D3.3.3 Soils in Sarbaz

(1) General Description

Sarbaz sub-basin forms the northern slope of the Dena Mountains and gravelly soils are largely extent at the foot slope of the mountains. Four soils are observed in the area, namely 1)Eutric Leptosols in hills, 2)Calcaric Cambisols in hills and plateaus, 3)Haplic Calcisols in plateaus, and 4)Calcaric Regosols in gravelly alluvial fans. Calcaric Cambisols and Haplic Calcisols are slow in permeability and heavy in texture. Soil depths are shallow in higher location and deep to very deep in lower location. Apple trees are planted and cultivated in lower area since 30 years before and recently in higher area. Eutric Loptosols is marly and medium in permeability and texture, and soil depth is very shallow. This soil is largely extent in the hilly area of Noorabad village, and young apple trees are planted recently where soils are relatively deep and irrigation water is available. Calcaric Regosols is gravelly texture and rapid in permeability.

(2) Soil Series and Units in Sarbaz

Soils of Sarbaz area are located on four physiographic units and contain nine soil series as follows:

Table D-3-3-3-1 Soil Series in Sarbaz

Physiography	Soil Series			USDA Soil Taxonomy (1999)			FAO-Unesco (1989)	Iranian Fourth Approximation
	No.	Area (ha)	%	Family	Subgourp	Order		
Mountains	1	1,085	17%	Clayey-skeletal, mixed, mesic	Typic Haploxerepts	Inceptisols	Calcaric Cambisols	Brown soils
	2			Fine, mixed, mesic	Typic Haploxerolls	Mollisols	Haplic Kastanozems	Brown Forest soils
Hills	3	1,235	19%	Fine, carbonatic, shallow, mesic	Typic Xerorthents	Entisols	Eutric Leptosols	Calcisols
	4	2,434	38%	Fine, carbonatic, shallow, mesic	Typic Haploxerepts	Inceptisols	Calcaric Cambisols	Brown soils
	5			Fine, carbonatic,, mesic	Typic Haploxerepts	Inceptisols	Calcaric Cambisols	Brown soils
Plateaux	6	343	5%	Clayey-skeletal, carbonatic, mesic	Fluventic Haploxerepts	Inceptisols	Calcaric Cambisols	Brown soils
	7	416	6%	Fine, carbonatic,, mesic	Typic Calcixerepts	Inceptisols	Haplic Calcisols	Calcic Brown soils
	8	714	11%	Fine, carbonatic,, mesic	Fluventic Haploxerepts	Inceptisols	Calcaric Cambisols	Brown soils
Gravelly Alluvial Fans	9	98	2%	Loamy-skeletal, carbonatic, mesic	Typic Xerothents	Entisols	Calcaric Regosols	Alluvio-Colluvial soils
Miscellaneous		146	2%					
Total		6,471	100%					

Table D-3-3-3-2 Soil Units in Sarbaz

Physiography	Soil Series	Soil Mapping Unit	Area (ha)	Area Ratio (%)	Soil Series Area (ha)	Soil Series Ratio (%)
Mountain	1	1.1				
	2	2.1				
Hill	3	3.1	1,235	19%	1,235	19%
	4	4.1			176	3%
		4.2	176	3%		
	5	5.1	104	2%	728	11%
		5.2	371	6%		
		5.3	252	4%		
Plateau	6	6.1	343	5%	343	5%
	7	7.1	416	6%	416	6%
	8	8.1	714	11%	714	11%
G. A. Fan	9	9.1	98	2%	98	2%
Association	1+2	1.1+2.1	1,085	17%	1,085	17%
	4+5	4.1+5.1	1,530	24%	1,530	24%
Miscellaeous	R		134	2%	146	2%
	RW		12	0%		
Total			6,471	100%	6,471	100%

1) No.1 Soil Series

On the map, it has been specified as 1.1, and in the classification it has been classified as:

"Clayey - skeletal, mixed, Typic Haploxerepts".

This soil is deep (80-120cm.) of dark reddish brown color (5 YR 3/3), Clay- silty clay. Fine angular blocky structure, 70% boulders and coarse gravels (0-15 cm, A, ochric epipedon) on a layer of reddish brown color (5 YR 4/3), clay, medium angular blocky structure, 40-50% boulders and coarse gravels (15-50 cm, Cambic horizon) on a layer of reddish brown (5 YR 4/3), clay, medium angular blocky structure, 50-60% boulders and coarse gravels (50-80 cm., Bw2, Cambic horizon) on a layer with more than 75% boulders and coarse gravels (+80 cm, C).

The representative profile of this soil series specifies as No.76 in 30° 51' 49N and 51° 34' 50E. The No.1 soil series contains one separated mapping unit as follows:

- Unit 1.1 No.1 soil series with clay – silty clay surface texture, 35-75% stones and boulders in subsoil and 35-75% boulders in topsoil, more than 75% stones and boulders within depth of 80-120 cm, 12-25% overall and 5-8% transversal slopes, strong micro relief, moderate water erosion.

2) No.2 soil series

On the map, it has been specified as 2.1 and in the classification it has been classified as:

"Fine, mixed, mesic, Typic Haploxerolls".

This soil is very deep of dark reddish brown color (5 YR 3/2), clay loam, granular structure, 30% coarse gravels (0-20 cm, A, mollic epipedon) on a layer of reddish brown color (5 YR 4/3), clay fine angular blocky structure, 30% boulders and coarse gravels (20-65 cm, Bw1, Cambic horizon) on a layer of dusky red (2.5 YR 4/4), clay, moderate angular blocky structure, 15-20% coarse gravels (65-85 cm, Bw2, Cambic horizon) on a layer with 50% boulders, clay, structureless (+85 cm, C)

The representative profile of this soil series specified as No.78 in 30° 57' 05N and 51° 34' 01E. The No.2 soil series contains one-separated mapping units as follows:

- Unit 2.1 No.2 soil series with clay loam surface texture, 15-35% coarse gravels and stones in subsoil and topsoil, 2-5% overall and 5-8% transversal slopes, moderate microrelieif and water erosion.

3) No.3 soil series

On the map, it has been specified as 3.1 and in the classification it has been classified as:

"Fine, carbonatic, shallow, mesic, Typic Xerorthents".

This soil is dark yellowish brown color (10 YR 4/4), clay loam, massive, 15% coarse gravels (0-15 cm, Ap, ochric epipedon) on a layer of pale brown (10 YR 6/3), silty clay loam, massive, weathered calcareous marls (paralithic) (15-60 cm, C1) on a layer of pale brown (10 YR 6/3), silty clay, massive, weathered calcareous marls (paralithic) (60-110 cm, C2) over limestone (+110 cm, R).

The representative profile of this soil series is specified as No.67 in 35° 55' 78N and 51° 35' 29E. The No.3 soil series contains one separated mapping unit as follows:

- Unit 3.1 No.3 soil series with clay loam surface texture, 15-35% coarse gravels in topsoil, weathered calcareous marls within depth of 10-25 cm., 5-8 to 8-12% overall and 5-8% transversal slopes, strong micro relief, moderate water erosion.

4) No.4 soil series

On the map. It has been specified as 4.1, 4.2 and in the classification it has been classified as:

"Fine, carbonatic, shallow, mesic, Typic Haploxerepts".

This soil is dark yellowish brown color (10 YR 4/4), clay loam, massive, 15% coarse gravels (0-20 cm., AP, ochric epipedon) on a layer of brown color (10 YR 5/3), clay, coarse angular blocky structure,

few secondary lime as powdery pockets (20-40 cm., Bw, cambic horizon) on a layer of light gray (10 YR 7/2), silty clay loam, weathered calcareous marls (paralithic (+40 cm., Cr).

The representative profile of this soil series is specified as No.229 in 30° 53' 49N and 51° 40' 35E. The No.4 soil series contains two separated mapping units as follows:

- Unit 4.1 No.4 soil series with clay loam surface texture, 15-35% coarse gravels in topsoil, weathered calcareous marls within depth of 25-50 cm, 2-5% overall and transversal slopes, slight micro relief and water erosion.
- Unit 4.2 No.4 soil series with clay loam surface texture, 15-35% stones in topsoil, weathered calcareous marls within depth of 25-50 cm, 5-8% overall and transversal slopes, moderate micro relief and water erosion.

5) No.5 soil series

On the map, it has been specified as 5.1, 5.2, 5.3 and in the classification it has been classified as:

"Fine, carbonatic, mesic, Typic Haploxerepts"

This soil is brown color (7.5 YR 4/3), clay, fine angular blocky structure, 15% coarse gravels (0-20 cm, Ap, ochric epipedon), on a layer of brown color (10 YR 4/4), clay, moderate angular blocky structure, 15-20% coarse gravels (20-50 cm, Bw, cambic horizon) on a layer of very pale brown color (10 YR 8/2), weathered calcareous marls (+50 cm, Cr)

The representative profile of this soil series specified as No.233 in 30° 53' 41N and 51° 36' 06E. The No.5 soil series contains three separated mapping units as follows:

- Unit 5.1 No.5 soil series with clay surface texture, 15-35% coarse gravels in subsoil and topsoil, weathered calcareous marls within depth of 50-80 cm, 2-5 to 5-8% overall and 2-5% transversal slopes, slight micro relief and water erosion.
- Unit 5.2 No.5 soil series with clay surface texture, 15-35% coarse gravels in subsoil, weathered calcareous marls within depth of 80-120 cm, 2-5 to 8-12% overall and 5-8% transversal slopes, moderate micro relief and water erosion.
- Unit 5.3 No.5 soil series with clay surface texture, 15-35% coarse gravels in subsoil and 35-75% coarse gravels in topsoil, weathered calcareous marls within depth of 80-120 cm, 8-12% overall and 2-5 to 5-8% transversal slopes, moderate micro relief, severe water erosion.

6) No.6 soil series

On the map, it has been specified as 6.1, and in the classification it has been classified as:

"Clayey- skeletal, carbonatic, mixed, Fluventic Haploxerepts".

This soil is reddish brown (5 YR 4/3), clay, fine angular blocky structure, 20-30% coarse gravels (0-15 cm, Ap, ochric epipedon), on a layer of reddish brown color (5 YR 4/3), clay, moderate angular blocky structure, 15-20% coarse gravels (15-30 cm, Bw1, cambic horizon) on a layer of reddish brown color (5 YR 4/4) clay, moderate angular blocky structure, 50% coarse gravels (30-45 cm, Bw2, cambic horizon) on a layer with more than 75% boulders and stones (+45 cm, C)

The representative profile of this soil series specified as No.55 in 30° 57' 09N and 51° 35' 65E. The No.6 soil series contains one-separated mapping unit as follows:

- Unit 6.1 No.6 soil series with clay surface texture, 35-75% gravels, stones and boulders in subsoil and 15-35% coarse gravels in topsoil, more than 75% coarse gravels and stones within depth of 25-50 cm., 2-5% overall and transversal slopes, moderate micro relief and water erosion.

7) No.7 soil series

On the map, it has been specified as 7.1 and in the classification it has been classified as:

"Fine, carbonatic, mesic, Typic calcixerepts".

This soil is very deep of dark yellowish brown color (10 YR 4/4), clay, massive (0-25 cm, Ap, ochric epipedon) on a layer of dark yellowish brown (10 YR 4/4), clay, moderate angular blocky structure (25-50 cm, Bw1, Cambic horizon), on al layer of yellowish brown color (1 YR 5/4), clay, moderate angular blocky structure 10-15% secondary lime as powdery pockets (50-90 cm, Bk1, calcic horizon) on a layer of yellowish brown color (10 YR 5/4), clay loam, moderate angular blocky structure, 30% secondary lime as powdery pockets, many loess dolls (90-150 cm, Bk2, calcic horizon).

The representative profile of this soil series is specified as No.225 in 30° 55' 20N and 51° 38' 68E. The No.7 soil series contains one separated mapping unit as follows:

- Unit 7.1 No.7 soil series with clay surface texture, 2-5% overall and 1-2% transversal slopes, slight micro relief and water erosion.

8) No.8 soil series

On the map, it has been specified as 8.1, and in the classification it has been classified as:

"Fine, carbonatic, mesic, Fluventic Haploxerepts".

This soil is very deep of brown color (10 YR 5/3), clay loam, massive, 2% coarse gravels (0-20 cm, AP, ochric epipedon) on a layer of brown color (10 YR 5/3), silty clay, moderate angular blocky structure, 1-2% coarse gravels (20-45 cm, Bw1, Cambic horizon) on a layer of light olive brown (2.5 Y 5/3), clay, moderate angular blocky structure, (45-80 cm, Bw3, Cambic horizon) on a layer of olive brown to light olive brown (2.5 Y 4.5/4), clay, moderate angular blocky structure (80-150 cm, Bwg, Cambic horizon).

The representative profile of this soil series is specified as No.60 in 30° 55' 84N and 51° 37' 02E. The No.8 soil series contains one separated mapping units as follows:

- Unit 8.1 No.8 soil series with clay loam surface texture, 2-5% overall and 1-2% transversal slopes, slight micro relief and water erosion.

9) No.9 soil series

On the map, it has been specified as 9.1, and in the classification it has been classified as:

"Loamy- skeletal, carbonatic, mesic, Typic Xerorthents".

This soil is brown color (10 YR 4/3), clay loam, massive, 25% coarse gravels (0-20 cm, AP, ochric epipedon) on a layer of brown color (10 YR 4/3), sandy loam, massive, 40-50% coarse gravels (20-45 cm, C1) on a layer with more than 75% gravels, stones and boulders (45-150 cm, C2).

The representative profile of this soil series is specified as No.70 in 30° 56' 97N and 51° 36' 76E. The No.9 soil series contains one-separated mapping unit as follows:

- Unit 9.1 No.9 soil series with clay loam surface texture, 35-75% coarse gravels and stones in subsoil and 15-35% coarse gravels in topsoil, more than 75% coarse gravels and stones within depth of 25-50 cm., 2-5% overall and 1-2% transversal slopes, slight micro relief and water erosion.

(3) Soil Properties in Sarbaz

Soils are generally clayey in Sarbaz as show in Table D-3-3-3-3. Gravel content is generally high except soil series 7 and 8 which are extending in the plateaus nearby the main river. Soil series 8 has relatively high permeability (Rapid-medium by USDA). The pH of soils are alkaline (7.06 – 8.03) and organic matter content is 1.49 % in average.

Table D-3-3-3-3 Soil Properties in Sarbas

Physiography	Soil series	Mapping Unit	Profile	Texture (%)				Texture	pH	OC (%)	Depth (m)	Sa (g/cm³)	Ib (cm/hr)
				Clay <0.002	Silt 0.002-0.05	Sand 0.05-2	Gravel>2 mm						
Hill	3	3.1	56	52	46	2	60	SiC		1.22	0.50		
			62	49	11	40	15	C		1.11	1.50		
			64	40	30	30	12.5	C-CL	7.97	0.83	1.10		4.08
			66	32	22	46	15	SaCL		0.77	0.55		
			67	40	40	20	15	C-CL	7.81	1.39	1.10		3.53
			68	34	22	44	50	CL		0.92	0.30		
			72	50	46	4	0	SiC		0.96	1.00		
			73	46	42	12	15	SiC		1.56	1.00		
			89	60	34	6	60	C		1.71	0.40		
			Ave.	45	33	23	27		7.89	1.16	0.83		3.81
	4	4.1											
		4.2	237	46	32	22	20	C		1.56	0.30		
			255	40	36	24	40	C-CL		1.49	0.50		
			Ave.	43	34	23	30			1.53	0.40		
	5	5.1	81	38	56	6	60	SiCL		2.66	0.50		1.80
			94	50	26	24	15	SiC		1.41	0.55		
			Ave.	44	41	15	38			2.04	0.53		1.80
		5.2	227	62	34	4	0	C	8.00	1.41	1.50	1.35	
			228	52	41	7	20	SiC		1.66	1.50		
			Ave.	57	38	6	10			1.54	1.50	1.35	
		5.3	234	43	48	9	40	SiC		2.49	1.50		
Plateaus	6	6.1	55	56	26	18	25	C	7.85	2.01	0.45		3.50
			58	52	22	26	40	C		0.96	0.30		
			59	42	38	20	10	C		0.65	0.65		
			65	50	30	20	40	C		0.91	0.35		
			69	40	36	24	10	C-CL		1.55	1.50	1.29	
			Ave.	48	30	22	25		7.85	1.22	0.65	1.29	3.50
	7	7.1	225	44	33	23	0	C	7.66	2.29	1.50	1.41	
			226	50	47	3	0	SiC		1.46	1.50		
			Ave.	47	40	13	0		7.66	1.88	1.50	1.41	
	8	8.1	60	40	34	26	2	C-CL	8.03	0.81	1.50	1.38	10.73
			61	46	36	18	10	C		0.69	1.50		
			63	40	36	24	3	C-CL		1.32	1.50		
			230	36	37	27	0	CL	7.80	0.80	1.50	1.35	
			231	44	38	18	10	C		1.68	1.50		
			232	44	37	19	10	C		1.91	1.20		
			236	44	52	4	2	SiC		0.85	1.50		
			Ave.	42	39	19	5		7.92	1.15	1.46	1.37	10.73
Gravelly Alluvial Fan	9	9.1	70	40	40	20	25	CL	7.99	1.07	0.45		
			71	40	40	20	40	SiCL		1.39	0.40		
			Ave.	40	40	20	33		7.99	1.23	0.43		
Associations	1+2	1.1+2.1	76	56	40	4	70	C-SiC	7.06	2.30	0.80		
			78	40	40	20	30	CL	7.09	1.74	1.50		
			86	56	38	8	40	C		1.57	1.00		
			87	54	32	14	80	C		2.08	1.00		
			92	26	38	36	60	L		1.30	0.40		
			96	52	36	12	60	C		1.43	0.40		
			97	52	46	2	50	SiC		2.35	0.40		
			Ave.	48	39	14	56		7.08	1.82	0.79		
	4+5	4.1+5.1	229	38	41	21	15	CL	7.92	0.58	1.00	1.33	
			233	44	21	35	15	C	7.81	3.12	1.00		
			238	46	27	27	25	C		1.98	0.90		
			239	40	31	29	40	C-CL		1.79	1.20		
			241	46	44	10	15	SiC		1.93	0.70		
			248	40	39	21	25	C-CL		1.00	1.50		
			Ave.	42	34	24	23		7.87	1.73	1.05	1.33	
Miscellaneous	R												
	RW												
Total				*45*	*36*	*19*	*26*		*7.76*	*1.49*	*0.96*	*1.35*	*4.73*

(Notes) 1) Soil texture, pH, Organic Carbon Content, Specific gravity are for top soil.
2) When depth is 1.50m or more, actual depth is more than mentioned depth.
3) Soil texture abbreviation C: Clay, CL: Clay Loam, SiC: Silty Clay, SiCL: Silty Clay Loam, SiL: Silty Loam, L: Loam, LSa: Loamy Sand, SaC: Sandy Clay, SaCL: Sandy Clay Loam, SaL: Sandy Loam

(4) Laboratory Test Results of Representative Profiles in Sarbaz

Table D-3-3-3-4 Laboratory Test of Soil Profile No. 76 (Soil Series 1) in Sarbaz

Area :	SARBAZ (KOLBELUK)	منطقه :
Soil Series :	1	سري خاك :
Soil Profile No. :	76	شماره نيمرخ خاك :
Soil & Water La. :	SCWRC	آزمايشگاه خاك و آب :
Lab. No. :		شماره آزمايشگاه :

عمق (سانتيمتر)	افق	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر)				بافت	درصد اشباع	هدايت الكتريكي (دسي زيمنس بر متر)	واكنش گل اشباع	درصد كربن آلي
Depth (cm)	Horizon	Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2	Texture	SP	Ece*10^3(ds/m)	PHa	OC%
0-15	A	4	40	56	70	C-SIC	53.3	0.56	7.06	2.3
15-50	Bw1	10	30	60	40-50	C	49.84	0.56	7.45	0.53
50-80	Bw2	10	32	58	50-60	C	51.5	0.45	7.6	0.3
+ 80	C				>75					

عمق (سانتيمتر)	ازت كل	فسفر قابل جذب	پتاسيم قابل جذب	درصد مواد خنثي شونده	گچ	سديم قابل تبادل	ظرفيت تبادل كاتيوني	درصد سديم تبادلي	نسبت جذب محلول	درصد اشباع بازي
Depth (cm)	Total N	Ava. P	Ava. K	T.N.V %	Gypsum	Ex. Na	C.E.C	ESP	SAR	BS %
		p.p.m	p.p.m		Meq/100g Soil مي‌لي اكي والان درصد گرم خاك					
0-15	0.2	60.8	632	7.8			46.22		0.19	
15-50	0.014	26.2	352	6.18			47.48		0.77	

عمق (سانتيمتر)	كاتيونهاي محلول (ميلي اكي والان در ليتر)					آنيونهاي محلول (مي‌لي اكي والان در ليتر)				
Depth (cm)	Soluble Cations (meq/l)					Soluble Anions (meq/l)				
	Ca++	Mg++	Na+	K+	Sum	CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-15	3.6	1.6	0.32	0.15	5.67	0	4	1	0.66	5.66
15-50	2.4	2	1.14	0.14	5.68	0	2.5	2	1.29	5.79

عمق (سانتيمتر)	درصد آب موجود Water Content %			وزن مخصوص ظاهري	وزن مخصوص حقيقي	درصد	قابليت نفوذ Permeability		نفوذ پذيري Infiltration Rate	
Depth (cm)	Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	BD (gr cm3)	PD (gr cm3)	Total Porosity %	سانتيمتر بر ساعت cm/h	كلاس Class	سانتيمتر بر ساعت cm/h	كلاس Class

Table D-3-3-3-5 Laboratory Test of Soil Profile No. 78 (Soil Series 2) in Sarbaz

Area :	SABRAZ (KOLBELUK)		منطقه :
Soil Series :	2		سري خاك :
Soil Profile No. :	78		شماره نيمرخ خاك :
Soil & Water La. :	SCWRC		آزمايشگاه خاك و آب :
Lab. No. :			شماره آزمايشگاه :

عمق (سانتيمتر) Depth (cm)	افق Horizon	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر)				بافت Texture	درصد اشباع SP	هدايت الكتريكي (دسي زيمنس بر متر) Ece*10^3(ds/m)	واكنش گل اشباع PHs	درصد كربن آلي OC%
		Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2					
0-20	A	20	40	40	30	CL	35	0.47	7.09	1.74
20-65	Bw1	16	32	52	30	C	60.5	0.35	7.58	0.78
65-85	Bw2	18	22	60	15-20	C	69.01	0.36	8	0.76
85-150	C	20	30	50	50	C	54	0.32	8	0.4

عمق (سانتيمتر) Depth (cm)	ازت كل Total N	مقدار فسفر جذب Ava. P p.p.m	پتاسيم قابل جذب Ava. K p.p.m	درصد مواد خنثي شونده T.N.V %	گچ Gypsum	سديم قابل تبادل Ex. Na	ظرفيت تبادل كاتيوني C.E.C	درصد سديم تبادلي ESP	نسبت جذب سديم SAR	درصد اشباع بازي BS %
					Meq/100g Soil ميلي اكي والان درصد گرم خاك					
0-20	0.18	4.5	632	6.18			18.96		0.41	
20-65	0.16	13.2	328	6.64			22.61		0.54	
65-85				14.31			23.65		0.59	

عمق (سانتيمتر) Depth (cm)	كاتيونهاي محلول (ميلي اكي والان در ليتر) Soluble Cations (meq/l)					آنيونهاي محلول (ميلي اكي والان در ليتر) Soluble Anions (meq/l)				
	Ca++	Mg++	Na+	K+	Sum	CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-20	2.8	1.2	0.59	0.13	4.72	0	2.5	2	0.18	4.68
20-65	2.2	0.6	0.64	0.08	3.52	0	2.5	1	0.08	3.58
65-85	1.6	1.2	0.7	0.12	3.62	0	2	1.5	0.15	3.65

عمق (سانتيمتر) Depth (cm)	درصد آب موجود Water Content %			وزن مخصوص ظاهري BD (gr/cm3)	وزن مخصوص حقيقي PD (gr/cm3)	درصد تخلخل و فرج Total Porosity %	قابليت نفوذ Permeability		سرعت پذيرش Infiltration Rate	
	Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي				سانتيمتر بر ساعت cm/h	كلاس Class	سانتيمتر بر ساعت cm/h	كلاس Class

Table D-3-3-3-6 Laboratory Test of Soil Profile No. 67 (Soil Series 3) in Sarbaz

Area :	SARBAZ	منطقه :
Soil Series :	3	سري خاك :
Soil Profile No. :	67	شماره نيمرخ خاك :
Soil & Water La. :	SCWRC	آزمايشگاه خاك و آب :
Lab. No. :		شماره آزمايشگاه :

عمق (سانتيمتر)	افق	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر)				بافت	درصد اشباع	هدايت الكتريكي (دسي زيمنس بر متر)	واكنش گل اشباع	درصد كربن آلي
Depth (cm)	Horizon	Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2	Texture	SP	Ece*10^3(ds/m)	PHs	OC%
0-15	Ap	20	40	40	15	C-CL	45.97	0.5	7.81	1.39
15-60	C1	13	51	36		SICL	42.5	0.35	8.04	0.44
60-120	C2	16	42	42		SIC	47.71	0.31	8.15	0.2
+ 120	R									

عمق (سانتيمتر)	ازت كل	فسفر قابل جذب	پتاسيم قابل جذب	درصد مواد خنثي شونده	گچ	سديم قابل تبادل	ظرفيت تبادل كاتيوني	درصد سديم تبادلي	قسمت جذب سديم	درصد اشباع پذيري
Depth (cm)	Total N	Ava. P p.p.m	Ava. K p.p.m	T.N.V %	Gypsum	Ex. Na	C.E.C	ESP	SAR	BS %
					Meq/100g Soil ميلي اكي والان در صد گرم خاك					
0-15	0.16	29.2	144	54.77			9.91		0.57	
15-60	0.012	7.6	104	54.77			7.13		0.49	
60-110				54.77			7.65		0.39	

عمق (سانتيمتر)	كاتيونهاي محلول (ميلي اكي والان در ليتر)					آنيونهاي محلول (ميلي اكي والان در ليتر)				
	Soluble Cations (meq/l)					Soluble Anions (meq/l)				
Depth (cm)	Ca++	Mg++	Na+	K+	Sum	CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-15	2.5	1.6	0.82	0.09	5.01	0	3.5	1.5	0.06	5.06
15-60	1.7	1.3	0.6	0.03	3.63	0	2	1.5	0.15	3.65
60-120	1.3	1.3	0.45	0.02	3.07	0	2	1	0.14	3.14

عمق (سانتيمتر)	Water Content % درصد آب موجود			وزن مخصوص ظاهري	وزن مخصوص حقيقي	درصد خلل و فرج	Permeability قابليت نفوذ		Infiltration Rate نفوذ پذيري	
Depth (cm)	Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	BD (gr/cm3)	PD (gr/cm3)	Total Porosity %	سانتيمتر بر ساعت cm/h	كلاس Class	سانتيمتر بر ساعت cm/h	كلاس Class

Table D-3-3-3-7 Laboratory Test of Soil Profile No. 64 (Soil Series 3) in Sarbaz

Area : SARBAZ — منطقه :
Soil Series : 3 — سري خاك :
Soil Profile No. : 64 — شماره نيمرخ خاك :
Soil & Water La. : SCWRC — آزمايشگاه خاك و آب :
Lab. No. : — شماره آزمايشگاه :

عمق (سانتيمتر) Depth (cm)	افق Horizon	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر) Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2	بافت Texture	درصد اشباع SP	هدايت الكتريكي (دسي زيمنس بر متر) Ece*10^3(ds/m)	واكنش گل اشباع PHs	درصد كربن آلي OC%
0-20	Ap	30	30	40	10-15	C-CL	48.19	0.27	7.97	0.83
20-60	C1	35	30	35	5-10	CL	38.74	0.24	8.16	0.43
60-110	C2	19	41	40	5-10	SIC	61.04	0.24	8.25	0.35
+ 110	Z									

عمق (سانتيمتر) Depth (cm)	ازت كل Total N	فسفر قابل جذب Ava. P ppm	پتاسيم قابل جذب Ava. K p.p.m	درصد مواد خنثي شونده T.N.V %	گچ Gypsum Meq/100g Soil	منيزيم قابل تبادل Exc. Na	ظرفيت تبادل كاتيوني C.E.C مولي لكي والان درصد گرم خاك	درصد سديم قابلي ESP	نسبت جذب سديم SAR	درصد اشباع وازي BS %
0-20	0.016	18.2	230	53.84			9.74		0.55	
20-60	0.014	9	88	54.55			6.5		0.4	
60-110				50.58			9.91		0.37	

عمق (سانتيمتر) Depth (cm)	كاتيونهاي محلول (مولي لكي و آن در ليتر) Soluble Cations (meq/l) Ca++	Mg—	Na+	K+	Sum	آنيونهاي محلول (مولي لكي والان در ليتر) Soluble Anions (meq/l) CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-20	1.6	0.4	0.55	0.06	2.61	0	1.5	1	0.14	2.64
20-60	1.2	0.8	0.4	0.02	2.42	0	1	1	0.46	2.46
60-110	1.2	0.8	0.37	0.03	2.4	0	1	1	0.35	2.35

عمق (سانتيمتر) Depth (cm)	درصد آب موجود خاك Water Content Field moisture رطوبت صحرائي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	وزن مخصوص ظاهري BD (gr/cm3)	وزن مخصوص حقيقي PD (gr/cm3)	درصد تخلخل و فرج Total Porosity %	قابليت نفوذ Permeability سانتيمتر بر ساعت cm/h	كلاس Class	نفوذ پذيري Infiltration Rate سانتيمتر بر ساعت cm/h	كلاس Class

Table D-3-3-3-8 Laboratory Test of Soil Profile No. 229 (Soil Series 4) in Sarbaz

Area :	SARBAZ	منطقه :
Soil Series :	4	سري خاك :
Soil Profile No. :	229	شماره نيمرخ خاك :
Soil & Water La. :	SCWRC	آزمايشگاه خاك و آب :
Lab. No. :		شماره آزمايشگاه :

عمق (سانتيمتر) Depth (cm)	افق Horizon	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر) Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2	بافت Texture	درصد اشباع SP	هدايت الكتريكي (دسي زيمنس بر متر) Ece*10^3(ds/m)	واكنش گل اشباع PHs	درصد كربن آلي OC%
0-20	Ap	21	41	38	15	CL	42.2	0.52	7.92	0.58
20-40	Bw	23	37	40		C	41.35	0.37	8.01	0.74
40-100	Cr	19	44	37		SICL	38.77	0.34	8.27	0.12

عمق (سانتيمتر) Depth (cm)	ازت كل Total N	فسفر قابل جذب Ava. P p.p.m	پتاسيم قابل جذب Ava. K p.p.m	درصد مواد خنثي شونده T.N.V %	گچ Gypsum	سديم قابل تبادل Ex. Na	ظرفيت تبادل كاتيوني C.E.C	درصد سديم تبادلي ESP	نسبت جذب سديم SAR	درصد اشباع وازي BS %
					Meq/100g Soil ميلي اكي والان درصد گرم خاك					
0-20	0.014	21.4	136	54.3			24.7		0.27	
20-40	0.016	12.6	160	52.91			27.72		0.38	
40-100				54.54			16		0.48	

عمق (سانتيمتر) Depth (cm)	كاتيونهاي محلول (ميلي اكي والان در ليتر) Soluble Cations (meq/l) Ca++	Mg++	Na+	K+	Sum	آنيونهاي محلول (ميلي اكي والان در ليتر) Soluble Anions (meq/l) CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-20	3.2	1.6	0.43	0.08	5.31	0	3.5	1.5	0.39	5.39
20-40	2	1.2	0.49	0.04	3.73	0	2.5	1	0.2	3.7
40-100	1.6	1.2	0.57	0.07	3.44	0	2	1	0.43	3.43

عمق (سانتيمتر) Depth (cm)	درصد آب موجود % Water Content Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	وزن مخصوص ظاهري BD (gr/cm3)	وزن مخصوص حقيقي PD (gr/cm3)	درصد خل و فرج Total Porosity %	قابليت نفوذ Permeability سانتيمتر بر ساعت cm/h	كلاس Class	نفوذ پذيري Infiltration Rate سانتيمتر بر ساعت cm/h	كلاس Class
0-20	20.78	31	14	1.33	2.6	51.15				
20-40	19.61	31	15	1.42	2.77	51.26				

Table D-3-3-3-9 Laboratory Test of Soil Profile No. 233 (Soil Series 5) in Sarbaz

Area :	SARBAZ	منطقه :
Soil Series :	5	سري خاك :
Soil Profile No. :	233	شماره نيمرخ خاك :
Soil & Water La. :	SCWRC	آزمايشگاه خاك و آب :
Lab. No. :		شماره آزمايشگاه :

عمق (سانتيمتر) Depth (cm)	افق Horizon	Particule size classes (mm) درصد ذرات خاك (قطر به ميليمتر) Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2	بافت Texture	درصد اشباع SP	هدايت الكتريكي (دسي زيمنس بر متر) Ece*10^3(ds/m)	واكنش گل اشباع PHs	درصد كربن آلي OC%
0-20	Ap	35	21	44	15	C	49.57	0.57	7.81	3.12
20-50	Bw	25	25	50	15-20	C	55.17	0.44	7.96	0.6
50-100	Cr	33	45	22		L	31.49	0.44	8.25	0.21

عمق (سانتيمتر) Depth (cm)	ازت كل Total N	مقدار فسفر جذب Ava. P p.p.m	پتاسيم قابل جذب Ava. K p.p.m	درصد مواد خنثي شونده T.N.V %	گچ Gypsum	سديم قابل تبادل Exc. Na	ظرفيت تبادل كاتيوني C.E.C ميلي اكي والان درصد گرم خاك Meq/100g Soil	درصد سديم قابل تبادل ESP	نسبت جذب سديم SAR	درصد سديم تبادلي ESP
0-20	0.24	23.2	488	48.03			34.78		0.5	
20-50	0.014	19.6	176	51.51			30.7		0.55	
50-100				54.4			9.91		0.28	

عمق (سانتيمتر) Depth (cm)	كاتيونهاي محلول (ميلي اكي والان در ليتر) Soluble Cations (meq/l) Ca++	Mg++	Na+	K+	Sum	آنيونهاي محلول (ميلي اكي والان در ليتر) Soluble Anions (meq/l) CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-20	2.8	2	0.78	0.22	5.8	0	3.5	1.5	0.84	5.84
20-50	2	1.6	0.75	0.1	4.45	0	2.5	1.5	0.4	4.4
50-100	3.2	0.8	0.4	0.04	4.44	0	2	1.5	0.88	4.38

عمق (سانتيمتر) Depth (cm)	درصد آب موجود Water Content % Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	وزن مخصوص ظاهري BD (gr/cm3)	وزن مخصوص حقيقي PD (gr/cm3)	درصد تخلخل و فرج Total Porosity %	قابليت نفوذ Permeability سانتيمتر بر ساعت cm/h	كلاس Class	نفوذ پذيري Infiltration Rate سانتيمتر بر ساعت cm/h	كلاس Class

Table D-3-3-3-10 Laboratory Test of Soil Profile No. 227 (Soil Series 5) in Sarbaz

Area :	SARBAZ	منطقه :
Soil Series :	5	سري خاك :
Soil Profile No. :	227	شماره نيمرخ خاك :
Soil & Water La. :	SCWRC	آزمايشگاه خاك و آب :
Lab. No. :		شماره آزمايشگاه :

عمق (سانتيمتر) Depth (cm)	افق Horizon	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر) Sand 2 - 0.05	Silt 0.05 - 0.002	Clay <0.002	Gravel > 2	بافت Texture	درصد اشباع SP	هدايت الكتريكي (دسي زيمنس بر متر) Ece*10^3(ds/m)	واكنش گل اشباع PHs	درصد كربن آلي OC%
0-20	A	4	34	62		C	45.52	0.48	8	1.41
20-50	Bw1	5	41	54		C	44.9	0.58	8.07	0.99
50-100	Bw2	7	41	52		C	45.94	0.41	8.12	0.8
100-150	Cr	7	39	54		C	48.11	0.36	8.17	0.69

عمق (سانتيمتر) Depth (cm)	ازت كل Total N	فسفر قابل جذب Ava. P p.p.m	پتاسيم قابل جذب Ava. K p.p.m	درصد مواد خنثي شونده T.N.V %	گچ Gypsum	سديم قابل تبادل Ex. Na	ظرفيت تبادل كاتيوني C.E.C ميلي لكي والان درصد گرم خاك Meq/100g Soil	درصد سديم تبادلي ESP	نسبت جذب سديم SAR	درصد اشباع بازي BS %
0-20	0.16	47	470	46.86			35.1		1.12	
20-50	0.016	24.4	350	46.86			32		1.24	
50-100				48.96			30.26		0.58	
100-150				54.77			27.22		0.6	

عمق (سانتيمتر) Depth (cm)	كاتيونهاي محلول (ميلي لكي والان در ليتر) Soluble Cations (meq/l) Ca++	Mg++	Na+	K+	Sum	آنيونهاي محلول (ميلي لكي والان در ليتر) Soluble Anions (meq/l) CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-20	2.4	0.8	1.42	0.13	4.75	0	3	1.5	0.29	4.79
20-50	2.8	1.2	1.76	0.17	5.93	0	3.5	2	0.33	5.83
50-100	1.6	1.6	0.74	0.07	4.01	0	2	2	0.03	4.03
100-150	2.4	0.4	0.71	0.04	3.55	0	2	1.5	0.02	3.52

عمق (سانتيمتر) Depth (cm)	درصد آب موجود Water Content % Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	وزن مخصوص ظاهري BD (gr/cm3)	وزن مخصوص حقيقي PD (gr/cm3)	درصد خل و فرج Total Porosity %	قابليت نفوذ Permeability سانتيمتر بر ساعت cm/h	كلاس Class	نفوذ پذيري Infiltration Rate سانتيمتر بر ساعت cm/h	كلاس Class
0-20	17.5	34	15	1.35	2.56	52.7				
20-50	20.5	33	17	1.37	2.6	52.6				
50-100	21.4	34	15	1.35	2.56	52.73				
100-150	17.82	33	17	1.37	2.6	52.69				

Table D-3-3-3-11 Laboratory Test of Soil Profile No. 55 (Soil Series 6) in Sarbaz

Area :	SARBAZ	منطقه :
Soil Series :	6	سري خاك :
Soil Profile No. :	55	شماره نيمرخ خاك :
Soil & Water La. :	SCWRC	آزمايشگاه خاك و آب :
Lab. No. :		شماره آزمايشگاه :

عمق (سانتيمتر) Depth (cm)	افق Horizon	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر) Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2	بافت Texture	درصد اشباع SP	هدايت الكتريكي (دسي زيمنس بر متر) Ece*10^3(ds/m)	واكنش گل اشباع PHs	درصد كربن آلي OC%
0-15	Ap	18	26	56	20-30	C	62.1	0.48	7.85	2.01
15-30	Bw1	24	24	52	15-20	C	59.3	0.3	7.96	1.89
30-45	Bw2	38	28	44	50	C	72.28	0.43	8.04	0.8
+ 45	C				>75					

عمق (سانتيمتر) Depth (cm)	ازت كل Total N	فسفر قابل جذب Ava. P p.p.m	پتاسيم قابل جذب Ava. K p.p.m	درصد مواد خنثي شونده T.N.V %	گچ Gypsum	سديم قابل تبادل Ex. Na	ظرفيت تبادل كاتيوني C.E.C	درصد سديم تبادلي ESP	نسبت جذب سديم SAR	درصد اشباع پذير BS %
					Meq/100g Soil ميلي اكي والان درصد گرم خاك					
0-15	0.19	21.6	430	47.56			14.6		0.45	
15-30	0.16	26	320	45.7			13.48		0.53	
30-45	0.014	13.4	184	51.51			11.48		0.82	

عمق (سانتيمتر) Depth (cm)	كاتيونهاي محلول (ميلي اكي و آلان در ليتر) Soluble Cations (meq/l) Ca++	Mg++	Na+	K+	Sum	آنيونهاي محلول (ميلي اكي والان در ليتر) Soluble Anions (meq/l) CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-15	1.6	2.4	0.64	0.09	4.73	0	3	1.5	0.2	4.7
15-30	0.5	1.9	0.58	0.02	3	0	2	1	0.08	3.08
30-45	1.6	1.6	1.04	0.06	4.3	0	2.5	1.5	0.22	4.22

عمق (سانتيمتر) Depth (cm)	درصد آب موجود % Water Content Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	وزن مخصوص ظاهري BD (gr/cm3)	وزن مخصوص حقيقي PD (gr/cm3)	درصد حجم خل و فرج Total Peresity %	قابليت نفوذ Permeability سانتيمتر بر ساعت cm/h	كلاس Class	نفوذ پذيري Infiltration Rate سانتيمتر بر ساعت cm/h	كلاس Class

Table D-3-3-3-12 Laboratory Test of Soil Profile No. 225 (Soil Series 7) in Sarbaz

Area :	SARBAZ	منطقه :
Soil Series :	7	سري خاك :
Soil Profile No. :	225	شماره نيمرخ خاك :
Soil & Water La. :	SCWRC	آزمايشگاه خاك و آب :
Lab. No. :		شماره آزمايشگاه :

عمق (سانتيمتر) Depth (cm)	افق Horizon	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر) Sand 2 - 0.05	Silt 0.05 - 0.002	Clay <0.002	Gravel >2	بافت Texture	درصد اشباع SP	هدايت الكتريكي (دسي زيمنس بر متر) Ece*10^3(ds/m)	واكنش گل اشباع PHs	درصد كربن آلي OC%
0-25	Ap	23	33	44		C	46.18	0.78	7.66	2.29
25-50	Bw	22	28	50		C	49.46	0.52	8.02	0.58
50-90	Bk1	18	34	48		C	64.47	0.52	8.08	0.44
90-150	Bk2	24	38	38		CL	45.43	0.47	8.14	0.27

عمق (سانتيمتر) Depth (cm)	ازت كل Total N	فسفر قابل جذب Ava. P p.p.m	پتاسيم قابل جذب Ava. K p.p.m	درصد مواد خنثي شونده T.N.V %	گچ Gypsum	سديم قابل تبادل Ex. Na	ظرفيت تبادل كاتيوني C.E.C	درصد سديم تبادلي ESP	قليت جذب سديم SAR	درصد اشباع بازي BS %
					Meq/100g Soil مولي اكي والان درصد گرم خاك					
0-25	0.2	31.4	336	54.54			17.74		0.4	
25-50	0.014	25	176	54.7			14.6		0.83	
50-90				54.77			13.22		0.52	
90-150				54.77			14.96		0.5	

عمق (سانتيمتر) Depth (cm)	كاتيونهاي محلول (مولي اكي والان در ليتر) Soluble Cations (meq/l) Ca++	Mg++	Na+	K+	Sum	آنيونهاي محلول (مولي اكي والان در ليتر) Soluble Anions (meq/l) CO3 --	HCO3 -	Cl -	SO4 --	Sum
0-25	4.2	2.6	0.74	0.32	7.86	0	3	2.5	2.41	7.91
25-50	2.4	1.6	1.18	0.1	5.28	0	3	2	0.27	5.27
50-90	4	0.4	0.78	0.06	5.24	0	3	2	0.27	5.27
90-150	2.4	1.6	0.71	0.02	4.73	0	1.5	2	1.18	4.68

عمق (سانتيمتر) Depth (cm)	درصد آب موجود Water Content % Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	وزن مخصوص ظاهري BD (gr/cm3)	وزن مخصوص حقيقي PD (gr/cm3)	درصد خلل و فرج Total Porosity %	قابليت نفوذ Permeability سانتيمتر بر ساعت cm/h	كلاس Class	نفوذ پذيري Infiltration Rate سانتيمتر بر ساعت cm/h	كلاس Class
0-25	22.77	35	18	1.41	2.57	54.86				
25-50	21.97	36	17	1.4	2.54	55.12				
50-90	23.79	34	15	1.45	2.64	54.92				
90-150	20.78	31	14	1.33	2.6	51.15				

Table D-3-3-3-13 Laboratory Test of Soil Profile No. 60 (Soil Series 8) in Sarbaz

Area :	SARBAZ	منطقه :
Soil Series :	8	سري خاك :
Soil Profile No. :	60	شماره نيمرخ خاك :
Soil & Water La. :	SCWRC	آزمايشگاه خاك و آب :
Lab. No. :		شماره آزمايشگاه :

عمق (سانتيمتر) Depth (cm)	افق Horizon	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر) Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2	بافت Texture	درصد اشباع SP	هدايت الكتريكي (دسي زيمنس در متر) Ece*10^3(ds/m)	واكنش گل اشباع PHs	درصد كربن آلي OC%
0-20	Ap	26	34	40	2	C-CL	46.18	0.41	8.03	0.81
20-45	Bw1	10	46	44	1-2	SIC	75.3	0.38	8.1	0.62
45-80	Bw2	21	33	46		C	61.8	0.42	8.18	0.44
80-150	Bwg	24	34	42		C	43.54	0.31	8.12	0.37

عمق (سانتيمتر) Depth (cm)	ازت كل Total N	فسفر قابل جذب Ava. P p.p.m	پتاسيم قابل جذب Ava. K p.p.m	درصد مواد خنثي شونده T.N.V %	گچ Gypsum	سديم قابل تبادل Exc Na	ظرفيت تبادل كاتيوني C.E.C	درصد سديم تبادلي ESP	نسبت جذب سديم SAR	درصد اشباع بازي BS %
					Meq/100g Soil ميلي اكي والان درصد گرم خاك					
0-20	0.016	23.8	304	54.3			9.39		0.37	
20-45	0.014	10.2	248	53.84			9.74		0.67	
45-80				54.3			9.04		0.71	
80-150				54.3			8		0.63	

عمق (سانتيمتر) Depth (cm)	كاتيونهاي محلول (ميلي اكي والان در ليتر) Soluble Cations (meq/l) Ca++	Mg++	Na+	K+	Sum	آنيونهاي محلول (ميلي اكي والان در ليتر) Soluble Anions (meq/l) CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-20	1.7	1.7	0.45	0.11	3.96	0	2.5	1.5	0.07	4.07
20-45	2	0.8	0.8	0.11	3.71	0	2.5	1	0.25	3.75
45-80	1.6	1.6	0.9	0.08	4.18	0	2.5	1.5	0.21	4.21
80-150	1.2	1.2	0.69	0.06	3.15	0	1.5	1.5	0.12	3.12

عمق (سانتيمتر) Depth (cm)	درصد آب موجود % Water Content Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	وزن مخصوص ظاهري BD (gr/cm3)	وزن مخصوص حقيقي PD (gr/cm3)	درصد تخلخل كل Total Porosity %	قابليت نفوذ Permeability سانتيمتر در ساعت cm/h	كلاس Class	نفوذ پذيري Infiltration Rate سانتيمتر در ساعت cm/h	كلاس Class
0-20	16.01	38	16	1.38	2.54	54.33				
20-45	16.13	28	13	1.39	2.51	55.38				
45-80	15.72	32	15	1.38	2.5	55.2				
80-150	15.61	32	17	1.45	2.66	54.51				

D3.3.4 Soils in Tang Sorkh

(1) General Descriptions of Soil Series in Tang Sorkh

In Tangsorkh, four soils are observed, namely 1)Eutric Leptosols in hills, 2)Calcaric Cambisols in old alluvial fan and plateaus, 3)Calcaric Regosols in gravelly alluvial fans, and 4)Calcaric Fluvisols in river beds. Eutric Leptosols is observed at hilly area where marl is extensively distributed. This soil contains high percentage of stones and soil depth is very shallow. Young apple trees were recently planted in this soil and irrigated by pump irrigation from the Boshar river. Drip irrigation system was introduced for irrigation due to coarse texture. Calcaric Cambisols is one of major soils in this area, which is forming old alluvial fans and plateaus. Texture of this soil is heavy but it contains high percentage of gravel and stone. Most area of this soil is utilized as rangeland and partly as dry farmland. Carcaric Regosols is also one of major soils in this area and it forms gravelly alluvial fans. Most area of this soil is irrigated by gravity system for wheat and partly apple trees. *Calcaric Fluvisols is forming lower river bank terrace of the Boshar river.*

(2) Soil Series and Units in Tang Sorkh

Soils of Tang Sorkh area are located on five physiographic units and contain six soil series as follows:

Table D-3-3-4-1 Soil Series in Tang Sorkh

Physiography	Soil Series			USDA Soil Taxonomy (1999)			FAO-Unesco (1989)	Iranian Fourth Approximation
	No.	Area (ha)	%	Family	Subgourp	Order		
Plateaux	1	87	7%	Fine-loamy, mixed, thermic	Typic Haploxerepts	Inceptisols	Calcaric Cambisols	Brown soils
Gravelly *Alluvial Fans*	2	268	22%	Loamy-skeletal, *carbonatic, thermic*	Typic *Xerorthents*	Entisols	Calcaric Regosols	Alluvio-colluvial soils
Old Alluvial Fans	3	310	25%	Fine-loamy, carbonatic, thermic	Fluventic Haploxerepts	Inceptisols	Calcaric Cambisols	Brown soils
	4		0%	Clayey-skeletal, carbonatic, thermic	Fluventic Haploxerepts	Inceptisols	Calcaric Cambisols	Brown soils
River Beds	5	197	16%	Fine-loamy, carbonatic, thermic	Typic Xerofluvents	Entisols	Calcaric Fluvisols	Stratified Alluvial soils
Hills	6	259	21%	Loamy-skeletal, mixed, (calcareous), thermic	Lithic Xerorthents	Entisols	Eutric Leptosols	Lithosols
Miscellaneous		108	3%					
Total		1,229	34%					

Table D-3-3-4-2 Soil Units in Tang Sorkh

Physiography	Soil Series	Soil Mapping Unit	Area (ha)	Area Ratio (%)	Soil Series Area (ha)	Soil Series Ratio (%)
Plateau	1	1.1	87	0.07	87	7%
Gravelly Alluvial Fan	2	2.1	40	3%	268	22%
		2.2	154	13%		
		2.3	73	6%		
Old Alluvial Fan	3	3.1	120	10%	310	25%
	4	4.1	190	15%		
River Bed	5	5.1	29	2%	197	16%
		5.2	168	14%		
Hill	6	6.1	259	21%	259	21%
Miscellaeous	RW		108	9%	108	9%
Total			1,229	100%	1,229	100%

1) No.1 Soil Series

On the map, it has been specified as 1.1, and in the classification it has been classified as:

"Fine – loamy, mixed, thermic, Typic Haploxerepts".

This soil is deep of brown color (10 YR 4/3), clay loam, structureless, 15-20% coarse gravels (0-20 cm, Ap, ochric epipedon) on a layer of brown color (10 YR 4/3), clay loam, angular blocky structure, 30-40% coarse gravels (20-38 cm, Bw1, cambic horizon) on a layer of brown color (10 YR 4/3), clay loam, angular blocky structure, 5% coarse gravels (38-70 cm, Bw2, cambic horizon) on a layer of yellowish brown (10 YR 5/4), silty clay loam, angular blocky structure (70-105 cm, Bw3, cambic horizon) on a layer of yellowish brown (10 YR 5/4), clay loam, massive, common mycelia of lime (105-150 cm, C).

The representative profile of this soil series is specified as No.25 in 30° 26' 61N and 51° 46' 01E. The No.1 soil series contains one-separated mapping unit as follows:

- Unit 1.1 No.1 soil series with clasy loam surface texture, 15-35% coarse gravels in subsoil and topsoil, 2-5% overall and 5-8% transversal slopes, moderate micro relief and water erosion.

2) No.2 soil series

On the map, it has been specified as 2.1, 2.2, 2.3 and in the classification it has been classified as:

"Loamy- skeletal., carbonatic, thermic, Typic Xerorthents".

This soil is very deep (more than 120 cm), at places deep of dark yellowish brown color (10 YR 4/4), clay loam, massive, 20-30% coarse gravels (0-20 cm, Ap, ochric epipedon) on a layer of dark

yellowish brown color (10 YR 4/4), sandy clay loam, massive, 50-60% coarse gravels (20-55 cm, C1) on a layer of yellowish brown color (10 YR 5/4), sandy clay loam, massive, 40-50% coarse gravels (55-110 cm, C2) on a layer of light olive brown color (2.5 Y 5/4), silty clay loam, massive, 5-10% coarse gravels (110-150 cm, C3).

The representative profile of this soil series is specified as No.27 in 30° 27' 18N and 51° 45' 71E. The No.2 soil series contains three separated mapping units as follows:

- Unit 2.1 No.2 soil series with clay loam surface texture, 35-75% coarse gravels in subsoil and 15-35% coarse gravels in topsoil, 2-5% overall and 1-2% transversal slopes, slight micro relief, moderate water erosion.
- Unit 2.2 No.2 soil series with clay loam surface texture, 35-75% coarse gravels in subsoil and 15-35% coarse gravels in topsoil, 2-5% overall and transversal slopes, slight micro relief, moderate water erosion.
- Unit 2.3 No.2 soil series with clay loam surface texture, 35-75% coarse gravels in subsoil and 15-35% coarse gravels in topsoil, more than 75% coarse gravels within depth of 80-120 cm., 2-5% overall and transversal terraced slopes, moderate and micro relief water erosion.

3) No.3 soil series

On the map, it has been specified as 3.1 and in the classification it has been classified as:

"Fine- loamy, carbonatic, thermic, Fluventic Haploxerepts".

This soil is very deep of dark yellowish brown (10 YR 4/4), clay loam, fine angular blocky structure (0-15 cm, A, ochric epipedon) on a layer of brown color (10 YR 5/4), slity clay loam, angular blocky structure (15-55 cm, Bw1, cambic horizon) on a layer of olive brown color (2.5 Y 4/4), silty clay loam, weak angular blocky structure (55-100 cm, Bw2, cambic horizon) on a layer of weathered shale (100-150 cm, Cr)

The representative profile of this soil series specified as No.30 in 30° 26' 60N and 51° 45' 56E. The No.3 soil series contains one-separated mapping unit as follows:

- Unit 3.1 No.3 soil series with clay loam surface texture, 3-15% coarse gravels in topsoil,2-5% overall and transversal slopes, moderate micro relief and water erosion.

4) No.4 soil series

On the map, it has been specified as 4.1 and in the classification it has been classified as:

"Clayey- skeletal, carbonatic, thermic, Fluventic Haploxerepts".

This soil is moderately deep (50-80 cm) of brown color (7.5 YR 4/4), clay, fine angular blocky structure, 20-30% coarse gravels (0-15 cm., Ap, ochric epipedon) on a layer of brown color (7.5 YR 4/4), clay, medium angular blocky structure, 40-50% coarse gravels (15-35 cm, Bw, cambic horizon) on a layer of brown color (7.5 YR 4/4), clay, massive, 50-60% coarse gravel and stones (35-70 cm, C1) on a layer with more than 75% coarse gravels and stones (+70 cm, C2).

The representative profile of this soil series is specified as No.35 in 30° 27' 90N and 51° 44' 79E. The No.4 soil series contains one-separated mapping units as follows:

- Unit 4.1 No.4 soil series with clay surface texture, 35-75% coarse gravels and stones in subsoil and 15-35% coarse gravels in topsoil, more than 75% coarse gravels and stones within depth of 50-80 cm., 2-5% overall and transversal slopes, moderate micro relief and water erosion.

5) No.5 soil series

On the map, it has been specified as 5.1, 5.2 and in the classification it has been classified as:

"Fine- loamy, carbonatic, thermic, Typic Xerofluvents".

This soil is very deep groundwater table, 1.20-2m, at places 2-3m dark yellowish brown color (10 YR 4/4), loam, massive (0-15 cm, A, ochric epidedon) on a layer of yellowish brown color (10 YR 5/4), clay loam, massive (15-45 cm, C1) on a layer of olive brown color (2.5 Y 4/4) silty clay loam, coarse platy structure, common medium distinct light brown mottles (7.5 YR 6/4) (45-80 cm, Cg1) on a layer of olive brown color (2.5 Y 4/4), loam, massive, many coarse prominent light brown mottles (7.5 YR 5/6) (80-100 cm, Cg2) on a layer of dark yellowish brown color (10 YR 4/4), loam, massive many coarse prominent light brown mottles (7.5 YR 5/6) (100-150 cm, C) on a layer of olive color (5 Y 4/4), loam, massive (150-200 cm, Cg).

The representative profile of this soil series specified as No.43 in 30° 28' 88N and 51° 45' 10E. The No.5 soil series contains two separated mapping units as follows:

- Unit 5.1 No.5 soil series with loam surface texture, 0-2% slope, slight micro relief and water erosion, groundwater table 1.2-2 m., slight hydromorphy and flooding hazards.
- Unit 5.2 No.5 soil series with loam surface texture, 0-2% slope, moderate micro relief and water erosion, groundwater table 2-3m, moderate-flooding hazards.

6) No.6 soil series

On the map, it has been specified as 6.1 and in the classification it has been classified as:

"Loamy- skeletal., mixed (calcareous), thermic, Lithic, Xerorthents".

This soil is very shallow (10-25 cm), olive brown color (2.5 Y 5/4), clay, massive, 60-70% stones and coarse gravels (0-18 cm., A) overlying by weathered shale (paralithic) (+18 cm., Cr).

The representative profile of this soil series specified as No.34 in 30° 26' 27N and 51° 44' 94E. The No.6 soil series contains one-separated mapping unit as follows:

- Unit 6.1 No.6 soil series with clay surface texture, 35-75% coarse gravels in subsoil and 35-75% stones in topsoil, weathered shales within depth of 10-25 cm, 5-8% overall and 8-12% transversal slopes, strong micro relief, moderate water erosion.

(3) Soil Properties in Tang Sorkh

Soils are generally clayey in Tang Sorkh as show in Table D-3-3-4-3. Gravel content is generally high. Soil units 2.2 and 3.1 have relatively high permeability (Rapid-medium by USDA). The pH of soils are alkaline (7.39 – 7.98) and organic matter content is 1.23 % in average.

Table D-3-3-4-3 Soil Properties in Tang Sorkh

Physiography	Soil series	Mapping Unit	Profile	Texture (%)				Texture	pH	OC (%)	Depth (m)	Sa (g/cm³)	Ib (cm/hr)
				Clay <0.002	Silt 0.002-0.05	Sand 0.05-2	Gravel > 2 mm						
Plateaus	1	1.1	25	40	31	29	17.5	C-CL	7.60	0.81	1.50	1.40	1.21
			28	38	32	30	25	CL		0.64	1.00		
			32	50	28	22	20	C		1.15	1.00		
			Ave.	43	30	27	21		7.60	0.87	1.17	1.40	1.21
Gravelly Alluvial Fan	2	2.1	29	42	42	16	17.5	SiC		0.92	1.50		0.85
		2.2	27	40	34	26	25	C-CL	7.56	0.91	1.50		7.94
		2.3	26	48	34	18	25	C		2.01	1.50		
			41	47	35	18	50	C		0.52	0.80		
			Ave.	48	35	18	38			1.27	1.15		
Old Alluvial Fan	3	3.1	30	40	38	22	10	C-CL	7.98	0.85	0.90		6.37
			33	60	26	14	30	C		1.07	0.35		
			Ave.	50	32	18	20			0.96	0.63		6.37
	4	4.1	35	68	28	4	25	C	7.72	1.39	0.70		
			36	56	44	0	40	SiC		3.75	0.70		
			Ave.	62	36	2	33		7.72	2.57	0.70		
River Bed	5	5.1	43	44	34	22	0	L	7.39	1.19	1.50		0.97
		5.2	31	36	30	34	40	CL		1.66	0.70		
			37	27	30	46	0	L		0.79	1.50		
			38	47	33	20	15	C		1.36	1.50		
			Ave.	37	31	33	18			1.27	1.23		
Hill	6	6.1	34	56	30	14	65	C		1.29	0.18		
			44	52	24	24	1.5	C		0.55	0.15		
			Ave.	54	27	19	33			0.92	0.17		
Miscellaneous	RW												
Total				47	33	21	24		7.65	1.23	1.00	1.40	3.47

(Notes)

1) Soil texture, pH, Organic Carbon Content, Specific gravity are for topsoil.
2) When depth is 1.50m or more, actual depth is more than mentioned depth.
3) Soil texture abbreviation
   C: Clay, CL: Clay Loam, SiC: Silty Clay, SiCL: Silty Clay Loam, SiL: Silty Loam, L: Loam, LSa: Loamy Sand, SaC: Sandy Clay, SaCL: Sandy Clay Loam, SaL: Sandy Loam

(4) Laboratory Test Results of Representative Profiles in Tang Sorkh

Table D-3-3-4-4 Laboratory Test of Soil Profile No. 25 (Soil Series 1) in Tang Sorkh

Area : TANG SORKH — منطقه :
Soil Series : 1 — سري خاك :
Soil Profile No. : 25 — شماره نيمرخ خاك :
Soil & Water La. : SCWRC — آزمايشگاه خاك و آب :
Lab. No. : — شماره آزمايشگاه :

عمق (سانتيمتر) Depth (cm)	افق Horizon	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر) Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2	بافت Texture	درصد اشباع SP	هدايت الكتريكي (دسي زيمنس بر متر) Ece*10^3(ds/m)	واكنش گل اشباع PHs	درصد كربن آلي OC%
0-20	Ap	29	31	40	15-20	C-CL	42.2	0.38	7.6	0.81
20-38	Bw1	25	39	36	30-40	CL	48.66	0.32	7.57	2.76
38-70	Bw2	25	40	35	5	CL	40.79	0.39	7.75	0.43
70-105	Bw3	20	47	33		SICL	43.04	0.37	7.75	0.25
105-150	C	27	40	33		CL	40.47	0.38	7.95	0.08

عمق (سانتيمتر) Depth (cm)	ازت كل Total N	فسفر قابل جذب Ava. P p.p.m	پتاسيم قابل جذب Ava. K p.p.m	درصد مواد خنثي شونده T.N.V %	گچ Gypsum	سديم قابل تبادل Ex. Na	ظرفيت تبادل كاتيوني C.E.C ميلي اكي والان درصد گرم خاك Meq/100g Soil	درصد سديم تبادلي ESP	نسبت جذب سديم SAR	درصد اشباع بازي BS %
0-20	0.016	18.8	200	43.84			22.61		0.55	
20-38	0.18	14.6	420	22.92			26.43		0.37	
38-70				38.26			22.61		0.53	
70-105				45.7			15.65		0.63	
105-150				52.91			16		0.6	

عمق (سانتيمتر) Depth (cm)	كاتيونهاي محلول (ميلي اكي والان در ليتر) Soluble Cations (meq/l) Ca++	Mg++	Na+	K+	Sum	آنيونهاي محلول (ميلي اكي والان در ليتر) Soluble Anions (meq/l) CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-20	2	1	0.68	0.08	3.76	0	0.5	2	1.18	3.68
20-38	2.1	0.5	0.43	0.11	3.14	0	1.5	1.5	0.19	3.19
38-70	1.6	1.6	0.68	0.07	3.95	0	2	1.5	0.35	3.85
70-105	2.5	0.4	0.76	0.04	3.7	0	2	1.5	0.24	3.74
105-150	2.4	0.4	0.71	0.07	3.58	0	2	1.5	0.14	3.64

عمق (سانتيمتر) Depth (cm)	درصد آب موجود % Water Content Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	وزن مخصوص ظاهري BD (gr/cm3)	وزن مخصوص حقيقي PD (gr/cm3)	درصد تخلخل و فرج Total Porosity %	قابليت نفوذ Permeability سانتيمتر بر ساعت cm/h	كلاس Class	نفوذ پذيري Infiltration Rate سانتيمتر بر ساعت cm/h	كلاس Class
38-70	13.54	36	17	1.4	2.59	54.05				
70-105	15.4	35	14	1.39	2.6	53.46				
105-150	15.94	31	13	1.36	2.64	51.52				

Table D-3-3-4-5 Laboratory Test of Soil Profile No. 27 (Soil Series 2) in Tang Sorkh

Area :	TANG SORKH	منطقه :
Soil Series :	2	سري خاك :
Soil Profile No. :	27	شماره نيمرخ خاك :
Soil & Water La. :	SCWRC	آزمايشگاه خاك و آب :
Lab. No. :		شماره آزمايشگاه :

عمق (سانتيمتر)	افق	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر)				بافت	درصد اشباع	هدايت الكتريكي (دسي زيمنس بر متر)	واكنش گل اشباع	درصد كربن آلي
Depth (cm)	Horizon	Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2	Texture	SP	Ece*10^3(ds/m)	PHs	OC%
0-20	Ap	26	34	40	20-30	C-CL	40.79	0.73	7.56	0.91
20-55	C1	60	6	34	50-60	SaCL	35	0.32	8.01	0.1
55-110	C2	55	10	35	40-50	SaCL	38.84	0.35	8.07	0.12
110-150	C3	20	40	40	5-10	SiCL	39.22	0.39	8.02	0.083

عمق (سانتيمتر)	ازت كل	فسفر قابل جذب	پتاسيم قابل جذب	درصد مواد خنثي شونده	گچ	سديم قابل تبادل	ظرفيت تبادل كاتيوني	درصد سديم تبادلي	نسبت جذب سديم	درصد اشباع بازي
Depth (cm)	Total N	Ava. P p.p.m	Ava. K p.p.m	T.N.V %	Gypsum	Ex. Na	C.E.C	ESP	SAR	BS %
					Meq/100g Soil ميلي اكي والان درصد گرم خاك					
0-20	0.016	56	120	54.07			24.7		0.3	
20-55	0.01	8.6	112	54.3			24.35		0.58	
55-110				53.61			28.17		0.4	
110-150				53.37			27.22		0.47	

عمق (سانتيمتر)	كاتيونهاي محلول (ميلي اكي والان در ليتر)					آنيونهاي محلول (ميلي اكي والان در ليتر)				
	Soluble Cations (meq/l)					Soluble Anions (meq/l)				
Depth (cm)	Ca++	Mg++	Na+	K+	Sum	CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-20	4.7	2	0.55	0.09	7.34	0	2	2	3.3	7.3
20-55	1.6	0.8	0.64	0.08	3.12	0	2	1	0.14	3.14
55-110	1.5	1.5	0.5	0.09	3.59	0	2.5	1	0.04	3.54
110-150	2.8	0.4	0.6	0.11	3.91	1	2.5	1	0.33	3.83

عمق (سانتيمتر)	درصد آب موجود Water Content %			وزن مخصوص ظاهري	وزن مخصوص حقيقي	درصد	قابليت نفوذ Permeability		نفوذ پذيري Infiltration Rate	
Depth (cm)	Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	BD (gr/cm3)	PD (gr/cm3)	خلل و فرج Total Porosity %	سانتيمتر بر ساعت cm/h	كلاس Class	سانتيمتر بر ساعت cm/h	كلاس Class

Table D-3-3-4-6 Laboratory Test of Soil Profile No. 30 (Soil Series 3) in Tang Sorkh

Area :	TANG SORKH	**منطقه :**
Soil Series :	3	**سري خاك :**
Soil Profile No. :	30	**شماره نيمرخ خاك :**
Soil & Water La. :	SCWRC	**آزمايشگاه خاك و آب :**
Lab. No. :		**شماره آزمايشگاه :**

عمق (سانتيمتر) Depth (cm)	افق Horizon	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر) Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2	بافت Texture	درصد اشباع SP	هدايت الكتريكي (دسي زيمنس بر متر) Ece*10^3(ds/m)	واكنش گل اشباع PHs	درصد كربن آلي OC%
0-15	A	22	38	40	10	C-CL	49.03	0.41	7.98	0.85
15-55	Bw1	9	56	35		SiCL	35.55	0.35	8	0.75
55-100	Bw2	11	55	34		SiCL	30.73	0.35	8.04	0.32
100-150	Cr									

عمق (سانتيمتر) Depth (cm)	ازت كل Total N	فسفر قابل جذب Ava. P p.p.m	پتاسيم قابل جذب Ava. K p.p.m	درصد مواد خنثي شونده T.N.V %	گچ Gypsum	سديم قابل تبادل Ex. Na	ظرفيت تبادل كاتيوني C.E.C ميلي اكي والان درصد گرم خاك Meq/100g Soil	درصد سديم تبادلي ESP	قابليت جذب سديم SAR	درصد اشباع بازي BS %
0-15	0.016	21.8	112	54.55			15.65		0.49	
15-55	0.014	11.8	112	54.77			15.22		0.54	
55-100				54.55			14.96		0.46	

عمق (سانتيمتر) Depth (cm)	كاتيونهاي محلول (ميلي اكي والان در ليتر) Soluble Cations (meq/l) Ca++	Mg++	Na+	K+	Sum	آنيونهاي محلول (ميلي اكي والان در ليتر) Soluble Anions (meq/l) CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-15	2.2	1.2	0.64	0.09	4.13	0	2.5	1.5	0.12	4.12
15-55	2.4	0.4	0.64	0.07	3.51	0	2	1.5	0.06	3.56
55-100	2	0.8	0.55	0.07	3.42	0	2	1	0.34	3.34

عمق (سانتيمتر) Depth (cm)	درصد آب موجود Water Content % Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	وزن مخصوص ظاهري BD (gr/cm3)	وزن مخصوص حقيقي PD (gr/cm3)	درصد خلل و فرج Total Porosity %	قابليت نفوذ Permeability سانتيمتر بر ساعت cm/h	كلاس Class	نفوذ پذيري Infiltration Rate سانتيمتر بر ساعت cm/h	كلاس Class

Table D-3-3-4-7 Laboratory Test of Soil Profile No. 35 (Soil Series 4) in Tang Sorkh

Area :	TANG SORKH	منطقه :
Soil Series :	4	سري خاك :
Soil Profile No. :	35	شماره نيمرخ خاك :
Soil & Water La. :	SCWRC	آزمايشگاه خاك و آب :
Lab. No. :		شماره آزمايشگاه :

عمق (سانتيمتر)	افق	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر)				بافت	درصد اشباع	هدايت الكتريكي (دسي زيمنس بر متر)	واكنش گل اشباع	درصد كربن آلي
Depth (cm)	Horizon	*Sand* 2 - 0.05	*Silt* 0.05 - 0.002	*Clay* < 0.002	*Gravel* > 2	Texture	SP	Ece*10^3(ds/m)	PHs	OC%
0-15	Ap	4	28	68	20-30	C	60.95	0.38	7.72	1.39
15-35	Bw	18	26	56	40-50	C	52.44	0.3	7.9	1.13
35-70	C1	21	27	52	50-60	C	48.27	0.41	7.92	0.43
+ 70	C2				>75					

عمق (سانتيمتر)	ازت كل	فسفر قابل جذب	پتاسيم قابل جذب	درصد مواد خنثي شونده	گچ	سديم قابل تبادل	ظرفيت تبادل كاتيوني	درصد سديم تبادلي	نسبت جذب سديم	درصد اشباع بازي
Depth (cm)	Total N	Ava. P p.p.m	Ava. K p.p.m	T.N.V %	*Gypsum*	Ex. Na	*C.E.C*	ESP	SAR	BS %
					Meq/100g Soil مي‌لي اكي والان در صد گرم خاك					
0-15	0.16	18.8	408	10.38			56.34		0.36	
15-35	0.14	17.6	240	34.08			47.48		0.45	
35-70	0.014			51.75			32		0.53	

عمق (سانتيمتر)	كاتيونهاي محلول (مي‌لي اكي والان در ليتر)					آنيونهاي محلول (مي‌لي اكي والان در ليتر)				
	Soluble Cations (meq/l)					Soluble Anions (meq/l)				
Depth (cm)	Ca++	Mg++	Na+	K+	Sum	CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-15	2.8	0.4	0.46	0.07	3.73	0	2	1.5	0.29	3.79
15-35	1.6	0.8	0.5	0.06	2.96	0	1.5	1	0.4	2.9
35-70	2	1.2	0.68	0.04	3.92	0	2	1.5	0.37	3.87

عمق (سانتيمتر)	درصد آب موجود Water Content %			وزن مخصوص ظاهري	وزن مخصوص حقيقي	درصد خل و فرج	قابليت نفوذ Permeability		نفوذ پذيري Infiltration Rate	
Depth (cm)	Field moisture رطوبت همزراعي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	BD (gr/cm3)	PD (gr/cm3)	Total Porosity %	سانتيمتر بر ساعت cm/h	كلاس Class	سانتيمتر بر ساعت cm/h	كلاس Class

Table D-3-3-4-8 Laboratory Test of Soil Profile No. 43 (Soil Series 5) in Tang Sorkh

Area :	TANG SORKH	منطقه :
Soil Series :	5	سري خاك :
Soil Profile No. :	43	شماره نيمرخ خاك :
Soil & Water La. :	SCWRC	آزمايشگاه خاك و آب :
Lab. No. :		شماره آزمايشگاه :

عمق (سانتيمتر)	افق	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر)				بافت	درصد اشباع	هدايت الكتريكي (دسي زيمنس بر متر)	واكنش گل اشباع	درصد كربن آلي
Depth (cm)	Horizon	Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2	Texture	SP	Ece*10^3(ds/m)	PHs	OC%
0-15	A	44	34	22		L	40.74	0.53	7.39	1.19
15-45	C1	29	42	29		CL	41.7	0.43	7.7	0.83
45-80	Cg1	11	56	33		SiCL	48.5	0.53	7.85	0.58
80-100	Cg2	38	38	24		L	42.4	0.48	7.8	0.58
100-150	C	49	28	23		L	39.44	0.39	8.01	0.5

عمق (سانتيمتر)	ازت كل	فسفر قابل جذب	پتاسيم قابل جذب	درصد مواد خنثي شونده	گچ	سديم قابل تبادل	ظرفيت تبادل كاتيوني	درصد سديم تبادلي	قسبت جذب سديم	درصد اشباع بازي
Depth (cm)	Total N	Ava. P p.p.m	Ava. K p.p.m	T.N.V %	Gypsum	Ex. Na	C.E.C	ESP	SAR	BS %
					ميلي اكي والان درصد گرم خاك Meq/100g Soil					
0-15	0.16	19.8	136	54.3			13.22		0.24	
15-45	0.14	17.2	136	54.77			13.57		0.61	
45-80				54.55			24.35		0.35	
80-100				54.77			14.52		0.52	
100-150				54.77			13.22		0.22	

عمق (سانتيمتر)	كاتيونهاي محلول (ميلي اكي والان در ليتر)					آنيونهاي محلول (ميلي اكي والان در ليتر)				
	Soluble Cations (meq/l)					Soluble Anions (meq/l)				
Depth (cm)	Ca++	Mg++	Na+	K+	Sum	CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-15	3.8	1.1	0.38	0.14	5.42	0	3.5	1.5	0.49	5.49
15-45	1.6	1.9	0.81	0.06	4.37	0	2.5	1.5	0.38	4.38
45-80	2.2	2.5	0.54	0.09	5.33	1	2.5	1.5	0.28	5.28
80-100	2	2	0.74	0.09	4.83	0	2.5	1.5	0.8	4.8
100-150	1.6	2	0.3	0.07	3.97	0	2	1.5	0.41	3.91

عمق (سانتيمتر)	Water Content % درصد آب موجود			وزن مخصوص ظاهري	وزن مخصوص حقيقي	درصد خلل و فرج	Permeability قابليت نفوذ		Infiltration Rate نفوذ پذيري	
Depth (cm)	Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	BD (gr/cm3)	PD (gr/cm3)	Total Porosity %	سانتيمتر بر ساعت cm/h	كلاس Class	سانتيمتر بر ساعت cm/h	كلاس Class
0-15	16.52	23	11	1.3	2.62	49.62				
15-45	21.64	31	12	1.33	2.59	51.35				
45-80	24.4	32	15	1.37	2.66	51.5				
80-100	19.93	19	10	1.35	2.93	46.08				
100-150	22.18	20	12	1.33	2.67	49.81				

Table D-3-3-4-9 Laboratory Test of Soil Profile No. 34 (Soil Series 6) in Tang Sorkh

Area :	TANG SORKH	منطقه :
Soil Series :	6	سري خاك :
Soil Profile No. :	34	شماره نيمرخ خاك :
Soil & Water La. :	SCWRC	آزمايشگاه خاك و آب :
Lab. No. :		شماره آزمايشگاه :

عمق (سانتيمتر)	افق	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر)				بافت	درصد اشباع	هدايت الكتريكي (دسي زيمنس بر متر)	واكنش گل اشباع	درصد كربن آلي
Depth (cm)	Horizon	Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2	Texture	SP -	Ece*10^3(ds/m)	PHs	OC%
0-18	A	14	30	56	60-70	C				1.29
18-100	Cr	weathered	shale							

عمق (سانتيمتر)	ازت كل	فسفر قابل جذب	پتاسيم قابل جذب	درصد مواد خنثي شونده	گچ	سديم قابل تبادل	ظرفيت تبادل كاتيوني	درصد سديم تبادلي	نسبت جذب سديم	درصد اشباع بازي
Depth (cm)	Total N	Ava. P p.p.m	Ava. K p.p.m	T.N.V %	Gypsum	Ex. Na	C.E.C	ESP	SAR	BS %
						Meq/100g Soil ميلي اكي والان درصد گرم خاك				

عمق (سانتيمتر)	كاتيونهاي محلول (ميلي اكي والان در ليتر)					آنيونهاي محلول (ميلي اكي والان در ليتر)				
	Soluble Cations (meq/l)					Soluble Anions (meq/l)				
Depth (cm)	Ca++	Mg++	Na+	K+	Sum	CO3 - -	HCO3 -	Cl -	SO4 - -	Sum

عمق (سانتيمتر)	درصد آب موجود Water Content %			وزن مخصوص ظاهري	وزن مخصوص حقيقي	درصد	قابليت نفوذ Permeability		نفوذ پذيري Infiltration Rate	
Depth (cm)	Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	BD (gr/cm3)	PD (gr/cm3)	خلل و فرج Total Porosity %	سانتيمتر بر ساعت cm/h	كلاس Class	سانتيمتر بر ساعت cm/h	كلاس Class

D3.3.5 Soils in Zeras

(1) General Description

Zeras is formed mostly by very steep slope and flat area is very scarce. Red colour soils are extensively covering this area even at very steep slope so that all area is grazed and dry farming is carried out even at very steep slopes up to approximately 50%. Soil texture of slopes is heavy and depth is generally very deep. Although soil contains high percentage of stone and gravel, permeability is slow due to heavy texture. Since permeability is slow and texture is clayey, surface runoff easily occurs and soils are easily eroded where heavily grazed or improperly cultivated. Severe gully erosions are observed in such areas where land is not properly managed.

(2) Soil Series and Units in Zeras

Soils of Zeras area are located on three physiographic units and contain three soil series as follows:

Table D-3-3-5-1 Soil Series in Zeras

Physiography	Soil Series			USDA Soil Taxonomy (1999)			FAO-Unesco (1989)	Iranian Fourth Approximation
	No.	Area (ha)	%	Family	Subgourp	Order		
Old Alluvial Fans	1	159	30%	Clayey-skeletal, carbonatic, hyperthermic	Fluventic Haplustepts	Inceptisols	Calcaric Cambisols	Brown soils
Plateaux	2	116	22%	Fine, carbonatic, hyperthermic	Typic Haplustepts	Inceptisols	Calcaric Cambisols	Brown soils
Plateaux & Hills	3	260	49%	Fine, carbonatic, hyperthermic	Typic Calciustepts	Inceptisols	Haplic Calcisols	Calic Brown soils
Total		535	100%					

Table D-3-3-5-2 Soil Units in Zeras

Physiography	*Soil Series*	*Soil Mapping Unit*	*Area (ha)*	*Area Ratio (%)*	*Soil Series*	
					Area (ha)	*Ratio (%)*
Old Alluvial	1	1.1	56.61	11%	158.48	30%
Fan		1.2	101.87	19%		
Plateau	2	2.1	68.59	13%	115.89	22%
		2.2	47.3	9%		
		2.3	*			
Plateau &	3	3.1	27.21	5%	259.82	49%
Hill		3.2	24.96	5%		
		3.3	31.29	6%		
		3.4	100.2	19%		
		3.5	76.16	14%		
Total			534.19	100%		

(Note) Soil unit 2.3 is dominant in Plateau, but not enough surveyed.

1) No.1 Soil Series

On the map it has been specified as 1.1, 1.2 and in the classification it has been classified as:

"clayey-skeletal, carbonatic, hyperthermic, Fluventic Haplustepts".

This soil is shallow (25-50 cm.) of dark yellowish brown color (10 YR 4/4), silty clay loam, structureless, 15-35% stones (0-15 cm, Ap, ochric epipedon) on a layer of brown color (7.5 YR 4/4), silty clay, medium angular blocky structure, 40% stones and boulders (15-35 cm., Bw1, cambic horizon), overlying by brown color (7.5 YR 4/4), silty clay, medium angular blocky structure, 1% seconday lime as powdery pockets, more than 75% stones (+35 cm., Bw2, Cambic horizon).

The representative profile of this soil series, specified as No.1 in 31° 34' 52N and 50° 19' 53E. The No.1 soil series contains two separated mapping units as follows:

- Unit 1.1 No.1 soil series with silty clay loam surface texture, 35-75% stones and boulders in subsoil, 15-35% stones in topsoil, more than 75% stones and boulders within depth of 25-50 cm, 2-5% overall and 1-2% transversal slopes, slight micro relief and water erosion.
- Unit 1.2 No.1 soil series with silty clay loam surface texture, 35-75% stones and boulders in subsoil, 15-35% stones in topsoil, more than 75% stones and boulders within depth of 25-50 cm, 2-5% overall and transversal slopes, slight micro relief, moderate water erosion.

2) No.2 soil series

On the map, it has been specified as 2.1, 2.2, 2.3 and in the classification, it has been classified as:

"Fine, carbonatic, hyperthermic, Typic Haplustepts".

This soil is very deep of brown color (10 YR 4/3), silty clay loam, fine angular structure, 3-15% stones (0-20 cm, Ap, ochric epipedon) on a layer of brown (7.5 YR 4/3), silty clay, angular blocky structure (20-45 cm, Bw1, cambic horizon) on a layer of brown color (7.5 YR 4/4), silty clay, angular blocky structure, 1% secondary lime as mycelia (45-80 cm, Bw2, cambic horizon) on a layer of brown color (7.5 YR 4/4), silty clay, angular blocky structure, 1% secondary lime as mycelia (80-150 cm, Bw3, cambic horizon).

The representative profile of this soil series, specified as No.2 in 31° 34' 58N and 50° 20' 98E. The No.2 soil series contains three separated mapping units as follows:

- Unit 2.1 No.2 soil series with silty caly loam surface texture, 3-15% stones in topsoil, 2-5% overall and 1-2% transversal slopes, slight micro relief and water erosion.
- Unit 2.2 No.2 soil series with silty clay loam surface texture, 15-35% stones in topsoil, 5-8% overall and 2-5% transversal slopes, moderate micro relief and water erosion.
- Unit 2.3 No.2 soil series with silty clay loam surface texture, 3-15% coarse gravels in topsoil, 40-70% slope, strong micro relief and water erosion.

3) No.3 soil series

On the map, it has been specified as 3.1, 3.2, 3.3, 3.4, 3.5 and in the classification, it has been classified as:

"Fine, carbonatic, hyperthermic, Typic calciustepts".

This soil is very deep (more than 120 cm.), at places deep (80-120 cm.) of dark yellowish brown color, (10 YR 4/4), silty clay loam, structureless, 15-35% coarse gravels or stones (0-20 cm., Ap, ochric epipedon) on a layer of dark yellowish brown color (10 YR 4/4), silty clay, strong angular blocky structure, 10-15% secondary lime as powdery pockets and concretion (20-60 cm., B_k1, calcic horizon) on a layer of dark yellowish brown color (10 YR 4/4), silty clay, angular blocky structure, 5-8% secondary lime as powdery pockets and concretion (60-100 cm., B_k2, calcic horizon) on a layer of dark yellowish brown color (10 YR 4/4), silty clay, angular blocky structure, 2% lime as powdery pockets (100-200 cm., Bw, cambic horizon).

The representative profile of this soil series, specified as No.7 in 31° 34' 94N and 50° 20' 01E. The No.3 soil series contains five separated mapping units as follows:

- Unit 3.1 No.3 soil series with silty clay loam surface texture, 15-35% coarse gravels in topsoil, 2-5% overall and 1-2% transversal slopes, slight micro relief and water erosion.
- Unit 3.2 No.3 soil series with silty clay loam surface texture, 3-15% stones in topsoil, 2-5% overall and transversal slopes, slight micro relief, moderate water erosion.
- Unit 3.3 No.3 soil series with silty clay loam, 15-35% stones in topsoil, more than 75% coarse gravels and stones within depth of 80-120 cm, 2-5% overall and 5-8% transversal slopes, moderate micro relief and water erosion.
- Unit 3.4 No.3 soil series with silty clay loam surface texture, 15-35% coarse gravels in topsoil, more than 75% coarse gravels and stones within depth of 80-120 cm., 5-8% overall and 8-12% transversal slopes, moderate micro relief and water erosion.
- Unit 3.5 No.3 soil series with silty clay loam surface texture, 15-35% coarse gravels in topsoil, 2-5% overall and 8-12% transversal slopes, strong micro relief and water erosion.

(3) Soil Properties in Zeras

Soils are generally clay loamy in Zeras as show in Table D-3-3-5-3. Gravel content is generally high. Permeability is generally slow. The pH of soils are alkaline (7.69 – 7.91) and organic matter content is low as 0.98 % in average.

Table D-3-3-5-3 Soil Properties in Zeras

Physiography	Soil series	Mapping Unit	Profile	Texture (%)				Texture	pH	OC (%)	Depth (m)	Sa (g/cm³)	Ib (cm/hr)
				Clay <0.002	*Silt* 0.002-0.05	*Sand* 0.05-2	*Gravel* >2 mm						
Old Alluvial Fan	1	1.1	1	34	52	14	25	SiCL	7.69	1.06	0.70		0.72
		1.2											
Plateaus	2	2.1	2	36	58	6	9	SiCL	7.91	1.24	1.50	1.33	1.01
		2.2											
		2.3	12	34	48	18	9	SiCL		0.98	1.70		3.28
			13	40	58	2	7.5	SiC-SiCL		0.78	1.50		
			14	42	54	4	15	SiC		0.80			
			15	24	30	46	50	L		2.15			
			16	34	48	18	9	SiCL		0.81	1.50		
			17	38	52	10	17.5	SiCL		0.66			
			18	36	54	10	5	SiCL		0.69			
			19	34	52	14	9	SiCL		0.81	1.50		
			20	32	56	12	12.5	SiCL		0.33			
			22	40	44	16	45	SiC-SiCL		0.81			
			23	38	54	8	45	SiCL		0.81	1.20		
			24	34	40	26	25	CL		1.35			
			Ave.	36	49	15	21			0.92	1.48		3.28
Plateaux & Hills	3	3.1	4										
		3.2	3	36	50	14	9	SiCL		1.00	1.50		
		3.3											
		3.4	9	36	52	12	25	SiCL		0.72	1.20		
		3.5	7	36	58	6	25	SiCL	7.87	0.77	1.50		1.18
			Ave.	36	53	11	20		7.87	0.83	1.40		1.18
Total				36	51	14	20		7.82	0.93	1.38	1.33	1.55

(Notes)

1) Soil texture, pH, Organic Carbon Conternt, Specific gravity are for top soil.
2) When depth is 1.50m or more, actual depth is more than mentioned depth.
3) Soil texture abbreviation
C: Clay, CL: Clay Loam, SiC: Silty Clay, SiCL: Silty Clay Loam, SiL: Silty Loam, L: Loam, LSa: Loamy Sand, SaC: Sandy Clay, SaCL: Sandy Clay Loam, SaL: Sandy Loam

(5) Laboratory Test Results of Representative Profiles in Zeras

Table D-3-3-5-4 Laboratory Test of Soil Profile No. 1 (Soil Series 1) in Zeras

Area : ZERAS — منطقه :
Soil Series : 1 — سري خاك :
Soil Profile No. : 1 — شماره نيمرخ خاك :
Soil & Water La. : SCWRC — آزمايشگاه خاك و آب :
Lab. No. : — شماره آزمايشگاه :

عمق (سانتيمتر) Depth (cm)	افق Horizon	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر) Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2	بافت Texture	درصد اشباع SP	هدايت الكتريكي (ميلي زيمنس بر متر) Ece*10^3(ds/m)	واكنش گل اشباع PHs	درصد كربن آلي OC%
0-15	Ap	14	52	34	15-35	SICL	37.62	2.61	7.69	1.06
15-35	Bw1	11	49	40	40	SIC	36.55	0.5	7.9	0.5
35-70	Bw2	15	43	42	>75	SIC	44.29	0.38	8.1	0.37

عمق (سانتيمتر) Depth (cm)	ازت كل Total N	فسفر قابل جذب Ava. P p.p.m	پتاسيم قابل جذب Ava. K p.p.m	درصد مواد خنثي شونده T.N.V %	گچ Gypsum	سديم قابل تبادل Ex. Na	ظرفيت تبادل كاتيوني C.E.C Meq/100g Soil ميلي اكي والان درصد گرم خاك	درصد سديم تبادلي ESP	قدرت جذب سديم SAR	درصد اشباع بازي BS %
0-15	0.14	68.4	216	49.65			14.17		5.04	
15-35	0.014	11.8	200	52.21			14.96		0.71	
35-70				49.65			15.22		0.62	

عمق (سانتيمتر) Depth (cm)	كاتيونهاي محلول (ميلي اكي والان در ليتر) Soluble Cations (meq/l) Ca++	Mg++	Na+	K+	Sum	آنيونهاي محلول (ميلي اكي والان در ليتر) Soluble Anions (meq/l) CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-15	6.8	5.6	12.5	0.29	25.19	0	5	16	4.1	25.1
15-35	3.4	0.5	1	0.13	5.03	0	3	1.5	0.48	4.98
35-70	1.5	1.5	0.76	0.12	3.88	0	2.5	1	0.34	3.84

عمق (سانتيمتر) Depth (cm)	درصد آب موجود Water Content % Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	وزن مخصوص ظاهري BD (gr/cm3)	وزن مخصوص حقيقي PD (gr/cm3)	درصد خلل و فرج Total Porosity %	قابليت نفوذ Permeability سانتيمتر بر ساعت cm/h	كلاس Class	نفوذ پذيري Infiltration Rate سانتيمتر بر ساعت cm/h	كلاس Class

Table D-3-3-5-4 Laboratory Test of Soil Profile No. 2 (Soil Series 2) in Zeras

Area :	ZERAS	منطقه :	
Soil Series :	2	سري خاك :	
Soil Profile No. :	2	شماره نيمرخ خاك :	
Soil & Water La. :	SCWRC	آزمايشگاه خاك و آب :	
Lab. No. :		شماره آزمايشگاه :	

عمق (سانتيمتر) Depth (cm)	افق Horizon	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر) Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2	بافت Texture	درصد اشباع SP	هدايت الكتريكي (دسي زيمنس بر متر) Ece*10^3(ds/m)	واكنش گل اشباع PHs	درصد كربن آلي OC%
0-20	Ap	6	58	36	3-15	SICL	44.44	0.58	7.91	1.24
20-45	Bw1	7	51	42		SIC	44.82	0.48	8.07	0.75
45-80	Bw2	3	53	44		SIC	43.91	0.47	8.25	0.38
80-150	Bw3	2	55	40		SIC	43.15	0.53	8.3	0.17

عمق (سانتيمتر) Depth (cm)	ازت كل Total N	فسفر قابل جذب Ava. P p.p.m	پتاسيم قابل جذب Ava. K p.p.m	درصد مواد خنثي شونده T.N.V %	گچ Gypsum	سديم قابل تبادل Ex. Na	ظرفيت تبادل كاتيوني C.E.C	درصد سديم تبادلي ESP	قدرت جذب سديم SAR	درصد اشباع بازي BS %
						ميلي اكي والان درصد گرم خاك Meq/100g Soil				
0-20	0.16	43.4	230	48.26			18.43		0.48	
20-45	0.014	11.6	312	45			17.74		0.79	
45-80				47.79			17.39		0.93	
80-150				48.49			14.96		1.03	

عمق (سانتيمتر) Depth (cm)	كاتيونهاي محلول (ميلي اكي والان در ليتر) Soluble Cations (meq/l) Ca++	Mg++	Na+	K+	Sum	آنيونهاي محلول (ميلي اكي والان در ليتر) Soluble Anions (meq/l) CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-20	3.7	1.3	0.76	0.16	5.92	0	4	1.5	0.4	5.9
20-45	2	1.6	1.07	0.2	4.87	0	3	1	0.9	4.9
45-80	1.9	1.5	1.21	0.31	4.74	0	3	1.5	0.23	4.73
80-150	2.8	1	1.42	0.09	5.31	0	2.5	1.5	1.27	5.27

عمق (سانتيمتر) Depth (cm)	درصد آب موجود Water Content % Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	وزن مخصوص ظاهري BD (gr cm3)	وزن مخصوص حقيقي PD (gr/cm3)	درصد حجم خلل و فرج Total Porosity %	قابليت نفوذ Permeability سانتيمتر بر ساعت cm/h	كلاس Class	نفوذ پذيري Infiltration Rate سانتيمتر بر ساعت cm/h	كلاس Class
0-20	18.2	32	16	1.33	2.59	51.35				
20-45	17.03	30	14	1.36	2.59	52.51				
45-80	16.5	30	14	1.35	2.59	52.6				
80-150	14.31	32	17	1.37	2.59	52.9				

Table D-3-3-5-4 Laboratory Test of Soil Profile No. 7 (Soil Series 3) in Zeras

Area :	ZERAS	منطقه :
Soil Series :	3	سري خاك :
Soil Profile No. :	7	شماره نيمرخ خاك :
Soil & Water La. :	SCWRC	آزمايشگاه خاك و آب :
Lab. No. :		شماره آزمايشگاه :

عمق (سانتيمتر)	افق	Particle size classes (mm) درصد ذرات خاك (قطر به ميليمتر)				بافت	درصد اشباع	هدايت الكتريكي (دسي زيمنس بر متر)	واكنش گل اشباع	درصد كربن آلي
Depth (cm)	Horizon	Sand 2 - 0.05	Silt 0.05 - 0.002	Clay < 0.002	Gravel > 2	Texture	SP	Ece*10^3(ds/m)	PHs	OC%
0-20	Ap	6	58	36	15-35	SICL	46.53	0.46	7.87	0.77
20-60	Bk1	5	45	50		SIC	47.25	0.46	8.16	0.45
60-100	Bk2	3	51	46		SIC	72.11	0.3	8.28	0.25
100-150	Bw	7	51	42		SIC	76.78	0.36	8.35	0.13

عمق (سانتيمتر)	ازت كل	فسفر قابل جذب	پتاسيم قابل جذب	درصد مواد خنثي شونده	گچ	سديم قابل تعادل	ظرفيت تبادل كاتيوني	درصد سديم تبادلي	قابليت جذب سديم	درصد اشباع خاكري
Depth (cm)	Total N	Ava. P ppm	Ava. K ppm	T.N.V %	Gypsum	Ex. Na	C.E.C	ESP	SAR	BS %
					Meq/100g Soil ميلي اكي والان درصد گرم خاك					
0-20	0.014	33.6	312	49.65			18.43		0.58	
20-60	0.014	6.4	216	50.35			16.35		0.92	
60-100				51.28			16		0.45	
100-150				53.84			16.35		0.83	

عمق (سانتيمتر)	كاتيونهاي محلول (ميلي اكي والان در ليتر)					آنيونهاي محلول (ميلي اكي والان در ليتر)				
	Soluble Cations (meq/l)					Soluble Anions (meq/l)				
Depth (cm)	Ca++	Mg++	Na+	K+	Sum	CO3 - -	HCO3 -	Cl -	SO4 - -	Sum
0-20	2.8	0.8	0.78	0.13	4.51	0	3.5	1	0.02	4.52
20-60	2.4	0.9	1.18	0.11	4.59	0	3	1.5	0.1	4.6
60-100	0.8	1.8	0.52	0.04	3.16	0	1.5	1.5	0.15	3.15
100-150	2.1	0.5	0.95	0.08	3.63	0	2	1.5	0.12	3.62

عمق (سانتيمتر)	درصد آب موجود Water Content %			وزن مخصوص ظاهري	وزن مخصوص حقيقي	درصد	قابليت نفوذ Permeability		نفوذ پذيري Infiltration Rate	
Depth (cm)	Field moisture رطوبت صحرايي	33.3 Kpa ظرفيت زراعي	1500 Kpa حد پژمردگي	BD (gr/cm3)	PD (gr/cm3)	Total Porosity %	سانتيمتر بر ساعت cm/h	كلاس Class	سانتيمتر بر ساعت cm/h	كلاس Class

D3.4 Basic Infiltration Rate

D3.4.1 Method applied for Survey and Analysis

Infiltration rate is the rate with which water penetrates into the soil from the soil surface. It is one of significant parameter of soil in relation to irrigation practices.

Double cylinder method was used to measure the intake rate. In this standard method, water is allowed to penetrate into the soil throgh cylinder of about 15-25cm diameter, and the rate of penetration (as high of water normally in mm) is measured by the time. (Normally in minute)
The readings of cumulative penetration are then plotted against elapsed time in normal or logarithmic paper, on which the best curve is fitted. Formula used for calculation is:

$D = CT^m$
$I_{av} = 60\ CT^n$
$n = m - 1$
$I_b = a\ T_b^n$
$T_b = 600n$
a, b = parameters from plotted curve
D = cumulative infiltration (cm)
T = Time (min)
I_{av} = Average infiltration rate (cm/hr)
I_b = Basic infiltration rate (cm/hr)
$T = a/(60(n+1))$
I = instantaneous infiltration rate (cm)
$I = aT^n + b$

D3.4.2 Classification of Permeability

Standards of classification of permeability are as follows:

Table D-3-4-1 Classification of Permeability

USDA		
Grade	Classification	Basic Intake Rate (cm/hr)
1	Rapid	>25.00
2	Rapid - Medium	25.00 - 6.25
3	Medium	6.25 - 2.00
4	Medium - Slow	2.00 - 0.50
5	Slow	0.50 - 0.125
6	Very Slow	< 0.125

Soil Institute of Iran		
Grade	Classification	Basic Intake Rate (cm/hr)
1	Very Rapid	>25.00
2	Papid	25.00 - 6.00
3	Moderate	6.00 - 2.00
4	Slow	2.00 - 0.10
5	Very Slow	<0.1

D3.4.3 Result of the Infiltration Survey

Infiltration survey has been carried out totally at 25 sites in the study areas. The results are summarized in Table D-3-4-2 and details are shown in Table D-3-4-3.

Table D-3-4-2 Comparison of Infiltration Rate by Areas

Study Area	Basic Infiltration Rate (Ib cm/hr)		
	Max	Mean	Min
Vastegan	9.035	5.002	2.012
Chaman Goli-Bazoft	7.652	3.045	0.753
Sarbaz	10.731	4.729	1.797
Tang Sorkh	7.944	3.470	0.855
Zeras	3.282	1.547	0.720
Max, Mean, Min	10.731	3.559	0.720

Maximum infiltration rate is observed at 10.731 cm/hr in Soil Unit 8.1 in Sarbaz, and followed by 9.035 cm/hr in Soil Unit 3.1 in Vastegan. Those infiltration rates are evaluated as "Rapid-Medium" by USDA and "Rapid" by Soil Institute of Iran. On the other hand, permeability of Zeras is generally slow comparing to other four areas. Average permeability of Zeras is 1.547 cm/hr that is "Medium-Slow" by USDA and "Slow" by Soil Institute of Iran.

Table D-3-4-3 Basic Infiltration Rate in the Study Area

Vastegan

No.	Profile. No.	Soil Series	Basic Infiltration Rate (Ib) No.1	No.2	No.3	Average (cm/hr)	Grading USDA	Iranian Soil Institute
1	222	1.3	12.285	8.256	5.644	8.728	Rapid-Medium	Rapid
2	145	4.1	3.281	2.179	4.161	3.207	Medium	Moderate
3	143	3.1	8.832	8.698	9.576	9.035	Rapid-Medium	Rapid
4	174	6.2	2.561	2.660	3.145	2.789	Medium	Moderate
5	161	1.1	2.553	2.770	7.404	4.242	Medium	Moderate
6	146	5.1	2.008	2.204	1.825	2.012	Medium	Moderate
Average						5.002		

Chaman Gori-Bazoft

No.	Profile. No.	Soil Series	Basic Infiltration Rate (Ib) No.1	No.2	No.3	Average (cm/hr)	Grading USDA	Iranian Soil Institute
1	120	1.1+1.2	4.057	12.141	6.757	7.652	Rapid-Medium	Rapid
2	109	3.1	4.232	1.373	3.324	2.976	Medium	Moderate
3	126	3.2	1.173	1.173	1.273	1.206	Medium-Slow	Slow
4	112	2.2	0.346	0.946	0.966	0.753	Medium-Slow	Slow
5	117	3.1	2.069	3.937	1.912	2.639	Medium	Moderate
Average						3.045		

Sarbaz

No.	Profile. No.	Soil Series	Basic Infiltration Rate (Ib) No.1	No.2	No.3	Average (cm/hr)	Grading USDA	Iranian Soil Institute
1	55	6.1	4.126	2.514	3.868	3.503	Medium	Moderate
2	67	3.1	6.689	1.239	2.671	3.533	Medium	Moderate
3	60	8.1	11.617	8.090	12.487	10.731	Rapid-Medium	Rapid
4	81	5.1	1.221	0.866	3.304	1.797	Medium-Slow	Slow
5	64	3.1	4.887	3.824	3.536	4.082	Medium	Moderate
Average						4.729		

Tang Sorkh

No.	Profile. No.	Soil Series	Basic Infiltration Rate (Ib) No.1	No.2	No.3	Average (cm/hr)	Grading USDA	Iranian Soil Institute
1	25	1.1	1.171	0.951	1.501	1.208	Medium-Slow	Slow
2	43	5.1	1.389	0.673	0.844	0.969	Medium-Slow	Slow
3	27	2.2	3.755	10.167	9.910	7.944	Rapid-Medium	Rapid
4	30	3.1	6.413	5.089	7.622	6.375	Rapid-Medium	Rapid
5	29	2.1	1.040	0.816	0.708	0.855	Medium-Slow	Slow
Average						3.470		

Zeras

No.	Profile. No.	Soil Series	Basic Infiltration Rate (Ib) No.1	No.2	No.3	Average (cm/hr)	Grading USDA	Iranian Soil Institute
1	12	2.3	2.536	4.479	2.831	3.282	Medium	Moderate
2	2	2.1	0.510	2.217	0.288	1.005	Medium-Slow	Slow
3	7	3.5	1.675	1.286	0.575	1.179	Medium-Slow	Slow
4	1	1.1	1.048	0.640	0.471	0.720	Medium-Slow	Slow
Average						1.547		

D.4 Land Classification (Phase-2)

Table D-4-1 Evaluation Criteria for Land Classification for Irrigation

(Soil Institute of Iran, MOA)

4	G	H	g	2-	Z	I1	S2	A1
A	a	1	E1(E1)-	d1(d1)-	W1-	O1-	P1-	F

Subsoil Permeability (between 0.20 and 1.20m depth)
1 : "Very rapid" (>25 cm/hr, Maximum Land Class III)
2 : "Rapid" (from 6 to 25 cm/h, Maximum Land Class II)
3 : "Moderate" (from 2 to 6 cm/h, Maximum Land Class I)
4 : "Slow" (from 0.1 to 2 cm/h, Maximum Land Class II)
5 : "Very slow" (<0.1 cm/h, Maximum Land Class III)

Tentative Subsoil Permeability Rating by Subsoil Heaviest Horizon
C
L
M & H
V (non massive structure)
V (massive structure)

Subsoil stoniness (percentage of coarse fragment by volume between 0.20 and 0.80m)
no symbol : Size of coarse fragment are not distinguished (Maximum land Class I)
g : Between 15 and 35% of coarse fragments (Maximum Land Class II)
G: Between 35 and 75% of coarse fragments (Maximum Land Class III)
Z : >75% (Maximum Land Class IV?)

Topsoil texture (top 20cm)
Z : "Very coarse" sand - coarse sand (Maximum Land Class IV)
C : "Coarse" Loamy coarse sand, fine sand (Maximum Land Class III)
L : "Light" Coarse sandy loam, loamy fine sand (Maximum Land Class II)
M : "Medium" Loam, fine sandy loam, silt loam, silt (Maximum Land Class I)
H : "Heavy" Clay loam, silty clay loam, sandy clay loam (Maximum Land Class I)
V : "Very heavy" Sandy clay, silty clay, clay (Maximum Land Class II)

U.S. System
2-0.2mm: coarse sand
0.2-0.05mm: fine sand
0.05-0.002mm: silt
<0.002mm: clay

Topsoil stoniness (Volume by % and Maximum Land Class)

Volume %	Fine gravels	Coarse Gravels	Stones	Boulders
3-15%	(f)-I	(g)-II	(S)-II	(b)-II
15-35%	f-II	g-III	s-III	b-III
35-75%	F-III	G-IV	S-IV	B-IV
>75%	Z-IV	Z-VI	Z-VI	Z-VI

Coarse fragments
Fine gravels: size between 2mm and 2.5cm
Coarse gravels: size between 2.5 and 7.5cm
Stones: size between 7.5 and 25cm
Boulders: size above 25cm

Soil Depth
no symbol : "Very deep" > 120cm
1 : "Deep" 80 - 120cm
2 : "Moderately deep" 50 - 80cm
3 : "Shallow" 25 - 50cm
4 : "Very shallow" 10 - 25cm
R or RW : depth <10cm

Maximum Land Class

Limiting Layer	Fine sandy loam or finer						Coarser than fine sandy loam					
	no	1	2	3	4		no	1	2	3	4	
Z or P	I	I	II	III	IV		II	II	III	IV	IV	
L	I	II	III	IV	IV		II	III	IV	IV	IV	

Type-limiting Layer (for soil depth)
Z : "Gravel limiting layer" of unconsolidated gravel stone and coarse sand with at least 75%of the volume and thickness at least 30cm.
P : "Paralithic (lithic like) limiting layer" of continuous coherent material having hardness of mohs scale<3.
L : "Lithic limiting layer" of coherent unweathered rock having mohs scale >3.

Infiltration
no symbol : Rate > 2cm/h No limitation (Maximum Land Class I) (Note) Splinkler for > 7cm/ha
I_1 : Rate 1-2cm/h (Maximum Land Class II)
I_2 : Rate 0.5 - 1cm/ha (Maximum Land Class III)
I_3 : Rate 0.2 - 0.5cm/ha (Maximum Land Class IV)
I_4 : Rate < 0.2cm/ha (Maximum Land Class V)

Soil Salinity
no symbol : Ece < 4 mmhos/cm, no or very slight limitation (Maximum Land Class I)
S_1 : ECe = 4 - 8 mmhos/cm, slight salinity limitation (Maximum Land Class II)
S_2 : ECe = 8 - 16 mmhos/cm, moderate salinity limitation (Maximum Land Class III)
S_3 : ECe = 16 - 32 mmhos/cm, severe salinity limitation (Maximum Land Class V)
S_4 : ECe > 32 mmhos/cm, very severe salinity limitation (Maximum Land Class V or VI)

Soil Alkalinity (for the first 75cm of soil)
no symbol : "no alkalinity problem" ESP<10%, pH<8.5, SAR<8 (Maximum Land Class I)
A_1 : "slight alkalinity problem" ESP=10-15%, pH>8.5, SAR=8-13 (Maximum Land Class II)
A_2 : "smoderate alkalinity problem" ESP=15-30%, pH=8.5-9, SAR=13-30 (Maximum Land Class III)
A_3 : "severe alkalinity problem" ESP=30-50%, pH=9-9.5, SAR=30-70 (Maximum Land Class V)
A_4 : "very severe alkalinity problem" ESP>50%, pH>9.5, SAR>70 (Maximum Land Class VI)

Overall Slope (longest slope of mapping unit)
A : "Level to very gently sloping" 0-2% (Maximum Land Class I)
B : "Gently sloping" 2-5% (Maximum Land Class II)
C : "Sloping" 5-8% (Maximum Land Class III)
D : "Strongly sloping" 8-12% (Maximum Land Class IV)
E : "Moderately steep" 12-25% (Maximum Land Class IV/VI)
F : "Steep" 25-40% (Maximum Land Class VI)
G : "Very steep" 40-70% (Maximum Land Class VI)
H : "Extremely steep" >70% (Maximum Land Class VI)

When the slopes are terraced
At, I
Bt, I
Ct, II
Dt, III
Et, IV
Ft, IV
Gt, IV
Ht, IV

Transversal Slope / **Maximum Land Class related to the Overall Slope**

Transversal Slope	A	B	C	D	E	F	G	H
no symbol : slope < 1%	I	II	III	IV	IV*	VI	VI	VI
a : slope = 1-2%	II	III	III	IV	VI	VI	VI	VI
b : slope = 2-5%	III	III	IV	IV	VI	VI	VI	VI
c : slope = 5-8%	IV	IV	IV	IV	VI	VI	VI	VI
d : slope = 8-12%	IV	IV	IV*	IV*	VI	VI	VI	VI
e : slope = 12-25%	VI	VI	VI	VI	VI	VI	VI	VI
f : slope = 25-40%	VI	VI	VI	VI	VI	VI	VI	VI
g : slope = 40-70%	VI	VI	VI	VI	VI	VI	VI	VI
h : slope > 70%	VI	VI	VI	VI	VI	VI	VI	VI

(Note) IV*: IV or VI by local specifications

Table D-4-1 Evaluation Criteria for Land Classification for Irrigation (2/2)

(Soil Institute of Iran, MOA)

Micro-relief (unduration within 100m distance)

	Ave. micro-relief	Ave. cut & fill	Earth moving (m^3/ha)
none : "None or very slight" (Maximum land Class I)	0-15cm	<7.5	<375
1 : "Slight" (Maximum land Class II)	15-30cm	7.5-15cm	375-750
2 : "Moderate" (Maximum land Class III)	30-60cm	15-30cm	750-1500
3 : "Strong" (Maximum land Class IV)	>60cm	>30cm	>1500

Present Erosion Status

<Water Erosion>

none : "No apperent erosion" (Maximum Land Class I)
E_1 : "Slight erosion" (Maximum Land Class II)
E_2 : "Moderate erosion" (Maximum Land Class III)
E_3 : "Severe erosion" (Maximum Land Class IV)
"E" : "Destroyed by gully erosion" (Maximum Land Class VI)

Water Erosion Rating

Erosion Depth	Spacing of Rills and Gullies 150-500m	50-150m	50-20m	<20m
Rill (5-30cm)	-	-	E_1	E_2
Gully (30-100cm)	-	E_1	E_2	E_3
Gully (1-3m)	E_1	E_2	E_3	"E"

<Wind Erosion>

(E_1) : "Slight erosion" (Maximum Land Class II)
(E_2) : "Moderate erosion" (Maximum Land Class III)
(E_3) : "Severe erosion" (Maximum Land Class IV)

Wind Erosion Rating

No deposit and no rills by wind.
Shallow rills (5-15cm) by wind.
Extreme erosin by wind.

Present Sediment Status

<Water Erosion Products>

none : "No or slight deposition" (Maximum Land Class I)
d_1 : "Slight deposition" (Maximum Land Class II)
d_2 : "Moderate deposition" (Maximum Land Class III)
d_3 : "Severe deposition" (Maximum Land Class IV)

<Wind Erosion Products>

Rating of deposition by area affected

Area < 10%
Area = 10 - 40%
Area = 40 -75%
Area > 75%

	Rating of deposition
none : "No or slight deposition" (Maximum Land Class I)	Sparse unstabilized hummocks of loose sands more than 10m apart, with a height < 20cm
(d_1) : "Slight deposition" (Maximum Land Class II)	Sparse unstabilized hummocks of loose sands more than 10m apart with a height of 20-100cm, or many hummocks less than 10m with a height <20cm.
(d_2) : "Moderate deposition" (Maximum Land Class III)	Many unstabilized hummocks of loose sands less than 10m apart, without sand sheets with a height of 20-100cm.
(d_3) : "Severe deposition" (Maximum Land Class IV)	Scattered dunes > 1m height or Continuous sand sheets and/or micro-dunes <1m thick.
D : "Sand dunes" (Maximum Land Class VI)	Dunes and/or sand sheets > 1m thick.

Groundwater Depth

<Saline Groundwater> EC>1.5mmhos/cm
W_3 : < 1.20m deep
W_2 : 1.20 - 2m deep
W_1 : 2 - 3m deep
W_0 : 3 - 5m deep

<Sweet Groundwater> EC<1.5mmhos/cm
W_3 : < 75cm deep
W_2 : : 0.75 - 1.20m deep
W_1 : 1.20 - 2m deep
W_0 : 2 - 5m deep

Other Drainage Limitations

O_1 : *between 1.20-2m, presence of clay pan or a horizon of permeability <0.1mm/hr (Class I without W_0, II with W_0)*
O_2 : same between 0.75 - 1.20m (Class II without W_1, III with W_1)
O_3 : same between 0.20 -0.75m (Class III without W_2, V with W_2)

Ponding Hazard

P_1 : "Slight limitation" by ponding (Maximum Land Class II)
P_2 : "Moderate limitation" (Maximum Land Class III)
P_3 : "Severe limitation" (Maximum land Class V)

Rating of Ponding

Duration	Recurrent frequency 1-2yr	3-5yr	6-10yr
< 2weeks	P_1	P_1	-
2-6weeks	P_3	P_2	P_1
6-10weeks	P_3	P_2	P_2

Flooding Hazard

F_1 : "Slight" Class II (frequency 6-10yr)
F_2 : *"Moderate" Class III (frequency 3-5yr)*
F_3 : "Severe" Class V (frequency 1-2yr)

Table D-4-2 Land Classification and Its Major Restrictions

Land Classification of Vastegan

Class	Area (ha)	Ratio (%)
I	496.84	13.6%
II S	232.94	6.4%
II ST	92.60	2.5%
II SW	546.16	15.0%
III S	366.80	10.1%
III T	33.26	0.9%
III W	1,587.98	43.5%
III TW	169.41	4.6%
IV S	76.91	2.1%
IV T	3.65	0.1%
VI RW	41.38	1.1%
I	496.84	13.6%
II	871.70	23.9%
III	2,157.45	59.1%
IV	80.56	2.2%
VI RW	41.38	1.1%
Total	3,647.93	100.0%

Land Classification of Bazoft

Class	Area (ha)	Ratio (%)
II ST	252.89	10.3%
III ST	0.00	0.0%
III ST + IV ST	1,014.94	41.4%
IV S	630.67	25.7%
IV ST	555.85	22.6%
II	252.89	10.3%
III	0.00	0.0%
III+IV	1,014.94	41.4%
IV	1,186.52	48.3%
Total	2,454.35	100.0%

Land Classification of Sarbaz

Class	Area (ha)	Ratio (%)
II ST	1,129.99	21.0%
III S	98.11	1.8%
III ST	2,156.54	40.0%
IV T	371.20	6.9%
IV ST	1,487.66	27.6%
IV ST - VI ST + III ST	0.00	0.0%
VI RW	12.22	0.2%
VI R	133.79	2.5%
II	1,129.99	21.0%
III	2,254.65	41.8%
IV	1,858.86	34.5%
IV-VI+III	0.00	0.0%
VI RW	12.22	0.2%
VI R	133.79	2.5%
Total	5,389.51	100.0%

(Note) IV ST - VI ST + III ST (1,084.46ha) omited due to outside of the area.

Land Classification of Tangsorkh

Class	Area (ha)	Ratio (%)
II TW	29.12	2.4%
III T	120.32	9.8%
III ST	544.94	44.4%
III TW	167.74	13.7%
IV T	258.71	21.1%
VI RW	107.69	8.8%
II	29.12	2.4%
III	833.00	67.8%
IV	258.71	21.1%
VI	107.69	8.8%
Total	1,228.52	100.0%

Land Classification of Zeras

Class	Area (ha)	Ratio (%)
II ST	68.59	12.8%
III S	83.82	15.7%
III T	24.96	4.7%
III ST	180.46	33.8%
IV T	176.36	33.0%
VI T		0.0%
II	68.59	12.8%
III	289.24	54.1%
IV	176.36	33.0%
VI		0.0%
Total	534.19	100.0%

(Note) 1) *VI T is neglected in this table, but it covers the area extensivey.*
2) Detail descriptions are in Table D-4-3 (1) to (5)
3) Location of above classified lands is presented in Figure 3-6 to 3-10 in BATABASE MAPS.

Table D-4-3(1) Land Classification Mapping for Irrigation in Vastegan (1/2)

Row	Land classification symbols	class & subclass	soil series No.	soil mapping unit	Area (ha)	%	Description
1	3H / A-Eo	I	4	4.1	248.72	6.82	moderate permeability, heavy .surface soil texture, 0-2% slope.
2	3H / A-Eo	I	5	5.1	248.12	6.80	Moderate permeability heavy surface soil texture 0-2% slope.
3	4V1-p / A-Eo	IIS	1	1.1	56.97	1.56	Slow permeability, very heavy surface soil texture, weathered calcareous marls (paralithic) within depth of 80-120cm., 0-2% slopes
4	3H2 - Z / A - E0	IIS	5	5.2	175.97	4.82	Moderate permeability, heavy surface soil texture, more than 75% fine and coarse gravels within depth of 50-80 cm., 0-2% slope.
5	4V / A - E0 - O1 - W0	IISW	6	6.1	546.16	14.97	Slow permeability very heavy surface soil texture. 0-2% slope, slight hydromorphy limitaion, ground water table 2-3m.
6	4V (g) 1 - P / Ba1 - E1	IIST	1	1.2	92.60	2.54	Slow permeability very heavy surface soil texture, 3-15% coarse gravels in topsoil , weathered calcarous marls (paralithic) within depth of 80-120cm., 2-5% overall and 1-2% transversal slope, slight microrelief and water erosion.
7	2GMg / Aa - E0	IIIS	3	3.1	366.80	10.05	Rapid permeability, 35-75% fine and coarse gravel in subsoil, medium surface soil texture, 15-35% coarse gravels in topsoil, 0-2% overall and 1-2% transversal slopes.
8	4V (g) / Bb1 - E1	IIIT	1	1.3	33.26	0.92	Slow permeability, very havery surface soil texture, 3-15% coarse gravels in topsoil , 2-5% overall and transversal slope, slight micorelief and water erosion.

Table D-4-3(1) Land Classification Mapping for Irrigation in Vastegan (2/2)

Row	Land classification symbols	class & subdass	soil series No.	soil mapping unit	Area (ha)	%	Description
9	4V / A - E0 - O2 - W1	IIIW	6	6.2	1299.9	35.63	Slow permeability, very heavy surface soil texture, 0-2% slope, moderate hydromorphy limitaion, slightly high groundwater table (1.2-2m).
10	4V / A - E0 - O3 - W1	IIIW	6	6.4	232.44	6.37	Slow permeability very heavy surface soil texture, 0-2% slope, severe hydromorphy limitalion, slightly high groundwater table (1-20-2m).
11	4V / A - E0 - O2 - W2	IIIW	6	6.3	55.64	1.53	Slow permeability very heavy surface soil texture, 0-2% slope, moderate hydromorphy limitaion, moderately high groundwater table (0.8-1.20cm).
12	3H (g) / A1 - E2 - W0 - F2	IIITW	4	4.2	169.41	4.64	Moderate permeability, heavy surface siol texture, 3-15% coarse gravels in topsoil, 0-2% slope, moderate water erosion, groundwater table (2-3m), moderate flooding hazards.
13	1GLG / Ba1 - E1	IVS	2	2.1	76.91	2.12	Very Rapid permeability, 35-75% fine and coarse gravels in subsoi, light surface soil texture, 2-5% overall and 1-2% transversal slopes, slight microrelief and water erosion.
14	IV / T	IV	T		3.65	0.10	Hills
15	VI / RW	VI	RW		41.38	1.13	Gravelly and stony River wash
					3647.93	100	Total

Table D-4-3(2) Land Classification Mapping for Irrigation in Chaman Goli-Bazoft (1/2)

Row	Land classification symbols	class & subclass	soil series No.	soil mapping unit	Area (ha)	%	Description
1	4V (g) / Ba1 - E1	IIST	3	3.1	43.43	1.77	Slow permeability, very heavy surface soil texture, 3-15% coarse gravels in topsoil, 2-5% overall and 1-2% transversal slopes, slight microrelief and water erosion.
2	4V(g)1 - Z / Ba1 - E1	IIST	3	3.2	209.46	8.53	Slow permeability very heavy surface soil texture, 3-15% coarse gravels in topsoil, more than 75% fine and coarse gravels within depth of 80-120 cm., 2-5% overall and 1-2% transversal slopes, slight microrelief and water erosion.
3	4gVS / Bc2 - E2	IIIST	1	1.1	-	-	Slow permeability, 15-35% fine and eoares gravels in subsoil, very heavy surface soil texture, 15-35% stones in topsoil, 2-5% overall and 5-8% transversal slopes, moderate microrelief and water erosion.
4	4GVB1 - P / Bb2- E2	IVS	2	2.1	630.67	25.70	Slow permeability, 35-75% coarse gravels and stones in subsoil, very heavy surface soil texture, 35-75% boulders in topsoil, weathered calcareous marls within depth of 80-120 cm,. 2-5% overall and transversal slopes, moderate microrelief and water erosion.
5	4gVB / Ec2- E3	IVST	1	1.2	-	-	Slow permeability, 15-35% fine and coarse gravels in subsoil, very heavy surface siol texture, 35-75% boulders in topsoil, 12-25% overall and 5-8% transversal slopes, moderate microrelief, severe water erosion.

Table D-4-3(2) Land Classification Mapping for Irrigation in Chaman Goli-Bazoft (2/2)

Row	Land classification symbols	class & subclass	soil series No.	soil mapping unit	Area (ha)	%	Description
6	4GVB1 - P / Cc3 - E2	IVST	2	2.2	555.85	22.65	Slow permeability, 35-75% fine and eoares gravels in subsoil, very heavy surface soil texture, 35-75% boulders in topsoil, weathered calcareous marls within depth of 80-120cm, 5-8% overall and transversal slopes, strong microrelief, moderaste water erosion.
7	4gVS / Bc2 - E2 + 4gVB / Ec2 - E3	IIIST + IVST	1 + 1	1.1 + 1.2	1014.94	41.35	Association of 1.1.+1.2
					2454.35	100.00	Total

Table D-4-3(3) Land Classification Mapping for Irrigation in Sarbaz (1/3)

Row	Land classification symbols	class & subclass	soil series No.	soil mapping unit	Area (ha)	%	Description
1	4 H / Ba1-E1 4V / Ba1 - E1	IIST IIST	8 7	8.1 7.1	713.71 416.28	11.0 6.43	slow permeability , heavy or very heavy surface soil texture , 2-5% overall and 1-2% transversal slopes, slight microrelif and water erosion.
2	2GHg3 - 2 / Ba1 - E1	III S	9	9.1	98.11	1.51	Rapid permeability , 35-75% coarse gravels and stones in subsoil , heavy surface soil texture, 15-35% coarse gravels in topsoil , more than 75% stones and boulders within depth of 25-50 cm., 2-5% overall and 1-2% transversal slopes, slight microre lief and water erosion.
3	4 gHg / Bc2 - E2	IIIST	2	2.1	-	-	Slow permeability, 15-35% coarse gravels and stones in subsoil, heavy surface soil texture, 15-35% coarse gravels in topsoil , 2-5% overall and 5-8% transversal slopes, moderate microrelief and water erosion.
4	4 Hg3 - p / Bb1 - E1	III ST	4	4.1	-	-	Slow permeability, heavy surface soil texture, 15-35% coarse gravels in topsoil , weathered calcareous marls (paralithic) within depth of 25-50cm., 2-5% overall and transversal slopes, slight microrelief and water erosion.
5	4 HS3 - P / Cc2 - E2	IIIST	4	4.2	179.13	2.77	Slow permeability, heavy surface soil texture, 15-35% stones in topsoil , weathered calcareous marls (paralithic) within depth of 25-50 cm., 5-8% overall and transversal slopes, moderate microrelief and water erosion.

Table D-4-3(3) Land Classification Mapping for Irrigation in Sarbaz (2/3)

Row	Land classification symbols	class & subclass	soil series No.	soil mapping unit	Area (ha)	%	Description
6	$\frac{4\ gvg\ 2 - P}{Bb - Cb1 - E1}$	IIIST	5	5.1	104.34	1.61	Slow permeability , 15-35% coarse gravels in subsoil, very heavy surface soil texture, 15-35% coarse gravels in topsoil , weathered calcareous marls (paralithic) within depth of 50-80 cm., 2-5% to 5-8% overall and 2-5% transversal slopes, slight microrelief and water erosion.
7	$\frac{4GVg3 - Z}{Bb2 - E2}$	IIIST	6	6.1	342.92	5.3	Slow permeability , 35-75% coarse gravels and stones and boulders in subsoil , very heavy surface soil texture, 15-35% coarse gravels in topsoil , more than 75% stones and boulders within depth of 25-50 cm., 2-5% overall and transversal slopes, moderate microrelief and water erosion.
8	$\frac{4gV1 - P}{Bc - Dc2 - E2}$	IV T	5	5.2	371.2	5.74	Slow permeability, 15-35% coarse gravels in subsoil , very heavy surface soil texuture weathered calcareous marls (paralithic) within depth of 80-120cm. 2-5 to 8-12% overall and 5-8% transversal slopes, moderate microrelief and water erosion.
9	$\frac{4Hg4 - P}{Cc - Dc3 - E2}$	IV ST	3	3.1	1235.33	19.08	Slow permeability , heavy surface soil texture, 15-35% coarse gravels in topsoil , weathered calcareous marls (paralithic) within depth of 10-25 cm., 5-8 to 8-12% overall and 5-8% transversal slopes, strong microrelif , moderate water erosion.

Table D-4-3(3) Land Classification Mapping for Irrigation in Sarbaz (3/3)

Row	Land classification symbols	class & subclass	soil series No.	soil mapping unit	Area (ha)	%	Description
10	$\frac{4gVG1 - P}{Db - Dc2 - E3}$	IVST	5	5.3	252.33	3.89	Slow permeability, 15-35% coarse gravels in subsoil, very heavy surface soil texture, 35-75% coarse gravels in topsoil, weathered calcareous marls (paralithic) within depth of 80-120cm., 8-12% overall and 2-5% to 5-8% transversal slopes, moderate microrelief, severe water erosion.
11	$\frac{4GVB1 - Z}{Ec3 - E2}$	IV - VIST	1	1.1	-	-	Slow permeability, 35-75% stones and boulders in subsoil , very heavy surface soil texture, 35-75% Boulders in topsoil, more than 75% stones and boulders within depth of 80-120 cm., 12-25% overall and 5-8% transversal slopes, strong microrelief,moderate water erosion.
12	$\frac{4\ GVB1 - Z}{Ec3 - E2} + \frac{4gHg}{Bc2 - Ec}$	IV - VIST + III ST	1+2	1.1+2.1	1084.60	16.75	Association of 1.1 + 2.1
13	$\frac{4Hg3 - P}{Eb1 - E1} + \frac{4gVg2 - P}{Bb1 - Cb1 - E1}$	IIIST + III ST	4 + 5	4.1 + 5.1	1530.15	23.64	Association of 4.1 + 5.1
14	$\frac{VI}{RW}$	VI	RW		12.22	0.18	Gravelly and stony River wash
15	$\frac{VI}{R}$	VI	R		133.79	2.08	Rocky mountaions
					6474.11	100	TOTAL

Table D-4-3(4) Land Classification Mapping for Irrigation in Tang Sorkh (1/2)

Row	Land classification symbols	class & subclass	soil series No.	soil mapping unit	Area (ha)	%	Description
1	3M / A1- E1 - W1 - O1 - F1	IITW	5	5.1	29.12	2.37	Moderate permeability, medium surface soil texture, 0-2% slope, slight microrelief and water erosion, slightly high ground water table (120-2m), slight hydromorphy and flooding limitations.
2	3H (g) / Bb2 - E2	IIIT	3	3.1	120.32	9.75	Moderate permeability, heavy surface soil texture, 3-15% coarse gravels in topsoil, 2-5% overall and trasversal slopes, moderate microrelief and water erosion.
3	3 g H g / Bc2 - E2	III ST	1	1.1	86.51	7.04	Moderate permeability, heavy surface soil texture, 15-35% coarse gravels in subsoil and topsoil, 2-5% overall and 5-8% transversal slopes, moderate microrelief and water erosion.
4	3GHg / Ba1 - E2	IIIST	2	2.1	40.49	3.3	Moderate permeability, 35-75% coarse gravels in subsoil , heavy surface soil texture, 15-35% coarse gravels in topsoil, 2-5% overall and 1-2% transversal slopes, slight microrelief, moderate water erosion.
5	3GHg / Bb1 - E2	IIIST	2	2.2	154.35	12.56	Moerate permeability, 35-75% coarse gravels in subsoil, heavy surface soil texture, 15-35% coarse gravels in topsoil, 2-5% overall and transversal slopes, slight microrelief, moderate water erosion.
6	3GHg1 - Z / Bbt2 - E2	IIIST	2	2.3	73.43	5.98	Moderate permeability, 35-75% coarse gravels in subsoil, heavy surface soil texture, 15-35% coarse gravels in topsoi, more than 75% coarse gravels within depth of 80-120 cm., 2-5% overall and transversal terraced slopes, moderate microrelief and water erosion.

Table D-4-3(4) Land Classification Mapping for Irrigation in Tang Sorkh (2/2)

Row	Land classification symbols	class & subclass	soil series No.	soil mapping unit	Area (ha)	%	Description
7	$\frac{4GVg2 - Z}{Bb2 - E2}$	IIIST	4	4.1	190.16	15.48	Slow permeability 35-75% coarse gravels and stones in subsoil, very heavy surface soil textuure, 15-35% coarse gravels in topsoil, more than 75% coarse gravels within depth of 50-80 cm., 2-5% overall and transversal slopes, moderate microrelief and water erosion.
8	$\frac{3M}{A2-E2-W0-F2}$	IIITW	5	5.2	167.74	13.7	Moderate permeability, medium surface soil textue, 0-2% slopes, moderate microrelief and water erosion, groand water table 2-3m., moderate flooding hazards.
9	$\frac{3GVS4 - P}{Cd3 - E2}$	IVT	6	6.1	258.71	21.05	Moderate permeability, 35-75% coarse gravels in subsoil, very heavy surface soil texture, 15-35% stones in topsoil, weathered shale within depth of 10-25cm., 5-8% overall and 8-12% transversal slope, strong microrelief, moderate water erosion.
10	$\frac{VI}{RW}$	VI	RW		107.96	8.77	Cravelly & stony river washes
					1228.52	100	Total

Table D-4-3(5) Land Classification Mapping for Irrigation in Zeras (1/2)

Row	Land classification symbols	class & subclass	soil series No.	soil mapping unit	Area (ha)	%	Description
1	4H(S) / Ba1-E1	IIST	2	2.1	68.59	12.84	Slow permeability, heavy surface soil texture,3-15% stones in topsoil, 2-5% overall&1-2% transversal slopes, slight microrelief and water erosion.
2	4Hg / Ba1-E1	IIIS	3	3.1	27.21	5.09	slow permeability, heavy surface soil texture, 15-35% coarse gravels in topsoil, 2-5% overall & 1-2% transversal slopes, slight microrelief and water erosion.
3	4GHS3 - Z / Ba1 - E1	IIIS	1	1.1	56.61	10.6	Slow permeability, 35-75% stones and boulders in subsoil, heavy surface soiltexture, 15-35% stones in topsoil, more than 75% stones and boulders within depth of 25-50 cm, 2-5% overall and 1-2% transversal slopes, slight microrelief and water erosion
4	4H(S) / Bb1-E2	IIIT	3	3.2	24.96	4.67	slow permeability, heavy surface soil texture, 3-15% stones in topsoil, 2-5% overall and transversal slopes, slight microrelief, moderate water erosion.
5	4HS / Cb2-E2	IIIST	2	2.2	47.3	8.85	Slow permeability, heavy surface soil texture, 15-35% stones in topsoil, 5-8% overall and 2-5% transversal slopes, moderate microrelief and water erosion.
6	4HS1 - Z / Bc2 - E2	IIIST	3	3.3	31.29	5.86	slow permeability, heavy surface soil texture, 15-35% stones in topsoil, more than 75% coarse gravels and slones, within depth of 80-120 cm., 2-5% overall and 5-8% transversal slopes, moderate microrelief and water erosion

Table D-4-3(5) Land Classification Mapping for Irrigation in Zeras (2/2)

Row	Land classification symbols	class & subclass	soil series No.	soil mapping unit	Area (ha)	%	Description
7	$\frac{4GHS3 - Z}{Bb1-E2}$	IIIST	1	1.2	101.87	19.07	Slow permeability, , 35-75% stones & boulders in subsoil, heavy surface soil texture 15-35% stones in topsoil, more than 75% stones & boulders within depth of 25-50cm , 2-5% overall and transversal slopes, slight microrelief, moderate water erosion
8	$\frac{4Hg}{Bd3-E3}$	IVT	3	3.5	76.16	14.26	Slow permeability, heavy surface soil texture,15-35% coarse gravels in topsoil, 2-5% overall and 8-12% transversal slopes, Strong microrelief and water erosion.
9	$\frac{4Hg1- Z}{Cd2 - E2}$	IVT	3	3.4	100.2	18.76	slow permeability, heavy surface soil texture, 15-35% coarse gravels in topsoil, move than 75% coarse gravels and stones within depth of 80-120cm., 5-8% overall and 8-12% transversal slopes, moderate microrelief and water erosion.
10	$\frac{4H(g)}{G3 - E3}$	VIT	2	2.3	-	-	Slow permeability, heavy surface soil texture, 3-15% coarse gravels in topsoil, 40-70% slope, strong microrelief and water erosion.
					534.19	100.00	Total

D.5 Soil Erosion (Phase-2)

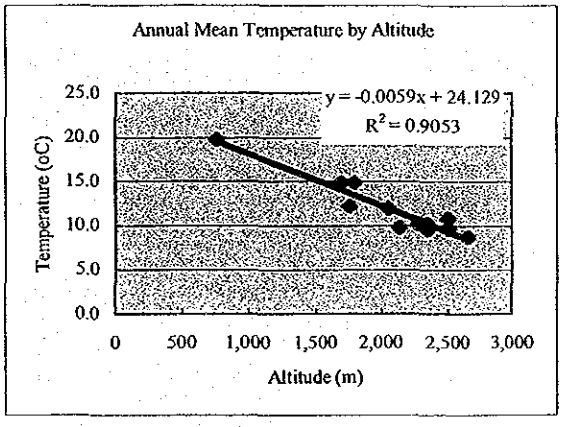
Table D-5-1-1 Climate Condition of 5 Master Plan Areas

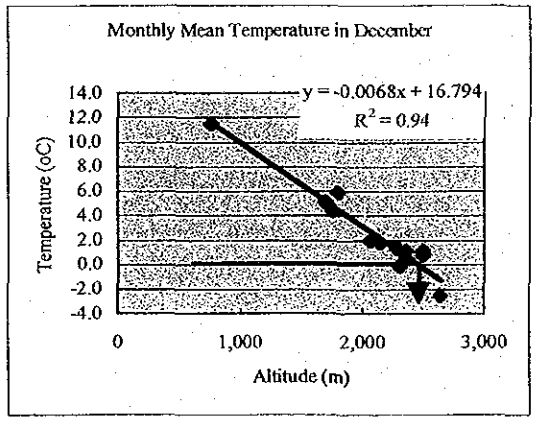
	Meh (Oct)	Aba (Nov)	Aza (Dec)	Dey (Jan)	Bah (Feb)	Esf (Mar)	Far (Apr)	Ord (May)	Kho (Jun)	Tir (Jul)	Mor (Aug)	Sha (Sep)	Total
Vastegan													
Precipitation													
Rain fall (mm)	17.8	72.7	137.3	117.8	131.8	159.6	85.5	43.7	3.8	3.5	1.6	0.0	775.1
Rainy day (days)	1	3	4	4	4	5	5	4	1	0	1	0	32
Temperature													
Tmax (°C)	18.1	10.6	3.5	0.5	2.6	7.4	13.0	18.9	25.4	28.7	28.3	24.5	15.1
Mean (°C)	8.5	2.6	-3.3	-6.4	-4.2	0.9	6.2	11.0	15.9	19.3	18.6	14.2	6.9
Min (°C)	-1.2	-5.4	-10.1	-13.2	-11.0	-5.6	-0.6	3.0	6.4	9.9	8.9	3.8	-1.3
Ref. ET_0 (mm)	91.1	54.6	33.8	27.6	34.7	58.6	78.9	127.1	154.5	163.7	153.5	127.2	1105.3
Frost days (days)													134
Chaman Goli-Bazoft													
Precipitation													
Rain fall (mm)	23.0	121.1	278.9	253.4	206.0	300.3	173.8	116.0	0.7	0.0	0.3	1.0	1474.5
Rainy day (days)	2	5	9	10	13	12	10	7	0	0	0	0	68
Temperature													
Tmax (°C)	21.3	14.2	5.4	2.3	4.7	8.9	14.2	22.0	28.9	32.7	32.0	28.2	17.9
Mean (°C)	13.5	7.5	-0.5	-4.6	-1.7	3.5	9.0	15.1	20.0	23.8	23.4	19.3	10.7
Min (°C)	5.7	0.7	-6.3	-11.5	-8.0	-2.0	3.8	8.1	11.0	14.9	14.7	10.3	3.5
Ref. ET_0 (mm)	74.7	40.5	26.4	21.7	30.0	53.6	90.0	136.1	154.5	166.8	150.0	114.3	1058.6
Frost days (days)													132
Sarbaz													
Precipitation													
Rain fall (mm)	5.3	46.3	107.1	108.8	114.9	128.4	117.5	38.5	15.3	8.7	1.6	0.0	692.4
Rainy day (days)	0	2	4	4	4	5	4	2	0	0	0	0	25
Temperature													
Tmax (°C)	17.6	11.9	5.9	2.4	5.4	9.4	14.6	20.1	25.8	28.8	27.6	22.1	16.0
Mean (°C)	8.3	3.3	-1.6	-5.2	-2.1	2.7	7.2	11.8	16.2	19.0	17.8	12.9	7.5
Min (°C)	-1.1	-5.4	-9.0	-12.8	-9.6	-4.1	-0.3	3.5	6.6	9.1	8.0	3.6	-1.0
Ref. ET_0 (mm)	111.0	66.9	43.5	38.1	43.1	54.9	93.0	127.1	158.1	179.8	179.8	151.8	1247.1
Frost days (days)													121
Tangsorkh													
Precipitation													
Rain fall (mm)	11.2	93.1	196.0	211.3	208.8	216.1	150.9	57.9	2.5	0.5	2.0	0.3	1150.6
Rainy day (days)	2	5	7	9	10	10	9	5	1	0	0	0	58
Temperature													
Tmax (°C)	20.2	13.1	7.8	4.2	5.7	9.2	16.1	22.2	28.4	31.1	30.3	26.6	17.9
Mean (°C)	12.4	6.5	2.2	-0.9	0.6	4.3	9.8	14.9	19.7	23.0	22.2	18.2	11.1
Min (°C)	4.6	-0.2	-3.5	-5.9	-4.6	-0.7	3.5	7.5	11.0	14.9	14.0	9.8	4.2
Ref. ET_0 (mm)	74.7	40.5	26.4	21.7	30.0	53.6	90.0	136.1	154.5	166.8	150.0	114.3	1058.6
Frost days (days)													51
Zeras													
Precipitation													
Rain fall (mm)	7.0	55.6	151.2	142.7	124.3	146.0	99.5	43.3	2.2	0.0	0.8	0.0	772.6
Rainy day (days)	1	4	6	7	7	9	7	4	0	0	0	0	45
Temperature													
Tmax (°C)	23.9	18.4	14.5	12.7	10.9	15.1	24.0	26.2	35.8	37.6	38.4	35.2	24.4
Mean (°C)	17.5	12.5	9.1	6.5	7.2	10.0	16.8	20.4	26.1	28.5	29.0	25.5	17.4
Min (°C)	11.0	6.6	3.7	0.2	3.5	4.8	9.6	14.5	16.4	19.4	19.5	15.7	10.4
Ref. ET_0 (mm)	108.2	61.8	38.4	37.8	49	83.1	117.9	165.9	195.3	219.2	197.8	151.2	1425.6
Frost days (days)													4

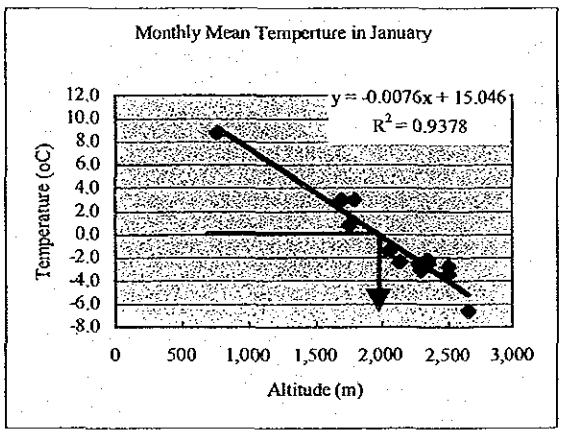
(Note)
Frost period

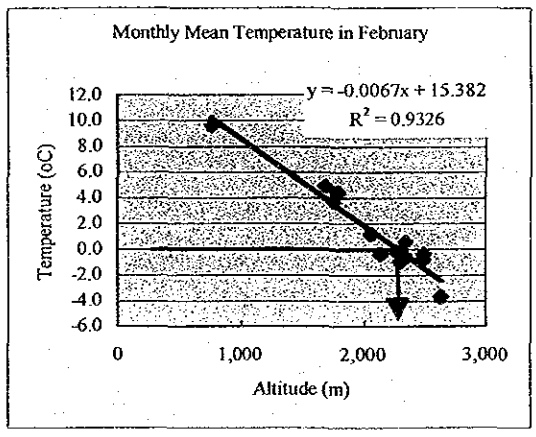
Table D-5-1-2 Relation between Altitude and Temperature

Station	Elevation	Mean Temperature (°C)												
	(m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Karkhane-Ghand-Yasuj	1,760	0.8	3.7	7.5	11.4	16.5	21.0	23.2	22.0	18.5	9.6	7.9	4.4	12.2
Yasuj	1,800	3.0	4.4	8.0	13.6	18.6	23.5	26.8	26.0	22.0	16.2	10.3	5.9	14.9
Hanna	2,350	-2.5	0.6	5.3	9.9	14.5	18.9	21.7	20.5	15.5	10.9	6.0	1.1	10.2
Lordjan	1,700	3.0	4.9	9.0	13.6	18.7	23.9	25.7	25.8	21.7	16.2	10.5	5.1	14.9
Mehrgerd	2,350	-2.2	-0.6	4.7	7.9	13.2	17.8	21.1	19.5	15.8	11.4	5.8	0.6	9.6
Adl	2,280	-2.6	-0.3	4.8	10.2	14.2	18.7	21.8	21.0	16.5	11.1	6.3	1.3	10.2
Emam-gheis	2,300	-3.1	-1.0	4.1	9.4	14.2	19.1	22.5	21.8	17.4	11.6	5.8	-0.1	10.1
Edalat-organ	2,500	-3.4	-0.8	3.2	8.7	13.5	18.6	21.9	20.4	17.1	11.1	5.4	0.8	9.7
Boroojen	2,140	-2.4	-0.4	4.3	9.7	14.1	18.7	22.1	20.9	16.4	11.1	6.3	1.8	9.8
Shahrekord	2,060	-1.5	1.2	6.1	10.6	15.9	20.8	24.1	23.2	18.8	13.2	7.6	2.0	11.9
Kohrang	2,650	-6.6	-3.7	1.5	7.0	13.1	18.0	21.8	21.4	17.2	11.5	5.4	-2.5	8.7
Semirom-olia	2,500	-2.8	-0.4	5.2	10.4	14.4	20.2	22.8	21.4	18.0	12.6	6.4	1.1	10.8
Izeh	764	8.8	9.6	12.3	19.2	22.8	28.5	30.9	31.4	27.8	19.8	14.9	11.5	19.8









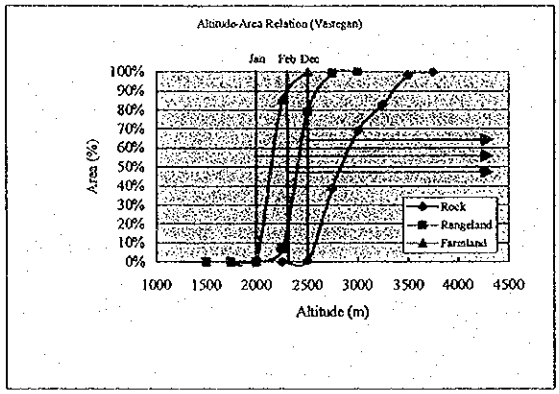
Altitude at 0°C of mean temperature

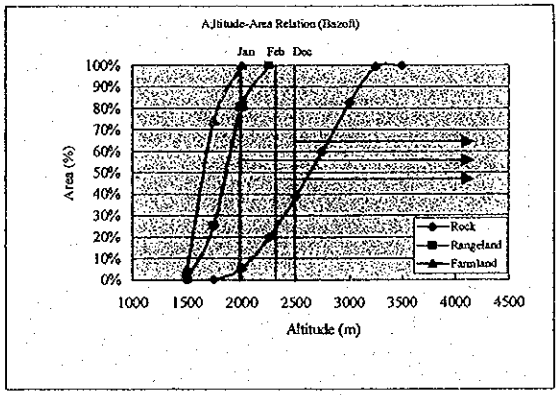
December	2,470 m
January	1,980 m
February	2,296 m

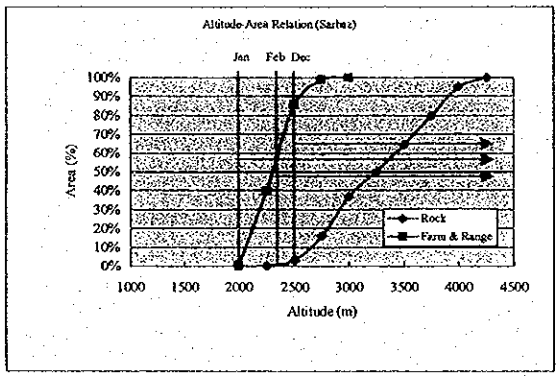
(Note)

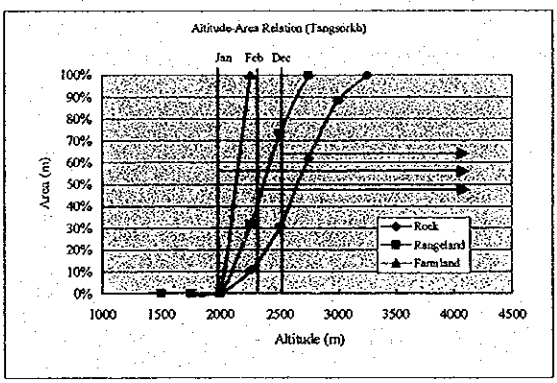
1) refering to Table C-2-5, Annex C.
2) Data of Khafr, Naghsh-bahram and Chalshotor have been omited because far from trend.

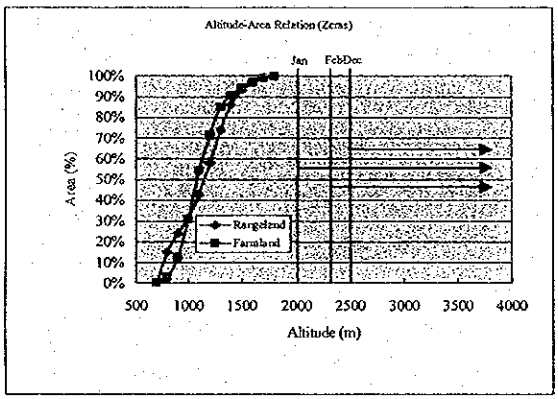
Table D-5-1-3 Estimation of Frost Period of Farmland and Rangeland by Alutitude

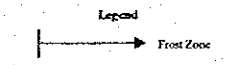












Frost Altitude

Dec	2,500 m
Jan	2,000 m
Feb	2,300 m

Vastegan

	Frost Area		
	Dec	Jan	Feb
Farmland	0%	100%	10%
Rangeland	20%	100%	80%
Frost Period	←	→	

1.5 Months

Chaman Goli Bazoft

	Frost Area		
	Dec	Jan	Feb
Farmland	0%	0%	0%
Rangeland	0%	20%	0%
Frost Period			

0 Months

Sarbaz

	Frost Area

Tangsorkh

	Frost Area

Table D-5-1-4 Rainfall Duration Analysis in the Study Area

Duration and rainfall intensity equation has been analyzed utilizing the relation of short duration and rainfall intensity in Yasuj. Its relation is as follows:

Relation of Duration and Rainfall Intensity in Yasuj

Return Period	Rainfall Intensity (mm/hr)										
(yr)	15 min	30 min	45 min	60 min	90 min	120 min	180 min	240 min	300 min	360 min	Daily
2	21.8	14.5	11.8	9.9	8.6	7.9	6.7	6.0	5.4	5.1	3.0
5	31.1	19.7	16.0	14.0	11.8	10.8	9.0	7.9	7.2	6.7	4.0
10	37.3	23.2	18.7	16.6	14.0	12.8	10.5	9.2	8.3	7.8	4.6
25	45.1	27.6	22.2	20.0	16.8	15.2	12.4	10.8	9.8	9.2	5.4
Return Period	Rainfall Amount (mm)										
(yr)	15 min	30 min	45 min	60 min	90 min	120 min	180 min	240 min	300 min	360 min	Daily
2	5.5	7.3	8.9	9.9	12.9	15.8	20.1	24.0	27.0	30.6	72
5	7.8	9.9	12.0	14.0	17.7	21.6	27.0	31.6	36.0	40.2	95
10	9.3	11.6	14.0	16.6	21.0	25.6	31.5	36.8	41.5	46.8	110
25	11.3	13.8	16.7	20.0	25.2	30.4	37.2	43.2	49.0	55.2	130

For estimating short duration rainfall Rt from RT, Sherman type equation is applied as below.

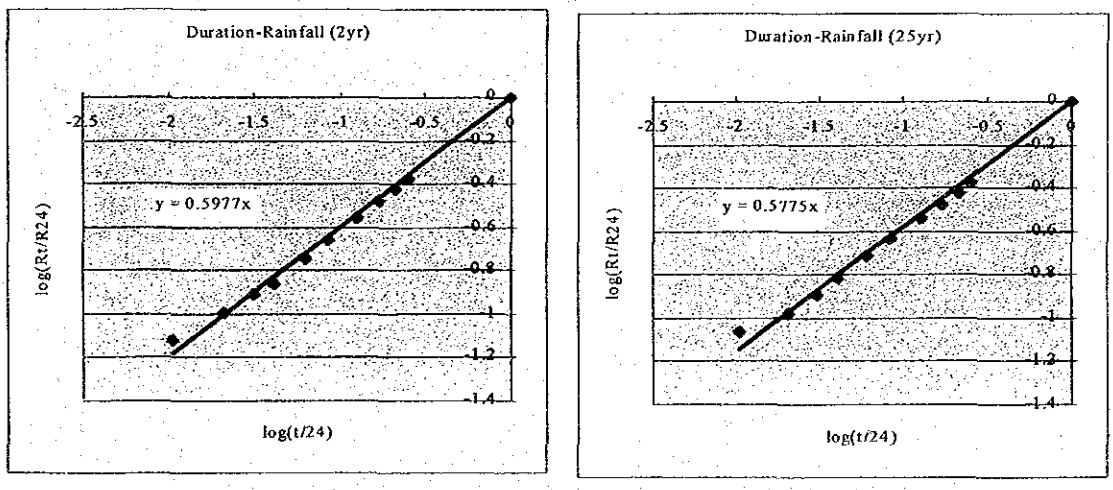
$$Rt = RT\left(\frac{t}{T}\right)^{k}$$

Where, RT: T hour rainfall (mm)
Rt: t hour rainfall (mm)
k: constant

Constant k is generally between 1/2 to 1/3, and 1/2 (0.5) is generally applied in Japan. Above equation can be converted to following equation:

$$Log\left(\frac{Rt}{RT}\right) = kLog\left(\frac{t}{T}\right)$$

When analyzing return period for two cases of 2 years and 25 years, constant k can be defined at 0.6 in Yasuj as below.



Relation of Duration and Rainfall Intensity in Yasuj

Table D-5-1-5 Computation of Hourly Rainfall and Its Energy and Erodibility Index

	Daily Rainfall		Computation of Rt (cm/hr)																							
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
day	R(mm)	R(cm)	0.15	0.08	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
1	71.3	7.13	1.06	0.55	0.44	0.39	0.35	0.32	0.3	0.28	0.27	0.26	0.25	0.24	0.23	0.22	0.22	0.21	0.21	0.2	0.2	0.19	0.19	0.19	0.18	0.18
2	35.7	3.57	0.53	0.27	0.22	0.19	0.17	0.16	0.15	0.14	0.14	0.13	0.12	0.12	0.12	0.11	0.11	0.11	0.1	0.1	0.1	0.1	0.1	0.09	0.09	0.09
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	44.6	4.46	0.66	0.34	0.28	0.24	0.22	0.2	0.19	0.18	0.17	0.16	0.16	0.15	0.14	0.14	0.14	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.11	0.11
9	121.9	12.19	1.81	0.93	0.76	0.66	0.6	0.55	0.51	0.49	0.46	0.44	0.42	0.41	0.4	0.38	0.37	0.36	0.35	0.35	0.34	0.33	0.32	0.32	0.31	0.31
10	50.3	5.03	0.75	0.39	0.31	0.27	0.25	0.23	0.21	0.2	0.19	0.18	0.18	0.17	0.16	0.16	0.15	0.15	0.15	0.14	0.14	0.14	0.13	0.13	0.13	0.13
11	74.6	7.46	1.11	0.57	0.46	0.4	0.36	0.34	0.31	0.3	0.28	0.27	0.26	0.25	0.24	0.23	0.23	0.22	0.22	0.21	0.21	0.2	0.2	0.19	0.19	0.19
12	2.1	0.21	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	1	0.1	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	2.6	0.26	0.04	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
16	4	0.4	0.06	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0.8	0.08	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	2.3	0.23	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	4.6	0.46	0.07	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	2.8	0.28	0.04	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	418.6 mm																									

	R(rainfall erodibility		Rainfall Energy of a Unit Raifll E={210+89log(It)}*Rt (m t/ha)																							
day	E 160/100	E	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	12.7	1199	225	102	78.9	66.8	59	53.4	49.2	45.8	43.1	40.7	38.7	37	35.5	34.2	33	31.9	30.9	30	29.2	28.4	27.7	27	26.4	25.8
2	2.68	505	98.4	43.7	33.6	28.3	24.9	22.4	20.6	19.1	17.9	16.9	16.1	15.3	14.7	14.1	13.6	13.1	12.7	12.3	11.9	11.6	11.3	11	10.8	10.5
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	4.43	669.3	129	57.6	44.3	37.4	33	29.8	27.4	25.4	23.9	22.5	21.4	20.4	19.6	18.8	18.1	17.5	17	16.5	16	15.6	15.2	14.8	14.4	14.1
9	41.7	2303	422	194	151	128	113	103	94.8	88.4	83.2	78.8	75	71.8	68.9	66.4	64.1	62	60.1	58.4	56.9	55.4	54	52.8	51.6	50.5
10	5.81	778.2	148	66.7	51.5	43.5	38.3	34.6	31.8	29.6	27.8	26.3	25	23.8	22.8	22	21.2	20.5	19.8	19.2	18.7	18.2	17.7	17.3	16.9	16.5
11	14.05	1268	237	108	83.4	70.6	62.4	56.5	52	48.5	45.5	43.1	41	39.2	37.6	36.2	34.9	33.7	32.7	31.7	30.9	30.1	29.3	28.6	28	27.4
12	0	6.71	2.37	0.81	0.55	0.42	0.34	0.28	0.24	0.21	0.18	0.16	0.15	0.13	0.12	0.11	0.1	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.04	0.04
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0.327	0.7	0.17	0.08	0.04	0.02	0.01	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0.1	-0.1	-0.1	-0.1
15	0	10.45	3.25	1.17	0.81	0.64	0.52	0.45	0.39	0.35	0.31	0.28	0.25	0.23	0.21	0.2	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.1
16	0.01	22.74	5.99	2.31	1.66	1.34	1.13	0.99	0.88	0.8	0.73	0.67	0.62	0.58	0.55	0.51	0.49	0.46	0.44	0.42	0.4	0.38	0.37	0.35	0.34	0.33
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	-0.428	0.46	0.08	0.02	-0	-0	-0	-0	-0	-0	-0	-0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	8.158	2.72	0.95	0.65	0.5	0.41	0.35	0.3	0.26	0.23	0.21	0.19	0.17	0.15	0.14	0.13	0.12	0.11	0.1	0.09	0.09	0.08	0.07	0.07	0.06
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0.02	28.64	7.26	2.84	2.07	1.67	1.42	1.25	1.12	1.01	0.93	0.86	0.8	0.75	0.71	0.67	0.64	0.61	0.58	0.55	0.53	0.51	0.49	0.47	0.45	0.44
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0.01	12.06	3.62	1.32	0.93	0.73	0.6	0.52	0.45	0.4	0.36	0.33	0.3	0.28	0.26	0.24	0.22	0.21	0.2	0.18	0.17	0.16	0.15	0.15	0.14	0.13
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R=	81.41																									

(Note) Computation for December in Tangsorkh.

Tabke D-5-1-6 Computation of Annual Crop Management Factors of Wheat and Dry Type Alfalfa

Area	Monthly and Annual Rainfall Erosivity Index R (tf·m2/ha·hr)													
	Meh	Aba	Aza	Dey	Bah	Esf	Far	Ord	Kho	Tir	Mor	Sha	Total	
	(Oct)	(Nov)	(Dec)	(Jan)	(Feb)	(Mar)	(Apr)	(May)	(Jun)	(Jul)	(Aug)	(Sep)	(Ra)	
Vastegan	0.19	0.00	13.13	0.00	5.18	21.63	11.68	15.59	0.00	0.00	0.00	0.00	67.40	
Bazoft	0.58	44.57	51.44	16.86	5.08	10.59	8.39	2.49	0.00	0.00	0.01	0.05	140.06	
Sarbaz	0.00	0.00	32.23	0.00	1.71	34.34	4.87	5.25	0.00	0.00	0.00	0.00	78.40	
Tangsorkh	0.00	5.53	81.41	0.00	20.13	30.20	7.22	0.00	0.02	0.00	0.00	0.00	144.51	
Zeras	0.20	7.91	3.69	13.78	2.24	4.98	3.38	1.07	0.00	0.00	0.00	0.00	37.25	

Computation of Annual Crop Management Factors

Area/	Meh	Aba	Aza	Dey	Bah	Esf	Far	Ord	Kho	Tir	Mor	Sha	Total	Annual
Crops	(Oct)	(Nov)	(Dec)	(Jan)	(Feb)	(Mar)	(Apr)	(May)	(Jun)	(Jul)	(Aug)	(Sep)	(Ri*Ci)	(Ca)
Wheat														
Vastegan	0.11	0.00	2.63	0.00	1.04	4.33	2.34	3.12	0.00	0.00	0.00	0.00	13.56	0.20
Bazoft	0.35	17.83	10.29	3.37	1.02	2.12	1.68	0.50	0.00	0.00	0.01	0.03	37.18	0.27
Sarbaz	0.00	0.00	6.45	0.00	0.34	6.87	0.97	1.05	0.00	0.00	0.00	0.00	15.68	0.20
Tangsorkh	0.00	2.21	16.28	0.00	4.03	6.04	1.44	0.00	0.01	0.00	0.00	0.00	30.01	0.21
Zeras	0.12	3.16	0.74	2.76	0.45	1.00	0.68	0.21	0.00	0.00	0.00	0.00	9.11	0.24
Dry Type Alfalfa														
Vastegan	0.02	0.00	0.26	0.00	0.10	0.43	0.23	0.31	0.00	0.00	0.00	0.00	1.36	0.02
Bazoft	0.06	2.67	1.03	0.34	0.10	0.21	0.17	0.05	0.00	0.00	0.00	0.01	4.64	0.03
Sarbaz	0.00	0.00	0.64	0.00	0.03	0.69	0.10	0.11	0.00	0.00	0.00	0.00	1.57	0.02
Tangsorkh	0.00	0.33	1.63	0.00	0.40	0.60	0.14	0.00	0.00	0.00	0.00	0.00	3.11	0.02
Zeras	0.02	0.47	0.07	0.28	0.04	0.10	0.07	0.02	0.00	0.00	0.00	0.00	1.08	0.03

Table D-5-1-7 Land Cover and Crop Management Factor in Rangeland for Present, Protection and Seeding

Area	Present Vegetation and Land Cover							Present						after Protection						after Seeding						Ca=Cm*Rm/Ra		
Veg.	Present land cover (%)							Veg. Cover		Non. Veg			Bare	Veg. Cover		Non. Veg			Bare	Veg. Cover		Non. Veg			Bare			
Type	Tree	Bush/ Shrub	Forbs/ Grass/ Other	Rock	Stone	Litter	Bare Land	Pere-nnial	Sea-sonal	Rock	Stone	Litter	Soil	Pere-nnial	Sea-sonal	Rock	Stone	Litter	Soil	Pere-nnial	Sea-sonal	Rock	Stone	Litter	Soil	Present	after Protection	after Seeding
Vastegan																												
AL	0%	24%	16%	19%	9%	7%	25%	24%	16%	19%	9%	7%	25%	24%	31%	19%	9%	7%	10%	24%	48%	19%	9%	0%	0%	0.17	0.08	0.03
BA	0%	0%	52%	8%	6%	7%	27%	0%	52%	8%	6%	7%	27%	0%	67%	8%	6%	7%	12%	0%	86%	8%	6%	0%	0%	0.19	0.10	0.03
EL	0%	4%	37%	6%	28%	4%	21%	4%	37%	6%	28%	4%	21%	4%	52%	6%	28%	4%	6%	4%	82%	6%	28%	0%	0%	0.15	0.07	0.03
Ave.	0%	9%	35%	11%	14%	6%	24%	9%	35%	11%	14%	6%	24%	9%	51%	11%	14%	6%	9%	9%	66%	11%	14%	0%	0%	0.17	0.08	0.03
Chaman Goli-Bazoft																												
QC-1	5%	0%	47%	25%	5%	15%	3%	5%	47%	25%	5%	15%	3%	5%	62%	25%	5%	3%	0%	5%	55%	25%	5%	0%	0%	0.09	0.08	0.08
QC-2	2%	11%	24%	11%	5%	7%	40%	13%	24%	11%	5%	7%	40%	13%	39%	11%	5%	7%	25%	13%	71%	11%	5%	0%	0%	0.28	0.21	0.08
QB	4%	0%	31%	35%	8%	6%	16%	4%	31%	35%	8%	6%	16%	4%	46%	35%	8%	6%	1%	4%	53%	35%	8%	0%	0%	0.14	0.07	0.06
QP	4%	3%	51%	12%	4%	17%	9%	7%	51%	12%	4%	17%	9%	7%	66%	12%	4%	11%	0%	7%	77%	12%	4%	0%	0%	0.13	0.09	0.09
Forest	6%	0%	33%	10%	18%	11%	22%	6%	33%	10%	18%	11%	22%	6%	48%	10%	18%	11%	7%	6%	66%	10%	18%	0%	0%	0.18	0.11	0.08
Ave.	4%	3%	37%	19%	8%	11%	18%	7%	37%	19%	8%	11%	18%	7%	52%	19%	8%	11%	3%	7%	66%	19%	8%	0%	0%	0.17	0.09	0.08
Sarbaz																												
AA	0%	25%	20%	18%	12%	5%	20%	25%	20%	18%	12%	5%	20%	25%	35%	18%	12%	5%	5%	25%	45%	18%	12%	0%	0%	0.14	0.06	0.03
AG	0%	18%	21%	15%	9%	3%	34%	18%	21%	15%	9%	3%	34%	18%	36%	15%	9%	3%	19%	18%	58%	15%	9%	0%	0%	0.22	0.14	0.04
AH	0%	20%	31%	6%	13%	3%	27%	20%	31%	6%	13%	3%	27%	20%	46%	6%	13%	3%	12%	20%	61%	6%	13%	0%	0%	0.19	0.11	0.04
AL	0%	18%	26%	7%	8%	3%	38%	18%	26%	7%	8%	3%	38%	18%	41%	7%	8%	3%	23%	18%	67%	7%	8%	0%	0%	0.25	0.17	0.04
DA	0%	33%	14%	7%	15%	4%	27%	33%	14%	7%	15%	4%	27%	33%	29%	7%	15%	4%	12%	33%	45%	7%	15%	0%	0%	0.18	0.10	0.03
EG	0%	4%	50%	7%	11%	4%	24%	4%	50%	7%	11%	4%	24%	4%	65%	7%	11%	4%	9%	4%	78%	7%	11%	0%	0%	0.18	0.09	0.04
GL	0%	6%	50%	8%	18%	7%	11%	6%	50%	8%	18%	7%	11%	6%	65%	8%	18%	3%	0%	6%	68%	8%	18%	0%	0%	0.11	0.04	0.04
GE	0%	0%	61%	10%	8%	8%	13%	0%	61%	10%	8%	8%	13%	0%	76%	10%	8%	6%	0%	0%	82%	10%	8%	0%	0%	0.12	0.04	0.04
Ave.	0%	16%	34%	10%	12%	5%	24%	16%	34%	10%	12%	5%	24%	16%	48%	10%	12%	5%	9%	16%	62%	10%	12%	0%	0%	0.17	0.09	0.04
Tangsorkh																												
AB	0%	23%	21%	22%	19%	7%	8%	23%	21%	22%	19%	7%	8%	23%	36%	22%	19%	0%	0%	23%	36%	22%	19%	0%	0%	0.08	0.03	0.03
AG	0%	11%	18%	9%	12%	7%	43%	11%	18%	9%	12%	7%	43%	11%	33%	9%	12%	7%	28%	11%	58%	9%	12%	0%	0%	0.28	0.20	0.05
GB	0%	4%	17%	22%	14%	2%	41%	4%	17%	22%	14%	2%	41%	4%	32%	22%	14%	2%	26%	4%	60%	22%	14%	0%	0%	0.27	0.18	0.05
QG	6%	2%	57%	15%	6%	4%	10%	8%	57%	15%	6%	4%	10%	8%	71%	15%	6%	0%	0%	8%	71%	15%	6%	0%	0%	0.11	0.05	0.05
WL	0%	18%	37%	4%	20%	6%	15%	18%	37%	4%	20%	6%	15%	18%	52%	4%	20%	6%	0%	18%	58%	4%	20%	0%	0%	0.13	0.05	0.05
Ave.	1%	12%	30%	14%	14%	5%	23%	13%	30%	14%	14%	5%	23%	13%	46%	14%	14%	5%	8%	13%	59%	14%	14%	0%	0%	0.17	0.09	0.05
Zeras																												
AB	0%	26%	23%	0%	4%	14%	33%	26%	23%	0%	4%	14%	33%	26%	38%	0%	4%	14%	18%	26%	70%	0%	4%	0%	0%	0.23	0.16	0.06
AE	0%	18%	20%	0%	12%	13%	37%	18%	20%	0%	12%	13%	37%	18%	35%	0%	12%	13%	22%	18%	70%	0%	12%	0%	0%	0.26	0.18	0.06
AP	0%	17%	29%	8%	6%	11%	29%	17%	29%	8%	6%	11%	29%	17%	44%	8%	6%	11%	14%	17%	69%	8%	6%	0%	0%	0.21	0.13	0.06
SH	1%	0%	52%	0%	10%	8%	29%	1%	52%	0%	10%	8%	29%	1%	67%	0%	10%	8%	14%	1%	89%	0%	10%	0%	0%	0.22	0.15	0.07
EA	1%	0%	46%	0%	6%	7%	40%	1%	46%	0%	6%	7%	40%	1%	61%	0%	6%	7%	25%	1%	93%	0%	6%	0%	0%	0.28	0.21	0.08
QE	1%	0%	38%	0%	13%	9%	39%	1%	38%	0%	13%	9%	39%	1%	53%	0%	13%	9%	24%	1%	86%	0%	13%	0%	0%	0.27	0.20	0.07
QC	4%	0%	22%	4%	5%	6%	59%	4%	22%	4%	5%	6%	59%	4%	37%	4%	5%	6%	44%	4%	87%	4%	5%	0%	0%	0.38	0.30	0.07
QH	6%	0%	27%	2%	3%	32%	30%	6%	27%	2%	3%	32%	30%	6%	42%	2%	3%	32%	15%	6%	89%	2%	3%	0%	0%	0.24	0.16	0.07
QB	5%	0%	32%	0%	5%	7%	51%	5%	32%	0%	5%	7%	51%	5%	47%	0%	5%	7%	36%	5%	90%	0%	5%	0%	0%	0.34	0.26	0.07
Ave.	2%	7%	32%	2%	7%	12%	39%	9%	32%	2%	7%	12%	39%	9%	46%	2%	7%	12%	24%	9%	82%	2%	7%	0%	0%	0.28	0.20	0.07

Vegetation Condition	Meh (Oct)	Aba (Nov)	Aza (Dec)	Dey (Jan)	Bah (Feb)	Esf (Mar)	Far (Apr)	Ord (May)	Kho (Jun)	Tir (Jul)	Mor (Aug)	Sha (Sep)
Perennial vegetation	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Seasonal vegetation												
Other than Zeras	0.5	0.2	0.1	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.5	0.5
Zeras	0.5	0.2	0.1	0.05	0.02	0.02	0.02	0.02	0.02	0.5	0.5	0.5
Rock	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Stone	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Litter	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Bare soil	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6

(Note)
1) Land cover refers to Table G-1 to G-5, Annex G.
2) Land cover of WL in Tangsorkh is the average of survey sites No. 4,5,6,10,11,12.
3) Perennial vegetation Cover: Tree, Bush, and Shrub.
4) Seasonal vegetation cover: Forbs, Grass, and Others.
5) Non-vegetation cover: Rock, Stone, and Litter.
6) Seasonal vegetation cover increases by 15% of rangeland area in bare land by protection.
7) All bare land is covered by seasonal vegetation by seeding.
8) Seasonal crop management factors (Ci) are assumed as in left hand Table.

Table D-5-1-8 Existing Waterway Condition in the Farmland Area

Area	Farmland		Waterway Density and Condition							
			Farmland Slope							Total
			- 5%	5% - 13%	13% - 20%	20% - 30%	30% - 40%	40% - 50%	50% -	
K4-1-9 Vastegan	IFL	Area (ha)	3,450	11						3,461
		Waterway Length (Km)	121	0						121
		Waterway Density (m/ha)	35	0						34.9
	DFL	Area (ha)		63						63
		Waterway Length (Km)		1.60						1.60
		Waterway Density (m/ha)		25.4						25.4
	Orchard	Area (ha)	5		41					46
		Waterway Length (Km)	0		0					0
		Waterway Density (m/ha)	0		0					0
	Total	Area (ha)	3,455	74	41	0	0	0	0	3,570
		Waterway Length (Km)	120.75	1.6	0	0	0	0	0	122.35
		Waterway Density (m/ha)	34.9	21.6	0.0					34.3
		Waterway condition	No serious waterway erosion except in upper marl formation basin.							
K5-19a Chaman Goli-Bazoft	IFL	Area (ha)		182	280	69	62			593
		Waterway Length (Km)		7.9	13.7	4.45	1.2			27.25
		Waterway Density (m/ha)		43.4	48.9	64.5	19.4			46.0
	DFL	Area (ha)		277	163	79	5			524
		Waterway Length (Km)		9.2	10.4	6.8	0.4			26.8
		Waterway Density (m/ha)		33.2	63.8	86.1	80.0			51.1
	FDF	Area (ha)		73	306	186	59			624
		Waterway Length (Km)		1.5	12.7	13.5	4.5			32.2
		Waterway Density (m/ha)		20.5	41.5	72.6	76.3			51.6
	Orchard	Area (ha)				23				23
		Waterway Length (Km)				0.8				0.8
		Waterway Density (m/ha)				34.8				34.8
	Total	Area (ha)	0	532	749	357	126	0	0	1,764
		Waterway Length (Km)	0	19	37	26	6	0	0	87.05
		Waterway Density (m/ha)		35.0	49.1	71.6	48.4			49.3
		Waterway condition	Some waterways of the left bank area of main river and nearby Ghale Tabarak village are serious.							
K7-0-19-1 Sarbaz	DFL	Area (ha)	26	20	122	40				208
		Waterway Length (Km)	0.5	2	3.7	2.5				8.7
		Waterway Density (m/ha)	19.2	100.0	30.3	62.5				41.8
	Orchard	Area (ha)	373	678	990					2,041
		Waterway Length (Km)	8.8	18	55.5					82.3
		Waterway Density (m/ha)	23.6	26.5	56.1					40.3
	Total	Area (ha)	399	698	1,112	40	0	0	0	2,249
		Waterway Length (Km)	9	20	59	3	0	0	0	91
		Waterway Density (m/ha)	23.3	28.7	53.2	62.5				40.5
		Waterway condition	Most waterways are steady except some active gullies are serious in and neaby rangeland.							
K7-48 Tang Sorkh	IFL	Area (ha)		145	81	24				250
		Waterway Length (Km)		4.2	3.8	1.6				9.6
		Waterway Density (m/ha)		29.0	46.9	66.7				38.4
	DFL	Area (ha)		80	84	44				208
		Waterway Length (Km)		4.3	8.4	3				15.7
		Waterway Density (m/ha)		53.8	100.0	68.2				75.5
	Orchard	Area (ha)			266					266
		Waterway Length (Km)			12.5					12.5
		Waterway Density (m/ha)			47.0					47.0
	Total	Area (ha)	0	225	431	68	0	0	0	724
		Waterway Length (Km)	0	9	25	5	0	0	0	37.8
		Waterway Density (m/ha)		37.8	57.3	67.6				52.2
		Waterway condition	Waterways in dry farmland are suffered from erosion due to marl weathered soil.							
K8-28 Zeras	DFL	Area (ha)		123	170	464	789	471	124	2,017
		Waterway Length (Km)		2.80	7.85	18.55	38.60	6.60	6.20	80.60
		Waterway Density (m/ha)		22.8	46.2	40.0	48.9	14.0	50.0	40.0
	Total	Area (ha)	0	123	170	464	789	471	124	2,141
		Waterway Length (Km)	0.00	2.80	7.85	18.55	38.60	6.60	6.20	80.60
		Waterway Density (m/ha)		22.8	46.2	40.0	48.9	14.0	50	37.6
		Waterway condition	Most waterways are serious on side slope erosion. (Rock and stone deposited on channel bed.)							
Grand Total	Area (ha)		3,854	1,652	2,503	929	915	471	124	10,448
	Waterway Length (Km)		130	52	129	51	45	7	6	418.80
	Waterway Density (m/ha)		33.7	31.2	51.4	55.1	48.9	14.0	50.0	40.1

(Note)

1) Excluding large channels or tributaries having a large catchment area from upstream.
2) Waterway length is measured on 1:10,000 map.
3) Average density of waterway is weighted by area.
4) IFL: Irrigated Farmland, DFL: Dry Farmland, FD: Forest with dry farming