

10 PLAN FORMULATION

10.1 Basic Policy of Master Plan

10.1.1 Overall Goal and Project Purpose

The Study area locates in the Zagros mountain range with average altitude of approx. 3,000 m. The area has been degraded by decrease of the vegetation and the forest area due to overgrazing and cutting trees for fuels and reclamation for increase of the new cultivation area. In case of heavy rainfall or rapid snow melting, many types of disasters such as debris flow and flood are anticipated. The area is suffering from a vicious cycle of natural-social environment: "Decrease of farm income (Poverty) - Further exploitation of land - Degradation of natural environment - Natural disasters and damage to farmland - decrease of productivity of land - Decrease of farm income (Poverty)". The vicious cycle is schematically shown below, and the regional society is facing the danger of collapse.

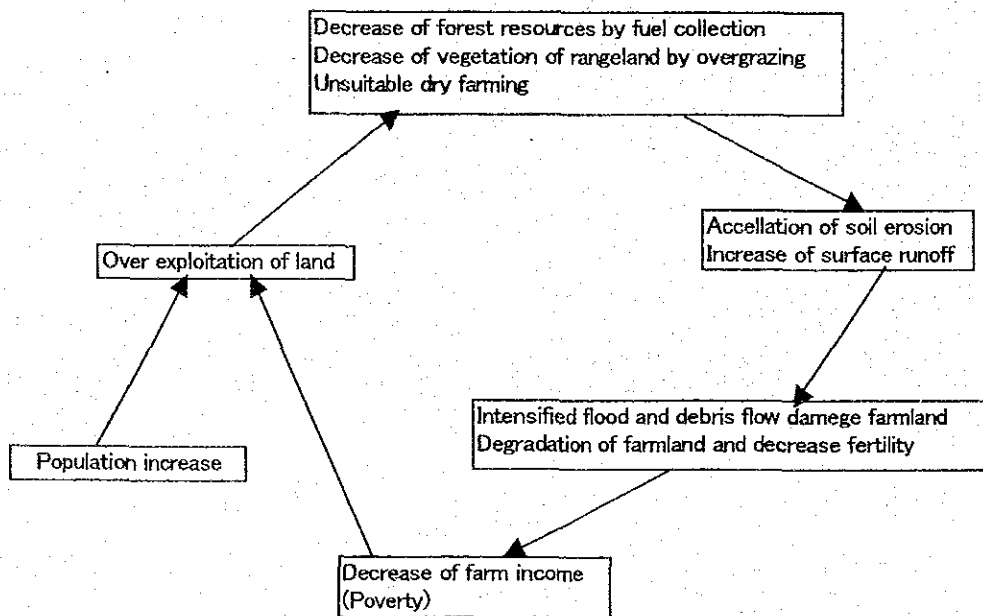


Figure 10-1 Vicious Cycle of Environment Degradation and Poverty

The existing conditions of each component of vicious cycle are as follows:

- (1) Destruction of natural environment
 - Decrease of forest resources by fuel collection
 - Decrease of vegetation of rangeland by overgrazing
 - Improper practice of dry farming
- (2) Increase of soil erosion and increase of direct runoff of rainfall
 - Increase of soil erosion
 - -Increase of direct runoff of rainfall
- (3) Intensified flood and debris flow and degradation of farmland
 - Intensified flood and debris flow
 - -Degradation of farmland and decrease of crop yield

(4) Decrease of farmer's income

Farm income would decrease as the agriculture production decrease because of the damages to crops and farmland. Furthermore, farmers have to bear the expense of the recovery and reconstruction of damaged farmland and irrigation facilities.

(5) Over exploitation of land

Farmers would expand reclamation of new land for dry farming without proper facilities to prevent erosion in order to keep their income level and farmers raise too many livestock more than the number within the carrying capacity, which lead to the over exploitation of land.

The overall goal of the master plan is to break through the above vicious cycle at two nodes of the "Degradation of natural environment" and "Decrease of farm income. In order to realize the overall goal, following five project purposes are proposed.

- 1) Mitigation of flood, debris flow and landslide damages
- 2) Control of soil erosion and conservation of water
- 3) Restoration and improvement of rangeland vegetation
- 4) Improvement of living standard
- 5) Improvement of agriculture product/input marketing and agriculture extension

The achievement of these project purposes could be expressed in terms of following tangible indexes. Several approaches to each project purpose are considered, and each approach forms an individual project. Execution of each approach (project) will produce an effect (effects) on the project purposes. The effect must be expressed by tangible indexes.

(1) Project Purpose-1: Mitigation of flood, debris flow and landslide damages

Achievement Index: Scale and frequency of disaster by flood, debris flow and landslide

1. Approach (Project) to Mitigation of flood, debris flow and landslide damage	
A : Structure measures	
1-1	Construction of check dam : In order to trap the sediment and reduce the riverbed gradient and stabilize the riverbed, construction of check dam is proposed. Normal size of check dams will be constructed by public work whereas small check dam to prevent expansion of gully erosion in farmland will be constructed by people's participation.
1-2	River improvement : Channel work and river treatment are planned in minimum extent to prevent further damages where damages were caused by the past flood.
1-3	Relocation of houses : Relocation of houses is planned only in Zeras where houses are located in hazardous area of debris flow and rock fall.
1.4	Landslide protection : Landslide protection is planned only in Sarbaz to stabilize the area of villages, roads and farmland, providing drains for snow melting water.
1-5	Rock-fall protection : Rock-fall protection is planned only in Chaman Goli-Bazoft along the road with hazard of rock fall.
B : Non-structure measures	
1-6	Training for procedure of small check dam construction, and maintenance & operation of disaster prevention facility (by people's participation) : Improve awareness of disaster prevention necessity and O/M of disaster prevention facility by villagers.

Note : O/M = Operation & maintenance

(2) Project purpose-2: Reduction of soil erosion and conservation of water

Achievement Index: Sediment amount, Number and scale of gully erosion

2. Approach (Project) to Reduction of soil erosion and conservation of water	
A : Structure measures	
2-1	Soil erosion protection : Soil erosion of steep farmland is protected by contour bund and gully protection in Chaman Goli-Bazoft and Zeras
2-2	Ground water monitoring & control : Groundwater monitoring system is planed for Vastegan area where groundwater exploitation seems to exceed the safety yield.
B : Non-structure measures	
2-3	Enlightenment for soil & water conservation activity : Awareness of soil & water conservation necessity is improved

(3) Project purpose-3: Restoration/improvement of rangeland

Achievement Index: Vegetation coverage

3. Approach (Project) to Restoration/improvement of vegetation	
A : Structure measures	
3-1	Rangeland vegetation improvement : Seeding and rotational use of rangeland and provision of water point for animals are planed to make the vegetation recovery.
3-2	Orchard Terracing : Orchard terracing is applied for the steep slope rangeland in Vastegan to prevent further soil erosion as well as production of Apples.
3-3	Forestland vegetation recovery : Almond tree plantation is planned in the forestland with poor vegetation in Chaman Goli-Bazoft, Sarbaz, Tang Sorkh and Zeras.
B : Non-structure measures	
3-4	Legislative measures on vegetation improvement : Rotation use of rangeland and legislative measures such as watchman posting & authorization, etc. in order improve vegetation.
3-5	Supply of grass seed : Grass seed is supplied to improve rangeland vegetation.
3-6	Allocation of vegetation production plots, and watchman posting : By posting authorized watchman, the vegetation condition in rangeland is improved.

(4) Project Purpose-4: Improvement of living standard

Achievement Index: Income, Job opportunity

4. Approach (Project) to Improvement of living standard	
A : Structure measures	
4-1	Increase of irrigated agriculture: By the rehabilitation of existing irrigation canal the saving water can be applied to the land now under rain fed farming. It will increase agriculture crop production.
4-2	Fish culture promotion: Fish culture of rainbow trout is planned in Chaman Goli-Bazoft and Sarbaz.
4-3	Collecting and grading center of apple and vegetable: Apple grading facilities are planned in Sarbaz and vegetable and apple grading facilities are planned in Tang Sorkh.
4-4	Rural water supply improvement: Rural water supply improvement is planned by extension of distribution pipelines to the out-of-service area and construction of additional reservoir tanks
4-5	Rural road improvement: Rural road improvement is planned including paving with asphalt and construction of bridges.
B : Non-structure measures	
4-6	Diversification to milk cow: A number of sheep and goat is converted to milk cow in order to decrease the pressure on the rangeland and increase the job opportunity of processing milk and give profit to farmers.

(5) Project Purpose-5: Improvement of agricultural products/input marketing and extension of agriculture technology

Achievement Index: Number of cooperative members, and number of attendance to extension services

5. Approach (Project) to Improvement of agricultural products/inputs marketing and extension of agricultural technology	
A : Structure measures	
5-1	Building & facility for cooperative activity : In order to stabilize the price of agriculture product and input and also strengthen agricultural extension service, building & facility for cooperative's activities are planned.
5-2	Community center building : Building for conducting enlightenment activities against natural disaster, health service promotion and improvement of living condition to women is planned.
B : Non-structure measures	
5-3	Establishment of cooperative : In order to stabilize the price of agriculture product and input and also strengthen agricultural extension service, establishment of cooperatives are planned
5-4	Community enhancement : Enlightenment activities against natural disaster, health service promotion and improvement of living condition to women are conducted.

The relation of Project purpose – Approach – Effect - is shown in Table 10-1-1.

Table 10-1-1 Project Purpose - Approach - Effect

Overall Goal	Project Purpose	Indicator	Approach (Project)	Effect	Indicator
Reduction of poverty and improvement of natural environment	1. Mitigation of flood, debris flow, and landslide damage	• Damage caused by flood, debris flow, and landslide	Structural Measures 1-1. Construction of check dams	• Sediment is reduced • Riverbed gradient is reduced, and riverbed and its banks are stabilized • Damage caused by debris flow on farmland, etc. are mitigated	• Amount of sediment • Trapped sediment • Scale and frequency of flood & debris flow damage
			1-2. River treatment (Vastegan, Chaman Goli-Bazoft, Sarbaz)	• Damage caused by flood on farmland, etc. along the river are mitigated	• Scale and frequency of flood damage
			1-3. Relocation of houses in hazard of debris flow & gully erosion (Zeras)	• Damage caused by debris flow & gully erosion in hazard area are reduced	• Scale and frequency of damage on houses, people & livestock caused by debris flow & gully erosion
			1-4. Landslide protection (Chaman Goli-Bazoft, Sarbaz, Zeras)	• Landslide-resistance on villages, farmland, roads, etc. is increased	• Scale and frequency of landslide damage
			1-5. Rock-fall protection (Chaman Goli-Bazoft)	• Damage caused by rock-fall is reduced	• Scale and frequency of damage on houses, people & livestock caused by rock-fall
			Non-structural Measures 1-6. Training for procedure of small check dam construction, and O/M of disaster prevention facility (by people's participation)	• Awareness of disaster prevention necessity is improved • O/M of disaster prevention facility will be done by villagers	• Number of villagers participated in check dam construction and O/M of disaster prevention facility
2. Reduction of soil erosion and conservation of water	• Soil loss amount • Number and scale of gully erosion	Structural Measures 2-1. Contour band (Chaman Goli-Bazoft, Sarbaz, Tangsorkh, Zeras)	Soil erosion at steep slope farmland is decreased	Soil loss amount	
		2-2. Groundwater monitoring & control (Vastegan)	• Ground water deposit is stabilized • Equal distribution of irrigation water is attained	• Ground water level • Area of irrigated farmland	
		(Check dam construction) (Chaman Goli-Bazoft, Sarbaz, Zeras)	Gully erosion at gentle slope farmland is decreased	Scale and frequency of gully erosion	
		Non-structural Measures 2-3. Enlightenment for soil & water conservation activity	Awareness of soil & water conservation necessity is improved	Number of villagers participated in soil & water conservation activity	
		3. Restoration/ improvement of vegetation	• Sediment amount • Vegetation coverage	Structural Measures 3-1. Rangeland vegetation improvement (seedling, water point)	• Carrying capacity of rangeland is increased • Damage on farmland caused by soil erosion is decreased
4. Improvement of living standard	• Income • Job opportunity	3-2. Orchard terracing (Vastegan)	• Damage on farmland caused by soil erosion is decreased	• Sediment amount • Orchard production • Forest coverage	
		3-3. Forestland vegetation recovery (almond tree plantation) (Chaman Goli-Bazoft, Tangsorkh)	• Rangeland vegetation is improved and carrying capacity is increased • Soil erosion is mitigated and damage to farmland is reduced	• Number of Legislative measures • Amount of seed supply • Protected areas & number of watchman posted	
		Non-structural Measures 3-4. Legislative measures on vegetation improvement	• Number of livestock in rangeland are decreased	• Number of livestock per unit area • Number of milk cow per unit area	
		3-5. Supply of grass seed			
		3-6. Vegetation production plot, Watchman posting			
		(Diversification to milk cow) (Vastegan, Chaman Goli-Bazoft, Sarbaz, Zeras)			
		Structural Measures 4-1. Upgrading of irrigation canal (Vastegan, Chaman Goli-Bazoft, Sarbaz)	• Farm labors income are increased • Employment opportunities are increased	• Amount of production • Job opportunity	
		4-2. Fish culture promotion (Chaman Goli-Bazoft, Sarbaz, Zeras)	• Fishermen's income are increased • Employment opportunities are increased • Consumption of fish is increased, and protein source shift from goats and sheep to fish	• Amount of production • Job opportunity • Amount of fish consumption	
4-3. Collecting & grading center of apple and/or vegetable (Sarbaz, Tangsorkh)	• Farm labors income are increased • Employment opportunities are increased	• Amount of production • Job opportunity			
4-4. Rural water supply improvement (Vastegan, Chaman Goli-Bazoft, Sarbaz, Tangsorkh)	• Safety water is provided • Water is stably provided	• Volume of water supply (m3/year)			
4-5. Rural road improvement	• Transportation cost of agricultural products are decreased • Information and commodity flow are activated	• Transportation cost • Saved time by road improvement			
4-6. Building & facility for production, processing & shipment of agricultural and milk products, and handicraft	• Farm labors income are increased • Employment opportunities are increased	• Number of building & facility • Amount of production & shipment			
(Orchard terracing) (Vastegan)	• Income from produced orchard is increased	• Amount of production • Job opportunity			
Non-structural Measures 4-7. Diversification to milk cow (Vastegan, Chaman Goli-Bazoft, Sarbaz, Zeras)	• Farmers income are increased	• Amount of production • Job opportunity			
5. Improvement of agricultural products/ inputs, marketing, extension of agricultural technology, and strengthening of community activities	• Number of cooperative member • Number of attendance to extension services	Structural Measures 5-1. Building & facility for cooperative activity	• Price of agricultural products are adjusted to appropriate prices • Amount of dairy products and handicraft products are increased • Extension services for agriculture and livestock are implemented	• Amount of production • Number of cooperative member • Number of implemented extension services • Number of attendance to extension services	
		5-2. Community center building	• Enlightenment activities against natural disasters are carried out • Health service are promoted • Activities of improvement of living condition to women are promoted	• Number of implemented activities • Number of participants	
		Non-structural Measures 5-3. Establishment of cooperative	• Price of agricultural products are adjusted to appropriate prices • Amount of dairy products and handicraft products are increased • Extension services for agriculture and livestock are implemented	• Amount of production • Number of cooperative member • Number of implemented extension services • Number of attendance to extension services	
		5-4. Community enhancement	• Enlightenment activities against natural disasters are carried out • Health service are promoted • Activities of improvement of living condition to women are promoted	• Number of implemented activities • Number of participants	

Note : O/M=Operation & maintenance.

10.1.2 Basic Policy for Disaster Prevention Works

In order to reinforce and/or supplement the resistance to natural disaster, civil structures in various types and vegetation measures are planned appropriately. With these measures, restoration and/or improvement on the devastated terrain will be accomplished and maintained properly, and eventually flood/debris flow and soil erosion is to be lessened and/or mitigated.

There are so many places physically required to take actions immediately. However, it is not practically possible to implement disaster prevention measures for all hazardous places from the viewpoint of cost and benefit. Thus, as direct objectives, protection of villages, farmland and infrastructure such as roads and irrigation facilities is planned as disaster prevention measures. In the plan formulation, the required number of facilities is examined based on the characteristic of each master plan area, and the urgency, which is dependent on the correlation between direct objectives for protection and degree of devastation.

Check dams, one of the major disaster prevention facilities, have functions of not only storing capacity for debris but also are expected to mitigate the riverbed gradient, prevent vertical/horizontal erosion of the river course, stabilize the foot of slope, prevent the movement of unstable sediment left on the riverbed, prevent devastation of riverbed and river banks and reduce the sediment to be carried downstream. In the planning of check dams, these functions are taken into consideration based on the characteristic of each master plan area.

In the planning of check dams and river treatment, the 25-year design flood discharge is taken into consideration. The materials available at sites are planned to utilize as much as possible and the reduction of construction cost is envisaged.

River-sediment data are very few, and only suspended load data are available at the flow gauging stations in and around the master plan areas. Thus, sediment volume for check dams is estimated with reference to the specific sediment volume of the dams planned in the basin nearby. In case no dams nearby, the specific sediment volume is assumed based on the characteristics of the terrain, geological condition, and river condition.

Landslide has no direct damage on villages, however, causes damage on farmland, roads and irrigation canals. External factor of landslides in the master plan areas is saturation of surface water fed by rainfall or snowmelt, which makes the slope unstable. Therefore, the countermeasures planned here is the drainage system comprised of vertical/horizontal ditch and drop chute in order to drain surface water securely. On the other hand, the main cause of landslides along the river is riverbank erosion at the foot of the slope. In such cases, check dams are effective in order to prevent vertical/horizontal

erosion of the river course and stabilize the foot of landslide slope. In addition, countermeasures are also taken into consideration only the landslides, which cause damage on direct objectives for protection.

There is another aspect of disaster prevention works although those measures do not act directly to disaster prevention. The erosion caused by the degradation of the watershed area becomes serious problem, which produces materials for debris flow. The countermeasure to control sedimentation is fundamentally equal to the countermeasure to control surface erosion in the watershed area. Vegetation recovery by means of controlled number of livestock and period of grazing, spreading seed of natural vegetation, control of cutting forest trees by substituting other fuel, forestation, control of the new reclamation land and improvement of cultivation method will be examined.

Non-structural measures, such as warning and evacuation system during disaster, and training for operation and maintenance on the disaster prevention facilities are to be examined.

10.1.3 Community Development

Most of the inhabitants are poor and have no awareness of disaster which is caused by the degradation of basin environment through overgrazing and cutting trees. The rural inhabitants should have economic stability to spare their resources by themselves for the facilities to prevent disasters. Some amount of capital accumulation will be necessary as only the people with economic sufficiency can afford time and mind for paying attention to environment and disaster. In this connection, many types of agriculture including rehabilitation of irrigation facilities and crop diversification, fish culture, and rural industry promotion should be taken place so as to make the rural people economic independent.

(1) Potential for Development

The Study Areas are generally very far from cities and in the mountainous area where the natural environments are deteriorated by over grazing and forest destruction. Marketing places are limited such as in and round their villages. Large marketing places are far from the areas. Access roads are not paved. Even if mail roads to access roads are paved, they are heavily steep and undulated. Limited areas are near markets. Main activities in the areas are agriculture and livestock. Other is fish culture using good spring water. Handicrafts such as making of gilim and carpets are conducted in some areas. Land for agriculture is limited. Existing agricultural land is located in the mountainous area and lack of irrigation water. On the other hand, population in and around the areas is increasing and that of townships and cities is more rapidly increasing. It causes an increment of unemployment rate and heavy problems in the country. It is also necessary to secure the food supply.

Development potential in the areas is limited. However, production increasing for wheat, barley and

feed would be expected in some areas, provided the construction of irrigation facilities at the perennial rivers. It is also expected to change into cow grazing and make milk and milk products, which is less affected to the environment than the present traditional livestock keeping. It is expected to increase handicraft such as making of gilim and carpet using the wool in the areas or raw materials gotten from cities. There are some places expected for fish culture utilizing springs and good water rivers. For solving over grazing fundamentally, it is necessary to reduce number of sheep and goats drastically. However, rapid reduction will cause destruction of present livestock keeping system depending on sheep and goats that has been traditionally developed and will result in social disorders. Therefore it is necessary for reducing sheep and goats to change present livestock keeping system gradually to milk processing system that makes to add values as well as restoration of vegetation in the rangeland and increase of fodder crop production such as alfalfa.

(2) Development Policies

Land size and production are limited in the Study Areas and the areas are far from marketing places. Therefore, development policies for marketing/processing/rural industry would be considered as follows:

- 1) To formulate the group producing and selling as possible for increasing the efficiency. To emphasize the producers' marketing strength through the unity of producers,
- 2) Therefore, to establish groups and cooperatives and conduct the activities systematically and intentionally,
- 3) For group formulation, to select the products which are produced at present or possible to produce in the future and to choose villagers as its members who have intention to developing their activities,
- 4) For cooperative establishment, to establish one cooperative per village as a rule, the cooperative includes various groups. Minimum unit should be as same size as that of Iran's administration. Minimum number of households may be 40-50. In case of smaller villages than that, it is considered that groups will be able to be established by means of uniting a few small villages near around. However, it is not considered in this stage,
- 5) To apply the participatory development scheme for strengthening the activities by villagers and their groups, and
- 6) To promote the firm formulation of groups for receiving the training and education by the government and to promote the implementation.

(3) Development Plan for Marketing/Processing/Rural Industry

Analyzing the areas' conditions based on the above development potentials and policies, development plans would be designed for handicraft, training and education during the short-term (5 years), for technology transfer and primary processing during the medium (10 years) and for making milk and milk products during long-term (20 years) as follows. It is necessary to apply the participatory

approach and proper training and education by the government for promoting these development plans. The promotion of these development plans should be required the further feasibility study and detailed design study.

Table 10-1-3-1 Development Plan for Marketing/Processing/Rural Industry

No.	Plan	Outline	Period
1	Handicraft promotion	1. Making of good quality carpet	Short term
2	Multi-purpose training center	1. Crop diversification, 2. Plant protection, 3. Primary processing, 4. Handicraft, 5. Cooking, nutrition, 6. Health, hygiene	Short term, Medium term
3	Training and education (technology transfer by the government)	1. Crop diversification, 2. Plant protection, 3. Primary processing, 4. Handicraft, 5. Cooking, nutrition, 6. Health, hygiene	Short term, Medium term
4	Milk production, processing 1. Milk products 2. Milk production	1. Making of milk product (yogurt, butter, Kashk, 2. Milk production and sale	Medium term, Long term
5	Fish culture	1. Rainbow trout production and sale, (Others: carp production and sale)	Medium term, Long term
6	Fruit processing 1. Collecting and grading center (Others: cooling storage facilities, Juice making or Jam making)	1. Apple collecting and grading facilities (Others: grape collecting and grading in future)	Short term, Medium term, Long term
7	Horticultural crops processing 1. Collecting and grading center (Others: cooling storage, Juice making)	1. Fruit vegetable crops (bitter gourd, cucumber, eggplant) 2. Leaf crops (cabbage, lettuce, spinach) 3. Root crops (potato, carrot)	Medium term, Long term

These development plans include "Structure Measure Plans" and "Non-structure Measure Plans". These two plans cannot be divided each other. They should make up for each other for accomplishment of themselves. Structure Measure Plans include procurement of equipment and materials, establishment of facilities, etc. On the other hand, Non-structure Measure Plans include establishment of groups and cooperatives, training and education by government to said groups and cooperatives.

(4) Proposed Plans and Village Selection Criteria

Proposed plans for Marketing/Processing/Rural Industry and village selection criteria are determined by means of the followings: (1) One part of selection criteria is taken into consideration the size of village, size of field, number of livestock, development situation, accessibility to markets, etc based on the socioeconomic survey of the Study Areas, and (2) other part is taken account of proposed areas' infrastructure plans, land use plans and production plans.

Table 10-1-3-2 Proposed Plans, Selection Criteria and Name of Area (Number of Village)

No.	Proposed Plan	Selection Criteria	Name of Area (Number of selected Village)
1	Establishment of groups and cooperatives for handicraft	More than 40-50 households in village, more than 20 households are active for handicraft at present.	Vastegan (4), Bazoft (1), Sarbaz (1), Zeras (4)
2	Establishment of multi-purpose training center	More than 50 households in village.	Vastegan (4), Bazoft (7), Sarbaz (7), Tang Sorkh (1), Zeras (3)
3	Training and education plan (by government)	(Conducting training and education to villagers using the multi-purpose training facilities.)	
4	Establishment of groups and cooperatives for milk processing center	Tolerable households in village at present, more than 100 heads of cow grazed.	Vastegan (4), Bazoft (5), Sarbaz (4), Zeras (2)
5	Collection and distribution center for milk	Tolerable households in village at present, more than 250 heads of cow grazed. More than 500 heads of cow grazed near the village.	Vastegan (1), Bazoft (1), Sarbaz (1)
6	Marketing plan of fish culture products	Tolerable households in village at present, being produced by villagers. Not being produced by entrepreneur.	Bazoft (1) (Rainbow trout),
7	Establishment of apple collecting and grading center	In case of large scale: more than 300ha apple field in village. In case of small scale: more than 100ha apple field in village.	Sarbaz (Large scale), Tang Sorkh (Small scale)
8	Establishment of horticultural crops collecting and grading center	Good accessibility, Considerable market is near the village. More than 30ha horticultural field at present.	Tang Sorkh

Remarks : Details are referred to ANNEX K-15 Proposed Development Plans & Selection Criteria.

10.1.4 Public Work and People's Participation

These civil works such as construction of check dams, rehabilitation of rural road and rural water supply will be implemented by public works in principle. In this case it is very important that people's participation is not for saving investment by using free labour force from people's groups, but for strengthening the people for sustainable development.

To achieve community development under people's initiative, an intensive approach to the village with technical information for plan formulation will be needed, and organizing and strengthening user's committees will trigger community development activities and reduction of vulnerability, then finally achieve a successful disaster prevention and community development project.

It is vitally important to select the farmers group and/or organization, who have strong willingness for development and are positive to pay for their share of project cost. Emphasis should be placed on the "Participatory" planning and implementation for the success of sustainable and positive development. The promotion of the better farmer's participatory organization is also important to get the official subsidies to the project and to receive the governmental training and education.

People's participation will be promoted step by step in the process of project implementation. Relevant government organization, especially in the provincial levers, should assist and facilitate the enhancement of the village organization. There are three steps in the process of the project implementation to enhance function of the village organization.

First step is at the beginning of the project implementation, and the village organization will be established based on the villager's willingness to participation in the projects. All members belong to the village organization will participate in the decision making process of their organization, and participate in the activities of the organization. Through these activities, a sense of participation will be formulated.

At the time of commencement of the project, plan of operations and detail activities of the villager are already designed by the government. The village organization, therefore, just receive the planned project. It should be noted that some of the members of village organization is dubious about for the result and effect of the project. The government officers have to make close communication with the village organization and build up intimate relations with them.

Second step is at the time of monitoring of the project. In the monitoring activities, villagers grasp the problem faced in the project implementation, and discuss how overcome the problems. The results of the monitoring are put into next activities. The village organization reviews their activities and improves their original plan by themselves. Through these activities, villagers can formulate and enhance a sense of ownership for the development projects.

Third step is at the time of completion of the project. At this time, government organization will hold the workshop for project evaluation under participation by village organization. The result of the project evaluation will be put into the next project activities. The village organization will choice next activity among the master plan projects, or will make new project plan based on their willingness to development. The government organization for project implementation have to support and facilitate villager's selection of next activities.

Under the above concept, the Study Team approached the rural people to discuss their needs, issues and willingness of people's participation during the field survey especially in the village survey and tried to make the information effective to formulate the community development plan.

Consequently, it is considered that these targets will be fulfilled through the combination of both : I Disaster Prevention Works and II - Community Development which will be categorized into (1) Structure Measures and (2) Non-structure Measures and should be implemented through both Public Works and People's Participation

These categorized works can be shown in the following matrix table.

		(1) Structure Measures	(2) Non-structure Measures
I Disaster Prevention Works	Public Works		
	People's Participation		
II Community Development	Public Works		
	People's Participation		

10.2 K4-1-9 Vastegan

10.2.1 Construction of Check Dam

(1) Specific Sediment Discharge

In order to estimate sediment discharge of each check dams on Gela River basin, the specific sediment discharge of $400 \text{ m}^3/\text{km}^2/\text{year}$ is applied, while that of the valleys on the steep cliff, $100 \text{ m}^3/\text{km}^2/\text{year}$ is adopted.

(2) Southern Part of Western Upland

This area is categorized as surface erosion type and erosion is very severe here. Therefore, main check dams are allocated to the key points of the upland basin in consideration of the existing check dams, design flood discharge, terrain of the dam sites and tributaries. Thirteen main check dams are planned mainly at just downstream of the confluences of tributaries in order to mitigate the riverbed gradient, prevent vertical/horizontal erosion of the river course, stabilize the foot of slope, prevent the movement of unstable sediment left on the riverbed, prevent devastation of riverbed and river banks and reduce the sediment to be carried downstream.

On the other hand, ten check dams are allocated between main check dams in order to supplement their function. The implementation is to be entrusted to people's participation.

Type C is applied for main check dams and Type D is for check dams.

(3) Narrow Gorge

Three main check dams are planned at the narrow gorge on the Steep Cliff, where all the tributaries on the Western Upland join and flow down into the Eastern Lowland. The main purposes of these dams are to dissipate flood flow energy and to store the sediment. In addition, recharge for groundwater is

expected through the impoundment of partial floodwater. Thus the implementation of these dams should be carried out after the completion of check dams in the upper reaches.

In view of the river condition, Type A is applied for three dams.

(4) Steep Cliff Area around Nasir abad

Five main check dams are planned on the valleys at the Steep Cliff Area around Nasir abad. Behind Nasir abad, two check dams are allocated in order to prevent the debris flow hit to the village directly. North of Nasir abad, also two check dams are allocated for the protection of farmland and a farm road in the downstream area. The last one is sited at the south of Nasir abad so as to decrease the direct damage on the spring, which is the source of irrigation canal and fishpond, farmland and a fishpond.

Type C is applied for main check dams.

(5) Steep Cliff Area around Vastegan

One check dam with Type C is planned on one of the valley at the Steep Cliff Area around Vastegan for the protection of farmland in the downstream area.

(6) Outline of Check Dams

The total number of check dams by type is summarized as follows;

Main check dam (Type A).....	3 Nos.
Main check dam (Type C).....	19 Nos.
Check dam (Type D).....	10 Nos.

(7) Effect of Check Dams

As aforementioned, check dams, one of the major disaster prevention facilities, have functions of not only storing capacity for debris but also are expected to mitigate the riverbed gradient, prevent vertical/horizontal erosion of the river course, stabilize the foot of slope, prevent the movement of unstable sediment left on the riverbed, prevent devastation of riverbed and river banks and reduce the sediment to be carried downstream. However, storing capacity for debris is the only clear index of effect. The total vacant volume (storing capacity for debris) of main check dams is around $110,000m^3$, that of existing check dams $120,000m^3$, and that of 10-check dams by people's participation $30,000m^3$ ($3,000m^3$ per each) and totally become $260,000m^3$. On the other hand, annual sediment discharge is estimated around $15,000m^3$. Thus, the total vacant volume is equivalent to about 17-years of sediment discharge.

10.2.2 River Improvement

After the completion of the check dams in the upstream, the riverbed scouring is expected on the lower reach, downstream of the lowest check dam (No.106). The flood prone plane forms gently sloped alluvial fan, therefore, as countermeasures, the river is improved with channel works and also its channel section is treated.

River improvement plan is divided into two parts; 1) Channel work sections are planned from the lowest check dam (No.106) to the bridge at Vastegan Village (hereinafter called as Sec.-1) and from the bridge at Vastegan Village to the siphon (hereinafter called as Sec.-2). 2) River treatment section is planned from the siphon to the end: around 6.3 km from the bridge (hereinafter called as Sec.-3).

Table 10-2-2-1 River Improvement Plan

	Sec.-1	Sec.-2		Sec.-3		
		Transition (162 m)			Transition	
Design discharge	160 cubic meters per second			180 cubic meters per second		
Channel width (bottom)	20 m	20 ~ 30 m	30 m	30 m	30 m~50 m	50 m
Channel depth	2 m					
Side (bank) slope	1:1	1:1~1:1.5	1:1.5			
Section length	0.8 km	2.7 km		3.6 km		
Riverbed profile	1/50	1/62	1/95-1/115	1/120~1/180		

The number of facilities planned for the channel work is as follows and the drawings and locations are shown in ANNEX.

Sec.-1: Consolidation dam – 2 Nos, Drop check chute - 4 Nos, Groundsill – 14 Nos, Mattress gabion – whole length on both banks

Sec.-2: Consolidation dam – 1 No, Drop check chute - 5 Nos, Groundsill – 36 Nos, Mattress gabion – transition section on both banks

On both banks of Sec.-2, maintenance roads, which are also served as farm road, are aligned with the width of 4 m. These roads connect to the road near Vastegan Village and the maintenance road of the upper irrigation canal. A certain amount of sedimentation is inevitable in the channel, especially on the transition section between Sec.-1 and Sec.-2 because of the change of profile and the width of channel. Thus, several inclined slopes are necessary for removal of such sediments.

Around 100,000 m³ of excavated materials are generated from the channel work, although efforts have been made to reduce the volume. The present river width is 30 ~100 m and 80 m is predominant.

Although the banks of the river are not clear in many locations, the land adjacent to the river is generally abandoned. Therefore, 80 m of river reserve (22 m from the bank shoulder on one side) is planned in order to pile these excavated materials temporarily.

10.2.3 Rangeland Vegetation Improvement

Improvement of rangeland vegetation is carried out in order to mitigate over grazing and to protect soil from erosion. Principles of plans formulated for improvement of rangeland vegetation in five master plan areas are:

- Seed of grasses is sown in parts with less than 40% slope
- Use of simple methods
- Consideration of ecological, social and economical conditions of the areas
- Speedy improvement of vegetation
- Time period for initial implementation, and the consequent treatment cycles is 10 years

In this sub basin, total area of rangeland is 1,142 ha, of which 734 ha have slope less than 40%. In first year seed production plot is established in 4 ha of this area and the remaining 730 is improved through seed sowing. Each year 73 ha (730 ha/10 years) is protected and sown by grass seed. When a new plot is established, the old plot is opened to herds. However seed-sowing area is 73 ha, whenever rangeland utilization norm (communal/ villages uses) does not permits, the work is done in few scattered smaller pieces, sum being 73 ha. 3 watering points for livestock are established in the area. 408 ha with slope more than 40%, are improved through protection and rotational use. Each year 41 ha (408 ha/10 years) is protected to enhance the natural recovery of the vegetation. When protection of a new plot begins, the old plot is opened to herds and utilized in a sustainable manner. However protected area is 41 ha, whenever rangeland utilization norm (communal/ villages uses) does not permits, the practice is performed in few scattered smaller pieces, sum being 41 ha.

10.2.4 Orchard Terracing

In rangeland AL-1, most area is covered with weathered marl soil that is not suitable for cultivation from soil texture aspect. However, some cultivable good soils are located on hilly mound areas. Such areas are used mostly for grazing and partly for dry farming. Orchard terracing is proposed at two locations on such hilly mound areas. This project aims following two effects from aspects of soil conservation and productivity.

Purpose of Project:

- 1) to drastically reduce soil loss from 81 t/ha/yr to negligible zero for 42ha.

2) to increase productivity from 80 kg/ha/yr of grass (dry weight) to 40 t/ha/yr of apple.

Proposed area size of two orchard terracing is 15ha for Area-1 and 27ha for Area-2, totally 42ha. Apple trees will be planted in the proposed areas. Irrigation water will be taken by a small diversion weir and carried by concrete open canal.

Table 10-2-4-1 Orchard Terracing and Facilities in Vastegan

Facilities	Area-1	Area-2
Intake Weir	New Intake Weir : 1 weir (use Proposed Check Dam 304)	Existing Weir: 1 weir (use Existing Weir)
Irrigation Canal	New Canal: 1,300m Q = 24 lit/s Open Concrete Canal B 0.20m x H 0.20 m	Canal: 1,100m Q = 43 lit/s Open Concrete Canal B 0.25m x H 0.20 m
Orchard Terrace	Orchard Terrace: 15ha Slope: 13%	Orchard Terrace: 27ha Slope 13%

Note: Unit water requirement = 1.61 lit/sec/ha

10.2.5 Groundwater Monitoring

Groundwater monitoring system should be established to observe groundwater table and water quality. The system consists of observation wells and database system. Density of wells is determined to be one well in every 10 km² at least. Also the depth of observation well is designed to be 60 meters. This observation well should be equipped with automatic data logger to obtain time series data for long term. Data processing and renewal is proposed to be conducted by computer system in PIC for future utilization of data. Then equipment for groundwater monitoring system is listed as follows.

- Observation well (depth 60 m) 4 nos.
- Database system (data logger, computer, printer, software) 4 sets

It is proposed that Project Implementation Committee (PIC) operate and maintain this system. On the other hand, it is indispensable to consider participatory approach for effective conservation of groundwater resources. For the purpose of education to villagers, PIC should prepare programs for management of groundwater and execute them periodically. By this project, conservation of groundwater will be promoted.

10.2.6 Increased of Irrigated Agriculture

(1) Irrigation Scheme

It is possible to reduce conveyance loss up to 20 % and surplus water is estimated at 26.7 % of present discharge by canal lining. Bijeh Gert left/right bank canals are proposed to be rehabilitated. After

rehabilitation of left canals, surplus water is estimated at 20 liter/s on the basis of field survey. As for right bank canal, it is not expected to produce surplus water. Rehabilitation projects of irrigation scheme are summarized as follows. These canals will be maintained by PIC. By these improvements, expansion of irrigated agriculture and/or increase of crop intensity will be expected.

- Improvement of Bijeh Gerd left bank canal (B 0.3 m x H 0.25 m) 1.7 km
- Improvement of Bijeh Gerd right bank canal (RCP ϕ 500) 2.3 km

(2) Agricultural Scheme

1) Potential of Development

In Vastegan, almost all farmland are irrigable. Farmland is located in alluvial fan and limited. According to the present land use, irrigable crop farmland is 3,524 ha, canals have been constructed, but planted farmland per year is 932 ha. It is quite different from irrigable farmland and planted farmland, because irrigation water source from surface as well as underground are quite limited. In crop farmland, wheat, barley, alfalfa, sugar beat, legume, potatoes, etc. are planted. It is said that irrigated agriculture has already been developed and some irrigation facilities become old. In such conditions, when the canals are rehabilitated, it is possible to obtain more water for irrigation and more agricultural production.

2) Development Plan

According to the above irrigation scheme plan, after rehabilitated the canal of Bijeh Gerd, production area increment in left bank will be reached 12.66 ha for alfalfa (or 10.64 ha for vegetable or 12.42 ha for apple). At present, wheat is planted in this left bank and as irrigation water is limited, alternate irrigation is applied. Considering the feed shortage for livestock, yield of crop, marketing conditions of products and village progress situations, it is recommendable to select the alfalfa to be planted.

Moreover, by the conservation plan, when it is implemented, crops areas could be slightly expanded.

When short period grown seeds are selected and cropping patterns are developed, it would be possible to expand more intensity in whole irrigated farmland considering the limited irrigation water. Such as wheat in winter season + legume (+ vegetable) in summer season would be expected depending on the availability of water. Apple could be planted in same alfalfa farmland, affected little the production of alfalfa.

Ministry of Jihad-Agriculture and related institutes should develop the cropping patterns for intensive agriculture, selection of seed variety, planting technology such as fertilizer application, improved pest management as well as conduct the application examination in the selected area before dissemination of the said seeds and cropping pattern, and promote the mechanization of agriculture with the provision of low interest loan to farmers.

10.2.7 Diversification to Milk Cow

(1) Potential of Development

In Vategan, over grazing rate is of 5.2. Development potential is very low, even if the feed would be obtained by purchasing.

(2) Development Plan of Diversification

However, it is possible to change the meat cow to milk cow in future for one of the method of reducing sheep and goats number. It will stabilize introduction of milk cow and milk processing industry, and make people to reduce number of sheep and goats for mitigating over grazing by means of adding values to products. According to the Livestock Office of Provincial Jihad, they promote to diversify into milk cow, varieties of which are Holstein and Semi-local.

In case of diversifying Local variety to Semi-local variety, milk production would be increased 8-11 litre/day and its duration is enlarged 40 days. Total milk production is increased 2,160-3,170 litre/year or average 2,665 litre/year per head. When all cows at present are diversified to milk cows, number of which will be reached 750 heads in the Vastegan Study Area.

This diversification plan should be promoted step by step with the help of Livestock Office, considering progress of artificial insemination, disease control, registering method, inspection method for milk cow as well as pasteurization, sterilization, disease control, inspection method for raw milk.

(3) Marketing Plan of Milk

Marketing plan should be conducted during the half time of diversification progressed or after diversified. For marketing of milk, it is necessary to apply the participatory approach, establishment of groups & cooperatives and proper training & education by the government for promoting these development plans. The promotion of these development plans should be required the further feasibility study and detailed design study. Plans are as follows:

Establishment of groups and cooperatives for milk processing center:	medium-, long-term
Collection & distribution center for milk:	long-term

1) Establishment of groups and cooperatives for milk processing center (medium-term)

a) Purpose:

To change to cow-grazing and to promote the sale of milk-processed products.

b) Participants:

A group should be established, whose members should grow cows and have intention for

development. Group should be set in a cooperative. The cooperative should be formed within each village, whose size should be as same level as Iran's administration.

c) Structural Measures:

Size of facilities: To establish the collection and distribution facilities for processed milk products. Approx. 1.0 t/day.

- Form of facilities: It should be constructed using the suitable materials for this area and environment and taking into consideration the participatory scheme. Basically, main building material is brick.
- Proposed villages: Konark Olya, Konark Sofla, Nasir Abad and Vastegan: 4 places
- Required equipment, materials and facilities for one place: Building, vehicle, mixing machine, etc.

2) Collection & distribution center for milk (long-term)

a) Purpose:

To promote sale of milk products.

b) Participants:

Participants will be villagers who graze cow or have intentions to produce milk products.

c) Structural Measures:

Size of facilities: To establish the collection and distribution facilities for condensed milk. Approx. 5t/day.

- Form of facilities: It should be constructed using the suitable materials for this area and environment and taking into consideration the participatory scheme. Basically, main building material is brick.
- Proposed villages: Konark Olya; 1 place
- Required equipment, materials and facilities: Building, vehicle, bulk cooler, etc.

10.2.8 Rural Water Supply Improvement

Domestic water demand per capita is applied to be 180 liter/day/person according to the suggestion by SED. Expansion of rural water supply in each village is proposed on the basis of estimated population in 2020. Surplus water demand by 2020 is 176 m³/day. Then it is planned to expand distribution tanks and connection pipeline for surplus water supply. Here, capacity of distribution tank is designed to be the volume of water supply for 12 hours and 30 % spare.

Dimensions of distribution tanks and pipeline are summarized as follows. It is desirable to execute projects on the two stages aimed to 2010 and 2020. Rural Water and Waste Water Company (RWWC) will operate and maintain facilities and collect water charges in cooperation with PIC. In addition, PIC will enhance villagers to recognize water charge system and desirable water use for 5

years after completion of construction. By these projects, necessary and clean water will be provided.

Table 10-2-8-1 Proposed Plan for Water Supply

Village	Distribution Tank	Pipeline
Konark Olya	B 7.8 m x L 7.8 m x H 3.0 m	PVC Pipe ϕ 75, L=900 m
Konark Sofla	B 4.2 m x L 4.2 m x H 3.0 m	PVC Pipe ϕ 50, L=200 m
Nasir Abad	B 5.4 m x L 5.4 m x H 3.0 m	PVC Pipe ϕ 50, L=400 m
Vastegan	B 6.3 m x L 6.3 m x H 3.0 m	PVC Pipe ϕ 75, L=600 m

10.2.9 Rural Road Improvement

There is a small unpaved road which passes along the Gandoman Wetland. For improvement of access conditions from villages to farmlands, construction of gravel paved road is proposed. Widths of road and pavement are designed to be 4 m and 3 m respectively. Rural road will be maintained by PIC. As for farm road, villagers will have responsibility for construction and maintenance. Project components in Vastegan are summarized as follows. By these projects, expenditure of driving will be reduced.

- Construction of gravel pavement road 9 km
- Transfer of technology for maintenance of road and side drain 5 years
- Construction and maintenance of farm roads by farmers 476 km

10.2.10 Establishment of Cooperatives

For establishment of cooperatives, it is necessary to apply the participatory approach and proper training and education by the government for promoting these development plans. Development plans are as follows:

- (1) Establishment of groups and cooperatives for handicraft: short-term
 - (2) Establishment of multi-purpose training center: short-term
 - (3) Training and education plan by government: short- medium-term
 - (4) Others (for formerly mentioned plans; establishment of groups and cooperatives for milk processing center and collection & distribution center for milk)
- (1) Establishment of groups and cooperatives for handicraft (short-term)
- 1) Purpose:
To emphasize villagers and promote the sale of produces and processed products made of and from raw materials grown in this area.
 - 2) Participants:

A group should be established, whose members should grow the raw materials and have intention for development. Group should be set in a cooperative. The cooperative should be formed within each village, whose size should be as same level as that of Iran's administration.

3) Structural measures:

- (a) Size of group: It will be set that one unit is 100 households in village. Size of group is of 20 members within the said village.
- (b) Proposed villages: Konark Olya, Konark Sofla, Nasir Abad and Vastegan; 4 places
- (c) Required equipment, materials and facilities for one place (In case of production of gilim and carpet): Building, weaving machine, etc.

However, in case of establishing multi-purpose training facilities, it should be used the said facilities for it.

(2) Establishment of multi-purpose training center (short-term)

1) Purpose:

To promote villagers, groups members for production and sales by area's processing and handicraft activities as well as to train and educate them for area's development.

2) Size of facilities:

Participants would be group members, cooperative members and villagers. If all villagers will happen to attend the meetings, a school or other larger place would be selected as venue. The standard size of multi-purpose training facilities should be for 50 persons. Facilities include building and play-yard.

3) Structural measures:

- (a) Size of facilities: Based on one village 100 households, required multi-purpose facilities to be constructed will be as large for 50 persons. Approx. 50m².
- (b) Form of building: It should be constructed using the suitable materials for this area and environment and taking into consideration the participatory scheme. Basically, main building material is brick.
- (c) Proposed villages: Konark Olya, Konark Sofla, Nasir Abad and Vastegan: 4 places
- (d) Required equipment, materials and facilities: Building, etc.

(3) Training and education plan by government (short-, medium-term)

1) Purpose:

To instruct, train, educate and transfer the technology to group and cooperative members and villagers for development of areas.

2) Extension service organization:

To improve the organization so as to be able to instruct, train, educate and transfer the technology to group and cooperative members and villagers.

- 3) Structural measures: None.

Each plan is basically independent. However, there would be rooms for reciprocal affection or common usage. Development plan should be implemented step by step. Suitable development could be led by conducting the monitoring, evaluation and feed back step by step taking into consideration the levels and situations of around development.

10.2.11 Community Enhancement

(1) Purpose

- a) To promote villager's participation in the projects implementation,
- b) To build up villager's mind for mutual aid, and capability against natural disasters,
- c) To strengthen villager's living environment.

(2) Organizing Villagers

To realize above purposes, village organization is planned to establish. Relevant government organizations, both in central and local levels, have to facilitate the establishment of the village organization, in cooperation with Village Islamic Councils. All villagers are naturally member of the village organization. But, the member of the organization should be formed case by case, based on the purpose of the project. Such type of project as profitable and, therefore, villager have to bear a part of project cost, should be organized by those villagers who have a willingness to the development. Followings are procedure for establishment of village organization.

- a) Relevant government organization, both in central and local government, establish committee for M/P project which promote implementation of proposed projects and facilitate the establishment of village organization.
- b) The government committee holds meeting with representatives of Village Islamic Councils to explain the project purpose, project components, implementation method, etc.
- c) Representatives of Village Islamic Council hold small meeting at each villages to explain outline of the project.
- d) The government committee facilitates to establish villager's organization based on the villager's willingness to participation in the project.
- e) The village organization discusses and establishes organizational structure, rules and regulations of operation, detail plan for participation in the project, etc., under the support by the government committee and Village Islamic Councils.

Followings are remarks of establishment of village organization

- Project Coordination Committee should facilitate establishment of the village organization in

cooperation with Village Islamic Council. The council is helpful to promote villager's participation, and to establish rules and regulations of the organization, and to arbitrate villager's conflict if it happens,

- Participatory approach should be taken into consideration at the beginning of the establishment. It is recommended to hold workshop to pull out villager's frank opinion when plan of operation and monitoring are formulated by villagers themselves,
- At the time of establishment of rules and regulation, including account system, general meeting should be held with all members' participation. It is quite important that all villagers participate in the decision making of important issue. Such issue as member's rights, duties, and penal regulation are also the matter of general meeting,
- All villagers in the organization, including member of Village Islamic Council, should have a vote as an individual right of members. It is important that all members have equal right to participate in their decision-making.

(3) Activities

Activities of village organization should be planned and conducted through discussion among members in the organization. Followings are basic activities to attain the purpose of community enhancement.

- a) Participation in implementation, operation and maintenance of the projects in cooperation with local and/or central government.
- b) Participation in monitoring and evaluation of the projects in corporation with relevant government officers,
- c) Participation in such enlightenment activities as project for sedimentation, flood and debris flow, implemented in other master plan areas.
- d) Promotion of health services and nutritional education.
- e) Meeting with other village organizations and relevant government organization to exchange information and experience which obtain through the projects.

Community enhancement will be promoted step by step in the process of project implementation. Relevant government organization, especially in the provincial levers, should assist and facilitate the enhancement of the village organization. There are tree steps in the process of the project implementation to enhance function of the village organization.

First step is at the beginning of the project implementation, and the village organization will be established based on the villager's willingness to participation in the projects. All members belong to the village organization will participate in the decision making process of their organization, and participate in the activities of the organization. Through these activities, a sense of participation will be formulated.

At the time of commencement of the project, plan of operations and detail activities of the villager are already designed by the government. The village organization, therefore, just receive the planned project. It should be noted that some of the members of village organization is dubious about for the result and effect of the project. The government officers have to make close communication with the village organization and build up intimate relations with them.

Second step is at the time of monitoring of the project. In the monitoring activities, villagers grasp the problem faced in the project implementation, and discuss how overcome the problems. The results of the monitoring are put into next activities. The village organization reviews their activities and improves their original plan by themselves. Through these activities, villagers can formulate and enhance a sense of ownership for the development projects.

Third step is at the time of completion of the project. At this time, government organization will hold the workshop for project evaluation under participation by village organization. The result of the project evaluation will be put into the next project activities. The village organization will choice next activity among the master plan projects, or will make new project plan based on their willingness to development. The government organization for project implementation have to support and facilitate villager' selection of next activities.

According to the interview survey, carried out by JICA Study Team, about 100ha of farmland located along by the Gela River was flooded in 1998, and part of the land is still covered with sediment. This kind of problems should be discussed in the organization, and such actions as sediment removal should be taken by mutual aid among villagers.

10.2.12 Increment of Household Income and Job Creation

Increasing household income and job opportunity is one of the most important matters in the villages in the Study Areas. Development plan will include the contents of increasing household income and job creation. These, in case of being fully developed, are shown as income generating activities below:

Table 10-2-12-1 Job Creation and Yearly Income Increment (with plan, fully developed)

Items	Job Creation (number)	Income Increment (Riel)	Increased income per household or person (Riel/H.H or person)
Diversification of Milk Cow			
Milk production (whole villages)	606 households	1,998,750,000	3,298,270 per h.h.
Milk processing center (4 villages)	606 households 20 operators	449,080,000 129,500,000	741,056 per h.h. 6,475,000 per p.
Milk collection & distribution center (one village)	250 households 7 operators	394,870,000 37,375,000	1,579,480 per h.h. 5,339,286 per p.
Handicraft facilities (4 places)	80 members 80 weavers	101,720,000 96,000,000	1,271,500 per p. 1,200,000 per p.

Note: Details are referred to ANNEX L Economic and Financial Evaluation, Annual O/M Cost and Value of Output.

10.3 K5-19a Bazoft

10.3.1 Construction of Check Dam

(1) Specific Sediment Discharge

Based on the topography, geological condition and riverbed condition, the specific sediment discharge for Gusale Bar River basin is applied $500 \text{ m}^3/\text{km}^2/\text{year}$, while that of the rivers of Feriak, Tabarak and others is adopted $300 \text{ m}^3/\text{km}^2/\text{year}$.

(2) Feriak River Basin

The catchment area of this basin is only 3 km^2 and has no flow in dry season. The oak forest seems well maintained, and farmland and houses are only located in the lower reaches. The riverbed gradient is steep in the middle reaches, however, it is mild in the upper and lower reaches.

Three main check dams of Type C are planned to mitigate the riverbed gradient, prevent the movement of unstable sediment left on the riverbed, prevent devastation of riverbed and river banks and reduce the sediment to be carried downstream, and protection of farmland and houses.

(3) Gusale Bar River Basin

Two right tributaries have large fan-shaped catchment areas and flood is very severe during snowmelt period and heavy rain. Judging from geology and river condition, debris flow is not so much in the upper right tributary than that of the lower.

a) Upper Reaches

On the right bank, gentle slope plateau is extending, while on the left bank a ridge with steep slope runs along the main road. Thick quaternary soil deposited on the right bank, while Marl and sandstone layers are formed on the left bank.

The deposited soil on the right bank is easily saturated and becomes muddy flow during snowmelt period and heavy rain. This area is categorized as perviousness erosion type and two countermeasures are considered; the vegetation work suited with soil condition and the channel work to prevent erosion by rainwater. However, the area is the utmost upper reaches and the tributary is very small stream without water most of the time, therefore only the vegetation work is to be applied here. In 1996, a severe debris/muddy flow occurred here and one of the Nomad tents was washed down. Three Nomads were killed and two or three were missing. The vegetation work should be implemented at the early stage.

b) Utmost Right Tributary Basin

This tributary has a large fan-shaped catchment area. Flood occurs frequently and causes some damage to the irrigation intake located at the narrow gorge in the middle reaches during snowmelt period and heavy rain.

Judging from the geological information, upper reaches seems to be stable, however, the river course in the lower reaches downstream of the narrow gorge is very devastated with very big boulders. Upstream of the irrigation intake at the narrow gorge, sedimentation is very scarce because of the flow velocity. Farmland and houses in the lower reaches are located apart from the river course and are not receiving serious damage from the river. In addition, a few temporary irrigation intakes made of earth mound are placed on the river course.

One main check dam with the height of 10 m is planned at the narrow gorge, immediate upstream of the irrigation intake in order to mitigate the riverbed gradient, prevent the movement of unstable sediment left on the riverbed, reduce the sediment to be carried downstream, and protect the existing irrigation intake. In addition, intake facility is to be installed on this check dam so as to stabilize the water for irrigation because this tributary has flow throughout the year.

c) Right Tributary Basin

This tributary also has a large fan-shaped catchment area. Flood occurs frequently and carries a lot of debris downstream from the riverbanks and the riverbed of the tributary, which are mainly composed of riverbank sediment. Farmland and houses in this basin are located on the riverbanks and are not receiving serious damage from the river.

Four main check dams with Type C are planned on this tributary in order to reduce the sediment to be carried downstream.

d) Right Tributaries on the Lower Reaches

Several short-steep tributaries flow into Gusale Bar River, just upstream of the sharp bent of the river course. These tributaries are located on the old riverbank deposit, therefore, small and big gravels/boulders are flushed down during snowmelt period and heavy rain.

Three main check dams with Type D are planned on the three tributaries in order to mitigate the riverbed gradient and prevent the movement of unstable deposit.

e) Left Tributaries at Baghchnar and Dorak

Several tributaries flow down from the mountains with thinly vegetated and erosive slopes and pass through these villages. The riverbeds become deeper and deeper and the riverbanks are extended into the farmland adjacent to the rivers.

The countermeasures to be considered here are to construct one main check dam on each tributary as a model and then other check dams are to be implemented by people's participation. Thus, two main check dams and six check dams are allocated in Baghchnar, and one main check dam and two check dams are planned in Dorak.

f) Main River Course

Four main check dams with Type C are planned on the main river course of Gusale Bar River in order to mitigate the riverbed gradient, stabilize the foot of slope, prevent the movement of unstable sediment left on the riverbed, prevent devastation of riverbed and river banks and reduce the sediment to be carried downstream. Among these main dams, the one planned downstream of Dorak is to protect landslide by means of stabilizing the foot of landslide slope.

(4) Tabarak River Basin

The basin shares almost half of the master plan area in the south and has a large fan-shaped catchment area. Two left tributaries near Tabarak Olya, and three right ones near Ghale Tabarak and Tabarak Sofla have been devastated, whereas the main river course with no inhabitants is not so much.

a) Right Tributaries

In the utmost upper reaches of the right tributary, debris derived from the hillside collapse covers the foot of the hillside. At present, the debris seems to be halted its movement by oak forest, while the forest is decreasing because Nomad cut these oak trees for living. Therefore, the countermeasures to prohibit tree cutting and to preserve forest are necessary in order to prevent the debris movement.

As the right banks of the right tributaries are liable to collapse or to be eroded easily, one main check dam with Type C, and two check dams to be implemented by people's participation are planned in order to stabilize the foot of slope, prevent the movement of unstable sediment left on the riverbed and prevent devastation of riverbed and river banks.

b) Left Tributaries

Devastation has been started in the upper reaches of the left tributaries because the villagers in Tabarak Olya and Nomad have been opened the oak forest in the area for cultivation. Countermeasures to prohibit opening forest and to preserve forest are necessary in order to prevent devastation.

Two main check dams with Type C are planned in order to stabilize the foot of slope, prevent the movement of unstable sediment left on the riverbed and prevent devastation of riverbed and riverbanks.

c) Main River Course

The devastation in the main river course is very limited, however, there is a landslide area located around 1 km upstream from Tabarak Sofla. Two check dams to be implemented by people's participation are planned in order to stabilize the foot of slope, prevent the movement of unstable sediment left on the riverbed and prevent devastation of riverbed and riverbanks.

(5) Other Tributaries

Main check dams are planned on the small tributaries, which flow Bazoft River directly.

a) Tributary-South of Chemghaleh

One small tributary located south of Chemghaleh, which crosses the road to Tabarak Sofla, sometimes causes flood and debris flow damage on the farmland and the road.

One main check dam with Type C is planned on this tributary.

b) Tributary-Southeast of Ghale Tabarak

Small farmland is located in the southeast of Ghale Tabarak and one small tributary with the catchment area of 0.5 km² runs through the farmland and joins into Bazoft River. The land in this area is so very erosive that the riverbed of the tributary becomes deeper and deeper and the riverbanks are extended into the farmland adjacent to the tributary.

One main check dam with Type C, and two check dams to be implemented by people's participation are planned in order to stabilize the foot of slope and prevent devastation of riverbed and riverbanks.

(6) Outline of Check Dams

The total number of check dams by type is summarized as follows;

Main check dam (Type A)	1 No.
Main check dam (Type B).....	1 No.
Main check dam (Type C).....	19 Nos.
Main check dam (Type D)	3 Nos.
Check dam (Type D)	14 Nos.

(7) Effect of Check Dams

The check dams planned here are mainly considering preventing the devastation of the basins, therefore, the storing capacity for debris is rather limited. However, the effect of check dams is to secure stable intake of irrigation water, to secure farmland, orchard, and village and to stabilize the foot of landslide slope. The total vacant volume (storing capacity for debris) of main check dams is around 53,800m³, that of existing check dams 800m³, and that of 14-check dams by people's participation

28,000m³ (2,000m³ per each) and totally become 82,600m³. On the other hand, annual sediment discharge is estimated around 30,500m³. Thus, the total vacant volume is equivalent to about 3-years of sediment discharge.

10.3.2 River Treatment

Lower reaches of Gusale Bar River bends sharply before entering into Bazoft River. Especially at around 800 m upstream of the confluence, there are two sharp bends and the riverbank erosion is so severe here that the riverbanks are extended into the farmland. The right bank of Bazoft River, just downstream of the confluence with Fariak River, farmland is eroded mainly because of the direction of river course of Bazoft. Countermeasures are planned on these locations as follows;

(1) Lower Reaches of Gusale Bar River

Riverbank erosion is so severe here because of the sharp bend of the river course, energy of the flooded water, and riverbank material being composed of riverbed sediment. Two ground sills and several spur dikes are planned for the bank protection. Two groundsills are placed just at immediate upstream of the first and the second bend from the bridge on the main road, while spur dikes are arranged at the two bends so as to keep away the water course from both banks and to protect land and farmland adjacent to the river.

(2) Right bank of Bazoft

Bazoft River bends sharply at this location and a narrow valley is located just upstream, therefore, floodwater hits to the right bank of Bazoft and causes erosion. Villagers of Fariak cultivate this bank and gabion type bank protection by people's participation is planned on this section, from the confluence with Fariak River to that of Gusale Bar River. The length of bank protection is around 500 m.

10.3.3 Landslide Protection and Rock-fall Protection

On the upper and middle reaches of Gusale Bar River, the main road runs along the left bank, where steep slope is formed with Marl and sandstone layers. Rock fall sometimes occur on this slope and causes damage on houses of Kachooz and the main road especially after heavy rain.

Retaining wall type rock fall protection is planned here in order to protect the lives and houses along the road. The planned rock fall protection is 3 m height with rubble concrete and the length of implementation is around 100 m.

Landslide occurs on the left bank of Gusale BarRiver, the vicinity of Tabarak sofla and Ghale Tabarak,

and south of Chemghaleh. The main cause of these landslides is saturation of surface water fed by rainfall of snowmelt, which makes the slope unstable. Therefore, the countermeasures planned here is the drainage system comprised of vertical/horizontal ditch and drop chute. On the other hand, the main cause of landslides along the river is riverbank erosion at the foot of the slope. In such cases, check dams are effective in order to prevent vertical/horizontal erosion of the river course and stabilize the foot of landslide slope.

The vertical and horizontal ditches are aligned in and around the landslide area, and drop chutes are allocated at every 20 m on the vertical ditches. As for the landslides on the Tabarak River, only check dams are allocated because they won't cause direct damage to houses, roads and farmland. The road sections to be protected with such countermeasures are estimated at around 6 km.

10.3.4 Soil Erosion Protection

In Chaman Goli-Bazoft, present basin-wise erosion rate is estimated at 17.7 t/ha/yr or 1.3 mm/yr, that is the lowest following Sarbaz. The soil loss is concentrated in rangeland and dry farmland. Dry farmland soil loss is estimated at 25.3 t/ha/yr or 1.8 mm/yr and rangeland soil loss is at 33.8 t/ha/yr or 2.4 mm/yr that are equivalent to 1.4 and 1.9 times of the basin-wise soil loss. The basin-wise soil loss will be reduced to 14.1 t/ha/yr or 1.0 mm/yr in future.

(1) Allowable Soil Loss

Problematic land use categories are dry farmland and rangeland from an aspect of soil erosion. There are no problems on soil erosion such as in the irrigated farmland, orchard and tree plantation.

There is no particular standard for the allowable soil loss in Iran. As the allowable annual soil loss for the farmland, 10 to 15 t/ha is considered in Japan, and US Department of Agriculture indicates 4.5 to 11.2 t/ha. Taking steepness of topography in the Study Area into consideration, 15 t/ha/yr is considered to be allowable soil loss in the Study Area. In case this standard is applied, dry farmland of about 2,900 ha or 78% of total dry farmland and rangeland of 12,800 ha or 85% of total rangeland are to be protected from soil erosion in 5 Master Plan areas.

(2) Protection Measures

For the dry farmland, contour bund method will be selected as the protection measures in the Study Area from the following aspects:

- Contour bund is easy and cheap on construction, and it is suited for the people's participation work.
- It is also easy in maintenance and repairing by people.

- It is already practiced and constructed by stone where stony soils are extended.
- Soil is too shallow for terracing and it is expensive except orchard terracing.
- Local materials such as stone and gravel are able to be fully utilized.

It is recommended to employ vegetative contour bund or contour hedges in the steep slopes over 40% inclination, because structural works are difficult in such steep slopes. Vetiver grass is recommended for this purpose. In case difficulties arise only by contour bund, crop diversification should be considered such as introduction of dry type alfalfa instead of wheat or in fallow land.

For the rangeland, tow different measures are undertaken as follows:

- Seeding for the deteriorated rangelands where the slope is less than 40% from a viewpoint of accessibility.
- Protection for the rangelands with less deterioration and the rangeland where the slope exceeds 40%.

It is difficult to set up the standard of allowable soil loss for the rangeland, because it depends on the improvement effects of protection and seeding. In this Study, following standards of effects by vegetation restoration are set based on the analysis:

- Seeding is able to reduce the soil loss within 15 t/ha/yr in all rangelands.
- Protection is able to reduce the soil loss, but the effects are rather limited and depending on the degree of deterioration of rangeland.

(3) Waterway and Gully Protection

Once contour bund is established in the land, rain water runs slower along the contour bund and the time of flood concentration becomes generally longer and the flood peak is reduced. It is safer to the downstream, but runoff discharge concentrates to the outlet from the tail of contour bund. Therefore, the riprap may be needed at the outlet to protect it and to avoid erosion. Due to gravelly soil in the area, the bottom of waterway is generally protected by the deposit of gravel and stone.

On the other hand, gully erosions are observed in the dry farmlands in Chaman Goli-Bazot and Zeras. Such farmlands are necessary to be protected from gully erosion. For protecting land from gully erosion, check dam has been considered for protecting the farmland from gully erosion.

Many check dams are necessary in case of steeper slope than 20%. It is, therefore, recommended to employ following criteria on construction of check dams taking participation of villagers into consideration.

- 1) From viewpoint of economic effect and villagers' participation, check dams are considered to be

concentrated in the farmland and to the smaller gullies. In this case, villagers are expected to attain the protection work to protect and save the farmland by themselves.

- 2) On the other hand, large gullies are existing and enlarging at the foot of hills and mountains. Some of them may cause serious damages not only to the farmland but also to the villages. Such large gullies are difficult for villagers to control. Those gullies should be protected by public works.
- 3) For the smaller gullies, loose-rock check dam will be employed from the viewpoints of easiness of construction and availability of materials. As a standard, the loose-rock check dam with a height of 1.0 m and a space of 20 m will be considered to the gullies less than 20 % gradient.

(4) Plan of Approach to Surface Erosion Protection

It is not right way to approach to establish the surface erosion protection plan only from the severity of present erosion conditions. It is necessary to approach taking the future plans of agriculture and rangeland improvement into account. Agriculture development plan Scenario-1 has been prepared from the aspects of present farming system and future requirement. On the other hand, rangeland improvement plan has been established in order to increase productivity of grasses for livestock in the various type of rangelands.

For the Scenario-1, soil protection plan was prepared according to the Agriculture Development Plan and the Rangeland Improvement Plan. However, in some farmlands especially with a steeper slope, it is difficult to keep the soil loss within the allowable level only by contour bund. In such case, it is considered to change crops to more protective crops such as dry type alfalfa or tree crops as well as to reduce the fallow land where the farmlands are left without cultivation. On such considerations, Senario-2 has been prepared.

For the rangeland improvement, further improvement plan was not prepared, because structural measures for the rangeland are not yet proved from the technical and economical aspects. It is recommended to experiment on possibility of seeding measures in the steep rangeland in the Further Study as described in Section 8.7.3.

(5) Prospect of Soil Erosion Protection in Scenario-2 in 5 Master Plan Areas

In order to prospect the soil erosion protection for 5 Master Plan areas in Scenario-2, important elements of plan have been analyzed as below.

- Erosion of all dry farmlands will decrease below the allowable level of 15 t/ha/yr (1.1 mm/yr) in Scenario-2.
- Erosion of rangeland of about 41% still remains above the allowable level in Scenario-2.

(6) Benefit of Surface Erosion Protection

Farmland price is about R4,000/m² by interview in the Study area. Based on this price, soil value is estimated at R40,000,000/ha for topsoil of 30 cm depth. When a depth of 1 mm could be saved in a year, benefit of surface erosion protection becomes R133,000/ha/yr.

(7) Plan of Surface Soil Erosion Protection in Chaman Goli-Bazoft

1) Surface Erosion Protection of Farmland

- Irrigated Farmland

Although some soil loss is observed in the furrow irrigation system, erosion of the irrigated farmland is kept rather small at 1.4 t/ha/yr (0.1 mm/yr) within the allowable level.

- Dry farmland and Forest with Dry Farming

For the surface soil erosion protection of the dry farmland and the forest with dry farming, contour bund provision of 25 m interval in average is proposed in 798 ha as well as crop diversification to alfalfa. Annual erosion rate is reduced from 32.4 t/ha (2.31 mm) to 13.3 t/ha (0.95 mm). Plan of soil erosion protection for farmland is summarized as follows:

Table 10-3-4-1 Surface Erosion Protection for Dry Farmland in Chaman Goli-Bazoft

Area (ha)	Type of Farmland	Slope	Facility	Alfalfa Introduction	Soil Loss	
					Present	Senario-2
798	Dry farmland	13%-40%	Contour Bund (25 m interval in average)	62ha	32.4 t/ha/yr	13.3 t/ha/yr
	Forest with Dry Farming				2.31 mm/yr	0.95 mm/yr

2) Rangeland Protection

Vegetation improvement is carried out in 857ha by protection and in 1,018ha by seeding, totally in 1,875ha. The annual erosion rate of rangeland is improved from 33.8 t/ha (2.4 mm) to 20.9 t/ha (1.5 mm) in total average. Seeding is able to reduce erosion from 27t/ha to 13 t/ha, that is below the allowable level, while protection is not able to reduce erosion enough. The erosion decreases from 42t/ha only to 30t/ha by protection.

3) Gully Protection

Gully protection is planned to protect the farmland in laying the loose-rock check dams in the gully. Ten gullies with the average length of 150 m are selected for implementation. The check dams of 75 numbers will be allocated at every 20 m in the gullies. By the provision of those check dams, the farmland of about 30 ha will be protected in the surroundings of Dorak village.

10.3.5 Rangeland Vegetation Improvement

Improvement of rangeland vegetation is carried out in order to mitigate over grazing and to protect soil from erosion. Total area of rangeland is 1,875 ha. Of this 1,019 ha with slope less than 40% is used for seed production plot (4 ha) and seed sowing plots (1,015). Each 101 ha (1,015 ha/10 years) is protected and sown with grass seeds. When a new plot is established, the old plot is opened to herds. However seed-sowing area is 101 ha, whenever rangeland utilization norm (communal/ villages uses) does not permits, the work is done in few scattered smaller pieces, sum being 101 ha.

3 watering points for livestock are established in the area. The remaining 856 ha having slope more than 40% are improved through protection and rotational use. Each year 86 ha (856 ha/ 10 years) is protected for natural recovery of its vegetation. The plots are used rotationally in a sustainable manner. However protected area is 86 ha, whenever rangeland utilization norm (communal/ villages uses) does not permits, the practice is performed in few scattered smaller pieces, sum being 86 ha.

10.3.6 Forestland Vegetation Recovery

Total area of forestland is 127 ha, of which 40 ha need recovery works. In a year 4 ha (40 ha/10 years) is sown by almond seeds to establish 400 plant/ha. The established plots are strictly protected for economical and environmental conservation benefits.

10.3.7 Increased of Irrigated Agriculture

(1) Irrigation Scheme

It is possible to reduce conveyance loss up to 20 % and surplus water is estimated at 26.7 % of present discharge by canal lining. It is planned to improve check dams as intakes and canals together. After improvement of these canals, surplus water is estimated as follows.

Table 10-3-7-1 Surplus Water and Imigation Demand Water of Major Crops

Canal	Production of Surplus Water (liters/s)	Water Demand (liters/s/ha)		
		Alfalfa	Vegetable	Apple
Gusaleh Bar left bank canal	40	1.56	1.88	1.64
Gusaaleh Bar right bank canal	23			
Kachooz canal	10			

Source) JICA Study Team and Revised Data of MOA

Major projects of irrigation scheme are summarized as follows. These canals will be maintained by PIC. By these projects, expansion of irrigated agriculture and/or increase of cropping intensity will be expected.

- Improvement of Gusaleh Bar left bank canal (B 0.40 m x H 0.40 m) 2.4 km

- Improvement of Gusaleh Bar right bank canal (B 0.70 m x H 0.45 m) 4.5 km

(2) Agricultural Scheme

1) Potential of Development

In Charman Goli-Bazoft, approximately half of total farmland is irrigable. Farmland is located in narrow alluvial fan and limited. In farmland, wheat, barley, alfalfa and vegetable are planted. It is said that irrigated agriculture has already been developed. However, some irrigation canals are constructed of earth. In such conditions, when the canals are rehabilitated, it is possible to obtain more water for irrigation and more agricultural production.

2) Development Plan

According to the above irrigation scheme plan, after rehabilitated the canal of Gusaleh Bar left and right banks and Kachooz, production area increment will be reached 46.79 ha for alfalfa, (38.83 ha for vegetable or 44.51 ha for apple). At present, wheat is planted in these banks and as irrigation water is limited, crops are not planted in summer season. Considering feed shortage of the livestock, yield of crops, marketing conditions of products and village progress situations, it is recommendable to select alfalfa to be planted.

Moreover, by the conservation plan, when it is implemented, crops areas could be slightly expanded.

When short period grown seeds are selected and cropping patterns are developed, it would be possible to expand more intensity in whole irrigated farmland considering the limited irrigation water. Such as wheat in winter season + legume (+ vegetable) in summer season would be expected depending on the availability of water. Apple could be planted in same alfalfa farmland, affected little the production of alfalfa.

Ministry of Jihad-Agriculture and related institutes should develop the cropping pattern for intensive agriculture, selection of seed variety, planting technology such as fertilizer application, improved pest management as well as conduct the application examination in the selected area before dissemination of the said cropping pattern and promote the mechanization of agriculture with the provision of low interest loan to the farmers.

10.3.8 Fish Culture Promotion

(1) General

At present, promotion of fish culture is conducted in Ghale Tabarak village under the Provincial Project. The dyke has already been constructed to obtain water through the canal. This plan includes construction of sediment pond to remove sand and impurities and to take good quality water into fish

culture. Production volume in a year may be 200t. Application form has already been submitted to the Fishery Organization in the Province and form of fund support has also been submitted.

(2) Marketing Plan

Taking into consideration such conditions such as that fish-breeding center is under construction and production volume would be huge, marketing plan of fish culture products is designed as follows. It is necessary to apply the participatory approach and proper training and education by the government for promoting these development plans. The promotion of these development plans should be required the further feasibility study and detailed design study

1) Marketing plan of fish culture products (short-, medium-term)

a) Purpose:

To effectively conduct sale of fish products.

b) Participants:

Participants will be the group of fish growers.

c) Remarks of fish products selling:

Cooperative will be established in village as the multi-purpose cooperative. The cooperative will be for multi-purpose cooperative having services of all kind activities for produces and sales of agriculture, livestock, fish culture, forestry, etc. All villagers will be expected to participate,

- Group will be established within the cooperative. Groups will be formed based on the produce, members of which would grow same products or have intension to grow same products,
- To make up the regulations and general rules, members should be well known,
- To make up the rule of general meeting, regular meeting and special meeting and to conduct them,
- To conduct election for board of directors. To decide the term of directors,
- To conduct the evaluation of productions and sales activities by using the multi-purpose training facilities.
- To record and calculate the volume and weight of production and sale in the village, and
- To create the marketing route. To establish the marketing channels within the village, to near villages, neighboring cities and large cities,

d) Structural Measures:

- Size of facilities: To establish the distribution facilities for various marketing routes. Approx. 200t/year.
- Form of facilities: It should be constructed using the suitable materials for this area and environment and taking into consideration the participatory scheme. Basically, main building material is brick.

- Proposed village: Ghale Tabarak; 1 place
- Required equipment, materials and facilities: Building, vehicle, etc.

10.3.9 Diversification to Milk Cow

(1) Potential of Development

In Charman Goli-Bazoft, over grazing rate is of 9.5. Development potential is very low, even the feed would be obtained by purchasing.

(2) Development Plan

However, it is possible to change to milk cow in future for one of the methods of reducing sheep and goats number. It will stabilize introduction of milk cow and milk processing industry, and make people to reduce number of sheep and goats for mitigating over grazing by means of adding values to products. According to the Livestock Office of Provincial Jihad, they promote to diversify into milk cow, varieties of which are Holstein and Semi-local.

In case of diversifying Local variety to Semi-local variety, milk production would be increased 8-11 litre/day and its duration is enlarged 40 days. Total milk production is increased 2,160-3,170 litre/year or average 2,665 litre/year per head. When all cows at present are diversified to milk cows, number of which will be reached 1,380 heads in Charman Goli-Bazoft Study Area.

This diversification plan should be promoted step by step with the help of Livestock Office, considering progress of artificial insemination, disease control, registering method, inspection method for milk cow as well as pasteurization, sterilization, disease control, inspection method for raw milk.

(3) Marketing Plan of Milk

Marketing plan should be conducted during the half time of diversification progressed or after diversified. For marketing of milk, it is necessary to apply the participatory approach, establishment of groups & cooperatives and proper training & education by the government for promoting these development plans. The promotion of these development plans should be required the further feasibility study and detailed design study.

Establishment of groups and cooperatives for milk processing center: long-term

Collection & distribution center for milk: long-term

1) Establishment of groups and cooperatives for milk processing center (long-term)

a) Purpose:

To change to cow-grazing and to promote the sale of milk-processed products.

b) Participants:

A group should be established, whose members should grow cows and have intention for development. Group should be set in a cooperative. The cooperative should be formed within each village, whose size should be as same level as Iran's administration.

c) Structural Measures:

- Size of facilities: To establish the collection and distribution facilities for processed milk products. Approx. 1.0 t/day.
- Form of facilities: It should be constructed using the suitable materials for this area and environment and taking into consideration the participatory scheme. Basically, main building material is brick.
- Proposed villages: Arteh, Baghchenar, Dorak, Fariak and Tabarak Sofla; 5 places
- Required equipment, materials and facilities: Building, vehicle, mixing machine, etc.

2) Collection & distribution center for milk (long-term)

a) Purpose:

To promote sale of milk products.

b) Participants:

Participants will be villagers who graze cow or have intentions to produce milk products.

c) Structural Measures:

- Size of facilities: To establish the collection and distribution facilities for condensed milk. Approx. 5t/day.
- Form of facilities: It should be constructed using the suitable materials for this area and environment and taking into consideration the participatory scheme. Basically, main building material is brick.
- Proposed villages: Arteh; 1 place
- Required equipment, materials and facilities: Building, vehicle, bulk cooler, etc.

10.3.10 Rural Water Supply Improvement

Domestic water demand per capita is applied to be 180 liter/day/person also according to the suggestion by SED. Expansion of rural water supply in each village is proposed on the basis of estimated population in 2020. Surplus water demand by 2020 is 1,682 m³/day. It is planned to expand distribution tanks and connection pipeline for surplus water supply. Here, capacity of distribution tank is designed to be the volume of supply for 12 hours and 30 % spare.

Dimensions of distribution tanks and pipeline are summarized as follows. In addition, Fariak village is under severe condition of water shortage and water supply system should be improved as quickly as possible. RWWC will operate and maintain facilities and collect water charges in cooperation with PIC. In addition, PIC will enhance villagers to recognize water charge system and desirable water

use for 5 years after completion of construction. By these projects, necessary and clean water will be provided to villagers.

Table 10-3-10-1 Proposed Plan for Water Supply

Village	Distribution Tank	Pipeline
Artch	B 6.7 m x L 6.7 m x H 3.0 m	PVC Pipe ϕ 75, L=900 m
Baghchenar	B 5.9 m x L 5.9 m x H 3.0 m	PVC Pipe ϕ 75, L=700 m
Chemgaleh	B 13.0 m x L 13.0 m x H 3.0 m	PVC Pipe ϕ 125, L=3,900 m
Dorak	B 6.7 m x L 6.7 m x H 3.0 m	PVC Pipe ϕ 75, L=900 m
Fariak	B 6.2 m x L 6.2 m x H 3.0 m	PVC Pipe ϕ 75, L=800 m
Ghale Tabarak	B 3.1 m x L 3.1 m x H 3.0 m	PVC Pipe ϕ 50, L=200 m
Kachooz	B 3.1 m x L 3.1 m x H 3.0 m	PVC Pipe ϕ 50, L=200 m
Khiyarkar	B 2.2 m x L 2.2 m x H 3.0 m	PVC Pipe ϕ 50, L=100 m
Tabarak Olya	B 5.3 m x L 5.3 m x H 3.0 m	PVC Pipe ϕ 50, L=600 m
Tabarak Sofla	B 5.3 m x L 5.3 m x H 3.0 m	PVC Pipe ϕ 75, L=1,000 m

10.3.11 Rural Road Improvement

It is planned to pave the road with asphalt and improve side drain from Chemghaleh to Ghale Tabarak. Widths of road and pavement are designed to be 4 m and 3 m respectively. In addition, bridge over Dareh Tavileh near Tabarak Sofla is proposed for easy access. After improvement, road will be maintained by PIC. As for unpaved road including farm road, villagers will have responsibility for construction and maintenance. In addition, it is necessary to transfer technology of road maintenance of road and side drain. Then, PIC should prepare training program. Project components are summarized as follows. By these projects, accessibility to the market will be improved.

- Improvement of road with asphalt pavement 6 km
- Construction of bridge (Tabarak Sofla) 1 nos.
- Transfer of technology for maintenance of road and side ditch 5 years
- Construction and maintenance of farm road by farmers 152 km

10.3.12 Establishment of Cooperative

For establishment of cooperatives, it is necessary to apply the participatory approach and proper training and education by the government for promoting these development plans. Development plans are as follows:

- (1) Establishment of groups and cooperatives for handicraft: short-term
- (2) Establishment of multi-purpose training center: short-term
- (3) Training and education plan by government:

short-, medium-term

- (4) Others (for formerly mentioned plans; marketing plan of fish culture products, establishment of groups and cooperatives for milk processing facilities and collection & distribution facilities for milk)

- (1) Establishment of groups and cooperatives for handicraft (short-term)

- 1) Purpose:

To emphasize villagers and promote the sale of produces and processed products made of and from raw materials grown in this area.

- 2) Participants:

A group should be established, whose members should grow the raw materials and have intention for development. Group should be set in a cooperative. The cooperative should be formed within each village, whose size should be as same level as that of Iran's administration.

- 3) Structural measures:

- (a) Size of group: It will be set that one unit is 100 households in village. Size of group is of 20 members within the said village.

- (b) Proposed villages: Fariak; 1 place

- (c) Required equipment, materials and facilities (In case of production of gilim and carpet): Building, weaving machine, etc.

However, in case of establishing multi-purpose training facilities, it should be used the said facilities for it.

- (2) Establishment of multi-purpose training center (short-term)

- 1) Purpose:

To promote villagers, groups members for production and sales by area's processing and handicraft activities as well as to train and educate them for area's development.

- 2) Size of facilities:

Participants would be group members, cooperative members and villagers. If all villagers will happen to attend the meetings, a school or other larger place would be selected as venue. The standard size of multi-purpose training facilities should be for 50 persons. Facilities include building and play-yard.

- 3) Structural measures:

- (a) Size of facilities: Based on one village 100 households, required multi-purpose facilities to be constructed will be as large for 50 persons. Approx. 50m².

- (b) Form of building: It should be constructed using the suitable materials for this area and environment and taking into consideration the participatory scheme. Basically, main building material is brick.

- (c) Proposed villages: Arteh, Baghchenar, Chemghaleh, Dorak, Fariak, Tabarak Olya and Tabarak Sofla; 7 places

(d) Required equipment, materials and facilities: Building, etc.

(3) Training and education plan by government (short-, medium-term)

1) Purpose:

To instruct, train, educate and transfer the technology to group and cooperative members and villagers for development of areas.

2) Extension service organization:

To improve the organization so as to be able to instruct, train, educate and transfer the technology to group and cooperative members and villagers.

3) Structural measures: None.

Each plan is basically independent. However, there would be rooms for reciprocal affection or common usage. Development plan should be implemented step by step. Suitable development could be led by conducting the monitoring, evaluation and feed back step by step taking into consideration the levels and situations of around development.

10.3.13 Community Enhancement

(1) Purpose

- a) To promote villager's participation in the projects implementation,
- b) To build up villager's mind for mutual aid, and capability against natural disasters,
- c) To strengthen villager's living environment.

(2) Organizing Villagers

To realize above purposes, village organization is planned to establish. Relevant government organizations, both in central and local levels, have to facilitate the establishment of the village organization, in cooperation with Village Islamic Councils. All villagers are naturally member of the village organization. But, the member of the organization should be formed case by case, based on the purpose of the project. Such type of project as profitable and, therefore, villager have to bear a part of project cost, should be organized by those villagers who have a willingness to the development. Followings are procedure for establishment of village organization.

- a) Relevant government organization, both in central and local government, establish committee for M/P project which promote implementation of proposed projects and facilitate the establishment of village organization.
- b) The government committee holds meeting with representatives of Village Islamic Councils to explain the project purpose, project components, implementation method, etc.
- c) Representatives of Village Islamic Council hold small meeting at each villages to explain

outline of the project.

- d) The government committee facilitates to establish villager's organization based on the villager's willingness to participation in the project.
- e) The village organization discusses and establishes organizational structure, rules and regulations of operation, detail plan for participation in the project, etc., under the support by the government committee and Village Islamic Councils.

Followings are remarks of establishment of village organization

- Project Coordination Committee should facilitate establishment of the village organization in cooperation with Village Islamic Council. The council is helpful to promote villager's participation, and to establish rules and regulations of the organization, and to arbitrate villager's conflict if it happens,
- Participatory approach should be taken into consideration at the beginning of the establishment. It is recommended to hold workshop to pull out villager's frank opinion when plan of operation and monitoring are formulated by villagers themselves,
- At the time of establishment of rules and regulation, including account system, general meeting should be held with all members' participation. It is quite important that all villagers participate in the decision making of important issue. Such issue as member's rights, duties, and penal regulation are also the matter of general meeting,
- All villagers in the organization, including member of Village Islamic Council, should have a vote as an individual right of members. It is important that all members have equal right to participate in their decision-making.

(3) Activities

Activities of village organization should be planned and implemented through discussion among members in the organization. Followings are basic activities to attain the purpose of community enhancement.

- a) Participation in implementation, operation and maintenance of the projects in cooperation with local and/or central government.
- b) Participation in monitoring and evaluation of the projects in corporation with relevant government officers,
- c) Participation in enlightenment activities against disasters such as flood, debris flow, landslide, rock-fall and soil erosion. Enlightenment activities will be carried out at least once after flood season. According to the Natural Disaster Survey, illegal deforestation is severe in such village as Tabarak sofla and Dorak. As a result, potential of natural disaster has been increased. Protection of forest should be discussed as urgent issue in these villages, this kind of issue should be discussed among the village organizations to build up mutual aid system in

the project area.

- d) Promotion of health services and nutritional education, environmental education such as fuel consumption.
- e) Meeting with other village organizations and relevant government organization to exchange information and experience which obtain through the projects.

Community enhancement will be promoted step by step in the process of project implementation. Relevant government organization, especially in the provincial levers, should assist and facilitate the enhancement of the village organization. There are three steps in the process of the project implementation to enhance function of the village organization.

First step is at the beginning of the project implementation, and the village organization will be established based on the villager's willingness to participation in the projects. All members belong to the village organization will participate in the decision making process of their organization, and participate in the activities of the organization. Through these activities, a sense of participation will be formulated.

At the time of commencement of the project, plan of operations and detail activities of the villager are already designed by the government. The village organization, therefore, just receive the planned project. It should be noted that some of the members of village organization is dubious about for the result and effect of the project. The government officers have to make close communication with the village organization and build up intimate relations with them.

Second step is at the time of monitoring of the project. In the monitoring activities, villagers grasp the problem faced in the project implementation, and discuss how overcome the problems. The results of the monitoring are put into next activities. The village organization reviews their activities and improves their original plan by themselves. Through these activities, villagers can formulate and enhance a sense of ownership for the development projects.

Third step is at the time of completion of the project. At this time, government organization will hold the workshop for project evaluation under participation by village organization. The result of the project evaluation will be put into the next project activities. The village organization will choice next activity among the master plan projects, or will make new project plan based on their willingness to development. The government organization for project implementation have to support and facilitate villager's selection of next activities.

10.3.14 Increment of Household Income and Job Creation

Increasing household income and job opportunity is one of the most important matters in the villages in the Study Areas. Development plan will include the contents of increasing household income and job creation. These, in case of being fully developed, are shown as income generating activities below:

Table 10-3-14-1 Job Creation and Yearly Income Increment (with plan, fully developed)

Items	Job Creation (number)	Income Increment (Riel)	Increased income per household or person (Riel/H.H or person)
Fish culture (one place, 3 villages)	164 household	409,920,000	2,499,512 per h.h.
	5 operators	32,375,000	6,475,000 per p.
Diversification of Milk Cow			
Milk production (whole villages)	1,089 households	3,677,700,000	3,377,135 per h.h.
Milk processing center (5 villages)	627 households	561,350,000	895,295 per h.h.
	25 operators	161,875,000	6,475,000 per p.
Milk collection & distribution center (one village)	271 households	394,870,000	1,457,085 per h.h.
	7 operators	37,375,000	5,339,286 per p.
Handicraft facilities (4 places)	80 members	101,720,000	1,271,500 per p.
	80 weavers	96,000,000	1,200,000 per p.

Note: Details are referred to ANNEX L Economic and Financial Evaluation, Annual O/M Cost and Value of Output.

10.4 K7-0-19-1 Sarbaz

10.4.1 Construction of Check Dam

(1) Specific Sediment Discharge

In order to estimate sediment discharge of each check dams, the specific sediment discharge used for the planning of Beaedeh Dam at Sarbaz ($400 \text{ m}^3/\text{km}^2/\text{year}$) is applied.

(2) North Basin

In North Basin, four medium and small tributaries flow into Marbor River. Among these tributaries, the one located in the utmost north near Sarbaz flows in the basin with gentle slope and a little erosion, whereas the basins of the other three are very devastated with severe erosion and landslides.

This area is categorized as surface erosion type and main check dams with Type C are allocated on these three tributaries in order to prevent vertical/horizontal erosion of the river course and the movement of unstable sediment left on the riverbed, stabilize the foot of slope, and protect farmland in the downstream.

a) T1 Basin

Seven main check dams on the main river course and three on the left tributaries are planned in the T1 Basin, which has the biggest catchment area in North Basin. Four check dams are located in the