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

MAIN REPORT

FEBRUARY 2004

PACIFIC CONSULTANTS INTERNATIONAL

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PREFACE

In response to a request from the Government of the Islamic Republic of Iran, the Government of Japan decided to conduct the study on Gharasu River Basin Agricultural Infrastructure Development Project Kermanshah Province in the Islamic Republic of Iran and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA dispatched a study team headed by Mr. Keiji Matsumoto of Pacific Consultants International to the Islamic Republic of Iran between January 2003 and December 2003.

The team held discussions with the officials concerned of the Government of Iran, and conducted field surveys in the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials of the Government and those concerned in the Islamic Republic of Iran for the close cooperation they have extended to the study.

February, 2004

Shinki Suzuki
Vice-President
Japan International Cooperation Agency

Tokyo, February of 2004

Mr. Shinki Suzuki
Vice-President
Japan International Cooperation Agency

Transmittal Letter

We are glad to submit the Final Report of "The Study on Gharasu River Basin Agricultural Infrastructure Development Project, Kermanshah Province in the Islamic Republic of Iran".

The report consists of the feasibility study for the irrigation and drainage project on priority areas, which have been prepared in consideration of the advices and recommendations of relevant ministries of the Government of Japan and JICA on formulation of development, as well as the discussions with the Iranian counterpart on the Draft Final Report and their comments on the report.

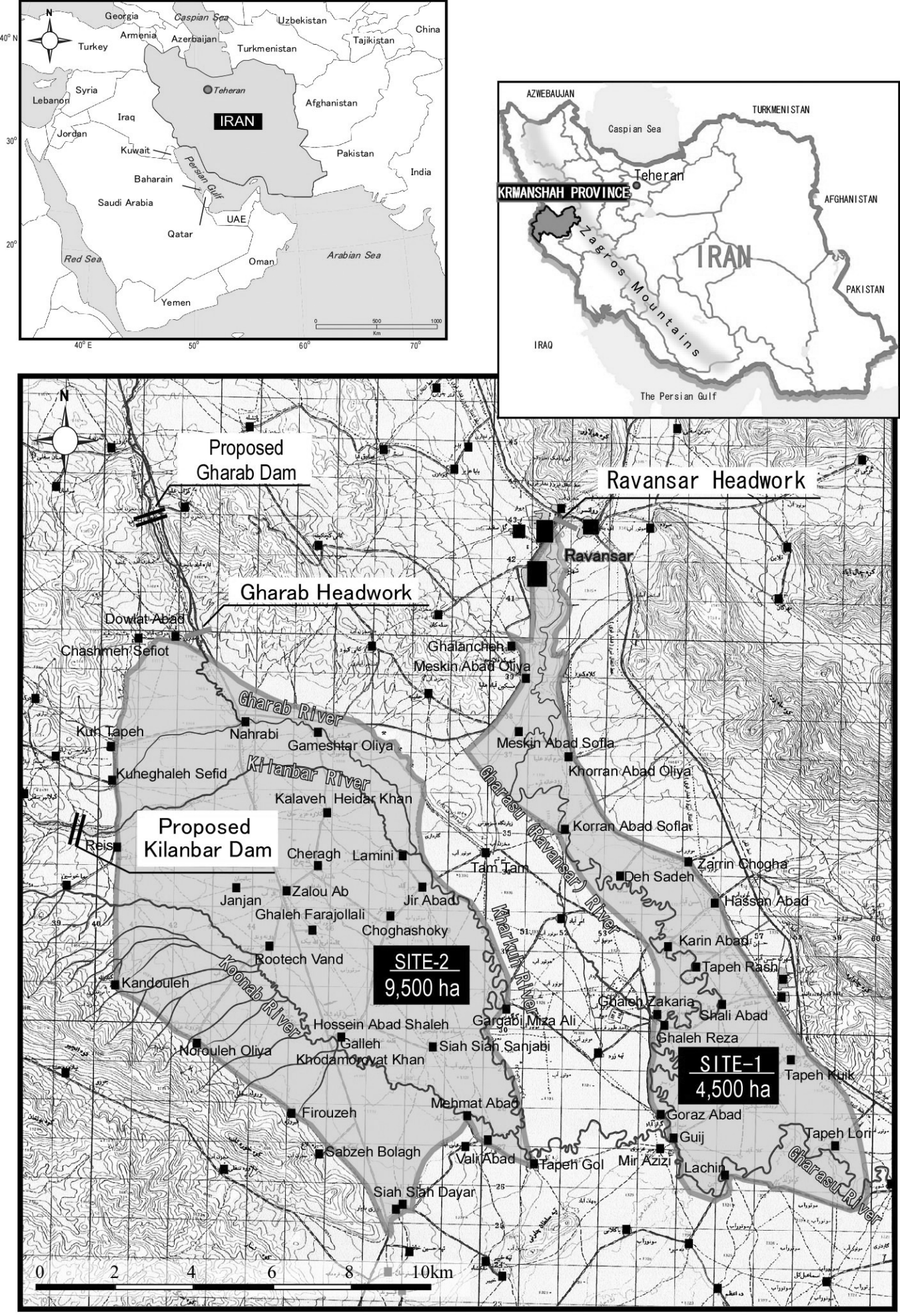
The Gharasu River Basin is located in the northern part of the Kermanshah Province in the western region of the Islamic Republic of Iran. It is comparatively rich in water resources in the country. Therefore, the improvement and stabilization of the agricultural production by introducing the appropriate technology will activate the regional economy and improve the living conditions of farmers. It is necessary to be careful in elaborating a development plan that is sustainable with an adequate future vision, and also being in constant harmony with the environment.

The agricultural development projects, which are contemplated in the report, will play important roles in the region, and improve the agricultural infrastructure such as Ravansar irrigation system management, introducing the crop rotation with pasture and integration of agriculture and livestock farming. These projects will utilize the regional resources more effectively and will aim at sustainable agricultural development, with the intention to increase the income of the farmers, elevate the living standard of the rural population and activate the regional economy. The plan is considered to produce a major socio-economic impact in the region. It is thus anticipated that these plans be put into implementation as soon as possible following the implementation schedule proposed in the report.

Taking this opportunity, we express our sincere gratitude to the officials of your Agency, the Ministry of Foreign Affairs and the Ministry of Agriculture, Forestry and Fisheries of the Government of Japan for their valuable advices and recommendations for our study. We are also grateful to the officials of the Ministry of Jihad-e-Agriculture of the Islamic Republic of Iran and the Kermanshah Jihad-e-Agriculture Organization and other public organizations involved in the Study for their devoted cooperation and support during the implementation of the Study in Iran.

Sincerely yours,

Keiji Matsumoto
Team Leader
The Study on Gharasu River Basin Agricultural
Infrastructure Development Project
Kermanshah Province



Location Map of the Study Area

Agriculture of the Study Area

Farmers Participation in the Study

Survey in the Ravansar Right Bank Canal Irrigated Area

Working Together with the Counterparts of the Study

Summary

SUMMARY

Chapter 1 Introduction

1.1 Background of the Study

The Government of the Islamic Republic of Iran made a request to the Government of Japan (hereinafter referred to as "GOJ") for the realization of the Study on Gharasu River Basin Agricultural Infrastructure Development Project (hereinafter referred to as "the Study"). Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for implementation of technical cooperation programs of GOJ, dispatched a Preparatory Study Team to Iran from March 7 to March 18, 2002 and the Scope of Works (S/W) for the Study was signed on March 16, 2002. Based on the S/W, the JICA Study Team, carried out the Study in Iran from January 2003 to December 2003 and the results of the Study are presented in this report.

1.2 Objectives and Scope of the Study

(1) Objectives of the Study

The Study has the following two major objectives:

1) To study the feasibility of the improvement of irrigation, drainage and of agricultural development by the participation of farmers in the area selected from the study area, and
2) To carry out technical transfer to the Iranian counterpart personnel through on-the-job training in the course of the Study.

(2) Study Area

The Study Area, which is located at the north-west of Kermanshah city, covers an area of approximately 14,000 ha. It is divided into two parts including Site 1 (4,500 ha), which is located along the Gharasu River on the eastern part of the Study Area, and Site 2 (9,500 ha), which is bordered by the Khurkuh River on the east and foot of the mountains on the west.

(3) Scope of the Study

The Study was carried out in 2 Phases. The division and the Study contents of each phase are listed below:

Phase	Work	Period	Study Item
Phase - I	1st Field Survey in Iran	Jan 2003 to Mar 2003	Field Survey of the Study Area, Selection of Priority Areas, Preparation of Progress Report (1)
Phase - II	1st Work in Japan	Apr 2003	Elaboration of the basic concept of the agricultural development, Preparation of the Interim Report
	2nd Field Survey in Iran	May 2003 to Oct 2003	Feasibility study of the priority areas, Preparation and discussion of the Progress Report (2)
	2nd Work in Japan	Nov 2003	Final confirmation of the feasibility study, Preparation of the Draft Final Report
	3rd Field Survey in Iran	Dec 2003	Explanation and discussion of the Draft Final Report
	3rd Work in Japan	Jan 2004	Preparation of the Final Report

Chapter 2 Background of the Study

2.1 Brief Description of Iran

(1) Natural Conditions

Islamic Republic of Iran is one of the largest Middle East countries with an area of 1.65 million km^2 and an estimated population of 65 million as of 2001. About 52 % of the country consists of mountains and deserts and 16% of the area has an elevation of more than 2 000 m above m.s.l. Its topographic frame consists of two major mountain ranges of the Elbourz Mountains and Zagros Mountains. The Central or Interior Plateau is located in between these mountain chains and covers over 50% of the country.

The climate of Iran is classified into 4 types, namely, the continental climate of the plateau areas of the Elbourz 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. Annual rainfall ranges from less than 50 mm in the deserts to more than 1600 mm on the Caspian Plain. The average annual rainfall is 252 mm and approximately 90% of the country is arid or semiarid. Overall, about two-thirds of the country receives less than 250 mm of rainfall per year.

(2) Socioeconomic Conditions

According to the population census in 1996, Iran's population is 60.05 million. The majority of the population is Persian (51%). Other ethnic groups include Azeri-Turkish (24%), Gilaki and Mazandarai and Baluchi (8%), Kurd (7%), Arab (3%), Lur (2%), Baloh (2%), Turkmen (2%) and others (1%). About 60 million or 99% of the total population of Iran are Muslims (Shiite-89% and Sunni-10%). Half of the poor, about 4.5 million persons or 1.47 million households, benefit from social coverage by government social safety net programs, charity institutions, and other non-profit organizations.

In Islamic Republic of Iran, the Socio-Economic and Cultural Development Plan for 5 years has been planned based on the Article 123 of the Constitution. Quantitative targets of the Third Five-year Development Program (FYDP) (2000-2004) are set as follows:

(% change)

	2000/01	2001/02	2002/03	2003/04	2004/05	Annual Average
GDP	4.5	5.5	6.5	6.7	6.8	6.0
Non-oil/Gas DGP	5.9	7.0	7.2	6.8	7.1	6.8
Total investment	6.0	6.9	7.3	7.8	7.9	7.1
Private	6.1	9.5	9.7	9.6	7.6	8.5
Public	5.6	2.8	3.3	4.7	8.4	5.0
Private consumption expenditures	3.3	3.4	3.5	3.6	3.7	3.5
Public consumption expenditures	6.1	0.3	1.5	3.5	1.9	2.5
Liquidity (M2)	20.8	18.0	15.7	14.2	13.1	16.4
Inflation	19.9	17.4	15.3	14.0	13.0	15.9

The Gross Domestic Production (current price) in 2002 was estimated at US$ 112.1 billion with annual growth rate at 5.9%. Iran's economy still depending on the oil and natural gas which was export shown 80.9% of total export amount at US$ 19,339 million in 2001/02. In the same period import value was counted US$ 18,129 million.

(3) Agriculture and Animal Husbandry

Iranian agriculture is characterized by extensive arable land, diverse climatic conditions, a growing rural population, and a growing work force during the growth and development of the sector. The 4 types of climate and 12,000 different varieties of flora enable the country to produce a wide range of temperate, subtropical and tropical crops.

Agriculture is an important sector in Iranian economy providing about 24% of the GDP from 1995 to 2000, and 22.2% of the population engaged in agriculture as per the census of 1996. In 2000 (Iranian year 1379), 12.34 million ha of agricultural land, equal to 7.49% of the total area of the Islamic Republic of Iran, was cultivated. And 10.27 million ha namely 83.23% of total agricultural land under cultivation was allocated to annual crops, and the rest (16.77%) to perennial crops respectively.

In 2000, 53.97% and 46.03% of the total cultivated area of the country was allocated to irrigated and rainfed land, respectively. Cereals and pulses were cultivated in an area of 7.01 million ha and 1.02 million ha respectively. Industrial products and vegetables accounted for 6.45% and 4.39% of total agricultural area respectively. 7.69% of total agricultural lands under cultivation were allocated for cultivation of forage plants.

In regard to perennial tree crops, 18.16% of total lands of trees (379,000 ha) were allocated to pistachio cultivation. 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.

Self-sufficiency rates of wheat and barley were 58.5% and 69.7% respectively, in 1999. The self-sufficiency rate of wheat was 82.5% in 1994, and the rate has gradually decreased since 1995. It is necessary to recovery the self-sufficiency rate of wheat of the staple food in Iran.

The cattle population in the end of 1999 was estimated as 8.05 million heads and bovine meat production was 0.256 million tons. The sheep and goat population in the end of 1999 was 79.7 million heads and the total meat production was 0.721 million tons.

(4) Farmers Organization

Development of Farmers Organization is one of the priorities in the agriculture sector of Iran. There are 3 types of farmers organization such as Rural Cooperative Organization (RCO) and Rural Production Cooperative (RPC) which are under the control of MOJA, and Cooperative which is under the control of MOC.

The Rural Cooperative Organization (RCO) was formed in 1963, with objectives of promoting economic and commercial services for the farmers through the cooperatives. One of the most important functions of the RCO is to distribute agricultural inputs including fertilizers, seeds and chemicals.

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 1990, the Ministry of Agriculture revived the operation of the Company in the name of Rural Productive Cooperatives (RPCs). The main activities of RPC are land consolidation, irrigation and water management, joint utilization of agricultural machines, distribution of agricultural inputs, extension activities, and joint sales of agricultural products.

All cooperatives related to agricultural activities, such as, animal husbandry, mechanization, agro-industries, processing etc. have been registered under the Ministry of Cooperative. The activities include the following.

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

(5) Government Policies of Irrigation Water Management

"All of the water resources in the country belong to the Government" is the national declaration made in the beginning of "the Law of Fair Water Distribution", enacted on March 1983. Ministry of Energy (MOE) is appointed as the Ministry in charge of the water law.

The Water Tariff Law (1991) states the procedure of pricing the water tariff of the national property and the major points in the law related with agriculture are as follows: 1) MOJA should bear water fee collection. (Presently MOE is in charge for this matter), 2) The minimum penalty of illegal water use should be 1.5 times of the water fee and 3) The water fee is to be defined depending on the farmers' gross income.

The Second Socio-Economic and Cultural Development Plan declares that MOJA should be in charge to establish guideline of proper crop water requirement by region and by crop. Also, the Ministry is in charge to form farmers groups to take care of the O&M activities.

The present Third Socio-Economic and Cultural Development Plan states that the relevant ministries should owe the obligation to establish the definition of region-wise optimum water consumption and measures of effective water use based on water saving concept. MOE should generate bylaws to materialize of the country's target of water-saving based effective water use enhancement under the collaboration with MOJA, Plan and Budget Organization and other relevant agencies.

The Joint-Committee, consisting of MOE, MOJA and MOC has been functioning with objectives to consolidate proper water utilization and management in the agricultural sector since 1996. MOE owes responsibilities on water resources development and provision of main system of water supplying system as function of "Water Supplier". MOJA shall be in charge to irrigation management at the on-farm level and to take initiatives to establish and function water users' groups. The scope of MOC is defined to the policy making and strategy generation for the subject of Water Users' Cooperatives (WUC) among the farmers.

2.2 Brief Description of the Kermanshah Province

(1) Administration

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*). Among 11 Districts, the Study Area lies in 2 Distrcts: Kermanshah and Javanrud. Provincial population (1997) was 1,778,596 and is 62% of people live in urban area.

(2) Natural Conditions

This province consists of a part of the Zagros Mountains which forms southern frame of topographic skeleton of the country and several discontinued highland plains. Peaks of the Mountains in the Province are undulating with an altitude ranging from 1,000m to 3,300 m a.m.s.l. Major plains of the province are followed to the mountain direction in a range of altitude from 1,750 m to 550 m a.m.s.l.

Average annual rainfall is about 300 to 800mm/year. It is said that about 400 to 500mm is expectable normally. While annual difference of temperature is about 15 ^{o}C in the mountains, it becomes about 25 ^{o}C in lower altitude.

(3) Socio-Economic Conditions

Overwhelming majority of population in Kermanshah Province are Moslems. Following Shiite, Sunni is also wide spread in the province particularly among the Kurdish population. The tribal groups include pastoralist nomads who migrate about 200 km in the province of Kermanshah. Traditionally, the nomadic tribes (*shayer-e kuchangeh*) have kept large heads of sheep and goats, which have provided the main source of red meat for Iran.

Kermanshah Province is geographically an important province for the foreign trade especial to the Iraq. Regarding the employment by sector, the service sector takes the most important part of the economy both at the provincial and district level. Agriculture sector is the second. Agriculture has traditionally been the main occupation of the rural people. But, there is a growing tendency of the migration of village people into urban areas in search of non-agricultural jobs. Unemployment has been one of the most serious social and economic problems in the Province.

(4) Agriculture and Animal Husbandry

In the Province, 820,000 ha of agricultural area were cultivated in 2001. The total irrigated land and rain-fed land were 165,841 ha (21.8%) and 594,373 ha (79.2%), respectively. That is, the characteristic of Kermanshah province in the land utilization is the high rate of rain-fed lands among 28 provinces in the country.

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%

In the Kermanshah Province, the main crops cultivated under irrigated farming are wheat, maize, sugar beet and barley, and the percentage of cultivated area of these crops to the total area are about 37% of wheat, 19% of maize, 10% of sugar beet and 8% of barley, respectively. On the other hand, the main crops grown under rain-fed farming are wheat, chick pea and barley. The percentage of cultivated area of these crops under rain-fed farming to the total area is about 40% of wheat and 37% of chick pea, respectively.

The total cultivated area of perennial crops in Kermanshah province is about 33,265 ha, with 4.1% of the total cultivated area of 820,000 ha. In 2001, about 10,713 ha, were allocated to walnut cultivation. In horticulture crops, irrigated grape, rain-fed grape, apple, olive accounting for 16.7%, 9.9%, 7.6%, 6.5% ranked second to fifth, respectively.

The numbers of tractors in Kermanshah Province are about 12,000 in 2002. In Kermanshah province, most of the farmers' fields are mechanized by contract with the machinery owners. The number of machinery is insufficient for the province. However, 70% of the tractors have been used for more than 10 years.

In Kermanshah Province, sheep takes priority in the number of livestock, with about 2.3 million heads, followed by cattle with 1.0 million heads. The percentage of each breed is 66% of the number of whole cattle in local breed, 23% in hybrid breed and 11% in Holstein, respectively. The Government of Province promotes the change from sheep to dairy cattle to keep the balance between the number of sheep and the area of range.

Kinds of fishes in inland water fishery are river shrimp, warm water fish, such as grass carp, silver carp, big head, common carp, etc., cold water fish, such as trout, rainbow trout, etc., respectively.

There are 18 RPCs including 1 Union in Kermanshah. In comparison to other provinces, the promotion of PRCs is delayed in Kermanshah Province due to the post-war reconstruction after the Iran-Iraq War. In Kermanshah Province, there are 110 RCOs at Dehestan level (or at the central place for several villages). In Kermanshah Province, there are 530 RCO shops selling sugar, rice and other general products and 555 RCOs selling petroleum and kerosene.

2.3 Environmental Protection

(1) Environmental Organization

In Iran, the Department of Environment (DOE) is responsible for the protection and enhancement of the environment, the prevention and control of any form of pollution or degradation leading to the disturbance of environmental balance, and for conducting all matters related to wildlife and the aquatic biota of the territorial waters.

(2) Environmental Laws, Planning and Management

The Environmental Protection Act (1974) is the major law for environmental conservation in Iran. The Supreme Council of the Environment is a legislative body that enacts relevant regulations for the environmental protection.

The major development projects require an Environmental Impact Assessment (EIA) to evaluate the degree of damage on the environment, and the ways to reduce, eliminate or remedy these impacts. Projects needing an EIA and the methods of assessment will be reviewed and updated at intervals, to ensure that progress is made in keeping up with the technical know-how of international environmental bodies.

(3) Kermanshah Provincial Directorate of Environment

The Kermanshah provincial directorate of environment is responsible for the protection of national environmental sites in the Kermanshah province and to carry out the environmental activities including environmental monitoring, and environmental training to its staff and the local population. The provincial directorate is responsible for making the evaluation and approval of Preliminary Environmental Impact Assessment (pre EIA) and detailed EIA.

Chapter 3 Existing Conditions of the Study Area

3.1 Administration and Population

The Study Area lies in spread over two districts of Javanrud and Kermanshah. Number of households and population are mentioned below.

District (Shahrestan)	Sub-District (Bakhsh)	Dehestan (cluster of villages)	No of Deh in Dehestan	No of Deh in Study Area	No. of Households in Dehestan	Population in Dehestan	No. of Households in the Study Area	Population in the Study Area
Javanrud	Ravansar	Badr	37	4	1,223	6,856	127	695
		Hassan Abad	39	21	1,204	6,394	783	4,469
		Dolat Abad	32	7	956	5,324	278	1,610
Kermanshah	Kuzaran	Sanjabi	105	27	3,035	17,055	606	3,461
Total			213	59	6,418	35,629	1,794	10,235

3.2 Natural Conditions

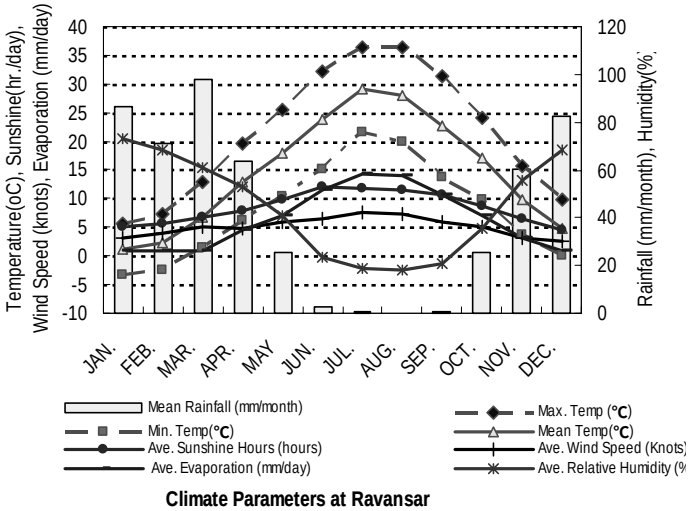
(1) Topography and Geology

The Study Area is surrounded by the Zagros mountainous ranges on the 3 sides of east, north, and west. The principal topographical form of the plain is the alluvial plain with an altitude of about 1,340m, which is formed as a result of sedimentation activities of 3 major rivers, i.e. the Kunab, Garab and Gharasu River.

The Study Area is composed of 3 layers, Radiolarite, Kermanshah Limestone and Bistoun Limestone, which belong to Jurassic to Cretaceous period in geological age. Radiolarite is distributed around west part of the Study Area. Kermanshah Limestone outcrops in the mountain area of southeastern part of the Study Area near Tapeh Kuik village. Bistoun Limestone is the major geo-formation in the area and it is distributed in a vast area around the eastern hinterland mountain range. From hydro-geological view points, the 2 forms of limestone mountain/Karst and alluvial deposit are considered to be important.

(3) Meteorology and Hydrology

The Study Area is located in the heart of the Sanjabi plain which is surrounded by mountains, and has mountainous climatic conditions. Daily difference of the air temperature is around 10 ^{o}C to 15 ^{o}C in the area. The mean annual relative humidity is 45 % and average sunshine duration is 8.4 hours per day. The average evaporation is 6.3 mm/day and the average wind speed was estimated as 5.0 km/day. Rainfall at Ravansar is 527.1 mm and around 90% of annual rainfall occurs from November to April.



Climate Parameters at Ravansar

The monthly coefficient of each year should be used to estimate the river runoff of the basin and 0.3 may be employed as an average coefficient to calculate flood discharge, based on average coefficient with base flow volume as a rough estimate.

(4) Water Resources

The main water resources used for irrigation in the Study Area can be divided into surface water, spring water and ground water. The main source of surface water in the Study Area is only the Gharasu River, especially during dry season. Gharab River and Kilanbar River can not provide stable water to agricultural land during dry season without any facility because these rivers are seasonal rivers at some portions of their flow.

One of the main water sources of the Gharasu River is the Ravansar Spring especially during dry season and it affects the river flow. The average annual discharge of the basin at Doab Marak station is 214.2 MCM and this amount of surface water source is used for irrigation.

There are 4 springs which are considered as important water resources; Ravansar, Jaberi, Ghara Daneh and Mir Azizi, among the 110 springs in the Study Area and its basin area. Available annual water volume from these 4 springs is estimated as 102.9 MCM/year. As an average, approx. 35.6 MCM/year is utilized for agricultural activities within available annual water volume from 4 springs.

According to the well inventory of MOE, there are 352 registered wells in the Study Area, and amount of approved water right is 45.24 MCM for irrigating 4,772 ha. In addition to these official figures, there might be many illegal wells and groundwater extraction at present. After the maximum recovery of groundwater in 1998, groundwater tables drop down rapidly since 1999.

(5) Soils

The Study Area can be broadly divided into the 6 land units of 2.2, 4.1, 4.2, 5.1, 5.2, and 8.2 based on the geology, climate and other factors.

Land unit	Description
2.2	This unit is the hilly area at the northwest and northeast part of the Site 2 with medium erosion. These are classified as calcaric regosols with low to medium coverage of steppe plants.
4.1	This unit is the piedmont area, which are mostly distributed in the northern and western part of the site 2 and eastern part of Site 1 with a slope of 2-5%.These soils are classified as Calacaric Cambisols and Eutric Cambisols. Land use in these soils include irrigated and rainfed cultivation, and tree planting in some areas.
4.2	This unit is a flat piedmont plains which are mostly distributed in the south eastern part of site 1. These soils are classified as Eutric Cambisol and are suitable for irrigated cultivation.
5.1	This unit is a sedimentary and alluvial plains and are mostly distributed in the middle part of site 2, mostly close to the rivers. These soils are classified as Cambisol. Present landuse includes irrigated and rainfed cultivation and the major limitation of these soils are the heavy texture of the soil.
5.2	This unit land is a sedimentary and alluvial plains and are mostly distributed in the western part of site 1 and eastern part of site 2. These soils are classified as Cambisols and Vertisols. Present landuse includes irrigated and rainfed cultivation and the major limitation of these soils are the heavy texture.
8.2	This land unit is fan shaped colluvium with gravel and are distributed in a relatively smaller area at the south western part of site 2. These soils are classified as Calcaric Regosols. Present landuse includes steppe cover and grazing and the major limitation of these soils are soil depth, and high amount of sand.

3.3 Socio-Economic Conditions

1) Social Structure - Most of people in the Study Area are Jaf Kurdish, who were settled in the area more then 250 to 300 years ago. In the Study Area, some of previous landlords are still 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) Rural Associations - Village Islamic Council is the smallest unit of government administration found in almost all the villages (dehs) in the Study Area. It is involved in the social, economic, cultural and development issues of the villages. In 5 villages studied, there was a RCO shop in Khorram Abad Oliya. There are about 15 cooperatives of deep wells in the Sanjabi Dehestan. In February 2003, Water Users Association (WUA) of the right bank canal of Site 1 was established and registered.

3) Economic Activities - People in the rural area are mostly engaged in agricultural and livestock breeding. Immigration to the urban area during the off-farm season in common in all the villages studied during the village survey. A whole family migrates to an urban area (Kermanshah, Ravansar or Javanrood) expect for the season for harvesting.

4) Rural Infrastructure - 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 only covered with gravel and not properly paved. Sources of drinking water in the Study Area are mainly groundwater, springs and the distribution system. During 1990 to 2000, all the villages are in the Study Area are electrified, except the uninhabited villages. Installation of telephone is relatively a recent development and the telephone came to the villages between 1998 and 2000.

5) Education and Health: The average literacy rate in the Study Area is 74% for male and 61% for female, which is almost similar to the provincial literacy rate 70% of the villages in the Study Area have primary school. There are 12 rural health centers in the study area (Population Census 1996). Mostly these centers provide first aid, vaccination for infant, family planning and first aid.

3.4 Agriculture and Animal Husbandry

(1) Number of Farm Households and Area

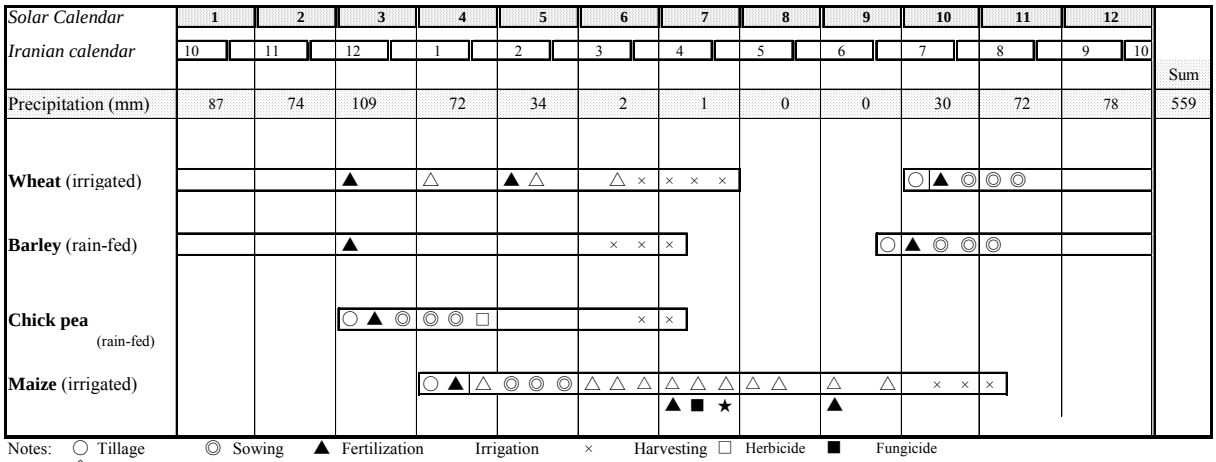
According to the statistics of Dehestans in 1999, the number of farm households was 919 in Site 1 and 1,182 in Site 2. The cultivated area was 11,599 ha in Site 1 and 11,297 ha in Site 2. The average farm scale of each Site is 14 ha per farm household in Site 1, and 9 to 11 ha per farm household in Site 2.

(2) Agricultural Production

According to the farm household economic survey of 54 farm households, the surveyed farmers have cultivated wheat, barley and chick pea as winter and spring crops, and maize for grain as summer crop. Besides, alfalfa and clover as forage crops are also cultivated by many farmers. Rapeseed was cultivated only by one farmer in 54 surveyed farmers.

Farm Work Calendar of Main Crops in Study Area is shown below.

Farm Work Calendar of Main Crops



Notes: ○ Tillage ◎ Sowing ▲ Fertilization Irrigation × Harvesting □ Herbicide ■ Fungicide
◇ Pesticide ★ Intertillage with caltivator
Source: Farm Household Survey, JICA Study Team, Feb. 2003

Yield of irrigated wheat of the 54 surveyed farmers ranges from 2.2 to 9 tons/ha and the yield of wheat in dry land ranges from 0.5 to 3 tons/ha. Yield of barley and chick pea, which are cultivated only in dry land, is 1.2 to 1.7 tons/ha of barley and 0.23 to 0.36 tons/ha of chick pea in average. Yield of maize for grain ranges from 4.7 to 12 tons/ha.

The number of tractors in Site 1 is about 115 and the area is 6,684 ha, which means that an average of 58 ha area is allocated to one tractor. In Site 2, 157 tractors work on 9,827 ha, which means that an average of 63 ha is also allocated to one tractor. In regard to combine, there are 14 numbers in Site 1 and 18 in Site2. There are 1,015 attachments in the Study Area.

(3) Animal Husbandry

1) Dairy cows - At present, local variety is a majority in the Study Area. About 160 heads of hybrid variety were already introduced to each zone (Zone1 and 2) of Site 1..

2) Sheep - Number of sheep in 4 districts, which include Site 1 and Site 2, is about 50,000 heads. Sheep in site 1 and site 2 is mostly Sanjabi breed.

3) Fishery - The existing fish ponds in and around the Study Area are concentrated in the Site 1 and there are 9 fish ponds in the Study Area. However, there is only one fish pond at Reis in the Study Area.

(4) Household Economy

Based on the results of survey of 54 farm households, the area of each farmer's land in both Sites, which includes own land and rent land, ranges from 1.5 ha to 46 ha. The annual gross income in farming of each farm household, which includes agriculture, animal husbandry and trust of farm works with own machinery, ranges from Rls. 3 million to Rls. 282 million.

The households whose annual gross income in farming including agriculture, animal husbandry and trust of farm works with own machinery in red (negative), are five. About half of the surveyed farmers have non-agricultural jobs, which are laborer, driver, animal trader, teacher, trader or shop keeper, etc. Annual living expenses of the 54 surveyed farm households range from Rls. 8.8 million to Rls. 84 million, Rls. 27 million, respectively. 40 farm households (74%) of the total surveyed farm households have some debts.

(5) Agro-Industry and Marketing of Agricultural Products

A brief summary of the marketing of major agricultural products is shown below.

Product	Marketing
Major grains	In the Study Area, a maize drying facility is found in both of Zālū Âb and Ravansar, and a feed plant in Deh Bagh. 'Ravansar, Livestock, Chicken and Fish Feeding Company' is located in Deh Bagh. At the moment it runs at the operational rate of 50 to 75 % to a 30,000 ton/year capacity because of the lack of market and short supply of two major ingredients, barley and wheat bran
Alfalfa	In the urban area of Kermanshah, alfalfa hay is sold at a feed wholesale market adjacent to the cereal market.
Chickpea	In Kermanshah Province the volume of production reached around 105,000 tons from 231,000 ha in 2001/02, which is sufficient for the local demand
Rapeseed	The producers sell it to the state oilseed cultivation organization, from which the industry buys.
Sugar beet	A beet sugar mill is found in each of Bīsotūn and Eslam-abad
Coriander	Coriander is meant for export. In Kermanshah, the commodity is dealt by the traders in the Islami market.
Rose	Golpar-e-Paveh (Marjoram of Paveh), a laboratory is being built in the Ravansar industrial Estate.
Milk and diary produce	A processing plant each is located in Bīsotūn and Eslām Âbād. Each has been sending tank trucks to collect milk every morning to the project site.
Honey	In the Study Area, beekeeping is concentrated in Hassan Âbād, where 200 beehives are found. Sales are done through family networks.
Fish	One or two individual shops are found here and there in the broader areas south of the central roundabout. Fish and poultry are sold side by side in some shops also.

(6) Agricultural Supporting System

1) Extension Service Centers (ESC)- There are three Extension Service Centers (ESCs) in the Study Area, namely, Ravansar, Hassan Abad and Kuzaran. Ravansar ESC covers Badr, and Dowlad Abad and Kuzaran ESC covers Sanjabi and Haft Ashlan dehstans. Hassan Abad ESC was established in 2003 and covers Hassan Abad.

2) Agricultural Research system and Researchers - There is an Agricultural and Natural Resource Research Center in the Kermanshah (KARC), which belongs to the National Research Organization (NRC). There is a Dry Land Research Station in Kermanshah Province, composed of grain (wheat, barley and pulse) section, oilseeds and forage crops section and resources management section.

3) Agricultural Credit - The interest rate a year of banks credit is generally 24%. There are 3 types of Government support for credit including support for animal husbandry, machinery and farm materials with an interest rate of 7%, 13% and 16% respectively.

4) Farmers Organizations - In Site 1, there is the beekeeping cooperative in Ravansar, which was established in 1992. In Site 2, there are 10~15 associations of common use of wells for irrigation, which were established in 2000 and organized by 2 to 6 farmers. Besides, there is an association of mechanization, which established in 2000 and organized by 7 farmers. And there is a broiler production association, which was organized 7 farmers and has raised 10,000 chickens.

3.5 Irrigation and Drainage

(1) Existing Irrigation and Drainage Schemes in the Study Area

The main irrigation and drainage projects in the study area are Ravansar irrigation scheme, Sanjabi drainage project, Kilanbar, and Gharab Dam projects.

(2) Ravansar Irrigation Scheme

1) Ravansar Right Bank Canal Project - This project aims to irrigate 700 ha of farm land located at the right bank of Gharasu river through the lining of canal and construction of diversion facilities.

2) New Ravansar Left Bank Canal Project - This project aims to irrigate 1,500 ha in dry season and 2,000 ha in rainy season which is located at the left bank of Gharasu river through the lining of canal and construction of diversion facilities.

3) Land Consolidation - Totally 9,385.5 ha of land re-plotting and 1,403.0 ha of land consolidation have been finished in and around the Study area

(3) Sanjabi Drainage Project

Ponding problem can be seen due to lack of land leveling in the study area, but drainage problem was reported at only half of Site II which is located in southern part. 43 km of drainage canal was excavated by KJAO 15 years ago and the situation of the area has improved in the normal year. However, some drainage problems still remain in the area.

(4) Kilanbar and Gharab Dam

.The studies on Kilanbar and Gharab Dam projects were carried out by KJAO; Now, MOE is carrying on the Study on the Kilanbar dam project, but the Gharab dam project study is yet to be carried out.

3.6 Water Management

Stakeholder is to be consisted of 1) farmers using irrigation water, 2) extension office or KJAO and 3) Water Affairs as MOE, for the aspects of water management. Mutual relationship among those stakeholders are to be summarized as the table on the right hand.

Operations of the Ravansar diversion works and gates are carried out by Ravansar Water Affair Office (RWAO). Any activities related to on-farm level are carried out by KJAO.

The Water Users' Association (WUA) was registered officially as one independent corporative on February, 2003. Settlements relate to the WUA are Meskin Abad Oliya, Meskin Abad Sofla, Ghalancheh, Korram Abad Oliya and Tam Tam.

Mutual Relation Among Stakeholders Related to Water Management

	Farmer	WUA	Extension Office	Water Affairs
Farmer	To conduct production individually To be a member of WUA	To request water demand for cultivation. To pay water fee as WUA member.	To be consultated as WUA member on agro-aspects.	To pay water fee directly in case of without WUA.
WUA	To conduct interface with out of village. To collect water fee from WUA members. To receive any requests on water use and agro-production.	To maintain WUA organi-zation as independent To coordinate management through MoC.	To convey any opinions and request to secure	To pay water fee collected from WUA members. To request as the WUA's own right to secure water.
Extension Office	To consultate & support services to improve agro-production. To guide proper water use as one of measures to improve production. To convey Govt's subsidies & assistances.	To reply to requests from WUA, to secure the improvement of	To issue programs in line of Govt's policies. To monitor & guide any farmers to improve agriculture.	To coordinate for improving production from view of water use.
Water Affairs	To guide farmers on proper water use.	To guide WUA to let farmers accept proper To claim and collect water fee from WUA.	To coordinate for improving water use of	To issue programs in line of Govt's policies. To maintain facilities to serveservices to water To monitor and consultate water users to save water.

Note : Presently only one WUA has been established in the Study Area.
WUA is to be under the management of the Ministry of Cooperatives.
Majorities of the Study Area are still without WUA.
In case of without WUA, the mutual relation as stakeholder of water management is to be acknoledged that farmers to contact with relevant agencies directly.

3.7 Watershed Management and Rangeland Rehabilitation

(1) Watershed Management

The Study Area is included in the Ravansar basin, which is located at the upstream side of Doab Malak hydrological station. Ravansar basin, which has an area 119,295 ha, 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. Normally watershed management plan requires very detailed studies on the different characteristics of watershed, detailed survey, mapping and planning. Because of the limitation of time and other resources, watershed management plan in this Study is carried out only at a master plan level. Based on the study, the cost of watershed management activities in the Ravansar basin is estimated as shown below.

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). Because of the high cost of carrying out all the watershed management activities, they are normally executed on a priority basis.

(2) Rangeland Rehabilitation and Management

In general, the planning of rangeland rehabilitation and management is carried out on individual village basis. 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	×	

3.8 Zoning of the Study Area

The Study Area can be categorized into the following zones for the agricultural development:

Site	Development Zone	Water Source	Soil and Drainage	Irrigation Zone	Remarks
Site 1	Upstream of Ravansar Canals: Availability of high amount of water	Surface Water	Heavy soil, poor drainage	Zone 1	Presently and after improvement of Ravansar canals, the Area is possible to be irrigated by the canals
				Zone 2	
	Downstream of Ravansar Canal: Low amount of water available			Zone 3	
Site 2	Groundwater/rainfed Irrigation, better drainage conditions	Ground-water	Silty soil, better drainage	Zone 4	Deep wells are required
				Zone 6	Divided into two part by soil texture
	Careful treatment of drainage with groundwater irrigation	Ground-water	Heavy soil, poor drainage	Zone 8	Main drains constructed
				Zone 7	Partially sloped area
	Proposed Irrigable Area by new dam construction	Planned surface water		Zone 5	Presently rainfed

3.9 Environment

(1) Existing Environmental Problems of the Study Area and the Region

1) Water Pollution and Water Quality by the farming practices, village wastes, dairy farm wastes, slaughter houses
2) Trashes left by the tourists and the passengers passing through these springs cause pollution.
3) Lime factories in the Study Area causing atmospheric pollution.
4) Discharge of the herbicide production factory
5) Irregular grazing and unbalance of livestock & pastures, resulting in soil erosion and sedimentation problems and flooding
6) Illegal farming at the foot of mountains leads to soil erosion and removal of soil depth.

(2) Environmental Problems Reported in Participatory Workshops

1) Health and Sanitation

- There is no proper sewage and other sanitation facilities in the villages
- The villagers reported that the animal wastes are mostly kept outside the homes causing air pollution and uncleanliness of the villages.
- There is no health center or the facilities in the centers are poor
- Poor or no drinking water facilities.
- There is no public bath facilities
- Poor road and transport conditions

2) Problems of Grazing and Range Areas with poor roads.

3) Social problems in water distribution between upstream and downstream side..

4) Influence of Kilanbar Dam - Although the Kilanbar dam is at the study stage, the farmers are concerned about the compensation for the loss of their land due to submergence.

Chapter 4 Problems and Potentials of the Agricultural Development of the Study Area

4.1 Existing Problems of Agricultural Development

The major problems of agricultural development are listed below.

(1) Natural Conditions

Water Resources	Soil	Socio-economic Conditions
1) Unstable distribution of rainfall 2) Surface water scarcity for irrigation 3) Prejudiced discharge of spring water 4) Decline of the groundwater level	1) Heavy texture of the soil 2) Fertility Status of the Soil 3) Slope	1) Unemployment 2) Migration 3) Lack of Self-Motivation of Village People

(2) Agriculture, Animal Husbandry and Fisheries

Agriculture	Animal Husbandry and Fishery	Others
<u>Crop Production</u> 1) The yields of cultivated crops are low. 2) Low accuracy of farm works by contractors of mechanization 3) Low organic matter and zinc in the soil 4) The rate of mechanization cost to total production cost is very high. 5) Farmers cannot purchase the farm materials in time. 6) The decreased income in maize production by losses influenced severely on farm economy of farmers. 7) The yearly interest rate of bank is very high. <u>Cultivation Areas</u> 1) Many small scale farmers with different farm holding size 2) High rate of rain-fed lands 3) The crop rotation is biased to fixed systems. 4) There are many puddles in the fields in winter and spring <u>Farm House Holding Economy</u> 1) High Mechanization charge. 2) Most of farmers do not have surplus for reproduction in the next year.	<u>Animal Husbandry</u> 1) Local breed of dairy cow is usually raised in Site. 2) Shortage of roughage <u>Inland fisheries</u> 1) Lack of familiarity to people with methods of fish production, consumption and distribution of breeding fishes. 2) Limitation of breeding fish varieties, breeding methods, and necessary information. 3) There are few local aquatics resources due to destruction of river, drought, irregular fishing and pollution.	<u>Mechanization</u> 1) The number of tractors and combines and the power (HP) of tractors are low. 2) Improper farming work by the machinery contractor 3) There is no repair shop in Site. 4) It is hard to procure the farm machinery. <u>Agricultural Extension Services</u> 1) Shortage of staff, cars, and other facilities. 2) The staffs are busy in approving subsidized agricultural chemicals. 3) It is necessary to do training of new technologies, such as plastic green house, for staff and farmers. <u>Agricultural Credit and Government Subsidies</u> Complicated procedures in bank and severe conditions <u>Agricultural Marketing and Pricing System</u> 1) No timely sales of products 2) Low price of products 3) Insufficient crop insurance 4) Low price of corn at the corn drying yards

(3) Irrigation and Drainage

Ravansar Right Bank Project	Ravansar Left Bank Canal	Sanjabi Drainage
1) Decrease of the beneficial area 2) Damage of existing facilities 3) Improper water distribution 4) No actual record against the design discharge	1) Low irrigation efficiency 2) Improper water distribution 3) Planning of the project stage by stage 4) Unsuitable canal route 5) Lack of supervision	1) Lack of secondary and tertiary drainage canal 2) Shortage of number and capacity of main regional road crossing culvert 3) No responsible organization for maintenance works

4.2 Potentials for the Agriculture Development

The potentials for agricultural development from the view points of agriculture, irrigation and drainage are mentioned below:

Agriculture	Irrigation and Drainage
1) Comparatively rich natural resources such as solar energy, water and soil resources 2) Favorable social conditions such as the living environment (electricity, telephone, health center, school, and roads), educational level, unemployed young men as participants of development etc. 3) Farmers have high ability and experience of farming. 4) With regard to animal husbandry, they have raised cows of local breed and sheep from old times, and have integrated agriculture and animal husbandry in their farming. 5) Recently, Government organization of province has strengthened in various sections, such as horticulture, mechanization, animal husbandry, fishery, extension and participation, etc.	1) By Proper water use, the irrigable area can be increased to approx. 1.4 times of the present irrigated land area. 2) Proposed irrigation schemes - Totally 2,420 ha of rainfed cultivation area can be irrigated by the proposed dams such as Kilanbar dam and Gharab dam. 3) Additionally, totally 1,500 ha can be received sufficient irrigation water from New Ravansar left bank canal under the proper water use system. 4) By land consolidation, mechanization can be introduced and crop production can be improved. 5) Introduction of secondary and tertiary drainage network will solve inundation problem. 6) By centralizing the wells and through suitable irrigation network, the irrigable area can be increased as well as the groundwater can be conserved. 7) New water source development is possible by reserving of unutilized water of Ravansar spring.

Chapter 5 Master Plan and Development Strategy of Agricultural Development and Selection of Priority Areas

5.1 Basic Concept of Agricultural Development

(1) Objective of the Agriculture Development in the Study Area

The objective of the agricultural development in the Study Area is the establishment of sustainable agriculture with high level of technology in line with the policies of the Government of the Iran and the Province, so that the difficult problems in farming at present will be solved, the living standard of farmers will be improved and the rural economy will be revitalized. To establish of sustainable agriculture, it is required to integrate organically the various sections of farming, such as crop cultivation, animal husbandry, horticulture, fisheries, etc. Precondition of agricultural development in the Study Area is the development of irrigation water source, and the establishment of low cost irrigation and drainage methods.

(2) Target Year of Agriculture Development

The target year of the agricultural development is set in the following three stages;

- Short Term: by 2005 within the 3rd FYDP for the preparation period.
- Mid Term: by 2010 within the period of the 4th FYDP
- Long Term: by 2020

(3) Basic Concept of Farming Plan

Basic Concept of Farming Plan and Agriculture Infrastructure Development Plan are mentioned below.

Farming Plan	Agriculture Infrastructure Development Plan
1) Integration of agricultural farming with animal husbandry should be promoted as the basic model of farming plan. 2) Well water, canal and river water is used for the winter crops and the summer crops. The basic cropping pattern is "wheat－maize – sugar beet – forage crops". 3) The excrements of cows are returned as compost to farmland in order to increase organic matter of soil. 4) Diversification of crop cultivation shall be carried out by introducing vegetables, rape sugar beet, and chick pea in the basic pattern of rotation. 5) To stabilize the income of farming in the small-scale farm households, it is examined to introduce vegetables in irrigated fields and in the plastic green houses. 6) In the upper reaches of the rivers, integrated farming with bee keeping and fisheries shall be carried out. 7) Extension system shall be strengthened	1) Improvement of Water Utilization by clarifying the available water source, establishing irrigation canals, O & M system, water users' association etc. 2) Improvement of Drainage Condition by establishing drainage network, maintenance system etc. 3) Improvement of Field Conditions through land consolidation 4) Improvement of Operation and Maintenance of Agricultural Infrastructure by establishing a proper organization for O&M system.

5.2 Initial Environmental Examination (IEE)

Based on the joint screening and scoping and in consideration of site description and project description and the project activities to be undertaken, the major environmental impacts to be assessed are as follows:

1. Water contamination and deterioration of water quality including eutrophication
2. Soil erosion, sedimentation and flooding
3. Soil contamination by agrochemicals
4. Influence on surface water hydrology
5. Influence of groundwater hydrology
6. Atmospheric Pollution
7. Health and sanitation

The agriculture development through irrigation and drainage projects will have the following the significant positive effects in the Study Area and the region:

1) Increased food production through the effective utilization of the wide plain area
2) New economic activities through marketing and agriculture processing
3) Expansion of employment opportunities of the local population
4) Substantial improvement in way of life
5) Reduction of inundation and flood by watershed management projects

As per the regulations of Iran, EIA needs to be executed for the dam of more than 15m height. If Kilanbar or Gharab dam Plans will be selected, then EIA should be conducted, since the proposed dam heights are higher than the EIA standard height of 15 m.

5.3 Required Activities and Candidate Schemes for the Further Study

(1) Required Activities in the Study Area

The required activities for the improvement and development of agricultural development in the Study Area are proposed as follows:

Agriculture development	Irrigation and drainage development	Rural infrastructure development
Introduction of crop rotation Integrated farming Improvement of mechanized farming Rangeland rehabilitation for livestock development Tree crop development on the mountain spring area Strengthening the extension service system Formulation of Rural Producers Cooperatives	Improvement on-farm irrigation system of Ravansar Irrigation Scheme Improvement of water management of Ravansar Irrigation Scheme Gharab dam irrigation scheme Kilanbar dam irrigation scheme Improvement of groundwater irrigation Improvement of drainage system	Improvement of rural road network Improvement of rural water supply system Improvement of rural sanitation and sewage system

These activities, either individually or combined to a scheme, will be the candidates for the Feasibility Study.

5.4 Selection of Priority Area for the Development

The results of examination on the priority of candidate schemes based on conditions for the selection, is shown in the following table.

Selection of Priority Areas and Programs

Items		Agricultural Infrastructure Plan			Agricultural Development Plan		
		Improvement of On-farm Facilities and Water Management of the Ravansar Irrigation Scheme	Gharab and Kilanbar Dam Irrigation Scheme	Improvement Scheme of Drainage System in Sanjabi Plain	Formulation of RPC	Integrated Agriculture Development Program	Strengthening Program of the Agricultural Extension System
Conditions for the Selection	To be model	◎	◎	◎	◎	◎	◎
	Easy to operate	◎	○	◎	○	○	○
	Advantages of the scheme	◎	○	△	◎	◎	○
	Practicability	◎	○	◎	◎	◎	◎
	Social issue	○	△	◎	◎	◎	◎
	Sustainability	◎	○	◎	◎	◎	◎
	Motivation of farmers	◎	○	○	○	○	◎
	Validity of the study	◎	△	◎	◎	◎	◎
Overall Decision		◎	△	○	◎	◎	◎

Remarks; ◎: Very well, ○: Well, △: Including some problem

As a result the following schemes are selected for further feasibility study.

1) Improvement of On-farm Facilities and Water Management of the Ravansar Irrigation Scheme
2) Formulation of RPC
3) Integrated Agricultural Development Plan
4) Strengthening of the Agricultural Extension System

The Priority Candidate Projects selected for the feasibility study is shown in Fig.S5.1.

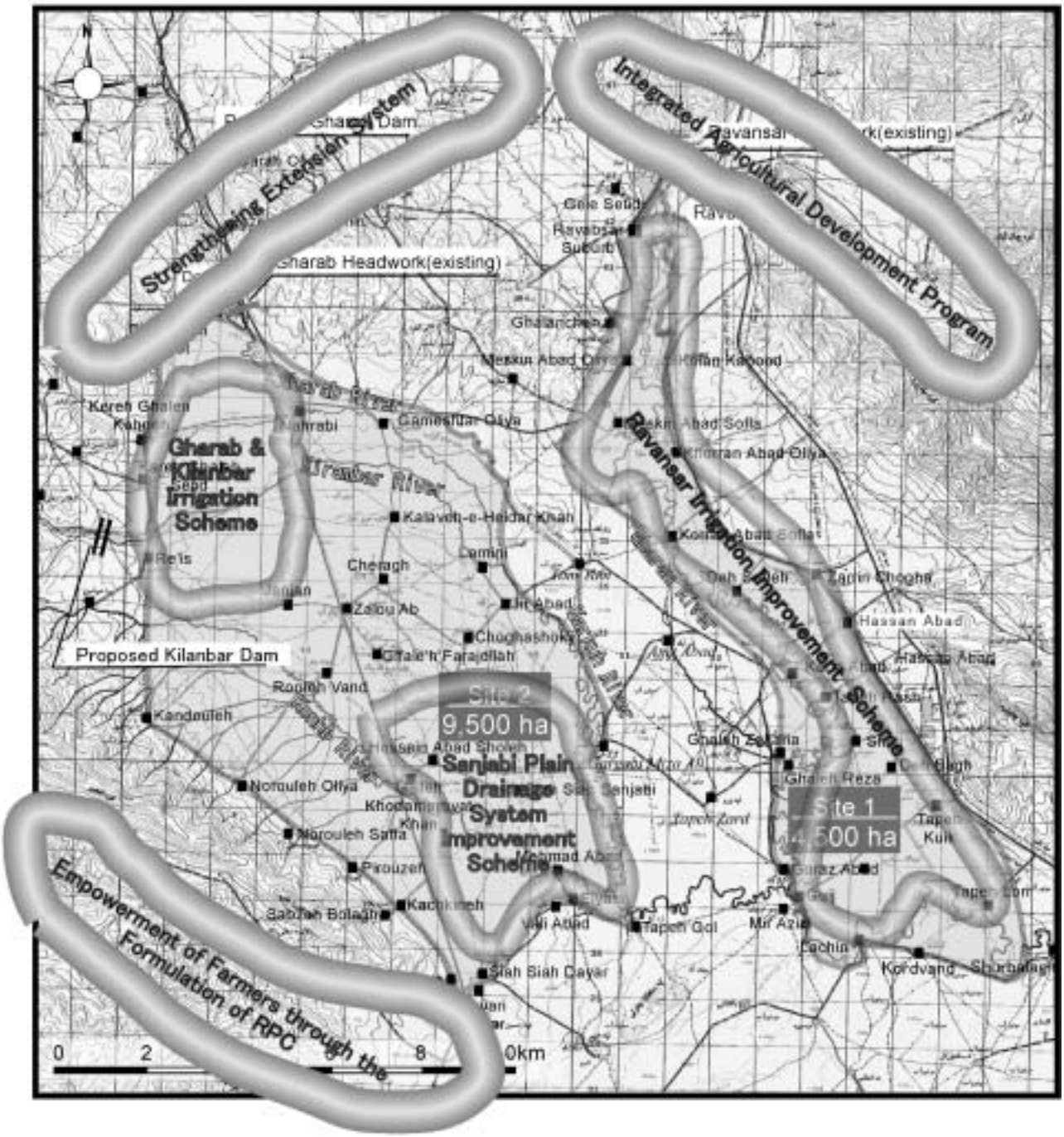


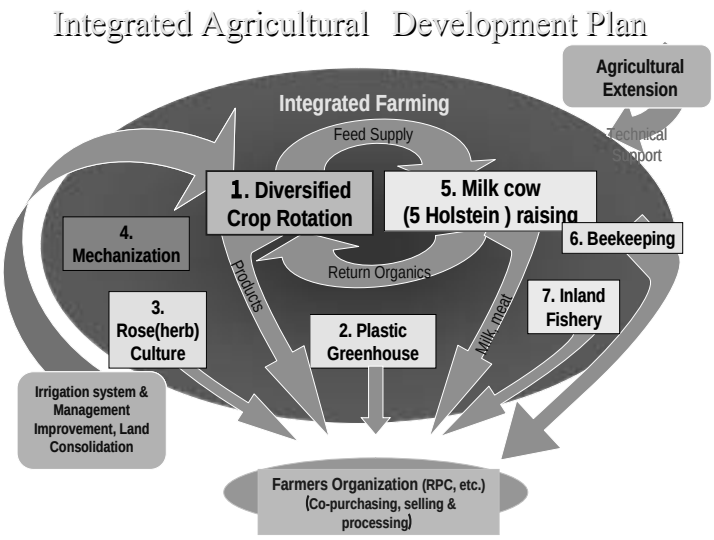
Fig. S 5.1 Candidates of Priority Project/Program

Chapter 6 Feasibility Study on Priority Projects and Programs

6.1 Integrated Agricultural Development Plan

The integrated agricultural development plan includes the following.

1) Promotion of Integrated Farming of agriculture, livestock, apiculture, horticulture, fishery, and mechanization.
2) Effective Use of Irrigation Water to increase the production of the area
3) Establishment of Crop Rotation System
4) Plan for the Weak and Small Scale Farmers and Farmers using Drylands
5) Introduction of Plastic Green House
6) Measures of Agricultural Mechanization
7) Promotion of the Processing Industry and
8) Maintaining the Food Safety



(1) Agricultural Development Plan

The crop rotation plan to be followed in Site 1 and Site 2 is shown in Fig.S6.1. A total of 9,632 ha shall be used as dry farm land, 1,569 ha shall be used as irrigated land in spring and 5,310 shall be used as irrigated land during all season. Besides, green houses of 2,000m^2 scale shall be established both in Site 1 and 2 totaling 5 places in each Site at the end of 10th year.

(2) Horticulture Development Plan

Rose shall be cultivated by the farmers who have an irrigated area of less than 5 ha and one family shall cultivate an area of 1ha. It is planned to introduce 100 ha in the Study Area.

(3) Farm Mechanization Development Plan

The number of needed tractors and combines needed in the study area are 63 heavy tractors (140 PS), 63 heavy tractors (4WD, 110 PS), 64 heavy tractors (2WD, 110 PS), 317 light tractors (75 PS), and 30 Combines.

(4) Livestock Raising Development Plan

The target of extension is 70% of all farmers in the Study Area, including small scale farmers and those who only have rain-fed farmland (excluding 30% farmers who don't want to raise cows).

(5) Beekeeping Development Plan

Totally 2800 beekeeping hives will be introduced in the Study Area with 40 bee hives/household. Targets of this beekeeping plan are farmers in rain-fed farmland area especially farmers on mountainous side where agrochemicals are not applied.

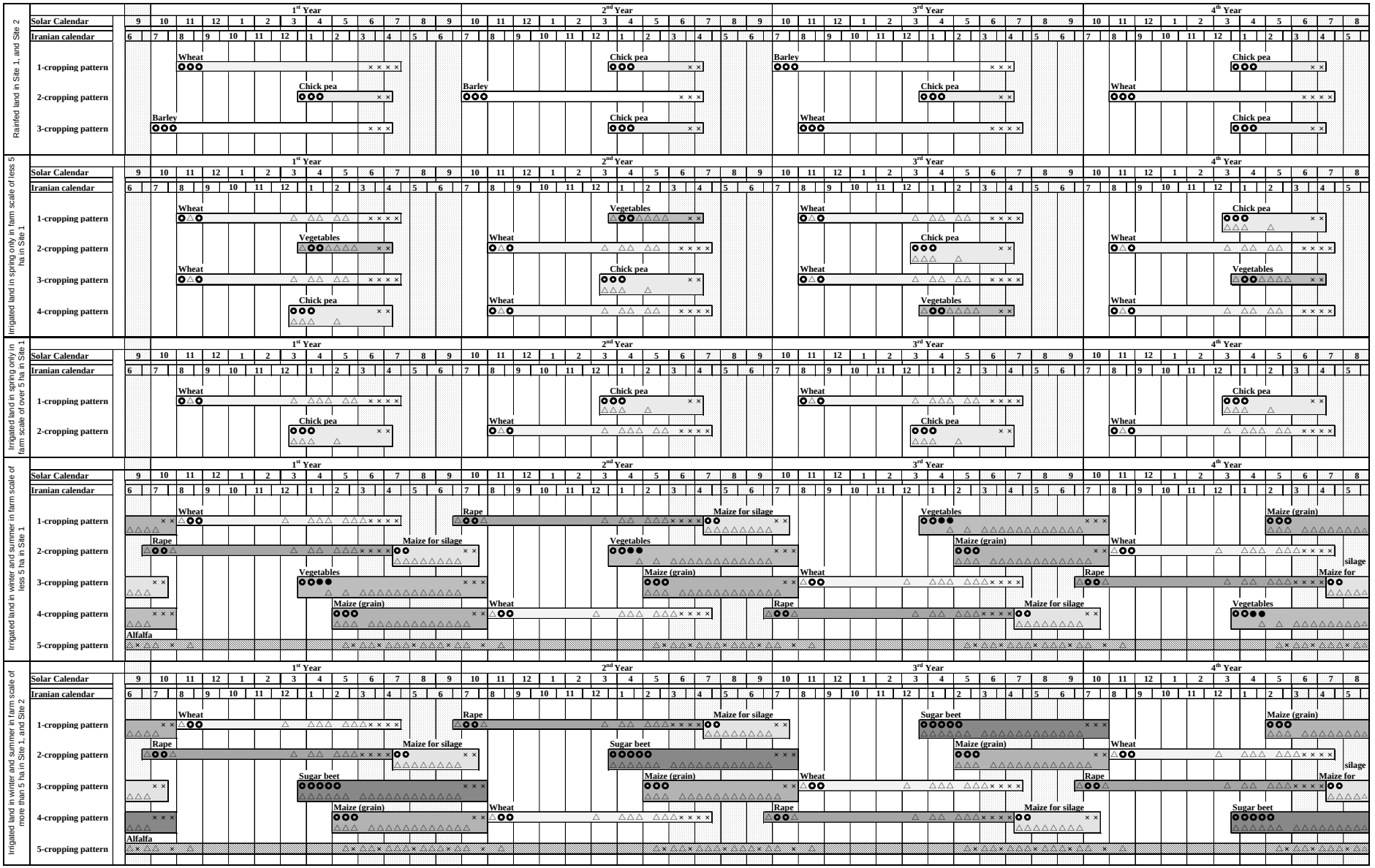


Fig. S6.1 Crop Rotation Plan

(6) Inland Fishery Development Plan

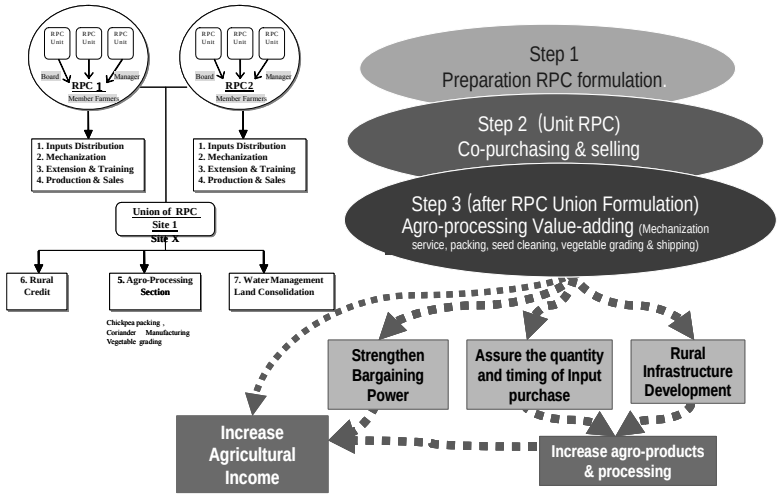
1) Trout Culture by Irrigation Wells – It is planned that 17 households shall carry out trout culture by irrigation well.

2) Trout Culture by Springs - It is planned that 10 households shall carry out trout culture by spring water. It is estimated that total production shall be 13 t/year after the implementation of the plan.

6.2 Farmers' Organization Development Plan

The farmers' organization development plan is shown in the figure. It is proposed that 2 RPC Unions will be formed in the Study Area: Site 1 and Site 2. As shown in the figure, the RPCs are consisted of 3 tiers: RPC units, RPC (RPC 1 and 2) and RPC Union is each Site.

Farmers Organization Development



The group formation starts from the RPC unit level where the people in one village or adjacent villages which have similar geographic, cultural, social and economic specification, can establish one RPC Unit. The activities at each level are shown below.

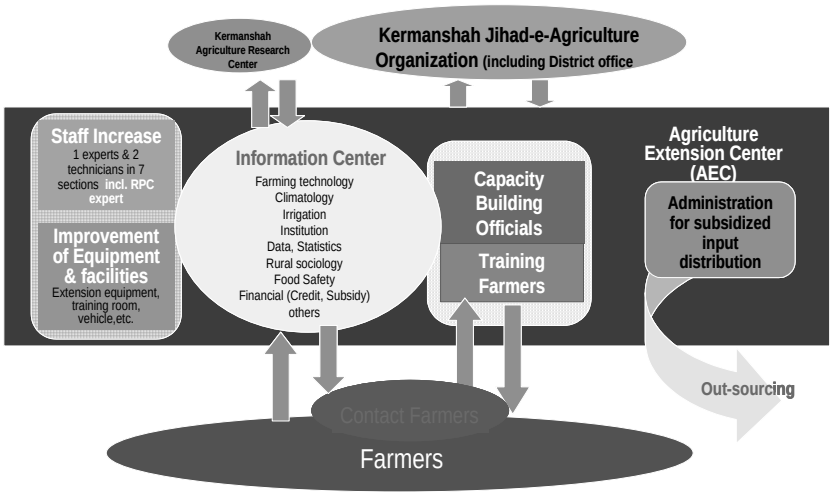
	Location and Covering Area		Responsible personnel	Function
	Site 1	Site 2		
RPC Unit	One to five 5 villages/ dehs (Adjacent villages with similar geographic, social and economic conditions can form one RPC Unit		One coordinator from each village	Coordination and information exchange between members Extension and training Land consolidation
RPC 1	Ravansar Dowlat Abad	Zalu Ab (3 units)	One Managing director Min. 5 Board members	Inputs distribution Joint sale of products Extension and training Mechanization
RPC 2	Hassan Abad	Kuzaran	1 Managing director Min. 5 Board members	
Union of RPC	RPC 1 + 2 Total 7,675 ha, 794farmers	RPC 1 + 2 Total 7,993 ha 800 farmers	1 Union Manager (directing manger of RPC 1 or 2) Coordination Committee (Board members of RPC 1 and 2)	Agro-processing Rural credit Fund Water management and land consolidation

6.3 Agricultural Extension System Improvement Plan

(1) Improvement of Agricultural Extension System

The following improvements are planned.

1) Strengthening of Human Resources, Facilities and Equipments
   i) Allocation of Experts and Technicians in 7 Sectors
   ii) Improvement of Facilities, Equipment and Materials
2) Demarcation of the Works of ESC
   i) Outsourcing of Agricultural Input Distribution Administration
   ii) Expansion of the Roles of Contact Farmers



Agricultural Extension System Improvement Plan

Main extension improvement plans and their extension methods are as follows.

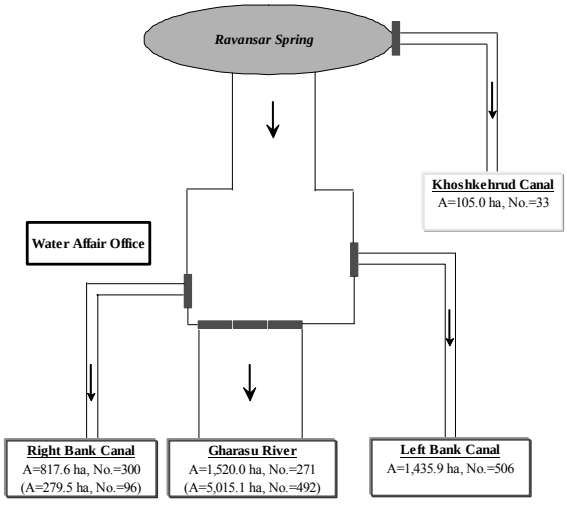
Extension Improvement Method	Training Plan	Capacity Building
1) Establishment of demonstration farms on agricultural and livestock farming 2) Extension Activities for Farmers 3) Support of KJAO and NRD 4) Support of foreign experts	1) Farm management 2) Mechanization 3) Farming techniques 4) Hybrid and Holstein cows raising 5) Horticulture 6) Plastic green house 7) Training on RPCs	1) Technical trainings on agriculture and 2) Trainings on farmers' organizations.

6.4 Improvement Plan of Ravansar Irrigation Canal Management and On-Farm Water Management System

(1) Irrigation System Improvement Plan

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. It can be considered that the proper diversion ratio for the right bank canal, the left bank canal and the Gharasu River will be 8.6 %, 44.4 % and 47.0 % respectively. According to the irrigable areas, diversion requirements of the right bank canal and the left bank canal are 0.19 m^3/sec.

Irrigation Networks Related to the Ravansar Spring



Remarks:
Area and number of Right bank canal is information on the water right holders in the list of WA.
( ) of Right bank canal is actual information on the water right holders.
Area and number of the Gharasu River is information on the water right holders till Doab village.
( ) of the Gharasu River is information on the water right holders in the list of WA.

and 0.99 m^3/sec. respectively. Under the present condition, open height of the gate at beginning of the right bank canal and the left bank canal for normal years were estimated as 0.26 m and 0.49 m respectively and the remaining water can be flown into the Gharasu River.

(2) Irrigation and Drainage Facilities Plan

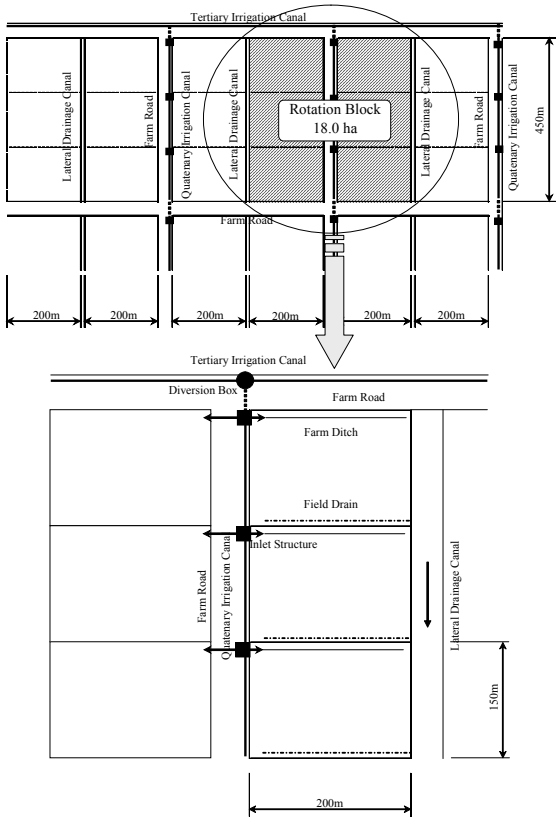
1) Ravansar Diversion Weir - Proper water distribution should be carried out in future based on the distribution rule. Some measurement tool should be installed to evaluate or check water distribution volumes for each stakeholder.

2) Main Irrigation Facilities on the Left Bank Canal - The total canal length of new main canal is approximately 18.0 km. Design discharge of the new main canal is at 2.20m^3/sec including free board at beginning. This volume is equivalent to water requirement volume for approximately 2,560 ha of farm land.

3) On-farm Irrigation Facilities on the Left Bank Canal - Total length of on-farm irrigation canals is estimated as approximately 47.4 km. A diversion box will be constructed with control gate at divergence point of tertiary or quaternary irrigation canals. Rotation block consists of 6 standard plots equivalent to 18.0 ha. Total length of pipe culvert is estimated as approximately 2.1 km.

4) Rehabilitation of the Right Bank Main Canal - The existing problems should be considered and farmers participation is necessary to make rehabilitation plan. A plan is prepared for the proposed irrigation network based on the present irrigation network.

5) On-farm Irrigation Facilities on the Right Bank Canal - Total length of on-farm irrigation canals is estimated as approximately 10.3 km. A diversion box will be constructed with control gate at divergence point of tertiary or quaternary irrigation canals. Rotation block consists of 6 standard plots equivalent to 18.0 ha. Irrigation water is delivered to a farm plot thorough an inlet facility with gate. Pipe culvert which can flow the design discharge within 80 % of the pipe section is employed for road crossing or access road crossing culvert of irrigation canals. Total length of pipe culvert is estimated as approximately 0.3 km.



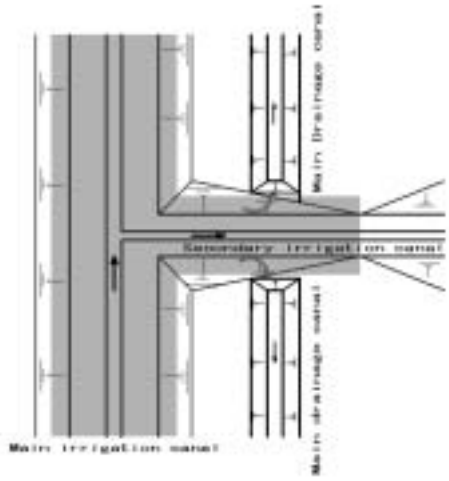
Standard Layout of Land Consolidation

(3) Land Consolidation Plan

Land consolidation is indispensable to carry out optimum water use. The maximum plot size on the left bank and right bank canal will be 3.0 ha with 200 m width and 150 m length considering the condition of irrigation method. Standard layout of land consolidation is shown in the figure.

(4) Drainage Plan

The main and on-farm drainage canals are planned as earthern canal. The pipe culvert or box culvert is set up for the road crossing structure. As for the on-farm drainage canal, the canal depth should be more than 30 cm from design water level at the beginning of the drainage canal for lowering down the groundwater level. Also, spill out structure is designed at outlet point of drainage to the Gharasu River in order to protect the erosion dike of the Gharasu River. The total length of drainage canal in the left and right bank canal area are approx. 42.3 km and 5.4 km respectively. The canal scale of the right bank canal area is comparatively smaller because of the mountainous basin.



(5) Irrigation Management Improvement Plan

Ravansar Irrigation System Management Improvement Plan is briefly summarized below.

Ravansar Right Bank WUC Strengthening Plan	Ravansar Left Bank WUC establishment plan
i) Extension of WUC Enhancement Program ii) Extension on land Consolidation Scheme iii) Guidance of WUC Management	i) Guidance of WUC program to farmers ii) Registration of the WUC iii) Physical Infrastructure Preparation iv) WUC organization

A union shall be formed to unite the WUCs which will depend on the Ravansar Spring. The responsibility of each stakeholder shall be finalized based on the task allocation of water management prepared during the survey.

6.5 Implementation Plan

(1) Components of the Project

The Project consists of 4 major components; 1) Integrated agriculture development, 2) Farmers organization development, 3) Extension system improvement, and 4) Ravansar canal irrigation system and management improvement.

(2) Implementation Schedule

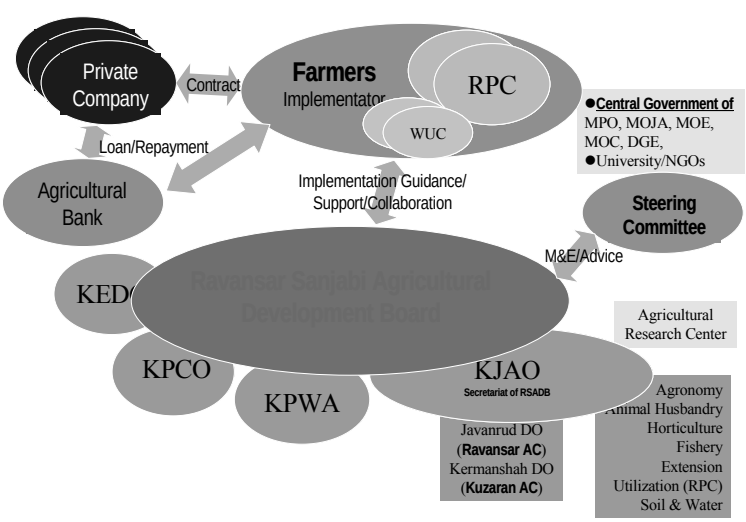
The implementation schedule is set as follows:

- Starting the Project: Iranian Fiscal Year (IFY)1383 (2004/03)
- Implementation period 10 years
- Short term (within 3 years) IFY 1384-86 (2004/07): middle of the 4th FYDP
- Medium term (within 5 years) IFY 1387-88 (2008/10) upto end of the 4th FYDP
- Long term (within 10 years) IFY 1389-93 (2010/15) upto end of the 5th FYDP

(3) Executing Agencies and Organization

The Project will basically be implemented by the Iranian Government budget and no external financial support is expected except technical support in specific fields.

It is proposed to establish a "Ravansar–Sanjabi Agricultural Development Board" (RSADB) for the coordination of the Project implementation stakeholders. Periodical general meetings will be held on the coordination of 1) budgetary preparation for the Project implementation, 2) implementation schedule adjustment, and 3) monitoring evaluation of the Project implementation. In order to support, monitor and evaluate the Project, Steering Committee (SC) is also proposed. The SC will consist of the representatives of related ministries of central government including Management Planning Organization, university or NGO, and Embassy of Japan, and JICA Experts to Iranian Government.



Ravansar-Sanjabi Agricultural Development Board

(5) Implementation Plan

1) Integrated Agriculture Development

Targets of integrated agriculture development plan in the Study Area including Site 1 and 2 during short, mid and long term are shown in the following table.

Category	Item	Short term (1^{st} year ~ 3^{rd} year)	Medium term (4^{th} year ~ 5^{th} year)	Long term (6^{th} year ~ 10^{th} year)
Agriculture	Crop rotation Dry farm land	10,054 ha wheat-chickpea-barley	10,054 ha wheat-chickpea-barley	10,054 ha wheat-chickpea-barley
	Irrigated land in Spring	1,302 ha wheat-chickpea or vegetables	1,302 ha wheat-chickpea or vegetables	1,302 ha wheat-chickpea or vegetables
	Irrigated land in all season	5,155 ha wheat-rape-maize-sugar beet or vegetables & alfalfa	5,155 ha wheat-rape-maize-sugar beet or vegetables & alfalfa	5,155 ha wheat-rape-maize-sugar beet or vegetables &alfalfa
	Plastic green house 2,000m^2	2 house	4 houses	4 houses
	Mechanization	50% of all shortage	20% of all shortage	30% of all shortage
Horticulture	Rose for perfume or Chinese medicine	20 ha	30 ha	50 ha
Animal husbandry	5 heads of Holstein	297 households (20% of total)	448 households (30% of total)	297 households (20% of total)
Beekeeping	40 bee-hives/ household	800 hives	1000 hives	1000 hives
Inland fishery	Trout culture using irrigation well	5 household	6 households	6 households
	Trout culture using spring water	3 households	2 households	5 households

2) Farmers Organization Development

When the registration of the RPCs will be completed after 6 to 7 months of preparation, the organization and its functions will be developed. The activities of the RPC Union will start from the 6^{th} year. By this time, each RPC will have enough experiences on the cooperative activities. With the completion of repayment of the loan, the RPC will also become financially

more viable and be ready to undertake Union's activities.

3) Agricultural Extension System Improvement

The major activities proposed in the extension system improvement plan are as follows:

i) Improvement of extension activities of the service centers
ii) Strengthening of human resources, facilities and equipments

It is proposed that the implementation of these activities shall be completed within the first year of the short term plan and then the activities shall be continued.

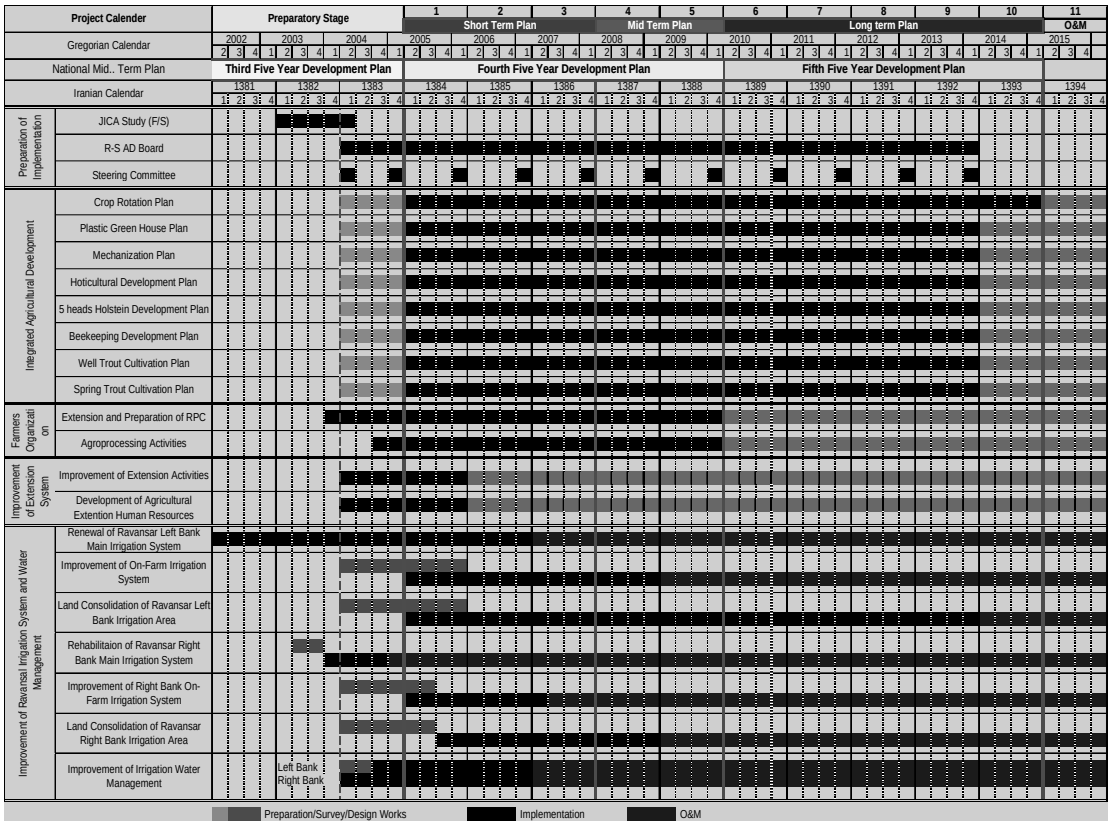
(4) Ravansar Irrigation System and On-farm Improvement

According to the budgetary plan for the main and secondary canal of the left bank irrigation system, it will take 3 years to complete. Design of the land consolidation for the left bank canal area will be started from one year before termination of the construction work on main and secondary irrigation canal. Implementation of the land consolidation will be carried out from the first of 2007 to the end of 2013.

As for the right bank canal, design of rehabilitation on main canal will take one year because farmer's participation is necessary for the design. The rehabilitation work will be carried out form the first of 2005 to the middle of 2006 because irrigation period is included. The design of land consolidation will be prepared in 2006 and implementation will be completed until the end of 2008.

(5) Total Implementation Schedule

Whole Project implementation schedule are summarized below.



6.6 Project Costs and Benefits

(1) Foreign Exchange rate

The foreign exchange rates applied for this estimate are US$ 1.00 = ¥ 111.50 = Iranian Rials (Rls.) 8,216 as of October 1, 2003.

(2) Project Cost

1) Integrated agriculture development

Initial investment cost for the implementation of the agricultural development plan is shown in the following tables for each stage of implementation in the agricultural development plan.

	Category	Item	Short term (1^{st} year ~ 3^{rd} year)	Medium term (4^{th} year ~ 5^{th} year)	Long term (6^{th} year ~ 10^{th} year)
Site 1	Agriculture	Plastic green house 2,000m^2; Rls. 380 million	1 Rls. 380 million	2 Rls. 760 million	2 Rls. 760 million
		Mechanization Supply of short machinery	50% of shortage Rls. 15,682 million	20% of shortage Rls. 6,273 million	30% of shortage Rls. 9,409 million
	Horticulture	Cultivation of rose for perfume; Rls. 5.9 million/ha	10 ha Rls. 59 million	15 ha Rls. 88.5 million	25 ha Rls. 147.7 million
	Animal husbandry	5 heads Holstein plan Investment; Rls. 100 million (Purchase 5 milk cows, building, facilities)	110 households Rls. 11,000 million	165 households Rls. 16,500 million	110 households Rls. 11,000 million
	Beekeeping	40 bee-hives; Rls. 15 million (Hives, nest, facilities)	200 hives Rls.75 Million	400 hives Rls. 150 million	400 hives Rls. 150 million
	Inland fishery	Trout culture using irrigation well; Rls. 17.5 million (60 m^2 pool, aeration facilities and pump)	1 household Rls. 17.5 million	2 households Rls. 35 million	1 household Rls. 17.5 million
	Total		Rls. 27,213.8 million	Rls. 23,806.5 million	Rls. 21,484.2 million
Site 2	Agriculture	Plastic green house 2,000m^2; Rls. 380 million	1 Rls. 380 million	2 Rls. 760 million	2 Rls. 760 million
		Mechanization Supply of short machinery	50% of shortage Rls. 23,558 million	20% of shortage Rls. 9,423 million	30% of shortage Rls. 14,135 million
	Horticulture	Cultivation of rose for perfume; Rls. 5.9 million/ha	10 ha Rls. 59 million	15 ha Rls. 88.5 million	25 ha Rls. 147.7 million
	Animal husbandry	5 heads Holstein plan Investment; Rls. 100 million (Purchase 5 milk cows, building, facilities)	187 households Rls. 18,700 million	283 households Rls. 28,300 million	187 households Rls. 18,700 million
	Beekeeping	40 bee-hives; Rls. 15 million (Hives, nest, facilities)	600 hives Rls. 225 million	600 hives Rls. 225 million	600 hives 225 Million Rls.
	Inland fishery	Trout culture using irrigation well; Rls. 17.5 million (60 m^2 pool, aeration facilities and pump)	4 household Rls. 70 million	4 households Rls. 70 million	5 household Rls. 87.5 million
		Trout culture using spring water; Rls. 3 million (80 m^2 pool, and facilities)	3 households Rls. 9 million	2 households Rls. 6 million	5 households Rls. 15 million
	Total		Rls. 43,001.0 million	Rls. 38,872.5 million	Rls. 34,070.2 million

2) Farmers organization development

The new building with office equipments costs is estimated at Rls. 478 million each. Total Project cost of the Site 1 and Site 2 will be Rls. 8,568 million.

Initial and O/M Cost

RPC Union Site 1 (Ravansar)

	year	1		2		3		4		5		6		7		8		9		10		Total		
		Initial	O&M	Initial	OM	Initial	OM	Initial	OM	Initial	OM	Initial	OM	Initial	OM	Initial	OM	Initial	OM	Initial	OM	Initial	OM	Total
RPC Activities	Office and Equipement (Ravansar)	478	30		30		30		30		30		30		30		30		30		30	478	303	781
	1. Agricultural inputs plan	340	11		11		11		11		11		11		11		11		11		11	340	108	448
	2. Mechanization plan	308	29		29		29		29		29		29		29		29		29		29	308	288	596
	3.Extension and Training plan																							
	Advising by a PRC expert		24		24		24		24		24		24		24		24		24		24	0	240	240
	Training by Extension center		13		13		13		9		9		9		4		4		4		4	0	92	92
	4. Joint sales of product plan	450	25		25		25		25		25		25		10		25		25		25	450	235	685
	Total	1,126	132	0	132	0	132	0	132	0	128	0	128	0	128	0	108	0	123	0	123	1,126	1,265	2,391
RPC Union Activites	5. Agro-Processing plan																							
	Packing factory (chickpea & pulse)											1,390	150		150		150		150		150	1,390	750	2,140
	wheat seed cleaning											800	98		98		98		98		98	800	490	1,290
	vegetable grading											640	150		150		150		150		150	640	750	1,390
	Total			0		0		0		0		2,830	398	0	398	0	398	0	398	0	398	2,830	1,990	4,820
	Total of PRC Union Activity	1,774	234	0	234	0	234	0	234	0	225	2,830	623	0	623	0	585	0	614	0	614	4,604	4,218	8,822
	(RPC 1 + RPC2)	2,008		234		234		234		225		3,453		623		585		614		614		**8,822**		

RPC Union Site 2 (Kuzaran)

	year	1		2		3		4		5		6		7		8		9		10		Total		
		Initial	OM	Initial	OM	Initial	OM	Initial	OM	Initial	OM	Initial	OM	Initial	OM	Initial	OM	Initial	OM	Initial	OM	Initial	OM	Total
RPC Activities	Office and Equipement (Kuzaran)	478	30		30		30		30		30		30		30		30		30		30	478	303	781
	1. Agricultural inputs plan	340	11		11		11		11		11		11		11		11		11		11	340	108	448
	2. Mechanization plan	308	29		29		29		29		29		29		29		29		29		29	308	288	596
	3.Extension and Training plan																							
	Advising by a PRC expert		24		24		24		24		24		24		24		24		24		24	0	240	240
	Training by Extension center		13		13		13		9		9		9		4		4		4		4	0	92	92
	4.Joint sales of product plan	450	25		25		25		25	0	25		25		25		10		25		25	450	235	685
	Total	1,126	132	0	132	0	132	0	132	0	128	0	128	0	128	0	108	0	123	0	123	1,126	1,265	2,391
RPC Union Activites	5. Agro-Processing plan																							
	Packing factory (chickpea & pulse)											1,390	150		150		150		150		150	1,390	750	2,140
	wheat seed cleaning											800	98		98		98		98		98	800	490	1,290
	Total	0		0		0		0		0		2,190	248	0	248	0	248	0	248	0	248	2,190	1,240	3,430
	Total of PRC Union Activity	1,774	234	0	234	0	234	0	234	0	225	2,190	473	0	473	0	435	0	464	0	464	3,964	3,468	7,432
	(RPC 1 + RPC2)	2,008		234		234		234		225		2,663		473		435		464		464		**7,432**		

3) Agricultural Extension System Improvement

The Site 1 has two extension centers. The investment cost is estimated to furnish the centers with office equipments and vehicles for extension activities at cost of Rls. 399 million.

The Site 2 has no extension center. So a part of the investment will be spent on building a new extension center at Zalou Ab with cost of Rls. 578 million. The second part, the investment cost is estimated on furnish the centers with office equipments and vehicles for extension activities at a cost of Rls. 600 million.

4) Ravansar canal irrigation system and management improvement

i) Left bank scheme main system improvement costs under MOE

The cost is summarized as follows:

Category	F/Year	Amount (million Rls.)	Contents of works
Expended	2000	3,480	5.3 km of concrete lined canal
	2001	1,900	2.4 km of concrete lined canal
	2002	2,720	3.3 km of concrete lined canal
	2003	2,000	3.6 km of concrete lined canal
Remains	Construction	6,500	2 km of main canal, & 17 km of secondary canals
	Design	800	
Total		17,400	

Source: KPWA, October 2003

i) Right bank main system rehabilitation cost

MOE is going to implement the right bank main irrigation system rehabilitation and the budget has been estimated by WRWA as follows:

Items	Estimation (million Rls.)
Renewal canal lining	1,000
Preparation & installation Measurement devices	30
Renewal gates of intakes	30
Other hydraulic structures	14
Total	1,074

Source: Utilization section of WRWA, July 2003

v) Land consolidation

It is estimated that the implementation costs will be Rls. 26,936 million for the left bank canal, Rls. 4,077 million for the right bank canal area, and Rls. 17,256 million for the Gharasu pump irrigation area. The total land consolidation cost including the dryland of Site 1 and Site 2 is estimated as Rls. 106,622 Million and Rls. 132,926 Million respectively.

(2) Operation and Maintenance Costs

1) Integrated Agriculture Development - The O&M cost for agriculture is mainly the production cost and cost of feed for the animal husbandry.
2) Farmers Organization Development - The O&M cost for each year is Rls. 135 million/year.
3) Agricultural Extension System Improvement - O&Ms costs of agricultural extension for Site 1 and Site 2 are Rls.847 Million and Rls.696 Million respectively.
4) Ravansar Canal Irrigation System and Management Improvement - O&M cost of irrigation system and the Gharasu River was estimated as following table;

(Unit: million Rls./year)

Name of system	Operation cost for every year	Maintenance cost for every year	Replacement cost every 10 years
Left Bank Canal	131	26	465
Right Bank Canal	91	6	356
Total	140	32	821
	172		

(3) Project Benefits

1) Integrated Agriculture Development

The tangible benefit of the Integrated Agriculture Development is expressed in the form of an aggregate net income from the increased produce from the project area, as they are resulted by the change of cropping patterns, more efficient mechanization with more intensive extension activities stipulated in the plan.

(Unit: million Rls.)

Area	Site 1			Site 2			Whole Project Area		
	Gross Income	Production Costs	Net Income	Gross Income	Production Costs	Net Income	Gross Income	Production Costs	Net Income
Present	27,132	7,180	19,952	39,227	11,054	28,173	66,359	18,234	48,125
3rd Year	40,677	12,132	28,545	51,837	16,816	35,021	92,514	28,948	63,566
5th Year	46,771	12,080	34,691	61,134	16,763	44,371	107,905	28,843	79,062
10th Year	58,482	11,993	46,489	73,260	16,676	56,584	131,742	28,669	103,073

The tangible benefit of the Integrated Agriculture Development from the dairy farming is derived from the increased volume of milk production, which will be twice as much as the present milking rate

2) Ravansar Irrigation and Management Improvement

Annual benefit from the Project is estimated at Rls. 0.18 million/ha, equivalent to the water fee collected by the Government.

6.7 Project Evaluation

(1) Economic and Financial Evaluation

Economic Evaluation

	With Sunk Cost			Without Sunk Costs	
	Site 1	Site 2	Total Project	Site 1	Total Project
Economic IRR	15.41%	15.69%	15.06%	16.93%	16.28%
NPV (10%) in mill. Rls.	72,166	68,682	141,448	106,876	142,528
B/C	1.33	1.26	1.27	1.38	1.31

Financial Evaluation

	With sunk costs			Without sunk costs	
	Site 1	Site 2	Total Project	Site 1	Total Project
Financial IRR	15.99%	16.08%	16.03%	19.31%	17.51%
NPV (17%) in mill. Rls.	-7,315	-5,108	-13,291	10,222	5,114
B/C	0.95	0.97	0.96	1.09	1.02

Financial Condition of Standard Farm Household

	Site 1		Site 2	
	Million Rls.	+%	Million Rls.	+%
At Present	32.4		28.8	
At 3rd Year	46.3	42%	35.8	24%
At 5th Year	56.3	74%	45.4	57%
At 10th Year	75.5	133%	57.9	101%

(2) Environmental Consideration

1) Based on the results of Initial Environmental Examination (IEE), it is concluded that Environmental Impact Assessment (EIA) is not necessary for implementing the development plans discussed in the Feasibility Study.

2) In regard to the natural environment, positive environmental impacts are highly significant, especially the development plans aim at the effective use of soil, water, and organic matter to perform sustainable agriculture, which maintains the natural circulatory system. Minor negative impacts can be solved by following proper measures.

3) In regard to social environment, substantial increase in farming income and standard of living will be achieved by implementing the development plans. However, proper measures are also necessary to avoid the conflicts within the villagers in the allotment of plots and distribution of water.

Chapter 7 Conclusions and Recommendations

7.1 Conclusions

The Project is chosen with high priority by integrating project/programs, which were selected among the required activities proposed in the master plan of the Agricultural Development in the Study Area. The Project consists of 4 major components; 1) Integrated agriculture development, 2) Farmers organization development, 3) Extension system improvement, and 4) Ravansar canal irrigation system and management improvement.

The agricultural development plan was prepared based on integrated farming of agriculture, livestock, apiculture, mechanization, horticulture and fishery. Integrated farming is essential for the effective use of land, water, and organic matter and to perform sustainable agriculture. Besides, through integrated farming, the farmer can attain a stable income by combining agriculture and other practices and can avoid the uncertainty of single practice in the region. The other components of the Project are also equally important since the successful implementation of the agricultural development depends on these components and there is a strong relationship and significant synergetic effect between each other.

Early implementation of the Project is strongly recommended in order to improve and stabilize the living standards of the farmers in the area through the improvement of their farming conditions by introducing integrated agricultural development. Furthermore, the Project is regarded as the pilot project of the region, and the early implementation of the Project is very important as a sustainable development model for the for the agriculture development of the area and the region.

7.2 Recommendations

(1) Participation of the Farmers in the Project

The proposed Project aims to achieve the sustainable agriculture development, and the main actors of the Project are the farmers of the area. In the case of agricultural and infrastructure development project, the positive participation of the farmers in the Project is indispensable for the successful operation and maintenance of the Project. Farmers involvement is highly critical for the farmers organization development, which is one of the main components of the project.

(2) Agriculture Development Plan

To succeed in the implementation of the plan, it is required to support of various organizations, such as Ministry of Jihad-e-Agriculture in Tehran, National Research organization, Agricultural Research Center in Kermanshah, KJAO, Provincial Agricultural organization, Extension Service Centers, Agriculture Bank, Private Companies, etc., especially in early stage of commencement.

The problems in the early stages of implementation need to be overcome and the following technologies should be introduced.

1) Suitable method of compost production for the study area
2) Suitable method of silage making for the study area
3) Simple drying facility of grains (maize, wheat, barley, etc.)
4) Planning of annual farm work schedule and personnel management of operators in suppliers of farm machinery

(3) Farmers Organization

1) Mainstreaming the Importance of RPC Promotions in KJAO - In promoting RPCs in the Study Area, training the concerning personnel in KJAO is necessary to familiarize the idea of RPCs and how it should be informed to the farmers in the study area. In addition to appointing a RPC expert at the extension centers in Dehestan, there should be at least one expert in the district office who is responsible for the RPC affairs in the district.

2) Development of Model RPCs in Kermanshah - KJAO needs to give adequate technical and financial supports to establish the model RPCs. The development of model RPCs should be promoted together with restructuring agricultural centers, for which Kermanshah Province in selected as a model province.

(4) Improvement of Ravansar Irrigation System and Irrigation Management Plan

1) Improvement of Irrigation Management - It is recommended that the administration shall adapt official permission rule for irrigation agriculture referring to availability of water for irrigation and land conditions.

2) Strengthening of WUC as a Pilot Project of the Irrigation Management - It is better to assist the farmers to provide a model WUC in the area. WUCs of the Right Bank and Left Bank can be good references to both farmers and the Government.

3) Measures to Activate Government Organizations - It is necessary to examine the possible ways to activate the movement of the government organizations such as increasing occasions to exchange opinions among relevant organizations.

4) Early Completion of Right and Left Bank Main Irrigation System - Early completion of the right and left bank main irrigation is necessary in order to implement the different cropping patterns proposed in the agricultural development plan.

(5) Environmental Monitoring and Management System

An environmental monitoring and management system shall be established to monitor the project's environmental impacts on the project area and the surrounding areas, aiming at adequately protecting the environment both during and after the project implementation. EMMS should include suitable environmental monitoring and management measures to avoid or mitigate potential adverse impacts. Kermanshah Provincial Directorate of Environment and Kermanshah Province Jiahd-e-Agriculture Organization shall coordinate together in establishing EMMS for the Province.

(6) Kilanbar and Gharab Dam and Irrigation Projects

1) Necessity of Additional Hydrological Information - It is impossible to make an accurate estimation without observed records on the rainfall and river discharge near the dam site, which is considered as the most important problem of the proposed Kilanbar and Gharab dam.

2) Requirement of Environmental Impact Assessment - Studies were conducted by Jihad-e-Agriculture Organization to verify the possibility of implementing Kilanbar Dam and Gharab Dam. MOE is now conducting the Study on Kilanbar Dam and if it will be implemented, then EIA should be conducted, since the proposed dam heights are higher than the EIA standard height of 15 m.

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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
EC	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, hh	Household
HP	Horse power
H-Q	(water) height-(discharge) quantity
IBRD	International Bank for Reconstruction and Development (World Bank)
ICA	International 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
JCO	Javanrud cooperative office
JICA	Japan International Cooperation Agency
KARC	Agricultural and Natural Resource Research Center in the Kermanshah
KCO	Kermanshah Cooperative 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
SCF	Standard Conversion Factor
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
WMD	Watershed Management Department
WMFRO	Watershed Management, Forest and Range Organization
WRWA	Western Region Water Affairs of MOE
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
cm^2	square centimeter
dS/m	deci Siemens per meter= mS/cm = 1,000 micro 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
km^2	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
m^2	square meter
m^3	cubic meter
m^3/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

Chapter 1 Introduction

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Islamic Republic of Iran (hereinafter referred to as "Iran") is currently in the midst of a major process of economic re-organization, and important evolution of its social and institutional system. Since the election of President Khatami in 1997, Iran has been undergoing a significant evolution, both internally and in its external relations.

The share of agriculture in total employment is 22.8%, and 11.4% in GDP, and contributes for 23% of total export except petroleum (January, 2001). However, under the severe natural conditions, the agricultural production has not been able to catch up with the population increase, resulting in low self-sufficiency rates of wheat (60%) and rice (67%) in 2001.

Kermanshah Province is located at the western flank of Zagros Mountains in the mid-west of Iran. The plateau areas with relatively good natural conditions are widely spread in the province with an annual precipitation of 500 mm, mainly due to snow and rainfall during the winter. These conditions make the region advantageous for agricultural production. Under these favorable conditions, the Kermanshah Province has implemented projects for construction/rehabilitation of irrigation facilities and other agricultural development projects during the last decade. However, the major concerns in the Kurdish territory, especially aging and shrinking of population in rural areas, effects of Iran-Iraq war and other socioeconomic constraints have hindered these projects to generate considerable achievements. Therefore, planning and implementation of sustainable agriculture and rural development projects are necessary based on the analysis of existing constraints and formulation of suitable action plans.

The Ministry of Jihad-e-Agriculture (hereinafter referred to as "MOJA") and Kermanshah Province Jihad-e-Agriculture Organization (hereinafter referred to as "KJAO") intended to study the improvement of irrigation and drainage system by the participation of farmers in the area. However, there are many technical issues to be addressed such as appropriate planning and designing of canals, sustainable farming method considering water management of the area and these issues should be planned with participatory approach to make the farmers more actively involved in the project and to strengthen the farmers' organization for operation and maintenance of infrastructure facilities.

Under these circumstances, the Government of the Islamic Republic of Iran (hereinafter referred to as "GOI") made a request to the Government of Japan (hereinafter referred to as "GOJ") and GOJ decided to conduct the Study in accordance with relevant laws and regulations in force in Japan. Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for implementation of technical cooperation programs of GOJ, dispatched a Preparatory Study Team to Iran from March 7 to March 18, 2002 for the purpose of discussing and confirming the Scope of Works (S/W) for the Study on Gharasu River Basin Agricultural Infrastructure Development Project (hereinafter referred to as "the Study". As a result of the discussions, the GOI, represented by the Ministry of Jihad-e-Agriculture (MOJA) and other relevant organizations, and the JICA Preparatory Team agreed on the S/W for the Study on March 16, 2002. Based on the S/W, the JICA Study Team, headed by Mr. Matsumoto Keiji of Pacific Consultants International (PCI) carried out the Study in Iran from January 11, 2003 to December 23, 2003.

1.2 Objectives and Scope of the Study

1.2.1 Objectives of the Study

The Study has the following two major objectives:

1) To study the feasibility of the improvement of irrigation, drainage and of agricultural development by the participation of farmers in the area selected from the study area, and
2) To carry out technical transfer to the Iranian counterpart personnel through on-the-job training in the course of the Study.

1.2.2 Study Area

The Study Area, which is located at the north-west of Kermanshah city, covers an area of approximately 14,000 ha. It is divided into two parts including Site 1 (4,500 ha), which is located along the Gharasu River on the eastern part of the Study Area, and Site 2 (9,500 ha), which is bordered by the Khurkuh River on the east and foot of the mountains on the west. (refer to the Location Map)

1.2.3 Scope of the Study

The Study is carried out in 2 Phases. The division and the Study contents of each phase are listed below:

(1) Phase I – Field Survey of the Study Area, Selection of Priority Areas (December 2002 to March 2003)

1) Preparation Work in Japan (December 2002)

- Explanation and Discussion of the Inception Report
- Collection and Analysis of Existing Data and Information

2) First Field Survey in Iran (January 2003 to March 2003)

- Explanation and discussion of the Inception Report
- Collection and analysis of existing data and information including hydrology, meteorology, irrigation and drainage systems and the facilities, land use, range land, cropping pattern, farming (agronomy, horticulture, animal husbandry, fishery and bee keeping), extension, training and watershed conditions, etc.
- Conduct surveys such as hydrology, soil, agriculture, regional economy, rural community and water quality
- Clarification of problems and constraints of the Study Area and elaboration of basic concept of agricultural development
- Initial Environmental Examination (IEE)
- Selection of the priority areas for F/S
- Preparation and discussion of the Progress Report (1)

(2) Phase II – Feasibility Study (April 2003 to February 2004)

1) First Work in Japan (April 2003)

- Elaboration of the basic concept of the agricultural development
- Preparation of the Interim Report

2) Second Field Survey in Iran (May 2003 to October 2003)

- Explanation and discussion of the Interim Report
- Topographic and cadastral survey
- Rural community and marketing survey
- Preparation of the feasibility study for the priority areas including integrated agricultural development plan, farmers organization development plan, agricultural extension system improvement plan, improvement plan of Ravansar irrigation management and on-farm water management, watershed management, implementation plan and estimation of project costs, benefits and project evaluation including environmental consideration
- Preparation and discussion of the Progress Report (2)

3) Second Work in Japan (November 2003)

- Final confirmation of the feasibility study for the priority area and recommendations for the agricultural development of the priority area, and
- Preparation of the Draft Final Report

4) Third Field Survey in Iran (December 2003)

- Explanation and discussion of the Draft Final Report

5) Third Work in Japan (January 2004)

- Preparation of the Final Report

Work Items of the Study are mentioned in Table 1.2.1.

1.3 Counterparts of the Study and the Steering Committee

1.3.1 Counterparts of the Study

The counterpart agency for the Study is Kermanshah Jihad-e-Agriculture Organization (KJAO) of the Ministry of Agriculture. The counterpart agency appointed the counterparts for JICA Study Team from KJAO, Kermanshah provincial directorate of environment and Kermanshah Water Resources Organization (KEO) of the Ministry of Energy. The Study Team was provided with office space in the Watershed Management Office of KJAO in Kermanshah.

1.3.2 Steering Committee

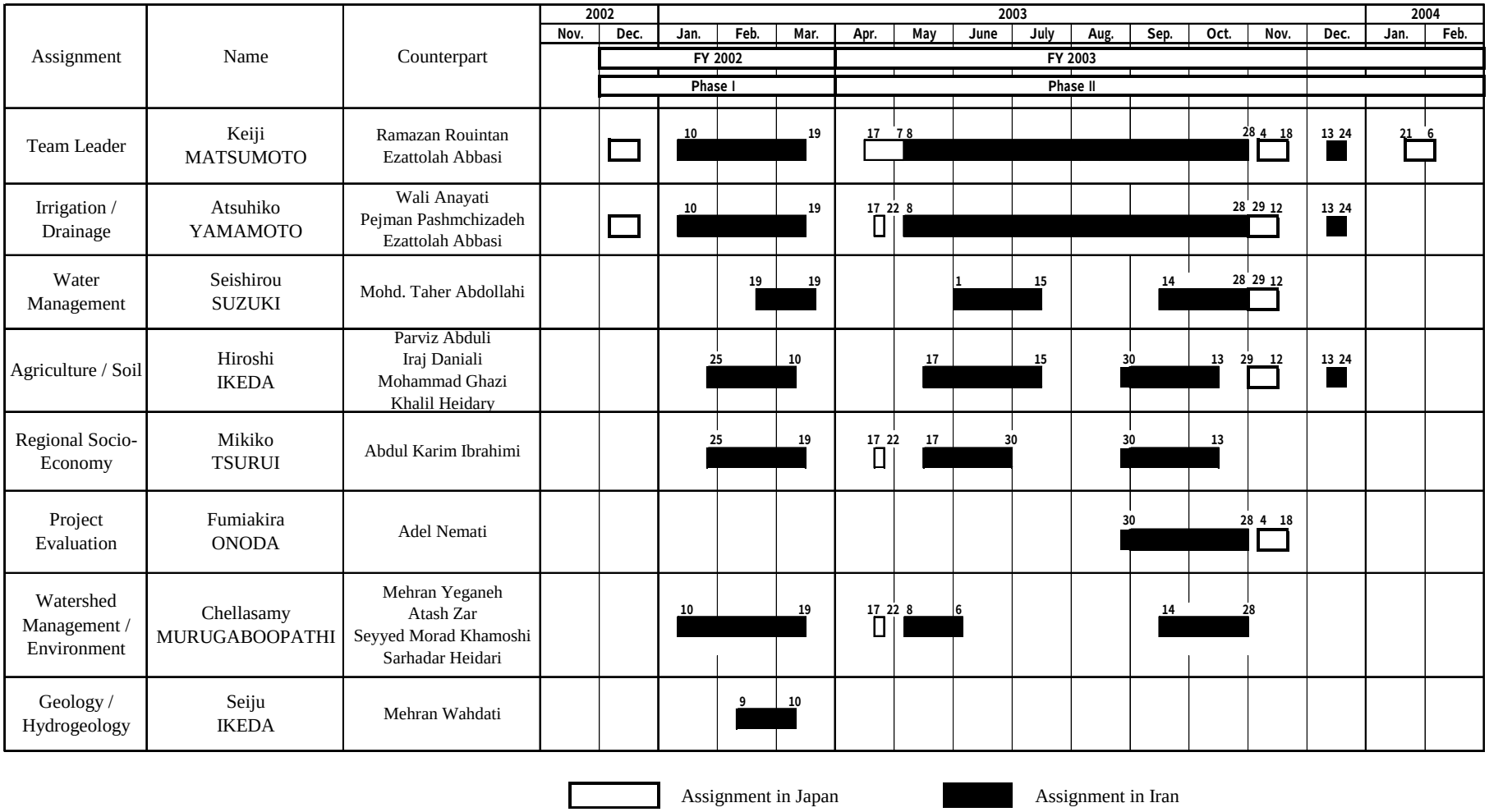
As agreed in the Minutes of Meeting (M/M) of S/W, steering committees were organized at the national level and at the provincial level, comprising of the following representative of related organizations, for the smooth and effective implementation of the Study in terms of technical and administrative aspects:

National level Committee	Provincial Level Committee
✧ Ministry of Jihad-e-Agriculture ✧ Ministry of Energy ✧ Environment Department	✧ Kermanshah Jihad-e-Agriculture Organization ✧ Kermanshah Water Supply General Office ✧ Kermanshah Provincial Directorate of Environment ✧ Kermanshah Provincial Government
✧ Embassy of Japan ✧ JICA Expert	
✧ JICA Study Team	

Table 1.2.1 Work Items of the Study

Phase		Item	Study Item
Phase - I	Preparation Work in Japan	【1】	Study and Analysis of Existing Data and Information
		【2】	Preparation of Inception Report
	1st Field Survey in Iran	【3】	Explanation and Discussion of the Inception Report
		【4】	Establishing Collaboration for the Study at the Federal and Provincial Level
		【5】	Preparation and Discussion on the Technical Transfer
		【6】	Collection and Analysis of Existing Data and Information
		【7】	Meteorological / Hydrological Survey
		【8】	Soil Survey
		【9】	Water Quality Survey
		【10】	Regional Economy Survey, Regional / National Marketing Survey
		【11】	Rural Community Survey
		【12】	Clarification of problems and potentials of the Study Area and establishment of basic concept of agricultural development
		【13】	Initial Environmental Examination (IEE)
		【14】	Selection of Priority Areas for F/S
		【15】	Preparation and Discussion of the Progress Report (1)
Phase - II	1st Work in Japan	【16】	Evaluation of the Possibilities of Agricultural Development and Finalization of Priority Areas for F/S
		【17】	Preparation of the Interim Report
	2nd Field Survey in Iran	【18】	Explanation and Discussion of the Interim Report
		【19】	Preparation of Topographic Map
		【21】	Natural Environment Survey
		【22】	Rural Community Survey& Marketing Survey
		【23】	Preparation of Project Plan for the Priority Areas
		【24】	Preparation and Discussion of the Progress Report (2)
	2nd Work in Japan	【25】	Final Confirmation of the Possibilities Agricultural Development and the Project Plan for the Priority Areas
		【26】	Preparation of the Draft Final Report
	3rd Field Survey in Iran	【27】	Explanation and Discussion of the Draft Final Report
	3rd Work in Japan	【28】	Preparation of the Final Report

Fig . 1.2.1 Staffing Schedule



Chapter 2 Background of the Study

CHAPTER 2
BACKGROUND OF THE STUDY

2.1 Brief Description of Iran

2.1.1 Natural Conditions

(1) Topography

Islamic Republic of Iran is one of the largest Middle East countries with an area of 1.65 million km^2 and an estimated population of 65 million as of 2001. It is bordered by Azerbaijan, the Caspian Sea and Turkmenistan to the north, Afghanistan and Pakistan to the east, the Gulf of Oman and the Persian Gulf to the south, and Iraq and Turkey to the west.

About 52 % of the country consists of mountains and deserts and 16% of the area has an elevation of more than 2 000 m a.m.s.l[1]. Its topographic frame consists of two major mountain ranges of the Elbourz Mountains and Zagros Mountains. The Elbourz Mountains stretches to the south by the Caspian Sea, from Turkey to Afghanistan, along the northern country territory. Zagros Mountains stretches to the South-East direction to the Pakistan border, which seems as a high rugged wall along the southern country border. Both mountains have heights from about 3,000 to 4,000m a.m.s.l, and form a primary frame of the country.

The Central or Interior Plateau is located in between these mountain chains and covers over 50% of the country. It is partly covered by a remarkable salt swamp (kavir) and partly by areas of loose sand or stones with stretches of better land near the foothills of the surrounding mountains. The lowest elevation of the country is the sea front of the Caspian Sea with –28m and the highest point is Qolleh-ye Damavand with an elevation of 5,671 m.

The width of Zagros Mountains widens, while going to the east and increasing number of highland plains among the mountains. Commonly, the mountain range is divided into Western Zagros, Central Zagros and Eastern Zagros. The Study Area is one of those discontinuous highland plains in the western side of the Central Zagros.

Such dynamic geographical conditions are generating a well diversified climatological conditions all over the country. It is believed that the condition of well-diversified ecosystem of Iran is caused by such background, which results in many original species of fauna and flora.

(2) Climate

The climate of Iran is classified into 4 types, namely, the continental climate of the plateau areas of the Elbourz 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 areas, there are many fertile basins, and the climate is dry and cold in winter and hot in summer. The climate of the coastal region of the Caspian Sea is mild and the precipitation is relatively high. The climate of the coastal region of the Persian Gulf is oppressively hot and humid under the influence of warm sea of the gulf and strong sunlight.

[1] above mean sea level

The two vast deserts, which lie from the central part to the eastern part of the Iran have an intense heat and a long period of dry season.

In general, the climate of Iran is one of the great extremes due to its geographic location and varied topography. The summer is extremely hot with temperatures in the interior rising much higher. In winter, however, the great altitude of much of the country and its continental situation result in far lower temperatures. Minus 30°C can be recorded in the north-west and minus 20°C is common in many places.

Annual rainfall ranges from less than 50 mm in the deserts to more than 1600 mm on the Caspian Plain. The average annual rainfall is 252 mm and approximately 90% of the country is arid or semiarid. Overall, about two-thirds of the country receives less than 250 mm of rainfall per year.

(3) Water Resources

Iran can be divided into the following major river basins: the Central Plateau in the middle, Lake Orumieh basin in the north-west, the Persian Gulf and the Gulf of Oman in the west and south, Lake Hamoun basin in the east, Kara-Kum basin in the north-east and the Caspian Sea basin in the north. With an area of 424,240 km², the Caspian Sea is the largest landlocked water body in the world and its surface lies about 22 m below sea level. The rainfall characteristics of the above basins are summarized in the table shown below.

Rainfall in the Major Basins in Iran

Basin	Total area (km²)	As % of total area	Rainfall (mm/year)	Rainfall (MCM/year)	As % of total rainfall
Central Plateau	832,000	51	165	138	33
Persian Gulf and Gulf of Oman	431,000	26	366	158	38
Caspian Sea	178,000	11	430	77	19
Lake Hamoun and Kara-Kum	150,000	9	142	21	5
Lake Orumieh	57,000	3	370	21	5
Total	1,648,000	100	252	415	100

All these basins, except the Persian Gulf and Gulf of Oman, are interior basins. There are several large rivers of which the Karun River is the only navigable river and the other rivers are too steep and irregular. The Karun River, with a total length of 890 km, flows in the south-west of the country to the Shatt-El-Arab, which is formed by the Euphrates and the Tigris after their confluence.

Internal renewable water resources are estimated at 128.5 MCM/year. Surface runoff represents a total of 97.3 MCM/year, of which 5.4 MCM/year comes from drainage of the aquifers, and groundwater recharge is estimated at about 49.3 MCM/year, of which 12.7 MCM/year is obtained from infiltration in the river bed. The total safe yield of groundwater (including non renewable water or unknown groundwater inflow from other countries) has been estimated at 49.3 MCM/year. The total agricultural, domestic and industrial water withdrawal was estimated at about 70 MCM in 1993 (of which 91.6% is used for agricultural purpose, 6.3% for domestic use and 2.1% for industrial use). Although this is equal to 51% of the actual available renewal water resource.

(4) Irrigation and Drainage

The problem of water supply has been a constant issue since the beginning of the country's history, thousands of years ago. Its inhabitants learnt to design and implement efficient techniques for harnessing limited water resources and for irrigation. Apart from the qanat, which was a major source of irrigation and domestic water supply for centuries, Iranians have in the past built various types of dams and weirs.

Agricultural land availability is not a major constraint in the development of Iranian agriculture. The major constraint is the availability of water for the development of these lands. The irrigation potential, based on land and water resources, has been estimated at about 15 million ha, or 29% of the cultivable area.

In general, the irrigation efficiency is rather low at the national level. Major causes of inefficiency include: operation without enough care, poor maintenance, negligible water prices, fragmentation of responsibilities among different governmental agencies and inadequate training of farmers. Low irrigation efficiency causes water logging and salinization in the irrigated areas, which are major problems in Iran.

By far the most important irrigated crop is wheat covering almost one-third of the total irrigated area, followed by irrigated fruit trees, covering one fifth of the total area. Other major irrigated crops are barley, rice, vegetables and nurses Wheat is also by far the most important rainfed crop covering 4.47 million ha, or almost two-thirds of the rainfed area.

(5) Institutions Related to Water Resources

According to the water legislation, MOE and MOJA are in charge of water resources assessment and development.

The Ministry of Energy (MOE) has two responsibilities: energy supplies and water resources. In the field of irrigation, it is in charge of the construction of large hydraulic works, including dams and primary and secondary irrigation and drainage canals for the distribution of water. Within MOE, the Water Affairs Department (WAD) is responsible for coordinating, planning, development, management and conservation of water resources. Fourteen publicly owned Regional Water Authorities (RWA), reporting directly to MOE, are responsible for feasibility studies, project execution and subsequent management. The operation and maintenance of primary and secondary irrigation and drainage canals are operated by operation and maintenance corporations affiliated to MOE. Organization chart of MOE is shown in Fig. 2.1.1.

The Ministry of Jihad-e-Agriculture (MOJA) is responsible for supervising rainfed and irrigated crop development. It is in charge of subsurface drains, tertiary and quaternary canals as well as on-farm development and irrigation techniques, planned and operated by the Provincial Agricultural Organizations and the Deputy Ministry for Infrastructure Affairs of the Ministry of Agriculture. It also deals with watershed management and rural development. Organization chart of MOJA is shown in Fig. 2.1.1.

(6) Trends in Water Resources Management

At present, a big gap exists between water delivery from the main canals and water application in the field. Compared to the large investments for water resources development, little has been done to improve irrigation water use at farm level. Water is delivered to old

traditional irrigation canals and on-farm conveyance and the use of irrigation water is generally rudimentary and wasteful. The use of earth bunds, unlined canals and poor leveling combined with low water charges have resulted in very low levels of water conveyance and use efficiencies (30% as a national average) and caused serious drainage problems.

A fundamental review of the organization and institutional changes were made to improve this situation. Since 1992, the Deputy Ministry for Infrastructure Affairs of the Ministry of Agriculture created five departments: farm development, pressurized irrigation systems, water supply, hydraulic constructions and operation and maintenance.

The Government policy includes:

- an increase in irrigation efficiency by changing the surface irrigation techniques to pressurized irrigation
- the establishment of a land Bank to provide loans for on-farm development projects
- a change in water pricing and delivery methods
- large-scale privatization.

2.1.2 Social Conditions

(1) General

Since the Revolution in 1979, the government of Iran has been giving 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 decade, 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)

(2) Population and Ethnic Group

According to the population census in 1996, Iran's population is 60.05 million. The annual population growth had declined from 2.2% in 1990 to 1.4% in 1997. The majority of the population is Persian (51%). Other ethnic groups include Azeri-Turkish (24%), Gilaki and Mazandarai and Baluchi (8%), Kurd (7%), Arab (3%), Lur (2%), Baloh (2%), Turkmen (2%) and others (1%). The official language is Persian. Besides Persian, people speak languages including Turk, Kurdish, Luri, Balochi, Arabic and Turkish (CIS, 2001).

(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 collage 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 and gross enrollment ratios are now nearly 100%. The Ministry announced that nearly 18.5 million students were registered for elementary and secondary schools during the academic year 2001(1379-80). The remaining problems are that there are gaps in the attainment in education between urban and rural, and between boys and girls. However, as far as girls' education is concerned, the gross secondary enrolment ratio of female students increased from 55 % in 1990 to 77% in 1997, despite the fact that male students have more opportunities to proceed to higher education.

(4) Health

In recent years, as a result of the improvement in health administration both in urban and rural areas, Iran experienced the remarkable decrease of traditional contagious diseases, such as such as influenza, and conjunctivitis. The number of doctors is estimated to be about 60,000 in year 2000 which makes the ratio of patients to doctors as 1,250:1. The regional distribution of medical personnel was uneven and there is a tendency for excessive number of doctors in the urban areas. As a result of the improved public health services, life expectancy in Iran rised from 61.1 years in 1988 to 69.5 years by 1997. Infant morally fell from 47 per 1,000 live births to 26 between 1990 and 1997. Likewise, the number of deaths from diarrhea declined from 10.5 per 1,000 children under five in 1989 to 3.4 in 1997.

(5) 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 as 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. In 2000, 3.4 % seats of the parliament were occupied by female members, while 9.4 % in government at ministerial level[2]. In the educational domain, there was a movement concerning the segregation of schools for boys and girls. Many

[2] 'Human Development Report of Islamic Republic of Iran', UN (United Nations) and Islamic Republic of Iran.

university engineering and arts courses were closed to women at a time. The Culture and higher Education Ministry lifted these restrictions in May 1989.

(6) Religion

The national religion of Iran is Shiite with twelve Imams. Shiism was first developed and spread among Iranians, but gradually extended all over the Muslim world. Most of the Muslims today are Sunnis or the 'people of the Prophet's tradition'. To the Sunnis Abu Bakr is the first successor to the Holy Prophet and to the Shias it is Imam Ali. To the former, their leader of the Muslims, the caliph is a temporal power, while to the latter, it is the Imam who holds the spiritual powers. Despite such differences, the Shaias and Sunnies agree on the basis of Islam.

About 60 million or 99% of the total population of Iran are Muslims (Shiite-89% and Sunni-10%). Apart from the majority of Muslims, there are other religions spread over the country such as Zoroastrianism which came into Iran before Islam. There are also minority of Christians and Jews. The non-Muslim Iranians also enjoy religious freedom while they are expected to observe Islamic codes of public conduct.

(7) Poverty Reduction

A poverty study undertaken by the Government showed 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 has an extensive social safety net and transfer system that reaches a large number of the poor. Half of the poor, about 4.5 million persons or 1.47 million households, benefit from social coverage by government social safety net programs, charity institutions, and other non-profit organizations. These programs include direct cash transfers, housing provision, education scholarships, and health and social security coverage. In particular, targeting and reaching the poor is made possible in Iran through the network of mosques, and other non-governmental institutions.

2.1.3 Economic Conditions

(1) Third Five Year Development Plan

In Islamic Republic of Iran, the Socio-Economic and Cultural Development Plan for 5 years has been planned based on the Article 123 of the Constitution. The Third Five-year Development Program (FYDP) (2000-2004) contains articles, policies, and guidelines covering 26 sectoral and intrasectoral areas and provide a comprehensive framework for resolving structural impediments and economic difficulties during the Plan period. The core element of the general policy framework of the Plan are as follows:

1) The "High Council of Administrative" will be established in order to reform administrative system and human resources management.
2) The financial position of all public enterprises will be assessed with the aim of either liquidating, privatizing, merging or restructuring them.
3) "State Tax Affairs Organization" will be established as a public institution under the supervision of the Ministry of Economic and Financial Affairs with the objective of improving the efficiency of the tax system.

4) "Oil Stabilization Fund" will be created for reducing budget reliance on oil revenue and ensuring the sustainability and preservation of national wealth.
5) The net increase in scheduled banking facilities will be reduced by 10 percent on an annual basis, taking 1378 approved figure as the benchmark. Government's support for economic support for economic activities in the form of preferential lending rates and loan repayment guarantees will become transparent and taken care of within the government's annual budgets.
6) The amount of official external obligations will be regulated, so that net present value of these obligations will not exceed US$ 25 billion and debt service ratio (excluding buy-back agreement) will not exceed 30 percent of government foreign exchange receipts at the five year of the Plan period.
7) Government will issue upto Rls. 5,000 billion specific participation papers for recapitalization of the banks. The proceeds from the sale of these papers will be used for strengthening financial position and government capital investment of the undercapitalized banks.
8) The Central Bank will prepare the condition for the operation of private banks and private non-bank credit institutions.
9) The government is authorized to extend facilities to investors who participate in job creating plans and small-scale industries in proportion to their financial contributions in projects.
10) In order to achieve the export targets during the 3rd FYDP;
    a) The customs duties and tariff of imported raw material and intermediate goods used in production of exportable goods will be refunded after export of goods.
    b) The exported goods and services are exempted from any tax and levy.
    c) The export goods and services are exempted from any permits except the mandatory standards and the certificates commonly applicable in international trades.
    d) In order to promote the export of non-oil commodities and technical and engineering services, a portion of surplus revenue received from oil exports will be allocated to increase the working capital of Export Development Bank.
11) The government is required to remove the non-tariff barriers, in order to promote foreign trade.
12) In order to design export strategies and determine the facilities to extended to export sector, the High Council of Non—oil Export Promotion will be established under the chairmanship of the President

Quantitative targets in 3rd FYDP are set as follows:

(% change)

	2000/01	2001/02	2002/03	2003/04	2004/05	Annual Average
GDP	4.5	5.5	6.5	6.7	6.8	6.0
Non-oil/Gas DGP	5.9	7.0	7.2	6.8	7.1	6.8
Total investment	6.0	6.9	7.3	7.8	7.9	7.1
Private	6.1	9.5	9.7	9.6	7.6	8.5
Public	5.6	2.8	3.3	4.7	8.4	5.0
Private consumption expenditures	3.3	3.4	3.5	3.6	3.7	3.5
Public consumption expenditures	6.1	0.3	1.5	3.5	1.9	2.5
Liquidity (M2)	20.8	18.0	15.7	14.2	13.1	16.4
Inflation	19.9	17.4	15.3	14.0	13.0	15.9

(2) 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 at 16.8% compared with GDP 2000/01. Iran indicated the highest GDP per capita US$ 3,676 in 1983. But IMF estimated the GDP (current prices) per capita in 2001 at US$ 1,753.

In Iran, the GDP is divided into the petroleum and non-petroleum sectors. The petroleum sector shows a high fluctuation according to the international crude oil price. Among the sectors, major share contribution of the GDP is the tertiary sector with about 50%, which is followed by secondary and the primary sector. The share of contribution of each sector and annual inflation rates are shown in following tables.

Share of Contribution to the GDP by Sector (%)

Sectors	1998/99	1999/00	2000/01	2001/02
Petroleum	8.7	14.7	17.8	15.2
Non-petroleum	91.3	85.3	82.2	84.8
Primary	17.3	14.9	13.6	13.4
Secondary	68.7	19.1	19.0	20.1
Tertiary	54.8	51.4	49.6	51.2
Total	100.0	100.0	100.0	100.0

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

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

(3) Export and Import

Due to the share of the crude oil and the natural gas is prominent with 85% in the trade, the trade balance depends on its prices. The trend of trade balance and trends of external debt are shown in following tables;

Trend of Trade Balances (Unit: US$ million)

	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02
Trade Balance	7,402	4,258	-1,168	7,597	13,375	5,775
Export	22,391	18,381	13,118	21,030	28,461	23,904
Petroleum and Natural gas	19,271 (86.1%)	15,471 (84.2%)	9,933 (75.7%)	17,089 (81.3%)	24,280 (85.5%)	19,339 (80.9%)
Non- Petroleum	3,120 (13.9%)	2,910 (15.8%)	3,185 (24.3%)	3,941 (18.7%)	4,181 (14.5%)	4,565 (19.1%)
Import	14,989	14,123	14,286	13,433	15,086	18,129

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

Trend of External Det

	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02
External Debt	16,835	12,117	13,999	10,357	7,953	7,214
Short term	4,557	3,289	4,503	3,618	3,678	2,652
Medium and Long team	12,278	8,828	9,496	6,739	4,275	4,562

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

2.1.4 Agriculture and Animal Husbandry

Iranian agriculture is characterized by extensive arable land, diverse climatic conditions, a growing rural population, and a growing work force during the growth and development of the sector. The 4 types of climate and 12,000 different varieties of flora enable the country to produce a wide range of temperate, subtropical and tropical crops. Equally importantly, there is often a temperature difference of 40 – 50 degrees centigrade at any one time between some areas, which makes it possible to produce, a variety of crops throughout the year. Owing to ample sunshine (an average of 300 days, excluding the Caspian Coastal region) the agricultural products, especially garden produce, are of high quality as regards color, texture and taste (Keshavarz, 2000).

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.

(1) Agriculture in Iran

Agriculture is an important sector in Iranian economy providing about 24% of the GDP from 1995 to 2000, and 22.2% of the population engaged in agriculture as per the census of 1996. In 2000 (Iranian year 1379), 12.34 million ha of agricultural land, equal to 7.49% of the total area of the Islamic Republic of Iran, was cultivated. And 10.27 million ha namely 83.23% of total agricultural land under cultivation was allocated to annual agricultural products, and the rest (16.77%) to permanent ones respectively.

In 2000, 53.97% and 46.03% of the total cultivated area of the country was allocated to irrigated and rainfed land respectively. The country's total annual production in 2000 stood at 44.71 million tons, out of which 39.97 million tons i.e. 89.4% of the total products gained from irrigated lands, whereas the rain-fed products amounted to 4.74 million tons i.e. 10.6% of the total agricultural products.

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 54% and 46% of the total cultivated land respectively. It is noteworthy that 10.36 million tons of cereals i.e. 80.5% of the total cereals yield was attained from irrigated area and 2.51 million tons i.e. 19.5% of the country's total agricultural products was produced in rain-fed area. 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) Pulses

An area of 1,015,000 ha i.e. 9.89% of total lands under cultivation was specified to pulses 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 pulses 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 pulses 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) 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.

6) 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.

7) Self-sufficiency of agricultural products

Self-sufficiency rates of main crops in Iran from 1992 to 1999 are shown in the following table. The crops with a self-sufficiency rate of above 100% have been exported. The rates of wheat and barley were 58.5% and 69.7% in 1999. The self-sufficiency rate of wheat was 82.5% in 1994, and the rate has gradually decreased since 1995. It is necessary to recovery the self-sufficiency rate of wheat of the staple food in Iran.

Self-sufficiency rates of main crops (%, 2000)

Year	Wheat	Rice	Pulses	Potatoes	Onions
1992	80.6	71.5	107.2	100.3	105.8
1993	81.5	66.4	121.3	100.9	101.5
1994	82.5	82.4	106.1	103.4	109.5
1995	72.3	66.7	100.5	100.1	102.0
1996	72.4	74.6	104.1	100.1	100.0
1997	62.8	78.7	127.4	102.6	106.8
1998	77.2	81.4	116.0	101.7	111.0
1999	58.5	69.7	101.9	101.4	105.1

(2) Animal husbandry

The livestock and meat production in Iran are in the following table. According to the following Table, 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.

Livestock 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

2.1.5 Present Conditions of Farmers Organization

(1) Basic Government Policy of Farmers Organization

Development of Farmers Organization is one of the priorities in the agriculture sector of Iran.

The Chapter 13, Article 109 E, of 'the Third Socio-Economic and Cultural Development Plan of the Islamic Republic of Iran', envisages that in order to achieve the maximum growth for the water and agriculture sector, the priority shall be given ' *to support the establishment of Agricultural Production Cooperatives and formation of entities for water, soil and natural resources utilization*'. It explicates the need of joint action by farmers through the Farmers' organizations such as the RPC to improve the management and utilization of water resources for agriculture such as stream water, irrigation network, deep well and so on. There are three type of farmers' organization such as Rural Cooperative Organization (RCO) and Rural Production Cooperative (RPC) which are under the control of MOJA, and Cooperative which is under the control of MOC.

(2) Rural Cooperative Organization (RCO)

1) Background

The Rural Cooperative Organization (RCO) was formed in 1963, with objectives of promoting economic and commercial services for the farmers through the cooperatives. Prior to the establishment of RCO, as a result of the enforcement of Land Reform Law in 1961 and the feudal massive lands were divided between farmers who used to work in their land. I this context, the formation of RCOs in rural areas was applied to replace the vacancy of the former management of feudalism. The activities of the RCO in earlier time were mainly the rural credit, joint sales and purchase and the common use of agricultural machineries and storages. These services were limited to the small farmers who gained their land after the Land Reform in 1961 but it was made available to all the farmers living in the covered area after the Islamic Revolution in 1979/80.

2) Organization structure

The Head Quarter of RCO is in Tehran. Central Organization for Rural Cooperative of Iran (CORC) is a competent authority of RCO. The primary capital of the RCO was provided by the Ministry of Jihad-e-Agriculture at establishment, but 22 % of the shares have been transferred to the Unions of RCO by now and more will be done in the near future. 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. 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.

3) Activities of RCO

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.

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.

4) Membership conditions

The criteria to be a member are 1) engaged in agriculture-related works including farming, animal husbandry, agricultural machinery operation, and agricultural industries, 2) living in the village covered by the RCO and 3) purchasing minimum one share (Rls. 10,000). Some of the activities such as distributing agricultural inputs or daily products are also available for the non-members in the covered villages. However, only members are eligible for taking credits, receiving dividends of the shares if the RCO has profits.

(3) Rural Production Cooperative (RPC)

1) Background

The RPC, formerly known as the Agriculture Companies were first introduction 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 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.

After the second Land Reform following the Islamic Revolution in 1979, the operation of the Company was abolished by the new Government which had a strong emphasis on the individual property rights. While the land was allocated to small or landless farmers after the Land Reform, the main problem was the sub-division of lands and inefficient operation of agriculture. In 1990 the Ministry of Agriculture understood the necessity for establishing economic formations in the field of agriculture and correct land uses and formulating the necessary organizations in this regard. The government thus revived the operation of the Company in the name of Rural Productive Cooperatives (RPCs). By the year 2000, there are 800 RPCs on the country which have covered nearly 2.2 million hectares of lands and it has been decided to increase this number up to 1700 companies with 4.5 million (ha) lands under cover according to the schedules of third 5 years plan.

2) Organization structure

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 RPCs comprises of a RPC Managing director, an accountant, agricultural technicians usually dispatched from the Utilization System of MOJA. Salary of these personals is also paid by the MOJA. The executive board, selected among the members comprises of 5

persons: a chairman of the Board, a deputy, a secretary and two board members. Election of the Board will carry out every three years and then inspectors also be selected who will check the condition of the RPC three or four times a year.

3) Activities

i) Land consolidation

One of the main aims of the RPC has been the consolidation of farmer's scattered lands for the efficient use of land. 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. In rural areas, people are generally not willing to accept land consolidation first as they may be disadvantaged by losing some of their lands. People are not willing to move their farm land from one place to another as the amount of land registered tends to be less than what they actually own. It takes the PRC staff a lot of time and efforts to convince farmers.

ii) Irrigation and Water Management

Establishment of irrigation network follows after the land consolidation. The construction of irrigation facilities, such as canals, wells, pumping stations and etc are used jointly by individual farmers, by villages /Dehs, rather than by the members of RPC as a whole. The role of RPC is limited in introducing the loan scheme and give technical information to the people interested in the use of irrigation facilities. The RPC members have better opportunities to receive loans from the Bank with concessions than individual farmers.

iii) Joint Utilization of Agricultural Machines

Mechanization of agriculture has been an important motive for the farmers to join the RPC. In comparison to individuals, RPCs have priority to the access to the agricultural machineries such as tractors and combines. Access to agricultural machineries is one of the main agricultural problems of this area not only because it is expensive, but also the supply is limited. Even some individuals apply to purchase machineries, there is always a long waiting list and the farmers usually have to wait for 2 years or more. However, Fast and cheap supply of agriculture machineries (13 out of 20-25 heavy tractors were supplied with RPCs last year, RPCs are exempted from the 50 % of interests)

Advantages for the PRC members are that they have a priority to the cheap and fast access to the RPC tractors. For example, the rental charge of the heavy tractor for ploughing will be:

	Member of RPC	Non-Member	Private
Irrigated land	Rls. 80,000/ha	Rls. 10, 000/ha	Rls. 12-15,000/ha
Rainfed	Rls. 60, 000/ha	Rls. 7, 000/ha	-

Ref: Anahita RPC, Kangawar District, Kermanshah Province

RPC earn some profit by renting their machines to the farmers. Or rather than renting the machine itself, the machine operator hired by the RPC goes to the field and work directly on the farmer’s fields.

iv) Distribution of agricultural inputs

As in the case of RCO, the RPC’s main activity as well as the sources of income is the distribution of agricultural inputs such as fertilizers, seeds and chemicals. In Kermanshah, 10 RPCs undertake this activity. The storage to keep the agricultural inputs is provided by the MOJA and the RPCs are responsible to sell them to the members and non-members with the permission of the Extension Service Centers.

v) Extension activities

Extension services to the RPC members are provided by the RPC staff of MOJA in collaboration with the extension service centers at the Baksh (sub-district). The extension and training include:

- Seasonal training for the member farmers (e.g., controlling of pesticide and timely control of pesticide)
- Distribution of agricultural information booklets and pamphlet
- Long-term training for the RPC staff from MOJA for the RPC management
- Introduction of modernization of skills and improved varieties of crops to the member farmers. (Make a visit to the advanced area on the 'farm day')
- To make a trip to introduce agro-processing factories to the farmers

vi) Joint sales of agricultural products

Since this year 2003, KJAO is going to make the contract with the wheat seeds producers with the non-governmental sectors including RPCs. The RPCs purchase wheat seeds for from the farmers, then process, sterilize and sell to the Government. This activity has been done by the agricultural support company before, but the Government intends to shift this work slowly to the RPCs and private sectors. The problem is the access to the loan from the bank. The RPCs needs considerable capital to purchase wheat seeds from the farmers.

4) Criteria for RPC establishment and membership

There are certain conditions to start a RPC in the villages. They are 1) the land of 20,000 ha, 2) high potentials of the village in terms of soil and water, 3) willingness of the farmers to participate, 4) More than 70% of the village people participate and 5) 90% of members are ready for the land consolidation. These are general conditions and not necessarily all RPCs satisfy there conditions at the establishment. The criteria to be a member are those with 1) land, and 2) paying the admission fee of Rls. 200,000~300,000 (irrigated land), and Rls.100,000~200,000 (rainfed land).

(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
Facilities and O&M	:	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

2.1.6 Government Policies of Irrigation Water Management

(1) Law related to Water Management; "Law of Fair Water Distribution, 1983 March"

"All of the water resources in the country belong to the Government" is the national declaration made in the beginning of "the Law of Fair Water Distribution", enacted on March 1983 (hereinafter referred to as "the Water Law 1983". Ministry of Energy (MOE) is appointed as the Ministry in charge of the Water Law 1983. The contents of the law, regarding irrigation water management, are as follows:

1) Authorization of water right

MOE, as the Water Supplier in Iran, is obliged to consider the quantity of water amount stated in the farmland ownership registration as his water right capacity. However, MOE keeps authority to define the proper and indispensable quantity of water for crop cultivation. Previously, MOE has been occupied with such enormous approval works for each applicant.

2) Three Member Committee to authorize optimum water consumption

The Government applies a procedure to decide the right quantity of water right to a certain farmer for which a "3-Member Committee" is in charge. The committee consists of i) Law expert (MOE), ii) Agricultural Expert (MOJA), iii) responsible person of the concerned area (such as the member of Islamic Council recommended by both the agencies). Water Affairs of MOE approve the results conveyed by the Committee

3) 5-Member Committee to authorize optimum water consumption

Matters, which are not concluded by the aforementioned committee, are conveyed to a "5-Member Committee" which consists of the following members:

i) Regional Water Organization (Deputy DG)
ii) Chief of Agricultural Organization (Deputy DG)
iii) Expert (MOE)
iv) Two (2) Persons responsible of the concerned area judged by MOE and MOJA respectively

Matters, which are not concluded by the committee, are to be conveyed to the court. Subjects related to trade-off between the watersheds are also handled by this committee.

4) Pricing of water fee, collection and operation and maintenance

As per the law, MOJA is in charge for defining the agriculture water fee and its collection, although it is actually carried out by MOE. It is stated in the law that the beneficiaries of water utilization facilities should owe the obligation of operation and maintenance, while MOE must owe responsibilities to issue the necessary permissions to repair and renovate them. It means that all the facilities provided for water sources and utilization should belong to the Government and the MOE should be in charge for maintaining those facilities.

5) Endeavors of materialization of the Water Law 1983

Scene of Interview on Iranian Water Law at DG of Water Policy & Surface Water Conservation Bureau Water Resources Management Organization (MoE)

Recognitions among the relevant officials are easily found out that materialization is indispensable of the Water Law 1983, in order to meet the diversification and alteration of the situations of sites of water utilization. Based on such understanding, MOE, especially Water Policy & Surface Water Conservation Bureau of Water Resources Management Organization has been tackling the subjects to generate regulations in line with the Water Law 1983. The direction of their efforts is i) water users should share some parts of burden of O&M, ii) to clarify task allocation between MOE and MOJA, iii) to realize fair water allotment and others.

(2) Other Laws Related to Water Management

The 3-Member Committee, or Joint-Committee of Fair Water Utilization is conducting the resolutions and decisions against the aspects of relevant cases in the front line of water utilization, based on the Water Law 1983 at both the central and provincial level. The laws related to their daily activities are as follows:

1) Water Tariff Law (1991)

This law states the procedure of pricing the water tariff of the national property and the major points in the law related with agriculture are as follows:

i) MOJA should bear water fee collection. (Presently MOE is in charge for this matter)
ii) The minimum penalty of illegal water use should be 1.5 times of the water fee.
iii) The water fee is to be defined depending on the farmers' gross income.

2) Second Socio-Economic and Cultural Development Plan of the Islamic Republic of Iran (2nd FYDP 1995-1999)

This law declares that MOJA should be in charge to establish guideline of proper crop water requirement by region and by crop. Also, the Ministry is in charge to form farmers groups to take care of the O&M activities.

3) Third Socio-Economic and Cultural Development Plan of the Islamic Republic of Iran (3rd FYDP 2000-2004)

This present 5-year plan states in the Chapter 13 as the chapter of "Water and Agriculture" that the relevant ministries should owe the obligation to establish the definition of region-wise optimum water consumption and measures of effective water use based on water saving concept. MOE should generate bylaws to materialize of the country's target of water-saving

based effective water use enhancement under the collaboration with MOJA, Plan and Budget Organization and other relevant agencies. Major contents of the plan are as follows:

i) To establish proper monitoring system of water resources quality and quantity
ii) To materialize monitoring system against water pollution and to enhance public awareness of necessity of water management among the people
iii) To strengthen water market in the local area（ To make concrete awareness of water business for agricultural sector）
iv) To establish and strengthen water-consume monitoring system for agricultural sector.
v) To consolidate and strengthen juridical system to meet with change of water management and technical view points.
vi) To generate institutional set-up to materialize optimum water resources utilization at water markets at the local level.

Besides, it is said that the necessity of aides and interest reduction schemes are also to be maintained as earlier as possible.

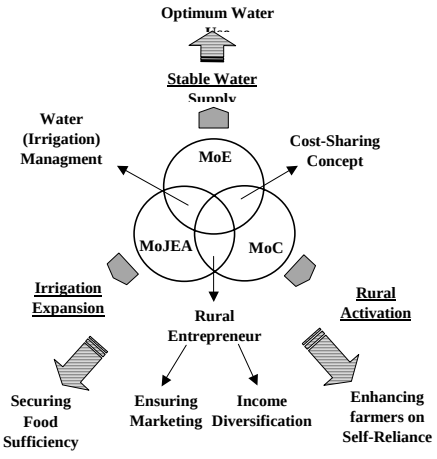
It is stated in the Article 107 of the Chapter 13 that the Government shall owe the responsibilities to mechanism of property pricing of land and water, based on "Law of Stabilizing Irrigation Fee", under the condition of participation of the property owners. For this purpose the Government is ready to generate necessary plans to issue certificates of property tenure to the owners.

Iran Daily Newspaper dated September 22, 2003 reported that MOE has drawn up draft of comprehensive water management for the coming 2 decades. "Details of the frame is to be materialized by Water Resources Management Company, MOE during the remaining period of the present 5-Year Plan period." As stated by the Deputy Minister of Water Management Bureau, MOE.

As reported as above, it might be said that the people in the water use field is under so called "transactional condition of system consolidation", starting from 1983 Law to the present.

(3) Joint-Committee of Three Ministries

The Joint-Committee, consisting of MOE, MOJA and Ministry of Cooperatives (MOC), has been functioning with objectives to consolidate proper water utilization and management in the agricultural sector since 1996. MOE owes responsibilities on water resources development and provision of main system of water supplying system as function of "Water Supplier". MOJA shall be in charge to irrigation management at the on-farm level and to take initiatives to establish and function water users' groups. The scope of MOC is defined to the policy making and strategy generation for the subject of Water Users' Cooperatives (WUC) among the farmers. This committee also exists in the provincial level, in the same line as the central level to maintain provincial level subjects.



Sectoral Intension under 3-Ministry Management

(4) Water Management Policy

Direction and policies of water management are summarized below based on the facts reported in the previous sections on history of water management policy, juristic background, activities and scopes of relevant ministries.

i) The government has recognitions that water resources potentials are so limited for enhancing promotion of agricultural production and therefore effective water use is necessary.
ii) The government intends to enhance farmers' organization as self-reliance foundation to take roles of proper water utilization management as sustainable and effective management.
iii) The government has plans to establish Water Users' Cooperative (WUC) as materialization of the government's intensions.
iv) WUC is planned to have the functions to maintain relevant facilities at on-farm level and to collect water fee.
v) Incentives for farmers to participate in WUC are planned to be prepared like 1) implementation of farm land consolidation to secure the effective water use 2) stable and higher income obtained as indirect effects of securing effective irrigation, 3) financial assistances and technical extension services and others.
vi) Merits for the Government are identified as 1) productivity improvement under limited water resources, 2) cost reduction of construction and O&M of irrigation facilities and 3) progresses of materialization of free-market based businesses based on establishment of self-reliance farmers' organization.

Now MOE predicts to hand over the function of water fee collection from MOE to WUC, if WUC is established and function well as self-reliance body. The collected fee is to be conveyed from WUC to MOE through MOJA which is in charge of irrigation management (comments of Water Policy & Surface Water Conservation Bureau, Water Resources Management Organization, MOE). The introduction of "Water Users' Cooperative" has just started under the present 5-Year development plan.

Establishment of WUC is still a new trial approach for materializing self-reliance water management. The government selected several provinces like Kermanshah, Hamadan, East and West Azerbaijan, Kurdestan, Mazandaran and others from 2000.

(5) Stakeholders of Irrigation Water Management and Water Fee Collection

Stakeholders involving to "Irrigation Water Management" from the field level are summarized in the table of the next page.

It is said that the water fee, especially for agriculture water use, is defined based on the reference of 3% of the farmers' gross-income and comply adapted the considerations. Provincial Water Affairs owes decision making officially and the firm, WRWUSC, is in-charge for fee collection.

Water tariff applied to the Study Area is summarized in the table, as defined by the Water Affairs of Kermanshah Province. Water fee for surface water is adapted only for Gharasu River because the perennial river in the area is only Gharasu River. There are noticed some range in the listed fee. Fee for water intakes with small capacity pump from Gharasu is set as

Rls. 5.0/m^3 evenly. It is reported by the agency that the number of such pumps registered is about 150 pumps as of March 2003.

There are classifications of the tariff based on the condition of canals like “modern” which indicates concrete canal, “semi-modern” for stone masonry or brick masonry canal and “traditional” for earth canal. Besides that some further clarifications are to be conducted on a subject based on the location like upstream and downstream along a canal, considering the trade-off among the users.

Also, there is a tariff for groundwater utilization. There are 352 wells registered already. They are set at Rls. 4.0/m^3 for water use for agriculture. It is explained that the owner of a well can use it forever after being accepted the authorization. MOE has never been conducting guiding the users to save the water consumption against the drought in recent years.

Major Stakeholders Related to Water Users' Cooperative Program

1 Farmers	a) Farmers are objectives for proceeding WUC policy and they must be one of main leading party for implementing the policy as member of WUC. b) But there are certain rooms on farmers' side to understand the policy, because they are not familiar with self-reliance paradigm for participating to the policy. c) Also they do not have enough experience of co-working or co-management together with neigbourers, which should be precious background to accept WUC d) Dependence to the irrigation water is not so serious because majority is still dealing with winter wheat production only.
2 Water Users' Cooperative (WUC)	a) Farmers foundation to be in charge for expanding policy of irrigation water management with self-reliance, as the Govt indents so. b) Govt never reached to its completed situation, what to be owed, what benefit might be, how it has to function. c) Govt admires that they have never obtained sufficient results to establish successful WUC, due to under developing necessary laws and bylaws. d) Also the Govt never proceeded effective Land Consolidation synchronizing with WUC establishment to realize rational water utilization.
3 Soil & Water Dept., MoJEA	a) owes tasks to extend WUC program and activate it from view on-farm technical points of irrigation management, under the collaboration with other relevant b) Even though being In charge to conduct Land Consolidation as measure of effective water use, never experienced proper results harmonized with WUC c) Hardly solve mis-matching on I&D plan and design with MoE, which owes tasks as water supplier and to care up to the end of secondary canal.
4 Agriculture Extension Center, MoJEA	a) Due to the experiences as function of interface between the Govt and farmers, owes tasks of explanation and guidance of WUC program to farmers. b) Hence owes obligation of understanding the WUC program sufficiently. If not, hardly to proceed the WUC program in the field.
5 Loan & Budget Dept., MoJEA	Is in charge to provide financial plan to implement any activities and projects including land consolidation as measure to realize effective water utilization.
6 Water Affairs, MoE	a) Owes responsibilities of water resources development, O&MM on relevant facilities and its distribution and roles as one of leading stakeholders for WUC program implementation. b) Has policy direction to leave management aspects like water fee collection and OMM to the third sector.
7 Water Utilization Company.	a) Is working under a contract with MoE for water fee collection and facility OMM. b) Seems there will be necessity to clarify scope allocation on the works dealing with , between WUC in near future.
8 MoC	a) Is in charge to proceed Cooperative program including WUC setting-up. b) Shares tasks to prepare financial assistances like loans or to owe parts of interest of loans.
9 Agriculture Bank	a) Owes disbursement works of most of the national budget for any activities which MoJEA, MOE and MoC are going to implement. b) Keeps function to implement any loans on behalf of the Govt to farmers directly.
10 Central Government	a) Owes obligation to generate any necessary plans to mobilize resources related to Soil & Water Projects also maintaining the execution system to serve to the b) Issues directions of Water & Agriculture Sector as development basic law through the 3rd 5-year plan. c) commits to establish necessary regulations and bylaws to make concrete conditions of water market including definition of proper water pricing.

Recently the agency has never issued the new permission for the request to construct the wells for agriculture for the area. It comes from the recognition that the present total amount of the groundwater yield is over the availability of groundwater use. (Besides that, permissions for drinking water, water for poultry farming and water for industry are still available.) Use of water of perennial spring is also to be charged with same rate of “traditional” of the irrigation canal tariff. Presently only Jaberi Spring is adapted in the Study Area.

Summay of Water Fee

Water Source	Water Fee
A Gravity intake from Gharasu River	120,000 / 160,000 Rials / ha / year
B Pump intake from Gharasu River	5 Rials / cms / year
C Gravity intake from irrigation canal	
From modern canal	120,000 / 160,000 Rials / ha / year
From semi modern	80,000 Rials / ha / year
From old canal	30,000 - 40,000 Rials / ha / year
D Groundwater yield from well	
For Agriculture	4 Rials / cms / year
For Industry	6 Rials / cms / year
E Water use of Spring	Same as charging of groundwater

cms ; cubic meter per second.
Source : Kermanshah Water Affairs

(6) Procedure of Fee Collection and Its Disbursement.

A company named “Western Region Distribution Exploitation Cooperation” under the Western Region Water Organization of the Ministry of Energy is dealing with water fee collection for five provinces of a) Kermanshah, b) Ilam, c) Hamedan d) Lorestan and e) Kurdestan under a contract with the Ministry, which has its headquarters in Kermanshah City.

(7) Control of Illegal Water Users

Staffs of WRWUSC are in charge to find out illegal water users in the area. After confirming the illegal water use in the site, it is defined to report to KWA and the local police office. The police office has to confirm the fact as ordinary criminal incident and to convey the case to the local court for their judgment.

According to the law, it is defined that the illegal water users has to obey to pay 1.5 times as penalty. But farmers said the actual penalty was cheaper than the water fee and hence the penalty is meaningless.

Farmers experienced the water intakes illegally explains the reasons like a) not available to be in time to apply the request while observing the rainfall condition, b) penalty paying is more convenient than legal case to save time for filling application in the busiest season, c) hardly to try to be in time while confirming the security of the Government's subsidies like seed, chemicals and fertilizer.

2.2 Brief Description of the Kermanshah Province

2.2.1 Administration

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*). Among 11 districts, the Study Area lies in 2 districts: Kermanshah and Javanrud.

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 (Villages)	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)

2.2.2 Natural Conditions

(1) Topography

This province consists of a part of the Zagros Mountains which forms southern frame of topographic skeleton of the country and several discontinued highland plains. Peaks of the Mountains in the Province are undulating with an altitude ranging from 1,000m to 3,300 m a.m.s.l. Major plains of the province are followed to the mountain direction in a range of altitude from 1,750 m to 550 m a.m.s.l, which are gradient from the direction, which have undulated topo-condition because consisting of piedmonts, alluvial deposits and fans.

The province is divided into two major river systems, Upper Karkheh River System and Border River System. Upper Karkheh system includes Gamasiab, Seymareh and Gharasu river basin, which includes the Study Area. Those rivers confluence into Seymareh river which flows into Iraq. Basin of this system covers almost whole area of Keramnshah Province. Besides that Border River System is consisted of Sirvan, Zemkan, Alvand and others, also flows to Iraq.

(2) Climate

The precipitation of the province is defined by monsoons from Siberia and Arabia, also turbulences from the Mediterranean Sea, which are caught with Zagros Mountains and exhausts precipitation on the slopes. Average annual rainfall is about 300 to 800mm/year. It is said that about 400 to 500mm is expectable normally. The province might be classified into four groups from view point of climatological characteristics as follows:

Class-1： Gentle Winter and Warm , dry Summer Climate
Ghasre-e Shirin, Sar-e-Pol-e-Zahad, Azgolehand others in south west of Javanmard.

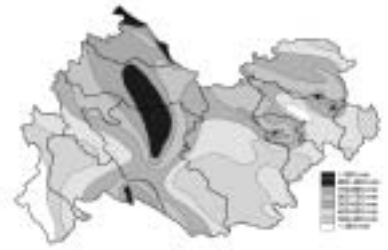
Class-2： Sever cold Winter and cool Summer Climate
Pareh, Javanmard and Karand Districts

Class-3： Semi-dry and cool Step Climate
Songhor, Posht-Darband and others in Kermanshah city.

Class-4： Semi-dry and warm Step Climate
Kangawar, Sahne, Harsin and its vicinities

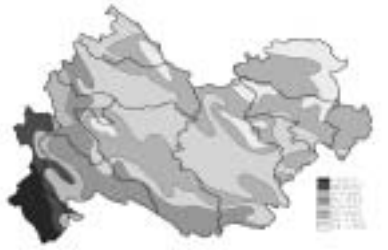
Climate Classification

Besides the classification as above, the Province is commonly divided into two areas. One is characterized as ‘warm winter area” mainly for western area including Ghasr-e Shirin, Pol-e Zahab, Guilan-e Ghard, Sumar, Naft-Shahr, Azgoleh, southern Kermanshah and the vicinities and the remaining area as ‘cool summer area’.



Isohyet Classification

Distribution of temperature reflects difference of altitudes. Generally while getting higher altitude, temperature is going down and being found opposite tendency while getting down the elevation. While annual difference of temperature is about 15 ^{o}C in the mountains, it becomes about 25 ^{o}C in lower altitude. Monthly fluctuation climatological indices at several stations in Kermanshah are shown in Fig. 2.2.1



Isotherms Classification

2.2.3 Natural Resources and Land Use

(1) Land Resource

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 colluvium with gravel. The

lands which fall in the other types are 3.1% (78,384 ha).

(2) Land Use

The present land use of the Kermanshah province according to the type of use is listed in the table. One third of the total area is used for agriculture purpose, 26.5% of the area is used as forestry area and 31.3% is used as range lands. Among the 33.4% of the agriculture area, 6.7 % is irrigated (one fifth of the agriculture area) and 26.7% are drylands (four-fifth of the agriculture area)

(3) 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 km length and 50 km 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.

Land use of the Kermanshah Province

No.	Type of Land Use	Area, ha	Area / Total
1	Agricultural Area	820,000	33.4%
2	Forestry Area	650,602	26.5%
3	Rangelands	768,863	31.3%
4	Other Use	214,635	8.7%
5	Total Area	2,454,100	100.0%
6	Irrigated Area	165,000	6.7%
7	Dry farming area	655,000	26.7%
	Agriculture Area	820,000	
8	Horticulture area	32,000	1.3%
9	Useful horticulture Area	31,200	1.3%
10	Unuseful horticulture Area	800	0.03%
11	Irrigated arable area	145,000	
12	Irrigated horticulture Area	27,000	1.1%
	Sub-total	172,000	
15	Irrigated wheat area	60,000	2.4%
16	Unirrigated wheat area	265,000	10.8%
17	Irrigated barley area	10,770	0.4%
18	Unirrigated barley area	98,000	4.0%
19	Sugarbeet area	17,000	0.7%
20	Maize area	26,180	1.1%
21	Irrigated suflower area	612	0.0%
22	Unirrigated sunflower area	2,235	0.1%
23	Kitchen garden crop area	6,968	0.3%
24	Fodder crop area	11,198	0.5%
25	Vegetable crop area	8,639	0.4%

Source: Kermanshah Jihad-e-Agriculture Organization

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.

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. They are supervised by 12 natural resource officers. Forest protectors, recognize the illegal forest extract activities, and collect enough information to take any legal action. In the regions, which have high potential for renewal, lands are distributed to people to grow trees and fruit gardens.

2.2.4 Socio Economic 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 the rural population. 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. Besides, there are several gaps between urban and rural or between male and female. The literacy rate of Kermanshah Province in 1996 was 76.6%, and that of male and female are 82.6% and 72.1% respectively. The literacy rate of male and female in the rural area are 77.1% and 59.8% respectively. In comparison to urban area, the students in rural area have less access to schools, particularly for guidance and secondary schools. While there are more than 2,000 primary schools in rural area, there are only 381 guidance schools and 69 high schools.

(3) Health

In Kermanshah Province, the number of doctors per thousand residents are 0.42. Existing number of doctors, specialists and dentists are shown in the following table. The number of doctors includes both the government and private doctors. In case of Kermanshah district and Javanrood district, the number of doctors per thousand residents is 0.48 and 0.35 respectively.

	Population	General practitioner	Specialist	Dentist	Total	Doctor per 1,000 patients
Total of Province	**1,778,596**	**747**	**292**	**147**	**1186**	**0.42**
Eslamabad-e-Gharb	215,392	72	25	14	111	0.33
Paveh	61,918	74	4	2	80	1.20
Javanrud	109,518	38	0	5	43	0.35
Sar-e-Pol-e-Zahab	81,624	32	6	5	43	0.39
Sonqor	112,014	38	10	4	52	0.34
Sahneh	82,043	27	7	3	37	0.33
Qasr-e-Shirin	20,006	16	0	2	18	0.80
Kermanshah	843,125	401	227	103	731	0.48
Kangavar	89,181	41	12	4	58	0.46
Gilan-e-Gharb	67,756	30	1	2	33	0.44
Harsin	96,019	28	0	3	31	0.29

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

(4) Religion

Overwhelming majority of population in Kermanshah Province are Moslems. 99.8 % are Moslems and the rest of 0.2 % comprises of Zoroastrian, Jewish, Christian and others. Following Shiite, Sunni is also widely spread in the Province particularly among the Kurdish population.

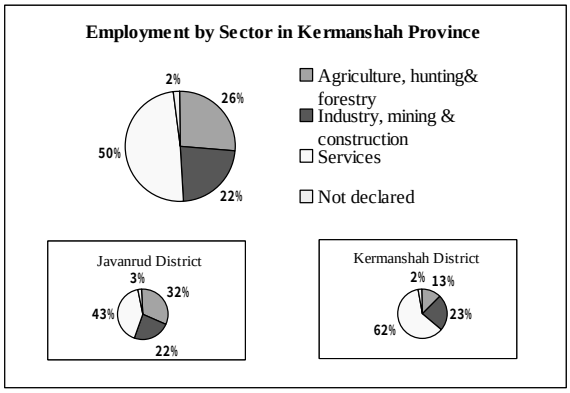
(5) Tribes and Nomads

The tribal groups include pastoralist nomads who migrate about 200 km in the province of Kermanshah. Traditionally, the nomadic tribes (*shayer-e kuchangeh*) have kept large heads of

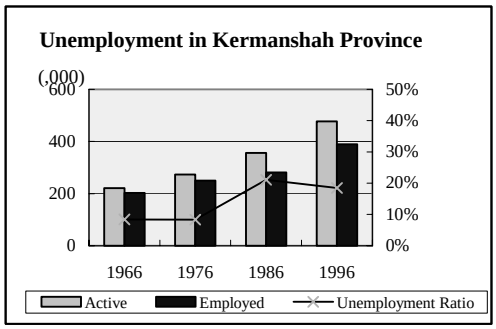
sheep and goats, which have provided the main source of red meat for Iran. During the migrations the tribes trade their live animals, wool, daily products and various knotted and woven textiles with villagers and townspeople in return for manufactured and agricultural goods that the nomads are unable to produce.

(6) Economic Conditions

Kermanshah Province is geographically an 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 and there are more than 20 export-oriented industrial factories with ISO certificate.



Regarding the employment by sector, the service sector takes the most important part of the economy both at the provincial and district level. Agriculture sector is the second, followed by industry, mining and construction. Agriculture has traditionally been the main occupation of the rural people. But, there is a growing tendency of the migration of village people into urban areas in search of non-agricultural jobs, due to the lack of employment opportunities in rural area.



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

Unemployment has been one of the most serious social and economic problems in the Province. As shown in the table below, whereas the unemployment rate remained less than 10 % in 1970s, it was 21.1% in 1986 and 18.5% in 1996. Although the rate slightly recovered in 1996, the unemployed population is still growing in number. The figure above shows the increase in the number of economically active population active[3] population and unemployed population in Kermanshah Province over the last 30 years.

2.2.5 Agriculture and Animal Husbandry

Agriculture in the Province is divided into three agricultural zones, namely, the cold zone, the warm zone and the medium zone. In general, animal husbandry is more active than agriculture in the northern part of the province. On the other hand, agriculture is more active than animal husbandry in the southern part of the province. In the medium zone, agriculture and animal husbandry keep balance each other in activities.

[3] All household members aged 10 and over, employed or unemployed (seeking work), during the last seven days preceding the census survey are considered economically active population. 'Not economically active population' are all household members aged 10 years and over who were not employed or unemployed (seeking work) during the last seven days. People classified under this category are student, homemaker and income recipient or other group.

(1) Agricultural Land Use

In the Province, 820,000 ha of agricultural area were cultivated in 2001. The percentage of the land used for agriculture in the Kermanshah Province is 28.84%, of which was ranked 5th in the country, and the ratio of the land under cultivation in the Province to the total area of the country was 5.15%. The total irrigated land and rain-fed land were 165,841 ha (21.8%) and 594,373 ha (79.2%), respectively. That is, the characteristic of Kermanshah province in the land utilization is the high rate of rain-fed lands among 28 provinces in the country.

(2) Annual Crops in the Province

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%

1) Annual Crops

In the Kermanshah Province, the main crops cultivated under irrigated farming are wheat, maize, sugar beet and barley, and the percentage of cultivated area of these crops to the total area are about 37% of wheat, 19% of maize, 10% of sugar beet and 8% of barley, respectively. On the other hand, the main crops grown under rain-fed farming are wheat, chick pea and barley. The percentage of cultivated area of these crops under rain-fed farming to the total area is about 40% of wheat and 37% of chick pea, respectively.

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.

(3) Mechanization

The numbers of tractors in Kermanshah Province are about 12,000 in 2002. In Kermanshah province, most of the farmers' fields are mechanized by contract with the machinery owners. The rates of area using tractors for the total cultivated area are 68 to 100% in tillage, 93 to 96% in harrowing except rain-fed lands, 65 to 100% in fertilization except rain-fed lands, respectively. In regard to combines, the rates of the mechanized area are 86 ~ 98% in wheat and maize. The number of machinery is insufficient for the province. However, 70% of tractor has used for more than 10 years. So, it is necessary to renew.

(4) Animal husbandry

In Kermanshah Province, sheep takes priority in the number of livestock, with about 2.3 million heads, followed by cattle with 1.0 million heads. The percentage of each breed is 66% of the number of whole cattle in local breed, 23% in hybrid breed and 11% in Holstein, respectively. The Government of Province promotes the change from sheep to dairy cattle to keep the balance between the number of sheep and the area of range. Furthermore, The Government promote the change from local breed, which farmers raise generally at present, to

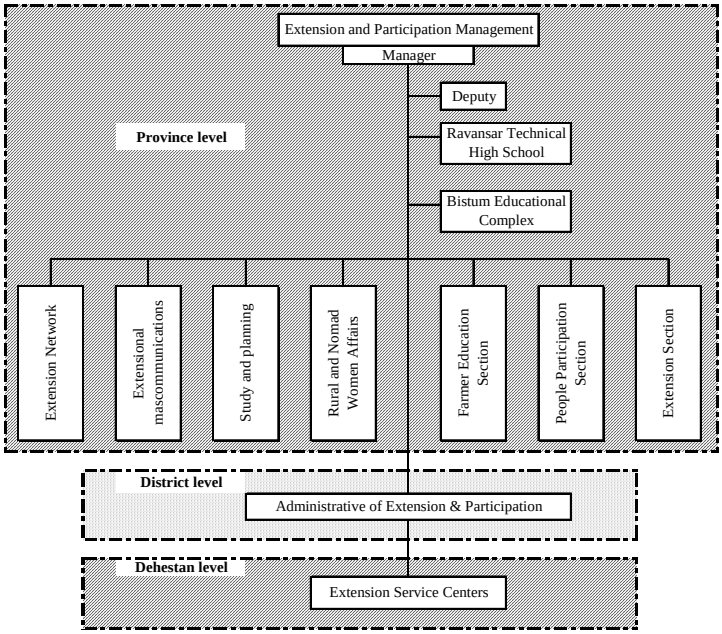
hybrid with Holstein, which is higher in milk yield than local breed with various subsidies. In regard to poultry, there are 634 enterprises of meat production in Kermanshah province, and the capacity of these enterprises is about 3 million chickens. There are three milk factories in the province. The total capacity of three factories is 88 tons per day. These factories have 16 milk collecting centers in province. Severe problem of the animal husbandry are lack and bad quality of feed and TDN.

(5) Fisheries

Kinds of fishes in inland water fishery are river shrimp, warm water fish, such as grass carp, silver carp, big head, common carp, etc., cold water fish, such as trout, rainbow trout, etc., respectively. The fishery department in the Jihad-e-Agriculture Organization of Kermanshah has been established in 1999, and until that time the Government of province didn't promote the fish culture. The annual consumption of fish per capita in Kermanshah province was 250 g in 1997. However, the annual consumption becomes 3 kg per capita in the province at present owing to exertion of the Government of province. The target of annual fish consumption in the 3rd five Years Plan of Government is 5 kg per capita.

(6) Extension Service System in Kermanshah Province

There is an Extension and Participation Deputy in the Kermanshah Jihad-e-Agriculture Organization (KJAO), as a lower branch of Deputy of Extension & Farming System of the Ministry of Jihade-e-Agriculture (MOJA). At the Provincial level, there is a Extension Council Committee headed by the Director of the KJAO. The Managers of each Deputy are the members of the committee and the secretary of the committee is the Manager of Extension and Participation. Under the committee, there are several sub-committee including animal husbandry, transfer of research (into the practice), watershed and natural resource, agriculture and horticulture, rural industry and development. Through these sub-committees, the development plan of extension are discussed and formulated.



Management System of Extension and Participation in Kermanshah Province

As shown in the figure, the extension management system in Kermanshah Province is organized by 3 tiers: Province, District and Sub-District or Dehestan.

(7) Farmers' Organization

1) Rural Production Cooperative (RPC)

RPC (Rural Production Cooperative) is a public agricultural corporation established by the Ministry of Jihad-e-Agriculture for the efficient utilization of agricultural resources in the

villages. The operation of RPCs is pursued under the Utilization System of Jihad-e-Agriculture. 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) Rural Cooperative Organizations (RCOs)

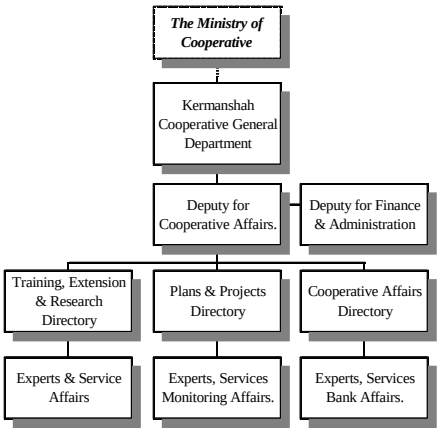
Rural Cooperative Organizations (RCOs) is a public corporation for improving rural livelihood through providing agricultural inputs, collecting agricultural products. The Head Quarter of RCO is located in Tehran. Central Organization for Rural Cooperative of Iran is a competent authority of RCO. In Kermanshah Province, there are 110 RCOs at Dehestan level (or at the central place for several villages). In Kermanshah Province, there are 530 RCO shops selling sugar, rice and other general products and 555 RCOs selling petroleum and kerosene.

3) Outline of MOC and Cooperatives

i) Organization of MOC in Kermanshah Province

Provincial level organization of the MOC is called "Directorate of General of Kermanshah, MOC" and is consisted of three departments; 1) Training, Extension and Research, 2) Plans & Projects and 3) Cooperative Affairs.

MOC owes tasks to enhance local people's activation and integration through the cooperative programs, without any staffs of function of interface between the program and the people, neither function of extension of agro-knowledge and technologies.



General Organization Chart of
Kermanshah Oooperative General Department

ii) Kinds of Cooperative under the MOC

Crop Cultivation Cooperative (by each crop like chick-pea, maize, flower, and orange), Livestock Cooperative, Crop Processing Cooperative, Crop Marketing Cooperative, Machinery Service Cooperative as example related to the agriculture or livestock. Besides those MOC deals with cooperative regarding mining, trade, supporting industry, rural industry for women and others.

iii) Government Intensions for Cooperative Program

Cooperative Program can contribute to both farmers and consumers by avoiding profit margins taken by the middlemen before, for instance, introducing a cooperative of "Greenhouse Horticulture" to outdoor frowners to let concentrate crop production under the stable condition. On the other hand a cooperative is to be set among people in cities as "Fresh Crop Consumer Cooperative" in the cities, as concrete recipients of the crops. Then profit margins can be avoided on the both sides, means higher income for farmers and lower price for consumers.

Adding to those basic ideas, MOC is proceeding the further assistances to activate the productions with introducing measures like "Cooperative of Crop Processing", for example, if available. "Agricultural Machinery Service Cooperative" is also available, according the explanation by the MOC, aiming enhancement of rational use of farm machinery.

iv) MOC and WUA

WUA establishment is one of "Cooperative Program" which MOC is dealing with. Merits of

WUA establishment are to reduce O&M cost with handing over the task from the Government to WUA. Adding to that, it is intended to enhance farmers' self-reliance and sense of entrepreneur due to introducing the "Cost Sharing Concept". There are two types of WUA by water source under the program.

a) *Ab baran* : WUA aims to fair water distribution among members on surface water developed by the Government.
b) *Chahdaram* : Same as *Ab baran* but for groundwater use.

v) Relation between WUA and RPC

Besides the activities of MOC, the MOJA is also involving for rural activations through RPC scheme. Procedure, organization is recommended, rights and duties, scope of subsidies and assistances are quite similar with WUA scheme.

According to the explanation of the MOC, RPC is high-lighting their assistances mainly to land consolidation, distribution of inputs like fertilizer or chemicals. Besides that WUA scheme aims mainly for relevant facilities of water use and ensuring sustainable O&M by the members. They said the task allocation is clear between the two ministries. But still there is possibility to make local people confuse between RPC and WUA manure. Members should to attend each meeting differently and should do quite similar things.

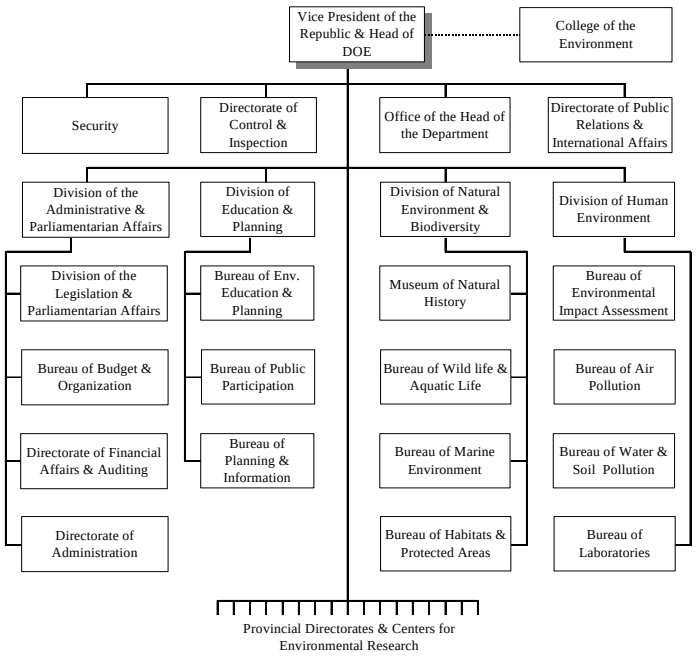
Also the office explained that the Central Government has a plan to unite those two programs into one management of the MOC after 10 years. (Due to the Third 5-Year National Plan includes a plan to unite or rational similar programs to reduce Governments' burden)

2.3 Environmental Protection

2.3.1 Environmental Organization

(1) Department of Environment (DOE)

In Iran, the Department of Environment (DOE) is responsible for the protection and enhancement of the environment, the prevention and control of any form of pollution or degradation leading to the disturbance of environmental balance, and for conducting all matters related to wildlife and the aquatic biota of the territorial waters. The Vice President of the Islamic Republic, who directs the daily operations of DOE heads the department with 4 deputies as shown in the figure.



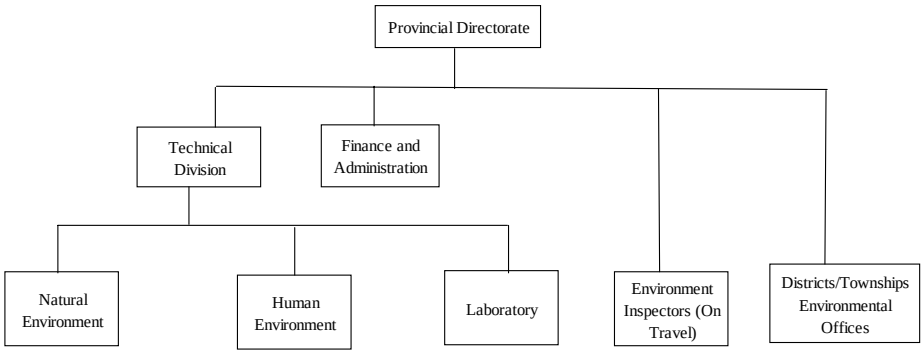
Organizational Chart of the Department of Environment

Each province of Iran has a DOE provincial directorate, which monitors all the aspects of environmental protection and the implementation of the department's programs. DOE is in-charge for defining the national regulations and standards for preserving and enhancing the quality of environment. A major part of this responsibility includes the provision of expert studies in human and industrial pollution, desertification, deforestation, soil erosion, rangeland degradation, improved water resource

management and protection of biodiversity. Considering the rapid development of the country, DOE is responsible for monitoring the quality of air and water.

(2) Kermanshah Provincial Directorate of Environment

The Kermanshah Provincial Directorate of Environment (KPDE) is responsible for the protection of national environmental sites in the Kermanshah province and to carry out the environmental activities including environmental monitoring, and environmental training to its staff and the local population. The provincial directorate is responsible for making the evaluation and approval of Preliminary Environmental Impact Assessment (pre EIA) and detailed EIA.



Administration set up of the Kermanshah Provincial Directorate of Environment

2.3.2 Environmental Laws, Planning and Management

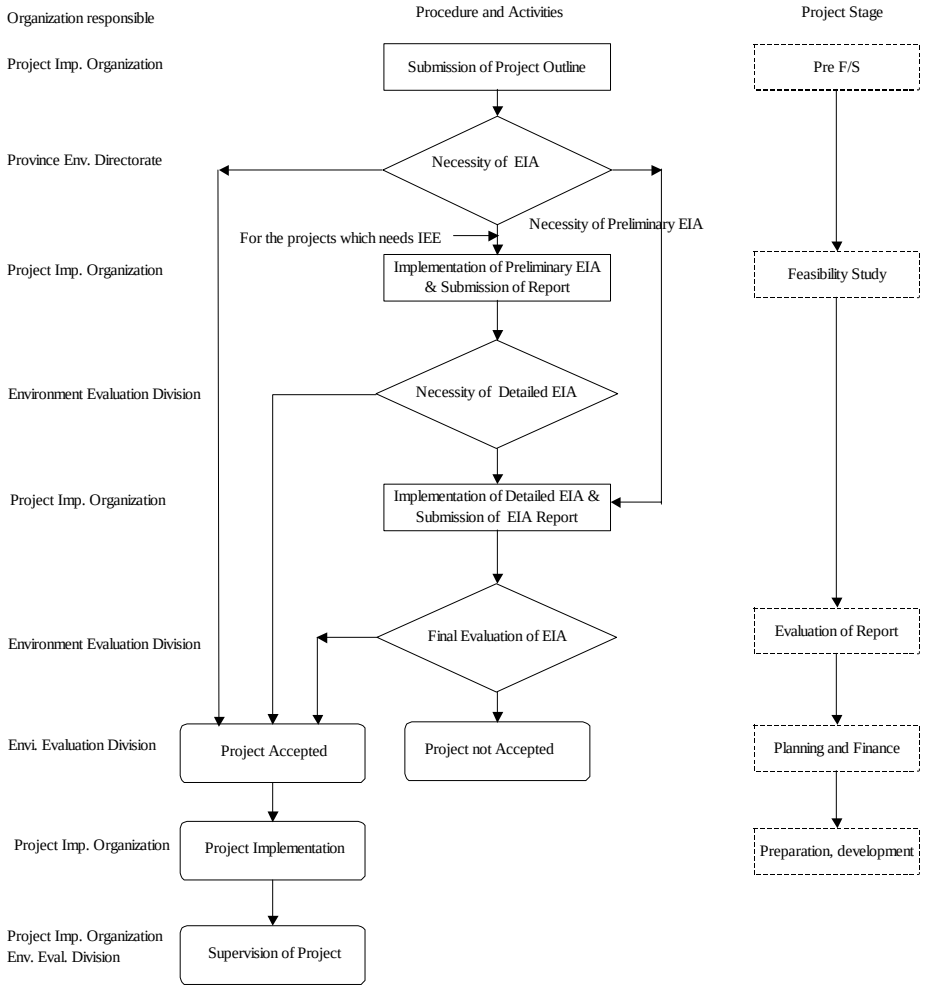
The Environmental Protection Act (1974) is the major law for environmental conservation in Iran. The Supreme Council of the Environment is a legislative body that enacts relevant regulations for the environmental protection. The laws enacted to protect the environment are as follows:

- Regulations for forested areas in 1920
- Municipality law concerning air pollution, solid waste disposal and reduction of industrial pollution in 1955
- The Environmental Protection and Enactment Act (EPEA) in 1974
- The executive rule of EPEA in 1975
- The clean air act in 1975
- Article 50 of the Constitution of the Iran approved in December 1979
- The Water Pollution Prevention Guideline in 1984
- The wastewater effluent standard in 1991
- The Amendment of Water Pollution Prevention Guideline in1994
- The Amendment of wastewater effluent standard in 1994
- Air Pollution Control Law in 1995
- Industrial Setting Guidelines
- Environmental Impact Assessment Guidelines and Framework in 1995
- Air Pollution Emissions Standards in 1998

The major development projects require an Environmental Impact Assessment (EIA) to evaluate the degree of damage on the environment, and the ways to reduce, eliminate or remedy these impacts. Projects needing an EIA and the methods of assessment will be reviewed and updated at intervals, to ensure that progress is made in keeping up with the technical know-how of international environmental bodies. EIA needs to be carried out for the following projects:

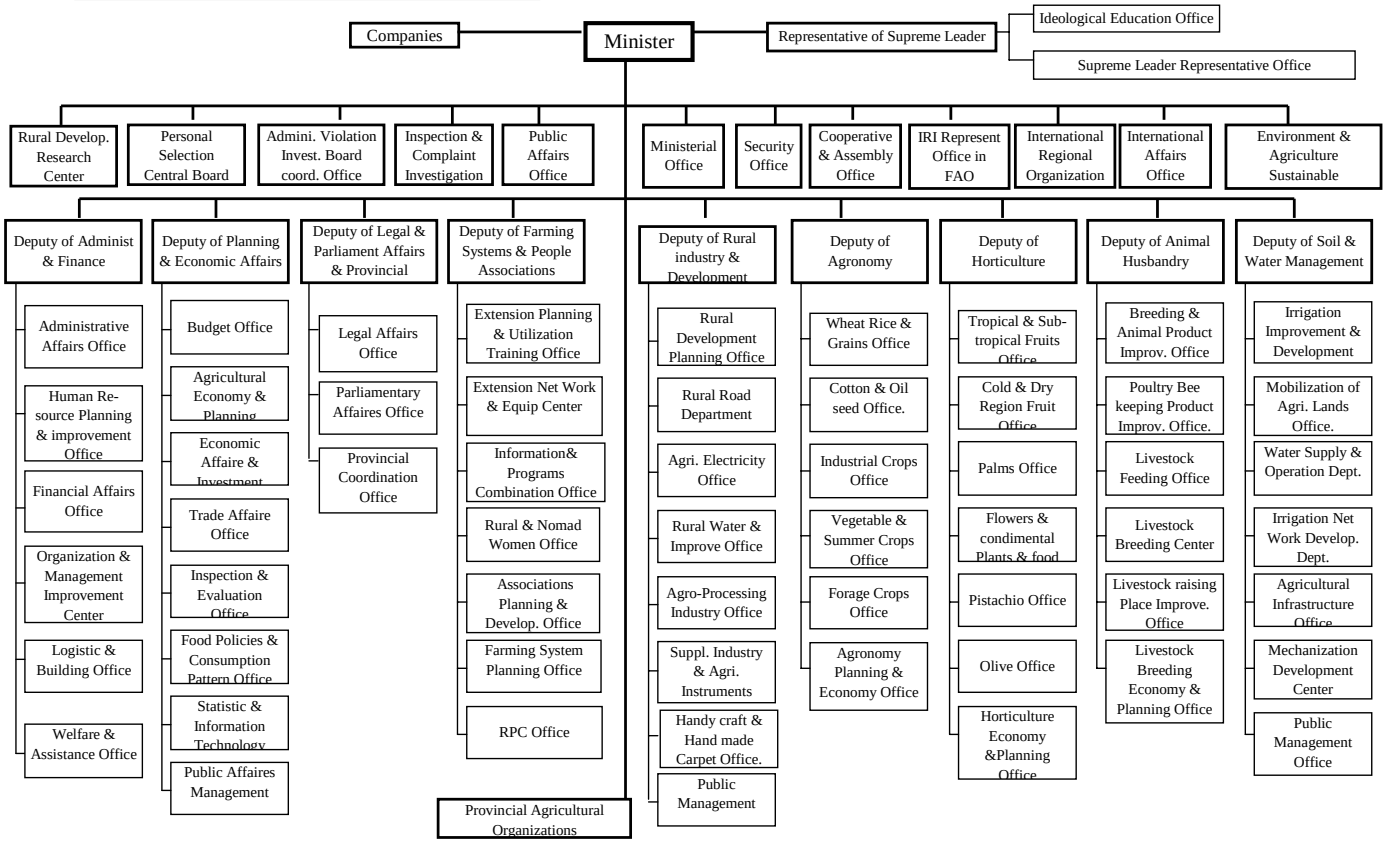
- Petroleum industries of any kind
- Refineries
- Power stations with capacity of more than 100 MW
- Steel industries
  a) Units of melted materials with a capacity of 300,000 ton/year
  b) Units of forming with a capacity of 100,000 tons/year
- Dams of more than 15m high with area more than 400 ha area
- Dams which keep pollutant materials in any measure should be evaluated by the environmental office.
- Man-made lakes with area more than 400 ha area
- The size of the lakes that breed fish with an area of less than 400 ha should be supervised by the department of agriculture.
- Irrigation and drainage projects with an area of more than 5,000 ha
- Airports with a landing area of more than 2,000m
- Forestry projects
- Projects of oil or gas pipeline transportation

EIA procedure followed in Iran is shown in the following figure.



Evaluation Procedure of Environmental Impact Assessment in

Ministry of Jihad-e-Agriculture



Ministry of Energy

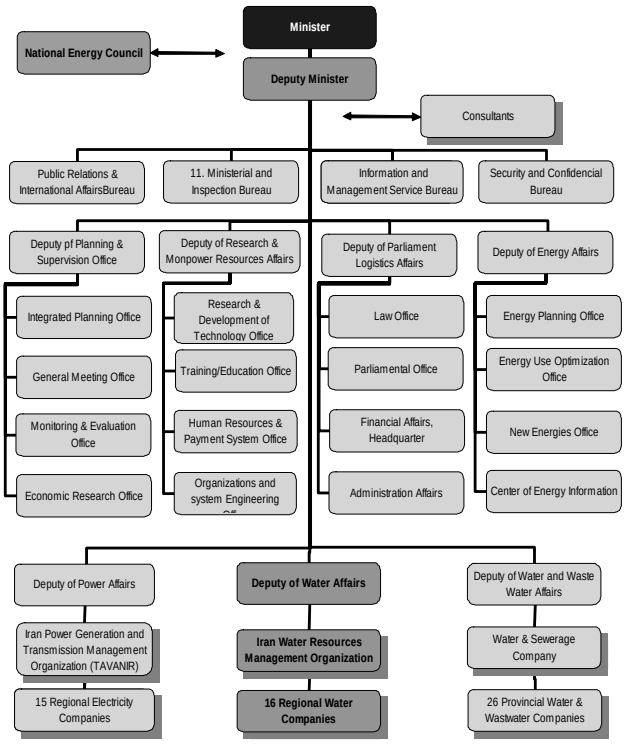
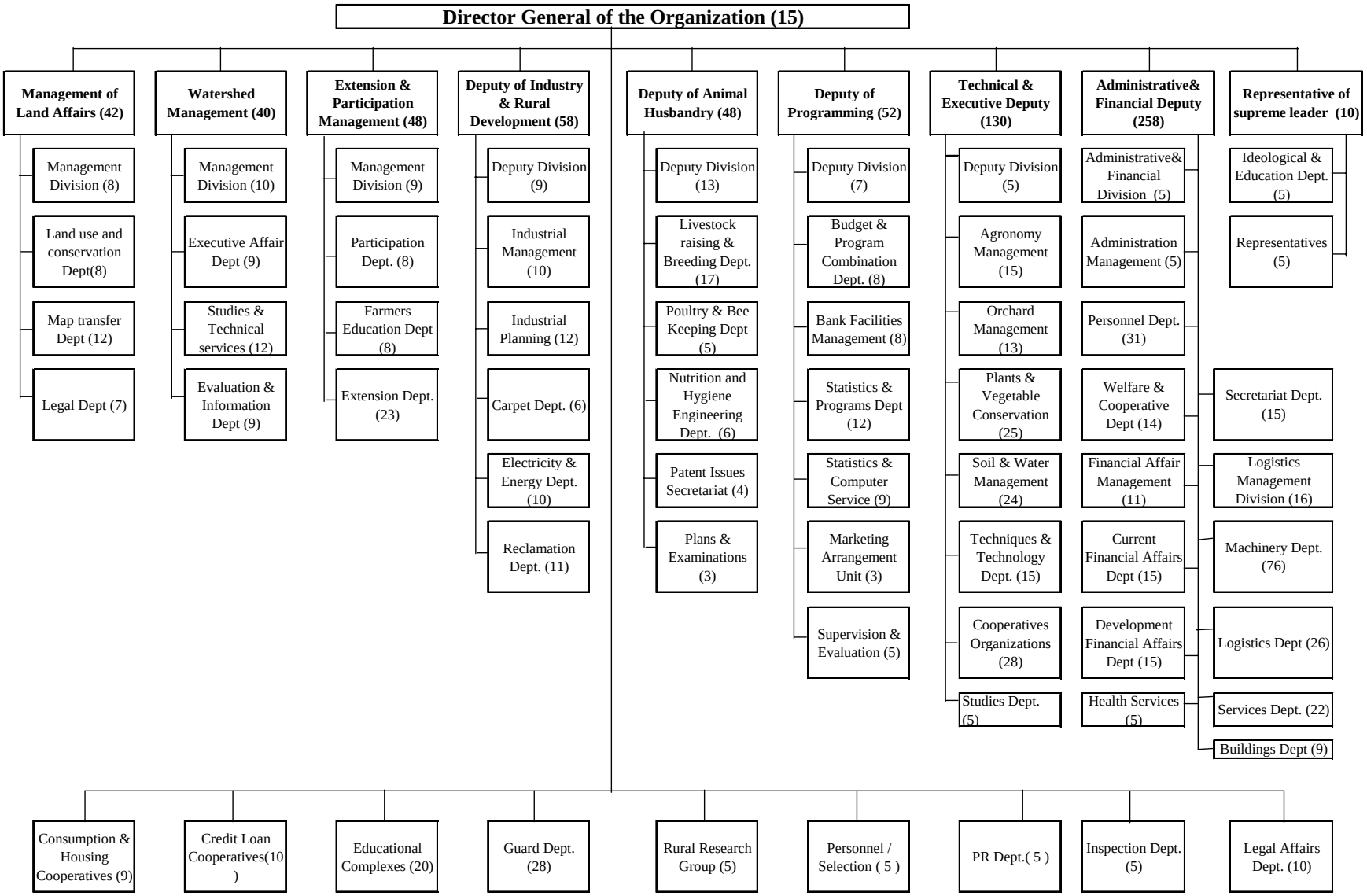


Fig. 2.1.1 Organization Chart of Ministry of Jihad-e-Agriculture and Ministry of Energy



*1 (Blanket ( ) indicates the number of Staff

*2 This chart does not include Nomades (tribes) ,Natural Resources developments personnels and others. At least 200 people should be considered for the addition

Fig. 2.1.2 Organizational Chart of Kermanshah Jihad-e-Agriculture Organization (KJAO)

Fig. 2.2.1 Districts in Kermanshah Province

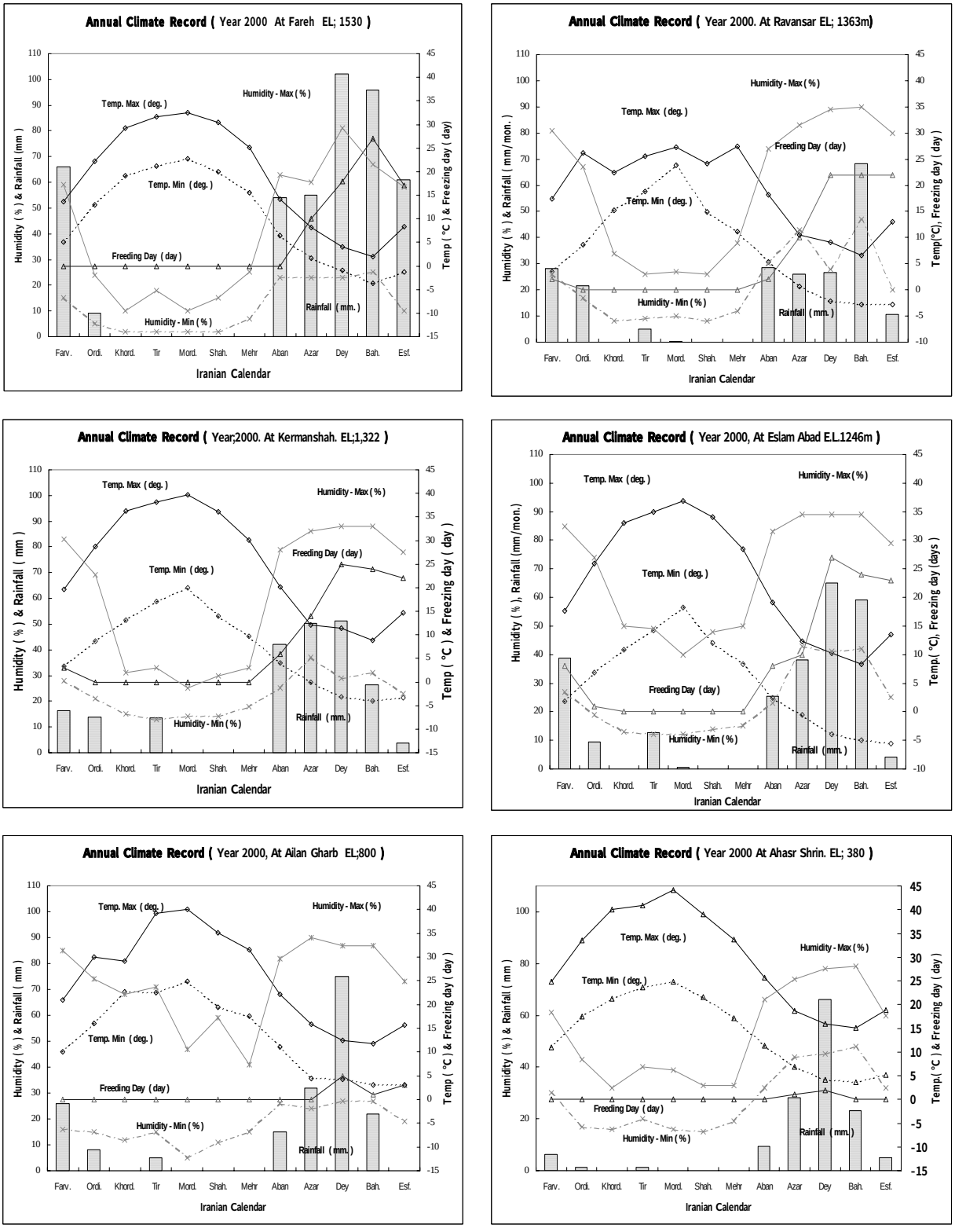


Fig. 2.2.2 Monthly Fluctuation of Climatological Indices in Kermanshah Province (Based on 2000 data)

Chapter 3 Existing Conditions of the Study Area

CHAPTER 3

EXISTING CONDITIONS OF THE STUDY AREA

3.1 General Features

3.1.1 Administration

The Study Area is spread over two Districts (*Shahrestan*) in Kermanshah Province: Javanrud and Kermanshah. As shown in the table below, the number of Deh (village) in Sanjabi Dehestan is almost three times more than other Dehestans in the Study Area (Fig. 3.1.1).

District (Shahrestan)	Sub-District (Bakhsh)	Dehestan (cluster of villages)	No of Deh In Dehestan	No of Deh in Study Area
Javanrud	Ravansar	Badr	37	4
		Hassan Abad	39	21
		Dolat Abad	32	7
Kermanshah	Kuzaran	Sanjabi	105	27
Total			213	59

3.1.2 Population

The population of the Study Area is indicated in the Table shown below:

Dehestan	Dehestan Total		Study Area	
	No. of Households	Population	No. of Households	Population
Badr	1,223	6,856	127	695
Hassan Abad	1,204	6,394	783	4,469
Dolat Abad	956	5,324	278	1,610
Sanjabi	3,035	17,055	606	3,461
TOTAL	6,418	35,629	1,794	10,235

Population of each deh is shown in Table 3.1.1. It is estimated that there are 1,794 households or 10,235 people live in the Study Area. Since the above data is based on the population census in 1996-7, the population in each deh or in the Study Area is expected to have been increased further as of 2003.

3.2 Natural Conditions

3.2.1 Topography, Geology and Hydrogeology

(1) Topography

The Study Area is surrounded by the Zagros mountainous ranges on the 3 sides of east, north, and west. The principal topographical form of the plain is the alluvial plain with an altitude of about 1,340m, which is formed as a result of sedimentation activities of 3 major rivers, i.e. the Kunab, Garab and Gharasu River. Karst is a series of flat hills and depressions, which is formed along the mountain foot slope in the north eastern part of the Study Area. Monadnock is a hilly small dome of base rock layer, looks like a small island inside a flat plain which is

found in the vicinity of Tam Tam village with an altitude 1,400m at the northern part of the basin.

(2) Geology

1) Geological Setting - According to the geological map of Iran, the area of the Study Area is situated in the transverse part between the Zagros and crushed zone which compose the major geological formations of the area (Fig. 3.2.1).

2) Base Rock Layer - It is pathologically composed of 3 layers, Radiolarite, Kermanshah Limestone and Bistoun Limestone, which belong to Jurassic to Cretaceous period in geological age. Radiolarite is distributed around west part of the Study Area (in the upstream reachs of the Kilanbar and Gharab rivers). Kermanshah Limestone outcrops in the mountain area of southeastern part of the Study Area near Tapeh Kuik village. Bistoun Limestone is the major geo-formation in the area and it is distributed in a vast area around the eastern hinterland mountain range.

3) Alluvial Deposit - Similar to the limestone layer, alluvial deposit is also main layer of ground surface geology in the area. Relevant alluvial deposit is river deposit (fan and/or terrace deposit) which is widely distributed around the rivers of Kunab, Gharab and Gharasu. Soil composition consists of clay dominant fine soil accompanied with gravels (pebbles and cobbles) and they store a great deal of groundwater in their layer as a confined water.

4) Geological Structure - The important element regarding geological structure is thrust fault (active seismic fault) named Zagros Thrust. It extends about 150 km long from NW to SE in direction, and its width is 2 to 10 km. It passes the eastern edge of the plain. Ravansar Spring is on the line. Influenced by this thrust fault rocks in the area are fractured and crushed in many places.

(3) Hydro-geology

From hydro-geological view points, the 2 forms of limestone mountain/Karst and alluvial deposit are considered to be important.

1) Limestone Mountain/Karst (marked as Jk1 , Rk1 , Rk2 , Fig. 3.2.2) - This is much widely distributed inside and outside of the plain and covers an area of over 10,000 km^2. A large quantity of water (fissure and cave water) is charged in the layer and it underflows extensively crossing over the border mountains of the basin (underflow into other basin). Therefore, there is possibility that groundwater in this plain is recharged from further limestone range of outer basin. The karst range which appears in the northeastern area of Ravansar is a remarkable source area of both surface flow and groundwater. Among these 3 zones, Bistoun Limestone is major layer in the Study Area. Its entire layer consists of limestone which bears under water, and big fountains appear in some places. For example, Ravansar fountain which becomes the source of Gharasu River is typical. Other two zones, Kermanshah Limestone (Rk1) and Radiolarite (Jk1, Rjr) are also limestone bearing layers which have relation to groundwater.

2) Alluvial Deposit (Qt1, Qt2) - Major alluvial deposit which has relation to hydro-geology is recent fan and terrace deposit (Qt2). It forms a wide, flat plain which extends around 3 main rivers in the basin (Kunab, Garab, Gharasu), and groundwater aquifer is distributed inside this deposit. In the upper part of this deposit, soil composition consists of clay rich soil (impermeable), as a result, its groundwater becomes confined water.

(4) Geology of Kilanbar and Gharab Dam Sites

Geology of Kilanbar and Gharab Dam Sites are briefly mentioned below:

Items	Kilanbar Dam	Gharab Dam
Geo-morphology	Gentle hills belong to Kermanshah formation of upper Cretaceous geo age continues to the whole area. At left bank side, slope gradient is about 20 degree, while at right bank side, much gentle slope of talus origin appears (10 to 15 degree). River bed is similarly flat and flood plain is widely spread.	Round shaped hilly mountains of Kermanshah Limestone (Upper Cretaceous geo age) appears continuously in surroundings. Mountain body looks like relatively fat and high (height difference between mountain top and river bed is about 150 m). Slope grade is about 20 degree at both banks. Riverbed is about 20 m in width and at left side flat terrace is formed (its width nearly 100 m). Along the edge of terrace plane, micro cliff (possibility of fault cliff) nearly 1m high is found and a group of spring water flow out there.
Geological Composition		
Base rock	Consists of chert, dolomite, limestone alternation. At the left river side, outcrop of chert appears. Open joints and cracks parallel to bedding plane are frequent.	Alternation of limestone, dolomite and chert. Outcrops are found at left bank in which rocks are fractured and open cracks are conspicuous that suggest fault possibility.
Sediment / Deposit	Left bank :Weathered rock origin fine grain size soil 5 to 7 m in thickness River bed: Gravels (pebbles, cobbles and boulders) are widely distributed 15 m in thickness. Right bank: Talus deposit (clay rich fine grain size soil with boulders) covers ground surface 5 to 7 m in thickness.	Left bank: Residual soil of weathered rock (clay with boulders) about 5m thick. Riverbed: Sediment in river course (sand and gravel) 10m thick. Terrace deposit (clay and gravel) about 10 m thick. Right bank: Talus deposit and residual soil of weathered rock (clay with gravels) 10 m thick
Rock Conditions	Strength: Sufficiently hard for earth fill dam foundation. Permeability: Very high due to frequent open cracks in the limestone bed. Possibility of cave.	Strength: It is fractured due to fault and open cracks are so frequent that rock becomes weak. Permeability: Very high, there is possibility of cave at left bank.
Problems to be Considered	Water Leakage: As a rule in limestone layer, water leakage is inevitable. In case of this dam site, a large quantity of water leak is foreseen from not only dam axis but also whole reservoir area. It is required to pursuit the trail of cave and open cracks. Active Fault: As it is remarked in the Kilanbar dam geological investigation report, dam site is located inside of the Zagros thrust fault (active seismic fault), and it is assumed that the fault under lies river bed and or right bank talus slope. Occurrence of critical earthquake is unknown factor, therefore, careful study is required.	Water Leakage: Judging from the open cracks and appearance of water spring group at left bank, serious water leak will be caused near dam axis. Active fault: Zagros thrust fault (active seismic fault) crosses near this dam site. Actually, outcrop of rock in the site is fractured in addition, open cracks are so conspicuous, that suggest the existence of the fault. Preservation of spring: Springs appear at left bank and close down stream position of dam site. Discharge is about 1 m^3/sec (observation date 20/Feb/2003), and this water is for the life of adjacent village people. Those are valuable resource, therefore its preservation should be considered carefully.

3.2.2 Meteorology and Hydrology

(1) General

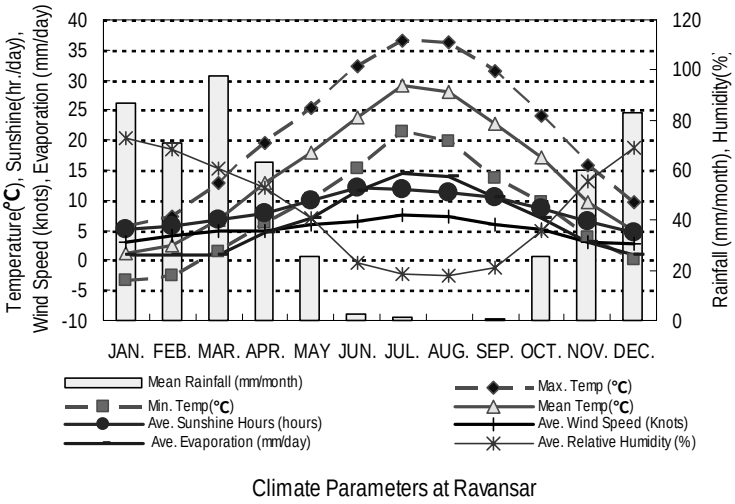
Ministry of Energy (MOE) and Meteorological Organization (IRIMO) are responsible to carry out the meteorological observation and the hydrological observation is carried out by Ministry of Energy in the nation. These data are compiled by both organizations respectively. Based on the list of existing meteorological 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.

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.

(1) Meteorology

The Study Area and its surrounding belong to Zagros series of mountains, 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 which is surrounded by mountains, and has mountainous climatic conditions. Meteorological data in Ravansar meteorological station is as follows:

Wind speed measurement is available for 8 years and the other measurements are available for a period of 14 to 16 years.



Climate Parameters at Ravansar

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 is around 10 ^{o}C to 15 ^{o}C in the area. According to the records of Ravansar station, mean annual relative humidity is 46 % and average sunshine duration is 8.0 hours per day. More than 10 hours of sunshine has been observed in the summer season, June to September and the sunshine hours in winter season are half of summer season due to a lot of rainy days and cloudy days.

The average evaporation is 6.3 mm/day and the highest evaporation volume is observed in

July. Annual evaporation volume can be estimated as approx. 2,000 mm equivalent to three times of annual rainfall. Monthly average wind speed ranges from 2.7 knots to 7.6 knots and average wind speed was estimated as 5.0 knots. Rainfall records at Ravansar Station shows the annual rainfall at 527.1 mm and it concentrates October to May and almost dry in summer. Around 90% of annual rainfall occurs from November to April and quite limited rainfall are observed from June to September. With these selected observatories, Thiessen Polygon was delineated as shown in Fig. 3.2.3.

Average annual rainfall in the study area can be estimated as 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

(2) Hydrology

1) River Runoff

Average annual runoff volume on monthly basis and 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

The discharge of Doab Marak station includes spring volume of a lot of springs located in Gharasu river basin and the basin can not be clarified because of the geological condition of the basin with limestone and with a lot of caves. Therefore, to grasp pure river discharge by the basin rainfall, the spring volume should be deducted from discharge data at Doab Marak station.

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 pure 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
	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
	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	-
	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
	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
	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	-	-	-	-	-
	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, RC: Runoff coefficient -: Impossible to calculate due to lack of data

The monthly and the annual runoff coefficients can not be standardized, since the phenomenon of runoff is different year by year. Actually, water flow of existing rivers has been flowing underground at some parts of the river route. 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 and 0.3 may be employed as an average coefficient to calculate flood discharge, based on average coefficient with base flow volume as a rough estimate.

2) Flood Discharge

Estimation of flood discharge of the river is made with return periods of 5 and 10 years in consideration of design condition of the project facilities. Due to the lack of long term rainfall and flood records, the Rational Formula is employed for estimation of flood discharge of the Study Area. In the formula, the following conditions are applied.

$$Q_p = (1/3.6) \cdot f \cdot r \cdot A$$

Q_p Peak discharge in m^3/sec, A: Catchment area in km^2, f: Runoff coefficient = 0.3
r: Rainfall intensity within an arrival time of flood(mm/hour) can be estimated by $r=(R_{24}/24) \cdot (24/T)^{2/3}$
R_{24} : Probable daily rainfall(mm/day), T : Arrival time of flood (hour) by Rziha's formula,,

Areal daily rainfall of five and ten year probability 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

Then, the probable flood discharges are estimated 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 was calculated as 399.1 m^3/sec with drainage area of 1,228 km^2. The 10 year return period discharge was estimated as 481.0 m^3/sec.

3.2.3 Water Resources

The main water resources used for irrigation in the Study Area can be divided into surface water, spring water and ground water. The main source of surface water in the Study Area is only the Gharasu River, especially during dry season. Gharab River and Kilanbar River can not provide stable water to agricultural land during dry season without any facility because these rivers will be seasonal river at some portion. As of year 2001, there were 399 wells inside the area, and now increase to 412.

(1) Surface water

One of the main water sources of the Gharasu River is the Ravansar Spring especially during dry season and it affects the river flow. The average annual discharge of the basin at Doab Marak station is 214.2 MCM and this amount of surface water source is used for irrigation.

According to the estimation of MOE, 201 pumps are registered to pump up irrigation water from the Gharasu River directly and the corresponding 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. An area of 122 ha is irrigated by these illegal pumps and 0.7 MCM of surface water of the Gharasu River is used without any payment. Ravansar headwork is the main facility used for the purpose of irrigation.

(2) Spring water

There are 4 springs which are considered as important water resources; Ravansar, Jaberi, Ghara Daneh and Mir Azizi, among the 110 springs in the Study Area and its basin area. The Ravansar and the Jaberi springs are located at the upstream of Site 1 and the Mir Azizi spring is located at the downstream of Site 1. The Ghara Daneh spring is located at the end point of

Site 2. Traditionally, these springs are used to irrigate some area of farm lands. Average monthly spring volumes of each spring are as follows;

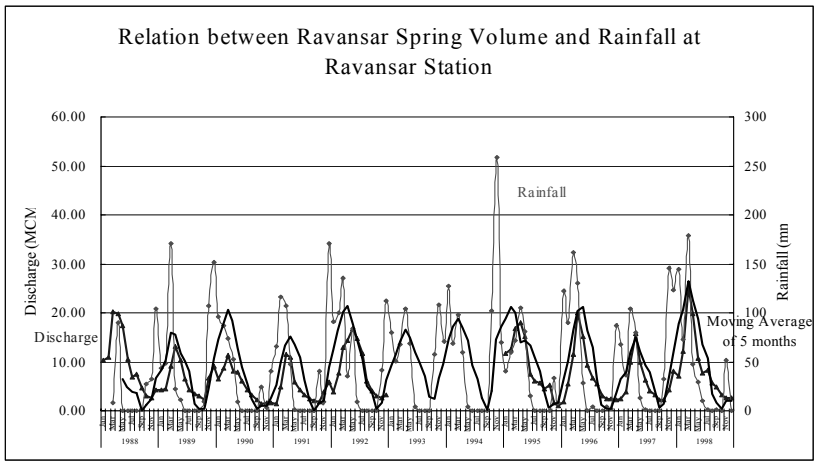
(Unit: m^3/sec)

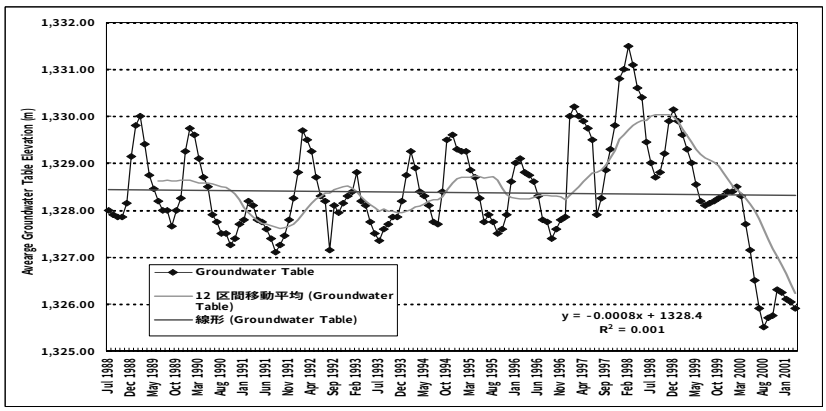
Name	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Ravansar	1.9	3.3	5.3	6.1	4.6	2.9	2.1	1.6	1.2	1.0	1.2	1.5
Jaberi	0.2	0.3	0.3	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.2
Ghara Daneh	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Mir Azizi	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Available annual water volume from these 4 springs is estimated as 102.9 MCM/year. As an average, approx. 35.6 MCM/year is utilized for agricultural activities within available annual water volume from 4 springs. It is very important to consider the ways of using the spring water in the winter season for the agricultural activities during summer season. Especially, the Ravansar spring is the most important water resource for Site 1. The relationship between Ravansar spring volume and rainfall at the Ravansar meteorological station is shown in the following figure. According to the calculation of moving average in 5 months, the peak of discharge agrees with the peak of rainfall and therefore, 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. It is very important that the detailed 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 (Table 3.2.1), and amount of approved water right is 45.24 MCM for irrigating 4,772 ha. In 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 Sanjabi Plain, of which 15 wells are in and near the Study Area. Average groundwater table in the Ravansar Basin between 1988 and 2001 is shown in the figure.





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

As shown in the Figure, groundwater table fluctuated almost in the same pattern up to 1996, except in the drought years of 1990 and 1993. After the maximum recovery in 1998, groundwater tables drop down rapidly since 1999. This tendency might be caused due to drought and over extraction of groundwater in the basin. According to data of 15 observation wells, the condition of water level of wells can be divided into three categories such as gradual drop down, sudden drop down since 1999 and relatively same condition. Assumed groundwater condition based on the observed data of each well is shown in Fig. 3.2.4.

3.2.4 Soils

(1) Previous Soil Studies Carried Out in the Study Area

In the Study Area, semi-detailed studies related to Mahidasht, Sanjabi and Ravansar region are carried out in 127,800 ha area in 1970 based on the aerial pictures of 1:20,000 and the results are summarized in the Semi-detailed study on Soil and Land Classification. Based on this study, they identify 11 soil series in the region located in different geomorphologic and physiographic conditions as mentioned below:

1. Alluvial and Colluvial fans which are seen in the valleys of mountains including many small stones and rocks on the ground – it includes one soil series called as Ravansar series covering an area of 15,070 ha (11.78% of the area) with a shallow soil depth
2. High plateau and upper terraces which are seen in the foot of mountains with 3 to 8% slope – It includes one soil series called as Merek series with an area of 19,450 ha (15.21%)
3. Piedmont plains with a slope of 1 to 5%. It includes 3 soil series (Kanoj, Samenah and Tiran Series) with a total area of 32,810 ha (25.65%)
4. River Alluvial plains which have a mild slope of 1% and higher soil depth– It includes 6 series called as Ateh, Valiabad, Ganjab, Mahidasht, Fakhriabad, and Bozbor series with a total area of 57,040 ha (44.9% of the area)
5. Other land types – It consists of hills, river washed and eroded areas which include a total area of 3,430 ha (2.67%). They have shallow soil depth and can not be used for cultivation.

The total area in the plain was classified into four land classes as mentioned below:

Land Class	Description	Area (ha)	Share
II	suitable for agriculture and irrigation	76,150 ha	59.60%
III	moderate limitation for agriculture and irrigation	41,180 ha	32.22%
IV	high limitation (topography) for agriculture and irrigation	7,040 ha	5.50%
V	Non-cultivable lands	3,430 ha	2.68%

The major limitations in the classes 2 and 3 are mainly due to very heavy soils, drainage, and ponding. The texture of the soils varies from heavy to very heavy both in top soil and subsoil. Soil permeability is low (0.1-2.0 cm/h). When there is high rainfall, water can not percolate into the soil easily, causing ponding and drainage problem leading to decrease in yields.

The surveys were also carried out after 1970 and the information was compiled into soil resource and land capability maps of 1:250,000 scale in 1989 for the Kermanshah province. The soil resource and land capability of the Study Area and the region is shown in Fig. 3.2.5.

The Study Area can be broadly divided into the 6 land units of 2.2, 4.1, 4.2, 5.1, 5.2, and 8.2 and the characteristics of each land unit is different based on the geology, climate and other factors. The discussion of soil characteristics is made based on these 6 land units.

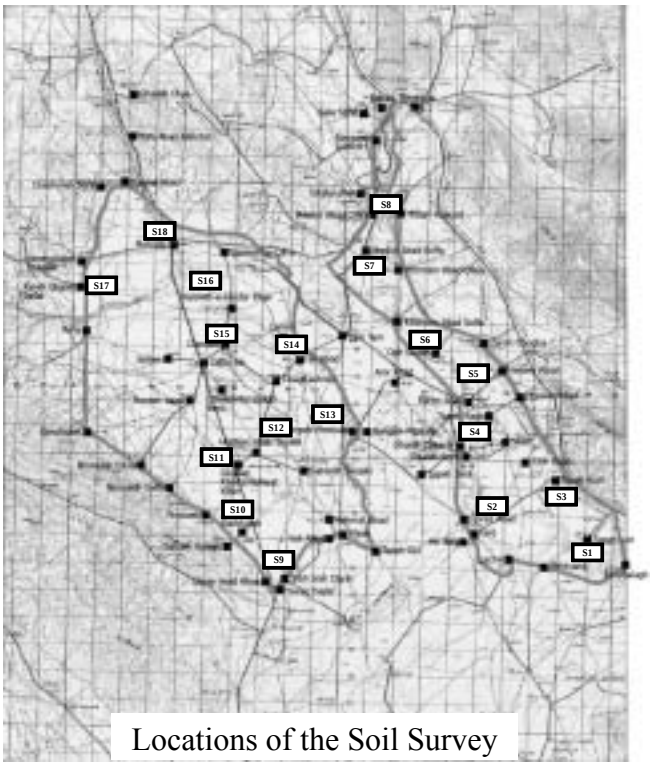
Land unit	Description
2.2	This unit is the hilly area at the northwest and northeast part of the Site 2 with medium erosion because of the slope which varies from 25 to 50%. These are the soils with minimum to medium soil depth. These are classified as calcaric regosols with low to medium coverage of steppe plants. Higher slope and limited soil depth are the major limitations of these soils. They have low to medium suitability for pasture and low suitability for rainfed cultivation. Sediment protection should be carried out in these areas to make them suitable for pasture cultivation.
4.1	This unit is the piedmont area which are mostly distributed in the northern and western part of the site 2 and eastern part of Site 1 with a slope of 2-5%. These are deep soils with very heavy to heavy texture with calcaric sub layers. These soils are classified as Calacaric Cambisols and Eutric Cambisols. Present land use in these soils include irrigated cultivation, rainfed cultivation and tree planting in some areas. The heavy texture and sand in some parts are the major limitations of this unit. If land improvement and leveling works are carried out, these soils have good capability for irrigated cultivation and tree planting.
4.2	This unit is a flat piedmont plains with a slope of 0-5-1.0%. They are mostly distributed in the south eastern part of site 1. They are deep soils with very heavy to heavy texture. These soils are classified as Eutric Cambisol. These soils are suitable for irrigated cultivation and the major limitation of these soils are the heavy texture of the soil. With the improvement of soil physical characteristics, these soils have good capability for irrigated cultivation.
5.1	This unit is a sedimentary and alluvial plains and most of the areas are nearly flat. They are mostly distributed in the middle part of site 2, mostly close to the rivers. They are deep soils with very heavy to heavy texture; These soils are classified as Cambisol. Present landuse includes irrigated and rainfed cultivation and the major limitation of these soils are the heavy texture of the soil. With the improvement of soil physical characteristics, these soils have good capability for irrigated cultivation.
5.2	This unit land is a sedimentary and alluvial plains and most of the areas are nearly flat. They are mostly distributed in the western part of site 1 and eastern part of site 2, mostly close to the rivers. They are deep soils with very heavy to heavy texture; These soils are classified as Cambisols and Vertisols. Present landuse includes irrigated and rainfed cultivation and the major limitation of these soils are the heavy texture of the soil and limitation of groundwater resource in some parts. With the improvement of soil physical characteristics, irrigation and drainage system, these soils have good capability for irrigated cultivation.
8.2	This land unit is fan shaped colluvium with gravel with a slope of 1-3%. They are distributed in a relatively smaller area at the south western part of site 2. They have shallow to moderate depth with light to medium texture with gravel over rock and calcaric materials. These soils are classified as Calcaric Regosols. Present landuse includes steppe cover and grazing and the major limitation of these soils are soil depth, and high amount of sand. With the improvement of sediment protection and flood control, these soils have good capability for pasture, tree planting and orchards.

(2) Soil Survey Carried Out in the Study Area

Soil survey was carried during the 1st Field Survey from January to March 2003. Soil profiles were dug out survey at 18 locations as shown in the figure, and soil samples were collected from each profile and detailed soil analyses were carried out in the laboratory. The site characteristics of the Soil profiles surveyed in the Study Area are shown in Table 3.2.2. Based on the results of the soil survey, field survey, and the other information collected, the characteristics of the soils of the Study Area are described below.

Most of the land class of the soil is 4 vh/A_1-E_0 IIst (permeability = 4 (slow-0.1-2.0 cm/h), vh – very heavy soil, slope A1 = 0-2%; E0 – No erosion; Land class – II with limitation of soil and topography). There are also other land classes in the areas near Kola kabood, Deh Rash and Kare Kaleh Sefid, which fall in the land class III mainly due to high topographic limitation. Soil temperature falls in Mesic - 8-15˚C and soil moisture is Xeric (deficient water with dry cropping season). The drainage condition is poor because the high clay content of the soil. Although there are some areas with higher slope, most of the study area is plain with a slope of less than 1%. The erosion is less and run off is slow. Subsoil permeability is slow in

the range of 0.1 – 2.0 cm/h.



Locations of the Soil Survey

The pH of the soils are mostly in the neutral range (7.0) and in some cases, it is slightly higher than 7.5. Above pH 7.0, there is an increasing liability of deficiency of micronutrients. EC of the soils are in the lower range of less than 2 mS/cm and the average value is about 0.5 mS/cm. Therefore, the salinity effects are mostly negligible. The average value of Cation Exchange Capacity (CEC) is about 25 me/100g and therefore, the general fertility of these soils can be considered as medium. The average level of organic carbon is 0.86% and total nitrogen is 0.08% which is in the lower to medium level. Phosperous is in the medium level of about 7.3 ppm and potassium is in the higher level of above 200 ppm. While comparing the level of micronutrients, iron and manganese are in the average range of 10 ppm, and the average level of copper is in the higher range of 2 ppm. However, the average level of zinc is in the lower level of 0.50 ppm, which is less than the critical level of 1 ppm. Zinc deficiencies occur mostly in basic soils, and in soils cropped to high zinc demand plants, such as corn, sorghum etc.

The physical characteristics of the soils indicate the major limitation of these soils, which is the very heavy texture of the soils with a high clay content. Except for the area around Jehan Abad, all the area mostly have a very heavy texture soil of silty clay or clay with an average clay content of 48%. In Jehan Abad area, there are some locations with sands and these soils have a medium loam texture. The texture of the soil in the Study Area is the major limitation which restricts these soils to class II. The heavy clay content is seen in all the profiles of the soil. The heavy clay content restricts the movement of machinery and also causes poor aeration in the soil .The subsoil permeability is in the lower level of 0.1 to 2.0 cm/h. The basic infiltration rate of the ploughed layer is in the moderately slow range of about 2.0 cm/h. Field capacity (FC) is about 33% (w/w (44% v/v)) and permanent wilting point is 16% (w/w (21%v/v)) and the average water holding capacity is 23 cm/m depth.

3.3 Socio-Economic Conditions

3.3.1 Social Structure

Most of people in the Study Area are Jaf Kurdish. They settled in the area more then 250 to 300 years ago. 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 pots within 40 ha in the Study Area, and they usually live in large cities such as Kermanshah and Tehran. Their land is generally better cultivation conditions and they are lent to the farmers having less cultivation area.

3.3.2 Land Reform

The first land reform took place in Iran in 1963 at the time of so-called 'White Revolution'. 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.

3.3.3 Rural Associations

(1) Village Islamic Council

Village Islamic Council is the smallest unit of government administration found in almost all the villages (dehs) in the Project Area[1]. After the Revolution, the constitution approved the establishment of Village Islamic Councils in villages as the arms of government in supporting Islamic revolution[2]. Their main duty of the Councils is to co-operate with different executive government organizations concerned with social, economic, cultural and development issues of the villages. The Council is also responsible when the executing agencies implement development project within the village.

Election of the Council takes place every 4 years. At the election, 3 council members, i.e., President, Vice President, and Secretary are elected by the village people.

(2) Rural Cooperative Organizations (RPCs)

Rural Cooperative Organization (RCO) is a public organization established for improving rural settlers' living standard through providing living necessaries, agricultural inputs, and collecting and shipping of agricultural products (c.f. Section 2.2.8). In Kermanshah Province, there are 530 RCO shops selling sugar, rice and other general products and 555 RCOs selling petroleum and kerosene. In 5 villages studied, there was a RCO shop in Khorram Abad Oliya. The member of RCO shop is operated mainly by the residents in Khorram Abad Oliya but there are also members from neighboring villages.

(3) Well Cooperatives

There are about 15 cooperatives of deep wells in the Sanjabi Dehestan. In Hassan Abad Shaleh, 4 cooperatives were established in 1999 for the construction and maintenance of the deep wells. Each cooperative is comprised of 7 to 17 families, as the minimum number of cooperative members are 7. The cost of 1 deep well is around US$15,000 to $20,000 and each Cooperative can take loans from the agricultural bank or Cooperatives (e.g., RCO) with the interest rate of 14 % (without cooperatives, the rate of interest is normally 24 %).

[1] According to the Census in 1996, the councils did not exist in the villages where the number of families was less than 14.
[2] At the time when the Iraqi army invaded into Iran one year after the revolution, Village Islamic Councils were made responsible for recruiting men for the war and for providing materials for the army. This was a holy duty for the council.

(4) Water Users Association (WUA)

In February 2003, Water Users Association (WUA) of the right bank canal of Site one was established and registered by the initiative of Jihad-e- Agriculture Office in Ravansar. The member villages of the WUA lie inside the Study Area: Ravansar , Villages of Meskin Abad Olya , Ghalanjeh and Khoram Abad Sofla.

(5) Other Farmers Organizations

There are few farmers' organizations in the Study Area. In Site 1, there is the beekeeping cooperative in Ravansar, which established in 1992 under the leadership of Government of province and covers whole Ravansar Dehestan. In Site 2, there are 10~15 associations of common use of wells for irrigation, which established in 2000 and organized 2 to 6 farmers. Besides, there is the association of mechanization, which established in 2000 and organized 7 farmers. And there is a broiler production association, which organized 7 farmers and has raised 10,000 of chickens.

3.3.4 Rural Women

(1) Women's Involvement in Agriculture

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. 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.

(2) Women's Associations

There was no women's association in 5 villages studied. 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.

3.3.5 Economic Activities

(1) Employment Conditions

People in the rural area are mostly engaged in agricultural and livestock breeding. There is less opportunity to get any other kinds of jobs such as industries and services available in the villages. Because of the sub-division of land between the family members, however, the opportunities of agricultural work, particularly for the young generations, tends to be limited. Many people go to Kermanshah and Ravansar to find job during the off-farm season.

(2) Migration

Immigration to the urban area during the off-farm season in 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, a whole family migrates to an urban area (Kermanshah, Ravansar or Javanrood) expect for the season for harvesting.

(3) Economic Assistance to Poor

Imam Khomeini Assistance Committee was established soon after the 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 applicants increased in recent year due to the increase in unemployment of the youth and the drought started in 1997.

3.3.6 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.

(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. In Shali Abad, 10 families have recently moved out of the village due to the scarcity of water.

(3) Electricity

Rural electrification was one of the most important tasks of the Ministry of Jihad before the merging with Ministry of Agriculture. During 1990 to 2000, all the villages are in the Study Area are electrified, except the uninhabited villages.

(4) Communication

Installation of telephone is relatively a recent development and 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.

(5) Education

The average literacy rate in the Study Area is 74% for male and 61% for female, which is almost similar to the provincial literacy rate (male – 77%; female – 60%). 70% of the villages in the Study Area have primary school.

(6) Health

There are 12 rural health centers in the study area (Population Census 1996). Mostly these centers provide first aid, vaccination for infant, family planning and first aid.

3.4 Agriculture and Animal Husbandry

Site 1 belongs mainly to Ravansar and Hassan Abad, and Site 2 belongs mainly to Daulat Abad and Sanjabi. Therefore, data from these four Dehestans were used for the statistics on the Study Area. Agriculture related facilities in the Study Area are shown in Fig.3.4.1.

3.4.1 Number of Farm Households and Area

According to the statistics of Dehestans in 1999, the number of farm household was 919 in Site 1 and 1,182 in Site 2. The number of Dehs(villages) was 25 in Site 1 and 34 in Site 2, therefore, the number of farm household in one Deh(village) was about 41 in Site 1 and 44 in Site 2 in average. The cultivated lands were 11,599 ha in Site 1 and 11,297 ha in Site 2. The cultivated area in one Deh was about 484 ha in Site 1 and 384 ha in Site 2 in average.

The rate of irrigated land for the total cultivated land in 1999 was about 40% in Hassan Abad, to which Site 1 mainly belongs. On the other hand, the rate was about 16% in Sanjabi, to which Site 2 mainly belong. According to the statistics in 2002, the rate in Kuzaran Dehestan increased from 16% in 1999 to 37% in 2002, owing to rapid increase of wells for irrigation. The average farm scale of each Site is 14 ha per farm household in Site 1, and 9 to 11 ha per farm household in Site 2.

3.4.2 Land Tenure and Land Holding

There were many land owners of 500 to 1,000 ha before the White Revolution in the Study Area. As stated in section 3.3.2. In 1963, the first land and the second reforms were carried out in 1963 and 1980. Lands hold by landlords were allotted to whole farmers. As a result, the differences of owned land among farmers were caused with range from several ha to 40 ha. However, almost of farmers holds their farm land of 8 ha to 12 ha. Farmers have the land ownership on their allotted farm lands and have the right of inheritance of their lands.

In some Dehs, the land consolidation has been carried out to collect together the farmer's scattered lands. As a result, the constructions of irrigation wells are promoted. At present, 10% of total farm land is leased in Site 2, and the land rent is 20% of products in case of maize cultivation.

3.4.3 Agricultural Production

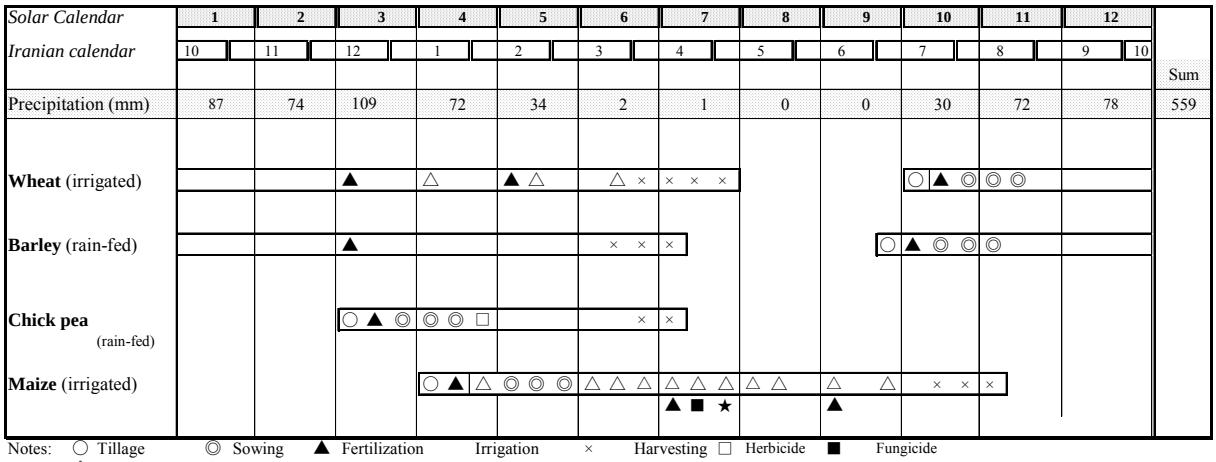
(1) Annual crop cultivation

The cultivated area and yields of main annual crops in four districts (*dehestans*) are shown in the Table 3.4.1. The cultivation of wheat and maize takes priority in irrigated lands of all Dehestans. On the other hand, in rain-fed land, the cultivation of wheat and chick pea takes priority.

The farm work calendar of the main crops in irrigated land and rain-fed land is shown in the figure below. In cultivation of wheat, seeding period is late in October to November and harvesting period is the end of June to July. Irrigated maize is sown in May and harvested in mid-October to early in November. Rain-fed chick pea is sown in the end of March to

mid-April and harvested in mid-June to early in July. The average farm materials and farm works per ha in cultivation of wheat, chick pea and maize in Kermanshah Province is shown in Table 3.4.2. The unit price and cost of each farm materials and farm work operations are also shown in this table.

Farm Work Calendar of Main Crops in Study Area



Notes: ○ Tillage ◎ Sowing ▲ Fertilization Irrigation × Harvesting □ Herbicide ■ Fungicide
◇ Pesticide ★ Intertillage with caltivator
Source: Farm Household Survey, JICA Study Team, Feb. 2003

According to the farm household economic survey conducted by the Study Team during June 2003, the surveyed farmers have cultivated wheat, barley and chick pea as winter and spring crops, and maize for grain as summer crop. Besides, alfalfa and clover as forage crops are also cultivated by many farmers. Rapeseed was cultivated only by one farmer in 54 surveyed farmers (Table 3.4.3).

1) Yield of crops

Yield of irrigated wheat is 4 to 5.5 tons/ha in average of each Zone, and the range of yields in 54 surveyed farmers is from 2.2 to 9 tons/ha. Yield of wheat in dry land is 1.2 to 2 tons/ha in average of each Zone, and the range of yields in 54 surveyed farmers is from 0.5 to 3 tons/ha. Yield of barley and chick pea, which are cultivated only in dry land, is 1.2 to 1.7 tons/ha of barley and 0.23 to 0.36 tons/ha of chick pea in average of each Zone, respectively. Yield of maize for grain, which is cultivated only in irrigated land, is 7.6 to 8.4 tons/ha in average of each Zone, and the range of yields in 54 surveyed farmers is from 4.7 to 12 tons/ha.

Technical index, which shows numbers of used 7 scientific techniques such as organic matter, chemical fertilizer, certified seeds, irrigation, herbicide, insecticide and fungicide, is 3 to 7 in irrigated wheat, 2 to 5 in wheat of dry land, 5 to 7 in maize, respectively. It is seemed that the higher yields are correlative with technical index, 5 to 7 of technical index at least.

2) Amounts of crop production

As shown in Table 3.4.4, the annual amounts of crop production in each farm household is about Rls. 18 million/year/household in average at the class of less 30 in Gross Income Index, about Rls. 41 million in average at the class of 30 to 40 in Gross Income Index, and about Rls. 75 million in average at the class of over 40 in Gross Income Index.

3) Rented land

In the Study Area, crop cultivation is carried out in own land and rented land. 13 farm households (24%) carried out crop cultivation in both lands. 9 households rent the irrigated lands, in which wheat and maize for grain are cultivated, and 3 households rent the dry lands and 2 households rent the irrigated lands and dry lands. In general, most of the rented lands are irrigated lands. Land rent is in the range from Rls. 1 million to 3.2 million of irrigated lands and from Rls. 0.4 million to 0.8 million/year.

(2) Present Conditions of Farm Machinery Owners

The number of tractors in Site 1 is about 115 and the area is 6,684 ha, which means that an average of 58 ha area is allocated to one tractor. In Site 2, 157 tractors work on 9,827 ha, which means that an average of 63 ha is also allocated to one tractor. In regard to combine, there are 14 numbers in Site 1 and 18 in Site2. There are 1,015 attachments in the Study Area (Table 3.4.5).

According to the farm household economic survey, 40% of the total surveyed farmers own tractors and 4% of farmers own combine. In regard to tractors, farmers owned tractors use about 400 hrs a year in average, ranged from 100 to 1,000 hrs, and used periods are 11 years in average, ranged from one to 22 years. 30% of the total tractors are purchased during last 5 years. Most of the combines are purchased within a few years, and works 750 hrs a year on average. Contracted farmers, who carry out farm works of other farmers with own machinery under contract, is 7 (13% of total surveyed farmers), and contracted area of a tractor is 291 ha in average, ranged from 40 to 900 ha. Annual gross income and net income of a contracted farmer are Rls. 27 million in average, ranged from 6 to Rls.75 million and Rls. 21 million in average, ranged from 6 to Rls. 53 million, respectively.

(3) Present Conditions of Soil Erosion and Soil Analysis of Farm's Land

Most of the surveyed farmers face soil erosion problem in their fields, 80% of the farmers in Khoram Abad, 43% in Shali Abad, 100% of Reis, 57% in Kalaveh Heidar Khan, 29% in Hassan Abad Shaleh and 100% in Noruley Olyia, respectively. Percentage (%) of farmers, which have ever done soil analysis in their fields, is 14% in Zone 2 and 3, respectively. However, that is 30 to 43% of total surveyed farmers in other Sites, of which half of farmers practiced soil analysis carry out every seeding time and others do every two years or more.

(4) Present Conditions of Use Manure

Dry excrements of cows and chicken, which do not ferment, are used for wheat, barley, maize and alfalfa by 9 (17% of total surveyed farmers),4,6, and 4 farmers, respectively. There is no effect on wheat, but the effect of use of manure is shown in increase of yield of about one ton/ha in maize production.

3.4.4 Animal Husbandry

(1) Dairy cows

At present, local variety is a majority in the Study Area. About 160 heads of hybrid variety were already introduced to each zone (Zone1 and 2) of Site 1. Extension of hybrid variety to Zone 3 is less and to Zalou Ab village in Zone 4 and Tapeh Ghol village in Zone 5 is promoted, though extension to other villages is poor.

According to the farm household economic survey, 31 farmers raise two milking cows on an average. Quantity of milk production in each farm household is 2.8 tons an year in average, and annual gross income of milk production is Rls. 2.7 million/household in average. Besides, other gross incomes earned are Rls. 2.9 million in average by sale of cows as beef in 10 farm households, Rls. 3.3 million in average by sale of calves in 17 farm households.

(2) Sheep

Number of sheep in 4 districts, which include Site 1 and Site 2, is about 50,000 heads. Sheep in site 1 and site 2 is mostly Sanjabi breed. This breed is bred in the Sanjabi plain for improvement of meat and wool. According to the farm household economic survey, 16 farmers (30% of total surveyed farmers) raise sheep, and each farmer raises 63 heads in average which compose of 28 heads of sheep and 35 heads of young sheep. 11 farmers raise dairy cows and sheep. Annual gross incomes by sheep production are Rls. 14.7 million in average by sale of young sheep, Rls. 5.4 million in average by sale of sheep, Rls. 0.7 million in average by sale of oil produced from milk and Rls. 0.2 million in average by sale of wool. The farmers, who sold milk, are 27 households (50% of total surveyed households), and annual amounts of sale are Rls. 5.9 million in average per household. On the other hand, the farmers, which sold products of sheep, are 16 households (30%), and annual amounts of sale are Rls. 14.3 million in average per household.

3.4.5 Fishery

The existing fish ponds in and around the Study Area are concentrated in the Site 1 and there are 9 fish ponds in the Study Area. However, there is only one fish pond at Reis in the Study Area. On the riverside of the Gharasu River, both of warm water fish and cold water fish can be cultured by the following methods.

1) Warm water fish can be introduced to farm land, which is second or third class of land classification and has little irrigation water. Fry on the big side is turned to pond in early spring and harvested at early autumn.
2) Cold water fish can be introduced to spring water pond.
3) It is ideal to integrate between fish culture and agricultural farming. Effective use of irrigation water can be carried out by using of water of fish culture in agricultural farming.

The Fishery Section of the Kermanshah Jihad-e-Agriculture Organization conducted the case study on profitability of inland fishery of warm water fishes. The result of study shows the estimated incomes are Rls. 21 million per 1 ha of pond.

3.4.6 Household Economy

To grasp the actual conditions of farm household economy by Zone in the Survey Area, the farm household economic survey was carried out for 54 households. The results of the farm households' survey are described below.

(1) Gross income index

To analyze the individual farmer's economy, Gross Income Index is used as an index of potential of gross income in individual farming, which is calculated by the following formula;

Gross Income Index

Irrigation type	Crops	Yield ton/ha	Unit price Rls./ha	Gross income million Rls./ha	Gross income million Rls./2 ha	**Gross income Index**
Dry land	Wheat Chick pea	1.3 0.4	1,450 2,500	1.89 1.00	2.89	**1.0**
Irrigated in spring	Wheat Chick pea	5.5 1.6	1,450 2,500	7.98 4.00	12.00	**4.2**
Irrigated at all season	Wheat Maize	5.5 9.0	1,450 1,070	7.98 9.63	17.61	**6.1**

Gross Income Index = area of dry land in the farm household × (a) + Irrigated area in spring only in the farm household × (b) + Irrigated area in all season in the farm household × (c)
(Constants: (a) = 1, (b) = 4.2, and (c) = 6.1)

The index is not only used in the analysis of farmer's economy, but also is used in the definition of "the weakness" in the Government support on implementation of agricultural development plan.

(2) Farm Household Economy

Table 3.4.4 shows the surveyed farmers' economic data, in which the individual farmer's data is arranged according to size of each Gross Income Index. Based on the table, the farmers' economy in the Survey Area can be concluded as follows;

a) The area of each farmer's land in both Sites, which includes own land and rent land, ranges from 1.5 ha to 46 ha.
b) The Gross Income Index of each farmer's land in both Sites ranges from 2 to 207.
c) The annual gross income in farming of each farm household, which includes agriculture, animal husbandry and trust of farm works with own machinery, ranges from 3 million Rls. to 282 million Rls.
d) In regard to animal husbandry in the surveyed farmers, there are two farm households of the single farming of livestock. And there are two farm households, which obtain over 50% of total gross income in integrated farming by animal husbandry, and nine farm households, which obtain 30% to 50% of total gross income by animal husbandry. On the other hand, the farm households, which do not raise livestock, are 23 households, 43% of total surveyed farm households of 54.
e) The households whose annual gross income in farming including agriculture, animal husbandry and trust of farm works with own machinery in red (negative), are five. The Gross Income Indexes of these five households are less than 14. Almost all of these farmers have only dry lands of less than 14 ha.
f) Percentage of components of running costs in the surveyed farmers' farming, which

includes agriculture and animal husbandry, is 27% of repayment of debt, 17% of inputs, 10% of mechanization cost, 9% of feed of livestock, 8% of labor cost, respectively.

g) About half of the surveyed farmers have non-agricultural jobs, which are laborer, driver, animal trader, teacher, trader or shop keeper, etc. The non-agricultural incomes of the surveyed farmers range from 0.36 million Rls. a year to 33 million Rls., and are 9.5 million Rls. in average.
h) Balances in economies of the surveyed farm households, which subtract the farming cost and living cost from the total gross income of household, are red in 25 farm households of 54 total surveyed households. Especially, in the case of the farm households, of which the Gross Income Indexes are less than 30, almost of households' economy are red. The land of less 30 of the Gross Income Index correspond to 30 ha of dry land, 7 ha of irrigated land in spring only or 5 ha of irrigated land in all season.
i) 40 farm households (74%) of the total surveyed farm households have some debts. In the case of over 40 of the Gross Income Index and red in household economy, the reasons of red are construction of house, purchase of farm machinery, construction of well for irrigation. On the other hand, in the case of less 40 of the Gross Income Index, farmers borrow money to purchase of farm materials and mechanization charge in general, even though a few farm household has also debt due to construction of house and construction of well for irrigation.

(3) Living Expenses

Table 3.4.7 shows the living expenses in the surveyed farm households. The annual living expense per capita was very low and 4.6 million Rls. in average, except that the five farm households needed a lot of expense for construction of house or education. Annual living expenses of the 54 surveyed farm households range from Rls. 8.8 million to Rls. 84 million, Rls. 27 million, respectively. Furthermore, the percentages of components of living expenses are 51% of food, 14% of clothing, 10% of education, 8% of housing, 6% of medical and transportation in average of 54 farm households, respectively.

(4) Debt

74% of the surveyed farm households in the Survey Area have debts as shown in Table 3.2.5. Creditors are banks, cooperatives, wholesalers, consignment loan lenders, relatives, and money lenders. The repayment situations of some farmers to cooperatives, consignment loan lenders, and money lenders are also overdue and requiring of legal instance. From economical point of view, as mentioned above, it is considered that the farm households, of which Gross income Index are less 40 at least, are classified as the weaker farm households.

3.4.7 Agro-Industry and Marketing of Agricultural Products

(1) General

At present, mainly the grains and pulse including wheat, barley, and chickpea are cultivated in the Study Area in the both rain fed and irrigated field and maize is cultivated in the irrigated field only. Milk is also produced in the area. The Agricultural Development Plan proposes the introduction of the following crops aimed at the markets mainly local, but long distance when and wherever possible within ten years time. They are; alfalfa, rape seed, maize for silage,

sugar beet to be grown in an area of around one thousand hectares each; and three vegetables, potato, tomato, and onion, in an area of 40 ha each. In the animal husbandry sector, besides diary farming, both beekeeping and trout-raising are proposed for the local market.

(2) Present Situation of Agricultural Market

1) Major grains and oil seeds

Three crops, wheat, maize grain and rape seed, are included in the group of strategic crops. Wheat is the one of the staple diet of the people. Around 8 million tons were produced domestically and 6.6 million tons were imported in 2000. The Government has been giving subsidy to absorb negative commission on its sale at a regulated price. So wheat growers sell all their harvest to the government, and buy their flour requirement from retailers such as RCOs using ration coupons.

The Province produced above 250 thousand tons in 2000/01, which covers around 20 % of the local demand. The rest is covered by the produce from Provinces of Khorasan (50%), Fars and others. In a lean year, the gap was filled by the import. In 2001/02, it came from Russia through Bandar-e-Anzali. The wheat bran goes to the feed industry. Barley, ninety percent of maize grain and alfalfa go to the feed industry. In the Study Area, a maize drying facility is found in both of Zālū Âb and Ravansar, and a feed plant in Deh Bagh. 'Ravansar, Livestock, Chicken and Fish Feeding Company' is located in Deh Bagh. It is financed by the Agricultural Bank. At the moment it runs at the operational rate of 50 to 75 % to a 30,000 ton/year capacity because of the lack of market and short supply of two major ingredients, barley and wheat bran. It is sold directly to the medium to small scale buyers, as bigger ones mix their own feed by themselves. It welcomes the increased barley production in the Study Area and the future scope of selling its five kinds of fish feed for the trout culture.

2) Alfalfa

In the urban area of Kermanshah, alfalfa hay is sold at a feed wholesale market adjacent to the cereal market. 20 per cent of alfalfa comes from the suburbs like Taq-e-Bostan, Kuzaran etc., and the rest from Hamadan Province (Ghorveh, Asadabad etc). The suburban producers have recently found it more lucrative to grow alfalfa than wheat, and hence it has become a vogue for the last two years. It is not generally thought that the quality of fodder of Kermanshah is good, but recently a new market found in Kuwait has raised the price from Rls. 150 to 500/kg.

3) Chickpea

Chick pea is a sub-staple food. In Kermanshah Province the volume of production reached around 105 thousand tons from 231 thousand ha in 2001/02, which is sufficient for the local demand. It grew mostly on the rain fed field. About half of the produce comes from Gahvareh and Kuhdasht, and the other half from Mahidasht, Sarab Nilufar and others. 85 % of the commodity is brought by producers themselves on their pick-ups, and the rest by middlemen. The commodity is cleaned, graded according to quality and size, and packed at two plants in Daulat Abad, west to the Isal Roundabout.

4) Rapeseed

Rape seed is another strategic crop (whose producer price is guaranteed by the government) for the edible oil industry. The producers sell it to the state oilseed cultivation organization,

from which the industry buys. Though the target area of cultivation plan will reach 20 per cent of the present provincial crop area of the oil seeds, it consists of only 2.6 per cent of the total country. Rape seed meal is costlier than other meals, and it goes directly to diary farms, than to feed mixing plants. The edible oil mill in Mahidasht produces 300 tons of oil a day, in which the share of rapeseed oil is ten per cent. It has the capacity of 1,200 tons a day, and has a plan to double the capacity before long. One ton of rapeseed turns into 400 to 420 kg of oil.

5) Sugar beet

A beet sugar mill is found in each of Bīsotūn and Eslam-abad. Production contracts have been bound between the mills and the producers to remove the problem of imbalances between supply and demand as well as to supervise the QC of the produce. The target area of cultivation will reach 7 % of the present provincial crop area. However, it only consists of 7.5 per cent of the total country. In Iran, only the climate in Khuzestan Province is suitable for sugarcane growing, and cubed beet sugar has been connected with the habit of drinking tea in Iran, and hence its market is domestically established. The beet-sugar mill in Bisotun processes 1,800 tons of sugar beet a day, and turns them into about 200 tons of beet sugar. It has a plan to increase the processing capacity to 2,500 ton by next year. Its present processing capacity of about 660 thousand tons a year is about 1.6 times more than the total production of the beet in Kermanshah Province in 2000/01. The factory gives away input in kind to the contracted farmers to collect at the time of harvest. So the market will offer good potential for the sales of the produce.

6) Coriander

Coriander growing is meant for export. Cilantro, fresh leaves of coriander, is daily used in cooking as a herb, found aplenty in the vegetable market places all the year round. They grow in the suburbs of the city, up the Gharasu basin, and up and downstream of the Study Area. At present domestic production is concentrated in the eastern region of the Province and Kangavar. In Kermanshah city, the commodity is dealt by the traders in the Islami Market. Apparently the local market itself would have space to accommodate the produce from the Study Area for some time. However, the target area of cultivation will reach three per cent of the present provincial crop area, which is the specialty producer of the country. So expected competition in the established marketing channel will lead the new comer to the export market whether it likes it or not.

7) Rose

Mahallat in Markazi Province, Qamsar and the suburbs of Esfahan, both in Esfahan Province, all situated on dry highlands between the eastern flanks of the East Zagros and the Central Zagros ranges, are three representative areas that grow rose in Iran. Golpar-e-Paveh (Marjoram of Paveh), a laboratory intending to extract the essential oil from herbal and medicinal plants, including Marjoram of Paveh of course, is being built in the Ravansar industrial Estate. It has also a plan to extract rose essential oil, and have the rose saplings grow on 100 hectares of land in the highland of Dinehvar area. With their planned capacity at present they can process the volume of pedals collected from the area of 300 hectares.

8) Plastic house

Along with the generic way of vegetable growing, some market gardens in the form of plastic

houses are found in the Study Area. The graduates majored in agriculture are the sources of entrepreneurship. As vegetables grown in plastic houses that can regulate the use of chemicals hold an attraction for consumers, buyers come directly to the houses so that the growers can sell their produce without going into the existing agro-marketing channel that consists of middlemen, wholesalers and retailers. Successful horticulturists are eager to get rid of soil and use water by switching their system to that of the hydroponics, as soon as the amortization period of the present loan is over.

9) Milk and diary produce

A processing plant each is located in Bīsotūn and Eslām Âbād. Each has been sending tank trucks to collect milk every morning to the project site. 'Ravansar Animal Husbandry Company' in Bīsotūn has enough capacity to buy the increased milk production from the Study Area.

10) Honey

In the Study Area, beekeeping is concentrated in Hassan Âbād, where 200 beehives are found. Sales are done through family networks. A tiny shop each in Ravansar and Kermanshah functions as a liaison to consumers at large. With the increase of flowering plants in the planned cropping patterns and diversification of crops, honeybee will have more space and time to collect honey.

11) Fish

Fishmongers in the city do not form a market place. One or two individual shops with a signboard of jumping fish on a blue background are found here and there in the broader areas south of the central roundabout. Fish and poultry are sold side by side in some shops also. They sell mainly sea fish with minuscule amount of freshwater fish. The catch of some 0.5 ton of trout from the breeding ponds are brought up daily from the area of the Seymareh River in Lorestan Province, downstream of the Gharasu River. Natural freshwater fish, the families of carp, catfish, and landlocked salmon are also found in the market, but in less quantity. On the contrary, in Sanandaj, fresh trout along with carp and other river fish are conspicuous in fishmongers in the main shopping thoroughfare.

12) Other commodities

Other herbs such as *Veleriana officinalis*, *Thymus serpyllum, Mentha piperatand Melissa officinalis* have potential in the international marketplace. Wool has demand in weaving industry. The two manufacturing centers of the Kurdish carpets and rugs are Sanandaj and Bījār in the neighboring Kurdestān. Buyers are coming down to the project sites to buy wool from the producers including the nomads who are on passage through the Study Area.

3.4.8 Agricultural Supporting System

(1) Extension Service Centers (ESC)

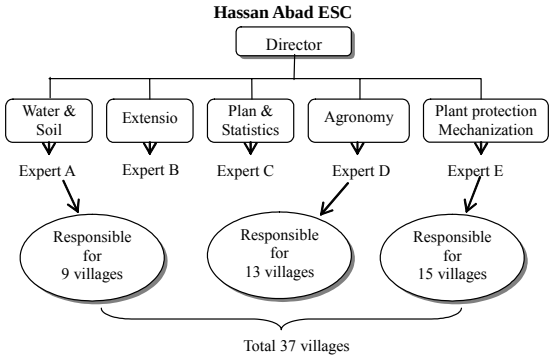
There are three Extension Service Centers (ESCs) in the Study Area, namely, Ravansar, Hassan Abad and Kuzaran. Hassan Abad ESC was established in July 2003 by replacing the training center which used to belong to Ravansar ESC. The basic information of three

Extension Centers is shown in the table below:

Area	Ravansar	Hassan Abad	Kuzaran
District	Javanrood	Javanrood	Kermanshah
Sub-district	Ravansar	Ravansar	Kuzaran
Covering Dehestan	Badr Dowlat Abad	Hassan Abad	Sanjabi Haft Ashian
Covering villages	60 villages	37 villages	134 villages
Experts & technicians	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)	Total :10+5 temporary staff agronomist(3) extension (1) animal husbandry(1) plant control (1) soil and water (2) technician (3),solders (3)*1 Basig-e-sazandegi (2) *2
Facilities	No training room, (using the praying room for training)	1 training room	1 training room in existing center (new training center is under construction)
Equipment	TV(1), video(1), amplifier(1), camera(1), white board (2)		TV(1), video(1), camera(1) ,amplifier(1)
Materials	posters, photos, training publication, extension letters and announcements, pamphlet		posters, photos, monthly magazine, publications
Transportation	4WD(2), Sedan (1)	4WD(2), Sedan (1)	4WD(3)
No. of contact farmer*3	Total 120 contact farmers from 97 villages, 30 women contact farmers in Ravansar Sub-district (Baksh)		134 (one person, one village)

*1 Dispatched the extension centers as a part of military service for two years
*2 Hired by 3-month contract by the Government policy to encourage the employ of youth
*3 Contact has license card of provincial government after training and are 1,000 persons in total in the Province

(2) Covering Area



In Kermanshah Province, the area covered by one ESC is 50 to 60 villages in average or two ESCs cover the villages of one Sub-District (Baksh). In Kuzaran, only one center exists in Kuzaran Baksh covering 134 villages. The number of villages under Kuzaran Baksh increased due to the administrative change in 1995 when 23 out of 30 villages covered by Ghaleh Zakaria ESC was shifted to Kuzaran ESC. Since there are far two many villages to look after, the Director of Kuzaran ESC has been requesting the KJAO to establish two new ESCs in Kuzaran Baksh for last 8 years. In Ravansar Baksh, there are two centers and 60villages are covered by Ravansar ESC and 37 by Hassan Abad ESC. Some experts in Ravansar, such as watershed, horticulture, animal husbandry and a women's extension are also responsible for the activities in Hassan Abad.

(3) Experts and Technicians

Apart from experts (university graduate) and technician (trained, non-graduate), there are temporary staff such as military servicemen whose assignment period is 2 years and Basig-e-sazandegi hired on the basis on every 3 month contract. In each ESC, the experts are

allocated with their villages in charge. As shown in the organizational chart of Hassan Abad ESC above, among 5 experts in the 5 section, 3 experts are given responsibilities to supervise the activities in total 37 villages. Thus, while the expert A is specialized in water and soil, he also has to supervise the farmer's activities on other specialties such as plant control, horticulture and mechanization. The supervision includes not only the extension and training, but also the issuance of permission for the supply of fertilizers and chemicals.

(4) Training and Extension Facilities, Equipment and Materials

For Kuzaran and Hassan Abad, there is 1 training room with the basic facilities such as a TV, video player, camera and the white board (s). Despite the increasing demand on the introduction of audio-visual extension through computers such as the PowerPoint presentation and showing extension films through VCD or DVD, no such modern facilities are available in any the centers. Extension and training materials such as posters, pamphlets, magazines are basically provided by the Province but the ESCs publish their original posters and magazines as and when necessary. Monthly magazines, introducing new agricultural technologies or agriculture activities in other regions are published by the MOJA for distributing to the contact farmers selected from each covering village. However, only number of magazines is provided in each ESC and not all the contact farmers have access to such materials. Also, other instruction materials or pamphlets are in shortage and the farmers cannot acquire much written information on agriculture at the ESCs.

(5) Transportation

Transportation of the staff is mainly the vehicle (4WD) provided by the ECSs. Currently there is no division which vehicle should be used by whom and by what purposes. Thus, the movement of the staff outside the ESC solely depends on the availability of vehicle. Due to the lack of vehicles, staffs often miss opportunities to visit villages for the field investigation or even for training.

(6) Contact Farmers

In each ECS, at least one contact farmer is selected from each covering village. For Ravansar and Hassan Abad, there are total 130 (including 30 women) contact farmers, and 134 contact farmers in Kuzaran ESC. The contact farmers act on the voluntary basis and are selected by the criteria of (1) a graduate of secondary school, (2) engaged and having good performance in agriculture. Going through a special training course, the contact farmers are provided with a certificate from the ESC. The activities and responsibilities of the contact farmers are:

- Attend meetings at the ESC once a month to report the agricultural problems of the villages and dissemination of new information on agriculture (e.g., pest controlling etc.)
- Attend new training programs organized by the ESC with priority
- Receive monthly magazines at the ESC
- Assist training courses and extension activities in the village
- Transfer new knowledge (given by ESC) to the farmers in the village

Due to the shortage of the manpower in the ESC, the contact farmers can be the important mediators between the Government and farmers. Currently, there are only a few contact farmers in each ESC who can properly handle the extension affaires in the villages by themselves. Staffs of the ESC are too busy to supervise the activities of each contact farmers.

(7) Agricultural Research system and Researchers

There is the Agricultural and Natural Resource Research Center in the Kermanshah (KARC). The KARC belongs to the National Research Organization (NRC), and receives whole management of the NRC, including budget. However, KARC carries out mainly researches on agricultural problems in Kermanshah Province. KARC is composed of 11 sections and researchers as follows:

Section	Number of Sraff
1. Natural resources	(18)
and watershed	(6)
3. Veterinary	(6)
Ghazanchi Station	(12)
4. Forestry & Rangeland	
5. Seed & Plant Development	(12)
6. Sugar beet	(2)
7. Plant protection	(6)
8. Soil and water	(9)
9. Fishery (2)	
10. Socio-economics	(2)
11. Socio ecology	
12. Veterinary	(4)
Total	79 researchers

Agriculture section is composed of soil and water section, plant diseases and insects section, plant breeding section, sugar beet section and agricultural socio-economics. Furthermore, rural development section is under preparation.

There is the Dry Land Research Station in Kermanshah Province, which is different from KARC in administrative and composed of grain (wheat, barley and pulse) section, oilseeds and forage crops section and resources management section.

(8) Government's Support for Agricultural Credit

The interest rate a year of banks credit is generally 24%. There are 3 types of Government support for credit as follows;

Objectives	Interest Rate a Year	Repayment Term
Support for animal husbandry	7%	5~6 years
Support for machinery	13%	5 years
Support for farm materials	16%	One year

However, farmers can not easily get a credit due to complicated procedures in bank and severe conditions to get a credit. It is desirable to get a credit under fairness and efficiency of business of banks and public offices.

(9) Government Subsidies

There are many subsidies for farmers in Iran as follows;

i) Purchase of farm machinery: Sale to farmers with lower price than purchase price of the Government
ii) Purchase of inputs: Sale to farmers with lower price than purchase price of Government, e.g. sale to farmers with Rls. 20,000/60 kg of fertilizer through MCO, which Government purchases with the price of Rls. 50,000/60 kg.

iii) Subsidy for the association of mechanization: Rapid purchase of machinery, low interest of credit (8~13% a year), giving priority to obtain farm materials, etc.
iv) Distributing of seedlings of fruits and roses to farmers without a fee
v) Subsidy for association of hybrid cow farming: Organizing with members of over 7 farmers, low interest (4~15% a year)

3.5 Irrigation and Drainage

3.5.1 Existing Irrigation and Drainage Schemes in the Study Area

There are seven existing irrigation and drainage projects in and near the study area. Location of these projects are shown in Fig. 3.5.1. Existing situation of these projects are as follows:

Present Situation of Irrigation and Drainage Projects in the Study Area

Name of project	Objectives	Location	Present Situation of the project
Kilanbar Dam Project	Irrigation and flood control	8 km upstream of Kilanbar river from Nahrabi village	Phase I and phase II study have been finished by Ministry of Jihad and Agriculture and the detail design for construction works is under the execution by Ministry of Energy. The detail design will be prepared soon.
Gharab Dam Project	Irrigation and flood control	6 km upstream of Gharab river from Nahrabi village	Phase I and phase II study have been finished by Ministry of Jihad. Ministry of Energy is going to study the dam if the budget is prepared.
Sedegh Aba Dam Project	Irrigation and flood control	10 km North west from Ravansar city	Phase I study has been finished by Ministry of Jihad and Agriculture and phase II study will be finished by the ministry near future. Ministry of Energy dose not decide to examine or not until now.
Gharab Headworks Project	Irrigation	Near Dowlat Abad at Gharab river	Headworks has been constructed by Ministry of Energy. However, Gharab headworks is under the reconsideration, because Gharab dam is newly proposed by Ministry of Jihad and Agriculture recently that located at upstream of Gharab headworks.
Ravansar Right Bank Canal Project	Irrigation	Right bank of Gharasu river from Ravansar spring	10 km of canal lining and construction of related facilities have been completed by Ministry of Energy until 1995 within total length 14 km. However, the implementation work has not been continued, because of budgetary problem.
New Ravansar Left Bank Canal Project	Irrigation	Left bank of Gharasu river from Ravansar spring	Construction work are continuously executing by Ministry of Energy now. Only 14 km of canal lining has been finished within total length 18 km. The other related facilities are under construction. According to the contract, the execution of upstream canal have to complete until May.
Sanjabi Drainage Project	Improvement of inundation	Downstream of Site II around Hossen Abad Shole	43 km of main drainage canal has been excavated by Ministry of Agriculture already fifteen years ago. However, there is no plan for excavation of secondary and tertiary drainage canal

3.5.2 Executed Irrigation and Drainage Schemes

(1) Gharab Headworks

Gharab Headwork was constructed to irrigate 35 ha of farm land, by the Ministry of Energy according to estimation of the ministry. However, Gharab headworks is under the reconsideration, because Gharab dam is newly proposed by Ministry of Jihad and Agriculture recently that located at upstream of Gharab headworks. Therefore, Main canal and related

structures are not constructed.

(2) Sanjabi Plain Drainage Project

Target area of the project had inundation problem caused by surface flow from mountainous area which are located in west part of the area. After completion of the project by Ministry of Agriculture, the situation of the area has been improved at normal year. Especially, critical inundate damage has not occurred in the recent five years because of drought year.

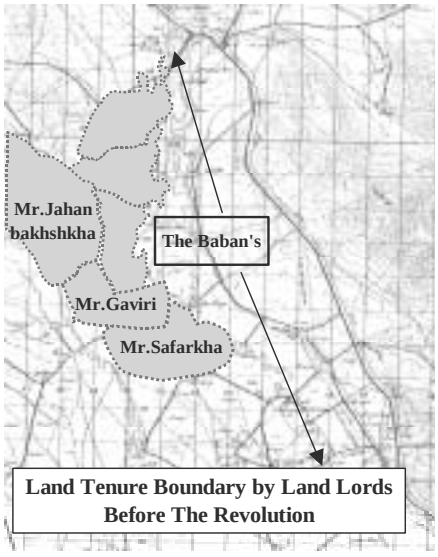
Main drainage is earth canal. Its sectional dimension is bottom width; 1.0 to 2.0 m, side slope; 1:1.0 and canal depth; 1.0 to 3.0 or 4.0 m. Longitudinal slope is 1/100 to 1/300. The dimension of the drainage canal are different by each route. Total length of the main drainage canal is approximately 43 km.

However, some problems are remained. For example, some of drainage route are cut off by main regional road due to shortage of number or capacity of the road crossing culvert. This problem affects especially at west part of the area. While, responsible organization for the maintenance works on the main drainage is not clear, therefore, maintenance works has not executed after excavation of main canal. As a result, obstruction of water flow has occurred by the sediments or collapse of road crossing culvert. Also, the ponding of the farm land has occurred at some portion of the area due to lack of farm drainage net work or lack of land leveling after rainy day.

(3) Ravansar Irrigation Scheme

1) Background before Introducing Irrigation Scheme

Almost all of the Study Area was shared by just a few large scale land owners (or their family members) before the Revolution (1979) as shown in the map on the right side. The average area of a land owner was in a range of 200 ha to 500 ha.



During landlord era, most of the farmers worked as farm laborers and obtained livelihood from their own crop production (10% of the harvested yield or 900kg wheat per year and this condition seemed to be different by location). At end of landlord era, means 1900s, agriculture firms were managing field cultivation and crop yield under contracts with land lord. Farmers today or their ancestors were working as laborers employed by those firms. Laborers were not working at defined location like tenant farming, but were ordered to work in different locations daily. This system might have been applied to avoid land occupation by farmers, according to an explanation of a local farmer.

Some few laborers were allowed to share a small plot like 1ha or 2 ha at that time, which was mainly given by lord for his special works like field foreman, machinery operation or accountant of the yield. Among those farmers, there were some, who were trustworthy to the lord, having 4 or 5 ha, for the work of farm management

Under this social situation, they used water of small streams originated from hills and water from several springs at foots of hills for agriculture as supplemental source, near Meskin Abad Oliya. Main farming system was dry farming, completely depended on seasonal rainfalls at that time and the present Right Bank Canal from Ravansar Spring did not exist. The right bank canal was constructed 48 years before (1955), and the left bank canal was constructed 35 years ago (1968).

It seems that they kept wheat cultivation same as the previous generation instead of introducing irrigation, since they should pay water fee. Also crop cultivation in summer season was not popular at that time. Most of farmers replied commonly that drought condition has become popular in these recent 7 or 8 years. A farmer who worked as a gate keeper (*Mir-Ab*) for 30 years also explained that he never experienced water shortage during the first 25 or 26 years. Then, Water shortage became serious from 7 or 8 years ago. The time is the same as starting of *Maize* cultivation as summer crop.

2) Ravansar Irrigation Scheme in the Large Scale Land Lord Era

Ravansar Irrigation Scheme, utilizing water from Ravansar Spring and Gharasu River, was established in 1955. Present main system of the scheme is to divert the water to four stakeholders consisting of the Right Bank Canal, the Left Bank Canal, downstream of the Gharasu river and Khoshkehrud Canal.

All of the canals were non-lined earth canals at the completion of the construction initially. Alignment of those canals were meandered along the outskirts border of the command areas. The scheme was introduced since the government in those days intended to develop "Mechanized Large Scale Management of Agriculture" and the scheme was constructed as one of measures to realize the objective. Direct beneficiaries were land lords who were dealing with crop production like wheat, cotton and chick-pea mainly.

3) Ravansar Right Bank Canal Project

This project aims to irrigate sufficient water for 700 ha of farm land which is located at the right bank of Gharasu river through the lining of canal and construction of diversion facilities. In accordance with the objectives, 10 km of canal lining and construction of related facilities have been completed by Ministry of Energy until 1995 within total length 14 km. However, secondary and tertiary canals are not completed. Main canal is concrete lining canal, whose sectional dimensions are 1.0 m bottom width,1:2.0 side slope and a canal depth of 0.9 m. Design discharge is 1.5 m^3/sec including freeboard.

One the other hand, at beginning period of the project, ten villages were concerning the main canal. However, seven villages could not receive any irrigation water for some years before 1999. Therefore, actual beneficial village is only four such as Ghalanjeh, Meskin Abad Olya, Meskin Abad Sofla as well as Khorram Abad Sofla and its land area is only 177.2 ha with 95 land owners at present. As for the situation of lining canal has been already completed, the lining has been already destroyed at several place and most of gates are also out of function, due to poor quality control during construction period and poor maintenance works. Therefore, leakage must occur at week point of the canal and proper water distribution to the secondary canal is so difficult.

4) New Ravansar Left Bank Canal Project

This project aims to irrigate sufficient water for 1,500 ha in dry season and 2,000 ha of farm land in rainy season which is located at the left bank of Gharasu river through the lining of canal and construction of diversion facilities. In accordance with the objectives, Only 14 km of canal lining has been finished within total length 18 km at present under the supervision of Ministry of Energy. The other related facilities are under construction. Secondary and tertiary canals are under the surveying. So. Layout of these canal are not clarified. According to the contract, the execution of upstream canal have to complete until May. Main canal is concrete lining canal. Its sectional dimension are bottom width; 2.0 m – 0.7m , side slope; 1:2.0 and canal depth; 1.5 m – 0.9 m. Design discharge is 2.2 m^3/sec. including freeboard. According to the estimation of Ministry of Energy, 559 land owners are registered with 1,478.4 ha at 12 villages. Summary of water use are as follows;

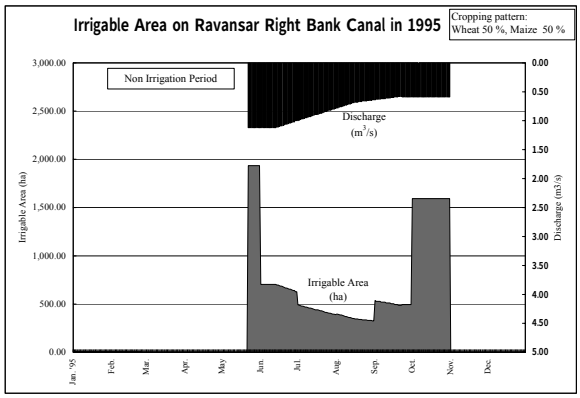
There is an old irrigation canal, but MOE is constructing new irrigation canal near old canal. The irrigable area of new canal is not so much increase compared to old canal. Since new irrigation canal is located at higher portion a little, excavation volume is so much increase and the canal is so lower than field along the canal at some part. Therefore, it is difficult to irrigate for farm land along the canal without pumping. So, there is some doubt regarding selection of route. It was better to rehabilitate old canal for the purpose of saving the budget, and also the result will be almost same.

5) Verification of On-going Irrigation Schemes

Water balance calculation was executed to verify the availability of on-going irrigation schemes. Following conditions were employed for the calculation.

- Utilizing the present cropping pattern at irrigated land.
- The potential evapo-transpiration is estimated by the Penman Monteith method using data of Ravansar meteorological station (Refer Table 3.5.1 and 3.5.2).
- Utilizing actual rainfall data to calculate the effective rainfall in 1995 which is equivalent to drought year with return period five years.
- Utilizing Thiessen Polygon to estimate average rainfall in the study area.
- Utilizing present irrigation efficiency.
- Utilizing actual discharge data of Ravansar headworks in 1995 which is equivalent to drought year with return period five years.

	Present	Plan
Irrigation Method	Furrow	Furrow
Canal	Unlined	Concrete
Land consolidation	Nil	Leveled
Conveyance efficiency, Ec	0.70	0.90
Canal efficiency, Eb	0.75	0.85
Field application efficiency, Ea	0.57	0.67
Irrigation efficiency, Ep	0.30	0.51

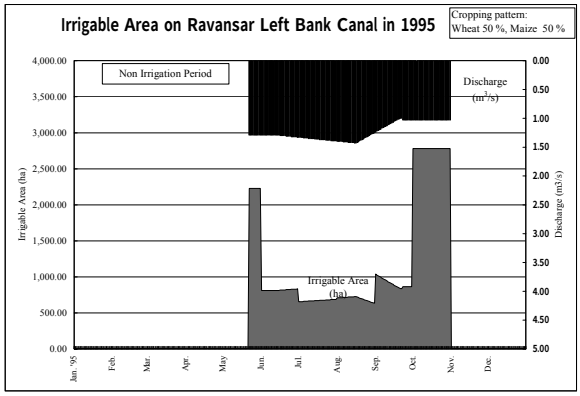


i) Water balance on Ravansar right hand canal under the Present Condition

Based on actual daily discharge on Ravansar right hand canal in 1995, available irrigation area was estimated. According to the results of estimation, the target area at beginning (700 ha) can be irrigated from end of May to middle of

June and October, but actual beneficial area (279.5 ha) can be irrigated by the canal.

ii) Water balance on new Ravansar left hand canal under the Present Condition



Based on actual daily discharge on Ravansar left hand canal in 1995, available irrigation area was estimated. According to the results of estimation, proposed irrigation area (1,500 ha in the dry season) can be irrigated on May and October only by the canal. Approximately 650 ha can be irrigated from June to September. Minimum irrigable area is estimated as 640 ha in the end of August.

3.5.3 Proposed Irrigation Schemes

(1) Proposed Dam Irrigation Schemes

There are three proposed irrigation schemes in the study area. The dimensions of dams are indicated in table shown below:

	Kilanbar Dam	Gharab Dam	Sedegh Aba Dam
Location of the dam	34°30′N 45°30′E	34°43′N 46°22′E	34°44′N 46°35E
Name of river	Kilanbar river	Gharab river	Gharab river
Purpose of dam		Irrigation & flood control	
Basin area	111 km^2	48 km^2	1,500 ha
Proposed total storage capacity	16.4 MCM	4.5 MCM	2.0 MCM
Proposed available storage capacity	14.0 MCM	4.3 MCM	1.8 MCM
Proposed irrigation area	2,000 ha	420 ha	180 ha
Type of dam	Earth dam	Earth dam	Earth dam
Dam height	34.0 m	24.4 m	29.0 m
Width of crest	8.0 m	10.0 m	
Length of crest	766.0 m	411.0 m	300.0 m
Elevation of crest	1,402 m from sea level		
High water level	1,398 m from sea level		
Low water level	1,380 m from sea level		
Amount of 25 years sedimentation	1.0 MCM		
Amount of 50 years sedimentation	2.0 MCM		
Type of outlet works	Tower intake	Tower intake	
Type of spillway	Overflow type	Overflow type	
Data Source	MOE	MOJA	MOJA

(2) Verification of Proposed Irrigation Schemes

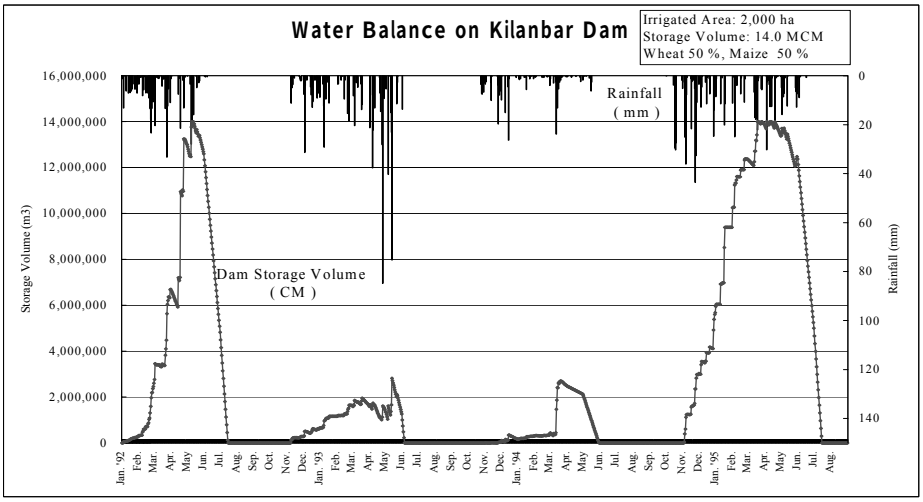
Water balance calculations were carried out to verify the availability of proposed Kilanbar dam and Gharab dam. Following conditions were employed for the calculation.

- Utilizing the present cropping pattern at irrigated land (same as on-going schemes).
- The potential evapo-transpiration is estimated by the Penman Monteith method using data of Ravansar meteorological station (same as on-going schemes).
- Utilizing actual rainfall data to calculate the effective rainfall in 1995 which is equivalent to drought year with return period five years (same as on-going schemes).

- Utilizing Thiessen Polygon to estimate average rainfall in the study area (same as on-going schemes).
- Utilizing present irrigation efficiency of 30% (same as on-going schemes).
- Utilizing actual runoff coefficient based on discharge data at Doab Marak hydrological station and rainfall data of selected observatories from 1992 to1995, because most of data are available at all selected observatories from 1992 to1995.

1) Kilanbar dam

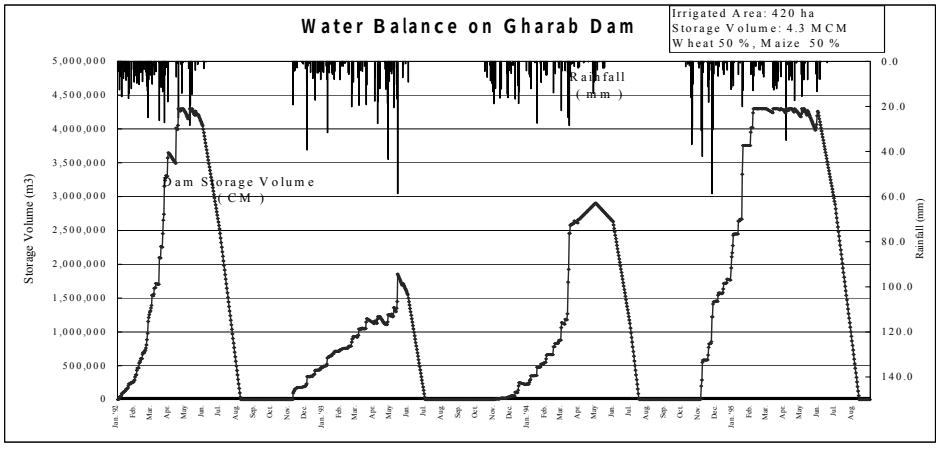
Based on actual daily rainfall and runoff coefficient from 1992 to 1995, water balance of the dam is estimated. However, evaporation from dam reservoir is not considered because the area of dam reservoir at each water level can not be clarified. The results of estimation are as follows;



According to the result, dam will be empty, so, 2,000 ha of farm land can not be irrigated every year. 500 ha can be irrigated fully based on the calculation. Usually, rainfall record of the Kilanbar dam basin and discharge record of Kilanbar river around proposed Kilanbar dam should be employed to verify the availability of the dam.

2) Gharab dam

Same calculation as Kilanbar dam has been carried out for the Gharab dam. The result of estimation is as follows;



According to the result, dam will be empty, so, 420 ha of farm land can not be irrigated every

year. Area of 200 ha can be irrigated fully based on the calculation. However, condition of the estimation is same as Kilanbar dam.

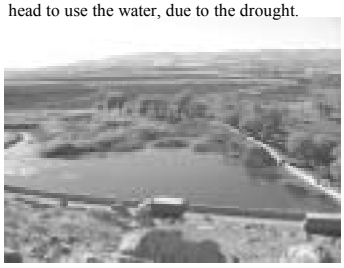
3.5.4 Water Use of Groundwater

Farmers there have been yielded groundwater for irrigation as stable water source from the old days. It is said that while 352 wells are registered to the Ministry of Energy, 331 wells are for irrigation. Its total amount of permitted well exploitation is about 44MCM/year which shares 98% of the whole authorized volume. The Ministry is assuming about 1,544.2ha in Site-1 and 3,218.3ha in Site-2 are benefited with the water. Refer to Table 3.2.1.

Between Site-1 and Site-2 of the Study Area, all of number of well, authorized yield and agricultural area for the irrigation with the wells are understood with a rate of 3:7 roughly. While the locations of wells in the Site-1 is almost even from Gele Sefid in upstream side to Tape Lori in downstream side, most of the well is concentrated to the south-western part bounded with the Kilanbar and Khonab rivers.

This well is an example of groundwater use in the Study Area. It is said that before it was artesian but recently constructed well head to use the water, due to the drought.

Groundwater level goes down resent 10 years. Therefore, the farmers try to dig shallow well more deeper or new deep well since 1993. As for the situation of deep well, groundwater level will decline, but there is not severe problem at present. Under the situation, there is a possibility that new well will be dug by farmer rapidly. In this case, it is worried that the groundwater resource may be exhausted.



Jabery Spring : Locates at foot edge of Mt. MahZard, 2.0km away from Ravansar City to south direction.

3.5.5 Spring Water Use

Just two perennial springs in the Study Area are utilized for water use, Ravansar Spring and Jabery Springs, while being identified about 110 ones in the whole upper watershed area (Referred to "Study on Gharasu Watershed Basin, 1993"). All of the water use by Ravansar Spring can be recognized that the Ravansar Weir catches to the Right and Left Irrigation Schemes. Besides that presently 44 water users are identified for total 74ha irrigation from Jabery Spring, according to the Ravansar office of Water Affairs. Each one is charged Rls. 108,000 / ha / year for the water use (This tariff is same as charge of "Semi-Modern Canal")

Ravansar Spring : Scene in Autumn Ravansar Spring : Scene in in March

Discharge of the Spring erupts in Iranian December (Later half of February) to 10 to 12 cmps and gradually decreases the flow gradually and becomes to the minimum in Iranian August /September (Early November in Solah).

3.5.6 Pumping Irrigation of River Water

According to the estimation of Ministry of Energy, 175 pumps are registered to pump up irrigation water from Gharasu river directly and those irrigated land area is 1,027.4 ha with a total exploitation of 5.9 MCM/year in Site I. To receive permission of pumping, the owner has to pay some amount of water charge every year based on irrigated land area. On the other

hand, 20 illegal pumps are also confirmed along Gharasu River. 81 ha is irrigated by these illegal pumps and 0.4 MCM of surface water of Gharasu river will be lost without any payment in Site I. Illegal pump is increasing recently because of drought. Summary of pumping irrigation of river water is shown in Table 3.5.3. Area applied the river water with pump might be limited within 200m to 300m from the river, due to the geographical and topographical condition.

3.5.7 Drainage Conditions

Since most of the study area is covered by heavy clay soil, generally drainage problem will be occurred in the study area. However, ponding problem can be seen due to lack of land leveling in the study area, but severe drainage problem is not reported at Site I and northern part of Site II. It can be considered that excess water can be drained because of suitable slope to the river. Drainage problem was reported at only half of Site II which is located in southern part. Ministry of agriculture has already carried out excavation of main drainage at the area 15 years ago. Total length of the main drainage is approximately 43 km. After completion of the project by Ministry of Agriculture, the situation of the area has been improved at normal year. Especially, critical inundate damage has not occurred recent five years because of drought year. However, some problems are remained as mention in the previous section.

3.5.8 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. According to the information, 1,354.5 ha of land re-plotting and 121.5 ha of land consolidation have been implemented in Site 1. 8,031.0 ha of land re-plotting and 228.5 ha of land consolidation have been implemented in Site 2. Also, 1,403.0 ha of land consolidation have been carried out between Site 1 and Site 2. Totally 9,385.5 ha of land re-plotting and 1,403.0 ha of land consolidation have been finished in and around the Study area.

3. 6 Water Management

3.6.1 Stakeholders and Quantity Used

(1) Water Sources in the Study Area

As being popular among the people with an old Iranian legend, Kermanshah Province, especially the area including the Study area has been well known for its water potential, especially there are many springs from old days. It is seemed that many springs and ponds at the foot of piedmont of mountains originated from Karstic hydro-geological characteristics of the region might cause people to recognize so.

Anyhow, the Study Area is a plain closed with mountains on 3 sides excluding south east side, under the geographical conditions of stripes of heights of the Zagros which run on direction of NW – SE. The plain is so-called Ravansar – Sanjabi Plain.

Sources of waters in the Area are listed as followers besides on understanding those above background.

1) River water
2) Groundwater
3) Spring water
4) Precipitation (Rain and snow)

Major river systems in the Area are Gharasu, Karkuh and Konhb. Konhb river confluences into Karkuh river at the outlet of the Plain then Karkuh joins to Gharasu which flows down with meandering along the foot of piedmont of Mount Mah Zard. Only Gharasu river is a perennial flow among the others.

It is ruled that all of river water uses such as irrigation, water services, industries and others are to register to the Water Affairs of the Ministry of Energy, actually to the office of Water Affairs in Ravansar City, excluding water delivery system in rural community. In the Study Area only water use for irrigation from Gharasu River is identified

Besides the farms of irrigation as reported in the above, dry farming area is existing as majority of the agriculture, whose are is assumed about 4,000ha at the upstream part of Site-2 Area.

(2) Involvements of Government Agencies for Water Use.

1) Water Affairs of the Ministry of Energy

It is defined jurisdictionally that Water Affairs of the Ministry of Energy should be in charge for managing water use and water sources in Iran. The agency has to monitor the existing conditions of water resources while conducting examination and issuing permission of water use for the requests from people who want to use it and also O&M of the water use facilities. O&M of water source facilities is also owned by the agency. As for ensuring the financial preparation and collecting water fees defined by kinds of water source.

2) Ministry of Cooperative

Iranian Government has been enhancing establishing Water Users' Association (WUA) and people's participation to the WUA activities as one of approaching to realize sustainable O&M of facilities of water use, high-lighting farmers of irrigation schemes. The Ministry of Cooperative is responsible for this task. Main intension the Government for the WUA program is to secure proper O&M with their self-reliance and water fee collection. Benefit area of the Right Bank Irrigation Canal Scheme is aimed to establish WUA and exactly it was established on February 4, 2003 as the first case in the Area. The agency has a plan to increase the number of WUA to 24 ones in the province. But correct planning of schedule of establishment, and were never confirmed.

It is explained that all of WUAs have to be registered as an independent corporation and should owe rights and obligations of conducting water management by

Households and Farm Area in the Study Area

Descriptions		Site -1	Site - 2	Total
Nos of Houses	Nos	312	743	1,055
Nos of Family	Nos	375	765	1,140
Population	person	1,949	4,244	6,193
Rainfed	ha	3,113	6,249	9,362
Irrigated farm	ha	1,495	3,241	4,736
Total farm area	ha	4,500	9,500	14,000
Irrigation Area	%	33.0%	34.0%	34.0%

Source : Assumed from Provincial Statistics (1996)

themselves, keeping qualification to borrow loans from banks and running businesses which are to be declared by their own articles of associations.

3) Kermanshah Jihad-e-Agriculture Organization (KJAO), the Ministry of Jihad-e-Agriculture

Besides the above, other involvements of the Government to water users, high-lighting aspects of 'on-farm'. This means a part of extension programs as the government's assistances for crop cultivation and farm management related aspects. Actual involvement by the Ministry is consultation or guidance of water management to farmers which is to be conducted by sub-district level extension center under the KJAO. Extension workers are said to conduct such extension works while visiting settlements (*Dehs*) regarding O&M for facilities of farming, the necessity of co-working for maintaining facilities and implements and cost reduction measures due to enhancing rationalization of water use and water management.

(3) Water Users

In this section, water users mainly mean the farmer. Number of stakeholders can be counted as number of head of families. Then the number of water users in the Area might be assumed as 1,055 farm houses, 1,140 families in four relevant Villages (*Dehstan*), according to the results of the latest National Census.

Ratio of dry farming farmers is to be assumed as about 66% in the area as land use base. So it might be caused about 390 farmers (=1,140 x 34%). Hence number of water users as stakeholder for the subject. Remained 750 persons are to be assumed as dry farming farmers.

(4) Mutual-Relation among Stakeholders on Water Management in the Field.

As reported in the previous, stakeholder is to be consisted of 1) farmers using irrigation water, 2) extension office or KJAO and 3) Water Affairs as MOE, for the aspects of water management.

Mutual relationship among those stakeholders are to be summarized as the table on the right hand. Farmers as water users are to be related with other two stakeholders when going to register their farm land. That is, authorization of farm land area has to be done by the Extension Center. Besides that authorization of proper water demand for the farm plot is to be done by the Water Affairs' Office. It is ruled that this registration has to be pre-condition of water utilization in the field.

Mutual Relation Among Stakeholders Related to Water Management

	Farmer	WUA	Extension Office	Water Affairs
Farmer	To conduct production individually To be a member of WUA	To request water demand for cultivation To pay water fee as WUA member	To be consulted as WUA member on agro-aspects	To pay water fee directly in case of without WUA
WUA	To conduct interface with out of village To collect water fee from WUA members To receive any requests on water use and agro-production	To maintain WUA organization as independent To coordinate management through	To convey any opinions and request to secure	To pay water fee collected from WUA members To request as the WUA's own right to secure water
Extension Office	To consult & support services to improve agro-production To guide proper water use as one of measures to improve production To convey Government's subsidies & assistances	To reply to requests from WUA, to secure the improvement of	To issue programs in line of Government's policies To monitor & guide any farmers to improve agriculture	To coordinate for improving production from view of water use
Water Affairs	To guide farmers on proper water use	To guide WUA to let farmers accept proper To claim and collect water fee from WUA	To coordinate for improving water use of	To issue programs in line of Government's policies To maintain facilities to serve to water users To monitor and consolidate water users to save water

Note: Presently only one WUA has been established in the Study Area.
WUA is to be under the management of the Ministry of Cooperatives
Majorities of the Study Area are still without WUA.
In case of without WUA, the mutual relation as stakeholder of water management is to be acknowledged that farmers to contact with relevant agencies directly

Payment of water fee is commenced with invoice for the payment from the Water Affairs' Office. The Agency is issuing them to all of registered water users, means farmers, before they start the cultivation every year. Farmers should transmit the claimed amount from the Agricultural Bank to the Agency.

Daily water management is guided and instructed by the agricultural extension center as one of subjects of the extension programs to farmers during the off-season, gathering them to community mosque and schools.

Subject of WUA is quite new matter for the Study Area. In case of existing WUA in a region, farmers or water users are going to have relations with other stakeholders through WUA. Details of WUA is to be referred to the latter part of this chapter.

3.6.2 Water Management during last Decades

(1) Water Management by Farmers and Community Decision Making

Up to one decade ago, farmers conducted water management as one of *Deh* (community) activities on the stage of small canals which run farm plots borders used as irrigation and drainage ditch. Farmers took water from the main canal (an earth canal at that time) into those ditches directly in responses of their necessity after the canal completion. Hence it can be said that farmers managed secondary canal level by them, which consisted of taking out sediments from canal, weeding, canal reforming and others. But they did not gather to discuss specially for "water management", but had decided activities related with water management as one of community decision making same as wedding ceremony, funeral, religious ceremonies, education etc. Hence it might be concluded that they did not have any gathering or groups specialized for water management, but for secondary and tertiary level co-working only. There was no certain organization among local people specialized for water management like "Water Managing Board". Decision making was done at community gathering chaired by dominant person like *Deh* elder who was respected by community members and the community gathering took function of decision making traditionally. Number of participants of the gathering was almost 20 members or so, who were mainly head of families.

The qualification of the participant to community gathering, head of the family, who shared the family land. This common understanding seemed to be a reference to apply to the present qualification of WUC member selection as "person who shares the registered farm land juristically".

According to their explanation of water management in those days, there was nor particular rules of watering order between drought year and ordinary ones. They took water from canals to meet with water conditions to be even rate as ordinary year. Farmers decided by themselves, or actually followed to same manner to the previous generation, regarding the order of water intakes from upstream area to down stream. That order was not been changed by year.

Before the days of becoming land tenured farmers from farm laborer, they did not participate with the main canal. After becoming land tenured, direct participation had never come out by the time of starting Maize cultivation as summer crop, which was initiated about 10 years ago in the area. So, farmers were understanding that main canal was provided by and belong to the government.

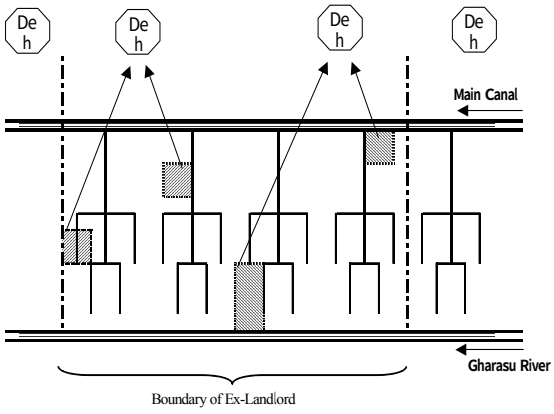
(2) Community Decision Making After the Revolution

Farmers kept community gathering whenever the community elder invited them. Cautious point here is members depending on one secondary canal are almost same members, not different ones between canal-A and canal-B, while rules are different by one canal. Gathering was held by a community which consisted of 10 or 15 families. Land deviation was conducted to be almost completely even condition. Hence the land was divided into so small plots by one area along a certain canal. One farmer has several plots as different locations.

Land tenure condition has been continued until today and it seems difficult to apply a concept to pile up unit groups at tertiary level gathering to the secondary level and same to the main canal. Instead of that WUC structure might be Deh based gathering along the main canal, for instance of the Ravansar Right Bank Canal. It might be an indication for a discussion of WUC organization frameworks that the whole area is to be divided into three blocks along the main canal, which are groups of Deh in the area.

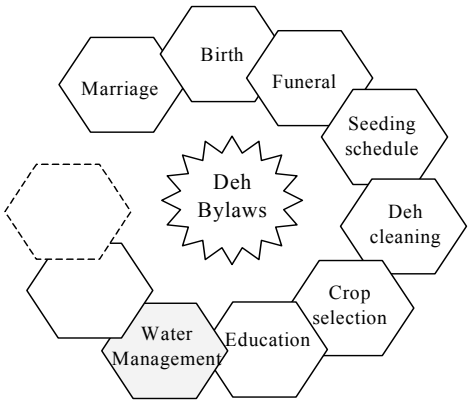
While discussing on the institutional aspects in hierarchical organization system in the government side, it means in an order of top-down system, at once entering into farmers' community, most of subjects there are melted into their daily activities same as cleaning roads, marriage, festivals and other events, not existing as one subject separately. It seems completely same as viewpoint of Prof. Okamoto, who showed a water management system based on such "Inverted T-shape water management ".

Procedure of decision-making in a community is distinguished by subject. There were a) subject entrusted to elder's decision, b) subject needed whole consent, c) subject decided with



Farmers recognized not to touch with the Main Canal, only from Secondary canal.
Bylaws were generated by each Deh as one of community decision making.
No inevitability to form water management group by secondary canal, but by Deh.
No coordination among Dehs, because of the Govt's obligation for the O&M of the Main Canal

Background of Deh-base Water Management at Secondary Canal Level.



Recognition of Water Management for Farmers

Water management was just one of any bylaws in a Deh community, as part of daily activities.

2/3 consent and d) subject needed consent gained majority, even though respondents could not distinguish those procedures to specified subjects. Subjects of water management could not be so serious aspects for them because they did not depend on it so seriously.

There was no rule or specialized gathering for aspects of the main canal essentially. They have been recognized that the main canal was provided by and belonged to the Government. Maintenance had to be owed by the government as their property and belonged to the

government. Actually they have never involved in the maintenance of the main canal during last half century.

Those farmers' understanding might cause a part of background of their opinions, whether the government hands over whole management to farmers or continues maintenance as previous because the main canal has been belonged to the government. It seems that the understanding of the government side to the history of the relation with the canal and farmers is not considered so deeply. This turning-over aspect has to be one of subjects to be solved with clear rule under mutual understanding.

(3) Irrigation Management By *Mir-Ab* and its Termination

At the time of completion of the canal construction under the monarchic government, Ravansar Water Affair Office was established to manage the irrigation scheme. The office employed 3 Mir-Abs on each bank, totally 6 ones to let them monitor the canals. Their scope of works were limited to the main canal and intakes to secondary ones and they did not participate to matters of downstream from the turn-outs directly. Though taking such works, *Mir-Ab* was functioning as interface between farmers and the office. They are saying that Mir-Abs were respectable by both the sides commonly.

Recently *Mir-Abs* have been terminated one by one. During the period of their termination Western Regional Water Utilization and Distribution Service Company, an affiliated association of the Ministry of Energy, collect water fee and facility maintenance, and has been taking over the works of *Mir-Ab*.

Because of the *Mir-Ab*s, there was certain mutual understanding between the office as water supplier and farmers as water users. After the dismissal of *Mir-Ab*, the relation between farmers and the water affairs office has become frictional and seems to be getting bigger. Farmers have intention that *Mir-Ab* is indispensable to maintain water management and also for functioning the WUC activities in cases of defining any organizational structures.

3.6.3 Operation of Main Canal and Its Maintenance

(1) Operation of Main Canal

Water from Ravansar Spring is diverted to 4 areas including 1) the Right Bank Canal area (280ha), 2) the Left Bank Canal area (1,436 ha), 3) Gharasu River downstream area (1,520 ha) and 4) Khoshkehrud Canal area (105 ha). Total area depending on the water is 3,341ha. Among those 4 areas, Khoshkehrud Canal area (105 ha) is to be omitted from the discussion, since the area is negligible for the subject of water trade-off.

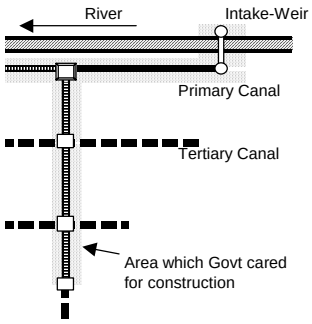
Diversion Weir (from upstream side) Left Canal Intake (from downstream side)
This weir locates in Ravansar City, just 1.0km down from the Ravansar Spring. " irrigation canals extend to both right and left sides for each I&D schemes.

Ravansar diversion works owes the role to divide the spring water to those 3 areas. Operations of the gates are carried out by Ravansar Water Affair Office (RWAO). Its authorized position is as a branch office on the line from the Ministry of Energy, which is appointed as "Water Supplier" juristically.

The gate operation is based on the summation of the individual requests raised by each farmer along the canals. The office operates the gate to meet with the daily demand for those gates, according to their operation scenario. The Agriculture Committee, which is deciding annual cropping pattern and their cultivation areas to meet with the Government's instruction at first, defines water demand through examination. Then summation of water requirement by each in-take along the main canal with delivery schedule tentatively. They predict the annual water delivery schedule through the similar works for the whole area. Naturally some differences are to be appeared from their predictions by the effective rainfall and the spring water discharge, while conducting the delivery. Hence the office starts the adjustments the water delivery with making narrow the gate opening if getting more severe drought conditions. It can be said that the agriculture practiced is still in the condition as 'gamble agriculture' due to its water supplying unsteady condition, because there is no storage facility of the sufficient water for annual or seasonal irrigation.

From year 2000, Western Region Water Affairs （WRWA; In charge to control 6 provincial water affairs in the vicinity, higher ranked institution than provincial level）started the out-sourcing contract to hire a quasi-public corporation, named as "Western Regional Water Utilization and Delivery Service Company (WRWUDSC)", for the works of water fee collection management and maintenance of the water use facilities. The capital of the firm is shared by MOE for 49% and the remains by the private sector. Staffs are stationed at a room of the RAWO and engaging to the works.

The firm has never conducted the maintenance work for the concerned facilities after the office establishment. There was no explanation whether the 20% portion includes the budget of facility maintenance or not, or whether MOE should owe the cost by his own budget besides the collected 80% or not. It could not be clarified yet what is the actual works of the scope of "water fee collection", because it is defined to let each farmer go up to the bank to transfer the fee to the Ministry. The stub is used as certificate at the Ravansar Agriculture Service Center to receive the government subsidies like seed & fertilizer. It is a bit difficult to understand the task of the firm, but it might be also be considered as the 'transitional stage' to enhance privatization.



- Water Affairs owed the task to provide Main and Secondary level facilities from water source to turn-outs along 2ry canal while farmers owed tertiary block development including 2ndary tertiary canal, according to the previous task demarcation of facility provision.
- This task demarcation has been one of backgrounds which farmers have poor sense of owership for the trunk facilities, while they have maintained secondary level by their own manner.
- Farmers were not involved for planning of the scheme and just had kept their own crop production as previous with rainfall mainly. Hence the scheme could not be shared with farmers actually.
- This indicates that transfer of O&M authority of whole facilities to farmers is seemed a new concept to farmers completely. GoI should consider some incentives to let them have sense of ownership.

Scope of O&M by Ministry of Energy (MoE) and Farmers' Sense of Ownership

There is an official task-allocation among MOE and MOJA, that the MOE should owe the task to maintain the main canal (Main and Secondary canal and appurtenant facilities along those canals). On the both of Right Canal and Left Canal is forming the irrigation system that tertiary canals derive from the main canal directly. (Excluding Tam-Tam Area, which is located in the down stream side of the Right Bank Canal area).

(2) Maintenance of the Main Canal

"Do you know any rental-house owners who are not going to maintain, even though receiving the rental fee every month?" was the explanation given from farmers to describe the present situation of canal maintenance, as reply to the interviews on canal maintenance in the area. It is defined that the maintenance works shall be under MOE and then both of RWAO and WRWUSC are in charge for the work in the field. But actual situation is as farmers reported.

(3) Operation and Maintenance of On-Farm Level Facilities.

Any activities related to on-farm level are carried out by KJAO. It is commonly recognized that the all of facilities of on-farm level should belong to the farmers which should be mutually agreed by both the sides.

3.6.4 Water Users' Association (WUA)

Information of a newly established WUA was obtained while conducting field surveys. This sub-chapters introduces WUA, Water Users Association. The WUA was registered officially as one independent corporative on February, 2003. Settlements relate to the WUA are five and they are 1) Meskin Abad Oliya, 2) Meskin Abad Sofla, 3) Ghalancheh, 4) Korran Abad Oliya and 5) Tam Tam.

(1) Objectives of the WUA

Iran is scarce for available water resources basically hence securing the effective water use is indispensable. Especially majority of present crop production is classified to dry farming system. Expansion of irrigation agriculture is necessary as concrete measure to increase crop production. This means measures to realize proper and effective water use is indispensable.

But in the field so many constraints and problems are existing and they are preventing realization of effective water use, which are like trade-offs of conflicts between upstream and downstream, or deterioration of facilities of water use. So some measures for approaching to effective water use are required.

WUA owes objectives;

a) to unite local farmers to let them participate for O&M and effective water use.
b) to reduce Government's burden, especially for O&M cost of relevant facilities.

(2) Establishment of the Ravansar Right Bank Canal Water Users' Cooperative Company

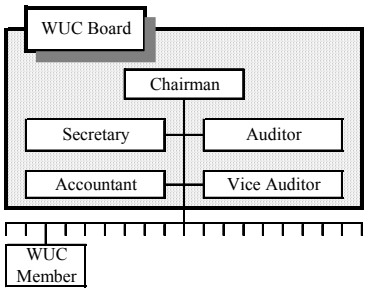
The WUC establishment was commenced in the field from January 2003, with an explanation meeting from local government officers to farmers gathered who belongs to the Ravansar Right Bank Canal Irrigation Scheme, to a mosque in Miskin Abad Olyiain Ravansar, without any briefings in advance. What the farmers were informed were that 1) the Right Bank Canal Area was selected as a pilot scheme to establish a WUC, 2) farmers should owe obligation to aspects of operation, maintenance and management by themselves in near future, 3) farmers should collect capital funds from members to establish WUC, 4) the subsidies might be discontinued if the farmers were not agree with the government intension. Those explanations like an order was taken just 20 minuets and the initiation of the Ravansar Right Bank Canal

WUC establishment, according to explanation of one of participant farmers. At that time any further explanation were not given from the local officers, which must be the most primitive contents like objectives of WUC, task-allocation between the WUC and the government, obligations of the government and so on. Members of WUC managing board were designated by those officers at that time.

Farmers, especially nominated farmers to WUC Managing Board, rushed to collect the minimum fund to establish WUC to avoid discontinuation of the government's subsidies and supports like fertilize , chemicals and seed distribution. They registered the WUC as instructed by the local agencies with the collected fund by the mid of February 2003.

(3) Organizational Structure of the Ravansar Right Bank WUC

Managing Board consists of five members as General Manager as representative of the WUC, secretary, auditor, vice auditor and accountant. All of the board members are more than 50 years old excluding the general manager who is just 31 year old. This situation is seemed quite rare in the Islamic Society, which respects elders at first. Also majority of WUC members, 52 members, are in elder age bracket more than 50s. Reason of such gathering of elder persons is coming from the admission condition to WUC. It is prescribed that a member should be a farmer owing land.



Source : Interview to Cooperative Affairs, Kermanshah Pro

Conceptual Organization Chart of Water Users Cooperative (WUC)

(4) Duties and Rights of WUA

Duties and rights of WUA are mentioned below.

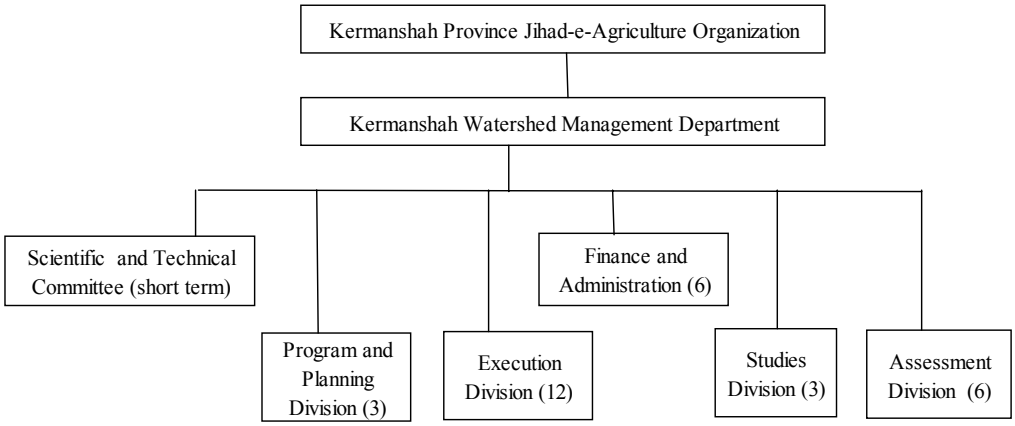
WUA's Duties	WUA's Rights
a) To receive O&M initiatives for relevant facilities through contract with MOE. b) To implement O&M of relevant facilities under the contract with MOE. c) To collect water fee from members and transmit to the Ministry. d) To conduct activities declared in the article of association as social responsibilities. e) To abide by internal rules declared into the registration.	a) To accept the maintenance right of water supply facilities b) Right to receive subsidies and assistances prepared by the Government. c) Right to run business based on their own assets and resources. d) Right to receive benefits generated by their own business.

3.7 Watershed Management and Rangeland Rehabilitation

3.7.1 Responsible Organization and their Activities

(1) Watershed Management Department of KJAO

In the Kermanshah province watershed Management activities are carried out by the Kermanshah Watershed Management Department of KJAO.



Organization Chart of the Watershed Management Department of KJAO

Program and planning division is responsible for the planning of the watershed management activities and studies division carry out the studies before the execution. Scientific and technical committee is created on short-term project basis. The assessment division assesses the effects of the watershed management after their execution. The assessment division also includes a GIS section. The execution division is responsible for the execution of the watershed management activities in the province.

(2) Watershed Management Activities Carried out by WMD of KJAO

The watershed management activities carried out in the province from 1997 to 2002 are shown below.

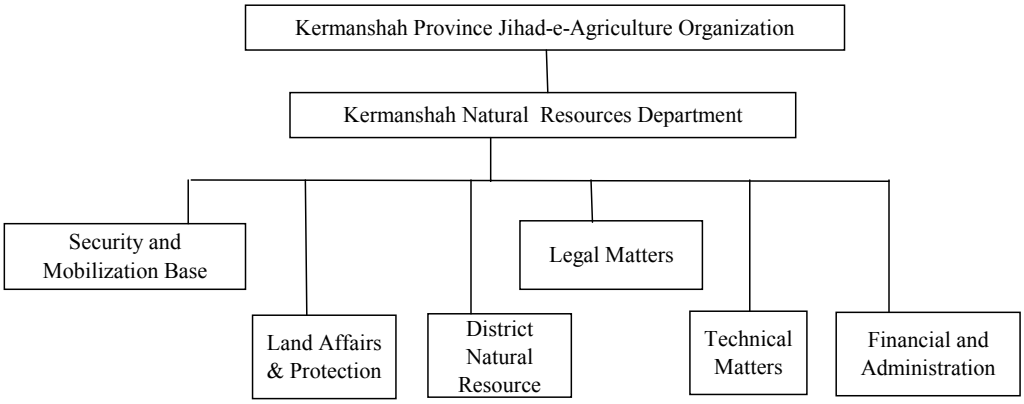
Watershed Management Activities Done in the Ravansar basin from 1997 to 2002

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 (Kermanshah Jihad-e-Agriculture, 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. Although the budget allocated varies year by year, about 10 billion Rials (about $1,250,000) is allotted this year to carry out the watershed management activities.

(3) Activities of Natural Resources Department (NRD) of KJAO

The organization chart of NRD of KJAO is shown below.



Organization Chart of Natural Resources Department 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. 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:

1) Preventing from changing the ranges to agriculture lands
2) Prevention of cutting of the trees & converting them for agriculture
3) Prevention of overfeeding of livestock
4) Controlling Fire accident etc. in the ranges & forests.
5) Provide training on protecting the nature.
6) Assisting the farmers in the preparation of village plans for the protection of range lands

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 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.

3.7.2 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. 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

(2) 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	×	×
	Sarabian	600.0	103,400	×	
	Sefid barg	1,983.0	75,350		×
	Kalaveh	2,463.0	738,699	×	
	Mehregan	4701	99,528	×	
	Gorgidar	2,019.6	54,461	×	
Kermanshah	Chogha khazan	1000	44,140		×
	Chahar zebar-e-olya	1,503.2	43,834		×
	Firuzeh	1,064.7	243,498		×
	Haft ashiyan	1,372.7	254,013	×	
	Kashanbeh oliya	1,387.7	236,805	×	

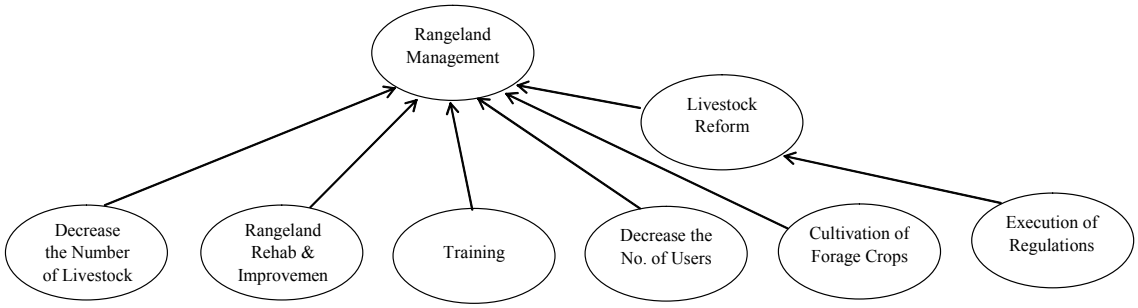
As it can be seen, 5 villages have stopped the range rehabilitation in the middle of the

implementation and the main reasons are as follows:

- The immediate benefit from the rangelands is less and therefore the villagers are not seriously interested to continue the rangeland rehabilitation
- 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

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.



Measures Needed for Rangeland Management

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

3.7.3 Watershed Management Plan

(1) Ravansar Basin

The Study Area is included in the Ravansar basin, which is located at the upstream side of Doab Malak hydrological station. Since there is a Gharasu basin at the downstream side, the upstream of Doab Malak station is always referred as 'Ravansar basin' by the Watershed Management Department (WMD) of KJAO.

Ravansar basin, which has an area 119,295 ha, 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. Based on the main rivers and changes in geological conditions, Ravansar basin can be divided into 3 sub-basins A, B and C with

areas of 45,505ha, 38,846 ha and 31,623 ha respectively. More detailed description of Ravansar basin is provided in Annex 5.

(2) 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. Normally watershed management plan requires very detailed studies on the different characteristics of watershed, detailed survey, mapping and planning. Because of the limitation of time and other resources, watershed management plan in this Study is carried out only at a Master plan level. 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:

1) Study and Mapping of Basin Information - Ravansar basin is studied based on the analysis of the following information using different maps including topography, geology, soils, slope and direction of the Kermanshah province which are used by the GIS section of WMD.
2) Overlapping of the Maps - After preparation of these maps, the maps were overlaid together and the homogenous units were separated. There are 851 units in the watershed area with different characteristics
3) 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.
4) 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.
5) Estimation of Cost - Cost of each project activity was estimated based upon the area and the number of locations.

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
Dry-farming 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.

(3) 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.

3.8 Zoning of the Study Area

(1) Aspects to be considered for Zoning

In order to analyze the present conditions and formulate the agricultural infrastructure development plan in the Study Area, firstly it is necessary to formulate the agricultural development plan. The agricultural zones of the Study Area will need different types of development plan. Based on this zoning, a land use plan in the Study Area will be established considering crop cultivation plan and regional economy.

Agricultural development shall be depend on i) climatic conditions, ii) social conditions, iii) land-use and topographic conditions, iv) surface water availability, and v) soil conditions. In case of the Study Area in the plain of Sanjabi, Ravansar and Hassan Abad, i) there is no significant difference of climate within the Study Area, ii) social conditions in the Study Area is rather homogeneous and it does not influence on agriculture within 20 km of area. Therefore, the agricultural zoning will be classified mainly based on 1) water resources availability, 2) soil conditions, 3) topographic conditions on the slope and drainage.

(2) Zoning by Water Resource Availability

Most of the Study Area is originally cultivated by rainfed, and after the construction of Ravansar irrigation schemes on the both bank of the Gharasu Rivers, the irrigated agriculture started in some parts of the Study Area. By installing well pumps, a limited area is irrigated by ground water.

The Study Area can be divided into 3 agricultural zones based on water sources such as i) area irrigable by dam water (around 2,000ha), ii) area irrigable by spring water (mainly Ravansar and Jaberi springs), and iii) rainfed agriculture area, which are partially irrigated by groundwater. As a minor category, small scale spring irrigation areas spread along the foot of western mountainous area can be considered.

From the view point of irrigation and drainage, the study area can be divided into 8 zones based on the results of hearing survey and field reconnaissance survey shown in Table 3.8.1. The zoning consists of three zones in Site 1 and five zones in Site 2. In the zoning, kind of water resources, situation of water resources and drainage situation are considered.

(3) Zoning by Slope

The Study Area can be broadly divided into the 6 land units of 2.2, 4.1, 4.2, 5.1, 5.2, and 8.2 and the characteristics of each land unit is different based on the geology, climate and other

factors. Land unit 2.2 is the hilly area at the northwest and northeast part of the Site 2 with medium erosion because of the slope which varies from 25 to 50%. Land unit of 4.1 is the piedmont area which are mostly distributed in the northern and western part of the site 2 and eastern part of Site 1 with a slope of 2-5%. Land unit of 4.2 is a flat piedmont plains with a slope of 0.5-1.0%. They are mostly distributed in the south eastern part of site 1. Land unit of 5.1 is sedimentary and alluvial plains and most of the areas are nearly flat. They are mostly distributed in the middle part of site 2, mostly close to the rivers. Land unit of 5.2 is a sedimentary and alluvial plains and most of the areas are nearly flat. They are mostly distributed in the western part of site 1 and eastern part of site 2, mostly close to the rivers. Land unit of 8.2 is fan shaped colluvium with gravel with a slope of 1-3%. They are distributed in a relatively smaller area at the south western part of site 2.

(4) Zoning by Soil Types

The physical characteristics of the soils indicate the major limitation of these soils, which is the very heavy texture of the soils with high clay content. Except for the area around Jehan Abad, all the area mostly have a very heavy texture soil of silty clay or clay with the average clay content of 48%. It also restricts the movement of machinery and alos cause poor aeration. In Jehan Abad area, there are some locations with sands and these soils have a medium loam texture. Some of the area in the flood plain of Gharasu, Gharab and Kilanbar rivers at the northern part of Site 2 and western border of Site 1, soils show the low contains of clay.

The drainage is also a major problem not only because of the soil, but also due to the slope of the field, especially at the southern area of Site 2 where several drains were constructed by KJAO. It is possible to classify the Study Area into two zones; i) better drainage condition area along the flood plains of Gharasu, Gharab and Kilanbar rivers located at the northeastern part of Site 2 and at the western area along the Gharasu River, and the other is ii) moderate to poor drainage area in the flat plain. Some sloped area on the southwestern border can be classified as the better drainage area.

(5) Comprehensive Zoning of the Study Area

In consideration of the above mentioned aspects, the Study Area can be categorized into the following zones for the agricultural development:

Site	Development Zone		Water Source	Soil and Drainage	Irrigation Zone	Remarks
Site 1	1	Upstream of Ravansar Canals: Availability of high amount of water	Surface Water	Heavy soil, poor drainage	Zone 1	Presently and after improvement of Ravansar canals, the Area is possible to be irrigated by the canals
					Zone 2	
	2	Downstream of Ravansar Canal: Low amount of water available			Zone 3	
Site 2	3	Groundwater/rainfed Irrigation, better drainage conditions	Ground-water	Silty soil, better drainage	Zone 4	Deep wells are required
					Zone 6	Divided into two part by soil texture
	5	Careful treatment of drainage with groundwater irrigation		Heavy soil, poor drainage	Zone 8	Main drains constructed
					Zone 7	Partially sloped area
	4	Proposed Irrigable Area by new dam construction	Planned surface water		Zone 5	Presently rainfed

The main agricultural zones in the Study Area are shown in Fig.3.8.1.

3.9 Environment

3.9.1 Environmental Conditions of the Study Area and the Region

The springs and the ponds located in and around the Study area are of major importance from the environmental point of view, because these springs not only act as the water source of the irrigation in the Study Area and the region, but also serve as the local tourist spots in the Study Area. Besides, they are also habitats for fishes and other fauna and flora. The water quality of these springs is a major environmental factor to be considered. The main springs and ponds in the Study Area and Other Areas of Kermanshah Province are mentioned below.

Main Springs and Ponds in the Study Area and Other Areas of Kermanshah Province

Name of Springs or Ponds	District	Location / Dehestan	Area (ha)	Average Depth(m)
Ravansar	Ravansar	Ravansar	2	1
Yavari	Kermanshah	Miyandarband	6	2
Sarabele	Kermanshah	Miyandarband	2	1
Khezr-e-Zendeh	Kermanshah	Miyandarband	5	1.5
Khezr-e-Elyas	Kermanshah	Miyandarband	3	1.5
Nilufar	Kermanshah	Baladarband	10	2
Gharadaneh	Kermanshah	Sanjabi	2	1
Gharsu artifical lake	Kermanshah	Kermanshah	5	1.5

Ravansar spring is located in the northern part of the Site 1 and acts the main water source of the Ravansar river. It also functions as a very important tourist location in the Ravansar city. Yavari spring in Miyandarband and Nilufar spring in Baladarband are located closer to the Study Area.

There is also an unique wetland, which is called as ‘Hashilan’, which is located at about 30 km of the Study Area. The area of the wetland area is 450 ha, which is one of the most beautiful ecosystem in the region and has about 110 numbers of small islands. The main plant species, which are growing in and around these spring areas are annual and perennial herbs, heliophytes including Carexdisance, Hispida, and some types of Junacaceae and Malvacae families.

The main mammals in the area are rodents such as mouse, wolf, fox, rabbit, jackal and wild cat. The mountainous area surrounding the Study Area is a suitable place for wild goat. The birds in the region are duck (with green head), small wild duck (khotka), Gilar, small wild duck that has a white feather and flat beak, keysham, gray ghoose, changar, kakai (green beak), Eigrette (small & large), stork, green foot rail, eagle, starling, songhor, kurkur, small owl, green finch, bee eater, partridge, quail, dull-yellow partridge, and wagtail.

3.9.2 Existing Environmental Problems of the Study Area and the Region

(1) Water Pollution and Water Quality

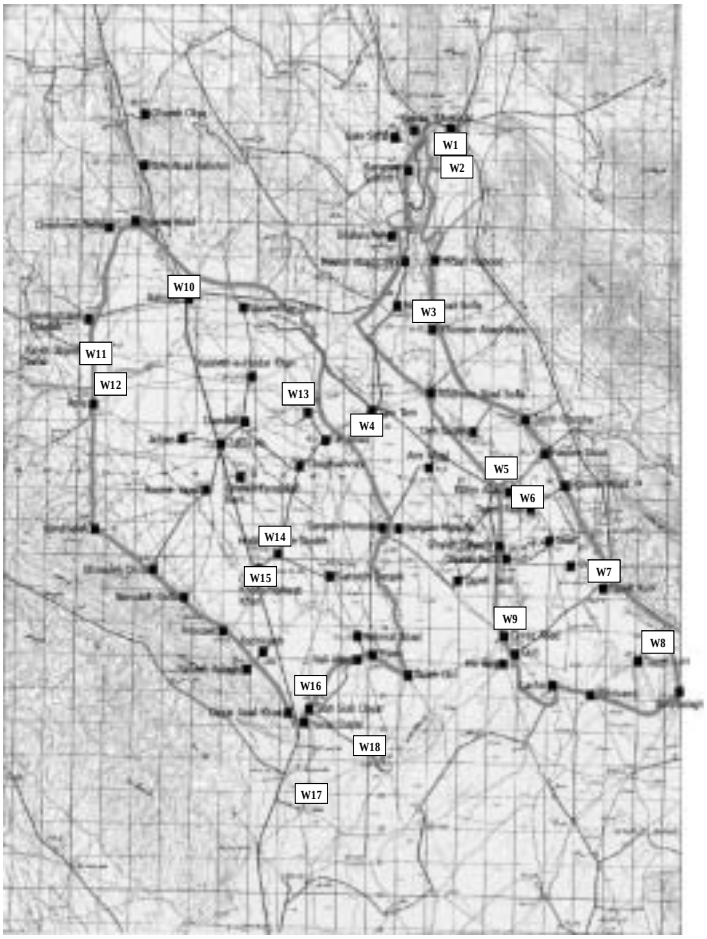
One of the most important problems in and around the Study Area is the water pollution of the surface water and groundwater, caused by the following ways:

1) By farming practices: All the agricultural pollutants including pesticides, fertilizers and

salts are penetrated into the soil and drained into the river through the drainage water causing pollution.

2) There are small villages located near the rivers and the wastes from houses living closer to the river are also thrown into the rivers causing pollution.
3) The wastes of the dairy farm are drained into the river causing pollution. Although the water pollution by the industries are controlled through environmental regulations, it is still impossible to control them fully.
4) Water pollution caused by the drainage of slaughter-houses in Ravansar town.

In order to analyze the water quality of the rivers, springs, canals and well water, water samples were taken during the 1st field survey in February 2003 in 18 locations as shown in the figure. More detailed information on water quality survey are provided in Annex 6.



Locations of Water Quality Survey

According to USDA classification, the water of Gharasu river is in the range of C1S1 to C2S1, and the salinity of water is in the lower to medium level. EC values measured at different periods do not vary significantly and they are mostly lesser than the medium level of 0.75 mS/cm. Therefore, the irrigation water does not cause serious salinity problems, if the soils are properly drained. Only the shallow well located in the southern part outside the Study Area has a higher salinity (C4) with an EC of 3.03 mS/cm. However, during the field survey, it was reported that there is salinity problem only in that area. pH of the water is within the normal range of 6.5 to 8.5, except for some cases (river near Khoram Abad and Canal Tapeh Rash) where the pH is above 8.5 mainly due to carbonate.

Although there is a slight amount of nitrogen, the level of other elements including P,K, Fe, Mn, Cu, Zn and B are in a much lower or negligible level. Total dissolved solids (TDS) are lower than the critical level of 450 mg/l for irrigation water. Dissolved Oxygen (DO) values of the rivers and springs are higher than 5 mg/l for most cases. Biological Oxygen Demand (BOD) is much lower than the critical level of 50 mg/l. Similarly Chemical Oxygen Demand (COD) is also much lower than the critical level of 100 mg/l.

Results of water quality survey of the springs in the Study Area and the region made by Kermanshah Environmental Directorate is shown below.

Results of Water Quality Survey of the Springs in the Study Area and the Region
Made by Kermanshah Environmental Directorate (January, 1995)

Name of Spring (1)	Elevation (metres) (2)	Average Discharge (l/s) (3)	pH (4)	EC mS/cm (5)	Turbidity ntu (6)	DO mg/l (7)	BOD mg/l (8)	COD mg/l (9)
Ravansar	1380	2586.5	7.00	0.100	8	8.7	Trace	10
Jaberi	1360	305.8	7.00	0.100	6	7.5	6	10
Ghare daneh	1400	192.0	7.10	0.200	3	7.5	16	32
Nilufar	1328	1000.0	7.20	0.400	8	7.2	18	34
Sabzali	1320	343.0	7.40	0.400	8	8.2	8	16
Yavari	1306	506.6	6.80	0.300	11	7.5	20	40

As shown in the Table, the pH is within the range of 6.5 to 7.5 and EC is lower than 0.4 mS/cm. Dissolved Oxygen is well above the critical level of 2 mg/l and similarly BOD and COD are also much below the critical level and turbidity is also lower.

In general, it can be concluded that the water quality of both spring water and rive water is suitable for irrigation, although there are some water pollution problems caused by house wastes and agriculture drainage water.

(2) Other Environmental Problems in the Region

1) Since the springs act as an important tourist attraction, the trashes left by the tourists and the passengers passing through these springs cause pollution.
2) There are some lime factories in the Study Area causing atmospheric pollution.
3) There is the herbicide production factory, and the discharge of this factory is one of the major pollutants of the region.
4) Irregular grazing and unbalance of livestock & pastures, resulting in soil erosion and sedimentation problems at the time of heavy rainfall. Some times causing flooding problems.
5) Illegal farming at the foot of mountains leads to soil erosion and removal of soil depth.

3.9.3 Environmental Problems Reported During Participatory Workshops

The major environmental problems reported during the participatory workshops in the 5 villages are summarized below. They mainly reported the health and sanitation as the major environmental problem of their villages as listed below.

(1) Health and Sanitation

1) There is no proper sewage and other sanitation facilities in the villages
2) The villagers reported that the animal wastes are mostly kept outside the homes causing air pollution and uncleanliness of the villages.
3) There is no health center or the facilities in the centers are poor
4) Poor or no drinking water facilities.
5) There is no public bath facilities

(2) Problems of Grazing and Range Areas

The farmers reported that the grazing area (natural ranges) for their animals are too far with poor roads. They complained that the government program to convert the grazing areas to agroforestry (Toba plan) is not supportive of grazing.

(3) Social problems in water distribution

Since there is no water users association and no clear rule in regard to water distribution, the farmers in the upstream side are more benefited compared to the farmers in the downstream side. Some times, it also creates social problems between two villages.

(4) Influence of Kilanbar Dam

Although the Kilanbar dam is at the study stage, some of the people in the Reis village, which is located within 1 km at the downstream part of the dam site expressed their concern about the compensation for the loss of their land due to submergence. It is also reported that a part of the village Kilanabar Oliya, which is at the upstream side of Kilanbar dam site will be submerged. The average elevation of the village is 1,420 m, which is about 20m higher than the estimated high water level of 1398m. It was reported that some part of this area belongs to the farmers of Reis village. While many farmers expressed their hope that the dam will be beneficial for irrigating their lands, they reported that the farmers who might loose their lands should be properly compensated.

Table 3.1.1 Demographic, social and agricultural information of Deh in the Study Area

no.	detesting	deh	site	zone	code of nature(*1)	road (*2)	nomads	no. of houses	no. of family	Population					Agriculture								Islamic consultation	Imam Homeini Assistant	% of beneficiaries	filtered water	non-filtered water	electricity	small clinic	doctor
										total population	% literate over 6yrs		% employed over 10yrs		agricultural land (ha)			% Irrigation.	orchard		No. of producers									
											male	female	male	female	total area	rainfed area	irrigated area		rainfed	irrigated	agriculture	orchard								
	Badr																													
1	1	Ghalancheh	1	1	1	1		6	6	34	81%	56%	38%	0%	446	358	88	20%			20		y		0%		y	y		
2	2	Gele Sefid	1	1	1	1	y	16	105	518	81%	64%	50%	2%	548	481	67	12%			106		y	58	55%					
3	3	Meskin Abad-e-Sofla	1	1	1	3		8	8	38	59%	53%	69%	0%	400	180	220	55%			25		y	4	50%					
4	4	Meskin Abad-e-Olya	1	1	1	1		22	22	105	52%	33%	44%	2%	540	411	129	24%			28		y	0	0%	y		y	y	y
	Hassan Abad																													
5	1	Tapeh Rash	1	2	1	2		26	26	123	73%	78%	44%	0%	410	160	250	61%	2	0	28	0	y	5	19%	y		y		
6	2	Tapeh Kuick	1	2	1	1		45	45	286	78%	65%	39%	5%	528	328	200	38%	0	0	25	0	y	14	31%		y	y	y	
7	3	Tapeh Lori	1	2	1	1		41	46	284	76%	67%	40%	0%	564	260	304	54%	0	4	60	0	y	5	11%			y		
8	4	Hassan Abad	1	2	1	1		150	177	904	79%	63%	42%	2%	870	670	200	23%	4	0	77	0	y	43	24%	y		y		
9	5	Hossein Abad	1	2	1	2		5	5	22	89%	70%	75%	11%	36	0	36	100%	0	0	6	0	y	3	60%			y		
10	6	Khoram Abad-e-Sofla	1	1	1	2		74	92	482	78%	65%	46%	2%	450	350	200	44%	0	0	58	0	y	15	16%	y		y	y	
11	7	Khoram Abad-e-Olya	1	1	1	1		66	67	295	78%	67%	40%	3%	613	413	200	33%	7	0	61	0	y	7	10%	y		y		
12	8	Deh Bagh	1	2	1	2		13	13	52	72%	61%	55%	5%	130	100	30	23%	1	0	8	0		2	15%					
13	9	Deh Sadeh	1	1	1	3		18	22	121	78%	63%	30%	0%	551	531	200	36%			32		y	4	18%			y		
14	10	Zarin Chagha	1	1	1	1		46	50	272	81%	69%	38%	0%	636	450	186	29%	1		61		y	13	26%	y		y		
15	11	Shali Abad	1	2	1	2		26	26	123	67%	57%	38%	0%	343	150	193	56%	2		39		y	7	27%			y		
16	12	Shour Balagh	1	2	1	1		23	28	171	83%	74%	42%	0%	475	375	100	21%		1	28		y	0	0%		y	y		
17	13	Ghale Zakariya	1	2	1	3		56	56	296	65%	61%	50%	0%	618	400	218	35%			73			17	30%		y	y		
18	14	Ghale Reza	1	2	1	3		13	13	60	85%	68%	46%	0%	618	300	318	51%			25			2	15%	y		y		
19	15	Kari Sharif	1	2	2	1		41	44	225	76%	69%	45%	1%	624	524	100	16%	2		44		y	5	11%		y	y	y	
20	16	Kareim Abad	1	2	1	2		29	29	145	53%	55%	52%	2%	370	180	190	51%			21		y	9	31%			y		
21	17	Gerazi Abad	1	2	1	2		31	38	187	77%	65%	41%	0%	438	300	138	32%			36		y	2	5%		y	y		
22	18	Gargabi Mestafa	2	3	1	3		1	1	3																		y		
23	19	Gargabi Mirza Ali	2	3	1	3		42	32	204	67%	57%	45%	0%	645	445	200	31%					y	12	38%			y	y	
24	20	Guij	1	2	1	2	y	20	20	106	79%	64%	51%	0%	466	420	46	10%			45		y	3	15%		y	y		
25	21	Mir Aizizi	1	2	1	2	y	17	16	108	76%	64%	54%	3%	468	370	98	21%			22		y	0	0%		y	y		
	Daulat Abad																													
26	1	Cheshmeh Sefid	2	3	3	2		20	23	114	63%	60%	58%	0%								1	y	0	0%	y		y		
27	2	Daulat Abad	2	3	1	2		80	91	418	75%	60%	49%	1%	543	512	29	5%		2	91	3	y	33	36%	y		y	y	y
28	3	Reis	2	3	1	2		33	40	186	64%	53%	64%	1%	343	288	51	15%		4	40		y	9	23%		y	y		
29	4	Kareh Ghale Sefid	2	3	1	1		17	26	145	74%	68%	64%	4%	384	330	54	14%			26	2	y	5	19%		y	y		
30	5	Kareh Ghale Kouneh	2	3	1	1		37	30	173	78%	61%	35%	2%	215	76	134	62%	4	1	30		y	4	13%		y	y		
31	6	Gamashtar-e-Olya	2	4	1	2	y	31	37	189	74%	67%	54%	0%	385	242	143	37%			37		y	8	22%	y		y		
32	7	Nahrabi	2	3	1	1		60	65	385	75%	63%	40%	1%	530	361	169	32%			68		y	30	46%	y		y	y	y
	Koozaran																	0												
33	1	Elyasei	2	5	1	3	y	11	11	52	60%	50%	52%	0%	303	228	75	25%			27		y	2	18%	y		y		
34	2	Pirouzeh	2	5	2	3	y	4	4	20	38%	50%	50%	17%	265	265	0	0%			9		y	1	25%	y				
35	3	Tapeh Ghol	2	5	1	3		53	53	299	78%	64%	46%	2%	601	495	106	18%		1	74	1	y	19	36%	y		y	y	
36	4	Jil Abad	2	5	1	2		14	14	88	70%	38%	39%	0%	155	127	28	18%			23			0	0%					
37	5	Chagha Shekar	2	5	1	2		18	18	127	75%	68%	32%	0%	255	130	125	49%			34		y	5	28%			y		
38	6	Dayar Asad Khan	2	5	1	2	y	16	16	86	75%	45%	65%	0%	199	142	57	29%			24		y	12	75%	y		y		
39	7	Deh Jan-jan	2	3	1	2		16	16	76	84%	50%	41%	0%	265	78	187	71%			24		y	3	19%	y		y		
40	8	Deh Cheragh	2	4	1	2		26	26	122	75%	69%	45%	2%	447	118	329	74%		3	33		y	7	27%		y			
41	9	Rootvand	2	5	1	2		17	17	96	67%	57%	48%	0%	353	246	107	30%			32		y	1	6%	y		y		
42	10	Zalou Ab	2	4	1	1	y	113	116	661	75%	65%	45%	0%	700	214	486	69%			97		y	37	32%	y		y	y	
43	11	SabzBolagh	2	5	1	2		28	28	172	67%	55%	44%	10%	288	213	75	26%		5	33	4	y	11	39%	y		y		
44	12	Siyah Siyah Dayar	2	5	1	2	y	22	23	111	74%	55%	58%	3%	273	164	109	40%			36		y	2	9%		y	y	y	y
45	13	Siyah Siyah	2	5	1	2		12	12	73	79%	83%	48%	0%	300	138	162	54%			30		y	0	0%	y		y		
46	14	Hossein Abad Shaleh	2	5	1	2		38	38	228	69%	55%	43%	1%	439	196	243	55%			54		y	8	21%	y		y	y	
47	15	Ghale Khoda Mororat	2	5	1	2		29	29	181	72%	58%	45%	1%	332	175	157	47%			47		y	7	24%	y		y		
48	16	GhaleFarajollah-e-Beig	2	5	1	3		8	9	33	50%	38%	50%	0%	268	232	37	14%			26		y	3	33%	y		y		
49	17	Kachkineh	2	5	1	2	y	10	10	74	66%	60%	44%	0%	382	255	127	33%		2	36	1	y	2	20%	y		y		
50	18	Kordvand	1	2	1	4		6	6	40	78%	67%	33%	0%	304	204	100	33%			18		y	0	0%	y		y		
51	19	Kalaveh Haidar Khan	2	4	1	2	y	29	29	169	72%	54%	39%	2%	411	143	268	65%			50		y	0	0%			y		
52	20	Kandouleh	2	5	2	2	2	33	33	192	68%	55%	53%	0%	579	546	33	6%			56			9	27%	y		y		
53	21	Golam Tabad	2	5	1	2	y	5	5	31	64%	21%	38%	0%	194	154	40	21%			11		y	3	60%	y				
54	22	Lachin	1	2	1	1	y	6	6	17	60%	43%	120%	0%	129	93	36	28%			15		y	0	0%	y				
55	23	Lamini	2	4	1	2		23	23	135	62%	55%	53%	0%	244	196	48	20%			35		y	5	22%					
56	24	Nouroleh Safla	2	5	3	3		8	8	42	53%	39%	60%	0%	272	237	35	13%			15		y	1	13%	y				
57	25	Nouroleh Oliya	2	5	3	3		36	36	215	61%	54%	49%	0%	702	506	197	28%			69	0	y	4	11%	y		y	y	
58	26	Vali Abad	2	5	1	2		7	7	35	64%	59%	45%	6%	201	132	69	34%					y	2	29%	y		y		
59	27	Yavari Dayar	2	5	1	2	y	18	16	86	74%	49%	48%	0%	215	105	110	51%			15		y	0	0%	y		y		

*1 Code of natural condition: 1: plain, 2: mountainous, 3: 1 + 2, 4: 1 + jungle, 5: 2 + jungle, 6: Others.

*2 Code of road: 1: asphalt, 2: graveled road, 3: dirt road, 4: animal path, 5:railway station, 6:water way.

Table 3.2.1 Groundwater Use of Registered Wells in the Study Area

	Name of Settlement	Summary of Well Number unit : nos						Summary of Groundwater Yield unit : cmpy						Irrigated Area (ha)						Irrigated Water (mm)		
		Depth Classification		Water Use Classification			Total	Depth Classification		Water Use Classification			Total	Settlement Total			Average in Settlement			Average in Settlement		
		Deep	Shallow	Agri	Drinking	Industrial		Deep	Shallow	Agri	Drinking	Industrial		Deep	Shallow	Total	Deep	Shallow	Total	Deep	Shallow	Total
Site - 1	Chagh Reza	2	0	2	0	0	2	79,200		79,200			79,200	10.0	0.0	10.0	5.0		5.0	792		792
	Gel Sefid	0	7	7	0	0	7	0	221,760	221,760			221,760	0.0	42.9	42.9		6.1	6.1		517	517
	Geraz Abad	2	0	2	0	0	2	237,600		237,600			237,600	22.3	0.0	22.3	11.2		11.2	1,065		1,065
	Ghale Reza	1	0	1	0	0	1	142,560		142,560			142,560	21.5	0.0	21.5	21.5		21.5	663		663
	Ghaleh Zaloria	12	0	11	0	1	12	3,207,096		3,077,496		129,600	3,207,096	353.0	0.0	353.0	29.4		32.1	909		909
	Guj	4	0	4	0	0	4	498,960		498,960			498,960	87.0	0.0	87.0	21.8		21.8	574		574
	Hasan Abad	1	6	5	0	2	7	166,320	476,330	522,770		119,880	642,650	21.0	60.0	81.0	21.0	10.0	16.2	792	794	793
	Karim Abad	0	3	2	0	1	3	0	112,464	110,880		1,584	112,464	0.0	10.0	10.0		3.3	5.0		1,125	1,125
	Khoram Abad -e-Olya	1	0	0	0	1	1	60,480		0		60,480	60,480	0.0	0.0	0.0	0.0					
	Khoram Abad-e-Sofla	0	1	1	0	0	1	0	31,680	31,680			31,680	0.0	0.3	0.3		0.3	0.3		12,672	12,672
	Kordvand	1	0	1	0	0	1	703,296		703,296			703,296	79.0	0.0	79.0	79.0		79.0	890		890
	Lachin	2	1	3	0	0	3	332,640	95,040	427,680			427,680	42.0	3.6	45.6	21.0	3.6	15.2	792	2,640	938
	Mardan Abad -e-Olya	1	1	2	0	0	2	79,200	39,600	118,800			118,800	7.0	5.0	12.0	7.0	5.0	6.0	1,131	792	990
	Mir Azizi	13	2	15	0	0	15	1,639,440	198,000	1,837,440			1,837,440	166.5	24.0	190.5	12.8	12.0	12.7	985	825	965
	Mir Azizi -e-Ghadim	11	0	11	0	0	11	1,544,400		1,544,400			1,544,400	180.9	0.0	180.9	16.4		16.4	854		854
	Mir Azizi -e-Jadid	14	0	14	0	0	14	1,821,600		1,821,600			1,821,600	203.5	0.0	203.5	14.5		14.5	895		895
	Tapeh Kuick	2	6	7	0	1	8	668,160	245,520	427,680		486,000	913,680	23.0	30.0	53.0	11.5	5.0	7.6	2,905	818	1,724
	Tapeh Lori	0	13	13	0	0	13	0	926,640	926,640			926,640	0.0	125.7	125.7		9.7	9.7		737	737
	Zarin Chigha	2	1	2	0	1	3	300,960	7,920	300,960		7,920	308,880	36.0	0.0	36.0	18.0	0.0	18.0	836		858
	Sub-Total	69	41	103	0	7	110	11,481,912	2,354,954	13,031,402	0	805,464	13,836,866	1,252.7	301.5	1,554.2	18.2	7.4	15.1	917	781	890
Site - 2	Chagh Kachiineh	0	1	1	0	0	1	0	0	0	0	0	0	0.0	3.0	3.0		3.0	3.0			0
	Chigh Shekar	6	3	9	0	0	9	602,280	166,320	768,600			768,600	73.2	51.0	124.2	12.2	17.0	13.8	823	326	619
	Deh Cheragh	16	2	18	0	0	18	2,542,320	902,900	3,445,220			3,445,220	284.0	18.0	302.0	17.8	9.0	16.8	895	5,016	1,141
	Dolat Abad	0	3	3	0	0	3	0	198,000	198,000			198,000	0.0	16.0	16.0		5.3	5.3		1,238	1,238
	Elyasi	4	4	8	0	0	8	609,840	208,920	818,760			818,760	67.0	25.5	92.5	16.8	6.4	11.6	910	819	885
	Gamashtar	1	1	2	0	0	2	63,360	63,360	126,720			126,720	4.0	4.0	8.0	4.0	4.0	4.0	1,584	1,584	1,584
	Gamashtar -e-Olya	10	30	40	0	0	40	601,920	1,886,480	2,488,400			2,488,400	62.1	262.6	324.7	6.2	8.8	8.1	969	718	766
	Gargabi	9	1	10	0	0	10	2,415,334	28,800	2,444,134			2,444,134	322.2	1.0	323.2	35.8	1.0	32.3	750	2,880	756
	Ghale Faryollah Beigi	4	0	4	0	0	4	475,200		475,200			475,200	48.0	0.0	48.0	12.0		12.0	990		990
	Ghale Khoda Morovat Khar	8	0	8	0	0	8	942,480		942,480			942,480	116.0	0.0	116.0	14.5		14.5	812		812
	Hossein Abad	6	8	13	1	0	14	1,484,640	435,600	1,560,240	360,000		1,920,240	124.5	52.0	176.5	20.8	6.5	13.6	1,192	838	1,088
	Jan Jan	10	1	11	0	0	11	1,283,040	79,200	1,362,240			1,362,240	136.1	8.0	144.1	13.6	8.0	13.1	943	990	945
	KachKineh	3	1	3	0	1	4	213,840	5,040	213,840		5,040	218,880	33.0	0.0	33.0	11.0	0.0	11.0	648		663
	Kandouleh	2	0	2	0	0	2	293,040		293,040			293,040	44.0	0.0	44.0	22.0		22.0	666		666
	Kozaran	0	1	0	0	1	1	0	7,920	0		7,920	7,920	0.0	0.0	0.0		0.0				
	Nahrabi	6	17	23	0	0	23	285,120	855,360	1,140,480			1,140,480	36.5	78.3	114.8	6.1	4.6	5.0	781	1,093	994
	Nouroleh	0	1	1	0	0	1	39,600		39,600			39,600	0.0	3.5	3.5		3.5	3.5		0	1,131
	Nouroleh Olya	8	0	8	0	0	8	839,520		839,520			839,520	116.3	0.0	116.3	14.5		14.5	722		722
	Nouroleh Sofla	1	0	1	0	0	1	47,520	63,360	110,880			110,880	14.0	0.0	14.0	14.0		14.0	339		792
	Pirousah	3	1	4	0	0	4	324,720		324,720			324,720	36.0	5.0	41.0	12.0	5.0	10.3	902	0	792
	Ress	4	0	4	0	0	4	198,000		198,000			198,000	44.3	0.0	44.3	11.1		11.1	447		447
	Rootvand	6	2	8	0	0	8	839,520	142,560	982,080			982,080	99.0	20.0	119.0	16.5	10.0	14.9	848	713	825
	Sabzeh Bolagh	4	0	4	0	0	4	388,080		388,080			388,080	35.3	9.7	45.0	8.8		11.3	1,099	0	862
	Siyah Siyah	4	0	4	0	0	4	776,160		776,160			776,160	90.3	0.0	90.3	22.6		22.6	859		859
	Siyah Siyah Dayar	5	0	5	0	0	5	728,640		728,640			728,640	102.0	0.0	102.0	20.4		20.4	714		714
	Tapeh Gol	3	7	10	0	0	10	990,000	348,480	1,338,480			1,338,480	131.5	34.4	165.9	43.8	4.9	16.6	751	1,013	807
	Tapeh Gol -e-Banjabi	1	0	1	0	0	1	0		0			0	15.0	0.0	15.0	15.0		15.0	0		0
	Vali Abad	6	2	8	0	0	8	1,172,160	134,640	1,306,800			1,306,800	128.5	30.0	158.5	21.4	15.0	19.8	912	449	824
	Zalvah	19	7	15	0	1	26	7,367,584	352,440	7,708,144		11,880	7,720,024	395.9	37.6	433.5	20.8	5.4	28.9	1,861	937	1,781
	Sub-Total	149	93	228	1	3	242	25,523,918	5,879,380	31,018,858	360,000	24,840	31,403,298	2,558.7	659.6	3,218.3	17.2	7.1	14.1	998	891	976
	Grand Total	218	134	331	1	10	352	37,005,830	8,234,334	44,049,860	360,000	830,304	45,240,164	3,811.4	961.0	4,772.4	17.5	7.2	14.4	971	857	948

Source : Ravansar Office of Water Affairs, Kermanshah Province

Table 3.2.2 Site Characteristics of the Soil Profiles in the Study Area

	Location	Coordinates	Soil Classification	Land Class	Elevation m	Climate	Drainage	Natural Vegetation	Land Use	Relief	Slope	Erosion	Runoff	Flooding	Subsoil Permeability
1	Tapeh Lori	34°34'49" N 46°44'31" E	Vertic Haploxerepts	4vh/A_1-E_0 IIst	1450	Mesic Xeric	Poor	Graminae/ legume	Fallow	1	1.0%	E_0	Slow	No	4 (slow) 0.1-2.0 cm/h
2	Goraz Abad	34°34'49" N 46°40'56" E	Vertic Calcixerolls	4vh/A_1-E_0 IIst	1347	Mesic Xeric	Poor	Graminae/ legume	Wheat	1	0.8%	E_0	Slow	No	4 (slow) 0.1-2.0 cm/h
3	Tapeh Quick	34°35'23" N 46°42'49" E	Vertic Haploxerepts	4vh/A_1-E_0 IIst	1459	Mesic Xeric	Poor	Graminae/ legume	Wheat	1	1.0%	E_0	Slow	No	4 (slow) 0.1-2.0 cm/h
4	Tapeh Rash	34°35'56" N 46°41'56" E	Vertic Haploxerepts	4vh/A_1-E_0 IIst	1455	Mesic Xeric	Poor	Graminae/ legume	Fallow	1	1.0%	E_0	Slow	No	4 (slow) 0.1-2.0 cm/h
5	Hassan Abad	46°41'57" N 34°37'49" E	Vertic Haploxerepts	4vh/A_1-E_0 IIst	1440	Mesic Xeric	Poor	Graminae/ legume	Fallow	1	1.0%	E_0	Slow	No	4 (slow) 0.1-2.0 cm/h
6	Deh Sadeh	46°41'57" N 34°37'49" E	Vertic Calcixerepts	4vh/A_1-E_0 IIst	-	Mesic Xeric	Poor	Graminae/ legume	Fallow	1	1.0%	E_0	Slow	No	4 (slow) 0.1-2.0 cm/h
7	Khoram Abad	34°38'58" N 46°39'52" E	Vertic Haploxerepts	4vh/A_1-E_0 IIst	1365	Mesic Xeric	Poor	Graminae/ legume	Fallow	1	1.2%	E_0	Slow	No	4 (slow) 0.1-2.0 cm/h
8	Kolah Kabood	34°40'05" N 46°39'30" E	Vertic Haploxerepts	4vh/cb_1-E1 IIIt	1426	Mesic Xeric	Poor	Graminae/ legume	Fallow	1	6.0%	E1	Medium	No	4 (slow) 0.1-2.0 cm/h
9	Siah Siah	34°35'42" N 46°36'59" E	Vertic Haploxerepts	4vh/A_1-E_0 IIst	1332	Mesic Xeric	Poor	Graminae/ legume	Fallow	1	0.8%	E_0	Slow	No	4 (slow) 0.1-2.0 cm/h
10	Kuchi gineh	34°35'23" N 46°35'40" E	Vertic Calcixerolls	4vh/A_1-E_0 IIst	1328	Mesic Xeric	Poor	Graminae/ legume	Fallow	1	1.0%	E_0	Slow	No	4 (slow) 0.1-2.0 cm/h
11	Ghale Khoda moratkhan	34°35'49" N 46°35'51" E	Vertic Calcixerolls	4vh/A_1-E_0 IIst	1296	Mesic Xeric	Poor	Graminae/ legume	Fallow	1	1.0%	E_0	Slow	No	4 (slow) 0.1-2.0 cm/h
12	Shaleh	34°36'03" N 46°36'14" E	Vertic Calcixerolls	4vh/A_1-E_0 IIst	1353	Mesic Xeric	Poor	Graminae/ legume	Fallow	1	1.2%	E_0	Slow	No	4 (slow) 0.1-2.0 cm/h
13	Deh Rash (Garghabi)	34°36'31" N 46°38'29" E	Vertic Calcixerolls	4h/B2-E_0 IIIt	1338	Mesic Xeric	Poor	Graminae/ legume	Wheat	2	2.5%	E_0	Medium	No	4 (slow) 0.1-2.0 cm/h
14	Jehan Abad	34°37'57" N 46°37'13" E	Vertic Haploxerepts	3l/A_1-E_0 IIt	1335	Mesic Xeric	Well drained	Graminae/ legume	Wheat	1	0.7%	E_0	Slow	No	4 (slow) 0.1-2.0 cm/h
15	Deh Cheragh	34°37'59" N 46°35'02" E	Vertic Calcixerolls	4vh/A_1-E_0 IIst	1338	Mesic Xeric	Poor	Graminae/ legume	Fallow	1	1.0%	E_0	Slow	No	4 (slow) 0.1-2.0 cm/h
16	Kalaveh Hidarkhan	34°38'49" N 46°35'41" E	Vertic Haploxerolls	4h/A_1-E_0 IIst	1335	Mesic Xeric	Poor	Graminae/ legume	Fallow	1	1.0%	E_0	Medium	No	4 (slow) 0.1-2.0 cm/h
17	Kare Galeh sefid	34°39'09" N 46°31'59" E	Vertic Calcixerepts	4vh/B_1-E1 IIIt	1338	Mesic Xeric	Poor	Graminae/ legume	Fallow	1	3.0%	E_0	Slow	No	4 (slow) 0.1-2.0 cm/h
18	Nahrabi	34°40'17" N 46°34'17" E	Vertic Haploxerepts	4vh/A_1-E1 IIst	1355	Mesic Xeric	Poor	Graminae/ legume	Fallow	1	1.0%	E_0	Slow to Medium	No	4 (slow) 0.1-2.0 cm/h

Table 3.4.1 Cultivated Area, production and Yield of Annual crops in each Dehestan of Survey Area (2001/2002)

Dehestan	Crops		Area (ha)				Yield		Production		
			Rain-fed	Irrigated	Rate of Irrigation	Total	Rain-fed	Irrigated	Rain-fed	Irrigated	Total
			ha	ha	%	ha	ton/ha	ton/ha	ton	ton	ton
Ravansar	Winter crop	Wheat	6,000	1,500	20	7,500	1.2	3.7	7,200	5,550	12,750
		Barley	2,000	50	2	2,050	2.2	6.5	4,400	325	4,725
		Others	200	50	20	250					
	Summer crop	Maize	0	1,000	100	1,000	0.0	10.0	0	10,000	10,000
		Sugar beet	0	15	100	15	0.0	25.0	0	375	375
		Chick pea	5,000	20	0	5,020	0.3	0.8	1,500	16	1,516
	Sum or average		13,200	2,635	17	15,835					
Hassan Abad	Winter crop	Wheat	3,000	3,000	50	6,000	1.2	3.7	3,600	11,100	14,700
		Barley	2,500	200	7	2,700	2.2	6.5	5,500	1,300	6,800
		Others	150	500	77	650					
	Summer crop	Maize	0	2,500	100	2,500	0.0	10.0	0	25,000	25,000
		Sugar beet	0	10	100	10	0.0	25.0	0	250	250
		Chick pea	4,000	20	0	4,020	0.3	0.8	1,200	16	1,216
	Sum or average		9,650	6,230	39	15,880					
Daulat	Winter crop	Wheat	6,000	1,000	14	7,000	1.2	3.7	7,200	3,700	10,900
		Barley	2,000	50	2	2,050	2.2	6.5	4,400	325	4,725
		Others	200	150	43	350					
	Summer crop	Maize	0	500	100	500	0.0	10.0	0	5,000	5,000
		Sugar beet	0	0	0	0	0.0	0.0	0	0	0
		Chick pea	6,000	0	0	6,000	0.3	0.0	1,800	0	1,800
	Sum or average		14,200	1,700	11	15,900					
Kuzaran	Winter crop	Wheat	2,800	1,590	36	4,390	1.4	4.4	3,920	6,966	10,886
		Barley	130	50	28	180	1.5	4.8	195	240	435
		Others	3	10	77	13					
	Summer crop	Maize	0	1,550	100	1,550	0.0	8.0	0	12,400	12,400
		Sugar beet	0	8	100	8	0.0	35.0	0	280	280
		Chick pea	2,500	0	0	2,500	0.5	0.0	1,125		1,125
	Sum or average		5,433	3,208	37	8,641					

Source: Statistics of each Dehestan.

Table 3.4.2 Production Costs in Kermanshah Province in 2001/2002 (Rls./ha)

Item	Unit	Wheat					
		Irrigated			Rain-fed		
		Quantity	Unit price	Cost	Quantity	Unit price	Cost
Tillage	times	1	80,000	80,000	1	70,000	70,000
Harrowing	times	1	50,000	50,000	1	50,000	50,000
Leveling	times	1	50,000	50,000			0
Making of plot and canal	times	1	70,000	70,000			0
Seeding	times	1	70,000	70,000	1	40,000	40,000
Seed	kg	180	1,285	231,300	150	1,200	180,000
Urea	kg	250	325	81,250	50	345	17,250
Phosphate	kg	200	295	59,000			0
Potassium	kg	100	215	21,500			0
Phosphate and Potassium	kg				100	500	50,000
Others	kg	200	1,200	240,000			0
Transportation (materials)	km	930	70	65,100	240	80	19,200
Fertilization	kg	750	80	60,000	150	80	12,000
Herbicide	lit.	2.5	23,000	57,500	1.5	25,000	37,500
Insecticide	lit.	1.5	19,000	28,500	1.5	25,000	37,500
Harvesting	ha	1	160,000	160,000	1	100,000	100,000
Spraying of chemicals	times	2	20,000	40,000	2	30,000	60,000
Top dressing	kg	0	0	0			0
Irrigation	man-day	6	30,000	180,000			
Total				1,544,150			673,450
Rate of mechanization (%)				37.6			49.3

Item	Unit	Maize			Chick pea		
		Irrigated			Rain-fed		
		Quantity	Unit price	Cost	Quantity	Unit price	Cost
Tillage	times	2	80,000	160,000	1	70,000	70,000
Harrowing	times	2	50,000	100,000	0	0	0
Leveling	times	1	50,000	50,000			0
Making of plot and canal	times	1	70,000	70,000			0
Seeding	times	1	70,000	70,000	1	30,000	30,000
Seed	kg	25	9,600	240,000	50	3,000	150,000
Urea	kg	400	345	138,000	0	0	0
Phosphate	kg	300	450	135,000	50	495	24,750
Potassium	kg	100	415	41,500			0
Phosphate and Potassium	kg	0	0	0	0	0	0
Others	kg	200	1,200	240,000			0
Transportation (materials)	km	1,025	80	82,000	100	70	7,000
Fertilization	times	2	40,000	80,000	50	80	4,000
Herbicide	lit.	4	25,000	100,000			
Pesticide	lit.	1	25,000	25,000	2	25,000	50,000
Insecticide	lit.	0	0	0	2	25,000	50,000
Harvesting	ha	1	160,000	160,000	1	300,000	300,000
Spraying of chemicals	times	2	30,000	60,000	2	30,000	60,000
Top dressing	kg	2	30,000	60,000			0
Irrigation	man-day	14	30,000	420,000			
Weeding	man-day	0	0	0	10	30,000	300,000
Ridging	times	1	30,000	30,000			
Total				2,261,500			745,750
Rate of mechanization (%)				34.5			21.5

Source: Kermanshah Jihad-e-Agriculture, 2002

Table 3.4.3 Farmers Production in the Study Area (2003)

Code No.	Deh	Own land			Rent land			Total	Yield (wheat)						(Barley)		(Chick pea)		(Maize)			(Alfalfa)	Condition of land rent	Kind of rent land
		Irrg.	Dry	Sum	Irrg	Dry	Sum		Own land	Tech.		Tech.	Rented land		Own land	Rented land	Own land	Rented land	Own land	Tech.	Rented land	Own land		
		ha	ha	ha	ha	ha	ha	ha	Irrig.	index	Dry land	index	Irrig.	Dry land	Dry land	Dry land	Dry land	Dry land	Irrig.	index	Irrig.	Irrig.		
									ton/ha		ton/ha		ton/ha	ton/ha	ton/ha	ton/ha	ton/ha	ton/ha	ton/ha		ton/ha	ton/ha		
S1	Khoram Abad Oliya	0.5	1.0	1.5	0.0	0.0	0.0	1.5	4.4	5					1.5									
S2	Khoram Abad Oliya	2.5	2.0	4.5	0.0	0.0	0.0	4.5	2.2	5					2.5									
S3	Khoram Abad Oliya	4.0	4.0	8.0	0.0	0.0	0.0	8.0	3.0	5					1.1									
S4	Khoram Abad Oliya	4.0	4.0	8.0	0.0	0.0	0.0	8.0	3.5	5					3.0									
S5	Khoram Abad Oliya	4.0	4.0	8.0	0.0	0.0	0.0	8.0	2.6	4					1.2		0.22							
S6	Khoram Abad Oliya	4.5	4.0	8.5	0.0	0.0	0.0	8.5	3.5	3					2.2		0.39		12.0	5				
S7	Khoram Abad Oliya	5.0	4.0	9.0	0.0	0.0	0.0	9.0	6.6	7					2.4		0.36		8.0	6				
S8	Khoram Abad Oliya	6.0	4.0	10.0	0.0	0.0	0.0	10.0									0.08		5.0	5				
S9	Khoram Abad Oliya	4.5	6.0	10.5	3.0	0.0	3.0	13.5	5.4	6			3.8		1.4	1.6	0.14		8.0	7		9.3	1.5 Million Rls./ha/year, terms of rent: 8 years	irrig. Land
S10	Khoram Abad Oliya	5.0	7.0	12.0	1.0	12.0	13.0	25.0	5.5	4					2.0	1.8	0.15	0.23	9.0	6		5.0	2.5 Million Rls./ha/year, terms of rent: 2 years	irrig. & dry land
S11	Khoram Abad Oliya	5.0	7.0	12.0				12.0	5.0	7			3.0		2.2		0.10		10.0	6		10.0	0.83 Million Rls./ha/year	
S12	Khoram Abad Oliya	10.0	5.0	15.0	12.0	0.0	12.0	27.0	6.0	5					1.2						5.0		2.0 Million Rls./ha/year	irrig. Land
S13	Khoram Abad Oliya	3.0	13.0	16.0	9.0	0.0	9.0	25.0	2.5	6	0.8				2.0		0.18		6.0	7	4.8	7.0	1.0 Million Rls./ha/year, terms of rent: 3 years	irrig. Land
S14	Khoram Abad Oliya	7.0	9.5	16.5	0.0	0.0	0.0	16.5	4.8	5	2.1								4.7	5				
S15	Khoram Abad Oliya	6.0	12.0	18.0	0.0	0.0	0.0	18.0	4.3	6	1.5				2.2		0.25		11.0	6				
S16	Khoram Abad Oliya	3.0	16.0	19.0				19.0		4			6.0		2.0		0.13		5.3	5		10.0	1.8 Million Rls./ha/year	irrig. Land
S17	Khoram Abad Oliya	4.0	16.0	20.0	0.0	0.0	0.0	20.0	4.7	6					3.6				9.0	6				
S18	Khoram Abad Oliya	10.0	10.0	20.0	0.0	0.0	0.0	20.0	4.5	5	0.5				2.3				8.5	7				
S19	Khoram Abad Oliya	2.0	23.0	25.0	0.0	0.0	0.0	25.0	4.0	7	1.3				1.5		0.22		12.0	7		10.0		
S20	Khoram Abad Oliya	3.0	27.0	30.0	9.0	0.0	9.0	39.0		7	2.0		5.7		2.0		0.18		9.3	7	6.8		1.1 Million Rls./ha/year	irrig. Land
	Average								**4.3**	**5**	**1.4**		**4.6**		**2.0**	**1.7**	**0.20**	**0.23**	**8.4**	**6**	**5.5**	**8.6**		
	Range								2.2 ~ 6.6		0.5 ~2.1		3.0 ~ 6.0		1.1 ~ 3.6	1.6 ~ 1.8	0.08 ~ 0.39		4.7 ~ 12.0		5.0 ~ 6.8	5.0 ~ 10.0		
S21	Shali Abad	0.5	1.0	1.5	0.0	0.0	0.0	1.5							1.3							4.0		
S22	Shali Abad	1.0	0.0	1.0	2.0	0.0	2.0	3.0	4.2	5													partnership (going halves with owner)	irrig. Land
S23	Shali Abad	2.5	1.5	4.0	0.0	0.0	0.0	4.0	5.4	6					1.1									
S24	Shali Abad	0.0	4.5	4.5	0.0	0.0	0.0	4.5							3.0		0.75							
S25	Shali Abad	6.5	1.5	8.0	0.0	0.0	0.0	8.0	3.4	6					0.9									
S26	Shali Abad	4.0	4.0	8.0	4.5	0.0	4.5	12.5	6.0	6			5.0		3.8	1.3							1.6 Million Rls./ha/year	irrig. Land
S27	Shali Abad	0.0	8.0	8.0	0.0	0.0	0.0	8.0				2			0.1		0.03							
	Average								**4.7**	**6**		**2**	**5.0**		**1.7**	**1.3**	**0.39**					**4.0**		
	Range								2.2 ~ 6.6		0.5 ~2.1		3.0 ~ 6.0		0.1 ~ 3.8		0.03 ~ 0.75							
S28	Reis	0.0	2.0	2.0	0.0	0.0	0.0	2.0			2.0	5			1.8									
S29	Reis	0.0	6.0	6.0	0.0	17.0	17.0	23.0			1.3	5		1.7									0.82 Million Rls./ha/year	dry land
S30	Reis	0.0	8.0	8.0	0.0	0.0	0.0	8.0			1.2	4					0.35							
S31	Reis	2.0	8.5	10.5	0.0	0.0	0.0	10.5	4.5	5	1.3				1.1		0.21							
S32	Reis	0.0	12.0	12.0	0.0	0.0	0.0	12.0			2.0	4			1.2		0.36							
S33	Reis	0.0	15.0	15.0	0.0	0.0	0.0	15.0			1.8	4			1.8		0.19							
S34	Reis	10.0	10.0	20.0	0.0	0.0	0.0	20.0	3.2	4							0.47							
	Average								**3.9**	**5**	**1.6**	**4**		**1.7**	**1.5**		**0.32**							
	Range								3.2 ~ 4.5		1.2 ~ 2.0				1.1 ~ 1.8		0.19 ~ 0.47							
S35	Kalaveh Heidarkhan	5.0	1.0	6.0	0.0	0.0	0.0	6.0	6.0	6	0.9								10.0	6				
S36	Kalaveh Heidarkhan	4.0	3.0	7.0	0.0	0.0	0.0	7.0	4.5	6	1.4								9.0	6				
S37	Kalaveh Heidarkhan	3.0	0.0	3.0	0.0	0.0	0.0	3.0	9.0	6									9.0	5				
S38	Kalaveh Heidarkhan	7.0	0.0	7.0	0.0	0.0	0.0	7.0	4.0	4									6.5	5				
S39	Kalaveh Heidarkhan	4.0	4.5	8.5	12.0	1.0	13.0	21.5	4.0	4					2.4	1.2	0.33			6	9.0		3.2 Million Rls./ha/year	irrig. Land
S40	Kalaveh Heidarkhan	10.0	0.0	10.0	0.0	0.0	0.0	10.0	5.7	4									6.9	5				
S41	Kalaveh Heidarkhan	8.0	6.0	14.0	0.0	0.0	0.0	14.0	5.0	4							0.10		8.5	6				
	Average								**5.5**	**5**	**1.2**				**2.4**	**1.2**	**0.22**		**8.3**	**6**	**9.0**			
	Range								4.0 ~ 9.0		0.9 ~ 1.4						0.1 ~ 0.33		6.5 ~ 10.0					
S42	Hassan Abad Shaleh	0.0	6.0	6.0	0.0	0.0	0.0	6.0			1.2	2					0.30							
S43	Hassan Abad Shaleh	4.0	2.0	6.0	0.0	0.0	0.0	6.0		5	1.5								10.5	6				
S44	Hassan Abad Shaleh	6.0	1.0	7.0	0.0	0.0	0.0	7.0	4.5	4	3.0								5.5	5				
S45	Hassan Abad Shaleh	10.0	2.0	12.0	0.0	8.0	8.0	20.0	6.3	7	3.0							0.36	10.0	7			going halves with owner	dry land
S46	Hassan Abad Shaleh	13.0	0.0	13.0	0.0	6.0	6.0	19.0	3.0	6				1.0		1.2			4.0	5			0.42 Million Rls./ha/year, terms of rent: 3 years	dry land
S47	Hassan Abad Shaleh	5.0	7.0	12.0	0.0	0.0	0.0	12.0	4.8	4	1.5						0.18		7.6	6				
S48	Hassan Abad Shaleh	16.0	1.5	17.5	0.0	0.0	0.0	17.5	4.5	4					1.3				8.0	5				
	Average								**4.6**	**5**	**2.0**	**2**		**1.0**	**1.3**	**1.2**	**0.24**	**0.36**	**7.6**	**6**	**9.0**			
	Range								3.0 ~ 6.3		1.2 ~ 3.0						0.18 ~ 0.30		4.0 ~ 10.5					
S49	Noroleh Oliya	0.0	4.0	4.0	0.0	0.0	0.0	4.0									0.32							
S50	Noroleh Oliya	0.0	6.0	6.0	0.0	0.0	0.0	6.0			2.0	4					0.30							
S51	Noroleh Oliya	6.0	6.0	12.0	10.0	0.0	10.0	22.0	5.5	5	1.1		3.0				0.30		5.6	6	5.6		1/3 of products	irrig. Land
S52	Noroleh Oliya	0.0	12.0	12.0	0.0	0.0	0.0	12.0									0.35							
S53	Noroleh Oliya	0.0	14.0	14.0	0.0	0.0	0.0	14.0		5	1.6				1.2		0.38							
S54	Noroleh Oliya	20.0	10.0	30.0	16.0	0.0	16.0	46.0	5.0	5	1.2				5.0				10.0	6	10.0		partnership (going halves with owner)	irrig. Land
	Average								**5.3**	**5**	**1.5**	**4**	**3.0**		**3.1**		**0.33**		**7.8**	**6**	**7.8**			
	Range								5.0 ~ 5.5		1.1 ~ 2.0				1.2 ~ 5.0		0.30 ~ 0.38		5.6 ~ 10.0		5.6 ~ 10.0			

Note 1) Technological index: Numbers of used technologies from 7 technologies, i.e. organic matter, chemical fertilizer, certified seeds, irrigation, herbicide, insecticide, fungicide.

Table 3.4.4 Farmers Economy in the Study Area (2003)

Code No.	Deh	Own land Irrg.	Own land Dry	Own land Sum	Rent land Irrg	Rent land Dry	Rent land Sum	Rent land Total	Gross* income index	Production Wheat	Production Barley	Production Maize (grain)	Production Chick pea	Gross income in agriculture	Adult cow	Bull	Calves	Sheep & goat Adult	Sheep & goat Lamb	Gross income of annimal husbandry	Gross income by trust of farm works	Total gross income in farming	Total cost in farming	Total net income in farming	Gross income in other jobs	Total gross income in household	Total household expenses	Balance in household	Total debts	Reason of debts
		ha	ha	ha	ha	ha	ha	ha		ton	ton	ton	ton	Miilion Rls.	heads	heads	heads	heads	heads	Million Rls.	Million Rls.	Million Rls.	Million Rls.	Million Rls.	Million Rls.	Million Rls.	Million Rls.	Million Rls.	Million Rls.	
28	Reis	0.0	2.0	2.0	0.0	0.0	0.0	2.0	**2.0**	2.0	1.8			2.88	5		3			7.55	7.60	18.03	15.59	2.45	1.80	19.83	27.96	▲ 24	16.40	Input and mechanization cost
1	Khoram Abad Oliya	0.5	1.0	1.5	0.0	0.0	0.0	1.5	**3.1**	2.2	1.5			4.25								4.25	2.43	1.81	3.36	7.60	11.82	▲ 7	5.85	
21	Shali Abad	0.5	1.0	1.5	0.0	0.0	0.0	1.5	**3.1**		1.3							20	26	10.07		10.07	3.85	6.22	13.50	23.57	19.07	1	14.60	Construction of house
49	Noroleh Oliya	0.0	4.0	4.0	0.0	0.0	0.0	4.0	**4.0**				1.3	3.02								3.02	5.22	▲ 2.19	16.20	19.22	15.83	▲ 2	2.50	
24	Shali Abad	0.0	4.5	4.5	0.0	0.0	0.0	4.5	**4.5**		10.5		0.8	10.98								10.98	6.58	4.41	21.60	32.58	29.35	▲ 3	4.80	Living expeses, especially for education
42	Hassan Abad Shaleh	0.0	6.0	6.0	0.0	0.0	0.0	6.0	**6.0**	6.0			0.3	7.18	1		1			1.60		8.78	17.71	▲ 8.93		8.78	14.18	▲ 23	20.00	Production cost and living expenses
50	Noroleh Oliya	0.0	6.0	6.0	0.0	0.0	0.0	6.0	**6.0**	8.0			0.6	11.56								11.56	2.45	9.11	8.50	20.06	17.91	▲ 0	10.00	Input and mechanization cost
27	Shali Abad	0.0	8.0	8.0	0.0	0.0	0.0	8.0	**8.0**	0.3	1.2			0.00	5	4	4			6.00		6.00	17.47	▲ 11.47		6.00	17.02	▲ 28	3.00	Input and mechanization cost
30	Reis	0.0	8.0	8.0	0.0	0.0	0.0	8.0	**8.0**	4.6				4.94	3	1				1.10		6.04	3.09	2.95		6.04	8.95	▲ 6	0.35	Input and mechanization cost
23	Shali Abad	2.5	1.5	4.0	0.0	0.0	0.0	4.0	**12.0**	13.5	1.7			16.84								16.84	20.06	▲ 3.22	3.50	20.34	9.57	▲ 9	10.00	
32	Reis	0.0	12.0	12.0	0.0	0.0	0.0	12.0	**12.0**	12.0	1.2		1.8	17.24	4	2	3	3	3	5.30		22.54	7.19	15.35	2.70	25.24	30.91	▲ 13	8.30	Input and mechanization cost
52	Noroleh Oliya	0.0	12.0	12.0	0.0	0.0	0.0	12.0	**12.0**				4.2	11.03								11.03	1.88	9.16	13.50	24.53	35.01	▲ 12	31.66	Less income in agriculture
2	Khoram Abad Oliya	2.5	2.0	4.5	0.0	0.0	0.0	4.5	**12.5**	5.5	2.4			10.82								10.82	6.10	4.72	4.90	15.72	15.64	▲ 6	7.00	Inputs
22	Shali Abad	1.0	0.0	1.0	2.0	0.0	2.0	3.0	**12.6**	4.2				5.12	3	2	1			7.32		12.43	11.41	1.03	1.25	13.68	9.51	▲ 7	25.27	Inputs and cows
53	Noroleh Oliya	0.0	14.0	14.0	0.0	0.0	0.0	14.0	**14.0**	8.0	6.0			9.81	2	1	1	48	20	9.03		18.84	48.78	▲ 29.94		18.84	65.51	▲ 95		
33	Reis	0.0	15.0	15.0	0.0	0.0	0.0	15.0	**15.0**	14.4	1.8		1.1	19.69	1		1	22	31	12.41		32.10	3.16	28.93		32.10	18.47	10		
31	Reis	2.0	8.5	10.5	0.0	0.0	0.0	10.5	**16.9**	13.0	0.5		1.2	18.08	1							18.08	3.86	14.23	4.80	22.88	8.80	10	0.65	Construction of house
37	Kalaveh Heidarkhan	3.0	0.0	3.0	0.0	0.0	0.0	3.0	**20.2**	9.0		18.0		22.98								22.98	9.89	13.10		22.98	29.95	▲ 17	13.00	Construction of well and irrigation facilities
3	Khoram Abad Oliya	4.0	4.0	8.0	0.0	0.0	0.0	8.0	**20.8**	12.0	4.5			17.66	1					1.47		19.13	9.32	9.81		19.13	29.75	▲ 20	8.00	Input and mechanization cost
4	Khoram Abad Oliya	4.0	4.0	8.0	0.0	0.0	0.0	8.0	**20.8**	14.0	12.0			26.99	3		2			7.80	6.24	41.02	25.20	15.82		41.02	29.29	▲ 13	13.00	Tractor
5	Khoram Abad Oliya	4.0	4.0	8.0	0.0	0.0	0.0	8.0	**20.8**	7.7	1.2		0.7	10.79								10.79	3.89	6.90	0.36	11.15	11.71	▲ 4		
29	Reis	0.0	6.0	6.0	0.0	17.0	17.0	23.0	**23.0**	36.8			1.4	46.77	1		1			1.60	6.00	54.37	28.63	25.74		54.37	14.22	12	1.00	Input and mechanization cost
26	Shali Abad	4.0	4.0	8.0	0.0	4.5	4.5	12.5	**25.3**	46.5	21.0		1.2	73.11	2		6			3.74		76.85	27.61	49.25	1.80	78.65	36.29	15	112.80	
36	Kalaveh Heidarkhan	4.0	3.0	7.0	0.0	0.0	0.0	7.0	**27.4**	14.2		18.0		34.94								34.94	31.84	3.10		34.94	16.67	▲ 14	22.00	Production cost and living expenses
6	Khoram Abad Oliya	4.5	4.0	8.5	0.0	0.0	0.0	8.5	**28.6**	10.5	6.6	18.0	0.4	34.33	1		1			1.20		35.53	10.62	24.91	7.20	42.73	20.12	12	7.00	Tractor
25	Shali Abad	6.5	1.5	8.0	0.0	0.0	0.0	8.0	**28.8**	22.0	1.3			27.67								27.67	9.87	17.80	2.00	29.67	23.53	▲ 4	20.96	Irrigation facilities and inputs
35	Kalaveh Heidarkhan	5.0	1.0	6.0	0.0	0.0	0.0	6.0	**31.5**	15.9		50.0		71.22								71.22	27.06	44.16		71.22	23.50	21	36.00	Construction of well for irrigation
19	Khoram Abad Oliya	2.0	23.0	25.0	0.0	0.0	0.0	25.0	**33.3**	9.2	15.0	5.0	2.0	22.29	2		2	35	25	25.66		47.95	29.46	18.48		47.95	22.67	▲ 4		
9	Khoram Abad Oliya	4.5	6.0	10.5	0.0	3.0	3.0	13.5	**33.6**	17.5	10.6	12.0	0.3	39.07	2		2	30	35	17.91		56.98	16.58	40.40		56.98	28.84	12	7.00	Input and mechanization cost
43	Hassan Abad Shaleh	4.0	2.0	6.0	0.0	0.0	0.0	6.0	**34.0**	3.0		42.0		38.27	1							38.27	11.90	26.37		38.27	15.32	11		
7	Khoram Abad Oliya	5.0	4.0	9.0	0.0	0.0	0.0	9.0	**34.5**	13.2	6.0	20.0	0.5	37.98	2		2	28	31	21.49		59.47	11.33	48.14		59.47	37.69	10		
11	Khoram Abad Oliya	5.0	7.0	12.0	0.0	0.0	0.0	12.0	**35.6**	19.0	8.8	20.0	0.3	46.27	2		4	30	32	23.30		69.57	14.65	54.92	5.00	74.57	18.63	41	2.00	Inputs
16	Khoram Abad Oliya	3.0	16.0	19.0	0.0	0.0	0.0	19.0	**36.2**	12.0	14.0	10.5	0.5	41.03				40	47	38.05		79.07	14.15	64.92		79.07	38.75	26		
47	Hassan Abad Shaleh	5.0	7.0	12.0	0.0	0.0	0.0	12.0	**37.5**	33.0		19.0	0.2	40.17								40.17	15.67	24.50	22.60	62.77	71.95	▲ 25	30.86	Construction of well and irrigation facilities
44	Hassan Abad Shaleh	6.0	1.0	7.0	0.0	0.0	0.0	7.0	**37.6**	16.5		16.5		35.26	1							35.26	11.04	24.22		35.26	21.64	3	4.55	Inputs
17	Khoram Abad Oliya	4.0	16.0	20.0	0.0	0.0	0.0	20.0	**40.4**	9.5	57.6	18.0		81.68								81.68	17.36	64.32		81.68	19.67	45	26.00	Input and mechanization cost
38	Kalaveh Heidarkhan	7.0	0.0	7.0	0.0	0.0	0.0	7.0	**42.7**	14.0		23.0		35.75	1	1	1			1.00		36.75	11.13	25.62		36.75	27.42	▲ 2		
15	Khoram Abad Oliya	6.0	12.0	18.0	0.0	0.0	0.0	18.0	**44.8**	21.5	13.0	22.0	0.8	55.30				15	20	7.75		63.05	23.54	39.51		63.05	23.91	16	6.00	Inputs
10	Khoram Abad Oliya	5.0	7.0	12.0	1.0	12.0	13.0	25.0	**51.8**	11.0	15.3	18.0	1.8	45.32	2	1	1	50	50	25.89		71.21	17.37	53.83		71.21	15.88	38		
8	Khoram Abad Oliya	6.0	4.0	10.0	0.0	0.0	0.0	10.0	**52.0**			30.0	0.3	24.86	1		1			2.93	6.00	33.79	17.05	16.74	21.60	55.39	32.40	6	1.90	Inputs
34	Reis	10.0	10.0	20.0	0.0	0.0	0.0	20.0	**52.0**	19.2	16.8		2.4	26.65							75.00	101.65	79.79	21.86		101.65	22.02	▲ 0	124.36	Machinery and child's employment
14	Khoram Abad Oliya	7.0	9.5	16.5	0.0	0.0	0.0	16.5	**54.1**	34.7		18.7		62.85	3	2	2			5.70		68.55	14.41	54.15	4.50	73.05	57.84	1		
41	Kalaveh Heidarkhan	8.0	6.0	14.0	0.0	0.0	0.0	14.0	**54.8**	20.0		34.0	0.6	60.11	2		1			1.80		61.91	16.09	45.82		61.91	15.63	30		
18	Khoram Abad Oliya	10.0	10.0	20.0	0.0	0.0	0.0	20.0	**63.4**	32.9	18.7	25.5		82.60	4		3			5.75		88.35	42.82	45.53		88.35	21.03	25	46.00	Machinery, input and living expenses
40	Kalaveh Heidarkhan	10.0	0.0	10.0	0.0	0.0	0.0	10.0	**64.8**	22.8		45.0		73.56								73.56	33.69	39.87	14.40	87.96	27.56	27	80.70	Input and mechanization cost
13	Khoram Abad Oliya	3.0	13.0	16.0	9.0	0.0	9.0	25.0	**67.2**	5.7	8.0	10.8	0.9	22.58	2	1	1	25	18	51.18		73.76	10.85	62.91		73.76	14.86	48		
45	Hassan Abad Shaleh	10.0	2.0	12.0	0.0	8.0	8.0	20.0	**71.0**	37.5		50.0	1.4	95.83	1		1			7.81	75.00	178.64	39.87	138.77		178.64	18.00	121	90.00	Construction of well for irrigation and inputs
39	Kalaveh Heidarkhan	4.0	4.5	8.5	12.0	1.0	13.0	21.5	**72.7**	16.0	3.6	36.0	1.2	58.59							10.00	68.59	21.00	47.59	33.00	101.59	38.46	42	20.00	Input and mechanization cost
51	Noroleh Oliya	6.0	6.0	12.0	10.0	0.0	10.0	22.0	**84.6**	30.0		33.6	0.6	68.55	1		1	15	15	4.28		72.83	28.88	43.96		72.83	12.91	31	139.30	Input and mechanization cost
20	Khoram Abad Oliya	3.0	27.0	30.0	9.0	0.0	9.0	39.0	**88.8**	29.0	20.0	40.3	2.0	80.75	3		2			19.55		100.30	49.56	50.74	10.00	110.30	43.31	17	21.00	Machinery
46	Hassan Abad Shaleh	13.0	0.0	13.0	0.0	6.0	6.0	19.0	**91.0**	18.0	3.6	32.0		56.67	3	1	3			12.68		69.36	54.34	15.02		69.36	49.98	▲ 35	240.10	Construction of well for irrigation and inputs
48	Hassan Abad Shaleh	16.0	1.5	17.5	0.0	0.0	0.0	17.5	**91.5**	45.5	1.9	48.0		109.88								109.88	15.09	94.79		109.88	64.40	30		
12	Khoram Abad Oliya	10.0	5.0	15.0	12.0	0.0	12.0	27.0	**97.4**	60.0	9.6			105.98	1		1		100	37.55		143.52	35.37	108.16	10.00	153.52	47.95	70		
54	Noroleh Oliya	20.0	10.0	30.0	16.0	0.0	16.0	46.0	**206.8**	18.0		200.0		282.34								282.34	196.40	85.95	100.00	382.34	83.80	102	350.00	Construction of well and irrigation facilities

Note 1) ▲: red in balance

2): Gross income index* is the index figure of evaluation on each farmer's land. The index is calculated by following formula; Index=dry area x a + irrigated area in spring only x b + irrigated area in spring and summer x c. a = 1, b = 4.2, c = 6.1

14 farm households (26%) of 54 households have no debt.

Table 3.4.5 Present Conditions of Agricultural Machinery of Each Village in the Study Area (2003)

Site	Zone	Deh	Agriculture		Number of Machinery				Cow		Beehive	
			No. of farm households	Cultivated area (ha)	Tractor	Combine	Seeder	Others	Local Variety	Hybrid and Holstein	Local	Modern
1	1	Ghalancheh	16	240	7	0	2	37	143	0	0	0
		Meskin Abad-e-Sofla	32	393	3	0	0	10	31	21	0	0
		Meskin Abad-e-Olya	36	426	10	0	0	35	-	-	-	-
		Khoram Abad-e-Sofla	64	603	8	1	1	37	73	75	0	6
		Khoram Abad-e-Olya	43	562	6	1	1	17	66	47	0	0
		Deh Sadeh	33	434	8	0	1	43	6	6	0	0
		Zarin Chagha	58	634	13	2	0	52	13	18	0	0
		Zone 1 Total	282	3,292	55	4	5	231	332	167	0	6
	2	Tapeh Rash	29	245	5	1	4	26	66	8	0	0
		Tapeh Kuick	26	316	6	1	3	28	50	15	0	0
		Tapeh Lori	34	452	14	0	2	61	7	17	0	0
		Hassan Abad	71	777	6	4	2	15	108	69	0	199
		Hossein Abad	7	50	3	1	0	12	0	0	0	0
		Deh Bagh	6	48	1	1	1	7	7	1	0	17
		Shali Abad	39	213	2	0	0	6	24	7	0	0
		Ghale Zakariya	71	586	14	0	1	66	69	31	0	0
		Ghale Reza	24	329	5	0	0	20	1	0	0	0
		Kareim Abad	27	376	4	2	2	23	3	13	0	0
		Zine 2 Total	334	3,392	60	10	15	264	335	161	0	216
			616	6,684	115	14	20	495	667	328	0	222
2	3	Daulat Abad	55	759	3	0	0	10	134	0	0	0
		Reis	40	482	9	2	2	38	52	0	0	0
		Kareh Ghale Sefid	31	276	4	2	0	8	16	1	0	0
		Kareh Ghale Kouneh	30	317	4	0	0	15	64	5	0	1
		Deh Jan-jan	22	257	5	2	0	16	12	2	0	0
		Zone 3Total	178	2,091	25	6	2	87	278	8	0	1
	4	Deh Cheragh	37	448	8	3	1	24	39	2	0	0
		Zalou Ab	74	695	16	5	5	59	68	39	0	0
		Kalaveh Haidar Khan	46	411	4	0	1	16	25	0	0	0
		Lamini	38	244	2	0	0	6	3	0	0	0
		Zone 4 Total	195	1,797	30	8	7	105	135	41	0	0
	5	Elyasei	29	302	2	0	2	7	0	9	0	0
		Pirouzeh	19	265	2	2	0	9	24	0	0	0
		Tapeh Ghol	74	598	6	0	1	28	8	85	0	0
		Jil Abad	26	155	1	0	0	3	36	5	0	0
		Chagha Shekar	28	241	5	0	1	20	31	0	0	0
		Dayar Asad Khan	19	199	2	0	0	7	13	2	0	0
		Rootvand	33	343	4	0	0	13	55	0	0	0
		SabzBolagh	34	291	14	0	0	40	91	2	0	0
		Siyah Siyah Dayar	23	271	2	0	2	14	6	8	0	0
		Siyah Siyah	25	300	3	0	0	8	3	0	0	0
		Hossein Abad Shaleh	47	433	10	0	2	26	11	4	0	0
		Ghale Khoda Mororat	46	332	2	0	0	25	68	0	0	0
		GhaleFarajollah-e-Beig	22	268	20	0	0	16	14	0	0	0
		Kachkineh	31	322	3	0	0	10	23	2	0	0
		Kandouleh	55	459	7	0	0	21	117	0	0	0
		Nouroleh Safla	19	266	4	0	2	16	14	0	0	0
		Nouroleh Oliya	57	694	13	2	1	60	158	19	0	0
		Vali Abad	18	201	2	0	0	5	15	4	0	0
		Zone 5 Total	605	5,939	102	4	11	328	687	140	0	0
		Site 2 Total	978	9,827	157	18	20	520	1,100	189	0	1
		Grand total of Study Area	1,594	16,511	272	32	40	1,015	1,767	517	0	223

Table 3.4.6 Agricultural Production Operation Expenses based on Farm Economy Survey

	Deh	Own land			Gross income	Running cost									Total cost	Net income	Gross income	Gross income	Gross income	Running cost	Net income	Total gross			Total cost	Total net
		Irrg.	Dry	Sum	in agriculture	Irri water	Machanaization	Inputs	Maintenance of machines	Combustible & lubricants	Render	Energy	Commercia-lization	Transport-ation	Labor force	in agriculture	in agriculture	in cow raising	in sheep raising	of annimal husbandry	Feed	of annimal husbandry	income of farming	Repayment	Others	in farming	income of farming
		ha	ha	ha	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.	M. Rls.
S1	khoram abad oliya	0.5	1.0	1.5	4.25	0.12	0.36	0.52	0.00	0.00	0.00	0.00	0.60	0.30	0.00	1.90	2.35				0.00	0.00	4.25	0.53	0.00	2.43	1.81
S2	khoram abad oliya	2.5	2.0	4.5	8.61	0.16	0.96	1.73	0.00	0.00	0.00	0.00	0.10	0.16	0.00	3.10	5.51				0.00	0.00	8.61	3.00	0.00	6.10	2.51
S3	khoram abad oliya	4.0	4.0	8.0	17.71	0.72	3.03	2.82	0.00	0.00	0.00	0.00	0.00	0.48	0.60	7.65	10.06	1.47		1.47	1.67	▲ 0.20	19.18	0.00	0.00	9.32	9.86
S4	khoram abad oliya	4.0	4.0	8.0	26.99	0.18	1.37	1.54	2.30	1.10	0.00	0.00	0.00	0.72	0.00	7.20	19.79	7.80		7.80	4.91	2.89	34.78	13.00	0.09	25.20	9.58
S5	khoram abad oliya	4.0	4.0	8.0	2.63	0.72	1.72	1.20	0.00	0.00	0.00	0.00	0.00	0.25	0.00	3.89	▲ 1.26				0.00	0.00	2.63	0.00	0.00	3.89	▲ 1.26
S6	khoram abad oliya	4.5	4.0	8.5	33.84	0.19	2.67	2.36	1.90	2.12	0.00	0.00	0.20	0.40	0.00	9.84	24.00			1.20	0.78	0.42	35.04	0.00	0.00	10.62	24.42
S7	khoram abad oliya	5.0	4.0	9.0	37.98	0.18	2.45	4.10	0.80	0.84	0.00	0.00	0.00	1.30	0.80	10.47	27.51	9.74	11.75	21.49	0.86	20.63	59.47	0.00	0.00	11.33	48.14
S8	khoram abad oliya	6.0	4.0	10.0	24.86	0.50	2.10	3.97	2.90	6.53	0.00	0.00	0.30	0.00	0.00	16.30	8.56	0.33	0.00	2.93	0.75	2.18	27.79	0.00	0.00	17.05	10.74
S9	khoram abad oliya	4.5	6.0	10.5	39.06	1.12	2.90	3.13	1.20	0.35	1.50	0.00	0.36	1.60	1.12	13.28	25.78	6.53	11.38	17.91	3.30	14.61	56.97	0.00	0.00	16.58	40.39
S10	khoram abad oliya	5.0	7.0	12.0	41.75	0.90	1.40	2.10	2.00	2.50	3.75	0.00	0.08	1.30	0.35	14.37	27.38	7.70	21.39	25.89	3.00	22.89	67.64	0.00	0.00	17.37	50.27
S11	khoram abad oliya	5.0	7.0	12.0	46.09	0.40	1.75	3.00	2.50	0.32	2.50	0.00	0.00	1.32	0.00	11.79	34.30	4.20	19.10	23.30	0.80	22.50	69.39	2.00	0.06	14.65	54.74
S12	khoram abad oliya	10.0	5.0	15.0	109.48	1.60	1.00	7.76	1.30	1.70	10.00	0.00	0.00	1.90	8.00	33.27	76.21		37.55	37.55	0.90	36.65	147.02	0.00	1.20	35.37	111.66
S13	khoram abad oliya	3.0	13.0	16.0	23.88	0.50	3.34	2.73	0.00	0.10	1.00	0.00	0.03	0.55	0.00	8.25	15.63	5.58	9.60	51.18	2.60	48.58	75.06	0.00	0.00	10.85	64.21
S14	khoram abad oliya	7.0	9.5	16.5	62.86	1.26	3.80	6.68	0.00	0.00	0.00	0.00	0.00	1.56	0.00	13.30	49.56	5.70		5.70	1.02	4.68	68.56	0.00	0.08	14.41	54.15
S15	khoram abad oliya	6.0	12.0	18.0	55.59	2.10	4.76	5.38	0.30	3.00	0.00	0.00	0.03	1.69	0.60	17.86	37.73		7.75	7.75	2.15	5.60	63.34	3.48	0.05	23.54	39.80
S16	khoram abad oliya	3.0	16.0	19.0	41.03	0.80	0.65	4.20	1.00	0.40	3.60	0.00	0.00	1.40	2.10	14.15	26.88		38.05	38.05	0.00	38.05	79.07	0.00	0.00	14.15	64.92
S17	khoram abad oliya	4.0	16.0	20.0	84.54	2.14	4.79	7.63	0.20	0.27	0.00	0.00	0.00	2.25	0.00	17.28	67.26				0.00	0.00	84.54	0.00	0.08	17.36	67.18
S18	khoram abad oliya	10.0	10.0	20.0	159.86	1.60	2.93	6.78	3.80	2.44	0.00	0.00	0.00	1.88	6.00	25.42	134.44	1.65		5.75	1.20	4.55	165.61	16.00	0.20	42.82	122.79
S19	khoram abad oliya	2.0	23.0	25.0	32.65	0.16	3.28	6.77	1.50	1.99	0.00	0.00	0.20	0.66	2.10	16.66	15.99		25.66	25.66	12.80	12.86	58.31	0.00	0.00	29.46	28.85
S20	khoram abad oliya	3.0	27.0	30.0	53.76	0.98	4.13	7.00	6.50	5.80	10.00	0.00	0.19	2.70	3.60	40.89	12.87	3.15	12.99	19.55	6.00	13.55	73.31	2.50	0.17	49.56	23.75
S21	shali abad	0.5	1.0	1.5	0.00	0.08	0.55	0.34	0.00	0.00	0.00	0.00	0.10	0.08	0.00	1.15	▲ 1.15		10.07	10.07	1.10	8.97	10.07	1.60	0.00	3.85	6.22
S22	shali abad	1.0	0.0	1.0	5.11	0.00	0.57	2.86	0.00	0.00	0.00	0.00	0.00	0.15	0.13	3.71	1.40	6.30	1.02	7.32	0.00	7.32	12.42	7.70	0.00	11.41	1.02
S23	shali abad	2.5	1.5	4.0	16.88	0.00	1.33	1.59	1.50	3.24	0.00	0.00	0.00	0.44	0.00	8.10	8.78				0.00	0.00	16.88	11.90	0.06	20.06	▲ 3.18
S24	shali abad	0.0	4.5	4.5	10.98	0.00	0.90	0.22	1.80	2.65	0.00	0.00	0.07	0.17	0.35	6.16	4.82				0.00	0.00	10.98	0.42	0.00	6.58	4.41
S25	shali abad	6.5	1.5	8.0	27.94	0.32	2.58	2.32	0.00	0.15	0.00	0.00	0.00	0.43	0.00	5.81	22.13				0.00	0.00	27.94	3.99	0.07	9.87	18.07
S26	shali abad	4.0	4.0	8.0	73.11	0.36	6.05	6.84	0.40	0.51	7.00	0.00	0.00	1.60	0.00	22.76	50.35	3.74		3.74	2.32	1.42	76.85	2.40	0.13	27.61	49.24
S27	shali abad	0.0	8.0	8.0	0.00	0.00	0.50	0.65	0.00	0.00	0.00	0.00	0.02	0.40	0.60	2.17	▲ 2.17	6.00		6.00	15.30	▲ 9.30	6.00	0.00	0.00	17.47	▲ 11.47
S28	Re'is	0.0	2.0	2.0	2.88	0.00	0.35	0.56	2.10	0.00	0.00	0.00	0.00	0.08	0.00	3.09	▲ 0.20	6.80	0.75	7.55	11.00	▲ 3.45	10.43	1.50	0.00	15.59	▲ 5.15
S29	Re'is	0.0	6.0	6.0	46.90	0.00	1.21	6.46	1.50	1.50	14.00	0.00	0.00	0.91	1.25	26.83	20.07	1.60		1.60	0.70	0.91	48.50	1.10	0.00	28.63	19.87
S30	Re'is	0.0	8.0	8.0	4.94	0.00	1.56	0.68	0.00	0.00	0.00	0.00	0.00	0.25	0.00	2.49	2.45	1.10		1.10	0.20	0.90	6.04	0.40	0.00	3.09	2.95
S31	Re'is	2.0	8.5	10.5	18.13	0.00	1.03	0.74	0.00	0.00	0.00	0.00	0.13	0.48	1.48	3.86	14.27				0.00	0.00	18.13	0.00	0.00	3.86	14.27
S32	Re'is	0.0	12.0	12.0	17.24	0.00	1.51	2.33	0.00	0.00	0.00	0.00	0.00	0.45	0.00	4.29	12.95	3.50		5.30	0.90	4.40	22.54	2.00	0.00	7.19	15.35
S33	Re'is	0.0	15.0	15.0	19.69	0.00	1.34	1.17	0.00	0.00	0.00	0.00	0.13	0.36	0.00	3.00	16.68	1.30	11.11	12.41	0.16	12.25	32.10	0.00	0.00	3.16	28.93
S34	Re'is	10.0	10.0	20.0	40.64	1.20	1.29	1.32	6.80	7.00	0.00	0.00	0.26	1.10	13.90	32.87	7.77				0.00	0.00	40.64	46.92	0.00	79.79	▲ 39.15
S35	kalave heydarkhan	5.0	1.0	6.0	72.41	0.75	4.90	4.48	0.00	0.00	0.00	1.80	0.45	0.88	1.75	15.01	57.41				0.00	0.00	72.41	12.00	0.05	27.06	45.35
S36	kalave heydarkhan	4.0	3.0	7.0	36.24	0.13	1.81	1.84	0.10	4.50	0.00	0.00	0.00	9.60	0.00	17.98	18.26				0.00	0.00	36.24	13.84	0.02	31.84	4.40
S37	kalave heydarkhan	3.0	0.0	3.0	22.98	0.40	1.83	1.15	0.40	0.53	0.00	0.00	0.00	0.68	0.20	5.19	17.80				0.00	0.00	22.98	4.70	0.00	9.89	13.10
S38	kalave heydarkhan	7.0	0.0	7.0	35.75	1.30	2.17	2.91	0.00	1.25	0.00	0.00	0.10	0.60	0.00	8.33	27.42			1.00	2.80	▲ 1.80	36.75	0.00	0.00	11.13	25.62
S39	kalave heydarkhan	4.0	4.5	8.5	58.59	0.25	2.38	5.95	2.50	8.20	0.00	0.22	0.15	1.20	0.00	20.85	37.74				0.00	0.00	58.59	0.00	0.15	21.00	37.59
S40	kalave heydarkhan	10.0	0.0	10.0	73.56	0.26	3.25	5.42	2.50	3.30	0.00	0.00	0.00	1.36	3.60	19.69	53.86				0.00	0.00	73.56	14.00	0.00	33.69	39.86
S41	kalave heydarkhan	8.0	6.0	14.0	60.11	0.27	4.24	7.54	0.85	1.50	0.00	0.00	0.20	1.20	0.00	15.79	44.32	1.80		1.80	0.30	1.50	61.91	0.00	0.00	16.09	45.82
S42	hassan abad shele	0.0	6.0	6.0	7.18	0.00	1.00	0.12	0.00	0.00	0.00	0.00	0.00	0.12	0.00	1.24	5.94	1.60		1.60	0.91	0.69	8.78	15.50	0.06	17.71	▲ 8.93
S43	hassan abad shele	4.0	2.0	6.0	38.27	1.30	1.95	2.80	1.95	0.60	0.00	0.90	0.40	0.50	0.00	10.40	27.87				1.50	▲ 1.50	38.27	0.00	0.00	11.90	26.37
S44	hassan abad shele	6.0	1.0	7.0	35.26	1.65	1.26	1.46	1.10	0.28	0.00	0.40	0.46	0.15	0.00	6.75	28.51				0.25	▲ 0.25	35.26	4.00	0.05	11.04	24.22
S45	hassan abad shele	10.0	2.0	12.0	95.83	0.35	2.45	8.21	5.60	14.19	0.00	0.00	0.25	1.67	4.90	37.62	58.21	7.81		7.81	2.10	5.71	103.64	0.00	0.15	39.87	63.77
S46	hassan abad shele	13.0	0.0	13.0	56.67	1.10	3.40	8.50	0.60	0.34	7.50	1.25	0.00	1.20	0.45	24.34	32.34	12.68		12.68	5.00	7.68	69.36	25.00	0.00	54.34	15.02
S47	hassan abad shele	5.0	7.0	12.0	56.36	0.86	2.69	2.23	0.00	0.00	0.00	0.90	0.00	1.28	0.00	7.96	48.40				0.00	0.00	56.36	7.71	0.00	15.67	40.69
S48	hassan abad shele	16.0	1.5	17.5	110.56	1.27	0.15	8.79	1.00	0.35	0.00	0.36	0.00	2.37	0.80	15.09	95.47				0.00	0.00	110.56	0.00	0.00	15.09	95.47
S49	noroleh olyia	0.0	4.0	4.0	3.02	0.84	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.79	2.22	0.81				0.00	0.00	3.02	3.00	0.00	5.22	▲ 2.19
S50	noroleh olyia	0.0	6.0	6.0	11.56	0.00	0.63	1.60	0.00	0.00	0.00	0.00	0.00	0.22	0.00	2.45	9.11				0.00	0.00	11.56	0.00	0.00	2.45	9.11
S51	noroleh olyia	6.0	6.0	12.0	68.49	0.40	1.84	4.93	0.20	0.82	0.00	16.00	0.00	1.99	0.00	26.18	42.31	1.20	3.08	4.28	0.70	3.58	72.77	1.80	0.20	28.88	43.89
S52	noroleh olyia	0.0	12.0	12.0	11.03	0.00	1.57	0.09	0.00	0.00	0.00	0.00	0.12	0.10	0.00	1.88	9.16				0.00	0.00	11.03	0.00	0.00	1.88	9.16
S53	noroleh olyia	0.0	14.0	14.0	9.81	0.00	0.50	3.11	0.52	2.69	0.00	0.00	0.20	0.10	0.00	7.12	2.69	2.00	7.03	9.03	17.53	▲ 8.50	18.84	0.00	24.13	48.78	▲ 29.94
S54	noroleh olyia	20.0	10.0	30.0	228.83	1.35	6.84	18.70	11.50	3.37	0.00	1.44	4.00	6.54	37.20	90.94	137.89				0.00	0.00	228.83	105.00	0.46	196.40	32.43
	%					2.5	9.5	16.5	5.9	7.1	5.0	1.9	0.8	5.1	7.7						8.7			27.0	2.3	100.0	

Note: Total gross income of farming do not include the gross income by trust of farm works.

Table 3.4.7 Annual Farm Household Expenses in the Survey Area (Farmers' Economic Survey, 2003)

	Deh	Own land			No. of Total Family			Annual Household Expenses (Family)											Annual
		Irrg.	Dry	Sum	male	female	Sum	Food	Housing	Clothing	Energy	Medical	Transport	Communication	Education	Taxes	Others	Total	expenses
		ha	ha	ha				Million Rls.	Million Rls.	Million Rls.	Million Rls.	Million Rls.	Million Rls.	Million Rls.	Million Rls.	Million Rls.	Million Rls.	Million Rls.	per capita
S1	Khoram Abad Oliya	0.5	1.0	1.5	2	3	5	7.20	0.45	0.52	0.30	1.75	1.00	0.30	0.00	0.00	0.30	11.82	2.36
S2	Khoram Abad Oliya	2.5	2.0	4.5	3	4	7	10.80	0.00	0.21	0.20	1.00	0.60	0.03	2.50	0.00	0.30	15.64	2.23
S3	Khoram Abad Oliya	4.0	4.0	8.0	1	3	4	15.60	1.80	7.20	0.21	0.40	2.00	0.24	1.80	0.00	0.50	29.75	7.44
S4	Khoram Abad Oliya	4.0	4.0	8.0	2	3	5	16.50	1.20	4.60	0.24	1.20	4.00	0.05	0.90	0.00	0.60	29.29	5.86
S5	Khoram Abad Oliya	4.0	4.0	8.0	2	2	4	6.20	0.10	1.50	0.18	0.50	2.50	0.18	0.20	0.00	0.35	11.71	2.93
S6	Khoram Abad Oliya	4.5	4.0	8.5	4	3	7	12.00	1.50	4.00	0.22	1.00	0.50	0.40	0.00	0.00	0.50	20.12	2.87
S7	Khoram Abad Oliya	5.0	4.0	9.0	1	2	3	19.00	1.20	4.50	0.24	1.50	4.00	0.15	6.60	0.00	0.50	37.69	**12.56**
S8	Khoram Abad Oliya	6.0	4.0	10.0	4	4	8	18.00	1.00	5.00	0.20	3.00	1.00	0.20	2.00	0.00	2.00	32.40	4.05
S9	Khoram Abad Oliya	4.5	6.0	10.5	2	2	4	14.50	1.20	4.60	0.24	3.00	3.50	0.10	1.20	0.00	0.50	28.84	7.21
S10	Khoram Abad Oliya	5.0	7.0	12.0	2	3	5	8.00	1.00	4.20	0.48	1.50	0.30	0.10	0.20	0.00	0.10	15.88	3.18
S11	Khoram Abad Oliya	5.0	7.0	12.0	2	2	4	7.80	1.25	3.00	0.25	2.00	1.00	0.15	2.76	0.00	0.42	18.63	4.66
S12	Khoram Abad Oliya	10.0	5.0	15.0	4	4	8	30.00	0.00	7.50	0.25	1.00	4.70	0.50	2.50	0.00	1.50	47.95	5.99
S13	Khoram Abad Oliya	3.0	13.0	16.0	2	3	5	8.00	0.80	3.00	0.21	0.70	1.00	0.15	0.80	0.00	0.20	14.86	2.97
S14	Khoram Abad Oliya	7.0	9.5	16.5	4	3	7	21.60	21.50	8.50	0.20	1.00	2.40	0.24	1.90	0.00	0.50	57.84	8.26
S15	Khoram Abad Oliya	6.0	12.0	18.0	2	2	4	7.00	1.20	3.00	0.21	3.00	0.40	0.10	9.00	0.00	0.00	23.91	5.98
S16	Khoram Abad Oliya	3.0	16.0	19.0	3	5	8	22.00	1.50	6.00	0.30	2.50	4.50	0.10	1.05	0.00	0.80	38.75	4.84
S17	Khoram Abad Oliya	4.0	16.0	20.0	2	2	4	9.60	0.50	3.50	0.35	2.00	0.80	0.12	1.80	0.00	1.00	19.67	4.92
S18	Khoram Abad Oliya	10.0	10.0	20.0	1	2	3	6.50	1.20	3.00	0.74	0.85	0.86	0.10	7.20	0.00	0.58	21.03	7.01
S19	Khoram Abad Oliya	2.0	23.0	25.0	3	2	5	15.00	0.00	3.50	0.25	1.00	1.50	0.12	1.00	0.00	0.30	22.67	4.53
S20	Khoram Abad Oliya	3.0	27.0	30.0	4	6	10	25.92	2.22	5.20	0.72	5.00	0.95	1.00	1.85	0.00	0.45	43.31	4.33
S21	Shali Abad	0.5	1.0	1.5	4	2	6	11.00	0.30	3.00	0.42	3.00	1.00	0.05	0.00	0.00	0.30	19.07	3.18
S22	Shali Abad	1.0	0.0	1.0	2	1	3	4.00	2.50	1.00	0.21	0.50	0.80	0.10	0.40	0.00	0.00	9.51	3.17
S23	Shali Abad	2.5	1.5	4.0	2	1	3	5.00	0.60	2.50	0.22	0.30	0.50	0.20	0.25	0.00	0.00	9.57	3.19
S24	Shali Abad	0.0	4.5	4.5	4	1	5	10.95	0.50	4.00	0.40	0.30	0.30	0.40	12.50	0.00	0.00	29.35	5.87
S25	Shali Abad	6.5	1.5	8.0	2	4	6	12.00	0.20	6.80	0.36	0.50	1.80	0.32	0.90	0.00	0.65	23.53	3.92
S26	Shali Abad	4.0	4.0	8.0	3	2	5	18.00	3.20	5.00	0.24	2.50	5.00	0.15	1.50	0.00	0.70	36.29	7.26
S27	Shali Abad	0.0	8.0	8.0	1	2	3	10.80	0.00	3.50	0.02	1.00	0.20	0.20	1.00	0.00	0.30	17.02	5.67
S28	Reis	0.0	2.0	2.0	3	3	6	16.00	0.20	7.50	0.27	0.25	3.00	0.24	0.00	0.00	0.50	27.96	4.66
S29	Reis	0.0	6.0	6.0	3	4	7	10.00	0.40	2.00	0.22	1.00	0.15	0.15	0.30	0.00	0.00	14.22	2.03
S30	Reis	0.0	8.0	8.0	3	1	4	6.00	0.40	1.50	0.25	0.15	0.60	0.05	0.00	0.00	0.00	8.95	2.24
S31	Reis	2.0	8.5	10.5	2	3	5	5.40	0.30	1.20	0.25	0.95	0.20	0.50	0.00	0.00	0.00	8.80	1.76
S32	Reis	0.0	12.0	12.0	4	4	8	12.60	0.00	4.00	0.36	0.80	3.00	0.20	9.65	0.00	0.30	30.91	3.86
S33	Reis	0.0	15.0	15.0	2	3	5	11.00	0.60	3.90	0.34	0.70	1.10	0.03	0.80	0.00	0.00	18.47	3.69
S34	Reis	10.0	10.0	20.0	3	2	5	11.00	1.00	5.50	0.96	1.50	0.45	0.16	1.00	0.00	0.45	22.02	4.40
S35	Kalaveh Heidarkhan	5.0	1.0	6.0	3	1	4	9.60	0.60	4.00	0.30	2.50	0.90	0.60	0.00	0.00	5.00	23.50	5.88
S36	Kalaveh Heidarkhan	4.0	3.0	7.0	4	3	7	5.00	1.50	2.50	0.45	3.00	0.80	0.12	3.00	0.00	0.30	16.67	2.38
S37	Kalaveh Heidarkhan	3.0	0.0	3.0	2	1	3	18.00	0.30	4.30	0.36	2.00	2.30	0.24	2.10	0.00	0.35	29.95	9.98
S38	Kalaveh Heidarkhan	7.0	0.0	7.0	1	1	2	11.80	0.00	3.00	0.30	1.00	2.60	0.02	8.40	0.00	0.30	27.42	**13.71**
S39	Kalaveh Heidarkhan	4.0	4.5	8.5	1	2	3	15.00	14.00	3.00	0.36	1.50	2.00	0.05	1.80	0.00	0.75	38.46	**12.82**
S40	Kalaveh Heidarkhan	10.0	0.0	10.0	6	2	8	19.00	1.00	4.60	0.36	1.20	0.50	0.15	0.30	0.00	0.45	27.56	3.45
S41	Kalaveh Heidarkhan	8.0	6.0	14.0	2	4	6	7.20	0.75	3.45	0.38	0.60	1.00	0.08	1.80	0.00	0.37	15.63	2.61
S42	Hassan Abad Shaleh	0.0	6.0	6.0	3	3	6	6.00	1.00	3.00	0.24	0.84	1.20	0.10	1.80	0.00	0.00	14.18	2.36
S43	Hassan Abad Shaleh	4.0	2.0	6.0	3	3	6	6.80	0.50	1.50	0.42	2.00	2.00	0.30	0.90	0.00	0.90	15.32	2.55
S44	Hassan Abad Shaleh	6.0	1.0	7.0	4	2	6	8.40	0.80	3.00	0.36	5.60	1.80	0.18	1.50	0.00	0.00	21.64	3.61
S45	Hassan Abad Shaleh	10.0	2.0	12.0	4	1	5	7.20	2.20	3.60	1.50	1.00	1.20	0.35	0.95	0.00	0.00	18.00	3.60
S46	Hassan Abad Shaleh	13.0	0.0	13.0	1	3	4	18.00	1.00	8.00	0.13	1.50	4.00	0.05	16.80	0.00	0.50	49.98	**12.50**
S47	Hassan Abad Shaleh	5.0	7.0	12.0	4	4	8	28.50	21.00	6.00	1.35	5.00	1.20	1.10	7.20	0.00	0.60	71.95	8.99
S48	Hassan Abad Shaleh	16.0	1.5	17.5	3	3	6	30.00	1.00	9.00	0.80	1.00	3.60	1.00	18.00	0.00	0.00	64.40	10.73
S49	Noroleh Oliya	0.0	4.0	4.0	1	1	2	5.80	0.00	3.00	0.48	1.20	0.60	0.22	3.75	0.00	0.78	15.83	7.92
S50	Noroleh Oliya	0.0	6.0	6.0	3	2	5	10.00	0.50	3.00	0.18	2.00	2.20	0.03	0.00	0.00	0.00	17.91	3.58
S51	Noroleh Oliya	6.0	6.0	12.0	2	4	6	7.00	0.60	1.00	0.24	2.10	1.00	0.07	0.90	0.00	0.00	12.91	2.15
S52	Noroleh Oliya	0.0	12.0	12.0	3	4	7	18.00	5.00	2.50	0.45	6.00	1.20	0.36	1.50	0.00	0.00	35.01	5.00
S53	Noroleh Oliya	0.0	14.0	14.0	7	5	12	54.00	0.00	3.00	0.36	4.00	3.60	0.25	0.00	0.00	0.30	65.51	5.46
S54	Noroleh Oliya	20.0	10.0	30.0	3	1	4	50.00	15.00	4.00	1.20	1.00	0.50	10.80	1.30	0.00	0.00	83.80	**20.95**
	Average (Million Rls./year)							14.08	2.16	3.88	0.38	1.71	1.66	0.43	2.70	0.00	0.47	27.46	4.63
	%							51.3	7.9	14.1	1.4	6.2	6.1	1.6	9.8	0.0	1.7	100.0	

Note: Average of annual expense per capita is calculated with exception of the farmers (S7, S38, S39, S46, and S54), who needed particularly high expenses in education and housing in 2002.

Table 3.5.1 Potential Evapotranspiration (ETo)

Project		Gharasu	
Alt.	z	1,362	(m)
Lat.		34.4	(°)
Lon.		46.4	(°)

0 (North= 0 、South = 1)

3 (RHmax & RHmin are available=1, RHmax & RHmean are available=2, only RHmean is Available =3)

Item		Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Input Data														
Tmax		℃	4.7	6.3	12.4	19.1	24.5	31.4	36.4	35.8	31.3	23.8	15.5	8.5
Tmin		℃	-4.1	-2.9	1.4	6.3	10.4	14.8	20.4	19.3	13.9	9.9	3.4	-1.0
Tmean	T	℃	0.3	1.7	6.9	12.7	17.5	23.1	28.4	27.6	22.6	16.9	9.5	3.8
RHmax		%												
RHmin		%												
RHmean		%	74	69	62	55	44	27	21	20	21	37	58	70
Sunshine Hours	n	hours	4.5	5.3	6.3	7.3	9.3	11.1	11.8	11.4	10.5	8.3	6.0	4.4
Wind Speed	u	km/day	137	178	223	217	265	291	336	318	268	231	135	120
Δ		kPa/℃	0.045	0.050	0.068	0.096	0.126	0.171	0.225	0.215	0.166	0.122	0.080	0.056
P		kPa	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2	86.2
γ		kPa/℃	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057
(1+0.34u2)			1.54	1.70	1.88	1.85	2.04	2.15	2.32	2.25	2.05	1.91	1.53	1.47
Δ+ γ (1+0.34u2)			0.134	0.147	0.176	0.203	0.243	0.294	0.358	0.344	0.284	0.231	0.167	0.141
γ (900/(T+273))u2			0.299	0.387	0.476	0.454	0.545	0.587	0.666	0.632	0.541	0.476	0.285	0.259
es		kPa	0.65	0.72	1.06	1.58	2.17	3.14	4.23	4.06	3.08	2.08	1.27	0.84
ea (1:Rhmax 、Rhmin)		kPa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ea (2:Rhmax)		kPa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ea (3:es)		kPa	0.48	0.50	0.66	0.87	0.95	0.85	0.89	0.81	0.65	0.77	0.74	0.59
es-ea		kPa	0.17	0.22	0.40	0.71	1.21	2.29	3.35	3.25	2.43	1.31	0.53	0.25
Ra		$MJm^{-2}day^{-1}$	18.46	23.52	29.71	36.03	40.02	41.59	40.79	37.57	32.00	25.42	19.65	17.07
N		hour/day	9.95	10.77	11.76	12.88	13.81	14.29	14.09	13.29	12.20	11.12	10.17	9.72
Rs		$MJm^{-2}day^{-1}$	8.79	11.66	15.39	19.21	23.48	26.55	27.28	25.51	21.76	15.85	10.71	8.13
Rso		$MJm^{-2}day^{-1}$	13.84	17.64	22.28	27.02	30.01	31.19	30.59	28.18	24.00	19.07	14.73	12.80
Rns		$MJm^{-2}day^{-1}$	6.77	8.98	11.85	14.80	18.08	20.44	21.01	19.64	16.76	12.20	8.24	6.26
ea		kPa	0.48	0.50	0.66	0.87	0.95	0.85	0.89	0.81	0.65	0.77	0.74	0.59
Rnl		$MJm^{-2}day^{-1}$	3.38	3.67	3.99	4.19	5.04	6.40	7.23	7.51	7.50	5.83	4.35	3.41
Rn		$MJm^{-2}day^{-1}$	3.39	5.31	7.86	10.60	13.04	14.04	13.78	12.13	9.26	6.37	3.89	2.85
G		$MJm^{-2}day^{-1}$	-0.14	0.46	0.77	0.74	0.73	0.77	0.31	-0.41	-0.75	-0.92	-0.92	-0.64
0.408(Rn-G)			1.44	1.98	2.89	4.02	5.02	5.42	5.49	5.11	4.08	2.97	1.96	1.42
ETo		mm/day	0.87	1.26	2.21	3.51	5.33	7.73	9.67	9.16	7.03	4.27	1.84	1.03
ETo		mm/month	27	35	69	105	165	232	300	284	211	132	55	32

Table 3.5.2 Unit Crop Water Requirement

Item		Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	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		30%													
A Maize (1)															
1 Cropping Pattern															
2 Crop coefficient	Kc-1						0.72	0.83	1.09	1.14	0.60	0.60			
	Kc-2							0.72	0.83	1.09	1.16	0.60	0.60		
	Average						0.72	0.78	0.96	1.12	0.88	0.60	0.60		
3 Days of irrigation		days					31	30	31	31	30	31	6		
4 ETcrop (Eto x Kc)		mm					119	180	288	317	186	79	33		
5 Area factor (Af)							0.50	1.00	1.00	1.00	1.00	0.69	0.02		
6 ETcrop net (Eto x Kc x Af)		mm					59	180	288	317	186	55	1		
7 Effective rainfall		mm/month					51.8	8.9	0.0	0.0	0.0	1.4	15.6		
8 Effective rainfall (=(5)*(7)*(3)/days of month)		mm					51.8	8.9	0.0	0.0	0.0	1.4	3.1		
9 Net requirement (=(6)-(8))		mm					8	171	288	317	186	53	0		
10 Diversion requirement (=(9)/c)		mm					25	570	960	1056	619	177	0		
11 Diversion requirement		mm/day					0.8	19.0	31.0	34.0	20.6	5.7	0.0		
B Wheat (1)															
1 Cropping Pattern															
2 Crop coefficient	Kc-1											0.40	0.40	0.64	
	Kc-2												0.40	0.40	
	Average											0.40	0.40	0.52	
3 Days of irrigation		days										10	30	31	
4 ETcrop (Eto x Kc)		mm										53	22	17	
5 Area factor (Af)												0.05	0.77	1.00	
6 ETcrop net (Eto x Kc x Af)		mm										3	17	17	
7 Effective rainfall		mm/month										1.4	15.6	5.1	
8 Effective rainfall (=(5)*(7)*(3)/days of month)		mm										0.5	15.6	5.1	
9 Net requirement (=(6)-(8))		mm										2	1	12	
10 Diversion requirement (=(9)/c)		mm										7	4	38	
11 Diversion requirement		mm/day										0.7	0.1	1.2	
C Wheat (2)															
1 Cropping Pattern															
2 Crop coefficient	Kc-1		0.75	0.82	1.15	1.15	0.51	0.25							
	Kc-2		0.65	0.75	0.83	1.15	1.15	0.49	0.25						
	Average		0.70	0.79	0.99	1.15	0.83	0.37	0.25						
3 Days of irrigation		days	31	28	31	30	31	30	31						
4 ETcrop (Eto x Kc)		mm	19	27	68	121	137	86	75						
5 Area factor (Af)			1.00	1.00	1.00	1.00	1.00	1.00	0.50						
6 ETcrop net (Eto x Kc x Af)		mm	19	27	68	121	137	86	38						
7 Effective rainfall		mm/month	18.5	25.5	44.8	65.5	51.8	8.9	0.0						
8 Effective rainfall (=(5)*(7)*(3)/days of month)		mm	18.5	25.5	44.8	65.5	51.8	8.9	0.0						
9 Net requirement (=(6)-(8))		mm	0	2	24	55	85	77	38						
10 Diversion requirement (=(9)/c)		mm	1	7	78	184	284	256	125						
11 Diversion requirement		mm/day	0.0	0.2	2.5	6.1	9.2	8.5	4.0						

Table 3.5.3 Water Right Holders of the Ravansar Irrigation and Gharasu River Pumping

	Village Name	Legal Water Users								Illegal Water Users								Total	
		Right Bank Canal		Left Bank Canal		Ghrasu River		Total		Right Bank Canal		Left Bank Canal		Ghrasu River		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					4	17.0	4	17.0			20	88.5			20	88.5	24	105.5
	Ghalancheh	12	42.0			1	7.0	13	49.0							0	-	13	49.0
	Gol Sefid							0	-							0	-	0	-
	Meskin Abad Olya	28	76.0			2	9.0	30	85.0	2	5.0					2	5.0	32	90.0
	Meskin Abad Sofla	36	135.1			1	5.0	37	140.1							0	-	37	140.1
	Meskin Abad							0	-							0	-	0	-
	Tapeh Rash			37	141.0	3	15.0	40	156.0							0	-	40	156.0
	Tapeh Kuick			36	106.0	2	12.0	38	118.0							0	-	38	118.0
	Tapeh Lori			38	130.6	27	132.0	65	262.6					2	7.0	2	7.0	67	269.6
	Hassan Abad			73	165.9			73	165.9							0	-	73	165.9
	Hossein Abad			4	24.0	5	220.0	9	244.0							0	-	9	244.0
	Khoram Abad Sofla	23	51.0	64	149.2	4	29.0	91	229.2			10	24.5	4	17.0	14	41.5	105	270.7
	Khoram Abad Olya	2	3.0	66	199.0	5	21.0	73	223.0			9	20.0	8	30.0	17	50.0	90	273.0
	Khoram Abad					2	9.0	2	9.0							0	-	2	9.0
	Kolah Kabood			33	38.5	1	4.0	34	42.5			6	12.0			6	12.0	40	54.5
	Zarin Chagha			45	120.3	2	11.0	47	131.3							0	-	47	131.3
	Deh Bagh			20	58.3			20	58.3							0	-	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	7	33.0	29	99.3							0	-	29	99.3
	Shour Balagh					13	65.0	13	65.0							0	-	13	65.0
	Ghale Zakariya	69	120.0			22	103.0	91	223.0							0	-	91	223.0
	Ghale Reza					14	71.0	14	71.0							0	-	14	71.0
	Kani Sharif							0	-							0	-	0	-
	Kareim Abad			35	123.3			35	123.3							0	-	35	123.3
	Gerazi Abad					13	64.0	13	64.0							0	-	13	64.0
	Guij					7	35.0	7	35.0					1	4.0	1	4.0	8	39.0
	Mir Azizi							0	-							0	-	0	-
	Jan Jan					9	42.0	9	42.0							0	-	9	42.0
	Lachin							0	-							0	-	0	-
	Kordvand							0	-							0	-	0	-
	others	3	6.0					3	6.0							0	-	3	6.0
	Sub-Total	173	433.1	506	1,435.9	144	904.0	823	2,773.0	2	5.0	50	156.5	15	58.0	67	219.5	890	2,992.5
Out of the Study Area	Gorgabi	29	90.0					29	90.0							0	-	29	90.0
	Amr Abad	19	138.0			12	64.0	31	202.0					2	9.0	2	9.0	33	211.0
	Birdad	24	59.0			4	20.0	28	79.0					7	32.0	7	32.0	35	111.0
	Deh Sorkh	1	1.0					1	1.0							0	-	1	1.0
	Goraz Abad	1	1.0					1	1.0							0	-	1	1.0
	Tapeh Zard	4	0.0					4	-							0	-	4	-
	Tam Tam	49	95.5					49	95.5							0	-	49	95.5
	Mir Azizi Salar							0	-							0	-	0	-
	Doab					16	63.0	16	63.0							0	-	16	63.0
	Nazar Abad							0	-							0	-	0	-
	Shahgodar					11	39.0	11	39.0					2	8.0	2	8.0	13	47.0
	Gholam Ali Bag					5	25.0	5	25.0					3	15.0	3	15.0	8	40.0
	Guyan Gura							0	-							0	-	0	-
	Kolah Abad							0	-							0	-	0	-
	Tapeh Kal							0	-							0	-	0	-
	Deh Mir							0	-							0	-	0	-
	Deh Azam							0	-							0	-	0	-
	Baklani							0	-							0	-	0	-
	Kurian Gura					5	23.0	5	23.0										
	Haji Abad					4	24.0	4	24.0										
	Sub-Total	127	384.5	0	-	57	258.0	184	642.5	0	0.0	0	0.0	14	64.0	14	64.0	189	659.5
	Total	300	817.6	506	1,435.9	201	1,162.0	1,007	3,415.5	2	5.0	50	156.5	29	122.0	81	283.5	1,079	3,652.0

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

Table 3.8.1 Study Area Zoning by the Irrigation & Drainage Conditions

Zone	Location	Related village	Characteristics
Zone 1	Upstream of Ravansar right bank canal in Site 1	Ghalancheh, Meskin Abad Olya, Meskin Abad Sofla	1. Water source is Ravansar right bank canal. 2. Secondary and tertiary canal for distribution of irrigation water from main canal are not studied. 3. During dry period, the water do not flow in the main canal because of excessive water intake at upstream. 4. Water distribution manager is out of function. 5. Some erosion can be seen due to unsuitable irrigation.
Zone 2	Upstream of Ravansar left bank canal in Site 1	Kolah Kabood, Khorram Abad Oliya, Khorram Abad Sofla, etc.	1. Water source is Ravansar left bank canal. 2. Water shortage has been occurred due to the lack of water distribution system. 3. Secondary and tertiary canal for distribution of irrigation water from main canal are under surveying by a consultant company.
Zone 3	Downstream of Ravansar left bank canal in Site 1	Hossen Abad, Shali Abad, Tape Kuik etc.	1. Water source may be Ravansar left bank canal, however, main water source can not be clarified. 2. The rainfed agriculture has been done mostly and pumping irrigation can be seen only some part of fields along Gharasu river. 3. New Ravansar left bank canal is under the construction, however, there is some doubt that the irrigation water arrives to the area or not. 4. At present, there is not water in the left bank canal during dry season.
Zone 4	Right bank of upstream in Site 2, along Gharab river	Gameshtar Oliya, Bahrabi etc.	1. There are 15 wells, however, rainfed agriculture has been done recent five years, because these wells already dried up. 2. There is not problem of drainage.
Zone 5	Leftt hand of Upstream in Site 2, proposed beneficial area of Gharab dam and Kilanbar dam	Dowlat Abad, Kerehghaleh Kohneh, Re'is etc.	1. Spring water is utilized for the irrigation at some part. 2. Mostly rainfed agriculture has been done in the area. 3. Inundation damage of the farming field has been occurred at downstream of proposed Kilanbar dam during flood.
Zone 6	Right hand of upstream in Site 2, around Kalaveh Azizkhan	Kalaveh Azizkhan, Lamini etc.	1. Water source is deep wells. 2. Some of wells are not electrified. 3. There is not poor drainage problem, because the soil is relatively light clay.
Zone 7	Left bank of middle to downstream in Site 2	Norouleh Olya, Norouleh Sofla Kachikineh etc.	1. Water source is wells. Spring water is also utilized at some part. 2. Land slope is relatively sharp. 3. There is a drainage problem due to surface water from mountainous area. 4. Main drainage canals have been excavated, however, secondary and tertiary drainage canal are not constructed yet. 5. One of the reason on the drainage problem is to be cut off the drainage route by main regional road. 6. Inundation damage of the farming field looks like a lake, has been occurred during flood.
Zone 8	Middle to downstream on the right bank in Site 2	Hossen Abad Shole, Siahsidh Sanjaki, Mehmat Abad etc.	1. Water source is wells. There is artisian, however, power tool is necessary at present. 2. Main drainage canals have been excavated, however, secondary and tertiary drainage canal are not constructed yet. 3. Some of road crossing culvert of the excavated drainages are buried under the soil or sediments. 4. Ponding of the farming field has been occurred due to insufficient land leveling. 5. Inundation damage of the farming field has been occurred during flood.

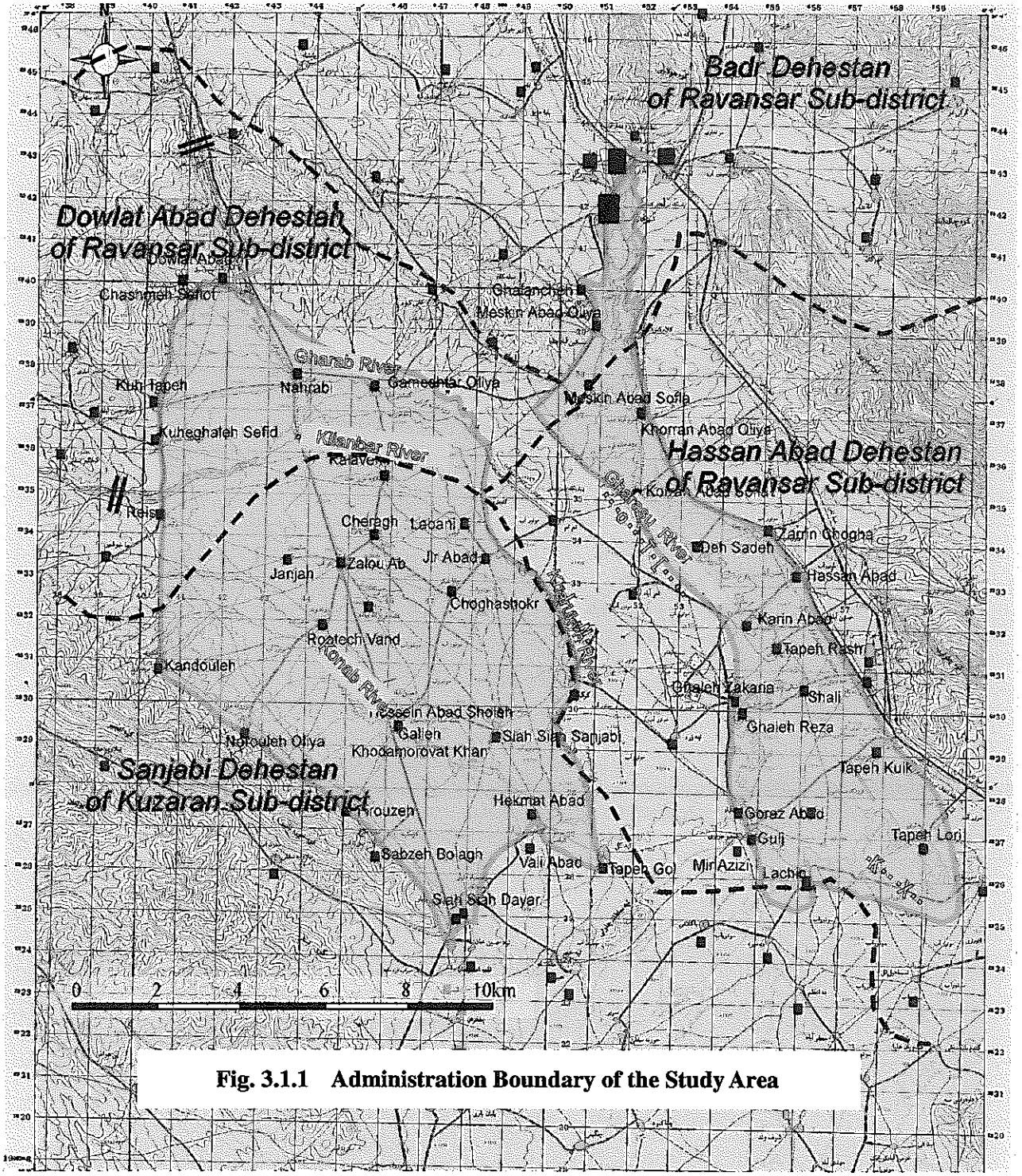


Fig. 3.1.1 Administration Boundary of the Study Area

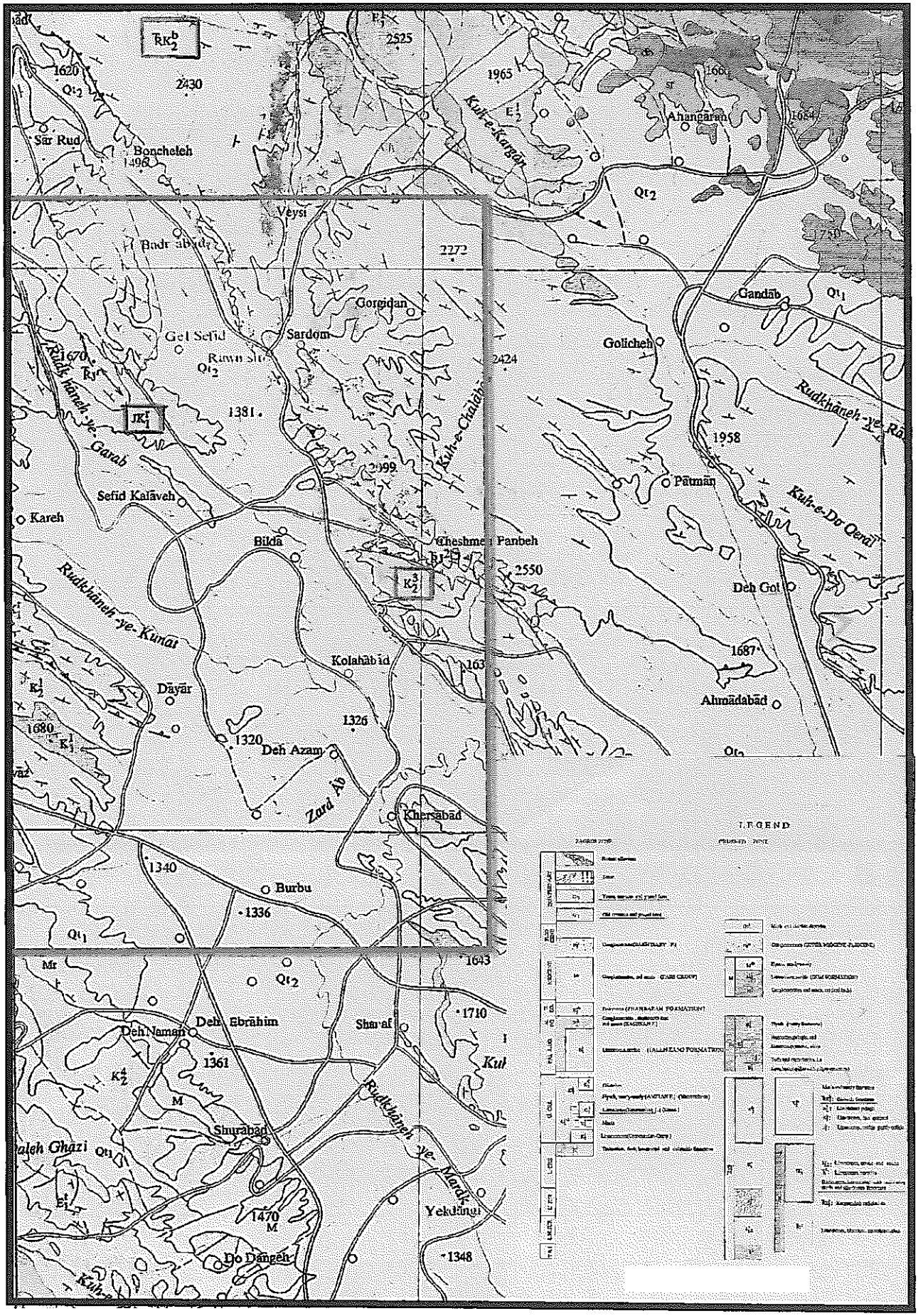


Fig. 3.2.1 Geology of the Study Area and Surroundings

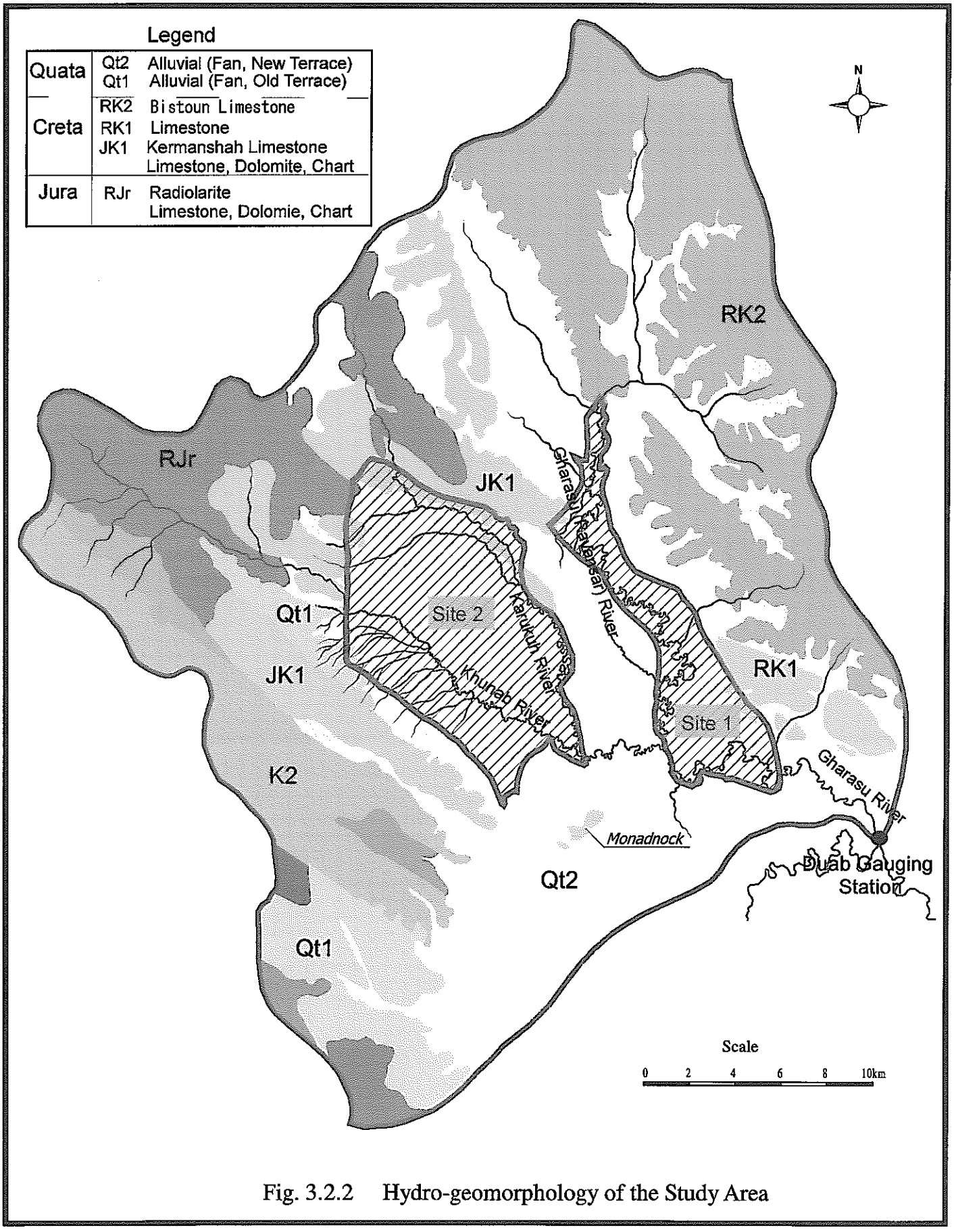


Fig. 3.2.2 Hydro-geomorphology of the Study Area

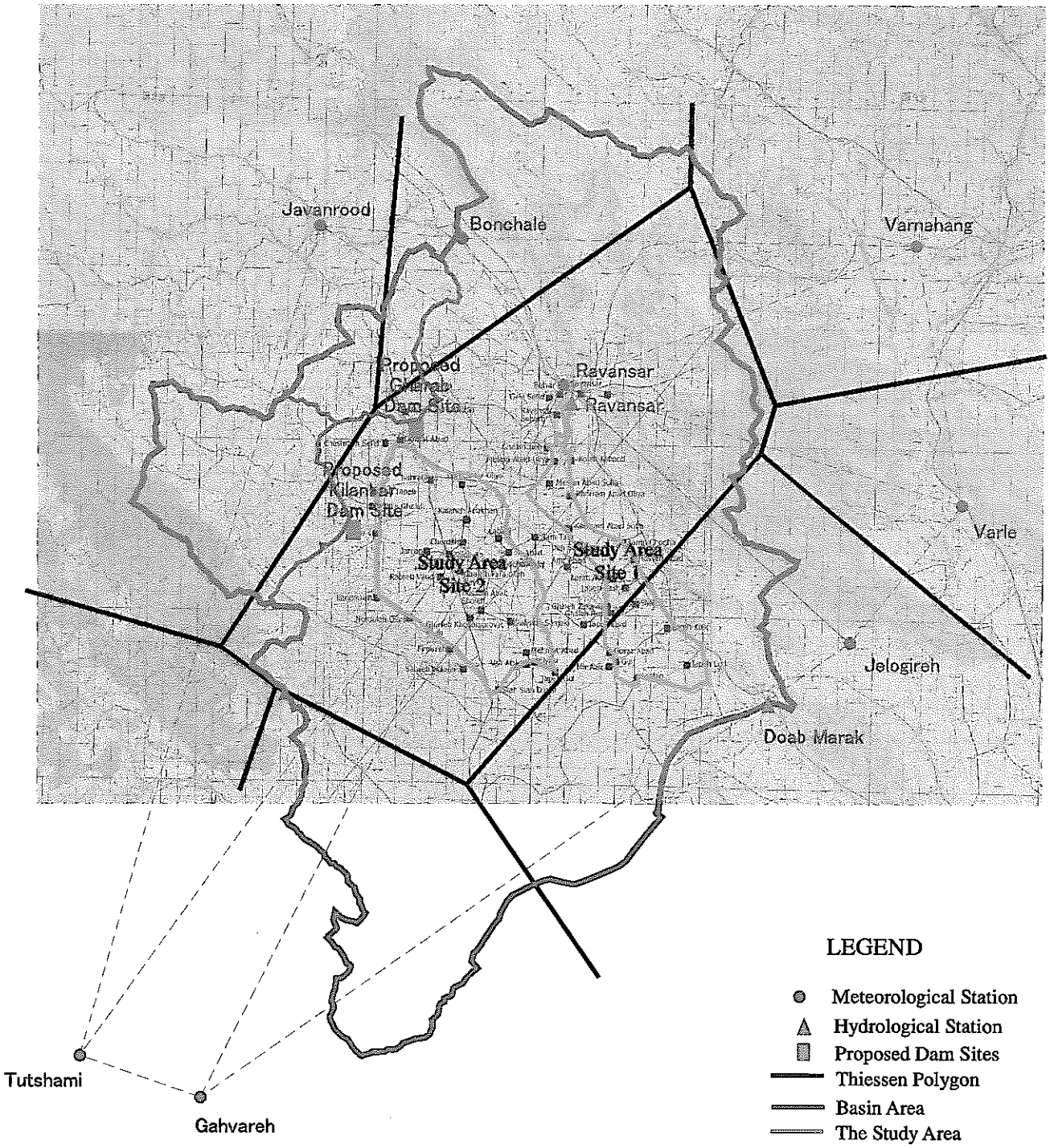


Fig. 3.2.3 Thiessen Polygon

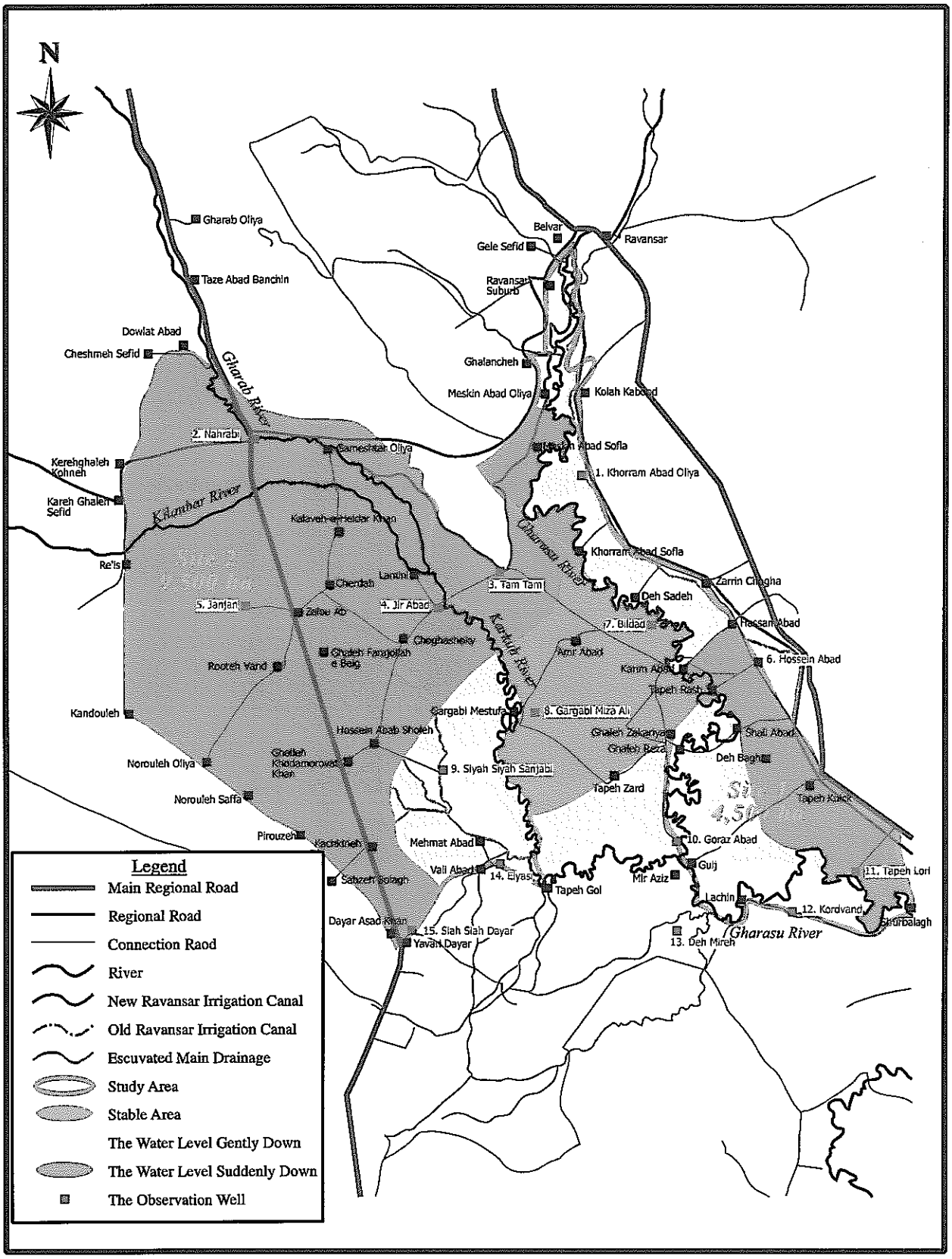


Fig. 3.2.4 Location of Observation Wells and Present Condition of Groud Water Tables in the Ravansar Area

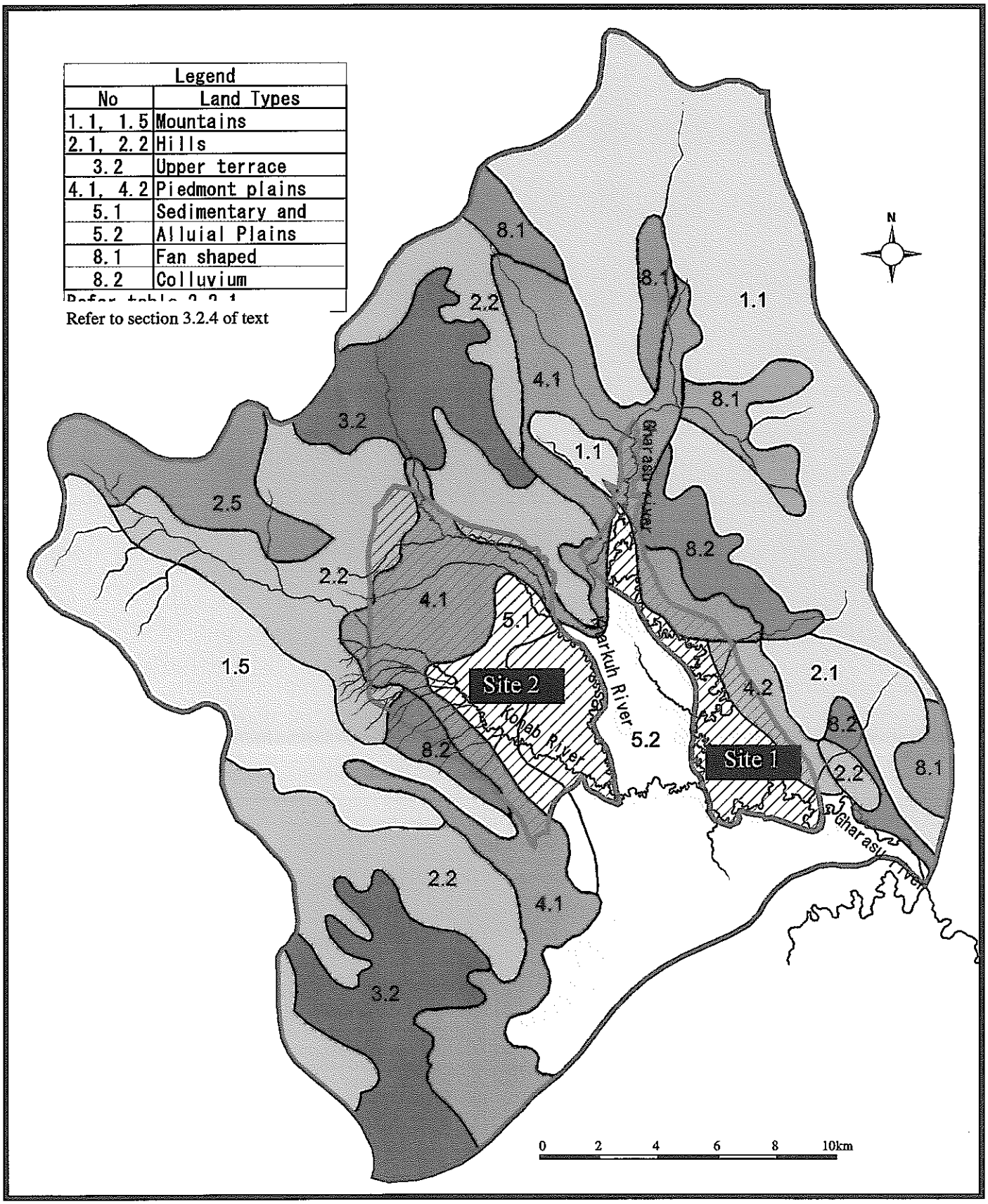


Fig. 3.2.5 Soil Resource and Land Capability Map of the Study Area and the Surroundings

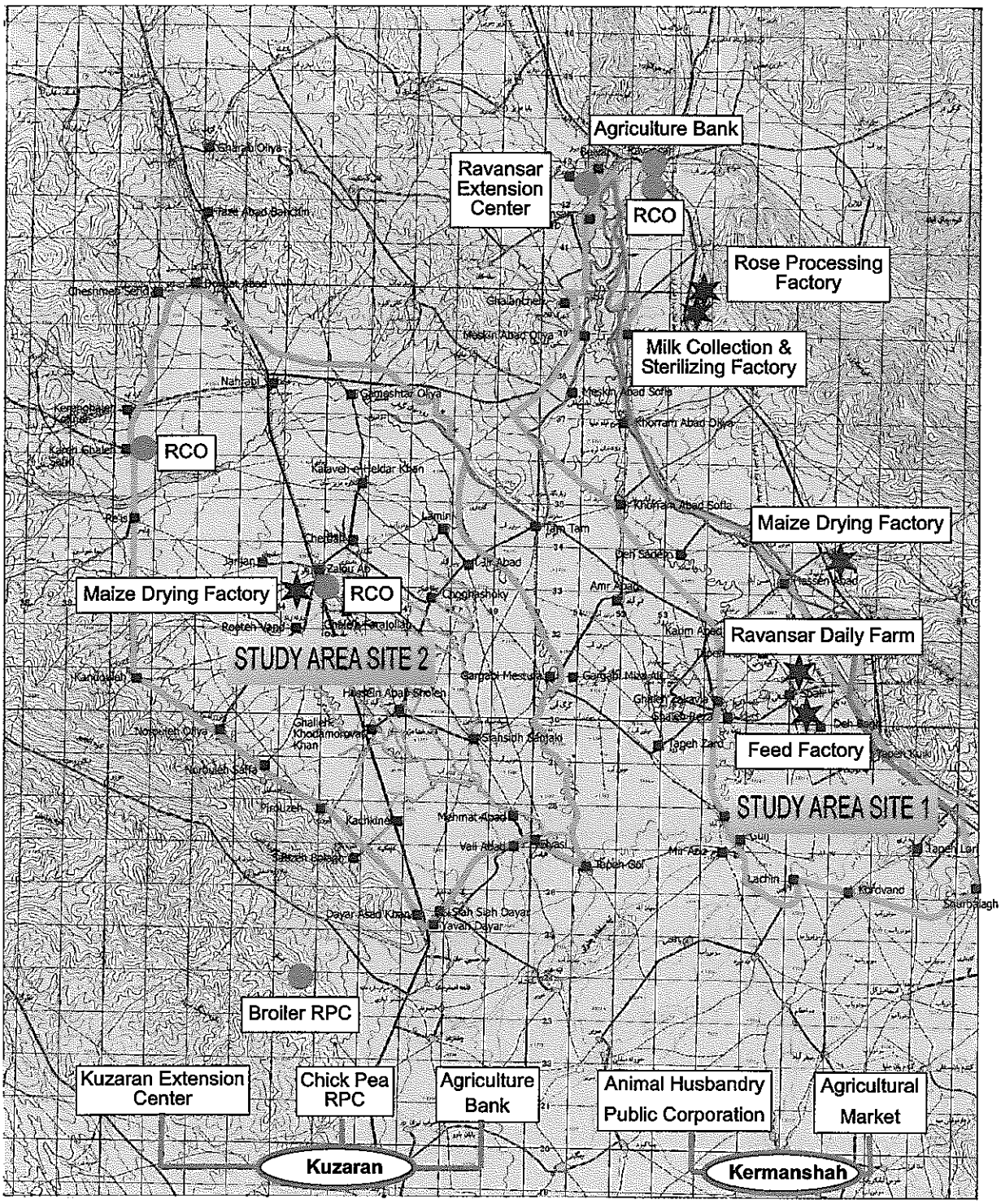


Fig. 3.4.1 Agricultural Facilities and Organizations in the Study Area

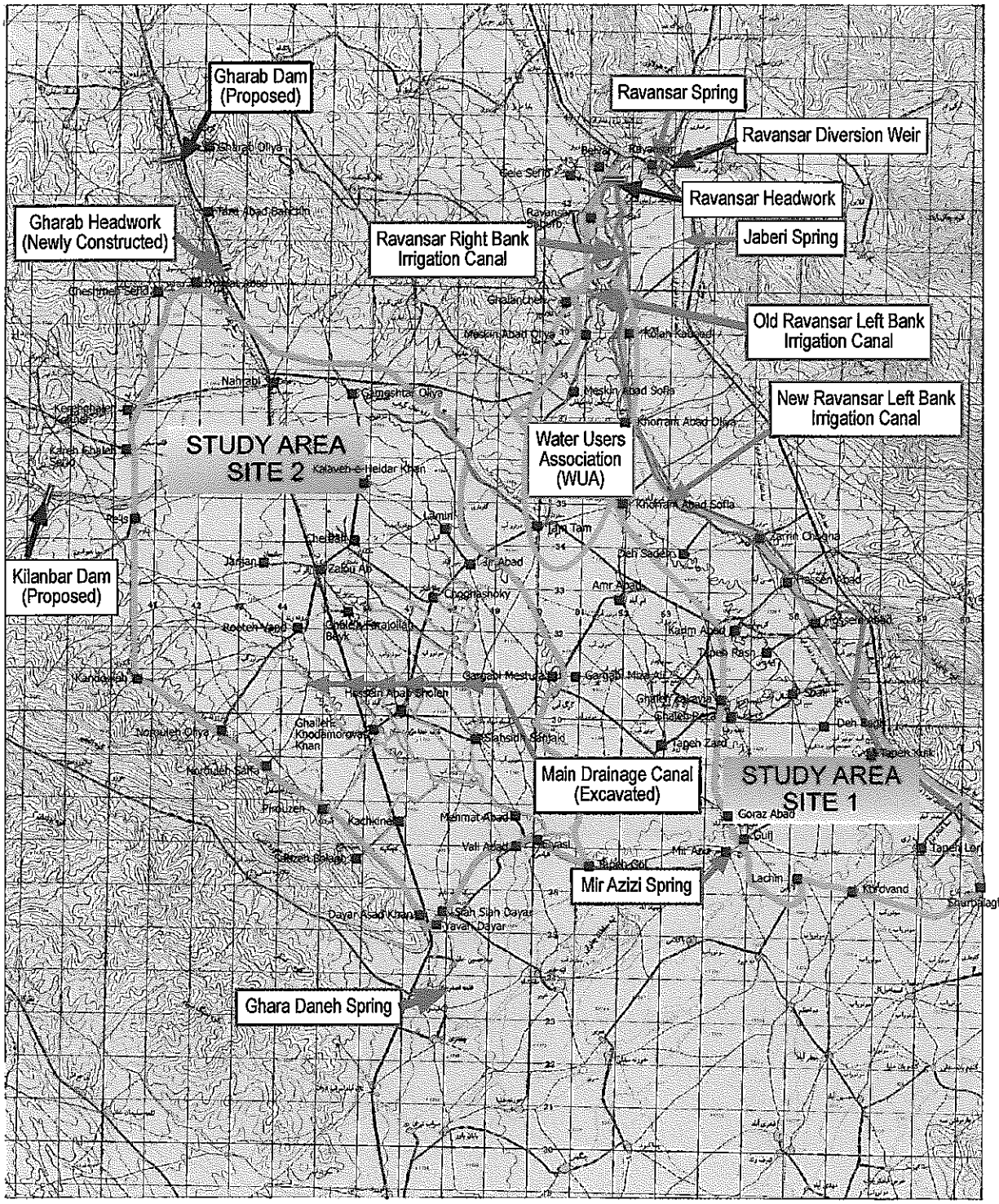


Fig. 3.5.1 Irrigation and Drainage Facilities and Institutions in the Study Area

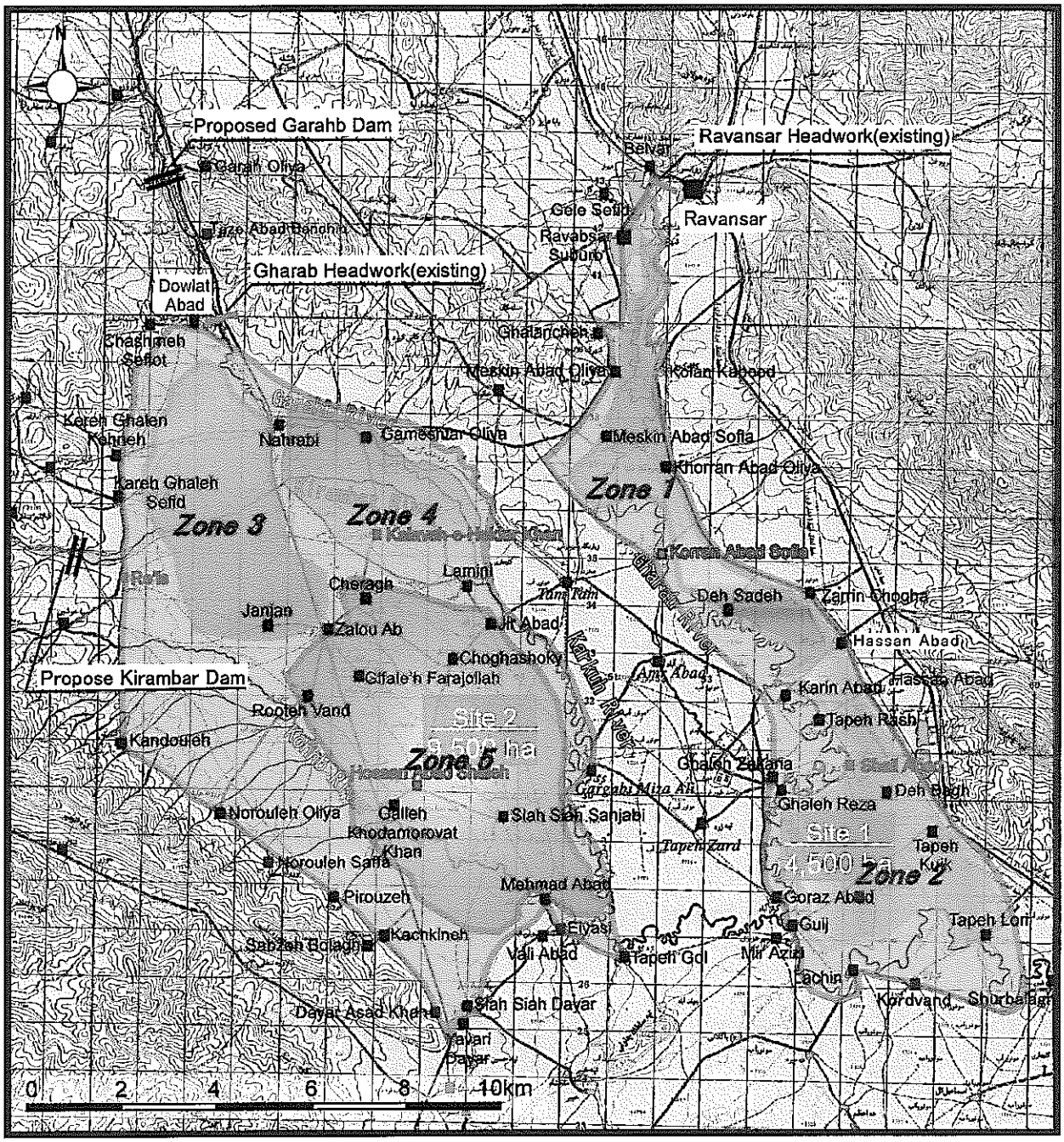


Fig. 3.8.1 Main Agricultural Zones in the Study Area

Chapter 4 Problems and Potentials of the Agricultural Development of the Study Area

CHAPTER 4

PROBLEMS AND POTENTIALS OF THE AGRICULTURAL DEVELOPMENT OF THE STUDY AREA

4.1 Study of Existing Agricultural Problems

4.1.1 Workshops and Rapid Rural Appraisal in the Study

Throughout the Study, a strong emphasis is placed on the participation of stakeholders to establish a common understanding of problems and perspectives of the agricultural development in the Study Area. In Phase 1, the participation of stakeholders was promoted by involving them in the workshops which were held several occasions for different purposes. These workshops provided the counterparts as well as the people in the Study Area with an opportunity to speak up and exchange their views on the agricultural problems. The main features of three workshops are summarized in the table below.

The Main Features of Workshops

	Participatory Workshop for Counterparts	**RRA* and Participatory Workshop**	**Countermeasure Workshop**
Date	2 February 2003	17-23 February 2003	6 March, 2003
Aims	・ Common understanding of the proposed project plan ・ To explore problems and solutions of the present plan	・ Understanding of agricultural conditions of the target villages ・ To explore the agricultural problems and prioritize them	・ Understanding zoning ・ Sharing the village problems with counterparts ・ To find out counter-measures of problems
Participants	Jihad-e-Agriculture of Kermanshah and Javanrood including: ・ Director ・ Deputy ・ Coordinator ・ Managers, ・ Counterparts	・5 Selected Villages 1. Hassan Abad Shaleh 2. Kalaveh Heidar Khan 3. Re'is 4. Shali Abad 5. Khorram Abad Oliya ・Staff of extension offices (Ravansar, Kuzaran)	・ 5 representatives from the selected villages ・ Counterparts of each expert ・ Staff of extension offices (Ravansar, Kuzaran)
Programs	1. Explanation of the Project Plan 2. Presentation of problems by managers 3. Analysis of problems and Solutions by the participants	1.RRA exercises: Village Mapping Seasonal Calender Village History Schedule of Women 2.Prioritization of village problems	1. Explanation of zoning 2. Presenting problems of each village 3. Analysis of problems and solutions by the participants

* Rapid Rural Appraisal

4.1.2 Participatory Workshop for the Counterparts

This workshop was conducted at the beginning of the Phase 1 Study. After the presentation of problems by the managers of the concerning Departments, the participants were divided into 3 groups: (A) Irrigation and Water Resources, (B) Agronomy (including horticulture and animal husbandry) and (C) Extension and Cooperatives.

The result the group exercises on the problems and solutions are summarized in the Table 4.1.1. Some of the major findings of the workshops are mentioned below.

- The counterparts and managers are responsible for the agricultural work in the Province as a whole and not yet familiar with the specific problems of the Study Area.
- For this reason, the problems raised by the participants tended to be general, the types of the problems commonly found in allover the Province.
- A good opportunity for the participants to be familiarized with the project plan, and the concept of participation and its approaches.
- Useful information for some of the experts to clarify the issues related with their subjects.

4.1.3 RRA and Participatory Workshop with Farmers in the Selected Villages

The workshops were held in 5 villages in 5 days. Except for Shali Abad, the participants, ranging from 25 to 50 persons, gathered in the village mosque. The majority of participants were men, but women also joined in the workshops in response to our requests. Some village women preferred meeting outside the Mosque. Children, too, have actively taken part in some of the workshops. Some of the major findings of the workshops are mentioned below.

- The common agricultural problems found in all the villages were (1) access to agricultural inputs, (2) agricultural marketing and (3) access to pasture lands.
- The problems related to irrigation were all area-specific, since 5 villages represent different natural characteristics according to the zoning (see 3.6 and 4.1.4).
- Generally women were more concerned with education (no guidance / secondary school in the village), sanitary and health than men. The problems raised by men were more to do with agriculture and rural infrastructure such as roads and water.
- Despite the stress on the agricultural problems, the rural infrastructure (roads, water, sewage, schools) were recognized as high-priority problems by the village people.
- The village problems reflect their economic positions. The worse-off villages raised basic problems such as lack of irrigation and drinking water, whereas the better-off villages emphasized on more capital-oriented type of issues such as mechanization of agricultural production and electrification of deep wells.
- When asked about the solutions of problems, participant farmers claimed that there are not so much that they can solve by themselves without the support of the government.

4.1.4 Countermeasures Workshop

Prior to the workshop, the problems raised by the farmers through RRA was studied and categorized by the Study Team in the following table.

Categorization of Village Problems

Agriculture (Common problems)	Irrigation (Area-specific problems)	Village Problems (non-agricultural problems)
1. Agricultural inputs	1. Khorram Abad Oliya (Zone1)	1. Rural Infrastructure
1.1 No timely access to inputs	1.1 No secondary canal	・ Bad road conditions (4 villages)
1.2 High interest of bank	1.2 No leveling of farmland	・ No guidance / secondary schools (5)
1.3 Shortage of agricultural inputs	2. Shali Abad (Zone2)	・ No sewage system (4)
2. Agricultural marketing	2.1Lack of water for irrigation	・ Lack of drinking water (2)
2.1 No timely sales of products	3. Re'is (Zone3)	2. Rural Health
2.2 Low price of products	3.1 No irrigation	・ No health center (3)
2.3 Insufficient insurance	3.2 Land submergence (Kilanbar dam)	・ Garbage & animal dung(3)
2.4 Corn dry yard do not buy maize by fair price	4. Kalaveh Haidar Khan (Zone4)	・ No public baths (3)
	4.1 Wells are not electrified	3. Unemployment
3. Natural pasture	5. Hassan Abad Shaleh (Zone5)	・ Youth unemployment (3)
3.1 Access to pasture is restricted	5.1 No canal lining	・ No activities for women (2)
3.2 Shortage of pasture	5.2 No enough wells	4. Private issues
	5.3 No leveling of land	・ No private phone (3)
		・ No bakery (3)

There was not enough time during the workshop for the discussions on the countermeasures of the problems between the counterparts and the village people. Table 4.1.2 summarizes the causes of the problems and the countermeasures given by the counterparts and the village people. Some of the major findings of the workshops are:

- The countermeasures suggested by the village people were mostly the opposite situation of the problems. For example, if the problem is 'lands are not consolidated' their countermeasure is simply 'land consolidation'. The participants did not go on to argue 'how' lands could be consolidated. This reflects the facts that the village people are relying on the action of the government and do not have much intention to change the situations by themselves.
- The counterparts suggested that some of the problems can be solved by the establishment of cooperatives, but no such suggestions were raised by the village side.
- There are certain misunderstanding between the officials and the villagers regarding the policy of the animal husbandry. As for the use of pasture lands, the villagers insist on having access to pasture lands for sheep and goats, whereas the officials suggest the decreasing excess livestock and changing from light livestock to heavy ones.
- Other important stakeholders apart from the villagers and the counterparts of Jihad-e-Agriculture came up through the workshop were the Ministry of Energy who is responsible for the construction of irrigation canal and wells and the agricultural and private banks as a source of agricultural investments.

The following sections analyze the subject-wise problems and the potentials of the Study Area.

4.2 Problems for the Agricultural Development

4.2.1 Natural Conditions

(1) Water Resources

The major problems for the water resources can be resumed as follows:

1) Unstable distribution of rainfall
2) Surface water scarcity for irrigation
3) Prejudiced discharge of spring water
4) Decline of the groundwater level

(2) Soils

The problems for agriculture development can be summarized as follows:

1) Heavy texture of the soil

The texture of the soil of the Study Area is very heavy to heavy in most of the Study Area with an average clay content of 48% in most of the soil layers. It is considered as the major limitation of the soil, which also influence on the low subsoil permeability which ranges from 0.1-2.0 cm/hr. When there is a sudden heavy rain, drainage and flooding occurs because of the low permeability of the soil.

2) Fertility Status of the Soil

The fertility of the soil is in the moderate range with an average CEC value of about 25 me/100g. The average level of organic carbon is 0.86% and total nitrogen is 0.08% which are in the lower to medium level. Phosperous is in the medium level of about 7.3 ppm. Among the micronutrients, the level of zinc is in the lower level of 0.50 ppm, which is less than the critical level of 1 ppm. Zinc deficiencies occur mostly in basic soils, and in soils cropped to high zinc demand plants, such as corn, sorghum etc.

3) Slope

A small part of the study area located at the northwest and northeast part of the Site 2, is on a hilly area with a slope of 25 to 50%. Erosion and sedimentation are the major problems in these areas. Because of erosion, the soil depth is also low.

4.2.2 Socio-Economic Conditions

(1) Unemployment

As it was observed during the RRA workshops, unemployment is one of the most serious problems in the Study Area. In rural areas, people counted as ‘unemployed’ are mostly the 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 work in their

father's land. Lack of employment opportunities for educated women has also been a serious problem in rural areas.

(2) Migration

Despite the Government's policy to create an equilibrium between the population in rual and urban, the increasing migration of rural people to towns and cities is an actual phenomena. As discussed earlier, the lack of employment opportunities, the inconvenience of rural life (water shortage and no high school etc.) are the main reasons for migration. Reduction in the number of households in a village causes further delay in the infrastructural development since the priority for the government investment in small villages are always lower than the larger ones. In and around the Study Area, there are several uninhabited villages where people come back only during the summer for cultivation.

(3) Lack of Self-Motivation of Village People

Since its establishment in 1983, the Ministry of Jihad had implemented a number of rural development projects in the name of 'participation'. However, these projects were mostly designed and implemented by the experts of concerning ministries and people were mobilized to participate in the form of labor contributions or payment of a part of estimated expenditure. The contradiction is that the ministries have been mobilizing the participation of village people to implement their top-down projects. By this form of the participation, all the initiative lies with the government and village people are only obliged to participate. No autonomy comes from inside of the community.

4.2.3 Agriculture

The major problems for agriculture can be resumed as follows:

(1) Land and Land-use

1) The difference of owned land among farmers were caused with range from several ha to 40 ha in twice land reforms, although almost of farmers holds their farm land of 8 ha to 12 ha. In the farming plan, it is necessary to consider the farming of these small scale farmers of several ha, for example, which integrates the cultivation of vegetable and horticulture and animal husbandry of hybrid cow or sheep to increase profits in small farm.
2) The characteristic of Kermanshah Province, included the Study Area, in the land utilization is the high rate of rain-fed lands. The yields of crops in rain-fed land are very low, therefore, the farming plan should be designed to irrigate to winter crops in the rain-fed land at first.
3) At present, the crop rotation is biased to fixed systems, such as "wheat – maize" in irrigated land, "wheat – chick pea" in rain-fed land, respectively. In the farming plan, it should be considered to integrate the various sectors, such as agriculture, horticulture, animal husbandry, fishery, etc., and to design the location of crops in the Study Area under consideration of "right crop for right land".

4) There are many puddles in the fields of Site in winter and spring. The puddles cause delay in crop growth, in sowing and ripening of succeeding crops, and then decrease of yield of succeeding crops. Therefore, it is necessary to carry out leveling of lands and drains.

(2) Crop Production

1) The yields of cultivated crops are low; especially yield of wheat in irrigated land.
2) It is worried that the low accuracy of farm works by contractors of mechanization, such as shallower tillage, imperfect harrowing, etc., makes hardpan in shallow depth of soil and gives rise to check the growth of crops.
3) It is necessary to supply micro-element of Zn as a result of soil analysis.
4) As a result of soil analysis, the quantity of soil organic matter in the Study Area is very low. Therefore, it is necessary to introduce annual grass to crop rotation in order to increase soil organic matter. Introduction of annual grass improves also the soil physics of heavy textured soil and soil fertility, and grass is used as roughage of livestock.
5) Farmers cannot purchase timely the farm materials at rural cooperative organization (RCO). Furthermore, when farmers purchase the shortage in private shop, as the quantity of subsidized materials is short, the prices of materials of private shop are very high.
6) The feed drying factory paid the price for 65~30% of maize and did not pay for the rest of 35~70% of maize as loss, because of high moisture contents of maize grain. The decreased income in maize production by losses influenced severely on farm economy of farmers. The Extension Center should advise the techniques to prevent the loss, such as suitable varieties, etc.

(3) Mechanization

1) The number of tractors and combines are short in Site, and 70% of these tractors are old types.
2) Ministry of Agriculture allots 100 of new tractors to each province every year. However, the power of these whole tractors is 75 PS, and these tractors are not suitable to heavy textured soil in Site due to shortage of power. Farm works in Site requires the tractors of over 100 PS.
3) The contractor of machinery would not like to work at other owners' land because machinery will be broken. Farmers without machinery felt that cost of machinery is so high but sufficient work does not performed by contractor. Especially, heavy texture of soil make the problem more severe in the Study Area.
4) When the rate of mechanization charge for total production cost is more than that of contractor of mechanization, a farmer should purchase the machinery in cooperation with other farmers.
5) There is no repair shop in Site.
6) It is hard to obtain the machinery even though farmers applied the machinery to the Government of province. It is desirable to administrate under fairness and efficiency

of business in banks and Government offices.

(4) Farm House Holding Economy

1) Mechanization charge presses the farmers' house hold economies.
2) Most of farmers do not have the surplus for reproduction in the next year. Therefore, they have to run into debt from bank which interest is 24% per year, for running cost of production in the next year.
3) Insufficient crop insurance - Crop insurance is available from the Agricultural Bank. But the insurance scheme is only limited to certain crops and the village people claimed that they are not sure about what kind of crop failures is covered by the insurance.

(5) Agricultural Extension Services

1) The severe problems are shortage of staff, shortage of cars, low quality and quantity of facilities.
2) The staffs are busy due to approving farmers' purchasing of subsidized agricultural chemicals. The Center recommend farmers to use agricultural chemicals and farmers can buy them at cooperatives and shops at low price. So, the farmers rush to the Center and the staffs are very busy with this. This work should be transferred to private sector.
3) It is necessary to do training of new technologies, such as plastic green house, for staff and farmers.

(6) Agricultural Credit and Government Subsidies

Farmers can not easily get an agricultural credit due to complicated procedures in bank and severe conditions. It is desirable to be got a credit under fairness and efficiency of business.

4.2.4 Animal Husbandry and Inland Fishery

Local breed of dairy cow is usually raised in Site. Local breed should be exchanged to hybrid breed to increase income by higher milk production.

One of the severe problems is shortage of roughage. Problems are not only shortage of drying feed but also TDN. Therefore, it is necessary to introduce annual grass to crop rotation in order to increase soil organic matter. Introduction of annual grass improves also the soil physics of heavy textured soil and soil fertility, and grass is used as roughage of livestock. Cultivation of annual grass as rotation crop can improve the soil physics of heavy textured soil and soil fertility by leaving of a lot of stubble and root of grass in soil, and annual grass is used as roughage of hybrid cow or Holstein, which requires roughage of high quality. In changing period from local breed cow to hybrid cow or Holstein, annual grass can be sold as hay, which has a high demand in the market of roughage.

The problems of Inland fisheries are as follows:

1) Lack of familiarity to people with methods of fish production, consumption and distribution of breeding fishes.
2) Limitation of breeding fish varieties, breeding methods, and necessary information.
3) There are few local aquatics resources due to destruction of river, drought, irregular fishing and pollution.

4.2.5 Agricultural Marketing and Pricing System

Problems of agricultural marketing and pricing system are summarized as follows:

(1) No timely sales of products

Several reasons are considered for this problem: 1) the delay of agricultural crops without knowing proper sowing time, 2) the lack of harvesting and processing machines, and 3) the lack of storages to keep and sell the products at the highest price.

(2) Low price of products

Among major crops, the price of chickpea is particularly unstable since there is no guarantee price of the government and village people have to sell the products to middlemen. Furthermore, the lack of domestic and international market information prevent the farmers to sell their products at the reasonable prices.

(3) Low price of corn at the corn drying yards

Corn drying factories are operated privately. Corns are purchased by these factories according to the weight, but both the farmers and the officials are not satisfied with the way in which the scaling is done. When there is excess moisture in the harvested corns, the purchasing price is reduced to half or even to 30 %. There are complaints that the moisture is often over-estimated by the factories that villagers have to sell at a loss.

4.3 Irrigation and Drainage

4.3.1 Existing Irrigation Project/Facilities

(1) Gharab Headworks

The project is not completed due to newly proposed Gharab dam project, however, the headworks has been constructed. So, in case that the construction of Gharab dam is decided, it is necessary to consider how to use the headworks in the water distribution plan of Gharab dam project. Otherwise, the headworks will be meaningless facility, moreover, the headworks may be a cause of inundation when the flood control gate is opened.

(2) Main Drainage Project

The major problems of the main drainage project area can be resumed as follows;

1) Lack of secondary and tertiary drainage canal
2) Shortage of number and capacity of main regional road crossing culvert

3) No responsible organization for maintenance works
4) Ponding of farm land due to lack of land leveling

(3) Ravansar Right Bank Project

The major problems of the Ravansar right bank canal project can be resumed as follows;

1) Damage of existing facilities
2) Improper water distribution and no actual record against the design discharge then beneficial area decreased

(4) New Ravansar Left Bank Canal

The major problems of the Ravansar left bank canal project can be resumed as follows;

1) Low irrigation efficiency at on-farm level
2) Improper water distribution
3) Planning of the project stage by stage
4) Unsuitable main canal alignment
5) Lack of construction supervision
6) No actual record against the design discharge

4.3.2 Proposed Irrigation Schemes

The major problems of the proposed Kilanbar dam and Gharab dam is no observed records on the rainfall and river discharge near the dam site. Existing discharge data is only observed records of Doab Marak station. However, the phenomenon of discharge between Doab Marak and Gharab, Kilanbar rivers may be different. So, the availability of the proposed dams can not be clarified excepted observed records on the rainfall and river discharge near the dam site.

On the other hand, according to the report on the proposed dams, the spillway is designed by a flood which return period is 1,000. However, existing rivers can not have the capacity against those floods. In this case, the design of flood control should be examined taking the capacity of existing rivers into account.

4.3.3 Present Groundwater Irrigation

Groundwater level goes down recent 10 years. Therefore, the farmers try to dig shallow well more deeper or new deep well at especially Site II. As for the situation of deep well, groundwater level will decline, but there is not severe problem at present. Under the situation, there is a possibility that new well will be dug by farmer rapidly. In this case, it is worried that the groundwater resource may be exhausted. So, the irrigation water from the wells should be used more effectively and also the digging of new deep well should be control severely.

The other problem is water distribution canal. Most of the irrigation canal to distribute the water from pumps is not lining. So, the conveyance loss will be a lot. Under the situation, the farmers have to pump up excess water for the loss. This situation seems to go against the conservation of groundwater resource.

4.3.4 Present On-farm Agricultural Facilities

Following problems concerning on-farm agricultural facilities are confirmed through the RRA surveys in the Study.

1) Shortage of the farm road causes the low efficiency of farming
2) Lack of land leveling causes the low irrigation efficiency at on-farm level
3) Lack of the irrigation canal lining causes low conveyance efficiency

4.3.5 Task-Allocation on Irrigation Management among the Stakeholders

The Government just commenced a trial of establishing water users' cooperative for the beneficial area along the Ravansar Right Bank Canal from January 2003. While monitoring the procedure and interviewing to relevant personnel related to the activities, the Study Team referred the lessons and considerable aspects on planning proper foundation of farmers, through monitoring government's preparation for the activities, procedure of WUC program extension, interviewing farmers for the program and others, for planning a farmers' foundation based on sustainability and mutual understanding among stakeholders.

According to the understanding that the procedure to generate such a foundation based on recognition of constraints and problems, examination and discussions on solution alternatives shall be summarized into rules to be accepted by stakeholders, "Task-Allocation among Stakeholders" and "(WUC Internal) Bylaw" are assumed as objective between the Government and the farmers' sides. But, it is obvious that these rules are not to be completed at one stroke, because required conditions for such understandings are to be effected by progress of stakeholders' understanding on WUC program, maturity of their knowledge and social/cultural background and others.

The activities and processes carried out to generate task-allocation and the lessons obtained are mentioned below.

(1) Understanding on Problems and Constraints related to Irrigation Management

During the Phase 1, the tasks include screening of general problems and constraints on rural community life or agriculture with participations of farmers and officers from relevant agencies. In this Phase 2 stage, it is aimed to make a deep understanding on agriculture and irrigation management through participatory discussions with farmers and government officers.

8Km Walk Through along the Right Bank Canal with confirming facility condition one by one.

(2) Confirmation of present site conditions of 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 canal (from June 10 to June 13), after having several interviews and discussions on the steps taken for establishing WUC and willingness/intentions for future development. During the walk-through, the general manager accompanied and gave explanation of constraints and

Workshop of Problem Analysis on Irrigation Management based on Walk Through Results. ('03 June 13)

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.

After summarizing the results of the walk-through, a workshop was hold with WUC members and farmers in the downstream of the canal as problem analysis on June 18 at Meskin Abad Oliya. Total participants were about 25. They concluded the workshop like 1) too much water intakes in the upstream than proper volume, 2) illegal pump intakes from the canal to area out of scheme area (concluded as defect of water distribution system with those two aspects), 3) weakening the canal lining, 4) provision of illegal intakes, 5) not cleaning obstacles like rocks fallen from slopes, trashes, and weeds.

(3) Mutual Confirmation of Task-Allocation

The Study Team reported the results to Kermanshah Joint Water Committee (KJWC) which consists of KJAO, KPWA and KPCO and proposed to have joint meeting with both WUC members and the KJWC on irrigation management aspects.

The first meeting was held on July 6, 2003, with participators of WUC representatives, KWJC and others in Meskin Abad Oliya. The major subjects discussed were 1) problems of the WUC, 2) necessary countermeasure alternatives proposed from both the sides. Also Ravansar Water Affairs office reported that the agency has a plan to implement the canal improvement within this fiscal year.

Through several meetings and workshops, the stakeholders summarized inconvenience aspects and examined /confirmed how to involve those subjects in the field. The major aspects obtained by the government officers and farmers by conducting those sessions on inconvenience of the irrigation management are as follows:

1) Aspects on irrigation canal operation

a Whether the water is sufficient or available to supply to all the farmers who are paying the water fee?
b Who is in-charge to confirm the area to be irrigated on the administration side?
c What is the reference to operate the diversion gate? Does the office have the reference?
d Who is responsible to control the gate?
e Who is responsible to conduct the proper and transparent gate operation?
f Who is responsible for proper & transparent intake operation in the field?
g Who is in-charge to define proper irrigation water?
h Who shall conduct the monitoring and control the illegal water use?

2) Aspects on irrigation canal maintenance

a What are the necessary actions to keep main and tributary canals in the field?
b Who is in-charge of main canal maintenance and how?
c Who will supervise the proper canal maintenance?
d What might be the government's subsidies to conduct the canal maintenance?

3) Aspects on financial matter

a How much might be the proper water fee for the government?
b How is the government using the collected water fee?
c Are they conducting fair fee collection?
d How does the Government assist for the water fee?

4) Social background aspects

a What are the necessary countermeasures to enhance farmers' participation to WUC?
b How to unite the efforts in the same direction among the individual programs of relevant agencies?

5) Other aspects

a How shall the land consolidation be implemented as measure of fair water distribution?
b How to simplify and rationalize the present dual examination system of irrigation system planning?
c How to clarify the potential of availability water resources for utilization?

As a result of these participatory discussions of stakeholders consisting of farmers and officers from relevant agencies, the "Task-Allocation", was prepared as shown in Table 4.3.1. Summary of major issues for irrigation management improvement is shown in Fig. 4.3.1.

(4) Lessons and Issues obtained through the Problem Recognitions and generating the Task-allocation.

1) Insufficient juridical preparation of water management on the Government side

As being recognized through the workshops, the present conditions without repairing and maintenance by the government while the farmers are paying the water fee causes farmers doubts on the performance of the government. Both of the provincial and the Western Region Water Affairs do not seem to have a clear definition of whether the fee is consisting of those portion or not.

Actually the head-quarter understands that the water fee is defined as about 3% of the farmers' gross-income level of the concerned region. It can be said that such understanding has already included considerations of relieving weak and assisting agriculture sector, but there is no measures on farmers' side to know it, also no measures on the government side to let farmers know it. It seems better to appeal to the beneficiaries though any channels.

Now the Government is developing necessary acts and bylaws based on "the Law of Fair Water Distribution (1983)". Besides the situation, officers are under conditions between the previous and new paradigm while conducting their obligations following to the present rule in

the filed. Such preparations are expected to be issued as earlier as possible.

2) Conditions necessary to harmonize on irrigation management system between Water Supplier; MOE and Users; MOJA

MOE owes obligation as manager on the national water resources as defined in “the Law of Fair Water Distribution (1983)”. According to that definition, the Ministry has been in-charge on the water resources development and maintenance of main facilities for water use in the country. Besides, projects of irrigation developments bigger than 5,000 ha scale is also under the Ministry’s scope. MOJA, on the other hand, is in the position to enhancement of consolidation of agriculture production infrastructure as the leading agency of the sector, limited in on-farm level.

Even though such task-allocation system is seemed quite rational apparently, some discord situations exist among those two agencies in the field, like less synchronizing achievements of the dual management. Namely less consideration on the results of the final design of facilities to the field condition to realize convenient conditions for farmers.

Some inconsistencies on the facility maintenance, that means “irrigation management actually”, are also notified. Any water use related facilities are provided as tools, aiming to increase crop production by owing to use limited water effectively, from view point of water use. But it is explained that land consolidation is suspended even though completing the canals and facilities or versus, just farmers are left under such unstable conditions.

If the structural simplification is also one of the government’s subjects to be owed, it might be an alternative as one of measure to let owe whole of works from construction to water management including facility maintenance from MOE to MOJA, after MOE defined the availability of water source as “ Water Supplier”. It is obvious that not keeping abreast in time due to the government’s discord management will cause farmers’ disappointments, who are terminal beneficiaries.

3) Non-limited enhancement of irrigation agriculture without consideration on regional available water resource.

The government has propelled the enhancement of irrigation agriculture, referring to the higher productivities of irrigating agriculture than rain-water agriculture to this region where the rain-water agriculture was kept during the long generations. The rain-water agriculture is easily affected by the fluctuation of rainfall amount and its precipitation pattern. The risks to be caused by such unstable natural conditions have been avoided by adopting large scale agriculture, which depended on farm laborers and crop cultivation in quite extensive area. But due to the rapid and explosive increment of comparative small scale landed farmers, instability of rain-water agriculture causes situations to be affected easily up to their survives.

Besides the above due to the acceleration of “cost-sharing concept”, “water market “concept has been penetrating into the people. The present system of applying water use and approvals for water use exist on such “water-market” concept. But the Government has never provided or owed any standard references which shall be the staring points for any kinds of development planning, like “design standard year for water availability” or “design standard water availability” to examine proper water allotment among sectors or among demands. It seems to allow such non-limited issue of water use permissions, without clarification of water balance.

Also none of land use control regulation causes the present non-limited expansion of agricultural area. Nobody cannot develop/extend the farm area without limitation. All of such plans should have been examined and controlled by the regional authority from view point of proper resources mobilizations to keep harmonization between development and conservation. Situation of such non-controllable on land development has been one of backgrounds to allow irrigation enhancement beyond any consideration on water availability.

4) Today's farmer can not become an enterpriser tomorrow. Needs steady guidance and assistance

Contents of the Article of Association are as reported in the previous. Most of the contents stated there seem for a general private firm and social treatments even though expecting some government supporting programs. It can not help deny questions whether farmers have managing know-how and necessary knowledge sufficient enough to be ranked with general private firm at the time of WUC establishment. Even though available to form a business system with making farmers establish WUC as water buyer as the government intends, it is obvious the country's foundation become so weak if the WUCs fall into bankruptcy and to be liquidated.

It is necessary for the Government to generate careful assistance programs to train farmers to be enterpriser on aspects like profit management, institution management, bookkeeping and also some technical transfer or vocational training like rural industry.

5) Haste introduction of WUC will cause confusion in the field.

WUC program, which the Government has been enhancing the proceeding into the field is quite reasonable intension. But its hasting approach makes some confusion, like ignorance of the field conditions. While stating the importance of respecting the social and cultural backgrounds of the recipients, farmers, on the Government side, actually the officers are conducting guidance of WUC with their mood. It's like compulsory activities as already reported in the previous section of this report. Discrepancies caused from such one-side approach are seemed to affect on progresses in the future. There might be some background behind the such haste approached to farmers on the WUC program, including considerable aspects. Those might be lessons for making planning.

(5) Summarization of Problems and Constraints on Irrigation Management Improvement

While the report in the previous section high-lights basic understandings for examining the measures for improving irrigation management, the contents presented this section are summary of problems and constraints obtained through study activities. The viewpoint applied here is to list up the problems under mutual relation among the stakeholders at first, and then nominate countermeasures for both direct and indirect approaches. Finally, those possible countermeasures are summarized into some groups as countermeasure programs. Problems and countermeasures in the table are contents raised by farmers and officers of relevant agencies through interviews, discussions and workshops of both Phase-1 and Phase-2 stages of this Study.

As the conclusion, the following aspects might be expressed, related to irrigation management improvement.

- As a result, it should be recognized that most part of the causes is on the administration side. But it could be understood that the present situation is on the way of pouring their efforts to find solution.
- It can be proposed that new conditions are sufficient enough to let local officers concentrate to subjects, leaving from the present situation continued from previous paradigm as strict administration framework.
- Actually it seems better to provide a specialized task-force or project team for the concerned subject tentatively, besides the ordinary administration organization, which might be sufficient enough to concentrate to the said subjects.
- On the other hand, some understanding are seemed necessary that the WUC program is not an aspect only for improving irrigation management, but also as the Government's steady trial to generate new relation with the people and good opportunity for both the sides to obtain useful lessons.
- That WUC concept generated by the Central Government is quite clear and reasonable. But it seems hard to apply to the field directly. There should be considerations to break-down into smaller sub-subjects to meet with capabilities of stakeholders in the field to accept and implement.

4.4 Problems of the Watershed Management

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 by over extraction of groundwater
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

4.5 Potentials for the Agriculture Development

4.5.1 Agriculture

The potential for agricultural development from agricultural point of view is as follows:

(1) Natural resources

Rich natural resources, rich solar energy, comparatively rich water resources for irrigation, comparatively good soil without problem of salinity and alkalinity in the Study Area, can be seen anywhere in Iran.

(2) Social conditions

Unemployed young men in the Study Area can be potential as participants of development. Almost of farmers have the educational level, the living standard, the living environment (electricity, telephone, health center, school, and roads) to a certain extent. Furthermore, they have awareness of development.

(3) Technical condition and experience of agriculture

Farmers have high ability and experience of farming.

(4) Experience of animal raising

With regard to animal husbandry, they have raised cows of local breed and sheep from old times, and have integrated agriculture and animal husbandry in their farming.

(5) Government Intensions

Recently, Government organization of province has strengthened in various sections, such as horticulture, mechanization, animal husbandry, fishery, extension and participation, etc.

4.5.2 Irrigation and Drainage

The potential for agricultural development from the irrigation and drainage point of view is presented below;

(1) Proper water use

The study area has scarcity of usable water resources presently, which was already recognized by the local government. However, the present condition of water use is not suitable and a lot of water resources are lost due to irresponsible water use by the farmers. If the proper water distribution management and irrigation method are carried out, the irrigable area can be approximately 1.4 times of the present irrigation land area.

(2) Proposed irrigation schemes

Some of additional investigation is necessary on the proposed irrigation schemes, however totally 2,420 ha of rainfed cultivation area will change to the irrigation land by establishment of proposed dams such as Kilanbar dam and Gharab dam. Additionally, totally 1,500 ha can be received sufficient irrigation water from New Ravansar left bank canal under the proper water use system.

(3) Consolidated land

Total of 1,403 ha of farm land has been consolidated by Kermanshah Jihad-e-Agriculture Organization (KJAO) and the farm road network, the irrigation network, the drainage network have been provided as well as the land leveling also has been carried out. So, if the sufficient water source is provided, the farm land will be able to product the crop with high yield. And also, it is very easy to introduce the mechanization for the area

(4) Main drainage network

Approximately 42 km of the main drainage canal has already been established by the efforts of KJAO. If the secondary and tertiary drainage network is provided, the farm land is available to cultivate crops under less inundation problem.

(5) Irrigation of the groundwater

Most of wells for the irrigation purpose belong to individual farmer or farmers group consist of 2 to 7 persons. As for the irrigation canal to distribute irrigation water from wells by pumps, are not lining by concrete, so, and conveyance loss will be high. Because the groundwater is pumped up individually, it can be imagined that the pumping loss also high amount. If these wells can be centralized and the suitable irrigation network is established, the irrigable area can be increased as well as the groundwater can be conserved.

(6) New water source development

The Study Area has scarcity of usable water resources presently, which was already recognized by the local government. Therefore, the ministries concerned examined some solution options such as provision of new reservoirs as stated previous sub-section. Also there is another idea, such as the reserving of unutilized water of Ravansar spring.

4.5.3 Watershed Management

(1) Natural Resources

Existing natural resources are having resistant against the stresses of the watershed. Existence of water resources in some parts of the basin to use for irrigation, and climatic conditions are suitable for growing local vegetation

(2) Soil Conditions

Soil is suitable for cultivation without salinity or other limitation. The only major limitation is the heavy texture of the soil. Soil moisture is sufficient enough to grow rangelands, horticulture lands and dry farming agriculture

(3) Construction Materials

Fair amounts rocks exists for constructing terracing, riprap, gabion, and good amounts of soil are suitable as construction material for constructing check dams, farm dams etc

(4) Manpower

Sufficient amount of manpower is available at low cost in the basin

(5) Tourism

It has enough possibility of developing tourist attractions in some areas, especially in the forestry areas and springs.

(6) Watershed Development Potential

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 to 12%. This area is considered to be suitable for irrigated or dry-land agriculture. Besides, 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.

Table 4.1.1 Results of the Group Exercises on the Problems and Solutions (1/3)

Sectors	Specific problems	Strategies
1. Irrigation and Drainage	- Improper use of surface and underground water and decrease in quantity of water and irrigation efficiency	• Collecting, conducting and storage of surface and underground water (dam, pumps, well and reservoir)
		• Operation and maintenance of water and irrigation networks and using the resources after executing irrigation and drainage plans
		• Study of Gharasu river in the Study area for planning rational and sustainable use of river water sources
	- Decline of aquifers because of over-exploitation	• Recharge the wells and increase the storage of aquifers
	- Drainage problem in rainy and dry years	• Land consolidation and improvement (leveling, consolidation and zoning)
	- Non-availability of water users associations/cooperatives	• Water users and consumers cooperatives for a rational consumption of water
	- Non-rational use of excess water in spring time	• Using excess water in the spring season for supplementary irrigation to increase the production
2. Watershed Management	- Occurrence of flood by decrease of vegetation cover	• Construction of checkdams in the watershed
	- Decline of aquifers because of over-exploitation (low level of water table of aquifers in the study area)	• Artificial recharge of aquifers
	- Soil Erosion and fertility decrease by improper exploitation ; Sedimentation in dams and lakes	• Developing contour farming, terraces and slopping of dry lands and prevention of wind and water erosion
	- Improper balance between livestock and pasture	• Combination of watershed management with forest ranges, orchards and farming
	- Ineffective use of surface and underground water	• Study of use of seasonal runoffs for use of supplementary irrigation in irrigation and horticulture for the purposes of vegetation cover, soil and water conservation and increase of agricultural production.
3. Natural Resources	- Improper balance between livestock and pasture	• Balancing of livestock and pasture land area
	- Cutting of natural vegetation	• Prevention of existing forests and pasture land area
	- Tree cutting for fuel	• Sustainable use of forests and pasture land area
	- No proper policy for rangelands and forests	• Combination of natural resources with watershed management, horticulture, irrigation and drainage, farming, animal husbandry and fisheries
4. Environment	- Potential negative impacts on air, water and soil pollution because of projects	• Need to study the environmental aspects and to carry out EIA, if necessary
	- Impacts on other development and industrial projects in the region	
	- Water quality impacts, especially the impacts on springs	
	- Impacts on birds migration	
	- Impacts on traffic situation in the region	
	- Impacts on regional ecosystem	
	- Non-balance of study, observation and execution	

Table 4.1.1 Results of the Group Exercises on the Problems and Solutions (2/3)

Sectors	Specific problems	Strategies
1. Agriculture	1. Small scale of each farmer's field for mechanization 2. .Low soil organic matter 3. Low suitability of land use 4. Insufficient spread of plastic green house 5. Health security problem in spraying of chemicals 6. Lack of suitable sprayer for weed control	1. Improvement and stabilization of yields of crops 2. Planning of suitable land use under consideration of economy, weather, soil and water recourses in the region 3. Increase of soil organic matters by fertilization, green manure, crop rotation & burying of crop residues 4. Extension on land consolidation 5. Supply of credit with low interest to producers of plastic green house 6. Introducing of suitable medical and industrial plants
2. Horticulture	1. Lack of studies on orchard potentials 2. Low level of studies on orchard farming 3. Low level of studies on flowering plants cultivation 4. Lack of plan of changing from traditional horticulture to modernized one by training or participation of producers 5. Lack of integrated farming of horticulture with agriculture or bee keeping 6. Low development of agro-processing in the region 7. Low level of irrigation systems	1. Increase of employment opportunity by introducing of cultivation of flower and medical plants 2. Effective use of irrigation water by gravity 3. Introducing of orchard to rain-fed and irrigated lands 4. Studies on new kinds and varieties of suitable orchards 5. Introducing of orchards tolerant to drought
3. Mechanization	1. Low level of mechanization 1) Undeveloped mechanization in whole fields of agriculture 2) Soil compaction (making of hardpan) by mechanization 3) Inefficiency in mechanization 4) Burying method of residues of maize and sunflower in soil 2. Lack of ploughing method at slope land	1. Introduce of machinery - Practical use of sub-soiler under subsidies of Government - Extension of mechanization - Promotion of non-chemical control of weeds & pests by biological methods (e.g. machinery) - Development of burying method of residues of maize and sunflower - Introducing of hay-maker for baling of wheat straw - Introducing of machinery for slope lands 2. Common use of machinery under proper management system
4. Plant protection	1. Farmers' indifferences to control diseases and pests 2. Depending over on chemicals to control weeds, diseases and pests 3. Pollution of the environment by pesticides and farmers' indifferences on it 4. Problems of pesticide residues in some fresh vegetables	1. Necessity of attention to IPM and ICM
5. Animal husbandry	1. Unbalance of number of heads between medium and large size livestock 2. Low production of large size livestock 3. Lack of prefabricated cowshed in small-scale livestock farming 4. Shortage of feeds (roughage and concentrates) 5. Farmers' indifferences to raise livestock 6. Farmers' indifferences for beekeeping, especially raising of Thoroughbred bees	1. Increase of large size livestock 2. Improvement of native cows by artificial insemination 3. Development of industrial animal husbandry such as dairy, broiler, layer, etc. 4. Use of forage crops in crop rotation and residues of crops 5. Farmers' training on new technologies in animal husbandry 6. Selection and extension of the suitable race of new honey bee in the region 7. Planning of optimal number and composition of suitable livestock in the region
6. Fisheries	1. Lack of people's awareness for fisheries, consumption of fish and popularization 2. Limitation of culture types, production elements and data in aquaculture 3. Decrease of fish resources in river and other water resources 4. lack of air blower and recirculation systems in aquaculture	1. Reconstruction of aquatic resources 2. Introducing of new varieties of fish 3. Extension of production and consumption of fishes 4. Supply of fishing implements 5. Supply of technologies of selection and packing of fishes

Table 4.1.1 Results of the Group Exercises on the Problems and Solutions (3/3)

Sectors	Specific Problems	Strategies
1. Research on animal husbandry	1. Traditionality of agriculture and livestock husbandry	- Loan with low amount of interests (bank interest
	2. No balance of livestock and pasture land	- Establishment of training class for animal owners (producers) - Study on proper foundations for changing to the mechanized - Research on possibilities of livestock disposal (combination) changes - the study on different exploitation system
2. Research on natural resources	1. Non-closing (open output) of watershed basin	- Watershed management
	2. Necessary of vegetation cover study	- Study on different exploitation system
	3. Non management of barren and low efficiency of dry land	
	4. Failure of erosion and sedimentation study	
	5. Failure of flood control and flood capacity	
	6. Failure of underground water study	
	7. Failure of comprehensive approach in watershed management	
3. Research on Agronomy	1. Low yield in dry lands	- Research on how to increase yield / ha & on profitable rotation of crop
	2. Improper Land use	- Study on land properness
4. Participation & extension	1. Low level of education, techniques, and know-how of agriculture producer	- Farmers training and increase in their vision & skills
	2. Non-classification of educational, training and extension needs	- Classification of extension and educational levels for farmers
	3. Constraints in presenting services (inputs, training, extension) because of dispersion of fields	- Teaching farmers about cooperatives, training of pioneer farmers
		- Making the proper foundations on training-extension in their living place
	4. Farmers non-interest in participation in training	- Try to give the best way with a high benefit farmers
	5. Non-participation of farmers in economical, social and productive plans	- Establishing the cooperatives considering the producer's needs
	6. Non-compatibility of Economical & social plan with natural resources	- Considering the economic infrastructure in the region
	7. Failure of information feedback between farmers and executive institution	
	8. Young people are not interested in agriculture	- Study in youth needs for their participation in agricultural activities
		- Making a suitable foundation fro youth participation in villages
5. Marketing	1. Inefficiency of bank facilities because of low efficiency of agriculture sector	- Government central for how farmers spend their loans
	2. Failure of proper system	- Making factories and like this to change the producers
	3. Non existence of agro-processing	- Crop pattern and methods should have reasonable profit for farmers
	4. Failure of a market -needs based information system	- the ways of ,marketing industrial production
	5. Necessity of studying small producers (farmers) problems	- Study about what is needed in markets and giving results to makers
		- Making suitable cooperative companies to find a market for farmers
		- Rural study the effect of rural industrial regions
		- how to decrease production cost of materials
		- Study of agriculture and industrial groups and relationship among them.
6. Cooperatives	Dispersion of cooperative system	- Making a suitable cooperative companies to find a market for farmers

Table 4.1.2 Causes of Problems and Countermeasures given by the villagers and Counterparts (Agriculture)

	Problems	Villagers		Counterpart	
		Causes	Countermeasures	Causes	Countermeasures
Agricultural Inputs	1.1 No timely access to inputs	1.1 Inputs are not timely bought by responsible organization 1.1 Inputs distribution are private companies 1.1 Farmers can not offord financially input purchase	1.1 Necessity of govt controls over private Inputs distributors 1.1 Local regional planning necassity	1.1 Local insufficiency of provision and transportation systeml Inputs distribution are private companies Farmers can not offord financially input purchase	1.1 Giving loan in good time, making cooperation company and NGOs in villagesto make subject important 1.1Government should work with emphasis on work hard, prevent from personal benefit 1.1 Private company shold distribute inputs
Agricultural Marketing	1.2 High interest of Bank	1.2 Giving subcidies to consumer in place of producer 1.2 High price of imported machin and other inputs 1.2 Illegal price df Imported machines of Inputs 1.2 Illegal storage of Inputs bu middlemen	1.2 Receiving low interest loan from bank	1.2 Bank enocurage industry for land but not for agriculture	1.2 Decreasing of interest to establish private bank for agriculture, establish stock market in Iran for agricutlure 1.2Comparative advantege in agricultural crop to provide recomplensate high intersts
	1.3 Shortage of agricultural inputs	1.3 Lack of Government budget 1.3 Inputs are not suffuciently and timely purchased by the govt		1.3 Non sufficiency of inputs production in Iran 1.3 Lack of knowledge of farmers towards timing (Price, place, time and selling)	1.3 Production of agricutureal inputs by private secotr 1.3 Estimation of inputs if need to import from other countries 1.3 Govt should announce the guranteed price of products before harvest.
Natural pasture	2.1 No timely sale of agricultural products	2.1 Lack of procrssing establishment 2.1 Lack of storage and keeping to sell sproduct in price rising time	2.1 Products should be purchased by the Govt (MoJ and Coop) 2.1 2.2 Proper planning of import and export	2.1 Propoer sowing timing is not considered 2.1 Lack of harvesting machines	2.1 2.2 Proper planning of import and export
	2.2 Low price of agricultural products(chick pea)	2.2 Lack of government store house (sillo) 2.2 Wrong planning of imported and exported products		2.2.1 No cordination of production with market and lack of processing and storage facilities 2.2 Lack of different crop pattern because of lack of experience, climate, limited investment. And scared of risk	2.2 Making different crop pattern 2.2 Promoting the full demand and profitable crops
	2.3 No sufficient products insurance	2.3 Not- fair judgement of insurance officers	2.3 Conformity of insurance fee is needed	2.3 Farmers low consideration in insurance 2.3 Bank does not have sufficient system	
	2.4 Corn low price in corn drying factory			2.4 Import from abroad	2.4 On tine and correct timing of corn considering fair humidity
				2.4 Governmental price evaluation and import and export politics	2.4 Date of cultivation to be observed
	3.1 Access to pasture land is restricted	3.1 Cutting the animal way because of the daily factory Tuba Project Cultivation of pasture lands and roads by farmers	3.1Correct attention of council members and natural resources members to confirm the villagers application 3.1 Proper control and monetary of Tuba Project 3.1 Constructing the road from Shali abad to Natural rangers (making the bridge on the canal)	3.1 Low fodder production and lack of rest land in pasture land 3.1 Lack of propoer pasture timing	3.1 Changing the heavy livestocks to light ones 3.1 Production of ranges, renewed and reformation
	3.2 shortage of pasture	No determination of pasture land location No reclamation and no suitable exploitation pasture	3.2 Livestock and ranging office planning for a ranging place supplying the fodder and water renew of grasses	3.2 Pasture destruction by nomads and tribes livestock, lack of pasture land keeping principals 3.2 Transforing pasture land to farm land and others.	
				4.1.1 Having limited amount of factories 4.1 Lack of valid machineries for different cultivations	4.1 Establishing the mechanizetion company and importing the different different machinaeries and decreasing the machinereys intersts.

Table 4.1.2 Causes of Problems and Countermeasures given by the villagers and Counterparts (Irrigation)

	Problems	Villagers		Counterpart	
		Causes	Countermeasures	Causes	Countermeasures
Khorram Abad Oliya Zone 1	1.1 No secondary canal	1.1 Not consolidatd lands 1.1 Main canal is not completed	1.1 Land consolidation 1.1 Completion of main canal	1.1 Study and implement main and secondary canals are slow and delayed 1.1 Lack of shorttime finances 1.1 Lack of cordination and planning related organization 1.1 Farmers non participation because of participation takes high costs 1.1 Lack of suitable monitaring over water distribution	1.1 Study and implement main and secondary canals are slow and delayed 1.1 Lack of shorttime finances 1.1 Lack of cordination and planning related organization 1.1 Farmers non participation because of participation takes high costs 1.1 Lack of suitable monitaring over water distribution
	1.2 No leveling of lands	1.2 Survey is just finished (waiting for next phase) 1.2 The contractor company is not determined to start the land leveling	1.2 As soon as possible, Government shoud start the work	1.2 lack of heavy machineries for leveling (scrabpers) 1.2 Lack of land consolidation and required loans	1.2 2.1, Unitilization sytem should be improved by cooperatives 1.2 Providing machines and good contractors
Shali Abad Zone 2	2.1 Insufficient irrigation water	2.1 the canal is constructed by soil and is not based on mechanization 2.1 Incorrect use of water by upstream villagers	2.1 Optimizing and mechanizing the old canal 2.1 Fair water distribution 2.1 Gharas river water pumpage into the canal		2.1 No more cultivation of products not need to much water 2.1 non using of traditional irrigation methods 2.1 Training of knowing products water demands (calender and date time of products, water demand of each product to farmers) 2.1 Establishng operator (users) cooperatives
Re'is Zone 3	3.1 No irrigation	3.1 Lack of irrigation water (only seasonal)	3.1 Construction of dam to control water		3.1 Providing budget and hurry in dam construction (Gharaba and Kilanbar Dam)
	3.2 Land submergence (Kilanbar dam)	3.2 Kilanbar dam construction	3.2 Paying the compensation for losers by govt. 3.2 Allocating the new lands for substitute their land	3.1 Lack of earth dam 3.2 Lands which are in reserviors are in river area	3.2 Damage payment should be paid to farmers 3.2 Land delivering andreplacing after consolidation 3.2 Giving the permission of fisheries to the vilagers 3.2 Organizing the river basins supplu water by small dams
Kalaveh Heidar Khan Zone 4	4.1 Well are not electrifed	4.1 Lack of fair loans to use the well that work with electricity 4.1 Min of energy do not give the permission of making electric wells	4.1 On time loan giving by Govt. 4.1 Issuing the permission by Min of Energy	4.1 Lack of provision for making the wells with electricity 4.1 Shortage of loan or budget	4.1 Issuing the permision and providin gthe facilities
Hassan Abad Shaleh Zone 1	5.1 No canal lining	5.1 Loan or budget is not allocated 5.1 Lack of peo participatio on this matter	5.1 Fair and timely loan by govt 5.1 Giving some info to people to their participation	5.1 Lack of study for arrnagement 5.1 Shortage of budget 5.1 &3 Lack of users participation	5.1 Study on system and agricultural arrangement 5.1 Providing enough budget
	5.2 Lack of wells	5.2 Waterboard do not give permision for drilling the wells 5.2 Farmers cannnot pay the costs related to log drilling	5.2 Cooperation of water affairs to issue the log drilling and changing it to well drilling 5.2 Giving the bank laon to farmers by govt	5.2 Lack of provision for well digging because of shortage in resources	5.2 Providing conditions for development of contructers
	5.3 No land leveling	5.3 Leveling is expensive	5.3 Paying laon and needed machineries supplied by the Govt.	5.1 &3 Lack of users participation	5.3 Bank budget should be provided to farmers

Table 4.3.1 Task Allocation on the Necessary Components of Water Management

Component	Necessity of the component	Necessary Actions for the Component				
		Government Side				
		Water Affairs	Kermanshah Jihad-e-Agriculture Organization	Kermanshah Cooperative Organization	Kermanshah Environmental Organization	Farmers
A. Aspects on Canal Operation						
1 What kind of information are necessary to identify the irrigable area of each canal and the Gharasu River ?	Irrigable areas have never been clarified based on available water resource.	· To improve Ravansar diversion weir so as to divide proper water volume. · To measure the outflow of Ravansar Spring. · To issue the Optimum Water Use Permission based on Water Right Documents in collaboration with MOJA. · To install gauges for measuring water discharges · To clarify present water use of water right holders · To define irrigable farm plots and locations.	· To clarify proper distribution water volume based on the optimum water requirement for the cropping pattern. · To provide Cadastral map of the project area. · To provide recommendable cropping pattern. · To collaborate with WA on issuing the Optimum Water Use Permission.			· To cooperate with WA and KJAO in providing requested statistics and data.
2 What kind of data are necessary to define the diversion volume to the Right and Left banks and Gharasu river?	There is no proper & sufficient data to divert the water to the canals and downstream of Gharasu river at the weir.	· To conduct hydrological studies in order to clarify Ravansar spring discharge. · To clarify the canal capacity · To set up available function to define the proper diversion rates in order to meet the water demands along the canals considering other water sources. · To set up mechanism to refer & consider the environmental impact assessment. · To investigate and clarify pollution of the spring water.	· To determine irrigable area. · To determine the cropping calendar. · To investigate & clarify soil classification. · To define proper diversion rate to the canals and the river.		· To monitor water quality of the river.	· To identify farm plots to be irrigated. · To determine cropping calendar in coordination with WA and KJAO.
3 What kind of information are necessary to determine rules to operate diversion gates?	Without any rule, fair distribution can not be carried out, which makes trouble to farmers.	· To determine the operation period of gates. · To establish local regulation based on the fair water distribution law. · To determine distribution rule during drought year. · To understand & clarify the social issue in coordination with KJAO.	· To determine the operation period of gates. · To establish local regulation based on the fair water distribution law. · To determine distribution rule during drought year. · To understand & clarify the social issue in coordination with WA.			· To determine the operation period of gates. · To establish local regulation based on the fair water distribution law. · To determine distribution rule during drought year. · To understand & clarify the social issue in coordination with WA and KJAO.
4 How to supervise the proper operation process of diversion gates at canal intakes?	If nobody obeys the rule, fair water distribution can not be realized.	· To establish the Ravansar Irrigation Committee consisting of three stakeholders of WUC and KJAO, · To measure the daily discharge · To identify the organization which should be supervise the execution of rules · To set-up measurement tools · To instruct proper gates to control easily	· To establish the Ravansar Irrigation Committee consisting of three stakeholders of WUC and KJAO, KPWA. · To identify the organization which should supervise the execution of rules.	· To identify the organization which should supervise the execution of rules.		· To establish the Ravansar Irrigation Committee consisting of three stakeholders of WUC and KJAO, KPWA. · To identify the organization which should be supervise the execution of rules · To cooperate fully with relevant organizations.
5 What kind of data are necessary to identify the diversion volume for each turnout?	Diversion volume is not clear for every turn out. Hence nobody can operate gates fairly & properly.	· To rehabilitate waterway from the spring to the diversion weir. · To clarify discharge of the spring · To issue water right documents · To set-up measurement tools · To clarify the information on water right holders	· To define proper water distribution program based on the optimum water consumption & cropping calendar · To prepare Cadastral map of command area. · To determine cropping pattern			· To identify the areas to be irrigated. · To determine the cropping calendar. · To observe irrigation issues and to keep necessary coordination with WA and KJAO.
6 What kind of items are necessary to determine a rule to operate check gates and turnout?	Without any rule, fair distribution can not be carried out, which makes trouble to	· To determine the operation period on gates. · To establish local regulation based on the fair water distribution law. · To determine distribution rule during drought year. · To understand & clarify the social issue in coordination with farmers.	· To determine the operation period on gates. · To establish local regulation based on the fair water distribution law. · To determine distribution rule during drought year. · To understand & clarify the social issue in coordination with WA & farmers			· To determine the operation period on gates. · To establish local regulation based on the fair water distribution law. · To determine distribution rule during drought year. · To understand & clarify the social issue in coordination with relevant organizations.
7 How to supervise the proper operation process of each check gate?	If nobody obeys the rule, fair water distribution can not be realized.	· To identify the organization which should supervise the execution of rules.	· To identify the organization which should supervise the execution of rules.	· To identify the organization which should supervise the execution of rules.		· To identify the organization which should supervise the execution of rules. · To employ Mir-Ab.
8 How to supervise the proper operation process of each turnout?	If nobody obey the rule, fair water distribution can not be realized.	· To identify the organization which should supervise the execution of rules.	· To identify the organization which should supervise the execution of rules.	· To identify the organization which should supervise the execution of rules.		· To identify the organization which should supervise the execution of rules. · To employ Mir-Ab. · To owe task to Measure daily discharge on turnouts
9 How to supervise the proper water distribution process at on-farm level?	If nobody obey the rule, fair water distribution can not be realized.	· To set up mechanism to identify & examine the decision made by the WUC as govt's responsibility to support them. · To take initiative of monitoring by WA	· To set up mechanism to identify & examine the decision made by the WUC as govt's responsibility to support them & to train WUC by concerning experts	· To set up mechanism to identify & examine the decision made by the WUC as govt's responsibility to support them.		· To establish suqad of beneficiaries by each turnout. · To owe task to control and supervise by the WUC
10 How to control illegal water users?	Legal water users in downstream are facing serious problem due to illegal water users.	· To use the compelling power of the government. · To identify the organization, which should supervise the execution of rules · To forbid completely instead of penalty rule · To collaborate between police forces and judiciary	· To use a compelling power of the government. · To identify the organization, which should supervise the execution of rules · To forbid completely instead of penalty rule · To collaborate between police forces and judiciary section	To use a compelling power of the government. · To identify the organization, which should supervise the execution of rules · To forbid completely instead of penalty rule		· The WUC should be an advisable association only. · To cooperate with concerning organizations

Table 4.3.1 Task Allocation on the Necessary Components of Water Management

Component	Necessity of the component	Necessary Actions for the Component				
		Government Side				Farmers
		Water Affairs	Kermanshah Jihad-e-Agriculture Organization	Kermanshah Cooperative Organization	Kermanshah Environmental Organization	
B. Maintenance Aspect of the canal						
11 What kind of activities are necessary to secure the proper condition of the diversion facilities?	If there is any problem in the diversion facilities, proper operation can not be carried out.	· To draw up a penalty rule to destroyer · To let the Staffs of the West Regional Water Utilization Company keep the rule · To conduct training to the staffs to operate gates · To collaborate between police forces and judiciary · Establish proper drainages	· To construct tertiary, on-farm canals and also necessary gates after completion of main & secondary networks by · To conduct training to the farmers			· To observe the inspection road of canals · To cooperate with relevant organizations and to avoid damages of canals and gates
12 What kind of aspects should be considered to rehabilitate the main canal successfully?	There are lot of damages in the main canal, leakage and water loss can be found at present.	· To let the farmers Participate in designing of the canal · To identify the location where facilities have some damages · To set up procedure that budget should be allocated based on the identification study · To conduct Quality control of construction. · To let use of proper materials · To determine the location of additional gates taking farmers' request into account.	· To co-share in order to provide some proportion of required budget. · To encourage the farmers to pay water fee on time.			· To participate during design period of the canal. · To identify the location where facilities got some damages. · To provide opinions and suggestions to determine the location of additional gates. · To make arrangement of adequate requests · To co-share some proportion of the required budget · To fully cooperate on payment of water fees on time
13 What are necessary routine work items to ensure the quality of facilities on the main canal?	At present, nobody is clear of what kind of routine work should be done.	· To make rules that the farmers along the canal have to owe responsibility to maintain some part of the canal. · To protect inspection roads · To execute the minor repairments before it becomes serious. · To conduct maintenance activities to prevent the natural disaster. · To conduct cleaning of the canal bank · To conduct cleaning of the canal · To remind the water utilization company as in-charge of canal's maintenance. · To provide proper operation rules of the gates in suitable seasons and occasions · To conduct cleaning operations of canals. · To conduct training to the farmers.	· To train the farmers to observe the operation rules and to encourage their cooperation on canals and gates maintenance.	· To conduct training to the farmers and WUC.	· To conduct environmental assessment.	· To monitor and to inform to WA · To co-share the construction of canals and gates and also to reconstruct them.
14 What are necessary periodical work items to ensure the quality of facilities on the main canal?	At present, nobody has understood what kind of periodical work should be done.	· The items are same as the above; however, the work volume or difficulties are at a large scale. · To repair and maintain the canals and installations periodically.	· To maintain cooperation in order to identify the damaged parts and to repair them.			· To monitor and to inform to WA · To maintain cooperation in order to identify the damaged parts and to repair them.
15 How to supervise the implementation of proper maintenance works?	The present situation of the Right bank canal is no-maintenance activities after construction.	· To draw up a penalty rule to offenders. · To secure fair water distribution to avoid damages of facilities. · To identify causes of damages of canals. · To identify the persons in charge. · To consider the farmers' opinion · To identify the organization which should supervise the execution of activities of Western Region Water Utilization company · To identify task allocation · To enhance motivation of farmers on the canal maintenance.	· To identify the organization which should supervise the execution of activities of Western Region Water Utilization company · To identify task allocation	· To identify the organization which should supervise the execution of activities of Western Region Water Utilization company. · To identify task allocation		· To identify the organization which should supervise the execution of activities of Western Region Water Utilization company. · To conduct the periodical walk through survey. · To identify the organization which should supervise the execution of activities of Western Region Water Utilization company. · To identify task allocation. · To enhance the motivation of canal beneficiary farmers. · To cooperate with relevant organizations.
16 What kind of technical support system should be provided by the government?	Most of the farmers do not have technical knowledge concerning not only the canal but also agriculture.	· To identify the organization which should supervise the execution of activities of the WUC & WA. · To conduct training to the WUC. · To encourage the farmers participation. · To let the WUC members master operation and utilization rules. · To provide the civil engineering support.	· To identify the organization which should supervise the execution of activities of the WUC & WA. · To conduct training to the WUC. · To encourage the farmers participation. · To let the WUC members master operation and utilization rules. · To provide the civil engineering support. To clarify necessary machineries. To conduct technical support of crop cultivation and pest control. To conduct technical support of primary processing of WUC.	· To train the farmers and WUC concerning their duties.		· To participate in training courses.

Table 4.3.1 Task Allocation on the Necessary Components of Water Management

Component	Necessity of the component	Necessary Actions for the Component				
		Government Side				Farmers
		Water Affairs	Kermanshah Jihad-e-Agriculture Organization	Kermanshah Cooperative Organization	Kermanshah Environmental Organization	
C. Financial Aspect						
17 How much is suitable water fee for the government?	It is not clear how much WUC has to pay for the government as water resource management fee.	· To determine the water fee based on task allocation · To identify the type of networks and to observe the rules on agreement of utilization company and WUC within scope of existing regulations.	· To Cooperate on collecting water fee.	· To encourage WUC to pay water fee.		· Cooperation between WUC and farmers on payment of water fee.
18 How much cost should be covered with the water fee for the WUC ?	It is not clear how much WUC has to collect the water fee to operate and maintain the facilities.					· O&M cost Administration cost
19 How to secure the collection of water fee?	At present, the water fee has not been collected completely.	· To review the law · To review the amount of the water fee. · To review the ways to collect the water fee · To collect the water fee based on the copping pattern. · To enhance regulation to collect the water fee · To collect the water fee strictly than present. · To commit farmers to pay water fee for water delivery and making contracts with the farmer's representatives.	· To identify irrigable area · To set rules of penalty against illegal water users, like to order to stop water use. · To encourage the farmers to pay water fee.	· To encourage the farmers to pay water fee. · To set penalty rules against illegal water users, like to discontinue financial supports to them.		· To review the ways to collect the water fee · To cooperate for the payment of water fee · To collect the water fee based on the copping pattern. · To collect the water fee strictly than present. · To make contract with WA and to keep commitment to pay water fee.
20 How to facilitate the application condition of governmental subsidy programs ?	Farmer would like to have some govt subsidy, but present programs and application procedure are hard to apply for farmers.	· To carry out social awareness through the mass media. · To extend repayment period of loans. · To identify the purpose to get loan. · To simplify the condition of loans and observing WA considerations if needed. · To set up mechanism to serve loans timely.	· To carry out social awareness through the mass media. · To extend repayment period of loans. · To identify the purpose to get loan. · To simplify the condition of loans and observing WA considerations if needed. · To set up mechanism to serve loans timely.	· To carry out social awareness through the mass · To extend repayment period of loans. · To identify the purpose to get loan. · To simplify the condition of loans and observing WA considerations if needed. · To set up mechanism to serve loans timely.		
D. Social Aspect						
21 How to encourage farmers to participate, who have water right of the canal ?	If all farmers concerning the main canal do not take part in the WUC, water distribution rule can not be carried out completely. Some unfairness will occur.	· To give some services to farmers that are more economically effective to them. at initial stage. · To encourage the govt. staffs not to cheat farmers. · To improve and generate proper supporting system on technical & financial aspects. · To make rule for govt' staffs not to discriminate farmers. · To set up procedure to circulate information among farmers through the mass media.	· To give some services to farmers that are more economically effective to them. at initial stage. · To encourage the govt. staffs not to cheat farmers. · To improve and generate proper supporting system on technical & financial aspects. · To make rule for govt' staffs not to discriminate farmers. · To set up procedure to circulate information among farmers through the mass media.	· To give some services to farmers that are more economically effective to them. at initial stage. · To encourage the govt. staffs not to cheat farmers. · To improve and generate proper supporting system on technical & financial aspects. · To make rule for govt' staffs not to discriminate farmers. · To set up procedure to circulate information among farmers through the mass media.		· To attain services that are more effective economically.
22 How to generate mechanism among agencies to share and understand opinions & decisions coming from the individual ones.?	At present, willingness of both sides is hard to be understood mutually.	· To establish a foundation to coordinate the concerned parties. · To establish mechanism to share opinions commonly. · To establish Ravansar irrigation committee. · To establish common procedures to share meetings through the Islamic council.	· To establish a foundation to coordinate the concerned parties. · To establish mechanism to share opinions commonly. · To establish Ravansar irrigation committee. · To establish common procedures to share meetings through the Islamic council.	· To establish a foundation to coordinate the concerned parties. · To establish mechanism to share opinions · To establish common procedures to share meetings through the Islamic council.		· To establish a foundation to coordinate the concerned parties. · To establish mechanism to share opinions commonly. · To establish Ravansar irrigation committee. · To establish common procedures to share meetings through the Islamic council.
23 How to improve the present poor collaboration among agencies ?	Insufficient relation among agencies is one of big problem to attain the progress.	· To integrate present co-sharing responsibilities into one representative agency regarding irrigation water. · To cooperate among staffs of relevant agencies for more deep mutual understanding. · To provide measures to enhance the mutual trusts and understandings among agencies.	· To integrate present co-sharing responsibilities into one representative agency regarding irrigation water. · To cooperate among staffs of relevant agencies for more deep mutual understanding. · To provide measures to enhance the mutual trusts and understandings among agencies.	· To cooperate among staffs of relevant agencies for more deep mutual understanding. · To provide measures to enhance the mutual trusts and understandings among agencies.		· To develop & strengthen cooperation with concerning organizations.
E. Other Related Aspects						
24 How to improve the situation concerning land development ?	Without establishment of irrigation and drainage network, it is impossible to realize the optimum water use.	· To request responsible authorities to carry out the tasks	· To create technical control system of the projects. · To supply the budget on time · To prepare operation manual. · To provide opportunity of field visit to generate collaboration with farmers.			· To conduct field visits. To undertake necessary follow up measures.
25 How to establish proper planning system ?	Present projects are carried out without collaboration among relevant	· To generate mechanism to let farmers participate in the planning. · To provide mechanism to consider land conditions & potentials for developing design. · To examine & establish sufficient ways to generate good relation between farmers & government. · To conduct studies and planning with regard to the condition of region. · To provide administrative procedure to allocate proper & timely budget.	· To generate mechanism to let farmers participate in the planning. · To provide mechanism to consider land conditions & potentials for developing design. · To examine & establish sufficient ways to generate good relation between farmers & government. · To provide administrative procedure to allocate proper & timely budget.	· To provide administrative procedure to allocate proper & timely budget.		· To participate in the activities of government from planning to the completion of construction.. · To make good relation between the govt. and farmers. · To share some proportion of expenses of certain project.
26 How to establish monitoring system on the availability of water resource?	At present, the availability of water resource has not been fully clarified.	· To conduct hydrological balance & water resources potential analysis to understand the present tendency.				
*Both the government and the farmers side agreed on the necessity of Mir-Ab (water distribution controller)						

Problems / Constraints Obtained Through Workshop

A. Farmer - Farmer

1. Irrigation water trade-off between upstream &downstream people.
2. Less experience to communicate with other communities.
3. Some less ground ill feelings among Dehs handed over from previous generation.
4. Deh-based gathering is more familiar than inter-Deh gathering, following previous manner.
5. Recently dry season cultivation is making bigger trade-off on irrigation water.
6. Younger generation are hardly to take initiative and to involve to WUC because of elder respecting tendency.

B. Farmer - WUC

1. Farmers hardly to understand the WUC itself.
2. Still observing WUC program achievements.
3. Shortage of WUC information makes less literacy to understand WUC.
4. Prefer to save expenditure of admission share.
5. Most of individual decision makers are aged and conservative for new activities.
6. WUC has no room of knowledges nor measure to explain WUC to ordinary farmers.
7. WUC itself has no confidence on water abailability from canal to introduce to ordinary farmers.
8. WUC has never been shown the future possibilities by the relevant agencies. Hence hardly to involve to WUC program.

C. WUC - WUC (Internal)

1. Doubts among WUC members, because less explanation and guidance by the relevant agencies.
2. Distinctions are caused among BOD members due to differences of understanding WUC.

D. Farmer / WUC - WRWUC

1. Farmers disappoint to the firm, because never maintained the irrigation system while the farmers are paying the water fee.
2. Farmers have noticed that the water delivery from the source is not operated properly, namely no control.
3. Both sides never clarified the water fee meaning, whether the fee is defined as water price or as irrigation utilization fee.
4. WRWUC never show clear future program of canal maintenance to farmers.
5. Both sides have predict trade-off of water management works will appear soon in a stage of management transfer.
6. Efforts of WRWUC to strengthen relation with farmers are hardly to find.
7. Farmers recognize WRWUC's monitoring for illegal users is not effective.
8. Farmers complaine that facilities are not proper conditions to use canal water.

E. Farmer / WUC - RWAO

1. Insufficient communication among those after establishing WRWUC.
2. RWAO / W.A has no reference to discuss proper water allotment from view point of water availability.
3. Most farmers disappointing to RWAO, because never maintained the irrigation system while paying the water fee.
4. Farmers admire that the relation / communication with RAWO is so poor .
5. Never shown clear task allocation between the office and WRWUC.
6. RWA has never shown clear future program to farmers regarding the maintenance of the canal.
7. RAW /KAW never clarified water availability for irrigation.
8. RWA / KAW issues water use permission without concrete reference of water balance between demand & water

F. Farmer / WUC - JCO

1. Insufficient explanation and future program on WUC activities from JCO to WUC / Farmers.
2. Farmers never received further following-up care to make the WUC mature.
3. Farmers / WUC has never understood the scope of WUC, which should be done by JCO.

G. Farmer / WUC - KJEAO / Soil & Water

1. Farmers desire implementation of land consolidation, including farm level canal provision.
2. KJEAO has understanding that the present water availability is not sufficient to irrigate whole area.

H. Farmer / WUC - RASC

1. Farmers depend on RASC for extension services but RASC has no sufficient manpower.
2. RASC owes many works from all departments of A.O. but has no sufficient manpower and measures to make sufficient
3. WUC program is one of many work items but RASC has function only to convey information but no authority to decide

I. WRWUC - RWAO

1. Scope and responsibilities of RWAO on WUC development is not clear, in the situation of WRWUC's contract works.

J. KWA - KJEAO

1. Both are in charge for proceeding WUC program.
2. Irri-sys has never been completed which shall function as tool of fair water distribution & efficient water use.
3. Dual examining of irr-sys planning by both never function well for the area.
4. KJEAO has idea that one of both should owe entire responsibility / initiative to avoid confusion in the field.
5. KJEAO has idea to reserve winter spring discharge to use it in dry season.
6. KWA faces insufficient budget to complete irri-sys inovation in short period.
7. KJEAO faces insufficient budget to complete L/C project in short period.

K. RASC - Other Provincial Agencies

1. Any information from agencies come to RASC and making bottle-necked condition.
2. RASC consume most of energy for deliver seed, fertilizer and chemicals & insufficient room to involve to the program.
3. RASC functions like interface between farmers and government, under limited manpower and budget.

L. Provincial Agencies - Central Government.

1. Each agency is on the line from the central, without sufficient room of independency.
2. Most of agencies has insufficient budget to conduct projects.
3. While able to understand WUC program, never reached to sufficient to implement it, because of limited budget.
4. Hardly to synchronize any agencies at the edge of the Govt administration system to meet with peoples demands.

Solution Alternatives / Countermeasures

CM-001	To let KJEAO / KCO provide programs to grow capable leader to guide farmers.
CM-002	To let RASC / JCO make programs to grow mutual understanding among Dehs in daily life.
CM-003	To let RASC / JCO make programs to enhance public awareness on rural activation with concrete programs.
CM-004	To let KJEAO make programs to enhance public awarding to contributors for such problem solution.
CM-005	To let KAW clarify actual water availability from engineering view.
CM-006	To let KJEAO make implementation program to realize efficient water use through Land Consolidation.
CM-007	To let KAW make system to monitor extensive water use in the field, on both farmers' and government sides.
CM-008	To let KJEAO / RASC grow mutual understanding among Dehs.
CM-009	To let KJEAO introduce less-water depend culture in the season, available for similar income.
CM-010	To let KJEAO introduce rotation of water use, under collaboration with KAW.
CM-011	To let RASC / JCO conduct continuous explanation to farmers that the AOA states eligibility of younger
CM-012	To let RASC enhance incentives to younger generation and to applause them on involvements through public
CM-013	To let RASC / JCO enhance younger generation in development in the rural society.
CM-014	To let KJEAO expand public awareness of the WUC program through any available channels, including
CM-015	To let KJEAO provide success story of WUC as a pilot project, available to adopt FTF awareness with sufficient
CM-016	To let KJEAO have continuous extension on WUC program, with awarding sys as social incentive.
CM-017	To let KJEAO proceed awareness with sufficient budget and material to introduce WUC program.
CM-018	To let KJEAO provide clear action program with task allocation among the BOD members through RASC.
CM-019	To let KWA guide the firm and to monitor the firm's performance.
CM-020	To let KWA provide sufficient budget with concrete IP to maintain present irri-sys as soon as possible.
CM-021	To let KWA conduct public awareness of water fee with clear definitions.
CM-022	To let KWA / MoE conduct public awareness how much the Govt has sacrifice the water resource development.
CM-023	To let RWA clarify proper gate operation for fair water diversion, as the govt's responsibility.
CM-024	To let RWA establish sufficient gate operation manual to divert water properly.
CM-025	To let KWA / RWA keep sufficient record of diverted water at water source.
CM-026	To let WRWUC clarify the revenue and budget schedule and report to farmers.
CM-027	To let WRAO improve the contract to meet with willingness of the end users.
CM-028	To let WRAO / MoE show task-allocation among A.W, WRWUC and WUC to avoid task trade-off in future.
CM-029	To let WRAO improve the contract to meet with willingness of the end users.
CM-030	To let WRAO guide the firm to conduct the field monitoring to guide farmers not to take water illegally.
CM-031	To let WRAO / W.A examine & adopt effective penal regulations to avoid illegal water users.
CM-032	To prepare sufficient budget to complete the facility improvement by WRAO / W.A.
CM-033	To KWA/KJEAO/KCO remind the importance of provision of a success story of WUC establishment as an
CM-034	To let RWAO develop communication with farmers as an office of in-charge agency.
CM-035	To let KWA / MOE examine measure to evaluate the firm on WUC program extension on the contract concretely.
CM-036	To let KWA / MOE conduct water resources availability study including comprehensive hydrological circulation.
CM-037	To let RWAO / KAW show task-allocation between WRWUC and RWAO on water management issues.
CM-038	To continue extension works from JCO to farmers to make the WUC mature.
CM-039	To evaluate the JCO as in charge office to lead farmers to participate to the WUC with correct indicator.
CM-040	To evaluate the JCO as in charge office to activate the WUC with correct indicator.
CM-041	To let JCO / KCO provide sufficient budget to set necessary material and manpower to continue extension.
CM-042	To let KJEAO obtain sufficient budget to implement Land Consolidation for the area as priority project.
CM-043	To let KJEAO prioritize potential areas for adapting L/C as indispensable tool of effective water use in the sector.
CM-044	To let KJEAO approach to proceed such further examination by MOE / KAW.
CM-045	To let KJEAO secure sufficient inputs to strengthen functions of RASC as a sole interface from Govt to
CM-046	To let KJEAO provide concrete program of ASC strengthening and obtain sufficient budget to meet with the
CM-047	To let KJEAO clarify tasks and scopes of ASC regarding WUC program with sufficient inputs of budget and
CM-048	To let KAW / WRWA clarify the task allocation between them with evaluation criteria.
CM-049	To let KAW / WRWA to convey the evaluation results to farmers.
CM-050	To let both agencies clarify and provide clear implementation program with evaluation criteria.
CM-051	To let MoJEA / MoE wind up those provincial agencies to remind the necessity of success story with sufficient
CM-052	To let the Govt make regulation to define initiative to one agency or to generate project team consisting of two
CM-053	To let the Govt strengthen the function with sufficient inputs.
CM-054	To let the Govt examine Structural Adjustment to enhance flexibility of administrative activities in provincial level.
CM-055	To let the Govt examine possibility to introduce evaluation system by regional departments to meet with bottom up
CM-056	To let the Govt apply sys to form project team for priority scheme as effective measure of the presentation to the
CM-057	To let the Govt encourage younger generation in rural area to enhance self-reliance mood among the people.
CM-058	To let the Govt generate indirect programs to penetrate " cost-sharing concept" among the people.

Major Issues for Irrigation Management

MI-01 Rural Activation Program (To generate mutual trust & self-reliance)

- P001 **KCO** to make plans to train farmers as enterpriser under collaboration with **KJEAO.**
- P002 **KJEAO / RASC** to make programs of indirect social trust enhancement with KCO.
- P003 **KCO** to make detail guidance program on WUC management
- P004 **KCO/KJEAO** to make mechanism of public awareness on WUC program
- P005 **KAW / KJEAO** to produce system of social awarding for people contributing to community / agriculture.
- P006 **KJEAO** to make system of community encouragement handled by farmers as enhance self-reliance measure.
- R007 **KJEAO** to let farmers make programs of social participation of younger generation

MI-02 Clarification of Water Balance on W.Availability

- P008 **KAW** to conduct study of hydrological circulation and water availability analysis.
- P009 **KJEAO** to conduct F/S on Land Consolidation to clarify potential water demand of irrigation.
- P010 **KAW** to conduct study of regional water balance analysis to clarify water supply potential.
- R011 **KAW** to prepare sufficient budget to conduct study on regional water resources availability.

MI-03 Inter-agency Integration Program 1 (Mainly for collaboration forfuture)

- P012 **KJEAO / KWA / KCO** to have committee to adjust annual project prioritization.
- P013 **KJEAO / KWA / KCO** to have program of project team provision on higher prioritized project, with dispatching staffs.
- P014 **KJEAO / KWA / KCO** to form **Ravansar-Sanjiabi regional Development Counsil** to generate framework.
- P015 **KJEAO / KWA / KCO** to form **Ravansar Irrigation Committee** with WUC to define annual water allocation.
- P016 **KJEAO / KWA / KCO** to introduce staff manifest & awarding system in organization.
- P017 **KJEAO / KWA / KCO** to set measures to increase mass media information utilization to appeal efforts

MI-04 Inter-agency Integration Program 2 (Mainly for Administrative sys improvement , KJEAO as lrading)

- P018 **KJEAO / KWA / KCO** to have system rationalization committee to simplify task-allocation on irrigation management.
- P019 **KJEAO** to have study on ASC improvement to reinforce it as important interface to farmers.
- P020 **KJEAO** to set measure to reiforce extension capability to expand communication with farmers to meet with work load
- P021 **KJEAO** to generate sufficient programs of WUC introduction to farmers with NGOs
- P022 **KJEAO** to clarify task allocation among divisions regarding WUC aspect and its evaluation system.

KA Recommendation / Premises

- R001 To examine to expand budget flexibility at provincial level.
- R002 To examine to apply NGO or NPO into administration activities.

Fig. 4.3.1 Summary of Major Issues for Irrigation Management Improvement

Chapter 5 Masterplan and Development Strategy of Agricultural Development and Selection of Priority Areas

CHAPTER 5

MASTER PLAN AND DEVELOPMENT STRATEGY OF AGRICULTURAL DEVELOPMENT AND SELECTION OF PRIORITY AREAS

5.1 Master Plan of Agricultural Development

5.1.1 Basic Concept of the Agriculture Development

The objective of the agricultural development in the Study Area is a establishment of sustainable agriculture with high level of technology in line with the policies of the Government of the Iran and the Province, so that the difficult problems in farming at present will be solved, the living standard of farmers will be improved and the rural economies will be revitalized. To establish of sustainable agriculture, it is required to integrate organically the various sections of farming, such as crop cultivation, animal husbandry, horticulture, fisheries, etc. Precondition of agricultural development in the Study Area is the development of irrigation water source, and the establishment of low cost irrigation and drainage methods. Matrix for the preparation of agricultural development plan in the fields of agriculture& animal husbandry and irrigation & drainage are shown in Tables 5.1.1 and 5.1.2 respectively.

In order to achieve the objective, establishment and execution of the plans on following items are required.

1) Basic pattern of crop rotation should be established in a short-term plan, and it should be extended and penetrated in a middle-term plan. The crop rotation would be fixed in a long-term plan. The basic pattern of the crop rotation is wheat/barley and chick pea in the rain-fed lands, and wheat, maize, sugar beet and forage crops in the irrigated lands.
2) To diversify the crop cultivation in the survey area, it is considered to introduce sunflower and vegetables as summer crops, and rapeseeds and barley as winter crops to the crop rotation as well as maize, sugar beet, wheat and chick pea in the basic pattern of rotation. With regard to possibility of introduction of these crops in the survey area, it will be examined from the viewpoint of various aspects, such as cultivation technology, economy, social conditions for processing of products, etc.
3) To stabilize the income of farming in the small-scale farm households, it is examined to introduce vegetables in irrigated fields and in the plastic green houses.
4) Integrated farming with livestock farming needs to be established through introducing forage crops into a crop rotation, and establishment and extension of the method of making silage and hay of forage crops. Moreover, local breed cows, which farmers raise generally at present, should be exchanged to Holstein, which is higher in milk yield than local breed, but is required the cow shed to manage more hygienically, and medical examination by veterinarians several times a year. Besides, the excrements of cows are returned as compost to farmland in order to increase organic matter of soil, so that heavy textured soil in this area is improved physically and is saved chemical fertilizer and pesticide.

5) Raising of sheep is very important farming for the small-scaled farmers. The Government of Province promotes the change from sheep to dairy cattle to keep the balance between the number of sheep and the area of range. However, the decrease of sheep incurs the risk of sudden rise in price of mutton and lamb. Therefore, it is necessary to recover the range. The recovery of range is very useful to prevent crops from damage of drought by holding soil water, of flood and of erosion of soil.
6) At sloping lands in the upper reaches of the rivers or canals, which run always throughout the year, or around the mountain's springs, the integrated farming of cultivation of rose for scent or some fruit trees with fisheries is recommendable. Water is used to fish culture of cold water fishes in case of springs' water, and of warm water fishes in case of rivers' water. The waste water is irrigated to crops, roses or fruit trees. The rose scent is extracted from flowers of roses in the processing factory, which is under construction in Ravansar.
7) Strengthening of extension agencies should be promoted. Needless to say, extension of agricultural sector is behind. But also specially, extension of production of forage for domestic animals, methods of making silage and hay, and hygienic management of dairy cattle are behind This technical extension contributes much to escaping from gamble farming. It is proposed that local TV stations have the programs on agriculture and animal husbandry to broadcast market information on agricultural and livestock products and technical information.

Through executing the plans mentioned above, it is sure to increase the possibility of agricultural development in the Study Area.

5.1.2 Target and Strategy of Agriculture Development

(1) Target Year

The Iranian Government has issued the mid term national development plan, the Third Five Year Plan (3rd FYDP, 2000/01-2004/05). Corresponding to the 3rd FYDP, agricultural development plan and Kermanshah development plan are preparation period for implementation. Considering these national and provincial development frameworks and the present conditions of the Study Area, the target year of the agricultural development is set in the following three stages;

- Short Term: by 2005 within the 3rd FYDP for the preparation period.
- Mid Term: by 2010 within the period of the 4th FYDP
- Long Term: by 2020

In the agricultural development plan, the improvement plans needed, the items to be clarified, expected outputs and the period are shown in Table 5.1.3.

(2) The Strategy of the Agricultural Development

The agricultural development plan has been formulated based on the above development concepts and target year. In the medium term agricultural development plan stage, the base of the development has been set for the implementation of the schemes which has the

demonstration and training functions. Then the development of the whole Study Area is to be realized. The investment to the development schemes in medium and long terms is arranged considering the financial ability of the Government and also the farmers. In order to empower the beneficiaries/farmers to achieve the sustainable agricultural and rural development, farmers shall be involved and participated from the planning, implementation and operation & maintenance stages.

The following process has been proposed for the implementation of the master plan:

- Farmers/villagers are targeted to improve their living standard through the agricultural and social development. They should take up the physical and institutional improvement by themselves.
- Farmers/villagers shall be involved in the development scheme from the planning stage and share the responsibility for implementation. The Government shall guide them and provide them with the required actions and coordination through the project implementation.
- After empowerment of the farmers/villagers through the implementation of the demonstrative development scheme, they are expected to maintain the sustainable development by themselves.

(3) Prioritization

The Agricultural Development Plan shall be operated in sustainable conditions by the end users or farmers. The present ability of the farmers and regional conditions in the Study Area has to be evaluated in the formulation of the proposed plan. There are many aspects to be considered in relation to the implementation of the plan. Agricultural subsidies and credits will require legal settlement by the Government also the large-scale investment cost shall meet the capability and scale of the Government budget. The components of the Plan which need external factors shall be excluded or given the lower priority for the implementation. Among the required components of the Plan, the components urgently required and the ones of which problems can be easily solved within the region shall be implemented in the first priority.

5.1.3 Basic Concept of Farming Plan

Cultivated crops in the Survey Area are mainly wheat and chick pea in rain-fed lands, and mainly wheat and maize in irrigated lands. Yields of wheat and chick pea are very lower and more unstable in rain-fed lands than in irrigated lands.

Basic concepts of farming plan are as follows:

1) It is considered that integration of agricultural farming with animal husbandry should be promoted as the basic model of farming plan. In the plan, Holstein cows of 5 heads are raised. As a result, farmer’s incomes consist of daily cash income from dairy cattle and income of crop production and farmers’ living are secured. The target of annual net income of farmer is Rls. 40 to 50 million in farm scale of 10 ha, which is around two

times of present average in the Study Area.

2) Well water, canal and river water is used for the winter crops and the summer crops. The basic cropping pattern is “wheat－maize – sugar beet – forage crops”.
3) In the area, which can irrigate in April to May but cannot irrigate in summer by shortage of water, the canal water is used for only winter crops, namely, wheat and chick pea, to increase the yields and stabilize the production as possible as can. The basic cropping pattern in the area is “wheat – chick pea”.
4) The excrements of cows are returned as compost to farmland in order to increase organic matter of soil, so that heavy textured soil in this area is improved physically and is saved chemical fertilizer and pesticide.
5) To diversify the crop cultivation in the survey area, it is considered to introduce sunflower and summer vegetables as summer crops, and rape and barley as winter crops to the crop rotation as well as maize, sugar beet, wheat and chick pea in the basic pattern of rotation. With regard to possibility of introduction of these crops in the survey area, it will be examined from the viewpoint of various aspects, such as cultivation technology, economy, social conditions for processing of products, etc. in Phase II survey.
6) To stabilize the income of farming in the small-scale farm households, it is examined to introduce vegetables in irrigated fields and in the plastic green houses.
7) At sloping lands in the upper reaches of the rivers, which run always throughout the year, or around the mountain’s springs, the integrated farming with bee keeping and fisheries is planned.
8) To strengthen the extension system, the extension service centers in the survey area are reviewed on number of staff, training of staff, facilities, programs of extension activities, etc. And then, the strengthening plan is examined as one of the agricultural infrastructure development plan.

5.1.4 Basic Concept of Agriculture Infrastructure Development Plan

Basic concept concerning irrigation and drainage plan are described below, and the conceptual framework of the irrigation and drainage plan is shown in Table 5.1.2.

(1) Improvement of Water Utilization

To improve the water utilization, the following concepts will be considered;

1) Clarification of available water source
2) Establishment of water users’ association
3) Provision of education and training of the proper irrigation method
4) Establishment of irrigation canals
5) Establishment of maintenance system
6) Integration of the well
7) Examination of new water resources development

Especially, following items which mentioned in Table 5.1.3, should be paid attention to improve the water management system.

- The basic concept is to let both the sides of government and the farmers to understand and to accept the sense of ownership.
- The O&M should be conducted jointly by the beneficiaries through participatory approach by each settlement as unit.
- Suitable organization (WUC or RPC) needs to be established for the O&M system and phased development of the O&M system is proposed.
- Extension Service Center should owe the task to strengthen RPC as O&M implementation body. For that purpose it is necessary to change the present conditions of RPC.

(2) Improvement of Drainage Condition

To improvement drainage condition, following concepts are considered;

1) Examination of the drainage capacity on the river
2) Examination of the drainage capacity on the main drainage canal
3) Establishment of the drainage network
4) Establishment of the maintenance system

(3) Improvement of Field Conditions

The improvement of field conditions by the land consolidation activities including land readjustment, land leveling, on-farm irrigation and drainage facilities are the best way to solve these problems comprehensively. However, the land consolidation should take a lot of budget and time. So, it is better to select improvement components as the need arises. Therefore, the local condition and problem concerning present on-farm agricultural facilities should be clarified through the field reconnaissance at the begging stage.

(4) Operation and Maintenance of Agricultural Infrastructure

Rural areas and production activities there need proper operation and maintenance of production infrastructure like farm plots, farm roads, irrigation canal, drainage canals and others and also of social infrastructure like electricity lines, communication facilities, roads among settlements and others. In this sub-chapter a concept is to be proposed on those O&M of social assets, especially for agricultural infrastructure. These are summarized in Table 5.1.4.

1) Considerable aspects for establishing Concept

Some passive relations, mainly to farmers' side, has been handed over for long times between the Government and farmers, it comes from behaviors of farmers to sit and wait for assistances from the Government. Hence hardly to develop the sense or self-consciousness as entrepreneur nor sense of ownerships for any aspects in the society. Besides that the local government agencies have been in a position to offer the instructed supports from the central government and kept well its scope. The concept to be proposed hereunder is to be sufficient to let both sides understand and accept the sense of ownership.

2) Operation and maintenance (O&M)

The O&M should be conducted jointly by beneficiaries through participatory approach by

each settlement as unit. Its intension is to generate/realize sustainable O&M by dint of letting farmers recognize and accept the sense of ownership, and also to penetrate the policy of cost-sharing concept into the farmers.

3) Organization for O&M

At first to set RPC (Rural Production Cooperative) by each settlement (*Deh*) which MOJA has been in charge, then each RPC (so called "unit RPC" tentatively) should owe the task as one of activities in a settlement. This intension is to generate foundation to keep and expand initiatives of MOJA to conduct rural activation later, which should be synchronized with as encouraging agriculture based on proper O&M of infrastructure. Also it is quite indispensable that organization in a settlement as recipient of the Government's assistances should be better simple as possible to let harmonize individual assistances offered by any relevant agencies effectively.

From such point of view, Water Users' Association (WUA) is also to be affiliated under the RPC, which is to share important part of O&M of agricultural infrastructure. O&M of water use related facilities by each water source as the National property should be conducted properly and with proper cost. It means actually let farmers owe the tasks based on their self-reliance after enhancing their sense of ownership. Hence the formation of federation of unit RPCs is seemed better to set lines by water source.

4) Phased Development of the O&M Implementation Body.

It is obvious that introduction and setting up a standardized RPC system and introduction of the concept of cash sharing is to be accepted by farmers hardly because of their present capability of economical and social maturities. This means better to proceed the plan phase by phase while observing their growth. To reduce the burden of the farmers as much as possible, unit RPC or the Joint RPC can utilize cooperative programs prepared by the MOC as measures to secure the subsidies and assistances. Besides that RPC should owe the task to consultant each farm economy aiming to encourage their awareness as an independent entrepreneur. So that the responsibility of farmers is to be handed over gradually from the Government, based on their process of empowerment.

5) Human Resources Development

Existing extension Service Center should owe the task to strengthen RPC as O&M implementation body. For that purpose it is necessary to change the present condition as inputs distributor, not extension servicing agency. Actually they are taught with administration works instead of extension now. So improvement to change the present status to be extension-based functions is required.

The anticipated circumstances to realize the proper O&M on the reference of rough time schedule is shown in Table 5.1.3. To securing sustainable O&M, it is indispensable that both of economical and social rooms are necessary on farmers' side to accept the social responsibilities and securing proper income from proper production. It requires certain time, not in one day or with one order to realize sufficient surroundings.

5.1.5 Basic Concept of Watershed Management

(1) Suggestions for Watershed Management

1) Performing suitable projects related to livestock grazing and protection of forests/ranges with people participation and providing conditional ownership to people (e.g. long term (50 years) rent)
2) Performing agroforestry activities
3) Development of terracing in the sloppy areas
4) Use of excess water in winter for supplementary irrigation of dry farming gardens to increase the production and vegetation
5) Changing the less productive dryland into perennial fodder lands to prevent plouging each year
6) Change of irrigation methods, especially in sloppy areas
7) Converting the sloppy irrigated area to agroforestry to increase the vegetation
8) Control of watershed protection activities such s riprap dam, gabion dam, check-dams to control flood and increase water infiltration into underground aquifers.
9) Changing the traditional animal husbandry to decrease the livestock dependency to natural ranges
10) Study and research on the probability of aquifer recharge and decrease in floods in the Gharasu river basin.

(2) Strategies of Watershed Management

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

1) Modify the prevailing system of land use
2) To plan and execute the soil, water and agriculture projects through people participatory approach
3) To set proper rules and regulations for the use of resources in the watershed
4) To provide facilities for the investment of private sector in the watersheds
5) Preparation of study projects in the province basins
6) Consideration of sustainable development related to mountainous and sloppy areas
7) Enhancement of public knowledge about protecting the existing eco-system and covering the shortages caused by incorrect operation of natural resources
8) Increasing the people participation as the main basis of basin
9) Recognition and study on the area which are sensitive against erosion, land slide and flood.
10) 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.
11) More coordination between the executing organizations/institutions to achieve the integrated management of the basin.
12) Providing practical suggestions to optimize the use of dry lands
13) Performing the flood control plans, artificial recharge, groundwater aquifers, erosion control and dam basin sediment control.

(3) 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 lands, 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 programs to be carried out by the local population.

(4) Goals of the Watershed Management Department

The quantitative targets of the Kermanshah watershed management department are as follows:

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

The final goals are:

1) Creating a balance between the human and environment.
2) 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.
3) 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.

5.2 Initial Environmental Examination (IEE)

Initial Environmental Examination (IEE) is undertaken at the outset of the development project planning stage to determine the environmental impacts that may be created by the particular project based on existing data and information related to the particular project, and the comments and judgments of specialists who are familiar with the environmental impacts of past similar projects. IEE is the preliminary environmental review to assess whether Environmental Impact Assessment (EIA) is necessary or not for the development plan.

In general, IEE is carried out in a short term with the use of existing data and experience of similar projects. IEE for this Study is carried out together with the counterpart of Kermanshah Provincial Directorate of Environment and Kermanshah Jiahd-e-Agriculture Organization.

(1) Joint Screening and Scoping

Screening and scoping were conducted based on the information collected and discussion with the Kermanshah Provincial Directorate of Environment. Joint screening and scoping were undertaken together with the counterparts of the Environment and Agriculture and the checklists were prepared. Most of the environmental issues have positive environmental impacts because of the agricultural development of the area through the improvement of irrigation and drainage system. However, agricultural development also results in increased use of agricultural fertilizers and chemicals, which induce pollution in the river. Water quality is one of the most important environmental aspects, for which regular monitoring is necessary.

(2) Project Description and Site Description

In the project description, the outline and components of the proposed project including 1) project background, 2) general information such as objectives, executing agencies, beneficiaries and area of proposed project, 3) project components and scale are described. The major environmental aspects and impacts to be reviewed or assessed in the environmental consideration process can be preliminarily selected after clearly identifying the project components. The environmental conditions with particular significance in the Study Area are described in the site description. More detailed information is provided in Annex 6.

(3) Preliminary Assessment of Environmental Impacts

Based on the joint screening and scoping and in consideration of site description and project description and the project activities to be undertaken, the major environmental impacts to be assessed are as follows:

1) Water contamination and deterioration of water quality including eutrophication
2) Soil erosion, sedimentation and flooding
3) Soil contamination by agrochemicals
4) Influence on surface water hydrology
5) Influence of groundwater hydrology
6) Atmospheric Pollution
7) Health and sanitation

More detailed information is provided in Annex 6.

(4) Positive Impacts of the Project

The agriculture development through irrigation and drainage projects will have the following the significant positive effects in the Study Area and the region:

- Increased food production through the effective utilization of the wide area of the plain
- New economic activities through marketing and agriculture processing
- Expansion of employment opportunities of the local population
- Substantial improvement in way of life
- Reduction of inundation and flood by watershed management projects

In line with the Government policy of agriculture development of the region, the positive impacts due to the projects weigh much higher than the negative impacts to be caused by the

project. However, suitable monitoring and management system of environment is necessary for the sustainable development of the region.

(5) Necessity of Environmental Impact Assessment (EIA)

As per the regulations of Iran, EIA needs to be executed for the following projects related to irrigation and drainage and agriculture development.

- New irrigation/drainage project, which exceeds the size of 5,000 ha or more.
- Dam of more than 15m high with area more than 400 ha area
- Man-made lake with area more than 400 ha area

If Kilanbar or Gharab dam Plans will be selected, then EIA should be conducted, since the proposed dam heights are higher than the EIA standard height of 15 m.

5.3 Selection of the Priority Area and the Feasibility Study

Based on the agricultural development plan of Kermanshah Province and the results of the field survey including irrigation and drainage plan and agricultural development plan, the sites for feasibility studies are nominated.

As stated in the previous chapter, the existing problems and the potentials for the development of the Study Area were reconfirmed. Based on the results, the items for the study are selected such that the results of the study and the plan in the area for feasibility study can be applicable to the whole Study Area. The matters concerning with overall agricultural policy in Iran, such as food safety, agricultural credit and subsidy systems, have been excluded taking into account of the characteristics and purpose of the Study into account. These matters shall be studied by another study.

As described in the Chapter 4, basic concepts of the agricultural development for the Study Area are formulated. Based on these development concepts, the required activities for the agricultural development of the Study Area are discussed below.

5.3.1 Required Activities in the Study Area

Based on the identified problems faced by the farmers through the Phase I field survey, the countermeasures to solve problems were studied, and potentials of agricultural development were confirmed. Required activities for the improvement and development of agricultural development in the Study Area are proposed as follows:

- Agriculture development

  A-1: Introduction of crop rotation
  A-2: Integrated farming
  A-3: Improvement of mechanized farming
  A-4: Rangeland rehabilitation for livestock development
  A-5: Tree crop development on the mountain spring area
  A-6: Strengthening the extension service system
  A-7: Formulation of Rural Producers Cooperatives

- Irrigation and drainage development

  W-1: Improvement on-farm irrigation system of Ravansar Irrigation Scheme
  W-2: Improvement of water management of Ravansar Irrigation Scheme
  W-3: Gharab dam irrigation scheme
  W-4: Kilanbar dam irrigation scheme
  W-5: Improvement of groundwater irrigation
  W-6: Improvement of drainage system

- Rural infrastructure development

  R-1: Improvement of rural road network
  R-2: Improvement of rural water supply system
  R-3: Improvement of rural sanitation and sewage system

The detailed scope of programs is shown in Table 5.3.1. These activities, either individually or combined to a scheme, will be the candidates for the further study in the Phase II of the Study.

5.3.2 Candidate Schemes for the Further Study

(1) Improvement Ravansar Irrigation Scheme (Site 1)

Ravansar irrigation scheme was implemented in 1956 by the Ministry of Energy (MOE) to irrigate Ravansar spring water diverting by headworks/weir in the Gharasu River in the Ravansar city to the right and left banks of the Gharasu River. Original main canals on both banks are deteriorated and the right bank main canal was reinstalled along the old main canal in 1998. Canal lining is not completed, while the concrete lining has already broken partially, it might be caused by the poor quality control of the construction. On the left bank old main canal is non-lining canal, they are seriously damaged the bank by bank erosion and poor maintenance. Therefore, MOE started reinstallation of main canal almost along the old canal recently, and it is under construction in the Study Area.

Irrigation command areas of both bank schemes have similar problems on the incomplete on-farm level irrigation system not only physical but also operation and maintenance. Conflicts on the water distribution of irrigation water occurred usually between the upstream and downstream area farmers. Farmers of upstream want irrigate water from canal more than requirement without appropriate volume and water users downstream.

Recently a water users association formulated in the Ravansar right bank scheme area by the Government guidance, mainly by MOE. But chairman of association expressed that he does not receive the guidance from the government field officials and could not fully understand function of WUA. They are on the final stage of registration under Ministry of Cooperatives.

Taking account of these situations, W-1 and W-2 shall be combined as necessary activities as mentioned above. In short, establishment plan of on-farm irrigation system and operation and maintenance plan of irrigation system by the water users' association will be examined based on the participation of farmers. The plan aims to improve farmers' income by the empowerment of farmers through the activity of the water users' association, the improvement of irrigation efficiency and the improvement of the agricultural productivity. Concrete main contents of the plan are assumed as follows:

- Drawing up the plan for the on-farm irrigation system
- Drawing up the water distribution plan based on the main irrigation canal will be rehabilitated and the proposed cropping pattern
- Drawing up the operation and management plan of the irrigation by the water users' association
- Drawing up the management manual of the Ravansar water organization office
- Setting up the water fee and improvement of it's collection system
- Extension activity of the irrigation technology for farmers

(2) Gharab and Kilanbar Dam Irrigation Scheme (Site 2)

Kilanbar and Gharab dam plans were studied and proposed by KJAO to KWO/MOE. Presently the investigation and design are prepared by KWO/MOE. This scheme is formulated by combining W-3 and W-4 mentioned above. Irrigation command area of both dam is considered to be the same area, and they are possible to consider one scheme. Both dam plans are still under investigation and design stage. In different with Ravansar irrigation scheme, this scheme is new irrigation scheme, therefore it is possible to introduce the participatory project implementation. Beneficiaries/farmers can be involved from the design stage upto operation and maintenance stage, and they can formulate the sense of ownership and belonging which can make the irrigation system sustainable under their participation of management of irrigation system. Differing with above Ravansar Irrigation plan, purposes of the plan are empowerment of farmers, improvement of agricultural productivity and farmers' income by the irrigation through the participation of farmers from the planning stage. Concrete main contents of the plan are assumed to be same as the Ravansar Irrigation Scheme, but including the new construction of irrigation and drainage system instead of the improvement.

(3) Improvement of Drainage System in Sanjabi Plain

The scheme area is rather flat with gentle undulation and occasionally cultivation field is inundated by flood. Especially, within the upstream/western area occasionally ponded with runoff from western mountains and interrupted the drain by the recently upgraded provincial road. KJAO constructed the 47km long drainage canal system at the southern area of Site 2 recently. They are constructed earth canal and many road crossing culverts were constructed. Previous works constructed main and secondary drains, tertiary and quaternary drains are not completed. And constructed road crossing culverts are already plugged by sedimentation caused by the poor maintenance. These facilities shall be rehabilitated and maintenance system shall be formulated. The main scopes and objectives of the scheme are as described as follows:

- Formulate on-farm drainage system including the tile drainage in the field
- Formulate the drainage system maintenance plan to be conducted by beneficiaries
- Rehabilitation of existing main and secondary drains and road crossing facilities

(4) Empowerment of Farmers through the Formulation of Rural Producers Cooperative

Farmers cannot purchase timely the farm materials at rural cooperative organization (RCO). Furthermore, when farmers purchase the shortage in private shop, as the quantity of subsidized materials is short, the prices of materials of private shop are very high.

Cooperatives have many merits, such as decreasing of cost by purchasing jointly of agricultural inputs, increasing of income by selling jointly of products, promotion of development of infrastructure including irrigation, drain, field, etc., education and training, mechanization, etc. Many problems, as mentioned in section 4.2.3, could be lightened by activities of the rural production cooperatives (RPCs). Therefore, it is required to organize of the rural production cooperatives by farmers themselves.

The main scopes of the scheme are as described as follows:

- Extension activity of the Rural Production Cooperative (RPC)
- Study to the advanced RPC and training among farmers (FTF)
- Establishment of the RPC at a village unit by farmers' own initiative
- Formal registration and trial of management
- Periodical monitoring and evaluation
- Expansion of the RPC to the Study Area and formulation of a RPC union
- Execution of the sustainable education and training

(5) Integrated Agricultural Development Program

This program combined with A-1, A-2, A-5 to a scheme. Basic pattern of crop rotation should be established in a short-term plan, and it should be extended and penetrated in a middle-term plan. The crop rotation would be fixed in a long-term plan. The basic pattern of the crop rotation includes annual grass besides wheat and chick pea in the rain-fed lands, and wheat and maize or sunflower in the irrigated lands in order to increase organic matter of soil. This intends to physical improvement of heavy textured soil in this area and saving chemical fertilizer and pesticide.

Integrated farming with livestock farming needs to be established through introducing pasture plants into a crop rotation, and establishment and extension of the method of making silage and hay of grass in order to use them in dry season. Moreover, local breed cows, which farmers raise generally at present, should be changed to hybrid with *Holstein*, which is higher in milk yield than local breed, but is required the cow shed to manage more hygienically, and medical examination by veterinarians several times a year.

At sloping lands in the upper reaches of the rivers or canals, which run always throughout the year, or around the mountain springs, the integrated farming of cultivation of rose for scent or some fruit trees with fisheries is recommendable. Water is used to fish culture of cold water fishes in case of spring water, and of warm water fishes in case of rivers' water. The waste water is irrigated to roses or fruit trees. The rose scent is extracted from peddles of roses in the processing factory, which is under construction in Ravansar.

The main scopes of the scheme are as described as follows:

- Studies the present conditions in each agricultural zone in the Study Area
- Study the appropriate and beneficial cropping and breeding plan
- Study the implementation program of the demonstration scheme
- Recommend the permissible integrated agriculture in the Study Area
- Implementation after required preparatory works including extension activities, financial arrangement and credit arrangement of credit under the support of KJAO.

(6) Strengthening the Extension System

The severe problems of the extension system are shortage of staff, shortage of cars, low quality and quantity of facilities. The staffs are busy due to approving farmers' purchasing of subsidized agricultural chemicals. The Center recommend farmers to use agricultural chemicals and farmers can buy them at cooperatives and shops at low price. So, the farmers rush to the Center and the staffs are very busy with this practice. This work should be transferred to private sector. It is necessary to do training of new technologies, such as plastic green house, irrigation and irrigation management for staff and farmers.

The main scopes of the scheme are as described as follows:

- Review the present extension system including physical and human resources
- Determine the proper number of staff, equipment, facilities and vehicles
- Prepare the required training materials and conduct training
- Study the required demonstration farm and new technology trial
- Study the out sourcing for the reduce the load of extension offices
- Monitoring and evaluation on activities and financial status by RPC members and external auditors.

(7) Other Activities

Other activities such as W-5: groundwater development and activities of the rural infrastructure development (R-1 to R-3), mentioned in the section 5.3.2, shall be implemented as a component of above programs.

5.3.3 Selection of Priority Area for the Development

(1) Conditions for the Selection

The study in the priority area for the development is to confirm the feasibility of items which composes the plan in accordance with the basic policy of the agricultural development in the Study Area. The priority area will be selected taking following items as well as some good results can be expected for the whole Study Area and the study can be applicable besides the Study Area into account.

Conditions for the Selection of the Priority Areas

Items	The approach for the order of priority on each items
To be model	Enable to apply the similar methods to other areas.
Easy to operate	Farmer's assistance agencies do not need high technology and ability for assisting farmers.
Advantages of the scheme	Higher sustainability and profitable.
Practicability	The projects that implementing agencies can carry out easily and the farmers can accept easily.
Social issue	There shall be no serious social problems in the project area.
Sustainability	Natural environment will not be deteriorated.
Motivation of farmers	There are appropriate leaders in farmers' groups and motivation to be improved.
Validity of the study	Some good results which are possible to be realized since before the implementation through the execution of the study.

(2) Evaluation of Candidate Schemes and Selection of Priority Area

Candidate schemes can be divided as follows; 1) irrigation and drainage improvement program which is a scheme by the agricultural zone in the Study Area, 2) related program with agriculture against the whole Study Area. Therefore, the priority of candidate schemes shall be examined on each candidate scheme in the respective agricultural zone. The feasibility study on three agricultural development program will be carried out in the selected area. The results of examination on the priority of candidate schemes based on conditions for the selection mentioned above, is as following table.

Selection of Priority Areas and Programs

		Agricultural Infrastructure Plan			Agricultural Development Plan		
Items		Improvement Scheme of On-farm Facilities and Water Management in the Ravansar Irrigation Area	Gharab and Kilanbar Dam Irrigation Scheme	Improvement Scheme of Drainage System in Sanjabi Plain	Formulation of RPC	Integrated Agriculture Development Program	Strengthening Program of the Agricultural Extension System
Conditions for the Selection	To be model	◎	◎	◎	◎	◎	◎
	Easy to operate	◎	○	◎	○	○	○
	Advantages of the scheme	◎	○	△	◎	◎	○
	Practicability	◎	○	◎	◎	◎	◎
	Social issue	○	△	◎	◎	◎	◎
	Sustainability	◎	○	◎	◎	◎	◎
	Motivation of farmers	◎	○	○	○	○	◎
	Validity of the study	◎	△	◎	◎	◎	◎
Overall Decision		◎	△	○	◎	◎	◎

Remarks; ◎: Very well, ○: Well, △: Including some problem

1) Improvement Scheme of On-farm Facilities and Water Management in the Ravansar Irrigation Area

The scheme is the reconstruction project of the existing irrigation system. A part of main canal has been constructed. Therefore, the initial investment can be kept as well as since the ostensible water users' association to manage the irrigation system has been organized, easy to operation, advantages of the schemes and sustainability are high. In the Phase I Study, the strong dissatisfaction against the monopoly of the irrigation water at upstream has been confirmed from farmers in downstream of the irrigation canal. While, the construction of new main irrigation canal has been completed, but there is no plan to establish the secondary and other canals for the whole target area. Therefore, farmers expect that enough irrigation water will be supplied in early stage. If establishment of secondary canal and other on-farm facilities based on the participation of farmers and establishment of proper water distribution system by the water users' association can be carried out, it can be judged that establishment of on-farm irrigation system will be easier and operation and maintenance of the facilities after completion of construction works, by the water users' association themselves will be available. While, the participatory irrigation system establishment method which will be employed in the Study, can be applied to the Kilanbar and Gharab dam irrigation schemes and the management of irrigation system by the water users' association in the area will be a model as a pioneering example.

2) Gharab and Kilanbar Dam Irrigation Schemes

The scheme is new irrigation projects. The panning and survey of dams are carried out by the MOE at present. The proposed site of the Kilanbar dam which has been presented by KJAO at beginning period, was moved to upstream of the river by the MOE. Suitable foundation treatment have to be examined for both dam sites, because both dams are located on the foundation with an active fault and caves. As stated in Chapter 3, both dam irrigation schemes aim to reserve the surface water during winter season and use the reserved water for irrigation water during spring and summer season. However, it is assumed that efficient water reservation will be difficult because of high evaporation rate and leakages from foundation. In consideration of such uncertain elements at the moment, it can be said that advantages of the scheme, easy to operate and practicability of the scheme are lower than the Ravansar irrigation area. While, preparation works for the compensation for the submergence due to construction of the Kilanbar dam and the Environmental Impact Assessment have not been started. So, there are environmental and social uncertain elements. Since the scheme is new irrigation project in semi-arid are, high economic impact can be expected compared with rain-fed agriculture.

3) Improvement Scheme of Drainage System in Sanjabi Plain

The project site is located at lowland plain along the downstream of the river which is located at southern part of the Study Area. So, inundate damage of the winter wheat has occurred often due to the surface water caused by the thawing at some area. While, 43 km of main drainage canals has been excavated by the KJAO in the area in order to prevent inundate damage at western part of the project area caused by the construction of road connection between Kuzaran and Javanrood. The main drainage has been excavated, but secondary and tertiary drainage canals are not excavated. So, some problems still remain such as shortage of drainage capacity due to lack of number and capacity of road crossing culvert. It can be considered that existing main drainage do not function sufficiently. Inundate damage has not been seen recently because of draught, but farmers expect establishment of on-farm drainage and reconsideration of main drainage canals. Under cooperation with farmers on the construction and land acquisition, main work will be connection between on-farm drainage and main drainage. So, initial investment will be relatively low, but expected benefit shall be low and the advantage of the scheme is low. Planning and execution of on-farm drainage improvement including underdrain is effective for the area which is covered by heavy clay.

4) Agricultural Development Plan

The target of the agricultural development plan consist of formulation of RPC, integrated agriculture development program as well as strengthening program of the agricultural extension system is the whole Study Area. The plan should be examined as the basic component of above three schemes. The RPC which is the basis of the agricultural development and activities of the water users' association in order to manage the irrigation system, is important element for all of three schemes. Since the agricultural development is not realized by present farmers' ability without sufficient extension activities of the extension worker which will be an information source in order to strengthen the agricultural productivities form the outside. Therefore, improvement of agricultural extension system is also essential item for the agricultural development in the region. The crop farming and the

animal husbandry are closely connected with each other in the field of the agriculture in Iran. So, the combination between crop farming which profitability is low and animal husbandry which profitability is high, is effective even for the are where natural source is relatively abundant such as the Study Area.

(3) Selection of Priority Area for the Development

The priority area, where the feasibility study shall be carried out, is the Ravansar irrigation area as mentioned above. The study on the agricultural development, which establishment of on-farm irrigation system and strengthening of management system will take leading parts, will be carried out in the Study Area.

The definition of the areas, herein after mentioned is as follows:

The Study Area is defined in the Scope of Works (S/W) and divided into two parts, Site 1 with 4,500 ha and Site 2 with 9,500 ha, with a total coverage is 14,000 ha as shown in the figure of the Study Area.

The Priority Area of Ravansar Irrigation System is defined as the irrigation command area of the system that includes Site 1 and the area between the Site 1 and 2 and estimated 2,254 ha.

The Target Area of the Agricultural Development is defined the area to be cultivated by farmers living in villages within the Study Area for the farm management of the individual farm household, and it is estimated totally 16,511 ha which is consisted of 6,684 ha and 9,827 ha in Site 1 and Site 2, respectively.

5.3.4 Contents of the Feasibility Study in the Priority Area for the Development

The feasibility study which establishment of irrigation system, strengthening of management system and agricultural development plan take leading parts, shall be carried out in the selected Ravansar irrigation area. Major study contents of the feasibility study are summarized as follows;

(1) Establishment of the On-farm Irrigation System and Strengthening of Management System in the Ravansar Irrigation Area

1) Clarification of water utilization plan (Available intake volume, Clarification of responsible release volume for the downstream etc., Reconsideration of the irrigation period, Determination of the proposed cropping pattern, Reexamination of the irrigable area of each canal)
2) Establishment of irrigation canal network (Collection of topographical survey data, Collection of the data on the design or executed results of main and secondary canals, Confirmation on adjustment between the overall plan and the on-farm irrigation canal plan, Determination of the proper irrigation method and water volume, Determination of the on-farm irrigation facility plan, Planning of the on-farm irrigation canal network, Estimation of the construction cost, Introduction of the necessary quality control items)
3) Establishment of farmroad and drainage networks (Determination of the design criteria, Drawing up the road and drainage improvement plan in line with the irrigation canal network, Estimation of the construction cost)

4) Strengthening or establishment of water users' association (Grasping of the existing structure of water users' association, Examination of the structure of the association, Determination of proper water distribution rules, Establishment of the effective water management system, Establishment of the leading system for management of the association)
5) Provision of education and training to farmers (Strengthening of the education and training system, Examination of the education and training program, Procurement plan of facilities and equipment for the education and training)
6) Establishment of operation and maintenance system (Identification of the O&M organization, Confirmation of the necessary O&M items, Determination of O&M rules, Establishment of the leading system for management of the organization)
7) Economic evaluation

(2) Formulation of Rural Production Cooperative (RPC) and Operation and Management Plan

1) Investigation of the Advanced RPC and WUA (Case Study)

- The progress until formulation (Advice of the government, Gathering of farmers' intension, Procedures until establishment)
- Contents of the governmental assist (All items)
- Preparation of funds
- The articles of an association and the structure of the cooperative
- Activities of the internal affairs of the cooperative (WUA, Mechanized cooperative, Drying and preparing unit, Distribution and procurement of the materials, Processing unit, Collection and disinfecting of the milk etc.)
- Kinds and procedures to introduce the possessed facilities and machinery
- Situation of the O&M on the cooperative (Financial affairs, Marketing research and distribution, Talent, Education of the extension, Problems of women, Improvement of the life etc.)
- Situation of the O&M on the facilities and machinery of the cooperative
- Problems and solution method

2) Drawing up the production plan on agriculture, animal husbandry, fishery respectively in the area where covered by the RPC (in the Priority Area)

- Data collection on each Deh (Irrigation area of the summer crop and winter crop respectively based on the irrigation plan, Number of farmers and area of every farming scale, Number of farmers and area of irrigated and rain-fed respectively, Number ,force power and model of the possessed machinery, Water use practice – If there is an association, the articles of an association and situation of the O&M)
- Potential of the Production on the orchard based on topographic and slope (Area) and the location
- Potential of the Production on the bee-keeping
- Potential of the fishery based on estimation of the water source and water volume (Area) and the location
- Potential of the production on the sheep and cattle (Hybrid)
- Introduction plan of vegetables for the small scale farming (less than 5ha)

- Examination of the availability on the crop production excluding basic cropping pattern for more than middle scale farming (Sugar beet, Processed Tomato, Sun flower, Rape seed etc. including examination of processing factory)
- Farm economy and intension survey
- Drawing up and evaluation of the agricultural production plan for whole area – Drawing up the agricultural production plan (draft) (Administration, Organization in charge of the extension and farmers' intension)

3) Formulation of RPC and drawing up the O&M plan

- Structural plan (Mechanized cooperative, Drying and preparing unit, Distribution and procurement of the materials, Processing unit, Collection and disinfecting of the milk etc.)
- Financial plan
- O&M plan of the organization
- Construction plan of post-harvest facilities and others
- O&M plan of the mechanized cooperative
- O&M plan of facilities
- Financial management plan
- Extension and education plan on improvement of the farming and life

4) Confirmation of the intension on the draft plan of the government, the organization in charge of the extension and farmers.

(3) Integrated Agriculture Development Plan

The integrated agriculture development plan consists of combination between crop farming and animal husbandry in the whole Study Area. Following items will be examined.

1) Irrigation area of summer crop and winter crop respectively based on the irrigation plan
2) Potential of the Production on the orchard based on topographic and slope (Area) and the location
3) Potential of the Production on the bee-keeping
4) Potential of the fishery based on estimation of the water source and water volume (Area) and the location
5) Potential of the production on the sheep and cattle (Hybrid)
6) Number of farmers and area of each farming scale, irrigated and rain-fed respectively
7) Introduction plan of vegetables for the small scale farming (less than 5ha)
8) Examination of the availability on the crop production excluding basic cropping pattern for more than middle scale farming (Sugar beet, Processed Tomato, Sun flower, Rape seed etc.)
9) Drawing up and evaluation of the agricultural production plan for whole area

(4) Strengthening Program of the Agricultural Extension System

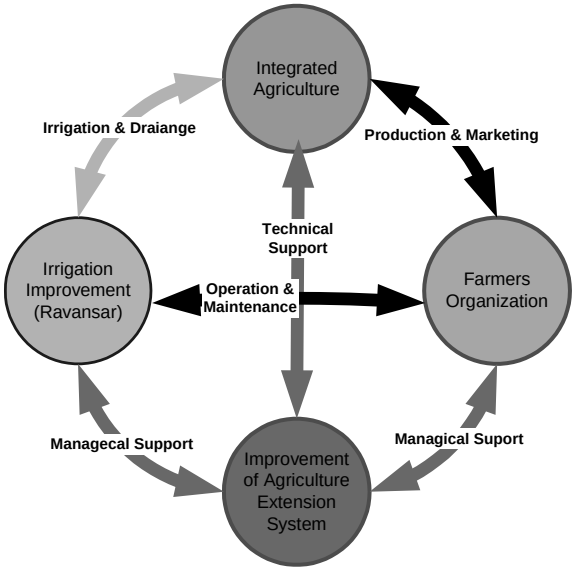
The strengthening plan of the extension for Kermanshah province and the Study Area shall be studied and examined taking farmers' intension in the Study Area into account. Items for the examination are following four points;

1) Strengthening of the organization (Agricultural products, Improvement of life,

Problems of women)
2) Strengthening of talent
3) Improvement of facilities
4) Procurement of the extension facilities and equipments

(5) Linkages among the Selected Scheme and Programs

1) Relationship and Synergetic Effect



Although each of the above selected development program is independent by itself, there is a strong relationship and significant synergetic effect between each other. For example, the success of the cropping pattern proposed in the integrated agricultural development program depends on the irrigation water supply from improvement of the Ravansar irrigation scheme and on-farm water management system in Site 1. Similarly the implementation of integrated agricultural development is possible only through the effective participation of farmers through the development of farmers organization and the techniques of the integrated agricultural development can be disseminated to the farmers through the improvement program of agricultural extension system.

Similarly on-farm water management system and operation and maintenance (O&M) system of facilities will be improved and proper water distribution will be possible through the effective functioning of farmers organization (WUC).

2) Focusing on the Whole Farming Community in the Study Area

While the above mentioned programs aim at increasing individual farm household income, it also focuses on the whole farming community in the Study Area through the programs such as Farmers Organization Development Program and Improvement Program of the Agricultural Extension System. The imbalance of irrigation water received between the upstream side and the downstream side can be solved through the Improvement of Ravansar Irrigation Scheme and On-farm Water Management System and Farmers Organization Development Program.

Table 5.1.1 Matrix of Agriculture, Animal Husbandry and Agriculture Support Services

	Problems and their Backgrounds					Potentials		Basic Concepts
	Existing Problems		Their Backgrounds					
Farming/Cultivation	a	Difference of the farmers' land holding area has been occurred through twice land reform.	a1	Average land distribution are of the first land reform was around 10 ha. On the other hand, the average area of second land reform was 4 ha. So, the second one is very	a1-1	It can be coped with drawing up the farming plan for the small scale land owner		A. Clarification of Available Water Source
	b	Rainfed irrigation area is a lot.	b1	The water source of irrigation is limited.	b1-1	If the winter crops in the rainfed area can be irrigated in April and May, the yields will increase and the production can be stabilized.		
	c	The crop rotations are simple such as "wheat - maize" in irrigated area, "wheat - chick pea" in	c1	The introduction of other crops is not spread.	c1-1	The agricultural income will be raised by the introduction of the integrated farming based on the right crop for right land.		H. Improvement of field condition
	d	There are many puddles in the fields of the Site in winter and spring.	d1	Lack of land leveling.	d1-1	It will be improved by execution of land leveling and establishment of the drainage.		
	e	The yields of cultivated crops are low.	e1	Farmers depend on the rainfed irrigation.	e1-1	If the winter crops in the rainfed area can be irrigated in April and May, the yields will increase and the production can be stabilized.		
	f	Shallower tillage and imperfect harrowing etc.	f1	The corner-cutting of contractors.	f1-1	The suitable size of machinery can be introduced through establishment of the RPC.		K. Establishment of RPC
			f2	The contractor would not like to work in other farmers land because the machine will be damaged due to heavy textured soil.	f2-1	The suitable size of machinery can be introduced through establishment of the RPC.		
	g	The soil is not fertile in the Study Area..	g1	The quantity of soil organic matter in the Study Area is very low.	g1-1	The soil improvement will be promoted by the crop rotation with annual pasture.		
			g2	Micro-element of Zn is not supplied.	g2-1	It can be solved by supplying the micro-element of Zn.		
	h	The rate of mechanization cost out of total production cost is very high.	h1	The number of machines is short and rental cost is very high.	h1-1	The suitable size of machinery can be introduced through establishment of the RPC.		
	i	Farmers cannot purchase the farm materials timely.	i1	The distribution period of RCO is not suitable.	i1-1	It can be purchased in cooperation after establishment of the RPC.		
	j	High moisture contents of maize grain during shipping period.	j1	The sowing is delayed due to the puddles and the ripening of succeeding crops is shortage.	j1-1	Suitable variety and farming technology can be introduced by the agricultural extension center.		L. Establishment of Compound Agricultural Management
	k	The number of tractors and combines are short in Site.	k1	MOJA allots new tractors of 75 PS to each province, however, the tractors are not suitable to heavy textured soil.	k1-1	It can be solved by allocation of the tractors of more than 100 PS which is suitable to heavy textured soil.		
			k2	It is hard to obtain the machinery even though farmers applied the machinery to MOJA.	k2-1	It can be coped with doing quick office work by MOJA.		
			k3	The contractor would not like to work in other farmers land because the machine will be damaged due to heavy textured soil.	k3-1	The suitable size of machinery can be introduced through establishment of the RPC.		
			k4	There is no repair shop in the Site.	k4-1	It can be solved by establishment of repair department of RPC.		
Animal Husbandry	l	The productivity of animal husbandry is low.	l1	Local breed is usually raised in the Site.	l1-1	It can be solved by introduction of high breed variety.		M. Strengthening of the Extension System
			l2	Shortage of high quality roughage.	l2-1	High quality roughage can be ready by the introduction of the cropping pattern with high quality grass.		
Agricultural Support	m	Farmers cannot receive the financing easily.	m1	It is very high that the yearly interest rate is 24 %.	m1-1	It can be solved by ensuring the credit with low interest.		
			m2	Farmers cannot correspond the procedure due to complicated procedures in bank and severe conditions.	m2-1	Every farmers can be gained the credit by the simplifying the procedure.		
	n	The agricultural extension activities is not carried out effectively.	n1	Shortage of staffs.	n1-1	It can be solved by strengthen of the agricultural extension service.		
			n2	Shortage of cars.	n2-1	It can be solved by strengthen of the agricultural extension service.		
			n3	Low quality and quantity of facilities.	n3-1	It can be solved by strengthen of the agricultural extension service.		N. Expansion of the Agricultural Credit and Government Subsidies Systems
			n4	The staffs are busy due to approving farmers' purchasing of subsidized agricultural chemicals and fertilizers. So, There is not time to carry out their normal works.	n4-1	It can be lightened by the consignment of distribution works of subsidized agricultural chemicals and fertilizers to private sector.		
			n5	The staffs do not have enough technologies.	n5-1	It can be solved by the education and training concerning with new technology of staffs.		
	o	The inland fishery is not spread.	o1	Farmers are not interesting against fishery.	o1-1	Farmers' interest can be awakened by strengthen of agricultural extension activity.		
	p	The price of crops without guarantee price of the government, is low.	p1	Farmers do not knows suitable period for sawing.	p1-1	It can be solved by extension of the proper farming technology.		
			p2	There is not storage to store the agricultural products.	p2-1	It can be solved by establishment of common facilities of the RPC.		
			p3	Fair trade of the agricultural products cannot be executed due to low quality of the products.	p3-1	It can be solved by extension of the proper farming technology.		
			p4	It is not clear what kind of crop failures is covered by the insurance of the Agricultural Bank.	p4-1	It can be solved by clarifying the limitation of guarantee and conditions.		

Table 5.1.2 Matrix of Water Resources, Irrigation & Drainage

		Problems and their Backgrounds					Basic Concepts	Items should be considered in the Study
		Existing Problems		Their Backgrounds		Potentials		
Water Resources Related Issues	Overall	a	Surface water is scarce for irrigation.	a1	Discharge of the Gharasu River remarkably reduces in the dry season.	a1-1 It can be coped with reserving the discharge during the rainy season in the dam.	A Clarification of available water source	Examination of available water volume of each water source and availability of its supply
				a2	The water flow cannot be seen at some parts of the Gharab River and Kilanbar River especially during the dry season.	a2-1 It can be coped with reserving the discharge during the rainy season in the dam.		Reconsideration of available irrigation area of each facility
		b	Discharge of spring water is unbalanced.	b1	Spring water volume in the dry season become around one third of the volume in the rainy season.	b1-1 It can be coped with reserving the spring water during the rainy season in the dam.		Examination of availability of new water sources
		c	The groundwater level has been declining recently.	c1	Excess pumping in and around the area causes the decline of groundwater level, in addition to the recent draught.	c1-1 It can be solved by control of groundwater pumping volume.		Review of irrigation period
				c2	Deforestation and reclamation of farmland cause decreases of the aquifer charging of the basin.	c1-2 It can be solved by precise grasping of existing groundwater use.		Determination of a planned cropping pattern
				c3	Proper guidance and control of the groundwater intake for water users have not been carried out by the ministries concerned .	c2-1 Aquifer charging of the groundwater can be promoted by making the outflow phenomenon of the basin inactive.	B Establishment of water users' association	Composition of the association
						c3-1 It can be solved by strengthening of mutual understanding and cooperation among the ministries concerned.		Grasping of the existing association's composition
		d	The irrigation scheme is executing without a comprehensive water resource utilization plan.	f1	The exact situation of demand and supply balance has not been grasped in the area, and the comprehensive distribution plan for the future has not been carried out.	f1-1 It can be solved by precise grasping of existing situation of water resources in the area.		Proper rules on water distribution
				f2	Effective cooperation among the ministries concerned on the main issues has not been carried out.	f2-1 It can be solved by precise grasping of existing situation of water resources in the area.		Effective water management system
Irrigation and Drainage Related Issues	Drainage System in Sanjabi Plain	e	Hindrance to growth is occurred due to poor drainage.	e1	The area is covered by heavy soil.	e1-1 It can be coped with the installation of the farm drainage, and underground drainage if necessary.		Establishment and strengthening of the guidance system
				e2	The secondary and tertiary drainage canal network has not been established.	e2-1 It can be solved by establishment of the secondary and tertiary drainage canal network.	C Provision of education and training to farmers	Strengthening of training and guidance system
				e3	Land leveling and farm drainage are not enough	e3-1 It can be solved by installation of the farm drainage and land leveling.		Grasping of proper irrigation method and irrigation water
		f	Inundation problem has been occurred at the west side of the main regional road.	f1	Number and capacity of the main regional road crossing culvert are not enough.	f1-1 It can be solved by securing enough capacity of the main regional road crossing culvert.		Education and training program
	Ravansar Right Bank Irrigation Canal	g	Beneficial area has been reduced.	g1	Water source has been changed to groundwater because irrigation water from the canal had not	g1-1 ?		Expansion of the equipment for the training
		h	Some of the existing facilities have collapsed.	h1	Concrete facilities have collapsed due to lack of quality control.	h1-1 The function can be recovered by rehabilitation of existing facilities under proper quality control.	D Establishment of irrigation canals	Obtaining of topographical survey data
		i	The farmers in the downstream area cannot receive irrigation water.	i1	The farmers in the upstream area use all of the irrigation water because irrigation water is not distributed properly.	i1-1 Water users' association should be established and it will carry out proper water distribution based on the decided rule.		Obtaining of the design data on main and secondary canals
				i2	Farmer do not have the knowledge of proper water use.	i2-1 Education and training to the farmers on the proper irrigation method and suitable water requirement will be provided.		Confirmation of the consistency between the overall plan and the field ditch plan
		j	The design discharge has not been observed.	j1	The spring volume of the Ravansar Spring is shortage.	j1-1 It can be solved by precise grasping of the available water source and examining the available intake water.		Determination of a proper irrigation method and irrigation water volume
				j2	The perpon in charge of water distribution do not know the design discharge.	j2-1 It can be solved by education of the person in charge of water distribution and execution of proper water distribution.		Determination of the field ditch design
	New Ravansar Left Bank Irrigation Canal	k	Irrigation efficiency is low.	k1	Proper irrigation has not been executed.	k1-1 Education and training to the farmers on the proper irrigation method and suitable water requirement will be provided.		Determination of the field irrigation ditch network design
				k2	Proper water distribution has not been carried out.	k2-1 Water users' association should be established and it will carry out proper water distribution based on the decided rule.		Proposal on the items of construction quality control
		l	The project is planned stage by stage.	l1	Each canal is not designed based on the comprehensive plan of the scheme.	l1-1 Consistent facilities in line with the overall plan can be constructed, if each facility can be designed based on the overall plan of the project.	E Establishment of O&M system	Clarification of O&M organization
				l2	There is not good relation among the ministries concerned.	l2-1 Main facility and on-farm facility can be corresponded by strengthening of mutual understanding and cooperation among the ministries concerned.		Confirmation of the necessary contents of O&M
		m	The farmers in the downstream area cannot receive irrigation water.	m1	The farmers in the upstream area use all of the irrigation water because irrigation water is not distributed properly.	m1-1 Water users' association should be established and it will carry out proper water distribution based on the decided rule.		Composition of the association
				m2	Farmers do not have the knowledge of proper water use.	m2-1 Education and training to the farmers on the proper irrigation method and suitable water requirement will be provided.		Clarification of O&M rules
		n	The design discharge has not been observed.	n1	The spring volume of the Ravansar Spring is shortage.	n1-1 It can be solved by precise grasping of the available water source and examining the available intake water.		Establishment and strengthening of the guidance system
				n2	The perpon in charge of water distribution do not know the design discharge.	n2-1 It can be solved by education of the person in charge of water distribution and execution of proper water distribution.	F Integration of wells	Grasping of the pumping capacity of the existing wells
		o	The canals are installed at the extremely lower area than the surrounding farmland, and the excavation volume is much.		The topographic conditions has not been grasped precisely during canal rute selection study.	o1-1 Digging volume and canal section can remain in the almost existing condition through rehabilitation of old drainage canals.		Selection of the available wells
		p	Some cracks can be seen at lining canal.	p1	Concrete facilities has collapsed due to lack of quality control during the construction period.	p1-1 The function can be recovered by rehabilitation of existing facilities under proper quality control.		Clarification of available irrigation area of each well
	Proposed Irrigation Schemes	q	Availability of the proposed dam cannot be clarified.	q1	There are not the observation records of rainfall and discharge at the proposed dam site.	q1-1 Observation of rainfall and discharge at the proposed dam site should be immediately started.		Establishment of a facility improvement plan for using wells in the integrative way
		r	Flood discharge is designed at 1,000 possibility years, but the existing river does not have the capacity against it.	r1	Drainage capacity of the downstream river has not been examined.	r1-1 It can be solved by taking a proper measure through conducting profile and cross leveling of the downstream river and examining discharge capacity.		Clarification of a pumping volume control system
		s	Irrigation area of the dam is not clarified.	s1	Irrigation area has been examined, but location of actual irrigation area is not decided.	s1-1 Main facility and on-farm facility can be corresponded by strengthening of mutual understanding and cooperation among the ministries concerned.	G Establishment of a drainage network	Obtaining of topographical survey data
				s2	There is not good relation among the ministries concerned.	s2-1 It can be solved by strengthening of mutual understanding and cooperation among the ministries concerned.		Conducting profile and cross leveling of the river and a main irrigation canal
	Groundwater Irrigation	t	Many wells are newly dug.	t1	Shallow wells have dried up at the upstream area.	t1-1 Aquifer charging of the groundwater can be promoted by making the outflow phenomenon of the basin inactive.		Clarification of drainage capacity of main drainage river and canal
				t2	There are not the other suitable water sources.	t1-2 It can be solved by control of groundwater pumping volume.		Determination of design criteria
						t1-3 It can be solved by precise grasping of existing groundwater use.		Determination of the design on filed facilities
		u	Irrigation efficiency is low.	u1	Irrigation canals from wells are not lined with concrete.	u1-1 It can be solved by lining irrigation canals.		Design on field drainage network
				u2	Water distribution efficiency is low due to lack of land leveling.	u2-1 It can be solved by land leveling and reclamation.		Criteria on construction quality control items
	Others	v	Proper O&M organization has not been established.	v1	Guidance from the ministries concerned is not sufficient.	v1-1 It can be solved by strengthening the guidance system.	H Improvement of field condition	Clarification of the necessary improvement items by region
				v2	Farmers lack autonomy and depend on the government for all.	v2-1 It can be solved by clarifying the O&M system.		Determination of design criteria
						v2-2 Proper rules on O&M should be determined.		Establishment of the improvement plan corresponding to farm roads and irrigation and drainage canals
							I Strengthening of mutual understanding and cooperation among the ministries concerned	
							J Basin management	

Table 5.1.3 Agricultural Development Plan (1/2)

Project	Necessary Improvement Plan	Items to be clarified	Expected Outputs	Expected Period		
				Short term (within 5 years)	Middle term (6 to 10 years)	Long term (11 to 15 years)
Improvement of Ravansar Irrigation Scheme	A. Clarification of Available Water Source	・Clarification of available intake volume and the release volume for the downstream area	Available irrigation water volume in the area will be confirmed.	○		
		・Reconsideration of the irrigation period	The irrigation period will be extended.	○		
		・Determination of the proposed cropping pattern	Proper cropping pattern can be formulated.	Trial	Expansion	○
		・Reexamination on the irrigable area of each canal	Irrigable area of the scheme will be clarified.	○		
	B. Strengthening or Establishment of Water Users' Association(The plan is included in "Empowerment of Farmers through Formulation of Rural Production Cooperatives")(The plan is included in "Empowerment of Farmers through Formulation of Rural Production Cooperatives")	・Grasping of the existing structure of water users' association	Systematic problems will be clarified.	○		
		・Examination of the structure of the association	Proper structure of the association will be formulated.	○		
		・Determination of proper water distribution rules	Proper water distribution can be implemented.	Practice	○	
		・Establishment of the effective water management system	Proper water distribution rules will be maintained.	Practice	○	
		・Establishment of the leading system for management of the association	The problems of the association will be solved smoothly.	Establishment	Practice	○
	C. Provision of Education and Training to Farmers(The plan is included in "Strengthening of the Extension System")	・Strengthening of the education and training system	The organization in charge of the education and training for the farmers can execute the education and training.	Establishment	○	
		・Examination of the education and training program	Education and training will be implemented effectively.	○		
		・Procurement plan of facilities and equipment for the education and training	Education and training can be easily understood by the farmers.	○		
	D. Construction of Irrigation Canals	・Collection of topographical survey data	The existing topographical and cadastral conditions can be identified.	○		
		・Collection of the data on the design or executed results of main and secondary canals	The basic condition to design tertiary and on-farm canal networks will be clarified.	○		
		・Confirmation on adjustment between the overall plan and the on-farm irrigation canal plan	All facilities can be constructed under the consistent policy.	○		
		・Determination of the proper irrigation method and water volume	Proper irrigation method will be executed and the irrigable area will be expanded.	Practice	○	
		・Determination of the on-farm facility plan	Suitable scale and type of farm facilities will be constructed.	○		
		・Planning of the on-farm irrigation canal network	Proper irrigation network will be constructed.	○		
		・Introduction of the necessary quality control items	The constructed facilities will be used sustainably without any damages.	○		
	E. Establishment of Operation and Maintenance System(The plan is included in "Empowerment of Farmers through Formulation of Rural Production Cooperatives")	・Identification of the O&M organization	Person in-charge or organization will be clarified.	○		
		・Confirmation of the necessary O&M items	Activities of the O&M organization will be clarified.	○		
		・Determination of O&M rules	Proper O&M activities will be executed.	Practice	○	
		・Establishment of the leading system for management of the organization	The problems of the organization will be solved smoothly.	Establishment	Practice	○
	H. Planning of Farmroad and Drainage Networks	・Determination of the design criteria	Suitable scale and type of farm facilities will be constructed.	○		
		・Drawing up the road and drainage improvement plan in line with the irrigation canal network	A proper farm network will be established.	○		
Gharab and Kilanbar Dam Irrigation Schemes	B. Establishment of Water Users' Association(The plan is included in "Empowerment of Farmers through Formulation of Rural Production Cooperatives")	・Examination on the structure of the association	A proper organizational structure will be established.		○	
		・Determination of proper water distribution rules	Proper water distribution can be executed.		Introduction	Practice
		・Establishment of an effective water management system	Proper water distribution rules will be prepared.		Introduction	Practice
		・Establishment of the leading system for management of the association	The problems of the organization will be solved smoothly.		Establishment	Practice
	D. Construction of Irrigation Canals	・Execution of topographic survey	The existing topographical and cadastral conditions can be found.	○		
		・Procurement of the design on dam, main canal and secondary canals	The basic condition to design tertiary and on-farm canal networks will be clarified.		○	
		・Determination of the proposed cropping pattern	A proper cropping pattern can be established.		Trial	Expansion
		・Determination of the proper irrigation method and water volume	A proper irrigation method will be executed and water will be saved.		Introduction	Practice
		・Planning of the on-farm irrigation canal network	A proper irrigation network will be established.		Introduction	○
		・Introduction of necessary quality control items	The constructed facilities shall be used sustainably without any damages.		Introduction	○
	E. Establishment of Operation and Maintenance System(The plan is included in "Empowerment of Farmers through Formulation of Rural Production Cooperatives")	・Identification of the O&M organization	Person in-charge or organization will be clarified.	○		
		・Confirmation of necessary O&M items	Activities of the O&M organization will be clarified.	○		
		・Determination of O&M rules	Proper O&M activities will be executed.		Introduction	Practice
		・Establishment on the leading system for management of organization	The problems of the organization will be solved smoothly.			
	H. Planning of Farmroad and Drainage Netv	・Determination of the design criteria	Suitable scale and type of farm facilities will be selected.		Introduction	○
		・Drawing up the road and drainage improvement plan in line with the irrigation canal network	A proper farm network will be established.		Introduction	○

Table 5.1.3 Agricultural Development Plan (2/2)

Project	Necessary Improvement Plan	Items to be clarified	Expected Outputs	Expected Period		
				Short term (within 5 years)	Middle term (6 to 10 years)	Long term (11 to 15 years)
Improvement of Drainage System in Sanjabi Plain	E. Establishment of Operation and Maintenance System(The plan is included in "Empowerment of Farmers through Formulation of Rural Production Cooperatives")	・Identification of the O&M organization	Person in-charge or organization will be clarified	○		
		・Confirmation of necessary O&M items	Activities of the O&M organization will be clarified.	○		
		・Determination of O&M rules	Proper O&M activities will be executed.	Practice	○	
		・Establishment on the leading system for management of organization	The problems of the organization will be solved smoothly.	Establishment	Practice	○
	G. Implementation of Drainage Network	・Execution of topographic survey	The existing topographical and cadastral conditions can be found.	○		
		・Execution of longitudinal and cross sectional survey of river and main drainage canals	Basic data to calculate drainage capacity will be available.	○		
		・Confirmation of the drainage capacity on rivers and main drainage canals	The drainage capacity of rivers and main drainage canals are clarified.	○		
		・Determination of the design criteria	Suitable scale and type of farm facilities will be selected.	○		
		・Determination of the on-farm facility plan	Suitable scale and type of farm facilities will be constructed.	○		
		・Planning of the on-farm drainage canal network	A proper drainage network will be constructed.	○		
		・Introduction of the necessary quality control items	The constructed facilities shall be used sustainably without any damages.	○		
	H. Improvement of Farmroad	・Determination of the design criteria	Suitable scale and type of farm facilities will be constructed	○		
		・Drawing up of the road improvement plan in line with the drainage canal network	A proper farm network will be established.	○		
Empowerment of Farmers through Formulation of Rural Production Cooperatives (RPC)	K. Establishment of RPC	・Examination of the existing organization	The problem of the organization can be clarified.			
		・Planning of integrated agricultural production in the covering area of the RPC	Integrated agricultural activities will be carried out in the area.	Trial	Expansion Trial	○ Expansion
		・Drawing up of the establishment and operation plan of the RPC	RPC will be operated based on the plan.	Practice	○	
		・Farmers' intension survey for the planning of the RPC	Farmers' intension will be considered in the plan of RPC.	○		
		・Assistance for establishment of RPC	Establishment or registration of the RPC will be carried out smoothly based on the establishment plan.	○		
		・Administrative guidance and monitoring	The problems of the organization will be solved smoothly.	Practice	○	
Integrated Agricultural Development Program	L. Establishment of Integrated Agricultural Management	・Drawing up of the agricultural plan for all of the study area	The strategy on the agricultural development will be clarified.	○		
		・Execution of farm economy survey	Situation of the farm economy and constraints of the farming will be clarified.	○		
		・Introduction of the proper agricultural management system for different condition of farmland	Farming income will increase and the farmers' economic situation will be secured.	Trial	Expansion Trial	○ Expansion
		・Examination of the demonstration plan	Demonstration farm as a farming model will be established and	○		
		・Administrative guidance and monitoring	The problem of the agricultural management will be solved smoothly.	Practice	○	
Strengthening of the Extension System	M. Strengthening of the Extension System	・Preparation of the strengthening plan of the agricultural extension service in the province	Strategy on the extension service in the province will be clarified.	○		
		・Preparation of the extension material establishment plan	The extension materials including equipment will be available.	○		
		・Preparation of the education and training plan for extension workers	Extension workers will play an important role in the field of extension service.	Practice	○	
		・Preparation of the plan of the agricultural extension service in the study area	Concrete activities of the service will be clarified.	○		
		・Farmers' intension survey in regard to the extension service in the Study area	Farmers' intension will be considered in the agricultural extension plan.	○		
		・Administrative guidance and monitoring	The problem of the extension service will be solved smoothly.	Practice	○	

Table 5.1.4 Expected Circumstances for Farmers' Self-reliance Based on Proper O&M for Agricultural Infrastructures

	Short Term (About 3 years)	Mid Term (3～5 years)	Long Term (3～5 years)
A Farmers' Organization	a Set up RPC by each settlement (*Deh*) b Strengthen RPC's functions. * To set clear allocation among members * To clarify profits as RPC. * To consultate farm economy by each. c To generate cooperatives offered by MoC. * Cooperatives of Livestock, Machinery service, WUA, a certain crop and * Extension center consultate cooperatives with MOC.	a To integrate RPCs to Joint RPC. * To set up WUAs at *Deh*s under Kilanbar Dam Scheme by RPC. * To set up WUAs at *Deh*s under Gharab Dam Scheme by RPC. b To guide RPC-affiliated-cooperatives. * RPC should guide & do extension cooperatives on management together with Extension Center.	a Joint RPCs continue guidance to unit RPCs. b To revise farm management to more diversified following market demand change. c Joint RPCs guide farmers to be self-reliance situation.
B Task Allocation on	d Bigger share by the Government (As initial stage) e Extension Center guide farmers through RPC on infrastructure O&M.	c To reduce Govt's burden, while increase RPC's burden. d To continue extension services to farmers on O&M aspects through RPCs.	d To reduce Govt's burden, while increase RPC's burden. e To continue extension services to farmers on O&M aspects through RPCs.
C WUA Establishment	f MoA guide RPCs to set up WUA by each settlement (*Deh*). g MoA guides RPCs to set up groundwater WUA by each settlement (*Deh*). h RPCs guide farmers on rationalized water use through WUA.	e To set up unit WUAs under Ravansar Spring beneficiaries. f To enhance integration of unit WUAs by water source and rationalized water use. g To hand over O&M of I&D facilities to WUAs.	f To hand over O&M of I&D facilities to WUAs.
D Extension Service Center	I To increase proper staffs, each one for several settlements (*Deh*). j To strengthen manpower at the Center . k To turn over the task to extension main from input supplying. l To set rules of WUA management. m To guide WUAs through RPCs on rationalized water use.	h To continue guide farmers on improving farm management through unit RPCs and Joint WUAs.	g To continue guide farmers on improving farm management through unit RPCs and Joint WUAs.
E External Condition			
Reg. MoA	n must complete plans of farm improvement. o must do publicity on annual action plans. p must complete setting up canals under Kilanbar Dam scheme. q do a study of storage facility of water from Ravansar Spring by himself. r do examine divercification of farm management.	I do a study on I&D development utilizing water from Ravansar Spring. j do extension services on cultivation, processing & marketing for agricultural development.	h do extension services on cultivation, processing & marketing for agricultural
Reg. MoE	s must complete Kilanbar Dam construction. t do publicity of Ravansar Right & Left Bank canal Irri. Scheme. u do a study on Gharab Dam Project.	k must complete Gharab Dam construction. l do a study of storage facility of water from Ravansar Spring by himself.	I to complete construction of storage facility of water from Ravansar Spring.

Table 5.3.1 Required Activities for the Improvement Agricultural Development in the Study Area (1/3)

Activity No.	Activities	Targeted Area	Executing agencies	Present Problems	Major Scope of works	Remarks
A-1	Introduction of appropriate crop rotation system	Whole area	KJAO	The present crop rotation is biased to fixed systems, such as “wheat - maize” in irrigated land, “wheat - chick pea” in rain-fed land, respectively. The yields of crops in rain-fed land are very low.	New crop rotation includes annual grass besides wheat and chick pea in the rain-fed lands, and wheat and maize or sunflower in the irrigated lands will be introduced in order to increase organic matter of soil	
A-2	Integrated farming	Whole area	KJAO		The integrate farming should be introduce with various sectors, such as agriculture, horticulture, animal husbandry, fishery, etc., and to design the location of crops in the Study Area under consideration of “right crop for right land”	
A-3	Improvement of mechanical farming	Whole area	KJAO	the low accuracy of farm works by contractors of mechanization, such as shallower tillage, imperfect harrowing, etc., makes hardpan in shallow depth of soil and gives rise to check the growth of crops.	To Introduce appropriate farming mechanization, for the heavy textured soil, crushing big plant and residues by applying 100 PH tractors to reduce the cost of mechanized farming.	
A-4	Rangeland rehabilitation for livestock development	Outside of Study Area	KJAO	Because of the deterioration or interrupted by other project, farmers cannot assess to the rangeland for small animals	Raising of sheep is important farming for the small-scaled farmers. It is necessary to recover the range. The recovery of range is very useful to prevent crops from damage of drought by holding soil water, of flood and of erosion of soil.	
A-5	Tree crop development on the mountain spring area	Sloped area on toe of the mountains	KJAO	To maximize the cultivation area within their land, the sloped area cultivated which get less yield and possibly cause the soil erosion	Around the mountain springs, the integrated farming of cultivation of rose for scent or fruit trees with fisheries is introduced.	

Table 5.3.1 Required Activities for the Improvement Agricultural Development in the Study Area (2/3)

Activity No.	Activities	Targeted Area	Executing agencies	Present Problems	Major Scope of works	Remarks
A-6	Strengthening the extension service system	Whole area	KJAO	Extension officers are busy for distribution documentation of agricultural inputs during the period of extension required by the farmers, and cannot advise the techniques to prevent the loss and suitable varieties in the area.	To strengthen the extension system, the extension service centers in the Study Area are reviewed on number of staff, training of staff, facilities, programs of extension activities, etc.	
A-7	Formulation of Rural Producers Cooperative	Whole area	KJAO	Farmers cannot purchase timely the farm materials at rural cooperative organization (RCO). Furthermore, when farmers purchase the shortage in private shop, as the quantity of subsidized materials is short, the prices of materials of private shop are very high. no storage houses, which store the products to sell at favorable time in marketing, no wholesale market near Site,	To decrease the cost by purchasing jointly of inputs, to increase the income by selling jointly of products, to promote the development of infrastructure including irrigation, drain, field, education and training, mechanization, etc., the farmers organization shall be organized by farmer themselves	
A-8	Land Leveling	Whole area	KJAO	The puddles cause delay in crop growth, in sowing and ripening of succeeding crops, and then decrease of yield of succeeding crops.	In order to conduct the cultivation efficiently by machinery for increase yield and to avoid the water ponding in the lower part of the field, land leveling will be conducted	
W-1	Improvement on-farm irrigation system of Ravansar Irrigation Scheme	Site 1	KJAO KWO/MOE	Ravansar left bank main canals are under renewal, but the proper plan for on-farm level is not prepared yet.	Appropriate plan on-farm level and secondary system shall be prepared by the farmers participation for the sustainable O&M	Main system shall be responsible by MOE
W-2	Improvement of water management of Ravansar irrigation scheme	Site 1	KJAO KWO/MOE KCO	No systematic management and O&M is applied without proper institutions. Recently WUA formulated but no technical guidance provided. Upstream farmer get water from main canal more than requirement, no water available farmers in downstream	Technical and management guidance to the WUA and capacity building of government institutions of the Project will be conducted for the sustainable O&M of the Project and empowerment of farmers organization including extension of irrigated agriculture	Legally activities of WUA is supervised by MOC

Table 5.3.1 Required Activities for the Improvement Agricultural Development in the Study Area (3/3)

Activity No.	Activities	Targeted Area	Executing agencies	Present Problems	Major Scope of works	Remarks
W-3	Gharab dam irrigation scheme	Site 2	KJAO KWO/MOE	Both dams' plan and design started but the command areas are not confirmed, also no public consultation conducted	Planning irrigation plan after the offtakes of the dam and O&M under the participation of beneficiaries for the sustainable system operation	Strong communication and collaboration work required between KJAO and KWO
W-4	Kilanbar dam irrigation scheme					
W-5	Improvement of groundwater irrigation	Site 2	KJAO KWO/MOE	Groundwater table declining by the over extraction against recharge. Catchment area deteriorated caused by over grazing cattle	Regulate the proper groundwater extraction and monitoring including the increase recharge by watershed management and irrigation extension	communication and collaboration work required between KJAO and KWO
W-6	Improvement of drainage system	Site 2	KJAO	Casual flooding in the lower area of the Study Area damaging the agricultural production. Constructed drain poorly maintained and reduced the capacity	Install secondary and on-farm level drains, formulate the proper maintenance system conducted by the farmers and rehabilitation existing drainage facilities	
R-1	Improvement of rural road network	Whole area	KJAO	Poor rural road to be used access road of farming and transportation of agricultural products	Improvement of road conditions with villagers participation	Community organization can be main actors
R-2	Improvement of rural water supply system	Whole area	KJAO	Poor and insufficient water supply in the community	Improve or install community water supply system by installing deep well that will be maintained by community	
R-3	Improvement of rural sewage system	Whole area	KJAO	Poor drainage and sewage system in community cause the poor sanitation and uneasy smells	Improvement of road conditions with villagers participation	

Notes: KJAO: Kermanshah Jihad-e-Agriculture, KWO: Kermanshah Water Organization, MOE: Ministry of Energy
KCO: Kermanshah Cooperative Organization

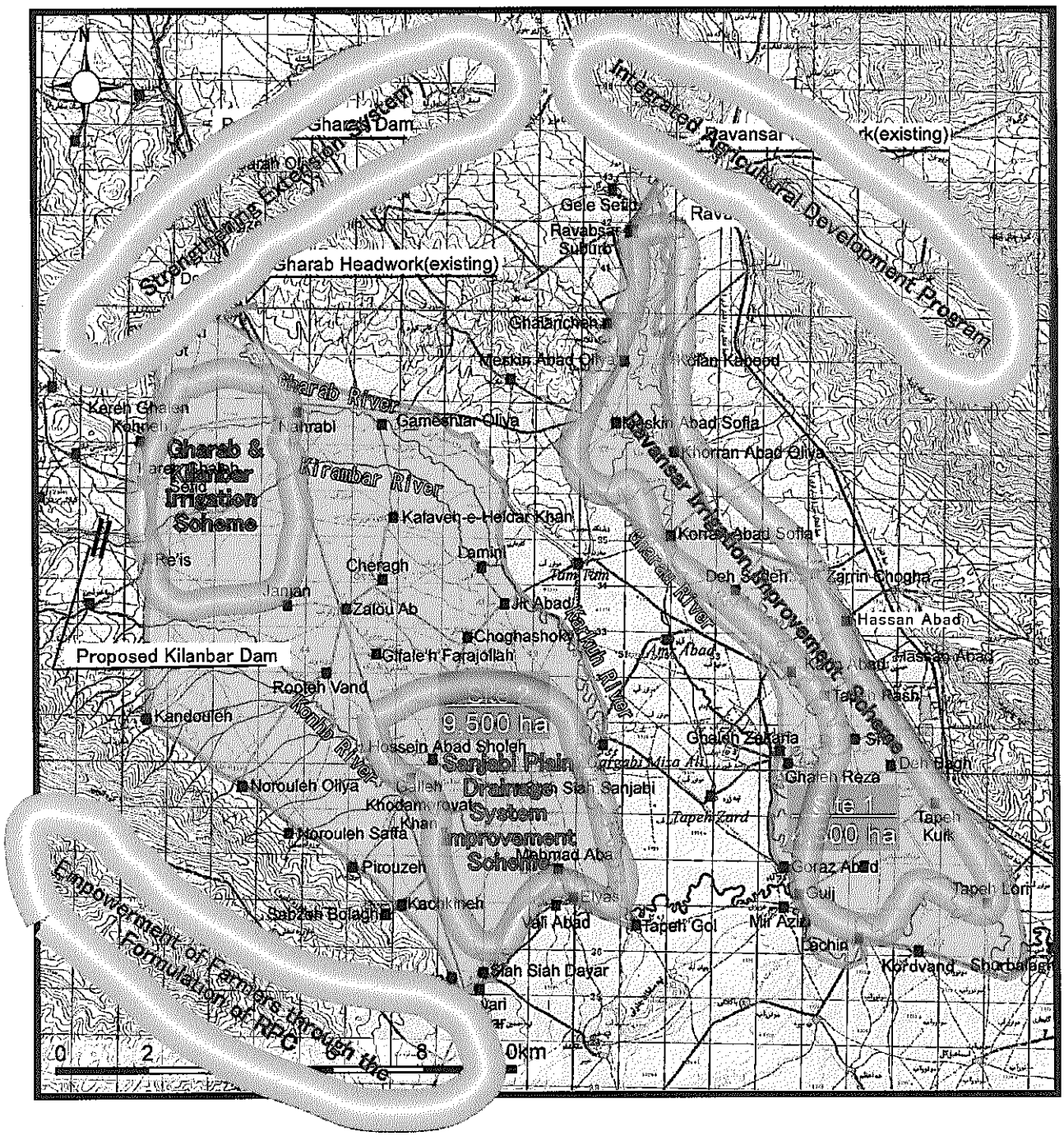


Fig. 5.3.1 Candidate of Priority Project/Program