

#### 8.2.4 Productivity

Determination of rangeland productivity based on which carrying capacity is calculated is important in drawing plan/program for sustainable utilization of this natural resource. Amount of natural herbage produced in rangeland reflect its productivity; and optimum number of animals, which can be fed on this herbage in a sustainable manner, indicates the carrying capacity. It should be noted that simply a large rangeland, does not have high production. Because many factors such as amount/distribution of rainfall, soil type/fertility, and the percentage of space available for vegetation growth, govern the rangeland and its productivity.

Since animal husbandry is an important occupation in Mater Plan Areas, and natural vegetation is main feed of livestock, productivity of rangelands has been investigated to provide a base for their management. In the field fresh weight of plants was determined in 1m<sup>2</sup> plot, converted to dry matter basis, to mention the productivity (kg/ha). Then the obtained figure was divided to 60 to know the carrying capacity in Animal Unit Month (AUM). The figure 60 is amount of herbage required by an Animal Unit (AU) in one month (on dry matter basis). In Iran a female goat of 40 kg is decided as 1 AU, based on which AU for other livestock is calculated. A cow is equivalent to 5 AU.

Productivity status in five master plan areas is briefly mentioned below, relation between vegetation cover and vegetation production is shown in Figure at end of this text, and other relevant information/data are given in ANNEX G.

##### (1) K4-1-9 Vastegan

Total production of rangeland in this sub basin is 208.5 tons, or about 182 kg/ha. Considering the potential of the area, which is judged based on availability of large % of bare soil and amount of precipitation, the mentioned figure is very low. Result of field survey indicates that about 24% of area is bare soil. If natural vegetation is given opportunity to expand itself, the productivity might increase by 115 kg/ha. The present low productivity can be partly attributed to following factors:

- Removal of pasturage vegetation (shrub) for fuel and other purposes
- Overgrazing, under which vegetation get no opportunity to expand
- Decline in soil fertility and land quality due to increase in soil erosion rate.

##### (2) K5-19a Chaman Goli-Bazoft

Since this sub basin is a mountainous area most of its natural vegetation is comprised of large trees, particularly of Quercus (oak), which have no direct grazing benefit to herds, but pastoral plants growing among the trees are grazed. Due to presence of large percentage of rocks, % of pasturage vegetation cover in grazing area is only about 45%, chiefly of annual grasses. The remaining part is non-vegetation with no role in productivity of the area.

Total production of grazing area is 306.8 tons, in an average 163 kg/ha. Considering the geological and topographical conditions of the area, this amount seems reasonable. Because hard rocks permit no vegetation expansion, and plant seeds produced (if any) on steep slope easily move away by water, wind and some other means, to places where have no opportunity to germinate. Daphne a bush with almost no pasturage value occupies 3% of the rangeland, inducing low productivity.

(3) K7-0-19-1 Sarbaz

As compared to other sub basins, vegetation of this area has a better status. Due to occurrence of good soil, availability of river (Morbor)/spring water, and favorable climatic conditions, rangeland possess many vegetation types of different production level. Total production of rangeland is 865.7 tons, in an average 161 kg/ha, which is far less than productivity potential of the area. Because about 24% of rangeland is bare soil, which can be due to over exploitation and poor management of natural resources. If vegetation is given opportunity to regenerate and spread in bare soil, an addition production of 620 tons/year can be attained. It should be noted that the vegetation is chiefly comprised of shrubs with less grazing benefit, because due to presence of thorn animals are able to feed on their fresh leaves only. This is also another agent of low productivity.

(4) K7-48 Tang Sorkh

This is the only sub basin in which degraded/abandoned range (wasteland) was identified. In Iran when production of a grazing area reaches below 50 kg/ha (on dry matter basis) it is declared as unusable, and grazing on it is terminated. This situation indicates the over exploitation and poor management of natural resources. In contrary some localities in rangeland far from villages have good status and produce satisfactory amount of herbage. Gundelia (artichoke) forbs with low palatability, but high production dominates the rangeland and largely contribute to its production. Many trees particularly of Quercus (oak) and Amygdalus (wild almond) are seen in grazing area, providing shade and litter to pastoral plants, promoting their growth and production. Presences of annual grasses, which produce large amount of herbage, also promote productivity of the area. Total production of rangeland is 604.2 tons, in an average 194 kg/ha.

However among the master plan areas, productivity of rangeland is the highest, but it still has potential for further improvement. At present vegetation occupies 56% of the rangeland, and the remaining 44% is comprised of bare soil, rock, stone, and litter. Vegetation should be given opportunity to spread and occupy the empty spaces. This would bring-about higher herbage production and more availability.

(5) K8-28 Zeras

In this sub basin rangeland is extended on areas with steep slope, where soil is susceptible to water and wind erosion. Parts near by village/farmland which are under continuous grazing pressure have lost

most of their vegetation and hence their productivity. In such localities vegetation cover is only 34%, and remaining 66%, is occupied by bare soil, rock, stone, litter, and large trees, particularly of *Quercus* (oak) with no direct grazing benefit. On the other hand, in localities somewhat near to Karoon River where more moisture exist in soil, some forbs and annual grasses produce large amount of herbage, contributing to overall productivity of the area. Total production of rangeland is 638.9 tons, in an average 190 kg/ha. However 39% of rangeland is bare soil, due to low soil fertility, low rainfall and its uneven distribution, not much expansion in vegetation and productivity of the area is expected.

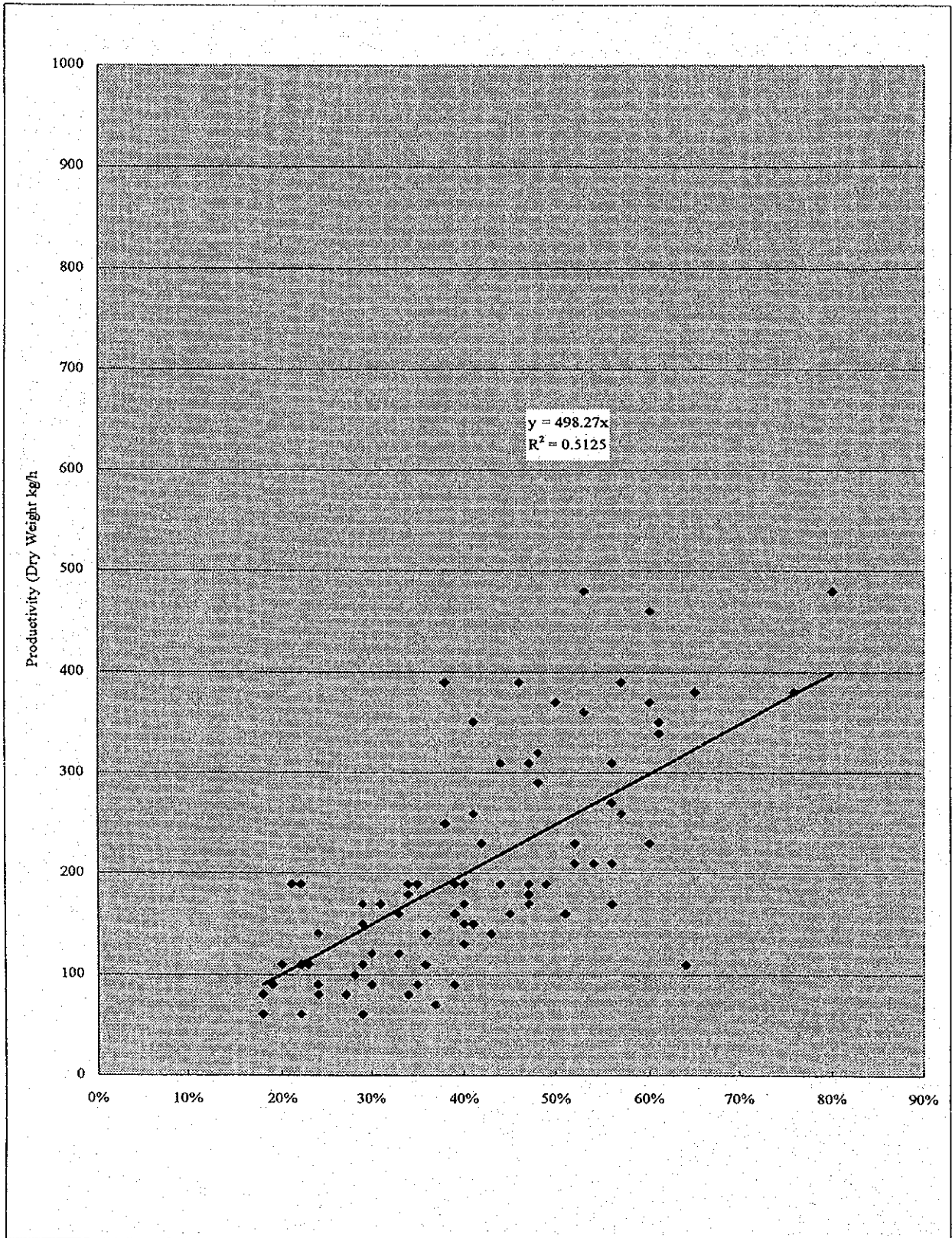


Figure 8-2-4-1 Present Relation between Vegetation Cover and Vegetation Productivity in Five Master Plan Areas

### 8.2.5 Present Grazing Situation

In general, grazing situation in Karoon basin, including the Master Plan Areas, follows the grazing situation in Iran, but three times worse than that. Overgrazing is common features of country's rangelands, since they are forced to accommodate livestock even 3 times more than their capacity. While the rate of overgrazing in some areas of Karoon basin is even 10 times more than the rangeland capacity, means 3.3 times worse than the undesirable national rate. Overgrazing not only suppress the regeneration of natural vegetation, but leads to decline in soil fertility and degradation of land quality, imposing a great loss to national resources. It is believed that overgrazing has close connection with increment of human population. Because increase in demand for meat and other dairy products encourages the livestock holders to enlarge their herds to fulfill the demand and obtain higher benefits. In rural families, particularly nomads, when male member attain adult age, start a independent life and establish a new household by acquiring a number of animals and feeding them in already poor rangeland.

Overgrazing results in disappearance of valuable plant species, and spread of unpalatable species, which are grazed only when there is no alternative. Rangeland dominated by grasses of less nutritional value and low palatability has low carrying capacity, which induce negative impact on animal production and livestock industry. Because poorly fed animals have high mortality rates, low calving rates, slow growth rates and are susceptible to diseases. It should be noted that beside feed supply, rangeland vegetation play important roles in maintenance of biological balance.

Intensive field survey and comprehensive study were undertaken to grasp the present grazing situation in five master plan areas. Collected information/ data are used in formulating plans for restoration/improvement and sustainable utilization of rangelands. Results of field survey and outcome of the study are briefly mentioned below.

#### (1) K4-1-9 Vastegan

Total area of rangeland is 11.42 km<sup>2</sup>, produces 208.5 tons of herbage, which is sufficient for 3,475 Animal Unit Month (AUM). 1 AUM is equivalent to 60 kg of dried forage. While presently 20,090 AU are in the area, consuming 1,205.4 tons of herbage per month. Means an overgrazing rate of 5.78 times more than the rangeland carrying capacity. Further more rangeland is of low quality, because it is mainly comprised of less nutritious/least palatable shrub and forbs, being not favorites of livestock. In general, the rangeland has decreasing trend, as judged by presence of bushes such as Daphne (mezereon), which have no/low pasturage value. By getting rid of such plants and increasing the soil fertility some nutritious grasses of high productivity might regenerate in the area, reducing the problem of overgrazing. Rangeland has potential for improvement and situation can be corrected through some proper and timely measures.

(2) K5-19a Chaman Goli-Bazoft

This is a mountainous/rocky sub basin in which the grazing area, being 18.75 km<sup>2</sup>, is comprised of large trees, bushes, forbs and grasses of different status. Total herbage production is 306.8 tons on which 5,113 AUM can feed. While total number of livestock grazing in the area is 37,550 AU, with an herbage requirement of 2,253.0 tons per month. Means the rate of overgrazing is 7.34 times more than the rangeland production, being highest rate among the five master plan areas. In this rocky area with steep slope, fully depending on farming for livelihood is a great risk. Therefore the inhabitants keep relatively large number of livestock, which feed on natural vegetation and bringing about the overgrazing.

Due to topography and other natural limitation, quick removal of these problems through rangeland improvement activities is not possible. Therefore reduction in livestock number should be considered.

(3) K7-0-19-1 Sarbaz

This sub basin has large area of rangeland (53.92 km<sup>2</sup>) but its vegetation is of low palatability and decreasing trend. The area produces 865.7 tons of herbage, being sufficient for 14,429 AUM, while presently 56,510 AU with a monthly herbage requirement of 3,390.6 tons depend on this area. Means 3.91 times feed shortage than minimum monthly requirement. This can be partly due to presence of high percentage of rock and stone in rangeland, which limit the plant growth and hence productivity of the area.

Since there are natural obstacles in expanding the grazing area, increasing the productivity/quality of existing rangeland through sowing seeds of nutritious, palatable and fast growing pasturage vegetation is a reasonable approach.

(4) K7-48 Tang Sorkh

Total production of rangeland is 604.2 tons, on which 10,069 AUM can feed, while total number of livestock grazing in this area is 23,595 AU, which require 1,415.7 tons of herbage per month. Accordingly the rate of overgrazing is estimated at 2.34. Beside numerical calculation this fact was revealed during the field survey, through observation of deformed shrubs, which is a physical sign of overgrazing. Due to feed shortage, animals particularly goat frequently graze the aerial parts of shrubs, causing their deformation.

This overgrazing can be partly attributed to following points:

- Many nomads along with their herds move to this area and due to good weather stay for a long period, during which livestock graze in rangeland.
- Topographical and geological conditions limit the farming activities, therefore majority of

inhabitants get engage in traditional livestock sector, inserting continuous pressure on rangeland resources.

Since arrangement for improving productivity of rangeland, which may prove less success in this rocky/sloppy area, takes some time, reduction in number of livestock can be an urgent remedy.

(5) K8-28 Zeras

Total production of rangeland is 638.9 tons, sufficient to feed 10,648 AUM only, while 33,170 AU, with a monthly herbage requirement of 1,990.2 tons, enter into area for grazing, imposing an overgrazing rate of 3.11 on rangeland. Due to steep slope, occurrence of soil with low fertility and susceptibility to erosion, inhabitants can perform no profitable farming, therefore keep large herds, mainly of goat, which by itself is an agent of vegetation destruction. Low soil moisture content being attributed to low rainfall can be another reason for over grazing. Annual natural grasses with capability to produce large amount of herbage in grazing season, require sufficient moisture for germination and growth. In dry year they may suffer and disappear, bringing-about overgrazing and deterioration of rangeland. Majority of plants growing in rangeland are of low palatability and less pasturage value, being unsuitable for accommodating large number of animals.

Due to limitation mentioned above, quick increase in rangeland productivity cannot be attained by structural measures, therefore reduction in livestock number, protection and rotational utilization of rangeland are considered as quick remedies for reducing the overgrazing rate of the area.

Present grazing situation in master plan areas is summarized in Table below.

Table 8-2-5-1 Summary of Present Grazing Situation in Master Plan Areas

Master Plan Area	Animal Unit Month		Over-Grazing Rate (B/A)	Additional Herbage Requirement (ton)
	Optimum (A)	Presently Graze (B)		
K4-1-19 Vastegan	3,475	20,090	5.78	996.9
K5-19a Chaman-Goli Bazoft	5,113	37,550	7.34	1,946.2
K7-0-19-1 Sarbaz	14,429	56,510	3.91	2,524.9
K7-48 Tang Sorkh	10,069	23,595	2.34	811.5
K8-28 Zeras	10,648	33,170	3.11	1,351.3

Source: JICA Study Team, Vegetation and Village Surveys, May-July 2001.

### 8.3 Socio-economic Condition

In order grasp the socio-economic condition of the selected five Master Plan Study Areas, the socio economic village survey on all the villages has been carried out. The survey also includes the awareness of problems encountered in villages and the willingness to community development.

The survey was conducted by the Study Team members and a counterpart personnel together with the provincial Jihad officials. They visited all the villages in the selected Master Plan Study areas and interviewed the representatives of the villages (mostly Shora). The fill-upped questionnaires of each village are shown in ANNEX H. The following section describes only major features of socio-economic condition of the study area.

#### 8.3.1 Administrative Division

The whole study area extends over five provinces of Chaharmahal va Bakhtiyari, Kohgiluyeh va Boyerahmad, Esfahan, Khuzestan and very small part of Fars (1 %). The selected Master Plan Study areas belong to four provinces, two Study Areas in Chaharmahal va Bakhtiyari and each one Study Area in Kohgiluyeh va Boyerahmad, Esfahan, and Khuzestan respectively. Administrative division of the area is in accordance with the Law of Administrative Division, promulgated in 1992. Province (Ostan) is divided into several townships (Sharestan), each township into several districts, (Bakhsh) each District into several rural districts (Dehestan), and each rural district into several villages (Deh). Rural district consists of 15 to more than 100 villages. Besides, there are some towns in the district. Administrative division and target villages of the selected five Master Plan Study Areas are in Table 8-3-1-1.



Table 8-3-1-1 Administrative Division and Target Villages of Master Plan Study Areas

Master Plan Area	Province	Township	District	Target Villages
K4-1-9 Vastegan	Chaharmahal va Bakhtiyan	Boroujen	Gandoman	Konark Olya, Konark Sofla, Nasir Abad, Vastegan
K5-19a Chaman Goli-Bazoft	Chaharmahal va Bakhtiyan	Farsan	Bazoft	Arteh, Baghchenar, Chemghaleh, Dorak, Fariak, Ghale Tabarak, Kachooz, Khiyarkar, Tabarak Olya, Tabarak Sofla
K7-0-19-1 Sarbaz	Esfahan	Semiron	Padena	Deh Bozorg, Dangazloo, Dorahan, Devergan Olya, Devergan Sofla, Kahangan, Noghel, Noorabad, Sarbaz, Telmohamad, Zabih Abad
K7-48 Tang Sorkh	Kohgiluyeh va Boyerahmad	Yasuj	Central	Allah Abad, Cheshmeh Chenar, Hassan Abad, Islam Abad, Mehrab Abad, Sar Tang Sorkh, Tang Sorkh
K8-28 Zeras	Khuzestan	Izeh	Dehdaz	Ali Bandeh, Badelon, Bardkal, Behoz, Cham, Dareh Sohrab, Dareh Zangi, Dawodiha, Gard Lidan, Lir Siya Mozrom, Lir Siya Shapouri, Sartuf, Sebalutak, Shahghaz, Zeras

### 8.3.2 Population

The population of the Study areas was surveyed in village basis by villagers and nomad and summarized in the following table.

Table 8-3-2-1 Population

Sub-basin	Village			Nomad				Total		
	Male	Female	Total	Male	Female	Total	Ratio(%)	Male	Female	Total
K4-1-9	1,700	2,000	3,700	400	360	760	17.0	2,100	2,360	4,460
K5-19a	2,951	2,955	5,906	1,344	1,166	2,510	29.8	4,295	4,121	8,416
K7-0-19-1	2,553	2,477	5,030	2,902	2,943	5,845	53.7	5,455	5,420	10,875
K7-48	556	602	1,158	352	361	713	38.1	908	963	1,871
K8-28	1,195	1,149	2,344	0	0	0	0.0	1,195	1,149	2,344
Total	7,760	8,034	15,794	4,998	4,830	9,828	35.1	12,758	12,864	27,966

Source: Study Team 2001 August

Nomadic people in the study area concentrate in the provinces of Chaharmahal va Bakhtiyari, Kohgiluyeh va Boyerahmad and Khuzestan. According to the socio-economic census of tribal nomads 1999, the sub-basin of highest nomadic population is K8 (43.4%) and follows K6 (26.4%), K7 (25.5%), however, the specific sub-basin of our Study Area has quite different characteristics. K8-28 Zeras located in Khuzestan Province has 0 % of nomad population, whereas K7-0-19-1 Sarbaz has a highest nomad population ratio of 53.7 % although the area belongs to Esfahan Province. The average nomad population ratio is 35.1 %.

Because the whole study area is situated in the mountainous area and the upstream of the Karoon River, the overall population density is low and shows 38 persons per km<sup>2</sup> in the whole study area.

Table 4-3-2-2 shows the population density of the average village population size in the Study Area. The population density is lower than the average of the whole Study Area in K7-48 Tang Sorkh and K8-28 Zeras, because K7-48 Tang Sorkh has vast mountainous area and K8-28 Zeras extends over the very steep slope with scarce water resources. The village population sizes of these two areas are also small compared with other three areas.

Table 8-3-2-2 Population Density and Population per Village

Sub-basin	Total Population	Sub-basin Area (km <sup>2</sup> )	Population Density (No./km <sup>2</sup> )	Number of Village	Population /Village
K4-1-9 Vastegan	4,460	89.9	49.6	4	1115.0
K5-19a Chaman Goli-Bazoft	8,416	113.2	74.3	10	841.6
K7-0-19-1 Sarbaz	10,875	154.5	70.4	11	988.6
K7-48 Tang Sorkh	1,871	65.4	28.6	7	267.3
K8-28 Zeras	2,344	63.7	36.8	15	156.3
Total / Average	27,966	486.7	57.5	47	595.0

Source: Study Team 2001 August

### 8.3.3 Income Level

Main income of farmers including nomadic people in the study area derives from agriculture and animal husbandry. In order to grasp the living condition of farmers and nomadic people and to reflect to formulate the master plan, village surveys were carried out. Table 4-3-3 shows the average annual income level of both villagers and nomad in the Study Areas separating the income source of crop production and livestock.

Table 8-3-3 Average Income Level (Unit: million Rials /year /household)

Sub-basin	Village			Nomad		
	Crops	Live stock	Total	Crops	Live stock	Total
K4-1-9 Vastegan	6.750	3.500	10.250	0.250	14.000	14.250
K5-19a Chaman Goli-Bazoft	0.775	0.835	1.610	0.330	1.120	1.450
K7-0-19-1 Sarbaz	33.636	4.109	37.745	7.864	8.818	16.682
K7-48 Tang Sorkh	2.671	2.943	5.614	1.571	4.214	5.786
K8-28 Zeras	6.843	6.113	12.957			
Total / Average	10.135	3.500	13.635	2.003	5.630	7.634

Source: Study Team 2001 August

The data of Chaman Goli-bazoft might be doubtful and is under verification.

As a whole, the income source of crop production to the total income of village people is 74 %, whereas the income source of crop production of the nomad occupies 26 % and livestock occupies 74 %. However, the ratio of income source of crop production is largely affected by the high income study areas such as K4-1-9 Vastegan and K7-0-19-1 Sarbaz. In the low income areas like K5-19a

Chaman Goli-Bazoft and K7-48 Tang Sorkh, even village people get the more income from the livestock than crop production.

### 8.3.4 Employment Opportunity

Economically active population (age 10 and over) in the study area is 75.8 % of the total population and the average unemployment rate shows 11.4%. High unemployment ratio of more than 20 % are found in the K5-19a Chaman Goli-Bazoft and K8-28 Zeras, the unemployment ratio of which is 27.5 % and 23.5 % respectively. Those two areas are remote to the nearest industrial towns and/or cities. It is almost impossible to commute to the factories of neighboring towns as employees. They also have disadvantage to get the information of employment.

Table 8-3-4 Unemployment Ratio

Sub-basin	Village			Nomad			Total		
	Population >10 yr	Un Employment	Ratio (%)	Population >10 yr	Un Employment	Ratio (%)	Population >10 yr	Un Employment	Ratio (%)
K4-1-9 Vastegan	3,100	220	7	655	0	0	3,755	220	5.9
K5-19a Bazoft	4,553	990	22	1,802	755	42	6,355	1,745	27.5
K7-0-19-1 Sarbaz	4,162	210	5	5,218	97	2	9,380	307	3.3
K7-48 Tang Sorkh	1,078	121	11	635	28	4	1,713	149	8.7
K8-28 Zeras	1,513	356	24	0	0	0	1,513	356	23.5
Total / Average	12,893	1,541	12	8,310	880	11	21,203	2,421	11.4

Agriculture and livestock keeping are the main occupation in the study areas, and other occupation is quite few except for government employee, and small shop owner, etc. According to the village survey, conducted by the study team on August 2001, 89% of households in the study area earn from agriculture and livestock production, and other occupations are government employee: 5%, merchant/technician: 3%, craftsman and others: 3%. Among the master plan areas, K8-28 Zeras is the lowest in occupational diversification, and 94% of households engage in agriculture and livestock. On the other hand, K4-1-9 Vastegan is the highest in the occupational diversification, and 82% of families engage in agriculture and livestock, and 10% of household are employed by local government. Vastegan is located near Bourjen (20km distance), Arbal (50km), and Sharekord (80km) which is capital city of Chaharmahar va Bakhtiyari province. It is possible for peoples in the Vastegan area to commute to large town such as Sharekord.

### 8.3.5 Land Tenure and Land Holding

By the legislation of the law of land reform in the 60's from the landlord related to the Shah rule, land ownership of farmer was realized. However, its land reform was incomplete. Although the confusion centering the land occurred for a while after the Islamic Revolution, the land reform was settled at

latter half of the 80's.

After the Revolution, the government has made the priority policy for an independent farm, instead of large-scale farm such as agricultural corporation and agribusiness. Consequently, own farmer takes leading part in agricultural production. However, it produced a large number of small scale farmers who have less than 2 hectares of farmland. Land tenure in the study area is also presented the same situation. All farmers in the area are own farmers.

Average land holding and land use conditions per household in the Study Areas, according to the data of our village survey, are estimated as follows.

Table 8-3-5 Land Holding (unit: ha/household)

Sub-basin	Farmland	Orchard	Total
K4-1-9 Vastegan	1.87	0.10	1.97
K5-19a Chaman Goli-Bazoft	2.03	0.13	2.17
K7-0-19-1 Sarbaz	0.41	4.26	4.67
K7-48 Tang Sorkh	2.30	1.70	3.99
K8-28 Zeras	3.43	0.01	3.44
Total / Average	1.73	1.50	3.24

Source: Study Team 2001 August

It is known from the Phase I study that the average land holding size in the whole study area is 3.3 ha. Smaller sizes of land holding than the average of the whole study are found in the Study areas of K4-1-9 Vastegan and K5-19a Chaman Goli-Bazoft. Those two Study Areas belong to Chaharmahal va Bakhtiyari.

The problem on land tenure and land holding is a subdivision of farmland by inheritance. This subdivision produces a difficulty and limitation of farm management by rural family.

### 8.3.6 Structure of Rural Community and Process of Its Decision Making

#### (1) Administrative Structure

There are following National Public Organizations concerning the administration of Rural Communities,

Ministry of Jihad-e-Sazandegi (Jihad and Agriculture)

- Nomadic Affairs Organization
- Forest and Rangeland Organization
- Livestock Organization
- Handicraft Organization
- Silat Company (Public Company for Fishery)

Ministry of Education

Ministry of Health and medical Education  
Plan and Budget Organization  
Statistical Center of Iran

At the Province level, there are such Provincial Organizations as the extension of National level organizations,

Provincial Jihad-e-Sazandegi Organization

- Nomadic Affairs Office
- Forest and Rangeland Office
- Livestock Office
- Handicraft Office
- Silat Company (Provincial Public Company for Fishery)

Provincial Education Organization

Provincial Health Organization

Provincial Plan and Budget Organization

#### (2) Unit of a Village

A village is basically composed of a single community. However, there are some cases when several communities within a proximity make up a village.

#### (3) Rural organization

Each Village(Community) is having the Islamic Council (Shora) as the lowest reach of administration. This Shora is conducting general village administration under the Ministry of Interior with three councillors directly elected by the villagers of which the chairman as the village-chief.

In some cases, there organized Revolution Defence Body under the strong influence of the Ministry of Jihad-e-Sazandegi. At present its main purpose and function is changed to develop remote rural communities.

In either case, most councillors are elders and/or seniors of the village. As such, it is said that the development of each villages mainly depends on the quality and initiative of its councillors. However, band and kin relationships with central and/or provincial government sometimes works an important role in the development of the village as well.

#### (4) Consciousness of Villagers

Because of traditional and religious community systems, decision is exclusively made by the elders and family-heads until recently. At present, such systems seem changing gradually with increasing numbers of youths who are going out to urban areas for seasonal works, development of education and information dissemination through mass-medias such as radio and T.V. Also the change of life-style with improved production and distribution systems gives impetus to this tendency.

#### (5) Opinion Leaders and Reformers in the Rural Area

Teachers and medical/health personnels in villages are representing intellectual group of the rural area and are playing important role in abovementioned changes. However, as the old customs die hard, the movement is taking a course of not much radical but moderate and gradual improvement of life-styles. In other cases, farmers with higher education levels and outside traders are inducing newer and improved life-styles.

#### 8.3.7 Fuel Source of Households

Present situation of fuel consumption in households has been surveyed by the village survey from an aspect of forest conservation in the Master Plan areas. The results are shown in the Table below. In the village households, ratio of consumption of gas/petrol and fuel wood is 53% and 47% respectively as a whole, while 20% by gas/petrol and 80% by fuel wood in Nomad households. Consumption of fuel wood is very high in Nomad households. Nomad households have more problems from a viewpoint of river basin preservation. In village household, gas/petrol is more than 90% and fuel wood is less than 10% in Vastegan and SarbaZ, and about 50-50 in Tangesorkh, while more than 80% by fuel wood in Chaman Goli-Bazoft and Zeras. In later tow areas, village households have problems on river basin preservation. On the other hand, Nomad households depend on fuel wood more than 90%. From above results, following problems are pointed out.

- 1) Nomad households: There is no stable market system of gas/petrol due to migrant life system.
- 2) Chaman Goli-Bazoft: Village households are low in purchase power of gas/petrol due to low income and remoteness.
- 3) Zeras: Village households are in difficulty to purchase gas/petrol due to difficulties in village access roads to the main road.

Above problems are to be solved as early as possible from the viewpoint of river basin preservation. Although exact consumption amount of fuel wood consumption could not be obtained in the Village Survey, it is estimated at about 3 tons for one household in a year based on amount of stock of fuel wood.

Table 8-3-7-1 Fuel Source of Households

Study Area	Ratio of Fuel Source in Household (%)				Household income (million Rial/yr)		Villages expressing difficulties in access road.
	Village Households		Nomad Households		Village Households	Nomad Households	
	Gas/Petrol	Fuel Wood	Gas/Petrol	Fuel Wood			
Vastegan	93%	8%	23%	77%	10.3	14.3	0%
Chaman Goli-Bazoft	16%	84%	5%	95%	1.6	1.5	60%
Sarbaz	93%	7%	45%	55%	37.7	16.7	27%
Tang Sorkh	46%	54%	8%	92%	5.6	5.8	0%
Zeras	15%	85%	-	-	13.0	0.0	87%
Whole Areas	53%	47%	20%	80%	13.6	7.6	49%

(Source) Village Survey

(Note) Although 71% of villages expressed the difficulty on road in Tang Sorkh. However their difficulty is rapid decrease of direct sale of apples due to decrease of passengers by new by-pass road, but not by difficulty on accessibility.

(Source) Village Survey in this study

- 1) Nomad: no steady marketing routes to buy gas and petrol due to shifting of their stay.
- 2) Bazoft: low income and remoteness to buy gas and petrol.
- 3) Zeras: low accessibility to the villages from a main road.

Above problems on soil erosion and sediment are to be solved to preserve the river basins.

#### (1) Soil Erodibility Survey

Soil erodibility survey was carried out in the study areas in order to grasp surface erosion conditions quantitatively. The survey is composed of following

- 1) Soil Erodibility survey: Visual evaluation of soil erodibility at slopes using BLMD determination sheet composed of 7 surface factors as shown in Table 4-9-3-1.
- 2) Land Cover and Vegetation Survey: Measurement of land cover by vegetation, rock and stone quantitatively and visual evaluation of vegetation categories. (Details are in Chapter 4.2.4)
- 3) Soil Survey: Soil texture and organic content measurement by laboratory analysis.
- 4) Infiltration Survey: Infiltration survey using double ring cylinder.

#### (2) Soil Erosion Estimation

Using above survey results, soil erosion amount will be estimated quantitatively. Analysis will be conducted by Revised PSIAC Method and supplemented by Universal Soil Loss Equation (USLE) to know differences between two methods. Criteria of Revised PSIAC Method is presented in Table 4-9-3-2.

## 8.4 Rural Infrastructure

### 8.4.1 Rural Road

#### (1) Road Network

The road network in the Study area is generally subject to natural topography as the high mountain ranges are dominant in the basin. Chaharmahal va Bakhteyari Province is connected with adjacent provinces through 17 principal roads, including 12 with Esfahan Province, 4 with Khuzestan Province and 1 with Kohkiluyeh va Boyer Province.

#### (2) Roads in Master Plan Areas

##### a) Vastegan (K4-1-9)

Vastegan is located 60 km south of Shahre kord. The National Road from Shahre kord to Yasuj through Burujen and Gandoman is the main access to this area, and the road is in very good condition. The road distance from Shahre kord to the entrance of Vastegan on the National Road is about 90 km.

From the entrance on the National Road, a paved road is connected to the villages of Konark Sofla, Konark Olya, Vastegan and Nasir Abad, however, the road is not so good condition because of poor maintenance. Two bridges are located on this access, one is crossing R.Aghabolugh near Konark Sofla and another is on Gela River near Vastegan. In the farmland, there are several farm roads, and most of them are dirt roads. The maintenance roads along the irrigation canals are graveled.

In addition, there is another access to Nasir abad, which is aligned along the left bank of R.Aghabolugh, crosses R.Aghabolugh before entering the wetland, follows along the earth canal towards the south, and joins the canal-maintenance road from Nasir abad. A dirt road from the village of Vastegan climbs up the hill to reach the mountainous area, and continues to Sabze Khu Area.

##### b) Chaman Goli-Bazoft (K5-19a)

Chaman Goli-Bazoft is located 80 km west of Shahre kord. There are three mountain ranges between Chaman Goli-Bazoft and Shahre kord and there are two access roads. One is to approach from the north passing through Sureshjan town, Farsan, the center of Farsan District, covering northeastern part of Chaharmahal va Bakhteyari Province, and the valley of Khurang river. The road section crossing the valley of Khurang River is mainly gravel. This road joins with the road from the south near the village of Doab samsami, which is located at the foot of the third mountain range.



Another is to approach from the south passing through Karaji, Tange Darkesh Varkesh, Rostam abad, Dashtak and Doab samsami. The road from Shahre kord to Karaji is the National Road, which is connected to Ahaz. At present, this approach is closed because the tunnel is under construction at Tange Darkesh Varkesh. This road is generally paved. From Doab samsami, the road crosses the path with the height of 2,800 m on third mountain range and reaches the Bazoft Valley. Around three kilometers of this mountain crossing section, new route is under construction on the Bazoft side and not paved yet.

The road distance from Shahre kord to Chaman Goli-Bazoft (Chemghaleh, the center of this area) through the northern approach is around 180 km. This road continues to northwest, following the tributary of Bazoft River, towards Seil abad and Masjed Soleyman in Khuzestan Province. The villages of Chemghaleh, Khiyarkar, Arteh, Dorak, Baghchenar, and some houses of Fariyak and Kachooz are located along this main road. The access to Tabarak Olya, Tabarak Sofla, Ghale Tabarak located in the south, and the major village of Fariyak and Kachooz is dirt road and some sections of the road are in bad condition. The Tabarak River borders Ghale Tabarak, located in the southern tip of the area, and only the concrete panel is placed on the riverbed at the crossing. During the flood season, the crossing is sometimes not passable.

c) Sarbaz (K7-0-19-1)

Sarbaz is located about 180 km southeast of Shahre kord and 200 km south of Esfahan. The National Road from Shahre kord to Yasuj through Burujen is one of the main access to this area, and the road is in very good condition. From Burujen, the local paved road connects to Bideh, the center of the area, through Semirom. There is a national road, which connects from Esfahan to Semirom.

On the other hand, the local road from Yasuj through Si sakhit, and the pass with elevation of 3,200 m in Dena Mountain also connects to Bideh. This road is paved from Yasuj through Si sakhit, around 30 km, however, the rest is gravelly-dirt road and the improvement of this section is carried out near Si sakhit. In winter, the road is closed with heavy snowfall for about five months.

The road distance from Semirom to Bideh is around 110 km, while from Yasuj to Bideh is 60 km.

Noorabad is located along the Yasuj-Bideh road, while Sarbaz is connected from the road along the Marbor River. A new bridge crossing Marbor River and connecting to Bideh is under construction because the previous flood washed the old bridge away.

The major access to the eastern part of the area, such as Deh Bozorg, Dangazloo, Dorahan, Devergan Olya, Devergan Sofla, Kahangan, Noghel, Telmohamad, Zabih Abad is the local road, the most part of which is mainly paved and also crosses the Marbor River. Another access is the dirt road branching off the Yasuj-Bideh road and runs through the foothill of the Dena Mountains.

The landslides, especially from winter to spring, affect some road sections of the area.

d) Tang Sorkh (K7-48)

Tang Sorkh is located 30 km southeast of Yasuj and there are two access roads. The new access is a part of the National Road; Teheran-Esfahan-Yasuj-Shiraz, which runs near the Shah ghasemi Dam and aligned along the Parikdoon River. Another is the old National Road, which connects Yasuj to Shiraz. The both routes are paved, in good condition and join at the village of Allah Abad, located in the western part of the area.

The access to the western part of the area, such as Allah Abad, Cheshmeh Chenar, Hasan Abad, Islam Abad, Mehrab Abad is the old road, which runs on the left bank of the Boshar River.

The access to Sar Tang Sorkh and Tang Sorkh is the local dirt road branching off the National Road and crossing the Boshar River.

The road distance from Yasuj to the area is about 45 km.

e) Zeras (K8-28)

Zeras is located around 100 km southwest of Shahre kord. The National Road from Shahre kord to Ahaz is the main access to this area, and the road is in very good condition. The main entrance of Zeras, named De dez, is located outside of the area in the north, however, it functions as the center of the area.

A paved road branches off at De dez, climbs up the slope of the mountain range along the Karoon River, passing through Dawodiha, located on the ridge of the mountain range, and reaches the bridge on the Karoon River. The pumping stations for the drinking water are located here. The dirt roads from this access connect Zeras, Shahghaz, Sebalutak, Sartuf, Lir Siya Shapouri and Lir Siya Mozrom, however, the road to Bardkal is not passable because gully erosion is developed on the road.

A dirt road from Dawodiha also goes down to Ali Bandeh and Behoz, however, deep gully erosion is well developed along the road in the middle part of the slope and the car is not passable.

The rest of the area located on the east such as Badelon, Cham, Dareh Sohrab, Dareh Zangi and Gard Lidan has two accesses. One is the dirt road from the bridge at Karoon River to this area, the condition of which is very poor and critical because of gully erosion, rough surface and its steep gradient. The pipeline for the drinking water from the spring located on the left bank of the Karoon River through the bridge is aligned. Another access is also a dirt road which branches off the National Road and crosses the mountain range aforementioned on the eastern part of the area. The villagers of the area are usually using this access because of its short distance to the National Road. The road distance from Shahre kord to the entrance of Zeras is approximately 220 km, and from De dez to the bridge at Karoon River is 4.5 km.

#### 8.4.2 Water Supply and Sewage

##### (1) General Condition of the Study Area

Every village in the Master Plan area has its water supply system and it is reported that domestic water demand varies from 90 liter/day/person to 120 liter/day/person in rural area. It is considered to be low demand in Zeras and some parts of Tang Sorkh compared to the other area. Main water source is spring and approximately 50 % of total demand is supplied by surface water in Zeras. As for sewage, it is difficult to find water treatment facilities in the Master Plan area and all villagers utilize traditional way, which infiltrate waste water to the ground through well structures.

There are 2 types of water supply system in rural area. One is the system without regular water charge. All facilities constructed by villagers are not necessary to be charged excluding emergency repair. On the other hand, facilities which were newly constructed by Rural Water and Waste Water Company demand water charge. In this system, water charge is counted according consumption volume of water, which is measured by meters at each distribution pipe to household. Water charge is established in each province and consists of basic rate and consumption rate.

In Kohgiluyeh va Boyerahmad, for example, 480 rials per month as basic rate and 73 rials as 5 m<sup>3</sup> consumption will be charged. According to this company, Water supply system in 180 villages out of 2,026 villages are operated and maintained by company and collecting rate of water charge varies from 20 % to 60 %.

##### (2) General Condition of the Master Plan area

###### a) Vastegan

Vastegan has 4 villages in the area, namely Vastegan, Nasir Abad, Konark Olya and Konark Sofla. Each village has spring as its source of rural water supply except Konark Sofla, which depends on well as water source for rural water supply. In these village, Konark Olya, Nasir Abad and Vastegan request to improve condition of water supply because of turbidity in

winter season. Spring yield in the area is estimated at about 0.10 m<sup>3</sup>/s based on discharge measurement. On the other hand, it is estimated at 20 liters/sec in the report prepared by MOA. Then it is provisionally recommended to rehabilitate water supply facilities such as intake to reduce turbidity of water in winter, nevertheless it is supposed to be sufficient for water demand.

b) Chaman Goli-Bazoft

Chaman Goli-Bazoft has 3 villages in Dareh Tavileh basin and 7 villages in Gusaleh Bar basin. In Dareh Tavileh basin, each village have spring for water supply and 2 villages, namely Ghale Tabarak and Tabarak Olya, complain shortage of water supply. In Gusaleh Bar basin, every village except Kachooz complain shortage of water. Generally speaking, every village is supposed to be under the condition of water shortage with its water supply system. Bagchenar has severe problem of water shortage and utilize neighboring spring water, which yield is measured to be 0.2 liters/s. And Fariak village is under the same condition. In Chaman Goli-Bazoft, it is recommended to improve water supply system for Bagchenar and Fariak.

c) Sarbaz

Sarbaz has 8 villages in Ly Sorkh basin and 2 villages in other basins. Every village except Dangazloo, Devergan Olya complains shortage of water. Especially, Dorahan village faces severe shortage of water supply. In addition, Kahanghan village have two water supply system. One was constructed 20 years ago to supply water to 140 households and the other was constructed in cooperation with Jihad 8 years ago for 50 households. This village request Jihad to construct new water supply system.

d) Tang Sorkh

There are 2 villages, Tang Sorkh and Sar Tang Sorkh on the right bank of Boshar river and 5 villages on the left bank. In these villages, Hassan Abad, Mehrab Abad and Islam Abad depends on 1 spring which locates at north eastern mountain in the distance of about 15 km from Hassan Abad. This water supply system was constructed 20 years ago and has no capacity to supply water to these all villages. As for Cheshneh Channar, new storage tank is under construction.

e) Zeras

There are 15 villages in Zeras and many of them depend on small springs and Karoon river for drinking and domestic use. In this area, only 9 small springs, which yields are averagely 0.5 liters/sec., have been used and Bardkal, Behoz, Cham, Gard Lidan depend on Karoon water and suffer from not only deficit of water but also high turbidity in flood. And Shagaz have

no water supply system. Water from Karoon No.4 dam will be supplied to some of these village in the future.

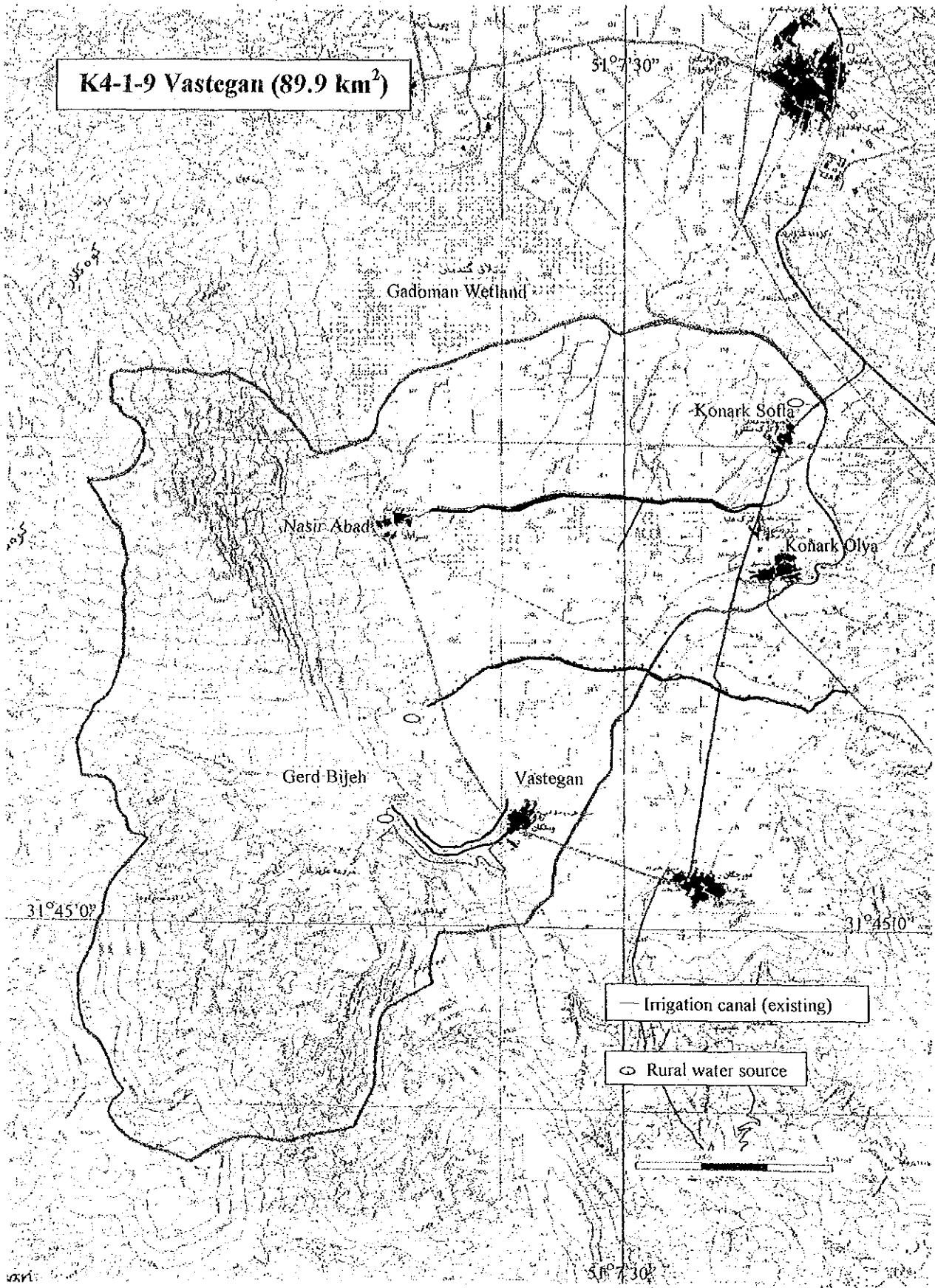


Figure 8-4-2-1 Location Map of Water Use Facilities in Vastegan

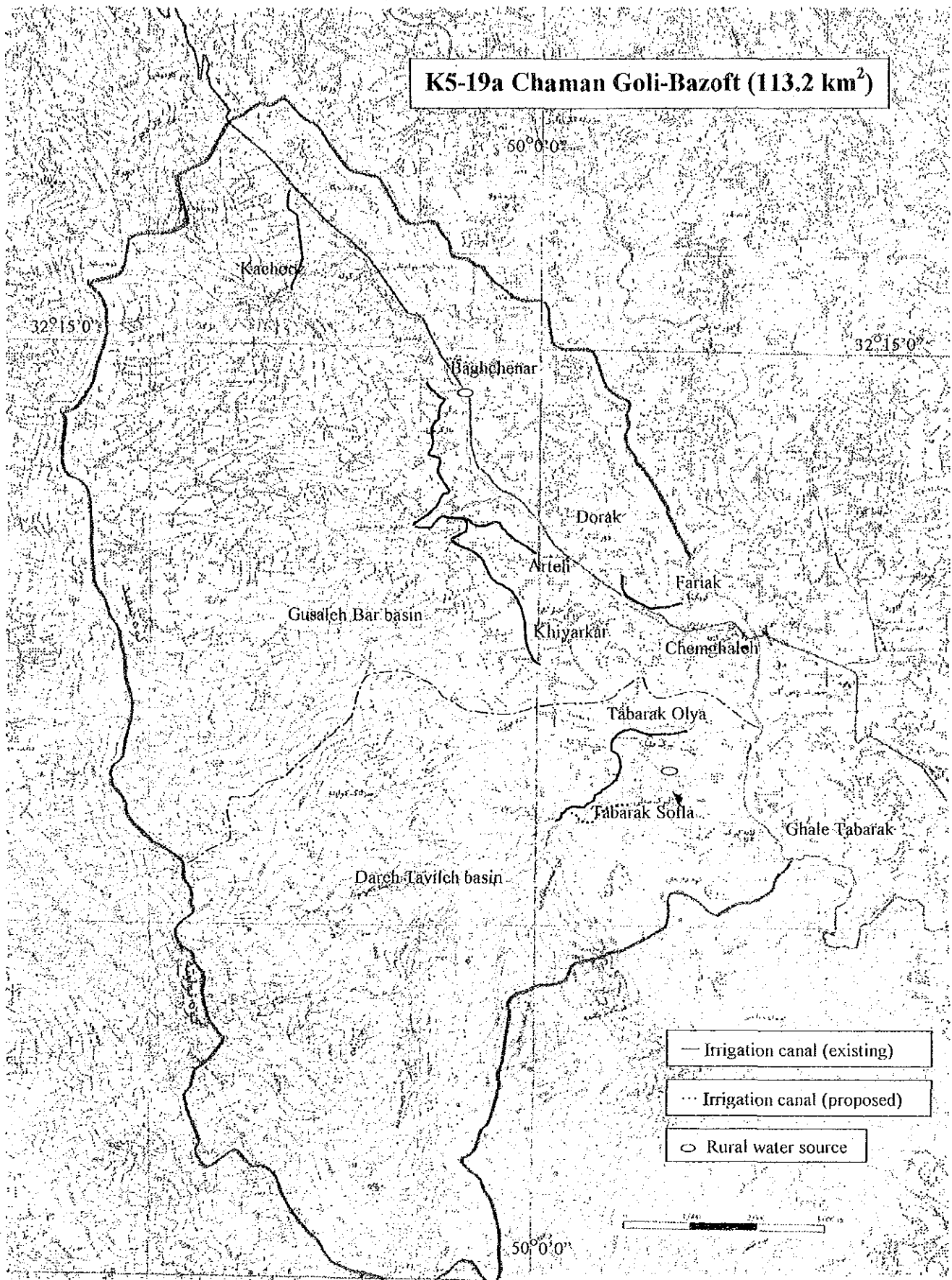
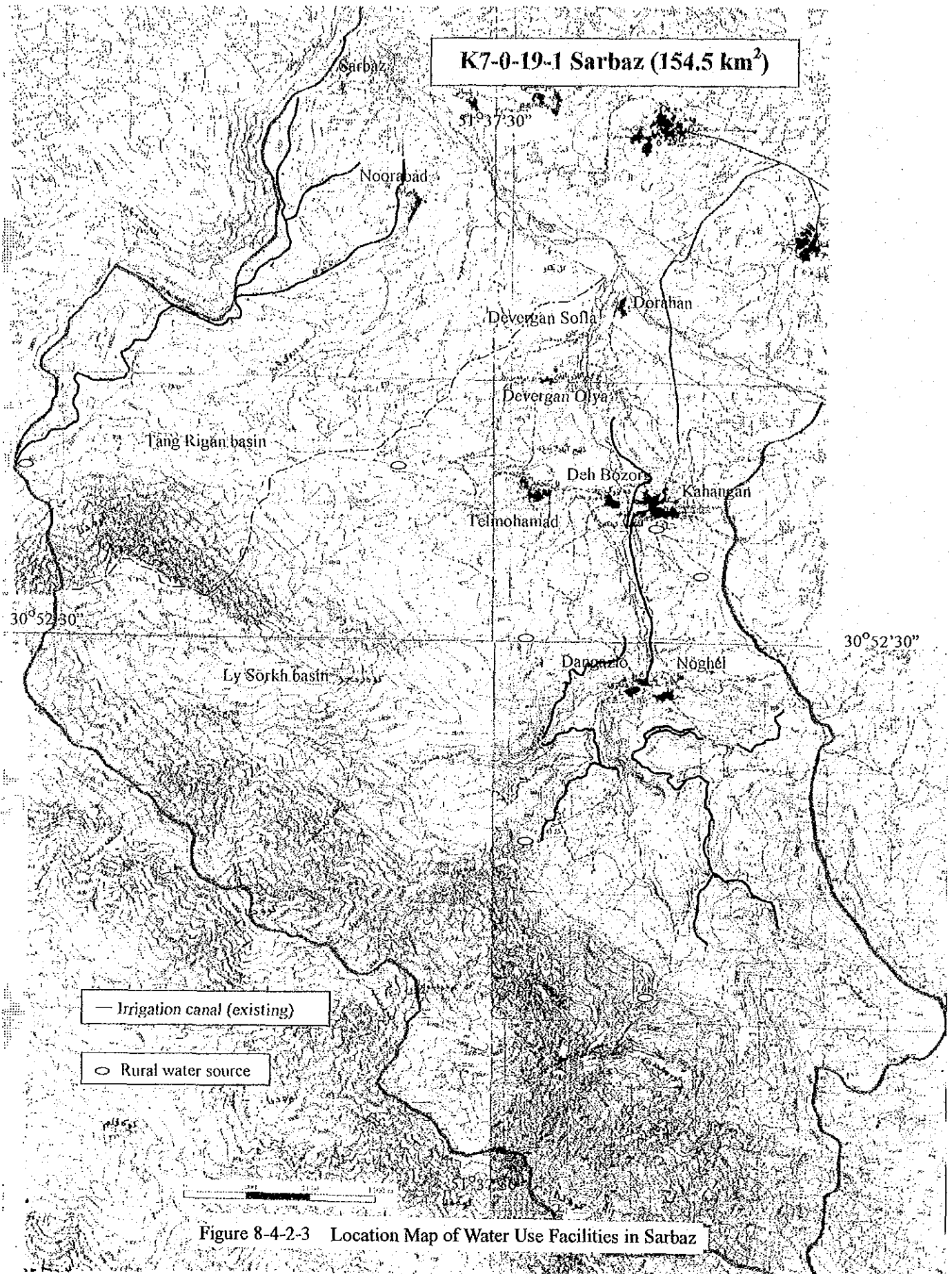
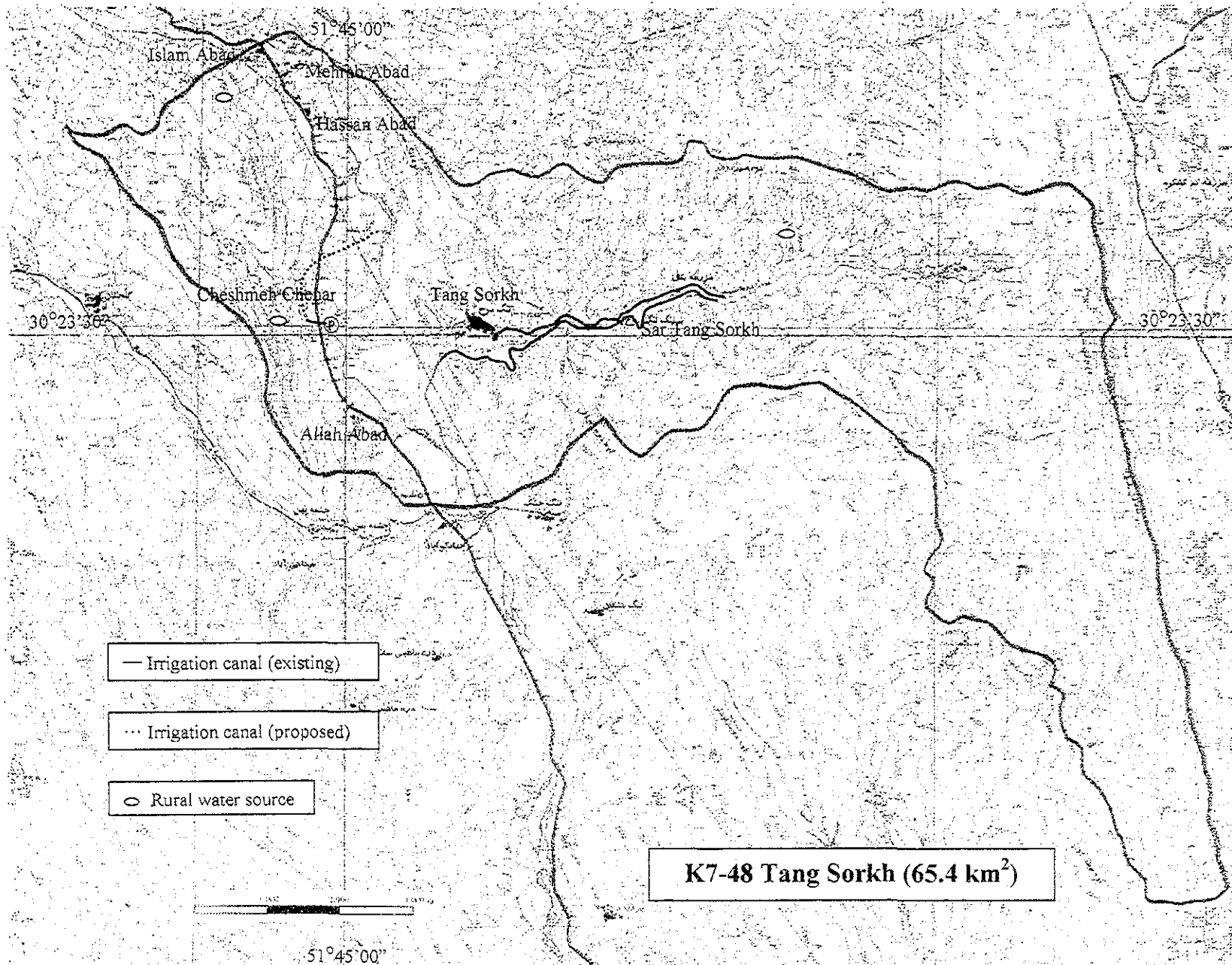


Figure 8-4-2-2 Location Map of Water Use Facilities in Chaman Goli-Bazoft







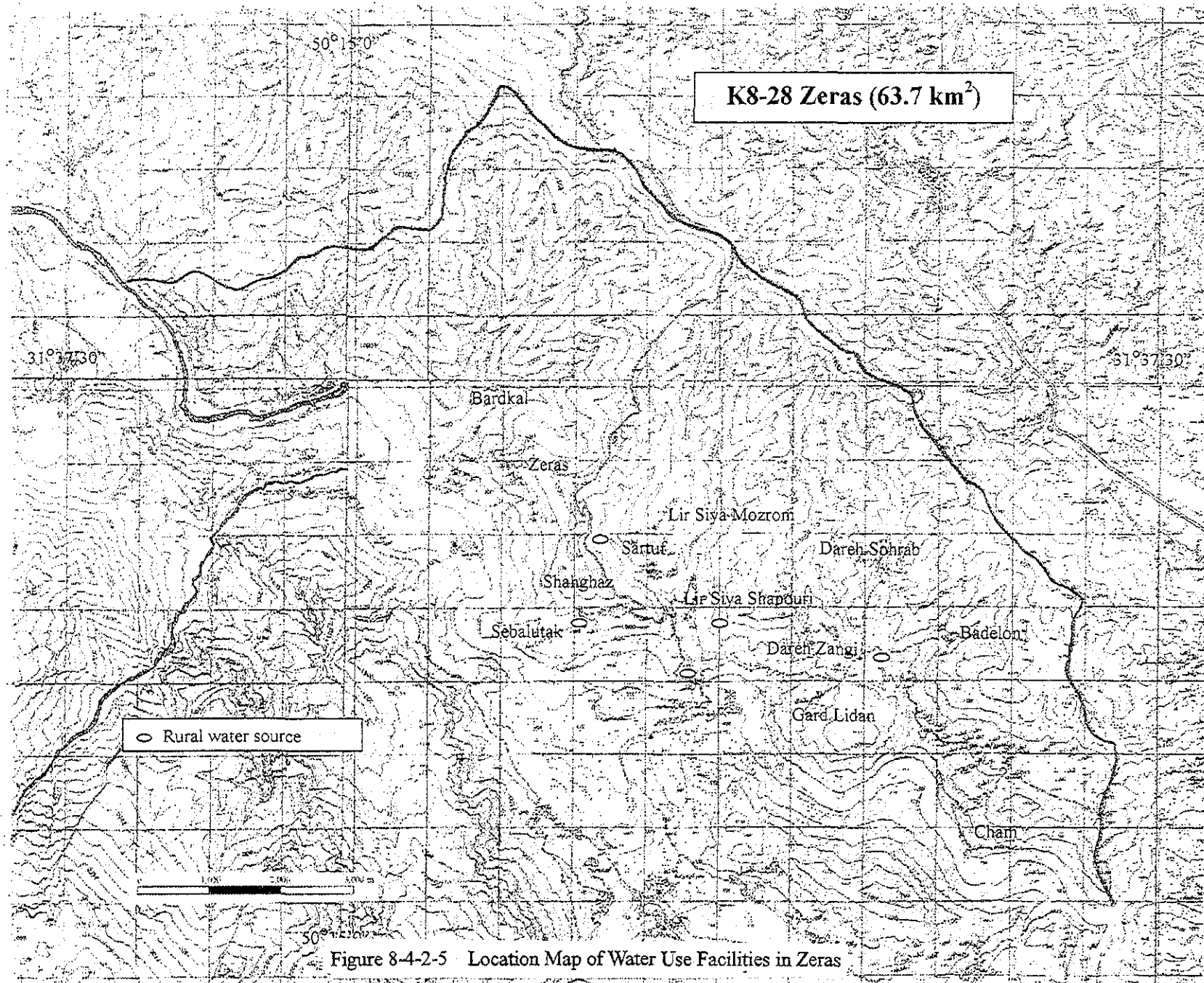


Figure 8-4-2-5 Location Map of Water Use Facilities in Zeras

### 8.4.3 Electrification

All the villages within the selected five (5) Master Plan Study Areas is electrified. According to the Behavioral Survey conducted by the Study Team through RRC, 181 households out of 204 (88.7 %) within the Master Plan Study Areas is using electricity. Major purpose of electricity usage "Lighting" (all the users) followed by mass-communications (Radio and TV) and "Refrigerator". Not much usage for "Cooking" and "Heating" is answered may be because more than 60% of people feel the electricity charge to be "Expensive".

Table 8-4-3 Electricity Usage

		(%)	Actual Figure
Using Electricity		88.7	(181/204)
Purpose of Electricity Usage	Lighting	100.0	(181/181)
	Radio	72.4	(131/181)
	Refrigerator	71.3	(129/181)
	TV	65.7	(119/181)
	Electric Fan	42.0	(76/181)
	Ironing	22.7	(41/181)
	Vacuum Cleaner	14.4	(26/181)
	Cooking	8.8	(16/181)
	Air Conditioner	8.3	(15/181)
	Washing Machine	6.6	(12/181)
	Heating	4.4	(8/181)
	Water Pump	2.2	(4/181)
Concerning Electricity Charge	Cheap	10.8	(18/166)
	Reasonable	29.3	(47/166)
	Expensive	60.8	(101/166)

Source: Behavioral Survey by Study Team/ RRC (July, 2001)

### 8.4.4 Irrigation

#### (1) Vastegan

Irrigate farmland and orchard are informed to be 924 ha and 25 ha, respectively. In Vastegan, 4 major irrigation scheme and many pumping facilities for irrigation are found. These 3 irrigation scheme out of four (4) have been improved by MOA. Water resources of these canals are surface water of Bijeh Gerd and springs. Intakes locate at 2.5 km upstream from Vastegan village, where is the stricture of Bijeh Gerd. In summer season, almost all of surface water is derived for irrigation there.

Pumping wells have been constructed by villagers in cooperation with MOA and are scattered in north

east area of Vastegan. Depth of groundwater table is averagely 50 m in depth. However, recently, groundwater table is come down by over pumping and it become to be necessary to drill again up to 60 m in depth. In these days, some legal controls of constructing pumping wells have been imposed. It is supposed to be indispensable not only to improve irrigation efficiency but also to promote recharge of groundwater.

a) Chaman Goli-Bazoft

Irrigate farmland and orchard of Chaman Goli-Bazoft are informed to be 672 ha and 77 ha, respectively. Ratio of irrigation farmland and orchard in whole farmland are also informed to be 55 % and 6 %. Especially, orchard without irrigation is not found. Major villages except Dorak, Kachooz and Tabarak Olya, requested to improve irrigation facilities for the deficit of irrigation water. As for irrigation scheme, 5 major irrigation scheme and 1 irrigation scheme, which is under construction by MOA, are found in the area. Major water conveyance canals of these irrigation scheme have been lined with concrete. However, in some of these canals, intakes and appurtenant facilities such as water distributors and spill ways are supposed to be necessary to improve.

As far as live stock, request for construction of watering basin have not been found in the area. On the other hand, request for construction of fish ponds have been found in Fariak, Ghale Tabarak and Tabarak Olya. Here, diversion work for fish pond is under construction near Ghake Tabarak. And one fish pond is under construction in Tabarak Olya. These facilities will start their operation in a few years. Then, it is supposed to be necessary to pay attentions for these activities to establish Master Plan.

b) Sarbaz

Irrigate farmland and orchard of Sarbaz are informed to be 541 ha and 2,472 ha, respectively. And almost all farmlands and orchards in the area are also informed to be irrigated. Complain of major villages except Devergan Olya/Sofla, Kahanghan and Zabih Abad is unsteady water supply for irrigation.

In Sarbaz, there are 6 major irrigation scheme and total lengths of each canal is much longer than that of the other Master Plan area. And majors of water conveyance canals in Ly Sorkh basin are lined with concrete, nevertheless main canal in Tang Rigan, which is not lined with concrete. In Sarbaz, it is consider to be necessary to study from the aspect of not only availability of irrigation water, but also proper water distribution.

c) Tang Sorkh

Irrigate farmland and orchard of Tang Sorkh are informed to be 116 ha and 243 ha,