## CHAPTER 4 WETLAND ECOLOGICAL MANAGEMENT PLAN

#### 4.1 Introduction

The Anzali Wetland still holds ecological character of international importance as habitats for various endangered species and 150,000-400,000 migratory birds that visit the wetland every year. The wetland also supports livelihood of many local residents who depend on natural resources in the wetland, such as fish. However, the present status of the wetland indicates considerable environmental deterioration of these natural properties. Among the various causes of the environmental deterioration, the most direct impacts are caused by human activities within and around the wetland, such as over hunting and over fishing, illegal access to ecological sensitive areas, encroachment of the wetland boarder, uncontrolled speedboats, introduction of exotic species (e.g., *Azolla*), etc. In order to maintain the ecological character of the wetland, and to benefit from the natural resources and other values of the wetland, the Wetland Ecological Management Plan presented below proposes ways to control these activities and use the wetland sustainable.

### 4.2 **Objective and Strategies**

### 4.2.1 Objective

The Wetland Ecological Management Plan aims to:

- secure the ecological balance to maintain the natural properties of the Anzali Wetland as far as future generations.

#### 4.2.2 Strategies

To achieve the objectives stated above, the following strategies of (1) Environmental Zoning, (2) Adaptive Management, (3) Wise Use, and (4) Participatory Conservation, are employed in this master plan.

#### (1) Environmental Zoning

Ecological features and human activities vary in different places so that management plans should be developed with different strategies suitable to specific requirements. Zoning is one of the bases of this planning by clearly identifying boundaries of lands for different management purposes. DOE is aware of the importance of zoning as a management tool for the Anzali Wetland and has delineated different zones based on a study by Guilan University (1999). However, this zoning has not been widely accepted and/or used since the plan was developed as an academic exercise with little involvement of other stakeholders. This existing zoning was, therefore, reviewed and revised in this master plan.

Zoning defined in the Ramsar Guidelines<sup>1</sup> does not include a buffer zone but the zoning of this master plan consists of the following three zones: a) core protected zone, b) buffer zone and c) transition zone, with an application of the zoning concept of the Biosphere Reserve of the United Nations Educational, Scientific and Cultural Organization (UNESCO). Main concepts and features of this zoning are as follows (Figure 4.2.1):



Figure 4.2.1 Conceptual Model of Zoning

#### (2) Adaptive Management

An ecosystem is dynamic and naturally changes in time and space in a complex manner so that management actions should be adjustable with specific requirements at any given time. Therefore, the management decision-making process has to be as flexible as possible. For such a management process, it is critical to conduct systematic monitoring that provides scientifically sound data and evidence as a basis for making an appropriate decision. This flexible and systematic decision-making process based on sound data is regarded as the adaptive management.

In the case of Anzali, human activities such as encroachment by agriculture, over-hunting, over-fishing and introduction of alien species present a high risk of significant disturbance to the wetland ecosystem. The impacts from these human activities should be closely monitored and quantified to design suitable management actions regulating those activities. Institutional set up, which makes this management system function is critically important.

<sup>&</sup>lt;sup>1</sup> New Guidelines for Management Planning for Ramsar Sites and Other Wetlands (Resolution VIII. 14 of COP 8, November 2002)

### (3) Wise Use

Wise use is one of the main concepts of the Ramsar Convention, which indicates attributes of resource use where natural resources are maintained in the long-tem including future generations. It is necessary that management actions regulating some human activities in the wetland be accepted by local people. However, this may be difficult if management actions largely restrict necessary economic activities. Since the Anzali Wetland holds economic value supporting the livelihood of many people, economic activities should continue without over exploitation. Therefore, conservation and economic activity should be balanced to attain sustainability of natural resources with the use of those values under control.

#### (4) Participatory Conservation

Public participation is generally required in a master plan according to JICA's Guidelines for Environmental and Social Considerations (JICA, 2004). Public understanding and agreement are necessary to carry out management actions; therefore, public participation particularly by local people, is critical and therefore, participatory conservation is also an important strategy of this M/P.

Stakeholders in the conservation of the Anzali Wetland include primarily hunters, farmers and fishermen living around the wetland. It is critical that those stakeholders understand the value of the wetland since a clear understanding of the value can lead to practical directions in conservation. Stakeholder meetings gathering views and ideas of the local residents were conducted and incorporated into the master plan.

## 4.3 Environmental Zoning

## 4.3.1 Proposed Zoning

The main policy and criteria for each zone are shown in the following Table. The entire Anzali Wetland is defined as the core protected zone, which is further divided into conservation sub-zone and wise use sub-zone using the status of legal protection. Width of the buffer zone and transition zone are determined considering the ecological feature and the range of potential significant impact respectively. The proposed zoning is shown in Figure 4.3.1.

Zone	Main Policy	Zoning Criteria
Core Protected Zone	Non-consumptive use of	Legally designated protected areas of the
a) Conservation Sub-Zone	natural resources	wetland (including proposed areas for legal
		protection): wildlife habitats with richer
		biodiversity and higher wildlife populations
		compared with those of the wise use sub-zone
b) Wise Use Sub-zone	Restricted consumptive	Not legally designated protected areas (areas
	use of natural resources	other than the conservation sub-zone)
Buffer Zone	Reduction of impact on	Ecotone: A mixture of area where an ecosystem
	water quality of the	transfer to another and such an area is often rich
	wetland: Promotion of	in biodiversity (edge effect). Ecotone for the
	organic farming	Anzali Wetland is defined mainly as the water
		fluctuation zone that is 500 m from the border
		of the wetland.
Transition Zone	Restricted development	The range of area that can cause significant
	avoiding significant	impact to the wetland: about 3 km from the
	impacts to the wetland	boarder of the buffer zone.
	-	

Table 4.3.1 Main Foncy and Zonnig Criteria	<b>Table 4.3.1</b>	Main	Policy	and	Zoning	Criteria
--	--------------------	------	--------	-----	--------	----------



### 4.3.2 Physical Description of Each Zone

#### (1) Core Protected Zone

The delineation of each zone is based on the analysis of recent satellite images and GPS-based site surveys by DOE on wetland vegetation and other wetland characteristics<sup>2</sup>. The Core protected zone is divided into "Conservation Sub-Zones" and "Wise Use Sub-Zones."

### 1) Conservation Sub-Zones

The conservation sub-zones consist of wildlife refuge and protected areas. When the water level of the Caspian Sea rises, private lands within the buffer zone should be purchased by the Government since those areas will be considered as part of the core protected zone. Conversely, the size of the core protected zone will not be changed with the reduction of the water level of the Caspian Sea.

a) Wildlife Refuge

There is a gazetted wildlife refuge, Selke (360 ha), and a proposed wildlife refuge, Sorkhankol (1,156 ha<sup>3</sup>), under the Environmental Protection and Enhancement Act.

b) Protected Area

The Protected Area includes gazetted and proposed protected areas. Siakeshim (4,127 ha) is a gazetted protected area under the Environmental Protection Act. It provides spawning grounds for fish and nesting areas for bird species. In addition, it is proposed to include the following areas in the protected areas; the area between Selkeh and Hosseinbekandeh, the spawning ground of *Abramis brama orientaris*, *Esox lucius* and *Cyprinus carpio*, and the four rivers, Kolesar, Masuleh, Siahdarvishan and Pasikhan, are the spawning grounds of *Chalcalbunus chalcoides*, *Rutilus frisii kutum* and *Vimba bimba persa*. These proposed areas should also be included in the conservation sub-zone.

c) No Hunting Area

No hunting areas occur sporadically in the wise use sub-zones, but the area is under legal protection so that it should be considered as part of the conservation sub-zone. There are the gazetted non-hunting areas of Chokam (346 ha), Ghalm Godeh (119 ha) and the proposed no-hunting area of Hosseinbekandeh (367 ha) under the Game and Fish Law. In addition, it is proposed that the Cargon area, which is an important wintering habitat in the west of the lagoon, be protected as a no hunting area. Chomam and Hosseinbekandeh may be upgraded to protected areas in the future.

<sup>&</sup>lt;sup>2</sup> The majority of the area designated as wetland belongs to either NRGO or DOE, though it seems there are abandoned private lands and or land illegally occupied and then transferred to other owners. Due to unclear land tenure, it has been difficult to clearly identify the ownership of the lands in the wetland.

<sup>&</sup>lt;sup>3</sup> Part of Sorkhankol (477 ha) has been gazetted as a wildlife refuge. Proposed expansion has not been approved.

### 2) Wise Use Sub-Zone

There is no legally designated protected area in this sub-zone, but some rules and regulations such as hunting and fishing regulations are still applied. It comprises marshes and lagoons.

#### a) Marsh

Marsh is the area covered by the emergent plants and the floating plants. It has spread especially in the eastern part of the wetland.

#### b) Lagoon

Lagoon is the open water area that spreads out in the west part of the wetland. This is a main area for fishing and a variety of aquatic sports.

#### (2) Buffer Zone

This zone covers the range of water level fluctuation due to changes in the level of water in the Caspian Sea. This type of ecosystem is usually considered as an ecotone, which holds rich biodiversity but in the case of Anzali, the wetland is mainly surrounded by tree plantations and agricultural areas, primarily rice fields (Chapter 2). Agricultural chemicals are used in these areas so that the effluent and drainage from this zone is likely contaminated, which is a direct source of wetland degradation.

#### (3) Transition Zone

This is the area surrounding the buffer zone in which sustainable use is promoted. The boarder of this zone is roughly the road from Khomam to Rezvanshahr. This area is largely covered with paddy field, and some tree plantations, industries/factories and townships are included in this zone. The width is determined referring to the feeding area of waterfowl<sup>4</sup> and spawning ground of anadromous fish. The city of Bandar Anzali and small towns in Somehsara are included in this transition zone.



Feeding of Waterfowl

#### 4.3.3 Regulatory Framework in Each Zone

Different regulations should be imposed according to the management aims of each zone, which are involved with land tenure, and restrictions over development projects and other human activities. Under the current procedures, the proposed zoning plan, including the

 <sup>&</sup>lt;sup>4</sup> \*: The amount of energy consumption of a waterfowl =400 kcal/day =100 g of Rice The amount of food supply per ha of paddy field in winter

<sup>=</sup>  $3000 \text{ kg/ha} \times 0.03 = 90 \text{ kg/ha} = 900 \text{ days of food for a waterfowl}$ 

If it is assumed that a waterfowl stays for 90 days in winter, one hector of paddy field feeds ten waterfowls. If the number of waterfowl which feed on land is assumed to be 100,000 birds,

the required feeding area =100,000 birds / 10 birds/ha = 100 ha

designation of protected areas needs to be approved by the Supreme Council for the Environment<sup>5</sup>. However, before submitting a proposal to the council, the following proposed regulations should be discussed and agreed upon among the stakeholders including DOE, MOJA/NRGO and PSO. This involvement of stakeholders is particularly important in the buffer zone and transition zone since there are many privately owned lands in both zones.

### (1) Core Protected Zone

A considerable part of the core zone (approximately two thirds of the wetland) is not legally protected, which makes the management of human activities in the wetland difficult. It is, therefore, proposed that the whole area of the wetland be clearly designated as a management area of DOE. With regard to this management in the legal status of the wetland, two important issues should be addressed.

First, there has to be a general agreement among the stakeholders, including those involved in wise use activities such as ecotourism and controlled fishing and hunting, so that a sustainable use of the wetland resources for conservation and wise use is achieved. Another management issue is the difficulty in resolving and transferring the land tenure of privately owned lands within the wetland. Any private lands within the core protected zone should be transferred to the government so that regulations can be imposed and observed properly.

Regulations in the Conservation Sub-zone prohibit any consumptive use of natural resources by harvesting any vegetation and wildlife. However, it is proposed that entering this area be allowed for the purpose of ecotourism. This is based on the wise use concept, and restricted ecotours, particularly in October to December would take advantage of natural resources without causing serious impact on migratory birds.

Regular hunting and fishing are allowed in the wise use sub-zone, but the regulations should be strictly observed. Proposed hunting and fishing regulations in the wise use zone are described in Section 4.6.2. Bag limits for hunting and fishing should be regulated with the concept of adaptive management. It is, therefore, proposed that the bag limits and species for harvest be examined and determined based on the annual monitoring data.

#### (2) Buffer Zone

The majority of this zone is agricultural area so that it is proposed that the use of pesticides and fertilizers be reduced through Integrated Pest Management (IPM) and organic agriculture being promoted in this zone (see Chapter 6).

Furthermore, waste water treatment facilities should be installed in all houses and commercial and industrial enterprises. Riverbanks are proposed to be covered by vegetation to purify wastewater. New development should be prohibited in the buffer zone in accordance with the existing zoning regulations of  $DOE^6$ .

<sup>&</sup>lt;sup>5</sup> The Supreme Council for the Environment is headed by the President of Iran, which is the most senior decision-making body for environmental matters in Iran.

<sup>&</sup>lt;sup>6</sup> For the last two years, DOE has announced the zone as a regulated area and has been refusing permits for any development within this zone.

### (3) Transition Zone

For the last two years, DOE has regulated rural development in this zone, and it is proposed that DOE continue this policy. As for the present commercial and industrial enterprises, water treatment facilities should be installed with subsidies. When any development projects are proposed within this zone, any potential negative impact to the wetland should be carefully analyzed in an environmental impact assessment (EIA). In this assessment, indirect impact from all proposed development projects should be analyzed with the goal of maintaining the ecological balance of the Anzali Wetland in the long-term.

### 4.3.4 Necessary Arrangements for Implementation of the Proposed Zoning

### (1) Boundaries

It is important to clearly mark the boundaries of the proposed zoning to introduce different regulations. However, fencing is not practical since it hampers movements of wildlife and therefore, placing signboards on the borders between zones is suggested.

### (2) Mechanism of Law Enforcement

In order to practice different regulations in each zone, collaboration between MOJA/NRGO, the provincial government and lower administrative divisions (e.g., municipalities), HUDO, the governor's engineering office, agricultural cooperatives, and DOE is essential. In order to ensure the implementation of the zoning plan, it should be approved by the Supreme Council for the Environment with representatives of all related government bodies. If this is difficult, at least a local ordinance should be issued by the Provincial Government.

#### (3) Periodical Review of Zoning

The proposed zoning plan should be reviewed according to the changes in the water level of the Caspian Sea. The boundaries should be reviewed once every 5 years based on the monitoring.

#### 4.4 Conservation of Wildlife

The wildlife conservation plan mainly consists of conservation of threatened species and control of alien species, which are part of biodiversity conservation, which is to maintain the natural balance of the wetland ecosystem.

#### 4.4.1 Conservation of the Threatened Species

#### (1) Conservation Needs of the Threatened Species

Threatened species targeted in this plan are listed along with their current ecological status in Table 4.4.1.

#### Nippon Koei Co., Ltd.

Species	Status and Conservation Needs			
Haliaeetus albicilla	Status: Main diets of the eagle include fish and waterfowl. Only one pair of this			
(White-tailed Eagle)	species is left in Anzali Wetland.			
	Conservation Needs: It builds a nest on a large tree in March. The pair of Haliaeetus			
	albicilla uses a large poplar tree at present. The tree should be protected, and no			
	one should be allowed to go near the area especially during the nesting and			
	breeding season. A substitute tree is needed in case the tree dies, and if that is			
	difficult, artificial breeding should be considered.			
Aythya nyroca	Status: Main habitat of the species is shallow water (1 to 2 m) and well-vegetated			
(Ferruginous Pochard)	areas.			
	Conservation Needs: Habitats with abundant submerged plants, fish and benthos			
	should be protected. Improvement of water quality and maintenance of water			
	depth is necessary. Habitats in Selkeh and Sorkhankol should, therefore, be			
	protected.			
Vimba vimba persa	Status: This fish inhabits the western part especially in summer. It requires high			
(Baltic Vimba)	concentrations of dissolved oxygen and enters the lower reaches of rivers for			
	spawning in May to July. Spawning takes place upstream on gravel.			
	Conservation Needs: It enters the rivers through the Siakeshim, and adequate depth			
	of water is necessary to move during the spawning season. Linkage of different			
	rivers is indispensable for the movements so that any obstacles such as barrage or			
	weirs should be avoided in the downstream reaches of the rivers.			
Lutra lutra	Status: Carnivorous mammal species at the top of the food chain in the Anzali			
(Eurasian Otter)	Wetland ecosystem. It feeds on fish and frogs. Although the animal is protected as			
	a non-game species, it is still hunted for its high quality fur.			
	Conservation Needs: It inhabits Sorkhankol and Selkeh, and enters rivers and the			
	Caspian Sea. Hunting of the animals should be strictly prohibited.			

 Table 4.4.1 Status and Conservation Needs of the Threatened Species

#### (2) Protection of Sensitive Areas

Impact on the sensitive areas should be minimized, and areas to be protected for the threatened species are:

- Siakeshim: nesting area of *Haliaeetus albicilla* (on the large *Poplus* tree) and *Phalacrocorax pygmaeus* (on the *Salix* tree).
- Selkeh: wintering area of Aythya nyroca and hunting area of predatory birds.
- Sorkhankol: spawning ground of threatened wildlife such as *Abramis brama* orientaris and *Rutilus frisii kutum*, and feeding area of *Lutra lutra*.

#### (3) Installation of Signboards

Signboards should be installed, especially in the above-mentioned sensitive areas, indicating the ecological status of the targeted species and their conservation needs.

(4) Control of Illegal Activities

Illegal activities including hunting, fishing and any other forms of harvest are detrimental and should be strictly prohibited for the conservation of the threatened species. Education of hunters and fishermen is required, therefore, it is proposed that hunting and fishing handbooks be distributed with license, and a lecture also be held when a license is issued by DOE. Penalties including fines and imprisonment for illegal hunting and fishing should be presented in the lecture in order to increase the public understanding of the importance of conservation.

#### 4.4.2 Control of Alien Species

*Azolla* is an alien floating water fern, and is a nuisance in the Anzali Wetland. The removal of thick mats of *Azolla* should be carried out in order to reduce its adverse effects on water quality and habitats. Suitable areas for the removal of *Azolla* are proposed in reference to the study conducted by the Guilan University (Figure 4.4.1).



Figure 4.4.1 Suitable *Azolla* Removal Area by the Guilan University (1999)

A pilot activity was undertaken as part of this master plan to examine the use of *Azolla* compost as fertilizer (see Chapter 12, "Capacity Development"). According to the study by the Guilan University, distribution of *Azolla* in the wetland is roughly estimated at 1,000 ha. The wet weight of *Azolla* is about 30 to 80 t/ha so that 30,000 to 80,000 ton of *Azolla* exists in the wetland. Approximately 4 tons of *Azolla* (wet weight) are required to be used as compost for one hectare of paddy field. It is, therefore, estimated that the potential total compost made out of *Azolla* from the wetland can cover about 7,500 to 20,000 ha of paddy field. However, it is difficult to remove a large amount of *Azolla* so that introduction of machinery to remove *Azolla* is recommended. One machine, an "Aquatic Plants Harvester", can remove about 0.8 ha per hour. It is proposed that at least 30% of the *Azolla* be removed from the wetland as a means of environmental restoration.

In addition to *Azolla, Hemiculter leucisculus, Gasterosteus aculeatus, Liza aurata* (fish) and Comb jellyfish inhabit the wetland as alien species. These species have not shown apparent negative consequences in the wetland ecology at present, but this is probably due to a lack of data. Distribution and abundance of native wildlife are often negatively affected by alien species so that prevention of the release of alien species as well as control of existing alien species is recommended while the impact is still not at a serious level.

#### Nippon Koei Co., Ltd.

### 4.5 Conservation of Habitat

Anzali Wetland has a rich ecosystem, abundant wildlife and beautiful landscape. Conservation of wildlife habitat is as important as the conservation of threatened species. Regulation and rehabilitation are, therefore, proposed as conservation measures to maintain the ecological balance of the wetland.

#### 4.5.1 Strengthening of Regulations

#### (1) Construction of Guard Stations

DOE has reported that there is a dramatic reduction in poaching where guard stations are established<sup>7</sup>. It is likely that construction of guard stations is effective to reduce poaching. Ten years ago, four guard stations were constructed at Ghalam Godeh, Selke, Siahdarvishan and Esfand and are still in use. Four other wooden guard stations were constructed at Sorkhankol, Siahkesim, Abkenar and Hosseinbekandeh, though only Sorkhankol functions at present. One additional guard station was constructed at Cargon in 2003.

In order to regulate illegal activities up to a sufficient level, it is proposed that three further guard stations be constructed at important locations such as Chokam (newly announced nohunting area), the southern side of the lagoon (to regulate the illegal activities in the wide lagoon) and within the eastern part (it is difficult to approach from other guard stations and is necessary to eliminate the illegal hunting).

#### (2) Capacity Development of Rangers

Capacity development is required for rangers. In addition to knowledge on wetland ecosystems, including the names of species, ecological features of wildlife, status of the wetland ecosystem, understanding the importance of the management system that is based on a linkage between monitoring and decision-making process is necessary. Seminars and workshops should be held at least once a year to strengthening the management capacity of DOE.

#### (3) Regulation of Motorboats

The noise of motorboats in the wetland is considered as a disturbing influence on birds and other wildlife. Moreover, the "wash" caused by fast boats causes bank erosion and damages fish spawning sites. It is, therefore, necessary to control the size or power of engines and/or introduce a speed limit. DOE is currently investigating the technical feasibility of introducing quieter engines (possibly electrically driven). Given the large number of boats with high power engines that are already in use, the control of engine size or type could only be introduced gradually over time. In this circumstance, it is proposed that a speed limit of 8 knots be applied by PSO for the important bird habitats and fish spawning areas at the eastern side of Sorkhankol.

<sup>&</sup>lt;sup>7</sup> Summery report of natural environment activity DOE of Guilan (Hossein Esmaily, 2003)

# 4.5.2 Rehabilitation and Maintenance of Habitat

Active manipulation of habitats can be a management tool. However, an ecosystem is dynamic and changes over time so that physical management measures (i.e. rehabilitation and maintenance of habitats) should, therefore, be based on sound data. Management activities including creating deeper pools for fish or small islands, partially cutting dense stands of *Phragmites* (reed) and *Typha* (bulrush), planting trees and extending areas of open water for waterfowl are identified as potential management tools at present, and those should be implemented according to scientific data. Systematic monitoring should be carried out to analyze ecological consequences.

(1) Rehabilitation of Habitat

Reed beds provide valuable habitats for many fish species, and provide nesting materials and cover for birds. On the other hand, excessive distribution of reed beds can reduce open water that provides feeding sites for birds and fish. In the middle of Shiakeshim, there is a decrease in the waterfowl habitats and hunting space of *Haliaeetus albicilla*. In 1982, aerial photos indicated that more than 10 ha of open water were distributed in Shiakeshim. Most of this is now covered with reed beds, therefore, it is proposed that the reed bed in the two areas of 200 m x 200 m and 400 m x 400 m be removed. The ecological response to this management action should be monitored, and adaptive measures should be taken when required.

It is also proposed that new channels be established to improve the flow of water in the stagnating areas in Siakeshim. DOE has obtained approval and funding to establish such a channel along the southern boundary of Siakeshim to restrict public access to this protected area. However, there are some risks associated with the plan including physical disturbance, mobilization of pollutants, and the disposal of a large volume of dredging so that an EIA should be conducted before implementation.

(2) Prevention against Solid Waste Inflow

Rubbish entering the wetland is not collected at present, which is detrimental to wildlife habitats. The collection and proper disposal of garbage should be carried out in the wetland and rivers. A considerable amount of the rubbish enters the wetland with the Pirbazar River. It has been proposed that waste disposal in the catchment must be improved, and two pilot projects are being implemented to stimulate that improvement. However, in the meantime, floating waste (plastic bottles, etc.) could be intercepted by placing a floating boom at an angle of 45 degrees across the Pirbazar River, near its entrance to the wetland. Rubbish accumulated at the downstream ends of the boom would need to be removed each week. The boom should be inspected periodically and adjustments made such as the angle (i.e. 45 degrees) and location.

## 4.6 **Promotion of Wise Use**

The Anzali Wetland has a high potential for generating sustainable benefits to the local society. Anzali is one of the major sightseeing spots in Iran so that ecotourism is an effective means of achieving the promotion of incentives and sustainable use of natural resources with the application of the wise use principle. In order to maintain fishing and hunting, harvesting pressure should be controlled in the Anzali Wetland. Furthermore, beneficial use of other natural resources such as *Azolla* and *Phragmites* should also be promoted in the wetland.

### 4.6.1 Development of Ecotourism

#### (1) Ecotourism Resources

Anzali Wetland has been used for small-scale tourism, mainly motor boating. However, the ecotourism in the wetland has not been fully developed, and there is some development potential with sustainable use of natural resources. Potential resources for ecotourism are, therefore, identified and presented in Figure 4.6.1.



Figure 4.6.1 Ecotourism Resources

Some facilities such as a watch tower, a bird hide and signboards were constructed in the pilot activity of the master plan. The watch tower and bird hide were constructed at Selkeh so that it is proposed that these facilities be fully utilized in the ecotours. Signboards are installed at Selkeh, Sorkhankol and Anzali port, which should also be used in the ecotours for the purpose of tourist education.

Nippon Koei Co., Ltd.

#### (2) Ecotourism Approach

Based on the availability of natural resources, it is proposed that the following activities be developed for ecotourism in the Anzali Wetland.

- Structuring of Ecotourism Network
- Nature interpreter training
- Preparation of infrastructure
- Programming the ecotour
- Implementation of the ecotour
- 1) Structuring of the Ecotourism Network

Implementation of ecotourism is the responsibility of tour organizers, but it is suggested that DOE support the development of ecotourism in the wetland. Therefore, DOE should act as the center of the ecotourism network involving a variety of stakeholders. The membership of the network and its benefits are presented in Figure 4.6.2.

DOE, CHTO and travel agencies were assembled, and the pilot activity "Ecotour" was implemented as part of the master plan. A local nature interpreter was trained and coordinated the ecotour. This small network functioned well in the pilot program so that it should be developed further to involve other stakeholders as well.



Figure 4.6.2 Network of Ecotourism

### 2) Nature Interpreter Training

Ecotourism requires nature interpreters who can explain how to experience the nature and culture of the area. Candidates for ecotourism nature interpreters are DOE staff, tour guides and the people who are interested in the conservation of the wetland and ecotourism. The ecotourism nature interpreters should be familiar with wetland ecology and have strong leadership and nature interpretation skills. Training fishermen and hunters as nature interpreters is also recommended. The number of nature interpreters initially required is about 5 to 10 persons based on the implications of the pilot study. A pilot activity "Ecotour" should be prepared including a textbook and training of two nature interpreters.

### 3) Preparation of Infrastructure

It will be provided essential infrastructure for tourists, which includes wetland information facilities, bird watching hides/towers, low-impact paths to areas for ecotourism, boardwalks, appropriate accommodation, toilets, litterbins, car parks, visitor center, access route, etc. Some of the infrastructure facilities (environmental education center, watch tower, walking path and signboards) were constructed as part of the pilot activity during the course of the master plan. It is proposed that facilities developed in the master plan be further elaborated. These public facilities should be maintained by DOE while private facilities such as boats, canoes and fishing rods should be prepared by the tour organizer.

#### a) Visitor Centre

The Visitor Centre in the Anzali Wetland should be used as the center of ecotourism as well as research, monitoring, and environmental education. Based on the local discussions among DOE, NRGO and other stakeholders, Hosseinbekandeh is the candidate site for this facility. This would be accessible by boats (new jetty required) and vehicles.

#### b) Access Routes

Access routes to the key areas and facilities for ecotourism and environmental education need to be improved. The routes that require improvement include:

- Access road to the Selke area including parking,
- Access road to the proposed new Visitor Centre,
- Routes for environmental education and ecotourism (e.g. boat routes),
- Construction of jetties enabling boats to link with paths,
- Establishment of a bicycle track around the wetland.

All of the above facilities need to be carefully constructed so as not to disturb the wetland ecosystem. The use of wood and compacted gravel is recommended.

#### Nippon Koei Co., Ltd.

### c) Jetty

Jetties are necessary at the visitor center (Hosseinbekandeh) and the park (Abkenar) for access. It is important to secure easy access for tourists.

d) Bike Track

A bicycle road race was held around the Anzali Wetland in 2003 as part of the pilot activity, and it was successful enough to have about 50 participants. It is recommended that two bike tracks be constructed, one each, at Pilalibagh and the southern shore of the lagoon. Pilalibagh is close to the city. A dike is now constructed at Pilalibagh, and the top of the dike can be prepared as a bike track. The southern shore of the lagoon has a fine view.

e) Watch Tower

One watch tower was constructed at Selkeh in the pilot activity "Ecotour." Tourists can look out over the wetland from this tower. It is recommended to construct another tower in the wetland at the site of an old research center that is no longer used at the border of Sorkhankol and Siakeshim in the wetland.

f) Hide

Using a hide for bird watching is effective, and an abundance of birds and land regulations are considered to be factors to determine candidate sites for the construction. It is recommended that a hide be constructed at Hosseinbekandeh, Chokam and Pilalibar.

g) Park

Camping and walking are popular in Guilan province. The western part of Abkenar is proposed for the construction of a park because the area is mainly covered by forest and surrounded by the wetland.

4) Implementation of Ecotourism

Ecotourism needs tour programs that are based on available natural resources. The following resources should be considered in planning:

- Participation by local nature interpreters and stakeholders,
- Based on field reconnaissance,
- Ecotourism network.

The number of participants in ecotourism should be adjusted to control the negative impacts to the wetland. A total of about 50 persons are acceptable per day (e.g. 10 persons for bird watching: 30 persons for sports fishing: 10 persons for kayaking). Fishing is currently regulated with licenses. It is necessary that DOE issues one day license for tourists to promote fishing activity in the ecotour. The ecotour route should be established mainly outside of the protected area although some observation points can be located in the protected area, such as Selke, Sorkhankol and Siakeshim for bird and plant (lotus) observation and to experience nature while disturbance to

wildlife is minimal (in order to minimize the disturbance, routes and seasons should be limited). The proposed ecotour program is shown in Figure 4.7.3.

Implementation of the ecotour should be arranged by the ecotourism network, and each ecotour should be managed by the tour organizer. However, it is difficult to charge a fee high enough to cover all costs and produce a profit<sup>\*</sup> because:

- Constructions of facilities and training of nature interpreters take several years.
- Tourists cannot understand the value of ecotour in the early stage.

The tour cost is approximately estimated by the result of the pilot activity as follows.

Expense for 15 tourists	
Boat	1,200,000 Rials
Nature interpreter	348,000 Rials
Lunch	675,000 Rials
Miscellaneous	300,000 Rials
Total	2,523,000 Rials
Tour cost for a tourist	

(2,523,000 + 504,600 (20% of expense)) / 15= 201,840 Rials

Implementation of the eco-tour is, therefore, treated as a trial activity until the constructions of facilities. A subsidy should be provided during the trial period and the tour fee should be minimal. Ecotour programs should be examined, and evaluation and revision of the program should be implemented.



## 4.6.2 Sustainable Use of Natural Resources

## (1) Sustainable Hunting and Fishing

Sustainable hunting and fishing is indispensable to maintain wildlife populations, which can also be beneficial to the stakeholders. The appropriate number of hunting and fishing licenses are decided annually by DOE Guilan, and this should be determined by research and monitoring on the availability of resources. The license fees and bag limits should also be evaluated and revised annually. A preliminary revised management plan is shown in Table 4.6.1.

License	Proposed
Regular hunting license (weapon)	6 birds/day for 3 days/week 80,000 Rials
Trapping license	10 birds/day for 3 days/week 500,000 Rials
Rent license	20 birds/day for 3days/week (weapon and trap) 1,500,000 Rials
Fishing license (hook)	Unlimited 12,000 Rials

 Table 4.6.1 Present and Proposed Management of Hunting and Fishing Licenses

In addition to the above licenses, the Fishery department issues about 350 licenses which permit the use of net fishing gear. Those licenses are issued to the people who have vested rights with the Fishery department. Those licenses should be reduced. Licenses for sports fishing are proposed as a separate category of license to encourage ecotourism. Daily fishing licenses should be issued at DOE, and the license fee should be about 1,000 Rials/day.

## (2) Beneficial Use of Azolla

As presented earlier, alien species can be detrimental to the ecosystem so that they should be removed from the wetland. *Azolla* can be used for agriculture as fertilizer and for livestock industries and aquaculture as feed. The result of the pilot activity "Beneficial use of *Azolla*" showed that grain yields were not so different between the application of chemical fertilizer and composted *Azolla*. Therefore, *Azolla* is planed to be used as compost and applied especially to the paddy field in the buffer zone (more than 2,000 ha).

## 4.7 Environmental Monitoring

Scientific data are insufficient at present for making appropriate management plans. Therefore, the improvement of monitoring activities is critical so it is proposed that adaptive management having a system where a decision is made based on monitoring data with feedback (Section 4.2.2). The model of adaptive management is shown in Figure 4.7.1.



Figure 4.7.1 General Flow of Adaptive Management for the Anzali Wetland

Note: (1) Monitoring: Bird populations, fish populations and fish catch, and etc.

(2) Management decisions: Hunting regulations, fishing regulations and etc.

(3) Parameters: Same as (1) but additional surveys are to be conducted as required

(4) Management decisions: Evaluation of how to make management decisions

#### 4.7.1 Environmental Monitoring for Adaptive Management

The wetland ecosystem is dynamic and is affected by numerous factors such as the incoming pollution and sediment from streams and changes in the water level of the Caspian Sea. In order to manage the Anzali Wetland, the ecological dynamics of the wetland, including flora and fauna, should be studied and therefore, the following five environmental monitoring programs are proposed:

- Wetland ecological census (every 5 years)
- Annual ecological monitoring program
- Ecotourism monitoring program
- Environmental monitoring by universities
- (1) Wetland Ecological Census

The monitoring program is shown in Table 4.7.1. These surveys should be conducted every 5 years, and management activities should be evaluated along with the monitoring results. The evaluation should also be used to revise the management activities such as the boundaries of

different zones, the number and location of guard stations and conservation methods for the threatened species.

Organization	DOE and Bony Fishes Research Center
Monitoring Program	
-Birds	Species/Distribution; Every month; Analysis of important habitats
-Plants	Species/Distribution of emergent, floating, submerged and others plants; 3 times
	(Spring, Summer, Fall)
	Biomass of selected species (Azolla, Reed); 1 time (summer) + satellite image
	analysis
-Benthos &	Species/Distribution, 4 times (Spring, Summer, Fall, Winter)
Plankton	
-Fish	Species/Distribution/Size, 4 times (Spring, Summer, Fall, Winter)
-Satellite Image/	Wetland boundary, open water area, encroachment, others; 1 time; satellite/aerial
Aerial Photo	photo image analysis
Analysis and Storage	The results are analyzed by specialists from DOE and Bony Fishes Research Center
of Information	and an environmental census report (technical) is prepared.
Dissemination of	The prepared report is to be distributed among DOE, MOJA, Bony Fish Research
Information	Center, Universities and other interested parties as technical information about the
	ecological condition of the Anzali Wetland.
Evaluation and	The ecological condition is evaluated and fed back to the management activities.
Feedback	DOE and relevant organizations review the management activities.

 Table 4.7.1
 Wetland Ecological Census Program – every 5 years

### (2) Annual Ecological Monitoring Program

The monitoring program is shown in Table 4.7.2. The information is recorded every year to indicate changes in the wetland condition and used to review the ecological management plan with the result of the 5 year census. The information is also used to determine the number of license for hunting and fishing every year.

Organization	DOE and Bony Fishes Research Center
Monitoring Program	
-Birds	Species/Distribution; January and July
-Fish	Species/Distribution/Size; 4 times (Spring, Summer, Fall, Winter)
-Water Quality	General Parameters (Temp., DO, BOD, COD, salinity, T-N, T-P, SS, chlorophyll a,
	transparency, E.Coli), 15 locations, 4 times (spring, summer, fall, winter)
	Toxic Parameters (heavy metals, pesticides); 20 locations; 4 times
-Sediment Quality	General parameters (depth, texture, organic carbon, T-N, T-P), Toxic parameters
	(heavy metals, pesticides); 5 locations; 1 time;
-Water Level	Water levels: 5 gauging stations including the Anzali Port; weekly
Analysis and Storage	The results are analyzed by specialists from DOE and Bony Fishes Research
of Information	Center, and an annual ecological monitoring report is prepared by DOE. Also,
	electronic data bases are created to store the results. The 5-year census data are
	also stored in these data bases.
Dissemination of	The prepared report is to be distributed among DOE, MOJA, Bony Fish Research
Information	Center, Universities and other interested parties as technical information about the
	ecological condition of the Anzali Wetland.
Evaluation and	The ecological condition is evaluated and fed back to the management activities.
Feedback	DOE and relevant organizations review the management activities (especially
	annual activities such as the issue of fishing and hunting licenses).

 Table 4.7.2
 Annual Ecological Monitoring Program

Nippon Koei Co., Ltd.

## (3) Ecotourism Monitoring Program

The monitoring program is shown in Table 4.7.3. The information is used to develop ecotourism programs and investment plans for facilities for the ecotours. The monitoring is especially implemented during the trial activity (Section 4.6.1).

Organization	DOE and ITTO
Monitoring Program	
Ecotourism	Questionnaire to tourists; general information about tourists, impressions about the wetland, satisfaction with ecotourism program, suggestions for improvement, others; regular distribution to tourists + surveys in summer and winter
Analysis and Storage	Every year, DOE and ITTO are to compile the results into a short report.
of Information	
Dissemination of	The report is to be distributed to ITTO, tourism companies, DOE, and other
Information	interested parties.
Evaluation and	The ecotourism activities are evaluated and fed back to the activities such as
Feedback	ecotour programs, facilities and arrangement of ecotour.

#### (4) Environmental Monitoring by Universities

The monitoring program is shown in Table 4.7.4. It is suggested that the research implemented in the wetland be presented to the universities, and to seek an opportunity to collaborate using the advanced knowledge and technology of the universities. The results should be made available to the wetland management by DOE. The collected information should be recorded in a format that can be used by DOE, enabling the wetland management system to be amended if necessary.

 Table 4.7.4
 Environmental Monitoring by Universities

Organization	DOE. Ministry of Education. Universities
Monitoring Program	
Monitoring by	A special program is developed for the various specific purposes.
Students	
Analysis and Storage	The results are analyzed by university students and professors, and a report is
of Information	prepared. Also electronic data bases are created to store the results. The results are
	compiled with the 5-year census and annual ecological monitoring data.
Dissemination of	The prepared report is to be distributed among DOE, MOJA, Bony Fish Research
Information	Center, Universities and other interested parties as technical information about the
	ecological condition of the Anzali Wetland.
Evaluation and	The ecological condition is evaluated and fed back to the management activities.
Feedback	DOE and relevant organizations review the management activities.

#### 4.7.2 Environmental Research

Scientific data on the Anzali Wetland and information on its use are still incomplete. Collecting scientifically sound data is a critical factor in the efficiency of the wetland management and the effectiveness of environmental education. It is, therefore, proposed that the following research programs be developed:

- Basic ecological status of fauna and flora including habitat requirements,

- Formation of the Anzali Wetland system,
- Potential for algal blooms,
- Bioaccumulation of pesticide in Anzali Wetland,
- Damage to Nelumbium maciferum caused by diseases and harmful insects,

(Indicated from the top in order of priority)



Damage to Nelumbium maciferumAlgal bloomsFigure 4.7.2Photographs of Damaged Nelumbium and Algal Blooms

Biological indicators are the parameters of the wetland condition. *Vimba vimba persa, Alosa caspia* and *Perca fluviatilis* are sensitive to changes in water quality. *Alburnus filippii, Barbus capito* and *Rutilus rutilus caspicus* are endemic species (Caucasus-Black sea area), and monitoring of these species can indicate the level of degradation in the wetland ecosystem. Revision of the wetland management should be carried out through the monitoring and feedback.

*Lutra lutra* occupies the top of the food chain in the wetland ecosystem and therefore, changes in the ecological condition of the wetland, including an abundance of fish and water quality, can seriously affect the population dynamics of the species. *Lutra lutra* is, therefore, considered as a suitable biological indicator. As the number of individuals is decreasing recently (DOE pers. com.), monitoring and measurements are required. Detailed ecological studies of the species involving a radio-tracking study emphasizing movements and feeding behavior should be carried out. Furthermore, if an individual *Lutra lutra* is caught in a fish net, it should be brought into the laboratory to take necessary measurements. When a carcass of the species is secured, chemical concentration in the liver and kidneys should be measured. Biological concentration of chemical substances can be an outstanding biological indicator of water quality in the wetland.

Predatory birds such as *Haliaeetus albicilla, Falco peregrinus* and *Aquila clanga* can also analyzed for chemical concentrations. Breeding status of *Haliaeetus albicilla* should be closely monitored and special actions and care, such as artificial breeding, should be provided to the species upon requirement.

### 4.8 Summary of Proposed Wetland Ecological Management Plan

The wetland ecological management plan comprise 1) environmental zoning, 2) conservation of wildlife, 3) conservation of habitat, 4) sustainable use of natural resource, and 5) monitoring and feedback. Proposed projects are summarized in Table 4.8.1 and Figure 4.8.1.

Sub component	Dropogod Drojosts/Mossuros	Executing
Sub-component	rioposed riojects/measures	Organization
Environmental Zoning	(1) Establishment of environmental zones	DOE, HUDO, MOJA
	(2) Enforcement of zoning	DOE, HUDO, MOJA
Conservation of Wildlife	(1) Conservation of the threatened species	DOE, PSO
	(2) Control of alien species	DOE
Conservation of Habitat	(1) Strengthening the regulations	
	1) Construction of guard station	DOE
	2) Capacity development of rangers	DOE
	3) Regulation of motorboats	DOE, PSO
	(2) Rehabilitation and maintenance of habitat	
	1) Rehabilitation of habitat	DOE
	2) Prevention against solid waste inflow	DOE, MOE
Promotion of Wise Use	(1) Development of ecotourism	
	1) Structuring of ecotourism network	DOE, CHTO, PSO
	2) Nature interpreter training	DOE, CHTO
	3) Preparation of infrastructure	DOE, CHTO
	4) Implementation of ecotourism	DOE, CHTO
	(2) Sustainable use of natural resources	
	1) Sustainable hunting and fishing	DOE, MOJA
	2) Beneficial use of natural resources	DOE, MOJA
Monitoring and Feedback	(1) Environmental monitoring for adaptive management	DOE, MOJA
_	(2) Environmental research	DOE, MOJA

Table 4.8.1 Summary of Proposed Wetland Ecological Management Plan



### 4.9 Cost Estimate

#### 4.9.1 Project Cost

The project cost and the operation and maintenance cost are shown in Table 4.9.1. See Chapter 3 for the general conditions for cost estimation. The total project cost is estimated at 30,811 million Rials. The largest cost is anticipated for the establishment of environmental zoning, because some land acquisition may be needed. The cost for development of ecotourism is used to construct tourism facilities.

	Drainat Coat	O&M Cost	
Proposed Projects/Measures	(million Rials)	Overall (million Rials)	Annual Average (million Rials/Year)
1. Environmental Zoning			( , , , , , , , , , , , , , , , , , , ,
(1) Environmental zoning	18,000	0	0
(2) Enforcement of zoning	175	732	49
2. Conservation of Wildlife			
(1) Conservation of the threatened species	175	262	20
(2) Control of alien species	2,076	420	32
3. Conservation of Habitat			
(1) Strengthening of regulations	737	2,974	228
(2) Rehabilitation and maintenance of habitat	449	690	111
4. Promotion of Wise Use			
(1) Development of ecotourism	9,199	3,298	392
(2) Sustainable use of natural resources	0	524	35
5. Monitoring and Feedback			
(1) Environmental monitoring for adaptive management	0	5,656	377
(2) Environmental research	0	700	50
Total	30,811	15,256	1,294

Table 4.9.1	Cost Estimate of the	Wetland Ecological	Management Plan
14010 11/11	COSt Estimate of the	The second secon	s in the mage me in the in

## 4.9.2 Operation and Maintenance Cost

The total operation and maintenance cost is estimated at 15,256 million Rials. Environmental monitoring and operation of ecotourism activities are the components that require relatively large amount of operation costs among the projects and programs proposed in the Wetland Ecological Management Plan.

### 4.10 Implementation Program

#### 4.10.1 Executing Organizations

Wetland Ecological Management will be implemented by DOE in collaboration with other organizations as follows.

- 1) Environmental Zoning: DOE, MOJA, HUDO and municipalities.
- 2) Conservation of Wildlife: DOE, PSO
- 3) Conservation of Habitat: DOE, PSO and MOE
- 4) Promotion of Wise Use: DOE, ITTO, MOJA and PSO
- 5) Monitoring and Feedback: DOE and MOJA

### 4.10.2 Criteria for Prioritization

Criteria for prioritization are listed below.

- 1) Effect: Wetland Ecology, Wetland Sustainability, and Income Generation
- 2) Urgency
- 3) Efficiency
- 4) Conformity with National Policy
- 5) Response by Executing Organization
- 6) Required Level of Environmental Awareness
- 7) Project Maturity
- 8) Required Capacity of Executing Organization
- 9) Investment Cost

#### 4.10.3 Evaluation of Proposed Projects for Prioritization

Priority of proposed measures is evaluated in Table 4.11.1. Each project is ranked A, B or C and scored. According to the evaluation, differences of scores among the projects are small; therefore, priority was examined taking account financial feasibility of the proposed measures for 15 years.

Priority measures are Establishment of Environmental Zones, Structuring of Ecotourism Network, and Monitoring and Research. Zoning is the base of wetland ecological management and it is necessary to complete it first. It is also necessary to start monitoring soon so that management plan can be reviewed every five years.

Short-term measures are Enforcement of Zoning, Conservation of the Threatened Species, Control of Alien Species, Construction of Guard Stations, Capacity Development of Rangers, Regulation of Motor Boats, Rehabilitation of Habitats, Nature Interpreter Training, Preparation of Infrastructure for Ecotourism, Implementation of Ecotour, Sustainable Use of Natural Resources, and Environmental Research.

Mid-term measures are Land Acquisition and Prevention of Solid Waste Inflow. Most of measures are continued in Long-term, however those are to be reviewed with monitoring results as adaptive management.

Criteria Project		Effect				Conformity	Response	Required		Required		
		Wetland Ecology	Wetland Sustainabilit y	Urgency	Efficiency	with National Policy	by Executing Organization	Level of Environment al Awareness	Project Maturity	Capacity of Executing Organization	Investment Cost	Total Score
1	Environmental Zoning	А	А	А	А	В	А	в	в	В	В	B(25)
(1)	Establishment of Environmental Zones	А	А	А	А	В	A B		в	А	А	A(27)
(2)	Enforcement of zoning	А	А	А	А	В	В	в	В	С	С	B(22)
2	Conservation of Wildlife	A	В	В	А	А	В	В	В	В	А	B(22)
(1)	Conservation of the threatened species	А	В	А	А	А	В	В	В	В	А	B(23)
(2)	Control of Alien Species	А	А	в	А	А	А	В	В	В	В	A(25)
3	Conservation of Habitat	А	А	В	А	В	А	В	В	В	С	B(23)
(1)	Strengthening of Regulations	А	А	В	А	В	В	В	А	А	В	B(25)
1)	Construction of Guard Station	A	A	в	А	в	A	в	А	A	С	B(25)
2)	Capacity Development of Rangers	А	A	в	А	В	В	в	А	A	В	B(25)
3)	Regulation of Motorboats	А	В	в	А	В	В	А	В	В	В	B(21)
(2)	Rehabilitation and Maintenance of Habitat	В	A	В	В	В	А	В	В	В	С	C(18)
1)	Rehabilitation of Habitat	В	А	в	В	В	А	В	В	В	С	C(18)
2)	Prevention against Solid Waste Inflow	в	В	в	в	в	в	в	в	В	В	C(15)
4	Promotion of Wise Use	В	А	A	А	А	А	А	А	А	В	A(26)
(1)	Development of Ecotourism	В	А	А	А	А	А	А	А	А	В	A(26)
1)	Structuring of Ecotourism Network	В	А	А	А	А	А	А	А	А	В	A(26)
2)	Nature Interpreter Training	В	А	в	В	А	А	А	А	А	В	B(23)
3)	Preparation of Infrastructure	В	А	в	В	А	В	А	А	А	В	B(22)
4)	Implementation of Ecotour	В	А	в	А	А	А	А	А	А	В	B(25)
(2)	Sustainable use of natural resources	В	А	В	А	А	А	В	А	А	В	B(24)
5	Monitoring and Feedback	А	А	А	А	В	В	А	в	А	В	A(26)
(1)	Environmental monitoring for adaptive management	А	А	А	А	В	В	А	А	В	А	A(27)
(2)	Environmental research	А	А	В	А	В	В	В	В	В	В	B(23)
Wei	ght	3	3	1	2	1	1	1	1	1	1	-

Note: Score A=2, B=1, C=0 Overall evaluation A: above 26, B: 25 - 21, C: below 20

#### 4.10.4 Implementation Schedule

The proposed implementation schedule of the Wetland Ecological Management Plan is shown in Table 4.10.2. It is envisaged that the basic framework of the Wetland Ecological Management be established by 2009, and then gradually improved based on the results of environmental monitoring.

Proposed Measures		Fourth 5-year Plan Period				Fifth 5-year Plan Period				Sixth 5-year Plan Period						
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1. Environmental Zoning																
(1)	Establishment of Environmental Zones															
(2)	Enforcement of Zoning															
2. Conservation of Wildlife																
(1)	Conservation of the Threatened Species															
(2)	Control of Alien Species															
3. Cons	servation of Habitat															
(1)	Strengthening of Regulations															
1)	Construction of Guard Station															
2)	Capacity Development of Rangers								-							
3)	Regulation of Motorboats															
(2)	Rehabilitation and Maintenance of Habitat															
1)	Rehabilitation of Habitat															
2)	Prevention against Solid Waste Inflow															
4. Pron	notion of Wise Use															
(1)	Development of Ecotourism															
	1) Structuring of Ecotourism Network															
	2) Nature Interpreter Training															
	3) Preparation of Infrastructure															
	4) Implementation of Ecotour			Trial A	ctivitv					Full Ac	tivity					
(2)	Sustainable Use of Natural Resources															
5. Monitoring and Feedback																
(1)	Environmental Monitoring for Adaptive Management															
(2)	Environmental Research															

#### Table 4.10.2 Proposed Implementation Schedule of the Wetland Ecological Management Plan

#### 4.11 **Priority Projects**

Among the projects/measures to be implemented in the first five year, that is, Forth Five-year Development Plan period, the projects/measures to be commenced immediately are selected as a priority project. The priority projects in the proposed Wetland Ecological Management Plan are selected as follows:

- 1) Environmental Zoning
- 2) Development of Ecotourism
- 3) Environmental Monitoring for Adaptive Management

## CHAPTER 5 WATERSHED MANAGEMENT PLAN

#### 5.1 Introduction

As reviewed in Chapter 2, the watershed of the wetland, especially the upper watershed, is the main source of the sediment load to the wetland. Roughly 80% of the total sediment load (approximately 400,000 tons/year) come from the upper watershed. Overgrazing, deforestation, and limited erosion control works are among the main causes of the erosion problem in the watershed. In addition, these are the causes of other problems, such as (i) degradation of the mountain ecosystems that constitute a major part of the Greater Anzali Ecosystem, (ii) the economic problems of graziers and other local residents who depend on natural resources in the rangelands and forests, and (iii) weakening the capacities of the watershed to recharge and regulate water, and to control disasters, such as flooding and debris flow.

The need to protect the watershed is obvious, and much effort has been put into watershed management by NRGO, MOJA, DOE, and others. However, these efforts have not been able to solve the overgrazing, deforestation and other problems partly because the approaches taken so far did not sufficiently take the socio-economic dimensions of the problems into consideration, as explained in Section 2.5.7. Therefore, the Watershed Management Plan below, which is built on existing watershed management plans and activities by relevant organizations, introduce new dimensions to watershed management.

#### 5.2 **Objectives and Strategies**

#### 5.2.1 Objectives

The principle objective of the watershed management plan is to improve the wetland environment through:

- reduction of sediment inflow from the watershed into the wetland; and
- restoration and protection of the fabric of the watershed to enhance the biodiversity of the area.

#### 5.2.2 Strategies

A common theme underlying all the components of the watershed management plan to attain the above-mentioned objective is "sustainable watershed management". Therefore, the proposed watershed management plan becomes a holistic program not only for solving the physical problems (soil erosion, land slides, land degradation, etc.) but also for improving social problems (livelihood, conflict with graziers, etc.) in the watershed. Basic concepts employed in planning the watershed management plan are outlined below.

# (1) Control of Further Progression of Soil Erosion and Land Slides

Control of erosion is crucial both to minimize the inflow of sediment into the wetland and to protect the watershed itself from further degradation. Hence, the emphasis is put on taking necessary measures to prevent soil erosion and land slides as soon as possible. In particular, areas that have already been degraded to a level beyond natural recovery should be urgently stabilized by applying physical control measures (e.g., erosion control and landslide control works) in addition to vegetative control measures (e.g., tree planting, seeding and fencing).

# (2) Promotion of Participatory Resource Management

In order to restore the watershed to its near natural condition, over-exploitation of rangelands and forests has to be controlled. So far, regulatory measures, such as licensing and resettlement of graziers, have been taken to control over-exploitation. However, regulating measures would not be able to resolve such problem since it is deeply rooted in complex social issues, especially livelihood of graziers in the upper watershed.

Since graziers heavily rely on natural resources (forests and rangelands) for their lives, it is important to make a balance between natural resource protection and livelihood stabilization to solve such problem. Therefore, a participatory resource management concept, which allows local people (stakeholders) to use resources in a sustainable manner but has them protect resources by themselves, should be introduced in the management of the upper watershed. In fact, many developing countries have shifted their attitude/policies on resource management from "government-centered or regulatory-based" to "participatory management", because many of the regulatory-based initiatives had ended in failure in the past.

Ideally, the responsibility of managing natural resources needs devolving onto local people so as to make them real managers. In fact, once they realize that resources in their assigned area are part of their properties, they would be good managers of the area. This is one of keys to making the participatory forest management initiatives more sustainable.

(3) Livelihood Development of Graziers and Forest Dwellers

Limited livelihood opportunity in the upper watershed is one of the basic causes of overgrazing as well as deforestation. Improvement of the livelihood situation of graziers and forest dwellers is essential for sustainable resource management. It is also true in the livestock resettlement program that the livelihood support to affected families needs to be strengthened since it is insufficient at present and the long-term effect of the resettlement program is in question for that reason. Therefore, there is a need to put a scheme together to assist local residents in the forest in securing their livelihoods so as to reduce their dependence on natural resources.

(4) Improvement of the Livelihood Resettlement Program

As determined in Section 2.5.7, there are several limitations in the livestock resettlement program and it is speculated that the project would cause the deterioration of the wetland and social insecurity in urban areas. In particular, its consultation process and continuous

livelihood support to affected families should be improved to minimize the adverse effect induced by the resettlement program.

1) Introduction of proper consultation processes

A series of consultations is necessary in the resettlement program to avoid a social conflict after relocation. A full process of consultations should be taken from the beginning of the program so that affected families could realize their situation after resettlement. Simultaneously, several types of support (e.g., job training, income generating activities, financial management, etc.) for livelihood development should be undertaken to help affected families to secure another source of income.

2) Continuous support after relocation

NRGO Guilan has undertaken no monitoring activity on the resettlement program so far. At present, there is little information as to whether affected graziers are satisfied with the present situation or faced with economic difficulties. It is expected that it will take some time for affected families to settle down to their new lives. Hence, NRGO should monitor the condition of graziers periodically after relocation and provide support to graziers when necessary.

(5) Establishment of Effective Institutional Set-up

The institutional strengthening is essential to smooth operation of proposed activities of the watershed management plan. The following should be considered in the watershed management plan.

1) Development of inter-organizational coordination

While various organizations are striving to execute existing duties to manage the watershed, many watershed management issues involve more than one organization, and without co-operative efforts, it is difficult to implement effective management of the watershed. Among the examples of such issues are regional environmental protection, erosion control, land use management and resettlement program. The master plan will thus consider effective mechanisms for inter- and intra-organizational co-ordination.

#### 2) Development of necessary regulations/guidelines

The concept of participatory resource management is still new to the country and only a few pilot projects have been carried out so far. Legislative support is indispensable for applying the new concept extensively under such circumstances. In particular, regulations related to resource management and guidelines for project implementation need preparing since the concept of participatory resource management requires changing the attitude of the government offices and devolving their authorities over resources to local people.

### (6) Capacity Development of Provincial and Local Offices

Capacity development of local offices is necessary for achieving the sustainable use of the watershed. In particular, the capabilities of proper designing of erosion control works and preventive measures for land slides, participatory resource management, livelihood support, and sustainable management of watershed based on monitoring and evaluation activity are still weak in the government offices concerned. Therefore, capacity development of provincial and local offices should be emphasized in the watershed management plan.

#### (7) Precondition/External Condition

The following factors were considered as preconditions and/or external conditions in the preparation of the watershed management plan.

- 1) The livestock resettlement program is regarded as an existing program since the program is on-going and was already programmed into the Fourth Five-year Development Plan (2005-2009). Therefore, the program is not incorporated into the proposed activities of the master plan.
- 2) Forest and rangeland management activities to be proposed in the watershed management plan need to be adjusted to the schedule of the resettlement program. Those activities would be ineffective or moreover might create additional conflicts with graziers if they were implemented prior to the resettlement program.

### (8) Components of the Watershed Management Plan

Since MOJA (WMD) and NRGO have different responsibilities for watershed management, namely, the soil erosion control under MOJA and natural resource management under NRGO, the proposed activities of the watershed management plan are also packaged based on the duties of the respective organizations. Consequently, the watershed management plan is composed of the following components:

Component	Responsible Organizations				
1. Soil Erosion Control and Prevention of Land Slides	MOJA, (NRGO)				
2. Forest and Rangeland Management	NRGO				
3. Plain Area Management	MOJA				
4. Livelihood Development	NRGO				
5. Institutional Arrangement	MOJA, NRGO				
6. Monitoring Plan	MOJA, NRGO,				
	Agriculture and Natural Research Center (MOJA)				

 Table 5.2.1
 Components of the Plan and Their Responsible Organizations

# 5.3 Soil Erosion Control and Prevention of Landslides

## 5.3.1 Soil Erosion Control

Although MOJA Guilan has made efforts to control soil erosion to minimize sediment load from the upper watershed, there are still many areas left untreated due to budgetary constraints. Among others, areas that have been degraded to a level beyond control should be stabilized as soon as possible. Therefore, the proposed watershed management plan puts its focus on preventing further land degradation in the degraded rangelands of about 77 km<sup>2</sup>.

(1) Standard Designs of Erosion Control Works

There are various techniques to control erosion and the choices of these measures depend on the stage of the erosion as well as other factors, such as geology, rainfall, etc.



Figure 5.3.1 Erosion Stages and Appropriate Countermeasures

In order to select the erosion control measures applicable to the study area, a model area was selected in the upstream of Masuleh Town (175 ha), and a set of standard measures were designed for this model area (see Supporting Report, Part 4, Watershed Management). In addition, a pilot activity was carried out in the same area to examine the applicability of the proposed measures (see Chapter 12). Assuming similar soil erosion control works to those applied in the pilot area could be introduced in all the degraded areas (about 77 km<sup>2</sup>) in the upper watershed, the total quantities of erosion control measures for the entire upper watershed are estimated as shown in Table 5.3.1

Counter- measures	Measures	Unit (nos. /km <sup>2</sup> )	Area (km <sup>2</sup> )	Total numbers	Total Cost (million Rials)
Structural Measures	Concrete Check Dam	1.7	76.7	131 nos.	47,160
	Gabion Check Dam	37	76.7	2836 nos.	49,630
	Wooden Dam	12	76.7	920 nos.	2,760
	Contour Bund	2.5	76.7	191 km	956
	Sub-total	-	-	-	100,506
Biological Measures	Straw matting	0.1	76.7	7.67 km <sup>2</sup>	38,330
	Seeding	All areas	76.7	76.7 km <sup>2</sup>	2,729
	Fertilization	All areas	76.7	76.7 km <sup>2</sup>	713
	Sub-total	_	-	-	41,772
Total Cost		-	_	-	142,278

 Table 5.3.1
 Total Numbers of Measures and Estimated Cost for the Measures in the Upper Watershed

Source: JICA Study Team (Supporting Report Part 4 "Watershed Management")

#### (2) Maintenance of Erosion Control Facilities

It is noted that many existing erosion control facilities in the upper watershed have malfunctioned as shown in Figure 5.3.2. There is an urgent need to repair and maintain these structures since the situation could cause serious damage (e.g., debris flow and floods) to the downstream areas. Periodical monitoring and adequate maintenance of constructed soil erosion facilities are indispensable for keeping those facilities effective.



Figure 5.3.2 Condition of Existing Gabion Check Dams

#### (3) Implementation

Although the total quantities of erosion control works for the entire watershed are estimated as in Table 5.3.1, a long-term plan and detailed execution studies for the respective degraded areas need to be prepared prior to the implementation of soil erosion control works since the design of the proposed measures should be determined based on the actual conditions of the sites. Construction of the soil erosion control works will be undertaken by local contractors. However, it is proposed that graziers be involved in the works, especially biological measures, since the measures could create sizable job opportunities for them and are not difficult to apply. In addition, annual maintenance work after construction can be contracted out to graziers as a part of rangeland management so as to empower them through securing an alternative source of income and strengthening a sense of ownership for the rangeland.
## 5.3.2 Prevention of Landslides

A number of roads are being constructed in the forest for timber transport and regional development. Unfortunately, these roads are constructed on the standard cross-section designed for an area with stable geology and no slope protection is practiced. For this reason, slope collapse and landslides are common in geologically unstable areas. In the sections where a slope collapse or landslide has occurred, no remedial measure has been taken due to lack of technique and a shortage of budget. As a result, secondary slope collapses and landslides would be induced by heavy rain or snow melt, and eventually, severe floods and debris flows would cause damage to the downstream areas. According to the GIS Center of MOJA Guilan, there are 20 landslides untreated in the Watershed.

### (1) Selection of Landslides and Slope Collapse Measures

Measures to cope with landslides and slope collapse should be carefully considered because of their scale and complex mechanisms. Thus, it is recommended that execution studies with detailed designs should be carried out for all the land slide sites.

- (2) Countermeasure Works
  - 1) Landslides

The countermeasures against landslides are broadly divided into two major works: control works and restraint works. These two types of works should be combined to prevent landslides in the study area. The proposed measures against a weathered rock slide, a colluvial deposit slide (e.g., upstream of Masuleroud River) and the landslide of Masuleh Town, which are major landslides in the study area, are outlined as follows:

Site situation	Suggested Countermeasures
Weathered rock slide	Counter weight embankment, Ground anchor
Colluvial deposit slide	Drainage works (Channel works / Horizontal gravity drain), Counter
	weight embankment, Gabion wall
Masuleh Town landslide	Horizontal gravity drain, Removal of soils, Counter weight
	embankment, Gabion wall

Table 5.3.2	Suggested	Countermeasures	against	Landslides
-------------	-----------	-----------------	---------	------------

Source: JICA Study Team

The Supporting Report Part 4 "Watershed Management" gives typical designs of the proposed countermeasures listed above.

2) Slope collapse

A slope collapse is usually caused by a surface failure of the slope. This type of collapse can be controlled by a combination of shotcrete, soil nails, and protection walls with gabions beside the road. An example design is also presented in the Supporting Report Part 4 "Watershed Management".

(Unit: tons/year)

It is also important to grasp the geological feature of construction sites and predict the possibility of landslide in the planning stage. In general, a ground movement of land slide occurs in areas of particular geology and geological structures. The ground moves continuously at a very slow speed and ultimately slips down. The movement deforms the ground relief in a particular shape called "Landslide Morphology". Recognition of the particular morphology enables one to predict the distribution or location of landslide areas.

## 5.3.3 Effect of Soil Erosion Control Works

Assuming that devastated areas of rangelands (grass lands to bare lands) are returned to grass land by the vegetative measures, the erosion rate could be reduced by about 415  $m^3/km^2$  (310  $m^3/km^2$  by EPM method or 517  $m^3/km^2$  by PSIAC method). Likewise, assuming that all the devastated forests are restored<sup>1</sup>, the erosion rate would be reduced by 109  $m^3/km^2$  (120  $m^3/km^2$  by EPM method or 95  $m^3/km^2$  by PSIAC method). If the proposed measures were implemented in all the degraded areas, about 51,900  $m^3/year$  (32,000  $m^3/year$  from rangelands and 19,900  $m^3/year$  from forests) or 67,900 ton/year (41,500 ton/year from rangeland and 25,900 ton/year from forests) of sediment load would be eliminated. Usually, vegetation works can not be effective immediately after planting, especially in reforested areas. It is assumed that the effect of reforestation will be 2/3 of the calculated volumes to be on the safe side.

					(	Unit. tons/ year
A #22		Current		Reduced Sediment	After Implementation of	
Area		Current		Load * <sup>1</sup>	Measures * <sup>2</sup>	
Bare land		119,300		0	119,3	300
Rangeland	Bare	58,100		41,500	16,600	
	Grass	6,700	64,800	0	6,700	28,300
Forest	Grass	14,100		17,200	3,100	
	Forest	125,500	139,600	0	125,500	128,600
Total		323.	700	58,700	276,2	200

Table 5.3.3 S	ummary of Effect of Countermeasures
---------------	-------------------------------------

Note: Bulk density of soil is estimated at 1.3.

```
*^{1} 41,500 = 415 x 77 x 1.3 and 17,200 = 109 x 182 x 1.3 x 2/3
```

\*<sup>2</sup> Measures include overgrazing control, reforestation, and erosion control works. Source: JICA Study Team, 2004

## 5.4 Forest and Rangeland Management

## 5.4.1 Introduction

The proposed forest and rangeland management plan aims to restore as much vegetation as possible in the degraded areas and protect natural resources of the whole watershed from degradation in order to enhance the functions of the watershed for the wetland environment. This is in line with the NRGO target, which is to restore the vegetation of the watershed up to

<sup>&</sup>lt;sup>1</sup> Forest management plan including reforestation activities is discussed in Section 5.3.

the level of 1963. The proposed management plan also pays attention to making a balance between the restoration of vegetation and livelihood development for local people by adopting the concept of participatory resource management.

The forest and rangeland management plan is composed of eight (8) components, namely, i) pilot activity of participatory resource management, ii) reforestation of the 70 km<sup>2</sup> of degraded forests below 1,500 m above sea level, iii) reforestation of 112 km<sup>2</sup> of grasslands in the margin areas, iv) forest management under forestry plans, v) conservation of protected forests, vi) rangeland management of the entire rangelands, vii) preparation of regulations necessary for participatory resource management and viii) improvement of the livestock resettlement program.

## 5.4.2 Pilot Activity for Participatory Resource Management

Although the aim of this forest and rangeland management plan is to restore the vegetation of the watershed through adopting the concept of participatory resource management, it would not be easy for NRGO to instantly apply the concept to its forest and rangeland management activities at the ground level since the concept is still new to the country. Therefore, the master plan study proposes implementing a pilot activity of participatory resource management at the beginning of all the proposed activities to open the eyes of local NRGO offices. It is expected that NRGO staff could learn how to implement a participatory resource management project through the implementation of the pilot activity. The outline of the pilot activity is summarized as follows:

Item	Description
1. Objective	The main objective of the pilot activity is to enable NRGO to go through the process of
	participatory resource management and to get the knowledge and lessons necessary for
	formulating a participatory resource management project and its supporting regulations.
2. Pilot sites	The pilot activity would be undertaken in the major four townships (Rezvanshahr,
	Fuman, Shaft and Masal) in the watershed to involve all the local NRGO offices in the
	process. The estimated area of the pilot site is assumed as 500 ha in the forestland.
3. Target Group	Target families for the pilot activity should be forest dwellers or graziers who stay in the
	forest. The estimated number of participants per pilot site would be $50 - 100$ families.
4. Duration	The period of the pilot activity is five (5) years.
5. Executors of the	Since there seems to be no expertise in participatory management in NRGO Guilan,
activities	competent local consultants/NGOs should be outsourced to assist NRGO in
	implementing the proposed activities.
6. Major Activities	a. Conduct of a socio-economic survey
	b. Explanation of the pilot activity to graziers/forest dwellers (target people)
	c. Organization of the target people and provision of training
	d. Preparation of a forest management plan with the target people
	e. Forest management (reforestation, maintenance of forests, thinning, and protection) by
	the target people (under a contract with NRGO)
7. Necessary inputs	Several fields of external experts (consultants/NGOs) are required.

Table 5.4.1	<b>Outline of the Pilot Activity</b>
-------------	--------------------------------------

# 5.4.3 Reforestation of Degraded Forests (70 km<sup>2</sup>)

This aims to reforest the degraded forests of 70 km<sup>2</sup> below EL. 1,500 m to improve the functions of forests in the upper watershed. Major activities of the reforestation plan are i) surveying and mapping, and ii) reforestation activities (land preparation, planting, maintenance, thinning and protection). For some sub-watersheds, reforestation activities would be undertaken by local people (graziers and forest dwellers) under the concept of participatory resource management. Hence, the organization of local people and assistance in forest management will be added to the major activities in those sub-watersheds.

## (1) Surveying, Mapping and Designing

Prior to the implementation, a ground survey is to be carried out in the degraded areas to prepare base-maps. Based on the maps prepared, plantation designs would be prepared. The standard designs that NRGO Guilan uses are 1.5 m x 1.5 m (Oak) and 2 m x 2 m (Alder, Ash, Pissea, etc.).

(2) Recommended Species and Silvicultural Practices

In principle, native but valuable species are recommended to minimize any unwanted environmental impacts as well as enhance the values of forests. Oak (*Quercus* sp.), Ash (*Fraxinus exselsior*), Alder (*Alnus glutinosa*), Acer (*Acer insign*), Pine (*Pinus* sp.), Beach (*Fagus orientalis*), Hackberry (*Celtis ostralis*) and Poplar (*Poplus* sp.) are generally recommended for reforestation. Site conditions such as soils, topography, lighting, elevation (climate) should be considered in selection of species. The recommended silvicultural practices are summarized in Table 5.4.2.

Practice	Summary
Nursery	Seedlings will be produced in nurseries of NRGO. The following should be practiced in
Operation	seedling production.
	- Seeds for seedlings should be collected from healthy mother trees
	- Matured (plantable sized), healthy and not deformed seedling should be delivered.
Land	Strip brushing and hole digging are to be undertaken in land preparation.
preparation	Special attention should be paid to the following.
	- The size of the holes should be three times as large as the plastic bag.
	- In refilling a hole, top soil should be put in first and sub-soil is laid on the top soils.
Season	November – April
Fencing	All plantations should be fenced to protect planted trees from animals.
Tending /	Weeding, cultivation and fertilization should be undertaken for at least three years.
Maintenance	If the mortality in the plantation is high, replanting should also be done.
Thinning	Thinning, which removes dead, unhealthy and unwanted trees, should be undertaken at the
_	5 <sup>th</sup> and 10 <sup>th</sup> years after planting.

 Table 5.4.2
 Recommended Silvicultural Practices

Source: JICA Study Team

## (3) Proposed Works

The summary of proposed works for reforestation and forest management of the degraded forest of 70  $\text{km}^2$  is summarized as follows.

						(Unit: ha)
Year	Surveying, Mapping	Land prep. / Planting	Fencing	Maintenance	Thinning	Patrolling
2005~2018	6,970	6,970	6,630	20,910	13,940	72,790

Table 5.4.3	Summary of the	Reforestation	Plan for the	<b>Target Area</b>
-------------	----------------	---------------	--------------	--------------------

Source: JICA Study Team (Supporting Report Part 4 "Watershed Management")

### (4) Implementation

At present, many reforestation woks are done by local private firms in addition to forest management of the forestry areas (4 sub-watersheds: Chahroud, Morghak, Pasikhan, and Siahroud). The proposed reforestation activities will also be contracted out to private firms in the initial stage. Even so, NRGO should instruct contractors to hire as many graziers/forest dwellers as possible in reforestation and forest management.

For Masulehroudkhan and Plangvar sub-watersheds, the participatory management concept should be introduced in reforestation and forest management in the degraded forests in such sub-watersheds. The activities undertaken in the pilot activity of participatory resource management can be replicated in those areas (see Section 5.4.2 above). It is however expected that it would be very difficult for NRGO Guilan to undertake such activities without the help of external experts (local consultants/NGOs) who have experience in participatory/community-based forest management. The same experts hired for the pilot activity will be used for such activities.

## 5.4.4 Reforestation of Margin Areas (112 km<sup>2</sup>)

The reforestation of the margin areas is in line with the aims of the master plan as well as NRGO. However, there should be an assessment whether or not all the areas could be reforested prior to the planning, since the margin areas are part of major grazing grounds.

(1) Determination of Target Areas

A rough comparative assessment based on the number of livestock remaining after the resettlement program and stocking capacity of the area was carried out. The assessment determined that all the degraded margin areas could be reforested.

Total	Degraded	Stocking	Stocking Capacity * <sup>3</sup>		Estimated no.	of livestock * <sup>4</sup>
Grassland*1	Forest * <sup>2</sup>	density	Maximum	Minimum	Graziers	Livestock
44,126 ha	18,200 ha	3 units /ha	132,378	77,778	693	76,048
			units	units	families	units

 Table 5.4.4
 Potential for Grazing and Estimated Number of Livestock

Note:  $*^1$  The 44,126 ha includes grasslands in the forest.

\*<sup>2</sup> The 18,200 ha consists of the degraded forests of 6,980 ha and grasslands in the margin areas of 11,230 ha.

 $*^{3}$  The following estimations are used: 44,100 x 3 = 132, 300 and (44,100 - 18,200) x 3 = 77,700

\*<sup>4</sup> As stated in Section 2.5.5

Source: JICA Study Team based on information from NRGO

Reforestation and management works in the margin areas could also become alternative livelihoods of the graziers who have to quit grazing but can stay in the watershed if all works

(Unit ha)

related to reforestation and forest management of the margin areas can be contracted out to the retired graziers. Consequently, it is recommended that all the 112 km<sup>2</sup> should be reforested to recover the functions of the watershed and create sizable employment opportunities for the retired graziers.

## (2) Reforestation and Forest Management Plan

The reforestation plan for the margin areas is outlined below.

Items	Summary
1. Target Area	11,230 ha in the rangeland
2. Period of the plan	For reforestation: 2009-2014 (For maintenance: 2010-2024)
3. No. of graziers involved	About 1,700 families (80 % of the retired graziers will remain in the areas.)
4. Project executors:	Groups of retired graziers (graziers who will have to quit grazing)
	(Organization of the retired graziers is to be done based on the experience of
	the pilot activity.)
5. Forest management activities	Same as the activities described in 5.4.3
6. Recommended Species	Oak (Quercus sp.), Ash (Fraxinus exselsior), Alder (Alnus glutinosa), Beech
	(Fagus orientalis), Acer (Acer insign), Walnut (Juglens regie), Promus
	Avium, Surbus terminalis
7. Silvicultural practices	Same as the practices described in 5.4.3
8. Unit Cost of forest activities	Same as the unit costs described in 5.4.3

<b>Table 5.4.5</b>	Outline of the Reforestation Plan for the Margin Arc	eas
--------------------	--	-----

Source: JICA Study Team

The summary of reforestation and forest management works in the margin areas is summarized as follows.

### Table 5.4.6 Summary of Reforestation Plan for the Margin Areas

						(Unit. na)
Year	Survey, Mapping	Land pre./ Planting	Fencing	Maintenance	Thinning	Protection
2009~2019	11,230	11,230	11,230	35,400	16,850	94,890

Source: JICA Study Team (Supporting Report Part 4 "Watershed Management")

## (3) Implementation

It is proposed that reforestation and forest management works for the margin areas should be undertaken by the retired graziers under the concept of participatory resource management. Therefore, external experts should be hired for the implementation of the plan, especially to organize graziers and assist them in forest management.

## 5.4.5 Forest Management under Forestry Plans

Four (4) sub-watersheds, i.e., Chahroud; Morghak; part of Pasikhan; and Siahroud, are presently managed by private firms in accordance with the forestry plans prepared by NRGO. The forestry plans seem technically appropriate, but there are some problems found in the implementation, such as improper road construction, improper exploitation, etc. It is recommended that NRGO should pay more attention to monitoring and supervision of

contractors' works at the field level. Another crucial issue in the four sub-watersheds is a social conflict with graziers. Although the livestock resettlement program will reduce the number of graziers in the forest, conflicts with graziers, regardless whether registered or unregistered (illegal), would probably continue unless a certain measure to secure their livelihood is taken. The master plan study recommends that NRGO Guilan take the following actions in the four sub-watersheds.

- 1) to request contractors to hire graziers/forest dwellers as casual laborers for forestry works. (2005-2009)
- 2) to assist graziers/forest dwellers in organizing themselves to make a forest cooperative and provide necessary technical assistance. (2005-2015)
- 3) to make an arrangement with contractors to subcontract part of the forestry works to the organized cooperatives of graziers. (2010-2019)
- 4) to contract out the management works for some series of the sub-watersheds to the organized cooperatives of graziers (2015-2019)

## 5.4.6 Conservation of Protected Forests

The following protected areas should be conserved and maintained by both DOE and NRGO as they have been doing.

Protected area	No. of sites	Area		
Shaft-Siahmezgi forest	1 site	39,511 ha		
Protected forests	29 sites	3,250 ha		
Conservation of genetic flora	25 sites	10~100 ha/site		
Source: NRGO Guilan				

 Table 5.4.7
 Protected Areas in the Watershed

The jurisdiction of Shaft-Siahmezgi forest is being transferred from NRGO to DOE. The designation of the area as a protected area under the Environmental Protection and Enhancement Act needs to be approved as soon as possible so as to avoid any confusion in managing the area. Then, regular protection works, e.g., fencing and patrolling, should be done by DOE to protect the area from illegal exploitation.

## 5.4.7 Rangeland Management by Graziers

As described in section 5.3, the degraded rangelands of 77  $\text{km}^2$  will be rehabilitated in the frame of soil erosion control works. This section focuses on how to manage the entire rangelands of the upper watershed in a sustainable manner.

(1) Balancing the Number of Livestock (Incorporation of Livelihood Schemes)

As analyzed in Table 5.4.4, the number of livestock remaining after the resettlement program can balance with the stock capacity of the grasslands in the upper watershed. However, an inventory survey should be conducted after the resettlement program so as to identify the remaining graziers and livestock that will depend on the rangeland.

As a part of the balancing of the number of livestock, NRGO Guilan plans to convince small-sized graziers to quit grazing and sell some of their livestock to large-sized graziers so as to reduce the number of livestock and to make the grazing size of remaining graziers more profitable. The Study Team believes that it would be difficult for small graziers to change their occupation without having alternative sources of income. Considering the difficulty in consolidation of graziers, the Study Team proposes incorporating a scheme to develop alternative livelihoods of graziers into rangeland management. One of the livelihood options that graziers/groups of graziers can engage in is to work on soil erosion control works, especially vegetative measures and maintenance of the applied erosion control works as discussed in Section 5.3.

## (2) Empowerment of Graziers

The rangeland should be managed by the remaining graziers in a sustainable manner since they are the main users of the area. In order to empower the remaining graziers, the following activities, which are the same as those for participatory resource management, will be undertaken by NRGO.

Work item	Activities
1. Organization	a. to conduct socio-economic surveys
of graziers	b. to discuss with graziers present condition of rangeland, problems, and countermeasures.
	c. to facilitate them to organize themselves as a group
	d. to prepare rules/norms of organizations and uses of rangeland
2. Demarcation	a. to prepare a rangeland management plan on the ground together with graziers
of area	b. to formulate a rotation schedule for rangeland together with graziers
	c. to train graziers on the management of rangelands
3. Contract with	a. to prepare an annual work plan for rangeland management together with graziers
NRGO	b. to enter into a long-term contract with NRGO for management and use of rangeland
4. Necessary	a. to assist graziers in managing rangelands
assistance	b. to assist graziers in developing alternative livelihood activities

<b>Table 5.4.8</b>	<b>Proposed Activities</b>	for Empowerment	of Graziers
	1	1	

## (3) Management Activities

After the organization of the remaining graziers, the actual rangeland management works will be undertaken by the organized graziers with the assistance of NRGO. It is proposed that the following activities are to be done by the graizers.

Item	Activities
Regular work	a. Control of grazing season (June – September: 120 days)
	b. Identification of grazable areas
	c. Conclusion and control of rotation schedule
	d. Monitoring of the condition of grasses
Contracted work	Under the vegetative erosion control works
	a. Seeding and fencing for degraded areas
	Under the rangeland management and maintenance works
	b. Fencing along the boundaries between forests and rangelands
	c. Fertilization (once a year in the first 5 years and every two years from the 6 <sup>th</sup> year)
	d. Protection of rangelands from any fires / unsustainable uses (every year)
	e. Replacement of fences (every seven years)

## (4) Volume of Works

The quantities of the management activities except for the vegetative erosion control works proposed in Section 5.3 are tabulated as follows:

 Table 5.4.10
 Total Volume of Works for Rangeland Management

Sub-watershed	Fencing	Fertilization * <sup>1,</sup> * <sup>2</sup>	Protection * <sup>1, *<sup>2</sup></sup>	Replacement of fence	
Whole Rangeland	188 km	28,462 ha/yr	28,462 ha/yr	188 km	
Note: *1 Fertilization should be undertaken once a year in the first 5 years and it should be every 2 years from					

ote: \*<sup>1</sup> Fertilization should be undertaken once a year in the first 5 years and it should be every 2 years from the 6<sup>th</sup> year. Protection should be regular annual work.

 $*^{2}$  The volumes of works are estimated assuming areas between 1,500 m and 2,000 m would be managed as rangelands.

Source: JICA Study Team (Supporting Report Part 4 "Watershed Management")

### (5) Implementation

As mentioned above, the rangelands will be managed by the remaining graziers under the concept of participatory resource management. Therefore, external experts like the reforestation of the margin areas need to be hired for assisting the retired graziers in rangeland management.

## 5.4.8 Regulations Necessary for Participatory Resource Management

To promote participatory resource management projects, new regulations (decrees), especially on the management of resources and lands, should be prepared by 2007/08. New regulations should secure the following rights of graziers for a certain period.

- Control over resources in the assigned area
- Land use/management (Land use rights)

Implementation guidelines for a resource management project should also be prepared by 2007/08 so that the local staff of NRGO and the contractors (local consultants/NGOs and local people) could use them as guides for implementation.

## 5.4.9 Improvement of the Livestock Resettlement Program

Although the livelihood resettlement program is treated as a precondition and not incoporated into the master plan, the Study Team proposes the following improvements to be done in order to minimize adverse social issues derived from the resettlement program.

(1) Preparation of a Field Handbook

The livestock resettlement program is being implemented in accordance with the existing guideline. The guideline merely focuses on the compensation and it does not emphasize the need for long-term support for livelihood improvement of affected people nor co-ordination among relevant organizations. There is a high probability that the affected families would face financial difficulties in a few years after the implementation of the resettlement program. Ideally resettlement needs to be planned like a development project and the details of each resettlement initiative need to be set out in a Resettlement Action Plan (RAP) and then

monitored during implementation. NRGO is urged to revise its guideline document based on the JICA Guidelines for Environmental and Social Considerations (2004) and other relevant guidelines.

The Study aims at improving the process of the resettlement program rather than stopping it since the program is on-going and it seems hard to stop at present. A field handbook that contains the necessary steps for consultations, including livelihood support, should be prepared so that the local staff to be involved in the program can take the proper procedures in the field. The results of the pilot activity of participatory livelihood development will also be incorporated into the handbook. Competent experts, probably local consultants or NGOs who have a great deal of experience in either resettlement or community development, will be hired for its preparation.

(2) Training of Local NRGO Staff

After the field handbook is completed, training/guidance on it should be given to local NRGO staff.

(3) Strengthening of the Forestry Conservation Committee

Currently, the resettlement program involves a number of different organizations as follows:

Category	Tasks	Organization	
Resettlement	Consultation with resettlers, development of	Conservation Committee of NRGO	
	resettlement programs, valuation of assets	Resettlement Office of NRGO	
Livelihood	Agricultural production (e.g., rice)	Cultivation and Agriculture Department of	
Support		MOJA and relevant cooperatives	
	Animal husbandry	Livestock Affairs Department of MOJA and	
		relevant cooperatives	
	Job training for people on welfare programs	EMDAD	
Infrastructure	Development of housing	Livestock Affairs Section of MOJA and	
Development		Housing and Urban Development	
		Organization	
	Water supply and wastewater management	Rural Water and Wastewater Company	
	School	Ministry of Education	
Financial	Low interest loans	Agricultural bank	
Assistance			

 Table 5.4.11 Organizations Involved in the Resettlement Program

Source: JICA Study Team based on information from NRGO and MOJA

There should be one organization formed with the participation of all the government organizations related to the resettlement program. There is an option that the forest conservation committee that NRGO and DOE have established is to be strengthened to function as an executing/coordinating organization of the resettlement program. In the concrete, one additional unit with five (5) additional contractual staff responsible for livelihood assistance should be added to the existing organization.



Source: JICA Study Team

Figure 5.4.1 Proposed Organizational Structure of the Conservation Committee of NRGO

### 5.5 Plain Area Management

Due to the favorable combination of flat topography and the presence of the paddy fields that dominate this area of the watershed, the amount of sediment run-off from the plain is approximately 74,000 ton/year, and this is considered to be low compared to the total amount of sediment load from the entire basin which is approximately 400,000 ton/year. Thus, no quantitative target for the reduction of sediment load from the plain area is set here.

However, there are various measures that can reduce the amount of the sediment runoff from the plain area. It is important that a long-term plan for run-off control of the entire plain area be formulated so as to determine effective measures with their potential sites. Some measures are discussed in this section.

## 5.5.1 Source-level Control of Sediment Runoff in the Plain Area

Though sediment runoff from the plain area is limited (about 74 tons/year), there are various measures to control sediment runoff at each source level e.g., conservation of farmlands, control of sediment from construction sites, removal of sediment from urban areas, etc. They can be promoted to minimize sediment runoff from the plain area.

## 5.5.2 Construction of Sediment Trap

As a measure to intercept the sediment from entering the wetland, effectiveness of sediment traps in rivers before the wetland was evaluated in the Supporting Report Part 2 "Hydrology". The evaluation shows that sediment traps can effectively intercept sediment.

At present, the Shiakeshim area is under pressure from sediment deposition. Two of the four primary rivers which enter the Shiakeshim area, the Palangvar River and the Morghak/Khalkaii Rivers, flow directly into the primary resting area for migratory birds. Given the importance of preserving the Shiakeshim area as a bird sanctuary, priority for the sediment basins is given for these two rivers (the other two rivers, the Bahambar and

Masulehroudkhan Rivers, do not flow directly into the resting area and thus, are not believed to be a priority at present). The locations of the proposed sediment basins are shown in Figure 5.9.1. According to the assessment, the dimensions and trap rate of the sediment trap basins are as shown below.

Basin	Area (m <sup>2</sup> )	Dimension	Q <sub>in</sub> (ton/year)	Q <sub>trapped</sub> (ton/year)	Trap Rate (%)
Basin 1 (Palangvar River)	10.000	200 m long x	23,000	9,000	40
Basin 2 (Morghak/Khalkaii River)	10,000	50 m wide	41,000	16,000	40

 Table 5.5.1
 Basic Plan of Construction of Sediment Traps

Source: JICA Study Team

It is necessary to remove the sediment trapped in the basin and removal cost is estimated at about 25,000 USD/year. If the operation and maintenance cost can be reduced or the traps can be used for other purposes, the construction of sediment traps might be justified. According to MOJA, it would be possible to encourage local people to use the sediment caught in the traps as construction material (aggregate) and minimize the operation and maintenance cost. Another potential alternative to control inflow of sediment is to construct open waters within the wetland (e.g., Siahkeshim) with a dual objective, (i) to actively create a diverse environment, and (ii) to trap the sediment.

### 5.5.3 River Management for Extreme Conditions

Many wetlands in Iran (e.g., Uromiyeh Lake) have been devastated by the combined impacts of draughts in recent years and increased use of river water for irrigation. Fortunately, the Anzali Wetland has not experienced such devastation, mainly because (i) the area has relatively high rainfall (1,619 mm/year at Ghalehroudkhan Station), (ii) as much as 42% of the watershed of the Anzali Wetland is covered by forests, and (iii) the watershed receives a substantial amount of irrigation water from Sefidroud River through two main irrigation channels (approximately 150-400 million m<sup>3</sup>/year from the Fuman Tunnel alone). Furthermore, the wetland itself has substantial water regulating capacity because (iv) it is relatively large, (v) it is connected to the alluvial groundwater network in the plain, which is also connected to paddy fields that extensively cover the area, and (vi) it is connected to the Caspian Sea through a surface water channel and probably through groundwater flow.

For these reasons, the wetland seems relatively insensitive to extreme draughts as well as major storms. Thus, artificial management of discharges by construction of dams and weirs should be kept as minimal as possible. Moreover, construction of large facilities in rivers and other river works could damage the natural functions of the rivers (e.g., spawning of certain fish species).

A potential option to counter an extreme draught is to take more water from Sefdroud River through Fuman Tunnel. In the case of flooding, paddy fields may be used for temporary storage of water.

There is no doubt that the water level of the Caspian Sea has a major impact on the environmental conditions of the wetland. However, the fluctuation of the Caspian is natural phenomenon, and it progresses in the time scale of years to decades. Thus, unless an extreme condition that jeopardizes the existence of the wetland occurs (e.g., rapid and substantial drop of the Caspian level), no active control of water level by manmade structures e.g. construction of weirs to regulate outflow from the Wetland, is recommended.

## 5.6 Livelihood Development

Livelihood development of local people in the upper watershed is a common issue in the watershed management plan. Securing alternative sources of income is very crucial for maintaining the effect of the on-going livestock resettlement program and the sustainability of the proposed forest and rangeland management plan. Livelihoods for the following local people would be improved in the course of the study.

Target people	Direct adverse effect in case there is no livelihood support
Resettlers	a. Increase of the jobless in urban areas and major villages
	b. Increase of illegal cutting/grazing
Retired graziers	a. Increase of illegal cutting/grazing
	b. Opening of forests for farming
Remaining graziers	a. Increase of number of livestock (overgrazing)
Other forest dwellers	a. Increase of illegal cutting/grazing
	b. Opening of forests for farming

 Table 5.6.1
 Target Local People for Livelihood Development

Source: JICA Study Team

As described in the preceding sections, the retired graziers and other forest dwellers will be involved in reforestation and forest management of the degraded forests, while the remaining graziers will be involved in rangeland management. Those who will be involved can obtain earnings from the management works in the period of the master plan. On the other hand, the resettlers should establish an alternative livelihood by using their compensated money with the assistance of NRGO. The same kind of assistance should be provided by NRGO to the other local people (the retired and remaining graziers and other forest dwellers) in order for them to establish alternative sources of income after the management works.

## 5.6.1 Participatory Study on Livelihood Development of Graziers

Because of issuance of the presidential decree on the forest management in the northern region, the control of grazing activity in the forest is tightened and the resettlement program has launched on letting graziers who reside in the forest quit livestock grazing in the forest and rangeland. Since the program lacks necessary consultations and livelihood supports for affected graziers, it is expected that the resettlement program would bring a huge social impact to the study area,.

Under the circumstances, the JICA Study Team hired a NGO (CENESTA) to carry out a participatory study on livelihood improvement of graziers in 6 villages in the upper watershed

in order to identify their alternative livelihood options instead of livestock grazing and demonstrate to the organizations concerned a participatory planning method used for possible livelihood identification. The outline of the participatory study is as follows:

 Table 5.6.2
 Outline of the Participatory Study on Livelihood Development of Graziers

Study area	Upper Watershed	
Target people	Graziers who reside in the forest in the upper watershed	
Sampled villages	6 villages	
Method of study	Interview survey, Participatory planning method, Market research	
Study items	- Socio-economic conditions of graziers	
	- Structure of villages	
	- Potential livelihood options	
	- Marketability of major products and market potential of the options	
	- Adaptability of the participatory planning method	

Source: The Study on Livelihood Improvement for Graziers (CENESTA, 2004)

The results of the participatory study on livelihood improvement are summarized in the following table.

Study items	Summary of results
Socio-economic condition	
(1) Major sources of income	Livestock razing, tea cultivation, horticulture, sericulture, etc.
(2) Estimated annual income	Approximately 26.5 million Rials per family
(3) Number of livestock	Most (about 80%: 86 families) of respondents raise 50-200 heads of
	sheep.
Structure of village	All the sampled villages are Talesh origin. Though their traditional
	lifestyle has gradually changed from seasonal-migrant life-style to
	settlement-typed life-style, their traditional norms (e.g., the way of
	decision making, participation of collective work, etc.) still exist in the
	villages. Recently, the population structure of the sampled villages have
	become hollow since the young generation have been migrating to towns /
	cities to find new jobs.
Potential livelihood options	The following livelihood options are enumerated as possible options.
	Farming (paddy, horticulture), Livestock raising (semi-industry), Fishery,
	Poultry, Handicrafts, Tourism, Transportation, Sericulture, Tea cultivation,
	Tree planting. Among others, the NGO concluded that the following
	livelihood options were considered as potential livelihood options
	considering natural conditions, preference of graziers, their capability and
	experience, marketability, and technology required for implementation.
	a. Cattle farming (semi-industrial)
	b. Sericulture
	c. Poultry
	d. Fish culture (cold and warm)
	e. Tree planting (in farmlands)
Marketability	Annual gross incomes of the potential livelihood options are estimated
	based on the present marketing conditions of products.
	Cattle farming: 150–175 million Rials/20 head of cattle (dairy and meat)
	Sericulture: 20 million Rials/25-30 boxes of silk worm eggs
	Poultry: 300-320 million Rials/1 season production
	Fish culture: 75 million Rials/1 season production (10,000 peaces.)

 Table 5.6.3 Results of the Participatory Study on Livelihood Development of Graziers

Source: The Study on Livelihood Improvement for Graziers (CENESTA, 2004)

# 5.6.2 Capacity Development of NRGO Provincial and Local Offices

# (1) General

NRGO is aware of the importance of livelihood development and therefore, has promoted several livelihood options (e.g., cold water fish culture, apiculture, mushroom culture, non-timber forest products, etc.) to local people as a part of forest management activities. However, livelihood development should not be just to provide money nor "prepackaged livelihood options", but to enable local people to find alternative livelihoods by themselves and prepare themselves to implement their own ideas. In other word, participation of local people in planning and empowerment of them to operate a livelihood activity are essential for maintaining sustainability.

It has to be mentioned that many of NRGO staff as well as other organizations have little experience in participatory livelihood development/community development. Thus, this section proposes a pilot activity of participatory livelihood development so as to enable the NRGO staff to undergo the whole processes of participatory livelihood development by adopting a participatory planning approach.

# (2) Objectives

The main objective of the capacity development is to expand the horizons of NRGO provincial and local offices through involving them in the process of participatory livelihood development and training them on the participatory livelihood development. To do so, two activities, i) Pilot activity of participatory livelihood development and ii) Training of provincial and local NRGO offices should be undertaken.

## (3) Pilot Activity of Participatory Livelihood Development

The outline of the pilot activity is summarized as follows:

Item	Description
1. Pilot sites	The pilot activity would be undertaken in the four major townships (Rezvanshahr, Fuman,
	Shaft & Masal) in the watershed to involve all the local NRGO offices in the process.
2. Target Group	Target families (the target graziers) for the pilot activity should be graziers that are to be
	affected by the livestock resettlement program.
3. Duration	The period of the pilot activity is three (3) years.
4. Executors of	NRGO should contract out the implementation to either local consultants or NGOs that
the activities	have enough experience in and expertise on community development.
5. Proposed	Major proposed activities are as follows:
Activities	- Socio-economic survey
	- Explanation of the activity to the target people
	- Organization of the target people
	- Identification of possible livelihood activities
	- Preparation of business plans for possible livelihood activities
	- Prioritization and selection of a priority livelihood activities
	- Assistance to the graziers in preparing themselves to implement the livelihood activity
	- Provision of training
	- Implementation and management of livelihood activity
	- Monitoring and evaluation
6. Necessary	External experts (consultants/NGOs) need to be outsourced for implementation of the
inputs	pilot activities.

Table 5.6.4	Outline	of the	Pilot	Activity
1 4010 01011	outine	or the	1 1100	110010103

# (4) Training of Local and Provincial NRGO Offices

Local and provincial NRGO offices should be trained in participatory livelihood development. The pilot activity will be a venue for this purpose. In particular, the capabilities of the following fields should be enhanced through a series of training.

- Participatory planning method
- Business planning
- Training needs assessment
- Development of linkages with other organizations
- Monitoring and evaluation of business operation

## 5.6.3 Livelihood Development of Local People in Forest and Rangeland Management

As mentioned above, the graziers who will participate in forest and rangeland management works can earn substantial income from the management works. In this section, the annual cash incomes of graziers from the management works are estimated.

(1) Estimated Income from Forest Management in the Margin Areas

Provided 60 % of the affected graziers (who will have to quit grazing activity but stay in the forest) in the sub-watersheds will participate in the management activity and all the margin areas of 112 km<sup>2</sup> will be managed by them, the cash income that participating graziers can earn is estimated as shown in Table 5.6.5.

Sub-watershed	No. of Graziers	2009	2010	2011	2012	2013	2014	2015	Ave *1
Morghak	109 families	0.0	16.1	23.9	21.0	9.3	7.4	5.3	9.4
Khalkai	87 families	0.0	18.9	36.4	31.9	13.5	11.6	6.9	13.6
Plangvar	237 families	0.0	0.0	0.0	0.0	2.0	0.4	0.4	0.5
Masulehroudkhan	147 families	5.3	8.8	5.0	2.9	2.2	1.4	2.0	2.8
Gharoukhan	235 families	0.0	0.0	0.0	2.4	3.3	0.9	0.9	1.2
Siahmazigroud	136 families	0.0	0.0	0.0	6.7	10.4	10.1	4.2	5.2
Pasikhan	245 families	3.3	4.5	2.9	1.6	1.2	0.9	1.0	1.6
Average	1,196 families	4.1	9.8	12.3	7.7	4.6	3.3	2.2	4.4

Table 5.6.5	Estimated Annual Income per Grazier from Forest Management in the Margin Areas
	(Unit: million Rials)

Note: Estimated costs for each work are adjusted by 0.8 assuming 80 % of the costs are from labor wages. \*<sup>1</sup> Annual average until 2019

Source: JICA Study Team (Supporting Report Part 4 "Watershed Management")

The assessment shows that the reforestation activity in the margin areas could provide supplemental annual income ranging from  $0.5 \sim 13.6$  million Rials/family (4.4 million Rials/family on average) to the retired graziers in addition to compensation. This (4.4 million Rials/family) is equivalent to about 28 % of the average annual income in rural area in the province (16 million Rials/family).

### (2) Estimated Income from Rangeland Management

Assuming the vegetative erosion control and rangeland management works will be contracted out to the remaining graziers, the cash income from rangeland management is estimated by using the following assumptions:

- All remaining graziers will participate in management and be organized as groups for the work.
- Basically, graziers will work in the respective sub-watersheds.
- Graziers in Plangvar will be split into two (2) sub-watersheds (Khalkai and Masulehroudkhan) and those in Siahroud will be organized into the group of Pasikhan.

							(Un	it: millio	n Rials)
Sub-watershed	No. of Graziers	2007	2008	2009	2010	2011	2012	2013	Ave. *1
Chafroud	61 families	7.8	7.6	7.6	7.6	1.8	0.0	1.8	3.1
Morghak	108 families	0.0	21.1	20.3	20.3	20.3	4.5	0.2	8.5
Khalkai	104 families	0.0	25.4	24.5	24.5	24.5	3.4	0.2	9.5
Masulehroudkhan	126 families	0.0	0.0	16.8	16.2	16.2	16.2	4.7	7.8
Shakharaz	132 families	0.0	0.0	0.0	4.0	3.7	3.7	3.7	2.2
Pasikhan	162 families	0.0	0.0	0.0	17.6	17.6	17.6	2.6	7.8
Average	693 families	2.1	19.4	18.3	15.3	14.8	9.0	5.9	7.3

 Table 5.6.6
 Estimated Annual Income per Grazier from Rangeland Management

Note: Estimated costs for each work are adjusted by 0.8 assuming 80 % of the costs are from labor wages. \*<sup>1</sup> Annual average until 2019

Source: JICA Study Team (Supporting Report Part 4 "Watershed Management")

On average, remaining graziers can earn about 7.3 million Rials/family/year in addition to the income from grazing activity. Assuming the annual income delivered from one goat is 100,000 Rials<sup>1</sup>, the income from the management work would be equivalent to that from 73 heads of goats. Consequently it could help them to reduce the number of livestock.

(3) Possible Livelihood Options

As listed in Table 5.6.3, the participatory study on livelihood improvement revealed that the following livelihood options were considered as possible livelihood options that the local people could engange in.

- a) Cattle farming (semi-industrial)
- b) Sericulture
- c) Poultry
- d) Fish culture (cold and warm)
- e) Tree planting (in farmlands)

Other livelihood options for graziers are: i) Handicrafts (weaving, wooden handicrafts); ii) Fruits/orchard production; iii) Non-timber forest products (ferns, medicinal plants, walnuts, wild berries, etc.); iv) Rice farming; v) apiculture; vii) mushroom culture; and v) Management of eco-tourism parks. However, as the local people may not be familiar with those options or the options may not necessarily be profitable, there is a rather high risk that they might fail in operation.

## 5.7 Environmental Monitoring

## 5.7.1 Introduction

A major issue in planning the watershed management plan was lack of monitoring data. For instance, there is no recent data on the number of graziers or livestock as pointed out in previous sections. Lack of data/information makes the planning difficult as well as unreliable. To enable the organizations (MOJA/NRGO) to make a realistic plan and manage the watershed flexibly based on the conditions at the field level, proper monitoring and feedback to planning are necessary. In this section, it is proposed that the following monitoring activities be carried out during the master plan period.

- 1) Monitoring of soil erosion controls
- 2) Monitoring of land use/vegetation cover
- 3) Monitoring of rangeland management
- 4) Monitoring of forest management
- 5) Monitoring of resettlement programs

<sup>&</sup>lt;sup>1</sup> This is the same as the assumption used by the livestock resettlement program.

# 5.7.2 Monitoring Plan

The proposed monitoring activities are outlined as follows:

## Table 5.7.1 Proposed Monitoring Plan on Erosion Control Work (1/4)

### 1) Monitoring Soil Erosion Control

Items	Summary
1. Responsible organization	WMD of MOJA
2. Objectives	(1) to find necessary maintenance works before things progress beyond
	control
	(2) to evaluate the effectiveness of the applied measures
3. Frequency	After heavy rains (on average twice a year)
4. Items to be monitored	(1) Necessity of repairing facilities (conditions of dams and other facilities)
	(2) Changes in gully configuration at dam sites
5. Coverage	(1) All concrete dams, check dams and wooden dams constructed
	(2) Sampled check dams (2 monitoring sites per sub-watershed)
6. Methodology	(1) Field observation to determine if there is a need to repair facilities.
	(2) Change in configurations should be monitored in accordance with the
	following steps:
	- measure cross sections of gullies at sampled check dams
	- fix benchmarks (which would be made of concrete, rocks or other durable
	material) at intervals of 5 meters at the sampled check dam
	- observe silt deposit based on the benchmarks after heavy rains
7. Necessary inputs	(1) Workers for field observation
	(2) Benchmarks (concrete posts or similar) and Field workers
8. Expected Output	(1) An inventory of erosion control facilities
	(2) Estimated effect of the soil erosion control works
9. Dissemination of	MOJA should prepare an annual monitoring report and distribute the
information	monitoring report to DOE.
10. Possible Feedback	- Maintenance and repair plan
	- Soil erosion control for other areas

Source: JICA Study Team

#### 2) Monitoring Land Use and Vegetation Cover

Items	Summary
1. Responsible	Watershed Management Division of MOJA
organization	
2. Objectives	to maintain the watershed and wetland environment through periodic
	monitoring of land use conditions
3. Frequency	Every 5 years
4. Coverage	Whole Study Area (3,706 ha)
5. Methodology	A land use/vegetation cover map will be prepared by analyzing the latest
	LANDSAT images at a scale of 1:150,000 – 1:250,000.
6. Necessary inputs	- Satellite images (Purchase of LANDSAT/SPOT images)
	- Field validation survey (Additional technical staff)
	- Data analysis (Regular work of the staff)
7. Expected Outputs	- Area of each land category
	- Changes / trends in land use/vegetation cover
8.Dissemination of	MOJA should prepare a land use map with findings on land use changes and
information	distribute it to the organizations concerned, NRGO, HUDO, etc.
9. Possible Feedback	- Control of land use
	- Issuance of regulations/guidelines
	- Enhancement of restoration/rehabilitation of vegetation

Items	Summary
1.Responsible organization	Rangeland Management Division of NRGO
	Agricultural and Natural Research Center
2. Objectives	to manage rangelands sustainably through periodical monitoring
3. Frequency	Twice a year (May and November)
4. Coverage	Four (4) plots per basin or one for every direction
	Size of plot: 10 m x 10 m
5. Methodology	The condition of grasses inside the fence will be compared with those outside
(1) General	the fence.
(2) Items to be monitored	- Growth of grasses and forbs
	- Intensity of grasses and forbs
	- Composition of grasses and forbs
	- Vegetative cover
	- Palatability
	- Management practice applied
	- Grazing intensity and season (for the areas without fence)
	- Rocks and litter
	- Rainfall data
6. Necessary input	- Materials for fencing
	- Casual laborers for fencing
	- Technical staff for monitoring
7. Expected output	- Interrelationship between the growth of grasses and management practices
	- Recommendation for proper rangeland management
	- Optimum number of livestock in the area
	- Production of palatable crops
8. Dissemination of	- NRGO and the Research Center should compile the findings into a annual
information	monitoring report.
	- Results should be shared with graziers who use/manage the areas.
9. Possible Feedback	- Designation of protected areas
	- Control of rangeland uses
	- Cancellation of contracts for rangeland management
	- Intensification of management activities

Table 5.7.1	Proposed Monitoring Plan on Erosion Control Work (2	2/4)
-------------	---	------

#### 3) Monitoring Rangeland Management

Table 5.7.1	Proposed Monitoring Plan on Erosion Control Work (3/4	)
-------------	---	---

#### 4) Monitoring Forest Management

Items	Summary
1. Responsible	Technical Division of NRGO
organization	
2. Objectives	(1) to have contractors (private firms) comply with the sustainable forest
	management practices defined by NRGO
	(2) to assist and guide contractor (organized graziers) in managing forests in
	accordance with the sustainable management practices
2. Frequency	(1) Twice a year for private firms
	(2) Once a quarter for organized graziers
3. Coverage	(1) Forests managed by private firms
_	(2) Forests managed by organized graziers
4. Methodology	A validation survey should be carried out to check if the following works are
	properly undertaken in accordance with the plans (annual work plans/forestry
	plans).
	General
	- Reforested area (for both)
	- Any events (fires, diseases, etc.) (for both)
	- Volume of trees harvested (only for private firms)
	- Area harvested (only for private firms)
	- Length of constructed roads (only for private firms)
	- Length of fences (only for organized graziers)
	- Area under maintenance and thinning (only for organized graziers)
	- Protection works (only for organized graziers)
	Technical
	- Silvicultural practices used (for both)
	- Planting design (for both)
	- Protection practices (for both)
	- Road construction and slope protection (only for private firms)
	- Livelihood development (only for organized graziers)
5. Expected output	- Validation report
	- Annual forest management report for the area
	- Recommendation on management practices
6. Necessary input	- Technical staff for validation
7. Dissemination of	- Each validation activity should be compiled into a validation report.
information	- NRGO should also compile all findings into an annual monitoring report.
	- Validation report and recommendations should be shared with contractors.
8. Possible Feedback	- Cancellation of contracts for forest management
	- Recommendation on management practices
	- Issuance of related regulations/guidelines

5) Monitoring Resettlement Program

Items	Summary
1. Responsible organization	Resettlement Division and Conservation Committee of NRGO
2. Objective	To identify any problems so that the organizations concerned could provide
	necessary assistance to recover and stabilize livelihoods of affected graziers
3. Frequency	Twice a year for 5 years (after the program)
4. Coverage	Major villages in the upper watershed and resettled areas prepared by NRGO
5. Methodology and Items	An interview survey should be conducted to affected families (who did not
to be monitored	relocate). Items to be surveyed are:
	- Socio economic situation
	- Condition of livelihood activities
	- Problems and issues on the management of livelihood activities
	- Other social issues/conflicts
6. Necessary input	- Additional technical staff or external experts for surveys
7. Expected output	- Financial report on on-going livelihood projects
	- Recommendations/advice to improve livelihood activities
	- Socio-economic data on resettled/affected households
8. Dissemination of	- NRGO should compile findings into a monitoring report.
information	- Data and results should be shared with the affected families so that they
	could improve their livelihood activities.
9. Possible decision making	- Revision of the resettlement program
based on monitoring	- Revision of the existing guidelines

Table 5.7.1	Proposed Monitoring Plan on Erosion Control Work (4/4	)
-------------	---	---

Source: JICA Study Team

### 5.8 Institutional Arrangements

### 5.8.1 Coordination among Relevant Organizations

## (1) Coordination of NRGO and WMD of MOJA

Currently, both NRGO Guilan and WMD of MOJA Guilan are responsible for watershed management of the Study area and have a common goal of watershed management. Although they have been merged already at the central level, they are still independent at the provincial level. These organizations must coordinate as closely as possible so as to make the management works more efficient as well as effective.

(2) Coordination of NRGO and DOE

Both NRGO and DOE have programs for environmental management and designate protected areas in the upper watershed. However, there is little co-ordination between these organizations. They should discuss possible options for sharing information and joining work forces for management of the protected areas.

(3) Information Shearing among NRGO, WMD and RWO

Coordination among NRGO, WMD and RWO (Regional Water Organization) on water and sediment management issues seems limited, and information (e.g., hydrological data) is not shared. These organizations should share more information about hydrology and sediment transport.

## 5.8.2 Capacity Development for Sustainable Watershed Management

Capacity development of the executing organizations (MOJA / NRGO) is an essential element to implement the proposed plan smoothly and attain its objectives. Due attention should be paid to this component during the project period, especially in the initial stage of the plan.

# (1) Capacity Development for Participatory Resource Management

Participatory resource management is still a new concept in the country and may call for radical changes of the conventional management styles of NRGO. Although some NRGO staff, even at the provincial level, are aware of the importance of the people's participation in forest and rangeland management, it seems that no one has gone through the actual process of participatory forest and rangeland management. The following training courses should be provided.

- Basic knowledge on participatory resource management
- Practices needed for participatory resource management (participatory planning)
- Field trip to the pilot sites for actual observation
- Regulations/guidelines that would be prepared for implementation
- (2) Capacity Development for Long-term Visions and Plans

Neither organization (WMD nor NRGO) has any long-term visions, and their plans generally focus on controlling immediate problems through countermeasures. This is one of the reasons why the organizations tend to rely on regulation-based control measures. In order to stop this near-sighted approach, the provincial offices should build their own capacity to develop long-term visions and plans for the region.

(3) Capacity Development for Environmental Monitoring

Proper monitoring is essential for making an appropriate plan as well as taking proper action for sustainable watershed management. However, there seems to be no systematic data collection being undertaken by either organization (MOJA or NRGO). Lack of monitoring often causes the lack of long-term visions and plans. Capacity development of both organizations to monitor the watershed condition is the first step for sustainable management. The capability of the organizations should be enhanced through the implementation of monitoring activities as described in Section 5.7 "Environmental Monitoring Plan".

## 5.9 Summary of Proposed Watershed Management Plan

The watershed management plan is composed of the following components.

Sub components		Proposed Projects/Messures	Executing
		Floposed Flojects/Measures	Organizations
Soil Erosion	(1)	Soil erosion control	
Control and		1) Vegetative measures	MOJA (NRGO)
Prevention of		2) Structural measures	MOJA
Land Slides	(2)	Prevention of landslides	MOJA
Forest and	(1)	Pilot activity of participatory resource management	NRGO
Rangeland	(2)	Reforestation of degraded forests (70 km <sup>2</sup> )	NRGO
Management	(3)	Reforestation in the margin areas (112 km <sup>2</sup> )	NRGO
•	(4)	Forest management under forestry plan	NRGO
	(5)	Conservation of protected forests	NRGO
	(6)	Rangeland management by graziers	NRGO
	(7)	Development of regulations necessary for participatory resource	NRGO
	, ,	management	NRGO
	(8)	Improvement of the livestock resettlement program	NRGO
Plain Area	(1)	Source-level control of sediment runoff in plain area	MOJA
Management	(2)	Construction of Sediment Trap	MOJA
-	(3)	River management for extreme conditions	MOJA, MOE
Livelihood	(1)	Capacity development of NRGO provincial and local offices	NRGO
Development	(2)	Livelihood development of local people in forest and rangeland	NRGO
-		management	
Environmental	(1)	Monitoring of soil erosion controls	MOJA
Monitoring plan	(2)	Monitoring of land use/vegetation cover	MOJA
	(3)	Monitoring of rangeland management	NRGO *1 /MOJA
	(4)	Monitoring of forest management	NRGO
	(5)	Monitoring of livestock resettlement program	NRGO
Institutional	(1)	Coordination among relevant organizations	
Arrangement	, ,	1) Coordination of NRGO and WMD	NRGO & MOJA
U		2) Coordination of NRGO and DOE	NRGO & DOE
		3) Information sharing among NRGO, WMD and RWO	NRGO, WMD, RWO
	(2)	Capacity development for sustainable watershed management	
	( )	1) Capacity development for participatory resource	NRGO
		management	NRGO & MOJA
		2) Capacity development for long-term visions and plans	NRGO & MOJA
		3) Capacity development for environmental monitoring	

Table 5.9.1	Summary o	of Proposed	Watershed	Management	Plan
1 4010 01711	Summary	n i i oposeu	,, accipiica	1 Iunu Somono	

Note: \*<sup>1</sup> Agriculture and Forestry Research Center of MOJA, Guilan

The proposed projects are also summarized in Figure 5.9.1.



## 5.10 Cost Estimate

## 5.10.1 Project Cost

The total project cost of the watershed management plan is estimated at 726,785 million Rials, as shown in Table 5.10.1, of which 264,965 million Rials is expected for erosion and land slide control works, such as construction of sabo dams. The cost for the livestock resettlement program would be 273,221 million Rials. The unit costs for forest and rangeland management are based on those used by NRGO Guilan at present. Their breakdowns are given in the Supporting Report, Part 4, "Watershed Management".

	Desired Cost	O&M	Cost
December 1 Decise (a) A second	Project Cost	0 11	Average
Proposed Projects/Measures	(million Diala)	Overall	(million
	Kials)	(million kials)	Rials/year)
1. Soil Erosion Control and Prevention of Landslides * <sup>1</sup>			•
(1) Soil Erosion Control			
1) Vegetative measures (7.666 ha)	60,775	-	-
2) Structural measures (6 basins)	146.230	10,164	678
(2) Prevention of Landslides	57,960	4.000	267
Sub-total	264 965	14 164	945
2 Forest and Rangeland Management	201,905	11,101	710
(1) Pilot activity of participatory resource management	13 070	-	-
(1) The detrify of participatory resource management (2) Reforestation of degraded forests (70 km <sup>2</sup> )	59 559	-	-
(2) Reforestation of degraded forests (70 km) (3) Reforestation in the margin areas (112 km <sup>2</sup> )	97 424	_	-
(A) Forest management under forestry plans (A basins)	77,424	Regular work * <sup>2</sup>	
(4) Forest management under forestry plans (4 basins)		Regular work *2	
(6) Rengeland management (7 basing) by graziera	8 022		1 406
(0) Rangelation management (7 basins) by graziers	0,923	23,377	1,490
(7) Development of regulations necessary for participatory resource	236	-	-
(9) Improvement of the livesteely recettlement program	2 666		
(a) improvement of the investock resettlement program	182 877	-	1 406
2 Diain Area Management (Control of Sodiment Dup off)	102,077	23,377	1,490
(1) Source level control of codiment runoff in main area *!	02		
(1) Source-level control of sediment runoil in plain area *	83	-	-
(2) Measures to control inflow of sediment into the wetland	628	2,163	144
(3) River management for extreme conditions	-	-	-
Sub-total	/11	2,163	144
4. Livelihood Development	2.477		
(1) Capacity development of NRGO provincial and local offices	3,477	-	-
(2) Livelihood improvement of local people in forest and rangeland	-	-	-
management **	2.455		
Sub-total	3,477	-	-
5. Environmental Monitoring Plan		105	
(1) Monitoring of soil erosion effects	-	185	12
(2) Monitoring of land use / vegetation cover	-	83	6
(3) Monitoring of rangeland management	-	245	16
(4) Monitoring of forest management	-	594	40
(5) Monitoring of livestock resettlement program		2,520	168
Sub-total	-	3,627	242
6. Institutional Arrangement			
(1) Coordination among relevant organizations			
1) Coordination of NRGO and WMD * <sup>1</sup>		Regular work *2	
2) Coordination of NRGO and DOE*1		Regular work *2	
3) Information sharing among NRGO, WMD and RWO* <sup>1</sup>		Regular work *2	
(2) Capacity development for sustainable watershed management			
1) Capacity development for participatory resource management	1,023	-	-
2) Capacity development for long-term vision and planning	510	-	-
3) Capacity development for environmental monitoring	-	-	-
Sub-total	1.533	-	-
Total Project Cost excluding the Resettlement Program	453,564	43.331	2,889
Project Cost of Livestock Resettlement Program	273 221	-	-
Total Project Cost including the Resettlement Program	726,785	43,331	2,889

Table 5.10.1	Cost Estimate of the	Watershed	Management Plan
1 4010 0.10.1	Cost Estimate of the	i ater shea	management i ian

Note: \*<sup>1</sup> The items include "preparation of long-term plans and execution studies".

 $*^2$  Activities should be done within the regular work of the respective offices.

\*<sup>3</sup> The cost of "Livelihood improvement of local people" is not counted since all activities related to this work are already included in "Forest and Rangeland Management".

## 5.10.2 Operation and Maintenance Cost

The average annual operation and maintenance cost is estimated at 2,889 million Rials per year, which is mainly used for erosion and land slide controls and forest and rangeland management.

## 5.11 Implementation Program

### 5.11.1 Executing Organizations

The proposed plans are to be implemented by either MOJA or NRGO as shown in Table 5.9.1.

### 5.11.2 Criteria for Prioritization

### (1) Evaluation Criteria for Projects

In order to identify the priority projects and make the entire watershed management plan effective as well as efficient, all the proposed projects, except on-going and monitoring ones<sup>1</sup>, are evaluated based on the following criteria, i.e., i) effectiveness<sup>2</sup>; ii) urgency; iii) efficiency; iv) social impact; v) capacity; vi) conformity; and vii) cost. In evaluation, additional weight is put on the items i) ~ iv) (relevance, urgency; response and social impact).

(2) Evaluation for Sub-watersheds

On the other hand, nine (9) sub-watersheds are also evaluated based on the necessity of soil erosion control works to identify the priority sub-watersheds. Two criteria, i) volume of sediment and ii) rate of degraded rangelands to the watershed, are used for evaluation.

## 5.11.3 Evaluation of Proposed Projects for Prioritization

(1) Evaluation of Proposed Projects

Table 5.11.1 shows the results of the evaluation of the proposed projects.

<sup>&</sup>lt;sup>1</sup> On-going activities, which are being regularly implemented by the organizations, such as the livelihood resettlement program, management of forestry plans, and conservation of protected areas, are taken out of the evaluation. In addition, monitoring activities are not evaluated since they are inevitable for implementation. <sup>2</sup> Effectiveness is evaluated based on the reduced sediment volume.

Proposed Projects	Effect	Urgency	Efficiency	Social impact	Capacity	Conformity	Cost	Overall Evaluation		
1. Soil Erosion Control and Prevention of Landslides										
(1)Soil erosion control										
1)Vegetative measures	A (4)	A (4)	A (4)	A (4)	A (2)	A (2)	B (1)	A (21)		
2)Structural measures	A (4)	A (4)	A (4)	B (2)	A (2)	A (2)	B (1)	A (19)		
(2) Prevention of landslides	A (4)	B (2)	A (4)	B (2)	C (0)	B (1)	B (1)	B (14)		
2. Forest and Rangeland Management										
(1)Pilot activity of participatory resource management	A (4)	A (4)	B (2)	A (4)	B (1)	A (2)	A (2)	A (19)		
(2)Reforestation of degraded forests	A (4)	A (4)	A (4)	B (2)	A (2)	A (2)	B (1)	A (19)		
(3)Reforestation of in the margin areas	B (2)	B (2)	B (2)	A (4)	B(1)	A (2)	B (1)	B (14)		
(4)Forest management under forestry plans		Not evaluated * <sup>1</sup>								
(5)Conservation of protected forests				Not eval	luated * <sup>1</sup>					
(6)Rangeland management by graziers	A (4)	A (4)	A (4)	A (4)	B(1)	A (2)	A (2)	A (21)		
(7)Development of regulations necessary for participatory resource management	B (2)	B (2)	B (2)	A (4)	B (1)	A (2)	A (2)	B (15)		
(8)Improvement of the livelihood resettlement program	B (2)	A (4)	B (2)	A (4)	B (1)	A (2)	A (2)	B (17)		
3. Plain Area Management										
(1)Source-level control of sediment runoff in plain area	B (2)	B (2)	B (2)	B (2)	B (1)	B (1)	B (1)	C (11)		
(2)Measures to control inflow of sediment into the Wetland	A (4)	B (2)	A (4)	C (0)	B (1)	B (1)	C (0)	C (10)		
(3)River management for extreme conditions	B (2)	B (2)	B (2)	B (2)	B (1)	B (1)	B (1)	C (11)		
4. Livelihood Development										
(1)Capacity development of NRGO provincial and local Offices	A (4)	A (4)	B (2)	A (4)	B (1)	A (2)	A (2)	A (19)		
(2)Livelihood improvement of local people in forest and rangeland management	Not evaluated * <sup>2</sup>									
5. Institutional Arrangement										
(1)Coordination among relevant organizations	B (2)	A (4)	B (2)	C (0)	A (2)	A (2)	A (2)	B (14)		
(2)Capacity development for sustainable watershed management	A (4)	B (2)	B (2)	B (2)	B (1)	A (2)	A (2)	B (15)		
Weight	2	2	2	2	1	1	1	-		

Note: Scores for criteria: A = 2, B = 1, C = 0

Overall evaluation: A: 22~18, B: 17~14, C: 13~9, D: below 9

 \*<sup>1</sup> Regular works are not evaluated in the evaluation.
 \*<sup>2</sup> This is not evaluated since all activities related to this work are already included in "Forest and Rangeland Management".

Source: JICA Study Team

## (2) Evaluation of Priority Sub-watersheds

The results of evaluation of the sub-watersheds are summarized as follows.

	Total Sediment			
Sub-watershed	(m <sup>3</sup> /year)	(km <sup>2</sup> )	Portion of Watershed (%)	Priority Grade
Chafroud	7,500	3.24	2.7	2
Bahmbar	0	0.00	0.0	4
Morghak	32,500	20.17	8.1	1
Khalkai	29,500	15.66	6.6	1
Palangvar	0	0.00	0.0	4
Masulehroudkhan	38,000	13.28	4.1	1
Shakhazar	9,000	1.96	0.8	3
Pasikhan	36,000	22.35	5.7	2
Pirbazar	0	0.00	0.0	4
Total yield	152,500	76.66	4.4	-

### Table 5.11.2 Evaluation of the Sub-watersheds

Source: JICA Study Team

### 5.11.4 Implementation Schedule

The proposed activities of the watershed management plan are not "one-shot" activities, and if anything, these compose a holistic program. The activities often inter-relate with one another. It is therefore important to place each proposed activity in proper order. The following factors are considered in the preparation of an implementation schedule in addition to the results of prioritization.

## (1) Implementation Schedule of the Livestock Resettlement Program

Application of vegetative erosion control measures and reforestation of the degraded forests are dependent on the progress of the livestock resettlement program, since almost all the target areas are presently used by graziers. Therefore, the schedules of those activities need to be adjusted to fit that of the resettlement program.

## (2) Application of the Concept of Participatory Resource Management

A main concept underlying the rangeland and forest management is participatory resource management. However, the concept is still new to the country and there is no expert in NRGO. Hence, the pilot activity of participatory resource management needs to be carried out foremost among the forest management activities.

(3) Coordination of Soil Erosion Control and Rangeland Management

Rangeland will be managed by the graziers remaining after the resettlement program. Therefore, the empowerment of graziers financially as well as technically is very important for attaining sustainable rangeland management. In addition to the organization of graziers and provision of technical training to them, involvement of grazers in the soil erosion control works is important for improving their economic situation and more importantly creating their sense of ownership for the rangeland. The implementation schedule for rangeland management is adjusted for the vegetative soil erosion control measures, although it obtained the highest score in the prioritization.

The proposed implementation schedule for the watershed management plan for the next 15 years is presented in Table 5.11.3.

Proposed Measures			F	ourth 5	-year l	Pla	n Perio	d		Fif	fth 5-y	ear Pla	n Perio	1		Sixth 5-y	/ear Pla	n Period	1
		200	5	2006	2007	7	2008	2009	2010	2	2011	2012	2013	2014	2015	2016	2017	2018	2019
WATE	RSHED MANAGEMENT PLAN																		
1. Soil	Erosion Control and Prevention of Land Slides																		
(1)	Soil erosion control																		
1)	Vegetative meausres		I																
2)	Structural measures				T				l T	T									
(2)	Prevention of land slides									T									
2. Fore	est and Rangeland Management																		
(1)	Pilot activity of participatory resource management																		
(2)	Reforestation of degraded forests								1				1		1	1			)
(3)	Reforestation in the margin areas								I	T			I			I			
(4)	Forest management under forestry plan																		
(5)	Conservation of protected forests					ļ													
(6)	Rangeland management by graziers									1									
(7)	Development of regulations necessary for participatory resource management																		
(8)	Improvement of the livestock resettlement program				1			]											
3. Plai	n Area Management																		
(1)	Source-level control of sediment runoff in plain area																		
(2)	Measure to control inflow of sediment into the wetland																		
(3)	River management for extreme conditions																		
4. Live	elihood Development																		
(1)	Capacity development of NRGO provincial and local offices				1														
(2)	Livelihood improvement of local people in forest and rangeland management																		
5. Env	ironmental Monitoring Plan																		
(1)	Monitoring of soil erosion controls																		
(2)	Monitoring of land use / vegetation cover					ţ,													
(3)	Monitoring of rangeland management					ł													
(4)	Monitoring of forest management					ļ													
(5)	Monitoring of livestock resettlement program																		
5. Inst	itutional Arrangement																		
(1)	Coordination among relevant organizations					ļ													
(2)	Capacity development for sustainable watershed management					1			1	1									
Livesto Gover	ock Resettlement Program (done by Iranian nment)								-										

 Table 5.11.3
 Proposed Implementation Schedule of the Watershed Management Plan

Source: JICA Study Team

## 5.12 Priority Projects

As a result of the evaluation and scheduling, the following five (5) activities are identified as priority projects.

- 1) Vegetative erosion control measures
- 2) Structural erosion control measures
- 3) Pilot activity of participatory resource management
- 4) Reforestation of the degraded forests
- 5) Livelihood development (Capacity development of NRGO Offices)

"Structural erosion control measures", "Pilot activity of participatory forest management" and "Livelihood development" would be started in the first year (2005) as the highest priority projects. In 2006, "Vegetative erosion control measures" and "Reforestation of the degraded forests" will be commenced. The outlines of the five priority projects are given in the Supporting Report Part 4 "Watershed Management".

## CHAPTER 6 WASTEWATER MANAGEMENT PLAN

## 6.1 Introduction

The Anzali Wetland receives roughly 65,300 tons/year of COD, 6,930 tons/year of T-N, and 819 tons/year of T-P, from various pollution sources in the watershed, and the resulting water pollution is one of the most serious environmental problems in the wetland. It is affecting the entire ecosystem of the wetland, as exemplified by the overgrowth of macrophytes, fish kills due to low dissolved oxygen levels in water, change in the composition of fish species, and various other ecological changes. In order to control water pollution, the various organizations like DOE, MOJA and GWWC are making efforts in managing wastewater generated from domestic, industrial and agricultural activities. However, these efforts are still limited, and the greater part of the wastewater is discharged without any treatment. Because all wastewaters from the watershed accumulate in the wetland, much integrated efforts are needed to make significant improvement in water quality in the wetland. Thus, a comprehensive wastewater management plan covering all major pollution sources is proposed below.

## 6.2 **Objective and Strategies**

## 6.2.1 Objective

The objective of the wastewater management plan is as follows:

- To improve and maintain the water quality of the Anzali Wetland at a level acceptable for its ecosystem by implementing affordable and effective wastewater management.

## 6.2.2 Strategies

## (1) Setting of Target

For the wastewater management plan, the targets on ambient water quality in the Anzali Wetland and amount of pollution load reduction to the wetland are set up as below.

1) Target of Ambient Water Quality and Sediment Quality

For the management of the wetland conservation, the tentative targets of ambient water quality in Anzali Wetland are set as COD 30 mg/L, T-N 2.0 mg/L and T-P 0.20 mg/L for organic and nutrient pollution considering prevention of eutrophication. The targets of sediment quality are set as cadmium 3.5 mg-Cd/kg, lead 91 mg-Pb/kg, chromium 60 mg-Cr/kg, cupper 197 mg-Cu/kg, zinc 315 mg-Zn/kg for environmental risk management of heavy metal pollution, which are based on Canadian Environmental Quality Guidelines, 2002.

It should be noted that the wetland ecosystem is influenced by various factors and it is not easy to know the water quality level acceptable to a given species or ecosystem. The selected parameters are COD, T-N, T-P and heavy metals as these are the most relevant to the water pollution of the Anzali Wetland, i.e., organic pollution, eutrophication<sup>1</sup>, and environmental risks of heavy metals to the wetland ecosystem.

Table 6.2.1 shows the target values and actual water quality records on COD T-N and T-P.

Parameter	Target to 2019	Records in 2004
COD	30	Eastern Area (Eastern Part): Average 37 (22-61)
(mg/L)		Western Area (Siakeshim): Average 27 (15-50)
T-N	2.0	Eastern Area (Eastern Part): Average 2.3 (1.4-3.7)
(mg/L)		Western Area (Siakeshim): Average 1.9 (1.1-2.3)
T-P	0.20	Eastern Area (Eastern Part): Average 0.28 (0.17 – 0.42)
(mg/L)		Western Area (Siakeshim): Average 0.17 (0.08-0.29)

Table 6.2.1	<b>Target of Water</b>	Quality in th	he Anzali	Wetland

Source: JICA Study Team

Regarding the eastern side of Anzali Wetland, the average values of COD exceeded the target by about 20 %, the average values of T-N exceeded the target by about 10 % and the average of T-P values exceed the target by 40 %. On the other hand, the average values of COD, T-N and T-P in the western side of Anzali Wetland do not exceed the target. Table 6.2.2 shows that the values of heavy metals do not exceed the target.

Parameter	Targets	Records in 2004
Heavy Metals	Cd: 3.5, Pb: 91, Cr: 60,	Cd: n.d. – 0.2, Pb: n.d. – 51, Cr <sup>6+</sup> : 4 – 41
(mg/kg)	Cu: 197, Zn: 315	Cu: 19 – 86, Zn: 32 - 222

Source: JICA Study Team

## 2) Target of Pollution Load Reduction on COD, T-N and T-P

In order to achieve the target of ambient water quality overall the wetland, the targets of pollution load reduction in the eastern part of the basin are set up as 20% reduction in COD, 10% reduction in T-N and 30% reduction in T-P from the 2003 level, which are equivalent to as 44% reduction in COD (28,196 ton/year), 32% reduction in T-N (1,893 ton/year) and 52% reduction in T-P (439 ton/year) from the forecast 2019 level. Regarding the west side, the tentative targets have been achieved, and the target in 2019 is to make some improvement from the present condition in 2003, which is 1,945 ton/year, 205 ton/year and 25 ton/year for COD, T-N and T-P respectively from the forecast 2019 level.

<sup>&</sup>lt;sup>1</sup> Phosphorous is believed to be one of the main determining factors of eutrophication in the wetland.

				(Unit: ton/year
Item		Western Side	Eastern Side	Total
COD	Future Prediction	23,718	63,433	87,151
	Target Level	21,292	35,237	56,529
	Required Reduction	2,426	28,196	30,141
T-N	Future Prediction	2,748	5,838	8,586
	Target Level	2,543	3,945	6,488
	Required Reduction	205	1,893	2,098
T-P	Future Prediction	280	840	1,111
	Target Level	246	401	647
	Required Reduction	34	439	466

Table 6.2.3	Required	Reductions	of Pollution	Loads
			or r on attom	

Source: JICA Study Team









Figure 6.2.1 COD, T-N and T-P Load in Western and Eastern Parts of the Anzali Wetland

Nippon Koei Co., Ltd.

## 3) Target on Heavy Metals

The sources of heavy metals are limited from industrial activity. For management of heavy metals, only measures at the pollution sources (industrial factories) are required.

Based on the results of water quality surveys in the study, it is evaluated that there is no serious pollution from heavy metals at present, and the current level of heavy metal concentration seems acceptable for the eco-system in the Anzali Wetland. All of industrial factories are required to keep the effluent standard in order to keep the present condition in the Anzali Wetland.

## (2) Measures for Each Pollution Source

In order to improve and maintain the water quality of the Anzali Wetland, it is required to implement suitable wastewater management for all pollution sources in the basin. The management shall be considered for each pollution source. The following five sub-components of management plans are prepared separately in the wastewater management plan, because required measures are different depending on the pollution sources and responsible organization.

1) Management of Domestic Wastewater in Urban Area

Domestic wastewater in the urban areas is the biggest pollution source of COD and T-P to the wetland. Drastic decreases in the pollution loads are therefore required in order to achieve the targets. Existing plans for sewerage system development in the basin is highly appreciated for the Anzali Wetland Conservation. The measures for wastewater treatment shall be considered separately for application within the sewerage service area and outside of the service area. In addition to the wastewater treatment, measures for pollution source control shall be considered for phosphorous reduction, because conventional wastewater treatment is not effective for phosphorus removal.

## 2) Management of Domestic Wastewater in Rural Area

The pollution load in the rural area is not expected to have a serious impact on the wetland. Even if the measures for the rural wastewater are not necessary to achieve the target values, expansion of wastewater treatment in the rural area is required for continuous pollution load reduction to the wetland and for improvement of living condition in the basin. Wastewater treatment shall be developed within affordable financial parameters.

## 3) Management of Industrial Effluent

Industrial activities are expected to develop rapidly in the future. Even if all of the industrial factories keep the effluent standard in 2019, pollution load of the industrial activities is expected to increase by 2.75 times. If the measures are not implemented, the pollution load will be increased by more than 20 times, and may include large amount of heavy metals and toxic materials. The basic strategy of the management of
industrial effluent is that all industrial factories should take necessary measures to keep the effluent standard.

4) Management of Livestock

There are about 860,000 head of livestock in the basin. These animals are kept in four ways, i.e., .fed by Individual Farmers in the Plain, in the Grazing Land of the Mountain Area, in the Grazing Land of the Plain and in Industrial Animal Husbandry. The measures shall be considered on livestock for each category.

5) Management of Pollution from Farmland

Although the present application rates of chemical fertilizers and agricultural chemicals in the study area seem low, there is a possibility that applied fertilizers and agrochemicals would be discharged into the wetland with drainage water due to improper application and/or improper water management. Therefore, the aim of this master plan is to minimize as much pollution load from farmlands as possible by letting farmers adopt proper and environmentally-friendly farming practices. As described in Sub-section 2.6.7, the present extension works (programs) of MOJA have a certain effect on reducing the uses of farm inputs (fertilizers and agricultural chemicals). Hence, the proposed measure focuses on further strengthening the present extension activities of MOJA and improving the coordination between monitoring of pollution loads from farmlands and extension activities at the field level to avoid irretrievable damage to the wetland environment.

## 6.3 Management of Domestic Wastewater in Urban Area

## 6.3.1 Introduction

It is estimated that urban domestic wastewater is the biggest pollution source and will account for 60 - 70 % of total pollution load to the wetland in 2019. Measures for urban domestic wastewater should be considered as high priority. If reduction of pollution load on the wetland is the only goal, measures such as "Diverting and discharging wastewater directly to the Caspian Sea", are potential alternatives. However, such measures are not environmentally acceptable from the view point of protecting the Caspian Sea from pollution. NWWEC have several sewerage development plans in seven cities, which can treat wastewater generated by more than 90 % of the urban population in 2019. However, it seems difficult to implement all of the projects, because of financial constrain. To achieve the target on COD and T-N, it is required to implement some of the projects. To achieve the target on T-P, it is required to add other measures, such as introduction of advanced wastewater treatment process to wastewater treatment plant and introduction of use of low phosphorous detergent, because conventional treatment process of the sewerage system can not reduce enough phosphorous to achieve the target. The following measures are proposed for management of domestic wastewater in the urban area.

- 1) Implementation of some of the sewerage development projects planned by NWWEC, and introduction of advanced treatment process.
- 2) Other measures for outside of the sewerage service area
- 3) Promotion of use of low phosphorous detergent

## 6.3.2 Sewerage System Development

The target amounts of pollution load reduction up to 2019 are 28,196 ton/year of COD, 1,893 ton/year of T-N and 439 ton/year of T-P for the eastern part of the wetland, and 2,469 ton/year of COD, 205 ton/year of T-N and 34 ton/year of T-P for the western part.

As the design criteria of the sewerage development plan, water quality of raw wastewater and treated wastewater through secondary treatment process and advanced treatment process (A2/O Process: one of biological nutrient removal processes) are assumed in Table 6.3.1.

				(Unit: mg/L)
		Treated	Effluent	
Item	Raw Wastewater	Secondary Treatment Process	Advanced Treatment Process (A2/O Process)	Standard
BOD	290	30	30	30
COD	650	60	60	60
T-N	55	33	22	62
T-P	9.0	3.6	0.9	6.0

 Table 6.3.1 Water Quality of Raw Wastewater and Treated Wastewater for Design Criteria

Source: JICA Study Team

Based on the above figures, it is estimated that the sewerage system with secondary treatment process can reduce pollution load of 43 kg/p/year of COD, 4.4 kg/p/year of T-N and 0.39 kg/p/year of T-P, and sewerage system with the advanced treatment process can reduce pollution load of 43 kg/p/year of COD, 6.6 kg/p/year of T-N and 0.59 kg/p/year of T-P.

Even if all of the projects in the NWWEC plan are implemented and cover more than 90 % of the urban population in 2019, the sewerage system with secondary treatment process can not reduce phosphorous enough to achieve the target. The advanced treatment process is therefore required.

To achieve the target of pollution load reduction, it is proposed to implement sewerage system development with advanced treatment process, which can treat wastewater from 70 % of the urban population, which are more than 57,000 service population in the eastern area and more than 744,000 service population in the eastern area. The achievement to the target for T-P is critical in the eastern part. It is easy to achieve the target on COD and T-N even through a conventional secondary treatment process.

As shown in Table 6.3.2, all of sewerage projects planned by NWWEC can cover more than 120,000 service populations in the western area and more than 890,000 service populations in the eastern area. To achieve the target, Rasht Sewerage Project (Phase 1 & 2), Anzali Sewerage Project (Phase 1 & 2) and Somehsara Sewerage Project are selected for proposed projects in the master plan by 2019. The service population of each sewerage projects is shown in Table 6.3.2.

	Souverage		Service Population (Unit: persons)		
Basin	Drojecte	Status	Planned by	Proposed	
	TTOJECIS		GWWC	in the Study	
Eastern Part	Rasht (Phase 1)	Construction	253,816	253,816	
	Rasht (Phase 2)	Basic Design	378,284	378,284	
	Rasht (Phase 3)	Basic Design	93,600	-	
	Anzali (Phase 1)	Construction	77,920	77,920	
	Anzali (Phase 2)	Basic Design	51,000	51,000	
	Anzali (Phase 3)	Basic Design	8,712	-	
	Khomam	Basic Study	16,095	-	
	Shaft	Basic Design	14,357	-	
	Sub-total		893,784	761,020	
Western Part	Somehsara	Construction	56,980	56,980	
	Fuman	Basic Design	46,000	-	
	Masal Basic Study		24,762	-	
	Sub-total		127,742	56,980	
Total			1,021,526	818,000	

 Table 6.3.2 List of Planned Projects of Sewerage System Development

Source: JICA Study Team

To achieve the target of phosphorous reduction, advanced treatment process should be installed in wastewater treatment plants in all of proposed projects. However, two new constructing wastewater treatment plants in Rasht and Anzali cities do not have advanced treatment process to remove phosphorous. Additional construction works are required to them.

The outline of the proposed sewerage system in Rasht is described in Figure 6.3.1. The service area is divided into the central area, the eastern area and the western area. Some parts of the sewerage system in the central area are under construction, and the sewerage system in the eastern area is planned to be developed by the World Bank fund.



Figure 6.3.1 Outline of Rasht Sewerage System

The outline of proposed sewerage service system in Anzali is described in Figure 6.3.2. The service area is divided into the eastern area and the western area. Some parts of the sewerage system in the western area are under construction, and the sewerage system in the eastern area is planned to be developed by the World Bank fund.



Figure 6.3.2 Outline of Anzali Sewerage System

# 6.3.3 Promotion of Individual Wastewater Treatment Facilities outside Sewerage Service Areas

Since the proposed sewerage service area is not expected to cover the whole urban area, some wastewater will continue to be drained out without treatment. A regulation requiring the installation of individual wastewater treatment facilities may therefore be valuable for the areas outside the wastewater treatment service areas. This is not only for the wetland conservation but also for improvement of living conditions. It is estimated that about 5% of the urban population, which will be 113,000 residents in 2019, will not be in the wastewater treatment service area. Assuming one individual wastewater treatment facility for five residents, about 22,600 sets of treatment facilities need to be installed in the urban area by 2019.

## 6.3.4 Promotion of Low Phosphorus Detergent Use

Eutrophication is a major problem in the Anzali Wetland, and it is therefore important to control the inflow of nutrients. The removal of phosphorus as a stage of wastewater treatment is possible using advanced treatment processes such as A2/O Process which is one of biological nutrient removal process, and this is considered in the sewerage plan proposed by NWWC. However, it is well-known that the removal of phosphorus in wastewater treatment is costly. In many countries, such as EU countries, USA and Japan, the pollution load of phosphorus was reduced by promoting phosphorus-free detergents, and this approach is recommended for Guilan Province.

According to the results of the water quality survey between September and December 2003, it is estimated that most of the phosphorus pollution load is derived from domestic wastewater. Phosphorus in detergent seems to be one of the major sources. The wastewater treatment plants in Rasht and Anzali cities are expected to reduce the phosphorous content after installation of the advanced treatment process. In addition to sewerage system development, research and development of "Low Phosphorus Detergent" is proposed for the reduction of phosphorus discharged into the wetland.

It is expected to take a long time to promote use of the low phosphorous detergent, because the low phosphorous detergent has not been manufactured in Iran, and has not been distributed on the market. Moreover, the importance and effectiveness of use of the low phosphorous detergent have not been considered in Iran. As a first step of the procedure, research works on the low phosphorous detergent is proposed, and a campaign of trial sales and use of the detergent is proposed as a second step of the procedure. Finally, before introduction of the law to forbid sale and use of detergent with high contents of phosphorous, it is proposed to promote voluntary use of the detergent with low phosphorus.

#### Nippon Koei Co., Ltd.

## 6.4 Management of Domestic Wastewater in Rural Area

#### 6.4.1 Introduction

For improvement of living conditions in the rural area, the development plans for wastewater treatment systems were prepared by RWWC. The plan seems effective for pollution control also. Households in rural area usually have absorption tanks. The absorption tanks cause the following problems that deteriorate living conditions.

- Seepage wastewater from the absorption tanks flows into groundwater.
- In case of high groundwater level, the wastewater cannot infiltrate into underground and overflows onto the surface from the absorption tank.

To solve the above problems, wastewater in the rural area shall be collected, treated and discharged out of the residential area. One of the possible measures is development of a sewerage system. However it seems to be unaffordable in the rural area from the financial point of view. Considering this constraint, development of low-cost community-level wastewater treatment systems based on a sewer network, septic tanks and secondary treatment processes is recommended for rural communities. Currently, there is no such community wastewater treatment facility in the rural area, but designs of community wastewater treatment systems have been prepared for seven villages.

## 6.4.2 Community Wastewater Treatment System Development

## (1) RWWC Plan

RWWC has prepared detailed designs for the community wastewater treatment systems for sixteen villages in the Guilan Province to be developed during the period of the Fourth Five-year Plan (2005-2009). Out of the sixteen villages, seven villages are located in the Anzali Wetland basin as shown in Figure 6.4.1. The corresponding service population comes to 18,325 and which corresponds to 5 % of the rural population of 393,000 in the Anzali Wetland basin.



Figure 6.4.1 Locations of Community Wastewater Treatment Systems Proposed by RWWC

The type of wastewater treatment system proposed by RWWC is illustrated in Figure 6.4.2.



Figure 6.4.2 Image of Community Wastewater Treatment System Proposed by RWWC

Sub- basin	Village	Township	Service Population	Number of Septic Tank	Pipe Line (m)	Required Land for Additional Treatment	Туре
Α	Atashgah	Rasht	4,353	339	9,200	2.7ha	SDGS
В	Kheshtnasjed	Rasht	4,796	-	10,900	2.7ha	SS
С	Gasht	Fuman	3,402	470	23,000	1.2ha	SDGS
	Loleman	Fuman	999	25	3,700	1.2ha	SDGS
D	Norgeston	Somehsara	1,988	246	8,900	1.2ha	SDGS
	Sheikhneshin	Masal	1,370	138	12,700	1.3ha	SDGS
E	Aliabad	Anzali	1,417	-	5,300	1.2ha	SS

Table 6.4.1	List of Proj	ects for Comm	unity Wastewa	ter Treatment in	Seven Villages

Source: RWWC Notes: SDGS: Small Diameter Gravity System, SS: Simplified System

#### (2) Proposed Plan

As mentioned in Chapter 2, RWWC's target is to achieve a service coverage ratio of 40% by 2022. However, due to financial constraints, RWWC's plan to construct community wastewater treatment systems in sixteen villages could not be commenced within the Third Five Year Plan (2000-2004) and is expected to be started in the period of the Fourth Five-year Plan (2005-2009). To attain the original target of RWWC, the service coverage ratio has to be increased by more than 15% for every 5 year. Considering the financial conditions of RWWC and the delay of the commencement of RWWC's plan, it may be unrealistic for RWWC to meet the original target. Therefore, the present master plan employs a 5% increase for every Five-year Plan, i.e., 15% increase by 2019. The service population by 2019 will increase as shown in Table 6.4.2. From view point of Anzali Wetland conservation, it is proposed to develop community wastewater treatment systems in the villages located in the Buffer Zone, Transition Zone and are near the rivers in the Fifth and Sixth Five Year Development Plans.

Item	2004	up to 2009	up to 2014	up to 2019
Population	394,128	393,230	392,726	392,679
Service Population	0	19,000	38,000	57,000
(Service Ratio)	(0%)	(5%)	(10%)	(15%)
Number of Villages	-	7	14	21
Number of Villages	-	7	14	

 Table 6.4.2 Service Population by Community Wastewater Treatment System

Source: JICA Study Team

## 6.5 Management of Industrial Effluents

## 6.5.1 Introduction

The industrial production will increase by 2.75 times by 2019, and the amount of industrial effluent is expected to increase to 21,000  $\text{m}^3$ /day in the same period assuming a proportional increase in the amount of industrial effluent with industrial production. Even if all of the industrial factories keep the effluent standard in 2019, pollution load of the industrial activities is expected to increase by 2.75 times. If no measures are implemented, the pollution load will be increased by more than 20 times.

In addition to the rapid increase in the amount of industrial effluent, industrial effluent may include heavy metal and toxic material. Serious environmental impact is expected in case of no measures. The management plan proposes, not only construction of wastewater treatment systems, but also strict monitoring and effective control systems.

Basically, the Polluter Pays Principle (PPP) is to be adopted for the wastewater management of industrial effluent. Owners of industrial factories have the responsibility to keep to the effluent standard at their own cost. To make it easy to control and manage the industrial effluent in the basin, the measures for management of industrial effluent in the basin are as proposed below:

- Centralization of factories in industrial cities,
- Construction of Centralized wastewater treatment in the industrial cities,
- Strengthening of monitoring activities by DOE.

One of the alternatives is a restriction in the number of industrial factories in the basin in order to limit industrial pollution load generation in the basin. Because industrial development is planned in order to create job opportunities for the population, which is expected to increase in the basin, this alternative can hardly be accepted.

## 6.5.2 Centralization of Industrial Factories

There are five existing industrial cities and one planned, in the basin as shown in Figure 6.7.1. DOE and MOIM have already considered transferring major industrial factories to these industrial cities. For an effective procedure for the centralization, a guideline for centralization is proposed. First of all, criteria for the industrial factories to be transferred to the industrial cities should be clear. It is not necessary to transfer all industrial factories as some may have no effluent and no emissions. The following process is recommended for the transfer of factories to the industrial cities.

- New industrial factories, which have environmental impacts such as discharging effluent and emissions, should be constructed in the industrial cities,
- Existing factories, which have an environmental impact, should be transferred to the industrial cities within a certain period to be fixed, such as 5-10 years, or should have a complete wastewater treatment system.

In the case of Japan, industrial factories, which meet the criteria of an industrial factory by the law, cannot be constructed near residential areas. This provides environmental protection for living, and centralization of industrial factories is promoted for effective development of industrial activities and environmental conservation. The criteria in Japan are defined for each industrial factory by "Type of manufacture", "Floor area", "Type of material to be used for factories", etc.

For promotion of the centralization some incentives need to be prepared. The following privileges have already been prepared for factories to be constructed in the industrial cities.

- Four year exemption of municipality taxes

- Installment payments for land acquisition



- Financial assistance from the government

Figure 6.5.1 Location of Existing and Planned Industrial Cities

## 6.5.3 Construction of Centralized Wastewater Treatment Systems

Central wastewater treatment systems are proposed for the effective management of wastewater in the industrial cities. In the wastewater management plan, it is proposed to construct centralized wastewater treatment systems with treatment capacity to meet the  $21,000 \text{ m}^3/\text{day}$  of the total industrial effluent predicted in the basin. At present, there are no wastewater treatment systems in the industrial cities, though as a first step, a small-scale wastewater treatment system with a treatment capacity of  $100 \text{ m}^3/\text{day}$  is under construction in Anzali Industrial City. Rasht Industrial City Company is considering a plan for construction of a wastewater treatment system. Based on discussions with relevant organizations, proposed wastewater treatment capacity for each industrial city is tentatively estimated as shown in Table 6.5.1. At present, there is no plan to construct wastewater treatment systems except for the Rasht and Anzali industrial cities. The image of the centralized wastewater treatment system is as shown in Figure 6.5.2.

14000 3/1		
$14,000 \text{ m}^3/\text{day}$	Rasht	There is a plan for construction of the treatment
	Company	system. Rasht industrial City Company is
	Company	wastewater treatment system.
$500 \text{ m}^3/\text{day}$	MOIM	No plan
$500 \text{ m}^3/\text{day}$	MOIM	No plan
$500 \text{ m}^3/\text{day}$	MOIM	No plan
$500 \text{ m}^3/\text{day}$	MOIM	No plan
5,000 m <sup>3</sup> /day	MOIM	A treatment plant with a treatment capacity of $100 \text{ m}^3/\text{day}$ is under construction. Expansion of the treatment capacity is required, but no plan for
	500 m <sup>3</sup> /day 500 m <sup>3</sup> /day 500 m <sup>3</sup> /day 500 m <sup>3</sup> /day 5,000 m <sup>3</sup> /day	14,000 m /day     Rash Industrial City Company       500 m³/day     MOIM       500 m³/day     MOIM       500 m³/day     MOIM       500 m³/day     MOIM       5,000 m³/day     MOIM

Table 6.5.1	Wastewater	Treatment	Systems	in	Industrial	Cities in	the	Study	Area
-------------	------------	-----------	---------	----	------------	-----------	-----	-------	------

Source: JICA Study Team based on information from MOIM and DOE



Figure 6.5.2 Image of Centralized Wastewater Treatment System

## 6.5.4 Strengthening of Monitoring Activities by DOE

DOE, Human Environmental Department is expected to play an important role to control industrial effluent from each industrial factory. The following activities are proposed for strengthening of DOE activities for industrial effluent control.

## (1) Expansion of Monitoring Activity

Current monitoring by DOE is only carried out on major industrial factories several times per year. If any problem is found from the monitoring, DOE Guilan issues an order to improve the effluent system in the factory. There are about 50 water quality parameters in the effluent standards, including heavy metals and other toxic materials. However, monitoring by DOE Guilan only covers 30 parameters, and those do not include heavy metals or other toxic materials. Monitoring, including these substances, is proposed for all of the industrial factories in the basin. As mentioned in Section 6.8.2, it is proposed to monitor activities of the industrial factories in the basin and make a data base. The database shall be revised once a year based on new monitoring data.

## (2) Expansion of the Human Environmental Department

For expansion of industrial monitoring activities, a new water quality laboratory with an atomic absorption spectrophotometer is under construction for heavy metal analysis in DOE, Guilan headquarters. It is also proposed to increase technical staff for environmental monitoring and inspection of industrial factories.

## 6.6 Management of Livestock Waste

## 6.6.1 Introduction

There are about 860,000 head of cows, buffalo, sheep and goats in the basin. These animals are kept in four ways, i.e., .fed: by individual farmers in the plain, in grazing land of the mountain area, in Grazing Land of the Plain and in industrial animal husbandries. It is evaluated that livestock fed by Individual Farmers in the Plain and in Grazing Land of the Mountain Area have no serious impact of Anzali Wetland, because waste from livestock fed by the farmers has been managed, and waste from livestock in grazing land of the mountain area can hardly reach to the wetland. With the decrease of 250,000 head of livestock under the rangeland management by NRGO, about 13 % of the pollution load from livestock are expected to decreases without any measures. The following measures are proposed for management of livestock waste.

 Table 6.6.1 Measures for Management of Each Group of Livestock

Group	Measures
1) Livestock in Industrial Animal Husbandry	Installation of treatment facilities for waste from industrial
	animal husbandry
2) Livestock in Grazing in the Plain Area	Installation of Watering Points and a Buffer Zone to prevent
	livestock waste discharging directly to rivers

## 6.6.2 Treatment of Waste from Industrial Animal Husbandry

A building for industrial animal husbandry is a point source like an industrial factory. Waste from industrial animal husbandry should be managed the same as industrial effluent, according to the bylaws. As shown in Figure 6.6.1, any industrial animal husbandry is required to install storage for livestock manure and a wastewater treatment facility. A re-use plan for livestock manure shall be prepared.

Industrial animal husbandries, which feed more than 20 head of cows, feed about 3,000 heads at seventeen sites in the basin. At present there is not any wastewater treatment facility for industrial animal husbandry in the basin. Wastewater treatment facilities and storage of livestock manure shall be installed in all the industrial animal husbandry facilities.



Figure 6.6.1 Image of Management of Livestock Waste in Industrial Animal Husbandry

At present, new buildings for industrial animal husbandry, which feed not less than 20 heads of cows, are required to have a suitable wastewater treatment facility and storage for livestock manure. Before issue of construction permission to new buildings for industrial animal husbandry, DOE, Human Environmental Department evaluates the treatment system of livestock waste in it.

## 6.6.3 Control of Livestock Waste in Grazing Lands in the Plain Area

About 20,000 head of cows and buffalo are fed in the grazing land in the plain area, which is located near the wetland and the rivers. This may be a serious pollution source, because livestock waste may discharge directly to the wetland and the rivers. Because it is not possible to collect and treat the livestock waste in the grazing land, installation of watering points and dykes is proposed to prevent livestock waste from discharging to the wetland and the rivers as below.

- Installation of watering points for livestock far from rivers and installation of fences along the river, in order to prevent livestock from going to the river. Livestock tend to excrete when they drink water, and when livestock drink water in a river, it may a serious situation for river pollution caused by livestock,
- Installation of dykes to prevent drainage water in the rangeland from discharging into rivers.

These are popular measures for pollution control of livestock waste in Japan. The locations required for the proposed measures are the grazing area in the Buffer Zone and the Transition Zone (see Section 4.3) and along the wetland and the rivers. The proposed dykes consist of a grass zone and trees between the plain and the rivers. The measure is illustrated in Figure 6.6.2.

#### Nippon Koei Co., Ltd.



Figure 6.6.2 Image of Water Points and Buffer Zone

## 6.7 Management of Pollution from Farmland

## 6.7.1 Introduction

The Agricultural Support Center of MOJA has been implementing programs to reduce the use of chemical fertilizers and other agricultural chemicals. As a result, the application rate of phosphorous in the area has dropped to almost 1/10 of previous level in the last 10 years, and as many as 20,000 ha or some 22% of the agricultural areas received biological pest management in 2002. According to extension service specialists and farmers, about 80% of the farmers in the study area follow the instructions of the agricultural extension specialists, and the purchase of farm inputs (chemical fertilizers and other agrochemicals) is controlled through the cooperatives. Overall, substantial efforts have already been made to control applications of chemical fertilizers and other agricultural chemicals.

According to MOJA, it is estimated that about 6,000 ton of nitrogen and 324 ton of phosphate were used in the area last year. Although the average application level of fertilizer for rice farming in the area is not high, the total quantities of fertilizers used are rather large since the paddy fields extend widely in the study area. Likewise, the application level of agricultural chemicals seems low, but the total quantity of agrochemicals used in the study area amounts to 500 to 600 ton /year as a whole.

At this point, it is difficult to evaluate whether further reduction of fertilizers and other agricultural chemicals is practical, as such decisions could affect the livelihood of local farmers, and more discussions and researches are needed. Nevertheless, there are many reasons to at least tighten the control of fertilizes and other agrochemicals, if not reduce their uses.

- Pesticides and herbicides potentially have detrimental impacts on the wetland ecosystem. Even though many species may have significant tolerance to such

Nippon Koei Co., Ltd.

chemicals, there are susceptible species<sup>2</sup>, and loss of these species could affect the entire ecological balance of the region.

- It is generally desirable to minimize the amounts of agrochemicals in agricultural products from the perspective of food safety.
- Groundwater pollution by nitrate has been reported in the plain areas of the northern provinces, which may be partially attributed to excessive use of chemical fertilizers.

Considering the need to balance the production and environmental conservation, the master plan proposes the following programs.

## 6.7.2 Promotion of Farming with Less Input

(1) Promotion of use of compost such as livestock manure and/or Azolla

Traditionally, farmers use livestock waste as one of the farm inputs in the study area. Although it might possibly cause water pollution by COD, T-N and T-P if it is dosed excessively, livestock waste-based compost should be further promoted to minimize the use of chemical fertilizers, especially nitrogen-based ones (e.g., urea, ammonium sulfate, etc.). Application of organic materials can make soil healthy and help minimize an outbreak of diseases and pest infestation if it is properly applied. The Agricultural Service Center needs to disseminate proper application of organic materials as well as appropriate application level of chemical fertilizers based on the dosage of organic materials.

The following actions should be considered to promote the use of compost.

- to provide subsidy for using organic materials
- to give added value to products organically grown (e.g., promotion of the product brand "Organic Rice from Guilan Province")
- to develop a network with industrial livestock raisers to encourage recycling of livestock waste

As discussed in Chapter 4, the use of compost/organic materials should first focus on the Buffer Zone to minimize the pollution load to the Wetland.

(2) Expansion of Integrated Pest Management through Farmer Field School

Integrated pest management (IPM) has been promoted by MOJA as one of their extension programs. The main principle of IPM is to increase the farm profit of individual farmers through reducing the expenses for external farm inputs while maintaining productivity. Major practices taken under IPM are i) identification and prediction of pests, ii) determination whether pest population will reach a level that could cause economic damage, iii) application of

 $<sup>^{2}</sup>$  For example, crustaceans and some fish species are sensitive to diazinon, a pesticide widely used in the area. The reported PNEC (predicted no effect concentration) for aquatic species is as low as 0.00026 ug/L (Ministry of Environment, Japan, 2003).

Nippon Koei Co., Ltd.

agricultural chemicals in case the situation is severe, and iv) maintenance of crop health. Farmer Field School (FFS), which are training courses composed of guidance and practical sessions in the field, have been a major tool for the promotion of IPM. Since all the practices from identification to chemical application should be done by farmers themselves, the capacity development of farmers is essential for the implementation of IPM. In general, FFS for rice farming organizes a field session per week and lasts for one cropping season.

Although MOJA has conducted the IPM program since 1999, the coverage of the activity is limited and the IPM practices seem unfamiliar to farmers in the study area. It is, therefore, proposed that two groups of two experts on IPM conducts 10 FFSs every year at different sites, and give guidance to about ten families of farmers on each school for several months. The experts on IPM need to keep good relations with farmers and give technical guidance to farmers to enable them to use the proposed practices. As a result of the 10 FFSs, about one hundred families of farmers can get guidance for about 200 ha of farmland every year. The farmers who get the guidance are expected to be trainers and disseminate trained knowledge to his/her neighbors. FFS includes the following guidance:

- Guidance on identification and prediction of insects / pests to be controlled
- Guidance on methods for pesticide use with suitable types and amounts of pesticide to meet the site conditions
- Guidance for biological control of insect pests in order to reduce pesticide consumption
- Guidance for methods of herbicide reduction

The proposed IPM program should be concentrated in the buffer zone at the beginning of the master plan, and thence, it will expand its activity to the transition zone gradually.

(3) Promotion of Proper Farming Practice

Farming practices on farm input application and water management are crucial for the control of pollution loads from farmlands. Draining irrigation water soon after application of farm inputs (fertilizers / agricultural chemicals) results in discharge of highly polluted water with nitrogen, phosphorous or toxic materials to rivers as well as the wetland. Needless to say, over-dosage can easily cause contamination of drainage water.

As shown in Section 2.6.2, Diazinon is the main agricultural chemical presently used in the area. Since it has the property of being easily hydrolyzed and degraded in paddy fields, water retention for a certain period after application is very important. Due attention should be paid to water management to minimize the discharge of pollution loads to river systems. Therefore, the Agricultural Service Center should also emphasize water management at the field level in addition to the extension works on the uses of agricultural chemicals and fertilizers.

## 6.8 Environmental Monitoring

#### 6.8.1 Introduction

The wastewater management plan was prepared based on available data on environmental condition of the Anzali Wetland and the situation of pollution sources in the basin. During development of the wastewater management plan, the management plan shall be revised to meet actual future situations on the following items.

- 1) Changing water quality in the Anzali Wetland and the rivers following to the wetland
- 2) Changing amount of pollution load generation in the basin
- 3) Progress of implementation of proposed projects in the wastewater management plan
- 4) Operational condition of proposed projects in the wastewater management plan

It is proposed that every 5 years the wastewater management plan will be revised based on the monitoring data shown above.

## 6.8.2 Monitoring Programs

In addition to the monitoring of ambient water quality in the Anzali Wetland proposed in the Wetland Ecological Management Plan, the following 5 programs are proposed for monitoring for the wastewater management.

	<u> </u>	
Monitoring	Organization	Purpose
1) Domestic Wastewater Treatment	GWWC, RWWC	<ul> <li>Preparation of data for revising the management plan for domestic wastewater in urban area and</li> </ul>
		rural area
2) Industrial Factories	DOE	- Preparation of data for revising the management plan for industrial effluent
3) Agricultural Activity	MOJA	- Preparation of data for revising the management plan for livestock waste and pollution from farmland
4) Pollution load to the wetland	DOE	- Preparation of data for revising the overall wastewater management plan
5) Ambient Water Quality	DOE and MOE	- Preparation of data for revising the overall wastewater management plan

Table 6.8.1 Proposed Monitoring Program for Wastewater Management

The details of the above 5 programs are described as below.

-	
Objective	To monitor condition of domestic wastewater treatment
Organization	GWWC, RWWC
Monitoring Program	
- Influent/Effluent	General Parameters (discharge rate, Temp., BOD, COD, T-N, T-P, SS), each
	Wastewater Treatment Plant, One time/day
	Toxic Parameters (heavy metals, pesticides), 1 time/month
- Development of	Length of Sewer Pipes by each diameter, once a year
Sewerage Systems	Total Operation Capacity of Wastewater Treatment
- Condition of	Sewerage Service Population, once a year
Wastewater	Service Population of Individual Wastewater Treatment Facility, once a year
Treatment	Service Population of Community Wastewater Treatment System, once a year
Analysis and Storage Every year, GWWC compiles the findings into a report.	
of Information	

Table 6.8.2	Monitoring of Domestic Wastewater Treatment
-------------	---

Objective	To inspect compliance of industries with effluent standards.
Organization	DOE and IMO
Monitoring Program	
- Industrial Activity	Basic Data (Type of industry, production amount, water consumption, number of
	employees, location, etc.), all industrial factories, updated once a year
- Industrial	General Parameters (discharge rate, Temp., BOD, COD, TDS, T-N, T-P, SS), 40
Wastewater	locations, 1 time/year, Toxic Parameters (heavy metals, pesticides); 40 locations; 1
	time/year
Analysis and Storage	Every year, DOE compiles the findings into a technical report.
of Information	

## Table 6.8.4 Monitoring of Agricultural Activity

Objective	To monitor the condition of pollution sources in agricultural activities
Organization	MOJA
Monitoring Program	
- Livestock	Number of cows, buffalo, sheep and goats, once a year
	Information on Industrial Animal Husbandry (location, number of livestock,
	situation of management of livestock waste), once a year, updated
- Activity in	Total area of agriculture land
Farmland	Total consumption of chemical fertilizer, Total consumption of pesticide and
	herbicides and other agricultural chemicals, once a year
- Analysis and	Every year, MOJA compiles the findings into a technical report.
Storage of	
Information	

Objective	To monitor ambient water quality of rivers and groundwater. The water quality of the wetland is monitored under a different program.
Organization	DOE and MOE
Monitoring Program	
- Water Quality and	General Parameters (Flow rate, BOD, COD, T-N, T-P, SS), 7 locations, 4 times/year
River Discharge	(spring, summer, fall, winter)
Analysis and Storage	DOE compiles the findings into a technical report. A database of river water quality
of Information	should be developed by DOE.

Nippon Koei Co., Ltd.

Objective	To monitor ambient water quality of rivers and groundwater. The water quality of the		
	wetland is monitored under a different program.		
Organization	DOE and MOE		
Monitoring Program			
- Water Quality	General Parameters (Temp., DO, BOD, COD, T-N, T-P, SS, transparency), 20		
	locations, 4 times (spring, summer, fall, winter)		
	Toxic Parameters (heavy metals, pesticides, herbicide); 20 locations; 3 times/year		
- Sediment Quality	General parameters (depth, texture, organic carbon, T-N, T-P), Toxic parameters		
	(heavy metals, pesticides); 10 locations; 1 time/year		
- Groundwater	General Parameters (Temp., MnO <sub>2</sub> demand, NO <sub>3</sub> , NH <sub>4</sub> , T-P, turbidity, TDS, others),		
	10 locations, 4 times (spring, summer, fall, winter)		
	Toxic Parameters (heavy metals, pesticides); 10 locations; 1 time/year		
Analysis and Storage	DOE compiles the findings into a technical report. A database of river water quality		
of Information	should be developed by DOE.		

For dissemination of all information from the above monitoring, report will be distributed among DOE, MOE, GWWC, RWWC and other interested parties.

#### 6.9 Institutional Arrangement

In order to effectively implement the proposed wastewater management plan, the following institutional arrangement is proposed.

(1) Revision of Regulations related to Effluent Standard

There appear to be conflicting regulations about the effluent standard, pollution charges related to effluent, pollution tax on industry, and fines and punitive measures associated with pollution. These regulations should be clarified and unified under a clear legal framework for pollution control.

(2) Establishment of Ambient Water Standard

Iran has no standard or guideline for ambient water quality. It is recommended that ambient water quality standards should be established for different water bodies (rivers, lakes, coastal wetlands, etc.) taking into consideration the ideal water quality, the current situation and uses of the water bodies.

## 6.10 Summary of Proposed Wastewater Management Plan

The summaries of the proposed projects in the wastewater management plan are as shown in Table 6.10.1 and Figure 6.10.1.

Sub Components		Proposed Projects/Messures			
Sub-Components	Proposed Projects/Measures		Organizations		
Management of	(1)	Rasht Sewerage System Development Project	GWWC		
Domestic		Phase 1 Service Population: 253,816 residents			
Wastewater in		Treatment Capacity: 80,000 m <sup>3</sup> /d			
Urban Area		Phase 2 Service Population: 378,284 residents			
		Treatment Capacity: 80,000 m <sup>3</sup> /d			
	(2)	Anzali Sewerage System Development Project	GWWC		
		<u>Phase 1</u> Service Population: 77,920 residents			
		Treatment Capacity: 34,000 m <sup>3</sup> /d			
		<u>Phase 2</u> Service Population: 51,000 residents			
		Treatment Capacity: 20,000 m <sup>3</sup> /d			
	(3)	Somehsara Sewerage System Development Project	GWWC		
		Service Population: 56,980 residents			
		Treatment Capacity: 12,700 m <sup>3</sup> /d			
	(4)	Promotion of Individual Wastewater Treatment Facilities outside of	DOE		
		Sewerage Service Area			
		Target Population: 113,000 residents			
		Number of Septic Tank Installation: 22,600 units			
	(5)	Promotion of Low Phosphorous Detergent Use	DOE		
Management of	(1)	Community Wastewater Treatment System Development	RWWC		
Domestic		Service Population: 57,000 residents			
Wastewater in		Sites: 21 villages			
Rural Area					
Management of	(1)	Centralization of Industrial Factories	DOE/MOIM		
Industrial Effluent		Sites: Six Industrial Cities (Anzali, Rasht, Somehsara,			
		Fuman, Shaft and Masal)			
	(2)	Construction of Centralized Wastewater Treatment System	DOE/MOIM/		
		Sites: Six Industrial Cities (Anzali, Rasht, Somehsara,	Private		
		Fuman, Shaft and Masal)	company		
		Total Treatment Capacity: 21,000 m <sup>3</sup> /day			
	(3)	Strengthening of Monitoring Activities by DOE	DOE		
Management of	(1)	Treatment of livestock waste from industrial animal husbandry	DOE		
Livestock Waste		Sites: 17 sites of existing industrial animal husbandries			
	(2)	Control of livestock waste in grazing lands in the plain area	DOE		
Management of	(1)	Promotion of farming with less input	MOJA		
Pollution from		1) Promotion of use of compost such as livestock manure and/or			
Farmland		Azolla			
		2) Expansion of Integrated Pest Management through Farmer Field			
		School			
		2) Promotion of proper farming practice			



## 6.11 Cost Estimate

## 6.11.1 Project Cost

The construction cost and O&M cost for the proposed projects are calculated based on the following data, as shown in Table 6.11.1. For the general conditions of cost estimation, please see Chapter 3.

Project	Data Source
Rasht Sewerage System	Based on Rasht Water Supply and Wastewater Collection and Disposal,
Development	Feasibility Studies (Final Report) in August 2004
Anzali Sewerage System	Based on Rasht/Anzali Water Supply and Wastewater Collection and
Development	Disposal, Feasibility Studies (Draft Report) in March 2003, the units
	prices are modified considering price escalation up to 2004. The cost of
	WWTP is estimated by JICA Study Team.
Somehsara Sewerage System	Based on the data from GWWC
Development	
Development of Community	Based on the data prepared by RWWC, Gilan in 2001, the unit prices are
Wastewater Treatment System	modified in conformation with RWWC suggestions.

Table 6.11.2 shows the estimate of total investment cost and O&M cost of the proposed projects. Total investment cost is estimated about 2,449,866 million Rials. Of which, 2,259,795 million Rials is for sewage management, especially for construction of sewerage systems in Rasht, Bandar Anzali and Somehsara.

		O&M Cost	
Proposed Projects/Measures	Project Cost (million Rials)	Overall (million Rials)	Average Annual (million Rials/year)
1. Management of Domestic Wastewater in Urban Areas			<b>y</b> /
(1) Rasht Sewerage System Development Project			
1) Rasht sewerage (Phase 1), for 253,816 residents	741,088	274 210	25.010
2) Rasht sewerage (Phase 2), for 378,284 residents	588,426	274,218	25,810
(2) Anzali Sewerage System Development Project	,		
1) Anzali sewerage (Phase 1), for 77,920 residents	510,018	00.1(1	0.442
2) Anzali sewerage (Phase 2), for 51,000 residents	177,633	90,161	8,443
(3) Somehsara Sewerage System Development Project for 56 980 residents	214,380	33,984	4,076
(4) Promotion of Individual Wastewater Treatment	28 250	283	283
(5) Promotion of Low Phosphorous Detergent	0	1 940	194
Sub-total	2.259.795	400.586	38.806
2. Management of Domestic Wastewater in Rural Areas	,,	,	
(1) Community Wastewater Treatment System			
Development			
1) Initial Stage for Seven Villages	19,830		
2) Second Stage	19,830	8,349	1,089
3) Third Stage	19,830	ŕ	ŕ
Sub-total	59,490	8,349	1,089
3. Management of Industrial Effluent	,	,	,
(1) Centralization of Industrial Factories	1,330	0	0
(2) Construction of Centralized Wastewater Treatment Systematics	em		
1) Rasht industrial city	67,500	17.240	2.052
2) Anzali, Somehsara, Fuman and other industrial cities	60,750	17,249	2,052
(3) Strengthening of Monitoring Activities by DOE	0	4,095	273
Sub-total	129,580	21,344	2,325
4. Management of Livestock Waste			
(1) Treatment of Livestock Waste from Industrial Animal	500	260	20
Husbandry	500	200	20
(2) Control of Livestock Waste in Grazing Lands in the	500	300	84
Plain Area	500	300	04
5. Management of Pollution from Farmland			
(1) Promotion of Farming with Less Input			
1) Expansion of use of compost such as livestock manure			
and/or <i>Azolla</i>			
2) Expansion of integrated pest management through	0	3,960	402
farmer field school			
3) Promotion of Proper Farming Practice			
6. Environmental Monitoring	0	5,250	350
Total	2,449,866	439,766	42,634

Table 6.11.2	Cost Estimate of the	Wastewater N	Ianagement Plan
1 abic 0.11.2	Cost Estimate of the	masic match 1.	ranagement i lan

Source: JICA Study Team

## 6.11.2 Operation and Maintenance Cost

The average annual O&M cost for the proposed projects are estimated at 42,634 million Rials/year.

# 6.12 Implementation Program

#### 6.12.1 Executing Organizations

The responsible organizations for the proposed projects are shown in Table 6.10.1.

#### 6.12.2 Criteria for Prioritization

The proposed projects are prioritized using the following criteria with the following weight.

Criteria	Implication	Weight			
1) Effect	a. Reduction of Organic Pollution	2			
	b. Reduction of Heavy Metals and Toxic Materials	2			
2) Efficiency	a. Speed of Response	1			
3) Urgency		2			
4) Cost					
5) Capacity of executing organi	2				
6) Conformity with National Po	2				
7) Environmental Impact					
8) Social Impact	a. Improvement of Public Health	1			
9) Other criteria	a. Technical Difficulty				

#### Table 6.12.1 Criteria for Prioritization

## 6.12.3 Evaluation of Proposed Projects for Prioritization

The summary of the results of the evaluation for prioritization is described in Table 6.12.2.

Criteria		1	2	3	4	5	6	7	8	9	Overall	
Proposed Projects	а	b	а		4	5	0	/	а	а	Evaluation	
1. Management of Domestic Wastewater in Urban Areas												
(1) Rasht Sewerage System Development Project	А	С	А	А	С	В	А	А	А	В	A (21)	
(2) Anzali Sewerage System Development Project	А	С	А	А	С	В	А	А	А	В	A (21)	
(3) Somehsara Sewerage System Development Project	В	С	А	В	С	В	А	А	А	В	A (17)	
(4) Promotion of Individual Wastewater Treatment	В	С	В	С	С	С	С	А	В	С	C (6)	
(5) Promotion of Low Phosphorous Detergent	А	С	А	В	В	С	С	А	С	С	B (11)	
2. Management of Domestic Wastewater in Rural Areas												
(1) Community Wastewater Treatment System Development	В	С	В	В	В	В	А	А	А	В	A (17)	
3. Management of Industrial Effluent												
(1) Centralization of Industrial Factories	В	В	С	В	В	В	А	А	А	А	A (19)	
(2) Construction of Centralized Wastewater Treatment System												
1) Rasht	А	В	А	А	В	В	В	А	В	В	A (21)	
2) Others	В	В	В	С	В	В	В	А	В	В	B (14)	
(3) Strengthening of Monitoring Activities by DOE	В	А	В	А	А	В	В	А	В	В	A (21)	
4. Management of Livestock Waste												
(1) Treatment of Livestock Waste from Industrial Animal Husbandry	В	С	В	А	В	В	В	А	В	В	A (16)	
(2) Control of Livestock Waste in Grazing Lands in the Plain Area	В	С	В	С	В	С	С	А	В	А	C (9)	
5. Management of Pollution from Farmland												
(1) Promotion of Farming with Less Input	В	В	В	В	А	А	В	А	В	В	A (19)	
Weight	2	2	1	2	1	2	2	1	1	1	-	

Note: Criteria 1= Effect, a. Reduction of organic pollution, b. Reduction of heavy metals and toxic materials

2= Efficiency, a. speed of response, 3= Urgency, 4= Cost,

5= Capacity of executing organization, 6= Conformity with national policy,

7= Environmental impact, 8= Social impact, a. Improvement of public health

9= Other criteria, a. technical difficulty

Score A=2, B=1, C=0

Source: JICA Study Team

## 6.12.4 Implementation Schedule

It is proposed that the wastewater management plan be implemented by 2019, as shown in Table 6.12.3.

## (1) Management of Urban Domestic Wastewater

1) Sewerage System Development

Rasht sewerage project (Phase 1) and Anzali sewerage project (Phase 1) are under construction and planned to be completed in the Fourth Five-year Development Plan. Somehsara sewerage project is also under construction, and planned to be completed in the Fifth Five-year Development Plan. Some parts of Rasht sewerage project (Phase 1) and Anzali sewerage project (Phase 1) are planned to be financed by WB. According to the original plan prepared by NWWEC, Rasht sewerage project (Phase 2) and Anzali sewerage project (Phase 2) were planned to be completed in the Fifth Five-year Development Plan. However, from a financial point of view, it is proposed in the master plan that the both Phase 2 projects be implemented in the Fifth and Sixth Development Plans.

2) Individual Wastewater Treatment

Wastewater treatment outside of sewerage service area is proposed to commence in Sixth 5-year Development Plan, because the priority is relatively low as shown in Table 13.3.2.

3) Promotion of Low Phosphorous Detergent Use

For reduction of the phosphorous load, the promotion of low phosphorous detergent is evaluated to be an effective measure. However, the measure can not commence soon, because no organization has not considered a plan for this measure at present and no manufacturers in Iran produce low phosphorous detergent. The promotion is proposed to commence in the Fifth Five-year Development Plan.

(2) Management of Rural Domestic Wastewater

Community Wastewater Treatment Systems are proposed to be developed as mentioned in Section 6.4.2.

(3) Management of Industrial Effluent

All proposed measures for the management of industrial effluent, "Centralization of Industrial Factories", "Centralized Wastewater Treatment System" and "Strengthening of DOE" have already commenced.

(4) Management of Livestock Waste

The measures for Industrial animal husbandry are planned to commence and be completed in the Fourth Five-year Development Plan, because it is a high priority and there are only 16 target sites of industrial animal husbandry. The measures for livestock in the rangeland in the plain area are not so high priority, and are planned to commence in the Sixth Five-year Development Plan.

Nippon Koei Co., Ltd.

# (5) Management of Pollution from Farmland

Parts of the proposed measures for the management of pollution from farmland have already commenced, and are proposed to be carried out continuously until 2019.

Drangood Magguroo		Fourth 5-year Plan Period			Fifth 5-year Plan Period				Sixth 5-year Plan Period							
	Proposed Measures	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
WAST	EWATER MANAGEMENT PLAN	-						•		-				-	•	•
1. Mar	agement of Domestic Wastewater in Urban Area															
(1)	Rasht Sewerage System Development Project															
1)	Rasht Sewerage (Phase 1)				1	1										
2)	Rasht Sewerage (Phase 2)															
(2)	Anzali Sewerage System Development Project															
1)	Anzali Sewerage (Phase 1)			1												
2)	Anzali Sewerage (Phase 2)							1								
(3)	Somehsara Sewerage System Development				i –	i –					i –					
(4)	Promotion of Individual Wastewater Treatment															
(5)	Promotion of Low Phosphorous Detergent Use							1					1			
2. Mar	agement of Domestic Wastewater in Rural Area															
(1)	Community Wastewater Treatment System Development															
1)	First Stage (Seven Villages)				1	1	I									
2)	Second Stage & Third Stage															
3. Mar	agement of Industrial Effluent															
(1)	Centralization of Industrial Factories				г											
(2)	Construction of Centralized Wastewater Treatment System															
1)	Anzali	CCC														
2)	Rasht				1	1 1	I									
3)	Others															
(3)	Strengthening of Monitoring Activities by DOE															
4. Mar	agement of Livestock Waste															
(1)	Treatment of Livestock Waste from Industrial Animal Husbandry						1									
(2)	Control of Livestock Waste in Grazing Lands in the Plain Area										[		1			
5. Mar	agement of Pollution from Farmland															
(1)	Promotion of Low External Input Farming															
1)	Expansion of use of compost such as livestock manure and/or Azolla															
2)	Expansion of integrated pest management through farmer field school															
3)	Promotion of proper farming practice															
6.Envi	ronmental Monitoring															
(1)	Monitoring of Domestic Wastewater Treatment															
(2)	Monitoring of Industrial Factories															
(3)	Monitoring of Agricultural Activities															
(4)	Monitoring of Pollution Load to the Wetland															
(5)	Monitoring of Ambient Water Quality															

Table 6.12.3	Proposed In	nplementation	Schedule f	or the <b>'</b>	Wastewater	Management P	lan
14010 0.12.0	1 Toposeu II	nprementation	Schedule I	or the	rastemater .	management i	1

## 6.13 **Priority Projects**

The priority projects are defined as parts of proposed projects in Fourth Five-year Development Plan, which are proposed to be carried out urgently, and exclude on-going works. As shown in Table 6.12.2, the following projects scored high, and are selected as the Priority Projects, which are to be carried out urgently as a part of the Projects in the Fourth Five-year Development Plan.

- 1) Rasht Sewerage Project (Phase 1)
- 2) Anzali Sewerage Project (Phase 1)
- 3) Capacity Development of DOE, Human Environmental Department
- 4) Centralized Wastewater Treatment in Rasht Industrial Cities

## CHAPTER 7 SOLID WASTE MANAGEMENT PLAN

## 7.1 Introduction

As discussed in Chapter 2, the waste collection coverage is only 65% on a population basis, and no collection service is provided in rural areas. Consequently, illegal dumping is ubiquitous and as much as 66 tons/day of solid waste is dumped into the tributaries of the Anzali Wetland. Even in urban areas where a door-to-door collection service is provided almost everyday, dumping into rivers and open spaces is common due to the low environmental awareness of the residents. Environmental contamination around the existing dumping sites is also a concern as no leachate control is practiced at any of the dumping sites, including the Anzali dumping site located adjacent to the Wetland. There is no established system to manage the hazardous wastes, and management of non-hazardous waste is a potential issue in the future. Given these situations, drastic improvement of solid waste management is needed.

## 7.2 **Objectives and Strategies**

## 7.2.1 Objectives

Solid waste management problems in the area are the manifestations of poor environmental management in the area, and the resulting scattering of uncollected waste is both a public health concern and the main reason for the downstream contamination of Anzali Wetland by solid waste. Thus, the informal disposal of uncollected solid waste and open dumping should be controlled urgently. In addition, industrial waste, especially hazardous wastes, must be controlled carefully, as their environmental impact can be significant. The objectives of the Solid Waste Management Plan are thus:

- To reduce uncontrolled disposal of municipal solid waste by proper management, including the prevention of its flowing to the Wetland, and
- To implement proper control of industrial solid waste.

## 7.2.2 Strategies

## (1) Environmental Awareness Raising

Environmental awareness raising is one of the most crucial strategies, because the problems of solid waste management in the area are rooted, not only in technical and financial issues, but deeply in the behavior of people, as is evident from illegal dumping even in areas where daily and door-to-door waste collection service is provided. The environmental awareness is expected to become more important in the future, as the residents would face increasingly difficult waste management issues, such as reduction of the amount of waste, construction of landfills, reduction in excessive solid waste management cost by reducing collection

frequencies and points, etc. These measures require people's understanding about the needs, and people's cooperation and active participation in these measures.

# (2) Provision of Efficient Municipal Solid Waste Collection Service to the Whole Area

Limited waste collection coverage is another major cause of improper waste management in the study area, especially in rural areas where there had been no waste collection service at all (see Chapter 2.7). However, the new solid waste law promulgated recently finally made it mandatory to provide solid waste management in rural areas. Thus, the main strategy is to develop a system of waste collection systems in rural areas. In the urban area, where rather excessive collection service has been provided, the improvement of service efficiency is the primary direction.

(3) Proper Disposal of Municipal Solid Waste

The government is pursuing a strategy to construct composting plants to separate, recycle and stabilize waste before final disposal so that the amount of waste brought to final disposal sites can be reduced. There is already a composting plant in Rasht, and another composting plant will open in 2006 in Ab Kenar. Thus, waste reduction using these facilities is considered in the plan. In addition, new sanitary landfills should be constructed as the existing dumping sites were not properly designed or constructed.

(4) Possible Measures to Achieve the Targets of Industrial Solid Waste Management

The amount of hazardous industrial solid waste containing toxic substances, such as heavy metals, is limited (about 50 ton/year), but it could pose significant environmental threat to the wetland located downstream. Thus, some urgent measures to control hazardous waste should be implemented. The same can be said about infectious waste. Then, more comprehensive measures, such as information management systems, waste reduction, licensing systems or possible regulatory measures to control industrial waste should be introduced to control the growing quantities of industrial waste in the future.

## 7.3 Municipal Solid Waste Management

- 7.3.1 Environmental Awareness Raising
- (1) Introduction

The problem of illegal dumping in the study area is rooted in the long-term habit of throwing waste anywhere, and the priority is to raise environmental awareness of the local residents. This is to be achieved in two steps. First, a simple participatory recycling activity similar to the one implemented as a pilot activity, 'community-based recycling activity'(Chapter 12), is introduced. This activity is then expanded to broader environmental education and participation activities.

## (2) Participatory Recycling Activity

It is not sufficient to just tell people not to throw waste into rivers. Environmental consciousness is raised most effectively by encouraging people to participate in solid waste management projects. Recycling is a good project in which people can participate, and the study has already piloted 'community-based recycling activity', which can be used as the prototype of future activities. Activity participation of residents is the key for successful recycling activity; time, place and target recyclables (e.g., glass bottles, PET bottles, steel and paper) can be discussed between recyclers and local groups, such as communities, schools, private offices and municipal offices. The proposed frequency is once per month. Separated recyclables can be sold and residents can make small profit, which can be used as an incentive for residents to start recycling. In order to implement successful, long-lasting activities, collaboration with NGOs is recommended.

## (3) Linkage to Environmental Education

The participatory recycling activity will be a good start for raising environmental awareness among people. However, this alone is not sufficient to prepare people to broader solid waste management issues anticipated in the future, such as further reduction of the volume of waste, construction of landfills, cut down in excessive solid waste management cost by reducing collection frequencies and points, and balancing the level of service provision and solid waste management fee. It is thus proposed to implement structured environmental education programs that are specifically programmed to boost the knowledge and participation of local residents in such solid waste management issues. The environmental education programs become the most effective when they are done with action based programs like recycling. The following ways to educate people should be mixed.

- Media to mention how and why to separate waste
- Seminars/Workshops to mention how and why to separate waste
- Site visits to some waste management facilities, such as composting plants and landfill sites, to impress the importance of recycling

## 7.3.2 Provision of Efficient Municipal Solid Waste Collection Service to the Whole Area

## (1) Introduction

Limited collection coverage has been a primary cause of improper waste management in the study area (see Chapter 2.7). This was particularly true in rural areas, where no waste collection service had been provided because there was no law requiring such services. However, this is about to change with the promulgation of the new solid waste management law, which mandates the Governor of the Bakshes (counties) to be responsible for solid waste management even in rural areas. In the urban areas, the collection service is provided 6 or 7 days in a week for every household. This is considered excessive, and is becoming a

major financial burden to municipalities. Thus, optimization of collection frequency and collection points was considered here.

- (2) Provision of Waste Collection Service to Villages
  - 1) Collection and Disposal System in the Village

In order to meet the requirements of the new solid waste management law, it is necessary to prepare collection vehicles and disposal facilities. New collection vehicles should be purchased by Bakshes (counties). On the other hand, disposal facilities may be shared among municipalities by paying tipping fees, as it is not realistic to construct disposal facilities in each county.

2) Number of collection vehicles required

Figure 7.3.1 compares the required numbers of waste collection vehicles by alternatives<sup>1</sup>. The number of collection vehicles required to provide the collection service to villages is 30-40 vehicles based on the condition that the wastes are collected three times a week from every 20 households. This will cost villages about 7,454 million Rial.



Figure 7.3.1 Number of Required Vehicles

<sup>&</sup>lt;sup>1</sup> The alternatives are as follows: (i) "present" is the present service level, (ii) "provision to villages" is to expand the collection service to villages (3 days/week), (iii) "with recycling in municipality" is "provision to village" + recycling activities as proposed in Section 7.3.1, and (iv)"collection freq. and place change with recycling in municipality" is "with recycling in municipality" + change in the collection frequency and locations as proposed in Section 7.3.2 (3) below.



Source: JICA Study Team

Figure 7.3.2 Required Collection Costs





## (3) Change of Collection Frequency and Collection Point in Urban Area

1) Rules for Waste Discharge

At present, people in urban areas discharge their waste in front of their houses, as illustrated in the left figure in Figure 7.3.4. This system may be convenient, but is expensive as collection vehicles have to go all houses<sup>2</sup>. Moreover, some residents do not seem to appreciate this system as they have to put their garbage in front of their houses<sup>3</sup>. The suggested future rule requests people to bring their wastes to the nearest waste stations, which are located every 10-20 houses. Proper places for waste stations are public open areas from the practical point of view.

Also, at present, people can discharge their waste everyday. In the proposed system, people cannot discharge everyday, but only 3 or 4 times a week.



Source: JICA Study Team

Figure 7.3.4 Illustration of Change of Collection Frequency and Collection Points

#### 2) Collection Cost Reduction

According to the results of the cost simulation (see Supporting Report, Part 6, Solid Waste Management), the combination of changes in collection frequency and points and introduction of recycling in Section 7.3.1 can reduce the overall collection cost in the urban areas by 45%, from about 20,000 million Rials/year to about 11,000 million Rials/year (see Figure 7.3.2).

<sup>&</sup>lt;sup>2</sup> For the results of cost simulation, see Part 6, Solid Waste Management, Supporting Report.

<sup>&</sup>lt;sup>3</sup> See the result of a pilot activity, waste drop-off center, in Chapter 12.

## 3) Implementation Steps

The proposed change in the collection frequency and points will result in a significant reduction in collection cost, and the study team had suggested this change at an early stage of solid waste management plan. However, many residents seem reluctant to give up the privilege of daily collection, and DOE staff raised concern about increase in illegal dumping. Thus, the introduction of the new system has to wait until more discussions among stakeholders are held, and environmental awareness is raised as suggested in Section 7.3.1.

## 7.3.3 Proper Disposal of Municipal Solid Waste

## (1) Introduction

None of the waste dumping sites in the study area have leachate collection/treatment systems. In order to minimize further environmental damage, these open dumping sites should be closed soon, and sanitary landfills that are equipped with adequate pollution control be constructed. However, there is a strong concern against construction of a waste disposal site that accepts raw waste because the groundwater table in the plain area is high, and the risk of groundwater pollution is not negligible.

A solution that has been pursued by the Iranian government is construction of composting plants in order to separate and stabilize waste before dumping. Based on this policy, the government has already constructed a composting plant in Rasht (capacity 250 ton/day). Another plant is going to be constructed by the Anzali municipality soon (capacity 300 ton/day). The downside of composting is a 40-60% increase in waste management cost. Nevertheless, the introduction of composting facilities has many positive aspects, such as reducing the amount of waste to be landfilled, as analyzed in Supporting Report, Part 8, Solid Waste Management, and the decision has already been made. Thus, the study adopted introduction of composting systems as a given condition, and proposed a waste disposal system based on composting plants and sanitary landfills as explained below.

- (2) Composting of Municipal Solid Waste
  - 1) Composting Process

The composting plant should be equipped with a sorting process as a front end processor, shown in Figure 7.3.5, because it deals with mixed wastes. The organic components for composting can be sorted out.

#### Nippon Koei Co., Ltd





Figure 7.3.5 Composting Process

## 2) Required Facilities and Their Capacities

There are four alternatives with regard to the number of composting plants. Final disposal sites and how they are shared among municipalities were compared (see Supporting Report, Part 6, Solid Waste Management). As is shown in Figure 7.3.6, the realistic choice is to construct 2 to 3 composting plants and 2 to 3 landfills in the study area, and share these facilities. Because there is a compositing plant in Rash and another one is to be constructed in Anzali, there is no immediate need to construct additional composting plants. The composting plant in Rasht is to be shared by Rasht, Khoman and Sangar, and the one in Anzali is shared by Bandar Anzali, Shaft, Somehsara, Tolam, Fuman, Masuleh and Masal (see Figure 7.3.9). In order to meet the future demands, the capacity of the plant in Rasht has to be extended from the current 250 tons/day to 759 tons per day, and the capacity of the new plant in Anzali has to be expanded from 300 tons/day to 384 tons per day in the future.

 Table 7.3.1
 Three Composting Plants required in the Study Area

No.	Members	Capacity (t/d)	Remarks
1	Rasht, Komam, Sangar	759	The operation shift should be added.
2	Bandar Anzali, Shaft, Somehsara, Tolam, Fuman, Masuleh, Masal	384	Now under construction.

Source: JICA Study Team

#### 3) Required Cost

Figure 7.3.6 compares the estimated total costs for collection, composting and land filling. Alternative C is the proposed system with two composting plants, one each in Rasht and Anzali. The composting costs approximately 12 billion Rials per year.


Source: JICA Study Team

Figure 7.3.6 Required Cost for Collection, Composting and Landfill

4) Compost Users

In order to ensure sustainable operation of compositing plants, it is very important to have enough compost users. At present, the existing composting plant in Rasht produces a good quality compost, but even so, there are not enough users. As the amount of compost will increase, the compost market will be more competitive. Thus, it is essential to promote the use of compost in the area.

- (3) Sanitary Landfill Construction
  - 1) Structure of Sanitary Landfill

The Fukuoka Method is well known for its low construction cost, and the technology is available in Iran, since Fukuoka University had a technical workshop in Tehran in 1998. This has embankments to contain waste within 'cells', a methane gas collection and venting system, leachate collection pipes and leachate sedimentation/treatment pond, as shown in Figure 7.3.7. A bulldozer will be needed to distribute and compact the wastes, and to place the daily surface covering of soil and/or construction waste. A photo of a newly constructed landfill with the Fukuoka method in Rostamabad near the study area is shown in Figure 7.3.8.

A sanitary landfill does not have to be a big dumping site, but it has to be properly designed. The embankment should be constructed strong enough so as not to be broken, when the waste is compressed to the embankment in making cells, and the

second embankment should be constructed after the first layer was finished. Gas releasing pipes and leachate collection pipes are also very important to keep the interior semi-aerobic. They should not be clogged with wastes or soils. Daily soil covering should be done to prevent flies.



Source: JICA Study Team









#### 2) Number of Landfill sites and Required Capacities

There are two required landfill sites corresponding to the composting plants. The required areas are shown in Table 7.3.2. The total area required for the two landfill

sites is 18 ha, assuming that wastes will be placed to a height of 15m in the landfills. The constructions of landfill sites should be started as soon as possible to keep the composting plants operational.

No.	Members	Location	Amount of Waste to be Landfilled in 15 years (thousand tons)	Required Area (ha)
1	Rahst, Khomam, Sangar	Rasht	1,195	12.0
2	Bandar Anzali, Shaft, Somehsara, Tolam, Fuman, Masuleh, Masal	Anzali/Som ehsara	382	5.8

 Table 7.3.2
 Capacities of Landfill Sites to be Constructed

Source: JICA Study Team

### 3) Proposed Sites

The proposed sites are shown in Figure 7.3.9. Though it is not easy to find proper sites for landfills in the study area, and detailed studies and EIAs are necessary, one of the practical sites is near the existing landfill site in Sarawan.

As for another landfill for Anzali and other municipalities, Anzali municipality is planning to construct a landfill site on the proposed site for the composting plant. It should be pointed out this site is located near the Anzali Wetland, and is not an ideal site for wetland conservation. However, apparently finding a location in other areas has been difficult and DOE Guilan has already agreed on this site. Thus, it was assumed that the composting plant and a landfill are constructed at this site. Adequate pollution control measures would be essential to prevent environmental pollution.

Considering the impacts to the wetland, the Study Team recommended an alternative area in the low mountains near Masal or Fuman. If this option is to be considered, a third composting plant may be constructed at the site to minimize the transportation cost between the compositing plant and the landfill.





Figure 7.3.10 Proposed Construction Site in Anzali for Composting and Landfill

(4) Closure of Present Open Dumping Site

It is very important to close the open dumping sites carefully. They should be covered with soil firmly and be vegetated in order to avoid collapse. Also, it is better to install gas releasing pipes from the surface of the dumping sites. Even after closure, long-term monitoring of the leachate and underground water around the closed sites will be necessary.

### 7.4 Industrial and Medical Solid Waste Management

- 7.4.1 Proper Treatment of Hazardous Solid Waste
- (1) Construction of Pretreatment Facility for Solid Waste Containing Heavy Metals
  - 1) Generated Hazardous Industrial Waste

The amount of hazardous wastes generated is only 50 ton/year at present. Plating processes are the major sources of hazardous waste. Almost all of the waste is sludge containing chromium.

2) Preliminary Pretreatment Facility Structure

It is possible to dispose of hazardous wastes in the municipal landfills by 'co-disposal'. However, if hazardous wastes are dumped in the landfills directly, pollution may occur. Some pre-treatment to mix with concrete cement is therefore necessary. The structure of the facilities can be very simple as short term urgent measures.

3) Capacity

Only one facility is required, because the amount of HISW at present is very small. The required capacity is 300 kg/day, which will be sufficient to treat the 104 kg/day of hazardous waste estimated to be generated in year 2019.

4) Required Cost

Construction of one solidification facility costs about 100 million Rial. There are 6 Industrial Cities in the Study Area. This amounts to 600 million Rial for construction. The total operational cost up to 2019 will be about 1,800 million Rial.

## (2) Establishment of Separation and Collection System for Infectious Waste

Another urgent issue is infectious wastes. The existing incinerator for infectious waste is too old to continue using and is not equipped with an adequate gas treatment system. To improve the present situation, Rasht municipality has constructed an incinerator for infectious wastes with a capacity of 400kg per hour. This can cover the all infectious wastes from hospitals in the area, which is expected to amount to 1.8 ton per day in 2019 and infectious wastes from private clinics could also be incinerated. A separation system at hospitals and collection system from hospitals is a prerequisite for proper management of medical waste.

### 7.4.2 Non-hazardous Solid Waste Management

- (1) Promotion of Reduction/Recycling of Industrial Solid Waste
  - 1) Necessity of Industrial Solid Waste Treatments

The problems of non-hazardous industrial waste are not obvious at present. However, the amount of non-hazardous industrial waste will increase according to the economic growth. However, unlike municipal solid waste, industrial solid waste is generally uniform and is easily recycled both physically and economically. Thus, recycling industries targeted to the factories in the area should be promoted. Also, incinerators are effective to reduce the amount of industrial wastes and can produce electricity.

### 2) Basic Processes

Various technologies are available to recycle industrial wastes as shown below:

- Particle board factory recycling waste woods discharged from wood factories
- Recycled plastic pellet factory recycling waste plastics discharged from factories
- Composting factory recycling organic waste from food factories
- Waste steel dealer equipped with a shredder
- Crusher plant for bulky waste
- Asphalt and cement concrete recycling factory
- Waste concrete recycling factory for crushing and classification
- Incinerator with electricity generator for all kinds of ISWs, especially used tires and waste oil
- Solidification plant for sludge containing heavy metals
- Neutralization plant for acid and alkali waste

### 3) The First Step to Implementation

There is no information on non-hazardous ISW. Even DOE does not monitor the kinds of ISWs or the amount of each waste. The first step is to establish a system to monitor the amount of ISWs regularly. After data on ISWs are obtained, target wastes, capacities and applicable technologies can be discussed.

4) Promoting Organization

The plants should be planned, constructed and operated by private companies. The Industrial and Mining Organization and Rasht Industrial City are the proper responsible bodies. Their role is to promote waste reduction and recycling plants.

### (2) Establishment of Regulations for Industrial and Medical Solid Waste

### 1) Information Management System

Any ISW, especially HISW, should be monitored strictly. Annual report submission should be required of factory managers and waste management companies. The following items should be reported in the specified format by the specified date every year.

- Company name, location, responsible person, products and basic processes
- Kinds of wastes discharged
- Self-disposal facility
- Amount of each discharged waste
- Disposal methods
- Waste management company contracted, if any

### 2) Licensing System

A licensing system is needed in order to regulate and control the activities by private solid waste management companies. A license will be issued after the following items are cleared and renewed at a certain interval, for instance every 5 years.

- Company name, Location, Responsible person
- Number of employees
- Number of waste collection vehicles and types
- Capacity of each waste management facility
- Process of waste management
- Material balance and energy balance of the process
- Other related items to prove the safety of the facility
- 3) Disposal Standard

Disposal standard should be prepared for each kind of hazardous waste.

Disposal standards should be prepared for each kind of hazardous waste. For example, for infectious waste, the following contents can be proposed.

- Any infectious waste should be separated at the source.
- Infectious waste should be packed in adequately robust containers, so that sharps do not pierce them.
- Infectious waste containers should be stored separately inside a room in a building with the door locked.
- When infectious wastes are handed over to a licensed private company to transport, it should be done in the presence of the responsible person of the hospital
- Any infectious waste should be incinerated in a controlled incinerator equipped with a proper gas treatment system

## 7.5 Environmental Monitoring

Lack of information is one of the major obstacles to effective solid waste management in the area. Thus, a series of monitoring programs are proposed here. Considering the current capacities of the municipalities and DOE, the proposed monitoring programs are minimal. However, the information required to optimize solid waste management evolves as the solid waste management becomes sophisticated. Thus, periodic review of required information is necessary.

### 7.5.1 Monitoring of Municipal Waste Management in Urban Areas

As urban areas already have established waste management systems, the monitoring system should focus on the flow of waste, i.e., generation, collection, operation of composting plants, and disposal. Once the flow of waste is identified, efficiencies of the service should be analyzed. It is strongly recommended that the collected information be shared among the municipalities in the area, so that the municipalities can compare their performances.

Objective	To monitor solid waste management practices in urban area.
Organization	Municipalities, DOE
Monitoring Program	
- Amount of Waste	Amount of solid waste
- Collection	Collection frequency, collection places
- Disposal	Operation of composting plants, construction and operation of disposal sites,
	remaining capacity
- Management	Fee collection, budget and expenditure, satisfaction of residents and other
	management issues
Analysis and Storage	Every year, municipalities compile the findings into reports.
of Information	
Dissemination of	The report is to be distributed among municipalities, NGOs, DOE and other
information	interested parties.

 Table 7.5.1
 Monitoring of Municipal Waste Management in Urban Areas

Source: JICA Study Team

### 7.5.2 Monitoring of Municipal Waste Management in Rural Areas

For rural areas, a system is yet to be established. Thus, the monitoring should first focus on the performance, such as the amount of waste collected. Again the experiences should be shared among the villages.

Objective	To monitor solid waste management practices in rural areas.
Organization	Communities, local NGOs
Monitoring Program	
- Collection	Collection frequency, collection places
- Disposal	Construction and operation of disposal sites
- Other	Satisfaction of community members
Analysis and Storage	Every year, municipalities compile the finding into short reports.
of Information	
Dissemination of	The report is to be distributed among municipalities, village councils, NGOs, DOE
information	and other interested parties.

Table 7.5.2	Monitoring of Municipal	Waste Management in	Rural Areas
-------------	-------------------------	---------------------	-------------

Source: JICA Study Team

#### 7.5.3 Monitoring of Recycling Activities

Recycling activities have two objectives, i.e., reduction of waste volume and awareness raising. It is suggested that relevant information, such as the amount recycled and the life of disposal sites should be widely disseminated, so that the participants can understand the meaning of their activities.

 Table 7.5.3
 Monitoring of Recycling Activity

Objective	To analyze the composition of the wastes.
Organization	DOE, municipalities
Monitoring Program	
- Waste composition	Waste composition
- Recycling activity	Amount of solid waste recycled, Number of people receiving regular solid waste
	collection, Number of recycling activities coordinated
Analysis and Storage	Every year, municipalities compile the finding into reports.
of Information	
Dissemination of	The report is to be distributed among municipalities, DOE and other interested
information	parties. Also, the results should be disseminated to local residents.
a	

Source: JICA Study Team

#### 7.5.4 Monitoring of Leachate

This program is designed to check the extent of environmental pollution around the existing disposal sites.

Objective	To monitor water quality of leachates, treated leachate and groundwater at solid waste disposal sites.		
Organization	DOE and Municipalities		
Monitoring Program			
- Leachate and	General Parameters (Flow rate, Temp., BOD, COD, T-N, T-P, SS, transparency),		
treated leachate	5 locations, 4 times (spring, summer, fall, winter)		
	Toxic Parameters (heavy metals, pesticides); 5 locations; 4 times/year		
- Groundwater	General Parameters (Temp., BOD, COD, NO <sub>3</sub> , NH <sub>4</sub> , T-P, turbidity, TDS, others),		
	10 locations, 4 times (spring, summer, fall, winter)		
	Toxic Parameters (heavy metals, pesticides); 10 locations; 4 times/year		
Analysis and Storage	Every year, municipalities compile the findings into reports.		
of Information			
Dissemination of	The report is to be distributed among municipalities, Provincial government, DOE		
information	and other interested parties.		
Analysis and Storage of Information Dissemination of information	Every year, municipalities compile the findings into reports. The report is to be distributed among municipalities, Provincial government, DOE and other interested parties.		

Table 7.5.4	Monitoring of	Leachate
-------------	---------------	----------

Source: JICA Study Team

### 7.5.5 Monitoring of Industrial and Medical Solid Waste

It is important to control toxic substances, such as heavy metals, as the environmental consequence of pollution is detrimental. Chemical analysis is needed, but even interviewing those handling industrial and medical wastes would help understand the situation. The program should first focus on potentially significant pollution sources. Then, more general programs should be developed.

Table 7.5.5	Monitoring of Industrial Solid	Waste Management
-------------	--------------------------------	------------------

Objective	To monitor industrial waste.
Organization	Industries, IMO, DOE
Monitoring Program	
- Amount of Waste	Amount of industrial solid waste
- Collection	Collection method, handling of hazardous waste
- Disposal	Solidification, construction of disposal sites, operation of disposal site
- Toxic Substances	General parameters (depth, texture, organic carbon, water content, ignition loss),
	Toxic parameters (heavy metals, pesticides); 20 locations; 1 time/year
- Management	Fee collection, other management issues
Analysis and Storage	Every year, each industry reports relevant information to DOE.
of Information	
Dissemination of	The report is to be distributed among IMO, factories and DOE.
information	
C	

Source: JICA Study Team

Objective	To monitor the practice of waste disposal from hospitals, clinics, dentists and labs.
Organization	Hospitals, Ministry of Health, DOE
Monitoring Program	
- Amount of Waste	Amount of medical solid waste
- Collection	Collection method, handling of infectious waste
- Disposal	Amount of waste incinerated, other disposal methods used
- Management	Cost sharing, other management issues
Analysis and Storage	Every year, each hospital reports relevant information to DOE.
of Information	
Dissemination of	The report is to be distributed among hospitals, Ministry of Health and DOE.
information	
a	

Table 7.5.6	Monitoring of Medical	Waste Management
-------------	-----------------------	------------------

Source: JICA Study Team

### 7.6 Institutional and Organizational Arrangements

### 7.6.1 Implication for Charging Fee

The solid waste management cost is expected to increase after the new system is introduced. In order to ease the budget pressures on the local governments, it is recommended to charge a SWM fee to the residents, because even now, the municipalities are not able to come up with enough budget. This can be achieved by adding the solid waste management cost to the municipal tax, which is currently charged based on the area of a house. For example, the rate in Rasht municipality is 100,000 Rial per household per year to a resident living in a house of 80 m<sup>2</sup>.

It is desirable to fully recover solid waste management cost by municipal tax. However, the full cost recovery requires a household with 4 members to pay about 165,000 Rial in urban areas and 352,000 Rial in rural areas. While the amount is within the affordable level, it would be difficult to raise the tax at once, especially in rural areas. Thus, support from the local and central governments may be necessary in the beginning. See Chapter 10 for the result of the financial evaluation.

### 7.6.2 Solid Waste Improvement Meetings

While all municipalities provide municipal solid waste management services, there seems to be little coordination among them. Similarly, the coordination among industries and hospitals is limited. Thus, it is proposed that stakeholder meetings should be held. These "Solid Waste Improvement Meetings (SWIM)" should have the following sub-meetings: "SWIM-M" for municipal wastes, "SWIM-H" for hospital wastes, and "SWIM-I" for industrial hazardous wastes. "SWIM-I" should include discussions on industrial wastewater problems because wastewater treatment will generate solid waste. "SWIM-M" has already started as part of this Anzali Wetland Conservation Study, coordinated by DOE. Guilan Physician & Science University is in a position to co-ordinate "SWIM-H". A Joint "SWIM" should be held once or twice a year to exchange opinions and to share experience of progress.

The sub-meetings can be held when appropriate. The proposed organization is shown in Figure 7.6.1.



Source: JICA Study Team

Figure 7.6.1 Framework of Executing Organizations for Solid Waste Management

#### 7.7 Summary of Proposed Solid Waste Management Plan

The proposed projects in the Solid Waste Management Plan are summarized as follows.

Sub-components	Proposed Projects/Measures	Executing Organizations
Municipal Solid Waste	(1) Environmental awareness raising	Municipalities
Management	1) Participatory recycling activity	
	2) Linkage to environmental education	
	(2) Provision of efficient municipal waste collection services to	
	the whole area	
	1) Provision of waste collection service to villages	
	2) Change of collection frequency and collection point in	
	urban areas	
	(3) Proper disposal of municipal solid waste	
	1) Composting of municipal solid waste	
	2) Sanitary landfill construction (Rasht, Anzali)	
	3) Closure of present open dumping sites	
Industrial and Medical	(1) Proper treatment of hazardous industrial solid waste	
Solid Waste Management	1) Construction of pretreatment facility for solid waste	IMO
_	containing heavy metals	
	2) Establishment of separation and collection system for	MOH
	infectious waste	
	(2) Non-hazardous industrial solid waste management	IMO
	1) Promotion of reduction/recycling of industrial solid waste	
	2) Establishment of regulations for industrial and medical	DOE
	solid waste	
Environmental	Monitoring of municipal waste management in urban areas	Municipalities
Monitoring	Monitoring of municipal waste management in rural areas	Municipalities
	Monitoring of recycling activities	Municipalities
	Monitoring of leachate	DOE
	Monitoring of industrial and medical waste	IMO/MOH

Table 7.7.1	Summary of Proposed Solid	Waste Management Plan
-------------	---------------------------	-----------------------

Note: \* : Municipality in this table means Baksh (county), but coordination at the Shahr (City) and Dehstan (Rural District) level will be needed. Large projects, such as construction of landfills may be carried out at the Ostan (province) or Shahrestan (township) level.



## 7.8 Cost Estimate

### 7.8.1 Project Cost

Table 7.8.1 summarizes the total project cost and operation and maintenance (O&M) costs of the proposed projects. The total project cost in SWM between 2005 and 2019 is 146 billion Rial, of which 121 billion Rial is for vehicle purchase and 17 billion Rial is for composting plant construction.

		O&M Cost				
Proposed Projects/Measures	Project Cost (million Rials)	Overall (million Rials)	Average Annual (million Rials/year)			
1. Municipal Solid Waste Management						
(1) Environmental awareness raising						
1) Participatory recycling activity	0	0	0			
2) Linkage to environmental education	0	0	0			
(2) Provision of efficient municipal waste collection						
service to the whole area						
1) Provision of waste collection service to villages	22,471	61,717	5,740			
2) Change of collection frequency and collection point in urban areas	99,180	284,044	16,633			
(3) Proper disposal of municipal solid waste						
1) Composting of municipal solid waste	17,083	178,557	11,904			
2) Sanitary landfill construction (Rasht)	3,817	8,372	558			
3) Sanitary landfill construction (Anzali)	3,089	3,892	259			
4) Closure of present open dumping sites	0	0	0			
2. Industrial and Medical Solid Waste Management						
(1) Proper treatment of hazardous industrial solid waste						
1) Construction of pretreatment facility for solid waste containing heavy metals	600	1,793	119			
2) Establishment of separation and collection system for infectious waste	0	6,459	428			
(2) Non-hazardous industrial solid waste management						
1) Promotion of reduction/recycling of industrial solid waste	0	0	0			
2) Establishment of regulations for industrial and medical solid waste	0	0	0			
3. Environmental Monitoring	0	3,494	233			
Total	146,240	548,328	35,874			

Table 7.8.1 Cost Estimate of the	Solid Waste Management Plan
----------------------------------	-----------------------------

Source: JICA Study Team

Note: The project and O&M costs in this table account for the increase in the amount of waste in the future, while the simulation results in the previous sections consider the project cost as depreciation, and are based on the present amount of waste.

# 7.8.2 Operation and Maintenance Cost

The total operation and maintenance cost is estimated at 548 billion Rials. Details are shown in Supporting Report, Part 6, Solid Waste Management, Appendix 1.

### 7.9 Implementation Program

### 7.9.1 Executing Organizations

The organizations responsible for implementation of the proposed projects were summarized in Table 7.7.1 above. Municipal solid waste management will be carried out by Shahrs (cities) or Dehestans (rural districts) under the responsibility of Bakhshes (counties). However, construction of sanitary landfills may be carried out by the Ostan (province) or Shahrestans (Townships) because the facilities are shared by many Bakhshes. The management of industrial waste is carried out by each factory under the supervision of IMO and DOE. Similarly, the management of medical waste is the responsibility of each hospital/clinic under the supervision of MOH.

### 7.9.2 Criteria for Prioritization

The proposed projects were prioritized with respect to the following criteria:

Criteria	Implication in Solid Waste Management
Effectiveness	Whether the proposed measure reduces the inflow of solid waste into the Anzali
	Wetland or contributes to reducing pollution by leachate.
Efficiency	Whether the proposed measure could contribute to significant improvement of the
	environmental conditions of the Anzali Wetland.
Urgency	Whether the proposed measure should be implemented urgently to control immediate
	problems.
Cost	Whether the cost required to implement the proposed measure is reasonable
	compared with the current level of expenditure as estimated by the cost simulation
	model.
Capacity of executing	Whether the stakeholders involved in solid waste management, such as communities,
organization	municipalities, factories, hospitals and NGOs, have enough technical/management
	capacity to implement the proposed measure.
Conformity with	Whether the proposed measure is in conformance with relevant solid waste
relevant policies	management policies and plans, including the new solid waste management law.
Environmental Impact	Whether the proposed measure would result in significant environmental impacts,
	such as pollution of water bodies around a waste disposal site.
Social Impact	Whether the proposed measure would bring significant negative social impacts, in
	particular to the local residents around the solid waste management facilities to be
	constructed, and whether the measure contributes to improving sanitary conditions.

#### Table 7.9.1 Criteria for Prioritization

### 7.9.3 Evaluation of Proposed Projects for Prioritization

### (1) Evaluation Criteria to Prioritize Projects

The proposed projects were evaluated by the following criteria to prioritize the projects. Each criterion was scored by using "A", "B" or "C" (Ranked as A is the superior), as shown in Table 7.9.2 The ranking of "A", "B" and "C" were given scores of 1, 2 and 3, and the scores were totaled considering criterion weights.

### 1) Bad Effects without the Project

The more and larger the bad effects are, which may happen, if the project is not done, the higher the ranking is. The bad effects were divided to two aspects.

- Conservation of the Wetland
- Public Health
- 2) Response of Improvement after the Project

The faster the response, the higher the score.

3) Policy Needs

The projects are preferable if they are in line with current or proposed policies. Two levels of policies were considered. One is the policy of the central government, and another one is the local policy. The local policy needs were evaluated from the viewpoint of the attitude of the major executing organization. If the project conforms to the national policy, a high score will be awarded to the project. If the executing organization will approach the project in a highly supportive manner, the project will get a high score.

- Conformity to National Strategy
- Degree of support of Major Executing Organization

# 4) Required Level of Public Environmental Awareness

Some projects need a high level of public environmental awareness. However, at present, people's environmental awareness is low. The projects that need a high level of environmental awareness have a low probability of success. Such projects were given a low score.

# 5) Project Maturity

There are some projects already planned or that have made some progress. The on-going projects were evaluated as "A" and plans about which no one is concerned were evaluated as "C".

# 6) Required Ability of Concerned Organization

The ability of concerned organizations was evaluated.

7) Cost

The low cost projects were evaluated as "A".

(2) Results of the Evaluation

The results are shown in Table 7.9.2. The project can be assigned to three terms in the total duration of the Master Plan by their total scores. The 12 projects were prioritized so that the numbers of projects in each term is the same as much as possible.

		Bad Effect without the Project			Policy	Needs						
Crit	Criteria Project		Conservation of the Wetland	Public Health	Efficiency	Conformity to National Strategy	Positiveness of Major Executing Organization	Required Level of Public Environmental Awareness	Project Maturity	Required Ability of Concerning Organization	Investment Cost	Total Score
1	Environmental Awareness Raising											
(1)	Participatory Recycling Activity		А	А	С	В	В	А	В	В	А	A(20)
(2)	Linkage to Environmental Educatio	n	А	А	С	В	С	В	С	С	А	B(13)
2	Provision of Efficient Waste Collect to the Whole Area	tion Service										
(1)	Provision of Waste Collection Serv Villages	ices to	А	А	А	А	А	А	С	С	В	A(21)
(2)	Change of Collection Frequency ar Collection Point in Urban Areas	nd	С	С	А	В	С	С	сс		А	C (5)
3	Proper Disposal of Municipal Solid Waste											
(1)	(1) Composting of Municpal Solid Waste		А	А	А	В	А	А	А	В	С	A(24)
(0)	Ossilassi as ifil Ossetsutias	(1) Rasht	В	В	А	В	С	А	С	С	В	B(12)
(2)	Sanitary Landiii Construction	(2) Anzali	В	В	А	В	С	А	С	С	В	B(12)
(3)	3) Closure of Present Open Dumping Site		А	А	В	С	С	А	С	С	А	B(15)
4	Proper Treatment of Hazardous So	did Waste										
(1)	Construction of Pre-treatment Faci Waste Containing Heavy Metals	lity for Solid	С	А	А	А	А	А	С	С	А	A(18)
(2)	(2) Establishment of Separation and Collection System for Infectious Waste		С	А	А	А	А	А	А	В	А	A(23)
5	5 Non-hazardous Industrial Solid Waste Management											
(1)	(1) Promotion of Reduction and Recycling of		С	С	В	С	С	С	С	С	А	C (3)
(2)	(2) Medical Solid Waste		А	А	А	В	С	В	С	С	А	B(15)
Wei	ght		2	2	1	1	2	2	2	1	1	-

T 11 700		1	с <b>р</b>
Table 7.9.2	Evaluation of Pro	oposed Projects	for Prioritization

Source: JICA Study Team

### 7.9.4 Implementation Schedule

Based on the results of prioritization, the schedule of the proposed measures is proposed as shown in Table 7.9.3.

1) Participatory Recycling Activity

To raise public awareness on solid waste management is very important and essential to prevent people from throwing their waste into the rivers. This participatory recycling program will work well in raising public awareness. However, the response to the project is slow. Therefore, this should be carried out first by voluntary groups from the fourth five-year development plan period. Fuman and Somehsara municipalities can be proposed as the target municipalities, as the pilot activity in the Study has been tried in Fuman and Somehsara municipalities. This trial can be extended in the fifth five-year development plan period toward full practice in the sixth five-year development plan period.

2) Provision of Waste Collection Service to Villages

The provision of collection service to villages is an urgent task for counties (Bakshes) because it is now required by law. However, it will take a certain period to extend the service area to all the villages. The villages around the Wetland should be prioritized in the fourth five-year development plan period.

## 3) Change of Collection Frequency and Collection Point in Urban Areas

This project is very effective in reducing the collection cost. However, it is not easy to change their daily behavior of residents. Furthermore, this project will bring them inconvenience, although the present service level is excessive. In order to introduce this project, a deep understanding of residents is necessary. This should be introduced after people's environmental consciousness has been raised enough. Also the practice should be started as trials in some target municipalities in the fifth five-year development plan period and be extended in the municipalities in the sixth five-year development plan period.

## 4) Composting of Municipal Solid Waste

In addition to the composting plant in Rasht, Bandar Anzali municipality is planning to construct a composting plant which would deal with wastes from Somehsara, Fuman, and other cities in the western part of the watershed. When this plant is constructed, the situation in dumping sites will be improved. This project is ongoing and also urgent.

5) Sanitary Landfill Construction

Composting plants will stabilize the quality of waste. However, they still generate residues whose major component is plastics. To dispose of these residues properly, landfill sites are very important. In fact, the present dumping sites need urgent improvement. Landfill construction should be started as soon as possible. However, the municipalities, DOE and NGOs insisted to start construction a composting plant first. Landfill construction should be done after the composting plants have been constructed and are operating well.

6) Closure of Present Open Dumping Sites

This should be done at the same time as the "Sanitary Landfill Construction".

7) Construction of Pretreatment Facility for Solid Waste Containing Heavy Metals

Simple hazardous waste pre-treatment plants, such as solidification plants, can be constructed relatively easily compared with landfill sites so it would be preferable to construct them as soon as possible.

8) Establishment of Separation and Collection System for Infectious Waste

Construction of an incinerator for infectious waste is relatively easy because a complete system can be bought from manufacturers 'off the shelf'. Rasht municipality has constructed an incinerator on the site of the composting plant. Separation and collection systems in hospitals should be established. Considering these situations and the urgency, this project should be started as soon as possible.

9) Promotion of Reduction/Recycling for Industrial Solid Waste

In 15 years, the amount of industrial solid waste will be double staying in step with the economic growth. It is proposed that this project will be scheduled during the fifth five-year development plan period.

10) Establishment of Regulations for Industrial and Medical Solid Waste

There is no strict system to control ISW, such as an information management system, licensing system or technical standards. After finishing the most urgent issues of hazardous waste, this control system should be established in the fifth five-year development plan period.

11) Environmental Monitoring

The monitoring of solid waste should be started as soon as possible.

Proposed Measures		Fourth 5-year Plan Period				Fifth 5-year Plan Period				Sixth 5-year Plan Period				1		
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SOLID WASTE MANAGEMENT PLAN																
1. Mur	icipal Solid Waste Management															
(1) Env	vironmental Awareness Raising															
1)	Participatory Recycling Activity															
a)	Pilot Activities by Volantary Groups				I											
b)	Extention of Target Groups															
c)	Full Activity															
(2) Pro	vision of efficient municipal waste collection serv	vice to th	ne whole	e area												
1)	Provision of waste collection services to villages															
a)	Phase 1 (Villages along the rivers)															
b)	Phase 2 (Villages near the Anzali wetland)															
c)	Phase 3 (Villages away from the Anzali wetland)															
2)	Change of collection frequency and collection point in urban areas															
1)	Trial Operation in selected cities															
2)	Extension of Target cities															
3)	Full Operation in selected cities															
(3) Pro	oper disposal of municipal solid waste															
1)	Composting of municipal solid waste				I I											
2)	Sanitary landfill construction															
1)	Rasht															
2)	Anzali															
3)	Closure of present open dumping sites															
2. Indu	strial and Medical Solid Waste Management															
(1) Pr	oper treatment of hazardous solid waste															
1)	Construction of pretreatment facility for solid waste containing heavy metals															
2)	Establishment of separation and collection system for infectious waste															
(2) No	n-hazardous industrial solid waste management															
1)	Promotion of reduction and recycling of industrial solid waste															
2)	Establishment of regulations for industrial and medical solid waste															
3. Env	- ironmental monitoring															
(1)	Monitoring of Municipal Waste Management in Urban Areas															
(2)	Monitoring of Municipal Waste Management in Rural Areas															
(3)	Monitoring of Recycling Activities															
(4)	Monitoring of Leachate															
(5)	Monitoring of Industrial Waste Management															
(6)	Monitoring of Medical Waste Management															

### Table 7.9.3 Proposed Implementation Schedule for the Solid Waste Management Plan

## 7.10 **Priority Projects**

The following 5 projects were proposed as priority projects. They have to be implemented in the first term of the fourth five-year development plan.

Proposed Priority Project	Justification
Participatory Recycling	As reviewed in Chapter 2, low environmental awareness is a root cause of solid
Activity	waste management problems in the study area. Moreover, environmental
	awareness raising is essential to implement other solid waste management
	projects and programs. Thus, this component should be started immediately.
Provision of Waste Collection	In order to comply with the recently enacted solid waste management law, the
Service to Villages	waste collection systems in rural areas should be established as soon as
	possible.
Composting of Municipal Solid	The area already has a composting plant in Rasht, and the another plant
Waste	becomes operational in 2006. Effective use of these facilities should be
	promoted.
Construction of Pre-treatment	Considering the high environmental risk from hazardous waste, the construction
Facility for Solid Waste	of pretreatment facility should be commenced soon.
Containing Heavy Metals	
Establishment of Separation	Rasht municipality has constructed an incinerator for infectious waste. The
and Collection System for	operation of this facility should be commenced as soon as possible.
Infectious Waste	

Table 7.10.1	Proposed Priority Projects in the	e Solid Waste Management Plan
14010 /11011	risposed riseries risjeets men	e sona maste management i han

## CHAPTER 8 ENVIRONMENTAL EDUCATION PLAN

### 8.1 Introduction

Environmental education, awareness raising, and public participation are three vitally important aspects of the master plan that are essential for the successful implementation of any management plan in this master plan. Considering that these are important to everybody, while the needs and approaches are different from stakeholder to stakeholder, separate, actionoriented programs were proposed for different target groups, namely decision makers, religious leaders, business and industries, farmers and farming communities, general public and tourists, NGOs and journalists, students, teachers and professionals.

### 8.2 **Objectives and Strategies**

#### 8.2.1 Objectives

The objectives of Environmental Education Plan are to:

- Increase the level of environmental awareness and understanding through effective provision of information and life-long learning, so that all stakeholders are more able to adopt environmentally sustainable behaviours and make environmentally focused decisions.
- Increase the level of all stakeholders' participation in decision making about their local environment so that they are more committed to and engaged in bringing about sustainable development.

This Plan describes the action that is proposed at a provincial level. Some of these recommendations will also need to be pursued at a national level and will have national level implications.

#### 8.2.2 Strategies

#### (1) Target Groups

The strategies below focus on the following target groups. These target groups have been selected on the basis of their current impact on the environment conservation of the Anzali Wetland and its watershed, and their potential for having a positive impact on the environment in the future.

- Students at school and university
- Teachers and university staff
- Decision makers in government and non government organizations
- Islamic leaders
- Business leaders
- Farmers and rural communities

- The general public and tourists
- NGOs and journalists
- (2) To Create Basic Frameworks for Environmental Education, Awareness Raising and Public Participation

There are essentially no basic frameworks for environmental education, awareness raising and participation, on which various activities can be built on. Thus, the first strategy is to create basic frameworks. This will include the integration of environmental education into the formal education at all levels in a structured and systematic way, development of an environmental education statement, development of a strategy for farmers and rural education, and the development of a system of public participation in development activities.

(3) To Build the Capacities of Key People

In order to deliver environmental education or to develop environmental awareness among stakeholders, the capacities of key people delivering these concepts have to be develop. This will include, the development of teacher training programs, training for decision makers in government and non government organizations, and seminar series for business leaders and Islamic leaders.

(4) To Create Resources to Support Environmental Education, Awareness Raising, and Public Participation

The third strategy is to create resources, such as education materials and facilities, required to promote environmental education, awareness raising, and public participation. This will include establishment of a Wetland Education Center and a regular program of courses for students, establishment of a network of demonstration farms and an organic farms accreditation system, publication of a State of the Wetland Report for the general public, the publication of a Teachers Handbook on Environmental Education, and the establishment of networks of people involved in environmental education, awareness raising, and public participation.

### 8.3 Environmental Education

### 8.3.1 Environmental Education in Schools

Environmental Education means different things to different people! In Iran the term is most commonly understood as "ecological education" and the focus is largely on knowledge about the environment and environmental problems. What is meant by the term environmental education in this section is broader and follows the definition adopted by UNESCO in 1977<sup>1</sup>

<sup>&</sup>lt;sup>1</sup> The goals of environmental education adopted in the Tibilis declaration are: (i) to foster clear awareness of, and concern about, economic, social, political, and ecological interdependence in urban and rural areas; (ii) to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment; and (iii) to create new patterns of behavior of individuals, groups, and society as a whole towards the environment.

Nippon Koei Co., Ltd

and little improved on until being added to by the Rio Declaration on Environment and Development. However, one of the challenges of producing an environmental education plan is that the concept is in a period of development and is likely to change over the period of this Plan. 2005 will see the start of UNESCO's decade of "education for sustainable development" and UNESCO will encourage schools to adopt a more sustainable development focus for education to replace the current environmental education. The organizations with responsibly for implementing this plan should be aware of this changing definition and to ensure that the activities proposed meet the current and future needs of society. The environmental education activities proposed in the Plan are described below.

# (1) Development of an Environmental Education Statement

The Schools Environment Group (SEG, see Section 8.5 below) should develop a short statement about environmental education to be sent to all schools by 2006. The statement should explain clearly what environmental education is, and provide ideas on how environmental can be taught in schools. The statement should be based on current international statements developed by UNESCO, adapted for an Iranian context.

## (2) Preparation of a Teacher's Handbook on Environmental Education

A Teachers Handbook on Environmental Education should be produced. The book should take a general approach and be aimed at teachers from Elementary, Guidance and High Schools of all grades of students. It should contain short general information about local national and global environmental issues, how to teach environmental education in different subjects, provide advice on effective teaching methodologies for environmental education, contain a list of resources to use and local NGOs and organizations that can support environmental education in the watershed. A copy should be provided for each school by 2007.

# (3) Preparation of Resources to Support Environmental Education

A text book should be produced on "The Anzali Wetland", and should be used to support teaching of the regional Guilan element of the Curriculum in High Schools and in other subjects as appropriate. This should be done by 2008. The text book should be designed in such a way as to encourage student-centered learning. Other educational materials about the Wetland should also be produced. These should include a large teaching poster, special activity books for students about the wetland, wetland bird and other identification keys, videos and other education materials. An environmental education web site should be developed and linked with an appropriate current web site which would contain up to date environmental information, education materials, teaching ideas and student resources in a format accessible to teachers.

# (4) Development of Teacher Training Courses

Three kinds of Teacher Training courses should be developed.

A *pre-service teacher training* course on environmental education should be created and be taught as a compulsory module to all University and College students trained to be teachers,

especially those trained to teach in Primary and Guidance Schools. This should be a minimum of 10 hours.

An *in-service training course* on environmental education should be developed and provided by the Ministry of Education Human Resources Department at the Provincial Education Center. The Environmental Education coordinators appointed in each school should attend this course. The course should be a minimum of 10 hours. and open to NGOs and other bodies with an interest in environmental education. About 100 teachers should attend the course each year.

A training course should be developed by 2008 on "How to be an Environmental Education Trainer". About 15 people are expected to participate in the course. This training course will also be open to teachers, NGOs and should be provided by a national training institution working with an international organization. The purpose of the course will be to build a body of environmental education trainers in the region who can deliver the environmental education courses at a Provincial level and ensure that there is human capacity in the watershed for the ongoing development of environmental education.

(5) Establishment of a Wetland Education Center and Programs

A Wetland Education Center for Schools should be established. The Center should consist of a classroom and other education facilities such as education trails, and bird-watching facilities. A simple Wetland Education Center and a number of educational facilities, such as a trail and a bird hide, have been constructed as a part of this study (see Chapter 12), and these facilities are already available for environmental education. The Center should have a full-time member of staff provided by DOE and supported by the Ministry of Education, and offer programs to all the schools in the Wetland Area. A target of 1,000 children and 150 teachers should attend the programs each year. The Ministry of Education should create a system that ensures that all students in the area around the wetland have an opportunity to participate in courses. Should the wetland education center prove successful then other Education Centers should be considered, including a Forest Education Center.

(6) Establishment of an Eco Schools Scheme

An Eco Schools Program for Guilan Province Schools should be developed by 2008, and a target of 40 schools be accredited by 2010. Eco Schools does not mean the establishment of new schools, but is a simple and effective internationally recognized environmental management system for schools. It involves schools undertaking environmental audits and then with the support of staff, students and the community implementing environmental improvements. UNESCO has stated that in their decade of "Education for Sustainability" to start in 2005, Eco Schools are seen as an important method of delivery (see www.ecoschools.org). In the first two years of the scheme the focus should be on solid waste management, and support the implementation of the Solid Waste Management Plan. Other themes should be adopted after this. Up to 20 schools should join the scheme each year and be supported through teachers meetings and a newsletter.

# (7) Establishment of an Environmental Education Support Network

NGOs and other organizations should be encouraged to develop education materials and take a greater role in the education process. NGOs are in a good position to establish more information eco clubs for children and young people and develop other out of school activities. The SEG should establish an "Environmental Education Network" of people and organizations willing to support environmental education initiatives including teachers, NGOs, University Students and Professors, and others willing to support environmental education. The network should be established by 2008, and should have a target of 100 members in the first year. If appropriate the EE Network could take responsibility for the EE website and produce their own newsletter.

# 8.3.2 Environmental Education in Higher Education

(1) Review of Higher Education Provision of Environmental Education.

The Higher Education Environment Group (HEEG) should review the provision of environmental education in the Universities and Vocational Training Centers in the watershed area. The review should include a number of consultation events and the outcomes should be matched with the future human resources needed to support sustainable development in the watershed and Iran. For example, the Caspian Environment Programme has pointed out the serious lack of people with adequate training in biodiversity monitoring and integrated environmental management. The review and report should make recommendations for the development of new courses to meet future needs, especially with regard to the implementation of the recommendations in this Master Plan.

# (2) Development of New Bachelor and Masters Courses

On the basis of this Review, the HEEG should plan for the development and delivery of new courses to meet current and future needs. The initial target is to attract 20 students by 2008. It is not possible to be specific about the courses that will be developed but they should include both courses at Bachelors and Masters Level. A Masters in Environmental Planning and Management should be a high priority and the HEEG should also plan for the integration of environmental issues into the content of other degrees courses, giving a high priority to economics and the development of an environmental economic module within Economic degrees.

(3) Key University Staff to Gain International Experience through Masters Courses and Academic Links

Key members of the HEEG should participate in Environmental Planning and Management courses at Universities in other countries with an international reputation in these areas, to build capacity for the development and delivery of courses in Guilan. The academic staff to participate in such courses should be closely involved in the development of the new masters Courses at the University.

The Institutions responsible for the development and delivery of these courses should also form Academic links with Institutions both within Iran and internationally.

(4) Development of an International "Wetland Management" Masters Course in Partnership with the Ramsar Convention Bureau and Other International Partners

Linked to the development of the Ramsar Training Center, the Universities of the Caspian Sea Coast area should work in partnership together with international Institutions to develop a Masters course for an international target group, on "Wetland Management" by 2010, and attract up to 10 students in the first year. The lecturers on the course would come from both Iran and overseas.

The course would be part lecture based in Guilan and part experience based in a wetland in the home country of the students.

(5) Development of the "Greening" of Higher Education

The HEEG should build on international experience and develop an Environmental Management System to enable the "Greening of Higher Education" and encourage the adoption of this system. The development of a system should be launched at special Conference at Guilan University by 2008.

# 8.4 Public Awareness Raising and Participation

8.4.1 Decision Makers

# (1) Review of Current Activities and Development of an Action Plan

The Wetland Professional Development Group (WPDG) should undertake a brief review of the current training needs for Decision Makers in relation to environmental awareness raising and public participation. This should involve a number of round table discussions with stakeholders together with a review of other training needs undertaken through other projects such as the Caspian Environment Program. As a result of the review process, the WPDG should with its member organizations develop and coordinate programs of training.

(2) Training of Managers and Decision Makers

Specific professional development training courses should be developed for DOE, MOJA and other government departments, local administration and NGOs on different issues associated with raising awareness, public participation and specific wetland and watershed issues. Two kinds of training courses are envisaged. Firstly, a number of courses should be developed that are compulsory for specific groups of manages and decision makers to attend. For example, all DOE, MOJA, NRGO and other government senior department staff that have a responsibility of working with the general public and other stakeholder groups should attend two courses - "Effective Awareness Raising" and "Effective Public Participation". Secondly, other courses should be developed to meet specific needs after consultation with the target groups. These could include effective information provision, communication and participation techniques, how to conduct participatory rural appraisals and content based

training related to different aspects of the implementation of the Master Plan. For example, the establishment of a Conservancy will require organizational and management training for the new staff to ensure that the concept is successfully implemented. In some cases courses might have to be developed through a program involving international support. As recommended in the Institutional Plan, the training for Managers and decision makers will be particularly valuable if a cross-sector approach is taken. In other words, those attending the courses should come from all the stakeholder groups, including business and NGOs rather than running separate courses for the DOE, MOJA and so on.

(3) Preparation of Publications for Key Staff and Organizations

The WEAG should commission a series of locally appropriate short publications, on topics identified through the review including how to provide effective information and communication, how to encourage public participation, and so on. The first set of materials should be distributed by 2008. These publications will also make various international awareness and information statements, such as the Aarhus Convention, available to the decision makers. Key themes linked with the Wetland Ecological, Solid Waste, Wastewater and Watershed Management Plans should also be covered.

## (4) Training for Local Government

Short courses should be provided for the elected members of the local council members in the villages and town. During the training, the councils should be provided with information about the various environmental education and awareness raising activities proposed in this plan, and especially the opportunities provided by the small grant schemes. A short handbook for local government should also be developed.

# 8.4.2 Religious Leaders

# (1) Islam and Environment Seminars

There are many opportunities to promote environmental awareness through the Mosques. The Islam and Environment Group (IEG) should prepare a series of seminars to be held regularly for the leaders of the Mosques on environmental issues and how these relate to the teachings of the Koran. If appropriate the seminars should be a regular part of the training for religious leaders and they should build on the outcomes of a major national DOE Islamic Conference held in 2002. The target is to have five seminars during 2006 attended by up to 250 religious leaders.

(2) Preparation of a Handbook on Islam and Environment

The IEG should also develop a series of publications including a handbook for religious leaders on Islam and the environment. The handbook, which should be developed by 2010, should contain a basic summary of environmental problems together with a description of environmental teachings in the Koran, and how these can be effectively communicated to those attending the Mosques.

(3) Preparation of a Short Leaflet for the General Public Attending Mosques

The IEG should also develop a short leaflet for distribution in the Mosques on "Islam and the Environment", and also to produce a short television program linked to this leaflet. These should both be in a popular style, and should be ready by 2007..

# 8.4.3 Business and Industry

(1) Business and the Environment Seminar Series

The Business Environment Association (BEA) should organize an annual series of regular seminars business leaders with the goal of providing information about the impacts that business has on the wetland and watershed and promoting best environmental practice. The target groups should initially be on those businesses that have most impact on the wetland environment. The target is to gain at least 250 members by 2010. The BEA should also organise other activities as part of an annual program including study tours to visit best practice businesses in other parts of Iran and the region and produce a regular newsletter for its members. SWIM-I recommended in the Solid Waste Management Plan should be a sub group of the BEA.

(2) Publications to Encourage and Support Business/Industry to Adopt Better Environmental Practices

The BEA should develop a series of specific publications to encourage businesses to reduce their environmental impact. These should be short publications designed for busy business people and should focus on environmental responsibility and how being good for the environment can be good for business. They should promote specific ways in which businesses could adopt "win win" solutions. The BEA should develop an information and support role for businesses and encourage members to implement environmental legislation.

(3) Pilot Businesses/Industries for Environmental Audits and Adoption of Environmental Management Systems

The BEA should identify businesses/industries that would be willing to participate in an appropriate environmental audit (ISO 14401, EMS or Waste Minimization), and then to implement the recommendations resulting from the audit and to publicize this to other businesses of the same type. The pilot businesses should be willing to act as champions for the process and host visits of other businesses.

(4) More Focus on Supporting Local Community Environmental Initiatives by Businesses

DOE should encourage businesses to provide support and take part in environmental initiatives in local communities. This is part of businesses need to develop a "triple bottom line" that includes social and environmental as well as economic elements.

#### Nippon Koei Co., Ltd

# 8.4.4 Farmers and Farming Community

# (1) Review and Strategy Development

The work of government and non governmental organizations in rural areas, including the rangelands and forests has been strongly criticized for lacking strategic coordination and direction. As a key task, therefore, the Rural Environment Group (REG) should review the current situation in terms of the awareness of farmers, graziers and the rural community and evaluate the activities undertaken by the different stakeholders, and on the basis of this review produce a short strategy and action plan, to coordinate education, awareness raising and participation of those living and working in rural communities. This action plan, which should be developed by 2006, should give priority to supporting the needs required by activities recommended in other Sections of this Master Plan. For example, the Wastewater Management Plan recommends the promotion of the sustainable use of pesticides, fertilizers and herbicides and the adoption of Integrated Pest Management whilst the Watershed Management Plan has significant recommendations related to participatory processes in the relocation of forest and rangeland graziers.

# (2) Training of MOJA, NRGO, DOE and Other Organizations

Specific environmental training courses should be developed for MOJA, NRGO, DOE and other organizations that have staff that work directly with farmers and foresters. The courses should focus both on updating staff knowledge and awareness of environmental and farming/forestry issues and on process such as how to manage participatory development in the farming community. The development of courses specifically for the Rural Advisers Network (RAN) and other MOJA, NRGO and DOE staff that work with farmers and other in rural communities. All the RAN members should have attended the courses by 2007. The RAN should also attend the courses for senior managers mentioned above.

# (3) Establishment of a Small Grant Scheme and a Network of Demonstration Farms

A small grant scheme should be established by 2007, by MOJA and NRGO for farmers, to encourage the adoption of more environmentally friendly ways of farming. The scheme should be administered by the MOJA and NRGO Environment Officers advised by the REG. Farms would be encouraged to apply through the Rural Advisors Network and one condition of accepting a grant should be the willingness of the farmer for his farm to be used as a demonstration farm for other farmers. Over time the farms receiving grants can be organized into a network of environmentally sensitive demonstration farms/forests. The Advisers should organize regular visits to these demonstration farms. In the first year the target is to award 10 grants, rising to 25 grants a year after the first year of the scheme has been evaluated.

(4) Development of Environmental Courses for Farmers

The Environment Officers and Rural Advisers Network should work with the MOJA Agricultural Service Centers and extension services to develop more strongly focused courses on environmentally sensitive methods of farming and forestry. These courses should be strongly linked to the awareness raising, education and training needs of the other components

of the Plan. The first courses should focus on sustainable rural development for graziers.

(5) Development of a Range of Appropriate Environmentally Focused Publications and Other Media for Farmers/Foresters

The Environment Officers and network of Advisers should develop a range of publications to promote environmentally sensitive farming/forestry practises, and especially publications that disseminate good practice and the success of local farmers. Publications should be coordinated with other media including radio and television and be linked with other elements of this Master Plan.

(6) Pilot Organic Farming Accreditation Scheme and Sustainable Forest Management Scheme

An organic farming accreditation scheme should be established by 2009 and piloted. Organic Accreditation can be awarded to farms that meet specific criteria in terms of the use of organics fertilizers and pesticides. If successful then the scheme should be actively promoted to the general public (see Section 6.7). A sustainable forest accreditation scheme should be established, possibly using one of the currently established global schemes such as the FSC (Forest Stewardship Council)

# 8.4.5 The General Public and Tourists

(1) Establishment of a Wetland Information Center

DOE should establish a Wetland Information Center for the general public and tourists. This should be in an easily accessible location, possibly within the Visitor Center proposed in the Wetland Ecological Management Plan, and will provide a range of information about the wetland, together with facilities for visitors such as boardwalk trails and awareness raising programs and events. In the short term this Center will share space with the Wetland Education Center. After a review of effectiveness it should be appropriate to establish a separate building and over time, other centers around the Wetland. The Eco Tourism component of the Master Plan describes information provision in more detail.

# (2) Preparation of an Annual State of the Anzali Wetland Environment Report

DOE should produce an annual "State of the Anzali Wetland Environment Report" in an attractive and popular format (also see Chapter 9). This Report should contain information about the wetland and its watershed presented in the form of environmental quality indicators related to different aspects of the local environment. Each year the report should show graphically whether each indicator is getting worse, staying the same or getting better, using for example, a traffic light system. The report should be simple and should be available as a full report to the general public, as a small leaflet. It should also be reproduced in full by local newspapers. The first report has been produced in 2004 as a part of the pilot study (see Chapter 12).

## (3) Annual Awareness Raising Campaign

Currently, the DOE and other organizations run an increasing number of small, uncoordinated and usually un evaluated events that have little impact. The DOE and the Wetland Awareness Group should consider running one annual high profile and focused awareness raising event in the Wetland attracting the participation of a large number of people. A single large mass event would achieve a much higher and longer lasting impact. This mass event could be on a new day or week specifically allocated for the Wetland - "Annual Forum on Anzali Wetland and its Watershed". Schools and other organizations could be encouraged to hold specific activities on the same day and. The first event could focus on the launch of the "State of the Wetland" or the "Wetland Code".

## (4) Specific Information to be Targeted at Different Groups

DOE and the Wetland Awareness Group should develop a series of information leaflets targeted at different wetland user groups. Examples of such leaflets include information on where people can have safe access to the wetlands and facilities for them to enjoy the wetlands. Specific information should be provided for tourists. Mass numbers of copies of the Wetland Code and a specially produced Environment of Guilan leaflet which emphasizes environmental issues, should be made widely available through shops, hotels and through the ITTO and Red Crescent activities at Norouz. Tourists should also be targeted through other activities in the Wetland.

(5) Establishment of a Small Grant Scheme to Support Community Improvements

A small grant scheme should be established by DOE aimed at providing support for local community environmental initiatives. This could be called the "Improving Anzali" Scheme, and established by 2007. There would be an annual award program aimed at supporting initiatives proposed by the Islamic Community Councils and other local community based organizations. The grant scheme, similar to schemes in the UK such as the Shell Better Britain Campaign or the Heritage Lottery Fund, would provide small grants for specific improvements and to qualify, organizations would have to present applications that met certain criteria both for content and management, including for example, NGO involvement. The small grants could be linked to the proposed activities in other components of the Master Plan. For example, in the first three years of the scheme priority should be given to community solid waste management schemes.

### (6) Development of a Range of Courses by the Community Learning Centers

A range of courses for different groups in the community should be developed with a focus initially on women and housewives. The adult education courses can be delivered by the Community Learning Centers (CLCs) and should be linked to the DOE strategy, priorities and specific project needs and the training and awareness requirements of the activities proposed in other Section of this Master Plan. For example, courses developed can be used to support community solid waste initiatives. Trainers from the CLCs would need to be trained to develop and deliver the courses.

# (7) Pilot Consultation with the General Public on Planning Issues

As described in Chapter Two, there is no effective process in Iran to ensure public participation in development control planning processes or future development planning. In the context of this Plan it is not realistic to recommend the creation and adoption of such systems - such developments have to take place at a national level. However it is possible to recommend that when the partner organizations in this Study, such as the DOE and MOJA, propose new developments, that consultation takes place. The Wetland Advisory Group working with the Conservancy and other bodies should -

- produce and implement a simple system to pilot public participation and consultation when new developments are planned are planned by DOE and MOJA a development control system.
- produce and implement a simple system to ensure that the recommendations made in the Master Plan are subject to consultation before being implemented.

This process should be led by DOE who should develop and then pilot the consultation systems in relation to developments that DOE is planning. This system should build on the current experience of DOE in a number of projects in other provinces in Iran notably the Zagros Mountain project. It is suggested that the consultation system for Master Plan Recommendations should be developed and in place by 2008, and the DOE and MOJA should ensure implementation of the system. The DOE should pilot the consultation system for development control by 2009 in at least two planning issues related to the wetland.

### 8.4.6 NGOs and Journalists

### (1) Increase of NGO Participation

This section contains only three recommendations for NGOs. This is not because NGOs do not have an important role, but because NGOs should be formally involved in most of the activities described in previous sections of the Environmental Education Plan. For example, NGOs should be formally represented on all the groups established as part of the plan and will play an particularly important role in supporting environmental education in schools. NGOs should have at least one member on each of the Teams and Groups listed below in Section 8.5.

# (2) Training to NGOs in the Watershed

It is recommended that more formal training be provided for these NGOs to encourage better management, more effective activities, and establishment of new community based organizations. This training should be provided by a competent body, probably another NGO from outside the Province working with an international NGO. It should also be closely linked to the training proposed by the Caspian Environment Programme (CEP) to reduce potential overlap. The members of the Green Network should identify priorities for training. The Green Network is suggested to identify training needs and then supported by the DOE or other funders, organize training courses related to those needs. Courses should start from 2007 and attract at least 10 NGO members.

# (3) Establishment of a Small Grant Scheme for NGOs in Guilan

A formal small grant scheme for NGOs should be established by 2008, by DOE to support the development of awareness raising activities. The small grant scheme can be funded from the income generated by fines from businesses and can be managed by DOE and each year would focus on encouraging activities related to a different theme. The themes selected each year should relate to one of the priorities identified in the Master Plan and also be related to other funding opportunities, such as the CEP Small Grant Scheme to ensure an effective use of funding.

# (4) Establishment of Training Courses for Journalists

Training for journalists has been included in this section, largely because, like NGOs they are a stakeholder outside the government administration that has an important role in providing information to the general public and encouraging the development of civil society. DOE should run a course for journalists on the problem of the Anzali Wetland. Journalists with an interest in the environment should be encouraged to network with each other. Journalists should also be exposed to other national and international experience. Activities should link closely with the CEP program for support for journalists. CEP for example is intending to produce a "media kit" for journalists in the region.

## 8.5 Institutional and Organizational Arrangements

Figure 8.5.1 summarizes the proposed organizational plan for the Environmental Education Plan.



Figure 8.5.1 Proposed Organizational Arrangement for Environmental Education Plan

### 8.5.1 Environmental Education in Schools and Universities

### (1) Environmental Education in Schools

Environmental Education should be promoted in three ways and should largely be the responsibility of the Ministry of Education (MOED). The MOED should appoint a full time officer with responsibility for guiding Environmental Education in the Province. This person should chair the Schools Environment Group and act as an Adviser for Schools to promote environmental education. A Schools Environment Group (SEG) should be established to coordinate the implementation of activities in schools. The group should be chaired by the MOED Environmental Education Officer, and with the support of the Ministry of Higher Education, should have representation drawn from the different stakeholder groups including DOE, schools, teachers groups and NGOs. Each school should appoint a teacher with responsibility for environmental education in the school. This teacher will have the responsibility for promoting the development of environmental education programs and activities, managing the Eco Schools Program, and coordinating visits to the Wetland Education Center. The SEG should be established and the environmental education officer appointed during 2005. By 2006 at least 35% of schools should have identified environmental coordinators rising to 50% by 2008.

(2) Environmental Education in Higher Education

The Ministry of Higher Education and the University of Guilan should establish a Higher Education Environment Group (HEEG). The group should have representation from appropriate Departments and Ministries including DOE and the Ministry of Industry and
Mines, MOJA, MOE and others. Leading environmental academics from other Universities in Iran should be invited to join the Team. The Team should be established in 2005/6

# 8.5.2 Public Awareness Raising and Participation

# (1) Decision Makers

This should be the responsibility of a cross sector Wetland Professional Development Team (WPDT) established by the DOE and supported by MOJA. Government and non-government organizations with a responsibility for developing environmental awareness should be invited to join the team. The remit of the team should be to plan and coordinate opportunities for professional development of decision makers and that funding is shared to ensure the most effective and efficient use of human and financial resources.

## (2) Religious Leaders

This should be the responsibility of an Islam and Environment Group (IEG) with members appointed by the Representative of the Supreme Leader. The group will lead and coordinate activities to raise the capacity of Mosque leaders to engage in environmental education, and coordinate the production of materials.

## (3) Business and Industry

A high level seminar should be organised by DOE with the support of the Ministry of Industry and Mines and other appropriate bodies and a Business and Environment Association (BEA) should be established as a result of this seminar to implement the recommendations for business. The group should be open to membership from all businesses, and should include representations from other stakeholders, especially the Ministry of Industry and Mines, DOE, MOE and MOJA. The BEA should be supported by these Ministries and Department though at a later stage it should become financially self sufficient.

## (4) Farmers and the Farming Community

A high level Seminar should be organised by MOJA, NRGO and DOE for all governmental and non-governmental organizations with responsibility for, and working with farmers and graziers. The main purpose of the seminar should be to establish a Rural Environment Group (REG) to coordinate the recommendations in Environmental Education Plan, Watershed Management Plan and Wastewater Management Plan. This group should be chaired and coordinated jointly by MOJA and NRGO and both organizations should appoint a full time officer each with responsibility for overseeing and promoting environmental initiatives. The MOJA Environmental Officer should have responsibility for working with farmers, and the NRGO Environmental Officer should have the responsibility of working with graziers in the rangelands and forests. The two Officers should be based at the same office to facilitate communication and coordination, and they should jointly share the management of the Rural Advisers Network (RAN). The members of the RAN should be appointed by MOJA and NRGO. The network members need not necessarily be full time employees and should be independent from the current network. The network could include farmers themselves, NGOs, retired MOJA or DOE officers. The network should be provided with a significant input of training related to sustainable farming practices and would be given specific tasks related to farmers and graziers in a particular area. The network of Advisers should have the remit to visit farms and promote new environmentally sensitive farming practices (such as IPM) organize meetings of farmers and to work with the MOJA Education Centers to assist in providing training courses. They should be involved in spearheading new initiatives such as participatory processes in the relocation of forest graziers.

### (5) The General Public and Tourists

DOE should establish a Wetland Environmental Action Group (WEAG) to be responsible for the implementation of the recommendations for the General Public and Tourists. The WEAG should be chaired by the DOE and include representatives from MOJA, NRGO, MOED, ITTO, communities around the Wetland and other stakeholder Groups including NGOs and the Islamic Councils. Specific recommendations should be allocated to sub groups of the WEAG as appropriate. For example, ITTO should be responsible for working with tourists. The WEAG should also develop a system to allow the participation of local stakeholders, and especially the general public in the management of the Wetland and the implementation of the recommendations in the Master Plan as a whole. Should the Conservancy be established a priority should be to create a process that will give representation to local communities on the management Board. Prior to the establishment of the Conservancy, the WEAG should have not more than 20 members and meet regularly to give feedback to DOE on the management of the Wetland.

### (6) NGOs and Journalists

A Green Network with an established structure and way of working is already in existence and therefore no new partnerships are required for the implementation of the recommendation for NGO and Journalists

### 8.5.3 The Conservancy and NGOs

The Institutional Plan (Chapter 9) recommends the establishment of a Conservancy body to manage the Wetland. If this recommendation is adopted, then the teams and groups established to have responsibility for the delivery of environmental education to different stakeholder groups will also include a representative of the Conservancy body. The Wetland Environmental Action Group will be part of the Conservancy as it deals directly with environmental education around the Wetland. NGOs also have an important role and should be fully represented on the groups and teams mentioned above.

### 8.6 Summary of Proposed Environmental Education Plan

The proposed projects in the Environmental Education Plan are summarized as follows.

#### Table 8.6.1 Summary of Proposed Environmental Education Plan (1/2)

Sub-Components	Proposed Projects/Measures	Executing			
Environmental Education	<ul> <li>(1) Environmental Education in School <ol> <li>Development of an Environmental Education </li> <li>Preparation of a Teacher's Handbook on environmental education </li></ol> </li> <li>Preparation of resources to support environmental education <ol> <li>Development of Teacher Training courses</li> <li>Establishment of a Wetland Education Center and programs</li> <li>Establishment of an Eco Schools scheme </li> <li>Establishment of an Environmental Education support network</li> </ol> </li> <li>Environmental Education in Higher Education <ol> <li>Review of higher education provision of environmental education <ol> <li>Development of new bachelor and masters courses</li> <li>Key university staff to gain international experience through master courses and academic links</li> <li>Development of an international "wetland management" master course</li> <li>Development of "greening" of higher education</li> </ol> </li> </ol></li></ul>	Ministry of Education, SEG, HEEG			
Public Awareness Raising and Participation	<ol> <li>Decision Makers         <ol> <li>Review of current provision and development of an action plan</li> <li>Training for managers and decision makers</li> <li>Preparation of publications for key staff and organizations                 <ol> <li>Training for local government</li> </ol> </li> <li>Religious Leaders                       <ol></ol></li></ol></li></ol>	Ministry of Education, Wetland Professional Development Team, Islam and Environment Group, Business and Environment Association, Rural Environment Group, Rural Advisers Network, Wetland Environmental Action Group			

Sub-Components	Proposed Projects/Measures	Executing Organization
Public Awareness Raising and Participation	<ul> <li>(4) Farmers and Rural Communities <ol> <li>Review and strategy development</li> <li>Training of MOJA, NRGO,DOE and other organizations</li> <li>Establishment of a small grant scheme and a network of demonstration farms</li> <li>Development of environmental courses for farmers</li> <li>Development of a range of appropriate environmentally focused publications and other media for farmers/foresters</li> <li>Pilot organic farming accreditation scheme and sustainable forest management scheme</li> </ol> </li> <li>(5) General Public and Tourists <ol> <li>Establishment of a small grant scheme to support an annual awareness raising campaign</li> <li>Specific information to be targeted at different groups</li> <li>Establishment of a range of course by the community learning centers</li> <li>Pilot consultation with the general public on planning issues</li> </ol> </li> <li>(6) NGOs and Journalists <ol> <li>Increase of NGO participation</li> <li>Training to NGOs in the watershed</li> <li>Establishment of a small grant scheme for NGOs in Guilan</li> <li>Establishment of training course for journalists</li> </ol> </li> </ul>	Ministry of Education, Wetland Professional Development Team, Islam and Environment Group, Business and Environment Association, Rural Environment Group, Rural Advisers Network, Wetland Environmental Action Group

 Table 8.6.1 Summary of Proposed Environmental Education Plan (2/2)

### 8.7 Cost Estimate

#### 8.7.1 Project Cost

The estimated project cost and the operation and maintenance cost are shown in Table 8.7.1. The total project cost is estimated at 1,175 million Rials. This is mainly used to establish the Wetland Information Center.

		O&M Cost				
Proposed Projects/Measures	Project Cost (million Rials)	Overall (million Rials)	Average Annual (million Rials/Year)			
1. Environmental Education						
(1) Environmental Education in Schools	0	3,324	222			
(2) Environmental Education in Higher Education	0	4,838	323			
2. Public Awareness Raising and Participation						
(1) Decision Makers	0	2,416	161			
(2) Religious Leaders	0	1,052	70			
(3) Business and Industry	0	1,825	122			
(4) Farmers and Rural Communities	0	9,715	648			
(5) General Public and Tourists	1,175	11,140	743			
(6) NGOs and Journalists	0	4,150	277			
Total	1,175	38,460	2,564			

Table 8.7.1 Cost Estimate of the Environmental Education Plan

### 8.7.2 Operation and Maintenance Cost

The total operation and maintenance cost is estimated at 38,460 million Rials. This can be seen as highly cost effective funding especially as much of this funding is not "new" money, but can come from a reallocation of current spending or income generation.

For the best use to be made of resources the key organizations involved should be prepared to review their current activities critically and be prepared to reallocate resources. Unfortunately, there is a tendency, once something has been done, to continue doing it regardless of effectiveness. This can be called the "we've always done that" or "we do that every year" approach. Unfortunately these activities often take funding away from activities that might result in a greater impact and take staff time in preparation and delivery that would be better spent on other activities.

For example, DOE already has a budget for public awareness raising, and Government Ministries and Local Administration all have budgets to enable staff to attend meetings, for staff training and so on. A reallocation of current spending after the recommended reviews have been undertaken should therefore be possible. In some case additional funding might be required. For example, extra funding might be needed to support the development of new training courses, but additional funding can be used for staff to attend these courses.

For a number of proposed activities such as the Wetland Education Center and Wetland Information Center, the start up of new Higher Education Courses, new funding will be required. This is also the case for new members of staff to be appointed though in some cases reallocation of current staff might be possible. Some of the activities proposed have the potential for income generation especially after the initial development and pilot phase. For example both the Wetland Education and Information Centers have the potential for charging for services and products. Other recommended activities such as the environmental audits and adoption of management systems for businesses and the organic farm accreditation schemes, can also be paid for by the businesses and farms themselves, after the awareness and education programs have convinced the target groups that they such schemes are "good for business" as well as "good for the environment".

### 8.8 Implementation Program

8.8.1 Executing Organizations

The responsible organizations for the proposed projects are shown in Table 8.6.1.

#### 8.8.2 Criteria for Prioritization

Criteria for Prioritization are listed below. See Chapter 3 for the general explanation of project prioritization in this study.

- 1) Necessity
- 2) Urgency
- 3) Efficiency
- 4) Impact on Environment
- 5) Cost
- 6) Capacity
- 7) Policy

### 8.8.3 Evaluation of Proposed Projects for Prioritization

Priority of proposed projects is evaluated in Table 8.8.1. Each project is ranked A, B, C and scored.

Criteria		Necessity	Urgency	Efficiency	Impact on Environ.	Cost	Capacity	Policy	Overall Evaluation	
1 Environmental Education										
(1)	Environmental Education in Schools	А	А	А	В	В	В	А	A(11)	
(2)	Environmental Education in Higher Education	В	А	А	В	С	В	А	B (9)	
2	Public Awareness Raising and Participation									
(1)	Decision Makers	А	В	А	А	В	В	А	A(11)	
(2)	Religious Leaders	В	С	В	В	А	С	С	C (5)	
(3)	Business and Industry	А	В	В	А	А	С	В	B (9)	
(4)	Farmers and Rural Communities	А	А	А	А	В	В	А	A(12)	
(5)	General Public and Tourists	А	В	В	А	С	В	А	B (9)	
(6)	NGOs and Journalists	В	С	В	В	А	В	А	B (8)	

Table 8.8.1 Evaluation of Proposed Projects for Prioritization

Note: scoring A=2, B=1, C=0

### 8.8.4 Implementation Schedule

It is proposed that the environmental education plan shall be implemented until 2019, as shown in Table 8.8.2.

Proposed Measures		Fourth 5-year Plan Period			Fifth 5-year Plan Period				Sixth 5-year Plan Period							
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ENVIRONMENTAL EDUCATION PLAN																
1. Environmental Education																
(1)	Environmental Education in Schools 1) education statement, 2) teacher's handbook, 3) preparation of resources, 4) teacher training course, 5) wetland education program															
	Environmental Education in Schools 6) eco school scheme, 7) establishment of support network					-										
(2)	Environmental Education in Higher Education. 1) review, 2) develop bachelor/master courses, 3) international experiences															
	Environmental Education in Higher Education 4) develop international "wetland management" course															
	Environmental Education in Higher Education 5) greeing of higher education															
2. Pub	lic Awareness Raising and Participation															
(1)	Decision Makers 1) review, 2&4) training of manager. & local governvment, 3) preparation of publications										-					
(2)	Religious Leaders 1) Islam and the environment seminars															
	Religious Leaders 2) prep. hadbook, 3) prep. leaflet															
(3)	Business and Industry 1) business & environment seminar series															
	Business and Industry 2) publication, 3) pilot business/industry EMS, 4) support of local comm. environ. initiatives															
(4)	Farmers and Rural Communities 1) review, 2) training, 3) small grant, 4) environ. course, 5) publications															
	Farmers and Rural Communities 6) pilot organic farming accrediation															
(5)	General Public and Tourists 2) annual statement, 3) awareness raising campaign, 4) information dissemination															
	General Public and Tourists 1) wetland info center, 5) small grant, 6) course preparation, 7) public consultation															
(6)	NGOs and Journalists 1) NGO participation, 2) NGO training, 3) small grant, 4) journalist training															

Priorities were selected on the impact the proposed activities can have on wetland conservation, the institutional capacity to implement the activities, the cost of the activities and so on. The activities described above have been grouped into those that will be started in 2005-2009 in the Fourth 5-year Development Plan (short term starting), those that will be started in the period 2010-1014 in the Fifth 5-year Development Plan (medium terms activities) and a few activities that will not start until the Sixth 5-year Development Plan (long term activities). Activities have also been put in a logical order. The establishment of the Team and Working Groups, Review of Activities, the development of Action Plans all have a

high priority. These should be followed by capacity building of decision makers, and the development and implementation of the specific activities.

The environmental education plan is different to many plans presented in the Master Plan. Because each component of the Environmental Education Plan falls within the responsibility of one or two organizations as listed in the Implementation Schedule it is possible for the activities for the different target groups to all start within the first five years. Few of the activities require a long lead in time and nearly all the new systematic approaches proposed can be in place within ten years.

## 8.9 **Priority Projects**

According to the evaluation, priority projects are:

- 1) Environmental Education in Schools
- 2) Decision Makers (Environmental awareness raising and participation)
- 3) Farmers and Rural Communities (Environmental awareness raising and participation)