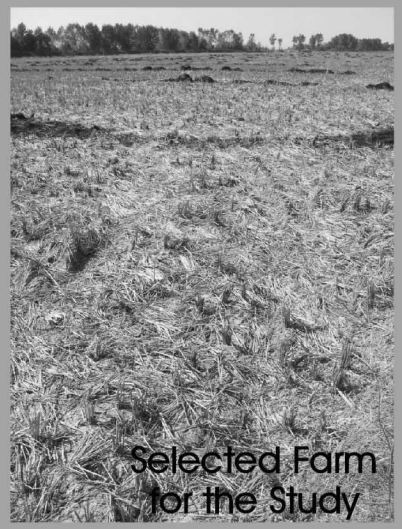
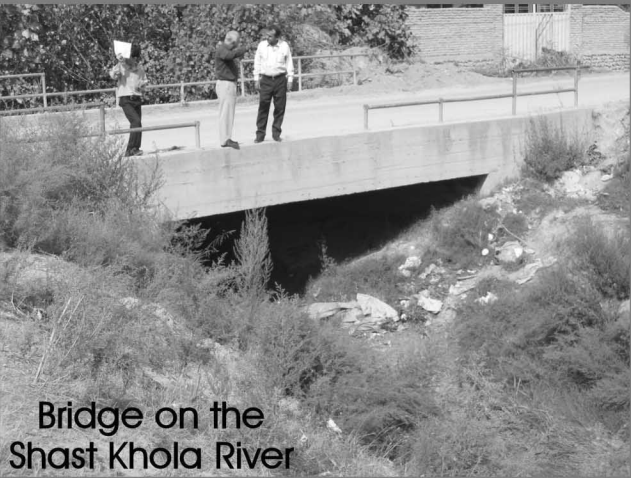


# Cheldin Area

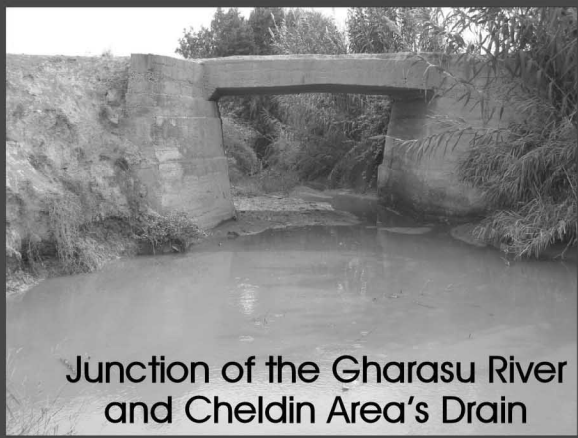
Selected Farm for the Study



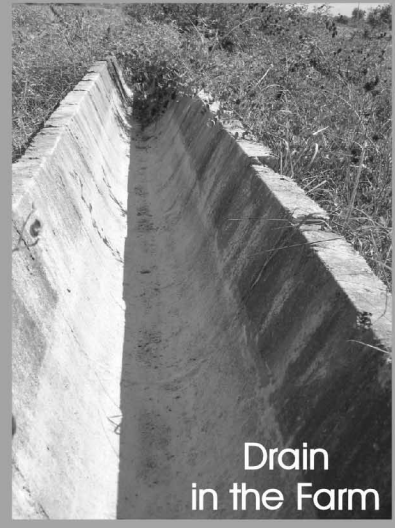
Selected Farm for the Study



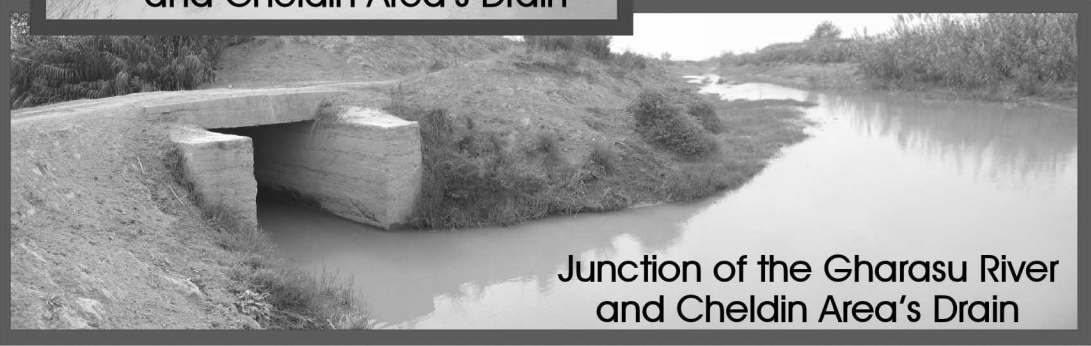
Bridge on the Shast Khola River



Junction of the Gharasu River and Cheldin Area's Drain



Drain in the Farm



Junction of the Gharasu River and Cheldin Area's Drain

## **Summary**

# Summary

## Chapter 1 Introduction

### 1.1 Background of the Study

The Government of Iran has requested to the Government of Japan for the realization of the Study on the Agricultural Development Plan in the Gorgan Plain of Golestan Province, in November 1999. As a response to this request, the Government of Japan sent a Preliminary Study Team through JICA in February 2001, and the Scope of Works was signed on March 12, 2001.

Based on the Scope of Works, JICA dispatched a Study Team, and the Study Team conducted the study in Iran 3 times in January to February 2002, May to July 2002 and September to November 2002. Based on the results of the field surveys and home office works in Japan, the Agricultural Development Plan of the Gorgan Plain was elaborated and Feasibility Study of the priority area was prepared. The results are presented in this report.

### 1.2 Objective of the Study

The Study has the following 2 objectives.

- To prepare an Irrigation and Drainage Plan, considering efficient water use and the salinization control in 800 km<sup>2</sup> of the Golestan Province in the Gorgan Plain.
- To realize technical transfer to the counterpart personnel on each aspect of the Study including survey method, development concept and the preparation of the development plan.

### 1.3 Study Area

The total Study Area is 800 km<sup>2</sup>, which is situated in the Golestan Province (Bandar-e-Torkman, Kordkuy, Aq Qala and Gorgan districts). The Study Area shall be extended to the surrounding areas, if necessary.

### 1.4 Scope of the Study

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

- (1) Phase I (January 2002 to June 2002)
  - 1) 1st Field Survey in Iran (January 2002 to February 2002)
  - 2) 1st Home Office Work in Japan (March 2002). Preparation of the Interim Report (1).
  - 3) 2nd Field Survey in Iran (May 2002 to June 2002)
- (2) Phase II (July 2002 to March 2003)
  - 1) 2nd Home Office Work in Japan (August 2002). Preparation of the Interim Report (2).
  - 2) 3rd Field Survey in Iran (September 2002 to October 2002). Feasibility Study.
  - 3) 3rd Home Office Work in Japan (December 2002). Preparation of the Draft Final Report.
  - 4) 4th Field Survey in Iran (January 2003). Explanation/Discussion of the Draft Final Report
  - 5) 4th Home Office Work in Japan (February 2003). Preparation of the Final Report.

## Chapter 2 Socioeconomical Background and Existing Conditions

### 2.1 General Profile of Iran

<b>General Profile of Iran</b>	
National Area	1,648,000km <sup>2</sup>
Political Division	31 provinces
Population	63,900,000 persons (2000)
Literacy (1998)	<ul style="list-style-type: none"> <li>• &gt;15 years old : 74.6%</li> <li>• 15 ~ 24 years old : 93.2%</li> </ul>
Economy	<ul style="list-style-type: none"> <li>• GDP Increase : 5.9% (2000/2001)</li> <li>• Inflation : 12.6% (consumer price) 14.7% (wholesaler price) 16.3% (producer price)</li> <li>• Agricultural Sector GDP : 12.9% (2000)</li> <li>• Trend of External Debt : 7,952 Million Dollar (2000)</li> </ul>
<b>Agricultural Policy Third 5 Years Plan (1999 – 2004)</b>	
Major Outline	Remove the economic dependency on oil, and increase the exportation of non-petroleum products. The strengthening of agriculture infrastructure is of great importance to achieve these goals.
Policy	<ol style="list-style-type: none"> <li>1) To focus on suitable agricultural products to support the economy not based on oil, such as oil seeds</li> <li>2) To achieve proper agricultural conditions to increase national investment and investing it in other areas</li> <li>3) To complete unfinished projects and implementing regional projects in small scales</li> <li>4) Programming of regional development projects in regard to needs, existing resource and potentials of the area.</li> <li>5) Adjustment of government and the related organizations</li> <li>6) Increase the exploitation of natural resources for agriculture development</li> <li>7) Improve the conditions of agro-industries</li> <li>8) To build or complete the production line of agricultural products and industries</li> <li>9) To direct plans of other sectors related to water, energy, transportation, banks in order to support agricultural sector</li> <li>10) To provide facilities for agricultural development plans, natural resources and directing government credits and banks to invest in this sector and developing shareholding system.</li> </ol>
<b>Exportation/Importation of Agricultural Products</b>	
Importation of Agricultural Products (2000)	<ul style="list-style-type: none"> <li>• Wheat: 5,612 thousand tons</li> <li>• Rice: 1,167 thousand tons</li> <li>• Soybean Oil: 797 thousand tons</li> </ul>
<b>National Agriculture Conditions</b>	
Population Engaged in Agriculture	26.04% of the total workers (2000)
Agricultural Land	12.34 Million ha (2000) which is 7.49% of the national area. 10.27 Million ha for annual crops and 2.07 million ha for perennial crops.
<b>Agricultural Production</b>	
Main Crops	The main crop is wheat, followed by barley, rice and pea. The production of these four crops represents 73% of the total area (1999/2000).
Livestock (2000)	Number of Animals: cow: 8,048x10 <sup>3</sup> heads, sheep and lamb: 79,657x10 <sup>6</sup> heads

## 2.2 General Situation of the Golestan Province

<b>Social Conditions</b>	
Area	20,893 km <sup>2</sup> (About 1.3% of the Country)
Political Division	11 districts ( <i>Shahrestan</i> ), 18 cities and 50 villages ( <i>Dehestan</i> )
Population	1,591,849 persons (2000), 2.5% of the national population
Population Engaged in Agriculture	45.6% (1996), 2 <sup>nd</sup> in the country.
Production Structure (2000)	The population engaged in agriculture is 40.72%, followed by the service sector (33.11) and industry (26.17). The rate of the population engaged in agriculture stays in the 2 <sup>nd</sup> place in the country.
Education	There are 420,000 students, but this number is low compared with the population increase rate.
Province Income	More than 70% comes from the Central Government.
<b>Province Agricultural Development Program (Third 5 Years Plan-1999 ~ 2004)</b>	
Policy	<ol style="list-style-type: none"> <li>1) Increase water use efficiency</li> <li>2) Control flood damages</li> <li>3) Soil conservation against salinization/alkalinization</li> <li>4) Study related to irrigation/drainage and water resources and improvement of necessary facilities</li> <li>5) Create rules for the groundwater exploitation</li> <li>6) Water conduction from the Mazandaran province</li> <li>7) Promote the social participation</li> <li>8) Define the priority for the land and water resources use</li> <li>9) Improve land resources possible to be used by the farmers</li> </ol>
Target	In a period of 5 years starting from 1996, several targets were set for rural engineering, forestry, pasture, watershed management, horticulture, livestock, fishery and extension.
<b>Agriculture in Golestan Province</b>	
General	Agriculture in the province is mostly the agriculture in the climate of the plateau areas of the Elbourz Mountains, including partly in the climate of the coastal region of the Caspian Sea.
Agricultural Land Use	In the province, 630,718 ha of agricultural area were cultivated in 2000. The area of the total cultivated land for annual crops is 611,015 ha, of which irrigated area occupies 269,702 ha (44.8%).
Agriculture Production	50% is wheat, followed by cotton, oil seeds, rice and barley. These five crops represent 91% of the province cultivation area.
Farm Economy	The agricultural machinery/input prices increase more than the agricultural products price, suppressing the farm economy. The cotton and wheat stay in negative between the main crops.
Livestock	There are 2,700,000 sheep, 300,000 cows and other animals as lamb, buffalo, camel and horse. There are also 4.6 million chicken for broilers and 1.8 million for egg production.
Soil	<p>The province can be broadly divided into the land types as shown below:</p> <ol style="list-style-type: none"> <li>1. Elbourz Mountainous area at the southern part of the province</li> <li>2. Hilly areas mostly distributed at the northeastern part</li> <li>3. Plateaus and upper terraces distributed in the northwest and eastern parts and a small portion of southern parts</li> <li>4. Piedmont plains distributed along the middle of the province</li> <li>5. Sedimentary and alluvial plains along the Gorgan river and Atrak river</li> <li>6. Lowlands and saline areas at the western part</li> <li>7. Other areas including small areas of fan shaped colluvium at the upper part of piedmont plain.</li> </ol>

## Chapter 3 Existing Conditions of the Study Area

### 3.1 Natural Conditions

<b>Climate of Gorgan Plain</b>	
General	The Gorgan Plain, where the Study Area is situated, is located in the northern part of the country and eastern side of the Caspian Sea. The Gorgan Plain is situated in a dry to semi-wet region.
Rain	The rainy season is between November to May with an annual average of 270mm ~ 746mm.
Temperature	The average annual temperature is 17.2 °C, having the lowest average of 13.7 °C to 20.5 °C. The absolute minimum temperature reached -14 °C, and the absolute maximum is 46 °C.
Evaporation	The average minimum was 46.1 mm in December and the average maximum 217.9 mm in July. The rainfall is smaller than the evaporation from November to February.
Humidity	The average minimum was 70.3% in August and the average maximum 82.5% in December.
<b>Climate of the Study Area</b>	
Rain	Average of 461.9mm
Evaporation	Annual average of 835.9mm
Effective Rainfall	160.0mm annual
<b>Hydrology</b>	
Surface Water	Mainly Gorgan river (11,480 km <sup>2</sup> ) and Gharasu river (1,720 km <sup>2</sup> ). The annual average discharge in Aq Qala of the Gorgan river is 14.5 m <sup>3</sup> /s.
Caspian Sea Water Level	There are measurements of more than 400 years, showing that there are a cycle of 70 years where the water level varies between -25.5 m to -27.5 m.
Existing Dams	The Voshmgir dam (79 MCM) and Golestan dam (135 MCM) in Gorgan river and Kowsar dam (7.5 MCM) in Gharasu river. The flood control capacity of the Golestan dam is high, as shown in the flood in August of 2001 and 2002.
<b>Water Resources</b>	
Groundwater	There are 13,426 wells registered in the Gorgan Plain utilizing about 700 MCM/year. The number of springs and qanats are respectively 65 and 282, with a total exploitation of 93 MCM/year. So, the total annual water volume exploited from the groundwater in the Gorgan Plain is 793 MCM/year. The agricultural sector consumes about 690 MCM/year.
Surface Water	The main source of surface water in the study area is Gorgan River, which is under the management and responsibility of Ministry of Energy. The water volume for agriculture coming from the Voshmgir dam is 155.0MCM at the upstream and 34.0MCM at the downstream.
Available Water Resources	The Study Area, situated at the downstream of Voshmgir dam, has 34 MCM from the Voshmgir dam and 50.4 MCM from the Zaringol river as water source, with a total of 84.4 MCM.
<b>Topography</b>	
Topography	The Study area extends from 54°06'00" E to 54°42'00" E (about 45km on East-West direction) and from lat. 36°47'19" N to lat. 37°06'08" N (about 35km extends on North-South direction). The elevation is between 10 m to -20 m. The plain has a gentle slope from south to north and east to west.
<b>Geology</b>	
Mountain regions	The mountain front forms the southern boundary of the Study area and hydrologic boundary varies between a constant flux recharge boundary to a zero flux and impervious boundary in the bedrock area.
Foothill Region	Foothill region connects Elbourz Mountains and Gorgan Plain in about 10 or

	15km range along the Mountains, with loess covering the surface. Loess thickness is about 150m in Kalaleh area and this loess layer decreasing from North to South in Gorgan city area.
Plain Region	The Gorgan Plain is generally quite flat, having a gentle slope originating as a result of regression of the ancestral Caspian Sea. In almost all area in the Plain, a veneer of fine-grained sediments covers the surface. This veneer consists of silt and clay and ranges from zero to 50 m thick. Under this surface layer there is a layer of marine sediments.
Hydrogeology	The most important formation is the mountain area with alluvial fan deposits. It is estimated that there are several aquifer systems in the plain area.
<b>Soil</b>	
Piedmont Plain	In an area of about 138km <sup>2</sup> , these are deep soils with very heavy to heavy texture (silty clay, clay and silty clay loam). The salinity and alkalinity problems are at a lower level. The fertility status is usually at a moderate to high level.
Sedimentary and Alluvial Plains of Gorgan River	In an area of about 256km <sup>2</sup> , these are deep soils with medium to heavy texture (silt loam and silty clay loam). They are poorly drained soils with fluctuating saline groundwater table. The salinity and alkalinity problems are at moderate (S2A2) to severe level (S3A3). The fertility status is usually low to moderate level.
Low lands of Gharasu depression	In an area of about 187km <sup>2</sup> , these are deep soils with medium to heavy texture (silt loam and silty clay loam). The salinity and alkalinity problems vary widely from low (S1A1) to severe level (S4A4) depending on the drainage and the proximity to Caspian sea. The fertility status is usually low to moderate level.
Lowland and Saline Areas of Atrak river basin around Gomishan	In an area of about 170km <sup>2</sup> , these are deep soils with medium texture (silt loam). The salinity and alkalinity problems are severe (S3A3) to very severe level (S4A4). The fertility status is usually moderate level.
<b>Environment</b>	
Water Pollution	The salt concentration of Gorgan and Gharasu rivers is high during the dry season. Also the TSS values are high in the range of 700mg ~ 1,000mg.
Others	Atmospheric pollution due to burning of the fields immediately after harvesting of wheat. Also, house wastes and garbage are mostly thrown into the nearby canals or rivers causing diseases.

### 3.2 Socio-economic Conditions

General	The population of 4 Districts occupies 40% of that of Golestan Province. The agriculture is the main sector in this area. The road network is relatively improved. The electricity and water supply is not supplied to most of the farm areas. Telephone facilities are available only in the main cities.
Rural Organization	There are some public and private associations and groups: (Public) Rural Council, RPC (Rural Production Cooperatives), RCO (Rural Cooperative Organization), <i>Basiji</i> , Coupon Distribution Organization, Islamic Assembly: (Private) mosque management groups, women religious groups, milk collecting and transport organization, and <i>Qalz-al-Hassanah</i> . The RPC is a public organization established for an effective agricultural water use and the RCO is a public organization established for improving the living standard of rural settlers.
Rural Women	The difference among races was remarkably revealed from the life style of women.

Assistance from the Government and Finance for Farmers	<p>Governmental assistance programs for farmers and rural areas are now provided by Ministry of Jihad-e-Agriculture, Ministry of Industries and Mining, Ministry of Housing and Urbanization, Ministry of Education, Ministry of Health and Medical Treatment, and Islamic Revolution Housing Foundation. Besides these programs provided through Ministries, Agricultural Products Insurance Fund contributes much to securing agriculture and farmers' lives.</p> <p>Agricultural Bank or Bank Keshavarzi distributes about 65% of the total credit facilities extended to the agricultural sector, the rest 35% is provided by other national banks. Besides, RPC and RCO have a credit scheme for their members. Moreover, <i>Qalz-al Hassanah</i>, an informal money lending organization, is popular among Mazandarani Dehs.</p>
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### 3.3 Agriculture

General	Based on the agricultural conditions, the Study Area is divided into three regions, the southern region of Gharasu River with good conditions for agriculture, zones on both the banks of the Gorgan River with very good conditions for agriculture and high yield, and other areas not appropriate for the agriculture.
Farm Households	There are 55,000 farms in the 4 districts of the study area. Also, there are many farmers with no land. It seems that the high rate of rural population in Golestan province is caused by the existence of many small farms created by the land reforms after the revolution.
Farm Scale	The average of farm scale in the whole Golestan province is 6.7 ha. The farms with 3 to 5 ha is the highest in number, and between 10 to 15 ha is the highest in area. Also, the small scale farms (less than 10 ha) account for 80% of the whole number of farms.
Agriculture Production	The cultivation of wheat (3.3~3.8 tons/ha) and cotton (1.5~1.9 tons/ha) takes priority in irrigated areas. And cultivation of wheat (1.5 ~ 2.9ton/ha) and barley (1.0 ~ 1.7ton/ha) takes priority in rainfed areas. Other important crops are peach, egg plum, orange, olive and walnut.
Extension Service Centers	Most part of the Study Area is covered by 5 Extension Service Centers.
Farm Management in Dry Land Farming	The average yield of wheat is 840 kg/ha, and Golestan Province has the highest yield in Iran, 2.2 tons/ha. Golestan Province is considered as the best dry land farming region of Iran.
Number of Animals	Mainly, sheep (700,000), cow (125,000) and poultry (2,600,000) are raised. Sheep are raised by the farmers in the village for meat production with the traditional method. Cows are mainly raised for milk production. Lamb and buffalo are also raised. Natural pasture, straw of wheat, rice and barley are utilized to feed, but they are not in sufficient quantity in the area.
Farm Households' Survey	It was conducted for understanding actual situation of farm households in the Study Area. The result of this survey is used for concreting the objective of agricultural development. The common problems between the farmers were the lack of irrigation water and low income. The salinization/alkalinization of the soil is mentioned as problem in Aq Qala and Bandar-e-Torkman. Also, many farmers have large debts.
Processing Sector	Most of the processing industries are related to the wheat and livestock. They are flour milling, feed processing plant, dairy factory, leather,



	slaughterhouses.
Marketing	There is one big wholesale market in Gorgan City, where about 150 wholesalers are dealing in distribution of agricultural products. The main problems are the low educational level of the middlemen, lack of transportation means, lack of storage facilities, difficult access for the markets, etc.

### 3.4 Irrigation/Drainage

Existing and Schemes	Irrigation Drainage	There are 6 irrigation schemes in the Study Area. The Provincial Government provided primary facilities for 5 of them (Tazeh Abad, Aq Qala, Shadi Mehr, Gomishan and Gomishan Kesht) and is taking water from the Gorgan river. The remaining Cheldin area has been developed by the farmers themselves from old days and takes water mainly from the groundwater. But, all schemes present water shortage depending on the rainfall. The basin irrigation is widely utilized.
Problems of Existing Schemes	of the Irrigation	<ul style="list-style-type: none"> <li>• Unstable water supply</li> <li>• Water shortage</li> <li>• Inefficient irrigation method</li> <li>• Salinization of the soil</li> <li>• Incomplete Land consolidation</li> <li>• Unimproved irrigation/drainage facilities</li> <li>• Lack of governmental budget, etc.</li> </ul>
Necessary Improvements of Existing Schemes	of the Irrigation	<ul style="list-style-type: none"> <li>• Stable water supply</li> <li>• Improve the irrigation/drainage facilities</li> <li>• Drainage facilities for the salinization control</li> <li>• Guarantee enough water by farm pond, for example</li> </ul>
Responsibility of the Government		All I&D projects starts from the requests of the farmers or farmers' cooperatives to the local government. All costs of water source facilities and main canal networks are responsibility of the government. Costs related to on-farm facilities and appurtenants are shared by both sides. The O&M of the facilities is responsibility of the cooperative. The government will designate a manager for the first 5 years. The main activities of the cooperative will be define admission fee and annual membership fee and their collection, set water allocation rule for the irrigation season, conduct public awareness and define cost allocation rule and its collection for certain expenditures.

## Chapter 4 Problems, Potential and Basic Concept of the Agricultural Development

### 4.1 Problems of the Agricultural Development

Water Resources	<ul style="list-style-type: none"> <li>• Inappropriate distribution of rainfall and high rates of evaporation</li> <li>• Scarcity of surface water for irrigation</li> <li>• Overuse of groundwater resources</li> </ul>
Soil	<ul style="list-style-type: none"> <li>• Salinization and alkalization of the soils</li> <li>• Soil Limitation (texture, permeability, limiting layer, etc.)</li> <li>• Drainage limitation (groundwater depth, ponding problems, etc.)</li> </ul>
Socio-Economy	<ul style="list-style-type: none"> <li>• Urbanization in the vicinities and income gap between urban and rural areas</li> <li>• Insufficient establishment of marketing system</li> <li>• Social aspects, especially the traditional nature of farming</li> </ul>
Agriculture	<ul style="list-style-type: none"> <li>• Problems related to land tenure and farm management</li> <li>• Problems related to the present farming technology</li> <li>• Problems in the agricultural researches</li> </ul>
Livestock	<ul style="list-style-type: none"> <li>• Limitation in forage sources</li> <li>• No policy of guaranteed price</li> <li>• Lack of proper investment on improving sanitary activities for livestock and veterinary services</li> <li>• Lack of slaughterhouse</li> <li>• Lack of pastures</li> <li>• Lack of water</li> <li>• Lack of government assistance, etc.</li> </ul>
Marketing	<ul style="list-style-type: none"> <li>• Most of the middlemen are illiterate or have low educational level and hence their activities are limited</li> <li>• Shortage of transportation means for the products due to the large production in the Province</li> <li>• Shipping cost is high</li> <li>• Storage facilities are not enough</li> <li>• lack of standards for agricultural products quality making difficult it's pricing</li> <li>• Lack of market information</li> <li>• Lack of large markets, etc.</li> </ul>
Irrigation & Drainage	<ul style="list-style-type: none"> <li>• Absolute insufficiency of water</li> <li>• Unstable security of irrigation water</li> <li>• Incomplete drainage system to avoid salinization and alkalization hazards</li> <li>• Improper O&amp;M on I&amp;D facilities due to the low income</li> </ul>

### 4.2 Potentials of the Agricultural Development

Irrigation and Drainage	<ul style="list-style-type: none"> <li>• There are new water resources development plans</li> <li>• Already drained farmland showing low rates of salinization</li> <li>• There are production infrastructure that has already been constructed in lowland areas and alluvial plains, drainage system direct to the Caspian Sea can avoid discharge of salt accumulated water</li> <li>• Desilting ponds can increase the irrigation facilities use efficiency, decreasing the O&amp;M costs</li> <li>• New water resources development can improve the water management and increase the possibility for leaching the salt</li> <li>• The improvement of the on-farm drains can make the main drains functional</li> </ul>
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Agriculture	<p>The agricultural development in this area has great potential.</p> <ul style="list-style-type: none"> <li>• High and stable production of crops, especially wheat</li> <li>• Stable production in dry farms</li> <li>• Low cost mechanization of the agriculture by establishment of cooperatives</li> <li>• Sustainable farming by modernized combination of agriculture and animal husbandry</li> <li>• Effective extension activities</li> <li>• Increase of the employment opportunities</li> <li>• High living standard of farmers, etc.</li> </ul>
Livestock	<ul style="list-style-type: none"> <li>• Large area able to produce plant forage</li> <li>• Cultivation of alfalfa, clover, etc. are possible as secondary crops</li> <li>• Existence of investment for dairy product facilities, slaughter house and milk collection facilities</li> <li>• high rate of graduated people in veterinary</li> <li>• Increase of livestock cooperatives</li> <li>• Advantage of being close to the Mid-Asian countries, etc.</li> </ul>

### 4.3 Basic Concept of the Agriculture Development

Irrigation and Drainage	<p>Improvement on Water Utilization</p> <ul style="list-style-type: none"> <li>• Strengthen the Extension Services of Proper Irrigation Practice</li> <li>• Provision of Farm Pond</li> <li>• Provision of Desilting Pond</li> <li>• Irrigation Canal Lining</li> <li>• Realize Proper Water Management</li> <li>• Examination of New Water Resources Development</li> <li>• R&amp;D on Natural Environment Harmonized Farming Program</li> </ul> <p>Improvement on Drainage Systems</p> <ul style="list-style-type: none"> <li>• Increment of Drainage Density</li> <li>• Lowering of Groundwater Level</li> </ul>
Soil Improvement	<ul style="list-style-type: none"> <li>• Reclamation of salinity, and alkalinity</li> <li>• Improving the soil fertility</li> </ul>
Agricultural Production Infrastructure	<ul style="list-style-type: none"> <li>• Rural Roads Improvement</li> <li>• Processing Infrastructure</li> <li>• Storage Infrastructure</li> <li>• Agricultural Products Market</li> </ul>
Farming	<ul style="list-style-type: none"> <li>• Increase of productivities of crops</li> <li>• Promoting researches corresponding to real farming conditions</li> <li>• Sustainable farming</li> <li>• Promotion of plastic greenhouse</li> <li>• Promotion of processing</li> <li>• Promotion of rural production cooperatives</li> <li>• Promotion of mechanization</li> <li>• Introducing pastures into crop rotation</li> </ul>

#### 4.4 Initial Environmental Examination (IEE)

Major environmental impacts to be assessed	<p>The major environmental impacts to be assessed are as follows:</p> <ul style="list-style-type: none"> <li>• Water contamination and deterioration of water quality including eutrophication</li> <li>• Sedimentation</li> <li>• Soil contamination by agrochemicals</li> <li>• Soil salinization and alkalinization</li> <li>• Influence on surface water and groundwater hydrology</li> <li>• Atmospheric Pollution</li> <li>• Health and sanitation</li> </ul>
Environmental Monitoring and Management System (EMMS)	<p>It is necessary to include the following items in the EMMS.</p> <ul style="list-style-type: none"> <li>• Regular monitoring of water quality in Gorgan and Gharasu rivers and appropriate use of fertilizers and agriculture chemicals</li> <li>• Inclusion of desilting ponds in the project areas</li> <li>• Regular monitoring of soil properties and proper recommendation of fertilizers and chemicals</li> <li>• Inclusion of proper drainage system and adaptation of salinity resistant varieties</li> <li>• Proper distribution and usage of surface water and use of water saving methods</li> <li>• Regular monitoring of groundwater and use of water saving methods</li> <li>• Regular monitoring of atmospheric pollution and adoption of proper farm management practices</li> <li>• Monitoring of regulations of waste disposals and provision of waste disposal measures</li> </ul>
Impacts of the Project	<ul style="list-style-type: none"> <li>• Increased food production through the effective utilization of the wide area of the plain</li> <li>• Settlement of the people who have a strong nomadic culture</li> <li>• New economic activities through marketing and agriculture processing</li> <li>• Expansion of employment opportunities of the local population</li> <li>• Substantial improvement in way of life</li> <li>• Reduction of inundation and flood by drainage projects</li> </ul>
Regulations of Iran for the EIA	<p>EIA needs to be executed for the following projects related to irrigation and drainage and agriculture development:</p> <ul style="list-style-type: none"> <li>• New irrigation/drainage project, which exceeds the size of 5000 ha or more</li> <li>• Dam of more than 15m high with area more than 400 ha area</li> <li>• Man-made lakes with an area of more than 400 ha area</li> </ul>
Necessity of EIA	<p>Since these works are only a part of on-going works and the planned ponds are smaller than 400 ha, there is no need to carry out EIA.</p>

## Chapter 5 Scenario of Agriculture Development in Gorgan Plain and Selection of Priority Areas

### 5.1 Government Policies for Agricultural Development

Related Policies of the Central Government	<ul style="list-style-type: none"> <li>• Increase agricultural products and income of the farmers and to improve the facilities of marketing</li> <li>• Develop agricultural training and activities specially in the field of soil, water and renewed natural resources</li> <li>• Carry out development plans of water resources such as reservoirs, irrigation and drainage systems to increase the irrigation potential</li> <li>• Organize agricultural cooperatives, improving the livestock sector in regard to the existing pasture lands</li> <li>• Improve the administrative structure or organizations related to the objectives of development of agricultural sector</li> <li>• Provide new technical methods to farmers</li> <li>• Improve crediting system and investment in agricultural sector</li> <li>• Improve and protect natural resources by social and economical approaches</li> <li>• Improve and develop exportation of agricultural products</li> </ul>
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### 5.2 Intentions of the Province for Agricultural Development

Provincial Government	<ul style="list-style-type: none"> <li>• Increase the efficiency of water transfer (supply) and its distribution for different uses</li> <li>• Decrease the occurrence and damages caused by floods</li> <li>• Conserve the soil quality in order to prevent the process of soil degradation and its salinization / alkalization</li> <li>• Execution of studies and construction of irrigation / drainage systems and water supply plan</li> <li>• Establish the effective exploitation of groundwater</li> <li>• Transfer the excess water of Mazandaran Province to Golestan Province</li> <li>• Emphasize on social participation</li> <li>• Prioritize the plans which aim to increase in exploitation of water resources and agricultural lands</li> </ul>
Farmers	<p>Target income of the farmers:</p> <ul style="list-style-type: none"> <li>• Most of the farmers whose farm scale is less than 20 ha has a target of 20 million Rials and those larger than 20 ha is 115 million Rials to 130 million Rials. It is equivalent to 2 to 3 times the sum of the living and production cost.</li> <li>• Most of the farmers want to continue in the agriculture sector</li> <li>• Many farmers in Aq Qala and Kordkuy want to introduce new crops</li> <li>• Desire for varieties resistant for the local natural conditions</li> <li>• Farmers with lands greater than 3 ha desires to introduce livestock</li> <li>• Intend to invest in facilities</li> </ul>

### 5.3 Scenario of Agricultural Development

Phasing Alternative	<ul style="list-style-type: none"> <li>• Preparatory stage (2003 ~ 2004)</li> <li>• Phase I Short Term (2005 ~ 2009)</li> <li>• Phase II Medium Term (2010 ~ 2014)</li> <li>• Phase III Long Term (2015 ~ 2019)</li> </ul>
Phase I (Short Term)	<p>‘Preparation for Sustainable Agricultural Development and Rural Activation’</p> <ul style="list-style-type: none"> <li>• Projects execution in the priority areas</li> <li>• Commence the study for the ‘Integrated Water Resources Management and Watershed Conservation in the Gorgan Plain’</li> <li>• Commence research and development activities focusing on analyzing the</li> </ul>

	<p>optimal and suitable farm management practices for the region</p> <ul style="list-style-type: none"> <li>• Clarify available resources to be mobilized</li> <li>• Strengthen the coordination activities among relevant agencies</li> </ul>																																																											
Phase II (Medium Term)	<p>‘Improving the Present Agriculture and Preparation for Wider Development’</p> <ul style="list-style-type: none"> <li>• Extend the results of the research/test results of the Phase I continuing new study subjects</li> <li>• Construction of facilities to promote the water use, if there is enough available water</li> <li>• Construction of facilities shall be started, if the study on ‘Mazandaran Water Supply Project’ is concluded to be feasible</li> </ul>																																																											
Phase III (Long Term)	<p>‘Implementing Sustainable and Wider Range of Agricultural Development’</p> <ul style="list-style-type: none"> <li>• The Phase I and II results of research and development activities should be extended in the region.</li> <li>• If enough quantity of water shall be conveyed through ‘Mazandaran’, the water will be utilized for further agricultural development of the region</li> </ul>																																																											
<b>Study on Integrated Water Resources Development and Watershed Conservation</b>																																																												
Objective of the Study	<ul style="list-style-type: none"> <li>• Analyze the existing conditions of the Gorgan and Gharasu river watersheds including water resources potential, existing problems of the watersheds, watershed conservation measures, estimating the present and future water demand and realizing water balance in the Gorgan Plain</li> <li>• Formulate a well-balanced integrated water resources and watershed conservation, including inter-basin and inner-basin water transfer, considering natural and social environment in each river watershed as well as in the neighboring watersheds</li> </ul>																																																											
Study Schedule	<p>The study will be divided in 2 phases.</p> <p style="text-align: center;"><b>Study Schedule</b></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2">Phase</th> <th colspan="6">Phase I: Evaluation of the Present Water Resources</th> <th colspan="8">Phase II: Master Plan Study</th> </tr> <tr> <th colspan="6"></th> <th colspan="4">Alternative Study</th> <th colspan="4">M/P Formulation</th> </tr> <tr> <th>Month</th> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th> <th>7</th><th>8</th><th>9</th><th>10</th> <th>11</th><th>12</th><th>13</th><th>14</th> </tr> </thead> <tbody> <tr> <td>Schedule</td> <td style="background-color: black;"></td><td style="background-color: black;"></td><td style="background-color: black;"></td><td style="background-color: black;"></td><td style="background-color: black;"></td><td style="background-color: black;"></td> <td style="background-color: black;"></td><td style="background-color: black;"></td><td style="background-color: black;"></td><td style="background-color: black;"></td> <td style="background-color: black;"></td><td style="background-color: black;"></td><td style="background-color: black;"></td><td style="background-color: black;"></td> </tr> </tbody> </table>	Phase	Phase I: Evaluation of the Present Water Resources						Phase II: Master Plan Study														Alternative Study				M/P Formulation				Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Schedule														
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#### 5.4 Selection of Priority Area

Selection of Priority Area for the Feasibility Study	<p>The gradual development is promoted for the sustainable agricultural development in Gorgan Plain. An area will be selected between the 6 existing irrigation areas, promoted by the government, able to be a model for the development. A feasibility study will be realized for this area. The result will be utilized as base for the Gorgan Plain agricultural development.</p> <p>Selection Criteria</p> <ul style="list-style-type: none"> <li>• Farmers’ Organization, Participation Intention and others</li> <li>• Sufficiency of Present I &amp; D Facility</li> <li>• Salinization of Irrigation Water Source</li> <li>• Availability of Irrigation Water</li> <li>• Actual Irrigable Area</li> <li>• Affinity of the farming conditions to vicinities</li> <li>• Accomplishment of drainage activities</li> </ul>
F/S Area	The selection results are as follows:

Comparision Nominated Development Potential Areas						
Descriptions	No.1	No.2	No.3	No.4	No.5	No.6
	Tazeh-Abad	Hemmat (Aghghabar)	Shadi Mehr (Aghghabar)	Gomishan (Banaver)	Gomishan Keshl	Cheldin (Mehtar Kola)
Cooperative entry accomplishment	6	5	1	3	2	4
Cooperative activation	6	5	1	4	2	3
Sense of ownership, participating conditions of farmers	6	5	1	4	2	3
Sufficiency of Present Irrigation. & Drainage Facility	6	6	1	3	2	6
Salinization of irrigation water source	5	4	4	2	2	6
Availability of irrigation water source	5	4	4	2	2	6
Actual irrigable rate on extent	5	4	2	3	2	6
Affinity of the farming conditions to vicinities	6	6	6	6	6	1
Accomplishment of drainage activities	5	5	2	3	2	0
Total	50	44	22	30	22	35

Note ; 1). Bigger number is superior comparatively.  
2). Numbers are only impressive puriory only.

So, the Tazeh Abad Project was selected as the priority area for the F/S.

Selection of the Case Study Area

The Iranian side requested a Case Study in an area of about 20 ha in the Cheldin area with emphasis on the improvement of the farming system. The Cheldin area shares a part of piedmont agricultural area, which is considered as the main agriculture production area in Gorgan Region and it is necessary as an effective example to show the farmers on the way to improve the present conditions independently. After discussing with the MOA and RPC personnel, the selected area was an area owned by 8 persons with 27 ha in the northern part of the Cheldin area.

## Chapter 6 Feasibility Study of Tazeh Abad Irrigation and Drainage Project

### 6.1 Existing Conditions of the Project Area

<b>Natural Conditions</b>																																																																																																			
Climate	<p>The climate conditions are as follows:</p> <p style="text-align: center;"><b>Climatological Conditions</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Item</th> <th>Jan</th> <th>Feb</th> <th>Mar</th> <th>Apr</th> <th>May</th> <th>Jun</th> <th>Jul</th> <th>Aug</th> <th>Sep</th> <th>Oct</th> <th>Nov</th> <th>Dec</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Rain (mm)</td> <td>41.2</td> <td>44.4</td> <td>46.0</td> <td>34.2</td> <td>40.2</td> <td>12.7</td> <td>9.4</td> <td>12.6</td> <td>22.6</td> <td>38.0</td> <td>47.3</td> <td>52.7</td> <td>401.3</td> </tr> <tr> <td>Temperature (oC)</td> <td>9.9</td> <td>15.7</td> <td>18.3</td> <td>22.3</td> <td>27.3</td> <td>32.0</td> <td>31.2</td> <td>27.5</td> <td>22.4</td> <td>17.1</td> <td>12.5</td> <td>9.2</td> <td>20.5</td> </tr> <tr> <td>Evaporation (mm)</td> <td>58.7</td> <td>72.4</td> <td>97.6</td> <td>137.9</td> <td>196.7</td> <td>227.3</td> <td>213.6</td> <td>179.5</td> <td>114.4</td> <td>87.6</td> <td>60.2</td> <td>53.4</td> <td>1499.3</td> </tr> <tr> <td>Humidity (%)</td> <td>73.0</td> <td>76.3</td> <td>78.7</td> <td>84.5</td> <td>84.7</td> <td>84.5</td> <td>83.1</td> <td>79.3</td> <td>72.9</td> <td>75.0</td> <td>73.3</td> <td>75.0</td> <td>78.4</td> </tr> <tr> <td>ETo (mm)</td> <td>38.1</td> <td>47</td> <td>63.5</td> <td>89.6</td> <td>127.9</td> <td>147.8</td> <td>138.9</td> <td>116.7</td> <td>74.4</td> <td>56.9</td> <td>39.1</td> <td>34.7</td> <td>974.6</td> </tr> <tr> <td>Effective Rain (mm)</td> <td>14.7</td> <td>16.6</td> <td>17.6</td> <td>10.5</td> <td>14.1</td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td>3.6</td> <td>12.8</td> <td>18.4</td> <td>21.6</td> <td>129.9</td> </tr> </tbody> </table>	Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Rain (mm)	41.2	44.4	46.0	34.2	40.2	12.7	9.4	12.6	22.6	38.0	47.3	52.7	401.3	Temperature (oC)	9.9	15.7	18.3	22.3	27.3	32.0	31.2	27.5	22.4	17.1	12.5	9.2	20.5	Evaporation (mm)	58.7	72.4	97.6	137.9	196.7	227.3	213.6	179.5	114.4	87.6	60.2	53.4	1499.3	Humidity (%)	73.0	76.3	78.7	84.5	84.7	84.5	83.1	79.3	72.9	75.0	73.3	75.0	78.4	ETo (mm)	38.1	47	63.5	89.6	127.9	147.8	138.9	116.7	74.4	56.9	39.1	34.7	974.6	Effective Rain (mm)	14.7	16.6	17.6	10.5	14.1	0.0	0.0	0.0	3.6	12.8	18.4	21.6	129.9
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Hydrology	<p>The main water sources are the Voshmgir dam and Zaringol river. The dam discharge and river discharge (10 years return period) are shown bellow.</p> <p style="text-align: center;"><b>Surface Water (MCM)</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Item</th> <th>Jan</th> <th>Feb</th> <th>Mar</th> <th>Apr</th> <th>May</th> <th>Jun</th> <th>Jul</th> <th>Aug</th> <th>Sep</th> <th>Oct</th> <th>Nov</th> <th>Dec</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Voshmgir Dam</td> <td>0.4</td> <td>0.7</td> <td>2.2</td> <td>6.0</td> <td>5.8</td> <td>3.6</td> <td>6.4</td> <td>5.1</td> <td>2.0</td> <td>0.8</td> <td>0.6</td> <td>0.4</td> <td>34.0</td> </tr> <tr> <td>Zaringol River</td> <td>4.4</td> <td>6.8</td> <td>7.6</td> <td>5.7</td> <td>8.2</td> <td>0.4</td> <td>0.0</td> <td>0.0</td> <td>1.0</td> <td>0.2</td> <td>2.3</td> <td>2.1</td> <td>38.8</td> </tr> <tr> <td><b>Total</b></td> <td><b>4.8</b></td> <td><b>7.5</b></td> <td><b>9.8</b></td> <td><b>11.7</b></td> <td><b>14.0</b></td> <td><b>4.0</b></td> <td><b>6.4</b></td> <td><b>5.1</b></td> <td><b>3.0</b></td> <td><b>1.0</b></td> <td><b>2.9</b></td> <td><b>2.5</b></td> <td><b>72.8</b></td> </tr> </tbody> </table> <p>Also, there are 8 wells in the area with a pumping capacity of 5 lit/sec.</p>	Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Voshmgir Dam	0.4	0.7	2.2	6.0	5.8	3.6	6.4	5.1	2.0	0.8	0.6	0.4	34.0	Zaringol River	4.4	6.8	7.6	5.7	8.2	0.4	0.0	0.0	1.0	0.2	2.3	2.1	38.8	<b>Total</b>	<b>4.8</b>	<b>7.5</b>	<b>9.8</b>	<b>11.7</b>	<b>14.0</b>	<b>4.0</b>	<b>6.4</b>	<b>5.1</b>	<b>3.0</b>	<b>1.0</b>	<b>2.9</b>	<b>2.5</b>	<b>72.8</b>																																										
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Soil	<ul style="list-style-type: none"> <li>• pH of 7.5 ~ 8.1</li> <li>• Major part of the soils in the area has high salinity value, except the area near the Gorgan river where is practiced the irrigation</li> <li>• The alkalinity value is high in the west area</li> <li>• CEC value ranges between low (&lt;15) to medium (&lt;25)</li> <li>• The texture is medium but has heavy texture in some parts</li> </ul>																																																																																																		
Environment	<p>The main problems are presented below:</p> <ul style="list-style-type: none"> <li>• High salinity and alkalinity of the soils of the Project Area</li> <li>• High level of underground water</li> <li>• Water quality of Gorgan River</li> </ul> <p>Since these works are only a part of on-going works, there is no need to carry out EIA.</p>																																																																																																		
<b>Socio-economical Conditions</b>																																																																																																			
Population	Tazeh Abad scheme has a cooperative called Pavand RPC with 451 members. This RPC covers 8 Deh which has a population of 9,216 persons.																																																																																																		
Economical Activities	The main economical activities are agriculture and livestock.																																																																																																		
Market	<p>The marketing channel of agricultural products from Tazeh Abad scheme is differentiated by product from the other areas. In the case of wheat the main buyer are the RCO, Cereal Organization (Public enterprise), Flour milling factories and Middlemen.</p> <p>The main Marketing Problems are:</p> <ul style="list-style-type: none"> <li>• Low price of the products</li> <li>• Relationship with the buyers</li> <li>• Lack of market information</li> <li>• Transportation means and cost</li> </ul> <p>There is no agricultural product processing industry in the area.</p>																																																																																																		



Pavand RPC	<p>Organization: RPC Pavand comprises of a President and an accountant dispatched from Jihad-e-Agricultural Organization and other 5 persons in the executive board.</p> <p>Main activity</p> <ul style="list-style-type: none"> <li>• Agricultural infrastructure improvement</li> <li>• Distribution of irrigation water</li> <li>• Land leveling</li> <li>• Sale of agricultural input</li> <li>• lending and selling agricultural machinery</li> <li>• collecting and shipping of agricultural products</li> <li>• providing agricultural extension service</li> </ul> <p>Problems of the RPC's members</p> <ul style="list-style-type: none"> <li>• Shortage of agricultural inputs</li> <li>• High rental of agricultural machinery</li> <li>• Insufficient Technical instruction</li> <li>• Shortage of irrigation water distribution and necessity to pay water fee even for locations where the irrigation net work is not completed</li> <li>• Poor farm economy</li> </ul> <p>Request to RPC Pavand from the members</p> <ul style="list-style-type: none"> <li>• Supplying of sufficient water and individual technical extension</li> <li>• Decrease of water charge and additional member's fee</li> <li>• Completion of concrete lining of the irrigation canals</li> <li>• Purchasing tracks for transporting their product</li> <li>• Selling of wheat seeds as the other years</li> </ul>
Agricultural Assistance and Finance	<ul style="list-style-type: none"> <li>• Among the members of RPC Pavand, 50-60% of them get Agricultural Product Insurance through the RPC. More precisely, all of the members who cultivate rapeseed and cotton get it because of high risk of their cultivation. The ratio of those who get the insurance in the members who cultivate wheat is about 30-40%.</li> <li>• The members of RPC Pavand mainly use Agricultural Bank through the intermediation of the RPC or by themselves. The credit organisms are the Bank Keshavarzi and other banks as Melli Iran, Saderat, Mellat, Tejarat and Sepah.</li> </ul>
Social Infrastructure	<p>The access condition to the area is good, but the roads in the area are not paved and have traffic problems during the rainy season. 100% of the farmers have electricity, 7 Deh have water supply and 4 Deh have telephone. Each Deh has at least 1 school and there are 4 health centers.</p>
<b>Agriculture</b>	
Agricultural Production	<p>The gross cultivable area is 3,210 ha. The number of households is 102 (28% of total households) for 0 to 3 ha of farming scale, 86 (24%) for 3 to 5 ha, 122 (33%) for 5 to 10 ha, 36 (10%) for 10 to 20 ha, 16 (4%) for 20 to 50 ha and 5 (1%) in over 50 ha, respectively.</p>
Farm Management	<p>In general, wheat is seeded in December and harvested in May, and irrigated with water of Gorgan River in 2 times of February and the end of March. Barley is irrigated once in February. After fallow in winter, cotton is irrigated in the middle of March as pre-irrigation to leach salt, and seeded in April, harvested in the end of November, and irrigated 3 times of June, July and August.</p>
Livestock	<p>The accurate number of livestock in the project area, such as cattle, sheep, camel, etc., can not be clarified. According to the leader of the RPC, 50% of the farmers in the project area raise 2 to 10 heads of cows, and 10% of the farmers raise 20 to several hundred heads of sheep.</p>

Farm Economy	<p>According to the farm households' survey of 7 farmers in project area, the farm scale of the surveyed farmers were ranged from 4 to 65 ha, and 4 farmers raised livestock. The compositions of animal husbandry in total annual gross income in the households were ranged from 10 to 25%. Besides, the compositions of non-agricultural incomes were ranged from 12 to 51%. At present, the project area is suffered by serious shortage of irrigation water and by drought. As farmers cannot count on crop production, it seems to expect on animal husbandry. All of the farmers intend to introduce milk cows of 2 to 20 heads.</p>																																																																																																																																		
Agricultural Extension	<p>At present, agricultural extension for farmers in the Pavand RPC is mainly carried out by the Anbar Olum Extension Service Center. The extension activities are as follows:</p> <ul style="list-style-type: none"> <li>• The plan of training courses is presented by the Extension Service Center in every 3 months. RPC communicates to the Extension Service Center about the schedule and the participants and arranges to open the training courses. Trainers are the specialists of the Extension Service Center. In 2001, 56 training courses were carried out in the Peivand RPC, and participants of the training courses were 1,417 man-hour in total.</li> <li>• The RPC has trial fields and exhibition fields of 5 to 6 ha to transfer the cultivation techniques to farmers. In 2001, selection trial of wheat varieties were carried out in the trial field of 1 ha, and exhibition of cultivation techniques on 4 crops, such as wheat, barley, cotton, rape, is intended in the next year.</li> </ul>																																																																																																																																		
<b>Irrigation &amp; Drainage</b>																																																																																																																																			
Land Use	<p>The present land use of the Tazeh Abad scheme is presented below.</p> <p style="text-align: center;">Actual Land Use (ha)</p> <table border="1" data-bbox="767 1106 1078 1305" style="margin-left: auto; margin-right: auto;"> <tr><td>Agricultural Land</td><td>3,040</td></tr> <tr><td>Farm Road</td><td>42</td></tr> <tr><td>Residencial Area</td><td>2</td></tr> <tr><td>Pond</td><td>150</td></tr> <tr><td>Canal</td><td>108</td></tr> <tr><td>Total</td><td>3,320</td></tr> </table>	Agricultural Land	3,040	Farm Road	42	Residencial Area	2	Pond	150	Canal	108	Total	3,320																																																																																																																						
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Irrigation Method and Water Demand	<p>The original intension for introducing this irrigation scheme was as 'supplemental water supply for dry farming area by taking river water', and the most popular irrigation method in this area is 'Basin Irrigation Method'. Hence farmers do not fully depend on unstable irrigation system and they are still following dry farming practice.</p> <p style="text-align: center;">Actual Cropping Pattern</p> <table border="1" data-bbox="472 1543 1385 1854" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Crop</th> <th>Jan</th> <th>Feb</th> <th>Mar</th> <th>Apr</th> <th>May</th> <th>Jun</th> <th>Jul</th> <th>Aug</th> <th>Sep</th> <th>Oct</th> <th>Nov</th> <th>Dec</th> </tr> </thead> <tbody> <tr> <td>Wheat</td> <td></td><td></td><td></td><td></td><td></td><td>x x</td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Barley</td> <td></td><td></td><td></td><td></td><td>x x</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Rice Spring</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>x x</td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Rice Summer</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>x</td><td></td><td></td><td></td> </tr> <tr> <td>Cotton</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>x x x</td><td>x x x</td><td></td><td></td> </tr> <tr> <td>Rape</td> <td></td><td></td><td></td><td></td><td>x</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Soybean Spring</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>x x x</td><td></td><td></td><td></td> </tr> <tr> <td>Soybean Summer</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>x x x</td><td>x</td><td></td> </tr> <tr> <td>Cabagge</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>x x x</td><td>x</td> </tr> </tbody> </table> <p>The water demand for this cropping pattern is as follows.</p>	Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Wheat						x x							Barley					x x								Rice Spring								x x					Rice Summer									x				Cotton									x x x	x x x			Rape					x								Soybean Spring									x x x				Soybean Summer										x x x	x		Cabagge											x x x	x
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		Actual Irrigation Water Demand											
Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Cropping: Cotton													
Cropping: Wheat													
ET: Cotton (mm/day)					1.32	2.66	2.92	5.17	4.14	1.62			
ET: Wheat (mm/day)	0.36	0.65	0.85	2.62	1.32	0							
Effect. Rain (mm/Month)	21.6	14.7	16.6	17.7	10.5	14.1	0	0	0	3.6	12.8	18.4	
Water Demand (MCM/1000h)	0.02	0.23	0.38	1.46	0.75	1.52	1.88	3.34	2.59	1.01	0.00	0.00	

This irrigation of the total area (3,040 ha) by this cropping pattern will carry for an annual water demand of 40.1 MCM.

**Existing Irrigation/ Drainage Facilities**

**Intake Facility:** Two-story pump house is provided on the slope of right side riverbank with 9 centrifugal pumps with 300 lit/sec 25m head capacity with electric motor. Pumps are arranged in a row on semi-underground floor, at 3m below the entrance of the station. There is no de-silting facility on suction side, and instead, suction pipes are set at 50cm above the riverbed with silt screens at each pipe inlet.

**De-Silting Pond:** A de-silting pond of 1.5 ha is provided after the pump station, with 2.5 m depth excavated type. The total capacity of the pond is about 0.1 MCM.

**Irrigation Canal:** Irrigation canal system consists of 1) Main canal, 2) Secondary canal and 3) Tertiary canal. Main canal is structured with concrete lining commonly with same slope of side wall as 1:1.5, while bottom widths and depth are adapted with different sizes among I&D schemes. Bottom widths vary from 0.55m to 0.76m and a range from 0.8m to 1.25m for the depth respectively. Longitudinal gradient is 1/2,000 or 3/10,000. Secondary canal is constructed as earth lining structure basically and partially adopting concrete lining, Tertiary canal is constructed as earth canal. The irrigation water has high concentration of sediments and the farmers have to clean this sediment accumulation in the canals 2 or 3 times a year. This sedimentation is one of the problems for an proper irrigation.

**Drainage Canal:** Drain system is consisted of main and secondary drainage canals The original task of the drainage canal was to drain inundated water of seasonal rainfall and to discharge drain of irrigated water from the canal slope. The government constructed those drains before the beginning of irrigation works.

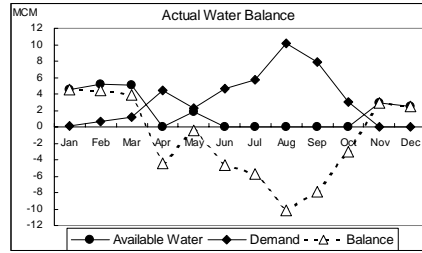
## 6.2 Constraints and Potentials for Development

<b>Constraints for the Development</b>	
Natural Conditions	<p>The Gorgan river has high concentration of salt between May to September, when the river discharge is small.</p> <div style="text-align: center;"> </div> <p>The problems of the soils are as follows:</p> <ul style="list-style-type: none"> <li>• Salinization and alkalinization of the soils</li> <li>• Drainage and groundwater depth limitation</li> <li>• Low Soil Fertility</li> </ul>
Socioeconomic Conditions	<ul style="list-style-type: none"> <li>• Insufficient fund for the agricultural activities</li> <li>• Characteristics of Turkmen</li> <li>• Shortage of staff and fund of RPC Pavand</li> </ul>
Agricultural Conditions	<p>The following conditions are necessary from the farming point of view.</p> <ul style="list-style-type: none"> <li>• Enough irrigation water</li> <li>• Enough drainage to leach salt in soil</li> <li>• Land consolidation having proper field size and proper land leveling</li> <li>• Proper soil management to promote desalinization, to prevent soil alkalization and to increase soil fertility by increase soil organic matter</li> <li>• Selection of suitable crops and livestock to the project area, in consideration of promoting of the agricultural policy of Government, decreasing of social repercussion, and profitableness to farmers</li> <li>• Establishing of cropping pattern and suitable rotation to keep a sustainable farming</li> <li>• Establishing of proper cooperative organization in mechanization and maintenance of farm machinery in crop cultivation, management and maintenance of canal and drains, of other facilities, such as plastic green house, etc</li> <li>• Establishing the high productivities in agriculture and husbandry by increase of yield and decrease of cost</li> <li>• Establishment of supporting system for the farmers, such as technological transfer of farming, cultivation techniques, profitable marketing, conditions loan to be easy for repayment, guarantee of farm products by Government, etc</li> <li>• Improvement of supply system of agricultural inputs and farm machinery</li> </ul>
Irrigation and Drainage	<ul style="list-style-type: none"> <li>• Unstable availability of irrigation water</li> <li>• Uncompleted irrigation canal networks</li> <li>• Insufficient drainage network for salt leaching</li> <li>• Irrigation &amp; Drainage system has no water measuring function</li> <li>• Present farmland condition is not leveled to conduct proper irrigation</li> </ul>

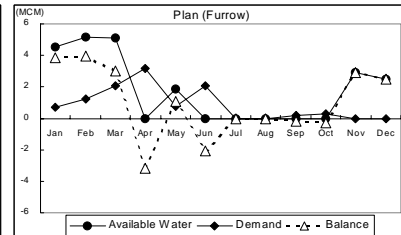
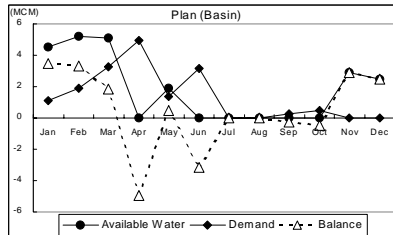
### Development Potential

Water Resources

The demand variation for the actual cropping pattern and irrigation method in the Tazeh Abad scheme is as follows.



If the cropping pattern and irrigation method is modified as planned in this study, the water demand can be estimated as follows:



Pavand RPC

- High motivation of the representatives of RPCs Pavand members
- High potential of RPC Pavand as an organization

## 6.3 Agricultural Development Plan

### 6.3.1 Outline of the Development Plan

The following aspects are considered for the agriculture development plan.

- The development plan should concentrate on income increment of farmers
- The plan should be made such that the cost burden on the farmers will be low
- The plan shall be in the line with phased development, distinguishing what farmers can do
- The plan is to be on the line with effective use of uncertain water resources

Based on such circumstances and its present conditions, it is confirmed that the placement of this plan is as follows:

- This plan has to bridge the gap which the scheme has never been reached to the goal of the initial stage even though several years have passed after the project commencement
- This plan will be the first step to fulfill the gap in line with phased development to approach stable agriculture based on irrigation
- The agriculture development shall fully consider the farmers' cultural background and deal with market situation

In consideration of the severe environmental conditions of the area, the agriculture development plan consisting of the following plans is prepared, in order to achieve sustainable agriculture and to provide stable income for the farmers.

- Farming Plan
- Irrigation and Drainage Facilities Improvement Plan
- RPC Pavand Strengthening Plan

### 6.3.2 Farming Plan

The farming activities in the area are mechanized excluding the harvest, and most part of the farms have more than 1 ha. So, the farming plan will include the farming in farms able to be mechanized, and introduce the plastic greenhouse for cucumber cultivation for those small scale farmers to make possible an efficient water use.

Cropping Pattern

To promote sustainable agriculture under the salinization / alkalinization problem of the soil and limited water conditions, the pasture will be included in the rotation of 5 crops in 4 years.

Item	1st Year								2nd Year														
	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7
Pattern	Wheat								Italian Ray Grass														
Pattern	Italian Ray Grass								Rape														
Pattern	Rape								Cotton														
Pattern	Pea								Wheat														
Cucumber in Greenhouse	x x x x								x x x x														

Item	3rd Year								4th Year														
	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7
Pattern	Rape								Pea														
Pattern	Pea								Wheat														
Pattern	Wheat								Italian Ray Grass														
Pattern	Italian Ray Grass								Rape														
Cucumber in Greenhouse	x x x x								x x x x														

Legend: Tillage Sowing, Transplz Fertilizer, Irrigator Harvest, Fungicide Herbicide, Pesticide

	<p>The water demand according to this cropping pattern is estimated as follows:</p> <p><b>for Basin Irrigation</b> 16.43 MCM/Year/All Scheme</p> <table border="1"> <thead> <tr> <th></th> <th>9</th> <th>10</th> <th>11</th> <th>12</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> <th>8</th> </tr> </thead> <tbody> <tr> <td>Water Demand (MCM/Month/All Schem</td> <td>0.25</td> <td>0.47</td> <td>0.00</td> <td>0.00</td> <td>1.10</td> <td>1.89</td> <td>3.24</td> <td>4.95</td> <td>1.39</td> <td>3.15</td> <td>0.00</td> <td>0.00</td> </tr> <tr> <td>River Q (MCM/Month )</td> <td>0.00</td> <td>0.00</td> <td>2.90</td> <td>2.50</td> <td>4.60</td> <td>5.20</td> <td>5.10</td> <td>0.00</td> <td>1.90</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> </tr> <tr> <td>Water Balance (MCM /Month )</td> <td>-0.25</td> <td>-0.47</td> <td>2.90</td> <td>2.50</td> <td>3.50</td> <td>3.31</td> <td>1.86</td> <td>-4.95</td> <td>0.51</td> <td>-3.15</td> <td>0.00</td> <td>0.00</td> </tr> </tbody> </table> <p><b>for Furrow Irrigation</b> 10.47 MCM/Year/All Scheme</p> <table border="1"> <thead> <tr> <th></th> <th>9</th> <th>10</th> <th>11</th> <th>12</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> <th>8</th> </tr> </thead> <tbody> <tr> <td>Water Demand (MCM/Month/All Schem</td> <td>0.16</td> <td>0.30</td> <td>0.00</td> <td>0.00</td> <td>0.70</td> <td>1.21</td> <td>2.08</td> <td>3.18</td> <td>0.78</td> <td>2.05</td> <td>0.00</td> <td>0.00</td> </tr> <tr> <td>River Q (MCM/Month )</td> <td>0.00</td> <td>0.00</td> <td>2.90</td> <td>2.50</td> <td>4.60</td> <td>5.20</td> <td>5.10</td> <td>0.00</td> <td>1.90</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> </tr> <tr> <td>Water Balance (MCM /Month )</td> <td>-0.16</td> <td>-0.30</td> <td>2.90</td> <td>2.50</td> <td>3.90</td> <td>3.99</td> <td>3.02</td> <td>-3.18</td> <td>1.12</td> <td>-2.05</td> <td>0.00</td> <td>0.00</td> </tr> </tbody> </table>		9	10	11	12	1	2	3	4	5	6	7	8	Water Demand (MCM/Month/All Schem	0.25	0.47	0.00	0.00	1.10	1.89	3.24	4.95	1.39	3.15	0.00	0.00	River Q (MCM/Month )	0.00	0.00	2.90	2.50	4.60	5.20	5.10	0.00	1.90	0.00	0.00	0.00	Water Balance (MCM /Month )	-0.25	-0.47	2.90	2.50	3.50	3.31	1.86	-4.95	0.51	-3.15	0.00	0.00		9	10	11	12	1	2	3	4	5	6	7	8	Water Demand (MCM/Month/All Schem	0.16	0.30	0.00	0.00	0.70	1.21	2.08	3.18	0.78	2.05	0.00	0.00	River Q (MCM/Month )	0.00	0.00	2.90	2.50	4.60	5.20	5.10	0.00	1.90	0.00	0.00	0.00	Water Balance (MCM /Month )	-0.16	-0.30	2.90	2.50	3.90	3.99	3.02	-3.18	1.12	-2.05	0.00	0.00
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Animal Husbandry	<p>An integrated farming with cow for milk production is proposed, due to the strong desire of the local farmers to raise cow and the unstable income of the agriculture due to the constraints of irrigation water. The outline is as follows.</p> <ul style="list-style-type: none"> <li>• Buildings: mother cow stall, stalls for young cattle and calves, storage room and paddock.</li> <li>• Facilities: milker, milk storage tank, etc</li> <li>• Purchase cost of 10 cows</li> <li>• Total investment of 82 million</li> <li>• Annual net income is about 24.5 million Rials</li> </ul>																																																																																																								
Economy of the integrated farming plan	<p>The annual profits were evaluated for the integrated farming in 4 ha with 5 crops in 4 years and raising 10 hybrid cows in the case of average harvest in Aq Qala and maximum value in Tazeh Abad. Yields of grass and pea are the estimated.</p> <table border="1"> <thead> <tr> <th>Crop</th> <th>Average (t/ha)</th> <th>Max (kg/ha)</th> </tr> </thead> <tbody> <tr> <td>Wheat</td> <td>2,541</td> <td>4,000</td> </tr> <tr> <td>Rape</td> <td>2,000</td> <td>2,500</td> </tr> <tr> <td>Grass</td> <td>4,000</td> <td>4,000</td> </tr> <tr> <td>Pea</td> <td>1,000</td> <td>1,500</td> </tr> <tr> <td>Cotton</td> <td>1,704</td> <td>2,000</td> </tr> <tr> <td>Milk (kg/year)</td> <td>18,000</td> <td>18,000</td> </tr> </tbody> </table> <p>The annual net profits introducing milk production, based on this harvest quantity, in average reach 33.6 million Rial and a maximum of 36 million Rial.</p>	Crop	Average (t/ha)	Max (kg/ha)	Wheat	2,541	4,000	Rape	2,000	2,500	Grass	4,000	4,000	Pea	1,000	1,500	Cotton	1,704	2,000	Milk (kg/year)	18,000	18,000																																																																																			
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Cultivation System	<p>The following farming techniques are necessary to increase the yields and profits.</p> <ul style="list-style-type: none"> <li>• Strict enforcement of pre-irrigation</li> <li>• Fertilization of sulfur, micro-elements</li> <li>• Organization of land use, mechanization in small scale farming and of irrigation, and conscientiously keeping of the rule in the organization</li> <li>• Participation in the training courses of RPC and the Extension Service Center</li> <li>• Strict enforcement of crop rotation</li> <li>• Increase of soil organic matter and soil fertility by annual grass cultivation</li> <li>• Trials of cultivation technologies on different crops, method of drainage in fields etc</li> </ul>																																																																																																								
Mechanization for Grass Cultivation	<p>The grass production will be introduced in the crop rotation but the experience of grass is very low among the farmers. So, the necessary machinery must be acquired, operated and managed in cooperative by the RPC. Besides, the grass production cost can also be reduced.</p>																																																																																																								

	<p>One-set of machinery for grass cultivation in 280 ha is composed of two tractors (75 PS), a baler, a disc harrow, a trailer, a broadcaster, a seeder, a rake and a mower, and the price of one-set machinery is about 190 million Rials.</p> <p>As a result, cost of hay decreases and cost of mechanization can be reduced. The cooperative use of machinery for hay making will become the trigger to the cooperative mechanization of other crops.</p>
Plastic Greenhouse	<p>The cucumber production in plastic green house can be promoted for an effective use of irrigation water. The outline of the plan is as follows:</p> <ul style="list-style-type: none"> <li>• Construction of 20 houses (1 unit composed by 4 houses of 500 m<sup>2</sup> each), with necessary facilities and machines to be managed in cooperation to decrease the costs</li> <li>• Facilities &amp; machines: water tank, generator, heater, irrigation facilities, lighting facilities, etc.</li> <li>• The cucumber will be cultivated 2 times, with an annual production in 500 m<sup>2</sup> of 10 tons</li> <li>• the net income per house is 7.25 million Rial</li> </ul>
Supporting Plans	<p>In order to execute the proposed plan, supporting activities in the technical, marketing, financial and others fields are indispensable.</p> <p style="text-align: center;"><b>Technical Assistance</b></p> <p>The main required supports are as follows:</p> <ul style="list-style-type: none"> <li>• Strengthening the extension service center of the Jihad-e-Agriculture Organization to realize technical support for irrigation &amp; drainage, cultivation technology of green house, farming, livestock, horticulture, etc.</li> <li>• Execution of ‘project of technological development research’ to carry out the trials and to verify the integrated farming in Tazeh Abad Project Area</li> <li>• Expansion of Government’s guaranteed prices to other important crops; apply to hay of grass</li> <li>• Improvement of extension under condition of low literacy rate and religious custom. Increase of exhibition fields, meeting under participation of the clergyman, etc</li> </ul> <p style="text-align: center;"><b>Marketing</b></p> <p>In order to increase farmers’ income, it is required that the production should reach markets and be sold at the price that can create benefit for them. So, it is proposed to establish a marketing section in RPC Pavand. Hereinafter, supply of the materials to agro-processing factories is proposed as one of the methods of obtaining the markets for newly produced crops such as cucumber and pea.</p> <p style="text-align: center;"><b>Agricultural Finance</b></p> <p>It is necessary to attain a stable supply of investment resources to increase the farm scale and for the production credit.</p> <p>The RCO is already accustomed to agricultural financing activities. Moreover, most of RCO has surplus and can afford to strengthen the present function. It means that there is a possibility for RCO to be a new loan providing organization with reasonably low interest rate through strengthening the present function.</p> <ul style="list-style-type: none"> <li>• Stage I     Strengthening present agricultural finance activities (5 years)</li> <li>• Stage II    Independence from RCO as a financial organization (5 years)</li> </ul>



### 6.3.3 Irrigation and Drainage Facilities Development Plan

<p>Design of the Irrigation and Drainage Facilities</p>	<p style="text-align: center;"><b>Intake Facilities</b></p> <p>The irrigation water is directly pumped from the Gorgan river. The following facilities were already set in the area, and the pump is in good condition. So, the existing pumps shall be utilized.</p> <ul style="list-style-type: none"> <li>• Utilization of the existing pump intake facility</li> <li>• De-silting pond</li> <li>• Farm pond for irrigation in dry season</li> </ul> <p style="text-align: center;"><b>Irrigation Facilities</b></p> <p>To irrigate 3,040 ha of farms, it is necessary to have the following improvements:</p> <ul style="list-style-type: none"> <li>• Incomplete secondary canal, including concrete lining</li> <li>• Canal lining for the existing earth secondary canal</li> <li>• Diversions on secondary canals</li> <li>• Incomplete tertiary canal, including concrete lining</li> <li>• Canal lining for the existing tertiary earth canal portions</li> <li>• Diversions on tertiary canals</li> </ul> <p style="text-align: center;"><b>Drainage Facilities</b></p> <p>The interval of the existing secondary drainage canal is about 400m or 500m. Therefore, the installation of new drainage canals between existing ones is planned through setting up a standard at 200m intervals. There are 3 ideas for the construction of new drains.</p> <ul style="list-style-type: none"> <li>• Installation of mole drain without reducing farmland. However, the percentage of clay in the subsoil layer must be more than 35% and therefore it may be a problem</li> <li>• Installation of open drain flowing in the existing secondary drainage canals. This plan is defined as an individual facility of farmers in Iran and total construction cost will be paid by the farmers. Moreover, decreasing area of the farmland will be large if the depth of the canals is set as same as the secondary canals</li> <li>• Installation of pipe drain running parallel with existing canals. In this case, the government and farmer will share 80% and 20% of total construction cost respectively. In this case, the farmer's share of cost is small and the reduction of the farmland can be avoided</li> </ul> <p style="text-align: center;"><b>Land Consolidation</b></p> <p>The farmland leveling is complete in only 100ha in the project area at present. Land leveling of the area is required for the following reasons:</p> <ul style="list-style-type: none"> <li>• Promoting the equalization of distributing irrigation water in the field plots for basin irrigation</li> <li>• Equal distribution of irrigation water functions to prevent salinization in the field plots</li> <li>• Promoting rapid operation of irrigation</li> <li>• Promoting efficient farming through smooth operation of agricultural machinery</li> <li>• Meeting the condition of promoting furrow irrigation which is expected to be introduced after basin irrigation</li> <li>• Decreasing irrigation loss through increasing irrigation efficiency</li> </ul> <p>Based on the above recognitions, land leveling is gradually introduced in this project. The slope of field surface after land leveling is 2% as instructed by Irrigation Organization.</p>
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### Farm Roads

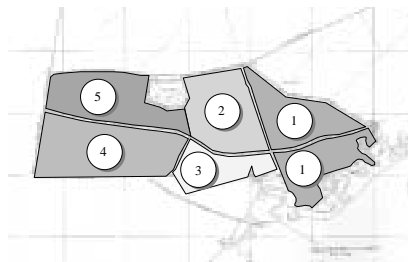
All the roads are constructed with excavated soil of canal construction and without any pavement. There are many requests from farmers to improve it because of muddy condition in the wet season. Hence, gravel pavement work shall be proposed in the plan

Irrigation and Drainage Facilities and other Infrastructures to be Constructed

### Division of the Project Area

The project area shall be divided into the following 5 areas

Area	Area	Area	Area	Area
822 ha	575 ha	246 ha	739 ha	658 ha
The most closer to the water source and well developed area.	Area Receiving water from the existing NM Canal	Area receiving water from SM Canal	Area irrigable by the farm pond water	Area waiting for the completion of the NM Canal



The contents of the construction works are as follows:

Work	Quantity
<b>Farm Pond &amp; Irrigation Facilities Related</b>	
1 Farm pond: 36ha, Storage Capacity: 1.2MCM, Depth	1 set
2 Pump st for the pond	1 set
3 Construction of Secondary Canals (Concrete Lining)	4,068 m
4 Construction of Tertiary Canals (Concrete Lining)	15,322 m
<b>Land Consolidation &amp; Irrigation Canals</b>	
1 Farm leveling (0.2%、 100ha already concluded )	2,940 ha
2 Construction of Secondary Canals (Concrete Lining)	11,474
3 Construction of Tertiary Canals (Concrete Lining)	41,728 m
4 Diversion works (from secondary to tertiary canals)	8 set
5 Water Intake	69 set
<b>Drain</b>	
1 Secondary drains	7,966 m
2 New secondary drains (between the existing canals)	54,106 m
<b>Farm Road</b>	
1 Gravel roads of 6m	2,294 m
2 Gravel roads of 4m	41,728 m

Implementation Schedule

### Schedule of the Implementation of Irrigation & Drainage Facilities

Item	1st Year	2nd Year	3rd Year	4th Year	5th Year
Farm Pond & Irrigation Facilities Related	■■■■■■■■■■				
Land Consolidation & Irrigation Canals	■■■■■■■■■■				
Drain	■■■■	■■■■■■■■			
Farm Road				■■■■■■■■■■	

Now, it will be necessary a preparatory period of 6 months before.

Cost of Irrigation and Drainage Facilities	<b>Details of the Work Costs</b>						
	Unit: million Rial						
	Item	1st Year	2nd Year	3rd Year	4th Year	5th Year	Total
	1 Works	6,434.6	6,814.7	7,236.0	303.6	552.7	21,341.6
	3 Consulting Services	104.3	38.4	38.4	25.6	19.2	225.9
	Sub-Total (1-3)	6,601.3	6,915.5	7,336.8	391.6	634.3	21,879.5
	4 Physical Contingency	462.1	484.1	513.6	27.4	44.4	1,531.6
	Sub-Total (1-4)	7,063.4	7,399.6	7,850.4	419.0	678.7	23,411.1
	5 Financial Contingency	353.2	370.0	392.5	21.0	33.9	1,170.6
	<b>Total (1-5)</b>	<b>7,416.6</b>	<b>7,769.6</b>	<b>8,242.9</b>	<b>440.0</b>	<b>712.6</b>	<b>24,581.7</b>
Rate (%)	30.2	31.6	33.5	1.8	2.9	100.0	
<b>O&amp;M</b>							
Implementation organism: Pavand RPC							
Main items of O&M:							
<ul style="list-style-type: none"> <li>• Operation and maintenance of the main Project</li> <li>• Instruction to the members in charge on water delivery and O/M of the canals</li> <li>• Collection of water charge from the users</li> </ul>							
Annual O&M Costs							
Item		Value (Rial)					
1. Salary		38,400,000					
2. Spare Parts		45,978,000					
3. Office Costs		3,072,000					
4. Electricity for Pumps		8,600,000					
Total		96,050,000					

### 6.3.4 RPC Pavand Strengthening Plan

RPC Pavand Strengthening Plan	Implementing agency: RPC Pavand and its members The implementation is going to be in 3 stages of 5 years each. <ul style="list-style-type: none"> <li>• Stage I Enhancing present functions (5 years)</li> <li>• Stage II Adding new functions (5 years)</li> <li>• Stage III Established with the enhanced and added functions (5 years)</li> </ul>
Organization Functions	Present enhancing functions: <ul style="list-style-type: none"> <li>• Policy making</li> <li>• Supply of agricultural inputs</li> <li>• Collective gathering and forwarding activities</li> <li>• Extension service</li> <li>• Water distribution</li> </ul> Newly added functions: <ul style="list-style-type: none"> <li>• Agricultural finance</li> <li>• Guiding and supervising of joint ownership group of agricultural machinery</li> </ul>

<p>Organization Structure</p>	
<p>Governmental Assistance for “RPC Pavand Strengthening Plan”</p>	<p>Support organization: Supporting Team for Assisting ‘RPC Pavand Strengthening Plan’ consisting of Departments of Cooperative Management, Extension, Crop and Breeding, Statistics, Animal Husbandry, Soil and Water Management in Jihad-e-Agricultural Organization and Agricultural Service Center</p> <p>Contents:</p> <ul style="list-style-type: none"> <li>• STEP 0 : Forming the supporting team</li> <li>• STEP 1 : Supporting to enhance the present functions</li> <li>• STEP 2 : Supporting to add the new functions</li> <li>• STEP 3 : Supporting to become established the enhanced and added functions</li> <li>• (STEP 4 : Starting a new supporting program)</li> </ul>
<p>Cost Estimation</p>	<p>Total cost is estimated at 2,596 million Rials for 15 years (3 phases)</p>

## 6.4 Implementation Plan of the Project

Project Components and the Project Cost																																																																																																																																																																																										
<p>Project Components</p>	<p>The project cost will be composed by the following 3 items:</p> <ul style="list-style-type: none"> <li>• Facilities for proposed farming system</li> <li>• Irrigation and drainage facilities</li> <li>• Strengthening of RPC Pavand</li> </ul>																																																																																																																																																																																									
<p>Project Cost</p>	<p>Project Cost for 15 Years</p> <table border="1" data-bbox="470 1411 1398 1545"> <thead> <tr> <th rowspan="2">Item</th> <th colspan="10">Year</th> <th rowspan="2">Total Cost (Million)</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> <th>8 ~ 10</th> <th>11 ~ 15</th> </tr> </thead> <tbody> <tr> <td>Facilities for Farming Pl</td> <td>6,200.8</td> <td>189.9</td> <td>379.8</td> <td>16,873.9</td> <td>379.8</td> <td></td> <td>10,434.0</td> <td></td> <td></td> <td></td> <td>34,458.2</td> </tr> <tr> <td>Irrigation/Drainage</td> <td>7,416.6</td> <td>7,769.6</td> <td>8,242.9</td> <td>440.0</td> <td>712.6</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>24,581.7</td> </tr> <tr> <td>Pavand RPC Strengtheni</td> <td>358.4</td> <td>160.4</td> <td>160.4</td> <td>160.4</td> <td>160.4</td> <td>160.0</td> <td>160.0</td> <td>160.0</td> <td>159.2</td> <td></td> <td>2,596.0</td> </tr> <tr> <td>Total</td> <td>13,975.8</td> <td>8,119.9</td> <td>8,783.1</td> <td>17,474.3</td> <td>1,252.8</td> <td>160.0</td> <td>10,594.0</td> <td>160.0</td> <td>159.2</td> <td></td> <td>61,635.9</td> </tr> </tbody> </table>										Item	Year										Total Cost (Million)	1	2	3	4	5	6	7	8 ~ 10	11 ~ 15	Facilities for Farming Pl	6,200.8	189.9	379.8	16,873.9	379.8		10,434.0				34,458.2	Irrigation/Drainage	7,416.6	7,769.6	8,242.9	440.0	712.6						24,581.7	Pavand RPC Strengtheni	358.4	160.4	160.4	160.4	160.4	160.0	160.0	160.0	159.2		2,596.0	Total	13,975.8	8,119.9	8,783.1	17,474.3	1,252.8	160.0	10,594.0	160.0	159.2		61,635.9																																																																																																											
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<b>Project Implementation Organization</b>	<p><b>Implementation agency:</b> Golestan J.A.O and Pavand RPC</p> <p><b>Implementation Method:</b> The Project Implementation Agency shall execute the detailed design of the Project facilities, prepare the tender documents, tendering and tender evaluation, select the contractor, sign the contract and supervise the construction works with the assistance of the Consultant to be contracted prior to the commencement of the Project.</p>
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## 6.5 Project Evaluation

<b>Principles for Project Evaluation</b>																																																																																					
Tazeh Abad agricultural development project aimed to get rid of the present unstable agricultural production conditions and to increase farmers' income through the improvement of irrigation and drainage facilities and to practice sustainable agriculture farming. In the project evaluation of the feasibility study, the financial evaluation together with farm profit analysis shall be given priority over the economic evaluation due to the fact that this project does not require a great amount of public investment and the majority of the investment shall be borne by the farmers.																																																																																					
<b>Evaluation Method</b>																																																																																					
The NPV is to be calculated on the basis of annual cash flow of the net incremental benefits (benefits minus costs) to cover the whole project life, which is obtained as a consequence of the balance of agricultural farming and investment between 'With' project situation and 'Without' project situation.																																																																																					
<b>Financial and Economic Evaluation</b>																																																																																					
Project Benefit	<p>The project benefit consists of quantifiable benefit such as increment of agricultural products and un-quantifiable benefit such as stabilized food supply, creation of employment opportunities and improvement of living standard of rural people. The quantifiable benefit is directly subjected to financial and economic evaluations, while un-quantifiable benefit is analyzed comprehensively for socio-economic effects.</p> <p style="text-align: center;">Net Benefit for Financial Prices</p> <p style="text-align: right;">Unit: Million Rial</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Item</th> <th>Unit Price</th> <th>Quantity</th> <th>Net Benefit</th> </tr> </thead> <tbody> <tr> <td>Farming</td> <td>4,396/ha</td> <td>3,040ha</td> <td>13,363.8</td> </tr> <tr> <td>Introduction of Livestock</td> <td>21,544/farmer</td> <td>367</td> <td>21,544.0</td> </tr> <tr> <td>Greenhouse</td> <td>7,184/unit</td> <td>20</td> <td>143.7</td> </tr> <tr> <td colspan="3" style="text-align: center;"><b>TOTAL</b></td> <td><b>35,051.5</b></td> </tr> </tbody> </table>	Item	Unit Price	Quantity	Net Benefit	Farming	4,396/ha	3,040ha	13,363.8	Introduction of Livestock	21,544/farmer	367	21,544.0	Greenhouse	7,184/unit	20	143.7	<b>TOTAL</b>			<b>35,051.5</b>																																																																
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Financial Analysis	<p>The required project costs such as irrigation and improvement costs of drainage facilities, agricultural machineries procurement costs, costs for plastic green houses, and hybrid cows will be financed through the Pavand RPC of Tazeh Abad area.</p> <p>The repayment is 5 years of equal annual reimbursement and the interest adopted for the similar cases of Agricultural Bank is 14% per year.</p> <p style="text-align: center;"><b>Investment</b></p> <p style="text-align: right;">Unit : Million Rial</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Year</th> <th>Irrigation/Drainage</th> <th>Agricultural Machinery</th> <th>Greenhouse</th> <th>Cow</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>2,001.9</td> <td>949.5</td> <td>591.3</td> <td>4,660.0</td> <td>8,202.7</td> </tr> <tr> <td>2</td> <td>2,097.2</td> <td>189.9</td> <td></td> <td></td> <td>2,287.1</td> </tr> <tr> <td>3</td> <td>2,224.9</td> <td>379.8</td> <td></td> <td></td> <td>2,604.7</td> </tr> <tr> <td>4</td> <td>118.8</td> <td>189.9</td> <td></td> <td>16,684.0</td> <td>16,992.7</td> </tr> <tr> <td>5</td> <td>192.3</td> <td>379.8</td> <td></td> <td></td> <td>572.1</td> </tr> <tr> <td>6</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>7</td> <td></td> <td></td> <td></td> <td>10,434.0</td> <td>10,434.0</td> </tr> <tr> <td>Total</td> <td>6,635.1</td> <td>2,088.9</td> <td>591.3</td> <td>31,778.0</td> <td>41,093.3</td> </tr> </tbody> </table> <p>In the case of crop cultivation through irrigation and drainage improvement, judging from one year profit loss, deficit continues up to 4<sup>th</sup> year and surplus will be generated from 5<sup>th</sup> year. In this case, if repayment period is changed to 10 years, surplus will appear after 6<sup>th</sup> year. In the case of the plastic green houses, surplus will be generated in the 5<sup>th</sup> year. Regarding the introduction of hybrid cows, two cases were carried out. In the case of one farming household, surplus will be generated in the 3<sup>rd</sup> year. However, in the case of hybrid cow, introducing to all the farmers in the project area, as the long interval investments, surplus will appear after 8 years.</p> <p>In the case of the integrating all aspects of the project, surplus will be generated from 8<sup>th</sup> year due to the introduction of hybrid cows.</p>	Year	Irrigation/Drainage	Agricultural Machinery	Greenhouse	Cow	Total	1	2,001.9	949.5	591.3	4,660.0	8,202.7	2	2,097.2	189.9			2,287.1	3	2,224.9	379.8			2,604.7	4	118.8	189.9		16,684.0	16,992.7	5	192.3	379.8			572.1	6						7				10,434.0	10,434.0	Total	6,635.1	2,088.9	591.3	31,778.0	41,093.3
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<b>Socioeconomic Synergy Impact</b>	
<p>The implementation of the Project increases the income of local farmers and improves their living standard to a great extent. An improved income further increases purchase power of the local farmers and vitalizes local commercial activities. Also, an increased purchase power and vigorous commercial activities are expected to promote local industries. Additionally, this project introduces combined agricultural management, and the negative impact of the implementation over surrounding ecosystem will be alleviated as far as possible.</p>	
<b>Comprehensive Evaluation</b>	
<p>The project aiming at diversification of farming activities which are within the context of project shall offer opportunities for local farmers who have been persistent to the traditional low productive and unstable farming, to get rid of present unfavorable situation, to make capital formation and to lead, as a consequence, to enjoy a more affluent and better rural life. Although this project is not so large in scale, their target areas represent the leading farm production of the Gorgan plain and thus their success in terms of agricultural diversification shall have greater impact socio-economically.</p> <p>Thus, the implementation of the project is judged as valid with the result of economic and financial evaluations as computed from tangible benefit. In addition, socio-economic impact evaluated from intangible benefit is also judged as sufficiently expectable. The Project is evaluated as a sustainable agricultural development plan considering the environmental situation. Moreover, the implementation of the project is justified to be feasible from technical combined with the technology verifications and tests. Furthermore, the Pavand RPC is verified as a suitable organization from the operational viewpoint. Accordingly, it is recommended that a high priority should be given to the project for its implementation in an early stage.</p>	

## 6.6 Projects to be Implemented in Short Term

<b>Technical Development Project</b>	
Necessities of the Project	<p>The agricultural development in Tazeh Abad scheme was considered feasible according to the F/S. So, it is necessary it's rapid execution, and succeed it as a development model for the Gorgan plain. The Iranian technology for salinization problems and agriculture in arid regions is very high, but this technology is not extended to the farmers. So, a Technical Development Project can be carried covering the following items:</p> <ul style="list-style-type: none"> <li>• Analyzing Different Problems of the Area under a Single Project</li> <li>• Coordinated Research</li> <li>• Technical Transfer to the Farmers</li> <li>• Communication between Research and Extension Organizations</li> <li>• Coordination with Concerned Agencies of the Province</li> </ul>
Effectiveness of the Project	<ul style="list-style-type: none"> <li>• It is expected to improve the administration system, extension system and research system in Iran, referring to the results of the project as a model. Therefore, the results of the project should be expanded to similar regions in other parts of the country</li> <li>• The development of technology will become effective, and feasible projects of the Provincial Government shall be carried out by integration of various sections of administration, extension and fields of researches. Besides, the participation of the extension section will permit to raise the level of the extension-workers and an effective extension to the Study Area are expected</li> </ul>
Contents of the Project	<p>An experimental farm of about 50 ha area will be used as a model farm for the development project. The project will be carried out for 5 years which mainly includes the following:</p> <ul style="list-style-type: none"> <li>• I Stage – Experimental Farming for 3 years</li> <li>• II Stage – Verification Farming for 2 years</li> </ul> <p>Research Subjects:</p>

	<ul style="list-style-type: none"> <li>• Agriculture Technology</li> <li>• Irrigation &amp; Drainage</li> <li>• Soil</li> <li>• Cooperatives</li> <li>• Processing and Marketing</li> <li>• Overall Farm Management</li> </ul>
Requirements of the Project	<p>The research experts are: Project leader (Cooperative expert), Agronomist, Forage Expert, Irrigation and Drainage Expert, Water Resources Expert and Soil Scientist</p> <p>A new project office (about 600 m<sup>2</sup>) and a farm machinery shed of about 1000 m<sup>2</sup> shall be necessary. The following machinery and equipment are required for the farm: Farm Machinery and Equipment, Equipment Required for Irrigation and Drainage, Soil and Water Laboratory Equipment, Computer Workstation, Office Equipment and Vehicles for transport at a total of 4,310 million Rials.</p>
Related Organizations	<p>Responsible organization: Government of Golestan Province</p> <p>Participating organizations:</p> <ul style="list-style-type: none"> <li>• Branches of the national research institutes</li> <li>• Provincial agricultural experiment stations</li> <li>• Gorgan Agricultural University</li> <li>• Other related organizations</li> </ul> <p>Foreign Collaboration: The possibility of foreign collaboration shall also be considered for the technical development project based on the policy of the government.</p>




## Chapter 7 Case Study in Cheldin Area

### 7.1 Scope of the Case Study and Site Selection

<b>Scope of the Case Study</b>	
To conduct a Case Study in an area of about 20 ha of the Cheldin area in order to examine the possibility of agricultural development for the area by proposing a suitable cropping pattern.	
<b>Site Selection</b>	
In discussion with the counterparts of Golestan Jihad-e-Agriculture Organization and Rooyesh-e-Mehtar Kalateh cooperative, an area of 26.8 ha was selected in Mehtar Kalateh area. The selection was done according to the following conditions:	
<ul style="list-style-type: none"> <li>• Bigger plot size</li> <li>• Cooperative operation of wells</li> <li>• Cooperative use of machinery</li> </ul>	

### 7.2 Present Conditions of the Area

<b>Natural Conditions</b>																																																																																																																																															
Climate / Hydrology	<p style="text-align: center;"><b>Climate Condition</b></p> <table border="1"> <thead> <tr> <th>Item</th> <th>Jan</th> <th>Feb</th> <th>Mar</th> <th>Apr</th> <th>May</th> <th>Jun</th> <th>Jul</th> <th>Aug</th> <th>Sep</th> <th>Oct</th> <th>Nov</th> <th>Dec</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Rain (mm)</td> <td>44.6</td> <td>53.7</td> <td>59.7</td> <td>49.0</td> <td>50.6</td> <td>21.0</td> <td>18.0</td> <td>25.9</td> <td>31.5</td> <td>52.6</td> <td>58.0</td> <td>57.5</td> <td>522.1</td> </tr> <tr> <td>Temperature (oC)</td> <td>8.3</td> <td>10.5</td> <td>15.5</td> <td>20.2</td> <td>25.2</td> <td>27.2</td> <td>26.6</td> <td>24.3</td> <td>18.9</td> <td>13.7</td> <td>8.7</td> <td>7.1</td> <td>17.2</td> </tr> <tr> <td>Evaporation (mm)</td> <td>30.8</td> <td>40.4</td> <td>63.2</td> <td>106.1</td> <td>147.5</td> <td>182.8</td> <td>190.7</td> <td>182.4</td> <td>118.4</td> <td>85.7</td> <td>47.2</td> <td>37.9</td> <td>1233.1</td> </tr> <tr> <td>Humidity (%)</td> <td>73.7</td> <td>73.0</td> <td>78.7</td> <td>92.7</td> <td>85.7</td> <td>92.7</td> <td>90.4</td> <td>72.7</td> <td>74.0</td> <td>72.1</td> <td>70.7</td> <td>79.3</td> <td>79.6</td> </tr> <tr> <td>ETo (mm)</td> <td>20.0</td> <td>26.3</td> <td>41.1</td> <td>69.0</td> <td>95.9</td> <td>118.9</td> <td>124.0</td> <td>118.6</td> <td>77.0</td> <td>55.7</td> <td>30.7</td> <td>24.6</td> <td>801.8</td> </tr> <tr> <td>Effective Rain (mm)</td> <td>16.8</td> <td>22.2</td> <td>25.8</td> <td>19.4</td> <td>20.4</td> <td>2.6</td> <td>0.8</td> <td>5.5</td> <td>8.9</td> <td>21.6</td> <td>24.8</td> <td>24.5</td> <td>193.3</td> </tr> </tbody> </table> <p style="text-align: center;"><b>Well Information</b></p> <table border="1"> <thead> <tr> <th rowspan="2">Item</th> <th colspan="4">Farm Number</th> </tr> <tr> <th></th> <th></th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>Area (ha)</td> <td>12.93</td> <td>8.1</td> <td>4.6</td> <td>1.12</td> </tr> <tr> <td>Well Depth (m)</td> <td>145</td> <td>130</td> <td>160</td> <td>-</td> </tr> <tr> <td>Type</td> <td colspan="3">Artesian</td> <td>-</td> </tr> <tr> <td>Construction Year</td> <td>98</td> <td>94</td> <td>92</td> <td>-</td> </tr> <tr> <td>Max.Q (lit/sec)</td> <td>8</td> <td>5</td> <td>5.5</td> <td>-</td> </tr> <tr> <td>Pump (HP)</td> <td>65</td> <td>18</td> <td>18</td> <td>-</td> </tr> <tr> <td>Max. Operation Hour (h/Year)</td> <td>2,200</td> <td>2,200</td> <td>2,200</td> <td>-</td> </tr> </tbody> </table> 	Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Rain (mm)	44.6	53.7	59.7	49.0	50.6	21.0	18.0	25.9	31.5	52.6	58.0	57.5	522.1	Temperature (oC)	8.3	10.5	15.5	20.2	25.2	27.2	26.6	24.3	18.9	13.7	8.7	7.1	17.2	Evaporation (mm)	30.8	40.4	63.2	106.1	147.5	182.8	190.7	182.4	118.4	85.7	47.2	37.9	1233.1	Humidity (%)	73.7	73.0	78.7	92.7	85.7	92.7	90.4	72.7	74.0	72.1	70.7	79.3	79.6	ETo (mm)	20.0	26.3	41.1	69.0	95.9	118.9	124.0	118.6	77.0	55.7	30.7	24.6	801.8	Effective Rain (mm)	16.8	22.2	25.8	19.4	20.4	2.6	0.8	5.5	8.9	21.6	24.8	24.5	193.3	Item	Farm Number								Area (ha)	12.93	8.1	4.6	1.12	Well Depth (m)	145	130	160	-	Type	Artesian			-	Construction Year	98	94	92	-	Max.Q (lit/sec)	8	5	5.5	-	Pump (HP)	65	18	18	-	Max. Operation Hour (h/Year)	2,200	2,200	2,200	-
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Evaporation (mm)	30.8	40.4	63.2	106.1	147.5	182.8	190.7	182.4	118.4	85.7	47.2	37.9	1233.1																																																																																																																																		
Humidity (%)	73.7	73.0	78.7	92.7	85.7	92.7	90.4	72.7	74.0	72.1	70.7	79.3	79.6																																																																																																																																		
ETo (mm)	20.0	26.3	41.1	69.0	95.9	118.9	124.0	118.6	77.0	55.7	30.7	24.6	801.8																																																																																																																																		
Effective Rain (mm)	16.8	22.2	25.8	19.4	20.4	2.6	0.8	5.5	8.9	21.6	24.8	24.5	193.3																																																																																																																																		
Item	Farm Number																																																																																																																																														
Area (ha)	12.93	8.1	4.6	1.12																																																																																																																																											
Well Depth (m)	145	130	160	-																																																																																																																																											
Type	Artesian			-																																																																																																																																											
Construction Year	98	94	92	-																																																																																																																																											
Max.Q (lit/sec)	8	5	5.5	-																																																																																																																																											
Pump (HP)	65	18	18	-																																																																																																																																											
Max. Operation Hour (h/Year)	2,200	2,200	2,200	-																																																																																																																																											
Soil	<p>The average pH of the soil is about 8.0. The EC of the soil is at a very low salinity level of less than 2 mS/cm (S0). In general, if the soils have EC values of less than 2mS/cm, the salinity effects are negligible except for the most sensitive crops. Sodium Adsorption Ratio (SAR) is also low with values of less than 8 (S0=SAR&lt;8). Cation Exchange Capacity (CEC) values, which shows the overall fertility status of the soil are in the slightly higher range of above 25. Organic carbon and total nitrogen are also in the slightly higher range. Phosphorus and Potassium are also in the higher range at the root zone depth.</p> <p>The most significant property of the soil in the Case Study Area is the texture of the soil with high clay content, which is mostly above 50%. In most of the cases, the clay content of the bottom layers are still higher than the top layers. Because of the clayey texture and the low infiltration rate, flooding occurs in the area, whenever there is heavy and sudden rain in and around the project area. Suitable drainage system is highly essential to solve the flooding problem of the area.</p>																																																																																																																																														
Environment	<p>The major environmental problems are as follows:</p> <ul style="list-style-type: none"> <li>• Heavy clay content of the soil</li> <li>• High groundwater table</li> </ul>																																																																																																																																														

	<ul style="list-style-type: none"> <li>Water quality, especially the heavy sediment load of Gharasu River</li> </ul> <p>An environmental monitoring and management system (EMMS) shall be established to monitor the environmental impacts on the project area and the surrounding areas, aiming at adequately protecting the environment both during and after the project implementation.</p>										
<b>Socioeconomic Condition</b>											
Population and Economic Activities	<p>The area of Case Study belongs to Deh Mehtar Kalateh and covered by RPC Rooyesh-e-Mehtar Kalateh (hereinafter referred as ‘RPC Mehtar Kalateh’). Number of households, population, main race, and religion in Deh Mehtar Kalateh are mentioned in the table shown below.</p> <p style="text-align: center;">Number of Households, Population, Race, and Religion</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Deh</th> <th>Families</th> <th>Population (Persons)</th> <th>Main Race</th> <th>Religion</th> </tr> </thead> <tbody> <tr> <td>Mehtar Kalate</td> <td>About 750</td> <td>About 3,500</td> <td>Mazandarani (80%), Sistani+Persian from Khorasan Prov. (20%)</td> <td>Islam Shiite</td> </tr> </tbody> </table> <p>Main economic activities of the settlers in Deh Mehtar Kalateh are agriculture, animal husbandry and public servants. About 30% of farmers deal with animal husbandry besides agriculture. <i>Ab-ban mirab</i> (a traditional water manager) exists in this Deh to manage water in the paddy field.</p>	Deh	Families	Population (Persons)	Main Race	Religion	Mehtar Kalate	About 750	About 3,500	Mazandarani (80%), Sistani+Persian from Khorasan Prov. (20%)	Islam Shiite
Deh	Families	Population (Persons)	Main Race	Religion							
Mehtar Kalate	About 750	About 3,500	Mazandarani (80%), Sistani+Persian from Khorasan Prov. (20%)	Islam Shiite							
Marketing	<p><b>Marketing Channel of Agricultural Products:</b> Wheat, rice and soybean produced are mainly sold by the RCO. The condition of the road from farmland to main road is not good but the main road is well-paved.</p> <p><b>Marketing Problems of Agricultural Products:</b></p> <ul style="list-style-type: none"> <li>Price of the products</li> <li>Relationship with middlemen and other buyers: RCO is the most reliable buyer for the farmers at present in the case of rice.</li> <li>Transportation means and cost</li> </ul>										
Rural Society and Gender	<p><b>Social structure of Deh:</b> The representatives of Deh Mehtar Kalateh are the members of Rural Council, elders, and mullahs. The society consists of land owner farmers, tenant farmers, agricultural labors, animal breeders, public servants, and small storekeepers, <i>ab-ban mirab</i> (traditional water manager). Among the representatives, Rural Council plays a big role. In Deh Mehtar Kalateh, <i>Ab-ban mirab</i> is in charge of water distribution in paddy fields.</p> <p><b>Gender:</b> The Mazandaran women get married between 15 to 20 years old and have 2 to 5 childrens. The main responsibility of the women are agricultural works and works for domestic consume as animal raise, dairy products, dressmaking, and house works. Handicraft is their hobby.</p>										
RPC Mehtar Kalate	<p><b>General:</b> The eligible persons to be a member of RPC are those who hold farmland in the covered area (Dehs) by RPCs. The entrance fee or the share of RPC Mehtar Kalateh is Rls.100,000/ha.</p> <p><b>Organizational structure:</b> RPC Mehtar Kalateh comprises of a RPC President employed by RPC itself, an accountant, an agricultural technician dispatched from Jihad-e-Agricultural Organization, a person in charge of mechanization, 4 agricultural machinery operators (tractor, combine, and transplanter), and an executive board selected among the members.</p> <p><b>Activities and decided matters of RPC:</b> Activities of RPC Mehtar Kalateh are 1) Training of the members through technical extension, 2) Setting a member’s plot as a demonstration plot, 3) Setting an experimental plot in the</p>										

	<p>RPCs' farmland, 4) Purchasing a rice trans-planter and lending it to the members at Rls.300 thousand/ha (2001), 5) Purchasing wheat combines and lending it to the members at Rls.40 thousand/ha (2002), 6) Selling agricultural inputs, 7) Analyzing soil, 8) Extending the method for prevention of weed and insects, 9) Buying cotton at the better price than middlemen, and 10) Preparing a pickles factory.</p> <p>Decided matters are 1) Getting grant from Agriculture Bank for Drought Damage Prevention Plan established by the RPC, 2) Installing farm roads, 3) Land grouping (it is decided but not proceeded due to two farmers' objection), 4) Making cadastre and topographical maps, and 5) Water distribution (by the executive board).</p> <p>Problems of the RPC member:</p> <ul style="list-style-type: none"> <li>• Lack of agricultural inputs</li> <li>• Lack of agricultural machinery</li> <li>• Lack of materials for technical instruction (extension)</li> <li>• Lack of irrigation water</li> </ul>
Agricultural Assistance and Finance	<p><b>Agricultural Assistance:</b> Golestan Jihad-e-Agriculture Organization provides the loan for purchasing domestic animals. Khomeini Foundation and Ministry of Labor and Social Problems also provide this kind of loan. The persons who graduated from a university but do not have any occupation have a priority to get the loan.</p> <p><b>Agricultural Finance:</b> The farmers borrow money from a bank, mainly Bank Saderat, with an interest rate for agricultural production of 16%/year. For well construction loaned from Agricultural Bank, the interest rate is 20%/year.</p>
Social Infrastructure	<ul style="list-style-type: none"> <li>• Access road to the area of Case Study is asphalted</li> <li>• A power transmission line is installed in Deh Mehtar Kalateh but not in the field</li> <li>• Water supply facilities and telephone line is already installed. Gas pipeline is not installed yet but it is planned by Rural Council.</li> <li>• There are 2 public primary schools (boys and girls), 2 public lower secondary schools (boys and girls) and 1 public upper secondary school (girls) in Deh Mehtar Kalateh. Most of the students go to until the level of upper secondary school</li> <li>• There are a small public clinic and a large health center in Deh Mehtar Kalateh.</li> </ul>
<b>Agricultural Conditions of the Project Area</b>	
General	<p>The Mehtar Kalateh is located in the northern zone of Kordkuy District, and the case study area is located in the lowest land area. The land height above sea level of the case study area is from – 22 to – 20 m. On the other hand, soil texture is classified as heavy soil texture, which contains 46 to 64% of clay. Therefore, the low land area, including the case study area, suffers from flooding by heavy rainfall, especially in the beginning of autumn and the end of winter to spring.</p> <p>There are 4 plots in the Case Study area with areas of 8.2 ha of the first plot, 12.9 ha of the second plot, 4.6 ha of the third plot and 1.1 ha of the fourth plot. All lands belong to the relatives and their families, and the joint farming is carried out in each plot by 3 families in the 1<sup>st</sup> plot, 8 families in the 2<sup>nd</sup> plot, 3 families in the 3<sup>rd</sup> and the 4<sup>th</sup> plot.</p> <p>Land conditions of the case study area are the worst in the lowland area, such as lowest in altitude, heavy textured soil, several pondings in winter every year, etc. Therefore, the cropping pattern in the area is generally “paddy rice – wheat”. Irrigation water source is well. When well's water is not enough for</p>

	<p>paddy rice cultivation, soybean is cultivated in a part of the plot instead of paddy rice.</p> <p>In each plot, the cooperative field use, common use of irrigation water by well and cooperative farm works are carried out. The products are allotted to each family.</p> <p>It is considered that the present cropping pattern “paddy rice – wheat” is the best, unless land conditions are improved by any ways, such as forcible drainage by pump, soil dressing with light textured soil, etc. Yields of crops under irrigation by well in the case study area are 6 to 7 tons/ha of rice, 2 to 4 tons/ha of wheat, and 2 to 2.5 tons/ha of soybean, respectively.</p> <p>In regard to mechanization, tractor cannot work in field in winter (December to March) due to wet land. And also, combine cannot work in field for harvest of paddy rice. Therefore, paddy rice is harvested by hand and transported to combine on a road, and then is threshed by combine.</p>
<b>Irrigation / Drainage Conditions</b>	
Water Source	The water sources are mainly rainfall and individual wells.
Problems Related to Irrigation and Drainage	<ul style="list-style-type: none"> <li>• It is impossible for a tractor to enter into the farmland due to frequent inundation during rainy season</li> <li>• The Gharasu River flows backward every several years. In this case, drainage of the drainage river is retarded</li> <li>• Groundwater level of the farmland is always high, which effects badly on crop cultivation</li> </ul>

### 7.3 Constraints and Potentials for Development

<b>Constraints for the Development</b>	
Natural Conditions	<p><b>Climate and Hydrology:</b> The drainage condition of the area is the main constraint. The area has two main drainage canals (one is the Shast Khola river) that drain the water to the Gharasu river. But the smooth slope of the Gharasu river and the canals, as the deposition of sediment and improper vegetation in the canal creates difficulties to the drainage process.</p> <p><b>Soils:</b> The major problem of the soils in the Mehtar Kalateh is the heavy texture of the soil with a high clay content of above 50%. Because of the clayey texture, the infiltration rate is low and causes flooding during heavy rain. In most cases, the clay content of the bottom layers is higher than the top layers. It is believed that the small clay particles might have percolated downwards during the rice cultivation during the past 10-20 years. Because of the clayey texture, tillage is also a problem in this soil.</p>
Socio-economy	<ul style="list-style-type: none"> <li>• Not well-maintained farm road</li> <li>• No electricity in the filed</li> </ul>
Agriculture	<ul style="list-style-type: none"> <li>• Basically, the case study area is in a poor condition for agriculture, such as low land, ponding by heavy rainfall, heavy textured soil, poor drainage, etc</li> <li>• There is no canal of surface irrigation water</li> <li>• Therefore, farmers invest in construction of wells. The cost of construction of well is very high, about \$ 25,000, and the cost of repairs is also very high, \$ 12,000</li> <li>• There are no crops, which correspond to the cost of well construction. Paddy rice is better than other crops</li> <li>• Measures of improvement of low land involve the huge budget</li> <li>• Cooperative construction, management and water use of wells are necessary, taking advantage of an opportunity of well’s renewal</li> <li>• Cooperative purchase, maintenance and use of farm machinery are necessary, taking advantage of an opportunity of tractor’s renewal</li> </ul>

	<ul style="list-style-type: none"> <li>• Land readjustment having proper field plot and proper land leveling</li> <li>• Cooperative land use by small-scale farmers</li> <li>• Establishing high productivities in agriculture and husbandry by increase of yield and decrease of cost</li> <li>• Decrease of debts</li> </ul>
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### 7.4 Agricultural Development Model

The agricultural development plan in the Case Study area has some prerequisites as follows:

- As the rice cultivation with the water from wells are prohibited in the area, other crops shall be recommended
- Improvement of soil conditions; Executing the forcible drainage of low land by pump, soil dressing with light textured soil, physical improvement of soil, sub-soiling, execution of drainage in the fields with low cost
- Land consolidation having proper field plot and proper land leveling
- Establishing of cropping pattern and suitable rotation to keep the sustainable agriculture
- Establishing of proper cooperative organization in mechanization and maintenance of farm machines in crop cultivation, management and maintenance of wells, of other facilities, such as plastic green house
- Establishing of supporting system for farmers, such as technological transfer of farming, cultivation techniques, profitable marketing, loan conditions to be easy for repayment, guarantee of farm products
- Establishing of supply system of farm materials and farm machinery

Cropping system

7 crops (wheat, corn, rape, cotton, pea and soybean) with grass cultivation is going to be promoted in a 4 years crop rotation for a sustainable agriculture.

Cropping system

Crop	1st Year								2nd Year															
	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8
Pattern	Soybean	Wheat								Corn					Italian Ray Grass									
Pattern			Italian Ray Grass												Rape								Cotton	
Pattern																								
Pattern																								
Pattern																								
Cucumber in Greenhouse																								

Crop	3rd Year								4th Year															
	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8
Pattern																								
Pattern																								
Pattern																								
Pattern																								
Pattern																								
Cucumber in Greenhouse																								

Water Demand for the Proposed Cropping System

Set	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
20.7	2.18	0.11	0.08	1.71	4.93	10.5	23	6.68	23.1	6.53	9.65

(x1000 m3)

Livestock

As in the Tazeh Abad scheme, it will be proposed the introduction of 10 hybrid cows per farmer for milk production.

Economy of the integrated farming model

The annual profits in the integrated farming of agriculture of 4 ha and animal husbandry of 10 hybrid cows are as follow:

Item	Average		High Level	
	Hasvest	Gross Income	Hasvest	Gross Income
	kg/ha	x10 <sup>6</sup> Rial/ha	kg/ha	x10 <sup>6</sup> Rial/ha
Wheat	3,190	2.282	5,000	4.141
Rape	2,200	3.511	3,500	5.984
Italian Ray Grass	4,000	1.546	4,000	1.546
Pea	1,200	0.917	2,000	2.221
Cotton	1,788	2.163	3,000	3.221
Soybean	1,523	0.946	2,200	1.952
Corn	2,558	0.079	3,000	0.280
Total Annual Gross Income(4ha)		11.443		19.345
Livestock ( 10 Heads )		24.524		24.524
<b>Total Annual Net Income</b>		<b>35.967</b>		<b>43.869</b>
Possibility to Introduce the Integrated Farming Model in the Mountain Area	The Integrated Farming Model can contribute to improve the farming activities of the low lands that use groundwater at the mountainous area.			

### 7.5 Suggestions for Future Study

<b>Drainage Related Aspects</b>	<p>The soil texture in the Case Study area is heavy clay and therefore, the following aspects are to be proposed as solution options, which shall be studied in more detail in the future study.</p> <ul style="list-style-type: none"> <li>• To provide sub-surface drainage system</li> <li>• To provide surface drainage canal against the surface inundation</li> <li>• To provide drainage gate at drainage river mouths</li> <li>• To conduct drainage river improvement</li> </ul>
<b>Land Reform Related Aspects</b>	<p>Land reform is an important aspect to be studied for the project area. Farmers in the area are adapting 'Basin Irrigation Method' under the situation of without land leveling of those four farm blocks. Irregularities of land surface cause partial inundation or non-uniform watering and also causes partial differences of crop growth. Besides, most of the measures of improvement described before can not succeed without land reform.</p>

## Chapter 8 Conclusion and Recommendation

The Gorgan Plain of Golestan Province is an important agricultural production area in the Province and is considered to possess a high agricultural potential due to its large plain area. However, severe natural conditions such as low rainfall, high rates of evaporation, severe salinity and alkalinity problems of the soil, and drainage limitations due to high groundwater level restrict the agricultural production of the area.

In order to improve the agriculture production in the Gorgan plain, Golestan Jihad-e-Agriculture Organization has been implementing irrigation and drainage schemes and six (6) such schemes have been implemented in the Study Area, since 1994. However, because of the budgetary constraints, the irrigation and drainage schemes are not yet fully completed.

At this juncture, various solution options available to solve the different problems related with water resource, soil, socioeconomy, irrigation and drainage and agriculture were analyzed and the basic concept of agricultural development of the Study Area was developed. In order to achieve sustainable agriculture development of Gorgan plain with maximum utilization of available resources, the following measures should be carried out in an integrated manner.

- Raising the stability and availability of irrigation water
- Enhancing soil improvement measures
- Reinforcing irrigation and drainage infrastructure facilities
- Introduction of site oriented farming programs to suite with the severe natural conditions
- Setting up measures to expand farm income through integrated and improved farm management
- Improving support policy for farmers and the farmers organization
- Strengthening research and development to support agriculture development of the region
- Development of the extension systems
- Building up of mutual trust between farmers and the government agencies
- Diversification of local market demands

Tentatively 3 phases with 5-year period for each stage are proposed, starting in 2005, considering that this Study will be finished on spring of 2003. Those stages are as follows:

- Preparatory stage: from the spring of 2003 to the end of 2004 2 years
- Phase (2005 ~ 2009): 'Preparation for Sustainable Agricultural Development and Rural Activation'
- Phase (1010 ~ 1014): 'Improving the present agriculture and Preparation for wider development'
- Phase (2015 ~ 2019): 'Implementing Sustainable and Wider Range of Agricultural Development'

The selection of the priority area was the first step to provide a 'success story' to the farmers in the vicinities for the future development of the region. Tazeh Abad Project Area was selected for the Feasibility Study. In addition, an area of 24 ha was selected in the Cheldin project area, which shares a part of piedmont agricultural area, and contributes significantly for the main agricultural production in the Golestan province

The implementation of the project in Tazeh Abad Area is judged as valid with the result of economic and financial evaluations as computed from tangible benefit. In addition, socio-economic impact evaluated from intangible benefit is also judged as sufficiently expectable

## **Recommendations**

The following items are recommended to achieve the targets of the present study.

### **Joint Coordination of the Stakeholders Concerned with the Project**

Joint coordination of all the stakeholders related to the Project including all the relevant government agencies and farmers' organizations is highly important for the success of the project. Research, administration and extension system of the province should work together in a systematic way to solve the problems of the Project Area. The governmental agencies should have more opportunities to discuss with farmers by using participatory methods and a mutual trust between the governmental agencies and the farmers should be built up.

### **Expeditious Implementation of Development of the Priority Area**

Tazeh Abad priority area can be developed as a sustainable development model for the future Gorgan plain agriculture development and therefore expeditious implementation of development plan of the priority area is necessary. The Technical Development Project should be carried out, as the first stage of the development plan. The results of the project should be expanded to similar regions in other parts of the country.

### **Study on Integrated Water Resources Development and Watershed Conservation**

It is highly important to secure stable and sufficient water resources to realize sustainable agricultural development in the Gorgan Plain. Besides, watershed conservation is also necessary to prevent the sedimentation and flooding problems in the Gorgan plain. An efficient water use and watershed conservation in future for the regional development, based on the availability of water resources will be studied. It will also recognize the water availability in both the watersheds, creating the basic conditions to succeed projects such as 'Water Supply from the Mazandaran Province'.

### **Solving the Drainage Problems of Cheldin Project Area considering the Whole Watershed**

In the Cheldin Project Area, the drainage problems of any particular farm or a small area can not be solved just by implementing individual drainage system for that area. The drainage problem has to be tackled for the entire drainage block or for the entire project area. Since land consolidation and reclamation is an important activity to be carried out in the drainage project, there is a necessity to arrive at a mutual consensus among the farmers, in order to implement the drainage project for the Cheldin Project Area. Therefore, the project should be developed and implemented in close cooperation with the farmers of the Project Area.

### **Controlling of Over-Exploitation of Groundwater Resources**

In the southern part of the Study Area near the Piedmont plain, wells have been extensively used to irrigate rice. The present case study demonstrated that it is possible to increase the farmers income by crops other than rice. According to the result, it must be promoted to change the rice production to other crops.

### **Strengthening of Farmers Organizations**

It is obvious that strengthening of farmers organizations is one of the basic necessities for agricultural development in the Gorgan Plain. There are many problems such as shortage of machinery, limitation of finance, shortage of technical personnel etc. So, it is necessary to enhance the present functions of the RPCs and new functions should be added. For eg. the machinery available in the Project area shall be grouped together, and the RPC shall provide guidance and supervision for the operation of these farm machinery.

### **Women's Participation in Agricultural Development**

Women's participation in agricultural development should be promoted for proceeding rural women's participation in the society and also for alleviating unemployment problem in this area. This should be considered by race and farming activity.