JAPAN INTERNATIONAL COOPERATION AGENCY
MINISTRY OF JIHAD-E-AGRICULTURE
THE ISLAMIC REPUBLIC OF IRAN

THE STUDY
ON
GHARASU RIVER BASIN AGRICULTURAL INFRASTRUCTURE DEVELOPMENT PROJECT KERMANSHAH PROVINCE IN THE ISLAMIC REPUBLIC OF IRAN

FINAL REPORT

ANNEX

FEBRUARY 2004

PACIFIC CONSULTANTS INTERNATIONAL

Exchange Rate (October 2003)		
US$ 1.00	=	Rial 8,216
Rial 1.00	=	US$ 0.000122
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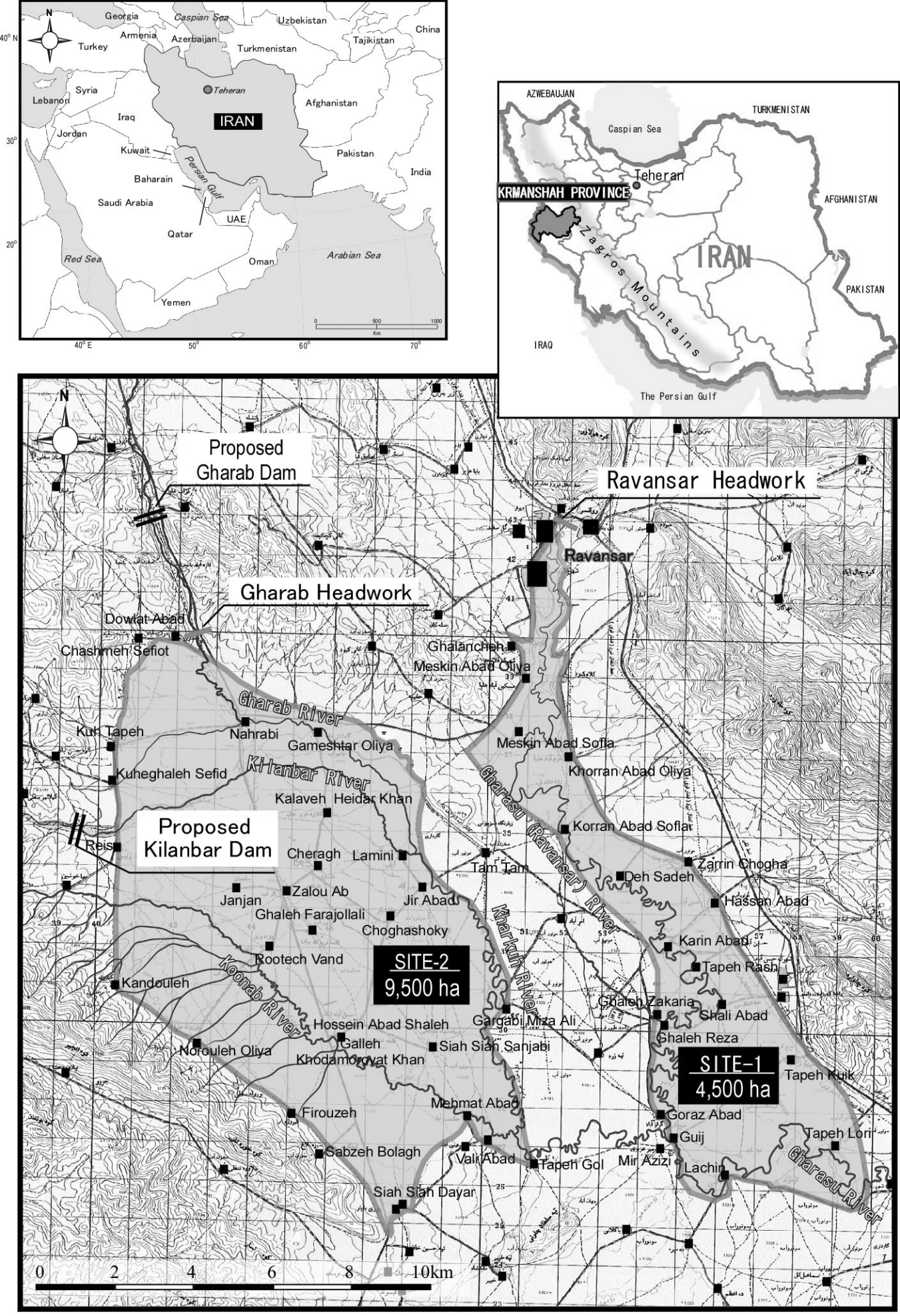

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Abbreviations and Local Terms

ASC	Agricultural Service Company
BOD	Board of director
CBI	Central Bank of Iran
CD	Compact disk
CEC	Cation Exchange Capacity
CORC	Central Organization for Rural Cooperative of Iran
DEM	Digital Elevation Model
DG	Director General
DVD	digital video disk
E.C	Electrical Conductivity
EIA	Environmental Impact Assessment
EMMS	Environmental Monitoring and Management System
ESC	Extension Service Center
ESP	Exchangeable Sodium Percentage
ETo	Potential evapo-transpiration
FAO	Food and Agriculture Organization of United Nations
FC	Field Capacity
FY	Fiscal Year
FYDP	Five-Year Development Plan
GDP	Gross Domestic Products
GII	Gross Income Index
GIS	Geographic Information System
GOI	Government of the Islamic Republic of Iran
GOJ	Government of Japan
HH	Household
HP	Horse power
H-Q	(water) height-(discharge) quantity
IBRD	International Bank for Reconstruction and Development
ICA	International Agricultural Cooperative Alliance
IEE	Initial Environmental Examination
IFY	Iranian fiscal year
IRIMO	Islamic Republic of Iran Meteorological Organization
Jaf	One of the major Kurdish groups in Kermanshah Province
JCOO	Javanrud cooperative organization office
JICA	Japan International Cooperation Agency
KARC	Agricultural and Natural Resource Research Center in the Kermanshah
KCO	Kermanshah Cooperative Organization
KEO	Kermanshah Water Resources Organization
KJAO	Kermanshah Jihad and Agriculture Organization
KWA	Kermanshah Water Affairs
M&E	Monitoring & Evaluation
MCM	Million Cubic Meter
Mir-Ab	Water Distribution Controller
MOC	Ministry of Cooperatives
MOE	Ministry of Energy
MOH	Ministry of Health
MOJA	Ministry of Jihad and Agriculture

MPO	Management Planning Organization
NGO	Non-government organization
NRD	Natural Resources Department
O&M	Operation and Maintenance
PCM	Project Cycle Management
PRA	Participatory Rural Appraisal
RASC	Ravansar Agriculture Service Center
RCO	Rural Cooperative Organization
RDC	Rural Development Cooperative (under the Ministry of Cooperative)
Rls.	Iranian Rials
RPC	Rural Production Cooperative
RRA	Rapid Rural Appraisal
RSADB	Ravansar–Sanjabi Agricultural Development Board
RWA	Regional Water Authorities
RWAO	Ravansar Water Affair Office
S/W	Scope of Works
Sanjabi	Name of plain & Kurdish tribe
SAR	Sodium Adsorption Ratio
SAR	Sodium Adsorption Ratio
TDS	Total Dissolved Solids
U.S.A	United States of America
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
Valad Beigi	Name of Kurdish tribe
VCD	Video cassette disk
WA	Water affairs
WAD	Water Affairs Department
WMD	Watershed Management Department
WMFRO	Watershed Management, Forest and Range Organization
WRWUSC	Western region water utilization & service company
WUA	Water Users Association
WUC	Water Users Cooperative (registered cooperative for water management)

Political Division

Ostan	Province
Shafrestan	District
Shahr	City
Surani	Southern Kurds
Bakhsh	Sub-District
Dehestan	Village
Deh	Settlement

Measurement Units

B/C	Benefit Cost Ratio
cm	centimeter
cm2	square centimeter
cms	cubic meter per second
dS/m	deci Siemens per meter= mS/cm = 1000micro S/cm
EL	elevation
E t	Evapotranspiration
FWL	Full Water Level
g	gram
ha	hectare
HP	Horse Power
hr	Hour
HWL	High Water Level
IRR	Internal Rate of Return
kg	kilogram
km	kilometer
km2	square kilometer
lit	liter
lit/sec	liters per second
LWL	Low Water Level
m	meter
m.s.l	Mean Sea Level
m/sec	meter per second
m2	square meter
m3	cubic meter
m3/sec	cubic meter per second
MCM	million cubic meter
mg/lit.	milligrams per liter
min.	Minute
mm	millimeter
No.	Number
Nos.	Numbers
O&M	Operation and Maintenance
ppm	parts per million
sec.	Second
t, ton	metric ton

Annex 1	**Socio-Economic Background**

ANNEX 1

SOCIO-ECONOMIC BACKGROUND

A1.1 Brief Description of Socioeconomic Conditions of Iran

A1.1.1 Social Conditions

(1) General

The Annex report is presented as a supplemental report of the Main Report to provide additional or more detailed information on some of the sections of the Main Report.

(2) Main Social Indicators of Iran

Since the Revolution in 1979, the government of Iran has been placing a strong and special emphasis on the human development, social protection and social justice. As a result of the major investments in the social sector over the last 2 decades, Iran had experienced remarkable achievement, particularly in education and health. Some of the major indicators are mentioned in the table shown below:

Main Social Indicators of Iran

	Iran	
	1990	1997
Population growth rate (%)	2.2	1.4
Illiterate Rate	36	27
Female Illiteracy (% of age 15-24)	18	10
Gross Primary School Enroll. (%)	112	98.4
Male	118	102
Female	106	95
Gross Secondary School Enroll. (%)	55	77
Male	64	81
Female	46	73
Life expectancy	61.1*[1]	69.5
Infant Mortality (per 1,000)	47	26
Access to safe water (%)	50	95

Source: World Bank: Interim Assistance Strategy (2001)

*[1] estimated in 1988 (Source: Human Development Report of the Islamic Republic of Iran, 1999)

Notwithstanding these achievements, Iran still faces three major challenges: (i) it still has a significant prevalence of poverty; (ii) it has dealt with poverty more through handouts and charitable transfers than through employment and empowerment; and (iii) while these explicit subsidies and transfers have the merit of reaching the poor, Iran also maintains, often in the name of the poor, an expensive and excessively large implicit subsidy system that is untargeted and distortionary.

(3) Education

The current education system comprises five years of primary education starting at about age six, followed by a three-years of 'guidance' education (equivalent to lower secondary), four years of secondary (or higher secondary) education and two to six years of higher education. At the secondary level, students are given choices between academic and technical / vocational education. The education reform in 1992 reduced the duration of secondary education to three years and introduced a pre-university years: replaced the vocational and training college programs with a five year technician training program. Over the past two decades, The Ministry of Education has very successfully expanded access to primary education. Gross enrollment ratios are now nearly 100%.

One serious educational problem before the revolution was the "brain drain". There had been the general perception among the upper and middle classes that foreign education is superior and the large numbers of Iranians opted for studying abroad. Under both the monarchy and the Republic, those thousands of graduated Iranians did not return but remained abroad. Since the Revolution, the government has tried to discourage Iranians from going abroad to study, although it has not prevented the practice.

(4) Women

Perceptions and legal restriction of women's role in Iranian society have revolved over a long time. In the traditional view, it was ideal for women to be confined to the home, where they performed the various domestic tasks associated with managing a household and rearing children. Men worked in the public sphere, that is, in the fields, factories, bazaars, and offices. Women generally practiced use of the chador (or veil) when in public or when males not related to them were in the house.

Being influenced by the western sense of modernization, the Pahlavi government encouraged women to get as much education as possible and to participate in the labor force at all levels. In 1936, Reza Shah banned the chador (or veil), which came to be perceived among the minority of elite and secular middle-class women as a symbol of oppression. Following the Revolution, the general social conditions have caused positive changes in women's social activities. The government stresses on the importance of the participation of women in social and political events.

(5) Poverty Reduction

A poverty study undertaken by the Government established a strong linkage between poverty and unemployment: 37% of poor households have no one working in the household, and 45% of them have just one working person.

Iran also maintains extensive implicit subsidies, including energy subsidies, exchange rate subsidies, and credit subsidies, that are excessively large (the energy subsidy alone is estimated at more than 12% of GDP), but are untargeted and ineffective. While the maintenance of these subsidies is often justified in the name of the needy, they do not proportionately benefit the poor. In fact a large part of the subsidy system, including those directed to basic needs such as bread and medicine, are highly untargeted vis-à-vis the poor.

A1.1.2 Economic Conditions

(1) National Development Plan

The Third FYDP aims at a growth rate of 6% per annum during the Plan period. To achieve its objectives of raising economic growth potential, increasing the living standards of the population, and reducing unemployment, the Plan envisages a wide range of structural reforms aiming at a balanced and gradual transition to a market economy. While greater private investment is expected to provide the basis for more rapid growth, the Plan gives special emphasis to agricultural and rural development, and housing as the key sectors underpinning the growth with distribution objectives. These sectors not only have the potential for growth but also promote job creation and poverty alleviation due to their higher labor-intensity, especially the unskilled and poor workers.

The major outlines of agricultural development policy are as follows:

1) To focus on suitable agricultural products to support the economy not based on oil, such as oil seeds

2) To achieve proper agricultural conditions to increase national investment and investing it in other areas
3) To complete unfinished projects and implementing regional projects in small scales
4) Programming of regional development projects in regard to needs, existing resource and potentials of the area.
5) Adjustment of government and the related organizations
6) Increase the exploitation of natural resources for agriculture development
7) Improve the conditions of agro-industries
8) To build or complete the production line of agricultural products and industries
9) To direct plans of other sectors related to water, energy, transportation, banks in order to support agricultural sector
10) To provide facilities for agricultural development plans, natural resources and directing government credits and banks to invest in this sector and developing shareholding system.

(2) Economic Structural Reform

Iran's economic reform strategy is based on a gradualist approach given the complexity of the reform process and the need to avoid undue social disruption. The magnitude and inter-locking nature of the various distortions require a careful sequencing of the reform measures. Nevertheless, the Government is committed to the full reform agenda of the Third FYDP and has already made good progress as indicated below:

Significant progress has been realized over the first year of the Third FYDP in several economic reform areas; i) foreign exchange (import exchange rate at Rls 1,750/$ unified with the current open market rate of about Rls 7950/$ at the beginning of the financial year 2002/03 in March 2002, ii) remove all non-tariff barriers (NTBs) and replace them with tariffs and reduce the tariff bands over the period of the Third FYDP for WTO agreement, iii) domestic energy price adjustment to meet the border price, iv) a new privatization agency has been set up in the Ministry of Finance to privatization of public enterprises to privates, v) following up on their commitment to strengthen banking supervision and reform prudential regulations, vi) Encouraging foreign direct investment in both the oil and non-oil sectors

(3) Gross Domestic Production (GDP)

According to the Central Bank of Iran, GDP (current prices) was estimated at Rls. 663,391 billion in 2001/02. This figure shows GDP growth rate of 16.8% compared with GDP in 2000/01. The highest GDP per capita in Iran was US$ 3,676 in 1983. IMF estimated the GDP (current prices) per capita in 2001 as US$ 1,753.

(4) Inflation

The inflation rate was higher than 20% until 1996. However, after 2000, it lowered down up to average of less than 15%.

Trend of Annual Inflation Rates (%)

	1998/99	1999/00	2000/01	2001/02
Consumer price	18.1	20.1	12.6	11.4
Whole sale price	16.7	24.2	14.7	5.1
Producer price	18.7	22.9	16.3	10.9

Source : "Economic Trends No.29 Second Quarter 1381", Central Bank of Iran

(5) Export of Agricultural Products

Among the exported agricultural products, pistachio, raisin and caviar are the major products. In recent years, the export of sheep leather has increased due to the improvement of the quality by the investment of the facilities. The destination countries of the major products are

pistachio to Germany, raisin to Pakistan, tomato puree to Russia and sheep hide to Italy.

The actual amount of the agricultural products in 1999 and 2000 are shown in the following table.

Agricultural Products in Non-petroleum Export (Amount is US$ million)

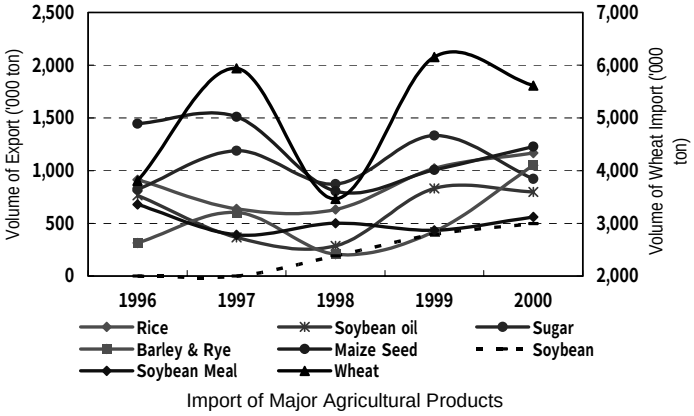
Products	1999		2000	
	Amount	Ratio	Amount	Ratio
Pistachio nut（Fresh/dried）	315.1	9.37	318.6	8.47
Raisin	53.9	1.6	55	1.46
Tomato Puree	37.1	1.1	40.8	1.08
Sheep Leather	5.3	0.16	40.2	1.07
Caviar	26.1	0.78	38.5	1.02
Sheep Hide	46.1	1.37	31.2	0.83
Others	2,871.4	85.62	3,238.5	86.07
Total	3362	100.00	3,762,8	100.00

Source: “Iran Trade Statistics 1999 and 2000”, Iran Customs Administration, compiled by JETRO Tehran

2) Import of Agricultural Products

The agricultural products account for approx. 10% of the total amount of import. Among these products, the amount of wheat imported was about 5 to 6 million tons and rice imported was 1 million tons, annually. The major countries of origin of agricultural products are wheat from Canada, rice from Thailand, soybean oil from Brazil and maize from Canada.

The share of import amount of wheat accounted for 6.3% in 1999 and 5.2% in 2000 of the total amount of the Iranian import value.

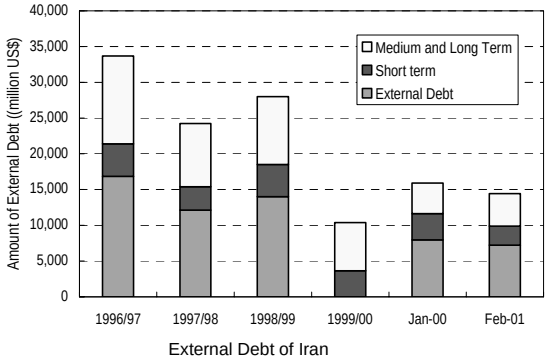


Import of Major Agricultural Products

Source: “Iran Trade Statistics 1999 and 2000”, Iran Customs Administration, compiled by JETRO Tehran

3) Trends of Iranian External Debt

As a result of the monetary policies boosted for the repayment of medium and long-term debt, the external debt of Iran in 2000 was decreased to half of the amount of 1996.



External Debt of Iran

Source: “Economic Trends No. 29 Second Quarter 1381”, Central Bank of Ira

A1.2 Brief Description of Socioeconomic Conditions of Kermanshah Province

A1.2.1 General

(1) General

Kermanshah Province covers an area of 24,434 km^2 is located in the Zagros Mountains in the west of Iran between longitude 34^o 20'N and 35^o 30'N and longitude 34^o-20'E and 35^o 30'E. It is bounded with Iraqi country border at its west end, Kordestan Province at the north, Hamedan Province at the east and both of Lorestan Provinceand Ilam Province at the south respectively. The Province is a mountainous region and is located between the Plateau of Iran and the Mesopotamian Plain. In the extended parts of the mountains, there are some alluvial plains. The Province enjoys a moderate mountainous climate with various rate of annual precipitation (average 500 mm) based on the altitude. Kermanshah Province is the main route from Tehran to Baghdad, and every year the Shiites Muslims go on a pilgrimage to Iraq via Kermanshah. Kermanshah City is one of the largest city along the Iraq border, and the route is used for international trade with Iraq.

Kermanshah Jihad-e-Agricultural Organization (KJAO) is directed by the Ministry of Jihad-e-Agriculture and headed by the Director General.

(2) Historical Background

Migrant of the Province started 3 to 4 BC, since then many dynasties governed the area such as Sassanide (226-651), Arabs, Kurds (Hasnooyeh), Mongolian (1220-1256), Qajar (1779-1925) and Allies. During the Iran-Iraq War, the Province was highly damaged because of its geographical location nearer to Baghdad. Thereafter, the reconstruction of the infrastructures of the Province, especially Kermanshah City was the major activities of the Province.

(3) Administration and Institutions of Provincial Government

The Kermanshah Province is composed of 11 districts (*Shahrestan*), 20 cities and 83 villages (*Dehestan*). Each district is divided into 1 to 4 sub-districts (*Bakhsh*). The total area of Kermanshah Province is 24,636 km^2 and the population in 1999 was estimated to be 1.7 million persons (Statistical Book of Kermanshah Province 2000). Among 11 Districts, the Study Area lies in 2 Districts: Kermanshah and Javanrood.

Number of Cities, Sub-Districts and Villages in Kermanshah Province

Districts *(Shahrestan)*	Administration			Population		
	No. of Cities	No of Sub-districts (Bakhshes)	No. of Dehestan	Total	Urban	Rural
Total of Province	20	25	83	1,778,596	62 %	38 %
Eslamabad-e-Gharb	2	4	12	215,392	42 %	57 %
Paveh	4	3	7	61,918	41 %	59 %
Javanrud	3	3	10	109,518	49 %	51 %
Sar-e-Pol-e-Zahab	1	1	7	81,624	8 %	92 %
Sonqor	1	1	8	112,014	36 %	64 %
Sahneh	1	2	7	82,043	38 %	62 %
Qasr-e-Shirin	2	2	4	20,006	31 %	64 %
Kermanshah	2	4	13	843,125	82 %	18 %
Kangavar	1	1	5	89,181	56 %	43 %
Gilan-e-Gharb	1	2	6	67,756	25 %	72 %
Harsin	2	2	4	96,019	57 %	43 %

Source: Iran Statistics Yearbook 1379, Iran Statistical Center (2001)
Statistical Book of Kermanshah Province (SBKP-2000), Management and Planning Organization (2000)

Iranian government system has centralized structure. Governor of the Province is appointed by the Minister of Home Affairs, and each ministry has the organization to the province. The provincial governor's office coordinates the individual organization for the provincial administration. The provincial development plan is formulated based on the central government guidelines set by ministries, and compiled by the governor's office and Management and Planning Organization in each province under the Presidential Office. Then the provincial development budget also come down to the provincial organization of each ministry including governor's office.

A1.2.2 Social Conditions

(1) Population

Total population of Kermanshah Province is 1,778,596 (SBKP-2000). Almost one half of these people are living in Kermanshah District where the capital of the Province is located. At the provincial level, the proportion of urban population is much higher than that of rural. At district level, however, the proportion of rural population exceeds that of urban population, apart from Kermanshah District. It is reported that the distribution of population in rural area has been decreasing due to the continuous out-migration of rural people to urban areas.

(2) Education and Literacy Rate

In comparison with Tehran, the literacy rate of Kermanshah Province is lower for both in male and female population. The table below describes the illiterate situation of Kermanshah Province by region and sex between 1966 and 1996.

Literacy Rate of Population in Kermanshah
Aged Six and Over (by Sex)

Total		1966	1976	1986	1996
Total	Total	25.1%	42.3%	55.9%	76.6%
	Male	34.7%	53.9%	67.7%	82.6%
	Female	14.2%	29.7%	42.8%	70.1%
Urban	Total	46.5%	59.8%	65.2%	81.6%
	Male	56.9%	68.6%	74.7%	86.3%
	Female	34.5%	49.9%	54.9%	76.7%
Rural	Total	12.5%	28.4%	43.6%	68.8%
	Male	21.4%	41.8%	58.8%	77.1%
	Female	2.5%	14.3%	27.3%	59.8%

Statistical Book of Kermanshah Province, Management and Planning Organization (2000)

As shown in the table, there are several gaps between urban and rural or between male and female. Among all, the lowest literacy rate was observed in the category of rural women, 40 % of which still remain illiterate. In rural areas, where means of transportation are restricted, parents are reluctant to let their daughters go to schools located kilometers away from their homes or villages. With increasing number of primary schools in rural areas, the situation has been improved in recent years; the literacy rate of rural women has been accelerated faster than any other groups over the last 30 years. The 'Literacy Movement', initiated by the Ministry of Education to provide literacy programs with uneducated adults was another factor contributed to increase in the literacy rare of women. The average number of students and school by region are shown below.

Average Number of Students and School by Region

	No. of Student		No. of School		Average no. of students	
	Urban	Rural	Urban	Rural	Urban	Rural
Primary school	145,586	93,866	519	2,113	281	44
Guidance school	111,900	36,098	336	381	333	95
Secondary school	124,741	10,251	313	69	399	149

Source: General Department of Education, Kermanshah Province, Statistical Book of Kermanshah Province, Management and Planning Organization (2000)

(3) Tribes and Nomads

Kermanshah is an area of several tribes which are best defined politically rather than by ethnic or geographical criteria. According to the nomadic study conducted by Dr. S. H. Haidari[1] of the Razy University, among 14 tribes existing in Kermanshah, most tribes are settled and only a few of them are continuing migration today as shown in the table below.

Population of Nomads and Semi-nomads in Kermanshah

Name of tribe	Population	No. of Family	Nomads	Semi-migration
Banzarde	1,260	171		x
Jomhur	621	90	x	
Zuleh	2,156	308	x	
Qalkhani	11,606	1,621		x
Kalhor	11,975	1,638	x	
Guran	3,289	451		x

Decline in the number of migrating tribes in Kermanshah can be partly explained by the changing government policies over the last 30 years or so. At the beginning of the Revolution, the government encouraged the continuation of migration, emphasizing on the importance of the traditional economy of nomads in producing wool, meat and dairy products. In spite of the danger of Iran-Iraq war in nomadic areas, the government support and the attraction of livestock market allowed them to continue migration during this period. From the end of 1980s, however, the issue of migrating tribe had become controversial again. On the contrary to encouraging migration, there was another view that migrating tribes should be settled permanently since the nomadic way of life causes more damage to rangelands and environment. The surplus population of nomads and their hasty and unplanned migration to cities has created difficulties for the Iranian Government. By early 1990s, the main policy of the high Council of Nomads was to settle the nomads in development centers within the next 20 years. Based on this policy, the government provided infrastructure and services such as roads, schools, clinics and public baths to those nomads who wish to settle. In addition, the government diversified nomad's economic activities through introducing intensified agriculture and animal husbandry.

A1.2.3 Land Reform

The first land reform took place in Iran in 1963 at the time of so-called 'White Revolution'. This reform, however, did not penetrated thoroughly. As the lands of landlords were divided among the peasants who used to work in their lands. The small and landless farmers who did not work for the landlords were excluded from the reform. On the same year, the Shah regime introduced agricultural cooperatives in rural areas all over Iran. The intention of the government was to increase the productivity and yield of land by introducing modern agricultural machineries. Under the cooperative, farmer's land taken from landlords were taken by the Government and in exchange for the stocks. The dividend of the stock were paid once a year. As a result, the profit of the cooperative increased dramatically during these years with increased both productivities and yields of agricultural products. However, increasing discontents of the farmers were evident as their income always remained low regardless of the cooperative's profit. Under this situation, the rural farmers were literally agricultural labor of

[1] "Development and Technical Change among the Kalhor Nomads after the Islamic Revolution of Iran" (PhD thesis for the Graduate Centre in the Social Science in University of Sussex)

the state-own cooperatives.

It was only after the second land reform in 1979, that the landless and small farmers obtained some land. The agricultural cooperatives were abolished and after twenty years of Revolution, the new problem arising is that the now the land provided by the reform is further divided into small pieces by the children of the first generation.

A1.2.4 Economic Conditions

(1) General

Kermanshah Province is geographically important province for the foreign trade especial to the Iraq. Also the province is one of the most affected provinces during the Iran–Iraq war. After the war, the reconstruction of the infrastructure in the province was developed such as airport, Eslam-Abad-e-Gharb economic special zone, and national highway. And there are more than 20 export-oriented industrial factories with ISO certificate.

(2) Regional Economy

The economic active population in the province is estimated 557 thousand in 2000, to attaining the 10.5% unemployment rate in 2004 more than 142 thousand jobs shall be created. Sectorial shares of the employment in 1997 were at 26%, 22% and 49% for primary, secondary and tertiary sector, respectively.

Value added value of the industrial sector was counted at Rls.405,696 million in 1999, of which of whole country at 7.1 %). Work productivity of the sector showed 45,666 thousand per worker, which is only 69.8% of national average. There is an oil refinery plant with daily capacity 30 thousand barrel in Kermanshah. Value of mining was Rls.9,370 million in 1999 which is 0.28% of total nation.

(3) Provincial Financial Arrangement in Third FYDP

According to the Provincial the third FYDP、Financial arrangement plan within the plan period is shown as follows:

Items (unit: million Rls.)	2000/01	2001/02	2002/03	2003/04	2004/05	Total
Development Credit	171,719	349,267	408,324	514,237	625,565	2,069,112
Provincial income	13,600	178,247	213,767	255,834	308,755	1,092,003
National income	35,719	171,020	194,557	258,403	317,410	977,109
Internal resource of government co.	7,712	15,087	16,100	17,700	21,000	77,599
Water sewage Co.	3,830	9,351	9,500	9,700	10,000	42,381
Industrial Zone Co.	3,882	5,736	6,600	8,000	11,000	35,248
Investment of private sector	272,944	185,108	263,534	288,174	301,897	1,311,657
Municipalities	1,701	13,427	17,455	23,241	30,985	86,809
Total	454,076	562,889	705,473	843,352	979,447	3,545,177

A1.2.5 Provincial Development Plan

The major indicators shown in the Third FYDP are as follows:

Development Program for Agriculture and Natural Resources

	Items	Unit ha	Base year 1999	Year 2004	Growth Rate(%)
1	Program for Development of Soil and Water Reservoir				
1-1	Development modern irrigation system	ha	7,254	20,112	22.6
1-2	Study of soil & water plans	ha		47,588	98.1
2	Forest and Pasture				
2-1	Forest Biological operation	ha	20,976	41,064	14.4
2-2	Restore of forests	ha	1,501	16,814	62.1
3	Watershed management				
3-1	Watershed and flood control	ha		91,895	165.0
4	Agronomy				
4-1	Pest and disease control	ha	-	505,250	37.8
4-2	Mechanization	ha	250,000	600,000	19.1
4-3	Agricultural production	1,000ton	1,368.3	3,827.7	22.8
4-4-1	Wheat production (irrigated)	1,000ton	177.1	261	8.1
4-4-2	Wheat production (rain-fed)	1,000ton	102.2	165	10.0
5	Horticulture				
6	Animal Husbandry & Poultry				
6-1	Improvement of animal husbandry	1,000	30	60	14.9
6-2	Husbandry services	1,000	-	24,548	66.6
6-3	Husbandry production	1,000	164.2	233.9	7.3
6-3-1	Fish & shrimp production	1,000	0.31	4.43	70
6-3-2	Meat production	1,000	24.8	25.8	0.8
7	Fishery				
7-1	Develop. of infrastructure and breeding sites for fish and	ha	80	5,654	134
7-2	Shrimp and fish breeding	ton	310	4,433	70
8	Training and extension				
8-1	Extension	case	380	961	45.1
8-2	Case study for of methods	case	1,060	4,550	33.8
9	Development of Veterinary				
9-1	Control of animal contagious disease	1,000	28,200	40,171	7.3
9-2	Construction laboratory and clinics for pests control	m2	100	400	31.9

Source; Management and Planning Organization of Kermanshah Province, 2001

The contents of the Provincial agricultural development plan are briefly mentioned below.

(1) To have the most rational use of existing resources such as surface & underground water, land and forest by preservation of sustainable agriculture.
(2) To achieve the best ways of exploitation and productivity of resources
(3) Cropping pattern should be selected based on the seasonality (cf. dry period from the month of Ordibehesht to Aban (21 April to 21 Nov.)), in order to have the most rational and economical production.
(4) During the rainy period from the month of Aban to Ridibesht (23 Oct to 21 May) the maximum output should be made from the basin (i.e. watershed, farm construction and use of surface and underground water).
(5) Suitable arrangement of livestock in the region in view of range decline and necessity of balancing livestock and ranges through raising heavy livestock such as thoroughbred cows as an approach to create employment and income in the region along with required agro-processing industries.
(6) Considering wide surface and underground water resources and availability of springs (sarabs), wheat could be proposed in order to use these resources for raising aquatics.
(7) In view of natural potentials of the region, the study on turkey, duck and goose

raising, their suitable breeds, management of poultry production along with slaughter houses and markets especially for exportation to abroad should be conducted.

(8) The constraints and potentials of dry lands should be studied.

(9) Propositions about conservation and increase of soil organic matters are necessary.

(10) Problems of management of resources use (exploitation) should be studied and ideal methods and rational people participation should be proposed.

(11) Producers training management should be evaluated, especially about rural community and women.

(12) Suitable propositions are required concerning creation productive employment opportunities, especially for rural women.

(13) Concerning the needs of paper industry of Kermanshah Province the potentials of Spruce Pite trees (Abies) plantation development should be studied.

(14) In view of huge amount of straw and residue from wheat, barley, corn and pulses, the studies of crops residue from all aspects, conservation of soil organic matters, wind & water erosion and humidity conservation and livestock food in proper package and its income and employment opportunities required.

The Provincial Water Resources Development Plan in the third FYDP is mentioned below.

Program of the 3rd Five Year Development Plan, Water Resources

	Items	Unit	Base year 1999	Year 2004	Growth rate
1	Small plan for water supply and distribution				
1-1	Construction of small dams	MCM		360	121.3
1-2	Construction of small pump station	MCM	232	464	14.9
2	To conduct water for small cities and industries	MCM			
2-2	To construct water tanks for cities	MCM	85.8	158.4	13.0
3	River management	MCM			
3-1	Management of local rivers outside of city zone	m	25	62	19.9
3-2	Volume of exploitation of underground water	MCM	814	1,314	19.0
3-3	Usage of water for agriculture	MCM	697	1,944.5	22.8
3-4	Increasing of exploitation from existing potentials	MCM			45.0

Source; Management and Planning Organization of Kermanshah Province, 2001

A1.3 Brief Description of Socioeconomic Conditions of the Study Area

A1.3.1 Location and General Features

The Study Area of 14,000 ha spreads at the northernmost part of the Mahidasht, Sanjabi and Ravansar Plain which continues to the Kermanshah City. It is located between latitude of 42°35' to 43° 45' North, and longitude of 36°25' to 38°0' East. The plain is bordered east and west by bold mountains with altitude of 2,000 to 2,500 m, and the plain.

The Study Area is divided into two areas, the eastern part is named as "Site 1" which lays along the left bank of the Gharasu River, and the western part is named as "Site 2" which is bordered at the eastern part by the Gharab River and the western part by the foot of western mountains. The area between both sites is omitted, since the agricultural infrastructure such as land consolidation and land leveling has already been developed under the assistance of Kermanshah Jihad-e-Agriculture Organization.

Both sites of the Study Area agricultural infrastructure development has started. In Site 1, the Ravansar irrigation scheme is under operation and the new irrigation scheme leading water to the Site 1 from the Jaberi Spring is under construction. On the other hand, in Site 2, two new irrigation schemes are under the planning and design stage, i.e. the Gharab Dam and Kilanbar Dam Schemes. While the headwork in the Gharab river was completed the construction without headrace canals.

At present, the Site 1 of the Study Area is rainfed or irrigated agriculture taking water from the existing irrigation canal or pumped from the Gharasu River, but the Site 2 area mostly rainfed agriculture and irrigated agriculture depend on the pumping of groundwater.

A1.3.2 Social Structure

As mentioned earlier, the Project Area is spread in 4 Dehestans in Kermanshah and Javanrood District. In order to understand the socio-economic conditions and problems of the Study Area, following 6 villages were selected as sample villages for the Rapid Rural Appraisal and Farm Household Economic Survey. Selection criteria of 6 villages were (1) one village from each zone, (2) Number of households should be 30 to 50, (3) At least one village from one Dehestan (No village was selected from Badr, due to the geographical unsuitability). General information of the selected villages is given as follows.

General Information of the Selected Villages

Deh	Dehestan/ Sub-district	Site and Zone	Population & households	Ethnicity	Religion
Khoram Abad Oliya	Hassan Abad / Ravansar	Site 1 Zone 1	500 (65 hhs)	Kurd (Jaf)	Sunni (all)
Shali Abad	Hassan Abad/ Ravansar	Site 1 Zone 2	100 (18 hhs)	Kurd (Jaf)	Sunni (all)
Re'is	Dolat Abad/ Ravansar	Site 2 Zone 3	250 (30 hhs)	Kurd (Jaf)	Sunni (all)
Kalaveh Heidar Khan	Sanjabi/Kuzaran	Site 2 Zone 4	150-180 (35 hhs)	Kurd (Jaf)	Sunni(33 hhs) Shia (2 hhs)
Hassan Abad Shaleh	Sanjabi/Kuzaran	Site 2 Zone 5	330 (43 hhs)	Kurd (Jaf)	Sunni (33 hhs) Shia (2 hhs), Ala-lahi (6 hhs)
Nourleh Oliya*	Sanjabi/Kuzaran	Site 2 Zone 6	280 (45 hhs)	Kurd (Jaf)	Sunni (38 hhs) Shia(4 hhs), Ala-lahi (3 hhs)

Notes: *RRA survey was not conducted, hhs = households

(2) Village and Household Size

According to the Farm Household Economic Survey, the typical household in the Study Area has 5 to 6 people (the average is 5.24 per family). Household forms in the Study Area is in a period of transition, moving away from the traditional large households to the nuclear family/ households. It is said that the household is the most importance economic and social unit, only people who are part of the household unit can be a part of the village society, and anyone who does not belong is an outsider. People in the villages in the Study Area, the number of population varies from the village with less than 50 people to the one with nearly 1,000 population.

(3) Kurds, Tribes and Religion

People living in the Study Area are *jaf* Kurds. *Jafs* are one of the major Kurdish groups in Kermanshah Province. Like other Kurdish groups, *Jafs* are made up of a number of clans, tribes, and tribal confederations, many of which have been in existence for thousands of years. *Jaf* Kurds are said to be a sub-dialect of a large dialect group recognized as '*Surani*', or Southern Kurds. There are considerable localized variations of the sub-dialects and even within the Study Area, there are some communication gaps among the people from the different regions particularly for older generations. As well as being Kurdish, the people in the Study Area originally belong to various tribes and clans such as *Sanjabi* and *Valad Beigi*. These two tribes had widely inhabited in the Districts of Javanrood and Kermashah as well as Eslamabad-e-Gharb. The patriarchic elements of tribal life have already vanished a long time ago and the people now do not possess a strong identity as a tribe or emphasis in its differences with others.

In the Study Area, the most of the people had the decamping life style in the past, engaged in pastoral subsistence and animal breeding. They have settled into a predominantly agricultural way of life in the last 300 to 100 years with the development of welfare facilities and land ownership. In the present day, villagers who have a large number of sheep have to take their herds to the mountain points like Bandgaz to use more pasture during the spring for 2 months or so. They decamp with all or several members of their families and relatives. These families divide their works of agriculture and livestock breeding among their members.

The Kurdish people in the Study Area are all Muslim, mostly being Shiite or Sunnis. However, in comparison to the northern Kurds, there is more diversity of religious practice in the Study Area where many villagers and townspeople follow Shia beliefs. Among 6 villages studied, three villages in Site 2 had minority of Shiite. There is also a small sect of people following Allah-lahi (people of the Truth) whose central belief is in seven successive manifestation of the divinity[2]. Arranged marriage took place only among the couple from the same religious sect in the past, but it happens also among the different sects in the present days as in the case of Nourleh Oliya village. The most of villages have built a mosque within the village by the donation of village members and use it for not only religious, but also for some cultural and social purposes for all the people.

(4) Society

In the Study Area, before the land reform, most of the land in the area were held and operated by few landlords and present farmers were employed as farm labours without land. Some of previous landlord still is keeping several plots within 40 ha in the Study Area, and they usually live in large cities such as Kermanshah and Tehran leaving their fields in the hands of the tenant farmers who has less cultivation area.

[2] Ref: http://www.krds.net/kurds.htm

Peoples are in the homogeneous society with former farm labour or tenant farmers before the land reform. After the revolution, no significant hierarchy of the society is observed in the Study Area at present. Even the religious leader can not show the strong leadership in their village.

According to the Farm Survey, farmers in the Study Area do certain types of activities together Among various activities in the villages, almost all village people tend to get together to conduct religious and ceremonial activities such as weddings and funerals. As for the agricultural (economic) activities, 50 % of the respondents answered that they do farming together by exchanging their labour at the time of harvest and 31% for grazing castles. As for the social activities such as cleaning for the public places, only 6 respondents answered that they do together. The people in the target area are rather individualistic for the social activites.

(5) Rural Women

Rural women in the Project area are engaged in agriculture and animal husbandry. Women are engaged in various phases of crop production, including planting, weeding, pest control, harvesting, processing and marketing. Women also play an important role in animal husbandry and dairy production. Introduction of agricultural machineries such as tractors and combines reduced the burden of many activities including planting, pest control and harvesting. However, women's burden in the agricultural activities have not been eased as much as men; it is their husbands or sons who operate agricultural machineries and women are yet involved in the traditional farming such as the production of chickpea and lentils which are only done by hands. In addition, the raising of domestic animals such as cows and hens are also the responsibility of women.

A1.3.3 Rural Women

The table below is a woman's schedule of a typical winter and summer day prepared as a part of RRA exercise in the village Shali Abad.

	Winter Time	**Summer Time**
6:00-7:00	Wake up and pray. Prepare and eat breakfast, send children to school	Wake up and pray Prepare & eat breakfast, send children to school.
7:00-8:00	Feed cattle, clean the hut, prepare bread, clean house	Feed cattle, make butter
8:00-9:00		Go to the farm (seeding, making fertilizer, particularly growing chickpea)
9:00-10:30	Make bread and lunch	
10:30-11:30	Bake bread	
11:30-12:00	Lunch	Prepare and have lunch, wash dishes
12:00-1:00	Washing dishes, cleaning hut, feed cattle	
1:00-2:00	Rest and make Tarhine	Prepare bread(flour and water)
2:00-3:00		Go and work at the farm
3:00-5:00	Cleaning house and washing clothes	
5:00-6:00	Feed cattle and milking	
6:00-7:30	Dinner and washing dishes	Prepare dinner, cleaning house, feed cattle, cleaning hut
7:30-8:30	Child care, spend time with family	Have dinner and clean dishes
8:30:11:00		Housework (cleaning, cattle, child care)
11:00-11:45	Last (forth) feeding to cow	Feeding cow
11:45-	Go to bed	Go to bed

As shown in this Table, women's schedule in summer time is much tighter than in winter time.

Within the limited amount of time, women have to manage housework, farming and animal husbandry. Also, considerable time is spent on the preparation and baking of breads as a part of house keeping.

There was no women's association in 5 villages studied. The absence of local associations does not necessarily mean that women do not cooperate with one another in their daily life. When there are problems related to the family matters or other things, young women tend to go and consult with the elderly women in the village. Married women are also likely to gather together in the health center or small clinic, if there is any in the village. Normally there is one permanent medical staff of women in the health center and apart from the usual function of the center, trainings on health issues such as sanitation, child care and family planning are conducted by the staff or outside trainers.

There is Women's Bureau in all 11 districts of Jihad-e-Agriculture extension offices in Kermanshah Province. The main activity is to promote women's empowerment and employment opportunity in relation to agriculture and rural industries. Due to the limitation of budget, however, not many village people can benefit from this program. In 2002, the budget was only allocated for 3 villages in Women's Bureau in Ravansar.

A1.3.4 Economic Assistance to Poor People: Imam Khomeini Assistance Committee

Imam Khomeini Assistance Committee was established soon after the Islamic Revolution by the Revolutional leader Imam Khomeini himself. The purpose of this committee is to provide economic assistance to the poor families in both urban and rural areas of Iran.

The number of the family receiving the assistance of Imam Committee could indicate the impoverished situation in the Study Area. Although there is no specific criterion for receiving assistance from the Imam committee, the most of the beneficiaries are widows, old ages and small farmers who suffer from chronic poverty.

The number of applicants increased in recent year due to the increase in unemployment of the youth and the drought started in 1997. These people are categorized as temporary poor and receive assistance from 6 months to a few years. The beneficiaries who received in Ravansar office, which covers the area of both Ravansar and Kuzaran sub-district, are 1,851 families in 120 villages.

Services	Description
Monthly subsidy	Amount depends on the number of family members: Rls180,000 for a family with 3 members, Rls. 220.000 for 4members and Rls.
House construction	Rls. 20,000,000 for one house (50m^2). In Ravansar, the budget for 10 houses was allocated in year 2001/2.
Health and sanitation	Reimbursement of the medical costs for the poor families.
Education	(1) Provide stationeries for children of poor families (2) Provide transportation fee for children of poor families (3) Supervision of study of children
Loan	No interest. Repayment through Overdue is accepted depending on the cases of economic difficulties. Amount of land depends on the type of activities : micro credit, agricultural machineries, animal husbandry etc.

A1.3.5 Economic Conditions

(1) Employment in Villages

People in rural area are mostly engaged in agricultural and animal husbandry. There are hardly any other kinds of jobs available such as industries and services in the villages. Apart from cultivating their own land, small and landless farmers often work as agricultural labor or tenants in the lands of land owners. In particular, more agricultural labors are needed for the cultivation of chickpea than any other crops as it is all done by hands in rain fed lands. Among 54 respondents of the Farm survey, 7 households have permanent employees and 25 households have temporary employees only for the peak season. Both permanent and temporary employees are found either from inside or neighbouring villages.

Lack of employment opportunities for educated women has also been the serious problem in rural areas. According to the Farm Survey, 44 out of 54 households have at least one unemployed members. Among these, 34 households have unemployed members of the age between 16 and 40, 32 families have at least 1 unemployed female members, 19 houses for at least 1 unemployed male. Most of the people counted as 'unemployed' are sons (married and unmarried) and daughters (unmarried) of the families who have completed education. Because of the lack of employment opportunities both inside and outside the village, young people, particularly sons of the families have no other choice but to work in their father's land.

(2) Migration

Immigration to the urban area during the off-farm season is common in all the villages studied during the village survey. There are two types of migration pattern: the long term and short term. As for the former, whole families migrate to an urban area (Kermanshah, Ravansar or Javanrood) expect for the season for harvesting. The reason for the long term migration includes, education of children (primary and secondary school), lack of infrastructure in the villages, let alone the shortage of income by agriculture. Also some people migrated from their small settlement to the central village nearby where necessary public facilities such as health center and schools are available.

People who migrate to cities / towns for a short period are mostly young people in search of employment during the off-season. Some of the main characteristics of long and short-term migration are described in the following table.

Migration Pattern in the Project Area

	Long term	Short Term
Characteristics	A family as a whole migrated to urban area	Mainly a youth male of the family migrate
Reason for migration	Lack of employment opportunities, Inconvenience of rural life (watershortage, lack of higher education etc)	Lack of employment opportunities
Period of migration	October to May	2 to 3 months a year during the off-season.
Type of work	Workers, Some have shops, work as civil servants	Workers (mainly construction works)
Destination	Kermanshah, Ravansar, Javanrud (mostly nearest urban area)	Kermanshah, Ravansar, Javanrud, Teheran, other provinces

A1.3.6 Rural Infrastructure

(1) Rural Road

In the Study area, the main roads connecting to towns and cities are all asphalt paved. On the other hand, rural roads connecting villages and the main roads are mostly only covered with gravel and not properly paved. The road condition in rural area is unfavorable especially in rainy season; the roads are pitted with puddles after the rain. The elevation of rural roads is another reason for the pits and puddles during the rainy season. Since the level of rural road is often equal to or even lower than that of agricultural fields, roads tend to be flooded and muddy without being drained. Bad conditions of rural roads make problems for the transportation of villagers during the rainy season, including the transportation of agricultural inputs and products. For these reasons, improving the elevation of rural roads and installation of culverts on the road side would make rural roads accessible throughout the year. Additionally, the materials for embankment of the road should be prepared in consideration of suitable grain size distribution. Full compaction of embankment of the road should be implemented. The gravel pavement is recommended to protect the roadway.

In the Study Area, the conditions of the rural roads are categorized in three levels: (i) paved by asphalt, graveled roads with good conditions throughout the year, (ii) unpaved (graveled roads) accessible throughout the year (iii) unpaved and only accessible by tractor or on foot during the rainy season. Most of the roads belong to the second (ii) category. However, as shown in Fig. A1.3.1, the condition is particularly unfavorable in the south and the north-west of Sanjabi Dehestan in Site 2.

(2) Drinking Water

Most of the villages in the Study Area have drinking water facilities either individually or shared by several families. Sources of drinking water in the Study Area are mainly groundwater, springs and the distribution system. Drinking water in Site 2 (except Dowlat Abad) comes from 2 wells in Rootvand village through the distribution system. The villagers of Reis suffer from occasional breakdown of the water distribution system and they often have to go miles away to fetch water from the spring. Two villages in Site 2 have springs in the hilly parts. In Site 1, drinking water in Badr and Dowlat Abad Dehestan are supplied by springs, while the villages in Hassan Abad Dehestan use groundwater. Two villages have no access of drinking water: Meskin Abad Sofla and Shali Abad. Due to the lack of drinking water, the people in the Meskin Abad Sofla moved to the neighboring villages or Ravansar. In Shali Abad, 10 families have recently moved out of the village due to the scarcity of water. In this village, people have to go and fetch water from the neighboring villages since their groundwater was dried up 3 years after the construction of a deep well. However, drinking water supply facility is going to be constructed by the government recently according to information of villagers in Shali Abad. Drinking water supply should be provided for villages which do have not any facilities or facilities with some problem, in accordance with design standard of the domestic water supply facility.

- Example from RRA exercise -
Rural History of Kalaveh Heidar Khan

1963 First Land Reform
1979 Second Land Reform
1987 Constriction of Rural road
1991 Constriction of Mosque
1993 Land consolidation
1993 First deep well
1996 Electrification of houses
2000 Drinking water tank (deep well)
2000 Rehabilitation of primary school
2001 Telephone center

(3) Electricity

Rural electrification was one of the most important tasks of the Ministry of Jihad before the merging with Ministry of Agriculture. In the Study area, all the villages are electrified apart from the uninhabited villages.

(4) Communication

Installation of telephone is relatively a recent development. In all 5 villages RRA was conducted, the telephone came to the villages between 1998 and 2000. The installation of telephone in the village telephone center made the life of inhabitants easier as they do not have to go all the way to the town to make a phone call. In one of the villages studied, since the telephone in the center is often out of work, people need of private telephone.

(5) Education

The percentage of literacy in the study area is summarized in the table shown below. There seems no much difference in the literacy level of the Study Area and Kermanshah Province. In general, the literacy of male is around 10 to 15 % higher than that of female.

Percentage of Literate Population in the Study Area

Dehestan	No. of Villages in Study Area	Percentage of Literate Population (over 6 years)	
		Male	Female
Badr	4	74 %	56%
Hassan Abad	21	76 %	65%
Dolat Abad	7	73 %	61%
Sanjabi	27	71 %	58%
Study Area	59	74 %	61%
Kermanshah (Rural) Total	-	77%	60%

Source: Population Census of Iran (1996)

Access to primary school in rural area has been improved even before the Islamic Revolution. 70% of the villages in the Study Area have primary school. However, the most of the schools were built more than 30 years ago and the buildings and facilities have needed some rehabilitation. The guidance or secondary schools are available only in larger villages. Female students often give up their study if their nearest school is kilometers away from the village. In case of Kuzaran (Site 2) there is only one secondary school in Zalu Ab and due to the limited facilities, many male students prefer to go to the school in Ravansar or Kuzaran. Number of primary school and secondary schools in the Study Area:

Sub-district	No. of Village	Primary School	Secondary School
Ravansar	32	25	5
Kuzaran	25	15	1

(6) Health

There are 12 rural health centers in the study area (Population Census 1996). Mostly these centers are to provide first aid, vaccination for infant, family planning and first aid. One or two personnel are dispatched in each health center from the Ministry of Health. Where there is no health center, people have to visit in neighboring villages for treatment. In the study area, there are two clinics with doctors and nurses. There are two clinics with a doctor in the center of Dehestan such as Hassan Abad and Dowlat Abad. In site 2, there are 5 health centers with nurses but no clinics with doctors.

(7) Sewage System

The most of villages in the study area have no sewage system. Only 8 villages in Site 1 and 4villages in Site 2 have rural sewage systems. Household sewage water goes directly into the sewage well. In Hassan Abad Shaleh, the village people, particularly women appreciate the introduction of sewage system since the hygienic condition of the village has been improved. Basic information of rural infrastructure in the Study area is summarized in Table A1.3.1.

Table A1.3.1 Basic Information of Rural Infrastructure in the Study Area

No.	Dehestan	Deh	Electricity	Rural Roads to Villages				Drinking Water Supply				Health Center				Schools			Sewage System		
				Paved		Unpaved		Not available	Available			Not available	Available			Not available	Available		Not available	Available	
				All time	Summer Only	All time	Summer Only		Wells	Springs	Distribution system		Doctor	Nurse / Others	None		Primary	Secondary		Good	Bad
	Badr																				
1	1	Ghalancheh	○	○						○							○		○		
2	2	Gele Sefid	○	○						○							○		○		
3	3	Meskin Abad Sofla	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	4	Meskin Abad Olya	○	○						○							○		○		
	Hassan Abad																				
5	1	Tapeh Rash	○			○			○								○		○		
6	2	Tapeh Kuick	○			○			○								○		○		
7	3	Tapeh Lori	○			○			○								○		○		
8	4	Hassan Abad	○	○					○				○	○			○	○		○	
9	5	Hossein Abad	○			○			○							○				○	
10	6	Khoram Abad Sofla	○			○			○								○	○	○		
11	7	Khoram Abad Olya	○			○			○								○		○		
12	8	Deh Bagh	○			○			○							○			○		
13	9	Deh Sadeh	○			○			○								○		○		
14	10	Zarin Chagha	○			○			○								○	○	○		
15	11	Shali Abad	○			○		○								○					○
16	12	Shour Balagh	○	○					○								○				○
17	13	Ghale Zakariya	○			○			○								○	○		○	
18	14	Ghale Reza	○			○			○								○		○		
19	15	Kari Sharif	○	○							○						○	○		○	
20	16	Kareim Abad	○	○					○								○			○	
21	17	Gerazi Abad	○			○			○							○				○	
22	18	Gargabi Mestafa	○			○			○								○			○	
23	19	Gargabi Mirza Ali	○			○			○								○		○		
24	20	Guij	○			○			○								○		○		
25	21	Mir Aizizi	○			○			○								○			○	
	Daulat Abad																				
26	1	Cheshmeh Sefid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	2	Daulat Abad	○	○						○	○		○	○			○	○			○
28	3	Reis	○				○			○	○					○			○		
29	4	Kareh Ghale Sefid	○	○						○	○						○				○
30	5	Kareh Ghale Kouneh	○	○						○	○						○				○
31	6	Gamashtar Olya	○	○					○								○				○
32	7	Nahrabi	○	○					○								○				○
	Koozaran																				
33	1	Elyasei	○			○			○						○		○		○		
34	2	Pirouzeh	○		○		○		○	○	○				○	○			○		
35	3	Tapeh Ghol	○			○			○		○	○					○			○	
36	4	Jil Abad	○			○			○		○				○		○		○		
37	5	Chagha Shekar	○				○		○		○					○			○		
38	6	Dayar Asad Khan	○			○			○		○				○	○			○		
39	7	Deh Jan-jan	○				○		○		○				○		○		○		
40	8	Deh Cheragh	○				○		○		○				○		○		○		
41	9	Rootvand	○	○					○		○				○		○		○		
42	10	Zalou Ab	○	○					○		○			○			○	○		○	
43	11	SabzBolagh	○			○			○		○				○		○		○		
44	12	Siyah Siyah Dayar	○			○			○		○	○					○		○		
45	13	Siyah Siyah	○				○		○		○				○	○			○		
46	14	Hossein Abad Shaleh	○			○			○		○	○					○			○	
47	15	Ghale Khoda Mororat	○	○		○			○		○				○		○			○	
48	16	GhaleFarajollah Beig	○			○			○		○				○	○			○		
49	17	Kachkineh	○			○			○		○				○	○			○		
50	18	Kalaveh Haidar Khan	○				○		○		○				○		○		○		
51	19	Kandouleh	○				○		○	○	○				○		○		○		
52	20	Golam Tabad	○			○			○		○				○	○			○		
53	21	Lamini	○			○			○		○				○	○			○		
54	22	Nouroleh Safla	○				○		○		○				○	○			○		
55	23	Nouroleh Oliya	○	○		○			○		○				○		○		○		
56	24	Vali Abad	○			○			○		○			○		○			○		
57	25	Yavari Dayar	○			○			○		○				○		○		○		

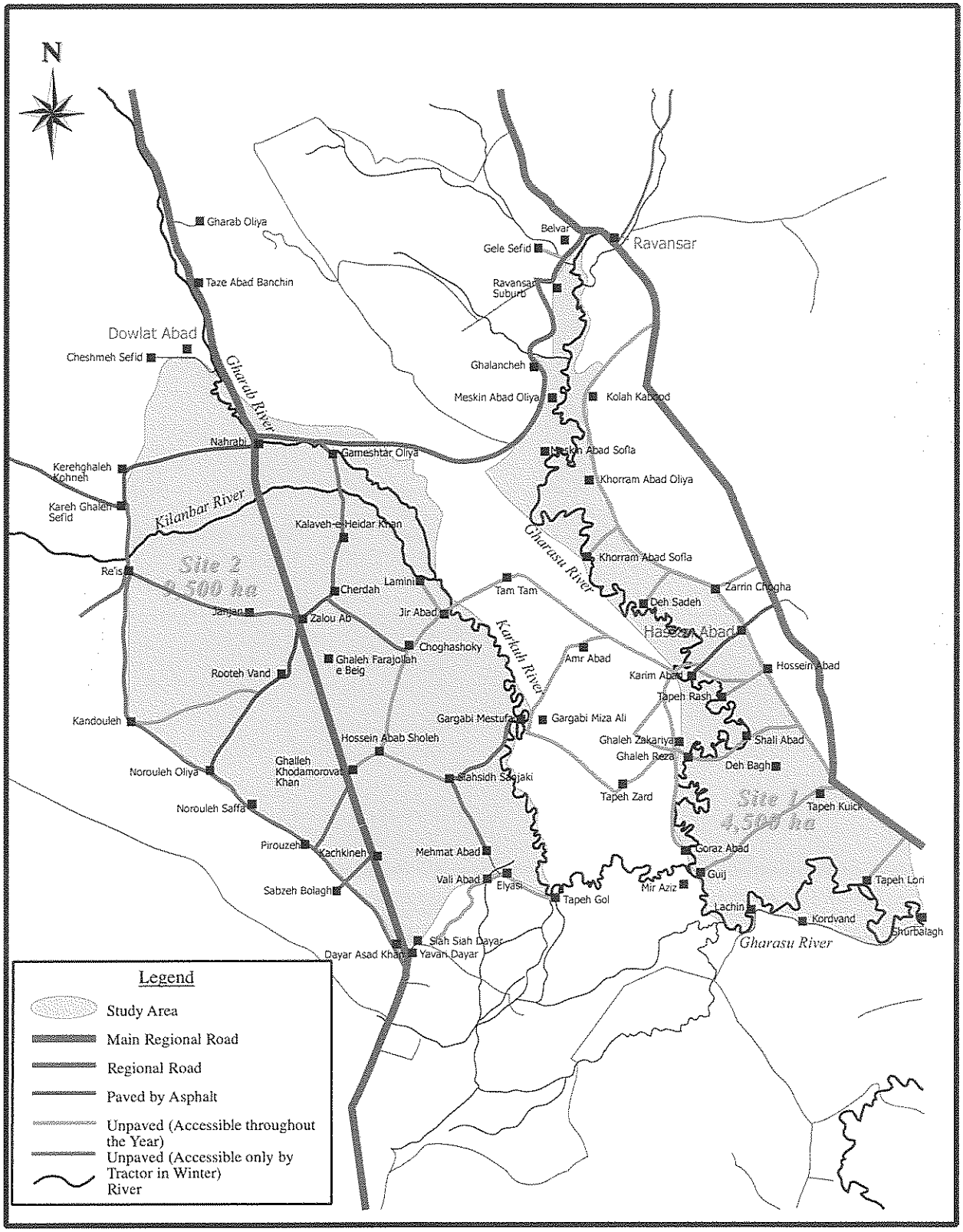


Fig. A1.3.1 Present Condition of Rural Road

Annex 2	**Meteorology, Hydrology and Water Resources**

ANNEX 2

METEOROLOGY, HYDROLOGY AND WATER RESOURCE

A2.1 Meteorology and Hydrology

A2.1.1 Meteorology

(1) General

Ministry of Energy (MOE) and Meteorological Organization (I.R.I.M.O) are responsible to carry out the meteorological observation. and the hydrological observation is carried out by Ministry of Energy in the nation. These data are compiled by both organization respectively. Based on the list of existing meteorological and hydrological observatories provided by both organizations, observed records on 6 meteorological stations and 4 hydrological stations located in and around the study area were selected for the study. Description of the selected stations is as follows;

Meteorological Station

Station	Lat.	Lon.	Alt.	Jurisdiction
Javanrood	34 ° 49 ′	46 ° 29 ′		MoE
Bonchale	34 ° 49 ′	46 ° 35 ′		MoE
Ravansar	34 ° 43 ′	46 ° 40 ′	1,363	I.R.I.M.O
Varmohang	34 ° 47 ′	46 ° 53 ′	1,418	MoE
Jelogireh	34 ° 35 ′	46 ° 51 ′	1,180	I.R.I.M.O
Gahvareh	34 ° 20 ′	46 ° 25 ′	1,520	I.R.I.M.O

Hydrological Stations

Station	Lat.	Lon.	Alt.	Jurisdiction
Nahre Asli	34 ° 43 ′	46 ° 39 ′	1,320	MoE
Nahre Rast	34 ° 43 ′	46 ° 39 ′	1,320	MoE
Nahre Chap	34 ° 43 ′	46 ° 39 ′	1,320	MoE
Doab Marak	34 ° 33 ′	46 ° 47 ′	1,290	MoE

All of observatories are being carried out regarding the rainfall though many lack of records can be found. Only the Ravansar meteorological station is available in the items of rainfall, temperature, evaporation, sunshine hour wind velocity for estimation of potential transpiration in and around the study area. Therefore, the meteorological data at the station is used for the study as the representative meteorological data in the study area. As for the hydrological stations, the daily discharge of Gharasu river is observed at only the Doab Marak station in Gharasu river basin. Nahre Asli, Nahre Rast and Nahre Chap stations are observing the discharge flow into Gharasu river from Ravansar spring, intake volume of the Ravansar right bank canal and the left bank canal from the Ravansar spring respectively. In short, total of three stations discharge is the spring volume of the Ravansar spring.

(2) Meteorological Data

The study area and its surrounding belong to Zagros area which is influenced by the Mediterranean and the Atlantic oceanic climate as well as the Siberian climate. The study area is located in the heart of the Sanjabi plain surrounded mountains with mountainous climate condition. Meteorological data in Ravansar meteorological station is as follows;

Item	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	AVERAGE
Temperature (℃)													
Max.	4.7	6.3	12.4	19.1	24.5	31.4	36.4	35.8	31.3	23.8	15.5	8.5	20.8
Min.	-4.1	-2.9	1.4	6.3	10.4	14.8	20.4	19.3	13.9	9.9	3.4	-1.0	7.7
Mean	0.3	1.7	6.9	12.7	17.5	23.1	28.4	27.6	22.6	16.9	9.5	3.8	14.3
Rainfall (mm/month)													
Mean	84.6	74.2	92.0	70.5	23.5	2.5	0.9	0.0	0.8	25.3	60.2	85.6	43.9
Relative Humidity (%)													
Ave.	74	69	62	55	44	27	21	20	21	37	58	70	46.5
Sunshine Hours (hours)													
Ave.	4.5	5.3	6.3	7.3	9.3	11.1	11.8	11.4	10.5	8.3	6.0	4.4	8.0
Wind Speed (knots)													
Ave.	3.1	4.0	5.0	4.9	5.9	6.5	7.6	7.2	6.0	5.2	3.0	2.7	5.0
Evaporation (mm/day)													
Ave.	1.0	1.0	1.0	4.5	7.1	11.5	14.4	14.0	10.6	6.9	3.0	1.0	6.3

Record periods in the table are follows;

Temperature	: 14 years (from 1988 to 2001)
Rainfall	: 16 years (from 1988 to 2003)
Relative Humidity	: 14 years (from 1988 to 2001)
Sunshine Hours	: 14 years (from 1988 to 2001)
Wind Speed	: 8 years (from 1988 to 1995)
Evaporation	: 10 years (from 1992 to 2001)

Generally, the maximum air temperature occurs in dry season, June to August, and minimum is the rainy season, January or February. Daily difference of the air temperature accounts around 10 ℃ to 15 ℃ in the area. From November to February, less than 0 ℃ of minimum air temperature has been observed and also maximum of air temperature sometime. Especially in January and February, two third of month are less than 0 ℃ of minimum air temperature. Frost has been found at that time.

According to the records of Ravansar station, mean annual relative humidity shows 46 %. The maximum relative humidity has been records in the winter season and minimum relative humidity occurs in summer season. Average sunshine hour is 8.0 hour per day. More than 10 hour has been observed in the summer season, June to September and the sunshine hour of winter season are half of summer season due to a lot of rainy days and cloudy days.

The evaporation data from December to March are not observed at Ravansar station. The average evaporation volume in the period is assumed as 1.0 mm per day. The average evaporation volume is 6.3 mm/day and high evaporation volume has been observed in July. Annual evaporation volume can be estimated approximately 2,000 mm equivalent to three times of annual rainfall based on the record.

Monthly average wind speed ranges from 2.7 knots to 7.6 knots and average wind speed has been estimated as 5.0 knots. The wind can be divided broadly into two categories. The wind in the winter season blows from west, named Shomal, brings moisture from the Mediterranean sea and it is suitable for farming. On the other hand, the wind in the summer season blows from north will be influenced by the Siberian climate. The wind, named Zelan, sometimes brings very dry and high air temperature. Sometimes, the Zelan make air temperature to rise more than 15 ℃. If strong Zelan continues for three days or more before harvesting, crop products will be reduced dramatically.

Around 90% of annual rainfall occurs from November to April and from June to September, quite limited rainfall is observed. For estimation of average annual rainfall in the study area, six (6) meteorological observatories were selected in view of location and its data period and also availability of collection. Monthly rainfall and data of non-rainy days at six meteorological observatories are shown in Table A2.1.1.With these selected observatories,

Thiessen Polygon was delineated as shown in Fig. A2.1.1 and average annual rainfall in the study area can be estimated at 546.3 mm as describe below;

Observatory	Data Period (years)	Mean Annual Rainfall (mm)	Areal Ratio (%)	Areal Rainfall (mm)
Javanrood	11	628.3	10.1	63.5
Bonchale	11	610.0	12.8	78.1
Ravansar	16	527.1	46.2	243.5
Varmohang	14	618.5	0.6	3.7
Jelogireh	21	536.0	16.7	89.5
Gahvareh	11	499.9	13.6	68.0
Total			100.0	546.3

Probable rainfalls for annual and daily are calculated using the observed data of each observatory. Probability of exceedance is basically adopted for calculation though probability of non-exceedance is also examined regarding the annual rainfall. Non-rainy days is studied taking the irrigation program into account. Probable non-rainy days is tabulated below together with the probable rainfalls stated above;

Observatory	Item	Return Period (year)					
		5	10	20	50	100	200
Javanrood	Daily Rainfall	62.7	79.0	97.1	124.1	147.3	173.1
	Annual Rainfall	492.0	447.1	413.3	378.7	357.4	339.1
	Non-rainy days	315	322	327	334	338	342
Bonchale	Daily Rainfall	57.5	67.6	78.5	94.5	108.0	122.7
	Annual Rainfall	434.5	366.8	318.4	270.9	242.7	219.3
	Non-rainy days	321	326	331	337	341	345
Ravansar	Daily Rainfall	54.8	63.6	72.5	84.7	94.4	104.6
	Annual Rainfall	415.3	374.9	345.5	316.0	298.3	283.3
	Non-rainy days	298	304	309	314	318	321
Varmohang	Daily Rainfall	65.2	77.6	91.4	112.1	129.9	149.6
	Annual Rainfall	511.0	465.2	430.5	394.5	372.1	352.8
	Non-rainy days	299	305	310	316	320	324
Jelogireh	Daily Rainfall	56.3	66.6	77.9	94.6	108.8	124.5
	Annual Rainfall	408.4	366.9	335.8	303.9	284.3	267.5
	Non-rainy days	322	328	333	339	344	348
Gahvareh	Daily Rainfall	55.3	70.2	86.9	112.2	134.0	158.4
	Annual Rainfall	401.9	363.5	334.9	305.8	288.1	272.9
	Non-rainy days	309	315	319	324	328	331

A2.1.2 Hydrological Data

As stated in the previous section, four (4) hydrological observatories were selected among the MoE hydrological observatories as the reference observatories to the study. However, as the continuous and long term river discharge records, daily basis flow regime at Doab Marak station having the river basin of 1,228 km2 is available in Gharasu river basin. And three (3) stations have been observing spring volume of Ravansar spring. Monthly basis discharge data at four stations are shown in Table A2.1.2.

(1) River Runoff

Average annual flow volume on monthly basis and distribution ratio of monthly flow at Doab Marak station are as follows;

Unit: MCM

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Average	15.9	22.3	54.7	45.1	23.4	9.3	6.2	4.1	3.5	5.1	10.8	13.8	214.2
Ratio(%)	7.4	10.4	25.5	21.1	10.9	4.4	2.9	1.9	1.6	2.4	5.1	6.4	100.0

However, the discharge of Doab Marak station includes spring volume of a lot of springs located in Gharasu river basin which basin of spring water can not be clarified because main geology of these basin is limestone with a lot of caves probably, such as Ravansar spring, Jaberi Spring, Ghara Daneh spring and Mir Azizi spring. Therefore, above mentioned discharge is not pure river discharge by the basin rainfall. To grasp pure river discharge by the basin rainfall, these spring volume should be deducted from discharge data at Doab Marak station basically. In the calculation of pure river discharge by the basin rainfall, only the spring volume of Ravansar flow into Gharasu river directory will deducts from discharge data at Doab Marak station. Because other spring volume are not so much and most of spring water will be used for irrigation.

Monthly basin rainfall and runoff coefficient of the river discharge at Doab Marak station are as follows;

Year	Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec	Annual
1992	R MCM	131.9	136.4	177.8	44.9	84.6	6.9	0.0	0.0	0.0	0.0	57.0	131.3	770.8
	DD MCM	8.9	27.6	69.7	86.2	54.6	17.5	10.5	5.5	4.4	6.5	7.4	10.8	309.6
	RD MCM	3.9	7.6	12.9	14.3	16.5	12.2	5.7	1.3	0.1	0.1	1.5	3.2	79.3
	TD MCM	5.0	20.0	56.8	71.9	38.1	5.3	4.8	4.2	4.3	6.4	5.9	7.6	230.3
	RC %	3.8	14.7	31.9	160.1	45.0	76.8	N.A.	N.A.	N.A.	N.A.	10.4	5.8	29.9
1993	R MCM	92.6	67.2	81.4	149.2	104.3	5.5	1.2	0.0	0.0	78.0	122.6	85.6	787.6
	DD MCM	13.8	11.9	20.5	19.4	22.5	6.7	3.7	1.4	1.3	2.1	6.5	13.6	123.4
	RD MCM	8.2	7.6	11.6	10.8	6.7	1.1	0.1	0.1	0.0	1.8	5.3	7.0	60.3
	TD MCM	5.6	4.3	8.9	8.6	15.8	5.6	3.6	1.3	1.3	0.3	1.2	6.6	63.1
	RC %	6.0	6.4	10.9	5.8	15.1	101.8	300.0	N.A.	N.A.	0.4	1.0	7.7	8.0
1994	R MCM	120.8	76.8	104.5	-	-	0.0	0.0	0.0	0.4	112.2	328.9	80.7	-
	DD MCM	21.0	24.4	55.9	31.6	15.1	6.0	3.4	1.7	3.4	6.5	57.7	42.7	269.4
	RD MCM	10.0	10.8	14.7	15.4	5.5	0.2	0.1	0.1	0.1	6.1	14.9	18.3	96.2
	TD MCM	11.0	13.6	41.2	16.2	9.6	5.8	3.3	1.6	3.3	0.4	42.8	24.4	173.2
	RC %	9.1	17.7	39.4	-	-	N.A.	N.A.	N.A.	825.0	0.4	13.0	30.2	-
1995	R MCM	43.0	70.0	90.7	124.3	86.6	13.0	0.0	0.0	0.0	2.3	30.1	10.4	470.4
	DD MCM	41.3	37.2	39.7	47.5	33.1	10.9	5.0	3.2	-	-	-	-	-
	RD MCM	11.7	12.6	16.8	17.9	13.0	1.2	0.1	0.1	0.1	1.0	1.5	1.1	77.1
	TD MCM	29.6	24.6	22.9	29.6	20.1	9.7	4.9	3.1	-	-	-	-	-
	RC %	68.8	35.1	25.2	23.8	23.2	74.6	N.A.	N.A.	-	-	-	-	-
1996	R MCM	145.0	106.2	205.4	148.1	36.2	0.0	2.7	0.0	0.0	6.6	13.6	94.1	757.9
	DD MCM	-	-	-	-	-	-	-	-	-	4.6	7.1	9.5	-
	RD MCM	1.7	5.4	11.6	19.9	13.0	5.3	1.5	1.0	0.0	0.0	0.5	2.0	61.9
	TD MCM	-	-	-	-	-	-	-	-	-	4.6	6.6	7.5	-
	RC %	-	-	-	-	-	-	-	-	-	69.7	48.5	8.0	-
1997	R MCM	83.0	44.9	136.8	101.9	19.9	1.0	0.2	0.0	-	-	-	-	-
	DD MCM	9.0	7.2	21.2	37.6	14.7	3.1	2.5	1.1	1.9	3.3	6.3	11.0	118.9
	RD MCM	2.4	3.8	9.9	15.9	4.8	0.0	0.6	0.4	0.3	0.8	4.0	8.0	50.9
	TD MCM	6.6	3.4	11.3	21.7	9.9	3.1	1.9	0.7	1.6	2.5	2.3	3.0	68.0
	RC %	8.0	7.6	8.3	21.3	49.7	310.0	950.0	N.A.	N.A.	N.A.	N.A.	N.A.	-
Ave.	RC %	19.1	16.3	23.1	52.8	33.3	N.A.	N.A.	N.A.	N.A.	23.5	18.2	12.9	24.9

R: Rainfall, DD: Doab Marak Discharge, RD: Ravansar spring Discharge flow into Gharasu river directly, RC: Runoff coefficient

-: Impossible to calculate due to lack of data

According to above table, the monthly runoff coefficient and the annual runoff efficient can not be standardized because the phenomenon of runoff is different by each year. Actually,

water flow of existing rivers have been going underground at some part of river rout. This phenomenon of river will effect to the different of river runoff condition on each observed year. Therefore, the monthly coefficient of each year should be used to estimate the river runoff of the basin basically. Generally, from June to September, some discharges are observed without rainfall. These discharges can be understood as the base flow of months. However, 0.3 may be employed as an average coefficient to calculate flood discharge, based on average coefficient with base flow volume at a rough estimate.

(2) Flood Discharge

Estimation of flood discharge of the river is made with return period of 5 and 10 years taking the design condition of the project facilities into account. Due to the lack of historical rainfall and flood records, rational formula is employed for estimation of flood discharge for the study area. In the formula, following condition is applied;

Runoff coefficient : 0.3
Arrival time of flood : Rziha's formula
Rainfall intensity within an arrival time of flood : $(R24/24)(24/T)^{2/3}$
R24 : Probable daily rainfall
T : Arrival time of flood

Areal daily rainfall of five and ten years provability in Gharasu river basin are as follows;

Observatory	Data Period (years)	Areal Ratio (%)	Daily Rainfall (mm)		Areal Daily Rainfall (mm)	
			1/5	1/10	1/5	1/10
Javanrood	10	10.1	62.7	79.0	6.3	8.0
Bonchale	10	12.8	57.5	67.6	7.4	8.7
Ravansar	15	46.2	54.8	63.6	25.3	29.4
Varmohang	14	0.6	65.2	77.6	0.4	0.5
Jelogireh	20	16.7	56.3	66.6	9.4	11.1
Gahvareh	11	13.6	55.3	70.2	7.5	9.5
Total		100.0			56.3	67.2

Estimated results are as follows;

Peak flood discharge at Doab Marak station

Probable Daily Rainfall (mm/day)		Arrival Time of Flood (hour)			Rainfall Intensity (mm/hour)		Peak Flood Discharge (m^3/sec.)	
1/5	1/10	L (km)	H (km)	T (hr)	1/5	1/10	1/5	1/10
56.3	67.2	57	0.69	11.2	3.9	4.7	399.1	481.0

The 5 year return period flood discharge at Doab Marak station has been calculated as 399.1 m^3/sec with drainage area of 1,228 km^2. Also, the 10 year return period discharge is 481.0 m^3/sec.

A2.2 Water Resources

The main water resources to irrigate the agricultural sector in the study area can be divided into surface water, spring water and ground water.

(1) Surface water

The main source of surface water in the study area is only the Gharasu River during dry

season. The Gharab River and the Kilanbar River can not provide stable water to agricultural land during dry season because these rivers will be seasonal river at some portion. One of the main water sources of the Gharasu River is the Ravansar Spring especially during dry season and it affects the phenomenon of the river flow. As state in the previous section, average annual discharge of the basin is 214.2 MCM at Doab Marak station. This volume will have a possibility to use the water in order to irrigate agricultural field as surface water resource.

According to the estimation of MOE, 201 pumps are registered to pump up irrigation water from the Gharasu River directly and those irrigated land area is 1,162 ha with a total exploitation of 6.9 MCM/year. To receive permission of pumping, the owners have to pay some amount of water charge every year based on irrigated land area and type of irrigation. On the other hand, 29 illegal pumps are also confirmed along the Gharasu River. Area of 122 ha is irrigated by these illegal pumps and 0.7 MCM of surface water of the Gharasu River will be lost without any payment. However, these situations can be seen at limited area only along the Gharasu River. As the other facility, the Ravansar headwork and the Gharab headwork were constructed for the purpose of irrigation. However, the Ravansar headwork became out of function at present and the Gharab headwork is under the reconsideration because the Gharab dam is newly proposed recently that located at upstream of the Gharab headwork.

Another three dams are under the study phase; the Kilanbar dam, the Gharab dam and the Sedeh Aba dam.

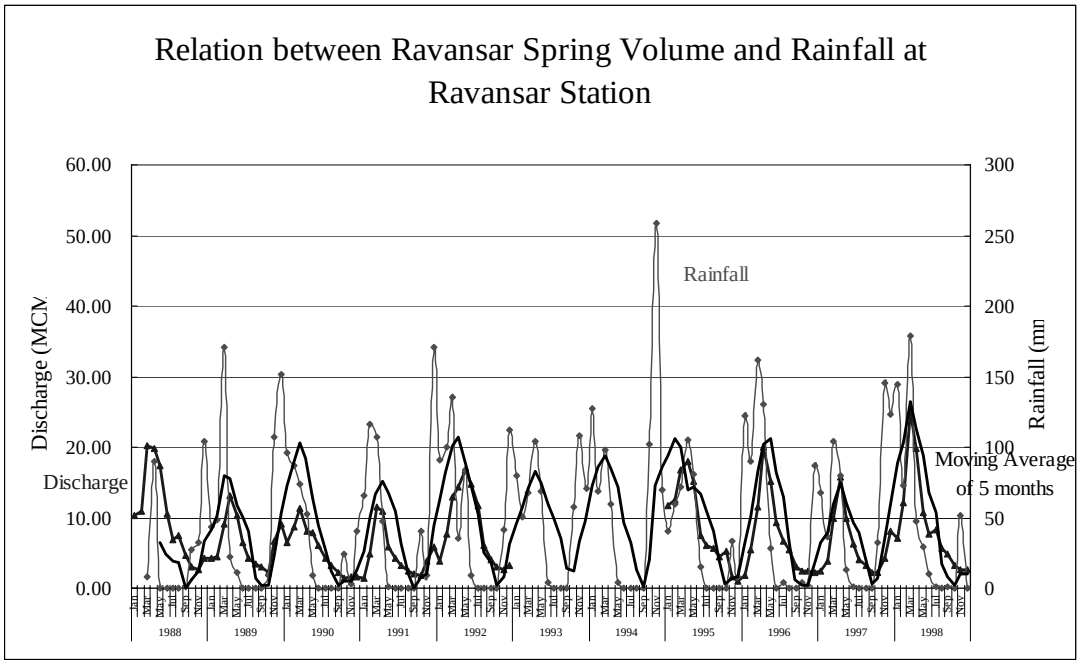
(2) Spring water

There are 4 spring which can be expected as a important water resource; the Ravansar spring, the Jaberi spring, the Ghara Daneh spring and the Mir Azizi spring, within 110 springs in the study area and its basin area. The Ravansar spring and the Jaberi spring are located in uptream of Site 1 and the Mir Azizi spring in down stream of Site 1. the Ghara Daneh spring is located in ending point of Site 2. These springs are used to irrigate for some of farm land traditionally. Average monthly spring volumes of each spring are as follows;

Unit: m^3/sec

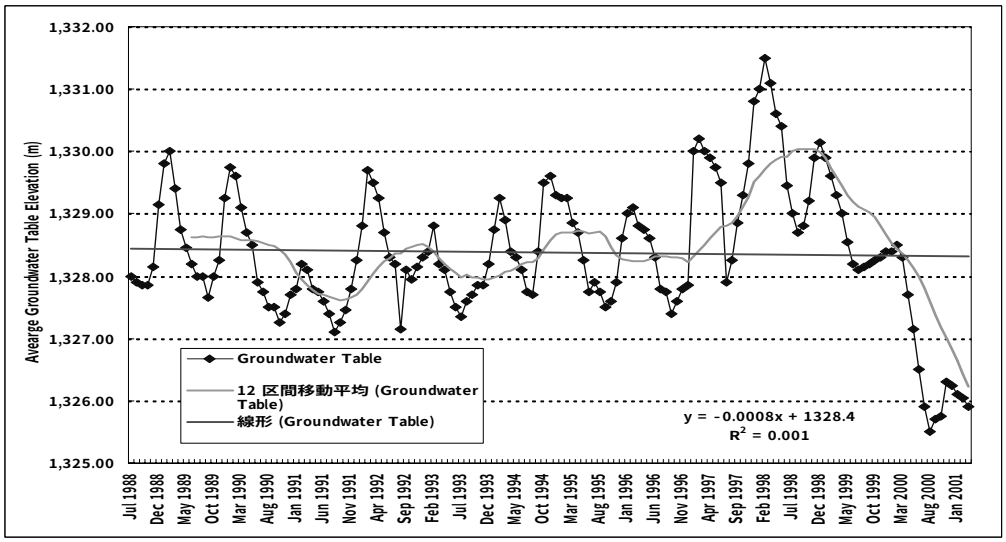
Name	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Ravansar	59.2	91.9	165.3	183.3	141.3	88.4	66.5	50.4	36.1	30.7	35.8	47.0	995.9
Jaberi	0.2	0.3	0.3	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.2	2.9
Ghara Daneh	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2.4
Mir Azizi	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.2

Available annual water volume from these 4 springs is estimated as 102.9 MCM/year. As an average, approximately 35.6 MCM/year is utilized for agricultural activities within available annual water volume from 4 springs. It is very important factor to develop the study area how to use spring water volume in the winter season for agricultural activities in summer season. Especially, the Ravansar spring is the most important water resource for Site 1. The hydrological analysis has not been carried out yet and also the basin area of the Ravansar spring is not clear. However, following figure has shown a tendency of spring volume on the Ravansar spring as an example. The relation between spring volume of the Ravansar spring and rainfall at Ravansar meteorological station can be seen by the figure. According to the calculation of the moving average with 5 months, the peak of discharge agrees with the peak of rainfall. As a tendency, the rainfall may effect to discharge after 5 months. Unfortunately, more detail hydrological analysis can not be carried out because of shortage of data at present. Anyway, it is very important that detail and continuous data concerning the discharge of the spring should be observed in order to draw up a comprehensive development plan using the Ravansar spring water.



(3) Groundwater and Wells in Alluvial Plain

According to the well inventory of MOE, there are 352 registered wells in the Study Area, and amount of approved water right is 4.524 MCM for irrigating 4,772 ha (ref. Table 3.5.3). Addition to these official figures, there might be many illegal wells and groundwater extraction at present. Groundwater table fluctuation is monitored by the Ravansar Water Office of the MOE at 24 observation wells in the Sanjab plain, of which 15 wells are in and near the Study Area. The data on observation wells from 1994 to 2001 are shown in Table A2.2.1. Average groundwater table in the Ravansar Basin between 1988 and 2001 is shown in the following chart.



Fluctuation of Average Groundwater Table in the Ravansar Basin (1988-2001)

As shown in the above chart, groundwater table fluctuated almost same pattern up to 1996, except drought years of 1990 and 1993. After the maximum recovery in 1998, groundwater tables going down rapidly since 1999. These tendencies might be caused by drought and over

extraction of groundwater in the basin. According to data of 15 observation wells, the condition of water level on wells can be divided into three categories such as gentry down, suddenly down since 1999 and relatively same condition. Tendencies of each well are shown in Fig. A2.2.1, and assumed groundwater condition based on the observed data of each well is shown in Fig. A2.2.2.

Table A2.1.1 Observed Rainfall Data (1)

Station Name: Javanrood

1992	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	62.0	152.5	138.0	47.0	77.0	0.0	0.0	0.0	0.0	0.0	24.0	117.0	617.5
Non-rainy day	23	13	21	26	25	30	31	31	30	31	24	17	302

1993	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	75.0	78.0	65.0	272.0	188.0	15.0	0.0	0.0	0.0	26.5	50.0	56.0	825.5
Non-rainy day	23	19	24	18	24	29	31	31	30	27	24	27	307

1994	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	0.0	0.0	61.0	0.0	11.0	0.0	0.0	0.0	0.0	100.0	205.6	102.4	480.0
Non-rainy day	31	28	24	30	28	30	31	31	30	23	14	21	321

1995	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	58.5	55.1	91.5	96.5	81.5	9.5	0.0	0.0	0.0	19.0	12.5	7.0	431.1
Non-rainy day	26	23	22	22	22	29	31	31	30	28	27	29	320

1996	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	167.0	102.2	208.5	138.5	28.0	0.0	0.0	0.0	0.0	18.5	17.0	121.5	801.2
Non-rainy day	15	14	13	20	26	30	31	31	30	26	26	14	276

1997	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	98.0	72.0	175.0	143.0	32.0	3.0	0.0	0.0	-	-	-	-	-
Non-rainy day	27	22	17	20	24	29	31	31	-	-	-	-	-

1998	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	-	-	-	-	-	-	-	-	-	0.0	55.0	1.0	-
Non-rainy day	-	-	-	-	-	-	-	-	-	31	28	30	-

1999	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	75.0	163.0	49.0	80.0	6.0	0.0	13.0	0.0	3.0	28.0	29.0	34.0	480.0
Non-rainy day	20	18	26	22	30	30	28	31	29	26	25	24	309

2000	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	178.5	66.5	92.0	52.5	6.0	0.0	0.0	0.0	4.0	48.5	30.0	141.0	619.0
Non-rainy day	17	21	23	24	30	30	31	31	29	22	24	15	297

2001	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	93.5	71.0	105.5	56.0	22.0	0.0	17.0	0.0	13.0	30.0	47.0	129.0	584.0
Non-rainy day	21	20	24	23	29	30	29	31	28	28	25	19	307

2002	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Sug.	Sep.	Oct.	Nov.	Dec.	Total
Total	136.0	49.0	111.5	211.0	25.0	0.0	0.0	0.0	0.0	19.0	93.5	216.0	861.0
Non-rainy day	18	25	22	11	28	30	31	31	30	26	24	17	293

Average	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Sug.	Sep.	Oct.	Nov.	Dec.	Total
Total	94.4	80.9	109.7	109.7	47.7	2.8	3.0	0.0	2.2	29.0	56.4	92.5	628.3
Non-rainy day	22	20	22	22	27	30	31	31	30	27	24	21	307

Table A2.1.1 Observed Rainfall Data (2)

Station Name: Bonchale

1992	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	281.0	166.0	189.0	55.0	66.5	7.0	0.0	0.0	0.0	0.0	61.5	139.0	965.0
Non-rainy day	13	14	21	26	27	29	31	31	30	31	24	24	301

1993	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	104.5	60.0	75.0	94.0	94.0	5.0	0.0	0.0	0.0	120.5	145.0	87.0	785.0
Non-rainy day	25	23	24	21	22	29	31	31	30	24	22	25	307

1994	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	134.5	122.5	124.0	79.0	18.0	0.0	0.0	0.0	0.0	106.5	257.5	43.0	885.0
Non-rainy day	24	20	22	25	28	30	31	31	30	26	23	27	317

1995	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	35.0	48.5	73.5	97.5	77.0	7.5	0.0	0.0	0.0	0.0	21.0	10.0	370.0
Non-rainy day	29	22	23	25	22	29	31	31	30	31	28	29	330

1996	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	153.0	68.5	204.5	150.0	34.5	0.0	0.0	0.0	0.0	3.5	12.5	92.4	718.9
Non-rainy day	23	21	20	19	28	30	31	31	30	30	27	20	310

1997	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	81.5	43.7	117.9	90.2	18.3	0.0	0.0	0.0	-	-	-	-	-
Non-rainy day	26	22	21	21	27	30	31	31	-	-	-	-	-

1998	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	-	-	-	-	-	-	-	-	-	0.0	57.0	0.0	-
Non-rainy day	-	-	-	-	-	-	-	-	-	31	28	31	-

1999	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	76.5	111.0	30.5	52.0	8.5	0.0	10.0	0.0	0.0	25.0	23.5	25.0	362.0
Non-rainy day	24	20	27	23	29	30	29	31	30	29	27	26	325

2000	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	118.0	61.0	69.5	42.0	5.0	0.0	3.0	0.0	8.0	32.0	20.5	106.8	465.8
Non-rainy day	21	21	25	27	29	30	30	31	29	24	25	17	309

2001	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	77.5	64.5	72.5	63.5	8.5	0.0	5.0	0.0	4.5	17.0	27.0	115.0	455.0
Non-rainy day	24	22	25	24	29	30	30	31	28	27	26	19	315

2002	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Sug.	Sep.	Oct.	Nov.	Dec.	Total
Total	116.5	39.5	66.0	174.0	23.5	0.0	0.0	0.0	0.0	6.5	75.0	183.0	684.0
Non-rainy day	19	24	24	15	27	30	31	31	30	29	24	15	299

Average	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Sug.	Sep.	Oct.	Nov.	Dec.	Total
Total	117.8	78.5	102.2	89.7	35.4	2.0	1.8	0.0	1.3	31.1	70.1	80.1	610.0
Non-rainy day	23	21	23	23	27	30	31	31	30	28	25	23	315

Table A2.1.1 Observed Rainfall Data (3)

Station Name: Ravansar

1988	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	-	-	8.0	89.7	0.5	0.2	0.0	0.0	1.0	27.3	32.3	104.1	-
Non-rainy day	-	-	29	17	29	29	31	31	29	24	15	21	-

1989	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	43.4	48.1	170.8	22.0	11.0	0.0	0.0	0.0	0.0	8.8	107.4	151.7	563.2
Non-rainy day	19	19	12	27	28	30	31	31	30	29	17	22	295

1990	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	96.4	87.3	73.6	52.6	9.0	0.0	0.0	0.0	0.0	23.8	3.3	40.6	386.6
Non-rainy day	15	18	21	24	28	30	31	31	30	26	26	24	304

1991	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	65.9	115.7	106.6	47.9	0.7	0.0	0.0	0.0	0.0	40.0	9.0	171.0	556.8
Non-rainy day	19	18	17	22	29	30	31	31	30	23	27	18	295

1992	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	91.3	99.5	135.5	35.6	83.8	9.3	0.0	0.0	0.0	0.0	41.9	112.5	609.4
Non-rainy day	19	10	15	23	21	26	31	31	30	31	20	15	272

1993	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	80.3	50.8	67.9	104.2	69.1	4.0	0.0	0.0	0.0	57.7	107.6	70.3	611.9
Non-rainy day	21	20	20	19	19	29	31	31	30	26	20	24	290

1994	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	127.6	68.3	98.1	59.3	4.4	0.0	0.0	0.0	0.4	102.2	258.8	69.5	788.6
Non-rainy day	16	12	15	19	28	30	31	31	29	21	14	19	265

1995	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	40.5	59.9	72.2	105.3	80.4	15.0	0.0	0.0	0.0	0.0	33.7	7.8	414.8
Non-rainy day	26	17	21	12	20	25	31	31	30	31	24	26	294

1996	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	121.8	90.3	161.5	130.5	28.5	0.0	4.0	0.0	0.0	4.3	1.9	87.0	629.8
Non-rainy day	15	16	12	17	24	30	30	31	30	26	26	20	277

1997	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	67.3	36.4	103.9	79.9	13.6	1.0	0.4	0.0	0.0	32.2	145.2	122.9	602.8
Non-rainy day	23	20	14	17	20	29	30	31	30	24	16	18	272

1998	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	144.4	72.5	178.4	47.2	29.0	10.2	1.3	0.0	0.6	0.0	51.1	0.2	534.9
Non-rainy day	13	11	17	21	23	27	30	31	29	31	27	30	290

1999	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	78.1	102.1	35.7	40.6	10.3	0.0	5.0	0.2	0.0	27.9	15.0	31.6	346.5
Non-rainy day	19	20	20	23	28	30	29	30	30	27	23	22	301

2000	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	118.1	29.3	71.1	37.0	3.9	0.0	0.4	0.0	5.5	18.1	14.1	103.5	401.0
Non-rainy day	19	21	23	22	27	30	30	31	28	26	23	14	294

2001	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	52.1	63.1	83.5	35.1	9.3	0.0	3.0	0.0	4.1	11.4	21.9	85.4	368.9
Non-rainy day	22	18	22	24	27	30	29	31	28	25	24	18	298

2002	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Sug.	Sep.	Oct.	Nov.	Dec.	Total
Total	74.6	48.9	68.3	158.3	4.3	0.0	0.0	0.0	0.0	25.4	59.3	125.7	564.8
Non-rainy day	17	23	22	10	28	30	31	31	30	28	22	15	287

2003	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Sug.	Sep.	Oct.	Nov.	Dec.	Total
Total	67.8	140.9	37.2	82.2	17.9	0.0	-	-	-	-	-	-	-
Non-rainy day	20	13	16	19	27	30	-	-	-	-	-	-	-

Average	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Sug.	Sep.	Oct.	Nov.	Dec.	Total
Total	84.6	74.2	92.0	70.5	23.5	2.5	0.9	0.0	0.8	25.3	60.2	85.6	520.1
Non-rainy day	19	17	19	20	25	29	30	31	30	27	22	20	289

Table A2.1.1 Observed Rainfall Data (4)

Station Name: Varmohang

1984	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	14.0	41.0	138.0	80.0	43.0	0.0	0.0	0.0	0.0	63.5	258.5	45.0	683.0
Non-rainy day	29	21	18	22	24	30	31	31	30	27	13	25	301

1985	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	73.0	78.0	75.5	75.0	7.0	4.0	0.0	0.0	0.0	0.0	112.5	139.5	564.5
Non-rainy day	18	16	22	20	28	29	31	31	30	31	23	19	298

1986	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	15.0	106.5	55.0	111.5	85.5	1.0	0.0	0.0	0.0	38.5	169.5	62.0	644.5
Non-rainy day	27	18	21	19	17	29	31	31	30	23	15	22	283

1987	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	19.0	100.5	230.0	49.5	13.5	0.0	9.0	0.0	0.0	188.5	67.0	166.0	843.0
Non-rainy day	26	14	11	22	26	30	27	31	30	17	27	19	280

1988	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	85.5	168.0	137.0	71.3	0.8	2.2	0.0	3.0	0.0	44.5	45.0	93.0	650.3
Non-rainy day	18	14	17	15	30	29	31	30	30	25	16	20	275

1989	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	68.0	52.5	163.0	9.5	24.5	0.0	0.0	0.0	0.0	12.0	103.0	127.5	560.0
Non-rainy day	20	21	9	25	29	30	31	31	30	28	19	22	295

1990	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	61.5	67.0	81.0	66.0	14.0	0.0	0.0	0.0	0.0	31.0	17.0	36.0	373.5
Non-rainy day	17	19	22	24	28	30	31	31	30	26	26	26	310

1991	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	45.0	109.0	120.5	64.5	3.0	0.0	0.0	0.0	0.0	45.0	13.5	148.5	549.0
Non-rainy day	23	17	20	24	29	30	31	31	30	23	27	15	300

1992	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	63.5	188.0	119.5	47.0	77.0	5.0	0.0	0.0	0.0	0.0	55.0	108.0	663.0
Non-rainy day	20	11	18	17	17	27	31	31	30	31	20	19	272

1993	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	79.5	56.0	86.0	95.5	80.0	0.0	0.0	0.0	0.0	49.5	122.5	91.5	660.5
Non-rainy day	21	22	22	17	21	30	31	31	30	26	19	25	295

1994	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	118.5	85.0	102.0	80.0	13.5	0.0	0.0	0.0	0.0	101.0	287.5	48.6	836.1
Non-rainy day	17	17	21	22	27	30	31	31	30	23	16	20	285

1995	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	38.7	86.0	60.0	138.9	104.0	23.2	0.0	0.0	0.2	0.0	33.3	9.3	493.6
Non-rainy day	25	17	24	13	19	26	31	31	29	31	22	27	295

1996	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	105.8	90.0	92.4	177.9	23.8	0.0	0.0	0.0	0.0	8.3	7.2	88.3	593.7
Non-rainy day	17	15	13	15	23	30	31	31	30	28	25	19	277

1997	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	56.2	34.7	114.7	87.2	17.6	0.4	0.0	0.0	-	-	-	-	-
Non-rainy day	26	22	15	23	24	29	31	31	-	-	-	-	-

Average	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Sug.	Sep.	Oct.	Nov.	Dec.	Total
Total	60.2	90.2	112.5	82.4	36.2	2.6	0.6	0.2	0.0	44.8	99.3	89.5	618.5
Non-rainy day	22	17	18	20	24	29	31	31	30	26	21	21	290

Table A2.1.1 Observed Rainfall Data (5)

Station Name: Jelogireh

1980	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	87.4	108.6	125.0	54.2	24.4	0.0	2.2	0.0	0.0	0.0	142.0	81.6	625.4
Non-rainy day	23	16	19	27	28	30	30	31	30	31	21	23	309

1981	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	82.2	117.9	119.2	-	-	-	-	-	-	86.7	42.8	10.0	-
Non-rainy day	21	15	19	-	-	-	-	-	-	25	28	30	-

1982	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	76.9	83.2	19.6	94.2	60.2	0.0	0.0	0.0	0.0	-	252.8	68.4	-
Non-rainy day	23	24	29	22	24	30	31	31	30	-	21	25	-

1983	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	54.1	66.7	50.5	64.1	24.0	-	-	-	-	-	52.5	94.8	-
Non-rainy day	26	21	22	26	25	-	-	-	-	-	26	22	-

1984	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	18.0	34.5	105.2	42.5	19.3	0.0	0.0	0.0	0.0	55.5	121.8	69.9	466.7
Non-rainy day	30	26	25	26	27	30	31	31	30	29	25	26	336

1985	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	102.0	60.4	104.5	78.3	3.7	0.0	0.0	0.0	0.0	0.0	178.8	138.7	666.4
Non-rainy day	22	20	24	23	30	30	31	31	30	31	19	21	312

1986	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	27.5	-	38.7	88.2	101.9	0.0	0.0	0.0	0.0	10.1	131.8	48.0	-
Non-rainy day	27	-	24	22	19	30	31	31	30	28	20	26	-

1987	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	12.0	56.5	221.0	23.7	18.1	0.0	2.8	0.0	0.0	147.4	35.6	147.6	664.7
Non-rainy day	30	21	15	25	26	30	30	31	30	23	26	21	308

1988	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	86.8	142.4	88.9	69.3	0.0	2.0	0.0	0.0	0.0	31.8	17.5	104.5	543.2
Non-rainy day	21	15	24	21	31	29	31	31	30	27	25	23	308

1989	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	66.1	48.3	182.8	17.8	8.0	0.0	0.0	0.0	0.0	5.7	93.2	131.8	553.7
Non-rainy day	22	21	17	27	29	30	31	31	30	29	22	23	312

1990	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	84.7	84.9	70.5	48.5	9.6	0.0	0.0	0.0	0.0	26.6	2.6	39.8	367.2
Non-rainy day	19	20	27	25	29	30	31	31	30	28	29	29	328

1991	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	69.7	119.0	116.7	42.6	0.0	0.0	0.0	0.0	0.0	40.3	8.0	184.1	580.4
Non-rainy day	22	21	20	26	31	30	31	31	30	24	28	18	312

1992	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	85.6	91.5	148.7	28.2	43.4	0.0	0.0	0.0	-	-	54.9	-	-
Non-rainy day	20	17	17	25	26	30	31	31	-	-	23	-	-

1993	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	74.4	53.1	67.6	106.6	71.1	1.5	0.0	0.0	0.0	55.5	85.1	64.6	579.5
Non-rainy day	24	23	24	19	24	29	31	31	30	27	20	25	307

1994	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	114.5	61.2	77.8	-	-	0.0	0.0	0.0	0.0	62.4	314.3	57.5	-
Non-rainy day	21	19	24	-	-	30	31	31	30	26	14	22	-

1995	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	21.0	62.0	70.1	102.3	39.5	5.0	0.0	0.0	0.0	0.0	14.0	7.2	321.1
Non-rainy day	29	20	25	20	20	28	31	31	30	31	26	28	319

1996	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	86.2	83.4	164.3	98.6	34.7	0.0	0.0	0.0	0.0	2.5	20.9	42.7	533.3
Non-rainy day	17	18	16	17	26	30	31	31	30	29	26	25	296

1997	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	66.6	23.0	111.7	62.5	8.5	0.0	0.0	0.0	0.0	16.0	96.2	99.4	483.9
Non-rainy day	27	23	19	22	28	30	31	31	30	27	23	22	313

1998	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	137.6	97.9	177.3	47.9	9.0	0.0	3.5	0.0	0.0	0.0	52.0	0.0	525.2
Non-rainy day	17	15	18	23	28	30	29	31	30	31	28	31	311

2001	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	28.5	2.5	80.6	45.3	8.5	0.0	2.5	0.0	6.2	13.9	18.5	95.5	302.0
Non-rainy day	28	28	23	26	28	30	30	31	28	29	28	25	334

2002	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	51.3	54.5	76.0	145.0	3.0	0.0	0.0	0.0	0.0	6.0	56.5	112.9	505.2
Non-rainy day	21	25	23	13	29	30	31	31	30	30	23	18	304

Average	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Sug.	Sep.	Oct.	Nov.	Dec.	Total
Total	68.2	72.6	105.6	66.3	25.6	0.4	0.6	0.0	0.3	31.1	85.3	80.0	536.0
Non-rainy day	23	20	22	23	27	30	31	31	30	28	24	24	313

Table A2.1.1 Observed Rainfall Data (6)

Station Name: Gahvareh

1990	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	107.0	32.0	91.0	35.5	30.0	0.0	0.0	0.0	0.0	16.0	7.5	-	-
Non-rainy day	18	24	19	26	29	30	31	31	30	29	27	-	-

1991	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	52.5	90.0	149.5	50.5	3.0	0.0	0.0	0.0	0.0	28.0	14.0	143.5	531.0
Non-rainy day	24	20	16	23	29	30	31	31	30	24	24	16	298

1992	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	61.0	88.8	136.0	25.0	45.7	3.0	0.0	0.0	0.0	0.0	53.5	95.5	508.5
Non-rainy day	17	10	15	23	21	28	31	31	30	31	21	20	278

1993	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	33.0	47.5	51.0	114.0	70.5	2.0	7.0	0.0	0.0	67.5	85.0	67.0	544.5
Non-rainy day	22	22	25	18	23	29	29	31	30	27	20	25	301

1994	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	116.0	83.0	93.0	38.0	2.0	0.0	0.0	0.0	0.5	69.5	296.0	57.5	755.5
Non-rainy day	24	16	21	23	29	30	31	31	29	23	15	19	291

1995	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	16.0	49.0	72.0	91.5	59.5	5.5	0.0	0.0	0.0	0.0	18.0	12.0	323.5
Non-rainy day	28	20	22	18	20	27	31	31	30	31	25	27	310

1996	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	76.0	82.5	128.3	70.5	23.0	0.0	2.5	0.0	0.0	4.5	25.0	34.0	446.3
Non-rainy day	18	17	13	17	23	30	29	31	30	29	26	24	287

1997	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	35.0	21.0	83.0	67.5	21.0	0.0	0.0	0.0	0.0	16.5	90.5	95.5	430.0
Non-rainy day	25	22	18	22	22	30	31	31	30	25	20	22	298

1998	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	148.0	77.0	240.5	48.5	23.0	0.5	0.0	0.0	0.5	0.0	54.5	0.0	592.5
Non-rainy day	15	16	15	23	27	29	31	31	29	31	28	31	306

2001	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	53.0	63.5	78.5	21.0	6.5	0.0	0.0	0.0	3.0	7.0	36.0	121.0	389.5
Non-rainy day	25	19	24	27	29	30	31	31	29	27	26	19	317

2002	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Total	76.5	50.5	80.0	140.0	2.0	0.0	0.0	0.0	0.0	8.5	71.5	150.5	579.5
Non-rainy day	20	24	23	17	29	30	31	31	30	30	23	19	307

Average	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Sug.	Sep.	Oct.	Nov.	Dec.	Total
Total	70.4	62.3	109.3	63.8	26.0	1.0	0.9	0.0	0.4	19.8	68.3	77.7	499.9
Non-rainy day	21	19	19	22	26	29	31	31	30	28	23	22	301

Table A2.1.2 Observed Monthly Discharge Data (1)

Station Name: Nahre Asli Unit: MCM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1956	4.54	8.10	14.22	18.99	19.76	14.00	8.85	6.50	-	-	2.64	2.55	-
1957	2.05	2.54	8.67	14.06	18.60	14.64	14.20	8.62	7.33	6.45	5.56	6.95	109.67
1958	7.91	8.44	11.82	11.23	8.34	7.38	3.38	2.90	3.30	3.30	1.82	7.13	76.95
1959	3.37	2.63	13.02	21.01	13.65	10.51	15.30	3.51	2.45	2.21	1.86	1.93	91.45
1960	1.83	1.54	2.41	7.14	7.98	4.28	2.54	1.50	1.24	1.19	1.41	1.36	34.42
1961	5.92	5.22	9.60	18.57	14.07	-	-	5.64	3.12	2.26	2.14	2.70	-
1962	6.19	9.04	13.14	11.19	7.93	4.42	3.26	2.63	2.08	1.79	1.31	2.94	65.92
1963	10.13	12.26	12.16	14.94	16.09	13.07	9.97	7.18	4.57	3.87	2.96	2.54	109.74
1964	2.68	4.40	10.71	13.99	11.48	6.07	4.41	3.14	2.44	1.97	1.56	1.33	64.18
1965	3.13	5.11	9.87	13.28	13.22	9.56	5.21	3.42	-	-	1.52	1.69	-
1966	1.41	3.88	11.46	13.41	12.51	-	-	-	-	0.51	1.58	1.67	-
1967	2.37	3.90	11.66	15.23	17.57	4.73	2.22	1.54	0.52	0.85	1.73	5.44	67.76
1968	6.85	6.61	12.22	14.03	13.94	7.81	3.46	1.03	0.25	0.14	3.38	8.63	78.35
1969	11.98	13.01	21.90	16.24	18.83	11.78	8.81	4.45	2.67	3.31	3.79	3.43	120.20
1970	6.01	9.14	14.39	13.63	12.42	6.93	3.21	2.94	1.34	0.03	1.25	2.29	73.58
1971	1.86	2.16	11.26	16.06	14.33	5.71	3.03	5.02	2.78	0.76	2.01	3.64	68.62
1972	4.44	5.52	11.32	15.26	17.38	14.64	11.15	8.06	6.08	3.86	2.45	3.20	103.36
1973	2.61	5.94	14.07	12.01	8.67	1.84	1.76	1.12	0.46	0.29	0.65	1.46	50.88
1974	1.94	3.86	22.65	22.11	17.53	10.66	7.35	5.52	2.95	1.79	2.45	2.71	101.52
1975	4.06	6.06	15.59	17.53	19.92	4.69	2.28	1.32	0.99	0.66	0.95	3.92	77.97
1976	7.06	10.71	14.80	23.77	23.86	9.47	5.43	3.34	1.66	1.45	2.79	2.80	107.14
1977	2.47	6.38	12.56	9.50	5.52	0.80	0.48	0.36	0.28	0.34	1.60	4.51	44.80
1978	9.16	13.08	20.30	17.74	6.39	2.98	2.36	2.09	0.94	0.57	0.86	1.39	77.86
1979	1.62	6.98	11.94	13.22	4.26	2.33	1.28	0.80	0.64	0.34	1.10	1.65	46.16
1980	3.02	6.07	13.64	17.59	13.60	5.92	3.84	2.93	1.25	1.95	5.74	3.05	78.60
1981	6.34	11.48	22.54	23.36	23.90	12.60	2.99	2.39	2.39	2.26	2.58	2.18	115.01
1982	2.71	5.33	14.36	27.16	37.07	25.49	15.13	3.70	0.70	0.77	5.32	5.47	143.21
1983	6.01	6.81	13.71	19.07	16.38	7.51	3.55	1.96	-	-	-	-	-
1986	4.69	6.60	10.78	13.70	14.30	4.99	2.30	0.41	0.06	0.52	2.29	4.28	64.92
1987	4.10	5.36	12.35	14.42	8.08	4.21	1.46	0.02	0.00	1.79	4.90	8.84	65.53
1988	10.31	10.89	20.29	19.77	12.85	3.79	2.08	1.04	0.14	1.45	2.63	4.33	89.57
1989	4.22	4.52	9.16	11.53	5.23	1.37	0.19	0.05	0.06	0.09	5.73	9.17	51.32
1990	6.49	8.67	11.36	7.35	3.72	1.16	0.08	0.03	0.07	0.94	0.65	0.51	41.03
1991	1.31	4.91	11.49	9.55	1.00	0.07	0.03	0.05	0.06	0.08	2.80	5.80	37.15
1992	3.86	7.60	12.88	14.29	16.48	12.18	5.71	1.27	0.07	0.11	1.51	3.17	79.13
1993	8.24	7.61	11.64	10.83	6.66	1.11	0.13	0.08	0.04	1.85	5.31	6.97	60.47
1994	9.99	10.76	14.68	15.45	5.53	0.22	0.08	0.08	0.09	6.09	14.91	18.29	96.17
1995	11.65	12.57	16.84	17.93	12.98	1.24	0.08	0.08	0.15	1.00	1.48	1.09	77.09
1996	1.72	5.37	11.61	19.92	12.97	5.27	1.52	1.02	0.00	0.00	0.54	2.02	61.96
1997	2.44	3.84	9.93	15.85	4.77	0.04	0.59	0.42	0.32	0.78	3.98	8.01	50.97
1998	7.12	12.13	25.14	18.44	6.40	2.32	3.33	1.67	1.51	2.17	2.43	2.53	85.19
Average	5.02	7.00	13.52	15.62	12.83	6.61	4.18	2.50	1.49	1.57	2.80	4.09	77.23

Table A2.1.2 Observed Monthly Discharge Data (2)

Station Name: Nahre Rast Unit: MCM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1976	0.00	0.00	0.00	0.00	0.00	1.07	1.49	0.99	1.07	0.50	0.07	0.00	5.19
1977	0.01	0.00	0.00	0.31	0.84	1.34	0.90	0.63	0.48	0.51	0.11	0.09	5.22
1978	0.00	0.00	0.00	0.12	0.48	0.68	1.13	0.90	0.68	0.40	0.20	0.00	4.59
1979	0.00	0.00	0.00	0.11	1.14	1.04	1.82	1.71	0.83	0.83	0.11	0.00	7.59
1980	0.00	0.00	0.00	0.00	0.63	1.13	0.59	0.63	1.08	0.60	0.03	0.00	4.69
1987	0.00	0.00	0.00	0.00	1.79	1.45	1.08	1.09	0.81	0.28	0.00	0.00	6.50
1988	0.00	0.00	0.00	0.00	2.54	3.19	2.41	4.32	2.50	0.50	0.00	0.00	15.46
1989	0.00	0.00	0.00	0.51	1.83	1.88	1.58	1.56	1.42	0.75	0.18	0.00	9.71
1990	0.00	0.00	0.00	0.18	1.68	2.08	1.52	1.15	0.86	0.21	0.17	0.20	8.05
1991	0.02	0.00	0.00	0.77	2.52	1.82	1.16	0.76	0.57	0.55	0.42	0.04	8.63
1992	0.00	0.00	0.00	0.00	0.29	2.18	3.20	2.66	1.98	1.30	0.50	0.02	12.13
1993	0.00	0.00	0.00	0.00	0.00	0.84	1.55	1.55	1.13	0.41	0.00	0.00	5.48
1994	0.00	0.00	0.00	0.33	1.84	2.43	1.78	1.14	0.67	0.39	0.00	0.00	8.58
1995	0.00	0.00	0.00	0.00	0.97	2.81	2.39	1.87	1.56	1.58	0.05	0.00	11.23
1996	0.00	0.00	0.00	0.00	0.98	1.56	1.78	1.59	1.14	0.95	0.49	0.06	8.55
1997	0.00	0.00	0.00	0.00	1.33	2.20	0.91	0.85	0.58	0.31	0.04	0.00	6.22
1998	0.00	0.00	0.00	0.74	2.10	1.94	1.98	1.48	0.88	0.48	0.07	0.00	9.67
Average	0.00	0.00	0.00	0.18	1.23	1.74	1.60	1.46	1.07	0.62	0.14	0.02	8.06

Station Name: Nahre Chap Unit: MCM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1976	0.00	0.00	0.00	0.00	0.03	1.19	1.25	1.26	1.22	1.13	0.00	0.00	6.08
1977	0.00	0.00	0.00	0.69	1.32	1.10	1.05	0.72	0.58	0.43	0.08	0.00	5.97
1978	0.00	0.00	0.00	0.38	1.47	1.32	1.27	0.99	0.90	0.99	0.42	0.00	7.74
1979	0.00	0.00	0.00	0.15	1.33	2.05	1.55	1.01	0.84	0.68	0.08	0.00	7.69
1980	0.00	0.00	0.00	0.00	0.59	1.49	1.28	0.87	1.07	1.13	0.05	0.54	7.02
1981	0.57	0.09	0.22	0.42	0.60	0.81	1.49	0.72	0.48	0.00	0.00	0.00	5.40
1982	0.00	0.00	0.00	0.00	0.00	1.00	0.80	1.19	1.32	1.36	0.00	0.00	5.67
1983	0.00	0.00	0.00	0.12	0.82	1.84	1.81	1.37	1.69	0.31	0.00	0.00	7.96
1987	0.00	0.00	0.00	0.00	2.74	2.33	2.46	2.46	1.82	0.84	0.14	0.00	12.79
1988	0.00	0.00	0.00	0.00	1.99	3.54	2.28	2.15	2.07	1.12	0.00	0.00	13.15
1989	0.00	0.00	0.00	1.12	3.31	3.19	2.56	1.92	1.46	1.35	0.72	0.00	15.63
1990	0.00	0.00	0.00	0.58	2.39	2.84	2.69	1.97	1.33	0.35	0.74	0.84	13.73
1991	0.09	0.00	0.00	0.57	2.38	2.33	2.01	1.59	1.34	1.11	0.54	0.06	12.02
1992	0.00	0.00	0.00	0.00	0.00	0.46	2.87	2.13	1.97	1.59	0.66	0.03	9.71
1995	0.00	0.00	0.00	0.00	1.11	3.37	3.65	3.68	2.82	2.76	0.09	0.00	17.48
1996	0.00	0.00	0.00	0.00	1.19	2.47	3.39	2.81	1.88	1.56	1.43	0.17	14.90
1997	0.00	0.00	0.00	0.00	3.88	4.00	2.49	1.96	1.34	1.18	0.22	0.00	15.07
1998	0.00	0.00	0.00	0.71	2.17	3.39	2.93	2.43	2.46	0.68	0.06	0.00	14.83
Average	0.04	0.01	0.01	0.26	1.52	2.15	2.10	1.74	1.48	1.03	0.29	0.09	10.72

Table A2.1.2 Observed Monthly Discharge Data (3)

Station Name: Doab Marak Unit: MCM

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1958	22.84	24.30	42.51	24.43	10.80	7.62	5.52	3.75	3.09	4.31	5.07	13.16	167.40
1959	8.39	7.07	34.15	50.62	19.88	8.48	5.37	3.88	3.54	4.82	6.16	5.73	158.09
1960	6.38	5.01	6.00	32.57	9.30	2.55	1.43	0.78	0.99	1.34	3.59	3.92	73.86
1961	56.58	12.70	17.42	36.38	43.83	7.49	4.51	2.60	2.41	3.11	5.62	7.12	199.77
1980	7.46	23.35	77.89	73.02	25.93	11.48	10.05	8.44	6.74	4.81	8.70	9.97	267.84
1981	25.63	30.84	71.56	54.71	26.01	12.82	9.17	6.46	4.13	5.12	6.35	7.65	260.45
1982	6.63	10.67	54.34	55.70	40.68	15.03	10.31	7.50	5.88	7.05	19.57	15.92	249.28
1983	22.10	29.44	51.54	51.77	30.78	13.86	6.78	6.01	5.02	6.68	8.05	12.74	244.77
1984	9.82	9.52	16.93	18.54	11.15	3.75	2.20	2.03	2.54	4.35	15.64	25.15	121.62
1985	33.84	37.18	52.60	55.45	28.30	13.90	8.70	5.94	4.35	4.53	7.83	14.43	267.05
1986	11.38	23.13	23.95	28.98	27.88	11.60	8.29	4.12	3.21	4.07	7.39	12.88	166.88
1987	10.44	9.94	64.94	47.20	16.38	8.57	5.89	4.49	3.38	9.54	11.70	20.48	212.95
1988	25.05	49.57	141.70	58.39	27.15	12.83	8.64	5.46	5.57	7.48	8.51	9.91	360.26
1989	8.47	7.99	76.87	40.08	16.17	6.64	3.34	2.83	2.88	4.04	6.66	20.78	196.75
1990	18.80	30.39	50.59	30.90	12.40	4.47	4.43	2.62	1.88	4.75	5.00	4.10	170.33
1991	5.90	5.54	35.81	28.77	6.78	5.38	7.10	4.65	1.42	3.76	3.52	10.20	118.83
1992	8.91	27.64	69.69	86.18	54.57	17.50	10.47	5.48	4.36	6.54	7.44	10.79	309.57
1993	13.80	11.94	20.47	19.40	22.46	6.65	3.67	1.45	1.33	2.06	6.46	13.61	123.30
1994	21.00	24.40	55.92	31.63	15.14	6.00	3.44	1.73	3.37	6.54	57.70	42.67	269.54
1995	41.31	37.25	39.72	47.53	33.06	10.86	5.03	3.22	-	-	-	-	-
1996	-	-	-	-	-	-	-	-	-	4.58	7.06	9.48	-
1997	9.04	7.19	21.19	37.61	14.75	3.12	2.48	1.11	1.94	3.27	6.27	11.03	119.00
1998	13.92	37.73	100.13	79.86	32.81	11.81	7.70	4.94	4.55	6.79	8.80	8.81	317.85
1999	8.95	10.43	13.87	11.06	1.57	0.26	0.14	0.14	0.60	1.28	2.05	2.49	52.84
Average	17.25	20.57	49.56	43.51	22.95	8.81	5.85	3.90	3.33	4.82	9.79	12.74	203.08

Table A2.2.1 (1) Data on Water Level of the Observation Wells

No.	Name of Village	Depth o Well (m
1	Khoram Abad	24.5
2	Nahrabi	60.0
3	Tam Tam	23.0
4	Jir Abad	21.0
5	Jan Jan	21.5
6	Hossein Abad	21.3
7	Bildad	20.7
8	Gargabi	20.0

Table A2.2.1 (2) Data on Water Level of the Observation Wells

No.	Name of Village	Depth of Well (m)	Absolute Elevation	Absolute Elevation of Water Level (1995)											
				Jan.	Feb.	Mar	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	Khoram Abad	24.5	1,339.92	1,335.62		1,335.70			1,335.68		1,335.82	1,335.72	1,335.12	1,334.94	1,334.68
2	Nahrabi	60.0	1,345.37	1,341.67		1,341.56			1,342.17		1,341.47	1,340.99	1,340.40	1,340.30	1,339.97
3	Tam Tam	23.0	1,331.64	1,329.44		1,329.46			1,329.95		1,329.64	1,329.24	1,328.94	1,328.82	1,328.38
4	Jir Abad	21.0	1,331.50	1,329.10		1,328.97			1,328.96		1,328.60	1,328.45	1,328.40	1,328.31	1,328.02
5	Jan Jan	21.5	1,344.16	1,342.16		1,342.01			1,340.06		1,339.46	1,339.11	1,338.64	1,338.48	1,338.13
6	Hossein Abad	21.3	1,328.22	1,326.77		1,326.81			1,326.82		1,326.47	1,325.97	1,324.38	1,324.25	1,323.89
7	Bildad	20.7	1,325.00	1,322.60		1,322.40			1,322.00		1,321.07	1,320.60	1,320.50	1,320.34	1,320.03
8	Gargabi	20.0	1,326.70			1,323.53					1,320.80	1,320.65	1,320.60	1,320.41	1,319.98
9	Siyah Siyah	24.3	1,326.65	1,324.05		1,323.96					1,322.35	1,322.25	1,322.18	1,322.03	1,321.67
10	Goraz Abad	17.5	1,321.92	1,317.37		1,317.31					1,315.52	1,315.12	1,314.87	1,314.79	1,314.33
11	Tapeh Lori		1,321.41	1,317.01		1,316.65			1,314.75		1,315.11	1,314.96	1,314.48	1,314.35	1,313.89
12	Kordvand	30.0	1,322.34	1,320.24		1,320.14			1,319.07		1,318.07	1,317.79	1,317.39	1,317.24	1,316.86
13	Deh Mireh	30.0	1,321.50	1,319.65		1,319.20			1,319.15		1,317.96	1,317.75	1,317.65	1,317.52	1,317.11
14	Elyasei		1,324.01								1,321.09	1,321.01	1,320.91	1,320.78	1,320.46
15	Dayar	22.5	1,339.99	1,330.49		1,330.38					1,328.69	1,328.39	1,328.29	1,328.05	1,327.62
16	Haji Abad	30.0	1,321.39	1,316.89		1,316.83			1,318.89		1,317.97	1,317.59	1,317.14	1,316.99	1,316.62
17	Jafar Abad	30.0	1,325.17	1,321.97		1,322.17			1,322.73		1,322.37	1,322.12	1,321.87	1,321.71	1,321.38
18	Sarbor	30.0	1,330.75	1,329.58		1,328.77									
19	Chogha Khazan		1,337.34	1,335.04		1,334.92					1,333.64	1,333.54	1,333.49	1,333.37	1,333.00
20	Chogha Elani	6.4	1,325.19	1,322.29		1,322.36			1,321.19		1,320.29	1,319.99	1,319.89	1,319.71	1,319.28
21	Ghale Galineh	24.0	1,332.24	1,329.04		1,328.83			1,330.69		1,330.04	1,329.29	1,329.19	1,329.07	1,328.72
22	Mir Azizi	27.0	1,344.73	1,243.73		1,343.55			1,342.91		1,342.50	1,342.41	1,342.38	1,342.22	1,341.81
23	Kuzaran	30.0	1,353.60	1,348.10		1,348.65			1,348.80		1,348.10	1,347.53	1,347.05	1,346.87	1,346.54
24	Khalwan	30.0	1,357.97	1,350.57		1,350.41			1,351.90		1,351.17	1,350.30	1,349.97	1,349.84	1,349.51

Table A2.2.1 (3) Data on Water Level of the Observation Wells

No.	Name of Village	Depth of Well (m)	Absolute Elevation	Absolute Elevation of Water Level (1996)											
				Jan.	Feb.	Mar	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	Khoram Abad	24.5	1,339.92		1,333.42		1,335.87	1,336.92	1,336.44	1,336.44	1,336.11	1,335.86	1,335.26	1,335.00	1,334.65
2	Nahrabi	60.0	1,345.37		1,340.87		1,342.37	1,341.87	1,341.70	1,341.70	1,341.54	1,341.20	1,340.54	1,340.35	1,339.92
3	Tam Tam	23.0	1,331.64		1,329.04		1,330.49	1,330.14	1,329.79	1,329.79	1,329.72	1,329.39	1,329.06	1,328.87	1,328.28
4	Jir Abad	21.0	1,331.50		1,329.00		1,330.20	1,329.11	1,328.88	1,328.88	1,328.63	1,328.50	1,328.35	1,328.18	1,327.97
5	Jan Jan	21.5	1,344.16		1,337.46		1,338.31	1,340.11	1,339.89	1,339.89	1,339.76	1,339.34	1,338.77	1,338.58	1,338.39
6	Hossein Abad	21.3	1,328.22		1,324.17		1,324.52	1,326.92	1,326.67	1,326.67	1,326.42	1,326.05	1,324.58	1,324.32	1,323.80
7	Bildad	20.7	1,325.00		1,320.85		1,322.30	1,322.45	1,322.07	1,322.07	1,321.83	1,321.36	1,320.82	1,320.51	1,319.96
8	Gargabi	20.0	1,326.70		1,321.40		1,322.22	1,322.90	1,320.82	1,320.82	1,320.77	1,320.65	1,320.53	1,320.44	1,319.80
9	Siyah Siyah	24.3	1,326.65		1,322.97		1,324.15	1,323.29	1,323.02	1,323.02	1,322.81	1,322.33	1,322.20	1,321.98	1,321.70
10	Goraz Abad	17.5	1,321.92		1,315.62		1,316.68	1,316.22	1,315.95	1,315.95	1,315.70	1,315.31	1,315.02	1,314.77	1,314.30
11	Tapeh Lori		1,321.41		1,315.07		1,315.91	1,315.63	1,315.24	1,315.24	1,314.93	1,314.81	1,314.41	1,314.19	1,313.95
12	Kordvand	30.0	1,322.34		1,319.04		1,320.36	1,319.38	1,319.06	1,319.06	1,318.73	1,318.15	1,317.53	1,317.22	1,316.76
13	Deh Mireh	30.0	1,321.50		1,318.28		1,319.60	1,318.68	1,318.20	1,318.20	1,317.88	1,317.69	1,317.56	1,317.42	1,317.07
14	Elyasei		1,324.01		1,321.08		1,322.16	1,321.75	1,321.43	1,321.43	1,321.28	1,321.06	1,320.93	1,320.73	1,320.28
15	Dayar	22.5	1,339.99		1,329.21		1,330.49	1,330.64	1,329.96	1,329.96	1,329.82	1,329.16	1,328.45	1,328.16	1,327.80
16	Haji Abad	30.0	1,321.39		1,318.01		1,318.44	1,318.49	1,318.17	1,318.17	1,317.84	1,317.61	1,317.22	1,316.93	1,316.54
17	Jafar Abad	30.0	1,325.17		1,322.35		1,323.47	1,322.84	1,322.48	1,323.48	1,322.30	1,322.17	1,321.81	1,321.65	1,321.25
18	Sarbor	30.0	1,330.75												
19	Chogha Khazan		1,337.34		1,333.29		1,334.32	1,333.92	1,333.80	1,333.80	1,333.72	1,333.46	1,333.42	1,333.29	1,332.46
20	Chogha Elani	6.4	1,325.19		1,320.61		1,321.59	1,321.53	1,320.87	1,320.87	1,320.65	1,320.21	1,319.95	1,319.69	1,319.41
21	Ghale Galineh	24.0	1,332.24		1,330.37		1,331.44	1,330.26	1,330.03	1,330.03	1,329.77	1,329.67	1,329.31	1,328.97	1,328.64
22	Mir Azizi	27.0	1,344.73		1,342.48		1,343.23	1,343.08	1,343.47	1,342.77	1,342.34	1,342.26	1,342.21	1,342.08	1,341.57
23	Kuzaran	30.0	1,353.60		1,347.42		1,348.30	1,348.43	1,347.88	1,347.88	1,347.66	1,347.48	1,346.96	1,346.76	1,346.60
24	Khalwan	30.0	1,357.97		1,350.02		1,350.87	1,351.64	1,351.10	1,351.10	1,350.82	1,350.45	1,349.90	1,349.70	1,349.56

Table A2.2.1 (4) Data on Water Level of the Observation Wells

No.	Name of Village	Depth of Well (m)	Absolute Elevation	Absolute Elevation of Water Level (1997)											
				Jan.	Feb.	Mar	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	Khoram Abad	24.5	1,339.92	1,333.72	1,333.21	1,334.33	1,335.02	1,335.45	1,335.30	1,335.03	1,334.87		1,332.69	1,332.81	1,333.22
2	Nahrabi	60.0	1,345.37	1,340.40	1,339.99	1,341.07	1,341.40	1,341.72	1,341.49	1,341.11	1,340.85		1,338.85	1,339.20	1,339.44
3	Tam Tam	23.0	1,331.64	1,328.52	1,328.24	1,328.90	1,329.04	1,329.44	1,329.28	1,328.99	1,328.71		1,326.71	1,326.88	1,327.88
4	Jir Abad	21.0	1,331.50	1,328.43	1,327.65	1,328.58	1,328.78	1,328.95	1,328.61	1,328.33	1,328.16		1,326.75	1,326.95	1,327.52
5	Jan Jan	21.5	1,344.16	1,337.84	1,336.92	1,337.68	1,337.82	1,338.42	1,338.19	1,337.74	1,337.41		1,335.92	1,336.03	1,337.25
6	Hossein Abad	21.3	1,328.22	1,320.94	1,321.37	1,322.34	1,323.57	1,324.40	1,324.22	1,324.01	1,323.78		1,322.10	1,322.20	1,323.40
7	Bildad	20.7	1,325.00	1,321.00	1,320.58	1,321.42	1,321.76	1,322.18	1,321.96	1,321.65	1,321.22		1,319.83	1,320.02	1,320.29
8	Gargabi	20.0	1,326.70	1,321.37	1,320.76	1,321.53	1,321.77	1,321.70	1,321.02	1,320.55	1,320.35		1,318.94	1,319.11	1,320.37
9	Siyah Siyah	24.3	1,326.65	1,322.44	1,322.28	1,323.42	1,323.65	1,323.81	1,323.22	1,322.81	1,322.42		1,321.03	1,321.17	1,321.76
10	Goraz Abad	17.5	1,321.92	1,314.74	1,314.45	1,315.57	1,315.87	1,316.07	1,315.77	1,315.44	1,315.06		1,313.67	1,313.96	1,314.38
11	Tapeh Lori		1,321.41	1,314.47	1,314.33	1,315.24	1,315.58	1,315.83	1,315.46	1,315.09	1,314.82		1,313.44	1,313.58	1,313.92
12	Kordvand	30.0	1,322.34	1,317.08	1,317.00	1,318.12	1,319.19	1,319.63	1,319.16	1,318.79	1,318.44		1,317.02	1,317.23	1,317.50
13	Deh Mireh	30.0	1,321.50	1,317.50	1,317.33	1,318.30	1,318.86	1,319.05	1,318.57	1,318.05	1,317.68		1,316.30	1,316.62	1,317.03
14	Elyasei		1,324.01	1,321.73	1,320.96	1,321.81	1,321.92	1,322.09	1,321.46	1,321.15	1,320.84		1,319.34	1,319.53	1,320.22
15	Dayar	22.5	1,339.99			1,328.45	1,328.89	1,329.56	1,329.17	1,328.92	1,328.67			1,328.89	
16	Haji Abad	30.0	1,321.39	1,317.14	1,316.60	1,317.84	1,318.27	1,318.63	1,318.19	1,317.93	1,317.60		1,316.20	1,316.46	1,316.81
17	Jafar Abad	30.0	1,325.17	1,321.69	1,321.98	1,322.92	1,323.12	1,323.24	1,322.77	1,322.20	1,321.95		1,320.57	1,320.79	1,321.26
18	Sarbor	30.0	1,330.75												
19	Chogha Khazan		1,337.34	1,332.73	1,332.01	1,332.84	1,333.17	1,333.58	1,333.29	1,332.96	1,332.56		1,331.02	1,331.17	1,332.36
20	Chogha Elani	6.4	1,325.19	1,319.79	1,320.26	1,320.91	1,321.11	1,321.35	1,320.93	1,320.62	1,320.29			1,319.47	1,319.63
21	Ghale Galineh	24.0	1,332.24	1,328.99	1,329.59	1,330.71			1,330.34	1,329.82	1,329.51		1,328.14	1,328.28	1,328.70
22	Mir Azizi	27.0	1,344.73	1,341.86	1,341.65	1,342.45			1,342.66	1,342.40	1,342.09		1,340.57	1,340.80	1,341.22
23	Kuzaran	30.0	1,353.60	1,346.77	1,346.67	1,347.74			1,347.95	1,347.66	1,347.24		1,345.90	1,346.14	1,346.62
24	Khalwan	30.0	1,357.97	1,349.79	1,349.61	1,350.43			1,350.82	1,350.67	1,350.25		1,348.74	1,348.99	1,349.54

Table A2.2.1 (5) Data on Water Level of the Observation Wells

No.	Name of Village	Depth of Well (m)	Absolute Elevation	Absolute Elevation of Water Level (1998)											
				Jan.	Feb.	Mar	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	Khoram Abad	24.5	1,339.92			1,335.71	1,336.01				1,336.17	1,335.37	1,335.17	1,334.99	
2	Nahrabi	60.0	1,345.37		1,340.09	1,342.43	1,343.02				1,341.42	1,340.62	1,340.47	1,340.22	
3	Tam Tam	23.0	1,331.64			1,330.34	1,330.56				1,327.29	1,326.54	1,326.39	1,326.24	
4	Jir Abad	21.0	1,331.50			1,329.45	1,329.59				1,328.12	1,327.12	1,326.95	1,326.68	
5	Jan Jan	21.5	1,344.16			1,340.33	1,340.60				1,339.84	1,338.91	1,338.51	1,337.91	
6	Hossein Abad	21.3	1,328.22			1,325.98	1,326.11				1,326.77	1,325.32	1,324.97	1,324.42	
7	Bildad	20.7	1,325.00			1,322.83	1,323.02				1,321.30	1,320.15	1,320.05	1,319.82	
8	Gargabi	20.0	1,326.70			1,322.19	1,322.61								
9	Siyah Siyah	24.3	1,326.65			1,324.25	1,324.47				1,322.22	1,321.45	1,321.25	1,320.97	
10	Goraz Abad	17.5	1,321.92			1,316.98	1,317.35				1,315.40	1,314.57	1,314.40	1,314.02	
11	Tapeh Lori		1,321.41			1,319.34	1,319.53				1,314.44	1,313.31	1,313.06	1,312.69	
12	Kordvand	30.0	1,322.34		1,316.74	1,319.47	1,320.56				1,318.24	1,317.14	1,316.94	1,316.79	
13	Deh Mireh	30.0	1,321.50		1,317.81	1,319.49	1,320.45				1,317.92	1,317.05	1,316.70	1,316.35	
14	Elyasei		1,324.01			1,322.37	1,322.48				1,321.69		1,320.16	1,319.71	
15	Dayar	22.5	1,339.99			1,333.24	1,333.75				1,331.24	1,330.14	1,329.94	1,329.39	
16	Haji Abad	30.0	1,321.39		1,315.71	1,318.98	1,319.78				1,316.81	1,316.04	1,315.64	1,315.29	
17	Jafar Abad	30.0	1,325.17			1,323.34	1,323.53				1,322.72	1,321.12	1,320.82	1,320.32	
18	Sarbor	30.0	1,330.75												
19	Chogha Khazan		1,337.34			1,335.18	1,335.33								
20	Chogha Elani	6.4	1,325.19			1,322.48	1,322.64				1,321.29	1,320.24	1,319.94	1,319.59	
21	Ghale Galineh	24.0	1,332.24			1,330.15	1,330.35				1,329.34	1,328.04		1,327.14	
22	Mir Azizi	27.0	1,344.73		1,342.20	1,342.70	1,342.90								
23	Kuzaran	30.0	1,353.60		1,345.14	1,348.74	1,349.99				1,348.45	1,347.50		1,346.75	
24	Khalwan	30.0	1,357.97		1,348.66	1,352.21	1,352.75				1,351.04	1,350.12		1,349.24	

Table A2.2.1 (6) Data on Water Level of the Observation Wells

No.	Name of Village	Depth of Well (m)	Absolute Elevation	Absolute Elevation of Water Level (1999)											
				Jan.	Feb.	Mar	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	Khoram Abad	24.5	1,339.92	1,335.12	1,336.72		1,334.52	1,334.76	1,334.49	1,334.58	1,333.34	1,333.24	1,333.12	1,332.96	1,332.52
2	Nahrabi	60.0	1,345.37	1,339.92	1,341.57			1,342.17	1,338.27	1,337.20					
3	Tam Tam	23.0	1,331.64	1,328.74	1,328.69		1,329.24	1,328.15	1,327.62	1,327.14	1,326.06	1,325.70	1,325.30	1,327.00	1,327.04
4	Jir Abad	21.0	1,331.50	1,327.30	1,328.80		1,328.90	1,328.34	1,327.98	1,327.30	1,326.09	1,325.70	1,325.40	1,326.60	1,327.16
5	Jan Jan	21.5	1,344.16	1,339.06	1,340.06										
6	Hossein Abad	21.3	1,328.22	1,325.02	1,325.42		1,321.56	1,321.16	1,320.39	1,319.70	1,318.85	1,318.58	1,318.24	1,318.43	1,318.44
7	Bildad	20.7	1,325.00	1,320.70	1,321.90		1,320.95	1,321.19	1,321.35	1,321.53	1,321.70	1,321.89	1,321.90	1,320.34	1,320.32
8	Gargabi	20.0	1,326.70					1,321.54	1,320.42	1,320.38	1,319.98	1,319.94	1,319.90	1,320.36	1,320.00
9	Siyah Siyah	24.3	1,326.65	1,321.90	1,323.45		1,322.75	1,322.29	1,322.19	1,322.88	1,322.85	1,322.39	1,322.15	1,322.21	1,322.17
10	Goraz Abad	17.5	1,321.92	1,315.12	1,317.37					1,314.82	1,314.48	1,314.27	1,314.14	1,314.25	1,314.34
11	Tapeh Lori		1,321.41	1,315.26	1,316.51			1,313.88	1,313.53	1,313.39	1,312.93	1,312.67	1,312.49	1,312.43	1,315.38
12	Kordvand	30.0	1,322.34	1,317.54	1,318.39		1,318.22	1,317.02	1,316.05	1,316.51	1,316.86	1,317.72	1,317.49	1,316.56	1,316.42
13	Deh Mireh	30.0	1,321.50	1,316.40	1,317.25		1,317.80	1,317.47	1,317.13	1,317.52	1,316.95	1,316.85	1,316.58	1,316.65	1,317.25
14	Elyasei		1,324.01	1,321.31	1,321.71			1,321.50	1,321.39	1,320.99	1,320.80	1,320.68	1,320.53	1,321.43	1,321.49
15	Dayar	22.5	1,339.99	1,329.19	1,331.84		1,328.24	1,327.46	1,327.28	1,327.08	1,326.43	1,326.10	1,325.93	1,327.20	1,327.94
16	Haji Abad	30.0	1,321.39	1,316.29	1,317.04		1,316.29	1,316.30	1,316.23	1,316.10	1,316.04	1,315.97	1,315.89	1,315.70	1,315.69
17	Jafar Abad	30.0	1,325.17	1,320.79	1,321.07			1,321.69	1,321.71	1,321.47	1,321.35	1,321.37	1,321.28	1,321.19	1,320.47
18	Sarbor	30.0	1,330.75												
19	Chogha Khazan		1,337.34												
20	Chogha Elani	6.4	1,325.19	1,321.14	1,321.99			1,319.49		1,319.30					
21	Ghale Galineh	24.0	1,332.24	1,328.06	1,328.49		1,328.14	1,327.80	1,328.57	1,328.47	1,328.38	1,328.30	1,328.17	1,328.02	1,328.52
22	Mir Azizi	27.0	1,344.73					1,342.12	1,341.98	1,341.79	1,341.76	1,341.60	1,341.43	1,341.33	1,340.75
23	Kuzaran	30.0	1,353.60	1,347.70	1,348.50		1,346.90	1,346.42	1,346.20	1,345.71	1,345.35	1,345.15	1,344.93	1,344.71	1,344.50
24	Khalwan	30.0	1,357.97	1,350.17	1,351.82		1,350.17	1,348.40	1,348.21	1,347.61	1,346.75	1,346.63	1,346.50	1,347.27	1,347.12

Table A2.2.1 (7) Data on Water Level of the Observation Wells

No.	Name of Village	Depth of Well (m)	Absolute Elevation	Absolute Elevation of Water Level (2000)											
				Jan.	Feb.	Mar	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	Khoram Abad	24.5	1,339.92	1,332.36	1,332.25	1,332.11	1,332.20	1,333.70	1,333.70	1,333.22	1,332.91				
2	Nahrabi	60.0	1,345.37									1,329.37			
3	Tam Tam	23.0	1,331.64	1,327.07	1,327.12	1,327.25	1,327.49	1,326.84	1,326.75	1,323.33	1,321.99	1,321.04			
4	Jir Abad	21.0	1,331.50	1,327.26	1,325.19	1,324.60	1,327.83	1,327.55	1,325.38	1,323.21	1,321.42	1,320.39			
5	Jan Jan	21.5	1,344.16												
6	Hossein Abad	21.3	1,328.22	1,318.43	1,317.97	1,317.74	1,317.80	1,318.73	1,318.64	1,317.40	1,316.83	1,316.49			
7	Bildad	20.7	1,325.00	1,320.33	1,320.51	1,320.45	1,320.64	1,321.46	1,322.35	1,320.30	1,320.02	1,319.65			
8	Gargabi	20.0	1,326.70	1,320.24	1,320.23	1,320.39	1,320.64	1,320.28	1,320.17	1,319.92	1,319.80	1,319.57			
9	Siyah Siyah	24.3	1,326.65	1,322.19	1,320.35	1,319.30	1,322.64	1,318.74	1,322.53	1,318.06	1,317.82	1,317.70			
10	Goraz Abad	17.5	1,321.92	1,314.48	1,314.63	1,314.84	1,315.07	1,314.94	1,314.62	1,314.26	1,313.62	1,313.57			
11	Tapeh Lori		1,321.41	1,315.47	1,315.72	1,317.20	1,312.23	1,312.12	1,312.07	1,311.07	1,310.54	1,310.01			
12	Kordvand	30.0	1,322.34	1,316.41	1,316.19	1,316.11	1,316.09	1,316.05	1,315.99	1,315.70	1,315.32	1,314.91			
13	Deh Mireh	30.0	1,321.50	1,317.32	1,317.21	1,317.18	1,317.12	1,317.15	1,316.83	1,316.52	1,316.09	1,315.63			
14	Elyasei		1,324.01	1,321.50	1,321.57	1,321.54	1,321.72	1,321.80	1,321.64	1,321.13	1,319.21	1,318.32			
15	Dayar	22.5	1,339.99	1,328.42	1,327.92	1,328.06	1,327.14	1,327.71	1,325.67	1,325.30	1,324.60	1,322.39			
16	Haji Abad	30.0	1,321.39	1,315.34	1,315.50	1,315.42	1,315.31	1,315.02	1,316.00	1,314.96	1,314.45	1,314.02			
17	Jafar Abad	30.0	1,325.17	1,319.85	1,320.08	1,319.86	1,320.00	1,320.06	1,320.00	1,319.68	1,319.27	1,318.80			
18	Sarbor	30.0	1,330.75												
19	Chogha Khazan		1,337.34												
20	Chogha Elani	6.4	1,325.19												
21	Ghale Galineh	24.0	1,332.24	1,328.54	1,328.43	1,328.40	1,328.51	1,328.56	1,328.29	1,328.05	1,327.76	1,327.56			
22	Mir Azizi	27.0	1,344.73	1,341.47	1,341.14	1,341.46	1,341.52	1,341.39	1,341.22	1,340.89	1,340.60	1,340.34			
23	Kuzaran	30.0	1,353.60	1,344.36	1,344.28	1,344.13	1,344.15	1,344.03	1,343.71	1,343.49	1,343.09	1,342.23			
24	Khalwan	30.0	1,357.97	1,347.48	1,347.49	1,347.63	1,347.67	1,347.58	1,344.87	1,344.25	1,342.86	1,342.22			

Table A2.2.1 (8) Data on Water Level of the Observation Wells

No.	Name of Village	Depth of Well (m)	Absolute Elevation	Absolute Elevation of Water Level (2001)											
				Jan.	Feb.	Mar	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1	Khoram Abad	24.5	1,339.92												
2	Nahrabi	60.0	1,345.37			1,329.44	1,329.93								
3	Tam Tam	23.0	1,331.64			1,324.66	1,325.45	1,325.04	1,321.84		1,317.94	1,316.04			
4	Jir Abad	21.0	1,331.50			1,324.01	1,324.70	1,323.56	1,320.10		1,318.00	1,316.40			
5	Jan Jan	21.5	1,344.16												
6	Hossein Abad	21.3	1,328.22			1,316.51	1,316.64	1,316.57	1,315.92						
7	Bildad	20.7	1,325.00			1,319.96	1,320.09	1,321.50	1,321.38		1,319.75	1,319.70			
8	Gargabi	20.0	1,326.70			1,321.91	1,322.13	1,322.01	1,321.61		1,321.24	1,320.67			
9	Siyah Siyah	24.3	1,326.65			1,322.32	1,322.55	1,322.46	1,322.09		1,320.71	1,319.93			
10	Goraz Abad	17.5	1,321.92			1,314.78	1,314.91	1,315.02	1,314.11		1,313.54	1,312.82			
11	Tapeh Lori		1,321.41												
12	Kordvand	30.0	1,322.34			1,316.43	1,316.54	1,316.55	1,316.16		1,314.69	1,314.51			
13	Deh Mireh	30.0	1,321.50			1,317.00	1,317.11	1,316.90	1,316.39		1,315.39	1,315.23			
14	Elyasei		1,324.01			1,320.30	1,320.51	1,320.47	1,319.54		1,317.88	1,317.38			
15	Dayar	22.5	1,339.99			1,325.42	1,325.55	1,325.59	1,324.31		1,321.50	1,319.69			
16	Haji Abad	30.0	1,321.39			1,316.30	1,315.41	1,315.59	1,314.18		1,311.61	1,311.43			
17	Jafar Abad	30.0	1,325.17			1,319.71	1,319.88	1,319.83	1,319.50		1,318.22	1,317.99			
18	Sarbor	30.0	1,330.75												
19	Chogha Khazan		1,337.34												
20	Chogha Elani	6.4	1,325.19												
21	Ghale Galineh	24.0	1,332.24			1,329.06	1,328.95	1,328.84	1,328.65		1,327.23	1,326.65			
22	Mir Azizi	27.0	1,344.73			1,340.83	1,341.04	1,341.12	1,340.70		1,339.76	1,339.02			
23	Kuzaran	30.0	1,353.60			1,342.21	1,342.44	1,342.37	1,340.62		1,339.85	1,339.40			
24	Khalwan	30.0	1,357.97			1,344.41	1,344.52	1,344.46	1,340.62		1,337.82	1,337.82			

Fig. A2.2.1 Tendency of Observation Well

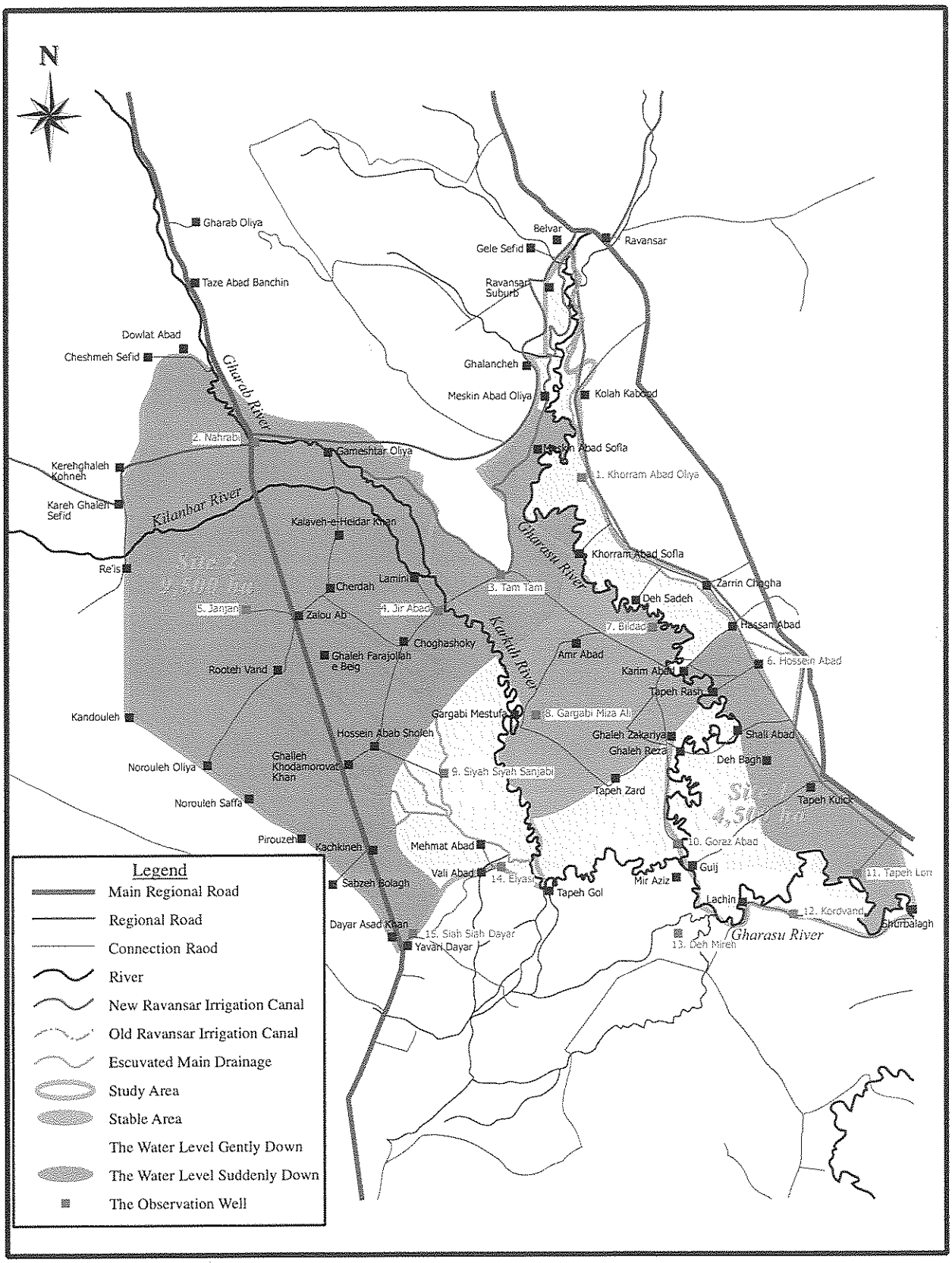


Fig. A2.2.2 Present Condition of Groundwater

Annex 3	**Irrigation and Drainage**

ANNEX 3

IRRIGATION AND DRAINAGE

A3.1 Irrigation Plan

A3.1.1 Stakeholders of the Ravansar Spring

Stakeholders of the Ravansar spring can be divided into four areas such as Khoshkehrud irrigation canal which takes the water from the Ravansar spring directly, left bank irrigation canal and right bank irrigation canal which distributes the water from diversion weir, which is located at approximately 1.0 km downstream from the Ravansar spring and an area where the irrigation water is pumped up from the Gharasu River directly. According to the registered list of water right holding area from KWA, summary of Water User Concerning the Ravansar Spring and the Gharasu River is shown in Table A3.1.1.

A3.1.2 Crop Coefficient

Recommended crops in the proposed cropping patterns are maize, maize for silage, sugar beet and vegetables such as potato, tomato, onion as the summer crop and wheat, rape in the winter crop. Coriander and chick pea are recommended for the spring season and alfalfa is selected as a feed crop. Since the crop coefficient varies with kind of crops, planting season and period of crop growth, the crop coefficients of the proposed crops are made referring to "An Estimate of Water Requirement of Main Field Crops and Orchards in Iran" mainly. However, in case of coriander and rape, it can not be found in Iranian standard, and hence data of "Crop Water Requirements, FAO Irrigation and Drainage Paper No. 56" is used. The crop coefficients of the proposed crops are shown in Table A3.1.2.

A3.1.3 Seasonal Irrigation Water Requirements

Table A3.1.3 shows the seasonal irrigation water requirements based on the proposed cropping pattern. Seasonal irrigation requirements are summarized below:

Unit: mm/day

Cropping pattern	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Pattern2	0.2	0.2	0.5	1.5	6.4	9.1	3.8	0.0	0.0	0.0	0.0	0.5
Pattern3	0.2	0.2	0.5	1.5	6.3	8.4	2.6	0.0	0.0	0.0	0.0	0.5
Pattern4	0.2	0.2	0.5	1.1	5.4	9.6	12.0	13.4	9.9	4.7	2.4	0.5
Pattern5	0.2	0.2	0.5	1.1	5.4	9.3	11.8	13.4	10.3	4.9	2.4	0.5

Ratio of the land owner between less than 5 ha and more than 5 ha, are estimated for each canal and river respectively based on the list of water right holders prepared by KPWA. They are summarized as follows:

	More than 5 ha		Less than 5 ha		Total	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
Left bank canal	439.8	30.6	996.1	69.4	1,435.9	100.0
Right bank canal	101.3	36.2	178.2	63.8	279.5	100.0
Gharasu River	1,064.2	70.0	455.8	30.0	1,520.0	100.0

According to the above ratios, irrigation water requirements of irrigation patterns for spring irrigation and all season irrigation on each canal and river are estimated as follows:

Unit: mm/day

Irrig. pattern	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Left bank												
Spring	0.2	0.2	0.5	1.5	6.4	8.9	3.4	0.0	0.0	0.0	0.0	0.5
All season	0.2	0.2	0.5	1.1	5.4	9.5	11.9	13.4	10.0	4.8	2.4	0.5
Right bank												
Spring	0.2	0.2	0.5	1.5	6.4	8.8	3.4	0.0	0.0	0.0	0.0	0.5
All season	0.2	0.2	0.5	1.1	5.4	9.5	11.9	13.4	10.0	4.8	2.4	0.5
Gharasu River												
Spring	0.2	0.2	0.5	1.5	6.3	8.6	3.0	0.0	0.0	0.0	0.0	0.5
All season	0.2	0.2	0.5	1.1	5.4	9.4	11.9	13.4	10.2	4.8	2.4	0.5

A3.1.4 Newly Proposed Secondary Canal Alignment

Design of proposed secondary canals has been completed already by KPWA of MOE. 23 turnouts of secondary canals were designed previously according to the design plan which was received from consulting company by the Study Team. This consultant is in charge of supervision of the implementation. However, according to final design, the numbers of turnouts are reduced to 10 places. Location of previous and final design of turnout are shown in Table A3.1.4. Reasons of the modification could not be clarified by the Study Team during the reporting period, even though the Study Team requested for the meeting with the person in charge of the design in KPWA by an official letter through the Soil and Water Department of KJAO. Proposed irrigation network of new secondary and tertiary canals also could be received through the Soil and Water Department of KJAO. The proposed irrigation network is shown in Fig. A3.1.1. The proposed irrigation network design did not consider the present irrigation network system, border of villages and topographic conditions at some places. There is no irrigation network whose area is located across a boundary of villages in the present irrigation network.

A3.2 Walk-through Survey on the Right Bank Canal

From the beginning of June 2003, Site walk-through was conducted with farmers along the Right Bank Canal from the Ravansar Diversion Gate to the end of the concrete lining canal (from June 10 to June 13). During the walk-through, the general manager accompanied and gave explanation of constraints and problems of facilities and irrigation management.

Through these activities, the problems were recognized such as problems of canal improvement, remaining works, destructions of turn-outs and check-gates by farmers, increments of illegal intake points and illegal water intakes with pumps. Besides, it became clear that there were no water distribution rules along the tertiary canals and many trade-off conflicts have been increased recently. As a result of work through survey, problem list and summarized map were prepared. Problem list is shown in Table A3.2.1 and the summarized map is shown in Fig. A3.2.1.

A3.3 Implementation Cost on the Land Consolidation

A3.3.1 Unit Price

Unit price for the governmental project has been published by MPO every year. The project cost has been estimated based on the unit price. Provincial coefficient, workshop coefficient and overhead coefficient will be multiplied to standard unit price taking condition of province or type of project into account. Coefficient rates are 1.15, 1.06 and 1.30 respectively. These prices are including direct implementation cost. As indirect costs, supervision cost, employer's cost and insurance and municipality due cost are going to add to implementation cost. Rates of these indirect costs are 5.0 %, 7.0 % and 5.0 % of direct implementation cost respectively. Major prices are as follows;

Items	Unit	Unit Price (Rials)	Items	Unit	Unit Price (Rials)
Excavation	m3	6,800	HP ϕ 300	m	42,000
Back Fill	m3	4,000	HP ϕ 450	m	112,200
Embankment	m3	9,850	HP ϕ 600	m	172,000
Land Leveling	m3	4,550	HP ϕ 700	m	200,000
Sub-soil Compaction	m2	220	HP ϕ 800	m	210,700
Shaping of Side Slope	m2	2,000	HP ϕ 900	m	229,000
Gravel Pavement	m3	1,260	HP ϕ 1,200	m	395,000
Concrete Lining	m3	258,300	HP ϕ 1,300	m	467,500
Plain Concrete	m3	180,000	Riprap	m3	40,000
Reinforced Concrete	m3	379,000			
Form	m2	14,200			
Reinforced Bar	kg	5,400			

Source; Soil and Water Department in KJAO

A3.3.2 Working Volume of Land Consolidation

There are two type of land consolidation in Iran. One is land re-plotting without land leveling, or canal and road construction (hereinafter referred to as 'land re-plotting'). The other is pure land consolidation with land leveling and agricultural facilities such as farm road, irrigation canal network and drainage canal network. Situations of land re-plotting and land consolidation are shown in Table A3.3.1 based on the information of agricultural offices concerned.

Implementation cost of land consolidation on the left bank canal and the right bank canal area have been estimated based on above stated unit price and indirect costs respectively. As for the estimation of land consolidation cost for the right bank canal area, Meskin Abad area with 144.0 ha, has been selected as a model area. And also for the left bank canal area, Khoram Abad area with 280.4 ha, has been selected as a model area. Implementation costs of each canal area have been estimated based on implementation cost of each model area. As for the irrigation area by pump such as the Gharasu River direct irrigation area and Site 2, the irrigation network is not necessary because all farmers have a pump individually. So, average cost of both model except irrigation network establishment cost, was employed to estimate an implementation cost for these area. Working quantities in order to estimate the implementation cost on each model area are shown in Table A3.3.2 and Table A3.3.3. Also, design of major structures is shown in Fig. A3.3.1.

Table A3.1.1 (1) Summary of Water User Concerning the Ravansar Spring and the Gharasu River

	Village Name	Legal Water Users								Illegal Water Users								Total	
		Right Bank Canal		Left Bank Canal		Ghrasu River		Sub-Total		Right Bank Canal		Left Bank Canal		Ghrasu River		Sub-Total			
		Number of Farmers	Irrigated Area (ha)	Number of Farmers	Irrigated Area (ha)	Number of Farmers	Irrigated Area (ha)	Number of Farmers	Irrigated Area (ha)	Number of Farmers	Irrigated Area (ha)	Number of Farmers	Irrigated Area (ha)	Number of Farmers	Irrigated Area (ha)	Number of Farmers	Irrigated Area (ha)	Number of Farmers	Irrigated Area (ha)
In the Study Area	Ravansar Suburbs					1	3.0	1	3.0			20	88.5			20	88.5	21	91.5
	Ghalancheh	12	42.0			1	5.0	13	47.0							-	-	13	47.0
	Gol Sefid							-	-					3	20.0	3	20.0	3	20.0
	Meskin Abad Olya	28	76.0			1	5.0	29	81.0	2	5.0					2	5.0	31	86.0
	Meskin Abad Sofla	36	135.1					36	135.1							-	-	36	135.1
	Meskin Abad					1	2.4	1	2.4							-	-	1	2.4
	Tapeh Rash			37	141.0	4	18.0	41	159.0							-	-	41	159.0
	Tapeh Kuick			36	106.0	2	12.0	38	118.0							-	-	38	118.0
	Tapeh Lori			38	130.6	27	186.5	65	317.1							-	-	65	317.1
	Hassan Abad			73	165.9	5	210.0	78	375.9							-	-	78	375.9
	Hossein Abad			4	24.0	1	5.0	5	29.0							-	-	5	29.0
	Khoram Abad Sofla	23	51.0	64	149.2	8	25.5	95	225.7			10	24.5			10	24.5	105	250.2
	Khoram Abad Olya	2	3.0	66	199.0	1	10.0	69	212.0			9	20.0	4	9.0	13	29.0	82	241.0
	Khoram Abad					3	13.0	3	13.0							-	-	3	13.0
	Kolah Kabood			33	38.5	1	8.0	34	46.5			6	12.0			6	12.0	40	58.5
	Zarin Chagha			45	120.3	3	11.0	48	131.3							-	-	48	131.3
	Deh Bagh			20	58.3			20	58.3							-	-	20	58.3
	Deh Sadeh			33	113.5			33	113.5			5	11.5			5	11.5	38	125.0
	Shali Abad			22	66.3	10	41.8	32	108.1					4	22.0	4	22.0	36	130.1
	Shour Balagh					11	33.0	11	33.0							-	-	11	33.0
	Ghale Zakariya	69	120.0			22	81.2	91	201.2							-	-	91	201.2
	Ghale Reza					16	89.5	16	89.5							-	-	16	89.5
	Kani Sharif					3	10.0	3	10.0							-	-	3	10.0
	Kareim Abad			35	123.3	2	12.5	37	135.8							-	-	37	135.8
	Gerazi Abad					12	34.5	12	34.5							-	-	12	34.5
	Guij					6	23.0	6	23.0					1	4.0	1	4.0	7	27.0
	Mir Azizi					16	56.0	16	56.0							-	-	16	56.0
	Jan Jan					9	42.5	9	42.5							-	-	9	42.5
	Lachin					3	21.0	3	21.0							-	-	3	21.0
	Kordvand					6	68.0	6	68.0							-	-	6	68.0
		3	6.0					3	6.0							-	-	3	6.0
	Sub-Total	173	433.1	506	1,435.9	175	1,027.4	854	2,896.4	2	5.0	50	156.5	12	55.0	64	216.5	918	3,112.9
Out of the Study Area	Gorgabi	29	90.0					29	90.0							-	-	29	90.0
	Amr Abad	19	138.0			11	43.6	30	181.6							-	-	30	181.6
	Birdad	24	59.0			5	27.0	29	86.0					6	23.5	6	23.5	35	109.5
	Deh Sorkh	1	1.0					1	1.0							-	-	1	1.0
	Goraz Abad	1	1.0					1	1.0							-	-	1	1.0
	Tapeh Zard	4	0.0					4	-							-	-	4	-
	Tam Tam	49	95.5					49	95.5							-	-	49	95.5
	Mir Azizi Salar					20	21.0	20	21.0							-	-	20	21.0
	Doab					19	96.5	19	96.5							-	-	19	96.5
	Nazar Abad					4	32.0	4	32.0							-	-	4	32.0
	Shahgodar					12	46.5	12	46.5							-	-	12	46.5
	Gholam Ali Bag					7	55.5	7	55.5							-	-	7	55.5
	Guyan Gura					6	30.5	6	30.5							-	-	6	30.5
	Kolah Abad					4	37.0	4	37.0							-	-	4	37.0
	Tapeh Kal					3	10.0	3	10.0							-	-	3	10.0
	Deh Mir					1	11.0	1	11.0							-	-	1	11.0
	Deh Azam					1	7.0	1	7.0							-	-	1	7.0
	Baklani					3	75.0	3	75.0							-	-	3	75.0
	Sub-Total	127	384.5	0	-	96	492.6	223	877.1	0	0.0	0	0.0	6	23.5	6	23.5	229	900.6
	Other					221	3,495.1	221	3,495.1										
	Sub-Total	0	0.0	0	-	221	3,495.1	221	3,495.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Total	300	817.6	506	1,435.9	492	5,015.1	1,298	7,268.6	2	5.0	50	156.5	18	78.5	70	240.0	1,147	4,013.5

Source: Legal data from KWA Office in Kermanshah and illegal data from KWA Office in Ravansar.

Table A3.1.1 (2) Summary of Water User Concerning the Ravansar Spring and the Gharasu River

	Village Name	Legal Water Users						Illegal Water Users						Total	
		Khoshkeh Rud		Jaberi		Sub-Total		Khoshkeh Rud		Jaberi		Sub-Total			
		Number of Farmers	Irrigated Area (ha)	Number of Farmers	Irrigated Area (ha)	Number of Farmers	Irrigated Area (ha)	Number of Farmers	Irrigated Area (ha)	Number of Farmers	Irrigated Area (ha)	Number of Farmers	Irrigated Area (ha)	Number of Farmers	Irrigated Area (ha)
In the Study Area	Ravansar Suburbs	33	105.0			33	105.0			1	2.0	1	2.0	34	107.0
	Kolah Kabood			27	34.8	27	34.8			5	12.0	5	12.0	32	46.8
						-	-			15	33.5	15	33.5	15	33.5
	Sub-Total	33	105.0	27	34.8	60	139.8	-	-	21	47.5	21	47.5	81	187.3
Out of the Study Area	Sardom			15	23.0	15	23.0			3	6.0	3	6.0	18	29.0
	Sub-Total	0	0.0	15	23.0	15	23.0	0	0.0	3	6.0	3	6.0	18	29.0
	Total	33	105.0	42	57.8	75	162.8	-	-	24	53.5	24	53.5	99	216.3

Source: Legal data from KWA Office in Kermanshah and illegal data from KWA Office in Ravansar.

Table A 3.1.2 Single Crop Coefficient (Kc) and Length of Crop Development Stages

Crop	Cultivation Period				Length and Kc of Crop Development Stages						Remarks
	Sowing		Harvesting			Ini. Stage	Dev. Stage	Mid. Stage	Late Stage	Total	
	From	To	From	To							
Wheat	First of Nov.	End of Nov.	Mid. of Jun.	Mid. of Jul.	Days	27	128	37	28	220	
					Iran-Standard-Kc	0.40	0.85	1.30	0.51		Kermanshah
					FAO Standard-Kc	0.40	0.78	1.15	0.25		
Barley	First of Oct.	End of Oct.	Mid. of Jun.	1/3 of Jul.	Days	50	75	75	50	250	
					Iran-Standard-Kc	0.40	0.85	1.30	0.51		Refered to Wheat
					FAO Standard-Kc	0.30	0.73	1.15	0.25		
Chick Pea	2/3 of Mar.	2/3 of Apr.	2/3. of Jun.	1/3 of Jul.	Days	20	30	30	10	90	
					Iran-Standard-Kc	0.40	0.75	1.10	0.32		Kermanshah
					FAO Standard-Kc	0.60	0.80	1.00	0.35		
Coriander	First of Apr.	2/3 of Apr.	End of Jun.	1/3 of Jul.	Days	22	35	22	11	90	Refered to Crucifers
					Iran-Standard-Kc						
					FAO Standard-Kc	0.70	0.88	1.05	0.95		
Rape	First of Oct.	End of Oct.	First of Jun.	End of Jun.	Days	37	43	111	49	240	Refered to Crucifers
					Iran-Standard-Kc						
					FAO Standard-Kc	0.70	0.88	1.05	0.95		
Maize for Silage	1/3 of Jul.	End of Jul.	First of Oct.	2/3 of Oct.	Days	20	35	30		85	
					Iran-Standard-Kc	0.50	0.83	1.15			Kermanshah
					FAO Standard-Kc	0.37	0.79	1.20			
Maize (grain)	First of May	End of May	1/3 of Oct.	1/3 of Nov.	Days	30	40	50	40	160	
					Iran-Standard-Kc	0.50	0.83	1.15	0.64		Hamedan and others
					FAO Standard-Kc	0.37	0.79	1.20	0.35		
Tomato	2/3 of Mar.	2/3 of Apr.	First of Oct.	End of Oct.	Days	42	48	63	37	190	
					Iran-Standard-Kc	0.50	0.83	1.15	0.67		Kermanshah
					FAO Standard-Kc	0.70	0.93	1.15	0.80		
Sugar Beet	2/3 of Mar.	2/3 of May	First of Oct.	End of Oct.	Days	53	42	53	42	190	
					Iran-Standard-Kc	0.55	0.83	1.10	0.96		Kermanshah
					FAO Standard-Kc	0.35	0.78	1.20	1.00		
Alfalfa			End of May	End of Oct.	Days					0	
					Iran-Standard-Kc	1.00	1.05	1.10	1.00	1.03	Kermanshah
					FAO Standard-Kc	0.95	0.95	0.95	0.95		
Rose					Days					0	
					Iran-Standard-Kc						
					FAO Standard-Kc	1.00	1.00	1.00	1.00		Refered to Conifer Trees

Source: FAO Irrigation and Drainage Paper No.56
An Estimate of Water Requirement of Main Field Crops and Orchards in Iran

Table A3.1.3 (1) Proposed Unit Crop Water Requirement on Cropping Pattern 2

Item		Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Agu.	Sep.	Oct.	Nov.	Dec.	Year
Basic Data															
a ETo		mm/month	27	35	69	105	165	232	300	284	211	132	55	32	1,647
b Basic Rainfall (1/5)		mm/month	35.0	57.0	73.9	101.2	70.5	10.6	0.0	0.0	0.0	1.9	24.5	8.5	383.1
c Irrigation effeciency		51%													
A Wheat	50%														
1 Cropping Pattern															
2 Crop coefficient	Kc-1		0.85	0.85	0.85	1.24	0.79	0.51					0.45	0.85	
	Kc-2		0.85	0.85	0.85	0.85	1.24	0.75	0.51					0.46	
	Average		0.85	0.85	0.85	1.05	1.02	0.63	0.51				0.45	0.66	
3 Days of irrigation		days	31	28	31	30	31	30	8				30	31	
4 ETcrop (Eto x Kc)		mm	23.0	29.8	58.7	109.7	167.5	146.2	153.0				24.8	21.0	
5 Area factor (Af)			1.00	1.00	1.00	1.00	1.00	0.73	0.03				0.50	1.00	
6 ETcrop net (Eto x Kc x Af)		mm	23.0	29.8	58.7	109.7	167.5	106.7	4.6				12.4	21.0	
7 Effective rainfall		mm/month	18.5	25.5	44.8	65.5	51.8	8.9	0.0				15.6	5.1	
8 Effective rainfall (=(3)*(7)/days of month)		mm	18.5	25.5	44.8	65.5	51.8	8.9	0.0				15.6	5.1	
9 Net requirement (=(6)-(8))		mm	4.5	4.3	13.9	44.2	115.7	97.8	4.6				0.0	15.9	
10 Diversion requirement (=(9)/c)		mm	8.7	8.3	27.2	86.7	226.8	191.8	9.0				0.0	31.1	
11 Diversion requirement		mm/day	0.3	0.3	0.9	2.9	7.3	6.4	1.1				0.0	1.0	
B Coliander	25%														
1 Cropping Pattern															
2 Crop coefficient	Kc-1					0.75	0.90	1.01							
	Kc-2					0.70	0.81	0.96	0.99						
	Average					0.73	0.86	0.99	0.99						
3 Days of irrigation		days				30	31	30	19						
4 ETcrop (Eto x Kc)		mm				76.1	141.1	228.5	297.0						
5 Area factor (Af)						0.67	1.00	0.92	0.29						
6 ETcrop net (Eto x Kc x Af)		mm				51.0	141.1	210.2	86.1						
7 Effective rainfall		mm/month				65.5	51.8	8.9	0.0						
8 Effective rainfall (=(3)*(7)/days of month)		mm				65.5	51.8	8.9	0.0						
9 Net requirement (=(6)-(8))		mm				0.0	89.3	201.3	86.1						
10 Diversion requirement (=(9)/c)		mm				0.0	175.0	394.8	168.9						
11 Diversion requirement		mm/day				0.0	5.6	13.2	8.9						
C Chick pea	25%														
1 Cropping Pattern															
2 Crop coefficient	Kc-1				0.40	0.63	0.99	0.69							
	Kc-2					0.40	0.64	1.00	0.69						
	Average				0.40	0.52	0.82	0.85	0.69						
3 Days of irrigation		days			10	30	31	30	19						
4 ETcrop (Eto x Kc)		mm			27.6	54.1	134.5	196.0	207.0						
5 Area factor (Af)					0.05	0.77	1.00	0.86	0.19						
6 ETcrop net (Eto x Kc x Af)		mm			1.4	41.6	134.5	168.6	39.3						
7 Effective rainfall		mm/month			44.8	65.5	51.8	8.9	0.0						
8 Effective rainfall (=(3)*(7)/days of month)		mm			14.5	65.5	51.8	8.9	0.0						
9 Net requirement (=(6)-(8))		mm			0.0	0.0	82.7	159.7	39.3						
10 Diversion requirement (=(9)/c)		mm			0.0	0.0	162.1	313.1	77.1						
11 Diversion requirement		mm/day			0.0	0.0	5.2	10.4	4.1						
Average diversion requirement of the cropping pattern															
		mm/day	0.2	0.2	0.5	1.5	6.4	9.1	3.8	0.0	0.0	0.0	0.0	0.5	

Table A3.1.3 (2) Proposed Unit Crop Water Requirement on Cropping Pattern 3

Item		Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Agu.	Sep.	Oct.	Nov.	Dec.	Year
Basic Data															
a ETo		mm/month	27	35	69	105	165	232	300	284	211	132	55	32	1,647
b Basic Rainfall (1/5)		mm/month	35.0	57.0	73.9	101.2	70.5	10.6	0.0	0.0	0.0	1.9	24.5	8.5	383.1
c Irrigation effeciency		51%													
A Wheat	50%														
1 Cropping Pattern															
2 Crop coefficient	Kc-1		0.85	0.85	0.85	1.24	0.79	0.51					0.45	0.85	
	Kc-2		0.85	0.85	0.85	0.85	1.24	0.75	0.51					0.46	
	Average		0.85	0.85	0.85	1.05	1.02	0.63	0.51				0.45	0.66	
3 Days of irrigation		days	31	28	31	30	31	30	8				30	31	
4 ETcrop (Eto x Kc)		mm	23.0	29.8	58.7	109.7	167.5	146.2	153.0				24.8	21.0	
5 Area factor (Af)			1.00	1.00	1.00	1.00	1.00	0.73	0.03				0.50	1.00	
6 ETcrop net (Eto x Kc x Af)		mm	23.0	29.8	58.7	109.7	167.5	106.7	4.6				12.4	21.0	
7 Effective rainfall		mm/month	18.5	25.5	44.8	65.5	51.8	8.9	0.0				15.6	5.1	
8 Effective rainfall (=(3)*(7)/days of month)		mm	18.5	25.5	44.8	65.5	51.8	8.9	0.0				15.6	5.1	
9 Net requirement (=(6)-(8))		mm	4.5	4.3	13.9	44.2	115.7	97.8	4.6				0.0	15.9	
10 Diversion requirement (=(9)/c)		mm	8.7	8.3	27.2	86.7	226.8	191.8	9.0				0.0	31.1	
11 Diversion requirement		mm/day	0.3	0.3	0.9	2.9	7.3	6.4	1.1				0.0	1.0	
B Chick pea	50%														
1 Cropping Pattern															
2 Crop coefficient	Kc-1				0.40	0.63	0.99	0.69							
	Kc-2					0.40	0.64	1.00	0.69						
	Average				0.40	0.52	0.82	0.85	0.69						
3 Days of irrigation		days			10	30	31	30	19						
4 ETcrop (Eto x Kc)		mm			27.6	54.1	134.5	196.0	207.0						
5 Area factor (Af)					0.05	0.77	1.00	0.86	0.19						
6 ETcrop net (Eto x Kc x Af)		mm			1.4	41.6	134.5	168.6	39.3						
7 Effective rainfall		mm/month			44.8	65.5	51.8	8.9	0.0						
8 Effective rainfall (=(3)*(7)/days of month)		mm			14.5	65.5	51.8	8.9	0.0						
9 Net requirement (=(6)-(8))		mm			0.0	0.0	82.7	159.7	39.3						
10 Diversion requirement (=(9)/c)		mm			0.0	0.0	162.1	313.1	77.1						
11 Diversion requirement		mm/day			0.0	0.0	5.2	10.4	4.1						
Average diversion requirement of the cropping pattern		mm/day	0.2	0.2	0.5	1.5	6.3	8.4	2.6	0.0	0.0	0.0	0.0	0.5	

Table A3.1.3 (3) Proposed Unit Crop Water Requirement on Cropping Pattern 4

Item		Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Agu.	Sep.	Oct.	Nov.	Dec.	Year
Basic Data															
a ETo		mm/month	27	35	69	105	165	232	300	284	211	132	55	32	1,647
b Basic Rainfall (1/5)		mm/month	35.0	57.0	73.9	101.2	70.5	10.6	0.0	0.0	0.0	1.9	24.5	8.5	383.1
c Irrigation effeciency		51%													
A Wheat	20%														
1 Cropping Pattern															
2 Crop coefficient	Kc-1		0.85	0.85	0.85	1.24	0.79	0.51					0.45	0.85	
	Kc-2		0.85	0.85	0.85	0.85	1.24	0.75	0.51					0.46	
	Average		0.85	0.85	0.85	1.05	1.02	0.63	0.51				0.45	0.66	
3 Days of irrigation		days	31	28	31	30	31	30	8				30	31	
4 ETcrop (Eto x Kc)		mm	23.0	29.8	58.7	109.7	167.5	146.2	153.0				24.8	21.0	
5 Area factor (Af)			1.00	1.00	1.00	1.00	1.00	0.73	0.03				0.50	1.00	
6 ETcrop net (Eto x Kc x Af)		mm	23.0	29.8	58.7	109.7	167.5	106.7	4.6				12.4	21.0	
7 Effective rainfall		mm/month	18.5	25.5	44.8	65.5	51.8	8.9	0.0				15.6	5.1	
8 Effective rainfall (=(3)*(7)/days of month)		mm	18.5	25.5	44.8	65.5	51.8	8.9	0.0				15.6	5.1	
9 Net requirement (=(6)-(8))		mm	4.5	4.3	13.9	44.2	115.7	97.8	4.6				0.0	15.9	
10 Diversion requirement (=(9)/c)		mm	8.7	8.3	27.2	86.7	226.8	191.8	9.0				0.0	31.1	
11 Diversion requirement		mm/day	0.3	0.3	0.9	2.9	7.3	6.4	1.1				0.0	1.0	
B Rape	20%														
1 Cropping Pattern															
2 Crop coefficient	Kc-1		1.05	1.05	1.05	0.98	0.95					0.70	0.84	0.95	
	Kc-2		0.95	1.05	1.05	1.05	0.98	0.95					0.70	0.84	
	Average		1.00	1.05	1.05	1.02	0.97	0.95				0.70	0.77	0.90	
3 Days of irrigation		days	31	28	31	30	31	28				31	30	31	
4 ETcrop (Eto x Kc)		mm	27.0	36.8	72.5	106.6	159.2	220.4				92.4	42.4	28.6	
5 Area factor (Af)			1.00	1.00	1.00	1.00	1.00	0.42				0.50	1.00	1.00	
6 ETcrop net (Eto x Kc x Af)		mm	27.0	36.8	72.5	106.6	159.2	92.6				46.2	42.4	28.6	
7 Effective rainfall		mm/month	18.5	25.5	44.8	65.5	51.8	8.9				1.4	15.6	5.1	
8 Effective rainfall (=(3)*(7)/days of month)		mm	18.5	25.5	44.8	65.5	51.8	8.3				1.4	15.6	5.1	
9 Net requirement (=(6)-(8))		mm	8.5	11.3	27.7	41.1	107.4	84.3				44.8	26.8	23.5	
10 Diversion requirement (=(9)/c)		mm	16.7	22.1	54.2	80.5	210.6	165.2				87.8	52.5	46.2	
11 Diversion requirement		mm/day	0.5	0.8	1.7	2.7	6.8	5.9				2.8	1.7	1.5	
C Maize for Silage	20%														
1 Cropping Pattern															
2 Crop coefficient	Kc-1								0.50	0.83	1.11	1.15			
	Kc-2									0.62	0.89	1.15			
	Average								0.50	0.73	1.00	1.15			
3 Days of irrigation		days							20	31	30	24			
4 ETcrop (Eto x Kc)		mm							150.0	205.9	211.0	151.8			
5 Area factor (Af)									0.32	1.00	1.00	0.45			
6 ETcrop net (Eto x Kc x Af)		mm							48.0	205.9	211.0	68.3			
7 Effective rainfall		mm/month							0.0	0.0	0.0	1.4			
8 Effective rainfall (=(3)*(7)/days of month)		mm							0.0	0.0	0.0	1.1			
9 Net requirement (=(6)-(8))		mm							48.0	205.9	211.0	67.2			
10 Diversion requirement (=(9)/c)		mm							94.1	403.7	413.7	131.8			
11 Diversion requirement		mm/day							4.7	13.0	13.8	5.5			

Table A3.1.3 (3) Proposed Unit Crop Water Requirement on Cropping Pattern 4 (Continued)

D Maize	20%													
1 Cropping Pattern														
2 Crop coefficient	Kc-1					0.51	0.83	1.06	1.10	0.64	0.64			
	Kc-2						0.50	0.83	1.06	1.12	0.64	0.64		
	Average					0.51	0.67	0.95	1.08	0.88	0.64	0.64		
3 Days of irrigation		days				31	30	31	31	30	31	7		
4 ETcrop (Eto x Kc)		mm				84.2	154.3	283.5	306.7	185.7	84.5	35.2		
5 Area factor (Af)						1.00	0.86	0.86	0.86	0.86	0.86	0.86		
6 ETcrop net (Eto x Kc x Af)		mm				84.2	132.7	243.8	263.8	159.7	72.7	30.3		
7 Effective rainfall		mm/month				51.8	8.9	0.0	0.0	0.0	1.4	15.6		
8 Effective rainfall (=(3)*(7)/days of month)		mm				51.8	8.9	0.0	0.0	0.0	1.4	3.6		
9 Net requirement (=(6)-(8))		mm				32.4	123.8	243.8	263.8	159.7	71.3	26.7		
10 Diversion requirement (=(9)/c)		mm				63.4	242.7	478.1	517.2	313.1	139.7	52.3		
11 Diversion requirement		mm/day				2.0	8.1	15.4	16.7	10.4	4.5	7.5		
E Vegetable	20%													
1 Cropping Pattern														
2 Crop coefficient	Kc-1				0.50	0.50	0.81	0.95	1.15	1.00	0.67			
	Kc-2					0.50	0.50	0.82	0.95	1.15	0.99	0.67		
	Average				0.50	0.50	0.66	0.89	1.05	1.08	0.83	0.67		
3 Days of irrigation		days			10	30	31	30	31	31	30	27		
4 ETcrop (Eto x Kc)		mm			34.5	52.5	108.1	205.3	315.0	305.3	175.1	88.4		
5 Area factor (Af)					0.05	0.78	1.00	1.00	1.00	1.00	1.00	0.39		
6 ETcrop net (Eto x Kc x Af)		mm			1.7	41.0	108.1	205.3	315.0	305.3	175.1	34.5		
7 Effective rainfall		mm/month			44.8	65.5	51.8	8.9	0.0	0.0	0.0	1.4		
8 Effective rainfall (=(3)*(7)/days of month)		mm			14.5	65.5	51.8	8.9	0.0	0.0	0.0	1.3		
9 Net requirement (=(6)-(8))		mm			0.0	0.0	56.3	196.4	315.0	305.3	175.1	33.2		
10 Diversion requirement (=(9)/c)		mm			0.0	0.0	110.3	385.1	617.6	598.6	343.4	65.1		
11 Diversion requirement		mm/day			0.0	0.0	3.6	12.8	19.9	19.3	11.4	2.4		
F Alfalfa	20%													
1 Cropping Pattern														
2 Crop coefficient	Kc-1					1.00	1.00	1.00	1.00	1.00	1.00	1.00		
	Kc-2					1.00	1.00	1.00	1.00	1.00	1.00	1.00		
	Average					1.00	1.00	1.00	1.00	1.00	1.00	1.00		
3 Days of irrigation		days				15	30	31	31	30	31	15		
4 ETcrop (Eto x Kc)		mm				165.0	232.0	300.0	284.0	211.0	132.0	55.0		
5 Area factor (Af)						0.50	1.00	1.00	1.00	1.00	1.00	0.50		
6 ETcrop net (Eto x Kc x Af)		mm				82.5	232.0	300.0	284.0	211.0	132.0	27.5		
7 Effective rainfall		mm/month				51.8	8.9	0.0	0.0	0.0	1.4	15.6		
8 Effective rainfall (=(3)*(7)/days of month)		mm				25.1	8.6	0.0	0.0	0.0	1.4	7.5		
9 Net requirement (=(6)-(8))		mm				57.4	223.4	300.0	284.0	211.0	130.6	20.0		
10 Diversion requirement (=(9)/c)		mm				112.5	438.0	588.2	556.9	413.7	256.1	39.2		
11 Diversion requirement		mm/day				7.5	14.6	19.0	18.0	13.8	8.3	2.6		
Average diversion requirement of the cropping pattern		mm/day	0.2	0.2	0.5	1.1	5.4	9.6	12.0	13.4	9.9	4.7	2.4	0.5

Table A3.1.3 (4) Proposed Unit Crop Water Requirement on Cropping Pattern 5

Item		Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Agu.	Sep.	Oct.	Nov.	Dec.	Year
Basic Data															
a ETo		mm/month	27	35	69	105	165	232	300	284	211	132	55	32	1,647
b Basic Rainfall (1/5)		mm/month	35.0	57.0	73.9	101.2	70.5	10.6	0.0	0.0	0.0	1.9	24.5	8.5	383.1
c Irrigation effeciency		51%													
A Wheat	20%														
1 Cropping Pattern															
2 Crop coefficient	Kc-1		0.85	0.85	0.85	1.24	0.79	0.51					0.45	0.85	
	Kc-2		0.85	0.85	0.85	0.85	1.24	0.75	0.51					0.46	
	Average		0.85	0.85	0.85	1.05	1.02	0.63	0.51				0.45	0.66	
3 Days of irrigation		days	31	28	31	30	31	30	8				30	31	
4 ETcrop (Eto x Kc)		mm	23.0	29.8	58.7	109.7	167.5	146.2	153.0				24.8	21.0	
5 Area factor (Af)			1.00	1.00	1.00	1.00	1.00	0.73	0.03				0.50	1.00	
6 ETcrop net (Eto x Kc x Af)		mm	23.0	29.8	58.7	109.7	167.5	106.7	4.6				12.4	21.0	
7 Effective rainfall		mm/month	18.5	25.5	44.8	65.5	51.8	8.9	0.0				15.6	5.1	
8 Effective rainfall (=(3)*(7)/days of month)		mm	18.5	25.5	44.8	65.5	51.8	8.9	0.0				15.6	5.1	
9 Net requirement (=(6)-(8))		mm	4.5	4.3	13.9	44.2	115.7	97.8	4.6				0.0	15.9	
10 Diversion requirement (=(9)/c)		mm	8.7	8.3	27.2	86.7	226.8	191.8	9.0				0.0	31.1	
11 Diversion requirement		mm/day	0.3	0.3	0.9	2.9	7.3	6.4	1.1				0.0	1.0	
B Rape	20%														
1 Cropping Pattern															
2 Crop coefficient	Kc-1		1.05	1.05	1.05	0.98	0.95					0.70	0.84	0.95	
	Kc-2		0.95	1.05	1.05	1.05	0.98	0.95					0.70	0.84	
	Average		1.00	1.05	1.05	1.02	0.97	0.95				0.70	0.77	0.90	
3 Days of irrigation		days	31	28	31	30	31	28				31	30	31	
4 ETcrop (Eto x Kc)		mm	27.0	36.8	72.5	106.6	159.2	220.4				92.4	42.4	28.6	
5 Area factor (Af)			1.00	1.00	1.00	1.00	1.00	0.42				0.50	1.00	1.00	
6 ETcrop net (Eto x Kc x Af)		mm	27.0	36.8	72.5	106.6	159.2	92.6				46.2	42.4	28.6	
7 Effective rainfall		mm/month	18.5	25.5	44.8	65.5	51.8	8.9				1.4	15.6	5.1	
8 Effective rainfall (=(3)*(7)/days of month)		mm	18.5	25.5	44.8	65.5	51.8	8.3				1.4	15.6	5.1	
9 Net requirement (=(6)-(8))		mm	8.5	11.3	27.7	41.1	107.4	84.3				44.8	26.8	23.5	
10 Diversion requirement (=(9)/c)		mm	16.7	22.1	54.2	80.5	210.6	165.2				87.8	52.5	46.2	
11 Diversion requirement		mm/day	0.5	0.8	1.7	2.7	6.8	5.9				2.8	1.7	1.5	
C Maize for Silage	20%														
1 Cropping Pattern															
2 Crop coefficient	Kc-1								0.50	0.83	1.11	1.15			
	Kc-2									0.62	0.89	1.15			
	Average								0.50	0.73	1.00	1.15			
3 Days of irrigation		days							20	31	30	24			
4 ETcrop (Eto x Kc)		mm							150.0	205.9	211.0	151.8			
5 Area factor (Af)									0.32	1.00	1.00	0.45			
6 ETcrop net (Eto x Kc x Af)		mm							48.0	205.9	211.0	68.3			
7 Effective rainfall		mm/month							0.0	0.0	0.0	1.4			
8 Effective rainfall (=(3)*(7)/days of month)		mm							0.0	0.0	0.0	1.1			
9 Net requirement (=(6)-(8))		mm							48.0	205.9	211.0	67.2			
10 Diversion requirement (=(9)/c)		mm							94.1	403.7	413.7	131.8			
11 Diversion requirement		mm/day							4.7	13.0	13.8	5.5			

Table A3.1.3 (4) Proposed Unit Crop Water Requirement on Cropping Pattern 5 (Continued)

D Maize	20%													
1 Cropping Pattern														
2 Crop coefficient	Kc-1					0.51	0.83	1.06	1.10	0.64	0.64			
	Kc-2						0.50	0.83	1.06	1.12	0.64	0.64		
	Average					0.51	0.67	0.95	1.08	0.88	0.64	0.64		
3 Days of irrigation		days				31	30	31	31	30	31	7		
4 ETcrop (Eto x Kc)		mm				84.2	154.3	283.5	306.7	185.7	84.5	35.2		
5 Area factor (Af)						1.00	0.86	0.86	0.86	0.86	0.86	0.86		
6 ETcrop net (Eto x Kc x Af)		mm				84.2	132.7	243.8	263.8	159.7	72.7	30.3		
7 Effective rainfall		mm/month				51.8	8.9	0.0	0.0	0.0	1.4	15.6		
8 Effective rainfall (=(3)*(7)/days of month)		mm				51.8	8.9	0.0	0.0	0.0	1.4	3.6		
9 Net requirement (=(6)-(8))		mm				32.4	123.8	243.8	263.8	159.7	71.3	26.7		
10 Diversion requirement (=(9)/c)		mm				63.4	242.7	478.1	517.2	313.1	139.7	52.3		
11 Diversion requirement		mm/day				2.0	8.1	15.4	16.7	10.4	4.5	7.5		
E Suger Beet	20%													
1 Cropping Pattern														
2 Crop coefficient	Kc-1				0.55	0.55	0.71	0.88	1.10	1.03	0.96			
	Kc-2					0.55	0.55	0.72	0.89	1.10	1.03	0.96		
	Average				0.55	0.55	0.63	0.80	1.00	1.07	1.00	0.96		
3 Days of irrigation		days			10	30	31	30	31	31	30	27		
4 ETcrop (Eto x Kc)		mm			38.0	57.8	104.0	185.6	298.5	302.5	209.9	126.7		
5 Area factor (Af)					0.05	0.78	1.00	1.00	1.00	1.00	1.00	0.39		
6 ETcrop net (Eto x Kc x Af)		mm			1.9	45.0	104.0	185.6	298.5	302.5	209.9	49.4		
7 Effective rainfall		mm/month			44.8	65.5	51.8	8.9	0.0	0.0	0.0	1.4		
8 Effective rainfall (=(3)*(7)/days of month)		mm			14.5	65.5	51.8	8.9	0.0	0.0	0.0	1.3		
9 Net requirement (=(6)-(8))		mm			0.0	0.0	52.2	176.7	298.5	302.5	209.9	48.1		
10 Diversion requirement (=(9)/c)		mm			0.0	0.0	102.3	346.5	585.3	593.1	411.7	94.4		
11 Diversion requirement		mm/day			0.0	0.0	3.3	11.5	18.9	19.1	13.7	3.5		
F Alfalfa	20%													
1 Cropping Pattern														
2 Crop coefficient	Kc-1					1.00	1.00	1.00	1.00	1.00	1.00	1.00		
	Kc-2					1.00	1.00	1.00	1.00	1.00	1.00	1.00		
	Average					1.00	1.00	1.00	1.00	1.00	1.00	1.00		
3 Days of irrigation		days				15	30	31	31	30	31	15		
4 ETcrop (Eto x Kc)		mm				165.0	232.0	300.0	284.0	211.0	132.0	55.0		
5 Area factor (Af)						0.50	1.00	1.00	1.00	1.00	1.00	0.50		
6 ETcrop net (Eto x Kc x Af)		mm				82.5	232.0	300.0	284.0	211.0	132.0	27.5		
7 Effective rainfall		mm/month				51.8	8.9	0.0	0.0	0.0	1.4	15.6		
8 Effective rainfall (=(3)*(7)/days of month)		mm				25.1	8.6	0.0	0.0	0.0	1.4	7.5		
9 Net requirement (=(6)-(8))		mm				57.4	223.4	300.0	284.0	211.0	130.6	20.0		
10 Diversion requirement (=(9)/c)		mm				112.5	438.0	588.2	556.9	413.7	256.1	39.2		
11 Diversion requirement		mm/day				7.5	14.6	19.0	18.0	13.8	8.3	2.6		
Average diversion requirement of the cropping pattern		mm/day	0.2	0.2	0.5	1.1	5.4	9.3	11.8	13.4	10.3	4.9	2.4	0.5

Table A3.1.4 Location of Previous and Final Design of Turnout for Secondary Canal

Previous Design

No. of Turnout	Station No.	Canal Elv.
No.1	2+451.39	1,337.97
No.2	3+204.53	1,337.54
No.3	4+825.66	1,336.67
No.4	5+359.45	1,336.35
No.5	5+810.35	1,336.07
No.6	6+182.25	1,335.74
No.7	6+633.18	1,335.46
No.8	7+121.12	1,335.16
No.9	7+533.43	1,334.90
No.10	8+004.81	1,334.61
No.11	8+469.17	1,334.32
No.12	8+949.58	1,334.03
No.13	10+204.91	1,333.36
No.14	11+601.85	1,332.08
No.15	11+805.84	1,331.85
No.16	13+499.93	1,329.29
No.17	14+103.28	1,328.94
No.18	14+349.08	1,328.76
No.19	14+815.00	1,328.48
No.20	15+265.80	1,328.21
No.21	15+760.68	1,327.92
No.22	16+097.59	1,327.71
No.23	16+981.19	1,327.22

Final Design

No. of Turnout	Station No.	Canal Elv.
SC4	4+835.00	1,336.32
SC5	5+370.00	1,336.25
SC6	6+635.00	1,335.48
SC7	7+558.00	1,334.89
SC8	8+780.00	1,334.12
SC9	10+210.00	1,333.21
SC10	11+612.00	1,332.08
SC11	11+840.00	1,332.00
SC12	14+359.00	1,328.76
SC13	15+770.68	1,327.92
SC14	16+991.00	1,327.22

Table A3.2.1(1) Results of Walking Through on the Ravansar Right Bank Irrigation Canal

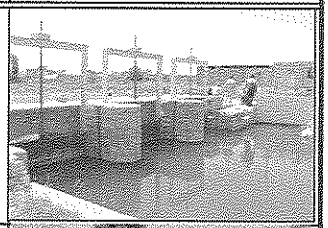
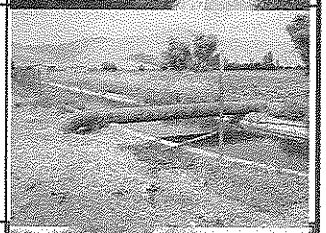
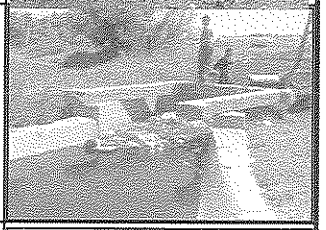
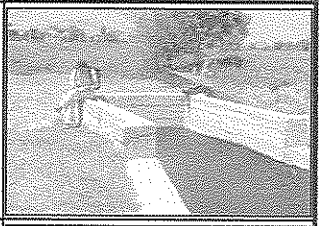
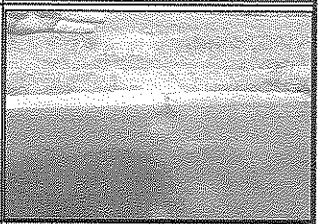
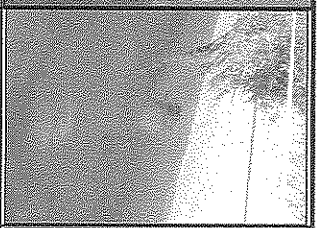
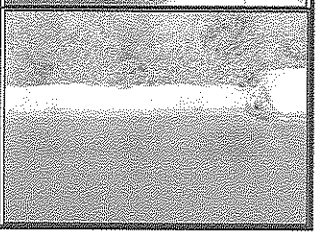
Station No.	Coordination	Situation	Photo
No.0	651,426 E 3,842,310 N		
No.0+021		Staff gauge	
No.0+346		Over sewage pipe (φ500mm)	
No.0+394	651,253 E 3,842,054 N	Inlet of Siphon Water level of upstream canal is lower than water level after the siphon	
No.0+430	651,250 E 3,842,021 N	Outlet of Siphon	
No.0+465	651,247 E 3,841,997 N	Illegal Intake (Left) Left bank lining are broken in places	
No.0+544	651,239 E 3,841,912 N	Drainage inflow hole	
No.0+563		Right bank lining are broken at 4 blocks	

Table A3.2.1(2) Results of Walking Through on the Ravansar Right Bank Irrigation Canal

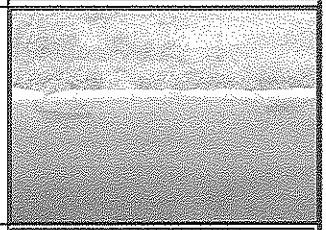
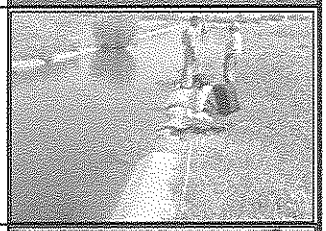
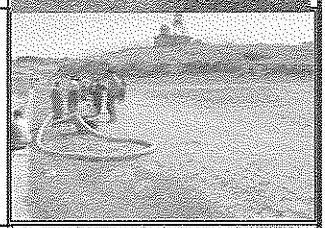
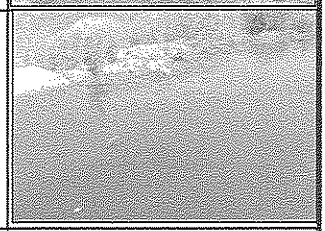
Station No.	Coordination	Situation	Photo
No.0+614		Illegal Intake (Right) with cobble placing	
No.0+620	651,263 E 3,841,857 N	Lining of one block are broken at both side Possible to irrigate	
No.0+700	651,306 E 3,841,709 N	Sediments flow into the canal in winter season Possible to irrigate for right bank	
No.0+964		Illegal weir made by stones (h=0.30m)	
No.1	651,334 E 3,841,505 N	Possible to irrigate for left bank	
No.1+100	651,330 E 3,041,391 N	Movable pump for filling the water tank	
No.1+132		Illegal intake (Left) Lining is broken	
No.1+143	651,329 E 3,841,352 N	Illegal intake (Right) Lining is deteriorated	

Table A3.2.1(3) Results of Walking Through on the Ravansar Right Bank Irrigation Canal

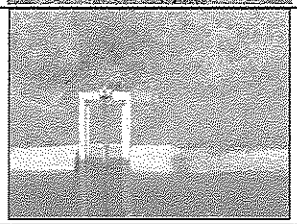
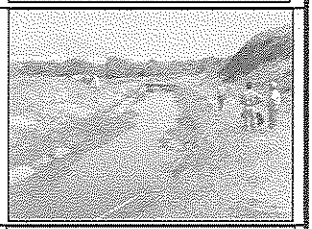
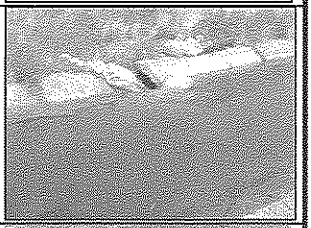
Station No.	Coordination	Situation	Photo
No.1+153	651,330 E 3,841,306 N	Sediments flow into the canal from the barracks	
No.1+297	651,356 E 3,841,191 N	Turn out (Left) No.1 Military drainage out let	
No.1+350	651,375 E 3,841,139 N	Lining are broken (L=50.0m)	
No.1+443		Big stone is in the canal	
No.1+449		Big stone is in the canal	
No.1+454		Concrete Bridge (B=7.3m)	
No.1+507		Illegal intake (Left)	
No.1+588		Military drainage out let	

Table A3.2.1(4) Results of Walking Through on the Ravansar Right Bank Irrigation Canal

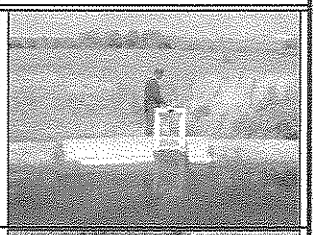
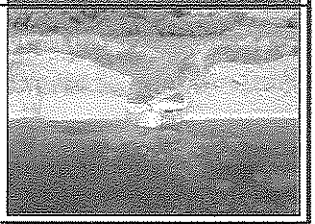
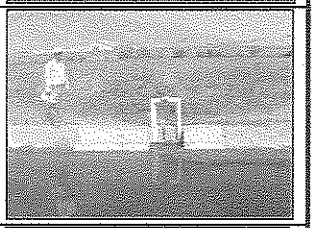
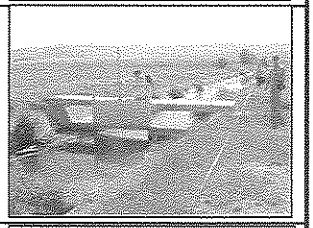
Station No.	Coordination	Situation	Photo
No.1+611	651,490 E 3,840,911 N	Turn out (Left) No.2	
No.1+756	651,518 E 3,840,767 N	Illegal intake (Left)	
No.1+867	651,501 E 3,840,664 N	Turn out (Left) No.3	
No.2+027		Turn out (Left) No.4 to old irrigation canal	
		Turn out No.5 (Right)	
No.2+303		Turn out No.6 (Left) Gate lode is broken	
No.2+344	651,227 E 3,840,322 N	Check gate No.1	
No.2+394	651,182 E 3,840,324 N	Leakage due to the subsidence of canal bed	

Table A3.2.1(5) Results of Walking Through on the Ravansar Right Bank Irrigation Canal

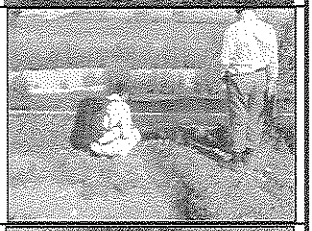
Station No.	Coordination	Situation	Photo
No.2+400	651,173 E 3,840,326 N	Military sewage pool (Left)	
No.2+500	651,069 E 3,840,323 N	End of inspection road	
No.2+514	651,062 E 3,840,312 N	Lining is broken due to inflow of drainage from right bank field	
No.2+526		Illegal intake (Left)	
No.2+764	651,067 E 3,840,077 N	Pipe from pump along the Gharasu river to right bank field	
No.2+781	651,070 E 3,840,067 N	Turn out No.7 (Left)	
No.2+926		Concrete bridge (B=5.0m)	
No.2+996	651,058 E 3,839,849 N	Turn out No.8 (Left)	

Table A3.2.1(6) Results of Walking Through on the Ravansar Right Bank Irrigation Canal

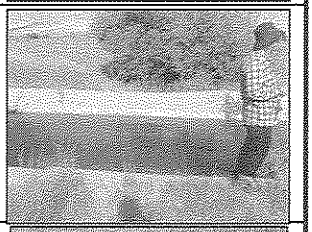
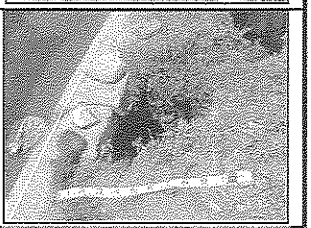
Station No.	Coordination	Situation	Photo
No.3		Poor quality of lining concrete	
No.3+046		Drainage culvert under the canal	
No.3+066		Turn out No.9 (Left)	
No.3+070	651,040 E 3,839,781 N	Check gate No.2	
No.3+267	650,999 E 3,839,606 N	Illegal pump	
No.3+593	651,031 E 3,839,272 N	Turn out No.10 (Left) Leakage from gate Beginning of inspection road	
No.3+802	650,934 E 3,839,083 N	Illegal intake (Left) Lining concrete is broken by farmer	
No.3+809	650,929 E 3,839,076 N	Spring water flow into the canal from right bank	

Table A3.2.1(7) Results of Walking Through on the Ravansar Right Bank Irrigation Canal

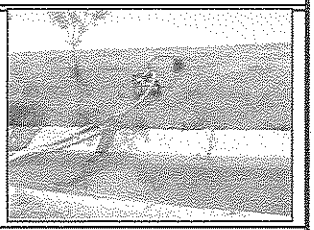
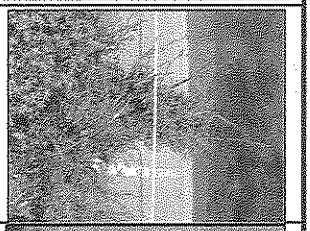
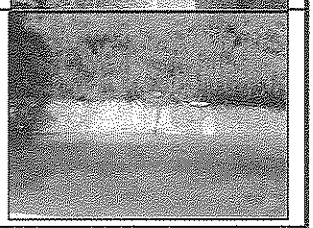
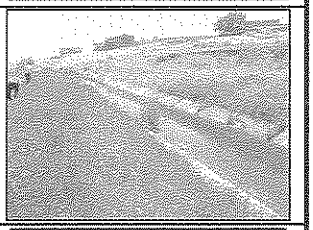
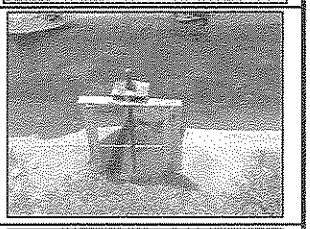
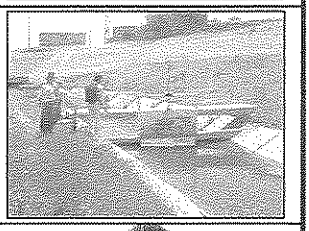
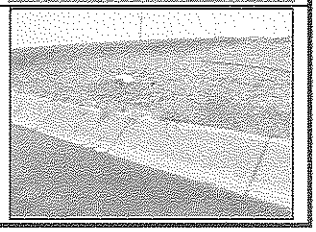
Station No.	Coordination	Situation	Photo
No.3+820	650,921 E 3,839,064 N	Illegal pump	
No.3+843	650,911 E 3,839,044 N	There is 30cm of space at concrete joint	
No.3+861	650,903 E 3,839,029 N	Spring water flow into the canal from right bank	
No.3+900	650,903 E 3,838,997 N	End of inspection road	
No.4+010	650,898 E 3,838,893 N	Turn out No.11 (Left)	
No.4+025	650,896 E 3,838,878 N	Check gate No.3	
No.4+049	650,895 E 3,838,846 N	Concrete bridge (B=4.0m) Sedimentation by small stone	
No.4+121	650,933 E 3,838,788 N	Illegal pump (Right) Already removed	

Table A3.2.1(8) Results of Walking Through on the Ravansar Right Bank Irrigation Canal

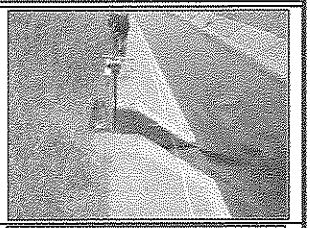
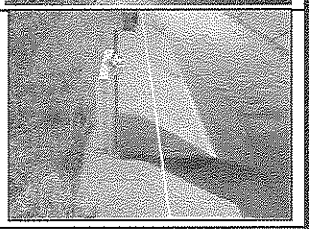
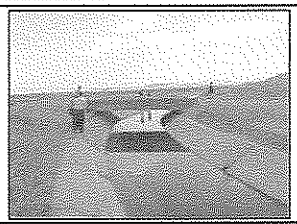
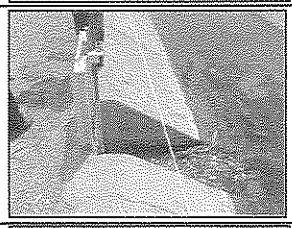
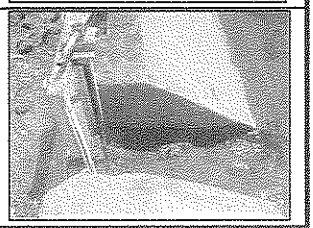
Station No.	Coordination	Situation	Photo
No.4+144	650,949 E 3,838,768 N	Turn out No.12 (Left)	
No.4+262	650,986 E 3,838,667 N	Illegal pump (Right) Already removed	
No.4+336	650,964 E 3,838,593 N	Illegal pump (Right)	
No.4+495	650,918 E 3,838,465 N	Turn out No.13 (Left)	
No.4+573	650,908 E 3,838,383 N	Illegal pump (Left) Already removed	
No.4+582	650,905 E 3,838,374 N	Concrete bridge (B=4.0m) Beginning point of inspection road	
No.4+638	650,873 E 3,838,327 N	Turn out No.14 (Left) Nine farmer irrigated from the turn out. So, problem of water distribution is occurred by farmers	
No.4+884	650,805 E 3,838,112 N	Turn out No.15 (Left)	

Table A3.2.1(9) Results of Walking Through on the Ravansar Right Bank Irrigation Canal

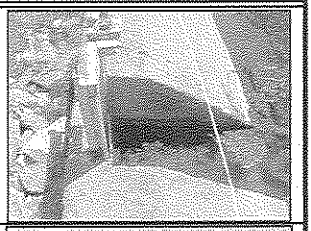
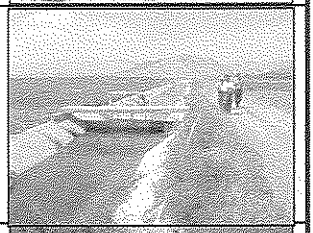
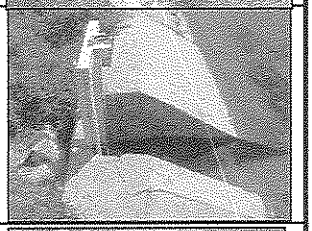
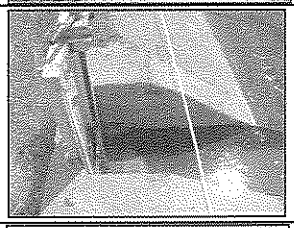
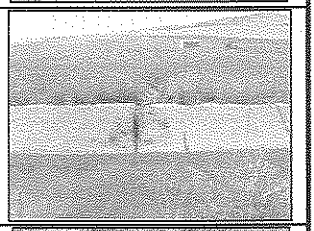
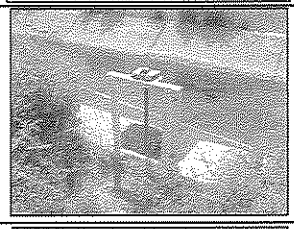
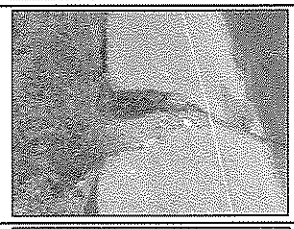
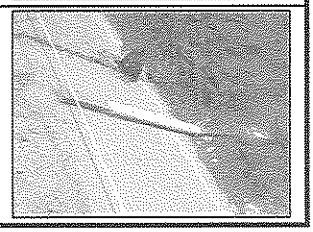
Station No.	Coordination	Situation	Photo
No.4+969	650,788 E 3,838,026 N	Turn out No.16 (Left)	
No.4+986	650,785 E 3,838,008 N	Check gate No.4	
No.5+184	650,732 E 3,837,820 N	Turn out No.17 (Left) Out of function	
No.5+367	650,635 E 3,837,654 N	Turn out No.18 (Left)	
No.5+524	650,575 E 3,837,531 N	Concrete joint of right side is collapsed	
No.5+563	650,561 E 3,837,491 N	Turn out No.19 (Left)	
No.5+755	650,498 E 3,837,317 N	Concrete joint of left side upper potion is collapsed	
No.5+774	650,492 E 3,837,298 N	Staff gauge	

Table A3.2.1(10) Results of Walking Through on the Ravansar Right Bank Irrigation Canal

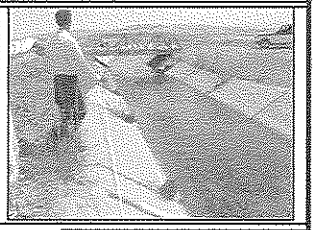
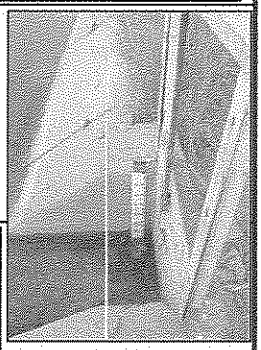
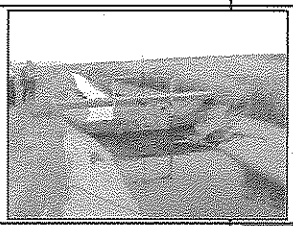
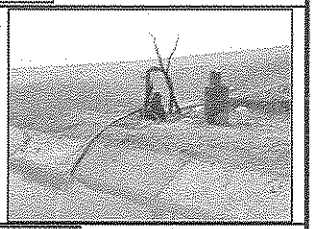
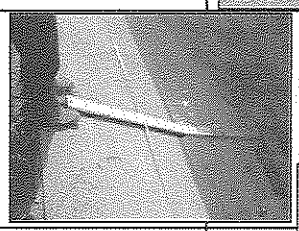
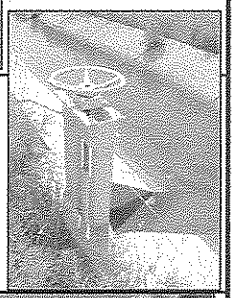
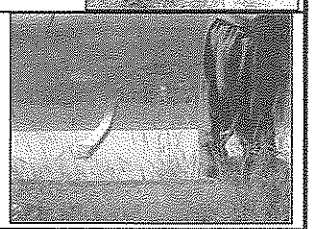
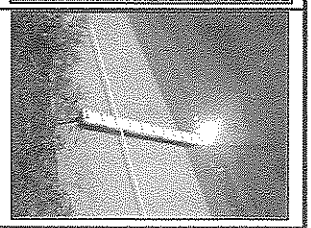
Station No.	Coordination	Situation	Photo
No.5+791	650,487 E 3,837,281 N	Steel bridge (B=3.0m)	
No.5+838	650,453 E 3,837,246 N	Turn out No.20 (Left) Staff gauge	
No.5+848	650,445 E 3,837,235 N	Check gate No.5	
No.6	650,323 E 3,837,143 N	Illegal pump	
No.6+075	650,266 E 3,837,099 N	Staff gauge	
No.6+094	650,248 E 3,837,083 N	Turn out No.21 (Left)	
No.6+101	650,245 E 3,837,081 N	Staff gauge	
No.6+245	650,139 E 3,836,976 N	Staff gauge	

Table A3.2.1(11) Results of Walking Through on the Ravansar Right Bank Irrigation Canal

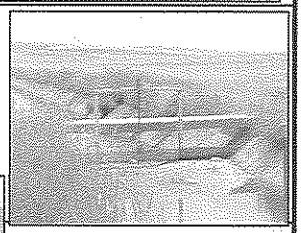
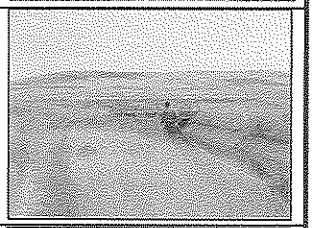
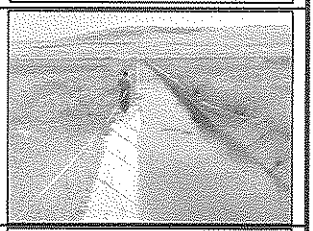
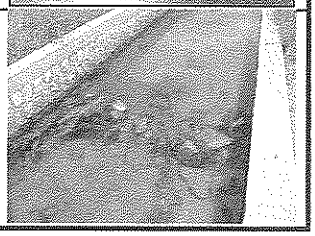
Station No.	Coordination	Situation	Photo
No.6+275	650,122 E 3,836,956 N	Turn out (Left) No.22	
No.6+289	650,114 E 3,836,946 N	Check gate No.6	
No.6+588	649,940 E 3,836,692 N	Turn out No.23 (Left)	
No.6+601		Staff gauge	
No.6+658	649,914 E 3,836,629 N	Steel bridge (B=3.0m)	
No.6+680	649,906 E 3,836,610 N	Canal section changes from Rectangular to Trapezoid.	
No.6+702	649,899 E 3,836,590 N	Illegal intake (Right)	
No.6+711	649,895 E 3,836,581 N	Illegal intake (Left)	

Table A3.2.1(12) Results of Walking Through on the Ravansar Right Bank Irrigation Canal

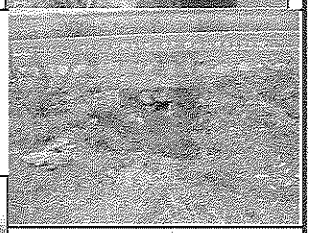
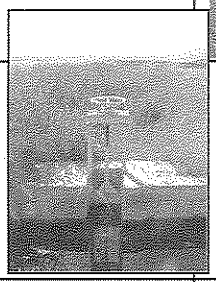
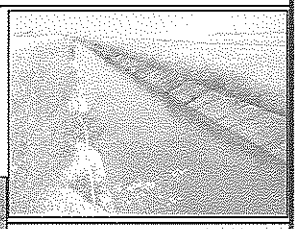
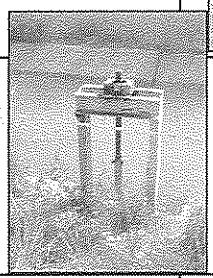
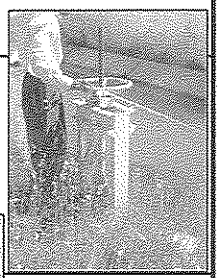
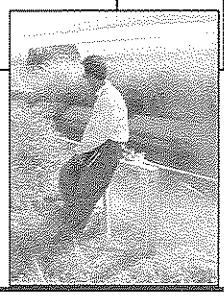
Station No.	Coordination	Situation	Photo
No.6+750	649,882 E 3,836,549 N	Illegal intake from bottom of the canal (Left)	
No.6+760	649,879 E 3,836,541 N	Illegal intake from bottom of the canal (Left)	
No.6+803	649,864 E 3,836,502 N	Illegal intake (Left)	
No.6+847		Turn out No.24 (Right)	
No.6+856		Canal section change to standard section	
No.7+082	649,921 E 3,836,252 N	Turn out No.25 (Left)	
No.7+123	649,933 E 3,836,222 N	Turn out No.26 (Left)	
No.7+345	649,989 E 3,835,995 N	Turn out No.27 (Left)	

Table A3.2.1(13) Results of Walking Through on the Ravansar Right Bank Irrigation Canal

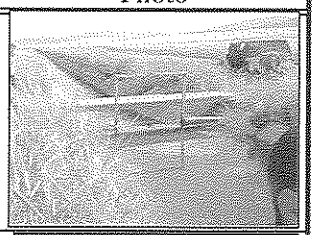
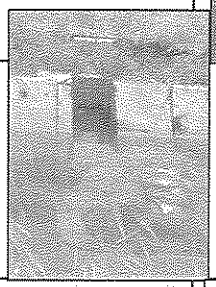
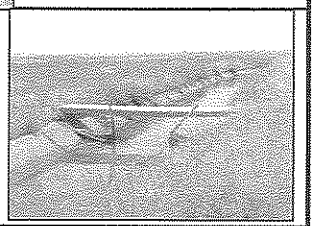
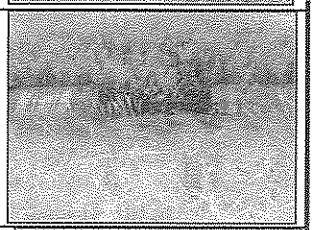
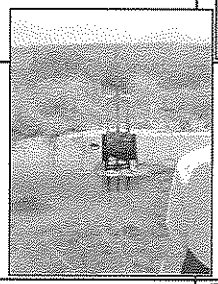
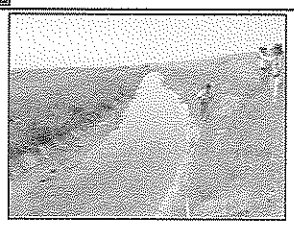
Station No.	Coordination	Situation	Photo
No.7+358	649,991 E 3,835,980 N	Check gate No.7	
No.7+897	650,069 E 3,835,476 N	Staff gauge	
No.7+907	650,071 E 3,835,471 N	Turn out No.28 (Left) Out of order	
No.7+920	650,078 E 3,835,454 N	Check gate No.8 Out of order	
No.7+986	650,093 E 3,835,386 N	There are not concrete lining at both side	
No.8+085	650,087 E 3,835,285 N	Staff gauge	
No.8+093	650,085 E 3,835,276 N	Turn out No.29 (Left)	
No.8+200	650,080 E 3,835,178 N	Sedimentation at inside of curve	

Table A3.2.1(14) Results of Walking Through on the Ravansar Right Bank Irrigation Canal

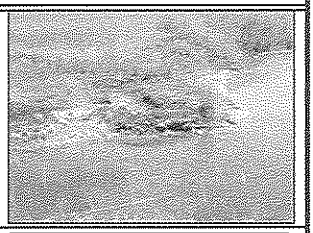
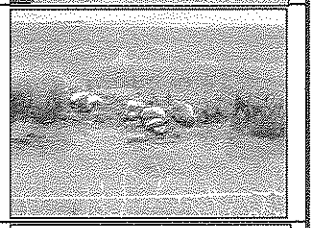
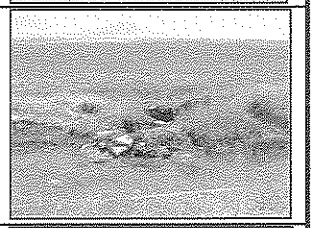
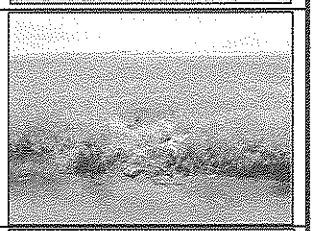
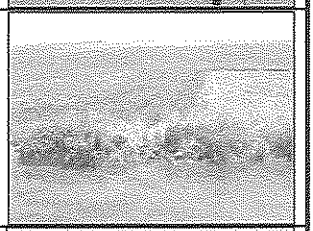
Station No.	Coordination	Situation	Photo
No.8+397	650,151 E 3,834,995 N	End of concrete lining canal Hereafter earth canal Old turn out (Left)	
No.8+536	650,218 E 3,834,879 N	Old turn out (Left)	
No.8+588	650,217 E 3,834,829 N	Old turn out (Left)	
No.8+630	650,210 E 3,834,790 N	Old turn out (Left)	
No.8+657	650,208 E 3,834,764 N	Old turn out (Left)	
No.8+730	650,209 E 3,834,691 N	Old turn out (Left) Out of function because operation is so difficult	
No.8+736	650,208 E 3,834,686 N	Old turn out (Left)	
No.8+755	650,207 E 3,834,671 N	Old turn out (Left)	

Table A3.2.1(15) Results of Walking Through on the Ravansar Right Bank Irrigation Canal

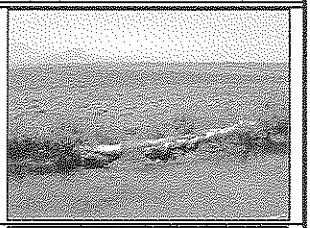
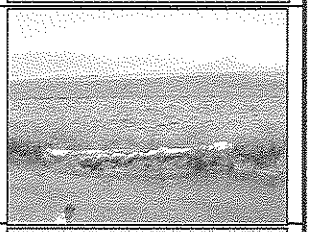
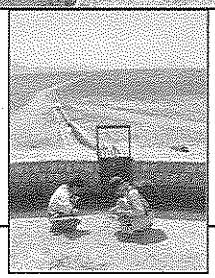
Station No.	Coordination	Situation	Photo
No.8+798	650,193 E 3,834,629 N	Old turn out (Left)	
No.8+832	650,184 E 3,834,599 N	Left bank of the canal is repaired	
No.8+907	650,162 E 3,834,517 N	Road crossing culvert	
No.8+915	650,158 E 3,834,508 N	Intake gate for Tam Tam land consolidation area The end	

Table A3.3.1 List of Village that Land Consolidation has been carried out

Village name		Land reform area (ha)	Land consolidation area (ha)
Site-1	Tapeh Kuick	190.0	
	Tapeh Lori	316.0	
	Deh Bagh	45.7	
	Shali Abad	122.3	
	Ghale Zakaria		121.5
	Kareim Abad	117.8	
	Gerazi Abad	312.7	
	Mir Azizi	250.0	
	Sub-Total	1,354.5	121.5
Site-2	Gargabi Mirza Ali		228.5
	Elyasei	303.0	
	Pirouzeh	265.0	
	Tapeh Ghol	601.0	
	Jil Abad	155.0	
	Chagha Shekar	254.5	
	Deh Jan Jan	265.0	
	Deh Cheragh	447.0	
	Rootvand	353.0	
	Zalou Ab	699.5	
	Sabz Bolagh	288.0	
	Siyah Siyah Dayar	273.0	
	Siyah Siyah	300.0	
	Hossein Abad Shaleh	438.5	
	Ghale Khoda Mororat	332.0	
	Ghale Farajpllah-e-Beig	268.0	
	Kachikineh	382.0	
	Kandouleh	579.0	
	Golmat Abad	193.5	
	Lamini	244.0	
	Nouroleh Sofla	702.0	
	Nouroleh Oliya	272.0	
	Vali Abad	201.0	
	Yavari Dayar	215.0	
	Sub-Total	8,031.0	228.5
Between Site-1 and Site-2	Tam Tam		343.7
	Amr Abad		327.5
	Tapeh Zard		381.8
	Sub-Total	0	1,053.0
	Total	9,385.5	1,403.0

Source: Javanrood Agricultural center, Kuzaran Agricultural Center, Kermanshah Agricultural Center

Table A3.3.2 (1) Quantities of Farm Road (Meskin Abad Area)

Route Name	Total Length (m)	Road Width (m)	Width of Roadway (m)	Height of Road (m)	Side Slope	Embankment Volume (m3)	Gravel Pavement h=0.15m (m3)	Shaping of Side Slope (m2)
FR-1	2,710.0	4.0	3.1	1.0	1:1.0	13,550	1,260	7,665
FR-2	917.0	4.0	3.1	1.0	1:1.0	4,585	426	2,594
FR-3	769.0	4.0	3.1	1.0	1:1.0	3,845	358	2,175
FR-4	232.0	4.0	3.1	1.0	1:1.0	1,160	108	656
FR-5	353.0	4.0	3.1	1.0	1:1.0	1,765	164	998
FR-6	658.0	4.0	3.1	1.0	1:1.0	3,290	306	1,861
FR-7	636.0	4.0	3.1	1.0	1:1.0	3,180	296	1,799
FR-8	706.0	4.0	3.1	1.0	1:1.0	3,530	328	1,997
	6,981.0					34,905	3,246	19,745

Table A3.3.2 (2) Quantities of Irrigation Canal (Meskin Abad Area)

Route Name	Total Length (m)	Open Canal Length (m)	Bottom Width (m)	Height of Canal (m)	Side Slope	Embankment Volume (m3)	Excavation Volume (m3)	Sub-soil Compaction (m2)	Shaping of Side Slope (m2)	Concrete Lining t=0.10m (m3)	Base Gravel t=0.15 (m3)
TI-1	119.0	113.0	0.50	0.60	1:1.0	246.34	180.08	384.67	95.88	37.49	77.12
TI-2	916.0	892.0	0.30	0.60	1:1.0	1,766.16	1,252.03	2,858.11	756.89	278.13	582.03
TI-3	419.0	413.0	0.80	0.60	1:1.0	1,024.24	775.87	1,529.82	350.44	149.42	300.46
TI-4	616.0	592.0	0.30	0.60	1:1.0	1,172.16	830.95	1,896.86	502.33	184.59	386.28
TI-5	152.0	146.0	0.30	0.40	1:1.0	207.32	139.89	385.22	82.59	33.84	71.91
TI-6	239.0	227.0	0.30	0.40	1:1.0	322.34	217.49	598.93	128.41	52.62	111.80
TI-7	429.0	423.0	0.30	0.60	1:1.0	837.54	593.73	1,355.36	358.93	131.89	276.01
TI-8	353.0	335.0	0.30	0.50	1:1.0	569.50	392.24	978.64	236.88	91.05	191.79
TI-9	492.0	486.0	0.50	0.60	1:1.0	1,059.48	774.50	1,654.42	412.38	161.25	331.70
TI-10	656.0	632.0	0.30	0.50	1:1.0	1,074.40	739.99	1,846.27	446.89	171.78	361.82
TI-11	470.0	464.0	0.80	0.60	1:1.0	1,150.72	871.68	1,718.73	393.72	167.88	337.56
TI-12	634.0	604.0	0.30	0.60	1:1.0	1,195.92	847.79	1,935.31	512.51	188.33	394.11
TI-13	442.0	436.0	0.80	0.60	1:1.0	1,081.28	819.08	1,615.02	369.96	157.74	317.19
TI-14	704.0	674.0	0.30	0.60	1:1.0	1,334.52	946.04	2,159.61	571.91	210.15	439.79
Total	6,641.0	6,437.0				13,041.92	9,381.36	20,916.97	5,219.72	2,016.16	4,179.57

Route Name	Culvert Length			Inlet (Type A)		Inlet (Type B)		Diversion
	Size of Cul.	Road (m)	Access Road (m)	Size	Number (places)	Size	Number (places)	(units)
TI-1	φ1,000	6.0	0.0					1.0
TI-2	φ600	0.0	24.0	0.60	4.0	0.60	6.0	
TI-3	φ1,300	6.0	0.0					1.0
TI-4	φ600	0.0	24.0	0.60	4.0	0.60	4.0	1.0
TI-5	φ450	0.0	6.0	0.40	1.0	0.40	1.0	
TI-6	φ300	6.0	6.0	0.40	1.0			
TI-7	φ1,000	6.0	0.0					1.0
TI-8	φ500	0.0	18.0	0.50	3.0	0.50	3.0	
TI-9	φ1,200	6.0	0.0					1.0
TI-10	φ600	0.0	24.0	0.50	4.0	0.50	5.0	
TI-11	φ1,200	6.0	0.0					1.0
TI-12	φ600	0.0	30.0	0.60	5.0	0.60	5.0	
TI-13	φ1,200	6.0	0.0					1.0
TI-14	φ600	0.0	30.0	0.60	5.0	0.60	5.0	
Total		42.0	162.0					7.0

Table A3.3.2 (3) Quantities of Drainage Canal (Meskin Abad Area)

Route Name	Total Length (m)	Open Canal Length (m)	Bottom Width (m)	Height of Canal (m)	Side Slope	Excavation Volume (m3)	Manual Embankment (m3)	Sub-soil Compaction (m2)	Shaping of Side Slope (m2)	Culvert Length		Junction Box (units)	Spill out Structure (units)
										Size of Cul.	Road (m)		
TD-1	222.0	222.0	4.00	2.10	1:1.0	3,409.92	106.56	888.00	1,883.45				1.0
TD-2	677.0	677.0	3.00	1.80	1:1.0	7,250.67	324.96	2,031.00	5,169.30				1.0
TD-3	458.0	458.0	2.00	1.60	1:1.0	3,393.78	219.84	916.00	3,238.06				1.0
TD-4	230.0	230.0	0.50	0.40	1:1.0	193.20	110.40	115.00	845.57				1.0
TD-5	347.0	347.0	3.00	2.10	1:1.0	4,497.12	166.56	1,041.00	2,943.95				1.0
TD-6	755.0	755.0	3.00	2.20	1:1.0	10,381.25	362.40	2,265.00	6,618.93				1.0
TD-7	771.0	771.0	4.00	2.40	1:1.0	13,947.39	370.08	3,084.00	7,195.28				1.0
Total	3,460.0	3,460.0				43,073.33	1,660.80	10,340.00	27,894.54				7.0

Table A3.3.3 (1) Quantities of Farm Road (Khoram Abad Area)

Route Name	Total Length (m)	Road Width (m)	Width of Roadway (m)	Height of Road (m)	Side Slope	Embankment Volume (m3)	Gravel Pavement h=0.15m (m3)	Shaping of Side Slope (m2)
FR-1	1,556.0	4.0	3.1	1.0	1:1.0	7,780	724	4,401
FR-2	356.0	4.0	3.1	1.0	1:1.0	1,780	166	1,007
FR-3	1,163.0	4.0	3.1	1.0	1:1.0	5,815	541	3,289
FR-4	1,267.0	4.0	3.1	1.0	1:1.0	6,335	589	3,584
FR-5	312.0	4.0	3.1	1.0	1:1.0	1,560	145	882
FR-6	1,621.0	4.0	3.1	1.0	1:1.0	8,105	754	4,585
FR-7	205.0	4.0	3.1	1.0	1:1.0	1,025	95	580
FR-8	206.0	4.0	3.1	1.0	1:1.0	1,030	96	583
FR-9	205.0	4.0	3.1	1.0	1:1.0	1,025	95	580
FR-10	206.0	4.0	3.1	1.0	1:1.0	1,030	96	583
FR-11	1,358.0	4.0	3.1	1.0	1:1.0	6,790	631	3,841
FR-12	753.0	4.0	3.1	1.0	1:1.0	3,765	350	2,130
FR-13	1,082.0	4.0	3.1	1.0	1:1.0	5,410	503	3,060
FR-14	463.0	4.0	3.1	1.0	1:1.0	2,315	215	1,310
FR-15	208.0	4.0	3.1	1.0	1:1.0	1,040	97	588
FR-16	649.0	4.0	3.1	1.0	1:1.0	3,245	302	1,836
FR-17	686.0	4.0	3.1	1.0	1:1.0	3,430	319	1,940
FR-18	200.0	4.0	3.1	1.0	1:1.0	1,000	93	566
FR-19	406.0	4.0	3.1	1.0	1:1.0	2,030	189	1,148
FR-20	1,312.0	4.0	3.1	1.0	1:1.0	6,560	610	3,711
FR-21	738.0	4.0	3.1	1.0	1:1.0	3,690	343	2,087
FR-22	205.0	4.0	3.1	1.0	1:1.0	1,025	95	580
	15,157.0					75,785	7,048	42,870

Table A3.3.3 (2) Quantities of Irrigation Canal (Khoram Abad Area)

Total Length (m)	Open Canal Length (m)	Bottom Width (m)	Height of Canal (m)	Side Slope	Embankment Volume (m3)	Excavation Volume (m3)	Sub-soil Compaction (m2)	Shaping of Side Slope (m2)	Concrete Lining t=0.10m (m3)	Base Gravel t=0.15 (m3)
6.0	0.0	0.80	0.70	1:1.0	0.00	0.00	0.00	0.00	0.00	0.00
12.0	12.0	0.50	0.50	1:1.0	22.80	16.09	37.46	8.49	3.50	7.23
365.0	341.0	0.30	0.30	1:1.0	388.74	260.99	803.27	144.67	65.40	140.66
1,091.0	1,061.0	0.30	0.50	1:1.0	1,803.70	1,242.30	3,099.52	750.24	288.38	607.42
1,337.0	1,277.0	0.50	0.60	1:1.0	2,783.86	2,035.06	4,347.12	1,083.57	423.71	871.55
6.0	0.0	0.80	0.60	1:1.0	0.00	0.00	0.00	0.00	0.00	0.00
1,626.0	1,554.0	0.30	0.60	1:1.0	3,076.92	2,181.23	4,979.27	1,318.61	484.54	1,013.99
1,585.0	1,519.0	0.30	0.50	1:1.0	2,582.30	1,778.56	4,437.49	1,074.10	412.86	869.63
285.0	279.0	0.50	0.50	1:1.0	530.10	374.10	870.85	197.28	81.41	168.10
752.0	722.0	0.30	0.60	1:1.0	1,429.56	1,013.42	2,313.41	612.64	225.12	471.11
235.0	229.0	0.30	0.30	1:1.0	261.06	175.27	539.44	97.16	43.92	94.46
547.0	511.0	0.30	0.60	1:1.0	1,011.78	717.25	1,637.33	433.60	159.33	333.43
462.0	444.0	0.30	0.30	1:1.0	506.16	339.83	1,045.90	188.37	85.16	183.15
405.0	387.0	0.30	0.50	1:1.0	657.90	453.13	1,130.55	273.65	105.19	221.56
789.0	741.0	0.30	0.60	1:1.0	1,467.18	1,040.09	2,374.28	628.76	231.04	483.50
786.0	750.0	0.30	0.60	1:1.0	1,485.00	1,052.72	2,403.12	636.40	233.85	489.38
737.0	713.0	0.30	0.40	1:1.0	1,012.46	683.14	1,881.23	403.33	165.27	351.15
582.0	558.0	0.30	0.50	1:1.0	948.60	653.35	1,630.10	394.57	151.66	319.46
11,608.0	11,098.0				19,968.12	14,016.53	25,241.61	6,182.38	3,160.34	4,982.29

Culvert Length			Inlet (Type A)		Inlet (Type B)		Diversion
Size of Cul.	Road (m)	Access Road (m)	Size	Number (places)	Size	Number (places)	(units)
ϕ1,300	6.0	0.0					1.0
ϕ900	0.0	0.0					1.0
ϕ300	12.0	12.0	0.30	2.0	0.30	2.0	
ϕ600	6.0	24.0	0.50	5.0	0.50	6.0	
ϕ900	12.0	48.0	0.60	8.0	0.60	10.0	
ϕ1,200	6.0	0.0					1.0
ϕ800	18.0	54.0	0.60	9.0	0.60	2.0	
ϕ700	6.0	60.0	0.50	10.0			
ϕ900	6.0	0.0					1.0
ϕ600	0.0	30.0	0.60	5.0	0.60	6.0	
ϕ300	6.0	0.0	0.30	1.0			
ϕ800	18.0	18.0	0.60	3.0	0.60	3.0	1.0
ϕ300	6.0	12.0	0.30	2.0			
ϕ600	0.0	18.0	0.50	3.0	0.50	3.0	
ϕ600	18.0	30.0	0.60	6.0	0.60	5.0	
ϕ600	18.0	18.0	0.60	3.0	0.60	3.0	1.0
ϕ450	6.0	18.0	0.40	3.0			
ϕ600	0.0	24.0	0.50	4.0	0.50	3.0	
	144.0	366.0					6.0

Table A3.3.3 (3) Quantities of Drainage Canal (Khoram Abad Area)

Route Name	Total Length (m)	Open Canal Length (m)	Bottom Width (m)	Height of Canal (m)	Side Slope	Excavation Volume (m3)	Manual Embankment (m3)	Sub-soil Compaction (m2)	Shaping of Side Slope (m2)	Culvert Length		Junction Box (units)	Spill out Structure (units)
										Size of Cul.	Road (m)		
TD-1	1,100.0	1,079.0	0.80	0.50	1:1.0	1,381.12	517.92	863.20	4,271.98	φ800	21.0		1.0
TD-2	1,577.0	1,533.0	5.50	3.50	1:1.0	54,176.22	735.84	8,431.50	19,075.43	8.50×3.50	52.0		1.0
TD-3	1,356.0	1,342.0	0.50	0.50	1:1.0	1,395.68	644.16	671.00	5,313.25	φ700	14.0		1.0
TD-4	777.0	767.0	3.00	2.30	1:1.0	11,167.52	368.16	2,301.00	6,941.04	5.00×2.30	11.0		1.0
TD-5	625.0	625.0	0.50	0.40	1:1.0	525.00	300.00	312.50	2,297.75				1.0
TD-6	525.0	525.0	0.50	0.40	1:1.0	441.00	252.00	262.50	1,930.11				1.0
TD-7	252.0	252.0	0.50	0.30	1:1.0	166.32	120.96	126.00	855.19				1.0
TD-8-1	693.0	693.0	7.00	4.50	1:1.0	39,251.52	332.64	4,851.00	10,582.94			1.0	1.0
TD-8-2	762.0	736.0	7.00	4.50	1:1.0	41,687.04	353.28	5,152.00	11,239.60	11.10×4.50	30.0		
TD-8-3	543.0	543.0	0.80	0.50	1:1.0	695.04	260.64	434.40	2,149.85			1.0	
TD-8-4	707.0	700.0	0.50	0.40	1:1.0	588.00	336.00	350.00	2,573.48	φ500	7.0		
TD-8-5	767.0	753.0	0.50	0.40	1:1.0	632.52	361.44	376.50	2,768.33	φ500	14.0		
TD-9	533.0	533.0	0.50	0.40	1:1.0	447.72	255.84	266.50	1,959.52				1.0
TD-10	124.0	116.0	0.80	0.60	1:1.0	177.48	55.68	92.80	492.07	φ800	8.0		1.0
Total	10,341.0	10,197.0				152,732.18	4,894.56	24,490.90	72,450.54		157.00		10.0

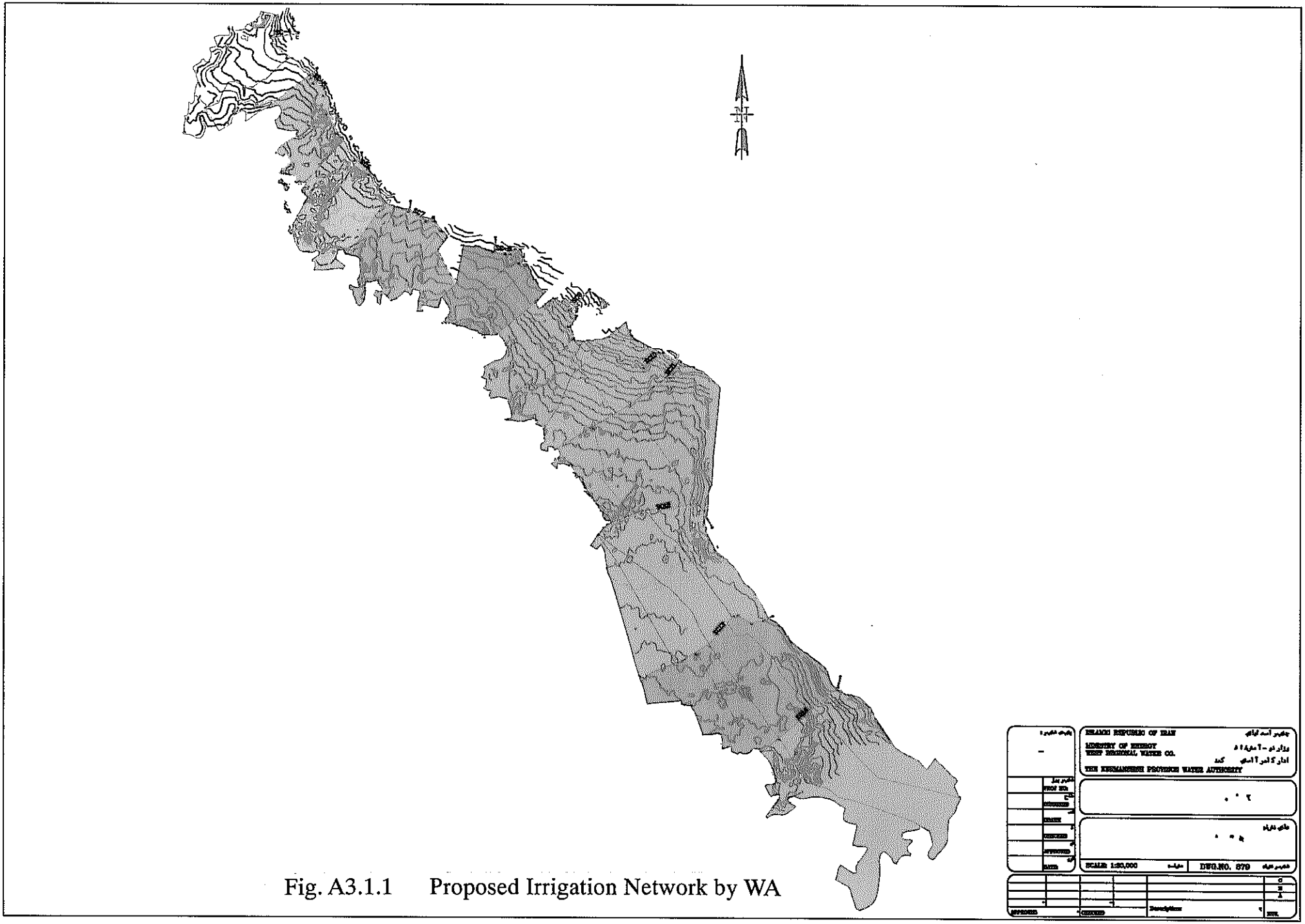


Fig. A3.1.1 Proposed Irrigation Network by WA

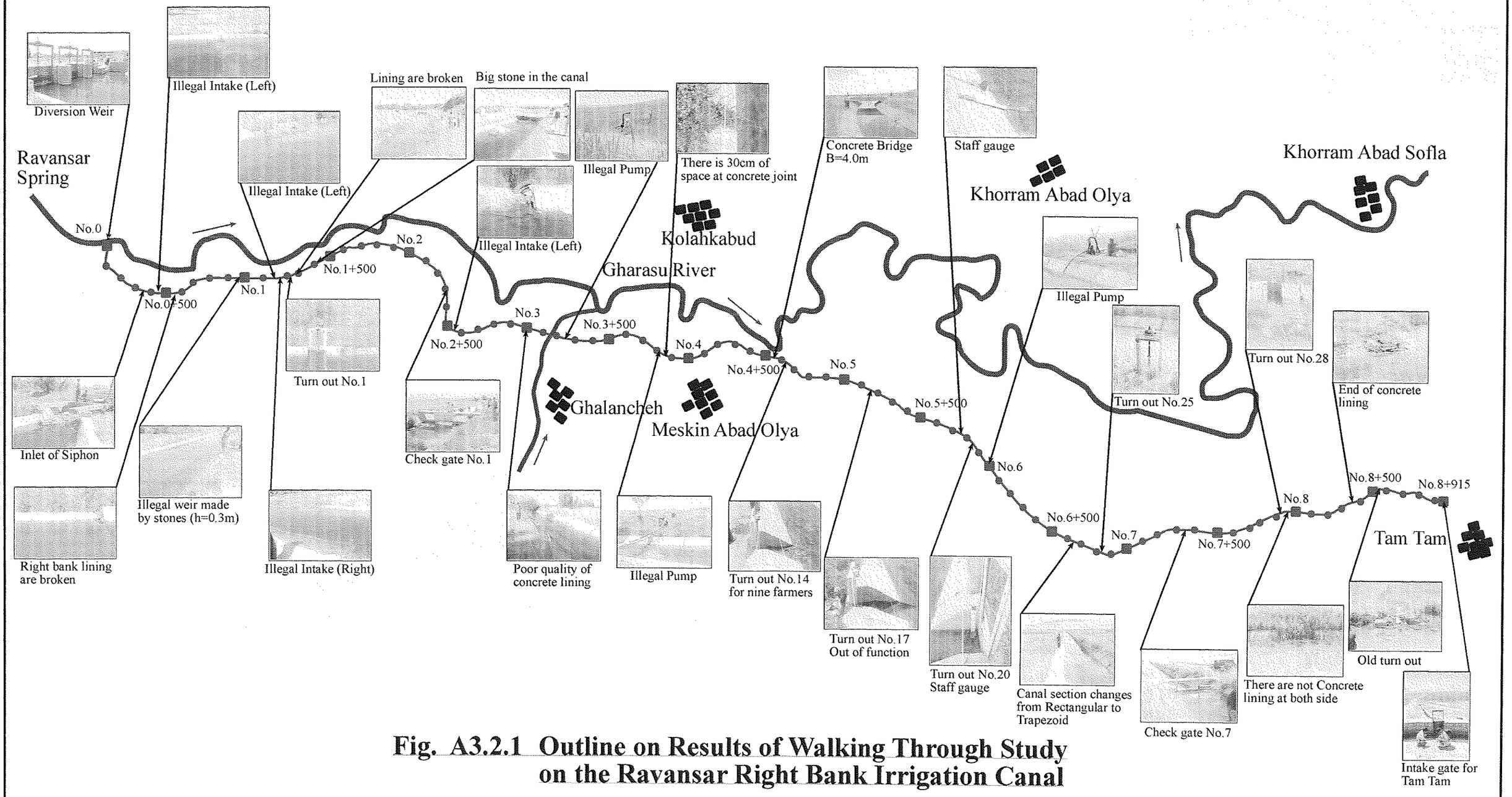


Fig. A3.2.1 Outline on Results of Walking Through Study on the Ravansar Right Bank Irrigation Canal

Fig. A3.3.1 Design of Major Structures

- Standard Plan of Farm Road, Irrigation and Drainage Canal
- Standard Plan of Inlet
- Standard Plan of Diversion Box
- Standard Plan of Pipe Culvert
- Standard Plan of Box Culvert
- Standard Plan of Outlet Structure to River

Standard Plan of Farm Road, Irrigation and Drainage Canal

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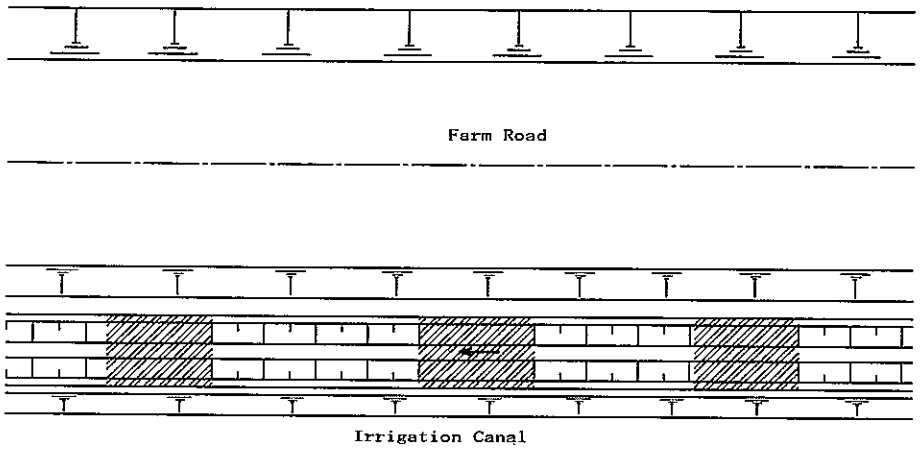

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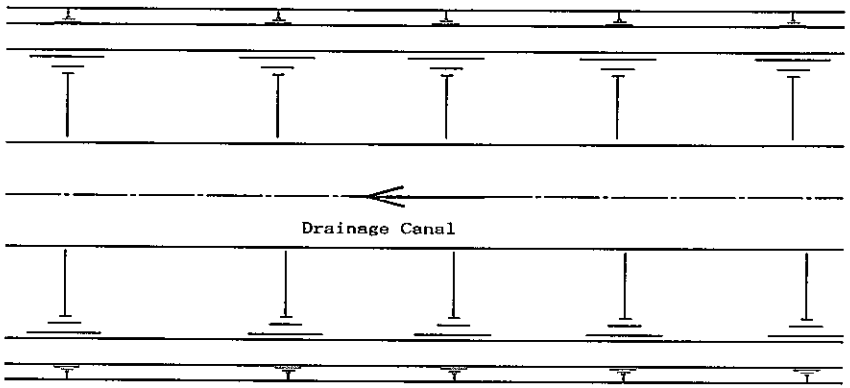

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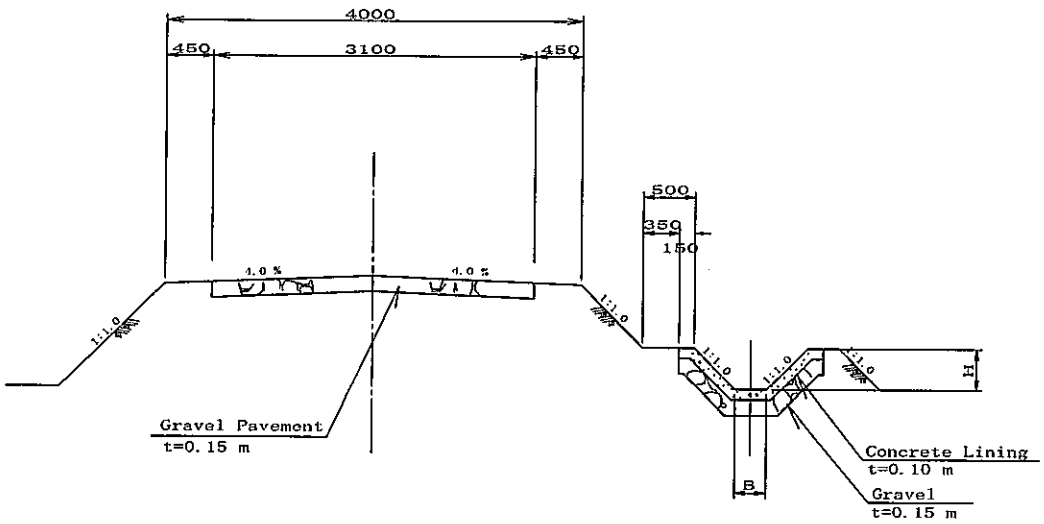

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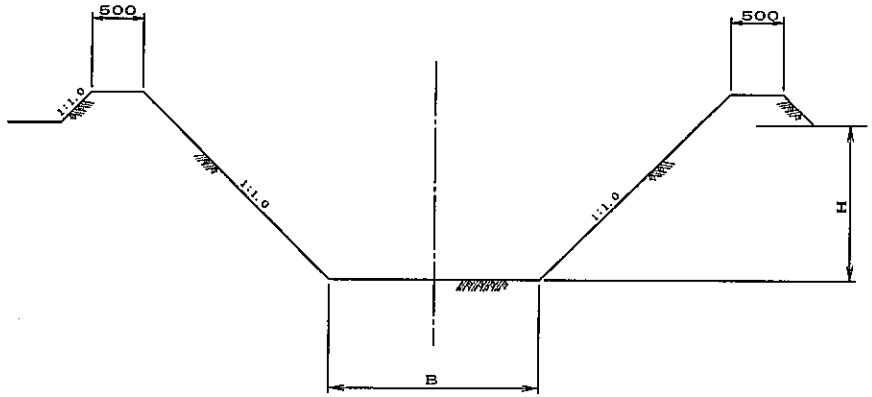

Standard Plan of Inlet

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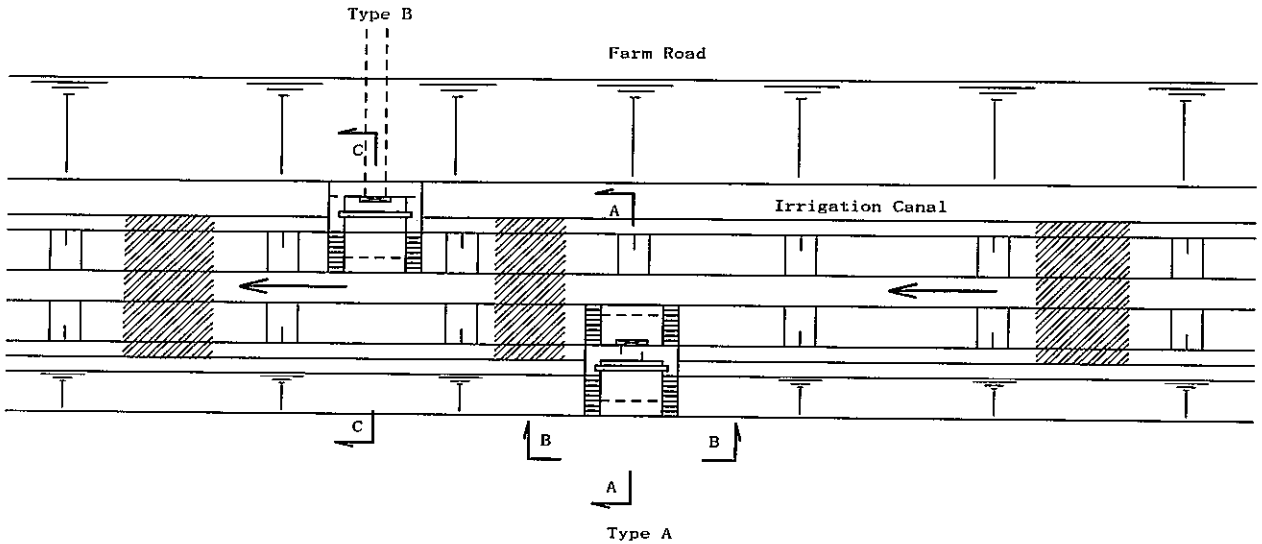

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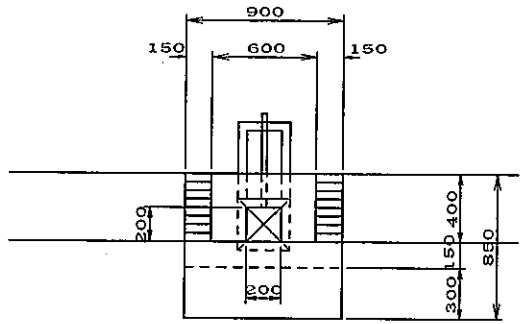

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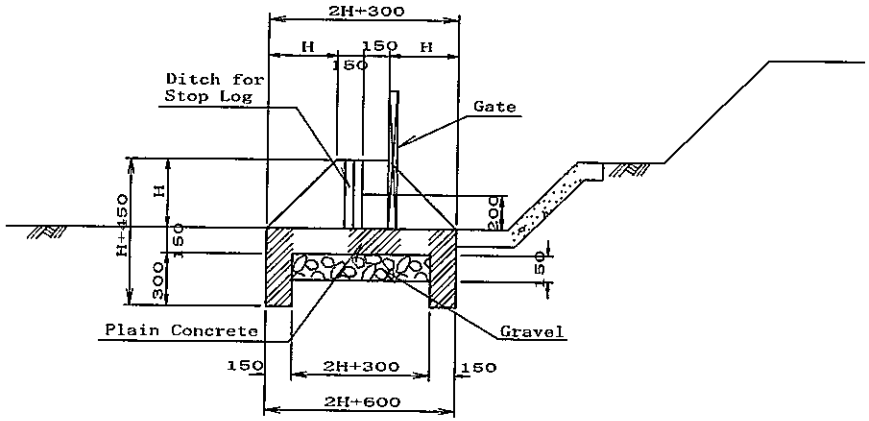

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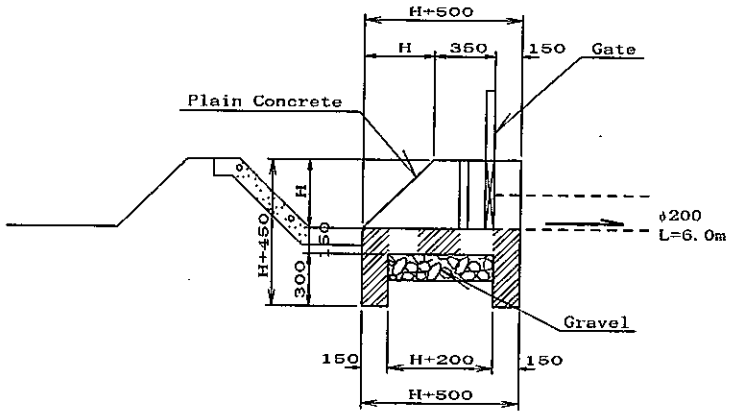
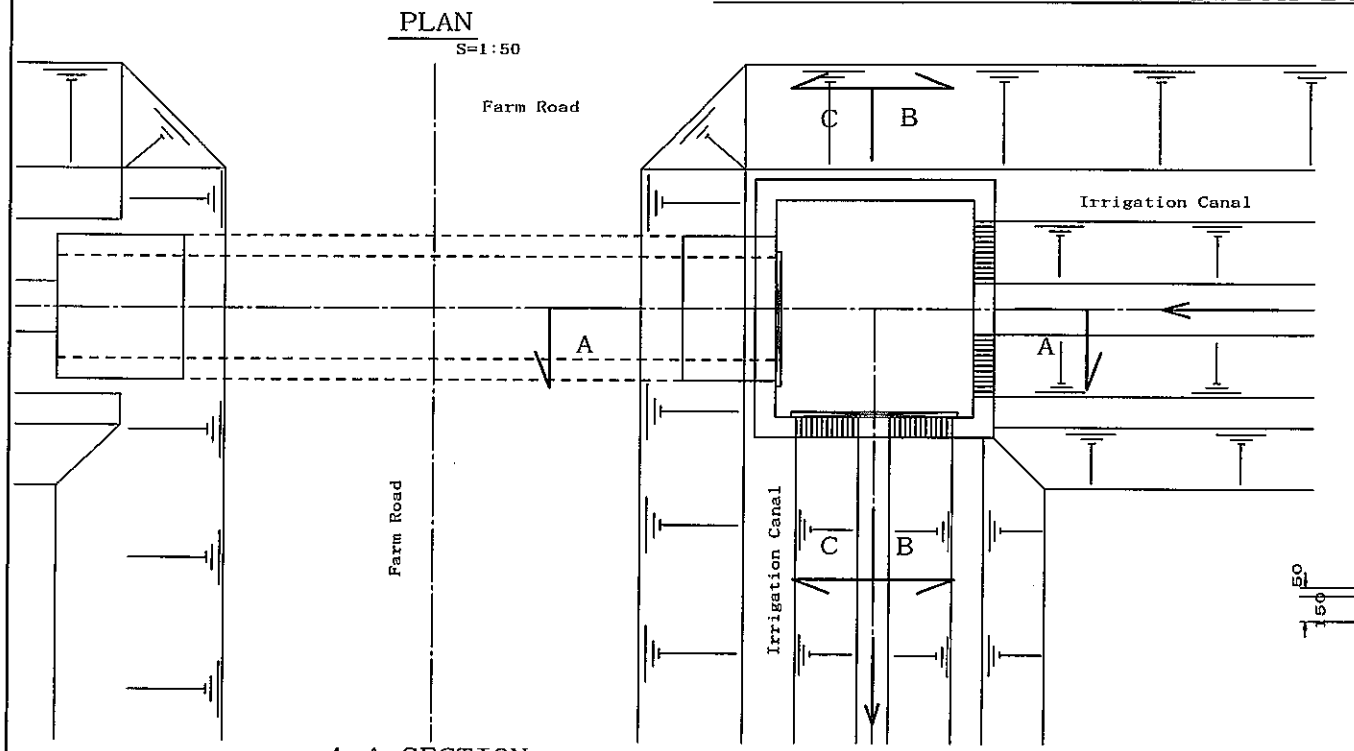
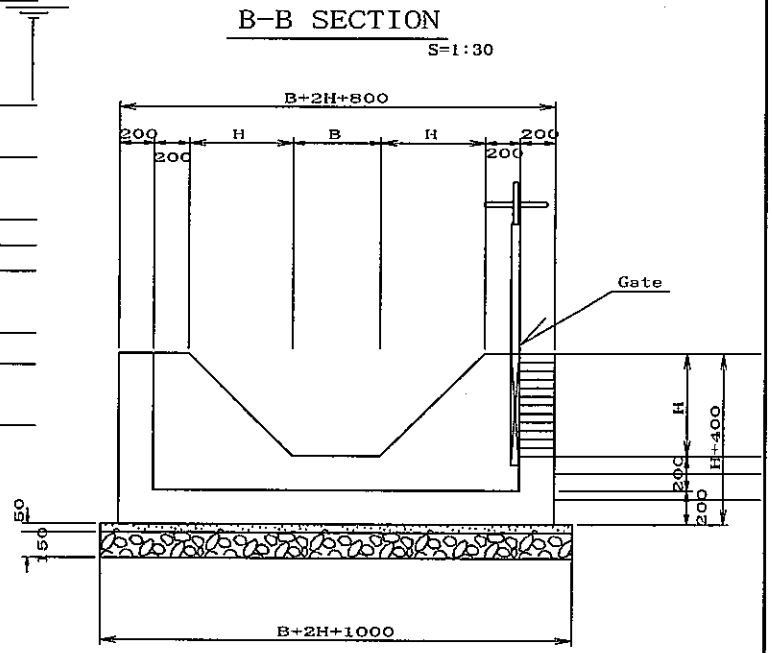
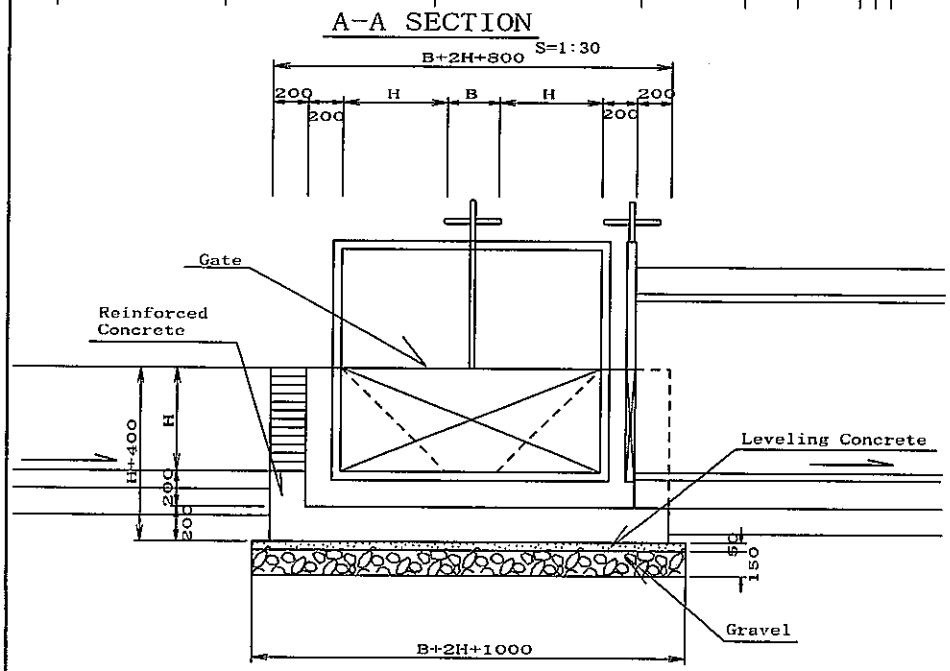
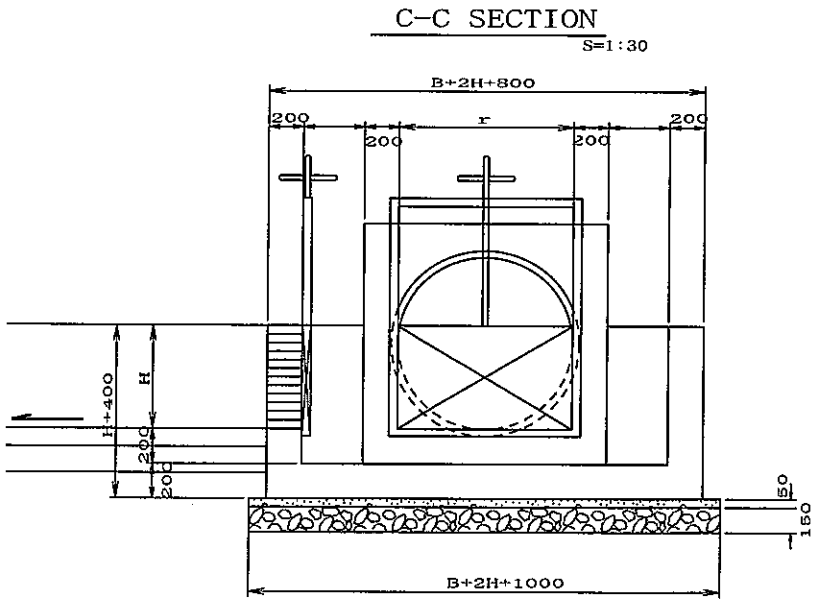


Standard Plan of Diversion Box









Standard Plan of Pipe Curvert

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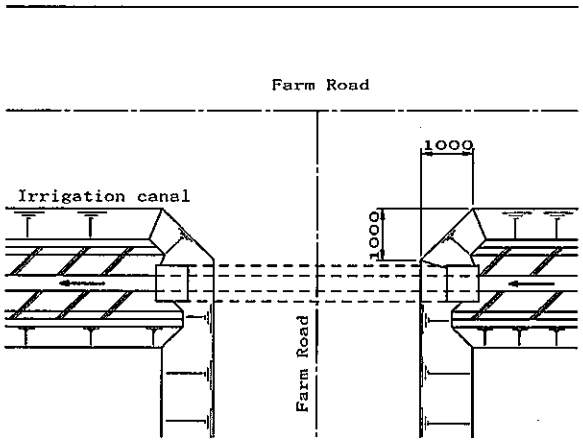

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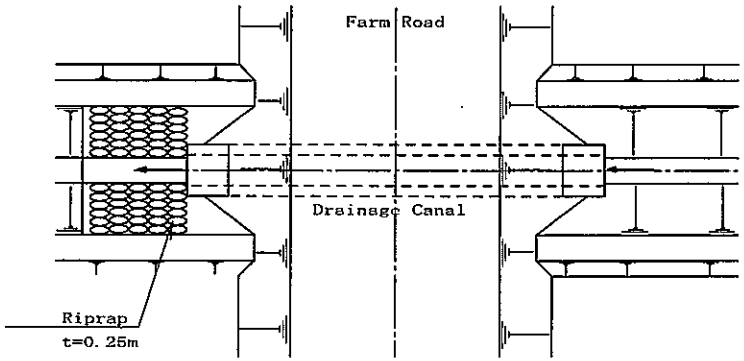

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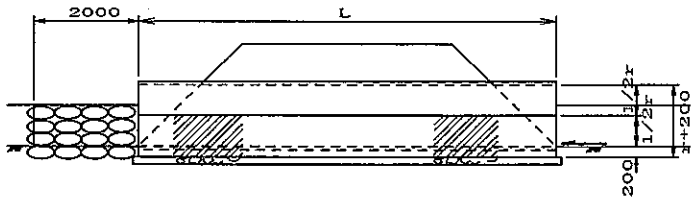

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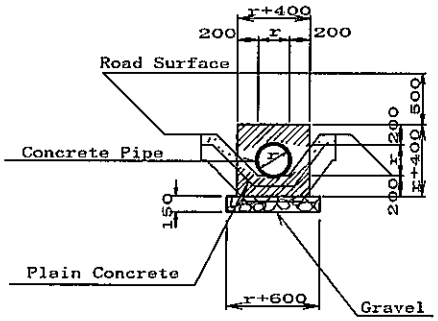

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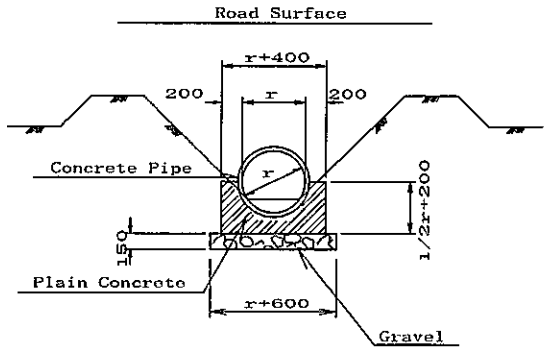

Standard Plan of Box Curvert

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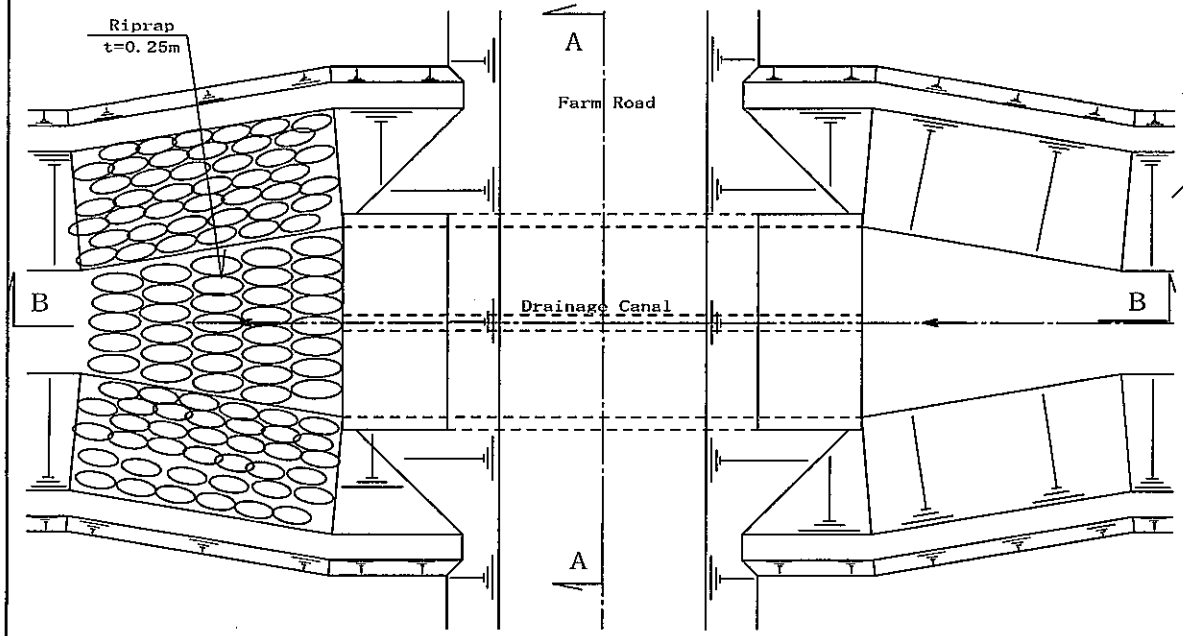

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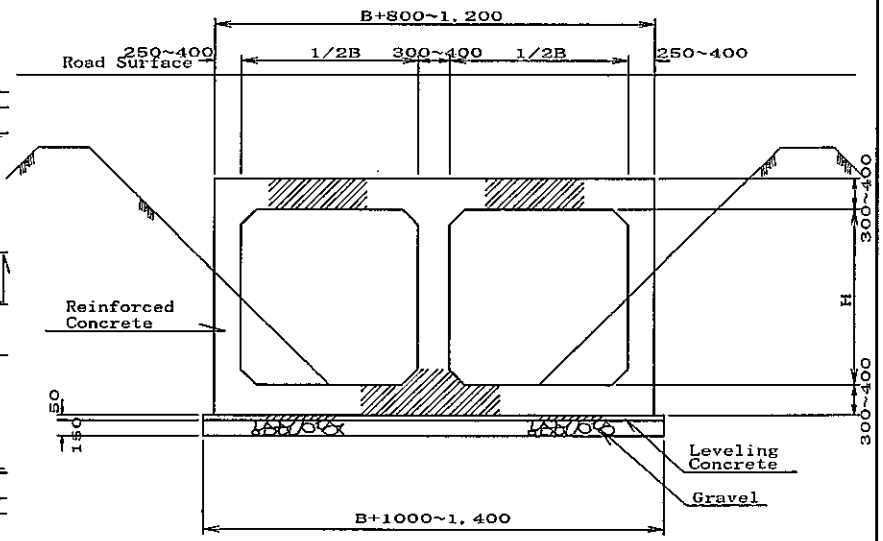

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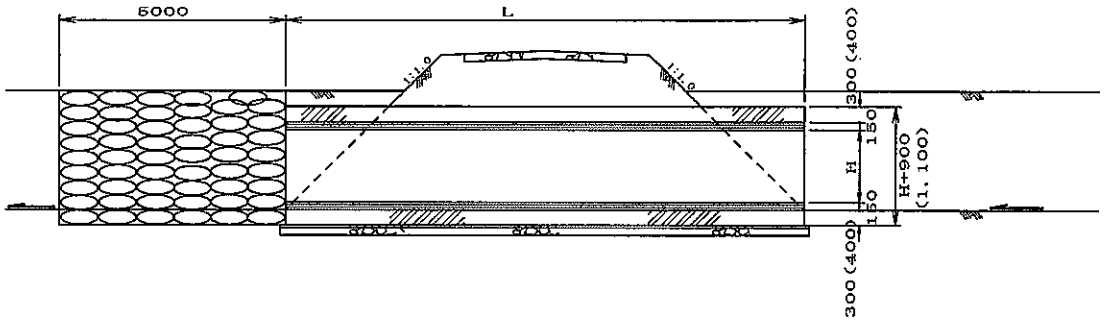
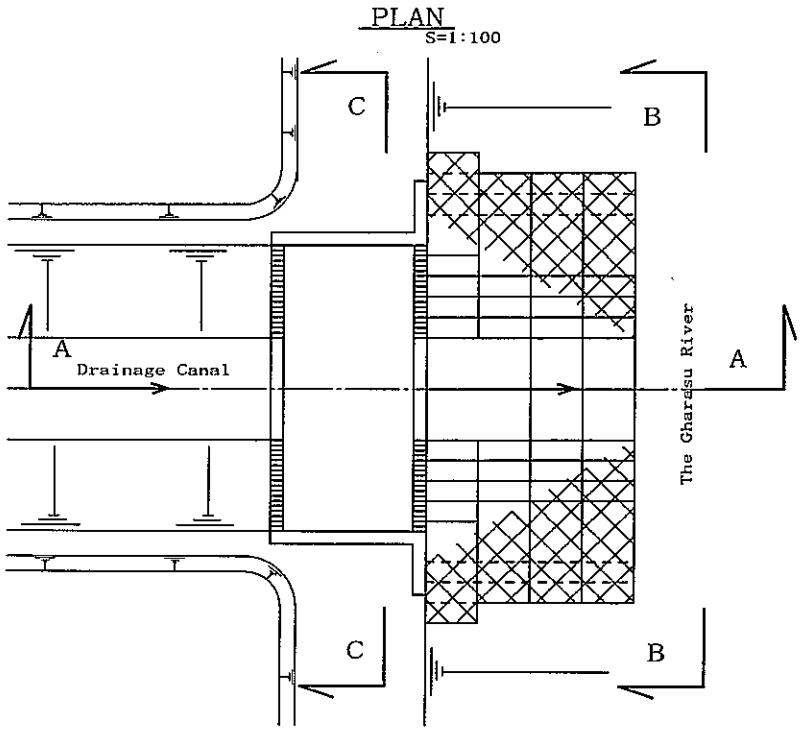
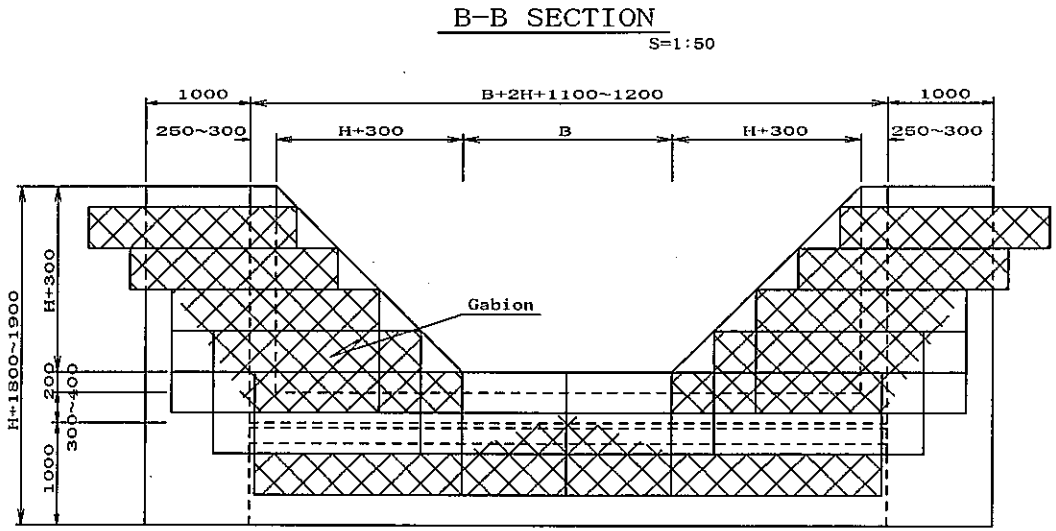
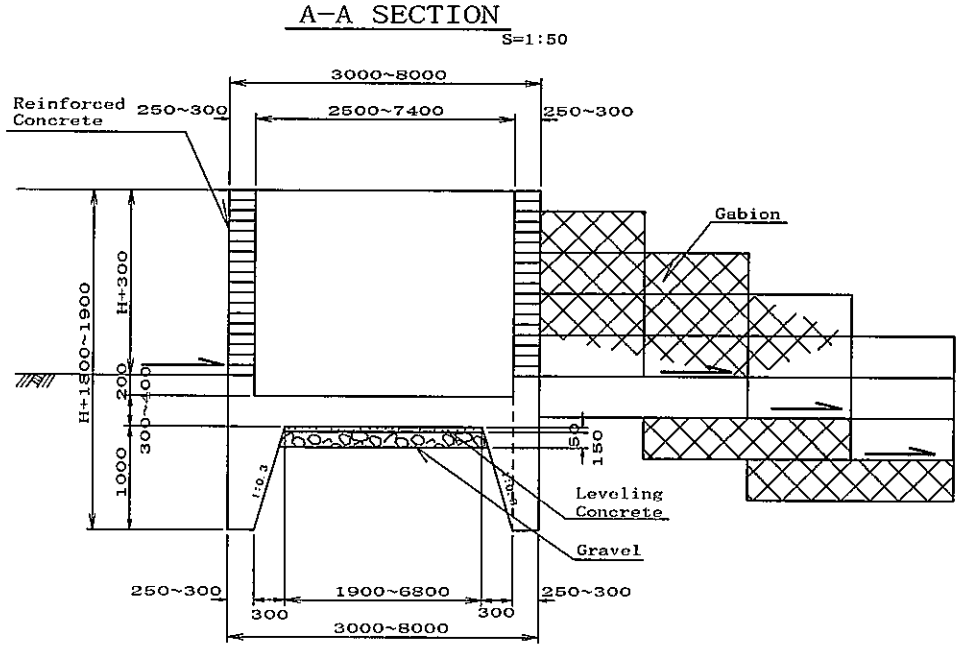
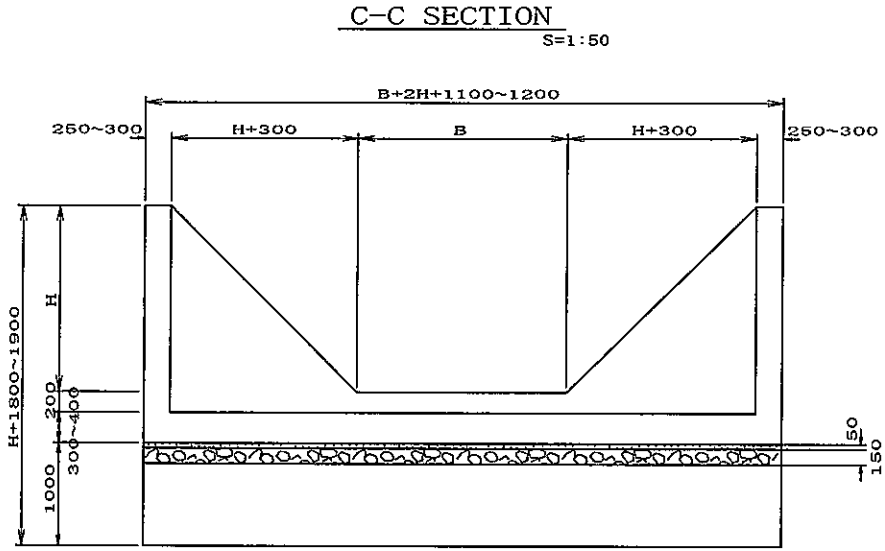


Standard Plan of Outlet Structure to River









Annex 4	**Agriculture and Animal Husbandry**

ANNEX 4

AGRICULTURE, AND ANIMAL HUSBANDRY

A4.1 Brief Description of Agriculture and Animal Husbandry in Iran

A4.1.1 Agricultural Conditions

(1) General

Agriculture is an important sector in Iranian economy providing about 24% of the GDP from 1995 to 2000. Iranian agriculture is characterized by extensive arable land, diverse climatic conditions, growing rural population, and growing work force during the growth and development of the agriculture sector.

The climate of Iran is classified to 4 types, namely, the continental climate of the plateau areas of the Elburz Mountains and Zagros Mountains, the Mediterranean climate in the coast region of the Caspian Sea, the desert climate in the east region of the country and the subtropical climate in the coast region of the Persian Gulf, respectively.

In the plateau area of the Zagros Mountains, there are forests of oak, walnut, almond and pistachio in the higher lands. On the other hand, in basins, there are orchards of figs and pomegranate, and wheat and barley are cultivated. In the Azerbaijan region, in the end of western part of the plateau areas of the Elbourz Mountains, wheat, cotton, paddy rice and tobacco are produced, and in the basins of Khorassan region, in the end of eastern part of the plateau areas of the Elbourz Mountains, wheat, barley, paddy rice and cotton are also actively produced. Agriculture in Kermanshah Province is mostly the agriculture in the climate of the plateau areas of the Zagros Mountains.

(2) Agricultural Development Policy

The development policy of the agriculture sector in the Third FYDP is compiled in Chapter 13 with the water sector, and described in articles 106 (priority development projects for investment). The outline of the agricultural development policy is mentioned below:

- Water resource, soil, irrigation/drainage network, small water scheme, restoration of *qanats* and spring
- Animal husbandry, poultry, veterinary and fisheries, natural resources (forest, pasture and desert), watershed management, silkworm harvesting, cultivation and gardening.
- Increment of investment for the agriculture sector by the Agriculture Bank and other non-governmental funds
- To allocate more than 25% of the country's banking system to the water and agricultural sector
- To give priority to the provision of the budget fund for water and agricultural sector
- To enhance employment and to economize foreign exchange by importing oil seed oil cake instead of vegetable oil.
- To create crop pattern in different regions for the water resource and efficient water use through allocating water to products with higher economic return and with less water requirement
- The Ministry of Energy is required to perform, to develop and to equip a survey network, to establish and develop networks to survey of water pollution, to strengthen the local water market, to establish and develop networks for measuring water consumption in the agriculture sector, to strengthen the legal basis of water commensurate with the management and technological changes, and to lay down

necessary foundation for strengthening local water management.

- To prepare conditions and criteria of gratuitous assistance and payment of interest subsidy and banking charge for the execution of the projects.

(3) Crop cultivation

1) Cereals

Agricultural lands under cultivation were estimated as 10.27 million ha, out of which 7.01 million ha (i.e. 68.27% of the total agricultural lands) was allotted to cereals cultivation. The area of irrigated and rain-fed lands under cultivation accounts for 53.97% and 46.03% of the total cultivated lands. Out of 44.71 million tons of agricultural products in 2000, cereals account for 12.86 million tons i.e. 28.76% of the country's total agricultural products. It is noteworthy that 10.36 million tons of cereals i.e. 80.5% of the total cereals yield was attained from irrigated land and 2.51 million tons i.e. 19.5% of the country's total agricultural products was produced in rain-fed lands. Out of 12.86 million tons of cereals produced in 2000, wheat, paddy, and barley with shares of 62.87%, 15.32%, and 13.11% ranked first to third respectively.

2) Grains

Some 1,015,000 ha i.e. 9.89% of total lands under cultivation was specified to grains production in 2000 out of which peas, lentil, and beans held shares of 63.57%, 20.27%, and 10.79% respectively. Irrigated and rain-fed cultivation accounted for 17.23% and 82.77% of total cultivated land. Out of 562,000 tons of grains produced in 2000, which accounts for 1.26% of total agricultural products, the shares of irrigated and rain-fed cultivation were 45.70% and 54.30% accordingly. The yield of grains gained from irrigated and rain-fed lands were 1,470 kg and 360 kg per ha.

3) Industrial products

Industrial products accounted for 6.45% of total cultivated agricultural lands out of which the shares of irrigated and rain-fed cultivation were 83.62% and 16.38% respectively. The highest shares of cultivated agricultural lands belonged to cotton, oilseeds, and sugar beet with shares of 31.17%, 31.42%, and 24.57% accordingly. Industrial products accounted for 16.69% of total agricultural products in 2000. 98.5% of industrial products were produced in irrigated lands and the rest in rain-fed lands.

4) Vegetables

In 2000, 450,430 ha equal to 4.39% of agricultural lands under cultivation was dedicated to vegetables cultivation. In this regard, the shares of irrigated and rain-fed cultivated lands were 91.99% and 8.01% respectively. The total vegetables production in 2000 stood at 10.64 million tons, which is equal to 23.8% of total agricultural products in the same year. The shares of irrigated and rain-fed lands were 95.39% and 4.61% respectively. The main items of these agricultural products were potato, tomato, and onion with shares of 37.48%, 26.34%, and 9.67% accordingly.

5) Patch products

Some 266,000 ha equal to 2.60% of total agricultural lands under cultivation was specified to patch products. In this connection, the shares of irrigated and rain-fed lands were 93.44% and 6.36% respectively. The main products in this group were watermelon, cucumber, and melon with shares of 31.18%, 29.25%, and 24.99% accordingly. The total amount of patch products stood at 4.51 million tons which is equal to 10.09% of the country's total agricultural products in 2000. In this regard, the share of irrigated land was 98.20%.

6) Forage plants

7.69% of total agricultural lands under cultivation were allocated for cultivation of forage plants. In this regard, the shares of irrigated and rain-fed cultivated lands were 86.10% and 13.9% respectively. 70.47% of total cultivated lands for this group of agricultural products were allocated to cultivation of alfalfa. The total production of forage plants in 2000 stood at 8.59 million tons equal to 19.21% of the country's total agricultural products. In this connection, the shares of irrigated and rain-fed lands were 85.60% and 14.40% accordingly.

7) Permanent agricultural products

16.91% of the country's total cultivated lands were allotted to horticulture (trees) in 2000. Out of 2,090 ha trees across the country, 94.59% is fruit trees and the rest 5.41% is allocated to infertile trees with industrial usage. 18.16% of total lands of trees in 2000 equivalent to 379,000 ha were allocated to pistachio cultivation. In this regard, grapes, citrus fruits, and dates accounting for 292,000 ha (13.97%), 239,000 ha (11.46%), and 220,000 ha (10.54%) ranked second to fourth respectively.

A4.1.2 Animal husbandry

The livestock numbers and meat production in Iran are shown in the following table.

Livestock Numbers and Meat Production in Iran (1999-2000)

	Items	Unit	1999	2000 Preliminary
Cattle and Bovine Meat				
1	Cattle numbers at beginning of a year	1,000 heads	8,785	8,048
	Females	1,000 heads	7,265	6,656
	of which: Dairy cows	1,000 heads	3,821	3,500
2	Calf crop (born over a year)	1,000 heads	2,896	2,654
3	Live cattle imports	1,000 heads	0	0
4	live cattle exports	1,000 heads	0	0
5	Cattle losses	1,000 heads	1,200	203
6	Slaughter	1,000 heads	2,433	2,229
7	Cattle numbers end of a year	1,000 heads	8,048	8,270
8	Average carcass weight at slaughter	Kg/head	105	119
9	Bovine meat production	1,000 MT	256	266
10	**Bovine meat imports**	1,000 MT	26	16
11	**Bovine meat exports**	1,000 MT	0	0
Sheep and Goats				
1	Sheep and goat numbers at beginning of a year	1,000 heads	79,657	79,657
2	Lamb and kid crop	1,000 heads	27,535	27,535
3	**Live sheep and goat imports**	1,000 heads	0	0
4	**Live sheep and goat exports**	1,000 heads	0	0
5	Sheep and goat losses	1,000 heads	2,315	2,315
6	Slaughter	1,000 heads	25,220	25,220
7	Sheep and goat numbers end of a year	1,000 heads	79,657	79,657
8	Average carcass weight at slaughter	Kg/head	17	17
9	Bovine meat production	1,000 MT	432	436
10	**Bovine meat imports**	1,000 MT	0	0
11	**Bovine meat exports**	1,000 MT	0	0
Total meat				
1	Total meat production	1,000 MT	721	729
2	Total meat imports	1,000 MT	26	16
3	Total meat exports	1,000 MT	0	0

Source: Ministry of Animal Husbandry

According to the Table shown above, 26,000 tons and 16,000 tons of bovine meat of cattle were imported in 1999 and in 2000 respectively, however, bovine meat of sheep and goat were not imported. In regard to meat of sheep and goat, it is considered to attain the self-sufficiency.

A4.2 Brief Description of Agriculture and Animal Husbandry in Kermanshah Province

A4.2.1 Agriculture

(1) Agricultural Crops

1) Annual Crops

The area of the total cultivated land for annual crops is 790,000 ha, of which the irrigated land and the rain-fed land were 140,519 ha (17.8%) and 589,990 ha (82.2%) respectively. The share of the annual crops for the total cultivated land is about 96.3%. The cultivated area, production and yield of annual main crops of the Kermanshah Province are shown in the following table.

Production of Annual Crops in the Kermanshah Province (2000/2001)

Products	Area (ha)					Production (ton)			Yield (kg/ha)	
	Irrigated		Rain fed		Total	Irrigated	Rain fed	Total	Irrigated	Rain fed
	ha	%	ha	%	ha					
Wheat	51,675	17.0	252,631	83.0	304,306	225,769	97,664	251,433	4,370	387
Barley	10,770	9.9	98,000	90.1	108,770	36,777	53,444	92,020	3,415	545
Maize	26,185	100	0	0.0	26,185	180,354	0	180,354	6,888	0
Chick pea	832	0.4	230,040	99.6	230,872	944	103,725	104,669	1,135	451
Sugar beet	14,000	100.0	0	0.0	14,000	422,300	0	422,300	30,164	0
Water melon	2,236	100.0	0	0.0	2,236	59,640	0	59,640	26,673	0
Cucumber	2,620	97.7	63	2.3	2,683	34,680	113	34,680	13,267	1,794
Tomato	1,984	100.0	0	0.0	1,984	33,045	0	33,045	16,656	0
Alfalfa	6,570	100.0	0	0.0	6,570	40,037	0	40,037	6,094	0
Total	140,519	17.8	589,990	74.7	790,000					

Source: Agricultural Statistics Yearbook 2000/2001

2) Permanent Crops

The percentage of the Kermanshah province in the total country's garden was only 0.94%, and the area of gardens in Kermanshah province was ranked 21st of 28 provinces in the country. The total cultivated area of permanent crops in Kermanshah province is about 33,265 ha, with 4.1% of the total cultivated area of 820,000 ha. The irrigated area for permanent crops (fertile trees) was 23,461 ha (71%), the rain-fed land was 3,878 ha (12 %), and the rest of 16% was for the sapling.

In Kermanshah province, about 32.1% of the total irrigated lands of gardens in 2001, about 10,713 ha, were allocated to walnut cultivation. In gardens, irrigated grape, rain-fed grape, apple, olive accounting for 16.7%, 9.9%, 7.6%, 6.5% ranked second to fifth, respectively.

The cultivated area, production and yield of permanent crops of the Kermanshah Province are shown in the following table.

Production of Permanent Crops in Kermanshah Province (1999-2000)

Trees	Area (ha)			Average yield (ton/ha)	Production (ton)
	Sapling	Fertile trees	Total		
Apple	572	1,955	2,527	14.5	28,946
Peach	473	655	1,127	9.7	2,323
Walnut	6,500	4,213	10,713	3.36	9,945
Almond (irrigated)	483	521	1,004	1.59	827
Grape (irrigated)	1,098	4,461	5,559	8.08	36,058
Grape (rain-fed)	1,699	1,599	3,298	5.51	8,817
Pomegranate	323	1,515	1,538	8.64	13,087
Olive	2,095	83	2,178	0.55	46
Others	1,552	3,468	5,321	-	21,904
Total	14,795	18,470	33,265	-	121,953

Source: Agricultural Statistics Yearbook 2000/2001

The reasons of low production of fruits in Kermanshah are presumed as follows;

i) The horticulture department in the Jihad-e-Agriculture Organization of Kermanshah was established in 1999, and until that time the Government of province didn't promote horticulture.
ii) Aftereffects of the Iran-Iraq War in 1980 ~ 1988
iii) Poverty of farmers

The horticulture section has actively promoted horticulture in province since 1999, and the area of orchard in province increased from 16,000 ha in 1999 to 34,000 ha in 2002 by various subsidies of the Government of province. The potential of area of orchard is estimated at 300,000 ha in Kermanshah province.

(2) Mechanization

The numbers of tractors in Kermanshah Province are about 12,000 in 2002. 70% of these tractors are old types, which have been used over ten years, and have many problems in accuracy of farm work operation. In Kermanshah province, most of the farmers' fields are mechanized by contract with the machinery owners. The number of machinery in the province is enough to mechanize all the area under cultivation in the province.

The introduction rate of mechanization for the main crops cultivation in Kermanshah Province is shown in the following table.

Mechanization of the Main Crops Cultivation in Kermanshah (2000-2001)

Farm Work	Wheat		Chick pea		Maize grains %	Sugar beet %
	Irrigation %	Rain-fed %	Irrigation %	Rain-fed %		
Land Preparation						
Tillage	100	68	100	98	100	100
Harrowing	93	73	98	12	98	96
Leveling	13	0	30	0	37	11
Seeding						
Fertilization	65	45	61	0	100	73
Combined drill	5	71	0	0	0	0
Broadcasting of seeds	53	20	0	0	0	0
Seeding	37	0	0	7	100	42
Row planting	0	0	0	0	0	0
Growth Management						
Pumping for irrigation	2	0	0	0	2	1
Supplemental irrigation	0	0	0	0	0	0
Spray of pesticide (tractor)	86	55	44	69	92	73
Spray of pesticide (knapsack power sprayer)	14	19	56	31	5	27
Aerial spraying	0	0	0	0	0	0

Farm Work	Wheat		Chick pea		Maize grains %	Sugar beet %
	Irrigation %	Rain-fed %	Irrigation %	Rain-fed %		
Intertillage & weeding (with cultivator)	0	0	0	5	0	39
Harvest						
Harvesting (with combine)	91	86	0	0	98	0
Harrowing of sugar beet	0	0	0	0	0	37

Source: Kermanshah Jihad-e-Agriculture Organization

(3) Extension Service

Extension service is most important to promote the agricultural policies of the Government of province and technological transfer to farmers.

There is an extension department in the Kermanshah Jihad-e-Agriculture Organization, as a lower branch of the extension section of the Ministry of Agriculture. The extension department of the province is the headquarter of rural extension and consists of 61 staff of sections, such as rural education, rural extension and information transfer, rural participation, rural and nomad women, planning and study, extension materials and extension network, and training facilities, etc.

The extension system in the province has four levels, such as province, districts, Dehestans and Dehs, respectively. In general, each district has the extension section, which consists of seven to nine staff, and each Dehestan has the extension and participation unit, which consists of 8 to 10 staff.

A4.2.2 Animal husbandry

(1) Livestock

The number of livestock in Kermanshah province is shown in the following table.

Number of Livestock (2000/2001)

Livestock	Total of province	Javanrood district	Kermanshah district
	heads	heads	heads
Sheep & lamb	2,368,254	124,560	470,844
Goat & kid	617,084	93,473	90,018
Cow & calf			
Local breed	1,014,312	191,020	310,464
Hybrid breed	357,032	9,016	36,803
Holstein	174,761	16,065	23,199
Buffalo	4,901	0	4,368
Horse & donkey	208,026	17,568	31,100
Total	4,744,370	451,702	966,796

Source: Kermanshah Jihad-e-Animal Husbandry Organization

One of the severe problems, which results from the increase of hybrid breed, is shortage of roughage, because hybrid breed requires roughage of higher quality. Therefore, it is necessary to introduce forage crops to crop-rotation.

In regard to poultry, there are 634 enterprises of meat production in Kermanshah province, and the capacity of these enterprises is about 3 million chickens.

Poultry (meat) enterprises in Kermanshah Province (2000/2001)

Scale Number of chickens	Total of province		Javanrood district		Kermanshah district	
	Number of enterprises nos	Capacity nos	Number of enterprises nos	Capacity nos	Number of enterprises nos	Capacity nos
2,000 ~ 3,000	169	422,110	0	0	34	82,450
3,000 ~ 4,000	150	634,810	0	0	42	149,910
4,000 ~ 5,000	106	472,430	0	0	35	158,140
5,000 ~ 6,000	85	479,540	0	0	38	213,240
6,000 ~ 7,000	45	299,270	0	0	25	167,920
7,000 ~ 8,000	30	229,950	0	0	11	83,650
8,000 ~ 9,000	14	121,790	1	8,000	5	44,400
9,000 ~ 10,000	15	148,700	0	0	6	59,700
> 10,000	20	337,250	0	0	8	138,050
Total	634	3,145,850	1	8,000	204	1,097,460

Source: Kermanshah Jihad-e-Animal Husbandry Organization

The total livestock productions in Kermanshah Province were 23,578 tons of red meat, 150,000 tons of milk, 22,793 tons of chicken, 3,529 tons of egg, and 217 tons of honey, respectively. 85% of the total milk production was produced by heavy livestock.

There are three milk factories in the province. The total capacity of three factories is 88 tons per day. These factories have 16 milk collecting centers in province.

Amount of feed produced in province is shown as following table.

Feed Resources in the Province in 2001~2002

Feed resources	Estimated annual amount (tons)
Crop residues after harvest	700,000
Natural pasture	350,000
Cultivated forage crops	300,000
Residues of processing factories	150,000

These resources of feed are equal to about 750,000 tons of TDN. However, the necessary quantity of TDN in province is about 1,000,000 tons of TDN, and amount of 250,000 tons of TDN is in short. 750,000 tons of TDN consist of crop residues and cultivated forage crops of 71%, natural pasture of 26%, residues of processing factories of 1% and others of 2%, respectively.

(2) Fisheries

Production and demand of fishes in Kermanshah province are as shown in the following table.

Production and Demand of Fish in Kermanshah Province (Unit: ton)

Type	2000 ~ 2001	2001 ~ 2002	2002 ~ 2003
Cold water fish	79	133	296
Warm water fish	395	376	400
Total	474	509	696

There is not exact statistics on consumption and demand of fishes in the province. In general terms, total annual demand of fishes in province up to 1999 was about 3,000 tons. And the demand in 2002~2003 is estimated about 6,000 tons. In 2002 ~2003, 14 warm water fish farms with production capacity of 277.5 tons and 9 cold water fish farms with production capacity of 209 tons are active in the province. However, there is no production center of fry in the province.

In Kermanshah, the north of Javanrood district is mountainous region and can only culture the cold water fishes. Other part of province can culture fishes of both types. Production and

demand of fishes in Kermanshah province are as shown in the following table.

Production and Demand of Fish in Kermanshah Province （Unit: ton）

Type	2000 ~ 2001	2001 ~ 2002	2002 ~ 2003
Cold water fish	79	133	296
Warm water fish	395	376	400
Total	474	509	696

This amount of production is very less than market demand, so a lot of fishes are imported from the other provinces every year.

A4.2.3 Farmers Organizations in the Province

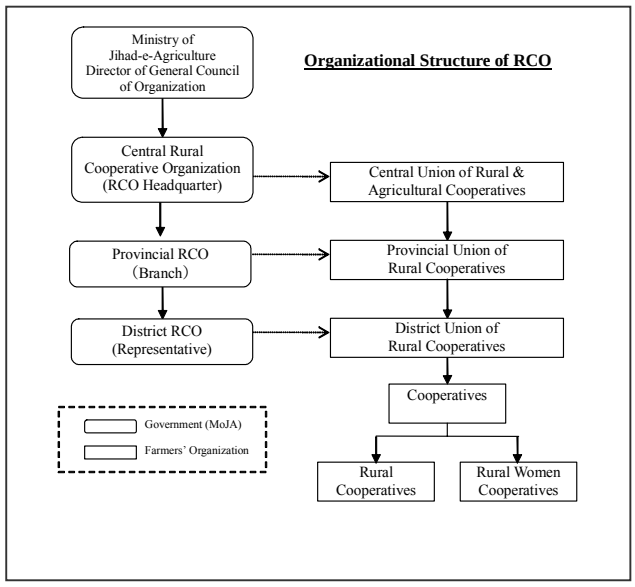
(1) Basic Government Policy of Farmers Organization

In Kermanshah Province, the strategy for increasing and promoting Farmers' organizations is linked with the restructuring plan of the local extension system. According to the MOJA's Development Plan, Kermanshah Province was selected as a model province for the restructuring Extension Service Centers (ESCs) along with Khosaran Province. In the Province, 3 Districts including Kermanshah District were selected to execute this policy. ESCs presently provide the services on as 1) the extension and training, 2) issuing permission on government subsidies including agricultural inputs. The restructuring plan is that the ESCs shall be an agricultural extension center, and other functions shall be transferred to the private sectors such as RPCs, Cooperatives and Companies. Accordingly, a number of farmers' organizations shall be established in Kermanshah Province. '*Increase of establishment and extension of Rural Productive Cooperatives (RPCs)*' is mentioned as one of the development priorities in the medium term as envisaged in the Section 2.3.5 of Third Five-Year Development Plan (2000-2004) of Kermanshah Province.

(2) Rural Cooperative Organization (RCO)

1) Organization Structure

The RCO has branches at each Province and preventative offices at the District level which supervise, audit and support the activities of RCO unions and Rural Cooperatives by the member farmers. At the village level, there are RCO shops selling or distributing the consumption goods and fuels. Both RCOs at Dehestan or Deh levels have an executive board comprising of 5 members: a chairman of the Board, a deputy chairman, a secretary and two board members. They are volunteers selected through the election among the members. Besides the executive boards, the RCOs employ a managing director selected through the election among the members. Accountants and storehouse keepers are also hired by the RCO. In Kermanshah Province, there are 110 RCOs at Dehestan level (and at the central place for several villages) , 530 RCO shops selling sugar, rice and other



consumption goods and 555 RCOs selling petroleum and kerosene at the village/deh level. There are also 6 Women's Cooperatives under the RCO in Kermanshah.

2) Activities of RCO

i) Distribution of agricultural inputs

One of the most important functions of the RCO is to distribute agricultural inputs including fertilizers, seeds and chemicals. It is the responsibility of the Agriculture Support Company (ASC) to supply the required amount of agricultural inputs to the distributors on behalf of the MOJA. Agriculture Support Company is known as a extra-departmental body of the MOJA. In Kermanshah, more that 50% of the agricultural inputs are distributed by RCOs. The rest of inputs are distributed by RPCs or the private distributors. For this activities, RCOs and other distributors, received commissions from the ASC. For instance, ASC pay the commissions of 6 % or Rls.27/kg for distributing 1kg of fertilizer which is Rls. 450/kg. Similarly, the commission for pesticide is 10% and 3% for seeds.

ii) Purchasing agricultural products by guaranteed price

RCOs purchase agricultural products from the farmers by guaranteed price. Guaranteed price of the agricultural products is set by the government to control the fluctuation of the prices of some of major items. The products dealt by the RCOs are different from Province to Province. In Kermanshah Province, the RCOs mostly purchase wheat and a limited amount of barely from the farmers. Purchased products are categorized according to the quality and sent to the seed organization of the Trade Ministry.

iii) Short-term credit for farmers

The RCOs provide credit functions to the members. The maximum amount of credit per member is Rls. 1,000,000 with the interest rate of 14 % and one year of repayment period (in case of Zal Ab RCO). The interest rate can be reduced by applying Qalz-al-Hassanah. Qalz-al-Hassanah is an informal money lending organization which lends money to the people who cannot borrow from banks. The loan is available without interests but with the commission of 4 %. Although this credit facility is not available to everyone, the members with good repayment records have priories to borrow.

iv) Selling consumption goods and distributing coupon products

In order to procure basic goods for the rural population, more than 11,000 consumption shops have been formed throughout the country. The basic goods include rice, sugar; cube sugar and so on are distributed through these RCO shops at the villages and the towns. With the coupons provided by the Government, the consumers can obtain these products 50 % (or more) cheaper than the market price. RCO also runs fuel distribution centers at the village level in exchange for coupons.

v) Other activities

With the request and agreement by the general assembly, it is possible for the RCO to expand its activities. By mobilizing the capital and profits, RCOs can start new activities such as running the mechanic warehouse, agricultural processing facilities、milk collection centers and etc. Purchasing of non-guaranteed products is also possible through the rural cooperative network.

3) RCOs in Kermanshah Province

In Kermanshah Province, there are 110 RCOs at Dehestan level (or at the central place for several villages). In the Project area, there are 4 RCOs at Dehestan level: Zalou Ab and

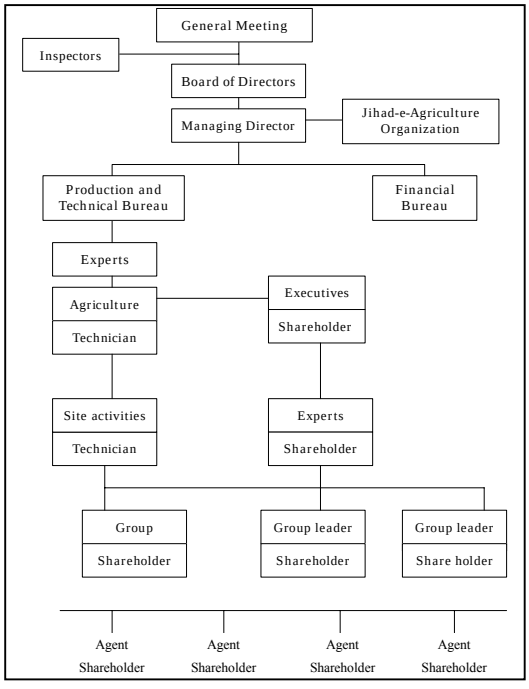
Kuzaran (Kuzaran District), Kareh Ghaleh Sefid and Ravansar. Their main activities include selling agricultural inputs, buying agricultural products (mainly wheat) from the member farmers, and providing agricultural loans. Furthermore, the RCOs operate shops at the at Deh level, selling consumer goods such as sugar, rice and oils. RCOs in Kermanshah and Javanrood districts are mentioned below.

RCOs in Kermanshah and Javanrood District

Kermanshah District			Javanrood District		
no.	Name of RCO	Address	no.	Name of RCO	Address
1	Kamar Gareh	Kamar Dakeh	1	Javanrood	Javanrood
2	Marzoani	Cheshmeh Kabood	2	Ravansar	Ravansar Shahrek
3	Mian dar Bahd	Mahmood Abad	3	Kareh	Kareh
4	Sarab-e-Nilofarza	Sarab-e-Nilofarza	4	Edalat salas	Salas
5	Raz Avar	Gharanchi	5	Tahid Eslam	Mir Abad
6	Vahdat	Deh Pahn	6	Azgleh	Kareh Ghaleh Sedid
7	Drofarman		7	Khan Ashar	Sheikh
8	Kahdad	Kahr-e-Oliya			
9	Amir Veha-e-Framan	Konjorina			
10	PhirozAbade Mahidasht	Helshi			
11	Sarab-e-Mahidasht	Sarab			
12	Salamat-e-Jalal vand	Chenar			
13	Haghighat-e-Jalal vand	Sarb Geryan			
14	Babvand	Babvand			
15	Belkaneh	Saris			
16	Kozaran	Kozaran			
17	Zalou Ab	Zalou Ab			
18	Sanjabi	Sheikh			
19	Haft Ashian	Zandhor			
20	Mahidasht	Mahidasht			
21	Chegha Kalbali	Chegha Kabuali			
22	Esar	Aaji			

(3) Rural Production Cooperative (RPC)

1) Background



The RPC, formerly known as the Agriculture Companies were first introduced in 1971 in some parts including Kermanshah Province for optimum exploitation of soil and water resources and also for rural development. In order to promote mechanization of agriculture, the Companies of this time encouraged small farmers to provide their lands in exchange for the shares (sahm) of the Company because the mechanization needed a large scale of land. The shareholding farmers received their dividends once a year while the agricultural operation was totally in the hand of Company. Under this system, many farmers gave up their lands and they either worked as agricultural labors or moved out of the village in search of employment. It was observed that the operation of Company was successful in view of efficient utilization of agricultural resources since the

productivity and yield of agricultural products increased considerably. However, the share of farmers remained unchanged regardless of the profit. As a result, many small farmers were reduced to the position of landless.

The government thus revived the operation of RPCs in 1990s. As of 2003, there are 192 RPCs all over the countries and 18 RPCs including 1 Union in Kermanshah. There is so far no RPC in the Study Area. In comparison to other provinces, the promotion of PRCs delayed in Kermanshah Province due to the post-war reconstruction after the Iran-Iraq War.

2) Responsible Organization

The operation of RPCs is pursued under the Utilization System of MOJA. In the headquarter, the RPC Bureau has been merged into the Deputy of Extension and Farming System Utilization System due to the Government Policy of enhancing the extension activities in agriculture. At the Provincial level, however, these Deputies are still in the process of merging and the Utilization System is taking initiatives in all activities. The Utilization System is defined in the following way: "the utilization system is an aimed set that has a certain organized struggle in direction of livestock and agricultural productions, maintaining, processing, selling and consuming of some productions in order to increase the income with its general concept by means of natural resources, available facilities, human power and certain methods".

3) Procedure and Criteria for Cooperative's Establishment

- Collection of the preliminary information, through questionnaire.
- Over 90% of the farmers should write application for establishing the RPC.
- Advertisement to inform the farmers.
- Payment of the membership fee
- Advertisement to invite the members for Founders General Meeting
- Selection of board of director's members
- Introduction of managing director
- Application to the district registration office
- The registration is publicized (printed) in the formal newspaper, by registration office
- Advertisement of the cooperative establishment, with the mentioned specifications
- Introduction for the cooperative stamp

4) Activities

One of the main aims of the RPC has been the consolidation of farmer's scattered lands for the efficient use of land. The process of land consolidation includes 1) preparation of topographic map, land registration map (cadastre), 2) land consolidation by mountain, plain and riverside, 3) construction of water canal, 4) construction of farm roads, 5) digging wells, and 6) land leveling. All above processes have been done by the subsidy of the Government in the past. Due to the financial difficulties, however, the Government now subsidies 60 – 70 % of the total cost and the rest of 30 - 40% is borne by the farmers. It is possible for the farmers to pay either by cash or by loan with the interest rate 7-14 % and 5 years repayment period.

RPC buys good quality of wheat seeds from the farmers. For buying seeds, RPC members have a priority to sell compared with non-members. The purchasing price of wheat seeds are about 20% higher than the ordinary wheat. According to the Utilization System, the profit for this activity would be Rls.250/kg. Some of the main functions of the RPC are summarized in the following table.

Main Functions of Rural Productive Cooperative (PRC)

Criteria for RPC establishment	-20, 000 ha land including 10,000 ha irrigated land) with some exceptions. -Capital of Rls.100 million (Rls, 100,000/ha) -Potential of villages (condition of soil and water availability should be favorable) -Willingness of farmers to participate in the RPCs.
Membership	-Land possession -Revolving fund Rls.100 million. -(Executive board members :5 including 1 Chairperson)
Activities	(1) Consolidation in cropping pattern (2) Use of the agricultural infrastructure and machineries (3) Distribution of agricultural inputs (chemical, fertilizer, etc) among the members. (4) Purchasing agricultural machineries by loan and lend them to the members. (5) Income generating activities: e.g., selling gasoline, running bakery.
Facilities	With the establishment of PRC, the loans by government should be available for (1) one storage, (2) office, (3) two tractors, (4) one combine, and (5) one to two staff from agricultural office in principal.

(4) Cooperatives under the Ministry of Cooperatives

1) Background

All cooperatives related to agricultural activities, such as, animal husbandry, mechanization, agro-industries, processing etc. have been registered under the Ministry of Cooperative. Prior to 1991, Technical and Executive Deputy of each Ministry was responsible for the registration of cooperatives related to their activities. In order to simplify and make the registration procedure more efficient, it was decided that the registration should be done only through the Ministry of Cooperative. However, there are some exceptions; Ministry of Cooperatives (MOC) in not involved in the registration of some cooperative organizations such as RCO and RPCs.

2) Organization Structure

Ministry of Cooperatives（MOC）has its offices at the Provincial and district level. Directorate of General of Kermanshah is in charge of all cooperative's affairs in the Province. At the District level, direct office of the MOC with the technical staffs of many specialties (agriculture, industry, rural development etc.) take charges of the registration and the monitoring of the Cooperative activities.

A cooperative can be a small group of people as its minimum membership in 7 people. There is no limitation in the number of members. A cooperative normally comprises of 3 to 5 board members (directing manager, deputy, secretary and members) and a Managing director selected by the board members.

3) Activities of Cooperatives for Agriculture

While cooperatives can be formed in all economic sectors: agriculture, industry and service. As far as agriculture in concerned, cooperative activities include;

Agriculture	:	Green house crops, chickpea, maize production
Animal husbandry	:	Milk production, cow/sheep/chicken fatting, horse breeding, bee keeping
Agro-industry	:	shoe making, carpet making
Processing	:	Corn drying factory, chickpea packing factory
Mechanization	:	-
Infrastructure	:	Well digging & equipping, and canal maintenance by Water Users' Association (WUA).

4) Procedure and Criteria for Cooperative's Establishment

i) Studying the necessity of cooperatives in each district by the District officer of MOC.
ii) Explanation to farmers the advantages and procedure of registration and encourage them to send a request to the District Cooperative office.
iii) Minimum 3 representatives of applicants send a request to the District Cooperative Office
iv) Examination of the application by cooperative experts in the Provincial Office
v) If the cooperative activity is related to agriculture, Provincial Office informs the MOJA and asks for their permission to accept the application.
vi) If the MOJA sends permission, Provincial Cooperative office also issue permission and send them to the District Cooperative office.
vii) District Cooperative officer ask the applicants to submit the name list and identification of all members.
viii) Conduct the first General Assembly to decide the board members and collect the admission fee from all the members. Admission fee is Rls. 300,000 for 3 year installment.
ix) Submit the identification, permission letters to the Registration office and pay the registration fee (Rls.500, 000 to 600,000)
x) Start of the Cooperative activities. (Start applying for the bank loan)

(5) Rural Development Cooperatives (RDP)

Since 2000, MOC started the promotion of Rural Development Cooperatives (RDCs) in the rural area of Kermanshah. RDC was introduced to cover the all activities to develop the industrial, agricultural and service sector in the rural villages. RDCs are considered to be widening the cooperative activities of RPC. The concept of RDC is that because of the importance of villages as production center, the agriculture development should be related with rural development, and establishing the powerful and democratic foundation in the village is necessary to operate the facilities and capabilities in the best way, and to prevent the depopulation from villages. Once the RDC is registered as a cooperative, it could extend activities in the future. For instance, for a RDC started as a cooperative of mechanization can also develop other activities such as cow husbandry, poultry, water management etc. Some of the main characteristic of RDC is described as below:

Objectives	1. Protecting the common interests among villagers and getting the support of the persons who left the village, already. 2. Collaboration among the farmers to supply the common services and agriculture inputs. 3. Conducting the small and scattered capitals, to invest in the implementation of watershed, service and production plans to raise up the villager's life quality. 4. Creating a suitable foundation for performing the extension schemes by the Ministry of Jihad-e-Agriculture
Criteria	70% of one village should be the members agriculture, industry, service
Activities	agriculture, industry, service

(6) Governmental Supporting System for the Farmers' Organizations

1) Agriculture Bank

The credit conditions of service, industry and agriculture sector is shown as below.

Sector	Interest rate	Primary Capital	Repayment period
Service	22%	20% of loan	1-5 year
Industry	17%	20% of loan	1-8 years
Agriculture	13.5-14%	10%-	1 to 8 years

In Kermanshah Province, 80% of agricultural loans and subsidies are transacted by the Bank Kershawarsi (Agriculture Bank). Other 20% of agricultural loans are given by the other national banks such as Bank Melli (7%), Saderat (5%), Mellat (3%), and Sepah (5%). While the agricultural bank mainly deals with the long term investment for more than 1 year, other banks give 1 year cash-flow.

The credits are distributed to wide range of agricultural activities related to production (92%) as well as services (8%) in the agricultural sector. The credit operations of the Bank is wide with regard to the establishment of farms, orchards, drilling of deep wells, renovation and integration of farms, construction of dams and irrigation networks, establishment of agro-industrial units, establishment of food processing plants as well as poultry, livestock and fishery units.

2) Available Finance for Cooperatives and RPCs

When taking loans from the Agricultural Bank, MOJA decides the budget allotment and its uses of Jihad-e-Agricultural Organization in each Province including Kermanshah. The budget is disbursed through Agricultural Bank. Rural Cooperative Organizations (RCOs), Rural Production Cooperatives (RPCs) or Cooperatives under the Ministry of Cooperatives obtain credits from Agricultural Bank in the different conditions from individual farmers when carrying out their activities such as installation of agricultural infrastructure, purchasing machineries, etc. The difference of the character is described in the table below.

Type of Debtor	Requirement	Borrowing condition
Individual farmer	Reserving fixed time deposit at the bank Give credible collateral to the bank Having no debt	(general) Interest rate 14%, primary capital 10-20% Repayment period 5 years
Cooperatives (RPC, Cooperatives)	- Not required of the reserving Bank guarantee is only needed by the document signed at the general assembly (by directing manager) and not individual	Interest rate 7-14%, primary capital 0-20% Repayment period 5 -8 years

When the government subsidy is applied to the RPCs or cooperatives, it is in the form of the discounted interest. For example, for purchasing a machinery of Rls. 300 million by loan, 33% of total loan is given by no interest as a subsidy while the rest of 66% is borrowed by the normal interest rate of 14%. The activity-wise list of the Government subsidies for cooperatives is shown in the Table A4.2.1.

There are 3 types of finance related to the cooperatives:

1) Cooperatives borrow and pay back to the Bank for cooperative activities.
2) Cooperatives borrows money from the Bank for the members activities (such as leveling for the individual land of the members), and individual pay back (or RPC pays back to the bank and later collect money from individuals).
3) Cooperative members can obtain the credit for the individual use in the same conditions with the RPCs with the inquiry letter from the Organization.

The following special note (Note 3) can be applied when the loan is taken by the bank to the cooperatives or RPCs take loan from the Bank:

- Executive Regulation of Budget Law of the Year 2003, Note 3 -

(Article 8) 7 % of loan shall be burdened by the agriculture, agro-industry, private school and other cultural plan, while 10 % for civil engineering, technical service and research plan. There is no requirement for the primary capital to conduct soil and water related works such as irrigation and drainage plan, pressurized irrigation.

(Article 9) RPCs with the objective of land consolidation or Cooperatives with the membership of more than 70 % of women, university graduates, and recipients of Imam Khomeini Assistance Fund, people living in the impoverished area, nomads and women cooperatives are exempted from the primary capital when borrowing from the bank

As mentioned in the Article 9, a RPC is exempt from paying the initial capital for land consolidations. Other relevant Notes and subsidiary schemes under the Budgetary Law is shown in the Table A4.2.2. Whether or not such subsidiary measures of the Government would be adopted depends not only on the criteria of the applicants but also on the budget allocated with the Government. Because of their long experiences, the budgetary provision for the Union of RCOs in Kermanshah has been specified in the Budgetary Law every year for buying crops from farmers, machineries or other activities. On the other hand, the financial provision for the RPCs or cooperatives is not specified in the budgetary law (there is no fixed budget) and each organization has to go through the bank system to apply loans and the government subsidies. The budgetary provision for RPCs has been improved in recent years due to the emergence of the active RPCs in some parts of Kermanshah such as Sarpol-e-Zahab and Kangawar.

3) Qarzolhasane "Without Interest Loan" for Rural Industry and Development

Deputy of Industry & Rural Development in KJAO was responsible for the rural infrastructure development in the villages before the merging of Jihad and Agriculture two years ago when rural infrastructural works were transferred to the department of each related area (rural water to water affairs offices, rural road to transportation offices) and currently the main activities are related to agro-industries and agro-processing.

Activities are divided into 3 types, i.e., (1) minor scale industry in rural areas, (2) rural agro-processing industry and (3) rural handicraft industry. The main purposes of the Rural Development Program is to prevent migration of the rural farmers to urban areas. The Department conducts a feasibility study before providing any facilities in the villages. Because even the Government provides facilities; people may migrate into the city or other villages. The main role of the Department is to assist the procedure of establishment of the industry by cooperative, companies including the access to loan, giving information on market both in and outside the region and technical support (such as training), if necessary. Assistance from the Department is given in the form of cooperatives and private companies, very rare but there are 2 RPCs involved in the football making. Staffs of the Department are directly involved in the activities in the rural area, although the department suffers from the shortage of the staff.

In order to promote rural development, the 'Qarzolhasane' (without interest loan) was developed in 2001. The terms and obligation of the Qarzolhasane Endowment is given as follows:

Terms & obligations of Qarzolhasane Endowment

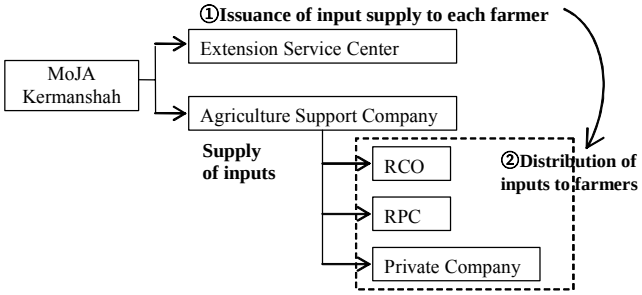
Purpose	creating, developing and stabilizing the employment in villages
Loan ceiling	Rls. 100 million at the most for real entities and group activities it amounts to Rls. 300 million proportionate to presented project.
Refunding	8 years for productive project and 4 years for service projects
Construction period	Qarzolhasane commences one year after terminating construction period of the project. At the most, two years for production projects at the most and one year for service projects.
Primary capital	10% of the expenses which their allocated loan is more than Rls. 50 million , in undeveloped rural areas or less than Rls. 50 million at least 5% Qualified university graduates are exempted from capital contribution
Service charge	Service charge is 3.5%, which is deducted from the loan as non-progress payment at the time of Qarzolhasane payment proportionate to the loan.
Priority	a Group activities, quick capital return and dependent on rural facilities projects. b *Isargaran* (war devotees) including: martyr's family members, war injured people with more than 25% of injury, prisoner's of war and those who have been fighting with the enemy for at least successive 6 months or in successive one year qualified by the relevant authorities. c University graduates, occupational and technical trainee's (formal & informal) and rural innovators qualified by the relevant authorities.
Failure and penalty	In case of any failure on the performance of obligations from the user's side or abandonment of the residing village all of the loan will be changed into present debts which in this case the bank should collect back the loan immediately plus the late repayment penalty and other occurred damages after the fund's written notice and settle these sums to the fund's account.

4) Agricultural Service Company (ASC)

Agricultural Service Company (ASC) was established as an extra-departmental body of MOJA after the Islamic Revolution. The head office is in Tehran. The main work of the ASC is to distribute agricultural inputs on behalf of the Government. The procedure of the inputs distribution is explained as below:

Procedure of Distribution of Inputs

1. Meeting with the MOJA to determine the cultivated area and the necessary amount of the inputs in the Province
2. ASC in Kermanshah Province report to the MOJA in Teheran about the amount of inputs
3. MOJA determine the portion of inputs in each province and request the ASC for supply
4. ASC Teheran prepares inputs according to the request (buy inputs from the supplier by contract or tender in case of import)
5. Purchased inputs to be distributed to each Province
6. MOJA (Province) inform the district office their portions of inputs
7. District office informs the distributors (RCO, RPC, Private companies) the amount of the inputs each should be dealt with.
8. Distributors pay the necessary costs of the inputs to the ASC's account.
9. Distribution of inputs.



In Kermanshah, there are 48 RCOs, 10 RPC and 66 private sectors which distribute fertilizer and seeds to the farmers. There are 112 distributors of chemicals and pesticides in Kermanshah a half of which is done by the RCOs. Since the decision on the amount of distribution is decided by the district Jihad-e-Agricultural office, agricultural inputs cannot be distributed without the issuance of permits by the extension service centers. Subsidies are given as the 'commissions' from ASC to the distributors: 6% of total cost for fertilizers, 10% for chemicals and 3% for seeds.

In Kermanshah, the RCOs have long been the main distributor of agricultural inputs and there is less involvement of RPCs due to be the late development in 1990s. There is an increasing role of the private companies as the distributors. Compared with the cooperatives such as RCOs and RPCs, private companies have fewer funds and often had problems in having sufficient storage capacity. However, the private companies are more flexible and quicker in action such as payment.

One of the main problems of the farmers in the Study Area is the timely and sufficient supply of agricultural inputs. According to ASC, since last year, the supply of the inputs was increased, e.g., the supplies of fertilizers were 88,000 ton last year but 140,000 ton this year. Supply of urea was increased from 440,000 ton to 770,000 ton. Also at present, ASC deals with all kinds of crop seeds not only wheat. It should be noted that not access to inputs are not only the problem of distributors but also of the farmers. Not knowing the soil type of their farm lands, farmers tend to use fertilizers and chemicals more than necessary.

A4.2.4 Farmers Organizations in the Study Area

(1) Existing Conditions of Farmers Organizations

The main farmers organizations in the Study Area are the Rural Cooperative Organizations (RCOs) under the Central Rural Cooperative Organization and the various agricultural cooperatives promoted by the Ministry of Cooperatives. The Rural Productive Cooperative (RPCs), the main agricultural cooperatives promoted by Utilization System of the Ministry of Jihad-e-Agriculture does not exist in the Study Area. The present conditions of the existing organizations in the Study Area and the farmer's perception on the farmers' organizations, particularly the establishment of RPCs are discussed in this section.

1) Rural Cooperative Organizations (RCOs) in the Study Area

In the Study Area, there are 3 RCOs at Dehestan level: Zalu Ab (Site 2), Ravansar (Site 1) and Kareh Gale Kohneh (Site 1). Some of the relatively highly populated villages have RCO shops and the people in the neighboring villages also buy daily products from these shops. The profiles of RCOs in the Study Area are summarized in the following table.

RCOs in the Study Area

Name of association	Established	No. of Members& Villages	Center	Services
Ravansar RCO	1963	1,200 68 villages	Ravansar	1) purchasing wheat from farmers (12,000 tons in 2001, 26,500 tons of wheat in 2002) 2) distribution of coupon goods and fuels 3) distribution of fertilizer & wheat seed 4) Credit (up to 500,000/year) 5) Lending machines
Kareh RCO	1971	1,300 38 villages	Kareh Gale Kohneh	1) purchasing wheat from farmers 2) distribution of coupon goods and fuels 3) distribution of fertilizer & wheat seed
Zalu Ab RCO	1978	1,300 40 villages	Zalu Ab	1) purchasing wheat and maize from farmers (35,000 ton (wheat), 12,000 ton (maize)in 2003) 2) distribution of coupon goods and fuels 3) distribution of fertilizer & wheat seed 4) Mechanization unit (3 tractors, 2 combines. renting machine is 10% cheaper than private) 5) Running a drying factory for maize (loan amount =Rls.1,400million) 6) Credit (up to Rls.1,000,000/year)

All of the RCOs in the Study Area have a long history of providing agricultural services for 25 to 30 years and its services are received by the majority of the farmers in the Study Area. The RCOs in the Study Area satisfy the basic functions of RCO, i.e., 1) distribution of agricultural inputs, 2) purchasing wheat, 3) selling and distributing coupon goods and fuel. Besides these functions, the RCO in Zalu Ab now operates the drying factory of maize by mobilizing the farmer's capital and taking Rls. 1,400 million of loan from the Agriculture Bank (5 years repayment, 14% interest). Thus, the operation of the RCOs can be expanded with the needs of the local people and the financial capacity of each RCO.

Generally, the RCOs in the Study Area are perceived as the agricultural service provider and not as the farmer's cooperative whose activities are based on the farmer's initiatives. Despite their long involvement in the Study Area, some of the problems which have not been solved are to timely and sufficient access to agricultural inputs such as fertilizers, seeds and chemicals. It is partly due to the delay of supply of inputs from the Agriculture Support Company (ASC). Another reason is the size of RCO. The RCOs are normally located in the center of Sub-district or the center of highly populated villages and one organization provides services for more than 1,000 members. Furthermore, agricultural inputs are distributed also to the non-members. It is difficult for the RCOs to provide inputs to all farmers concerned in an appropriate timing.

As a distributor of the agricultural inputs, the RPC itself has no power to control the amount of distribution. While RCOs are financially independent, most of the activities are related to the governmental work, such as distribution of inputs and coupon products and buying guaranteed products. The income sources of the RCOs are mostly from these activities, too.

In the Project area, there are 4 RCOs at Dehestan level: Zalou Ab and Kuzaran (Kuzaran District), Kareh Ghaleh Sedid and Ravansar. Some of the main functions of the RCO are summarized in the following table.

Main Functions of Rural Cooperative Organizations (RCOs)

Establishment	1963 (Before the Revolution, the Function of the RCO was different from the present ones.	
Criteria for Membership	- Engaged in agriculture-related works including farming, animal husbandry, agricultural machinery operation, and agricultural industries. - Residence of the village covered by the RCO - Purchase of minimum one share (Rls. 1,000)	
Executive board	Both RCOs at Dehestan or Deh levels have an executive board comprising of 5 members: President, Vice President, Secretary and two non-positioned persons. They are volunteers selected through the election among the members. Besides the executive boards, the RCOs employs RCO President selected through the election among the members. Accountants and storehouse keepers are also hired by the RCOs.	
Activities of RCOs at village and dehestan level	RCO shops in villages	(1) Distribution of products such as sugar, rice, etc. in exchange of coupon (2) Selling oil (petroleum, for tractors, pumps, and kerosene for stove) (3) Helping poor families (free distribution of milk)
	RCOs at Dehestan Level	(1) Selling agricultural inputs. (2) Purchasing agricultural products from the member farmers by guaranteed price. (3) Agricultural loan for the members (4) Lending agricultural machineries

2) Cooperatives

There are at least 10 agricultural cooperatives in Ravansar Sub-district (sub-district) and at 7 cooperatives in Kuzaran Sub-district as shown in the Tables below. Many of the existing cooperatives have started with the membership of 7 persons because this is the minimum requirement of the establishment of a cooperative, to get the loan from the bank with the discounted interest rate (usually 7 to 14% with the primary capital of 10 to 20 %). Some of the large scale cooperatives, such as maize cooperative and chickpea cooperatives in Ravansar are registered with the Cooperative Office at Javanrood District. However, they are still on the process of taking loan from the Bank. In the case of maize cooperative, the membership fee of Rls. 100,000 were collected from 102 members in 2001, but the access to the bank loan for building a maize drying factory (estimated as Rls.1,8 billion) is still awaited. In Kuzaran, there are 4 well cooperatives within the Site 2 which were established in 2002 by the support of the Extension Service Center of Kuzaran. For instance, in Hassan Abad Shaleh, 4 cooperatives were established in 1999 for the construction and maintenance of the deep wells. The cost of 1 deep well is around US$15,000 to $20,000 and each Cooperative can take loans from the Agricultural Bank with the interest rate of 14 %. There is a high demand for the construction of deep wells in the Study Area, particularly in Sanjabi region. However, Ministry of Energy limits to issue the permission of new well construction since the number of wells have been increased rapidly for last 3 years and the level of underground water should be controlled.

Agricultural Cooperatives in the Ravansar Sub-district

Sn.	Reg. No.	Activity type	Capacity (ha.)	Status			No. of members	Location
				Active	Under doing	Non-active		
1	163	Agriculture mechanization	–	●			7	Hassan Abad
2	1608	Agriculture mechanization	2,500	●			7	Meskin Abad Oliya
3	434	Gorgabi milk cow breeding	50 heads	●			7	Gorgabi
4	764	Fatten chicken	35,000 pcs	●			7	Zarin Chogha
5	1289	Digging well	40	●			7	Hassan Abad
6	1805	Green house products	2,000	●			7	Khoram a Sofla

Sn.	Reg. No.	Activity type	Capacity (ha.)	Status			No. of members	Location
				Active	Under doing	Non-active		
7	1854	Green house products	4,000	●			7	Tapeh Kuik
8	1976	Maize cooperative	–		●		102	Ravansar
9	2013	Chickpea cooperative	–		●		100	Ravansar
10	2188	WUA	–	●			52	Meskin Abad s/o& Khorram A s/o
11	2298	Chicken slaughterhouse	2,000 pcs/hr.		●		7	Kolah kabood

Cooperatives in the Kuzaran Sub-District

SN.	Reg. No.	Activity type	Capacity (ha)	progress			Location
				Active	Under doing	Non-active	
15	1657	Mechanization	-	●			Deh Cheragh
18	875	Calf fattening	150 heads	●			Nuruleh Olya
21	487	Milk cow	50 heads			●	Zalu ab
23	1218	Well digging & equipping		●			Zalu ab
25	1227	Well digging & equipping		●			Janjan
32	1257	Well digging & equipping		●			Rutwand
33	1238	Well digging & equipping		●			Nuruleh olya

3) Rural Productive Cooperatives (PRCs) in Study Area

As of 2003, there are 192 RPCs all over the countries and 18 RPCs including 1 Union in Kermanshah. Utilization systems' activities in Kermanshah Province were started from 1990 with establishing Baharan RPC Chachamal plain. Until now, there is no RPC in the Study Area. In comparison to other provinces, the promotion of PRCs is delayed in Kermanshah Province due to the post-war reconstruction after the Iran-Iraq. Table A4.2.3 presents the summary of the profiles of the some of the existing RPCs in Kermanshah Province: Anahita RPC in Kangawar District, Baharan RPC in Harsin District and Nilufar RPC in Central Markazi District.

(2) Farmer's Willingness to Join Farmers Organization

The opinions of farmers on the existing conditions and the future formation of farmer's organization are collected by two methods: socioeconomic survey and the informal interview:

1) Socioeconomic Survey

Socioeconomic survey was conducted along with the farm economy survey of 54 households from 6 villages, as samples.

i) Cooperatives and associations

For the question on the membership of cooperatives, 94 % of the interviewees answered that they have already been a member of the cooperatives. Apart of 3 respondents, all the rests are the members of RCOs, either in Ravansar, Kareh (Dowlat Abad) or Zalu ab (Kuzaran). 35% of respondents are the member of associations such as Tribal Mobilization Association, Baseej Eshariry[1] and Rural Assembly. Those 4 respondents who have not yet joined any organizations also want to be the member of agriculture related cooperative / associations in the future, such as, RCO, Mechanization cooperative, and the Water User's Association for

1 Established by the command of Khomeini after the Revolution. The main activities are (1) the promotion of culture and (2) helping the poor people.

the irrigation canal. It has been clear from the survey that all interviewed farmers are either a member of Agricultural Cooperative like RCO or willing to join agriculture related cooperative and there was no farmers who is not interested in cooperative.

ii) Satisfaction with the agricultural cooperatives

While farmers are feeling the need of the cooperatives their satisfaction with the services of cooperatives is another issue. When the villagers were asked whether they are satisfied with the services of RCOs, only 26 % gave positive answers. Majority of the respondents are in the opinion that the RCOs have not been functioning well due to the delay of supply of agricultural inputs and unavailability to sell their agricultural products to the market.

(2) Informal Interviews

Informal interviews on the formation of RPCs was conducted in 4 villages in the Study Area, i.e., Tapeh Lori, Ghale Reza, Tape Rash and Nourley Oliya. The main opinions on the constraint of forming farmers organizations is summarized as given as below:

1) Negative image of RPC as a legacy of agricultural company

Before the revolution, Agricultural Companies were promoted by KJAO in the Study Area, including in Zalu Ab, Deh Chera, Hassan Abad Shaleh and Hassan Abad. As mentioned earlier, the farmers were taken away the control over their land due to the joint operation by the Companies, and these negative memories the farmers, especially the older generations, overlap their negative memories on the current operation of RPCs. Furthermore, the image of RPC as to conduct only the land consolidation is negatively taken by some of the villagers. These villagers are scared of losing their lands though consolidating their lands.

2) Not enough information on the RPC in the region

In the Study Area, the activities of RPCs have not yet been familiarized with the people. Some young people commented that they are interested in solving agricultural problems such as access to mechanization, land consolidation, and irrigation water management through the formation of farmer's organization; they do not know how they could actually start. There have not been enough motivations for the farmers to take actions by themselves.

3) Lack of trust to the Government activities

It is not clear if the Government really support the farmers when they want to take actions. Although not in the form of RPCs, the village people collectively apply for the activities such as land leveling and rural road construction, but the Government is generally slow in action. Even when a project is approved, it takes such a long time until the implementation.

4) Lack of finance

Due to the continuous droughts in the last few years, it is difficult only by the farmers to establish a farmer's organization to start activities by taking a huge amount of loans. Without sufficient financial and technical assistance by the Government, farmers cannot be attracted to do any activities. If there is a sufficient supporting system established by the Government, farmers are ready to form an organization.

Farmers lack initiatives in forming farmers' organizations by themselves for many reasons as discussed above. While farmers, particularly young generation are interested in solving agricultural problems through the joint activities, a good rapport between the government and the farmers, and the farmers themselves should be first established. For this, the government has to give enough and accurate information on the farmer's organization such as RPCs and to activate the organization under the better farmers participation, how to take off from the

government guidance to self-reliance organization.

(4) RPC Study Tour

1) Background

Thirteen farmers participated in the tour to Kangawar District on 7 October 2003 to observe the activities of Anahita RPC which was established in 1996 with the membership of 320 farmers. The participants were selected from the contact farmers in the Study Area (7 from Site 1 and 6 from site 2). The activities of Anahita RPC include (1) mechanization, (2) distribution of inputs, (3) land consolidation, (4) irrigation (5) wheat seed cleaning and storage. In addition, the construction of chickpea packing facility has been planned and it is under the loan procedure. The participants were briefed on the background and activities of the RPC by the managing director and the board members and observed the wheat cleaning and storage facility which is operated by the joint venture of the private owner (of a member RPC) and the RPC. According to the questionnaire, the participants were most impressed with the wheat cleaning facilities as they could actually observe the activities. Other activities include the distribution of agricultural inputs and mechanization and land consolidation.

2) Interest in the formation of RPC

All 13 participants answered that they are interested in forming a RPC by themselves. The majority answered that they think the operation of RPCs will bring about the improvement in production and eventually increase agricultural income. Some of the participants commented that their preoccupation with the agricultural company existed before the Revolution was wiped away after seeing the real activity of the RPC. When asked about the activities for the RPC, 9 out of 13 participants answered that they are interested in land consolidation and leveling as a first priority as a result of the detailed explanation on the advantages of implementing land consolidation through the RPCs. The result of the questionnaire regarding the priority activities of RPC is as show in the box in the right.

Priority Ranking for RPC Activities

1. Land consolidation
2. mechanization
3. distribution of agricultural inputs
4. Joint sales of crops
5. Access to market information
6. Agro-industry

3) Formation of Organization and Leadership Issues

While Anahita RPC is composed of 11 villages and 320 members, a half of the participants from the Study Area prefer to form a RPC with their own village people. Another half of the participants want to establish a RPC with their neighboring villages. According to the participants, many of their village people in the Study Area see RPCs negatively due to the experience of the agricultural company and it is difficult particularly for old people to change their ideas. Thus, they are in the opinion that only those who is interested in the activities of RPCs should first start the activities together. As for the leadership issue, only one participant answered that the Government staff should take an initiative in the operation of RPC. The rest of participants commented that the RPC should be a farmer-led organization and the initiatives should be taken either by the member farmers who is reliable and respected by the village members. On the last question on the willingness for the leadership, 11 out of 13 participants answered, yes, that they are ready to take a leadership for the formation of RPCs.

4) Other Comments and Remarks:

The majority of participants found that the tour was useful. As a result of the active discussion with the managing director and the board members, the participants could obtain the information on the RPC in detail, including the financial and technical support of the

government in each activity. While the present operation of the RPC is led by the government staff from the utilization system of KJAO, one farmer clearly stated that the RPC should be the managed without the interruption of the government. Other comments include that they will share their experiences of the tour with the village people and discuss whether to establish a RPC together in the future.

Nonetheless, the study tour to the existing RPC gave a positive impact on the farmers in the Study Area. One of the most important implications was that the farmers understood that the objective and activities of the RPC which is totally different from the agricultural companies existed before the Revolution. RPC respects the initiatives of the farmers themselves to collectively solve agricultural problems and improve agricultural production and income. Before starting a RPC, some efforts by the government staff (the extension workers and staff of Utilization System) and by the contact farmers are needed to introduce the advantages of RPCs to the farmers in the Study area and take initiatives in organizing the meetings and the formation of the groups.

A4.2.5 Activities of Extension Service Centers

(1) Yearly Activities

Yearly Activities of the Extension Service Centers in the Study Area is summarized in the table below:

Annual Activities of the Extension Service Center

Month	Farmers' field activities	Activities of Extension Service Center			
		Extension/ Demonstration	Training	Issue permission for inputs	Other activities
Jan.	(off-farm)	-	Various training courses	-	festivals & other events
Feb					
Mar.	fertilization (wheat, maize barely), sowing (chickpea)	Inspection of bug and apply pesticide	-	Chemicals., fertilizer & pesticide (wheat)	Distribution of maize seeds
Apr.	fertilization (maize)	Pest control for chickpea	Various training for farmers	Chemi., fertilizer & pesticide (wheat, maize, chickpea)	
May	sowing (maize)	Nymph control, Combine operation	Combine operation Tanket sprayer	Chemi. & fertilizer (maize, chickpea)	Maize insurance
Jun.	harvest (wheat, barely, chickpea) irrigation of maize	Combine operation to prevent harvest loss, Crop manage of maize & sugar beet	Summer crop cultivation and double cropping	Chemicals & fertilizer (maize, sugar beet)	
Jul.		Visiting wheat buying centers	Various training for farmers		Agricultural statistic plan
Aug.	irrigation of maize	Seed cleaning (wheat)	Various training for farmers	Fertilizer, disinfect chemical for wheat	
Sep.	sowing (wheat, barely)	Combine operation wheat seeding	Training on Seeders	Fertilizer, disinfect chemical for wheat	
Oct.	Sowing (irrigated wheat)	Maize harvesting			Wheat insurance
Nov.	harvest (maize),		Various training for farmers		
Dec.	(off-farm)				

(2) Extension and Demonstration

As shown in the Table above, the extension activities by the staff are related directly to the filed activities of the farmers. Some of the important extension activities during the farming season are to make site inspection for the pest control for wheat, maize and chickpea, checking the operation of combines for preventing the harvest loss, side by side with the technical trainings. Because of the shortage of experts and technician in each ESC, not all the villages receive such technical support of the ESC. Thus, the site inspection is conducted mostly on the basis of request by farmers. Demonstration is conducted by using the demonstration farms of the farmers. In Kuzaran, there are 2 demonstration farms and 1 research extension farm. In Ravansar and Hassan Abad, there are 8 demonstration farms and 2 research farms in total 10 villages as shown below:

	Ravansar / Hassan Abad	Kuzaran
Demonstration farm	Wheat (10 ha - irrigated) Wheat (3 ha, 6 ha, 6.5 ha –rainfed) Rape seed (1.5 ha, rainfed) Chickpea (1 ha x 3 farms)	Wheat (2 ha) Rape seed (1 ha)
Research extension farm	Maize seed (1ha x 2 farms)	Chickpea (1 ha)

(3) Training for Farmers

Based on the farmers' needs and considering the types of agriculture practiced by farmers, the request letter on the farmer's training is sent from each ESC to the District Jihad-e-Agriculture Office, and then to the Provincial Office. The requests are sent to the district every three month and the training are conducted both at extension office and the filed. Approval of the training is based on the financial availability of KJAO. Trainings related to cultivation, harvest and land preparation are mainly done in the villages, either using the demonstration farms or the land of the contact farmers. Other training is conducted at the training room of the ESCs. The name and the number of training conducted in 2002 by each ESC is shown in the Table A4.2.4.

(4) Training for Experts

At the beginning of the fiscal year, the list of annual training plan for the staff of ESC is sent by the Province. Among the list of training, each expert is requested to apply maximum 4 national or provincial level training. While there are many new courses provided every year, experts can hardly attend any training due to the shortage of staff, especially after the merging of the Agriculture and Jihad-e-office.

(5) Issuance of Permission for Agricultural Inputs

Issuance of the permission for subsidized agricultural inputs has been the main task of ESC. As already mentioned, staffs of ESCs are engaged in issuing the permission of taking agricultural inputs including fertilizers, chemicals and seeds about 5 to 6 months of a year. These activities are mainly done at the beginning of the cultivation; staffs are busy for both this logistic work as well as the field investigation for farming. There are two reasons for issuing the permits by ESCs. First is to control the amount of inputs to be distributed since the supply of agricultural inputs is always limited and in shortage. Second is to prescribe the appropriate type and amount of inputs as farmers tend to misuse/overuse fertilizers or chemicals. For this reason, the staff of ESCs regard that the issue of permission needs the

Government authority and it is not as simple as to transfer to the private sectors. Kermanshah Province is chosen as a model province for restructuring the agricultural extension system. The restructuring plan is that ESCs should concentrate on extension and training while the function of distribution should be transferred to private sectors such as RPCs and private companies. The Government, however, has not been taking any concrete action the way in which private sectors can be involved in this activity.

(6) Other Activities

Other activities include making contract with the farmers, issuance of crop insurance and assisting the procedure of applying loans for the cooperatives and individuals. ESCs also organize some special events like the agricultural week, the harvest ceremonies and revolutionary ceremonies.

Table A4.2.1 Agricultural Subsidies for the Cooperatives and RPCs by the Ministry of Agriculture

Activities	Source of finance	Interest rate	Repayment term	Up limit of loan	Primary capital	Credit Eligibility	Remark (Advantages for RPC)
Agricultural inputs	(1) By Bank alone (2) Bank and Government subsidies*	(1). 13.5% (2) 7-8 %	1 year	No limit (based on the need)	10 %	Required documents and credible collateral	Legal body like RPC have more trust than the individual by bank
Building storage	(1) By bank alone (2)Bank & Govt subsidies	(1) 13.5% (2) 7-8%	5-10 years	No limit	10 - 30% (some parts be paid by loan)	Required documents and application, credible collateral	Ceiling of loan can be higher than individuals or small cooperatives
Land consolidation	70% govt subsidy, 30% by self-finance	13.5% for self-finance	Min.10 yrs	No limit	0 %	Required documents, , credible collateral, potential of water, soil and close to city	Govt may provide technical services and materials by free
Electrification of well	1. By Govt 30% 2. By bank 60% 3. By self 10%	13.5%	Min. 7 years	No limit	0 % or 10 % by loan	Confirmation by water affair office	Govt may provide technical services and materials by free
Irrigation canal	(1) By bank alone (2)Bank & Govt subsidies	(1) 13.5% (2) 7-8%	10 years	No limit	0 % or 10 % by loan	Guarantee document by Board members	Govt may provide technical services and materials by free
Mechanization	(1) By bank alone (2)Bank & Govt subsidies	(1) 13.5% (2) 7-8%	5 years	No limit	20 % (some parts be paid by loan)	Required documents, credible collateral by Board members,	Priority for RPCs to give machineries by MoJA
Animal-husbandry	(1) By bank alone (2) Bank and Government subsidies*	(1) 13.5% (2) 7-8%	5 years 8years (cow)	No limit	Min. 10%	Required documents and credible collateral	Bank has more trust on RPC than individuals or small cooperatives
Agro-processing	(1) By bank alone (2) Bank and Government subsidies*	(1) 13.5% (2) 7-8%	5 to 8 years	No limit	Min. 10%	Required documents and credible collateral	Bank has more trust on RPC than individuals or small cooperatives Loan can be repaid after the construction of the factory
Green house	1) By bank alone (2) Bank and Government subsidies*	(1) 13.5% (2) 7-8%	5 to 8 years	No limit	Min. 10%	Required documents and credible collateral Good market condition	Bank has more trust on RPC than individuals or small cooperatives
Fishery	1) By bank alone (2)Bank and Government subsidies*	(1) 13.5% (2) 7-8%	5 to 8 years	No limit	Min. 10%	Good market condition Existing performance	Bank has more trust on RPC than individuals or small cooperatives

Source: Economic Affaire, Planning Deputy KJAO

*1 :Composed by 33% of total cost given as the government subsidy (=loan without interest) and the rest of 66% is by the bank loan with the interest rate of 13.5 %, which makes the total interest rate of 7 to 8%.

Table A4.2.2 Application of the Special Note for the Agricultural subsidies

No	Source of Budget	Application's qualification	Interest rate	Repayment term	Up limit of loan	Primary capital
1	Not 3, Item 29	Having fattening permission	14%	5 year	Depend on project	20 %
2	Chicken complex owner liquidity	Having utilization permission	13.5%	6-12 month	Depend on project	20 %
3	Not 3, Item 19	general	14%	5-8 years	No limit	20 %
4	Fattening complex liquidity	Having utilization permission	14%	6-12 month	No limit	20 %
5	Article 56	Employer of complex permission	4%	4 years	30 million	No need
6	Note 3 Item 32	general	5%	5 years	No limit	20%
7	Article 1, Note 11	general	14%	5 to 8 years	No limit	20%
8	Item 27 (concentrate)	-ditto-	-ditto-	-ditto-	-ditto-	-ditto-
9	Note 12 Item 3	Drilling diesel well, pump station	13%	5 years	Based on needs	0%
10	Note 22 Item 1	Drilling diesel well, pump station		5 to 8 years	No limit	0%
11	Unexpected event	Evidence of loss	5%	7 years	Depend on amount of loss	10%
12	Current capital	Wheat producer	14%	1 year	Based on needs	10%
13	Qarzolhasane	Wheat producer	3%	3 years	50 million	10%
14	Note 3, Item 3	Financial feasibility study is completed	13%	3-10 years	Based on needs	0-20%
15	Note 3, Item 27	Financial feasibility study is completed	8%	3-7 years	Based on needs	5-20%
16	7,000 jobs	Unemployed card holders	14%	3-5 years	Based on needs	20%
17	Iran Scheme	Women, graduates	4%	3 years	10 million	0

Source: Economic Affaire, Planning Deputy KJAO

Table A4.2.3 Summary of the Profiles of Existing RPCs in Kermanshah Province

RPC	Anahita RPC Kangawar District	Baharan RPC Harsin District	Nilufar RPC Central Markazi District
Basic Information	Foundation: 1996 (loan started from RPC Members: 320, users:450 Covering Dehs: 11 Covered area : 3,895ha (Irr:571 ha, rain:3184ha, Orchard:140ha) Agricultural Crop: Wheat:170ha(irr),1,450 ha (rain) Barely: 50 ha (irr), 600 ha (rain) Chickpea: 1,400 ha (rain), Sugar beat: 70 ha (irr)	Foundation: 1990 RPC Members: 235 (55 at first) Covering Dehs: 5 Covered area : 2,040 ha (irr: 1,096 ha, rain: 944 ha) Agricultural Crop Wheat: 289 ha(irr), 465ha (rain) Barely: 80 ha (irr), 450 ha (rain) Chickpea: 200 ha, Sugar beat: 59	Foundation: 1992 RPC Members:168 (50 at first) Covering Dehs: 4 Covered Area: 2,899 ha (irr: 1,137 ha, rain: 1,762 ha) Agricultural Crop: Wheat:477ha(irr), 1096ha (rainfed) Barely:132 ha(irr), 74 ha (rainfed) Maize:439ha (irr), lentil:1ha (rain) Chickpea: 38 ha (irr), 590ha (rain) Watermelon : 39ha(irr)
Facilities	- RPC Office (by MoJA) -Storage for inputs (by MoJA) -Agricultural Machines (by RPC and MoJA) -Land for constructing chickpea (by	- RPC Office (by MoJA) - Storage for inputs (byMoJA) -Mechanical workshop(by MoJA) -The land of 2,820m2 (by MoJA) -Agricultural land (by RPC) -Agricultural machineries (by	- RPC Office (by MoJA) -Storage for inputs (by MoJA) -Mechanical workshop (by MoJA) -Agricultural machineries (by RPC and MoJA) -Wells and springs
Activities	(1) Lending machineries (2) Distribution of inputs (3) Land consolidation (4) Irrigation (5) Production of wheat seeds (6) Construction of chickpea packing factory	(1) Lending machineries (2) Distribution of inputs (3) Land consolidation (4) Irrigation (5) Production of wheat seeds (6) Extension service	(1) Lending machineries (2) Distribution of inputs (3) Land consolidation (4) Irrigation (5) Production of wheat seeds
Financial conditions	Income:Rls.90million/yr(inputs), Expense:100-110million/year (loan)	Income:Rls.120million/yr(inputs and Expense:Rls.70million/year (loan),	Income:Rls.80million/ yr (inputs) Rls.100million/yr (machines) Expense: Rls. 110 million and others
Problems	1. 5 years has past since the start of the PRC. But the RPC is still not handed over to the members from 2. Due to the capacity of the technical staff, the members cannot be increased at this moment.	1. Due to the lack of water, the area of irrigated lands are diminishing. 2.Govt is not satisfying its duties. Compared with before, the Govt are not cooperative in terms of financial supports.	1. Handing over is delayed. 2. No management authority: the RPC bought a combine by loan 2 years ago. But it was indeed the order of the Government and not the request of the RPC.
Strengths/ Potentials	1. Development of activities. e.g., chickpea factories. 2. Good financial aspect (loan be repaid by next year.) 3. Taking a major role in the Dehestan to provide agri. inputs. 4. Directing manager is active. 5. Having a progressive farmer.	1. The first RPC in Kermanshah and it received Govt subsidies more than 2. Having many facilities and lands which could be used more	1.Succeeded in land consolidation in all villages. 2. High irrigation rate after the RPC was formed. 3. Many functions in mechanic workshop. 4.Directing manager is active。
Weaknesses	1. Members depend actions and decisions on the manager. 2. Development of irrigation delayed (irrigation % is low)	1. Both the members and manager depend too much on the Govt 2. No new developments of RPC activities.	1. Members financially depend on the RPC and have not yet returned 2. Control of the Govt.

Table A4.2.4 Agricultural Training for farmers (2002, Ravansar)

1. List of training-extension courses (rural men) in the year of 2002

No.	Training course topic	Times	No.	Training course topic	Times
1	Fighting against weeds	9	32	Advantages & methodology of autumn season fertilizers for wheat & barley	1
2	Fighting against bug (nymph & maturity)	10	33	Wheat autumn season irrigation	3
3	Optimum use of fertilizer	6	34	Erection of gardens & planting the sapling	5
4	Utilization from the micro-nutrition	1	35	Extension on water & soil protection	6
5	Cultivation of sugar beet	10	36	Breeding & hybreeding the local cow	2
6	Mechanized cultivation of chickpea	1	37	Tractor attachments, O & M	1
7	Irrigation of wheat	1	38	Visiting tours to Mirabad animal husbandry component (salas)	1
8	Safflower	1	39	Plant diseases	1
9	Consumption of Azoth fertilizer	1	40	Fighting against pests & fertilizing the fruitful trees	1
10	Fighting against chickpea worm	2	41	Extension on changing the less-productive dry land to fodder	1
11	Fighting against chickpea pests	1	42	Common diseases between human & livestock	1
12	Oil seeds	2	43	Extension on breeding & hy breeding of sheep	2
13	Correct cultivation of maze seed, using the micro and macro fertilizer	1	44	Land leveling & consolidation	8
14	Different types of rain fed wheat	1	45	Visit tours to the Mehrgan animal husbandry component	1
15	Correct use from top-dressing fertilizer in maze	1	46	Erection of stable & purchasing the milky cow	1
16	Prevention from combine defoliation	1	47	Wheat diseases and pests	1
17	Maze fertilizing	1	48	Tomato cultivation	1
18	Seed cleaning & anti-bacterization	1	49	Irrigation & rain fed wheat, cultivation	1
19	Corns harvest	1	50	Fodder plants cultivation	1
20	Visit tour to the tape irrigation (allahyarikhani region)	6	51	Calf fattening	2
21	Maze irrigation	1	52	Control & prevention from livestock diseases	1
22	Lands equipping and revival	1	53	Making the local leaders, familiar with the extension affairs	1
23	Soil test	2	54	Training tours to Rojin tak company in Kermanshah	1
24	Mechanized cultivation	2	55	Corns cultivation	1
25	Series cultivation	3	56	Getting familiar with agriculture pesticides	1
26	Rape seed cultivation (creation a background to cultivate in the region)	2	57	Well equipping & the ways of getting the bank loan	1
27	Fruit trees, diseases	1	58	Setting the tractor attachments	2
28	Sapling, cultivation of rain fed grape, almond and rose	1	59	Cultivation of rain fed chick pea	1
29	Tractor attachments	4	60	Research on the land survey	1
30	Land preparation	4	61	Pitting and fertilizing in gardens	2
31	Terracing and planting of sapling	1	62	Breeding of local chicken	1

2. Training – extension courses- for rural women (2002)

No.	Training topic	Times	No.	Training topic	Times
1	Fighting against the chickpea disease	1	12	Seeds' anti bacterization & cleaning	1
2	Sunflower & its food & medicine specifications	3	13	Plant's diseases	1
3	Advantages & disadvantages of making the fire on straw	1	14	Chemical pesticides and their	1
4	Fighting against pests & fruit trees fertilizing	1	15	Weeds and control	1
5	optimum utilization from fertilizer (problems & advantages of fertilizers)	1	16	Lands consolidation & advantages of land consolidation	2
6	Advantages & methods of autumn season fertilizer in wheat & barley	1	17	Maze cultivation	1
7	Family health care	2	18	Cultivation of maze	1
8	Under pressure irrigation (sprinkle-drop irrigation)	7	19	Safety observation in	1
9	Methods of agriculture crops, storage	1	20	Individual & social hygiene and health care	1
10	Agriculture crops agro-processing	5	21	Method of fertilizer consumption in maze	1
11	Fodder plants	1	22	Corns diseases	1

Table A4.2.5 Results of Extension Officials' Workshop at Ravansar

	Current Situation		Problem	Future
	Ravansar	**Hassan Abad**		
No of technical experts	Total :10 agronomist(1) extension (1) women's training (1) animal husbandry(1) horticulture (1) plant protection (1) watershed(1), technician (2)	Total :5 agronomist(1) extension (1) plant control (1) soil and water (2)	1. No watershed experts, 2. Some experts are responsible for different profession 3. Each unit should be working together with one or two technician 4. Lack of mechanization experts	Agronomist (2) Mechanization expert(1) Extension(1) Animal Husbandry (1) Horticulture (1) Plant Control (1) Irrigation (1) Others: (2 technician for each part)
Training facilities	No training room, (using the praying room for training)	1 training room	No training room in Ravansar	Need to have 3 center in Kuzaran Baksh (Kuzaran, Zal Ab, Haft Asian
Machineries & equipments	TV(1), video(1), amplifier(1), camera(1), white board (2)		No computer, no CD Lack of space to keep training equipment	Video camera, OHP
Extension materials	posters, photos, training publication, extension letters and announcements, pamphlet		posters, photos, training publication, extension letters and announcements, pamphlet	To allocate suitable vehicles to go and return by experts
Transportation	4WD(2), Sedan (1)	4WD(2), Sedan (1)	1. having no suitable transportation even to go and return of personnel	1 section for 1 car
Contact Persons	Total 120 contact farmers from 97 villages, 30 women contact farmers in Ravansar Baksh		-	-

General Problems raised by the Participants of Workshop

- No proper planning of the Extension in the Province
- The number of staff is not sufficient and the experts cannot concentrate on their expertise
- Low salary of experts prevent development
- Even after the training, experts have to concentrate on the jobs unrelated to the training
- Although some graduates are sent to the ESC they are mostly non-agricultural specialist. Agriculture graduates are not necessarily given priority to work in the ESC.
- Even when the farmer's agricultural production may increase, extension office are not rewarded
- Farmers are too old to absorb the training contents
- Farmers do not accept the agricultural examination and new cultivation methods.
- Staffs are busy due to the issuance of permission for inputs but it is difficult to hand over this work to the private sector. The production (amount) of agriculture inputs is the main problem. If the supply of inputs is more than demanded, then the competition and finally giving the better services to farmers is facilitated.

Table A4.2.6 Results of Extension Officials' Workshop at Kuzaran

	Current	Problem	Future
No of technical experts	Agronomist(3) Extension (1) Animal Husbandry(1) Plant Control (1) Soil And Water (2) Technician (3) Solders (3)[*1] Basig-E-Sazandegi (2) [*2]	1. Shortage of experts 2. No permanent employ for solders and advisers 3. No balanced specialists 4. No merits or bonus unlike other office 5. Situation of employment is not clear 6. Receiving low salary & bonus 7. Too much work unrelated to his specialty	Agronomist (2) Mechanization expert(1) Extension(1) Animal Husbandry (1) Horticulture (1) Plant Control (1) Irrigation (1) Others: (2 technician for each part)
Training facilities	4 rooms, one saloon 1 training room in existing center (new training center is under construction)	1 Covered area id so vast 2 Facilities are not enough 3 One center is not enough (one center should cover 30-40 villages) 4 There is a plan to have an additional center but never implemented	Need to have 3 center in Kuzaran Baksh (Kuzaran, Zal Ab, Haft Asian
Machineries & equipments	Video(1), TV(1), Camera (1), Board (1) TV(1), video(1), camera(1) ,amplifier(1)	1 No computer 2 No CD (VCD by computer) 3 Lack of space to keep training equipment	TV (2), VCD (3) , DVD (1), Photocopy machine (1), camera (1), digital Camera (1) internet facilities New training motives
Extension materials	posters, photos, monthly magazine, publications	1. Not enough number of publication and training	To allocate suitable vehicles to go and return by experts
Transportation	4WD(3)	1. having no suitable transportation even to go and return of personnel	1 Mini bus for farmers Sedan (4) 1 section for 1 car
Contact Persons	134 (1 person per village)	-	-

General Problems

- Despite the heavy workload, there are not enough incentives (salary or pleasures).
- Lack of coordination between the government policies in execution and support section
- Lack of the adjustability in decision made by the Ministry and organization with the facilities of the service center
- Lack of needed research to allocate the resistant and adapted species of fruit trees
- Due to the wide coverage area, it is not possible to have continuous relationship with farmers
- Lack of technical and scientific information
- Farmers expectation are so high but the ESC can provide limited services
- Lack of needed research to allocate the resistant and adapted species of fruit trees

Annex 5	**Watershed Management and Rangeland Rehabilitation**

ANNEX 5

WATERSHED MANAGEMENT AND RANGELAND REHABILITATION

A5.1 Natural Resources of Kermanshah Province

A5.1.1 Land Resource and Plains

(1) Land Resource

The land resource map was prepared by Jihad-e-Agriculture Organization in 1989. This map was compared with the TM landsat data with the combination of RGB432 bands and some improvements were made and the land resource map of the province was prepared as shown in Fig. A5.1.1. A detailed description of the legends is presented in Table A5.1.1. Land Resource Distribution in the Kermanshah Province is shown in Table A5.1.2.

In the Kermanshah province about 46.5% (1,163,100 ha) of the land are mountainous areas, 21.7 % (542,232 ha) are hilly areas, 6.8% (168,012 ha) are plateau and upper terraces, 12.3% (307,567 ha) are piedmont plains, 5.3% (134,005 ha) are sedimentary and alluvial plains, 0.4% (9,354 ha) are flood plains, 1.8% (97,687 ha) are fan shaped colluviums with gravel. The lands which fall in the other types are 3.1% (78,384 ha).

(2) Plains of the Province

The plains of the province with the land classification are shown below.

Plains of the Province

Item	Name of Districts	Name of Plains	Area of Plain (ha)	Percentage of Land				Lands Area
				I	II	III	Others	
1	Kermanshah	Mahidasht-Sanjabi	117,140	0	63.00	37.00	0	89,700
		Bilevar-Miyandarband	28,750	8.1	58.28	33.62	0	20,075
		Kermanshah	89,813	0	48.27	50.73	0	63,644
		Talandasht	6,219	0	68.24	31.76	0	4,440
2	Kangavar	Kangavar	41,735	4.01	38.46	39.11	18.4	26,935
3	Sahney	Dinvar	19,312	11.86	83.55	4.59	0	9,820
		Sahneh-va-Bisotun	47,150	0	61.75	38.25	0	27,320
4	Harsin	Bisotun-Harsin	11,469	0	33.56	66.44	0	8,381
5	Songhor-va-Koliyai	Songhor	42,156	0	46.69	28.09	25.24	15,615
		gavrud	69,750	0	47.68	44.59	7.73	29,150
6	Eslamabad-e-gharb	Eslam abad-Harsem-Dizgaran	50,210	11.72	59.79	28.49	0	40,835
		Kerend-e-gharb	9,500	0	68.73	35.27	0	7,740
		Shiyan	9,583	0	90.42	9.76	0	4,100
		Hassan abad	12,000	0	27.30	72.70	0	10,710
		Biyeh nij	7,820	0	66.67	33.33	0	5,130

Class I – Arable; Class II – Arable with minor limitation for irrigated farming;
Class III – Moderate limitation for irrigated farming

The Study Area is located in Mahidasht-Sanjabi plain which contains 63% of the lands in class II and 37% of the lands in class III.

A5.1.2 Natural Resources

About 60% of the area of Kermanshah province is consisting of natural resources including forest (650,602 ha (26.5%)) and rangelands (768,863 ha (31.3%)) and are located in different climatic conditions.

The forest area continues from north-west (Paveh and Uramanat) and continues upto south-east with an area of 160 k.m length and 50 k.m width and it passes from Gahvareh, Janvanrud, Karand, Sarpolezahab, Gilanegharb, Ghalaje, Zardlan, Osmanvand and part of Dorude farman.

The main tree is Persian Oak and the other species are Persian Turpentine tree, Baluk, Howthorn, Kikam, Oriental Almond tree, and wild pears.

The rangelands (natural pastures) of the province are divided into three classes, considering the weather differences and plant species as mentioned below: The ranges of class 1) are located in the elevation of more than 1,650m and include species such as permanent grass, legumes, jashir, and lukoma. The yield varies from 400 to 550 kg of dry fodder/ha. The ranges of class 2) are located in the elevation of above 1,500 m and include species such as goat's thorn, grasses, legumes, which are mostly annual grasses. The yield varies from 250 to 300 kg of dry fodder/ha. The ranges of class 3) are located in the elevation of less than 1,500 m and include bushes, annual grasses, alfalfa etc. The yield varies from 200 kg of dry fodder/ha.

The area of rangelands distribution is shown in the following Table.

Rangelands Distribution and Area in Kermanshah Province

District	Class 1 Rangelands (ha)	Class 2 Rangelands (ha)	Class 3 Rangelands (ha)	Total (ha)
Eslam Abad	-	20,000	40,000	60,000
Paveh	10,000	-	7,000	17,000
Javanrud	-	20,000	-	20,000
Sarpol-e-Zahab	-	9,925	17,875	27,800
Songhor-e-Koliai	38,870	15,000	25,000	78,870
Sahne	20,000	26,000	30,000	76,000
Ghasr-e-shirin	-	151,513	25,000	176,513
Kermanshah	20,000	22,500	118,820	161,320
Kangavar	10,239	30,000	10,000	50,239
Gilan-e-Gharb	-	-	63,000	63,000
Harshin	10,000	33,331	21,927	64,258
Total	109,109	331,438	358,622	795,000

Overgrazing is a common feature in the rangelands of the Kermanshah province. Overgrazing not only suppress the regeneration of natural vegetation, but also leads to decline of soil fertility, degradation of land quality and imposing a great loss to natural resources.

There are about 12 divisions controlled by natural resource head office in Kermanshah. About 60 control officers are controlling the ranges and forests of the province. Forest protectors, recognize the illegal forest extract activities, collect enough information to take any legal action. In the regions, which have high potential for renewal, lands will be distributed to people to grow trees and fruit gardens.

The main reasons for the forest & destruction of ranges in Kermanshah province are:

- Increasing in human population
- Increasing in livestock population
- Poverty of rural and tribes
- Drought years
- Catch of Fires

The organizations which are incharge of nature protection, have finally succeeded to change the 'wood consumption culture' in 80% of the villages (800 villages) and to make them use

fossil fuels for cooking and to keep their houses warm.

When there are fires in forests and ranges, there are not enough technical facilities to extinguish fires and these regions are difficult to pass. The main way of fire extinguishing is to make earthern canals and some borders between the agriculture and forest lands. Finally, the fires are extinguished with the efforts of forest inspectors and with the help of users (people who use the forests and ranges).

The Government place more emphasis on the environment, ranges & forests protection in the third development plan. Some of the activities carried out by the government are:

- Organization support for forests & ranges
- Educating and training the villagers & tribes people

Through these activities, the government tries to protect the environment and increase the natural resources both in quality and quantity.

Tooba Program

Tooba Program was signed in 1997 between Ministry of Agriculture and Jihad Sazandegi. It include olive, walnuts, almond, dates, fig, pomegranate, mango, hazel nuts, mulberry, nuts trees, and medical species and wood (xylemogen) trees on the targeted one million ha in Iran within 10 years.

Objectives of Tooba Program

1. Reclamation and natural resources development
2. Optimal exploitation of soil & water
3. Sustainable Production
4. Foresting or promotion of employment
5. Providing some part of national demand of olive oil

Scope of the Program

1. All available forest land and wooded pasture which are situated outer side of Northern Iran
2. National arable lands outside the forester region
3. All arable Governmental lands
4. Private lands which are possession or rent of true or legal persons

Financial Sources of the Program

During 1999/2000, Rls. 260,431 million was allocated by MOA and MOJS, and Rls. 188,503.4 million was drawn out by provinces. Also in 2001, Rls. 104,500 million was allocated and transferred to the Bank in order to be mixed with Bank resources (35% of government subsidy, 55% of Loan of Agricultural Bank - at 14% of annual interest and 10 year repayment period including grace period of 5 year, and 10% of Private banks) and to be lent to the applicants in form of low interest loans. From 1999 to 2001, 25,701 programs with 95,900 ha and Rls. 517,474 million was invested finally, signed between the Bank and applicants.

Furthermore, in 1999/2000, Government subsidized credits of Rls. 28,753 million was allocated for 31,732 ha for grant trees seedling, distributed. Some provinces such as Chahar, Mahal-e-Bakhtiyari, West Azerbaijan, Far and Kermanshah have had the maximum absorption of the budget.

Kermanshah Province is the largest applicants, with 1,000 ha and Rls. 6,000 million mostly in Paveh/Javanrud districts. The tree nurseries are granted to the participants costing Rls. 4,000 million/year. The program promotion is obstructed by the delay of credit disbursement caused by the shortage of Bank staff. The program supported by technical committee members at provincial and district level. Most of the applicants given the priority to the people living near the proposed land or agricultural university graduates. After the screening in the technical committee and public consultation, the winner can start the implementation and get the certificate of land after payment of land at Rls. 4 million/ha. It is estimated the development cost is estimated at 10 million/ha for irrigated and 6 million/ha for rainfed and benefits are expected around Rls. 400 million/ha. There is no compensation to who was used the Tooba land as rangeland.

A5.1.3 Ravansar Basin

(1) Characteristics of Ravansar Basin

The terms watershed, river basin, catchment, and drainage area are all used to describe a land surface from which water flows downhill to a specified point on a watercourse. In some countries, the term ‘watershed’ is restricted sometimes to mean a comparatively small catchment, or sometimes to mean the upland, water-yielding portion of a larger river basin. (Guidelines and Manual on Landuse Planning and Practices in Watershed Management and Disaster Reduction, United Nations, 1997). Although the terms ‘basin’ and ‘watershed’ are used simultaneously in this report, the term ‘basin’ always refer to the whole area, while the term ‘watershed protection/management’ sometimes refers to the management activities at the upstream of the basin.

The Study Area is included in the Ravansar basin, which is located at the upstream basin of Doab Marak hydrological station. Since there is a Gharasu basin at the downstream side, the upstream of Doab Marak station is always referred as ‘Ravansar basin’ by the Water Management Department. In order to maintain continuity with other reports and to avoid confusion, the term ‘Ravansar basin’ is used to describe the basin of the Study Area.

Ravansar basin is studied based on the analysis of existing information of different maps of Kermanshah province, which are used in the GIS section of watershed department. Ravansar basin, which has an area 119,295 ha, is located in the north-west of Kermanshah province. It is situated between the longitude of 46˚22'05" N 46˚48'38" N and latitude of 34˚52'13" E 34˚21'40" E. The basin map was prepared mainly based on the topographic map (1:50,000 scale) and the small lime basin at the northern corner was not included, since their outlet is not clear. Based on the main rivers and changes in geological conditions, Ravansar basin can be divided into 3 sub-basins A, B and C (Fig. A5.1.2) with areas of 45,505ha, 38,846 ha and 31,623 ha respectively. Each of this sub-basin has a specified drainage work and their outlet is joined into the Gharasu river in the internal region O.

Sub-basins of Ravansar Basin

Sub-watershed	Area, km^2	Circumference,	% of
A	455.05	107	38.1
B	388.46	100	32.6
C	316.23	91	26.5
O	33.21	26	2.8
Total	1192.95	185	100.0

The River map is shown in Fig. A5.1.3. The main rivers included in the Ravansar watershed are Gharab, Kilanbar, Khunab, Khurkuh and Ravansar which are finally drained to Gharasu river at the elevation of 1,319m. The hypsometric map is prepared for the watershed is prepared as shown in Fig. A5.1.4. The minimum height of the watershed is 1,319 m at the exit location and the maximum height of the basin 2,516 m at the northern part of the basin. Slope map (Fig. A5.1.5) was prepared based on hypsometric map, point map and basin map. The main and effective characteristics of slope map are to define the slope classes and the distribution of slope in the basin is shown below.

Slope Class	Sub-basin A, km^2	Sub-basin B, km^2	Sub-basin C, km^2	Sub-basin O, km^2	Total, km^2	(%) of total area
0-2	146.35	152.94	140.95	30.79	471.03	39.5
2-5	37.46	42.36	68.98	1.67	150.47	12.6
5-8	23.06	34.48	55.49	-	113.03	9.5
8-12	35.03	27.09	15.03	-	77.15	6.5
12-20	52.48	65.42	26.42	-	144.32	12.1
20-30	29.97	41.51	7.11	-	78.59	6.6
30-60	109.45	24.66	2.25	0.75	137.11	11.4
>60	21.25	-	-	-	21.25	1.8
Total	455.05	388.46	316.23	33.21	1,192.95	100.0

About 52% of the area of the basin is within a slope of 5% and 48% are at a slope level of above 5%. Using Digital Elevation Model (DEM), the direction map Fig. A5.1.6) was prepared and the direction is determined with the following classes as shown below.

Classes of Direction

Direction Class	Slope (%)	Area, ha	% of the area
1	North (N)	3,319	2.8
2	Northeast (NE)	20,923	17.5
3	East (E)	10,190	8.5
4	Southeast (SE)	5,985	5.0
5	South (S)	13,065	11.0
6	Southwest (SW)	11,812	10.0
7	West (W)	5,984	5.0
8	Northwest (NW)	3,716	3.1
F	Plain	44,301	37.1
Total		119,295	100.0

According to the above mentioned Table, the maximum amount of area is related to the plains with an area of 44,301 ha (37.1% of the watershed area).

(2) Land Use of Ravansar Basin

Land use of Ravansar basin based on the Land resource map of the province as shown in Fig. Fig. A5.1.7. As shown in the Fig. A5.1.7, there are 7 land classes in the basin. The area of each class is shown below:

Land Use Code	Present landuse	Area, ha	% of Area
1	Irrigated + Dryland Farming	24,510	20.5
2	Agroforesty	19,875	16.7
3	Dryland agriculture	11,852	9.9
4	Barren Land	20,637	17.3
5	Steppe	29,259	24.5
6	Oak forest	11,189	9.4
7	Barren land+Steppe	1,973	1.7
Total		119,295	100.0

A5.2 Watershed Management

A5.2.1 Watershed Management Activities

Watershed Management activities in the Kermanshah Province is carried out by the Kermanshah Watershed Management Department under the Kermanshah Province Jihad-e-Agriculture Organization. The watershed management activities carried out in the province from 1997 to 2002 are shown below.

Watershed Management Activities Done in the Ravansar basin from 1997 to 2002

Type of Application	Unit	Quantity
Stony check dam (from smaller stones)	m^3	10,550
Stony check dam (from bigger stones)	m^3	2,800
Bench terracing (walls of stone)	ha	150
Channel terracing (channel on contour line)	m	9,000
Gabion dam	m^3	3,430
Farm dam (village dam)	m^3	53,000
Agroforestry (almond, rose and grape)	ha	60
Planting ranges	ha	56
Brushwood dam	m^2	480
Planting pasture	ha	10

During the first and second five year development plans, watershed implementation was carried out in105,000 ha and during the third development plan it is forecasted to complete 160,000 ha.

In the Kermanshah Province, the area of the basin is 2,462,190 ha (KJAO, Watershed Dept. Plans) and the average of net-soil erosion is 11.5 t/ha. The area which are exposed to erosion is 2 million ha. Total soil erosion in the province 27.5 million ton. Watershed management activities are carried out mainly to prevent erosion, sedimentation and flooding.

Amount of sediment controlled by different types of dams are shown below.

Farm Dam in the Ravansar Watershed

Amount of Sediment Controlled by Different Types of Dams

Type of Dam	Slopes of Floodways		Ave. Slope of Floodway	Width of Floodway	Height of Dam m	Ave. Vol of Sediment Protected m^3	Total Sediment Protected m^3
	a	b					
Stony Checkdam-1	0.50	0.50	0.20	2.0	1.5	26.5	5,565.0
Stony Checkdam-2	0.47	0.47	0.15	2.3	1.5	41.5	2,075.0
Gabion Dam - G1	0.70	1.00	0.10	13.5	2.5	693.0	2,772.0
Gabion Dam - G2	1.60	1.20	0.10	7.3	2.5	380.1	1,520.4
Gabion Dam - G3	1.70	1.40	0.10	8.5	3.0	630.2	3,151.0
Gabion Dam - G4	0.60	0.20	0.046	7.6	1.5	768.8	9,994.4
Gabion Dam - G4-1	0.30	0.40	0.042	10.0	2.0	2,314.8	2,314.8
Gabion Dam - G5	0.10	0.10	0.043	24.0	3.0	15,230.8	15,230.8

Although various watershed management activities are carried out by the department shortage of staff and budget are major problems faced by the department. The major problems of the watershed management are mentioned below.

A5.2.2 Present Problems and Potentials of Watershed Management

(1) Problems of Watershed Management

Generally, the human interference to the nature causes ecological imbalance to the watershed, such as disturbances of the forests and range lands. Other major problem is unsuitable method of ploughing in the sloppy lands of the watersheds. Because of these reasons, there are problems such as flood, increase in erosion and decrease in soil fertility, decrease in groundwater aquifers, pollution of water resources, change in soil texture and vegetation.

The major problems of the watershed of the Study Area are listed below.

1) Converting the forests and ranges into agriculture lands
2) Ploughing the sloppy lands in the same direction of land slope and causing erosion
3) Annual cropping (no perennial cropping) and plouging each year
4) Incorrect irrigation method leading to erosion and decrease in fertility
5) Cutting the forest trees for fuel
6) No management of grazing areas and over grazing of rangelands
7) Decrease of groundwater table in the recent years
8) Floods in the Ravansar city and the villages around the Gharasu river
9) Increase in the pollution of water resources at the time of rainfall.
10) Lack of ownership feeling in the ranges and forest users
11) Setting up the fire on the farmlands which decreases the humus in the soil
12) Lack of governmental organization/institutions, coordination for performing the integrated water management plan
13) Lack of concrete planning in agriculture, water, environment and rural development
14) Increase in population and high pressure on resources
15) Economic and cultural poverty related to the people in the basin

(2) Potentials of the Watershed Management

1) Existing natural resources are resistant against the stresses of the watershed
2) Soil moisture is sufficient enough to grow rangelands, horticulture lands and dry farming agriculture
3) Existence of fair amounts rocks for constructing terracing, riprap, gabion.
4) Existence of good amounts of soil as construction material for constructing check dams, farm dams etc.
5) Availability of manpower at low cost in the basin
6) Possibility of developing tourist attractions in some areas, especially in the forestry areas and springs.
7) Existence of water resources in some parts of the basin to use for irrigation
8) Soil is suitable for cultivation without salinity or other limitation. The only major limitation is the heavy texture of the soil.
9) Precipitation and climatic conditions are suitable for growing local vegetation

The watershed has a lot of potentials, especially from the view point of natural conditions such as soil, climate etc. These potentials need to be used to solve the problems in the watershed. In the Ravansar watershed 68.1% (811.68 km^2 of the area is located with a slope

range of 0-12%. This area is considered to be suitable for irrigataed or dryland agriculture. 18.7% (222.91 km^2) of the area is located within a slope range of 12-30%. This area is considered to be suitable for pasture. 11.4% (137.11 km^2) is located in the slope range of 30-60%. Watershed management activities can be carried out in these areas, if the soil and other conditions are suitable. Above 60% (21.25 km^2) is considered as preserved areas where biological watershed management can be carried out.

A5.2.3 Watershed Management Plan

(1) Methodology of Preparing Watershed Management Plan

Watershed Management Plan for the Ravansar Basin was prepared in close cooperation with the counterparts and other experts of the WMD of KJAO.

1) Study at the Masterplan Level

Normally watershed management plan requires very detailed studies on the different characteristics of watershed, detailed survey, mapping and planning. It takes quite a considerable amount of time and resources to fully survey the Ravansar basin which has an area of 1192.95 km^2. Because of the limitation of time and other resources, watershed management plan in this Study is carried out only at a Masterplan level. This plan provides a rough idea of the watershed management activities to be carried out in the basin and the budget required for those activities. However, more detailed studies will be needed before execution of the watershed management plan. In this Study, the watershed management plan is prepared as mentioned below:

2) Study and Mapping of Basin Information

Ravansar basin is studied based on the analysis of the following information using different maps of the Kermanshah province which are used by the GIS section of WMD.

- Topography
- Geology
- Soils
- Slope
- Direction

Although it would be much better to include other basin information such as land use, vegetation etc., the maps which are available are more than 10 years old and there are many changes since then and therefore these data were not included. Individual maps were prepared for the watershed area with a scale of 1:50,000.

3) Overlapping of the Maps

After preparation of these maps for the watershed area, the maps were overlaid together and the homogenous units were separated. There are 851 units in the watershed area with different characteristics (Fig. A5.2.1).

4) Field Survey

A preliminary field survey was carried out together with counterparts and experts of different fields, and units on the maps were verified at some selected areas. Simultaneously, the watershed management activities to be proposed for the area were also noted on the maps.

5) Preparation of Map of Watershed Management Plan

Based on the homogenous units and the information obtained during the field survey, a map of watershed management plan was prepared as shown in Fig. A5.2.2.

6) Estimation of Cost

Cost of each project activity was estimated based upon the area and the number of locations.

(2) Proposed Watershed Management Activities

Proposed Watershed management activities for the Ravansar basin is listed below.

Code	Type of proposed activities
1	Brush gully check and creating dry farming orchards
2	Terrace-earth embankment
3	Earth embankment
4	Water intrusion canal- earth embankment
5	Terrace- Gabion check dam-Non-mortar check dam- terracing- earth embankment - creating dry farming orchards & creating dry farming orchards by additional irrigation
6	Water intrusion canal- Terrace- Gabion check dam- Non-mortar check dam- Terracing & creating dry farming orchards
7	Terrace- Gabion check dam- Terracing- earth embankment - creating dry farming orchards
8	Terrace- Gabion check dam- no-mortar check dam- Terracing- Creating dry farming orchards
9	Water infiltration canal
10	Water infiltration canal- Non-mortar check dam- Terracing & Creating dry farming orchards
11	Terrace- Gabion check dam- Non-mortar check dam- Terracing- Creating dry farming orchards
12	Terrace- Gabion check dam- Non-mortar check dam- Terracing- Earth embankment - Creating dry farming orchards
13	No certain activity is proposed

The areas of implementing these activities are shown in Fig. A5.2.2.

(3) Cost of Watershed Management Activities

The cost of watershed management activities in the Ravansar basin is as follows:

Cost of Watershed Management Activities in the Ravansar Basin

Activity	Unit	Amount	Price (1000 Rls)	Total (1000 Rls)
Earth Embankment	1 set	1	2,500,000	2,500,000
Village Dam	m^3	383,535.0	4.8	1,840,968
Gabion Spillway	m^3	17,642.6	276.0	4,869,358
Rip-rap	m^3	18,793.2	130.0	2,443,116
Water Infiltration Canal	m^3	143,740.0	4.8	689,952
Check dam	m^3	567,180.0	126.5	71,748,270
Gabion Check Dam	m^3	703,381.0	276.0	194,133,156
Piling on water course	m^3	130,935.0	109.7	14,363,570
Bush Gully	m^2	272.9	52.9	14,436
Terracing	m^3	242,135.0	69.0	16,707,315
Dryfarming Orchard	ha	4,299.6	759.0	3,263,396
Orchard with irrigation	ha	148.0	2,000.0	296,000
Manual Terrace	m	1,427,300.0	4.0	5,709,200
Total				318,578,737

The total cost estimated is about 318.6 billion Rials (US$ 39.8 Million) which is about 30 years of watershed management activities budget of about 10 billion Rials/year. The budget changes each year, some times even 3 to 5 times than the present budget.

Because of the high cost of carrying out all the watershed management activities, they are

normally executed on a priority basis. The procedure of implementing the project of watershed and O&M in the Kermanshah province is mentioned below.

Procedure of Implementing the Watershed Project and O&M

1) Normally, the expert of the WMD visits some problem areas and discuss with the villagers such as the Islamic councils. If they are interested in the O&M of the facilities, then they start to plan and execute the activities. Priority is normally given to the projects, where there is a person who is responsible for the O&M.
2) The farmers pay the cost for the activities such as terracing, rainfed orchard and irrigated orchard. All the remaining are done by watershed department
3) Formally the Islamic councils are responsible for the watershed management activities, but mostly the farmers in the area take responsibility for the O&M. The farmers are trained to understand the benefit of watershed management activities such as the recharging of the wells by properly maintaining the farm dams and village dams. Sometimes, The farmers themselves plant some trees around and take care of them. Normally the O&M cost per year is about 5% of the construction cost.
4) Watershed management project is prepared based on land use and other conditions.
5) The project is implemented for a period of approx. 5 years and then the O&M responsibility is given to the villagers or village Islamic councils.
6) The watershed management projects should be beneficial for non-governmental purposes, because they have to take responsibility by themselves. They also need to take responsibility for the part or full costs.

The critical issues in the watershed management activities are its high cost and the importance of local participation in the watershed management activities.

A5.2.4 Strategies and Goals of the Watershed Management

(1) Strategies

As per the 'Forecast of watershed management plans' of WMD, the future strategies of the watershed management shall focus on the following:

- Modify the prevailing system of land use
- To plan and execute the soil, water and agriculture projects through people participatory approach
- To set proper rules and regulations for the use of resources in the watershed
- To provide facilities for the investment of private sector in the watersheds
- Preparation of study projects in the province basins
- Consideration of sustainable development related to mountainous and sloppy areas
- Enhancement of public knowledge about protecting the existing eco-system and covering the shortages caused by incorrect operation of natural resources
- Increasing the people participation as the main basis of basin
- Recognition and study on the area which are sensitive against erosion, land slide and flood.
- Giving some aids to create new jobs by performing the watershed combined plans and renewing the preservation system to increase people's income, who live in the basin.
- More coordination between the executing organizations/institutions to achieve the integrated management of the basin.

- Providing practical suggestions to optimize the use of dry lands
- Performing the flood control plans, artificial recharge, groundwater aquifers, erosion control and dam basin sediment control.

(2) Participation of Local Communities

An important strategy to be considered in the watershed management is the participation of local communities. Sustainable land use, as an important component of the watershed management can not work unless it is the land users who implement and maintain the soil conservation practices required.

A coordinate program of awareness, training, extension and motivation is required to make the village communities and other land users aware that the future of their land, and of the village community as a whole is threatened unless proper measures are undertaken to control land degradation. Therefore, policies must be developed to allow the implementation of watershed management ad land use programmes to be carried out by the local population.

Direct incentives, such as distribution of free seedlings from government nurseries may still have participatory approach as long as it allows the villagers to dedicate time and efforts to activities which are productive ad will make them financially independent. (Ref: Some aspects of watershed management in Iran, Watershed Management Dept., 1993).

(3) Goals of the Watershed Management Department

The Quantitative targets of the WMD are as follows:

- Decreasing the soil erosion from 11.5 ton/ha to less than 5 ton/ha
- Decreasing the entered sediments into the dams to less than 250,000 ton/year
- Solving the flood related problems (province cities) in the minimum return period of 50 years
- Decreasing the runoff coefficient to less than 20%
- Groundwater recharge and water loss control

The final goals are:

- Creating a balance between the human and environment.
- Protection and renewal of basins to decrease water losses and to reasonable use of existing soil and water and potentials for improving the socioeconomic conditions of people who live in the basin.
- Finally, to achieve the integrated basin management, which is the coordinated, planned and sustainable management of the natural resources within a river basin. This approach is management of land, water, vegetation and other natural resources seeks to maintain or enhance the quality of the basin environment and by adapting a variety of physical, social and economic policies and techniques, all aimed at minimizing the adverse consequences of natural disaster events, to improve and enhance the quality of life of the basin community.

A5.3 Rangeland Rehabilitation

A5.3.1 Activities of Natural Resources Department (NRD) of KJAO

Natural Resources Department of KJAO is responsible for the protection of natural resources (rangelands and forests) of the province, recognizing the lands, and determining the ownership of lands. According to the 'pastures and forests utilization and protection law (Article No.56) and Forest resources supply and protection law (Article No.2), the natural resources including forests and rangelands are protected and are referred in the registered documents with special tag number for each area or village. There are about 12 divisions controlled by the NRD department in Kermanshah. About 60 control officers are controlling the ranges and forests of the province. Their main works include the following:

i) Preventing from changing the ranges to agriculture lands
ii) Prevention of cutting of the trees & converting them for agriculture
iii) Prevention of overfeeding of livestock
iv) Controlling fire accident etc. in the ranges & forests.
v) Provide training on protecting the nature.
vi) Assisting the farmers in the preparation of village plans for the protection of range lands

There is special management by NRD to protect rangelands as mentioned below:

i) Rangelands auditing
   - Determine the common area
   - Livestock owners who have grazing rights are clarified and recognized
   - Determine the number of livestock for grazing
   - Determine the grazing period to protect the rangelands

ii) Reclamation and reformation activities are carried out in the lands where the lands were degraded because of over grazing, fire accident, drought, pests etc. The activities include preservation and seeding

iii) The rangelands become protected and reformed by the farmers themselves through rangeland cooperatives activities. The cooperative members can get training and financial supports.

iv) Seeds, fertilizers and the minor works such as installing small irrigation facilities from the springs etc. are carried out by NRD department.

A5.3.2 Rangeland Rehabilitation and Management

(1) Village Wise Rangeland Rehabilitation Plan

In general, the planning of rangeland rehabilitation and management is carried out on individual village basis. A plan is prepared for the village based on the livestock population and the farmers interested to participate in the plan. Normally, the implementation is carried out for 5 years which includes 2 years of preservation and 1-2 years light grazing with government supervision and control. Then rangelands are divided into 4-5 parts every year. Grazing is carried out in some parts and other parts are left as it is and this procedure is followed in rotational basis.

Grazing licences have been issued to village Islamic councils or nomad families to exclusive use of a defined area for a specified number of animal units for a given period, for eg. 100 days. Villagers have communal grazing rights and not individual licences. The terms of these

leases include the following:

1) Obligations by the lessees to carry out prescribed range rehabilitation actions, such as resting, reseeding and stock reductions.
2) Lessees may obtain low cost credit for rehabilitation works.
3) Leases may be sold or otherwise transferred, inherited and extended.

(2) Procedure of Implementing Rangeland Rehabilitation and Management

1) Normally, the NRD department selects the area where the rangelands can be improved. If the farmers, themselves want to participate in the rangeland rehabilitation, they can request the NRD to start the procedure.
2) Verification of documents in regards to ownership and verify the documents for the area.
3) Discuss with the villagers and check their interest and participation.
4) There is a questionnaire form containing about 40 questions to verify all the details such as land ownership, livestock population, forage, management plan etc. need to be answered by the farmers who want to participate in the plan and should sign the document
5) Each planning unit is assessed based on range type and condition, productivity, erosion, livestock, distribution of arable land.
6) NRD will make rangeland rehabilitation plan
7) NRD will recommend to the bank and get the loan for the project implementation
8) NRD will distribute the seeds, fertilizers etc. for range improvement NRD also provide assistance for minor structures to supply water.
9) During the implementation, NRD will supervise the implementation

There is a budge of from 2.2 billion Rials budget / year – provincial budget and 1.69 billion Rials from national project budget to carry out the plans of rangeland rehabilitation management and improvement

(3) Villages with Rangeland Rehabilitation Plans in the Ravansar Basin

In the Ravansar basin, the rangeland rehabilitation plans were prepared for following villages

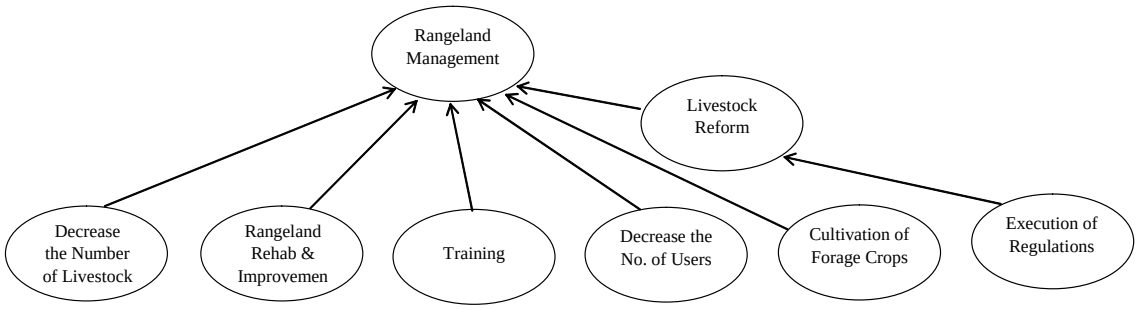
Villages with Rangeland Rehabilitation Plans in the Ravansar Basin

District name	Village name	Plan area (ha)	Total Cost (1000 Rls)	Implemented now	Stopped
Javanrud	Kharajian	4,099.7	91,661	×	×
Javanrud	Sarabian	600.0	103,400	×	
Javanrud	Sefid barg	1,983.0	75,350		×
Javanrud	Kalaveh	2,463.0	738,699	×	
Javanrud	Mehregan	4701	99,528	×	
Javanrud	Gorgidar	2,019.6	54,461	×	
Kermanshah	Chogha khazan	1000	44,140		×
Kermanshah	Chahar zebar-e-olya	1,503.2	43,834		×
Kermanshah	Firuzeh	1,064.7	243,498		×
Kermanshah	Haft ashiyan	1,372.7	254,013	×	
Kermanshah	Kashanbeh oliya	1,387.7	236,805	×	

As it can be seen, 5 villages have stopped the range rehabilitation in the middle of the implementation and the main reasons are as follows:

1) The immediate benefit from the rangelands is less and therefore the villagers are not seriously interested to continue the rangeland rehabilitation
2) Although the villagers could start the plan, they could not arrange the cost for implementation in the successive years since the implementation normally takes 5 years period.

(4) Measures Needed for Rangeland Management



Measures Needed for Rangeland Management

Rangeland management can not be carried out just by improvement of rangelands. Other activities such as decreasing the number of livestock, cultivation of forage crops and training for farmers should also be carried out simultaneously. The overriding management issue is that of controlling the total number of livestock. Without such control, no manipulation by rotational grazing or resting will result in successful recovery or improved productivity except on a short term basis. More importantly, farmers are actors of the rangeland management and their effective participation is critical for the success of the rangeland management. Coherent watershed management involving range and livestock strategy is important including the following:

- Control of range based livestock numbers
- Development of programs to improve forage production
- Financial and technical assistance to smallholders and nomads for range rehabilitation
- Development of community based participatory organization
- Economic and financial policies to avoid range-based livestock increases

Coordination between Watershed Management and Natural Resources

While the watershed management activities in the upstream basin are carried out by the Watershed management department, rangeland management activities are carried out by the Natural resources department. Since these two activities overlap with each other, it is necessary to combine the two activities and therefore, in the near future the two departments are planned to merge together.

Table A5.1.1 Description of the Soil Resources and Land Capability of the Kermanshah Province (1/3)

Legend	Land Type	Land Characteristics	Soil Characteristics and FAO Classification	Natural Vegetation and Present Land Use	Climate and Other features	Major Limitations	Land Capability	Required Development	Land Capability after Development
1.1	Mountains	Highly eroded very high mountains with long and sharp peaks formed of hard limestones with gradient of 60 to 100%. Height 1500-3300m	Mostly hard stony profiles without soil. In some parts very hard rocky soils. Lithosols	Barren land with very low vegetation coverage	Mostly including highest peaks covered with snow.	High slope and Erosion problem ; Lack of soil coverage	Barren lands; random pasture in some areas.	Waterways and ponds conservation	Barren lands; Aquiferous basin conservation
1.2		Round peak hills with some middle erosion on calcaric or marl materials; Gradient - 30-100%; Altitude - 1500 - 2900 m	Shallow soils with gravel, light to medium texture; Calcaric Regosols; Lithosols	Low to middle cover of steppe; seasonal grazing; dry farming at the foot of mountain	Fruit gardens and tree planting in most of the valleys; some outcrop in mountain hills	High slope; Limitation of soil depth; Medium erosion	Low to medium suitability for pasture; Low suitability for rainfed cultivation in some parts.	Soil Protection and prevention from ploughing; grazing control and pasture improvement	Barren land; Medium capability for pasture in the moutain foot; tree planting in valleys
1.3		Eroded mountains with many valleys consisting of limestones with a slope of 30 to more than 100%; Altitude 1800-3200 m.	Mostly barren without soil and consisting of rock outcrop in some parts of stony shallow soils ; Lithosols	Barren land with very low vegetation coverage	A lot of valleys; fruit gardens and tree planting in some villages	High slope; Lack of soil depth; High erosion	Barren lands ; random grazing in some parts	Floodways and reservoir protection	Barren lands ; basin protection
1.4		Eroded low mountains formed of gypsum marl with gradient of 40 to 100%. Altitude of 800 to 11100m	Stone out crop; Shallow soils in some parts ; Lithosols	Barren land with very little steppe cover in some parts	Mostly intricated floodways	High slope; Lack of soil depth; High erosion	Barren lands	Floodways and reservoir protection	Barren lands ; basin protection
1.5		Forest mountains with round peaks and deep valleys gradually formed of calcaric and marl rocks and materials with gradient of 40 to 100%. Altitude of 1500 to 2500m.	Soils with minimum to medium soil depth with medium texture situated on hard rocks or stones; Lithosols, Calcaric Regosols	Mostly with oak forest; In some areas seasonal grazing and rainfed cereals.	In some areas, rocky mountains with high sharpness	High slope; Lack of soil depth; High erosion	In some parts, there are oak trees, pasture and rainfed cereals.	Improvement of forest; control of pasture, protection of sediments and prevention of erosion.	Quite suitable for forest areas.
1.6		Eroded low mountains formed of sand and marl with gradient of 40 to 100%. Altitude of 900 to 1400m.	Parallel layers of stone, sand and marl; Lithosols	Barren land; very disperse shrub cover	Mostly black	High slope; Lack of soil depth; High erosion	Barren land	Protection of floodways	Barren land; Protection of catchment area
2.1	Hills	Highly eroded rocky hills and roughly sharp peaks formed of calcaric and transformed rocks; Gradient 35-100%; Altitude 1700 to 2000m above msl	There is no soil depth and barren rocky surface; In some areas, soils of minimum soil depth with rocks. Lithosols	Barren land with very low vegetation coverage; random grazing	Round peaks in some areas	High slope; Lack of soil depth; High erosion	Barren lands	Protection of floodways	Barren lands; Protection of floodways

Table A5.1.1 Description of the Soil Resources and Land Capability of the Kermanshah Province (2/3)

Legend	Land Type	Land Characteristics	Soil Characteristics and FAO Classification	Natural Vegetation and Present Land Use	Climate and Other features	Major Limitations	Land Capability	Required Development	Land Capability after Development
2.2	Hills	Round peak hills with some middle erosion on calcaric schist materials; Gradient - 25-50%; Altitude - 1700 - 1900 m	Soils with minimum to medium soil depth with medium texture; Regosols; Calcaric Regosols	Low to medium coverage of steppe plants; Seasonal grazing and rainfed cereals in some parts.	Slightly rocky profile in some parts	High slope; Limited soil depth; Medium erosion	Low to medium suitability for pasture; Low suitability for rainfed cultivation in some parts.	Protection of sediments and prevention of ploughing	Suitable for pasture
2.4		Low cut hills formed of calcaric-gypsum or salt; slope - 20-40%; Altitude - 500-800 m.	Undeveloped deep soils formed of gypsum or salt marls.	Generally barren land; seasonal pastures; rainfed cultivation in some areas	Stone ourcrop in some parts (sand stone); high erosion	High slope; Limited soil depth; High erosion	Barren land; low suitability for rainfed cultivation	Soil protection; prevention of pasture; protection of ploughing	Barren land; Conservation of catchment area
2.5		Forest hills with round peaks generally on calcaric or marl materials; slope - 25-40%	Shallow to medium deep soils over rocks and limestone; Lithosols; Calacaric Regosols	Mostly with oak forest; In some areas seasonal grazing and rainfed cereals.	In some parts deep soils with heavy texture and calcaric materials	High slope; Topography; Limited soil depth; Erosion	Relatively good oak cover; Random grazing; Rainfed cereals in some parts.	Control of pasture; Prevention of plouging and soil protection; Forest reclamation	Quite suitable for forest areas.
2.6		Hills with round and long peaks formed of marl, conglomerate and calcaric materials	Shallow gravelly soils; Lithosols	Low steppe cover; random grazing	Numerous erosive dry rivers	High slope; Limited soil depth; Erosion	Low suitability for pasture	Improvement and Control of pasture	Low suitability for pasture
3.1	Plateau and Upper Terrace	Upper plateau and terraces with middle vicissitudes (ups and downs); general slope - 4-8%; lateral 5-10%	Semi deep soils with heavy texture on gravel and limestone; Calcaric Cambisols, Calcaric	Mainly rainfed cereals; Seasonal pasture in some areas	Gravel in some parts; irrigated in some areas.	Slope and Topography; Erosion	Medium capability for cereals and pasture in some areas	Soil protection; conservation of soil moisture	Good capability for cereals cultivation
3.2		Upper plateau and terraces with low to middle vicissitudes (ups and downs); general slope - 2-5%; lateral 3-6%	Deep soils with heavy to very heavy soil texture with calcaric sub-layers; Calcaric Cambisols	Mainly raifed cereals; Seasonal pasture in some areas	Irrigated cultivation in some areas; Gravel in some parts	Slope and Topography; Erosion	Quite suitable for rainfed cereals	Soil protection; conservation of soil moisture	Good capability for cereals cultivation
3.3		Cut plateaus with litle vicissitudes	Shallow to semi-deep soils with heavy texture over calcaric materials and gravel	Middle steppe cover; seasonal grazing; Rainfed in some parts.	Erosion in some parts; highly eroded rivers.	Limited soil depth; heavy texture	Medium suitability for pasture	Soil protection; control of pasture; prevention from ploughing	Good suitability for pasture

Table A5.1.1 Description of the Soil Resources and Land Capability of the Kermanshah Province (3/3)

Legend	Land Type	Land Characteristics	Soil Characteristics and FAO Classification	Natural Vegetation and Present Land Use	Climate and Other features	Major Limitations	Land Capability	Required Development	Land Capability after Development
4.2	Piedmont Plains	Quite flat piedmont plains with a slope of 0.5-1.0%.	Deep soil with heavy to very heavy texture; Eutric Cambisols	Irrigated cultivation	Soils with deep cracks in some parts.	Heavy texture; limitation of groundwater resource in some parts	Quite suitable for irrigated cultaivation	Improvement of soil physical characteristics; lowering of ground water	Good capability for irrigated cultivation
4.3		Quite flat piedmont plains with low to medium salinity with a slope of 0.5-2.0%.	Deep soil with heavy to very heavy texture; Eutric Cambisols, Calcaric cambisols	Irrigated cultivation	Suitable drainage	Heavy texture; limitation of sailinity	Medium suitability for irrigation cultivation	Improve soil physical characteristics; drainage and leaching	Good suitability for irrigated cultivation
5.1	Sedimen-tary and Alluvial Plains	Nearly flat alluvial plains with a slope of 3-10%	Deep soil with heavy to very heavy texture; Cambisols	Irrigated cultivation; rainfed cultivation in some parts	In some parts soils with deep cracks	Heavy texture	Good capability for irrigated and rainfed cultivation	Improve soil physical characteristics ; Irrigation system	Good capability for irrigated cultivation
5.2		Flat and downstream alluvial plains with a gradient of 0.5 to 1%	Deep soils with very heavy texture; In many parts with deep cracks; Cambisols; Vertisols	Irrigated cultivation; rainfed cultivation	Limitation of groundwater resource in some parts	Heavy texture; limitation of groundwater resource in some parts	Good capability for irrigated and rainfed cultivation	Improve soil physical characteristics; drainage; irrigation system in some	Good capability for irrigated cultivation
7.1	Flood Plains	Nearly flat plains with a slope of 3-10%	Deep soil with moistorous heavy to very heavy texture with gravel; Eutric cambisols, Calcaric gleysols	Medium to high vegetation; Lawn and marsh; seasonal grazing and rainfed cereals	Spring in some parts	Heavy texture; limitation of groundwater resource in some parts	Good suitability for pasture and rainfed cultivation in some parts	Flood control needs to be studied.	It will be deicided in future studies. (Not decided)
8.1	Fan shaped colluvium with gravel	Fan shaped gravel sediments with medium slope and high amount of gravel; slope - 3-8%	Shallow soils with light to medium texture; Regosols; Calcaric Regosols	Medium steppe cover; Seasonal grazeland	There are many secondary branches in floodways	Slope; high amount of gravel; limited soil depth	Medium capability for pasture	Consideration of Pasture control and control of floodways	Relatively good capability for controlled pasture
8.2		Inferior Fan shaped gravel sediments with slight slope and high amount of gravel; slope 1-3%	Shallow to mod. deep soils with light to medium texture with gravel over rock and calcaric materials; Calcaric Regosols; Regosols	Medium to high steppe cover; Seasonal graze land	There are a few branches in floodways	Slope; high amount of sand; limited soil depth	Good capability for pasture, tree planting and orchards	Sediment protection and floodway control;	Good capability for pasture, tree planting and orchards
C1	All Types	Plateau soils mix (3.3) and Hills of 2.4.	Plateau soils mix (3.3) and Hills of 2.4.	Middle steppe cover; seasonal grazing; Rainfed in some parts.	Stony profiles in some parts	Slope; erosion; limited soil depth	Good capability for pasture, low suitability for rainfed cultivation	Erosion control and pasture prevention; control of pasture	Good capability for pasture (3.3), barren land (2.4)

Note : The table is prepared based on the legend of the Soil Resources and Land Capability Map, AREEO, 1985.

Table A5.1.2 Land Resource Distribution in the Kermanshah Province

Land Unit	Land Type	Natural Vegetation and Present Land use	Area, ha	% of Area
1.1	Mountains	Barren land with low vegetation	228,198	9.1
1.2		Low to middle cover of steppe; seasonal grazing; dry farming at the foot of mountain	199,525	8.0
1.3		Barren land with very low vegetation coverage	44,627	1.8
1.4		Barren land with very little steppe cover in some parts	99,836	4.0
1.5		Oak forest; seasonal grazing	590,914	23.6
1.6		Barren land; very disperse shrub cover	65,195	2.6
2.1	Hills	Barren land with very low vegetation coverage; random grazing	54,660	2.2
2.2		Low to medium coverage of steppe plants; Seasonal grazing	158,739	6.3
2.4		Barren land; seasonal pastures; rainfed cultivation in some areas	79,573	3.2
2.5		Mostly with oak forest; In some areas seasonal grazing and rainfed cereals.	170,210	6.8
2.6		Low steppe cover; random grazing	13,855	0.6
3.1	Plateau and Upper Terrace	Mainly rainfed cereals; Seasonal pasture in some areas	56,476	2.3
3.2		Mainly rainfed cereals; Seasonal pasture in some areas	104,035	4.2
3.3		Middle steppe cover; seasonal grazing	7,501	0.3
4.1	Piedmont Plains	Irrigated cultivation; tree planting; rainfed cereals in some parts	178,980	7.2
4.2		Irrigated cultivation	118,662	4.7
4.3			9,925	0.4
5.1	Sedimentary and Alluvial Plains	Irrigated cultivation; rainfed cultivation in some parts	35,488	1.4
5.2		Irrigated cultivation; rainfed cultivation	98,517	3.9
7.1	Flood Plains	Medium to high vegetation; seasonal grazing and rainfed cereals	9,354	0.4
8.1	Fan shaped colluvium with gravel	Medium steppe cover; Seasonal grazeland	35,058	1.4
8.2		Medium to high steppe cover; Seasonal graze land	62,629	2.5
C1	All Types	Middle steppe cover; seasonal grazing; Rainfed in some parts.	78,384	3.1
Total			2,500,336	100.0

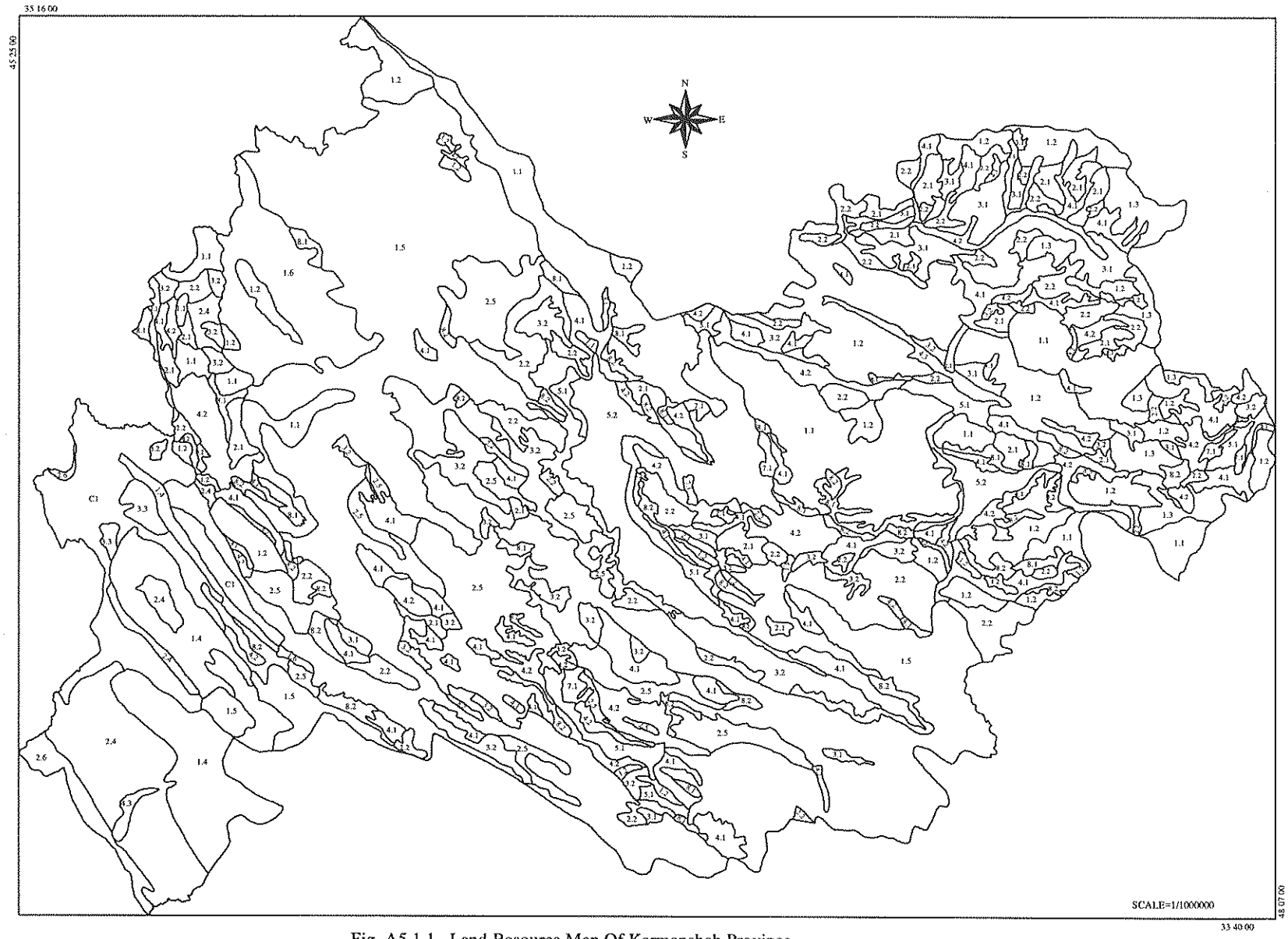


Fig. A5.1.1 Land Resource Map Of Kermanshah Province

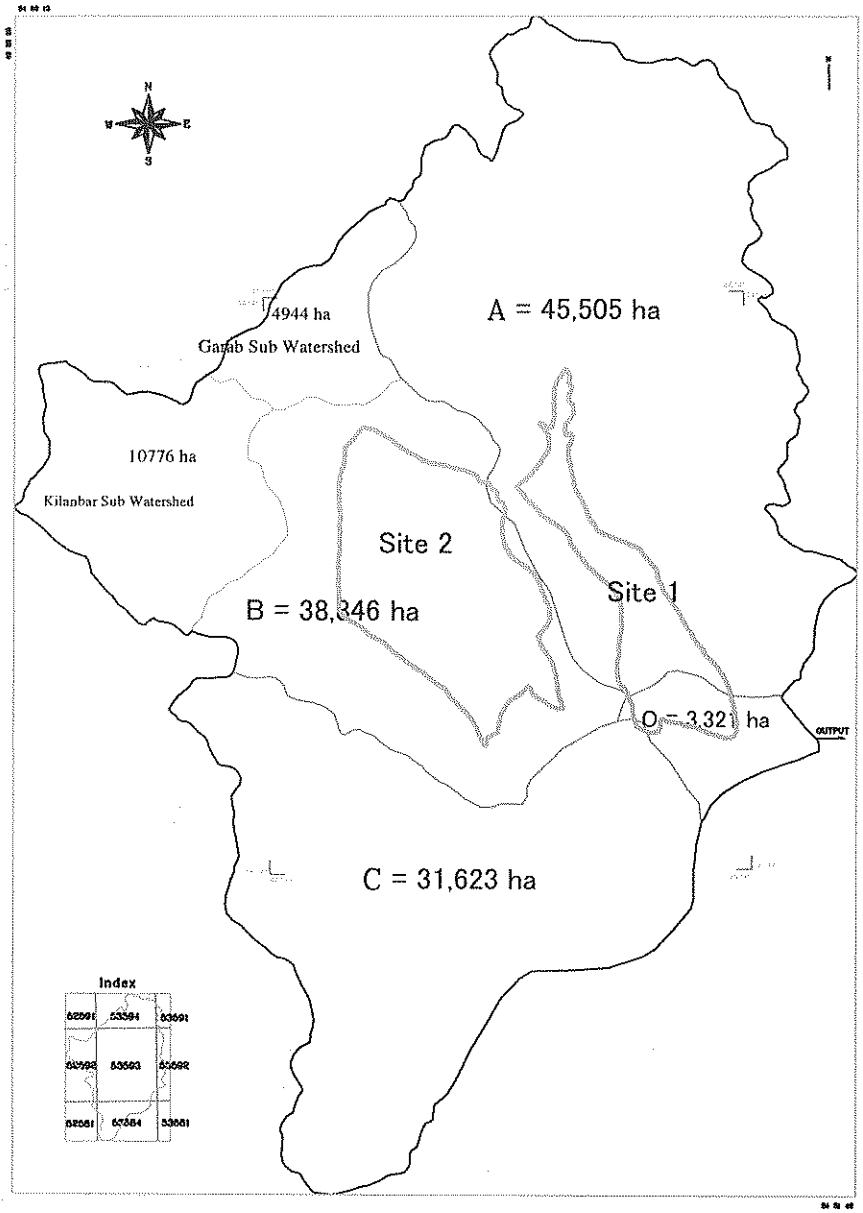


Fig. A5.1.2 Sub-basins of Ravansar Basin

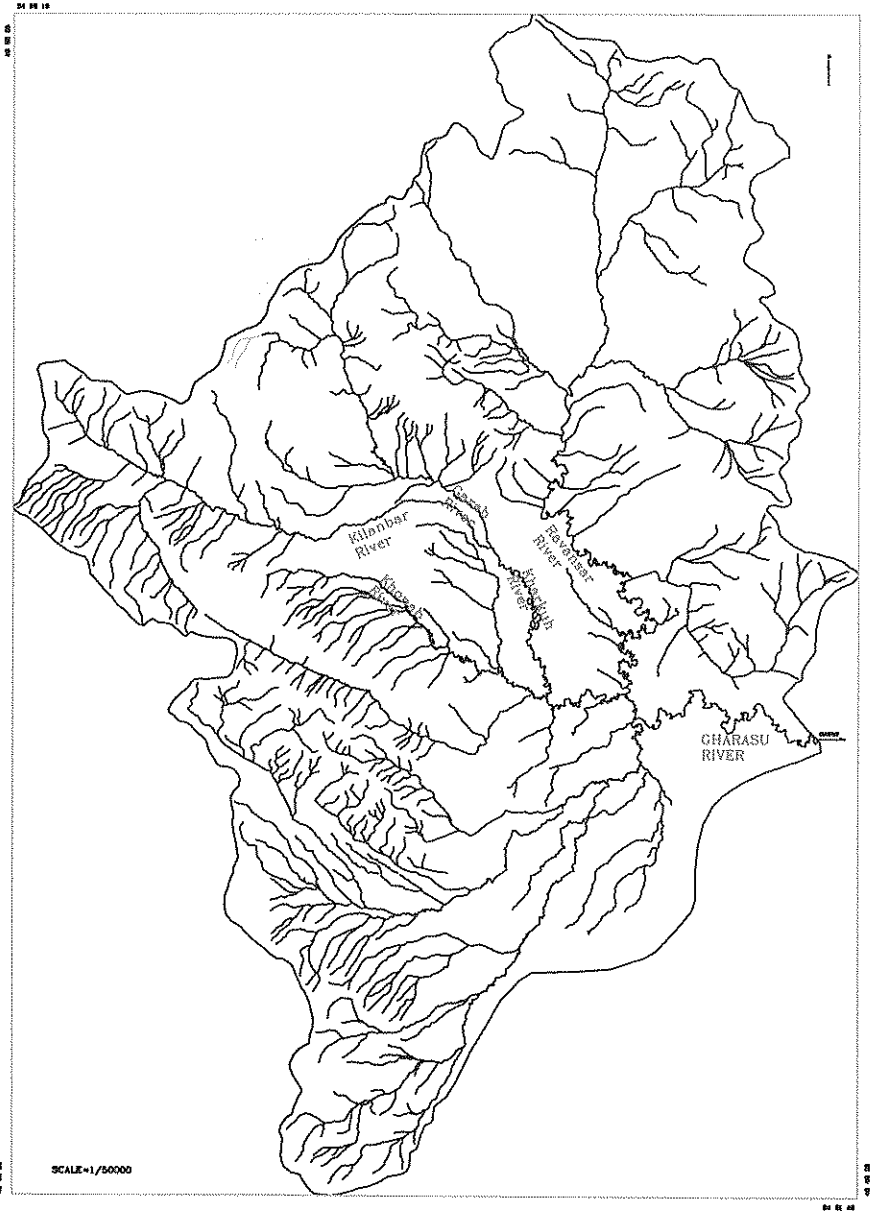


Fig. A5.1.3 River Map of Ravansar Basin

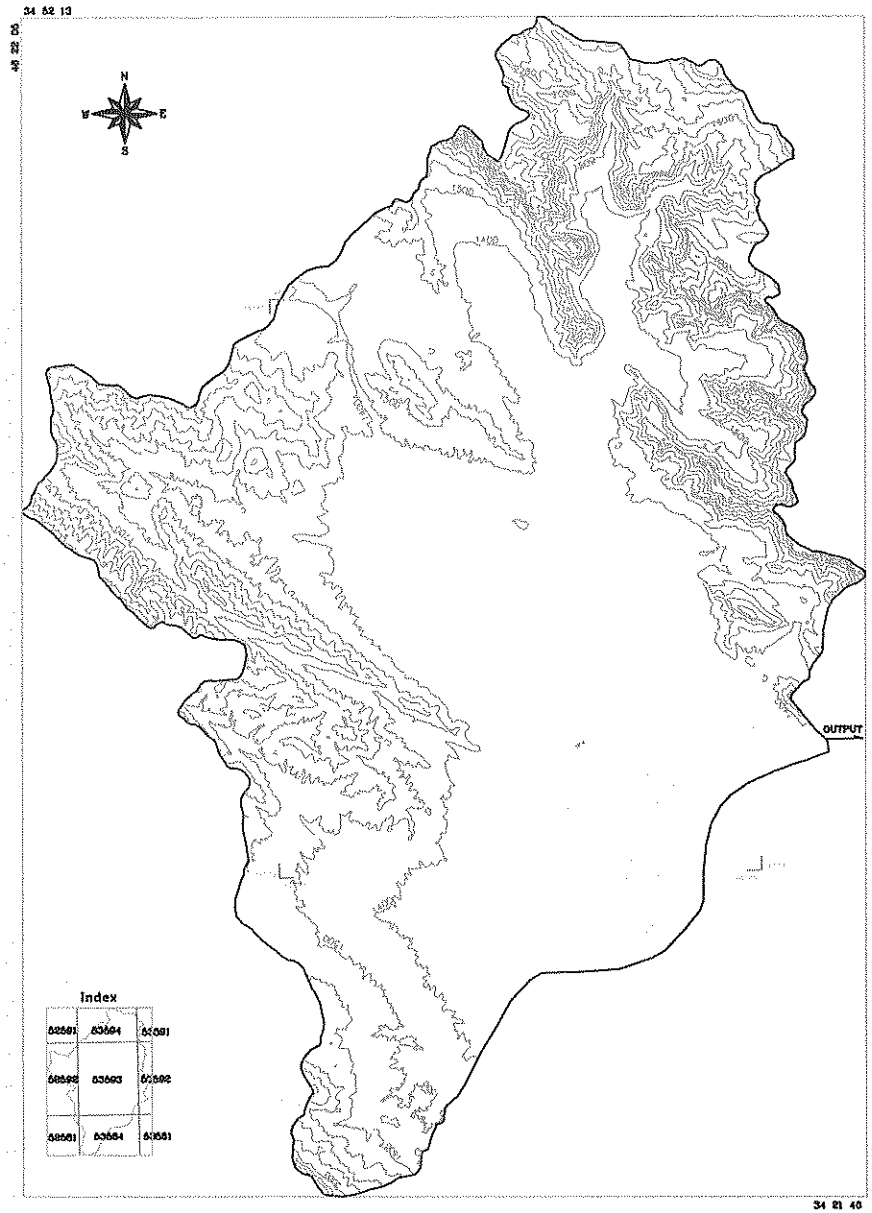


Fig. A5.1.4 Hysometric Map of Ravansar Basin

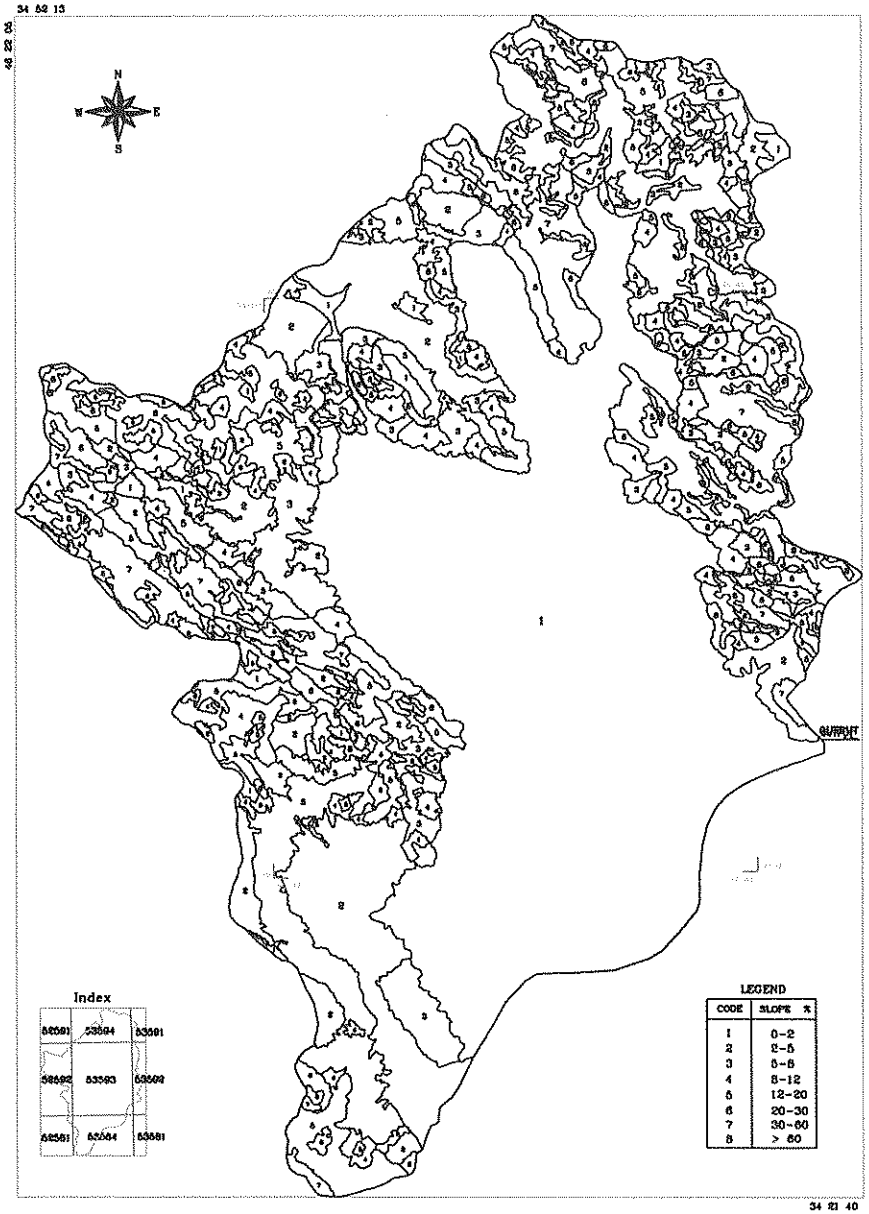


Fig. A5.1.5 Slope Map of Ravansar Basin

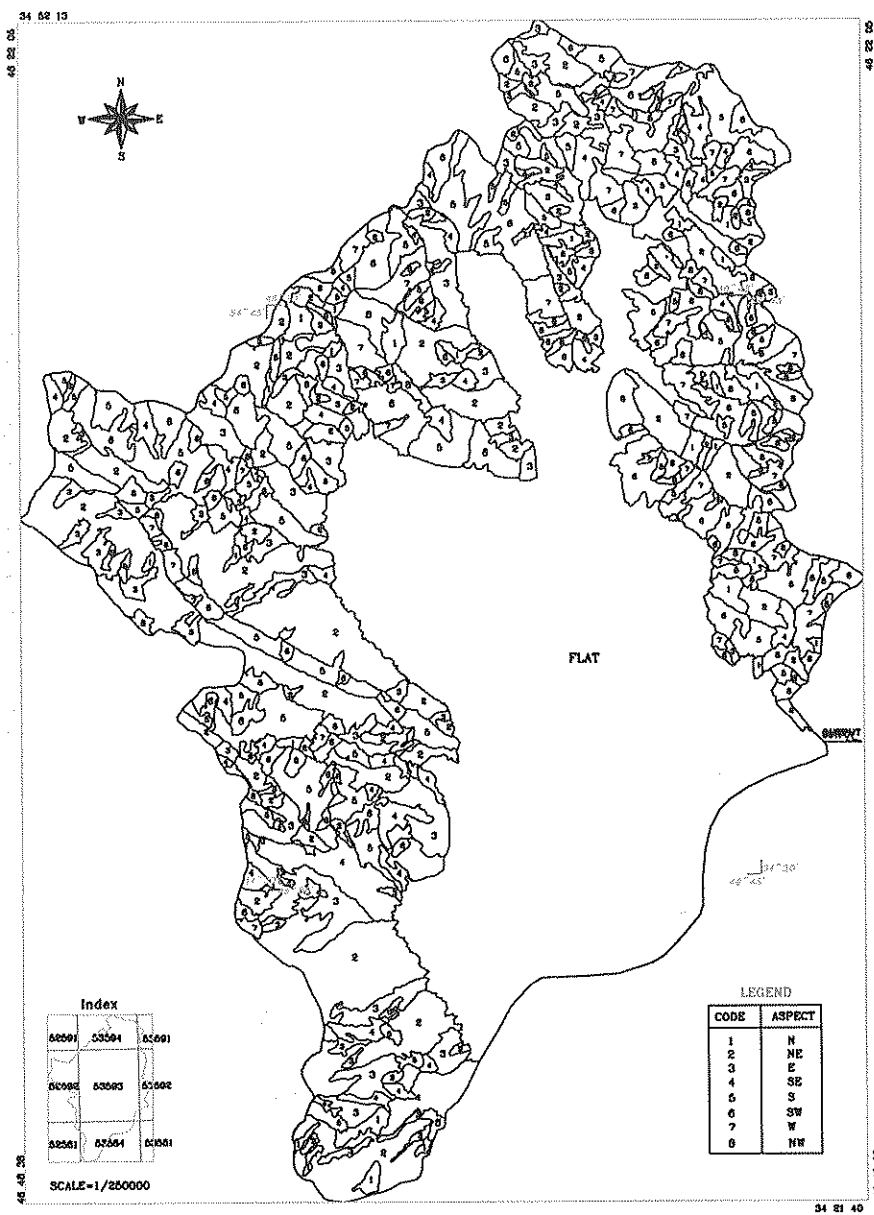


Fig. A5.1.6 Direction Map of Ravansar Basin

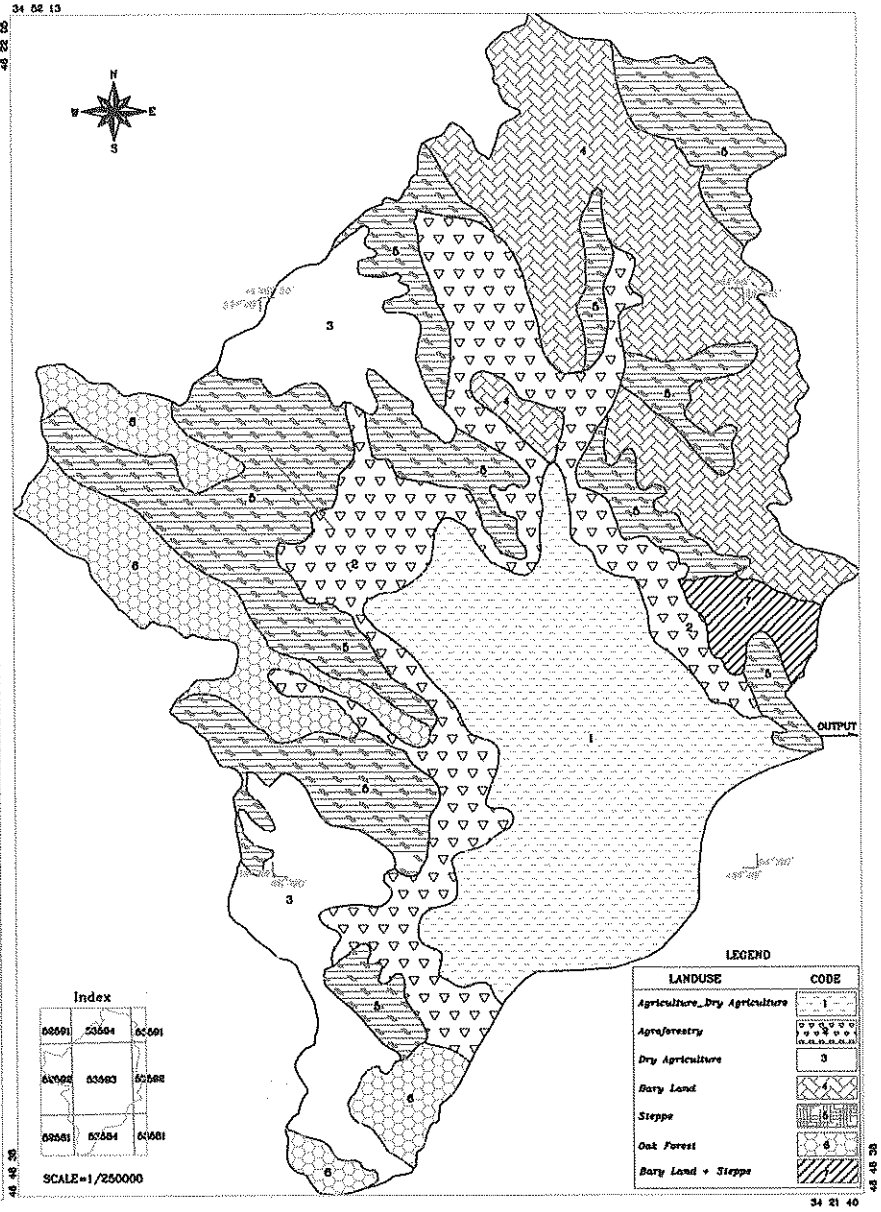


Fig. A5.1.7 Land Use of Ravansar Basin

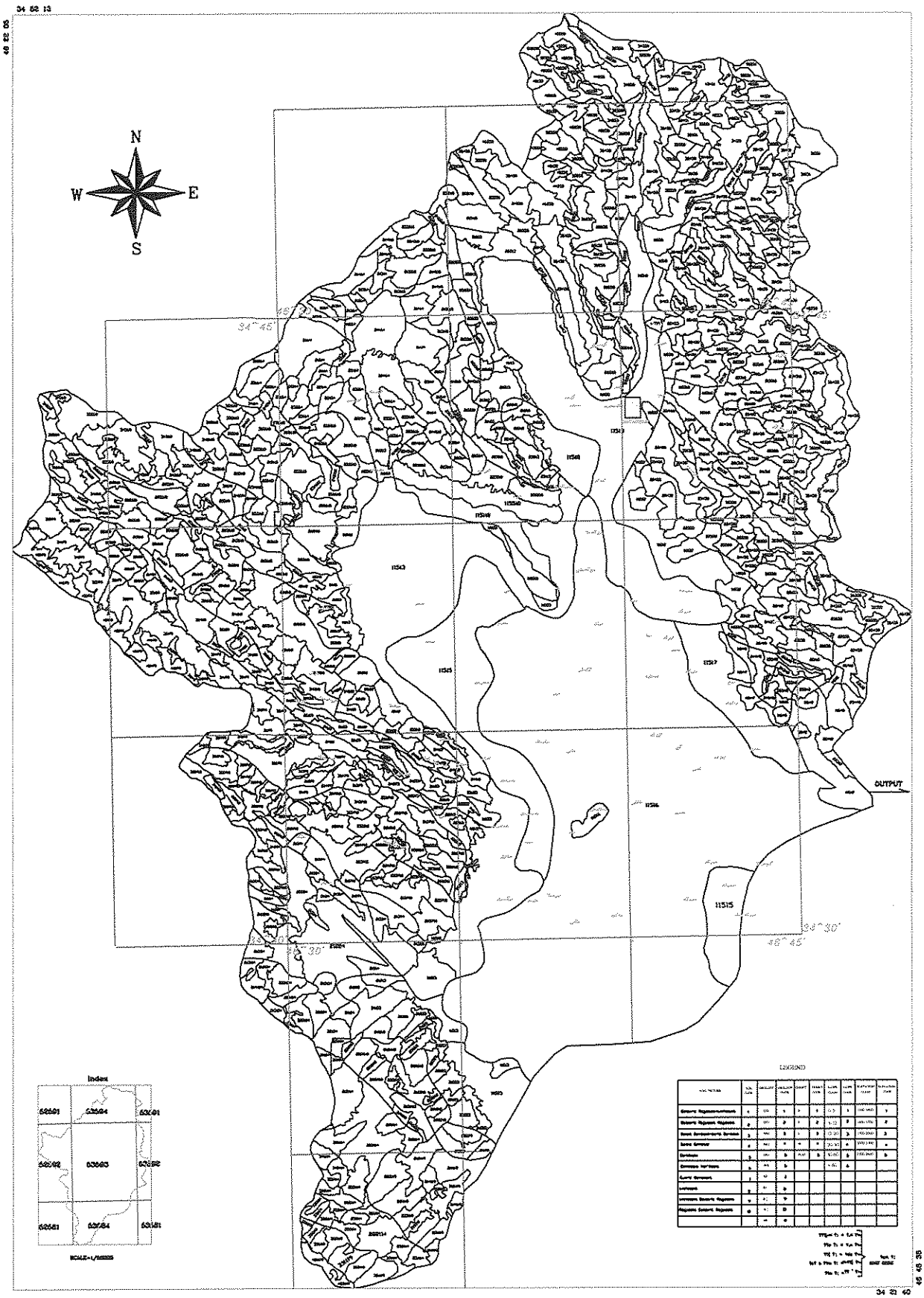


Fig. A5.2.1 Overlay Map of the Ravansar Basin

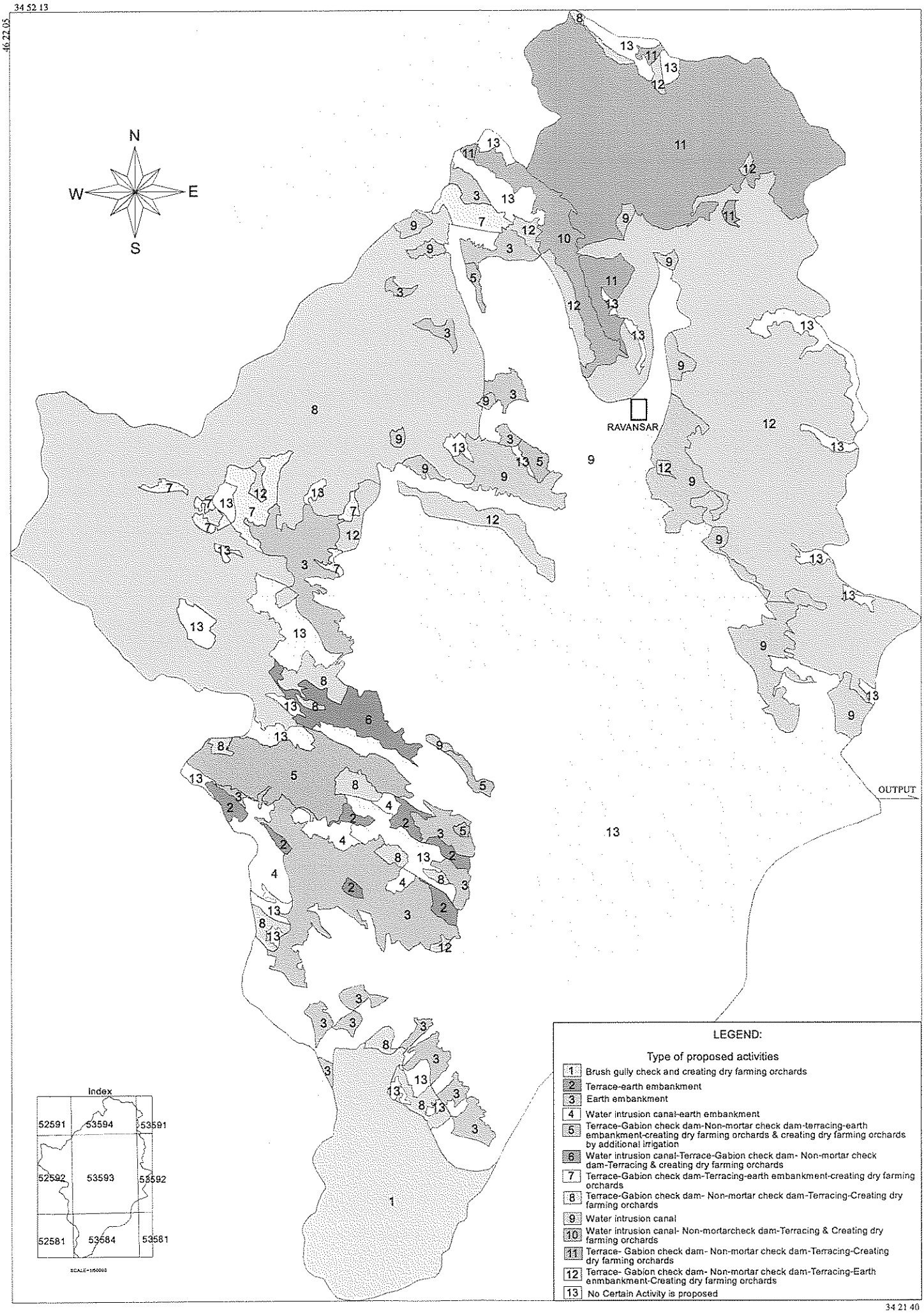


Fig. A5.2.2 Proposed Activities in the Ravansar Basin