0.27	0.920	0.850	0.782	0.218	0.28
Gabes	Oasis de Gabes	3.3	0.11	0.21	0.24	0.23	0.935	0.800	0.748	0.252	0.34
	Limaoua 1 et 2	3.5	0.11	0.23	0.26	0.25	0.920	0.850	0.782	0.218	0.28

Note : Conductivity of irrigation water is based on water quality test

Table H.2.2.1 List of unit cost for direct cost estimates

Item	Unit	Cost(TD)	Note
PVC ϕ140	m	5.31	H=1.0m
PVC ϕ160	m	6.72	H=1.0m
PVC ϕ200	m	10.40	H=1.0m
Turn-out	pcs	180.00	
Concrete 30x30	m	13.69	Gafsa
Concrete 30x25	m	12.60	
Concrete 25x25	m	11.70	
Concrete 25x20	m	10.80	
Concrete 20x20	m	9.00	
Turn-out	pcs	18.00	
Amenity Canal	m	12.00	
Field Drain	m	10.80	ϕ58/65
Open Drain	m	36.00	4.5～7.2(DT/m3)

Table H.2.2.2 Construction cost of irrigation and drainage facilities

(1) Gafsa Governorate

Cord No.	Name of Oasis	Planned Area(ha)	No. of Sample	Sample Area(ha)	Planned A./Sample A.	Improved Channel Length(m)	Improved Channel Turn-out	Pipeline Length(m)	Pipeline Turn-out	Drains(m) Field	Drains(m) Collector	Irrigation (D/ha)	Drains (D/ha)	Total Cost(D/ha)	Total Cost(000'D)
GF- 1	Kasba	698	4	46.320	15.1	5230	162			-	-	1384	0	1384	966
GF- 2	Sud Ouest	703	3	41.750	16.8	6275	148			-	-	1822	0	1822	1281
GF- 3	El Guettar	450	1	46.400	9.7	8200	250			-	-	2324	0	2324	1046
GF- 4	Lalla	700	4	46.030	15.2	6815	174			-	-	1800	0	1800	1260
GF- 5	El Ksar	578	3	44.620	13.0	5520	164			-	-	1514	0	1514	875
GF- 6	Oued Shili	56	1	4.620	12.1			740	19	-	-	2405	0	2405	135
GF- 7	Thelja	65	1	2.560	25.4			330	9	235	150	1499	3101	4600	299
GF- 8	Segdoud	217	2	15.360	14.1	1900	50			1510	450	1172	2116	3288	713
	Total	3,467	19	247.660	14.0	33940	948	1070	28	1745	600	1740	652	2392	6575

(2) Tozeur Governorate

Cord No.	Name of Oasis	Planned Area(ha)	No. of Sample	Sample Area(ha)	Sample A./Planned A.	Improved Channel Length(m)	Improved Channel Turn-out	Pipeline Length(m)	Pipeline Turn-out	Drains(m) Field	Drains(m) Collector	Irrigation (D/ha)	Drains (D/ha)	Total Cost(D/ha)	Total Cost(000'D)
TZ- 1	Tozeur	929	5	24.390	38.1			4180	92	780	250	1831	714	2545	2363
TZ- 2	Kastilia	50	1	3.200	15.6			480	12	-	-	2234	0	2234	112
TZ- 3	Oued El Koucha	62	1	4.000	15.5	535	15			320	-	1753	864	2617	162
TZ- 4	Neflayette	72	1	5.400	13.3			965	20	225	-	1868	450	2318	167
TZ- 5	Chemsa	90	1	5.920	15.2			825	18	480	-	1484	876	2360	212
TZ- 6	Helba Est	75	1	4.950	15.2	1045	21			220	120	2736	1353	4089	307
TZ- 7	Helba Ouest	50	1	4.095	12.2	275	8			345	-	881	910	1791	90
TZ- 8	Jhim 1	40	1	8.000	5.0	855	26			525	255	1405	1856	3261	130
TZ- 9	Jhim 2	167	1	6.000	27.8	595	20			395	235	1220	2121	3341	558
TZ- 10	Ibn Chabbat 3(*)	325	1	9.600	33.9	1800	112			760	238	2404	1748	4152	1349
TZ- 11	Nefta	852	4	26.388	32.3	3190	91			525	330	1368	665	2033	1732
TZ- 12	Ghardgaya	40	1	4.725	8.5	775	16			200	110	2128	1295	3423	137
TZ- 13	Ibn Chabbat 1 (*)	240	1	6.810	35.2	190	54			200	300	469	1903	2372	569
TZ- 14	Ibn Chabbat 2 (*)	272	1	7.470	36.4	1170	77			185	305	2018	1737	3755	1021
TZ- 15	Draa Sud	198	2	10.800	18.3	140	34			0	0	173	0	173	34
TZ- 16	Hazoua 1	72	2	6.645	10.8	600	16	840	20	720	175	2491	2118	4609	332
TZ- 17	Hazoua 2	48	2	4.030	11.9			615	14	250	155	1436	2055	3491	168
TZ- 18	Hazoua 3	238	4	19.346	12.3	900	28	970	32	1570	633	1205	2054	3259	776
TZ- 19	Oued Loghrissi	78	1	4.100	19.0			540	16	200	200	1588	2283	3871	302

TZ- 20	Tazrarit	48	1	4.340	11.1	495	16			400	103	1503	1850	3353	161
TZ- 21	Cedada	55	1	4.250	12.9			780	15	350	145	2543	2118	4661	256
TZ- 22	Dghoumes	104	2	6.320	16.5	710	36			600	210	1316	2222	3538	368
TZ- 23	Degache	822	3	26.500	31.0			4080	92	1025	60	2225	499	2724	2239
TZ- 24	Chakmou	90	1	7.700	11.7			1460	32	-	-	2023	0	2023	182
TZ- 25	El Hamma	400	2	9.900	40.4	1020	38			660	75	1275	993	2268	907
TZ- 26	Tamerza	80	1	6.680	12.0	720	21			570	540	1415	3832	5247	420
TZ- 27	Chebika	23	1	1.380	16.7	225	6			150	-	2133	1174	3307	76
TZ- 28	Foum El Khanga	48	1	1.380	34.8	205	4			230	-	1924	1800	3724	179
TZ- 29	Mides	29	1	2.500	11.6	100	8			70	98	490	1714	2204	64
TZ- 30	Ain El Karma	25	1	1.910	13.1	150	7			230	85	1055	2903	3958	99
	Total	5,622	47	238.729	23.5	15695	654	15735	363	12185	4622	1620	1470	3090	15473

(3) Kebili Governorate

Cord No.	Name of Oasis	Planned Area(ha)	No. of Sample	Sample Area(ha)	Sample A./ Planned A.	Improved Channel Length(m)	Improved Channel Turn-out	Pipeline Length(m)	Pipeline Turn-out	Drains(m) Field	Drains(m) Collector	Irrigation (D/ha)	Drains (D/ha)	Total Cost(D/ha)	Total Cost(000'D)
KB- 1	Bechri	162	1	4.480	36.2	795	18			265	193	1989	2190	4179	677
KB- 2	Bouabdallah	270	2	16.510	16.4			2750	62	1040	320	1796	1378	3174	857
KB- 3	Fatnassa	205	2	12.260	16.7	1780	42			290	300	1368	1136	2504	513
KB- 4	El Gliaa	94	1	6.550	14.4			1130	25	545	225	1847	2135	3982	374
KB- 5	Menchia	140	1	9.240	15.2			1690	40	625	530	2009	2795	4804	673
KB- 6	Nagga	181	2	9.940	18.2			1580	33	555	-	1442	603	2045	370
KB- 7	Oum Somaa	162	1	10.010	16.2			1655	40	705	503	1831	2570	4401	713
KB- 8	Oued Zira	176	1	9.600	18.3			1740	35	440	75	1875	776	2651	467
KB- 9	Ouled Touati	62	1	5.720	10.8			1470	28	260	-	2609	491	3100	192
KB- 10	Tenchig	54	1	3.520	15.3			435	14	325	100	1372	2020	3392	183
KB- 11	Zaouiet El Anes	125	1	5.060	24.7			425	19	295	-	1122	630	1752	219
KB- 12	Zaouiet El Harth	81	1	8.870	9.1			1630	35	735	203	1686	1719	3405	276
KB- 13	Ziret Louhichi	86	1	5.100	16.9			955	19	400	-	1930	847	2777	239
KB- 14	Chouchet Nagga	26	1	2.000	13.0			300	8	200	-	1728	1080	2808	73
KB- 15	Guataya	150	2	9.540	15.7			1300	34	185	-	1365	209	1574	236
KB- 16	Jedida	133	1	10.500	12.7			2020	41	640	675	1724	2973	4697	625
KB- 17	Mansoura	86	2	4.100	21.0			1270	44	510	-	3577	1343	4920	423
KB- 18	Rabta	162	2	9.470	17.1			1750	36	660	295	1666	1874	3540	573
KB- 19	Telmine	240	2	14.140	17.0			2450	55	630	595	1865	1996	3861	927
KB- 20	Tembib	118	1	7.070	16.7			1180	26	410	-	1784	626	2410	284
KB- 21	Tombar	127	2	4.400	28.9			1020	24	570	-	2540	1399	3939	500
KB- 22	Limagues	57	1	3.270	17.4			660	14	225	-	2128	743	2871	164

KB- 23	Mazraa Neji	66	1	3.000	22.0			400	12	300	150	1616	2880	4496	297
KB- 24	Oum El Farth let2	55	1	6.840	8.0			450	11	200	-	732	316	1048	58
KB- 25	Stiftimi	82	1	3.600	22.8			505	10	-	-	1443	0	1443	118
KB- 26	Saidane	30	1	2.000	15.0			350	8	100	-	1897	540	2437	73
KB- 27	Barghouthia	52	1	6.230	8.3			825	20	300	-	1468	520	1988	103
KB- 28	Bazma	146	2	9.480	15.4			1320	36	915	-	1620	1042	2662	389
KB- 29	B'chelli	135	3	8.060	16.7			1525	48	610	-	2344	817	3161	427
KB- 30	Blidette	75	1	4.530	16.6			500	16	400	-	1222	954	2176	163
KB- 31	Zarcine	70	1	5.500	12.7			775	21	340	-	1436	668	2104	147
KB- 32	Jemna	112	1	6.640	16.9	260	5			150	-	436	244	680	76
KB- 33	Mtouria	81	1	6.260	12.9	630	21			310	-	966	535	1501	122
KB- 34	Msaid	95	1	6.106	15.6			1040	23	520	-	1823	920	2743	261
KB- 35	Rahmat	85	1	4.310	19.7	750	16			400	-	1913	1002	2915	248
KB- 36	Ras El Ain	268	2	15.010	17.9			2800	60	1205	-	1974	867	2841	761
KB- 37	Souk El Baiez	65	1	3.890	16.7			475	13	360	-	1422	999	2421	157
KB- 38	Ben Zitoun let2	147	2	7.390	19.9	850	23			530	75	1505	1140	2645	389
KB- 39	Bourzine	94	2	6.440	14.6			845	22	200	105	1497	922	2419	227
KB- 40	Gueliada	103	1	6.960	14.8			800	24	400	-	1393	621	2014	207
KB- 41	Kelwamen	47	1	2.060	22.8			430	10	130	80	1982	2080	4062	191
KB- 42	Klibia	92	1	5.050	18.2			700	16	400	-	1502	855	2357	217
KB- 43	Sidi Hamed	100	1	7.890	12.7			600	24	615	-	1059	842	1901	190
KB- 44	Atilet	220	3	16.100	13.7			3280	101	1220	-	2499	818	3317	730
KB- 45	Douz	280	3	14.830	18.9			1290	52	805	185	1216	1035	2251	630
KB- 46	El Ghoula (*)	75	1	4.710	15.9			750	57	-	-	3249	0	3249	244
KB- 47	El Golaa (*)	65	1	2.350	27.7			215	12	105	100	1534	2014	3548	231
KB- 48	Grad (*)	111	1	6.980	15.9			1230	87	620	220	3428	2094	5522	613
KB- 49	El H'say	90	1	5.700	15.8			450	18	-	-	1099	0	1099	99
KB- 50	Nouiel	97	1	6.720	14.4			980	20	280	55	1516	745	2261	219
KB- 51	Zaafrane	101	1	4.620	21.9			240	14	-	-	895	0	895	90
KB- 52	Bouhamza	80	1	6.200	12.9			865	22	310	155	1577	1440	3017	241
KB- 53	Ksar Ghilane	100	1	5.200	19.2	550	16			400	255	1198	2596	3794	379
KB- 54	Sakkouma (*)	80	1	4.110	19.5			725	42	200	150	3025	1839	4864	389
KB- 55	Tarfaya (*)	77	1	4.620	16.7			690	32	430	0	2251	1005	3256	251
KB- 56	Dhomrana	45	1	2.200	20.5			200	6	200	100	974	2618	3592	162
KB- 57	Smida	64	1	4.700	13.6			535	16	200	105	1378	1264	2642	169
KB- 58	Ghidma	80	1	4.580	17.5	275	16			400	-	711	943	1654	132
KB- 59	Sabria	60	1	3.000	20.0			400	11	300	155	1556	2940	4496	270
KB- 60	El Faouar 1	87	1	6.840	12.7			705	21	440	220	1100	1853	2953	257
KB- 61	El Faouar 2	80	1	6.650	12.0			1310	36	510	-	2020	828	2848	228

KB- 62	Bechni	100	2	8.630	11.6	975	30			390	160	1283	1156	2439	244
KB- 63	Dargine (*)	72	1	4.730	15.2			1090	64	300	-	3659	685	4344	313
KB- 64	Matrouha	100	1	4.000	25.0			495	16	400	100	1377	1980	3357	336
KB- 65	Regim Maatoug 1	104	1	4.000	26.0			625	16	400	105	1550	2025	3575	372
KB- 66	Regim Maatoug 2	96	1	6.000	16.0			790	24	600	-	1419	1080	2499	240
KB- 67	Tarfayet Elma	52	1	2.050	25.4			150	7	200	50	1107	1932	3039	158
	Total	7,213	86	438.116	16.5	6865	187	58765	1680	27605	6539	1703	1242	2945	21376

(4) Gabes Governorate

Cord No.	Name of Oasis	Planned Area(ha)	No. of Sample	Sample Area(ha)	Sample A./ Planned A.	Improved Channel Length(m)	Improved Channel Turn-out	Pipeline Length(m)	Pipeline Turn-out	Drains(m) Field	Drains(m) Collector	Irrigation (D/ha)	Drains (D/ha)	Total Cost(D/ha)	Total Cost(000'D)
GB- 1	Ain Zrig	140	2	8.840	15.8	635	31	200	11	420	-	1054	513	1567	219
GB- 2	Temoula 1	40	1	3.220	12.4	315	12			260	25	948	1152	2100	84
GB- 3	Temoula 2	20	1	1.080	18.5			125	6	100	65	1615	3167	4782	96
GB- 4	Zrig Dakhlania	30	1	2.230	13.5			350	11	140	50	1943	1485	3428	103
GB- 5	Teboulbou	520	4	36.090	14.4	4855	115	1540	33	2700	705	1962	1511	3473	1806
GB- 6	Oasis de Gabes	734	6	49.600	14.8	5585	192			2740	248	1286	777	2063	1514
GB- 7	Limaoua 1 et 2	148	3	13.850	10.7			2370	67	920	320	2021	1549	3570	528
GB- 8	M'dou	40	1	4.070	9.8	580	13			355	175	1853	2490	4343	174
GB- 9	Chott El Ferik	31	1	4.570	6.8	480	17			95	-	1012	225	1237	38
GB- 10	Bouchamma	143	1	9.380	15.2			740	21	415	-	822	478	1300	186
GB- 11	Mahjoub	374	5	24.390	15.3	1705	52	2090	50	1885	115	1801	1004	2805	1049
GB- 12	Salem	99	1	8.250	12.0			1330	33	605	-	2396	792	3188	316
GB- 13	Sboui	72	1	4.240	17.0			765	17	345	135	1935	2025	3960	285
GB- 14	Faycal	260	3	14.950	17.4	1610	38	695	16	1280	320	1454	1695	3149	819
GB- 15	M'ziraa Ghannouch	280	2	18.330	15.3	1370	35	2130	45	1475	613	2065	2073	4138	1159
GB- 16	Methouia	268	3	14.080	19.0	1155	28	965	20	1010	-	1638	775	2413	647
GB- 17	Ouedhref	263	3	13.910	18.9	1165	28	1290	28	1190	168	1927	1359	3286	864
GB- 18	Aouinette	232	2	17.940	12.9	1745	38	1325	32	780	275	1627	1021	2648	614
GB- 19	Chenchou 1	57	1	4.000	14.3	545	15			380	100	1662	1926	3588	205
GB- 20	Chenchou 2	40	1	3.970	10.1			630	16	405	125	1792	2235	4027	161
GB- 21	Tekouri	32	1	1.700	18.8			425	11	180	68	2492	2584	5076	162
GB- 22	Hamma Oasis	400	5	19.440	20.6			2845	73	1345	358	1453	1410	2863	1145
GB- 23	Mziraa Hamma	80	2	6.660	12.0			1120	25	530	223	1569	2065	3634	291
GB- 24	Bechima 1	280	2	15.420	18.2	2130	72			1170	378	1327	1702	3029	848
GB- 25	Bechima 2	290	1	16.050	18.1	2135	74			1190	605	1280	2158	3438	997
GB- 26	Khebayet	96	1	6.660	14.4	450	16			400	-	895	649	1544	148
GB- 27	Ben Ghilouf	180	2	10.330	17.4	600	24			300	-	565	314	879	158

GB- 28	Glib Dokhane	70	1	5.420	12.9	900	25			-	-	1876	0	1876	131
GB- 29	Oued Nekhla	30	1	2.420	12.4	195	8			210	-	785	937	1722	52
GB- 30	Arram	163	1	11.210	14.5	1290	49			585	825	1321	3213	4534	739
GB- 31	Mareth 1	100	2	5.920	16.9	970	26			735	80	1996	1827	3823	382
GB- 32	Mareth 2	180	2	9.290	19.4	1635	45			935	263	1988	2106	4094	737
GB- 33	Mareth 3	30	1	2.250	13.3			355	8	95	113	1478	2264	3742	112
GB- 34	Mareth 5	115	1	6.620	17.4	1414	30			525	473	2773	3429	6202	713
GB- 35	Mareth 6	88	1	5.000	17.6	610	16			390	113	1156	1656	2812	247
GB- 36	Zarat 2	174	1	6.040	28.8	835	26			525	275	1571	2578	4149	722
GB- 37	Zerkine 1 et 3	116	1	6.480	17.9	425	24			605	-	657	1008	1665	193
GB- 38	Zerkine 2	156	1	6.240	25.0	1195	29			235	143	2152	1232	3384	528
GB- 39	Ayoune Zerkine	30	1	2.490	12.0			615	16	-	-	2468	0	2468	74
GB- 40	Madssia (*)	58	1	3.380	17.2	460	40			335	63	1438	1741	3179	184
GB- 41	Kettana 1	98	1	7.000	14.0			1230	26	615	173	1850	1839	3689	362
GB- 42	Kettana 3	140	2	8.420	16.6	1025	25			995	250	1149	2345	3494	489
GB- 43	Kettana 4	125	1	6.610	18.9	780	30			695	173	1144	2078	3222	403
GB- 44	Sidi Sellam	120	1	6.870	17.5	950	24			470	-	1556	739	2295	275
GB- 45	Zrig Barrania	71	1	4.760	14.9	670	22			400	-	1603	908	2511	178
GB- 46	Ghandri	30	1	3.300	9.1			550	13	215	95	1594	1740	3334	100
GB- 47	Laaradh 1	35	1	2.320	15.1			465	11	175	95	2201	2289	4490	157
GB- 48	Laaradh 3	55	1	2.380	23.1			340	9	430	0	1641	1951	3592	198
	Total	7,133	81	447.670	15.9	40414	1219	24490	598	31785	8205	1600	1563	3163	21594

Table H.2.2.3(1) Project cost

(Unit:000'D)

Item	1st Year	2nd Year	3rd Year	4th Year	5nd Year	6nd Year	Total
(1)Direct Cost (irr. and drain. facilities)	0	11,416	18,661	19,946	11,578	3,417	65,018
(2)Land Acquisition and Compensation	212	367	355	232	86	0	1,254
(3)Administration (1.5% of (1))	0	158	283	297	177	61	975
(4)Engineering Services	640	1,480	1,534	1,264	709	244	5,871
(5)Physical Contingency (10% of (1)+(2)+(3)+(4))	85	1,342	2,083	2,173	1,254	372	7,309
(6)Price Contingency(4%) (4% of (1)+(2)+(3)+(4)+(5))	37	1,204	2,861	4,061	2,990	1,086	12,239
Total	974	15,967	25,777	27,973	16,794	5,180	92,666

Table H.2.2.3(2) Economic cost

(Unit:000'D)

Item	1st Year	2nd Year	3rd Year	4th Year	5nd Year	6nd Year	Total
(1)Direct Cost (irr. and drain. facilities)	0	10,409	16,357	16,798	9,353	2,640	55,557
(2)Land Acquisition and Compensation	0	0	0	0	0	0	0
(3)Administration (1.5% of (1))	0	156	245	252	140	40	833
(4)Engineering Services	622	1,480	1,534	1,264	709	244	5,853
(5)Physical Contingency (10% of (1)+(2)+(3)+(4))	62	1,204	1,813	1,831	1,020	292	6,222
(6)Price Contingency(4%) (4% of (1)+(2)+(3)+(4)+(5))	27	1,081	2,490	3,421	2,431	853	10,303
Total	711	14,330	22,439	23,566	13,653	4,069	78,768

Table H.2.2.4 Engineering service and manning schedule

	M/M	1st Year		2nd		3rd	4th	5th	6th
(J)Team Leader	12	6			6				
(J)Eng.	72		12		12	12	12	12	12
(L)Eng.(Gafsa)	60				12	12	12	12	12
(L)Eng.	60				12	12	12	12	12
(L)Eng.(Tozeur)	60				12	12	12	12	12
(L)Eng.	60				12	12	12	12	12
(L)Eng.(Kebili)	60				12	12	12	12	12
(L)Eng.	60				12	12	12	12	12
(L)Eng.(Gabes)	60				12	12	12	12	12
(L)Eng.	60				12	12	12	12	12
(L)Eng.(Spec,Tender,D/D)	100		100						

Table, H.2.3.1 OM cost of irrigation and drainage facilities

(1) Gafsa Governorate

Cord No.	Name of Oasis	Planned Area(ha)	OM cost('000 DT)			
			facilities	Staff	Equip. and materials	Total
GF- 1	Kasba	698	8.6	3.4	2.5	14.5
GF- 2	Sud Ouest	703	11.4	3.4	2.5	17.3
GF- 3	El Guettar	450	9.3	2.2	1.6	13.1
GF- 4	Lalla	700	11.2	3.4	2.5	17.1
GF- 5	El Ksar	578	7.8	2.8	2.1	12.6
GF- 6	Oued Shili	56	1.2	0.3	0.2	1.7
GF- 7	Thelja	65	2.7	0.3	0.2	3.2
GF- 8	Segdoud	217	6.3	1.1	0.8	8.2
	Total	3,467	58.4	16.8	12.3	87.6

(2) Tozeur Governorate

Cord No.	Name of Oasis	Planned Area(ha)	OM cost('000 DT)			
			facilities	Staff	Equip. and materials	Total
TZ- 1	Tozeur	929	21.0	5.1	3.4	29.5
TZ- 2	Kastilia	50	1.0	0.3	0.2	1.5
TZ- 3	Oued El Koucha	62	1.4	0.3	0.2	2.0
TZ- 4	Lafayette	72	1.5	0.4	0.3	2.1
TZ- 5	Chemsa	90	1.9	0.5	0.3	2.7
TZ- 6	Nefta Est	75	2.7	0.4	0.3	3.4
TZ- 7	Nefta Ouest	50	0.8	0.3	0.2	1.3
TZ- 8	Chott I	40	1.2	0.2	0.1	1.5
TZ- 9	Chott 2	167	5.0	0.9	0.6	6.5
TZ- 10	Ibn Chabbat 3(*)	325	12.0	1.8	1.2	15.0
TZ- 11	Nefta	852	15.4	4.7	3.1	23.2
TZ- 12	Ghardgaya	40	1.2	0.2	0.1	1.6
TZ- 13	Ibn Chabbat 1 (*)	240	5.1	1.3	0.9	7.3
TZ- 14	Ibn Chabbat 2 (*)	272	9.1	1.5	1.0	11.6
TZ- 15	Draa Sud	198	0.3	1.1	0.7	2.1
TZ- 16	Hazoua 1	72	3.0	0.4	0.3	3.6
TZ- 17	Hazoua 2	48	1.5	0.3	0.2	1.9
TZ- 18	Hazoua 3	238	6.9	1.3	0.9	9.1
TZ- 19	Oued Loghrissi	78	2.7	0.4	0.3	3.4
TZ- 20	Tazrarit	48	1.4	0.3	0.2	1.9
TZ- 21	Cedada	55	2.3	0.3	0.2	2.8
TZ- 22	Oghoumes	104	3.3	0.6	0.4	4.2
TZ- 23	Degache	822	19.9	4.5	3.0	27.4
TZ- 24	Chakoou	90	1.6	0.5	0.3	2.4
TZ- 25	El Hamma	400	8.1	2.2	1.5	11.7
TZ- 26	Tamerza	80	3.7	0.4	0.3	4.5
TZ- 27	Chebika	23	0.7	0.1	0.1	0.9
TZ- 28	Foum El Khanga	43	1.6	0.3	0.2	2.0
TZ- 29	Hides	29	0.6	0.2	0.1	0.8
TZ- 30	Ain El Karma	25	0.9	0.1	0.1	1.1
	Total	5,622	137.6	30.8	20.6	188.9

(3) Kebili Governorate

Cord No.	Name of Oasis	Planned Area(ha)	O/M cost('000 DT) facilities	Staff	Equip. and materials	Total
KB- 1	Bechri	162	6.0	0.8	0.7	7.5
KB- 2	Bouabdallah	270	7.6	1.4	1.2	10.1
KB- 3	Fatnassa	205	4.6	1.0	0.9	6.5
KB- 4	El Gliaa	94	3.3	0.5	0.4	4.2
KB- 5	Menchia	140	6.0	0.7	0.6	7.3
KB- 6	Nagga	181	3.3	0.9	0.8	5.0
KB- 7	Oum Somaa	162	6.3	0.8	0.7	7.9
KB- 8	Oued Zira	176	4.1	0.9	0.8	5.8
KB- 9	Ouled Touati	62	1.7	0.3	0.3	2.3
KB- 10	Tenchig	54	1.6	0.3	0.2	2.1
KB- 11	Zaouiet El Anes	125	1.9	0.6	0.5	3.1
KB- 12	Zaouiet El Harth	81	2.5	0.4	0.3	3.2
KB- 13	Ziret Louhichi	86	2.1	0.4	0.4	2.9
KB- 14	Chouchet Nagga	26	0.6	0.1	0.1	0.9
KB- 15	Guataya	150	2.1	0.8	0.6	3.5
KB- 16	Jedida	133	5.6	0.7	0.6	6.8
KB- 17	Mansoura	86	3.8	0.4	0.4	4.6
KB- 18	Rabia	162	5.1	0.8	0.7	6.6
KB- 19	Telmine	240	8.2	1.2	1.0	10.5
KB- 20	Tembib	118	2.5	0.6	0.5	3.6
KB- 21	Tombar	127	4.4	0.6	0.5	5.6
KB- 22	Limagues	57	1.5	0.3	0.2	2.0
KB- 23	Mazraa Neji	66	2.6	0.3	0.3	3.3
KB- 24	Oum El Farth let2	55	0.5	0.3	0.2	1.0
KB- 25	Stiftimi	82	1.1	0.4	0.4	1.8
KB- 26	Saidane	30	0.6	0.2	0.1	0.9
KB- 27	Barghouthia	52	0.9	0.3	0.2	1.4
KB- 28	Bazma	146	3.5	0.7	0.6	4.8
KB- 29	B'chelli	135	3.8	0.7	0.6	5.1
KB- 30	Blidette	75	1.5	0.4	0.3	2.2
KB- 31	Zarcine	70	1.3	0.4	0.3	2.0
KB- 32	Jenna	112	0.7	0.6	0.5	1.7
KB- 33	Ktouria	81	1.1	0.4	0.3	1.8
KB- 34	Msaid	95	2.3	0.5	0.4	3.2
KB- 35	Rahmat	85	2.2	0.4	0.4	3.0
KB- 36	Ras El Ain	268	6.8	1.4	1.1	9.3
KB- 37	Souk El Baiez	65	1.4	0.3	0.3	2.0
KB- 38	Ben Zitoun let2	147	3.5	0.7	0.6	4.8
KB- 39	Bourzine	94	2.0	0.5	0.4	2.9
KB- 40	Gueliada	103	1.8	0.5	0.4	2.8
KB- 41	Kelwamen	47	1.7	0.2	0.2	2.1
KB- 42	Klibia	92	1.9	0.5	0.4	2.8
KB- 43	Sidi Hamed	100	1.7	0.5	0.4	2.6
KB- 44	Atilet	220	6.5	1.1	0.9	8.5
KB- 45	Doua	280	5.6	1.4	1.2	8.2
KB- 46	El Ghoula (*)	75	2.2	0.4	0.3	2.9
KB- 47	El Golaa (*)	65	2.1	0.3	0.3	2.7
KB- 48	Grad (*)	111	5.4	0.6	0.5	6.5
KB- 49	El H'say	90	0.9	0.5	0.4	1.7
KB- 50	Kouiel	97	1.9	0.5	0.4	2.9
KB- 51	Zaafrane	101	0.8	0.5	0.4	1.7
KB- 52	Bouhamza	80	2.1	0.4	0.3	2.9
KB- 53	Ksar Ghilane	100	3.4	0.5	0.4	4.3
KB- 54	Sakkouma (*)	80	3.5	0.4	0.3	4.2
KB- 55	Tarfaya (*)	77	2.2	0.4	0.3	2.9
KB- 56	Dhomrana	45	1.4	0.2	0.2	1.9
KB- 57	Saida	64	1.5	0.3	0.3	2.1
KB- 58	Ghidma	80	1.2	0.4	0.3	1.9
KB- 59	Sabria	60	2.4	0.3	0.3	3.0
KB- 60	El Faouar 1	87	2.3	0.4	0.4	3.1
KB- 61	El Faouar 2	80	2.0	0.4	0.3	2.8
KB- 62	Bechni	100	2.2	0.5	0.4	3.1
KB- 63	Dargine (*)	72	2.8	0.4	0.3	3.5
KB- 64	Matrouha	100	3.0	0.5	0.4	3.9
KB- 65	Regim Maatoug 1	104	3.3	0.5	0.4	4.3
KB- 66	Regim Maatoug 2	96	2.1	0.5	0.4	3.0
KB- 67	Tarfayet Elma	52	1.4	0.3	0.2	1.9
	Total	7,213	190.0	36.6	30.9	257.5

(4) Gabes Governorate

Cord No.	Name of Oasis	Planned Area(ha)	O/M cost('000 DT)			
			Facilities	Staff	Equip. and materials	Total
GB- 1	Ain Zrig	140	1.9	0.8	0.6	3.4
GB- 2	Temoula 1	40	0.7	0.2	0.2	1.1
GB- 3	Temoula 2	20	0.9	0.1	0.1	1.1
GB- 4	Zrig Dakhlania	30	0.9	0.2	0.1	1.2
GB- 5	Teboulbou	520	16.1	3.0	2.3	21.3
GB- 6	Oasis de Gabes	734	13.5	4.2	3.2	20.8
GB- 7	Limaoua 1 et 2	148	4.7	0.8	0.6	6.2
GB- 8	M'dou	40	1.5	0.2	0.2	1.9
GB- 9	Chott El Ferik	31	0.3	0.2	0.1	0.7
GB- 10	Bouchamma	143	1.7	0.8	0.6	3.1
GB- 11	Mahjoub	374	9.3	2.1	1.6	13.1
GB- 12	Salem	99	2.8	0.6	0.4	3.8
GB- 13	Sboui	72	2.5	0.4	0.3	3.3
GB- 14	Faycal	260	7.3	1.5	1.1	9.9
GB- 15	K'ziraa Ghannouch	280	10.3	1.6	1.2	13.1
GB- 16	Methoula	268	5.7	1.5	1.2	8.4
GB- 17	Ouedhref	263	7.7	1.5	1.1	10.3
GB- 18	Kouinette	232	5.5	1.3	1.0	7.8
GB- 19	Chenchou 1	57	1.8	0.3	0.2	2.4
GB- 20	Chenchou 2	40	1.4	0.2	0.2	1.8
GB- 21	Tekouri	32	1.4	0.2	0.1	1.8
GB- 22	Hamma Oasis	400	10.2	2.3	1.7	14.2
GB- 23	Mziraa Hamma	80	2.6	0.5	0.3	3.4
GB- 24	Bechima 1	280	7.5	1.6	1.2	10.4
GB- 25	Bechima 2	290	8.9	1.7	1.3	11.8
GB- 26	Khebayet	96	1.3	0.5	0.4	2.3
GB- 27	Ben Ghilfouf	180	1.4	1.0	0.8	3.2
GB- 28	Glib Dokhane	70	1.2	0.4	0.3	1.9
GB- 29	Oued Nekhla	30	0.5	0.2	0.1	0.8
GB- 30	Arram	163	6.6	0.9	0.7	8.2
GB- 31	Mareth 1	100	3.4	0.6	0.4	4.4
GB- 32	Mareth 2	180	6.6	1.0	0.8	8.4
GB- 33	Mareth 3	30	1.0	0.2	0.1	1.3
GB- 34	Mareth 5	115	6.3	0.7	0.5	7.5
GB- 35	Mareth 6	88	2.2	0.5	0.4	3.1
GB- 36	Zarat 2	174	6.4	1.0	0.8	8.2
GB- 37	Zerkine 1 et 3	116	1.7	0.7	0.5	2.9
GB- 38	Zerkine 2	156	4.7	0.9	0.7	6.3
GB- 39	Ayoune Zerkine	30	0.7	0.2	0.1	1.0
GB- 40	Hadssia	58	1.6	0.3	0.3	2.2
GB- 41	Kettana 1	98	3.2	0.6	0.4	4.2
GB- 42	Kettana 3	140	4.3	0.8	0.6	5.8
GB- 43	Kettana 4	125	3.6	0.7	0.5	4.8
GB- 44	Sidi Sellam	120	2.4	0.7	0.5	3.7
GB- 45	Zrig Barrania	71	1.6	0.4	0.3	2.3
GB- 46	Chandri	30	0.9	0.2	0.1	1.2
GB- 47	Laaradh 1	35	1.4	0.2	0.2	1.7
GB- 48	Laaradh 3	55	1.8	0.3	0.2	2.3
	Total	7,133	191.9	40.8	30.9	263.6

Table H.3.3.1 (1) Construction Schedule

Code No.	Name of Oasis	Area	Project Cost	19 97	19 98	19 99	20 00	20 01	20 02
		(ha)	(D. /000)						
Gafsa Governorate									
GF - 1	Kasba	698	1,268	☆	●	●	●	●	
GF - 2	Sud Ouest	703	1,620		☆	●	●	●	●
GF - 3	El Guettar	450	1,287		☆	●	●	●	
GF - 4	Lalla	700	1,595		☆	●	●	●	●
GF - 5	El Ksar	578	1,133			☆	●	●	●
GF - 6	Oued Sbih	56	166			☆	●		
GF - 7	Thelja	65	350			☆	●		
GF - 8	Segdoud	213	853			☆	●	●	
	Sub-total (8)	3,467	8,272						
Tozeur Governorate									
TZ - 1	Tozeur	929	2,856	☆	●	●	●	●	●
TZ - 2	Kastilia	50	138	☆	●				
TZ - 3	Oued El Krocha	62	197	☆	●				
TZ - 4	Neffayetie	72	205	☆	●				
TZ - 5	Chemsa	90	261	☆	●				
TZ - 6	Helba Est	75	362	☆	●				
TZ - 7	Helba Ouest	50	135	☆	●				
TZ - 8	Jbim 1	40	156	☆	●				
TZ - 9	Jbim 2	167	667	☆	●	●			
TZ - 10	Ibn Chabbat 3	325	1,500	☆	●	●			
TZ - 11	Nefta	852	2,162		☆	●	●	●	●
TZ - 12	Ghardgaya	40	163		☆	●			
TZ - 13	Ibn Chabbat 1	240	700		☆	●	●		
TZ - 14	Ibn Chabbat 2	272	1,211		☆	●	●		
TZ - 15	Draa Sud	198	93		☆	●	●		
TZ - 16	Hazoua 1	72	389		☆	●			
TZ - 17	Hazoua 2	48	199		☆	●			
TZ - 18	Hazoua 3	238	928		☆	●	●	●	
TZ - 19	Oued Loghlesi	78	357		☆	●			
TZ - 20	Tozrarit	48	192			☆	●		
TZ - 21	Cedada	55	300			☆	●		
TZ - 22	Dghoumes	104	438			☆	●	●	
TZ - 23	Degache	822	2,318		☆	●	●	●	●
TZ - 24	Chakmou	90	227			☆	●		
TZ - 25	El Hafima	400	1,119			☆	●	●	●
TZ - 26	Tamerza	80	488			☆	●		
TZ - 27	Chebika	23	91			☆	●		
TZ - 28	Foum El Khanga	48	212			☆	●		
TZ - 29	Mides	29	79			☆	●		
TZ - 30	Ain El Karma	25	117			☆	●		
	Sub-total (30)	5,622	18,759						
Kebili Governorate									
KB - 1	Bechri	162	797	☆	●	●			
KB - 2	Bouabdallah	220	1,027	☆	●	●			
KB - 3	Fatnassa	205	628	☆	●	●			
KB - 4	El Gilaa	94	442	☆	●				
KB - 5	Menchia	140	786	☆	●				
KB - 6	Nagga	181	461	☆	●	●			
KB - 7	Oum Somaa	162	837	☆	●	●			
KB - 8	Oued Zira	176	567	☆	●	●			
KB - 9	Ouled Touati	62	231	☆	●				
KB - 10	Tendrig	54	219	☆	●				
KB - 11	Zaouiet El Anes	125	278	☆	●	●			
KB - 12	Zaouiet El Hardh	81	329	☆	●				
KB - 13	Ziret Louhichi	86	289	☆	●				
KB - 14	Chouchet Nagga	26	88	☆	●				
KB - 15	Gualaya	150	365	☆	●	●			
KB - 16	Jedida	333	731	☆	●	●			
KB - 17	Mansoura	86	494	☆	●				
KB - 18	Rabia	162	682	☆	●	●			
KB - 19	Telmine	240	1,097	☆	●	●			
KB - 20	Tembib	118	349	☆	●	●			
KB - 21	Tombar	127	591	☆	●	●			
KB - 22	Limagues	57	198	☆	●				
KB - 23	Mazraa Neji	66	248	☆	●				
KB - 24	Oum El Farth 1 et 2	55	79	☆	●				
KB - 25	Stiftimi	82	154	☆	●				
KB - 26	Saidane	30	89	☆	●				
KB - 27	Barghouthia	52	129	☆	●				
KB - 28	Bazma	146	473		☆	●	●		
KB - 29	Brahelli	135	512		☆	●	●		
KB - 30	Blidette	75	202		☆	●			
KB - 31	Zaroiae	70	184		☆	●			
KB - 32	Jemna	112	116		☆	●	●		
KB - 33	Mouzila	81	158		☆	●			
KB - 34	Mouid	95	316		☆	●			
KB - 35	Rahmat	85	299		☆	●			
KB - 36	Ras El Aia	268	921		☆	●	●	●	
KB - 37	Souk El Barca	65	193		☆	●			
KB - 38	Ben Zitoun 1 et 2	142	473		☆	●	●		
KB - 39	Beyrdoe	94	279		☆	●			

Code No.	Name of Oasis	Area	Project Cost	19 97	19 98	19 99	20 00	20 01	20 02
		(ha)	(D. /000)						
Kebili Governorate									
KB - 40	Gueliada	103	260		☆	●	●		
KB - 41	Kebanica	47	225		☆	●			
KB - 42	Klibia	92	261		☆	●			
KB - 43	Sidi Hamed	100	239		☆	●			
KB - 44	Atilet	230	872		☆	●	●		
KB - 45	Douz	280	278			☆	●	●	
KB - 46	El Ghoula	75	292			☆	●		
KB - 47	El Golaa	65	274			☆	●		
KB - 48	Grad	111	212			☆	●	●	
KB - 49	El H'say	90	135			☆	●		
KB - 50	Nouiet	97	274			☆	●		
KB - 51	Zaafrane	101	128			☆	●	●	
KB - 52	Bouhamza	80	290			☆	●		
KB - 53	Ksar Ghilane	100	450			☆	●	●	
KB - 54	Sakkouma	80	454			☆	●		
KB - 55	Tarfaya	72	300			☆	●		
KB - 56	Dhonrana	45	193			☆	●		
KB - 57	Smida	64	206			☆	●		
KB - 58	Ghidma	80	169				☆	●	
KB - 59	Sabria	60	317				☆	●	
KB - 60	El Faouar 1	87	309				☆	●	
KB - 61	El Faouar 2	80	275				☆	●	
KB - 62	Bechni	100	299				☆	●	
KB - 63	Dergine	72	368				☆	●	
KB - 64	Matrouha	100	401				☆	●	●
KB - 65	Regim Maatoug 1	104	442				☆	●	●
KB - 66	Regim Maatoug 2	96	294				☆	●	
KB - 67	Tarfayet Elma	52	190				☆	●	
	Sub-total (67)	7,213	25,761						
Gabes Governorate									
GB - 1	Ain Zrig	140	283	☆	●	●			
GB - 2	Temoula 1	40	104	☆	●				
GB - 3	Temoula 2	20	112	☆	●				
GB - 4	Zrig Dakhlania	30	122	☆	●				
GB - 5	Teboulbou	520	2,152	☆	●	●	●	●	
GB - 6	Oasis de Gabes	734	1,886	☆	●	●	●	●	●
GB - 7	Limaoua I et 2	148	628	☆	●				
GB - 8	M'dou	40	204	☆	●				
GB - 9	Chott El Ferik	31	52	☆	●				
GB - 10	Bouchamma	143	246	☆	●	●			
GB - 11	Mahjoub	374	1,270		☆	●	●		
GB - 12	Selem	99	379		☆	●			
GB - 13	Sboul	72	337		☆	●			
GB - 14	Fayed	260	982		☆	●	●		
GB - 15	Mzraa Ghanneuch	280	1,365		☆	●	●		
GB - 16	Metouia	268	794		☆	●	●		
GB - 17	Ouedhref	263	1,033		☆	●	●		
GB - 18	Aoujelte	232	748		☆	●	●		
GB - 19	Chenchou 1	57	243		☆	●			
GB - 20	Chenchou 2	40	190		☆	●			
GB - 21	Teloust	32	189		☆	●			
GB - 22	Hamma Oasis	400	1,383		☆	●	●	●	●
GB - 23	Mzraa Hamma	80	345		☆	●			
GB - 24	Bechima 1	280	1,020		☆	●	●		
GB - 25	Bechima 2	290	1,189		☆	●	●		
GB - 26	Khebayet	96	192		☆	●			
GB - 27	Ben Ghilouf	180	225		☆	●	●		
GB - 28	Ghb Dakhane	70	166		☆	●			
GB - 29	Oued Nekhla	30	65		☆	●			
GB - 30	Arram	163	866			☆	●	●	
GB - 31	Mareth 1	100	453			☆	●	●	
GB - 32	Mareth 2	180	869			☆	●	●	●
GB - 33	Mareth 3	30	133			☆	●		
GB - 34	Mareth 5	115	824			☆	●	●	
GB - 35	Mareth 6	88	299			☆	●		
GB - 36	Zarat 2	174	850			☆	●	●	
GB - 37	Zerkine I et 3	116	247			☆	●	●	
GB - 38	Zerkine 2	156	630			☆	●	●	
GB - 39	Aycune Zerkine	30	90			☆	●		
GB - 40	Madssia	58	221			☆	●		
GB - 41	Kettana 1	98	429			☆	●		
GB - 42	Kettana 3	140	583			☆	●	●	
GB - 43	Kettana 4	125	482			☆	●	●	
GB - 44	Sidi Seffam	120	339			☆	●	●	
GB - 45	Zrig Barrania	21	218			☆	●		
GB - 46	Ghandri	30	119			☆	●		
GB - 47	Lauzah 1	35	185				☆	●	
GB - 48	Lauzah 3	55	235				☆	●	
	Sub-total (48)	7,133	25,976						
	Total (153)	**23,435**	**78,768**						

Remarks : ☆ : Detailed Design Work
● : Construction Work

Table II.3.3.1 (2) Construction Schedule by Oasis

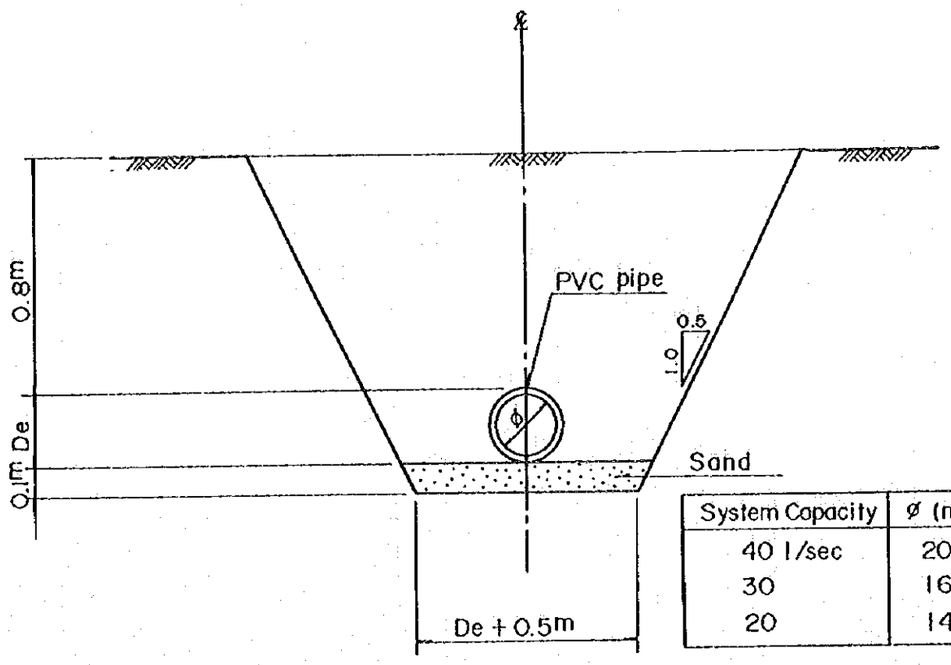
(Unit : ha)

Code No.	Name of Oasis	Area	19 97	19 98	19 99	20 00	20 01	20 02
		(ha)						
Gafsa Governorate								
GF - 1	Kasba	698		140	209	209	140	
GF - 2	Sud Ouest	203			143	210	210	140
GF - 3	El Guettar	450			135	180	135	
GF - 4	Lalla	700			140	210	210	140
GF - 5	El Ksar	578				178	230	170
GF - 6	Oued Shili	56				56		
GF - 7	Thelja	65				65		
GF - 8	Segdoud	217				108	109	
	Sub-total (8)	3,467	0	140	627	1,216	1,034	450
Tozeur Governorate								
TZ - 1	Tozeur	929		185	186	186	186	186
TZ - 2	Kastilia	50		50				
TZ - 3	Oued El Koucha	62		62				
TZ - 4	Neflayette	72		72				
TZ - 5	Chemsa	90		90				
TZ - 6	Helba Est	75		75				
TZ - 7	Helba Ouest	50		50				
TZ - 8	Jbim 1	40		40				
TZ - 9	Jbim 2	167		83	84			
TZ - 10	Ibn Chabbat 3	325		162	163			
TZ - 11	Nefta	852			170	256	256	170
TZ - 12	Ghardgaya	40			40			
TZ - 13	Ibn Chabbat 1	240			120	120		
TZ - 14	Ibn Chabbat 2	272			136	136		
TZ - 15	Draa Sud	198			99	99		
TZ - 16	Hazoua 1	72			72			
TZ - 17	Hazoua 2	48			48			
TZ - 18	Hazoua 3	238			73	95	70	
TZ - 19	Oued Leghrissi	78			78			
TZ - 20	Tozarit	48				48		
TZ - 21	Cedada	55				55		
TZ - 22	Dghoumes	104				52	52	
TZ - 23	Degache	822			164	247	247	164
TZ - 24	Chakmou	90				90		
TZ - 25	El Hamma	400				120	160	120
TZ - 26	Tamerza	80				80		
TZ - 27	Chebika	23				23		
TZ - 28	Foum El Khanga	48				48		
TZ - 29	Mides	29				29		
TZ - 30	Ain El Karma	25				25		
	Sub-total (30)	5,622	0	869	1,433	1,709	971	640
Kebili Governorate								
KB - 1	Bechri	162		81	81			
KB - 2	Bouabdallah	270		135	135			
KB - 3	Faouassa	205		103	102			
KB - 4	El Glaa	94		94				
KB - 5	Menchia	140		140				
KB - 6	Nagga	181		91	90			
KB - 7	Oum Somaa	162		81	81			
KB - 8	Oued Zira	176		88	88			
KB - 9	Ouled Touati	62		62				
KB - 10	Tenchig	54		54				
KB - 11	Zaouiet El Anes	125		63	62			
KB - 12	Zaouiet El Harth	81		81				
KB - 13	Zaret Louhichi	86		86				
KB - 14	Chouchet Nagga	26		26				
KB - 15	Guataya	150		75	75			
KB - 16	Jedida	133		67	66			
KB - 17	Mansoura	86		86				
KB - 18	Rabta	162		81	81			
KB - 19	Telmine	240		120	120			
KB - 20	Tembib	118		59	59			
KB - 21	Tombar	127		64	63			
KB - 22	Limagues	57		57				
KB - 23	Mazraa Neji	66		66				
KB - 24	Oum El Farth 1 et 2	55		55				
KB - 25	Stiftimi	82		82				
KB - 26	Saidane	30		30				
KB - 27	Barghoutbia	52		52				
KB - 28	Bazma	146			73	73		
KB - 29	B'chelli	135			68	67		
KB - 30	Blidette	75			75			
KB - 31	Zaroine	70			70			
KB - 32	Jemna	112			56	56		
KB - 33	Mouria	81			81			
KB - 34	Msaid	95			95			
KB - 35	Rahmat	85			85			
KB - 36	Ras El Ain	268			81	107	80	
KB - 37	Souk El Baica	65			65			
KB - 38	Ben Zitoun 1 et 2	147			74	73		
KB - 39	Bourzine	94			94			

Code No.	Name of Oasis	Area	19 97	19 98	19 99	20 00	20 01	20 02
		(ha)						
Kebili Governorate								
KB - 40	Guelida	103			51	52		
KB - 41	Kelwamen	47			47			
KB - 42	Khbia	92			92			
KB - 43	Sidi Hamed	100			100			
KB - 44	Adlet	220			110	110		
KB - 45	Douz	280				140	140	
KB - 46	El Ghoula	75				75		
KB - 47	El Golaa	65				65		
KB - 48	Grad	111				56	55	
KB - 49	El H'say	90				90		
KB - 50	Nouiel	97				97		
KB - 51	Zaafrane	101				51	50	
KB - 52	Bouhamza	80				80		
KB - 53	Ksar Ghilane	100				50	50	
KB - 54	Sakkouma	80				80		
KB - 55	Tarfaya	77				77		
KB - 56	Dhomrana	45				45		
KB - 57	Smida	64				64		
KB - 58	Ghidma	80					80	
KB - 59	Sabria	60					60	
KB - 60	El Faouar 1	87					87	
KB - 61	El Faouar 2	80					80	
KB - 62	Bechni	100					100	
KB - 63	Durgine	72					72	
KB - 64	Matrouha	100					50	50
KB - 65	Regim Maatoug 1	104					52	52
KB - 66	Regim Maatoug 2	96					96	
KB - 67	Tarfayet Elma	52					52	
	Sub-total (67)	7,213	0	2,079	2,420	1,508	1,104	102
Gabes Governorate								
GB - 1	Ain Zrig	140		70	70			
GB - 2	Temoula 1	40		40				
GB - 3	Temoula 2	20		20				
GB - 4	Zrig Dakhlania	30		30				
GB - 5	Teboulbou	520		104	156	156	104	
GB - 6	Oasis de Gabes	734		146	147	147	147	147
GB - 7	Limaoua 1 et 2	148		148				
GB - 8	M'dou	40		40				
GB - 9	Chott El Fedik	31		31				
GB - 10	Bouchamma	143		72	71			
GB - 11	Mahjoub	374			187	187		
GB - 12	Salem	99			99			
GB - 13	Shoul	72			72			
GB - 14	Faycal	260			130	130		
GB - 15	M'ziraa Ghannouch	280			140	140		
GB - 16	Metouia	268			134	134		
GB - 17	Ouedhref	263			132	131		
GB - 18	Aouinette	232			116	116		
GB - 19	Chenchou 1	57			57			
GB - 20	Chenchou 2	40			40			
GB - 21	Tekouri	32			32			
GB - 22	Hamma Oasis	400			80	120	120	80
GB - 23	Mziraa Hamma	80			80			
GB - 24	Bechima 1	280			140	140		
GB - 25	Bechima 2	290			145	145		
GB - 26	Khebayet	96			96			
GB - 27	Ben Ghilouf	180			90	90		
GB - 28	Ghib Dokhane	70			70			
GB - 29	Oued Nekhla	30			30			
GB - 30	Arram	163				82	81	
GB - 31	Mareth 1	100				50	50	
GB - 32	Mareth 2	180				54	72	54
GB - 33	Mareth 3	30				30		
GB - 34	Mareth 5	115				58	57	
GB - 35	Mareth 6	88				88		
GB - 36	Zarat 2	174				87	87	
GB - 37	Zerkine 1 et 3	116				58	58	
GB - 38	Zerkine 2	156				78	78	
GB - 39	Ayoune Zerkine	30				30		
GB - 40	Madssia	58				58		
GB - 41	Kettana 1	98				98		
GB - 42	Kettana 3	140				70	70	
GB - 43	Kettana 4	125				63	62	
GB - 44	Sidi Sellam	120				60	60	
GB - 45	Zrig Barrania	71				71		
GB - 46	Ghandri	30				30		
GB - 47	Laaradh 1	35					35	
GB - 48	Laaradh 3	55					55	
	Sub-total (48)	7,133	0	701	2,314	2,701	1,136	281
	Total (153)	23,435	0	3,789	6,294	7,134	4,245	1,473

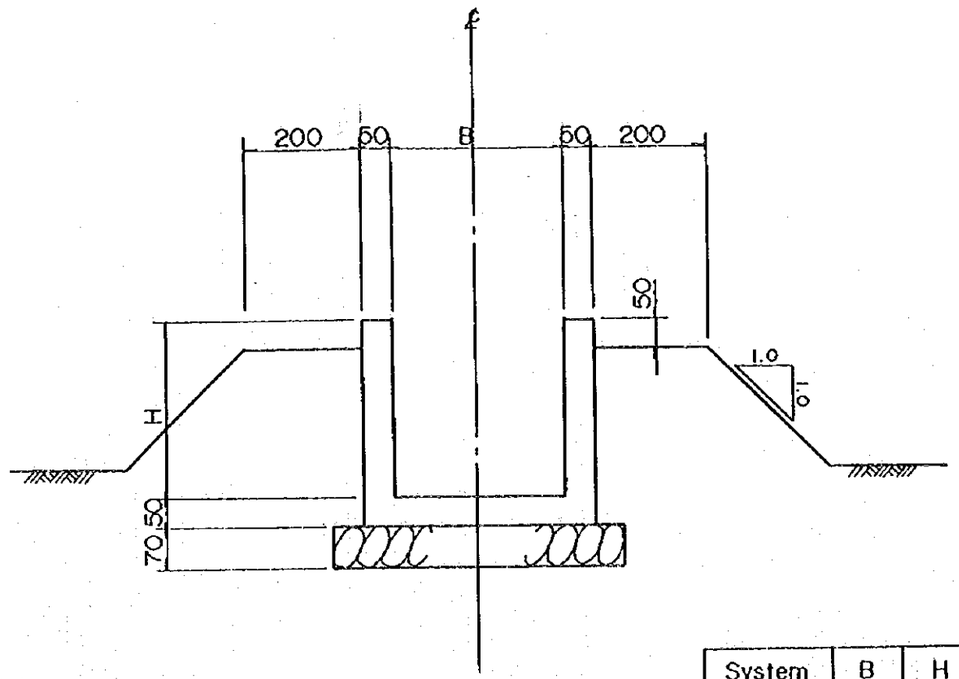
Ref. : Table II.3.3.1 (1)

Typical cross section of PVC pipe S = 1 : 20



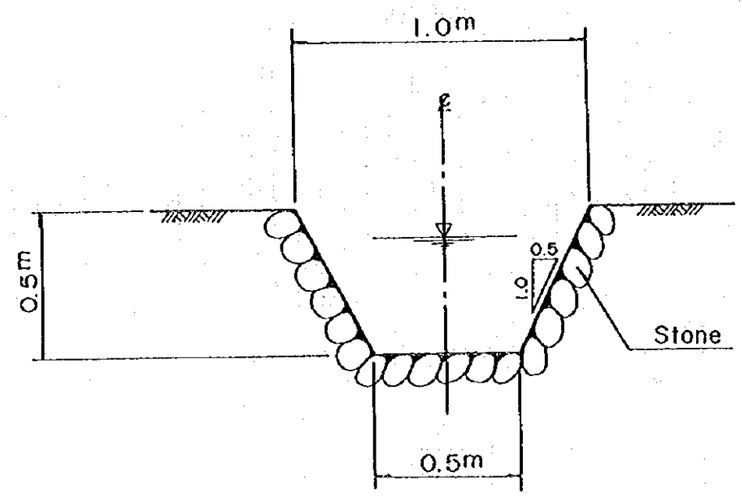
System Capacity	ø (mm)
40 l/sec	200
30	160
20	140

Typical cross section of concrete channel S = 1 : 10



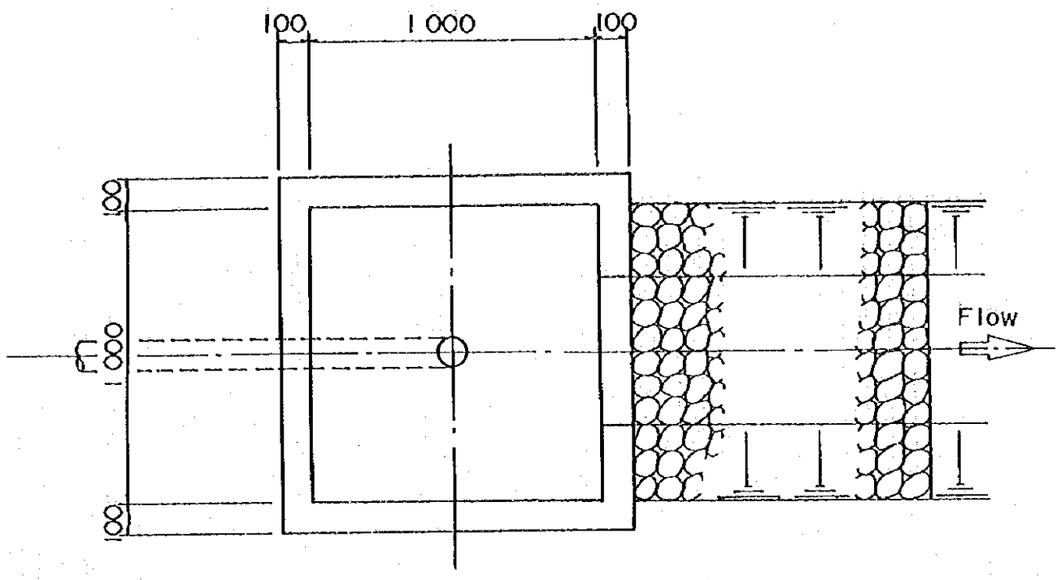
System Capacity	B (mm)	H (mm)
40 l/sec	300	250
30	250	250
26	250	200
20	200	200

Typical cross section of amenity canal S = 1 : 20

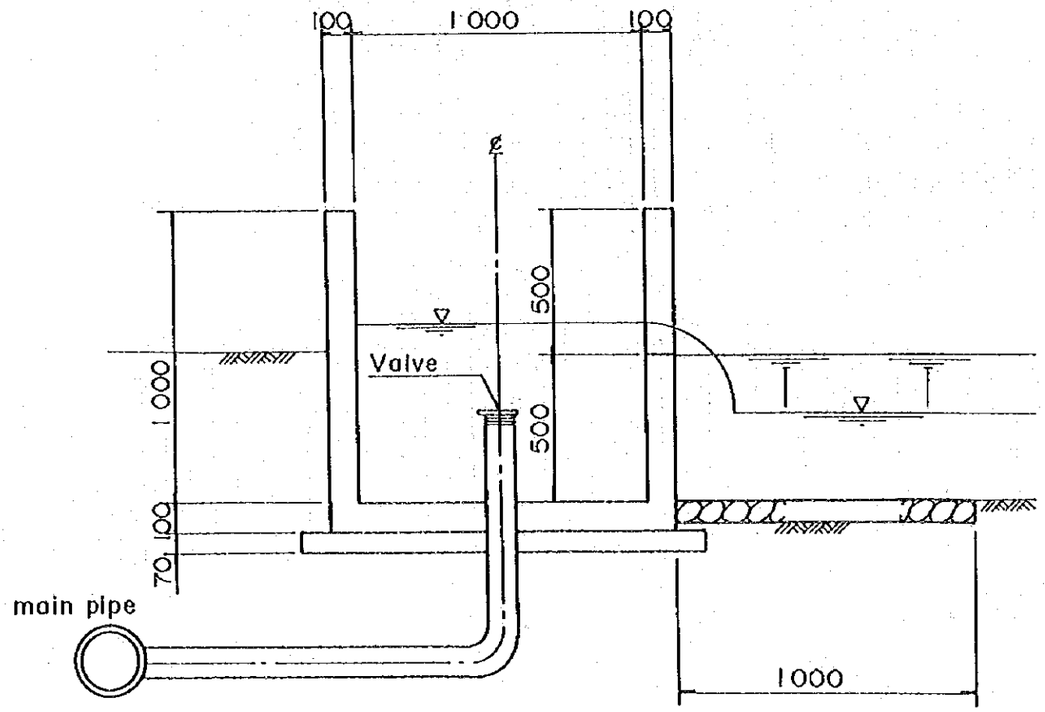


Fig, H.1.2.1 Typical cross section of Irrigation canal

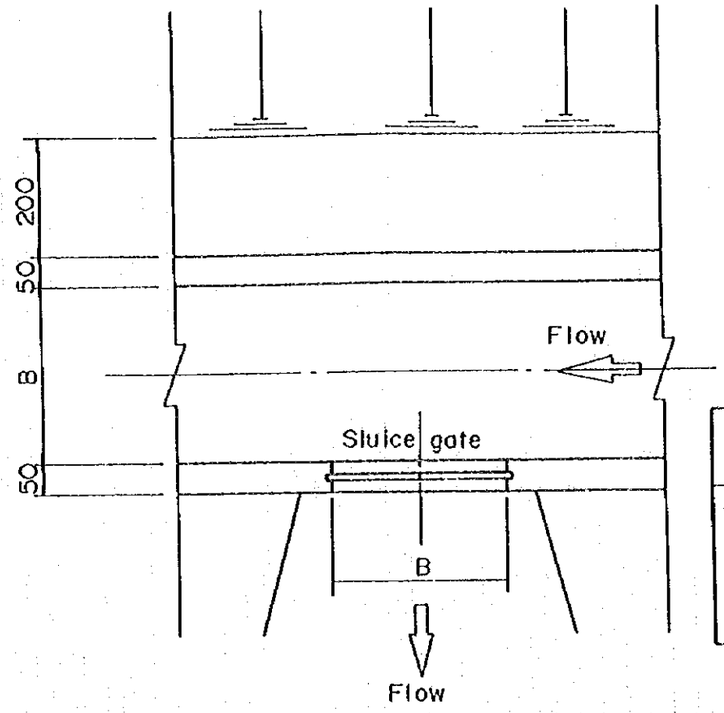
Plan of turn-out (Type 1) S = 1 : 20



Typical cross section of turn-out (Type 1) S = 1 : 20

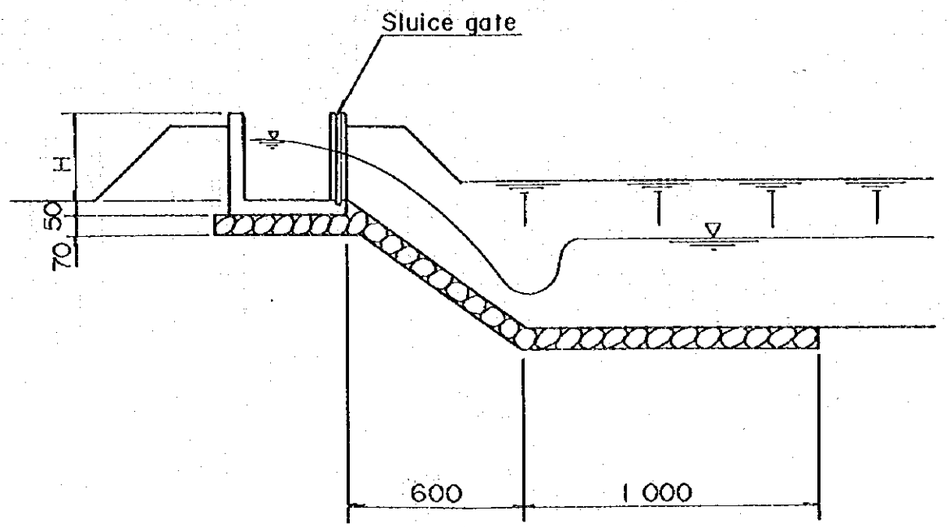


Plan of concrete channel and turn-out (Type 2) S = 1 : 10



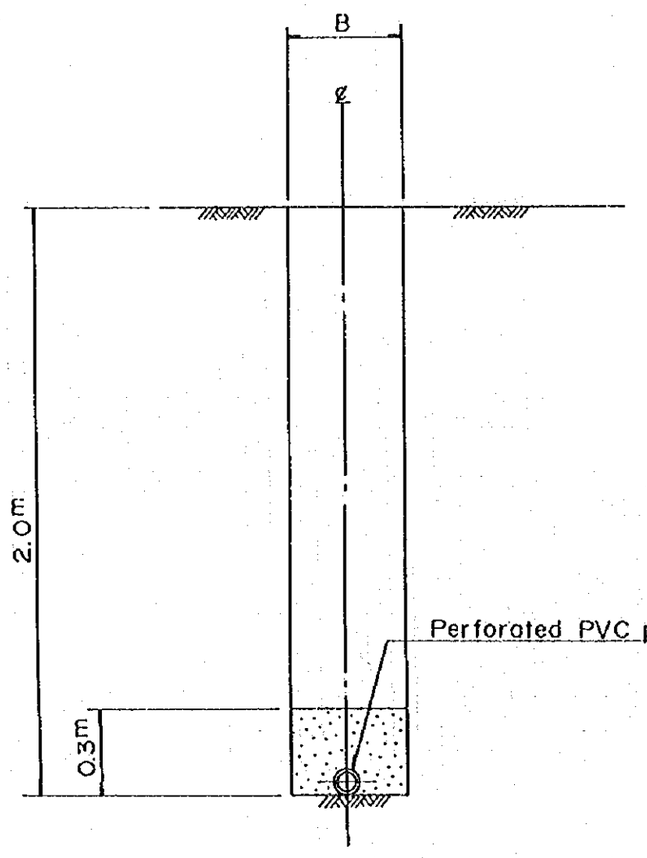
System Capacity	B (mm)	H (mm)
40 l/sec	300	250
30	250	250
26	250	200
20	200	200

Typical cross section of turn-out (Type 2) S = 1 : 20



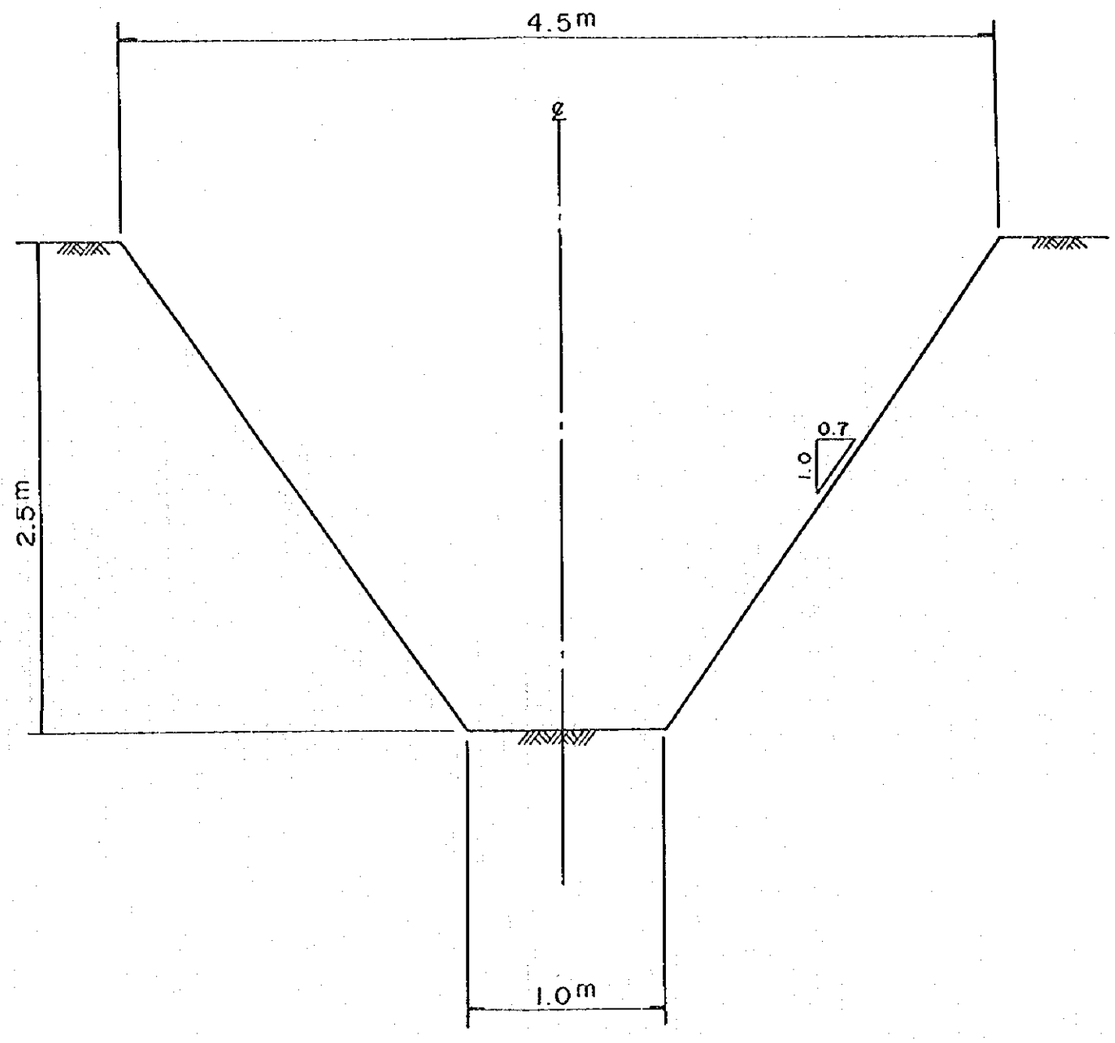
Fig, H.1.2.2 Typical cross section of turn-out

Typical cross section of field drain S = 1 : 20



PVC ø (mm)	B (cm)
58/65	30
71.5/80	40

Typical cross section of collector drain S = 1 : 30



Fig, H.1.2.3 Typical cross section of drainage canal

ANNEX - I

ENVIRONMENT

ANNEX - I

ENVIRONMENT

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ANNEX I ENVIRONMENT

I-1 Outline of the Study

The objective of this study is to save irrigation water mainly through the improvement of the earthen ditch canals in the land of oases as shown in the Table I-1-1. Serious environmental problems in the area are desertification, decline of groundwater level, and salt injury. Therefore, the Initial Environmental Examination was carried out with due attention to the following points;

(1) Influence on the recharge of the shallow groundwater by saving irrigation water
(2) Salt injury
(3) Influence on the existing systems and customs in relation to the right to use land, water, etc.

Table I-1-1 Outline of the Study

Items	*Contents*
Name of the Study	The Feasibility Study on the Irrigated Area Improvement in Oases in the South of the Republic of Tunisia
Background of the Study	Agriculture is the principal industry in Tunisia and the government of Tunisia is promoting the improvement and modernization of irrigation system and cultural technique. However, the improvement work of secondary ditch canals that should be carried out by farmers has been delayed and the water loss is critical. Besides, the use of groundwater for irrigation is increasing and as a result, the level of groundwater is declining and wells are becoming unavailable.
Objective of the Study	The objective is to save irrigation water mainly through the improvement of the secondary ditch canals and the introduction of economical irrigation method in order to use the groundwater most efficiently.
Location of the Study area	153 oases with the area of 23,453 ha located in four Gouvernorats in the south of Tunisia (Gafsa, Tozeur, Kebili and Gabes)
Implementing agency	Direction Générale du Génie Rural, Ministère de l'Agriculture
Environmental agencies	Direction de la Conservation de la Nature et du Milieu Rural, Ministère de l'Environnement et de l'Aménagement du Territoire Direction de l'Eau et de l'Aménagement du Sol et Direction des Forêts, Ministère de l'Agriculture
Beneficiaries	About 365,000 farmers
Type of the Study	Improvement of irrigation facilities
Scope of the Study	Terminal ditch canals in the above 23,453 ha (supply and delivery)

In Tunisia, the implementing agency for the environmental problem is Ministère de l'Environnement et de l'Aménagement du Territoire as shown in the Figure I-1-1. In the rural districts, the Direction of the Conservation of the Nature and the Rural District (Direction de la Conservation de la Nature et du Milieu Rural) is in charge of the environmental problem and it works mainly for the recycling of agricultural draining water and sanitary issues in the rural districts. Therefore, the data was collected from the Section of the Conservation of Water and Soil as well as from the Section of Forest in CRDA, both of which are deeply concerned with the environmental problems in this study. And direct hearing from farmers based on the questionnaire was carried out in the area.

I-2 Result of the study

I-2-1 Living conditions

The oases in the study area can be divided into three according to the living conditions of the farmers as follows;:

(1) Old oases or "ancienne oases" which have existed for a long time where date palms and fruit trees are grown densely without block readjustment. They have also a role of sightseeing spots now, and especially in Tozeur, many resort hotels are being constructed one after another. They are attracting many tourists not only from within the country but from abroad. In those areas economic activities are promoted, the employment expanded and the activities of neighboring towns increasing.

(2) New oases with the block readjusted, adjoining the towns where farmers have usually their houses in the oases.

(3) New oases with the block readjusted, developed by the government in the desert away from towns. Most of the houses are away from oases and farmers come to work there from towns.

The transportation of farmers to the oases is provided mainly by a cart with a donkey or a horse. The common problem of all oases is lack of irrigation water. Some farmers have only one-forth of dates harvest in the year of low rainfall. The supply of irrigation water is managed by AIC and farmers pay water fee. However, there is a substantial amount of water loss by infiltration from the ditch canals into the soil.

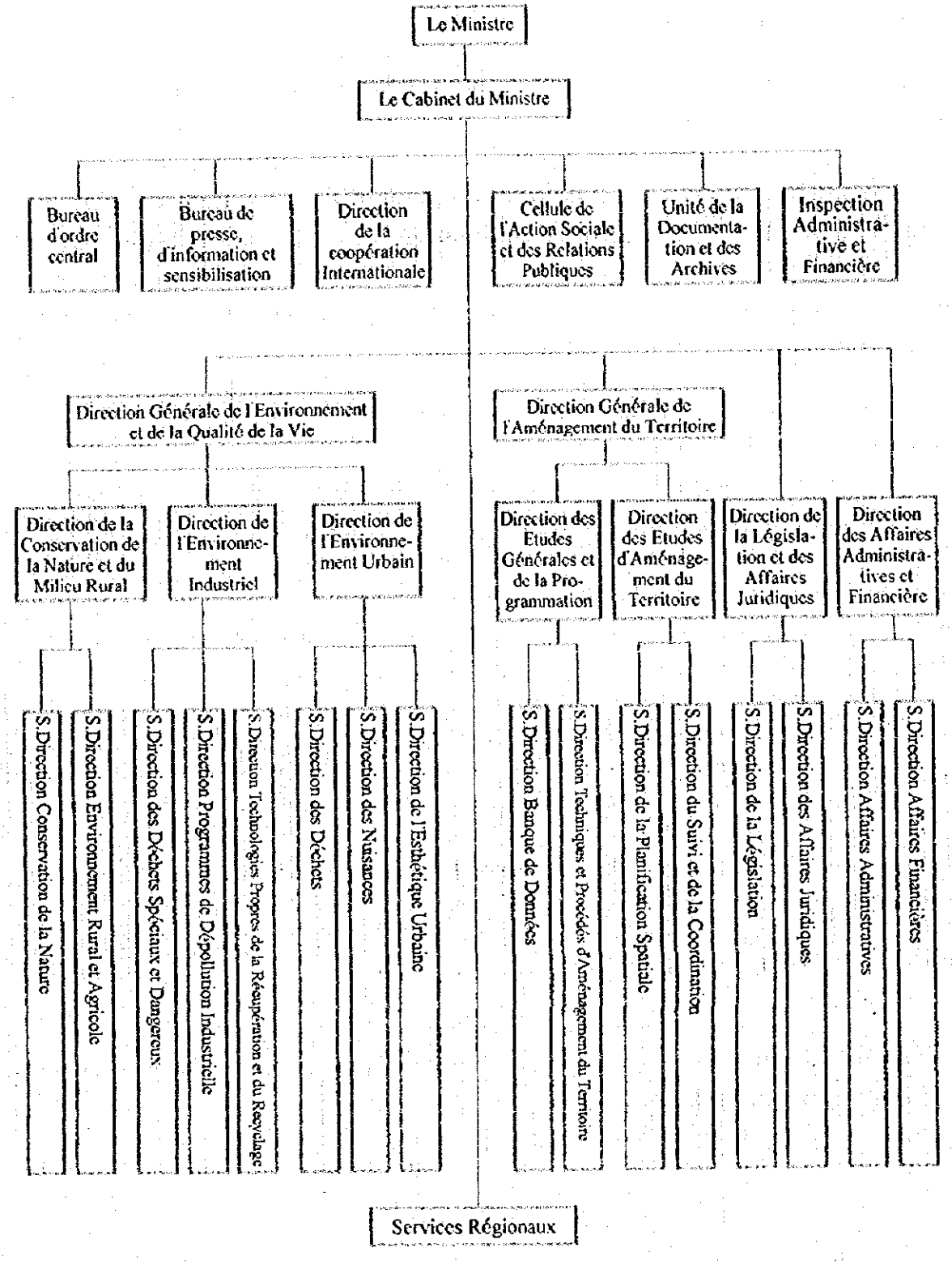

Figure I-1-1 Organigramme du Ministère de l'Environnement et de l'Aménagement du Territoire

source: Ministère de l'Environnement et de l'Aménagement du Territoire (avril 1995)

I-2-2 Natural environment

A countermeasure against the salt injury is leaching by basin method irrigation. However, in general there is not enough water for leaching and in some areas there is no drain channel. At present it seems that farm lands have not been influenced seriously by salt injury but in the survey, six in 38 farms recognized the existence of salt injury. Some areas such as Oued Shili and Segdoud in Gafsa, Oum El Ferth in Kebili, Chenchou in Gabes, etc. have more than 300 mS/m of EC in the irrigation water and especially, Oum El Ferth has 460 mS/m of EC in the soil. The soil which has more than 400 mS/m of EC is classified as saline soil so that it is necessary to pay attention to the salt injury.

The southern part of Tunisia suffers from erosion by flood and strong wind. It sometimes encounters strong wind including very fine particles of sand. On April 29, 1995 the sandstorm with the velocity of 80 km/h, the strongest in 50 years, caused great damage to the crops, destroying greenhouses, spreading diseases, increasing in injurious insects, etc. The roads were also covered with sand and removing it cost much. In such natural circumstances, the oases have a role not only for the places of economic activities but for the windbreak and they have achieved good effects to keep sand from accumulation in this area. Therefore, the protection of oases is an important subject.

The Ministry of Agriculture has been working for the countermeasure against wind and sand as follows to secure the water resources and it has approved the budget of 32,650,000 dinars in 1990 through 2000 in this area as shown in the Table I-2-1.

- Construction of stone walls: the stone walls along the slope of hills to intercept rain water for infiltration into the ground.
- Construction of fences: the fences by palm leaves around the oases and along the roads to stop the movement of sand in the desert.
- Afforestation: afforestation of eucalyptus, tamarisk trees, etc. on one side of stone walls and fences and around the salt lakes.
- Construction of dams: the dams to collect rain water in the basins and to supply it to the farms.

Table I-2-1 National strategy concerning the conservation of water and soil in the four Gouvernorats in the southern area (1990 - 2000)

Items	GOUVERNORATS			
	GAFSA	TOZEUR	KEBILI	GABES
Construction work of stone walls, fences, afforestation, etc. in the basins	11,345,000 DT (30,000 ha)	1,898,500 DT (3,500 ha)	3,475,000 DT (7,000 ha)	19,650,000 DT (30,000 ha)
Repair work of facilities of stone walls, fences, afforestation, etc.	6,100,000 DT (50,000 ha)	500,000 DT (4,000 ha)	920,000 DT (7,000 ha)	9,100,000 DT (50,000 ha)
Construction of dams, banks, etc. for water catchment	6,600,000 DT (500 ヶ所)	135,000 DT (10 ヶ所)	705,000 DT (55 ヶ所)	3,900,000 DT (300 ヶ所)
Total	24,045,000 DT	2,533,500 DT	5,100,000 DT	32,650,000 DT

source: Strategie Nationale de la Conservation des Eaux et du Sol (1990 - 2000)

I-2-3 Initial Environmental Examination

The Ministry of Environment became independent of the Ministry of Agriculture in 1991 and its own environmental guideline has been still in preparation. Therefore, the Initial Environmental Examination for this Project was carried out in accordance with the guideline of JICA agreed upon to be applicable in Tunisia, based on its definition of the categories of environmental impact. The result is shown in the ANNEX.

There are four national parks in the northern part (Iles Zembra et Zembretta National Park, Ichkeul National Park, Bou Kornine National Park, Feija National Park), Chaâmbi National Park in the center of Tunisia, Bouhedama National Park at 85 km east from the center of Gafsa and Jbil National Park at 90 km south from the center of Kebili. Although several species of animals protected by international treaties - hyaena barbara, vulpes zerda, cervus elaphus barbarus, gazella, etc. - are living there, since the areas are far from the study area, we consider there would be no influence on them by the implementation of the Project.

The expected benefit in the environment by decreasing water loss from the ditch canals and increasing water supply to the oases is as follows;

- Crop yields will increase and promote the improvement of nutritional conditions and the increase in agricultural income.
- Crop growth will improve and it will make the view of oases, tourist resources, more attractive and prevent desertification.
- Appropriate leaching will prevent the farm lands from salt accumulation possible in future.

- Troubles between the farmers and AIC over the disagreement of water fee and water quantity will be solved.

Expected negative impacts though it would be not important are as follows;

- With the increase of crop yields agrochemicals would increase gradually. It is to be desired that CRDA would provide a proper guidance about the treatment of agrochemicals for farmers.

- All saved irrigation water will be used for the farm lands because irrigation water is very much in short supply at present. As a result, when the crop density would be increased, the infiltration of water into the shallow groundwater would decrease in accordance with the increase of evapotranspiration rate. Therefore, it is necessary to secure water resources to promote the infiltration of rain water through the works of stone walls, afforestation, etc. as mentioned above.

Since this Project aims at the improvement of the secondary ditch canals it would not exert any important influence over the kinds of crops, species, methods of growth and distribution systems of the products. It requires no modification of the structure of AIC, the right to use water, the property right of the land; and it will not induce any important influence in the existing customs, practices and other rights. Further, if the small farmers will be properly subsidized, the Project would not give an important influence on the management and living styles of farmhouses.

As to the other categories of environmental impact, no category was found which is likely to bring about any significant environmental impact by the Project, and as a whole, rather the positive influence is expected. According to the estimation method of World Bank, the Environmental Impact Assessment (EIA) is not required in general where no significant impact is expected in the Project. We are of the opinion, therefore, that there is no need of EIA in this Project and it is necessary to realize the implementation of the Project at the earliest opportunity for effective use of the water resources.

Table I-2-2 Definition of Environmental Impact Categories

Categories of Environmental Impact	Definition
Social Environment	
(1) Socio-economic issues	
(1)-1 Social issues	
1. Planned residential settlement	New land settlement implemented in agriculture & rural development projects such as land clearing & leveling sea/swamp reclamation and irrigation development; settlement expected for nomad, landless farmers or shifting cultivators.
2. Involuntary resettlement	Forced resettlement of the inhabitants from their original dwelling places in the area that will be submerged with the development of the project.
3. Substantial changes in the way of life	Changes in the way of life of the people in particular in the role of women in family & society brought about by agricultural and rural development.
4. Conflict among communities and people	Friction due to conflicting interests between beneficiaries and non-beneficiaries, people in favor of and those against development, new settlers and host people, insiders and outsiders, people in a project area and those affected in the surrounding area.
5. Impact on native people	Adverse effects of development on local communities composed partly or entirely of indigenous people (including tribal groups), low-caste groups, ethnic minorities, or nomads.
(1)-2 Demographic issues	
6. Population increase	Significant population increase in a project or surrounding area due to development.
7. Drastic change in population composition	Drastic change in population composition in a project or surrounding area due to development.
(1)-3 Economic activities	
8. Changes in bases of economic activities	Forced or involuntary relocation of economic bases or means such as farmland, fishing grounds, etc., under a project due to land acquisition, changes in land use regulation, and deterioration or depletion of bases or means for economic activities.
9. Occupational change and loss of job opportunities	Forced or involuntary occupational change due to land acquisition and loss or deterioration of means or bases of economic activities; it includes loss of job opportunities due to farm mechanization.
10. Increase in income disparities	Increase in income disparities among groups brought about by the development; it implies relative impoverishment of the economically weak.
(1)-4 Institutional and custom related issues	
11. Adjustment & regulation of water or fishing (riparian) rights	Adverse development effects on water or fishing (riparian) rights and necessary adjustments or regulations.
12. Changes in social and institutional structures	Changes in social and institutional structures as a result of establishment of new or modified rural organizations caused by development.
13. Changes in existing institutions and customs	Changes in existing institutions and customs involved in or induced by development activities.

Categories of Environmental Impact	Diffinition
(2) Health and sanitary issues	
14. Increased use of agrochemicals	Increased use of chemical pesticides due to intensification of agriculture; introduction of high-yielding species & new crops and irrigation.
15. Outbreak of endemic diseases	Spreading of endemic diseases as a result of the adverse effects of development.
16. Spreading of endemic diseases	Spreading of endemic diseases attributable to the adverse effects of development.
17. Residual toxicity of agrochemicals	Accumulation in the natural environment (soil, water, etc.) of agrochemicals or chemical substances with high residual toxicity such as organo-chloric insecticides, etc.
18. Increase in domestic and other human wastes	Increase in domestic and other human wastes due to the consequences of development such as population increase.
(3) Cultural asset issues	
19. Impairment of historic remains and cultural assets	Direct or indirect impairment or destruction of sites, structures, and remains of archaeological, historical, religious, cultural, or aesthetic value as result of development.
20. Damage to aesthetic sites	Direct or indirect negative effects on aesthetic features as a result of development.
21. Impairment of buried assets	Impairment or destruction of buried assets due to development activities.
Natural Environment **(4) Biological and ecological issues**	
22. Changes in vegetation	Direct or indirect deterioration or degradation of vegetation due to development activities including removal of vegetation cover, alternation of land use, encroachment into forest, alteration of environmental conditions, etc.
23. Negative impact on important or indigenous fauna and flora	Adverse effects on important or indigenous animal & plant species due to destruction of or changes in habitats.
24. Degradation of ecosystems with biological diversity	Degradation of ecosystems that allows the wild species of plants and animals to withstand external stress.
25. Proliferation of exotic and/or hazardous species	Introduction of pathogenic agents or spreading of hazardous species due to creation of environment conductive to their propagation.
26. Destruction of wetlands and peatlands	Extinction of wetlands or peatlands caused directly by development activities such as large-scale earth filling, or indirectly by changes of hydrological regime such as drying and decomposition.
27. Decrease of tropical rain forests and wildlands	Decrease or disappearance of tropical rain forests due to direct or indirect effects of development.
28. Destruction or degradation of mangrove forests	Disappearance of mangrove forests attributable to direct destruction or deterioration of supporting environmental conditions.
29. Degradation of coral reefs	Disappearance of coral reefs due to direct destruction, or damage to and deterioration of the supporting environment caused by sedimentation, etc.

Categories of Environmental Impact	Definition
(5) Soil and land resources	
(5)-1 Soil resources	
30 Soil erosion	Washing or blowing away of soil from the earth surface by the action of water or wind.
31. Soil salinization	Phenomena in which soluble salts accumulate in the surface layer of soil and crops growth is consequently affected.
32. Deterioration of soil fertility	Deterioration of soil productivity due to leaching and decomposition of nutrients, nutrient absorption by plants, surface soil erosion, salinization, failure in soil management, etc.
33. Soil contamination by agrochemicals and others	Accumulation of agrochemicals in soil with high residual toxicity.
(5)-2 Land resources	
34. Devastation or desertification of land	Deterioration of land productivity or desertification caused by artificial or natural impacts.
35. Devastation of hinterland	Devastation of area surrounding a project area as a result of secondary or indirect impacts of development.
36. Ground subsidence	Subsidence of ground caused by the dehydration or drying of wetlands, peat swamp, or reclaimed lands, or excessive exploitation of groundwater.
(6) Hydrology, water quality and air	
(6)-1 Hydrology	
37. Change in surface water hydrology	Alteration of river discharge or water level as the effects of reservoir construction, irrigation water intake, or drainage.
38. Change in ground water hydrology	Changes in the groundwater recharge mechanism or groundwater table caused by infiltration of irrigation water and exploitation of groundwater.
39. Inundation and flooding	Overflowing of a river onto the surrounding land or the surrounding of sea water onto the coastal land. Inundation or flooding are caused by increased river or run-off discharge or poor water management.
40. Sedimentation	Settlement of transported sediment in river, estuaries and reservoir.
41. Riverbed degradation	Degradation of riverbed in lower basin areas due to insufficient sediment load to maintain riverbed level.
42. Impediment of inland navigation	Adverse impacts on navigation due to development activities.
(6)-2 Water quality and temperature	
43. Water contamination and deterioration of water quality	Deterioration of water quality due to development activities.
44. Water eutrophication	Accumulation in water of nutritive soluble salts such as nitrate and phosphate.
45. Sea water intrusion	Intrusion of salt water wedge along the riverbed.
46. Change in temperature of water	Adverse impact of low temperate irrigation water on crops.
(6)-3 Atmosphere	
47. Air pollution	Diffusion of agrochemicals, sand dust, stench and exhaust gas from vehicles and machines.

Table I-2-3 Checklist for Proving Environmental Impact

Applicable columns with the following impact degree are marked with "X".
SEI : Significant Environmental Impact
A : The subject SEI is unquestionably induced by the Project.
B : The subject SEI is likely to be induced by the Project.
C : The SEI is not fully known.
D : There is no possibility that the subject SEI is likely to be induced by the Project.

Categories of Environmental Impact	Evaluation A	B	C	D	Evaluation Basis
1. Planned residential settlement				X	No plan in this Project.
2. Involuntary resettlement				X	No plan in this Project.
3. Substantial changes in the way of life				X	Not expected.
4. Conflict among communities and people				X	This is accepted by all in this area.
5. Impact on native people				X	No negative impact for nomadic tribes.
6. Population increase				X	Not expected
7. Drastic change in population composition				X	Not expected.
8. Changes in bases of economic activities				X	Not expected.
9. Occupational change and loss of job opportunities				X	Not expected.
10. Increase in income disparities			X		Change may happen between large-scale farmers and small farmers. It is important to consider the subsidies to small farmers.
11. Adjustment & regulation of water or fishing (riparian) rights				X	Not expected.
12. Changes in social and institutional structures				X	Not expected.
13. Changes in existing institutions and customs				X	Not expected.
14. Increased use of agrochemicals				X	It is expected that diseases and insect damage are not very much because of companion planting. Use of agrochemicals would not increase rapidly.
15. Outbreak of endemic diseases				X	Not expected.
16. Spreading of endemic diseases				X	Not expected.
17. Residual toxicity of agrochemicals				X	Use of pesticide is not expected to increase rapidly.
18. Increase in domestic and other human wastes				X	Not expected.
19. Impairment of historic remains and cultural assets				X	No historic remains in this area.
20. Damage to aesthetic sites				X	Effective irrigation is good for crops in oases and it gives a positive impact to the oases

Categories of Environmental Impact	Evaluation A	B	C	D	Evaluation Basis
21. Impairment of buried assets				X	Not expected.
22. Changes in vegetation				X	Not expected.
23. Negative impact on important or indigenous fauna and flora				X	Not expected.
24. Degradation of ecosystems with biological diversity				X	Not expected.
25. Proliferation of exotic and/or hazardous species				X	Not expected.
26. Destruction of wetlands and peatlands				X	No wetlands or peatlands.
27. Decrease of tropical rain forests and wildlands				X	No tropical rain forests or wildlands.
28. Destruction or degradation of mangrove forests				X	No mangrove forests.
29. Degradation of coral reefs				X	No plan in this Project.
30. Soil erosion				X	It is effective to protect the soil from the damage of wind.
31. Soil salinization				X	Drainage plan against salt injury is included in this Project.
32. Deterioration of soil fertility				X	Farmers use homemade compost and chemical fertilizer. Many farmers grow alfalfa.
33. Soil contamination by agrochemicals and others				X	Significant impact is not expected.
34. Devastation or desertification of land				X	Positive impact is expected by the improvement of oases.
35. Devastation of hinterland				X	Positive impact is expected by the improvement of oases.
36. Ground subsidence				X	No risk of ground subsidence as the groundwater development is not included in this Project.
37. Change in surface water hydrology				X	Not expected.
38. Change in ground water hydrology				X	Significant impact is not expected.
39. Inundation and flooding				X	Not expected.
40. Sedimentation				X	Not expected.
41. Riverbed degradation				X	Not expected.
42. Impediment of inland navigation				X	Not expected.
43. Water contamination and deterioration of water quality				X	Significant impact is not expected.
44. Water eutrophication				X	Significant impact is not expected.
45. Sea water intrusion				X	Not expected.
46. Change in temperature of water				X	Not expected.
47. Air pollution				X	Not expected.

ANNEX - J

WOMEN IN DEVELOPMENT

ANNEX - J

WOMEN IN DEVELOPMENT

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J-1 Organizations for women

The Ministry of Woman and Family is in charge of matters related to women in Tunisia. The law of sexual equality for employment was enacted in 1983 (cord 83-112) and Secretary of the State for Affaires of Woman and Family was established in 1992. Tunisia is an Islamic country but monogamy is ordained by law.

There are several NGOs as follows;

- Union National de la Femme Tunisienne (UNFT): Esbablished in 1961 with the object of improvement in women's life. It has branches in all Gouvernorats.
- Association Tunisienne des Femmes Démocrates (ATFD): Established in 1989 with the object of doing away with sex discrimination.
- Asscoation des Femmes Tunisiennes pour la Recherche et le Développement (AFTRD): Established in 1989 for the study of WID.
- Association de Promotion des Projets de Femmes dans l'Economie (APROFE): Established in 1990 with the object of promoting employment of women.
- Chambre Nationale des Femmes Chefs d'Entreprises (CNFCE): Established in 1990 with the object of fostering women entrepreneures.
- Fédération Nationale des Agricultrices (FNA): Established in 1990 with the object of supporting women farmers. It has a branch only in Gafsa in the study area.
- Commission Nationale "Femme et Travail": Established in 1991 studying the social and economic problems of women.
- Mouvement Mondial des Mères - Section Tunisie : Established in 1992 with the object of supporting working and married women.

J-2 Present conditions of women

Illiteracy rate of women in rural area is 66.1% according to the statistics of 1989 in Tunisia as shown in the Table J-2-1. However, the illiteracy of girls between the ages of 10 and 14 in rural area is low, standing at 26% as shown in the Figure J-2-1. It means that the social circumstances of women is improving remarkably. Furthermore, the percentage of the attendance of girls in primary schools is 93.8% and their graduation 93.2%. The rate of girls is 42.7% in the secondary and high schools and the difference is decreasing between boys and girls. And the rate of women in the medical institutions is 42.7%as shown in the Table J-2-2.

It appears that the medical system is now easily available by women.

J-3. Activities of women in the study area

Information about respective roles of men and women and related customs, etc. was collected by personal hearing at farmhouses in the study area. In every region the work of carrying water as well as shopping are in principle the role of man. In each four Gouvernorats of the study area, the style of agriculture is different and the roles by sex is also different. The result of gender analysis is shown in Annex J-3-1 and J-3-2. In Gafsa, the main product is fruit trees and mainly olive trees. Women also work in the farm to weed and harvest and often work together. The Federation of Women of Farm (FNA) represented by CRDA staff is active and it participates in the exhibition of rural specialties for immediate sale held in Tunis several times a year. Women seem to have more opportunities of going out for shopping, etc. than in other three Gouvernorats.

In Tozeur, the date palm is a main crop and tenants called "accionnaire" magage the farm in irrigation and other farm work. Accionnaires have a right for one-fifth of date palm harvest and all of companion fruits trees and vegetables. Women customarily do not go out and make textile goods like rug, etc. at home. Farms have also tourist income from the sale of traditional craft works and public telephones as well as from running miscellaneous shops, cafeterias, etc. which only men are engaged in.

Kebili is the nearest region to the Sahara and suffering from the lack of water seriously. Few crops are cultivated except domestic crops and date palms. Management of date palms is difficult for women as the work is on the palm trees and there is not much work for women in the farm.

In Gabes, main crops are fruits like apples, pomgranates, etc., though various cash crops including tabacco are cultivated. It is known for high quality of Henna (plant for dyes on hands and feet of women at wedding ceremony, etc.) and pomgranates. However few women participate in agriculture and they make crafts such as hat by palm leaves.

There would be no increase of demand for manpower after the improvement of the ditch canals and the manpower for management would somewhat decrease. Therefore, the burden on women in agricultural work would not increase. And the improvement of food life is expected by better quality of crops with sufficient supply of water.

If the activities of NGOs become popular like those of FNA in Gafsa, social activities of women in these areas would gradually spread. Women's activities in urban area is good in Tunisia and expected to affect the rural areas in future.

Table J-2-1 Illiteracy rate (1989)

	women	men
Illiteracy rate	48.3%	26.4%
Illiteracy rate in urban area	36.6%	19.1%
Illiteracy rate in rural area	66.1%	37.6%

source: La Femme Tunisienne en Chiffres, mars 1994 (CREDIF)

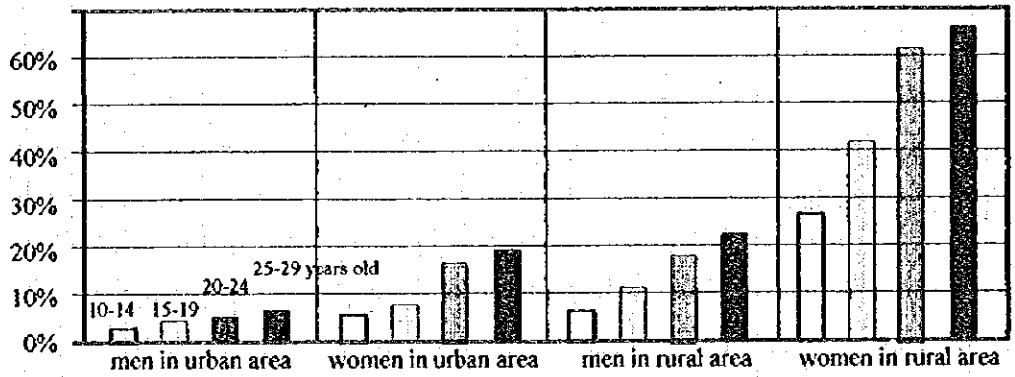

Figure J-2-1 Illiteracy rate classified by age (1989)

source: La Femme Tunisienne en Chiffres, mars 1994 (CREDIF)

Table J-2-2 Workers' rate by sex in public medical institutions (1992)

medical institutions	men	women
Doctors	67%	33%
Dental surgeons	43%	57%
Pharmacists	37%	63%
Veterinarianes and biologists	82%	18%
Medical support members	48%	52%
Total rate in medical institutions	54%	46%

source: La Femme Tunisienne en Chiffres, mars 1994 (CREDIF)

Annex J-3-1 WID - Hearing survey from farmhouses (Gafsa)

Exemple of activities of a farmer

(wife: 54 years old)		(husband: 59 years old)
	4:00	-get up, prayer
get up, prayer-	5:00	-drink tea
animal care-	6:00	-agricultural work
food preparation-	7:00	
breakfast-	8:00	-breakfast
agricultural work * -	9:00	(his wife
	10:00	bring it
	11:00	to the farm)
food preparation-	12:00	
lunch, rest-	13:00	-lunch (at home or farm)
	14:00	-agricultural work
cleaning-	15:00	-prayer
agricultural work-	16:00	-prayer
	17:00	
	18:00	
go home, food preparation-	19:00	-go home, prayer
dinner, drink tea-	20:00	-dinner, drink tea
TV-	21:00	-prayer, sleep
	22:00	
sleep-	23:00	

farm: 1.5ha, 700m from house, employ 4 workers in season (5 D/day)
crops: olive, fig, date palms (30), grape, pistachio
livestock: 6 sheep, 4 goats (couple takes care together)
*: weeding, harvesting of olive in winter

Gender Analysis (unit: person/hosehold*)

Items	access		control		comments
	F	M	F	M	
Farmland	9	10	2	9	1～12 ha (average 6 ha), main crop is olive. One is a tenant and has no farm.
Livestock	7	8	2	7	goat, sheep, horse, cow
Education fee	2	7	2	7	One is a widow and another is a tenant woman whose family is only her mother among 11 households
Medical fee	9	6	2	9	
Food fee	5	8	2	9	
Wages for tenant	1	8	-	9	
Irrigation water fee	1	9	1	9	
Other expenses	6	9	3	9	clothes, construction materials, fertilizer, seed, house rent (tenant)
Income of dates	-	3	-	3	
Other income of cash crops	1	8	2	6	lemon, armond, fig, pomgranade, pear, plum, peach, apple, olive, grape, apricot, pistachio, walnut, forage
Other income			-		wages of tenant (3 D/day), milk

access: user or participant
control: owner or responsible person
* details of 11 households : 9 women (ages: 22 - 59, average 31)
4 men (ages: 20, 59, 60, 60)

Annex J-3-2 WID - Hearing survey from farmhouses (Kebili)

Exemple of activities of a farmer

(wife: 55 years old)		(husband: 64 years old)
get up, prayer-	4:00	-get up, prayer, sleep again
animal care-	5:00	
food preparation, breakfast -	6:00	-agricultural work
agricultural work * -	7:00	
	8:00	
	9:00	
	10:00	
food preparation-	11:00	
	12:00	
lunch -	13:00	-lunch
agricultural work-	14:00	-agricultural work
prayer-	15:00	-prayer
prayer-	16:00	-prayer
	17:00	
go home, food preparation-	18:00	
prayer, dinner -	19:00	- prayer
	20:00	- go home, dinner
prayer, sleep-	21:00	-prayer
	22:00	-sleep
	23:00	

farm: 1ha, employ 1 worker
crops: date palm
livestock: 10 sheep, 3 goats (couple takes care together)
*: weeding, mowing of forage (barley), etc.

Gender Analysis (unit: person/hosehold*)

Items	access		control		comments
	F	M	F	M	
Farmland	6	10	1	10	0.375～3 ha (average 1.3 ha) Crops are mainly dates and pasture grass because of scarce water.
Livestock	8	8	-	10	goat, sheep, donky
Education fee	-	10	-	10	
Medical fee	-	10	-	10	
Food fee	-	10	-	10	
Wages for tenant	-	7	-	7	
Irrigation water fee	-	8	-	8	
Other expenses	1	4	1	5	
Income of dates	-	7	-	7	
Other income of cash crops	3	5	-	5	broad bean, carrot, alfalfa, spinach, parsley
Other income	3	8	-	9	sales of live stock, water (as worker of AIC), and handi-crafts, wages of tenant and construction work

access: user or participant
control: owner or responsible person
* details of 10 households : 10 women (ages: 32 - 62, average 48)
10 men (ages: 33 - 91, average 60)

ANNEX - K

PROJECT JUSTIFICATION

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PROJECT JUSTIFICATION

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PROJECT JUSTIFICATION

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K.1 INTRODUCTION

The Project of the Irrigated Area Improvement in Oasis in the South of the Tunisia primarily aims at increasing agricultural productivity by irrigation and drainage development. As for the Project formulation, preliminary technical and economic evaluation are made for 153 Oases as discussed in Chapter 4 of the Main Report. The results from assessment are selected for the proposed irrigation and agricultural development plans consisting 153 Oases with 23,435 ha.

The project justification involves making an assessment of project feasibility in view of economic, financial and socio-economic aspects. The economic feasibility is firstly evaluated by calculating of the economic internal rate of return (EIRR), benefit-cost ratio (B/C), benefit minus cost (B - C) at a discount rate of 7.5 % and sensitivity analysis based on the estimated project costs and incremental project benefits. For the financial evaluation, the repayment capacity of the Project and capacity to pay of the farmers is analyzed. The indirect benefits and social impact of the project are also studied briefly.

K.2 ECONOMIC EVALUATION

K.2.1 Basic Assumption

The basic assumptions applied for economic evaluation of the Project are summarized as follows :

(1) Project Life

The economic useful life of the Project is assumed to be until the year 2022, or 25 years from start of implementation.

(2) Price Level

All commodity prices are given as of September 1995 Tunisia Dinar value throughout the analysis. The exchange rate of US$ 1.00 = D. 0.944 = ¥ 101 as of September 1995.

(3) Standard Conversion Factor (SCF)

A standard conversion factor of 0.85 and a commodity specific conversion factor (CSCF) of 0.90 are applied referring to the study by NEA (Development Agricole dans le Gouvernorat de Gafsa, Project des Trente Forages, 1990). SCF is used in adjusting all benefits and costs in local currency.

(4) Economic Prices

Economic prices of farm inputs (Ammonium Nitrate, Triple Super Phosphate and Potassium Sulfate) will be estimated on the basis of he World Bank's long term price projection for 2005 in constant 1995 terms. Tradable agricultural products (date, olive) is estimated at export F.O.B. prices, Tunis. Economic prices of other non-tradable agricultural products (fig, pomegranate, vegetables and fodder crops) and farm inputs (seed/seedling, farm yard manure) are set at same financial prices. The transfer payment such as tax, duty, subsidy and interest are excluded for the estimation of economic costs and prices.

The economic prices estimation of agricultural products and farm inputs are shown in Table K.2.1.1 to K.2.1.3. The financial and economic prices of agricultural products and farm inputs are summarized in Table K.2.1.4.

K.2.2 Economic Benefit

Crop production benefit could accrue from the optimum irrigation water use by improvement of field irrigation and drainage canals in Oasis area, organized irrigation activities by farmer associations, and improvement of farming practices and productivity. Livestock production benefits are indirectly estimated through the value assessment of fodder crops.

Economic crop production budgets per ha for irrigated conditions are prepared under without and with project conditions on the basis of farm input requirement, present and future yields, and economic farm gate prices of farm inputs and products. For the arboriculture, weighted average net production value (net return) for the whole useful life period (25 years) in each species is adopted evenly throughout the project life since replanting of trees will be taken place at any time as required. Economic net crop production value per ha under without project and with project conditions for each crop are estimated as shown in Tables K.2.2.1 (1 to 7) and K.2.2.2, and summarized as follows :

(D./ha)

Items	Without Project			With Project			Increment		
	GPV	PC	NPV	GPV	PC	NPV	GPV	PC	NPV
1. Arboriculture :									
- Date	5,367	894	4,473	6,108	1,061	5,047	741	167	574
- Olive	2,990	697	2,293	3,333	742	2,591	343	45	298
- Pomegranate	2,328	845	1,483	2,720	895	1,825	392	50	342
- Apricot	4,987	958	4,029	5,543	1,022	4,521	556	64	492
- Fig	1,326	769	557	1,484	895	589	158	126	32
2. Vegetables :									
- Carrot	2,317	1,416	901	2,610	1,540	1,070	293	124	169
- Turnip	4,160	1,409	2,751	4,680	1,534	3,146	520	125	395
- Onion	4,032	1,568	2,464	4,570	1,647	2,923	538	79	459
- Kidney Bean	3,983	1,235	2,748	4,481	1,424	3,057	498	189	309
- Pepper	8,317	2,163	6,154	9,311	2,271	7,040	994	108	886
- Tomato	6,709	1,723	4,986	7,511	1,838	5,673	803	115	688
3. Fodder Crops :									
- Luceme	2,992	921	2,071	3,592	1,081	2,511	600	160	440
4. Industrial Crops :									
- Henna	2,666	1,144	1,522	3,237	1,294	1,943	571	150	421

Remarks : GPV ; Gross Production Value, PC ; Production Cost, NP V ; Net Production Value

Applying the net return per ha for each crop to those planted area, the total net production value or irrigation benefit to accrue from crop production will be calculated on the both the future without and with project conditions. Annual irrigation benefit at full development stage is estimated. Irrigation benefit for 133 Oases in four (4) Governorate are shown Tables K.2.2.3 and K.2.2.4, and summarized as below.

(D., '000)

Governorate	Without Project			With Project			Irrigation Benefit	
	GPV	PC	NPV	GPV	PC	NPV	Total	D. per ha
Gafsa	30,750	5,210	25,540	34,120	5,740	28,380	2,840	820
Tozeur	38,100	6,180	31,920	43,030	7,170	35,860	3,940	700
Kebili	59,630	12,450	47,180	67,020	14,250	52,770	5,590	770
Gabes	50,050	10,440	39,610	57,390	11,690	45,700	6,090	850
Total	178,530	34,280	144,250	201,560	38,850	162,710	18,460	790

Remarks : GPV ; Gross ProductionValue, PC ; Production Cost, NPV; Net Production Value

Incremental crop production value will be expected to increase year by year after the completion of development according to the implementation schedule. It will assumed that the built-up period to achieve full benefit is five (5) years after the completion of physical works (first year 20%, second 40%, third 60%, fourth 80%, fifth 100%).

As a result, irrigation benefit will be born from the year, 1999. It will gradually increase and attain its maximum in 2007. The irrigation benefit at full development stage is estimated at D. 18.5 million.

K.2.3 Economic Cost

The financial costs for the construction components are grouped into two parts of local and foreign costs. The local cost comprises three (3) items such as transfer payment, unskilled labour cost, and other costs for material and skilled labour. Construction Conversion Factors (CCFs) that are the weighted average of the respective cost items by applying other conversion factors will be estimated as the following procedure :

(1) Financial foreign cost accounts for the economic cost,
(2) Transfer payment in the local cost at the rate of 10% is excluded from the financial cost,
(3) The rest 90% of financial cost is split into unskilled labour and other costs,
(4) The part of unskilled labour is converted to the economic value applying the conversion factor of 0.88,
(5) The standard conversion factor of 0.9 is applied for the conversion of other costs, and
(6) The CCFs by the project components are calculated as the sum of economic shares by cost items after the conversion of those financial shares.

Conversion factor for O&M cost will be estimated same as the above procedure. The project and O/M costs pea year are estimated as follows. (Ref. Tables K.2.3.1, K.2.3.2 and K.2.3.3) :

Governorate	No of Oasis	Total Area	Total Cost	Cost per ha	Annual O&M Cost	O/M Cost per ha
		(ha)	(D., '000)	(D./ha)	(D., '000)	(D./ha)
Gafsa	8	3,467	8,272	2,390	87.7	25
Tozeur	30	5,622	18,759	3,340	189.0	34
Kebili	67	7,213	25,761	3,570	257.4	36
Gabes	48	7,133	25,976	3,640	264.0	37
Total	153	23,435	78,768	3,360	798.1	34

K.2.4 Economic Evaluation

Economic evaluation is made through the estimation of (a) Economic Internal Rate of Return (EIRR), (b) Net Present Value (NPV) and (c) Benefit-Cost Ratio (B/C) both at the discount rate of 7.5% as shown in Tables K.2.4.1 and K.2.4.2, and summarized as follows :

Items	Gafsa Governorate	Tozeur Governorate	Kebili Governorate	Gabes Governorate	Total 153 Oases
1. EIRR	22.0%	13.9%	14.5%	15.9%	15.7%
2. NPV (D., '000)					
- Benefit	18,015	26,117	30,105	40,833	124,106
- Cost	6,783	15,917	22,849	22,019	67,346
B - C	11,232	10,200	16,256	18,814	56,760
3. B / C	2.66	1.64	1.71	1.85	1.84

From above Table, the EIRR for 153 Oases is estimated to be 15.7 %. In order to evaluate soundness of the project against possible adverse changes in the future, sensitivity analysis are made for the following cases :

Items	Gafsa Governorate	Tozeur Governorate	Kebili Governorate	Gabes Governorate	Total 153 Oases
1. Project Cost overrun by 20.0%	18.8%	11.4%	11.9%	13.2%	13.0%
2. Benefit decrease by 20%	18.1%	10.9%	11.4%	12.6%	12.4%
3. Case 1 and Case 2	15.2%	8.6%	9.1%	10.1%	10.0%

K.3 FINANCIAL EVALUATION

In order to evaluate the Project from the financial aspect of the farmers, the farm budget analysis on average farm size of each typical farmer for 8 Oases in four (4) Governorate are made under the representative crop intensities in the future with project condition. Farm budget analysis is conducted to assess whether the project will have sufficient incentive to the farmers in the project oasis area and will bring enough income increase in the farmer's economy.

For the assessment of farmers' capacity to pay by the respective farm budget surplus (balance of gross income and gross out-going covering living expenses), water charges and repayment costs for the Project will be estimated on the basis of crop water requirement to the total O&M costs from the turnout to on-farm level. The construction cost will be collected from the farmers according to the crop water requirement and amortized in 25 years including 5 years of grace period by the interest rate of 10 % per year.