2.3 Development Cost

2.3.1 Conditions of Cost Estimate

The costs for the project works and their relevant works and services are estimated based on the following conditions and assumptions:

(i) Conversion rate among Tenge (T.), US dollar ($) and Japanese yen (¥) is assumed to be US$ 1.0 = T. 68.0 = ¥ 110.0, referring to the current exchange rate as of October 1996.

(ii) All the costs are estimated based on the unit prices in October 1996.

(iii) All the construction works for the irrigation and drainage canal systems as well as procurement of O&M equipment will be executed by the contractors selected through the international competitive bidding (ICB).

(iv) Machinery and equipment required for construction work would be provided by the contractors themselves. The depreciation costs of machinery and equipment are therefore counted in the unit prices of the construction works instead of the procurement cost.

(v) The project administration cost required during the construction period is estimated at 5 % of the direct construction cost.

(vi) A physical contingency of 10 % of the direct construction cost is included in the project cost.

(vii) No price contingencies are included in the project cost because of the vagueness of future price escalation in the remote future.

2.3.2 Project Cost

The project cost comprises: (i) direct construction cost; (ii) cost for procurement of O&M and office equipment; (iii) cost for procurement of farm machinery; (iv) project administration cost; (v) cost for technical support; (vi) land acquisition cost; (vii) cost for fishery compensation; and (viii) physical contingency. The following table shows the total project cost estimated on the preliminary basis.

(Unit: US$'000)

Description	Amount
1. Direct Construction Cost	
(1) Headworks' Intake Facility	9,818
(2) Left Main Canal	88,578
(3) Right Branch Canal	24,548
(4) Left Branch Canal	13,407
(5) Inter-farm/On-farm Canals	72,187
(6) North Collector	12,891
(7) South Collector	24,542
(8) Inter-farm/On-farm Collectors	20,973
(9) On-farm Facilities	57,612
(10) Buildings	3,924
(11) Post Harvest Facilities	112,535
(12) Rural Infrastructure	59,886
Sub-total of 1	500,901
2. Operation and Maintenance Equipment	
(1) O&M Equipment	5,175
(2) Water Management Equipment	6,386
Sub-total of 2	11,561
3. Farm Machinery	47,920
4. Project Administration	13,139
5. Technical Support	26,280
6. Land Acquisition	10
7. Fishery Compensation	1,000
Sub-total of 1 to 7	600,811
8. Physical Contingency	60,189
9. Total Project Cost	661,000

In addition to the above works, the following will be conducted by the Government's own effort :

(i) Agricultural Research

- to breed high quality and high yielding varieties,
- to produce high quality seeds,
- to make research on improvement of agricultural practices, increase of soil fertility and improvement of post harvest technique, and
- to keep a close linkage with extension wing for the distribution of and transfer of newly developed varieties and new technology to farmers.

(ii) Agricultural Extension Services

- to establish an agricultural extension system,
- to train farmers for modernized agricultural practices, and

- to demonstrate improved and modern technologies to increase production, to improve water use efficiency and to reduce environmental degradation.

(iii) Agricultural Credit

- to reduce the interest rate (45 - 50) for short term operating loans based on the present inflation rate of 16% per annum, and
- to ease the access of private family farm to institutional credit.

2.3.3 Annual Operation and Maintenance Cost

The annual operation and maintenance cost of the project facilities includes the salaries of the staff for the Project Office, staff of the WUAs, the materials and labor costs for repair and maintenance of the project facilities, the cost for operation, and repair and maintenance of O&M equipment. The estimated cost is US$5.66 million per annum for the total project area, which corresponds to US$ 65/ha per annum.

2.4 Project Evaluation

2.4.1 General

The economic evaluation of the project is from the perspective of the social welfare of the country as a whole. The underlying principle of the economic analysis is that resources used by the project and outputs of the project are valued at their opportunity cost, meaning their value to society in their next best alternative use. The economic feasibility of the project is determined by the economic internal rate of return (EIRR).

The economic evaluation is based on the following assumptions:

(i) The economic useful life of the project is 50 years.

(ii) All prices are expressed in constant US$ at the October 1996 level with an exchange rate of T.68 = US$1.

(iii) A standard conversion factor (SCF) of 0.9 is used to convert local currency financial prices to economic prices.

(iv) Transfer payments such as taxes, duties, and interest are not included in economic prices.

(v) A shadow wage rate factor of 0.65 is applied to the unskilled labor component of project cost.

(vi) The implementation (construction) period for each phase or block of land in the project is five years, with headworks construction in the first year; canal lining and drain rehabilitation from the second to 4th years, and on-farm work from the second year to the fifth year. The construction investment is staged 15% in the first year, 25%/year in the second through fourth years and 10% in the fifth year.

(vii) The estimated rate of build-up of benefits is zero benefits during the first three years of construction, 30% of full benefits in the fourth year, 40% in the fifth year, 60% in the sixth year (1st year after completion of construction), 80% in the seventh year, 90% in the eighth year, and full benefits in the ninth year.

2.4.2 Economic Cost

(1) General

Project financial costs are adjusted to economic costs by making the following changes:

(i) Delete all duties and taxes.

(ii) Delete price contingencies (inflation).

(iii) Apply the standard conversion factor (SCF) to adjust for distortions in local costs because of government trade restrictions.

(iv) Shadow price labor based on opportunity cost.

(v) Estimate a construction conversion factor (CCF).

The first two steps are not necessary in this case, because no duties or taxes have been included in the cost estimate, and the estimate is at the 1996 price level, without any contingencies for future inflation.

(2) Standard Conversion Factor (SCF)

Tariffs and trade restrictions introduce a distortion in the price relationships between traded goods (valued at market prices), and non-traded goods (valued at local prices). The benefits of the project are evaluated at world market prices. In order to make the project cost comparable to benefits, the SCF is applied to the price of non-traded goods. The estimated SCF is 0.9 based on 1995-96 trade statistics.

(3) Opportunity Cost of Labor

The unemployment rate in the raions concerned to the project ranges from 19% to 45%. Overall the unemployment rate of Kzyl-Orda Oblast is estimated at 28%.[12/] Considering such high unemployment, the estimated opportunity cost of unskilled construction labor is 60 to 70% of the wage rate.

(4) Construction Conversion Factor

The construction of project components is carried out by equipment, skilled and unskilled labor. For the economic analysis, the construction conversion factor is estimated as follows:

(i) Traded Component. This component includes capital intensive works which require imported materials. Since it is traded, the conversion factor is 1.0. It is estimated that about 40% of the construction costs fall under this category.

(ii) Non-traded Component. This component includes works that require skilled labor and locally manufactured materials. The SCF of 0.9 is used as the conversion factor for these works. About 20% of the construction costs are included in this category.

(iii) Unskilled Labor. An estimated conversion factor of 0.65 has been applied to about 40% of the construction costs which fall under this category.

Based on the above, the CCF is calculated to be 0.85.

(5) Project Costs

The economic cost of the project construction investment is as follows:

12/ MOA and JICA, The Study of Kzyl-Orda Irrigation/Drainage and Water Management Project inthe Republic of Kazakstan, Progress Report (I), November 1996, p.17

(Unit: US$'000)

Description	Total	Cost/ha
1. Direct Construction Cost		
(1) Headworks' Intake Facility	9,818	113
(2) Irrigation Facilities	198,719	2,284
(3) Drainage Facilities	58,408	671
(4) On-farm Facilities	57,611	662
(5) Buildings	3,924	45
2. Project Administration	13,139	151
3. Technical Support	26,280	302
4. Physical Project Cost	36,790	423
5. Total Project Cost	404,680	4,651
6. Economic Cost @0.85 CCF	343,978	3,954

The total project economic cost is US$344 million, US$3,954/ha. Capital components that are replaced after 25 years cost US$32.9 million.

The project costs for post harvest facilities, rural infrastructure, operation and maintenance equipment and farm machinery loans are not included in the benefit/cost analysis. The cost of post harvest facilities is accounted for as an annual cost per ton of yield in the crop budgets for milling and storage of paddy. Rural infrastructure is for domestic water supply, which is not included in the calculation of project benefits. Operation and maintenance equipment costs are covered in the annual O&M cost. Farm machinery costs are included in the crop budgets as an annual depreciation charge. The land acquired by the project is offset by the economic value of a greater quantity of land that is released back to grazing as a result of canal realignment. Fishery compensation is not included in an economic cost, because in fact there is no increase in amount of fishery loss as a result of the project investment.

The estimated O&M cost under with project conditions is US$5.7 million, or US$65/ha. The estimated O&M cost under without project conditions is based on the 1996 water charge, US$17/ha for 31,900 hectares, a total of US$542,300 as mentioned in Paragraph 2.1.7(2). The incremental O&M cost is US$5.1 million. The economic cost after applying the SCF 0.9 is US$4.6 million, about US$53/ha.

(6) Cost Allocation

For the economic analysis of individual farms, project costs were allocated between farms on the following basis:

(i) Headworks Intake: Allocated equally to the entire project area of 87,000 hectares.

(ii) Left Main Canal: Allocated to each farm according to the area served by the canal.

(iii) Right and Left Branch Canals: Allocated according to the amount of area served under each canal.

(iv) North and South Main Collectors: Allocated according to the area served under each collector.

(v) Buildings: Allocated equally over the entire project area.

2.4.3 Project Benefit

Net returns per hectare under the future "without project and "with project" conditions are estimated from economic crop budgets and shown as follows:

(Unit; US$/ha)

Crop	With Project	Without Project	Increase from Project
Rice	1,046	559	487
Lucerne	276	90	186
Wheat	230	12	218
Maize, silage	426	102	324
Safflower	363	-126	489
Vegetables	1,492	150	1,342
Melon	1,087	247	840

Note: Based on economic prices, no taxes are included.

The average net return per hectare is US$86 under the future "without project" condition , compared to US$696 under the future "with project" condition. The incremental benefit per hectare is US$610, and the total benefit from the combination of higher yields and more intensive cropping is US$53 million annually at full development of 87,000 hectares.

2.4.4 Economic Evaluation

The EIRR of the entire project is 11%. The EIRR(s) of individual farms ranging from 7.5% to 13.8% are listed in Table 2.4.1. Of the four raions in the Study Area, the farms of the Terenozek Raion have the highest average EIRR, 11.8%, followed by the Zhalagash Raion (11.0%), the Karmakshy Raion (10.2%) and the Syrdarya Raion (9.4%).

The reason for variations in benefits/ha between farms are differences in the amount of abandoned land and cropping patterns under the future "without project" conditions. Yields were not changed between farms and the same cropping pattern was used for all farms under the future "with project" conditions.

2.5 Development Priority and Implementation Program

2.5.1 Assessment of Development Priority of Project

(1) General

According to the results of the study made in the previous chapters, the whole Study Area of 87,000 hectares consisting of 25 farms is justified to be technically sound and economically feasible, and therefore it is recommended that the whole Study Area be taken up for the agricultural development. In this case, however, the construction cost would amount to about US$660 million, which seems extremely bigger than the MOA annual budget. In order to implement the project with such a huge construction cost in a practical way, it is necessary to prepare a staged development plan from the budgetary viewpoint. For the formation of this plan, an assessment of development priorities of the project works is first made as detailed in the following sub-sections.

(2) Summary of Present Situation in the Study Area

The Study Area extends over four raions: Syrdarya, Terenozek, Zhalagash and Karmakshy (Figure 2.1.1), in which 25 farms exist as shown in Tables 2.5.1 through 2.5.4. The present situation of the area is described below for the respective raions.

(i) Syrdarya Raion

There are four farms in this raion, having a total area of 37,500 hectares. The total agricultural land area is 27,210 hectares, of which the rice rotation area (original irrigation area) is 3,330 hectares (12%). This rice rotation area consists of rather small and scattered irrigation blocks compared to the other raions. In this raion, the presently irrigated land area is 2,780 hectares and the abandoned area is 550 hectares. The total number of beneficiaries is approximately 9,400 persons, and therefore the presently irrigated land area per beneficiary is 0.3 hectares. The overall cropping intensity in the raion is estimated at 74%.

(ii) Terenozek Raion

There are four farms in this raion, having a total area of 78,300 hectares. The total agricultural land area is 55,960 hectares, of which the rice rotation area is 23,670 hectares (42%). The ratio of the rice rotation area to the total agricultural land area is the highest among the four raions. This raion is located close to the headworks, after the Syrdarya Raion. In this raion, the presently irrigated land area is 20,830 hectares and abandoned area is 2,840 hectares. The total number of beneficiaries is approximately 11,150 persons, and therefore the presently irrigated land area per beneficiary is 1.9 hectares. The overall cropping intensity is estimated at 82%, which is the highest of the four raions.

(iii) Zhalagash Raion

There are ten farms in this raion with a total area of 130,640 hectares. The total farm land area is 115,370 hectares, of which the rice rotation area is 34,400 hectares (30%). The ratio of the rice rotation area to the total agricultural land area is the second highest of the four raions. In this raion, the presently irrigated land area is 28,190 hectares and abandoned area is 6,210 hectares. The total number of beneficiaries is approximately 18,030 persons, and therefore the presently irrigated land area per beneficiary is 1.6 hectares. The overall cropping intensity is estimated at 77%.

(iv) Karmakshy Raion

There are seven farms in this raion with a total area of 183,560 hectares. The total farm land area is 127,180 hectares, of which the rice rotation area is 25,610 hectares (20%). This raion is located downstream most of the main canal. In this raion, the presently irrigated land area is 23,290 hectares and the abandoned area is 2,320 hectares. The total number of beneficiaries is approximately 14,510 persons, and therefore the presently irrigated land area per beneficiary is 1.6 hectares. The overall cropping intensity is estimated at 79%.

(3) Limiting Factors to the Agricultural Development in the Study Area

According to the field survey made in the Phase-I Study, the following matters are pointed out as the limiting factors to the agricultural development in the Study Area:

(i) Due to deterioration of the irrigation canal system in the area, irrigation water can not reach the downstream area of the system.

(ii) Due to shortage of technicians and funds for O&M work, the irrigation and drainage systems are not properly operated and maintained.

(iii) Due to deterioration of drainage canal system in the area, salinized and inundated areas are increasing.

(iv) Due to poor land leveling in the plots of paddy fields, the yield is rather low.

(v) Due to the Government's low buying prices of farm products and delay of its payment, it is difficult for farms to buy fertilizers and other agricultural inputs.

(vi) Due to a shortage of farm budget, agricultural machinery and post-harvesting facilities have not been well maintained, and many of them have been damaged.

(4) Selection of Priority Project

(a) Basic Concepts for the Project

The objective of the Study is to establish an agricultural development plan for enhancement of agricultural productivity by means of: (i) improvement of agricultural

infrastructures including irrigation and drainage systems; (ii) establishment of water management system; and (iii) improvement of farming system.

Through the field survey made in the Phase-I Study, it has become clear that the existing irrigation and drainage systems have deteriorated seriously and are not functioning well. For the improvement of water management system and farming system, therefore, it would be of paramount importance to rehabilitate these existing irrigation and drainage systems, and it is technically justified to take the following steps for implementation:

(i) Considering that it is impossible to solve the problems of water shortage in the farm land and sand deposit in the branch canals and inter-farm/on-farm canals without rehabilitation and improvement of the main irrigation facilities, and also impossible to improve the drainage conditions in the farm lands without rehabilitation and improvement of the main drainage facilities, the rehabilitation and improvement of the Kzyl-Orda Headworks, Left Main Canal and North and South Main Collectors are pre-requisite for the profitable agricultural development in the Study Area.

(ii) Rehabilitation and improvement of the inter-farm/on-farm canals, inter-farm/on-farm collectors and on-farm system should be implemented in sequence from upstream to downstream along the Left Main Canal.

In addition to the above-mentioned basic considerations, it should also be taken into consideration that the priority project should have a demonstration effect to the other projects in the Syr Darya river basin. Furthermore, the development areas to be selected for the priority project should be selected in one raion, because the water management of all farms in a raion is totally controlled and supervised on the raion basis at present by the respective Raion Management of Water Economy System.

(b) Selection of Priority Project

From the above-mentioned basic concepts, the rehabilitation of the intake structure of the Kzyl-Orda Headworks, Left Main Canal and North and South Main Collectors and water management in the model area should be given the highest priority for this project. Further taking into consideration the recommended development sequence from upstream to downstream, a more detailed study is made for the Syrdarya Raion and the Terenozek Raion, both of which are located along the upstream reaches of the Left Main Canal, from the following viewpoints:

(i) The farm to be selected as a priority area should not be overlapped with the area of Irrigation and Drainage Improvement Project being implemented by World Bank.

(ii) The farms included in the Terenozek Raion will be given a higher priority than those in the Syrdarya Raion, because the Terenozek Raion is given a higher priority by the Kzyl-Orda Oblast Administration than Syrdarya Raion for agricultural development.

(iii) The farms which have a rice rotation area of more than the average farm size (3,900 hectares) in the Study Area is preferable as a model farm.

(iv) According to the result of field survey, the urgency of implementation and farmers' support for implementation are equally high in all the farms. Therefore, these items are taken to be equal for all the farms.

(v) The farms of which implementation will bring about a higher return of the project investment than the others, i.e., higher economic internal rate of return (EIRR), will be given a higher priority.

The following table compares the present situation between the Syrdarya Raion and the Terenozek Raion following the above-mentioned checking items:

Items	Syrdarya	Terenozek
(a) Overlapping with W/B project	None	None
(b) Development priority of Oblast Administration	Second	First
(c) Average size of planned irrigation area of the farm	830 ha	5,920 ha
(d) EIRR	9.4%	11.8%

From the above comparison, it is clear that the Terenozek Raion has a higher priority than the Syrdarya Raion for agricultural development. For practical development, however, it is not advisable to take up the total rice rotation area of 23,670 hectares in the raion, in addition to the rehabilitation and improvement of the intake structure of the Kzyl-Orda Headworks, Left Main Canal and North and South Main Collectors, because such a large scale development would require much investment and it may burden the Government from its budgetary viewpoint. Considering this possible difficulty and further considering the function of the selected area as the model farm, it is recommended that the irrigation area of 10,000 - 15,000 hectares be selected as a practical size for development in the Terenozek Raion. In selecting such size area in the raion, the following criteria are established:

(i) As a model farm, the farm having a planned irrigation area of more than the average farm size (3,900 hectares) in the raion is preferable.

(ii) The farm which has a higher EIRR should have a higher priority for selection.

(iii) Considering the convenience of farm management, the selected farms should be neighbors.

Based on the above-mentioned criteria, all four farms included in the Terenozek Raion are compared in the following table:

Items	Akzharma	Ilyasov	Shagan	Shirkeli
(a) Total area of farm (ha)	21,180	15,930	24,300	15,180
(b) Agricultural land (ha)	17,460	11,740	15,400	11,360
(c) Rice rotation area (ha)	5,620	6,480	7,210	4,360
(d) EIRR (%)	10.9	13.8	11.8	10.6

From the above comparison, it can be concluded that the Ilyasov Farm has the highest priority, followed by Shagan, Akzharma and Shirkeili, and as a result the Ilyasov Farm should be selected as a priority area. As mentioned above, however, since the irrigation area of 10,000-15,000 hectares is preferable as a model farm, it is recommended that the Shagan Farm, which can be ranked in the second priority, also be selected as the priority area. The following table shows the summary of present conditions of both Ilyasov and Shagan Farms, and their locations are shown in Figure 2.5.1:

Farm Name	Total Area of Farm (ha)	Number of Beneficiaries (persons)	Agricultural Land (ha)				
			Total	Rice Rotation Area	Presently Irrigated Area	Abandoned Area	Non-Irrigated Area
Ilyasov	15,930	2,217	11,740	6,480	5,200	1,280	5,260
Shagan	24,300	3,663	15,400	7,210	6,330	880	8,190
Total	40,230	5,880	27,140	13,690	11,530	2,160	13,450

2.5.2 Project Implementation Schedule

As mentioned above, a huge construction cost will be required to complete all the project facilities mentioned in Sub-section 2.3.2, and it would be difficult for the Government to arrange a sufficient budget for the construction of all the works at the same time. It is therefore proposed to implement the project in a stage-wise manner. In this context, the development packages and their priority rankings are decided as follows, mainly considering the economic viability of the work. The works included in the respective stages may be divided in some phases depending on the possibility of fund arrangement.

Stage-I Development

- Rehabilitation of the Kzyl-Orda Headworks,
- Rehabilitation of the Left Main Canal,
- Rehabilitation and improvement of the North and South Main Collectors, and
- Rehabilitation and improvement of the Ilyasov Farm and the Shagan Farm (13,690 hectares in total) including inter-farm/on-farm canals.

Stage-II Development

- Rehabilitation of Right and Left Branch Canals,
- Rehabilitation and improvement of remaining 2 farms in the Terenozek Raion (9,980 hectares in total) including inter-farm/on-farm canals, and
- Rehabilitation and improvement of all 10 farms in the Zhalagash Raion (34,400 hectares in total) including inter-farm/on-farm canals.

Stage-III Development

- Rehabilitation and improvement of all 7 farms in the Karmakshy Raion (25,610 hectares in total) including inter-farm/on-farm canals, and
- Rehabilitation and improvement of all 4 farms in the Syrdarya Raion (3,330 hectares in total) including inter-farm/on-farm canals.

Assuming that each stage will require 5 years minimum for implementation, the total implementation period would be more than 15 years.

The following table shows the project costs for the respective stages:

Stage	Project Cost (US$'000)	Project Cost per Hectare (US$/ha)
I	238.4	17,410
II	267.3	6,020
III	155.3	5,370
Total	661.0	7,600

According to the above table, the cost for Stage-I per hectare is extremely high as compared with those of Stages-II and III. This is mainly due to the reason that Stage-I work includes the rehabilitation and improvement of the main irrigation and drainage facilities such as the Kzyl-Orda Headworks, Left Main Canal, South and North Main Collectors, which will serve not only the Stage-I area but also the whole area of 87,000 hectares. Therefore, it should be understood that the cost for Stage-I includes the pre-investment cost for Stages-II and III.

2.6 Conclusion and Recommendation

Conclusion

(1) The Phase-I Study clarified that the main components for achieving sustainable agricultural development in the Kzyl-Orda Left Bank Area are:

(i) enhancement of irrigation efficiency through rehabilitation and improvement of the existing irrigation system;

(ii) assurances of operation and maintenance (O&M) of project facilities by farmers' organizations and beneficiaries themselves in the process of privatization of the agricultural production system;

(iii) prevention of salinization through proper management of irrigation and drainage and proper land use and cropping system;

(iv) mitigation of negative environmental impact caused by agricultural development; and

(v) enhancement of farmers' incentive towards agriculture through improvement of the agricultural production environment.

(2) Through implementation of the above-mentioned project components, the following benefits would be expected:

(i) Agricultural production would largely increase and the farmers' income would largely increase; US$86/ha to US$696/ha in economic value.

(ii) Improvement of a potable water supply to farm households will improve their health and reduce the inconvenience, time and drudgery of obtaining water.

(iii) Rehabilitation and improvement of the existing irrigation and drainage facilities will save irrigation water, which will increase the inflow to Aral Sea by 21% and contribute to environmental conditions in the lower basin of the Syr Darya river including Aral Sea.

(3) According to the result of the project evaluation, the agricultural development in the Kzyl-Orda Left Bank Area including 25 farms in 4 raions is technically sound, and economically feasible, showing the economic internal rate of return (EIRR) of 11% ranging from 7.5% to 13.8%.

Recommendation

(1) As mentioned in the above, the implementation of the project is technically sound and economically feasible. Furthermore, the project will be bring about various kinds of indirect social and economic benefits to the residents of the area. Thus, it is recommended that the project be implemented as early as possible following the priority sequence mentioned below:

<u>Stage-I Development</u>

- Rehabilitation of the intake structure of the Kzyl-Orda Headworks,
- Rehabilitation of the Left Main Canal,
- Rehabilitation and improvement of the North and South Main Collectors, and

- Rehabilitation and improvement of the Ilyasov Farm and the Shagan Farm (13,690 hectares in total) including inter-farm/on-farm canals.

Stage-II Development

- Rehabilitation of Right and Left Branch Canals,
- Rehabilitation and improvement of remaining 2 farms in the Terenozek Raion (9,980 hectares in total) including inter-farm/on-farm canals, and
- Rehabilitation and improvement of all 10 farms in the Zhalagash Raion (34,400 hectares in total) including inter-farm/on-farm canals.

Stage-III Development

- Rehabilitation and improvement of all 7 farms in the Karmakshy Raion (25,610 hectares in total) including inter-farm/on-farm canals, and
- Rehabilitation and improvement of all 4 farms in the Syrdarya Raion (3,330 hectares in total) including inter-farm/on-farm canals.

(2) In order to attain the projected target, it is recommended that the following agricultural supporting services be improved and strengthened by the GOK's own efforts.

(i) The activities of agricultural research should , within a limited budget, selectively focus on not only the development of technologies to resolve the agricultural restraints faced by farmers, but also the improvement of the social, managerial and agro-economic situation of farms and farmers.

(ii) Agricultural extension and farmer training should be reinforced by MOA to improve farm management, agricultural techniques, irrigation practices, business planning, marketing, water management and legal issues. Moreover, it is necessary to tighten the linkage between the agricultural research and extension wings at the oblast level.

(iii) The agricultural credit system should be strengthened through improving poor earnings, weak financial health, weak management and an excessively high rate of default on its loans.

(3) In order to improve productivity and output in the Kzyl-Orda Left Bank Area, it is recommended to strengthen and improve the present farm organizations by creating an agricultural cooperative that provides all of the project farms with marketing, input procurement and financing services, and by organizing a water users association.

(4) For successful implementation and O&M of such a large-scaled irrigation project as this project, it is recommended to establish an inter-ministerial coordination committee, which will consist of the representatives from the Ministry of Agriculture, the Ministry of Finance, Ministry of Economy, Ministry of Ecology and Bioresources, Ministry of Construction, Architecture and Housing, Ministry of Geology and the Project Manager of the Kzyl-Orda Irrigation and Drainage Project Office.

(5) Following the priority sequence mentioned above, it is recommended that the Feasibility Study be conducted for the Stage-I Development in the Phase-II Study period.

PART - III

FEASIBILITY STUDY ON THE PRIORITY PROJECT

3.1 Present Conditions of the Priority Project Area

3.1.1 Location and Administration

The Project Area is located in the Terenozek Raion of the Kzyl-Orda Oblast at 55 km west of the oblast capital of Kzyl-Orda. The administrative center of the raion, Terenozek town, is located 13.3 km north of the Project Area on the major national east-west highway and railroad line. The two major farms in the Project Area, Ilyasov Production Cooperative (398 households) and Shagan Production Cooperative (688 households), adjoin each other and are situated on an asphalt road south of Terenozek city. The Berlek Peasant Farm (56 households) is situated in the heart of the Ilyasov Area. The Abuov Zhaksylyk Peasant Farm (3 households) and four family peasant farms (Ilyas, Meras, Murat, and Beibit - each 1 household) are located within the boundaries of the Shagan Area. Farms are administered either as production cooperatives or "peasant farms". Production cooperatives are large collective organizations led by a manager and a board of directors. Peasant farms are typically small private units run by a family household or group of households.

3.1.2 Population and Labor Force

The Kzyl-Orda Oblast has a population of 676,800. Urban population is 64% and rural population is 36%. The Terenozek Raion, which encompasses the Project Area, has a total population of 29,700. The identified Project Area has a total population of 6,078 and 1,149 households. Household density is 5.3 persons per household. In the Project Area, 97.5% of the population are ethnic Kazaks; the remainder are Russian, Korean, German, Chechen, and Kalmik. The following table shows the population in the Project Area:

(Unit: person)

Location	Total	Male	Female	Children (<16)
Ilyasov Area				
Ilyasov PC	2,062	1,044	1,018	741
Berlek PF	233	122	111	90
Sub-total	2,295	1,166	1,129	831
Shagan Area				
Shagan PC	3,730	2,043	1,687	1,307
Ilyas PF	15	8	7	5
Meras PF	5	3	2	2
Murat PF	7	3	4	1
Beibit PF	8	5	3	3
Abuov Z. PF	18	8	10	6
Sub-total	3,783	2,070	1,713	1,324
Total	6,078	3,236	2,842	2,155

Note: PC; Production Cooperative
PF; Peasant Farm
Source: Ilyasov and Shagan Production Cooperatives & Farm Surveys

Labor activity in the Terenozek Raion is primarily in the agricultural sector and currently experiences low levels of official unemployment. The Kzyl-Orda Statistics Department reports that there are currently 17,400 persons employed in the raion and 906 registered unemployed persons; the 1997 unemployment index is 5%. Male unemployment is 7.2% and female unemployment is 2.8%.

The Terenozek Raion Office of Labor Protection identifies 155 unemployed persons within the Project Area and an unemployment index of 4.0%. Actual unemployment is likely higher because not all unemployed persons register for benefits. Unemployment benefits paid out to the unemployed in the Terenozek Raion last year were T.2 million and the Terenozek Labor Protection Office reports that claims for unemployment compensation are lower this year than last, although they expect new claims to increase after the harvest season is over.

3.1.3 Natural Conditions

(1) Topography

The Project Area with a gross area of 40,230 hectares (13,690 hectares net) extends over the upper part of the Kzyl-Orda Left Bank Area. The Project Area is bounded by the Syr Darya river in the north, by the Left Main Canal in the south for part of the Ilyasov Area and some roads and canals for part of the Shagan Area, again by the Syr Darya river in the east, and by several farm roads in the west. The Project Area is occupied by a very flat alluvial plain, of which elevation ranges from 124.0 m at the east end of the area to 116.0 m in the west end forming an average gradient of 0.02%, and has many small hills and depressions.

(2) Climate

The Project Area is located in the arid climate zone with hot and dry summers, and cold and snowy winters. The annual precipitation is scarce; only 155 mm in a year, of which 80% occurs during the rainy season (November-May). The precipitation during the cultivation period (April-September) is only 40 mm, or 25% of the annual precipitation. The one-day maximum precipitation in a normal year is 15.5 mm, and in a wet year (1/5 return period) it is 21.7 mm. Annual and monthly probable precipitation are shown in Table 3.1.1(1) and 3.1.1(2) respectively. Mean monthly air temperature varies from -8.2 °C in January to 27.6 °C in July at the Kzyl-Orda Meteorological Station. In the summer season (April-September), average temperature is generally above 20 °C and it is below 0 °C during the coldest period (December-February). The relative humidity is 56% on an average, varying from 35% (June-August) to more than 80% (December -January) in terms of monthly average. The north-east wind with the average velocity of 3-4 m/sec prevails in the area. The strong winds take place in spring and at the beginning of summer. Sunny months are generally from May to September with a duration from 10 to 12 hours/day, whereas the sunshine duration in winter season decreases to around 5 to 6 hours/day. The meteorological data at the Kzyl-Orda station are summarized in Table 2.1.2.

(3) Hydrology

(a) Syr Darya River

The Syr Darya river is water source for the Project Area. The Kzyl-Orda Headworks diverts the river water into the Left Main Canal for irrigation of the Project Area. The river flow at the Kzyl-Orda headworks is affected by operation of the Chardara reservoir, which is located about 920 km upstream of the headworks. The reservoir has a gross storage capacity of 5,220 MCM, a dead storage capacity of 980 MCM and an effective storage capacity of 4,240 MCM. The annual river flow released from the Chardara reservoir during a 26-year period (1970-1995) was 12,272 MCM (388 m^3/sec) on an average, varying from 5,266 MCM (166 m^3/sec) in 1975 to 21,453 MCM (678 m^3/sec) in 1993. The annual average river water available at the Kzyl-Orda Headworks into the Left Main Canal was 1,858 MCM (1976-1996). Table 3.1.2 shows the average monthly intake discharge into the Left and Right Main Canals from the Kzyl-Orda Headworks.

(b) Kuvan Darya River

The Kuvan Darya river is receiving drainage discharge from the Study Area. The two main drainage canals of the Project, the North and South Main Collectors, supply 297 MCM annually to the Kuvan Darya river during the cultivation period (May-September). The annual discharge into the Kuvan Darya river during the period from 1991 to 1996 is shown in Table 3.1.3. The Kuvan Darya river is receiving 61.4 MCM annually from the Zhana Darya river. The average annual discharge in the Kuvan Darya after joining with the said two collectors was 320 MCM during the period from 1991 to 1996. The monthly discharges in the Kuvan Darya river downstream of the junction point with North and South Main Collectors is shown in Table 3.1.4. The Kuvan Darya water is mainly used for hay making and lake system.

(4) Soils

(a) Soil Classification

Based on the result of the soil survey, the soil classification map on a scale of 1: 25,000 was prepared for the Project Area of 40,230 hectares (gross) as shown in Figure 3.1.1. Out of seven soil classes identified in the Kzyl-Orda Left Bank Area in the master plan, four soil classes were identified in the Project Area, namely, Alluvial-meadow Soils, Old Alluvial-meadow Soils, Meadow-boggy Soils and Solonchaks.

Alluvial-meadow Soils were formed on the Syr Darya river banks and are covered with shrubs, grass and reeds. Old Alluvial-meadow Soils are located at flat depressions and covered with weeds and tamarisk trees. Meadow-boggy Soils are the majority in the Project Area and are commonly used for irrigated rice cultivation. Solonchaks are spotted on the elevated areas and covered with scattered saltworts.

Based on the above-mentioned soil classification map, the area extent each soil class is estimated as follows:

	Ilyasov Area		Shagan Area		Total	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
Alluvial-meadow Soils	160	1	0	0	160	1
Old Alluvial-meadow Soils	3,900	24	6,690	28	10,590	26
Meadow-boggy Soils	8,140	52	11,420	46	19,560	49
Solonchaks	2,450	15	4,430	18	6,880	17
Others*	1,280	8	1,760	8	3,040	8
Total	15,930	100	24,300	100	40,230	100

Note: *; including irrigation canals, collectors, roads and built-up areas.

(b) Soil Salinity Hazard

Based on the result of laboratory analysis of soil and in accordance with the Salinity Classification of Kazakstan, the salinity hazard of soil in the Project Area is evaluated as follows:

Salinity Hazard	Ilyasov Area		Shagan Area		Project Area	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
Slight	5,010	31	6,850	28	11,860	30
Medium	4,040	25	4,100	17	8,140	20
Strong	3,150	21	7,160	29	10,310	26
Very Strong	2,450	15	4,430	18	6,880	17
Others*	1,280	8	1,760	8	3,040	8
Total	15,930	100	24,300	100	40,230	100

Note: *; including irrigation canals, collectors, roads and built-up areas.

Alluvial-meadow Soils show slight salinity hazard. Meadow-boggy Soils are affected by slight to strong salinization depending on the cultivated crops or present land use. The salinity hazard is slight in most of Meadow-boggy Soils on paddy field due to the leaching effect of irrigation, while most of the soils in lucerne fields or grass land show medium to strong salinity hazard because of little or no irrigation in the fields. Old Alluvial-meadow Soils and Solonchaks show medium to strong or very strong salinity hazard.

(c) Irrigation Suitability

Based on the result of laboratory analysis on soils mentioned above, the irrigation suitability classification is assessed taking into account soil salinity, soil texture and soil fertility (Figure 3.1.2). Solonchaks are not suitable for agriculture due to high content of salt in the soils. Most of Meadow-boggy Soils are suitable for irrigated paddy crop and marginally suitable for upland crops due to the less permeable soil texture, while most of Alluvial-meadow Soils are suitable for irrigated upland crops and marginally suitable for paddy crop due to the high permeability caused by coarse texture. Old Alluvial-meadow Soils are marginally suitable for irrigated agriculture both for paddy and upland crops, because they require some improvement of the soil fertility or the drainage condition to solve salinity problem. Thus, the area of each irrigation suitability classification for paddy and upland crops is estimated as follows:

(Unit : ha)

Irrigation Suitability	Ilyasov Area		Shagan Area		Project Area	
	For Paddy	For Upland	For Paddy	For Upland	For Paddy	For Upland
Highly or moderately suitable	8,140	160	11,420	0	19,560	160
Marginally suitable	4,060	12,040	6,690	18,110	10,750	30,150
Not suitable	2,450	2,450	4,430	4,430	6,880	6,880
Others*	1,280	1,280	1,760	1,760	3,040	3,040
Total	15,930	15,930	24,300	24,300	40,230	40,230

Note: *; including irrigation canals, collectors, roads and built-up areas.

3.1.4 Rural Infrastructure

(1) Transportation and Communication

The transportation network in the Terenozek Raion is developed for both railways and roadways, but roadways are in disrepair. Access to markets is favorable. The raion is intersected by the main national rail line connecting Moscow with Almaty. The rail link connects Terenozek to the northwest via the Aktobe Oblast and on to the Russian Federation. To the southeast, rails connect Terenozek to Kzyl-Orda, Taraz (Zhambyl), Shimkent, Almaty. Rail conditions are good and fuel is available.

There are 1,266 km of major roads in the Kzyl-Orda Oblast including 29 km concrete, 141 km gravel, and 1,096 km asphalt. Travel times are lengthening due to lack of maintenance; cars travel at 50-70 km/hr and trucks at 40-60 km/hr.

The Project Area, located 13.3 km south of Terenozek town on the Terenozek - Shagan Trunk road (asphalt), includes a total of 548 km of internal farm roadways. On-farm roads are in severe disrepair, particularly farm spur roads. The following table shows the lengths of farm roads in the Project Area:

(Unit: km)

Farm Area	Village Road	Main Farm Road	Farm Spur Road
Ilyasov Area			
Asphalt	4.5	19.0	0
Gravel/Dirt	0	22.5	225.7
Sub-total	4.5	41.5	225.7
Shagan Area			
Asphalt	2.4	12.3	0
Gravel/Dirt	0	26.2	246.5
Sub-total	2.4	38.5	246.5
Total	6.9	80.0	472.2

Source: Farm Surveys

Communications infrastructure includes telephones, televisions, radios, and newspapers. Within the Terenozek Raion, the Kzyl-Orda Department of Telecommunications estimates that there are 2,100 telephones, 3,481 radio receivers, and 4,976 television receivers. The raion publishes its own newspaper, the *Terenozek Spirit* and Kzyl-Orda publishes a paper which is also circulated in the Terenozek Raion.

Very high percentages of households in the Project Area are equipped with televisions and radios. Telephone infrastructure is under-developed. Telecommunication infrastructure is adequate for agriculture extension and training. The following table shows the percent of households with telecommunications in the Project Area:

Farm	Household	Telephone	Radio	Television
Ilyasov PC	390	41%	100%	100%
Berlek PF	56	13%	100%	100%
Shagan PC	688	44%	88%	94%
Peasant Farms	7	100%	100%	100%

Source: Farm Surveys

(2) Domestic Water Supply

The supply and quality of domestic water are serious problem in the Project Area. The Project Area is served by four deep wells of 300 to 460 meter depths; three wells in the Shagan Area and one in the Ilyasov Area (Table 3.1.5). Households access water by outdoor standing pipes and are not equipped with indoor plumbing. Ninety percent of households have nearby access to an outdoor standing pipe outlet. The remaining 10% have water delivered by truck or send women and children to carry water.

Deep wells and submerged pumps were installed between 1960 and 1980 and only three are functioning. All functioning wells are in serious disrepair. Although water quality at 350 - 400 meter depths is fair, the casing pipes in wells are damaged and allow groundwater leakage from shallow depths resulting in contamination at the source. The wells are purified twice a year. There are 13,600 meters of pipe lines for distribution throughout the Project Area serving 103 standing pipe outlets. Only 45 of the standing pipe outlets are functioning; 54% are broken beyond use. Distribution pipelines are seriously damaged and corroded allowing additional contamination through the conveyance system and requiring additional hand labor for carrying water. Pipes and standing outlets are often patched with tape and other unhygienic materials. Reservoirs are also not intact.

Tests of water quality by the Chief Doctor of the Terenozek Raion on water samples from the Shagan and Ilyasov wells indicate increasing levels of bacteria during the period 1986 - 1996. In 1996, 10% of samples in the Ilyasov Area did not conform to national norms for bacteriological content as shown in Table 3.1.6. In the same test period in the Shagan Area, 7% of samples did not conform to the bacteriological standard. In 1996 tests, water quality in both areas was also out of compliance with national standards for excessive chlorine, iron, ammonia, and "dry residues" or suspended material (Table 3.1.7).

(3) Education

Education is mandatory in Kazakstan through the eleventh grade. Completion and enrollment rates are high. According to the National Statistical Agency, adult literacy is 97.5%.

There are two schools in the Project Area operated by the Department of Education; one in the Shagan Area and another in the Ilyasov Area. Both are comprehensive schools offering education from the first to eleventh grade. There are no institutions of higher education in the

Terenozek Raion. In Kzyl-Orda town, there are two higher education institutions; a polytechnic institute and a university.

(4) Medical Facilities

There are two day hospitals in the Project Area; one in the Shagan Area and one in the Ilyasov Area. Because of funding limitations, patients needing 24 hour care are transferred to Kzyl-Orda where the nearest comprehensive hospital is located.

The hospital in the Shagan Area has 35 beds, 7 physicians, 24 sanitary workers and 13 other staff. The Ilyasov Area Hospital has 5 beds, 3 physicians, 1 dentist, 3 sanitary workers, and 7 other staff. The ratio of physicians to population is 1 : 608. Access to drugs and medical supplies is limited by funding and the physical infrastructure is poorly maintained. Minor out-patient surgery is performed in both hospitals; major surgery is performed in Kzyl-Orda. Health care is provided at no cost to the patient with funding from the raion and oblast Departments of Health.

Sanitary conditions in the Project Area are poor. There is no indoor plumbing and toilets are outdoor latrines. Drainage is poor and there is widespread standing water throughout the area with infestations of mosquitoes and other disease-bearing insects. Refuse is burned in the open and streets and pathways are not regularly cleaned of debris and trash. Winds carry airborne dust and salt. As noted in the section on domestic water, 10% of water samples do not meet national bacteriological standards.

3.1.5 Agriculture

(1) Land Holding and Land Tenure

The Project Area encompasses a total area of 40,230 hectares of which 13,690 hectares are arable and 13,450 hectares are pasture. A portion of the total area (14%) is held in reserve for inheritance by the children of current shareholders (5,680 hectares). There is 11,830 hectares of village land. The remainder consists of wetland, building area and roads as shown below.

Farm	Total	Arable	Pasture	Others
Ilyasov Area				
Ilyasov PC	8,930	4,620	2,980	1,330
Berlek PF	1,140	580	380	180
Reserve	2,410	1,280	740	390
Village Land	3,450	0	1,160	2,290
Sub-total	15,930	6,480	5,260	4,190
Shagan Area				
Shagan PC	12,471	5,457	4,157	2,857
Ilyas PF	50	49	1	0
Meras PF	39	5	34	0
Murat PF	50	45	5	0
Beibit PF	20	2	15	3
Abuov Z. PF	20	2	18	0
Reserve	3,270	1,650	1,270	350
Village Land	8,380	0	2,690	5,690
Sub-total	24,300	7,210	8,190	8,900
Total	40,230	13,690	13,450	13,090

Source: Terenozek Raion, Ilyasov and Shagan Production Cooperatives, Berlek Peasant Farm, interviews with peasant farmers, and farm surveys.

(2) Land Use

The present land use in the Project Area was clarified based on the 1:12,000-scaled land use map prepared by the JICA Study Team based on aerial photo (1997) and information collected from the Raion Committee on Land Resource, Management Committee and the related farms (1997). The land use pattern has also been further confirmed through the field survey and analysis of agricultural statistics.

The present land use in the Project Area in 1996 is shown in Table 3.1.8 and Figure 3.1.3, and summarized below.

Landuse Category	Ilyasov Area*1		Shagan Area*1		Total	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
(1) Agricultural land						
O. R. A.*2	6,480	41	7,210	30	13,690	34
Pasture	5,260	33	8,190	34	13,450	33
Sub-total	11,740	74	15,400	64	27,140	67
(2) Non agricultural land						
Marsh	970	6	1,260	5	2,230	6
Shrubs	540	3	1,760	10	2,300	6
Canals and collectors	960	6	1,400	5	2,360	6
Roads and streets	190	1	240	1	430	1
Built up	120	1	420	2	540	1
Others	1,410	9	3,820	15	5,230	13
Sub-total	4,190	26	8,900	36	13,090	33
Total	15,930	100	24,300	100	40,230	100

Note: *1; Former State Farms of "Ilyasov" and "Shagan".
*2; Original rice rotation area.
Source: Estimated on the basis of the land use map prepared by JICA Study Team.

The Project Area occupies an area of 40,230 hectares, of which 27,140 hectares or 67% of the total area is used for agricultural purpose including livestock grazing and hay making in 1996. While, the non agricultural land area is 13,090 hectares which includes marsh and

swamp, bush and forest, villages, roads, rivers, irrigation and drainage canals and desert. According to this table, the ratios of agricultural land to the total area and that of rice rotation area to the total area in the Ilyasov Area are higher than those in the Shagan Area.

The original rice rotation area (original irrigation area) in the Project Area is 13,690 hectares; 6,480 hectares in the Ilyasov Area and 7,210 hectares in the Shagan Area as shown below.

(Unit: ha)

Land category	Ilyasov Area	Shagan Area	Total
Original rice rotation area	6,480	7,210	13,690
Presently irrigated area	3,530	4,960	8,490
Presently abandoned area	2,950	2,250	5,200

Source: Estimated on the basis of the landuse map prepared by JICA Study Team.

According to the above table, 5,200 hectares or 38% of the rice rotation area is abandoned in 1996 because of such problems as water shortage due to deterioration of the irrigation canal system, soil salinization and water logging caused by poor drainage system, poor management of irrigation, and other reasons such as late arrival of irrigation water to the field, worn-out agricultural machinery, and shortage of agricultural inputs. The following table shows the areas abandoned by respective causes.

(Unit; ha)

Causes	Ilyasov Area	Shagan Area	Total
Shortage of water	300	180	480
Salinity	400	300	700
Water logging	280	400	680
Others*	1,970	1,370	3,340
Total	2,950	2,250	5,200

Note: *: including worn out agricultural machinery and shortage of farm inputs.
Source: Ilyasov and Shagan Production Cooperatives and Terenozek Raion Office.

Although the abandoned area (not planted area) in 1996 was 5,200 hectares, it is reported that this area has increased to 6,220 hectares in 1997.

(3) Crops and Cropping Pattern

The climate is very severe for crops; long winter, short spring and autumn and high temperature in summer. The cropping season of summer crops is limited to the period from late April to September (less than 130 days). In addition, soil is alkaline, and accumulation of salts is observed on the soil surface. Crops cultivated in the area should therefore have a short growth duration and be tolerant to salinity and high temperature in summer, which limits the selection of suitable crops. Under such natural conditions, and considering the marketability and benefit, the major crops presently cultivated are paddy, wheat and lucerne. Other crops are cultivated in a very limited area as shown in Figure 3.1.4.

Of the original rice rotation area of 13,690 hectares, 8,490 hectares was used for crop production in 1996. The planted areas of each crop in and around the Project Area in 1993 to 1996 are shown in Table 3.1.9. The planted areas in 1996 are summarized below:

(Unit: ha)

Crops	Ilyasov Area	Shagan Area	Total	Terenozek Raion	Kzyl-Orda Oblast
Paddy	1,500	2,000	3,500	10,210	66,030
Wheat	440	1,700	2,140	3,820	35,910
Lucerne	1,400	1,000	2,400	6,930	62,730
Vegetables	190	170	360	1,190	13,530
Other crops	0	90	90	940	5,400
Total	3,530	4,960	8,490	23,090	183,600
Cropping Intensity	0.56	0.70	0.62		

Note: Vegetables include potato and melons.
Source: Ilyasov and Shagan Production Cooperatives and National Statistical Agency.

In the Project Area, paddy, wheat and lucerne are major crops, followed by vegetables (including potato and melons). Other crops are cultivated in a very limited or negligibly small area. The planted area of paddy occupies 3,500 hectares or more than 40% of the total planted area. Wheat and lucerne areas occupy 2,140 hectares and 2,400 hectares or approximately 25% and 28% of total planted area, respectively. Vegetables are mainly cultivated in kitchen gardens and their area is 360 hectares in total. In the surrounding area of the Project Area, paddy is also a leading crop followed by lucerne and wheat. The cropping intensities in the Ilyasov and Shagan Areas are 0.56 and 0.70 respectively, and 30 - 40% of the original rice rotation area was not utilized for crop production in 1996.

Recently, the planted areas of major crops show a decreasing tendency. The total planted area in 1993 was approximately 13,140 hectares and had decreased to approximately 8,490 hectares in 1996. In 1997, the planted area has further decreased to 7,280 hectares. Cropping intensity of 0.96 in 1993 had decreased to 0.62 in 1996. The following table shows the planted area of major crops from 1993 to 1997 (Table 3.1.9):

(Unit: ha)

Year	Paddy	Wheat	Vegetables	Lucerne	Others	Total	C.I.
1993	5,470	2,700	810	3,100	1,060	13,140	0.96
1994	5,170	2,500	680	3,200	1,010	12,560	0.92
1995	4,400	2,400	590	3,400	660	11,450	0.84
1996	3,500	2,140	360	2,400	90	8,490	0.62
1997	3,780	1,100	280	2,100	20	7,280	0.53

Note: Vegetables include potato and melons.
C.I; Cropping intensity.
Source: Ilyasov and Shagan Production Cooperatives.

According to the above table, the paddy area has sharply decreased, while slight decreases were observed in the areas of wheat and lucerne during the period from 1993 to 1996.

A decrease of the planted area is attributed to water shortage and delay of irrigation water supply in the adequate planting time due to deterioration of the irrigation canal system,

soil salinization and water logging caused by poor drainage system, and other reasons as mentioned in the preceding section.

(4) Yield and Production

The yields of major crops in the Project Area from 1993 to 1996 are shown in Table 3.1.10, and those in 1996 are summarized below:

(Unit: ton/ha)

Crops	Ilyasov Area	Shagan Area	Average	Terenozek Raion	Kzyl-Orda Oblast
Paddy	3.83	5.02	4.51	3.39	3.08
Wheat	1.64	0.36	0.62	0.47	0.25
Lucerne	1.54	1.81	1.65	1.99	1.40
Vegetables	8.00	9.00	8.49	10.87	9.15

Note: Vegetables include potato and melons.
Source: Ilyasov and Shagan Production Cooperatives and National Statistical Agency.

The yields of wheat, lucerne and vegetables are very low compared to the world average (2.4 t/ha for wheat, 6.0 t/ha for lucerne, 20 - 30 t/ha for vegetables), but the paddy yield in the Project Area is more than the world average (3.7 t/ha), and much higher than the raion and oblast averages. While the yield of lucerne is lower than the raion and oblast averages.

According to the following table, the yields of major crops except paddy and vegetables show a decreasing tendency in the period from 1993 to 1996. The yield of paddy also shows a decreasing tendency until 1995, but suddenly increased in 1996, because a large amount of fertilizers was applied to paddy in 1996 compared to preceding years.

(Unit: ton/ha))

Year	Paddy	Wheat	Vegetables	Lucerne
1993	4.20	1.30	6.33	2.43
1994	3.32	0.88	8.26	2.95
1995	2.53	0.97	6.51	1.37
1996	4.51	0.62	8.47	1.65

Note: Vegetables include potato and melons.
Source: Ilyasov and Shagan Production Cooperatives.

The amounts of production of major crops in the Project Area from 1993 to 1996 are shown in Table 3.1.11 and those in 1996 are summarized below:

(Unit; ton)

Crops	Ilyasov Area	Shagan Area	Total	Terenozek Raion	Kzyl-Orda Oblast
Paddy	5,740	10,030	15,770	34,610	203,440
Wheat	720	610	1,330	1,780	11,450
Lucerne	2,160	1,810	3,970	13,770	88,060
Vegetables	1,520	1,530	3,050	12,930	123,850

Note: Vegetables include potato and melons.
Source: Ilyasov and Shagan Production Cooperatives and National Statistical Agency

The following table shows the production of major crops in the Project Area from 1993 to 1996.

(Unit: ton)

Year	Paddy	Wheat	Vegetables	Lucerne
1993	22,970	3,510	5,130	7,530
1994	17,140	2,200	5,620	9,430
1995	11,130	2,330	3,840	4,650
1996	15,770	1,330	3,050	3,970

Note: Vegetables include potato and melons.
Source: Ilyasov and Shagan Production Cooperatives.

According to the above table, the amount of production of major crops has drastically decreased during the period from 1993 to 1996 mainly due to decrease of their planted areas. The amounts of production of major crops in 1996 decreased compared with 1995, except paddy production which had increased by 42% owing to the large increase of its yield.

(5) Farming practices and Farm Inputs

In the Project Area, large-scale mechanized farming is predominant, because the field plot is very large, and the labor force is small compared to the cropped area. Due to shortage of budget, however, the farms can not repair or renew farm machinery, most of which have been used for more than 9 years, and as a result the cropped area is decreasing year by year, even in the irrigated condition of the land. According to farm interviews, more than half of the combine harvesters are not in good condition and need to be replaced. The number of combine harvesters is a decisive factor for determination of paddy cultivation area in the Project Area. The following table shows a summary of the number and present condition of key agricultural machinery at the end of 1996:

Items	Total	Condition			Need of Urgent Replacement
		Good	Fair	Poor	
Ilyasov Production Cooperative					
Wheel tractor	39	34		5	5
Crawler tractor	24	18		6	4
Wheel combine harvester*	25	12	2	11	10
Crawler combine harvester	na	na	na	na	na
Shagan Production Cooperative					
Wheel tractor	51	31	14	6	18
Crawler tractor	46	24	18	4	4
Wheel combine harvester	40	5	31	4	4
Crawler combine harvester	10	5	1	4	4

Note: *; includes crawler combine harvester.
Source: Ilyasov and Shagan Production Cooperatives.

Operation and maintenance of the agricultural machinery is carried out by the maintenance service department of the farm under the supervision of an engineer. There is a work shop for repair and maintenance of machinery, with some qualified mechanics.

The cropping season of summer crops starts in late April and lasts to the end of September. Since the cropping season is limited, a staggering period of all the work operations should be less than 30 days. Seeding of paddy starts in early May and harvesting starts in early September. Spring wheat is sown in late April and harvested in late July to August. Winter wheat cultivation starts in late September and ends in July. In the first year, lucerne is sown with wheat in the manner of mixed cropping system. Lucerne is usually sown 10 to 14 days after the seeding of wheat. This crop is kept in the field for three years, and harvested three to four times a year.

In the Project Area, a paddy-based 8-year crop rotation system had been employed until 1995, and a 6-year rotation system has been prevailing since 1996. In this cropping system, upland crops are cultivated just after paddy cultivation for one year for wheat and three years for lucerne, then again paddy cultivation.

Paddy is planted applying a broadcast dry seeding method, while wheat and lucerne are planted mainly in the manner of drill seeding at an interval of 10 to 15 cm. Vegetables are cultivated mainly in kitchen gardens. Except land preparation, all the cultural practices of vegetables are carried out by hand labor.

The quantities of farm inputs and labor requirements for major crops are shown in Table 2.1.10. Since completely mechanized farming is practiced in the area, the labor requirements for crop cultivation are very low; 37 man-hours/ha for paddy, 21 man-hours/ha for wheat, 26 man-hours/ha for maize, 29 man-hours/ha for lucerne, respectively. In recent years, due to absence of guaranteed price support and inputs from the state, declining trade with Russia and high interest rate on credit for procurement of farm inputs, farms and farmers are facing an economic crisis, and as a result they can not afford to buy the proper quantities of chemical fertilizers, agro-chemicals and other inputs.

In the production cooperatives and big peasant farms, cropping schedule and cultural practices are generally prepared by the specialist (agronomist) posted in the respective farms, and farm management is carried out by farm workers under supervision of the agronomist and brigade leaders.

(6) Animal Husbandry

Animal husbandry is also one of the main agricultural activities in the Project Area. The animal population by farm and farm category in the area is shown in the following table:

Farm	Cattle	Sheep	Horse	Pig	Camel	Poultry
Ilyasov Area						
Ilyasov P.C.	586	0	151	0	0	0
Individuals living in Ilyasov P.C.	930	2,012	332	0	0	5,500
Berlek P.F.	0	0	0	0	0	0
Individuals living in Berlek P.F.	111	64	14	0	0	0
Sub-total	1,627	2,076	497	0	0	5,500
Shagan Area						
Shagan P. C.	1,314	10	183	0	0	0
Individuals living in Shagan P.C.	1,835	4,165	335	24	0	3,500
Ilyas P.F. (Individual)	15	150	1	0	0	0
Meras P.F. (Individual)	5	0	3	0	0	0
Abnov Zhaksyly P.F. (Individual)	2	10	0	0	0	0
Murat P.F. (Individual)	1	5	1	0	0	0
Beibit P.F. (Individual)	1	10	0	0	0	0
Sub total	3,173	4,350	523	24	0	3,500
Total	4,800	6,426	1,020	24	0	9,000

Source: Ilyasov and Shagan Production Cooperatives and Terenozek Raion Office.

In the Project Area, cattle, sheep and goats are important animals. Forty percent of cattle are fed mainly in the production cooperatives, while almost all sheep, goats and poultry are fed by individuals. From the above table, it can be said that individuals play an important role in animal husbandry.

In the surrounding area; Kzyl-Orda Oblast and Terenozek Raion, the animal population, except poultry, has shown a decreasing tendency in the last four years. This decreasing tendency seems to be temporary due to the drastic change in the type of farm management in the process of farm privatization. The animal population of the farms (former state and collective farms and production cooperatives) has also decreased during this period, but on the contrary those of individuals and peasant farmers have largely increased as shown below:

Total animal population in Kzyl-Orda Oblast and Terenozek Raion in the past 4 years.

(Unit: '000heads)

Year	Cattle		Sheep and goats		Horses		Poultry	
	Oblast	Raion	Oblast	Raion	Oblast	Raion	Oblast	Raion
1994	182.4	20.6	979.1	62.1	63.4	5.7	183.2	13.7
1995	166.7	19.6	820.8	60.4	59.4	4.9	219.6	21.1
1996	163.7	19.5	660.9	60.2	56.1	5.0	189.4	29.0
1997	166.4	19.7	748.0	76.9	56.7	5.3	215.1	41.2

Animal population in Production Cooperatives in Kzyl -Orda Oblast and Terenozek Raion in the past 4 years

(Unit: '000heads)

Year	Cattle		Sheep and goats		Horses		Poultry	
	Oblast	Raion	Oblast	Raion	Oblast	Raion	Oblast	Raion
1994	61.2	9.4	670.7	36.0	40.9	4.0	40.1	0
1995	44.0	8.4	517.9	33.8	34.8	3.3	49.6	0
1996	24.2	6.7	303.0	28.1	21.7	3.1	0	0
1997	11.4	5.0	208.6	35.0	15.8	2.7	9.7	1.0

Animal population raised by individuals and peasant farms in Kzyl -Orda Oblast and Terenozek Raion in the past 4 years.

(Unit: '000heads)

Year	Cattle		Sheep and goats		Horses		Poultry	
	Oblast	Raion	Oblast	Raion	Oblast	Raion	Oblast	Raion
1994	121.2	11.2	308.4	26.1	22.5	1.7	143.1	13.7
1995	122.7	11.2	302.9	26.6	24.6	1.6	170.0	21.1
1996	139.5	12.8	357.9	32.1	34.4	1.9	189.4	29.0
1997	155.0	14.7	539.5	41.9	40.9	2.6	205.4	40.2

Source: National Statistical Agency.

In the Project Area, a number of ruminant animals are being bred and they require a large amount of grasses. Since grasses are not available in the grazing land particularly in winter, enough crude fodder needs to be stored in summer for winter feeding. At present, about 25% of the farm area is used for fodder production, but this area is decreasing year by year.

3.1.6 Irrigation and Drainage

(1) Irrigation Conditions

(a) Irrigation Area

The Project Area extends over the land on both sides of the Left Main Canal between the regulators PK 272 and PK 744 within the Kzyl-Orda Left Bank Massive Irrigation System. The total irrigation area is 13,690 hectares, consisting of 6,480 hectares for the Ilyasov Area and 7,210 hectares for the Shagan Area.

(b) Irrigation System

Irrigation water is supplied to the farms by the inter-farm/on-farm canal systems through the head gates built on both banks of the Left Main Canal. Five on-farm canals in the right bank side area and three inter-farm/on-farm canals in the left bank side area are provided in the Project Area (Figure 3.1.5). Among them, LMK-9 for the Shagan Area serves also a part of land area of the Shirkeli and Akzharma farms, 692 hectares in total, which are located outside the Project Area. The service area of each inter/on-farm canal is estimated as follows:

(unit :ha)

Inter/On-farm Canal	Ilyasov	Shagan	Shirkeli	Akzaharma	Total
LMK-6 &8	6,480	-	-	-	6,480
LMK-12, 14 & 16	-	4,154	-	-	4,154
LMK-9	-	1,961	230	462	2,653
LMK-11v-3 & 11G	-	1,095	-	-	1,095
Total	6,480	7,210	230	462	14,382

The present irrigation system has been established by reforming the original plan, based on experience in irrigation, soils, salinity problem, irrigation water constraint, manageable land size, etc. For instance, the original plans for some inter-farm/on-farm canals have been modified by changing the locations of their head gates, canal alignments and service areas, particularly in LMK-6, LMK-14 and LMK-11v-3, taking into account the insufficient water heads available at respective head gates, water allocation to other farms, etc. Besides the

inter/on-farm canals, the alignments of field canals and locations of turnouts have also been modified in some canal systems.

(c) Irrigation Canal

The Project Area has been equipped with various field canal networks in each inter-farm/on-farm canal system. In general, the inter-farm/on-farm canals branch off from the Left Main Canal, while the field canals branch off from the inter/on-farm canals to convey the irrigation water from these canals to the field ditches. Nonetheless, it turned out that such defined field canals, as a general term, should be further classified into the main field canals, the secondary field canals and the supplementary field canals depending on their command areas and alignment of field irrigation canal network. The lengths and densities of major canals are estimated, based on the collected data and information, and the 1/5,000 topographic maps, as follows:

Area	I/O FMC		MFIC		SFIC		Total	
	Length (m)	Density (m/ha)	Length (m)	Density (m/ha)	Length (m)	Density (m/ha)	Length (m)	Density (m/ha)
Ilyasov	44,000	6.79	26,490	4.09	10,500	1.62	80,990	12.50
Shagan	64,030	8.88	54,820	7.60	10,430	1.45	129,280	17.93
Total	108,030	7.89	81,310	5.94	20,930	1.53	210,270	15.36

Note: I/O FMC ; Inter-farm/On-farm canal
MFIC ; Main field canal
SFIC ; Secondary field canal

The irrigation canal system in the Ilyasov Area consists of two on-farm canal systems with a service area of 671 hectares and 5,809 hectares respectively, and it is comparatively consolidated. On the other hand, the Shagan Area has six inter-farm/on-farm irrigation canal systems with service areas of 178 hectares to 2,583 hectares or about 1,200 hectares on an average. In the Shagan Area, the canal density is high as shown in the above table, because the service areas of the canal systems are scattered over the area.

At the on-farm level, the supplementary field canals and field ditches are provided for each irrigation rotation area to irrigate farm lands. An irrigation rotation area consists of several irrigation land units composed of farm plots arranged in a row. For about 75% of the farm land, a field ditch is arranged along the long side of an irrigation land unit and a field drain in the other side. In another case, one field ditch is aligned in between two irrigation land units to irrigate the farm lands along both sides of the ditch. The supplementary field canal is aligned along the short side of the irrigation land unit, and its tail is connected to the field ditch.

The Left Main Canal with a length of about 90 km is unlined, except some sections provided with side-slope protection works. The canal is irregularly shaped by side-slope failure, erosion and scouring. Most of the side-slope protection works are failed. Such eroded materials are transported to the inter/on-farm canals. In addition, the seepage from the canal, which is estimated at about 15% of canal discharge, is the major cause of raising the groundwater table in the Project Area.

All the other irrigation canals in the Project Area are also irregularly shaped, due to deposits of silt materials, erosion and/or side-slope failures of canals, passage of farm machinery and so on. The canals with small flow capacities, particularly in the downstream area, have been thickly vegetated, due to absence of maintenance works. Along the major canals, the maintenance roads with a width of about 6 m are provided, which are passable but very rough.

(d) Irrigation Structures

The Kzyl-Orda Headworks, which was constructed on the Syr Darya to divert water to the Left Main Canal, has been heavily deteriorated as stated in Sub-section 2.1.6. As a result, much leakage through the flood gates, intake gates and scouring sluice gates is observed. Particularly, the leakage through the intake gates may be one of the serious problems in terms of the Aral Sea environmental constraints. In addition, the inoperative scouring sluice gates bring a bulk of sediment loads into the Left Main Canal.

For water distribution, the Left Main Canal is equipped with 39 head gates for the inter/on-farm canals and six regulators including the hydro-knots for the Right and Left Branch Canals at its end. Those structures, most of which were constructed in the 1960s, are currently operated, but hardly control the water level and discharge in the canal. The concrete has been worn out and most gates are not operational.

The canals in the Project Area are equipped with check structures, turnouts for the main field canals, off-takes for the field ditches, aqueducts over the drainage channels, bridges and road-crossings. The water measurement structures are constructed immediately below the head gates to measure the water quantity for the farms. All structures are deteriorated and do not properly function. The number of structures on the inter-farm/on-farm canals in the Ilyasov and Shagan Areas are summarized in the following table:

Area	turnout	off take	check	culvert	bridge	Aqueduct	Escape
Ilyasov Area	36	317	29	12	0	0	0
Shagan Area	70	451	32	25	2	2	1

(e) Major Constraints on Irrigation

Major concerns about canals are deposit of silt materials which have been brought in mostly from the Left Main Canal, seepage from the canals, erosion and side slope failure of canals, insufficient water head of the canal, vegetation in the field canals and ditches. Particularly, the seepage losses in the canal are serious, showing about 0.168 m^3/sec/km of losses or about 30 % of water discharge at its head gate for a canal length of about 16.7 km, which causes the wet land along the canal, resulting in suspension of crop cultivation there. On the other hand, the incoming silt materials from the Syr Darya river may be mostly bed loads rather than suspended loads, due to absence of scouring sluice operation. The removal of such canal deposits as well as the restoration of canal structures are urgently required, but have not been executed due to lack of funds.

The pumping irrigation system used to be employed in various places, getting water from the Syr Darya river and the drainage canals within the Project Area. The land irrigated by such pumping system is reported to be 480 hectares, but mostly abandoned at present, and will decrease more in future due to shortage of funds for pump operation.

At the on-farm level, constraints on irrigation are configuration of the farm plot, big difference in the ground elevation of the farm plots, big size of farm plots, inadequate discharge capacities of inlet and outlet for each farm plot, etc. As to the land configuration of farm plots, it might be caused by not only the original land development but also the cultivation by farm machinery. The big difference of farm plots in the ground elevation may result from land development in the original construction.

(2) Drainage Conditions

(a) Drainage Area

The drainage area to be considered under the Project is situated within the drainage area of the North Main Collector and the South Main Collector in the Kuvan Darya drainage area, and covers a gross area of some 40,230 hectares, of which 13,690 hectares are the irrigation area. The drainage water in the right bank area of the Left Main Canal is drained to the North Main Collector through the inter-farm/on-farm collectors or directly. In the left bank side area of the Left Main Canal, the drainage water flows down through two inter-farm/on-farm collectors to the South Main Collector. The drainage areas for both North and South Main Collectors in each farm are shown below:

(Unit : ha)

Drainage Channel	Ilyasov Area		Shagan Area		Total	
	Drain. A.	(Farm A.)	Drain. A.	(Farm A.)	Drain. A.	(Farm A.)
North Main Collector	15,930	(6,480)	14,620	(4,154)	30,550	(10,634)
South Main Collector	-	-	9,680	(3,056)	9680	(3,056)
Total	15,930	(6,480)	24,300	(7,210)	40,230	(13,690)

Note : The parenthesized farm land areas (Farm A.) are already included in the drainage areas.

(b) Drainage System

The drainage network of the North Main Collector extends to the north of the Project Area bounded by the Left Main Canal. This collector starts at the culvert under the on-farm canal, LMK-6, and traverses the central part of the Ilyasov irrigation area. Then, this collector turns toward the north-west in the west of the Ilyasov Area, changes its direction to the west in the north of the Shagan Area and finally joins with the South Main Collector after running for about 80 km. However, this collector is actually disconnected by the Right Branch Canal as mentioned in Paragraph 2.1.6(2). A number of the inter-farm/on-farm collectors join with the North Main Collector, which are provided only for the rice rotation area.(Figure 3.1.5).

The South Main Collector, which has a drainage area of some 2,060 km^2, originates in the KZ MIS Farm area in the Left Bank Area and runs toward the south-west. At Kzyl Tu, the collector changes its direction, runs along the south boundary of the Left Bank Area toward the west, and joins to the North Main Collector at PK1496. The drainage canal network in the Shagan Area consists of the inter-farm/on-farm collector systems of Yuk-8 and Yuk-12. As in

the same case of the drainage network of the North Main Collector, most field collectors are provided for the rice rotation area, and a few collectors are for the land other than the rice location area. The drainage water is discharged directly to the inter-farm/on-farm collectors in most area.

At the on-farm level, sub-surface water is received by the field drain and drained to the field collector. The field drain is located along the long side of an irrigation land unit or in between the field ditches. In most cases, the field drains are aligned parallel to the field ditches. For surface drainage, each farm plot is equipped with an outlet. Such on-farm facilities, however, are scarcely functioning due to absence of proper maintenance work.

(c) Drainage Canals

The drainage channels are, as a general term, classified into main collectors, inter-farm/on-farm collectors, field collectors and field drains. Nonetheless, the field collectors are further classified into the main field collectors, the secondary field collectors and the supplementary field collectors depending on the sizes of their drainage areas and topographic conditions. The drainage canal length and the canal density per irrigation area are estimated for each classified canal based on the collected data and the 1/5,000 topographic maps, as follows:

Drainage System	Area	MDC	I/O-FC	MFDC	SFDC	Total	Density
		(m)	(m)	(m)	(m)	(m)	(m/ha)
North Collector	Ilyasov	20,300	24,680	29,740	1,240	75,960	11.72
	Shagan	19,500	23,600	9,820	-	52,920	12.74
Sub-total		39,800	48,280	39,560	1,240	128,880	12.12
South Collector	Shagan	-	32,600	8,020	-	40,620	13.29
Total		39,800	80,880	47,580	1,240	169,500	12.38

Note: MDC ; Main collector
I/O-FMC ; Inter-farm/On-farm collector
MFIC ; Main field collector
SFIC ; Secondary field collector

The drainage canal density in the North Main Collector system is slightly high in the Shagan Area, as compared to that of the Ilyasov Area, because the Shagan Area has the irrigation area more sparsely scattered over the drainage area than in the Ilyasov Area. The drainage canal density in the South Main Collector drainage system is also high in the Shagan Area, because comparatively narrow irrigation lands are located alongside the inter-farm/on-farm collectors and main field collectors.

Earth drainage canals are prevailing but a few canals are provided with side slope protections. Most of the collectors were designed to be excavated deeply for sub-surface drainage, but they have enough flow capacity for surface drainage. However, all collectors have become shallow due to the absence of maintenance work.

(d) Drainage Structures

The structures on the main collectors are bridges and pipe culverts, while the structures on the inter-farm/on-farm collectors are bridges, canal outlets, field drain outlets and road crossings. The number of these structures is summarized below:

Collectors	bridge	culvert	road crossing	canal outlet	field drain outlet
North Main Collector	10	0	0	0	0
South Main Collector	12	0	2	0	0
Inter/On-Farm Collectors					
Ilyasov Area	1	2	7	37	300
Shagan Area	8	0	19	38	302

(c) Major Constraints on drainage

All collectors including two main collectors, inter-farm/on-farm collectors and the field collectors have become shallow due to sediment deposits in the canals. No recurrent excavation work has been made for remedy of the canal shape since early 1970s, so that such drainage canal conditions cause water logging, high groundwater table, and salt injury to the crops, resulting in lower yields of crops and abandonment of cultivated lands.

3.1.7 Water Management and O&M of Project Facilities

(1) Water Management Institutions by Level

The context of water management in the Study complies with the institutional structures in the Republic of Kazakstan with emphasis on the project level water management as follows:

(i) State Level Water Resources Management

Water together with land are the most fundamental resources for agricultural production, but both are not outcomes of human labor. This is the major reason why they are substantially different from the originally merchandised commodities. This fact calls for state intervention in water as well as land sectors in most countries.

The Committee on Water Resources under the Ministry of Agriculture is the responsible organization for overall water administration in Kazakstan as illustrated in Figures 1.2.1 and 1.2.3.

(ii) Basin Level Water Resources Management

The eight River Basin Organizations (BVOs) under the Committee on Water Resources cover the entire territory of the Republic. The Kzyl-Orda Irrigation/Drainage Project Area is under jurisdiction of the Syr Darya River Basin Organization in Shimkent.

(iii) Oblast Level Water Resources Management

Under the Committee on Water Resources, there are nineteen Oblast Committees on Water Resources. The Kzyl-Orda Oblast Committee on Water Resources is the responsible body for the Project. The organization chart of the Oblast Committee on Water Resources is presented in Figures 2.1.14 and 3.1.6.

(iv) Raion Level Water Management

The four Raion Management of Water Economy Systems under the Kzyl-Orda Oblast Committee on Water Resources are involved in the Project as per shaded boxes in Figure 2.1.14.

Both state and oblast level committees receive their funds from the central government, but all of the raion level operations are now self-supporting which seriously reduces the O&M activities in the Project Area.

(v) Project Level Water Management

Project level water management refers to the operation and maintenance (O&M) of the existing project facilities which are comprised of the following structures:

- The Kzyl-Orda Headworks completed in 1957,
- The Left Main Irrigation Canal System with a total length of 303.7 km completed in 1969, and
- The Left Bank Drainage Canal System with a total length of 518.5 km completed in 1969.

The Left Bank Massive Irrigation System consists of the Left Main Canal, the Right and Left Branch Canals and the inter-farm canals. Among them, the sections of the Left Main Canal and the Right Branch Canal down to the station number PK 420 are directly managed by the Hydro-Department for Kzyl-Orda Headworks, while the remaining sections are managed by the Raion Management of Water Economy System(Figure 2.1.15).

(vi) Farm Level Water Management

The farm (identical to production cooperative) level water management denotes O&M of the on-farm canal in the distributors and down to the field canal up to terminal farm plot (Figure 2.1.11). The objectives of the farm level water management are:

- To maintain the function of the on-farm facilities up to the original level as possible,
- To operate the facilities so as to ensure the planned discharge at each inlet, and
- To maintain the soil moisture conditions to meet crop requirements.

The on-farm O&M operations are currently undertaken by the Farm Hydro-Engineer under the instruction of the Agronomist. The organization structures of the Production Cooperatives in the Project Area relevant to on-farm O&M are shown in Figures 3.1.7, 3.1.8 and 3.1.9.

(2) Current Water Management Practices

(a) Confrontment of Water Supplier and Water User

There are two lines of institutions on the project water management as illustrated in Figure 2.1.17. The Committee on Water Resources represents the "Water Supplier" side, while the farm represents the "Water User" side. Both parties are independent self-financing bodies confronting each other at the water delivery point customarily called hydro-post in aspects of water quantity and water price.

(b) Annual Cropping Plan

There are two production cooperatives and six peasant farms in the Project Area as mentioned in Paragraph 3.1.8(5). Each farm draws out the annual cropping plan by the end of March. The seasonal water requirement is calculated based on the above cropping plan in order to request the water allocation from the Raion Management of Water Economy System as shown in Figure 2.1.17.

(c) Negotiation for Water Allocation and Water Pricing

The negotiation for water allocation and water pricing between both parties starts early April and concludes by the end of April. Coordination of the Raion Akim (District Chief) or Oblast Akim (Governor of Province) may be requested from both parties as the case may be, because it is difficult for the parties to agree.

(d) Water Delivery and Monitoring

The water delivery operation commences around mid-April to irrigate spring wheat and ends during late August according to the agreed water delivery schedules (Figure 3.1.4). The delivered water is measured at each hydro-post for the water charge collection with 10-day interval by the staff of the Raion Management of Water Economy Systems together with staff of the hydro stations. Telecommunication system between the hydro-station and the Raion Management of Water Economy System or Hydro Department for the Kzyl-Orda Headworks is the major means for water operation as depicted in Figure 3.1.10.

(e) Collection of Water Charge

The delivered water amount and water charge to be collected in 1997 are as indicated in Table 3.1.12. Site survey revealed that the water charge equivalent to 5.63 tiyn/m^3 has been fixed since 1995 and the estimated O&M cost is US$17/ha. Selective statistics on water charge collection are tabulated in Table 3.1.13.

(3) Findings on Project Level Water Management

(a) Institutional Issues

The Committee on Water Resources has been reorganized several times in the course of the transitional economy after dissolution of the former Soviet Union in 1991. The Committee on Water Resources was recently incorporated with the Ministry of Agriculture as shown in

Figure 1.2.1. However, its actual operations have been performed in the same manners without any serious institutional problem.

Meanwhile, the restructuring processes in the farm management are currently underway to cope with the huge tide of privatization under the transitional economy. The diversified farm management bodies call for the setting up of the water user association, because they materialize the bottom-up decision making process among water users particularly for the peasant farms. Detailed social backgrounds on the necessity of the water user association are described in Paragraph 3.1.8(5).

(b) Physical Constraints

The physical constraints for the proper water management refer to the deteriorated irrigation and drainage facilities and the worn-out telecommunication and data management systems. Both physical constraints cause currently serious drawbacks to desirable farm management in the Project Area, but are expected to be overcome through the implementation of the Project.

3.1.8 Agricultural Support Services and Farmers' Organizations

(1) Agricultural Research

Agricultural research and extension in the Project Area is detailed in Paragraphs 2.1.8 (1) to 2.1.8 (2). As noted in those paragraphs, the minimal research and extension activities of the state have collapsed as the economy has moved into the free market and the link between the Ministry of Agriculture and farms has weakened because of the elimination of production quotas and state supply of inputs. Although the scientific sector of agriculture was well developed under the Soviet Period, the research generated was unevenly distributed and consumed. Primarily agricultural research was directed toward meeting state data needs and extension, such as it was, was directed only toward senior staff.

The responsibility for agricultural research is with the Kazakstan Academy of Sciences which operates the National Center of Agricultural Research. This academy has been reduced in size and budget and a number of research farms have been privatized. Before 1994, there were two research institutes in the Kzyl-Orda Oblast ; the Kzyl-Orda Agriculture Research Institute and the Soil Research Institute. Presently, there is only one institute; the Pre-Aral Scientific Research Institute for Agro-Ecology and Agriculture. It is described in Sub-section 2.1.8.

(2) Agricultural Extension and Farmer Training

Extension services to farmers do not now exist in Kazakstan. During the Soviet Period, agricultural research findings regarding improved practices were distributed to Oblast and Raion Departments of Agriculture as well as managers of state farms. These findings were issued in the form of reports and pamphlets. During the current period, the Pre-Aral Institute is not publishing any research documents for farm use. The last pamphlet was issued in 1993.

Thus, agriculture extension and farmer training are not occurring in the Kzyl-Orda Oblast or the Project Area. There are no written reports issued directly to farmers, and there are no materials being disseminated via radio or television broadcast. No on-site training is being provided to farmers by the Pre-Aral Institute or the Ministry of Agriculture. The raion and oblast departments of agriculture are also not providing seminars or written training materials to farmers. Peasant farms and family farms are not being provided with any technical assistance or training.

(3) Agricultural Credit

As explained in Sub-section 2.1.8, Agroprombank is the only source for project farms to obtain cash operating loans except for special State Fund loans. Both Ilyasov Production Cooperative and Shagan Production Cooperative are in debt to the State Fund and both farms contract for production inputs such as fertilizers, fuel, and spare parts in exchange for paddy after harvest. But, the financial condition of the two production cooperatives is quite different.

The Shagan Production Cooperative owes the State Fund T.1,072,000 due on December 15, 1997 and has a long term debt of T.88,000 due in year 2004. The Ilyasov Production Cooperative owes the fund T.1,910,000 due on December 15, 1997 and has a long term debt of T.258,000 in 2004.

The Shagan Production Cooperative is in relatively good financial condition. It has T.4 million of debt that is due November 1. This production cooperative was able to borrow money this year to finance purchase of a rice mill, one elevator, 2 tractors, 3 reapers, and a combine. The German manufactured rice mill was purchased through a loan of US$286,000 financed by the ADB medium term credit program. The loan is to be repaid in 4 years at 11% interest. The interest rate is composed of 7% to ADB, 2% to Agroprombank, and 2% to the Organization of Agro Leasing.

The manager of the Shagan Production Cooperative is currently negotiating to buy a combine that costs US$140,000. The down payment is 35% of the cost and the remaining 65% is due in five months. He has applied for a loan from Kzyl-Orda Agroprombank to cover the 35% down payment through a 6 month term loan at 32% annual rate of interest.

The Ilyasov Production Cooperative currently has a debt of T.35 million. Last year it had a debt of T.79 million. This production cooperative can not get any credit, and uses all of its production to repay debt, so there is nothing to sell for cash. The manager of this production cooperative says that if they are able to pay off their debt this year, they will be able to get credit for production inputs for next year. He believes they can pay off their debt if the harvest is good, but, he is hoping for a paddy price of T.17-20 /kg. The price is more likely to be T.14-15/kg.

(4) Farm Inputs Distribution

The system for supply of production inputs to the project farms was described earlier in Sub-section 2.1.8. The manager of the Shagan Production Cooperative said that this year they were only able to obtain 60 to 70% of their requirement of fertilizers because of lack of supply

from "Kunarlylyk". They hope next year to get 100%. This year the Ilyasov Production Cooperative applied only 10% of the recommended quantity of fertilizer.

In 1997 the Shagan Production Cooperative purchased 2,400 liters of the herbicide Bazagran which was applied to 800 hectares of paddy. They bartered 208 tons of paddy at T.14.5/kg for the herbicide. The Ilyasov Production Cooperative applied Bazagran on 200 hectares.

The Shagan Production Cooperative exchanged paddy for fuel from Hurricane, at the price of T.14/kg of paddy. This production cooperative also pays interest on the loan of fuel at an annual rate of 37% from May to November.

The last time the Ilyasov Production Cooperative purchased equipment was a tractor and a combine, 6 years ago. Their equipment is old and worn out. The Shagan Production Cooperative is currently negotiating financing for purchase of a combine and most of their equipment is newer.

The wage rates reported by the two production cooperatives in the Project Area vary significantly. Probably because of its poor financial condition, wages are much lower on the Ilyasov Production Cooperative. The highest skill level driver of a combine is paid T.156/day (US$2.09) and crawler tractor drivers are paid T.130/day (US$1.73). For comparison, tractor driver's average salaries on the Shagan Production Cooperative are T.367/day (US$4.89).

(5) Farms and Farmer Organizations

The Project Area includes three different types of farms: the Production Cooperative and two types of Peasant Farms. All of the individual farmers in the Project Area are members of a production cooperative or are members of the Peasant Farm's Associations.

Production Cooperatives are the result of the privatization of state farms. National decrees required that all state farms be "privatized" and in many cases this has meant no more than being registered as a private farm and allocating shares on paper to all of the farm workers. The same administration is usually in place, including the same manager and the same specialists (agronomist, animal husbandry specialist, economists, engineers, etc.). The organization of the farm continues under central management with all major decisions being made at the top level.

The second type of farm is called a Peasant Farm. This class includes two sub-types; those with single household and those with multiple households. In this farm type, the unit has been registered as a private farm under the control of the household(s), and it is operated independently from a production cooperative. The peasant farm is a private enterprise in which the residents make all farm decisions. Registered peasant farms which submit a business plan are eligible for small loans from the Oblast Department of Agriculture. Peasant farms may own machinery or may rent cultivation services from a production cooperative. They receive irrigation water through the same hydraulic system that serves the production cooperatives and make payment to the production cooperative for the use of irrigation water. In some cases, they also sell their output to the production cooperative. The peasant farms included in the

Project Area are physically located within the area of the production cooperative, but are independent of its management. Most of the peasant farms within the Project Area are small scale units involving one to three households, though the Berlek Peasant Farm contains 56 households.

Farm Name	Farm Type	Households
Ilyasov	Production Cooperative	398
Berlek	Peasant Farm - Multiple households	56
Shagan	Production Cooperative	688
Ilyas	Peasant Farm - Single household	1
Meras	Peasant Farm - Single household	1
Murat	Peasant Farm - Single household	1
Beibit	Peasant Farm - Single household	1
Abuov Z.	Peasant Farm - Multiple households	3
Total		1,149

Source: Farm interviews and surveys

The production cooperatives are governed under publicly-registered by-laws which are approved by the office of the Raion Governor (Akim). Under privatization, all such units were required to allocate the total assets of the cooperative to the member workers.

In the case of the Ilyasov Production Cooperative, the former state farm was "privatized" in 1995 and registered in March 1997 by consent of the general assembly of farm members. Shares were allocated equally to all registered workers and their families within the cooperative. Registered members of the cooperative hold one share each of 4.7 hectares; excess lands (15%) are held in reserve for inheritance and population growth. Each share entitles a member to a proportionate part of the cooperative's debts and assets. Profits are paid either in-kind or in cash. Each adult member of the cooperative has one vote which may be exercised at the annual assembly at which time major decisions are made. There are 68 managerial, professional, and support staff. The remainder of employees are workers.

The Ilyasov Production Cooperative by-laws provide for a board of directors of 12 members. Most of the board are specialists employed by the cooperative. The manager serves as chairman of the board for a period of five years. The current manager, as is common throughout privatized state farms, is the same one who held this role during the Soviet period. Both routine and major farm decisions are made by the manager with input from the board. The administration is highly centralized. The manager describes administration as a farm which is "operated collectively under manager directorate". The by-laws also provide for a general assembly which meets in ordinary or extraordinary sessions. The general assembly is the "supreme organ" of the farm and meets periodically, at least once every fifteen months or more frequently as needed. The by-laws provide for an observation council which oversees contracts. An inspection commission is enacted to oversee agricultural production, finances, and audits. Any member of the production cooperative may resign membership, sell his share, or be discharged for repeated violations of by-laws.

The Ilyasov Production Cooperative carries out its agricultural work including irrigation water management through three sections of crop production, animal husbandry and maintenance service, and five brigades under supervision of specialists. Technical assistance is provided to the brigade leaders by the farm specialists. Cropping and rotation decisions are

made centrally by the manager and specialists. The present organizational structure of this cooperative is as shown in Figure 3.1.7.

The Shagan Production Cooperative is also a former state farm. It was "privatized" in 1995 and registered in March 1997 by consent of the general assembly of farm members. The organization of the Shagan Production Cooperative is essentially the same as that of the Ilyasov Production Cooperative and its by-laws are almost identical.

The Shagan Production Cooperative is also administered by a Manager who works with a Board of Directors of 11 members. The agricultural work is managed by the three sections of crop production, animal husbandry and machinery service, and eight brigades. Most of the directors are also farm specialists. The manager and directors serve for terms of five years. The current manager held the same role before privatization. There are 77 staff positions which report to the director including specialists and support staff and 470 laborers. Like the Ilyasov Production Cooperative, the Shagan farm by-laws call for an observation council and an inspection commission. The present organizational structure of this cooperative is as shown in Figure 3.1.8.

Like the Ilyasov Production Cooperative, the Shagan Production Cooperative operates under a highly centralized administrative model in which the manager is responsible for all major decisions including cropping patterns, rotations, procurement, and contracts under the oversight of the board of directors, observation council, and inspection commission. Individual shareholders have little direct influence on farm decisions, but have voting rights to elect directors, commissioners, and council members.

The Berlek Peasant Farm broke off from the Ilyasov Production Cooperative and was registered in 1997. They chose to call themselves a "peasant farm" even though in Kazakstan this generally means a single household farm or a farm unit of several households which are related by family. The Berlek Peasant Farm, comprised of 56 unrelated family households, is loosely and informally organized as shown in Figure 3.1.9. The farm does not have by-laws. at this time. It is organized like a production cooperative with an elected manager and specialists including engineer, accountant, agronomist and hydro technician. Agricultural labor is organized under two brigades. The elected ten member board of directors includes all of the specialists, the manager, brigade leaders, and selected farm laborers.

This new farm is in a fluid state of organization. The current manager and directors are elected for an initial three years term and the farm will be managed as a production cooperative during this initial period. At the end of the three year period (April 2000), the general assembly will meet to re-evaluate the farm's organization. During the interim, each member (264 persons) holds an equal share of the assets and debts, including pensioners and children. Each share is equal to 4.7 hectares per person. After three years, the farm members will decide whether to continue as a production cooperative or to adopt a new form of organization which may include disaggregation into family farms. In the meantime, the Berlek Peasant Farm functions like a small production cooperative.

There are five smaller "peasant farms" within the Project Area which operate as private family farms and hold legal privilege to "rights of use and inheritance". They function fully independently of the Shagan and Ilyasov Production Cooperatives. In four cases, the farm is comprised of a single family household and in one case of three households. Peasant farms control their own labor and finances. They may rent machinery or hire cultivation services from the closest production cooperative. Since they are within the hydraulic region of the larger production cooperatives, they make irrigation water payments to the cooperatives and do not receive water directly from the Raion Management of Water Economy System. They market their goods independently.

These farms were formed independently by registering and purchasing state farm shares as permitted under privatization "in order to improve our incomes and to control our own work". Unlike private family farms elsewhere in Kazakstan, incomes and production have not improved, since these units became independent because of limited access to credits for inputs and machinery, irregular water supply, and because peasant farmers lack management, business, and marketing expertise.

In the Terenozek Raion, peasant farms have formed an independent group called the Peasant Farms Association. This group is comprised of 94 member farms; all 5 of the peasant farms in the Project Area are members. This association has an elected chairman, board of directors, and holds annual assemblies, but does not have by-laws. The purpose of the organization is to assist peasant farmers in the preparation of business plans in order to become eligible for credit from the Oblast Department of Agriculture Peasant Farm Support Program. None of the farms in the Project Area have prepared such applications for credit nor received any financial support from the Oblast Department of Agriculture. The organization may provide the basis for a stronger association which is engaged in marketing and water use, however this has not happened yet due to inadequate financial support from the members, many of whom are unable to pay their dues. Thus, all of the individual farmers in the Project Area are members of a functioning production cooperative or farm association.

3.1.9 Market and Prices

(1) General

Market and price conditions have improved remarkably in the Kzyl Orda Oblast less than one year after the survey for the Master Plan study. The supply of inputs has improved, interest rates on farm loans have gone down, and farmers can get a fair price for their products, if they have some to sell. Some of the specific changes which have occurred are:

(i) The State Resource System of procurement and State Price Committees no longer exist.

(ii) With the end of state pricing controls, establishment of "Tabys" Commodity Exchange, and the presence of many independent buyers, farmers in the Kzyl Orda Oblast have access to market information and they can get a fair market price for their produce.

(iii) Consequently, the values at which paddy is exchanged in barter for production inputs are very close to the value of paddy based on the international market.

(iv) The problem of poor quality product caused by bad milling of rice is lessened because some new rice mills have been purchased under the ADB mid-term credit program.

(v) The supply of fertilizers increased from 45% of requirements in 1996 to 60% in 1997. Next year Kunarlylyk expects to supply 100% of requirements. But, still the problem of lack of cash with which to purchase fertilizers from manufacturer's exists.

(vi) The State Leasing Fund and the ADB mid-term credit line are making it easier for farmers to procure tractors and equipment.

(vii) The interest rate for loans from Agroprombank has dropped from 45-50% last year to 30% in 1997.

Even though these very significant changes have occurred, there still remain some problems:

(i) Farmers still lack cash to purchase production inputs and lack product to sell for cash, because most of their production is committed to repay barter debts for inputs and consumption goods.

(ii) Farmers still lack experience (knowledge) of marketing under a private enterprise system, and self-financing or arranging credit sufficient to cover operating costs for the next year's crop.

(iii) The physical infrastructure and equipment are deteriorated or worn out.

Both managers of the Ilyasov and Shagan Production Cooperatives stressed their concern about finding buyers, and the need for adequate complements of farm machinery, and adequate supply of fertilizer and chemical inputs in order to achieve the projected yield of 6 tons of paddy per hectare under the future "with project" conditions.

(2) Marketing

Although the general market situation is greatly improved, the managers of the Ilyasov and Shagan Production Cooperatives say that marketing is a big problem. However, the Ilyasov Production Cooperative has nothing to sell. Last year buyers came to the Shagan Production Cooperative trying to buy rice. This year members of the production cooperative are going to North and South Kazakstan trying to find buyers. The Shagan Production Cooperative uses the Tabys commodity exchange for information about prices.

Only paddy is sold or bartered by the Ilyasov Production Cooperative. All other crops such as wheat and vegetables, and livestock are consumed on the farm. The manager of the production cooperative says their biggest problem in the future will be to find buyers for their paddy. They use "Tabys", but, until their debt is paid off, they have nothing to sell.

Except for paddy, all other crops and livestock products produced on the production cooperatives are consumed internally.

(3) Prices of Crops and Farm Inputs

Average prices received by Kzyl-Orda farmers in 1996 as determined by the Oblast Department of Agriculture are summarized in the following table:

Commodity	Tenge/kg	US$/ton
Paddy	10.8	159
Vegetables	8.0	118
Potatoes	13.0	191
Melons	3.0	44
Beef, live weight	32.0	470
Mutton, live weight	28.0	412
Milk	23.0	338
Lucerne*	2.0	27

Note: Exchange rates;US$1 = T.68 in 1996 and US$1 = T.75 in 1997
*; August 1997 price of T.30/15 kg bale.
Source: Kzyl-Orda Oblast Department of Agriculture.

Similar data for 1997 are not yet available from the Oblast Department of Agriculture. The farm gate prices for paddy and wheat of US$200/ton and US$150/ton, respectively, for 1997 were calculated from international market prices projected by the World Bank.

According to Kokonis, melon prices range from T.3/kg at the peak to T.6-7/kg in the early and late season. An average price of T.4/kg was used in the melon crop budgets. The average price paid by Kokonis for carrots and onions was T.6/kg (US$80/ton). However, this is less than the average price of T.8/kg (US$118/ton) received by Kzyl-Orda farmers for all vegetables in 1996 as reported above. Since the Kokonis 1997 data covers only two vegetables, it was decided to use the higher 1996 average price for all vegetables in the financial crop budget representing present conditions.

Prices of seeds, fertilizers, herbicides and fuel are as follows:

Input	Tenge/kg	US$/kg	Input	Tenge/kg	US$/kg
Seeds			Fertilizer		
Paddy	20 - 30	0.33	Ammonium Sulfate	5 - 7	0.08
Wheat	12 - 16	0.19	Nitro-Ammo-Phos	15	0.20
Maize	70 - 80	1.00	Double Phosphate	15	0.20
Lucerne	100 - 200	2.00	Ammonium Nitrate	10 - 15	0.17
Melon	600 - 650	8.33	Ammonium Phosphate	15	0.20
Potato	15 - 20	0.23	Herbicides		
Onion	1,100 - 1,200	15.33	Bazagran	800	10.66
Carrot	1,100 - 1,200	15.33	Fatset	2,775	37.00
Safflower	100	1.33	Fuel		
			Diesel	12	0.16
			Gasoline	20	0.27

Sources: Oblast Seed Inspection Station, JSC "Kunarlylyk", and the Oblast Agriculture Department.

Depreciation and repair costs were calculated from 1997 purchase prices provided by Agropromtekhnika based on rates of machine use and projected life of equipment under MOA

"normative standards", except the estimated life of crawler tractors was increased to 10 years, and 9 years for wheel tractors based on advice from the Shagan Production Cooperative.

Farm labor wage rates used in the crop budgets were provided by the Shagan Production Cooperative. Based on a 7 hour day, the hourly rates are T.52.4 (US$0.70) for tractor drivers, and T.28/hr (US$0.37) for irrigation and other hand labor.

(4) Post-harvest, Agro-processing and Storage Facilities

The Shagan Production Cooperative has two new rice mills, built in 1996. A German manufactured mill with 20 tons/day capacity produces 60 to 63% of 1st class quality rice (7%-12% broken). A Russian manufactured mill with 50 ton capacity produces 57% to 60% of the first quality rice. They are modifying the Russian mill to bring it up to the production level of the German mill. On average from paddy they get:

60-63%	first class
20%	waste
13-15%	fodder

The Shagan Production Cooperative needs 4,000 to 5,000 tons of paddy from other farms to fully utilize the capacity of the two rice mills.

The Ilyasov Production Cooperative has only an old rice mill of 3 tons/day capacity that has a poor recovery rate of rice from paddy and a high percentage of broken rice, so they barter with paddy instead of milled rice. Also they don't have electricity to run the rice mill, because they can not pay for it.

The present condition of storage capacity on the two production cooperatives is summarized as follows:

(Unit: ton)

Commodity	Ilyasov P.C.	Shagan P.C.
Raw rice	5,600	8,500
Cleaned paddy	700	1,100
Polished rice and seeds	350	550
Byproducts	500	1,300
Wheat	110	300
Total storage	7,260	11,750

All other crop and livestock products are consumed on the farms. Both production cooperatives have flour mills, macaroni shops, milk plants, ice cream and sausage shops.

3.1.10 Farm Economy

(1) Crop Budgets

The main crops produced on the farms in the Project Area are paddy, lucerne, wheat, vegetables and melons. Crop budgets under present conditions were prepared to determine the income from these crops. The detailed budget is shown in Table 3.1.14. Yields used in the

budgets were the average over the most recent three year period 1994-96 reported by the farms (Sub-section 3.1.5).

The results of financial crop budgets under present conditions are listed in the following table:

Crop	Gross Value* (US$)	Production Cost & VAT (US$)	Labor Days (days)	Net Return (US$/ha)
Rice	738	533	5.6	205
Lucerne	136	181	4.1	-45
Wheat	151	298	3.3	-147
Vegetables	914	773	59.3	141
Melons	453	440	26.4	13

Note: *; including byproducts

Twenty percent value added tax is included in the price of everything purchased by the farm, and it is also charged on every sale. Farms are charged 20% VAT on sales, but, credited for VAT previously paid on production inputs[13/]. A social cost tax for pensions amounting to 32% of the total wage bill is also included in the budget.

Rice, vegetables and melons are the only profitable crops. Net losses from lucerne and wheat are caused by very low yields.

(2) Farm Budget

The average cropping pattern in the 13,690 hectares of the Project Area over the period 1994-96 representing present conditions is 28.4% paddy, 19.2% lucerne, 13.7% wheat, 3% vegetables, and 2% other crops. An average of 33.7% of the cropland has been idle over the past three years.

In addition to the VAT and social cost tax which were included in the crop budgets, a land tax is assessed in the farm budget at the rate of T.100 (US$1.33) per hectare. Income tax is charged at the rate of 10% of profits which are determined based on sales minus production costs.[14/] Results of the farm budget for a 6,800 hectares farm are summarized below:

13/ Information on VAT, land tax and income tax is from the Agronomist, Project Implementation Unit, MOA, Almaty.

14/ Ibid.

Item	Value (US$ '000)
Gross Value of Production*	
Rice (1,931 ha)	1,424.52
Other crops (2,577 ha)	523.70
Total	1,948.21
Crop Production Costs	1,732.69
Water charges, US$17/ha for 4,508 ha	76.64
Land Tax (US$1.33/ha)	9.04
Total Outflow	1,818.36
Net Return Before Income Tax	129.85
Income Tax, @10%	12.98
Net Return After Taxes	116.87

Note: *; Includes byproducts.

The detailed farm budget is shown in Table 3.1.15. The net return from the 6,800 hectares farm is US$116,870, or US$17.19/ha. The number of workers reported from the farm survey averages one worker per 4 hectares. Including US$125,880 from wages and US$116,860 of net farm income, the average income per worker is US$143.

The preceding results are indicative of the productivity of the Shagan and Ilyasov Production Cooperatives under present conditions. The Shagan Production Cooperative is better off than the situation depicted here, and the Ilyasov Production Cooperative is worse off. The farm budget does not reflect that workers are directly consuming much of the production of the farm and the farms also exchange paddy for most of their off-farm consumption goods or production inputs, thus reducing cash transactions, and resulting in less value added tax and income tax than shown in the budget. Also the crop budgets include an annual charge for depreciation of tractors and machinery purchased at current prices, which the farms are not actually paying at the present time. Nonetheless, the results of this analysis indicate that the two large production farms in the Project Area are not producing enough income under present conditions to sustain the workers and their families living on them.

There are six other farms in the Project Area. The largest of these, Berlek, consists of 56 families farming 1,161 hectares in the same manner as the large production cooperatives. The cultivated land on Berlek Peasant Farm is 494 hectares. Year of 1997 was the first crop year for this farm. The preceding estimates of income per hectare and per worker over the period 1994-96 are also representative of the present condition of this farm.

There are five small peasant farms in the Project Area. Four of them are single family farms, and one of them is comprised of three families. According to the farm survey conducted in 1996, one of these farms, consisting of 2 cultivated hectares out of 20 hectares total land ownership has ceased operation as a farm.

The remaining 4 small peasant farms were analyzed as a group based on data from the farm survey. The farms produced paddy, apples, potatoes, fodder, livestock and milk on 159 hectares, of which 36 hectares were cultivated. The gross value of their production was T.1,254,900. After deducting all production costs and taxes as in the previous table, their net income was T.367,400 plus T.94,000 of crop labor wage income included in production costs.

Therefore, the total net income after taxes is estimated at T.460,000. There are 29 men and women over the age of 16 living on these four farms. Assuming they all are workers, the average income/worker is T.15,860, or US$233 at the 1996 exchange rate.

3.1.11 Environment

(1) Water Resources

(a) River and Irrigation Canal Water

The monthly water quality data on the Syr Darya river are available from the Kzyl-Orda Oblast Office of Ministry of Ecology and Bioresources (MOEB) as shown in Table 3.1.16. According to the Guideline on Assessment of Water Quality Used for Kazakstan Irrigation Lands prepared by MOEB in 1994, the quality of river water at Kzyl-Orda is categorized in Class II in terms of salinity during the irrigation period of the Project Area from May to August, except in June when the water quality is in Class III.

In addition to the above-mentioned existing data, the detailed water quality analyses of surface water at the Kzyl-Orda Headworks on the Syr Darya river and the diversion point to the Ilyasov Area on the Left Main Canal were carried out by the survey team of Environmental Impact Assessment (EIA) under the sub-let contract in the Phase-II Study period, and the results of analyses are shown in Table 3.1.17. The concentration of heavy metals such as copper, zinc, lead, cadmium, arsenic, mercury and chrome is much lower than the standard referred to in the above-mentioned guidelines. The organic chemicals such as phenols, HCCH, DDE and DDT were not confirmed in the samples. Therefore, it is judged that the surface water of the Syr Darya river at the Kzyl-Orda Headworks and the Left Main Canal can be used as irrigation water for most crops except some salt-sensitive ones.

According to the result of bacterial analysis under the said EIA survey, total number of microorganism and coli index show 100,000-1,000,000 per milliliters, and 23 per liter respectively in the water samples collected at the headworks. These contents are more than the maximum levels of the standard for domestic water in Kazakstan, while the concentration of inorganic or organic materials is within the limit of the standard. For the domestic use of this water, therefore, the water quality should be interpreted with caution, and independent tests and purification are recommended.

(b) Drainage Water

The detailed water quality analysis was made on two water samples collected from the existing drainage canals in the Project Area (Table 3.1.17). In addition, the salt content analysis was carried out on seven water samples collected from the drainage canals in July 1997 under the sub-let contract (Annex J). According to these tables, salt content in drainage water is 2,100 mg/lit on an average, ranging from 2,000 mg/lit in the upper reaches of the North Main Collector to 2,500 mg/lit in its middle reaches, which reveals that the average salt content is around 2.0 times compared to that of irrigation water from the Syr Darya river. According to the irrigation water quality standard of Kazakstan, the quality of this drainage

water is categorized in Class IV, which is not suitable for irrigation use. Meanwhile, the result of water quality analysis of drainage water carried out in September 1996 under the sub-let contract of Phase-I Study period showed the salt content of 7,000 - 10,000 mg/lit, which is more than 3 times compared to the result of analyses carried out in the Phase-II Study period. The difference of salt content in July and September is explained by the fact that the period from June to July is the main irrigation season for paddy cultivation, and there is much return flow from paddy fields to the drains diluting the drainage water, while September is an off-season for irrigation, and there is less return flow to drains.

The result of detailed water quality analysis of drainage water also shows that the content of heavy metals is much lower than the above-mentioned standard, same as irrigation water. In addition, the organic chemicals such as phenols, HCCH, DDE and DDT were not found in the samples. Therefore, the pollution caused by the application of agro-chemicals is judged to be very low level in terms of drainage water from the Project Area at present.

(c) Groundwater

The water quality analyses on the water samples collected at upper, middle and bottom parts in 38 existing observation wells and 4 auger boring points were carried out under the sub-let contract in the Phase-II Study period in order to facilitate the salt balance study in the Project Area (Annex J). According to these results, most of the samples contain more than 2,000 mg/lit of salt, which is categorized in Class IV based on the Irrigation Water Quality Standard of Kazakstan. Therefore, the groundwater in the Project Area is judged not suitable for irrigation use.

In addition to the above water quality analyses, the water quality analysis was carried out on the water samples collected from the deep wells being used for domestic water supply purpose in both Ilyasov and Shagan Areas under the EIA survey, and the analyzed results are shown in Table 3.1.17. According to these results, the samples show more than 1,500 mg/lit of salt, which is more than the maximum level of the standard for domestic water in Kazakstan. The total number of microorganism and coli index also exceed the maximum levels of the standard. According to information from the officer who is in charge of the domestic supply system in the Project Area, the inflow of sub-surface water through the damaged casing pipes of wells causes the high contamination of water in deep wells.

(2) Biological Resource

(a) Vegetation and flora

According to the results of the EIA survey and land use survey, the vegetation cover in the Project Area is divided into two categories; planted vegetation and natural vegetation. Planted vegetation includes mainly rice, wheat, lucerne and vegetables in the original rice rotation area (original irrigation area). The trees are planted in and around the settlement areas and along the roads in the Project Area.

The natural vegetation includes dumetosous vegetation, reeds, mixed grass vegetation and saltworts vegetation. The dumetosous vegetation and mixed grass vegetation are used as

pasture land for cattle. The saltworts vegetation is located in the area with strong to very strong saline soils including Solonchaks. The reeds cover the wet area caused by poor drainage or the presently abandoned area of original rice rotation area.

The northeastern boundary of the Project Area is close to the Tugai vegetation area which is the most important ecosystem in the Kzyl-Orda Left Bank Area because of not only water conservation but also natural habitant for wildlife and birds including significant species. In addition, the Tugai vegetation contains rare species of plants; Populous diversifolia and Populous pruinosa.

(b) Fauna

Based on the result of EIA survey, the same rare species of fauna as shown in Paragraph 2.1.11(2) were confirmed in and around the Project Area. According to this result, 33 rare species in total, which consist of 11 mammals, 19 birds, 2 fish and one reptile are listed in Red Data Book (RDB).

According to information collected through the EIA survey, the number of fauna tends to have been reduced in and around the Syr Darya river due to decrease of river discharge, while the fauna including rare species maintains the same situation in desert area around the Project Area.

The preliminary estimate made by the Scientific Research Institute of Fish shows that about 200 - 300 tons of fish annually flow in the Left Main Canal through the intake facilities of the Kzyl-Orda Headworks from the Syr Darya river (Attachment VI). These fish are caught by people living along the irrigation canals during the irrigation period as an important protein source for them, or the fish die in the canals during the non-irrigation period, because the irrigation canals dry up. The Ordinance on "Protection of Fish Resource and Management of Inland Fishery" obliges to take the countermeasure to fish loss at the intake facilities. However, no countermeasure has been taken due to shortage of the government budget.

(c) Reforestation

The strong wind with sand dusts is reported in spring and the beginning of summer in the Project Area. The oblast office of Committee of Forest and Hunting is planting the seedling of saxual tree in the area in order to protect the desertification caused by strong wind. The activity of the committee is limited in and around settlement area due to the shortage of budget. In addition, it is difficult to grow the seedling without irrigation, because the tree needs irrigation water for 4 years after the planting. From these reasons, there are some difficulties for the committee at present to provide reforestation area even around the farm lands.

(3) Land Resources

(a) Soil Salinization

Of 40,230 hectares of the Project Area, the area with strong to very strong saline soils including Soloncheks is estimated at around 17,190 hectares or 43 %. The saline soils have a negative impact on soil fertility and crop yield. According to the result of soil survey and water quality analysis carried out under sub-let contract, the area of saline soils closely corresponds to the salt content in groundwater. The strongly saline soils are found around the observation wells with groundwater containing salt of more than 10,000 mg/lit. Most of the original rice rotation area is outside the area of strong to very strong saline soils.

According to information from the Terenozek Raion Administration and farms, only 700 hectares (5.1%) are reported as the presently abandoned area due to salinity problem in the original rice rotation area of 13,690 hectares. According to the result of the field survey, most of the salinized area in the original rice rotation area is located in the abandoned area where the farmers used to cultivate lucerne or other upland crops under poor drainage conditions, and as a result salt has been carried upward by capillary rise of groundwater which contains salt, and accumulated on the surface soil. While in paddy field, this salt movement is always downward being controlled by water percolation when the field is irrigated.

(b) Soil Pollution

According to the result of detailed soil analysis under the EIA survey (Annex J), the content of heavy metals is much lower than the Kazakstan standard for the soils. In addition, the organic chemicals such as phenols, HCCH, DDE and DDT were not confirmed in the samples. Therefore, soil pollution caused by the application of agro-chemicals is judged very low in the Project Area.

(4) Others

(a) Construction of Short-cut Canal

As mentioned in Paragraph 3.2.5(1), the upstream-most reaches of 9.0 km of the Left Main Canal is proposed to be short-cut for efficient canal operation and maintenance. The length of short-cut canal is 3.5 km, of which about 2.9 km will run across the grass lands owned by the government and managed by the Oblast committee on Water Resources. Remaining reaches of 0.6 km pass through private lands which are mainly used as country gardens with cottages (dacha), but the canal is so designed to pass the garden areas. Therefore, the cottages will not need to be dislocated.

(b) Cultural and Historical Assets

According to the result of the EIA survey, historical and cultural assets protected by law are not located in the Project Area, though some ancient tombs or monuments exist in the Project Area but outside of the original rice rotation area.

(c) Water-borne and Water-related Diseases

According to the information from the Kzyl-Orda Oblast Sanitary and Epidemiological Station, existence of water-borne diseases such as malaria, lymphatic filariasis and schistosomiasis is not reported in the Project Area. While, existence of some water-related diseases such as salmonellosis, virus hepatitis and typhoid fever are reported in the Project Area. These water-related diseases are mainly caused by deterioration of quality of drinking water mentioned in Paragraph 3.1.11(1).

3.2 Development Plan for the Priority Project

3.2.1 Objectives and Scope of Project

The main objectives of the Project are: (i) to improve agricultural infrastructures including irrigation and drainage system and farm road network; (ii) to establish a well-defined water management system; and (iii) to improve the present farming system including the farming practices and agricultural supporting system. Through these improvements and establishment, it is expected that presently abandoned agricultural land would be recovered to the cultivable land, and sustainable agricultural development would be realized in the Project Area. Moreover, due to improvement of irrigation facilities, irrigation efficiency would be much increased, and water saving would be realized at the intake structure of the headworks, which will result in increase of river flow downstream of the headworks and contribute to improvement of environmental conditions in the lower basin of the Syr Darya river including Aral Sea for long term.

In order to realize the above-mentioned objectives of the Project, the following scope of the Project is envisaged:

(i) Rehabilitation and improvement of the Kzyl-Orda Headworks, Left Main Canal, and inter-farm/On-farm canals to distribute irrigation water from the intake structure to the irrigation area in an efficient manner.

(ii) Rehabilitation and improvement of the North and South Main Collectors and inter-farm/on-farm collectors to lead excess water in farm lands to the Kuvan Darya river.

(iii) Rehabilitation and improvement of on-farm facilities including field canals, field ditches, field collectors and field drains to enable farmers to maintain proper water control in farm plots.

(iv) Introduction of improved farming practices, including the selection of profitable crops and diversified cropping system, proper and timely application of fertilizers and chemicals, and improvement of post-harvesting and marketing system.

(v) Improvement of agricultural support services such as agricultural research, agricultural credit, and establishment of agricultural extension system.

(vi) Establishment of agricultural cooperatives which will have the functions of marketing agricultural products, procurement of farm inputs and rental of agricultural machinery to farmers.

(vii) Establishment of an effective water management and O&M system.

(viii) Monitoring and evaluation of irrigation, agricultural and environmental aspects.